MANUAL OF FARM ANIMALS

By

M. W. Harper

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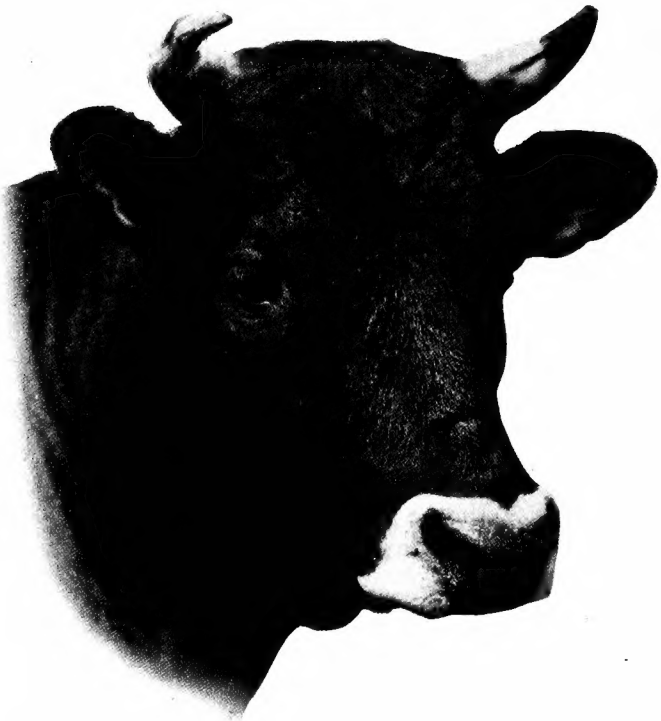

Jersey head of quality, illustrating what has been accomplished by improved methods of breeding and feeding, together with proper care and management.

MANUAL

OF

FARM ANIMALS

A PRACTICAL GUIDE

TO THE CHOOSING, BREEDING, AND KEEP
OF HORSES, CATTLE, SHEEP,
AND SWINE

BY

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PREFACE

In America, raising farm animals does not receive the recognition that is accorded it in Europe. Because of this relative neglect, when in search of animals with which to improve our studs, herds and flocks, we still look largely to foreign lands. Continental Europe provides us with blood to improve our draft horses, dairy cattle, and fine-wool sheep, while the British Isles furnish improved blood for our beef cattle, mutton sheep, bacon swine, as well as for horses, both light and heavy, and for dairy cattle.

A comparison of European methods with those employed in America reveals the fact that our methods are lacking and entirely inadequate to produce the greatest improvement. The live-stock farmers of Europe exercise much careful judgment in choosing their animals, in feeding, in breeding, and in the care and management. It has been with a view of aiding to promote such interest in the daily work with farm animals that this volume is written. This has been done with the thought that increased interest will lead to improved care, which in time, it is hoped, will produce a better and more useful class of farm live-stock. It is well recognized that a good animal husbandry lies at the bottom of a good agriculture.

From the above, it will be seen that the author's purpose is to discuss the general care and management of farm animals rather than the breeds. However, a knowledge of the breeds is necessary. To economize space and the reader's time, the writer has adopted the method of freely inserting pictures of good animals of many breeds, with liberal legends, letting them run as a minor motive throughout the book. By this plan it is hoped that some of the main characteristics of the breeds may be taken away by the reader with little effort on his part.

In a book of this range, many kinds of advice must be given. This advice may not all be of equal value, even though it be the product of actual experience. The author gives it for what it is worth, and it is the responsibility of the reader to apply it and to work it out as best he can. In the discussion of diseases, particularly, it is very difficult to give formal advice that will apply to all cases; and the statements are meant to be used as guides and suggestions and not as "doctor book" prescriptions or as substitutes for the help of a trained veterinarian. It is hoped that by calling attention to the diseases and ailments, the reader will see the importance of securing reliable aid when the subject is beyond his knowledge or skill.

The book is a manual, and therefore it considers the common practical matters in much detail. No doubt much information which we now accept in the breeding and feeding of animals is very imperfect; but the writer has tried to discuss the daily handling of farm live-stock in the light of such knowledge as is at present best accepted and most capable of application.

Recognizing the importance of such a work, the writer will be glad to correspond with those into whose hands the book may fall, concerning difficulties in the management of animals, and also to receive suggestions that will make future editions of the Manual — if such should be called for — more useful as a practical guide in raising farm animals.

M. W. HARPER.

ITHACA, N.Y.,
June 7, 1911.

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MANUAL OF FARM ANIMALS

CHAPTER I

CHOOSING A HORSE — JUDGING

In choosing any class of animals, there are three faculties that should be well developed — familiarity with what is wanted, powers of observation, and good judgment.

One must first consider the use for which the animal is desired and the type or breed that will best accomplish the given purpose. If the animal is wanted for light trucking and to deliver produce at the market, it might be a mistake to choose a heavy draft horse; whereas if the object is to deliver heavy freight from the car to the freight-house, it would be none the less a mistake to choose a running horse. Again, if the animal is demanded for a farm where there is considerable heavy work, such as breaking the land, especially if the soil is heavy, the type of horse should be unlike that for a dairy farm, where the team work is ordinarily light. The more familiar one is with the demand and the type best suited to meet it, the better his chance of success.

The power of observation should be well developed. The eye must see quickly and accurately, so that there may be no mistake in the observations that are to form the basis for a conclusion. Not only should one see things as they are, but there should be dispatch in detecting deviations from the correct form. There is much difficulty in this. One may be fa-

miliar with the fact that a few white hairs on the knee may indicate that the animal stumbles, and yet when examining the horse entirely overlook them; in like manner, he may know that gray hairs on the inside of the pastern may indicate that the animal interferes, and yet the white hairs go wholly unnoticed. The difficulty is often increased by the salesman attempting to cover up such signs, and this should serve to put the prospective purchaser on his guard.

Having noted the desirable and undesirable qualities of the animals under consideration, a mental picture of each should be retained, for it often happens that in the choice of a horse many animals are examined before one is found that is acceptable. Many live-stock judges, particularly poultry fanciers, have this faculty developed to a marked degree. It often happens that they are called on to judge large rings of animals, fifty or more in a single class, and to be able to place these animals properly they must remember each of the animals, as it is impossible to see them all at a glance. Again, retaining such a picture of horses is of value in matching teams. A well-matched team is far more valuable than if each animal is sold separately. There are those who make a business of buying animals singly, matching them, and selling the team thus matched. This is a very profitable business, a few transactions each year often netting a good sum.

After having examined a number of horses, good, bad, and indifferent, some of them filling the demand in part only, and some not at all, the judgment is brought into play to decide on the price. Perhaps one animal answers every demand, but the price is high; another does not please so well, but the price is low. Again, when judging a ring of animals, one must use the judgment as to which of two defects is the more serious. The judgment can and should be trained in much the same way as the power of observation and the ability to retain mental pictures.

In choosing a horse, efficiency depends much on practice and experience. The type to fill a certain demand, and the value of the animal for such purpose, are recognized much more quickly and accurately by one who is buying many horses daily than by those who buy one only occasionally.

There are a few considerations that apply with equal force to all classes of animals, such as the examination in general, estimating age, detecting unsoundness, and the like. These will be discussed first; then we will pass to the choice of the individual.

GENERAL EXAMINATION OF THE HORSE

In examining a horse, some system should be followed in order that no point go unnoticed. To facilitate this and to aid in establishing uniform values for the various points of the animal, the score-card was devised. Official score-cards have been adapted for many of the breeds, and while of little practical value in choosing or judging a horse, they do aid in establishing a uniform standard for the breeder. The examination of the horse cannot always be made at leisure, but enough time should be taken, if possible, to make the task complete.

Examination in the stable. — When possible, the horse should first be examined in the stable. Note the way in which the animal is tied to the manger; whether he has been chewing the tie-strap or the fixtures; how he stands in the stall; and his general behavior, when you step to his side. Note the horse's conduct while grooming, particularly along the belly, the backs of the forelegs, and the fronts of the hind legs and about the flank. Harness the animal. Note the manner of taking the bit; the behavior when placing the headstall over the ears; the harness over the back; the crupper under the tail; and when buckling the girth.

The horse may now be taken from the stall. Note the action as he is being turned around. In many sale stables there is a contemptible practice of introducing ginger into the rectum as

the animal is being taken out, as this serves to stimulate the animal and he shows to advantage. As the horse passes into the yard, the door-way affords a very good place to examine the horse's eyes, nostrils, mouth, and noting the age.

FIG. 1.—ARAB STALLION "SHAHWAN." Imported by J. A. P. Ramsdell, of Newburg, N. Y.

The Arab horse, named after his native country, is particularly noted as being the animal that gave the English Thoroughbred running horse its speed and endurance. Arabs are full of quality, very intelligent, and docile. They are chiefly used as officers' chargers, or for siring polo ponies.

Examination of the horse in action. — First, note action while being led by the halter. Without regard for type, observe the walk. This is a much neglected though very important gait for all types and breeds of horses. Next note the trot, and,

with the saddler the various saddle gaits. These trials should take place on pavement or hard surface, as solid footing affords the best conditions to detect the existence of lameness. These gaits should be noted from the front, from behind, and from either side. Second, note the action when hitched to the kind of vehicle for which the horse is intended. Observe the horse first at the walk, then the trot from in front, behind, and either side. Notice manner of starting, turning, stopping, backing, and the like. The prospective purchaser should now mount the vehicle and drive the horse, observing his action, general behavior, manner of taking the bit, ease with which he is driven and guided this way and that. When satisfied in all respects, stop the horse and observe him standing after the exercise, especially with respect to the regularity of breathing and his manner of standing. Third, if the horse is intended for saddle purposes, in part, he should be tried out under the saddle, observing his behavior when mounting, the ease of movement and the like, with even more caution than when being led or hitched to a vehicle.

HOW TO ESTIMATE THE AGE OF A HORSE

The age of a horse is an important factor in determining his present and prospective value. Familiarity with the characters that indicate age are, therefore, often extremely useful. A knowledge of these characters is not difficult to secure, but skill in their application depends much on continued practice.

General considerations. — In estimating the age of a horse, the teeth furnish the best index, yet there are other general considerations that play an important part, especially in the case of young and very old animals. In estimating the age of young animals, size is the principal factor to be considered. In very old horses, white hairs make their appearance around the temple, the eyes, the nostrils, and elsewhere; the poll or top of the head becomes more pointed; the sides of the face more depressed;

the hollows above the eyes deeper; the backbone becomes more prominent and often strongly curved downward, and the animal does not stand squarely on his legs, which show more wear.

Examination of the teeth. — While the order of the appearance of the teeth and their method of wearing are considered the most important and accurate means of estimating the age of domestic animals, and are the means employed by all horsemen, these are not absolutely accurate, and much depends on the condition as well as the individuality of the animal. The teeth of animals that have bones of somewhat open structure are likely to indicate that the animals are older than they really are; while the teeth of those whose bones are of fine close texture may indicate them to be younger than they are. Again, animals fed on soft and succulent food are likely to show a younger mouth, whereas those fed on hard, dry food are likely to show an older mouth.

The horse when full grown has forty teeth, twenty on either jaw, divided as follows: six nippers, two canines, one on either side, and twelve molars, six on a side. In the mare the canines are usually absent. Since only the nippers or incisor teeth are inspected in estimating the age, they alone will be considered. It is the order in which the nippers make their appearance that enables us to estimate the age of the horse up to five years, and the manner in which their surface is worn that aids us in the estimation from five to eleven years of age. After the horse has passed the eleventh year it is difficult to determine the age. In practice the age is designated as eleven, twelve, or fifteen past, as the case may be, but how much past cannot be told with any degree of accuracy.

The *colt* is provided before the end of the first month with a set of temporary or milk teeth, the first or middle pair appearing at about one week of age; the second or intermediate pair at one to two weeks of age; and the third or lateral pair appearing at about one month of age. The difference in size of the jaw-

bone between the foal and the grown horse makes a change from milk to permanent teeth necessary. The permanent replace the temporary teeth at two and one-half or three years of age up to five years. It is seldom that one is called on to estimate the age before two and one-half years because the animal has not yet reached the period of usefulness, and even if the age must be estimated, size is considered more than any other factor.

Three years old. — At about two years and nine months of age the permanent pair of center nippers replaces the temporary ones, and by the time the animal is three years of age they are up and ready for use. They will have deep cups and are much larger than the temporary teeth. If the colt be a male, small tusks will appear at about this time.

Four years old. — At about three years and nine months, the intermediate pair of permanent nippers appear and is up and ready for use at four years of age. The center pair shows much wear and the cups are about one-third gone. The tusks, if any, have enlarged, but are still sharp on their points and flattish on the inside.

Five years old. — At about four years and nine months, the permanent corner nippers make their appearance and are up and ready for use at five years of age. At five years of age the horse has a full mouth of permanent teeth; the center nippers show two years' wear and have changed slightly in shape, having become rounder on the inside, the cups being two-thirds gone; the intermediate nippers show one year's wear, the cup being one-third gone. Five years is the age preferred on the market, and occasionally horsemen extract the temporary nippers, which hastens the appearance of the permanent teeth.

Six years old. — The cups in the center pair in the lower jaw have disappeared, or nearly so; they have become much smaller in the intermediates and show one year's wear in the corner nippers.

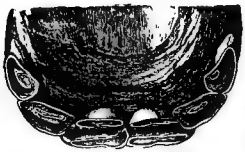

FIG. 2. — FRONT TEETH IN LOWER JAW AT THREE YEARS OF AGE. Two center permanent teeth up. — (FIGS. 2–17, from GOUBAUX and BARRIER.)

FIG. 3. — FRONT TEETH IN LOWER JAW AT FOUR YEARS OF AGE. Four center permanent teeth up.

FIG. 4. — FRONT TEETH IN LOWER JAW AT FIVE YEARS OF AGE. All permanent teeth up.

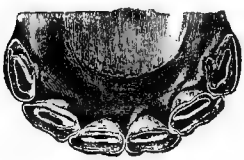

FIG. 5. — FRONT TEETH IN LOWER JAW AT SIX YEARS OF AGE. Cups out of center teeth.

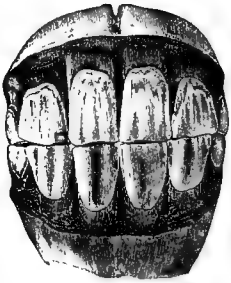

FIG. 6. — FRONT VIEW OF A FIVE-YEAR-OLD MOUTH.

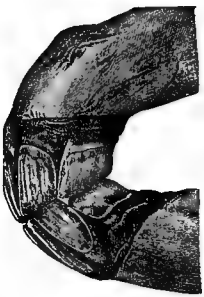

FIG. 7. — SIDE VIEW OF A FIVE-YEAR-OLD MOUTH.

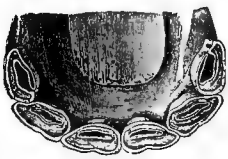

FIG. 8. — FRONT TEETH IN LOWER JAW AT SEVEN YEARS OF AGE. Cups out of intermediate teeth.

Seven years old. — At seven, the cups are gone from the intermediate pair in the lower jaw, and have become quite shallow in the corner nippers. There is a notch in the upper corner nipper where it overlaps the lower one. Marked changes in shape have taken place in the nippers; they are becoming thicker from inside out, rounder on the inside, and meet at a sharper angle than when they first made their appearance.

Eight years old. — At eight years, the cups are gone from all the nippers of the lower jaw. They are present in all of the upper jaw.

Nine years old. — The cups in the center pair of nippers of the upper jaw have disappeared, but are still present in the intermediate and corner nippers. The cups are not likely to disappear at as regular intervals in the upper jaw as they did in the lower. Therefore it is not always possible to tell the age of the horse so accurately.

Ten years old. — At ten years of age, the cups have disappeared from the upper intermediates, but are still retained in the corner nippers, though shallow. The teeth are more triangular in shape, and those of the upper and lower jaw meet at a sharper angle as the age increases.

Eleven years old. — At eleven years, the cups are gone from all the nippers of the upper jaw. However, because of the fact that some horses have denser bones than others, it is not uncommon to find shallow cups in the upper corner teeth as late as the twelfth or the fifteenth year.

Aged horses. — After the horse has passed the twelfth year, the matter of a year or two amounts to little. Much depends on the individuality of the animal, as some animals are worth more at fifteen than others at twelve. One's judgment of the value of a horse at these ages should be formed on general appearances and activities rather than on age.

In old horses, the nipper teeth have become nearly triangular, showing long wear and meeting at an acute angle. The tusks

FIG. 9. — FRONT TEETH IN LOWER JAW AT EIGHT YEARS OF AGE. Cups all out.

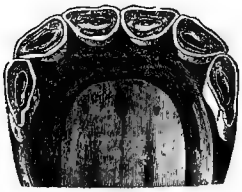

FIG. 10. — FRONT TEETH IN UPPER JAW AT NINE YEARS OF AGE. Cups out of center teeth.

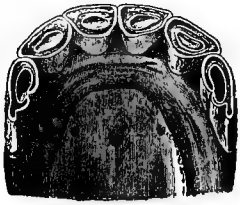

FIG. 11. — FRONT TEETH IN UPPER JAW AT TEN YEARS OF AGE. Cups out of intermediate teeth.

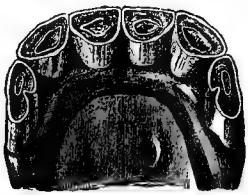

FIG. 12. — FRONT TEETH IN UPPER JAW AT ELEVEN YEARS OF AGE. Cups all out.

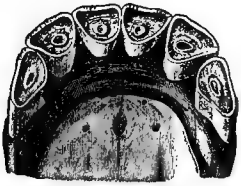

FIG. 13. — FRONT TEETH IN UPPER JAW AT FIFTEEN YEARS OF AGE. Teeth quite triangular.

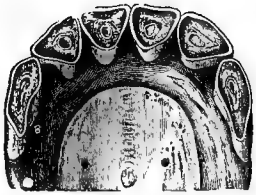

FIG. 14. — FRONT TEETH IN UPPER JAW AT TWENTY-ONE YEARS OF AGE.

are large, blunt, and round. The nippers may have grown out so long as to prevent the grinders from meeting, in which case a horse will spit out his food after masticating a part of it. If the nippers are rasped off, the grinders will meet, and the horse's life will be somewhat prolonged.

Irregularities in the teeth. — It often happens that the teeth are not regular, in which case the horse is said to have a false mouth. These irregularities may occur in the number: there may be more or less than the regular number — thirty-six in mares or forty in horses; they may occur in the form of the teeth or the uniting of two teeth; they may occur because one jaw happens to be longer or shorter than the other; they may come as the result of cribbing, some horses have the bad habit of biting the stall fixtures or other surrounding objects, thus breaking off the free borders of the teeth, which make the teeth irregular and which must not be confused with normal wear. Such cases can usually be recognized by the broken-off particles and the roughed surface.

Irregularities may result from the employment of fraudulent means, the horseman striving to give the

FIG. 15. — SIDE VIEW OF A TWENTY-ONE-YEAR-OLD MOUTH. Note the sharp angle at which the teeth meet.

FIG. 16. — FRONT VIEW OF A TWENTY-ONE-YEAR-OLD MOUTH.

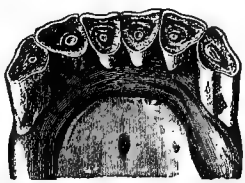

FIG. 17. — FRONT TEETH IN UPPER JAW AT THIRTY YEARS OF AGE.

mouth the characteristics of that period of life in which the horses have their greatest value, thus endeavoring to make the young appear old and the old appear young. It is ordinarily easy for one of experience to detect a mouth that has been tampered with. While many are very skillful at bishoping, it is a hard matter very materially to alter the mouth without detection. After the teeth have once been interfered with they can no longer serve as an index in estimating age, the dental tables, the cups, and the like having been partly or wholly destroyed.

DETECTING UNSOUNDNESS

A satisfactory definition of soundness or unsoundness is not easily given. The term "unsound" as used by horse dealers in this country is often loosely applied. It may mean anything from a mere bad habit to a defect that renders the animal absolutely worthless. The best usage warrants dividing these imperfections into two classes — blemishes and unsoundness.

A *blemish* may be defined as something that depreciates the value of a horse without interfering with his usefulness, such as wire cuts, car bruises, and the like which mar the appearance of a horse but do not limit his functions.

An *unsoundness* may be defined as an imperfection of so serious a nature as to interfere with the usefulness of the horse, such as ring-bones, side-bones, splints, curbs, and the like.

The ability to detect unsoundness depends largely on practice; yet some imperfections cannot be detected by an ordinary examination, and it is only after becoming familiar with the animal that these will be observed. In examining a horse for unsoundness, it is well to follow a regular order beginning with the head and ending with the feet. There are a great number of imperfections to be found among horses, too many to be catalogued here. The following list contains the more important: —

Decayed and broken teeth. — A foul odor indicates decayed or unsound teeth. This can easily be detected, as it attaches

itself to the hand on being introduced into the mouth. Nippers with broken edges indicate that the horse is addicted to cribbing.

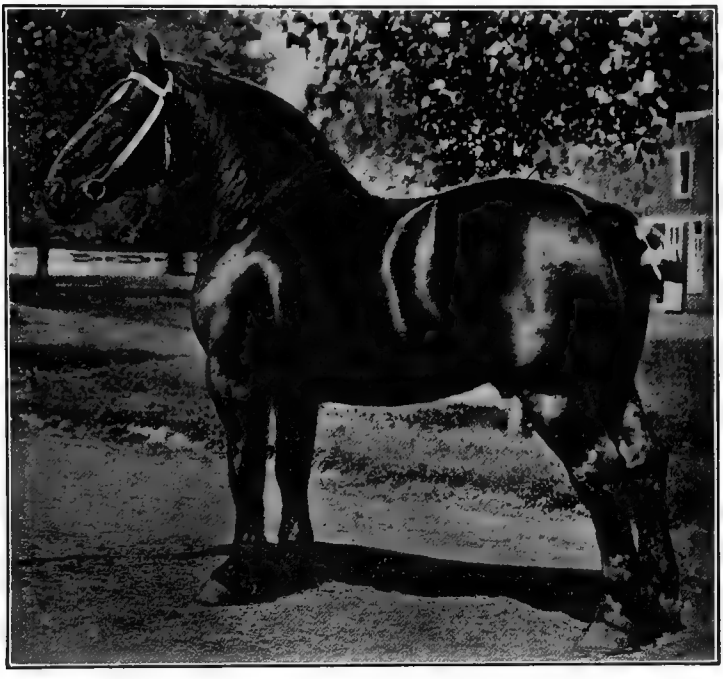

FIG. 18.—IMPORTED PERCHERON STALLION "CARNOT," No. 66666. Imported by J. Crouch & Son, Lafayette, Ind. Sold to W. S. Corso, Whitehall, Ill., for $10,000. "Champion Percheron Stallion of America."

The Percheron draft horse, a native of La Percha, France, is noted for his massive size, quality, endurance, and action. In weight, stallions usually average from 1700 to 2000 pounds and mares from 1400 to 1800 pounds. In height, stallions range from 15½ to 17 hands and mares from 15 to 16½. The color is exceedingly variable, though black and dapple gray predominate. This is the most common breed of heavy draft horses in the United States.

Discharge from the nostrils. — There should be no discharge from the nostrils, which should be fresh pink in color. A profuse

colored discharge suggests glanders, distemper, shipping fever, and similar diseases. This may be only temporary, but one cannot afford to take the risk.

Impaired vision. — A horse by its action will usually betray imperfect eyesight. Blind horses have a peculiar high stepping gait or are inclined to shy readily and often without cause. The ears are exceedingly active, as if trying to aid the eyes. Blindness may be discovered by moving the hand gently in front of the eyes or by closing the eye with the hand and excluding the light for a moment; the pupil should dilate to its utmost capacity; when the hand is removed and the light strikes the eye, the pupil should rapidly contract to its normal size. This shows that the eye is sensitive to light.

Defective hearing. — When the horse's ears are rigid, it indicates that the hearing is defective. The animal is unresponsive when spoken to, and the eyes are active. Defective hearing is more common than supposed.

Poll-evil is a disease located at the top of the head and is indicated by the parts being exceedingly tender. Its causes are many, and it is very serious.

Sweenied shoulders is a wasting away of the muscle on the outside of the shoulder blade. This can be readily detected as the shoulder appears flat and the blade bare of muscle.

Fistulæ. — Exceeding tenderness at the withers may indicate that the horse has fistulæ, though at the time there may be no external signs.

Capped elbows. — Sores formed on the elbows while the animal is lying down are unsightly and can readily be seen.

Unsound knees. — The knee should be examined for bony enlargements, wind-puffs, scars on the front, and speed-cuts. Scars on the front indicate the horse is a stumbler.

Splints. — Bony bunches on the inside of the cannon are called splints. These must not be confused with the two small bones associated with the cannon. Splints located on the back

part of the leg near the tendon or close to the knee joint are considered most objectionable, as they are likely to interfere with the action and cause the animal lameness. When located on the side, they are less likely to cause lameness and not so objectionable. Splints may disappear from young draft horses.

Ring-bones. — Bony bunches on the fetlock and pastern are called ring-bone. There are two forms, called high and low, depending on the location.

Side-bone. — Just at the top of the hoof, on either side, the cartilages should be examined to see that they are not ossified, forming side-bones. These are common on the front feet only.

Scratches is located on the back of the pastern, and can be easily detected; it often causes the horse a great deal of pain and annoyance.

Unsound hoofs. — The hoofs should be closely examined for quarter cracks — cracks extending from the coronary band downward; for sand cracks — cracks extending from the bottom upward; for seedy toe — a softening of the wall at the toe of the hoof; for thrush — a diseased condition of the foot in the region of the frog, which makes its presence known by a disagreeable odor; for quitter — a running sore occurring at the top of the hoof or coronet, sometimes called "gravel"; for corns — bunions located in the corner of the heels, common in animals with weak low heels; for laminitis or founder — congestion of blood in the region of the toe, common in heavy horses; and for navicular disease — caused by overworking the tendons that pass to the navicular bone, common in light and very active animals.

FIG. 19. — FIRST PRIZE PERCHERON STALLIONS. Owned by J. Crouch & Son, Lafayette, Ind.

Thoroughpin occurs between the tendon and the upper point of the hock. It consists of a soft swelling and may be easily detected, as it can be pushed from side to side.

Spavin. — There are three kinds of spavin — one, bog, and occult. Bone-spavin is the most common, and consists of a bony growth on the inside and front of the hind leg just below the hock. To detect bone-spavin, stand in front and to the side of the animal so the inner outline of the hind leg may be clearly seen. Bog-spavin occurs in the natural depression on the inner and front part of the hock and consists of a soft swelling, formed by the oil, which accumulates from the joint. The term "blood spavin" is sometimes applied to the enlargement of the vein that passes across the hock from the front. Occult-spavin is located in the joint and is hard to detect. The usual method of detection is to lift the suspected leg and then start the horse off quickly.

FIG. 20. — PERCHERON STALLION "Coco." A noted prize winner.

Stringhalt is a marked jerking of the hind leg as the horse travels. In some cases it is seen only when the horse first starts and disappears after a few steps have been taken.

Curb occurs on the back of the cannon just below the hock. It may be easily detected by looking at the leg from the side, as it is a variation from a straight line that should run from the point of the hock to the fetlock joint.

Forging and overreaching. — A horse is said to forge when the shoes of the hind feet strike those of the fore feet, making a characteristic sound. Overreaching is the striking of the fore and hind feet in such a way as to injure the horse.

Interfering. — A horse is said to interfere when he strikes his fore or hind feet together in such a way as to injure them.

Locating lameness. — When standing, a horse troubled with sore feet will extend them as far as possible. If only one is sore, he puts the lame one forward and is often spoken of as a pointer. When the trouble is in the shoulder, the leg will be flexed at the knee. When in motion, the horse puts the sound foot down with confidence and makes an effort to ease the ailing one by throwing the head up as it strikes the ground.

Unsound in wind. — There are three common defects in the wind — unsound wind, roaring, and heaves. To detect these, drive the horse rapidly for half a mile, then stop quickly and listen to the breathing by placing the ear near the lungs or by standing near the neck. If the horse gets his breath with difficulty, he is thick winded. If in breathing he wheezes and whistles, he is a roarer. If the breathing is irregular, it is likely he is troubled with heaves. To detect this, observe the flanks for the characteristic double movement, as the air from the lungs seems to be half expelled when the respiration stops for a brief period and then the expulsion of the air is completed.

If a horse has passed through many hands in a short period, it is safe to conclude that there is some radical blemish or unsoundness that is not easily discovered.

TYPES OF HORSES

There are two distinct types of horses. First, is the light type, useful for light work and for speed. This group is further divided into running, trotting, pacing, saddling, coaching, expressing type, and the like. Second, the heavy type for heavy work and is further divided into light draft, medium draft, and heavy draft type. Horses belonging to the first type are usually designated light horses; those belonging to the second, draft horses. As the form or conformation best adapted for one is different from that of the other, we cannot find both united in

the same animal. It is a physical impossibility to have maximum speed and maximum draft in the same engine, and such is none the less the case among horses.

The light type. — In conformation, horses belonging to the light type vary considerably, depending on the purpose for which they are adopted. For example, the saddle horse differs in many respects from the running horse, and the trotter or pacer has many characteristics unlike either. However, since horses belonging to the light type are each intended for light and rather fast work, they possess many points in common.

In general conformation, the light type of horse is rather tall, upstanding, the limbs long, the distance from the chest to the ground is more than one-half the height of the horse from the withers to the ground. The distance from the withers to the knee and from the hips to the hock is great. The animals are somewhat narrow but rather deep in front. In general form the light type resembles the greyhound.

Heavy type. — In general conformation, the heavy type of horse is massive, blocky, low set, the limbs short, the distance from the chest to the ground one-half the height of the animal from the withers to the ground. In general form, this type resembles the bull-dog. Weight is important. In order to pull heavy loads the draft horse must possess plenty of weight. A draft horse in fair condition at maturity weighs from 1500 to 2400 pounds, according to the class.

CHOOSING A LIGHT HORSE

Having considered the method of procedure and the type, we will now discuss the desirable and undesirable characters of each type. For convenience these are divided into two classes: first, the general appearance, those characters having to do with the horse as a whole, such as form, quality, and action; and second, the detail characters, having to do with each point in-

dependent of the others, such as the head, neck, shoulder, and the like.

General appearance in light horses

The form, action, quality, color, and temperament are very important characters among light horses, and add to or detract from their desirability.

Form. — One of the first characters to attract attention among light horses is the general form. In those of good form there is a peculiar balance and harmony throughout the make-up which is difficult to describe and must be observed to be appreciated. The form varies according to the object sought, that of the coacher being full and plump, while that of the trotter or runner will be lean and angular. The position and direction of the limbs should receive special consideration. They should be viewed from in front, behind, and either side. In this connection, it will prove helpful if one will bear in mind that the limbs should be so formed as to meet the following requirements: the fore leg when viewed from the side should be so formed that a plumb line dropped from the elbow joint would pass through the middle of the knee, the cannon, and the fetlock, and fall a short distance behind the heel; when viewed from in front, the line lowered from the point of the shoulder would divide equally the knee, the cannon, and the foot, leaving between the two feet an interval equal to the width of the hoof. The hind leg when viewed from behind should be so formed that a plumb line lowered from the point of the buttock will pass through the middle of the hock, cannon, pastern, and foot, leaving between the two feet an interval almost equal to the width of the hock. This line should also just touch the back of the hock and the pastern joint.

Action. — In the market for light horses there is no single feature held in higher estimation than that of good action. Desirable action varies according to the object sought, but to

sell well a light horse must possess as much as may be displayed and used to advantage. Excellence at a walk is a very desirable quality in all types of horses. The feet of the active walkers leave the ground with a quick snap, and move straight away, swerving neither to the right nor to the left, nor should the folding of the knees or the flexing of the hocks result in an outward pitching or spreading. In addition to being snappy, regular, and straight, it should be fast. This is a point often neglected, and many good acting horses are provokingly slow walkers.

Action at the trot will vary according to the class. In the roadster a strong, long-reaching knee-and-hock action, with the feet picked up snappy, is most essential. The stride should be long and not too high. In the coacher, a rather high, bold knee-and-hock action is the most sought. In all classes the movement should be straight and regular. There must be style and dash in the lifting and planting of the feet.

FIG. 21.—HACKNEY COACH TEAM. Well-trained and stylish.

The foot should be snapped from the ground and carried forward, while the limb unfolds, as if following the rim of a wheel. The hind feet should leave the ground with the same quick movement, and at no time should be allowed to hang back and give the horse the appearance of not gathering himself well together.

Quality is a term rather loosely applied and has reference to

the bones, skin, and hair. Evidences of desirable quality are clean-cut features, soft skin, silky hair, and clean dense bone. In those horses possessing quality the lines of the face are clearly defined, the veins in the skin show clearly, and there is a complete absence of coarseness. Freedom from coarseness in the joints and tendons emphasizes soundness and guarantees durability. Another evidence of quality is seen in those animals whose muscles stand out clearly defined and distinct. The best way to determine quality is to run the hand down the leg over the knee and cannon bone. The hair and skin should feel soft and pliable to the touch and the bone firm and smooth. The fingers should seem almost to touch each other as they pass between the tendon and the bone.

Coarse hair is associated with coarse thick skin which indicates an abundance of connective tissue which in turn is associated with soft, spongy bones that cannot endure strain or hard usage.

The *temperament* is reflected in the action and manners. It should be lively and pleasant. When possible, the purchaser should know something of the ancestors of the horse under consideration, as a horse may inherit characteristics which cannot be discovered until he has been used some time, and peculiarities of temper are among these characters.

Detail characters of a light horse

Having considered the general appearance of the light horse, then pass to a detailed examination of the characters; and in order that none go unnoticed they should be observed in the following order: —

Head. — Among light horses the head should be lean, with broad forehead tapering towards the nostrils, and the features of the face should be distinct. The nostrils should be large, open, and of pink color. The eye should be large, full, clear, and bright, indicative of a kind, generous disposition and good

health. The jaw-bones should be strong and wide, providing ample room for a large wind-pipe. The ears should be active, refined, neither large nor small, carried close and erect and turning slightly in at the tips. Lop ears indicate laziness. A smooth neat attachment of head to neck is highly essential, a fullness at the throat and about the wind-pipe being most undesirable.

Neck. — A nicely arched and well-muscled neck of sufficient length, carrying the head gracefully, is a highly desirable feature

FIG. 22. — AN AMERICAN TROTTER. A driving horse of good form.

The American Trotting breed of horses developed in United States. The breed is the outgrowth of a demand for a light road horse possessing speed and endurance. The weight and height are exceedingly variable. The body is light, narrow, but deep, and the legs are long, but clean, and free from coarseness. All colors are found, but solid colors such as browns and bays are preferred to grays, roans, and the like.

of the light horse. Much of the style and symmetry of the coach horse is observed in the make-up and carriage of the head and neck. The wind-pipe should be large, and the outline appear distinct from the rest of the neck. Many excellent road horses have a ewe neck, but it detracts very much from the

general appearance. The neck and body should blend smoothly at the attachment.

Chest. — Among light horses the chest should obtain its capacity more from depth than width. A deep chest permits a freer play of the shoulders, and indicates staying power. A wide chest throws the fore legs out of line with the hind ones and causes the horse to paddle or roll in his action. The chest should be not only deep, but the breast should be carried forward with some prominence.

Shoulders. — To give elasticity to the movement and to permit of quick and clean action the shoulder should be long and sloping well into the back, thus strengthening the back and extending the length of the underline. The high action of the coach horse and the long-reaching clean action of the roadster depend much on a long oblique shoulder. A steep shoulder prevents a strong rapid movement and results in hard stilted action, leading to defects of feet and legs.

Arms. — Among light horses the arm should be short and comparatively upright, giving the animal an upstanding appearance.

Elbows. — The elbow should work snugly alongside the animal; if too closely "tied in," as it is termed, the toes are usually thrown out; if turned out, the toes are likely to be thrown in.

The *fore-arms* should be long, wide, and well muscled. The capacity of the animal to cover much ground at a step depends on the direction of the shoulders and the length of the fore-arms. Long sloping shoulders, upright arms together with long fore-arms, give much distance from the withers to the knee, which is considered very essential in animals of speed. The muscles should be well developed and stand out distinctly just below the junction of the leg and body and taper gracefully downward. The fat accumulates very little at this point, and it is a safe guide to the muscular development of the animal.

The *knees* should be wide, deep, and straight. They should be much broader in front than the rest of the leg, either above or below. Breadth is desirable because the concussion is more evenly distributed among the several bones forming the knee joint. The bone forming the projection at the back of the knee should be prominent, since this gives a better attachment for the muscles and tendons which pass over it, thereby giving the leg a deeper appearance and increasing the efficiency. The knees are subject to many defects more or less serious, such as calf knees, knock knees, spring knees, open knees, speed cuts, scars, and the like.

The *cannons* should be short, wide, clean, and the tendons well detached. The back tendons should be parallel to the cannon-bones, and there should be no shrinking below the knees, as it indicates weakness. This defect is spoken of as "tied in," and is quite common among light horses. The cannon should be free from bony growths and puffiness. Evidences of firing or blistering to remove such growths are series of lines on the cannons or roughened places caused by blistering. On running the hand over the cannons they should be free from gumminess, puffs, and bony growths.

The *fetlock* joint should be clean, free from fullness due to wind-galls, and should be wide, giving favorable attachments to the tendons.

The *pasterns* should be sloping and strong. When the horse is standing, they should form an angle of 45 degrees with the floor and 135 degrees with the cannons. The upright pasterns cannot resist concussion, and bone diseases, such as ring-bones, side-bones, and the like, are the result. Again, it lessens the usefulness of the light horse, especially the saddler, as the step is short and stilted and very disagreeable to the rider. On the other hand, the pasterns are sometimes too long and slanting, especially among thoroughbreds, which weakens them, and occasionally ends in snapping the suspensory ligaments, resulting in

the animal "breaking down." There should be freedom from wind puffs and bony growths, as in the cannon.

The *feet* should be round, dense, fine in texture, of good size, and perfectly sound. They should be of equal size and shape and in line with the pastern. The hoof should have an oily coat of natural wax, and should not appear flat, brittle, shelly, or contracted. The heel should be rather vertical and about one-half length of toe. The sole should be concave; the bars strong, and the frog large, elastic, and bear the mark of natural usage as a buffer. The dark-colored feet seem to be in favor.

The *ribs* should be well sprung from the spine, of good length, and well inclined to the rear. The well-sprung rib gives lung capacity, the deep rib gives digestive capacity, and the ribs well inclined to the rear add much to the strength of the back.

Body. — The back should be short, strong, and well muscled. The body should have a short back with a long underline which not only adds strength to the back, but gives the legs free play and insures freedom of movements. The long back, the roach back, and the sway back are all very objectionable.

The *loin* should be wide, short, thick, and strongly joined. This combination results when the ribs are directed well backward. If the distance from the last rib to the hip is great, the horse is likely to be weak in the coupling and irregular in his action.

The *croup* should be long, muscular, and fairly straight. The croup of light horses should be more horizontal than in heavy horses. This in connection with its length allows greater play of the main muscles, which is favorable to the production of speed. The short, oblique croup interferes with the utility of the light horse and detracts from the general appearance. While examining the croup, the hips should also be observed to see that they are of equal prominence and squarely placed.

The *thigh* should be muscular, long, and deep. It should be so situated as to extend the muscles as far down towards the

hock as possible, without giving the leg too straight an appearance. Some horses are so straight in this respect that the muscle extends to the hock, giving it a thick appearance. Horses show much variation in the muscling of the quarters; some are full and heavily muscled, some decidedly lacking and called "cat hammed," while others are fairly full in this region, with deep, hard muscles.

The *hind legs* from the thigh to the hock should be long, fairly straight, and well muscled, though they must not be too straight, thereby causing either thoroughpin or bog-spavin. On the other hand, if the legs are bent too far forward, it is likely to develop curb. The position of the croup and thighs, together with the long legs, should be such as to give length from the hip to the hock, as this is the conformation desired among animals of speed.

The *hocks* should be wide, properly set, and clean. They should also be free from gumminess, fleshiness, and puffs of all kinds, and the bone firm without the least indication of unsoundness. The bone forming the point of the hock should be prominent, since this gives a better attachment for the muscles and tendons which pass over it, thereby giving the hind leg a deeper appearance and increasing its efficiency. The hocks are subject to many defects more or less serious, such as cow hocks, capped hocks, open hocks, crooked hocks, and the like.

The *hind cannons* should be short, wide, clean, with tendons well detached and parallel to cannon bones, which gives better attachments and strengthens the cannon. Slender hocks and narrow cannons, especially at the top, indicate a predisposition to curbs on account of the weakness thus produced. The cannon should be free from all evidences of unsoundness.

The *hind pasterns* should be sloping and strong. When the horse is standing, they will be more upright than the front pasterns, and this is not so objectionable as there is less concussion on the hind foot, the weight borne being only four-

ninths that of the total weight, and in addition the hind limbs are not intended to break concussion as are the fore limbs.

The *hind feet* should be oval, dense, fine in texture, of good size, and perfectly sound. They are inclined to become narrow, the sides often appear sunken, leaving them rather flat, thus causing the foot to appear narrow. The hind feet should have the characteristics that have been described in the reference to the desirable points of the fore feet.

CHOOSING A HEAVY HORSE

In choosing a heavy horse, it must be borne in mind that the fatter the animal the more difficult it is to detect many of the defects which would stand out clearly were the animal not padded with a thick coat of fat. A horse in serviceable condition will often show many defects, especially in the body, that a thick coating of tissue will hide. By changing the food one can increase or diminish the size of the abdomen: thus by feeding food containing much bulk, the shape of the *narrow-gutted* horse is modified; by feeding concentrated foods, such as oats, the *cow-belly* can be made to disappear. By regulating the light in the stable and increasing the temperature, the coat can be made to assume brighter shades and to reflect a more brilliant luster. By removing or clipping the hairs scattered over the face, around the mouth, nostrils, eyelids, along the lower jaw; in diminishing the thickness and length of the mane and tail; in clipping the thick hairs along the cannons and pasterns; and finally in cutting the hairs on the inner surface of the ears, the apparent quality of the horse can be greatly changed and a rough, coarse animal can be made to take on a rather refined appearance.

General appearance in heavy horses

The same general method should be followed in examining a heavy horse as in the light, with the difference, that we place much stress on weight.

The form. — In form, the draft horse should be massive, compact, blocky, and low set. Power and not speed is the requirement, and in order to attain this the animal must be

FIG. 23. — CLYDESDALE STALLION "CALIPT." Second Prize, International Live Stock Show, Alex. Galbraith, Dixon, Ill.

The Clydesdale draft horse originated in Scotland. An active breed, though not so heavy as the Shire or so massive as the Percheron. In weight stallions average 1600 to 2000 pounds, the mares 1400 to 1700 pounds. The height ranges from 15 to 16¾ hands. Bay or brown with white on forehead and on the legs below the knees and hocks is the most popular color, though there are many blacks, grays, and chestnuts. As with the Shire, the long hair on the back of cannons below the knees and hocks is a breed characteristic.

close to the ground, strong, and heavy. In animals of speed we find long bones, long muscles, and slightly angular joints; in animals of strength we find heavy bones, heavy muscles, and a comparative freedom from angularity about the joints.

The weight. — Among draft horses, weight is a very important consideration; in fact, a horse must weigh at least 1500 pounds to be classed as a draft animal. Draft horses are divided into three classes according to their weight: light draft, 1500 to 1600 pounds; medium draft, 1600 to 1800 pounds; and heavy draft, 1800 pounds and up. This weight must be due to strong bone, heavily muscled, as well as to large proportions, and not the result of excessive fatness.

The importance of bulk is well illustrated in the case of the freight engine, in which the efficiency depends upon the weight to such an extent that engines are graded according to their weight; thus we have the hundred ton freight engine on a certain section of the road and the hundred and twenty-five ton engine on another section. The engine must have much weight to keep the wheels from slipping on the track. Such is none the less the case among draft horses. This is well illustrated in the rather common experience of the teamster whose team is stalled, and observing that the animals seem too light to push into the collar, conceives the idea of mounting one of the animals, when to his satisfaction they are able to pull the load. Illustrations of this principle are very common in parts of the country where the heavy cart is used in which the animal carries a part of the load on its back. It frequently happens with vehicles of this kind that when the animal is stalled, if a part of the load is moved forward so that a larger portion rests on the back, it can pull the load with comparative ease.

The heavy horse is in very great demand for draft work in the cities. In our large cities the busy streets have become so crowded that it is necessary for the traffic to move slow. This has led to the use of larger loads and fewer trips, whereas formerly more trips were made and the loads lighter. To draw these heavy loads requires heavy horses; thus within the past few years there has arisen a great demand

for the heavy horse. For this extra weight the market is willing to pay. It is estimated that the heavy horse is worth 50 cents a pound for each additional pound that it weighs over 1400 pounds. In other words, a thin horse weighing 1400 pounds and worth $200 would be worth $250 if put in good condition and weighing 1500 pounds.

The action. — While action in the heavy horse is not considered as desirable as in the lighter types, yet it should receive much attention. The walk deserves special notice since it is the principal gait of the draft horse. It should be observed in much the same manner as in the lighter types — from before, behind, and either side. The horse should lift the feet clear of the ground with much snap, and the stride should be regular. Observe the fore and hind legs to see if they work in unison. Horses with long backs and weak loins often drag their feet in a disconnected manner. Observed from behind, the movement should be straight away and regular. The hocks are often turned outward, or bent inward when raised, both of which are very undesirable. The flexion of the hock should be free and straight.

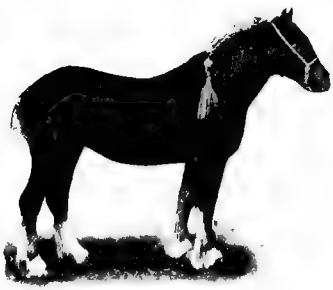

FIG. 24. — CLYDESDALE MARE. First Prize, International Live-Stock Show.

While action at the trot is not so essential as in light horses, yet the draft horse in trotting should go level, straight, and regular. The feet should be picked up with snap and carried clear of the ground. High knee and hock action is not essential, but a strong, full, true movement without paddling, dragging, or stiffness is very desirable. Good trotting action is not only valuable in itself, but it indicates many other

desirable qualities, such as temperament, conformation, and soundness.

Quality among heavy horses is as essential as among light ones, and the evidences are the same — clean-cut features, soft skin, silky hair, and clean, dense bone. The lines of the face will not be as clearly defined nor the veins in the skin show as prominently as in the light type. Quality is determined in the same way, and in running the hand over the cannon the bone should be flat, firm, and free from roughness and the tendons should stand out distinct from the bone. Among draft horses the mistake is sometimes made of considering small bone to be an indication of quality, which should be guarded against, as small bone is a very undesirable feature in a draft horse.

Detail characters of heavy horses

In considering the characters in detail among heavy horses the same general order should be followed as in the lighter types, in order that no character go unobserved. Only the differences are here pointed out, and those characters that are the same in both types are omitted.

The *head* should be lean and of medium size. The heads of draft horses are as a rule larger, fuller, and coarser proportionately than in the light type. Many of the breeds of draft horses have a characteristic Roman nose. The assertion is often made that small nostrils is associated with a Roman nose, and consequently the respiratory or breathing organs lack development; also that animals with very prominent Roman noses are self-willed. Both statements seem to lack sufficient evidence, and the opinion may owe its origin to a few observations made on Standard-bred animals. The nostrils, eyes, jaws, and ears should be observed as among light horses.

The *neck* should be short, strongly muscled, and massive. A well-arched neck is preferred. The neck of a draft horse is more horizontal than in horses of speed.

The *chest* should be deep, wide, and full. Its depth is about one-half height of horse. Horses slack in the heart girth are generally of weak constitution. Exceptional width in the chest is likely to result in rolling and paddling motion of the fore legs.

Shoulders. — Among heavy horses, the shoulder should be moderately sloping into the back and heavily muscled. The statement is made that upright shoulders give increased power, but such a conformation increases the concussion of the bones and may result in unsound limbs; it also increases the length of the back, which may result in weakness; and the step is short and the action stilted.

The *arm* should be short, heavily muscled, and sloping well to the rear, thus giving the animal a massive and low-set appearance.

Fore-arms. — Among draft horses, the fore-arms should be wide, heavily muscled, and large. As in the light type, the muscling affords a safe guide to the muscle development of the animal, as it is not padded with fat.

The *knees* should be broad and well defined. While the knees of heavy animals may not be as clean cut as among lighter horses, yet there should be a freedom from puffiness and gumminess.

The *cannon* should be short, wide, clean, and the tendons well detached. The Clydesdales and Shires have a fringe of hair, called "feather," starting from the knee and hock behind and extending to the fetlock. The "feather" often furnishes an index to the quality, as coarse hair is associated with coarse, thick skin, which indicates coarse, porous bone. On the other hand, fine, soft hair is commonly accepted as an indication of good quality.

Pasterns. — Among draft horses the pasterns should be sloping, strong, and of medium length. Horses of this type often possess pasterns that are too short and too straight. This conformation lacks springiness, the concussion comes more on the ends of the bones, resulting in ring-bones, side-bones, and the

like, also in a short stilted movement of the legs. Again, pasterns that are too straight often become more so with age, and the usefulness of the animal depreciates in proportion.

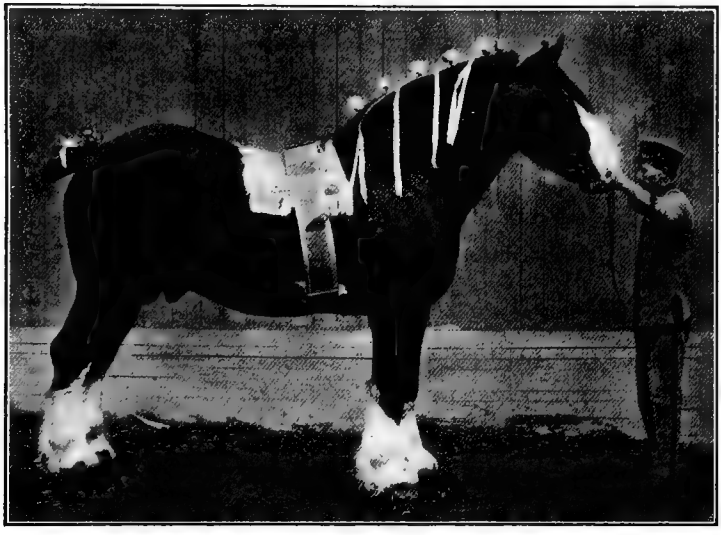

FIG. 25.—CHAMPION ENGLISH SHIRE STALLION "DAN PATCH." Trumans Pioneer Stock Farm, Bushnell, Ill.

The Shire draft horse was developed in England. This breed has long been noted as the "Cart Horse"; for heavy draft it is unexcelled. In size, Shires are equal to the largest stallions, ranging from 1700 to 2200 pounds, with the mares correspondingly less. In height stallions average from 15 to 17 hands. The preferred color is bay or brown with white on the forehead and on the legs below the knees and hocks. Grays, blacks, and chestnuts exist in abundance. Long hair on the back of the cannons below the knees and hocks is a breed characteristic.

The *feet* of the heavy horse deserve special attention, as sound feet are rather the exception. The feet should be round, dense, fine in structure, of equal size and shape, and perfectly sound. The hoof should be dark in color, and have an oily coat of natural wax. Common defects of the feet of heavy horses are:

soft hoof, dry and broken hoof, flat hoof, low or sloping heels, and large hoof.

The *body* should be short, the back broad, and the ribs well sprung, deep, and inclined well to the rear, thus giving a short loin, which should be broad and thick. The upright shoulder gives undue length to the back, which may become roached or sunken.

The *croup* should be broad, thickly muscled, and moderately sloping, although there is considerable difference in draft horses in this regard. A moderately sloping croup gives a favorable attachment of the muscles for the production of power. In some strains of draft horses, the croup is so very sloping that it detracts from their general appearance.

The *thighs* and quarters should be heavily muscled. The direction of the thigh should be such as to give the muscles the most favorable attachment for the development of power. This means perhaps that the lower part of the thigh should be inclined well forward, and that the leg should be moderately sloping from the thigh to the hock.

The *hock* of the heavy horse should be closely observed, for in this joint there is perhaps more work done than in any other single part of the body. The hock should be wide, properly set, and clearly defined. The tendons extending from the hocks downward should be lean and well detached, thus giving a deeper-appearing hock and a more favorable attachment of the muscles for developing power. Crooked, narrow, and tied-in hocks are subject to curbs, spavin, and the like. The hocks of draft horses are likely to be fleshy or gummy, thus indicating a liability to hock troubles and a general coarseness of the organization.

CHAPTER II

THE FEEDING OF ANIMALS — GENERAL DISCUSSION

THE economic feeding of farm animals involves a knowledge of the principles underlying the practice. The better knowledge one has of the food, its source, use, composition, and digestibility, the more familiar he is with the function of the various food materials, and the balancing of rations, the more intelligently can he choose the foods that constitute the ration.

FOOD

Food may be defined as any material that an animal can take into its digestive organs and from which it can absorb matter for the nourishment of its own body. Plants and their products and by-products constitute the food of farm animals, although some farm animals are in part carnivorous, feeding on other animals or parts of animals. Matter is transferred directly from the food to the tissue with or without chemical or physical change. Materials is not, however, the only thing the animal gets from the food. The plant during growth absorbs heat from the sun, which is held in latent form in the plant compounds. When these compounds are taken into the animal body and broken apart by digestion, some of this stored heat may be transferred to energy. The animal therefore gets from the food both matter and energy.

Use of food. — The matter and energy the animal collects from the food are put to three distinct uses: first, to support life; second, to reproduce life; and third, stored up in some

form. The animal must maintain its existence, and for this both energy and matter are required. A large part of the energy of the food goes to the maintenance of the body temperature. The body temperature of farm animals is considerably above that of the surrounding atmosphere, and its maintenance requires much heat, as the body is continually giving off heat. The body tissues become worn out and must be constantly renewed. This must be supplied by the matter and energy from the food. In the case of young animals, there is a constant formation of new tissue. This requires more matter than energy. Again, the muscular function of vital processes require much energy, which must be supplied by the food. Of the total amount of food that an animal will ordinarily consume, a very large proportion goes to support life and a small amount to production.

Composition of food. — The value of a food depends, among other things, on its composition. There is a tendency to ignore the fact that a food should be considered with reference to its composition. It is assumed that a pound of timothy hay, for example, is equivalent to a pound of clover hay, when as a matter of fact their composition is such as to make them widely different, so that one will not take the place of the other. The number of compounds found in the food is very large, and many of them very complex in their nature. For convenience in comparing foods, these compounds are grouped into classes. These classes are few in number, easy to comprehend, and serve the purpose well from a practical point of view. We recognize five distinct groups, one of which is divided into two sub-groups. They are as follows: —

1. Water			Dry-matter
2. Ash (mineral compounds)			
3. Protein (nitrogenous compounds)		Nutrients	
4. Carbohydrates	Crude fiber		
	Nitrogen-free extract		
5. Fats			

It is customary to group together all the substances of a food

except the water, and to speak of them collectively as dry-matter, and not with respect to their total weight. Ash is also eliminated, and the remaining three constituents are called nutrients. Each of these groups has its part to perform in the nutrition of animals, the function of one being different from the others. There are a few foods containing these several constituents in the proper proportions to meet the needs of the animal, but in most foods there is an excess of one and a deficiency of the others. This makes it desirable to add two or more foods of different composition in order to supply the proper balance for the best development of the animal.

Water. — Water is present in all foods, even the driest. It varies widely in different foods, running as low as 8 or 10 per cent in the case of grains or concentrates, such as corn, oats, or cotton-seed meal, and dried brewers' grains, to 85 or 90 per cent in the more watery foods, as silage, roots, tubers, and the like. Even dry hay varies considerably in this respect, alfalfa containing as low as 9 per cent and some clovers as high as 20 per cent. Water not being a nutrient, its presence or absence is an important factor in determining the usefulness and therefore the value of a food.

Ash. — Ash or mineral matter is present in all plant food, although it forms but a small part, shelled corn containing only 1.5 per cent, and alfalfa, one of the highest, containing only 8 per cent. The leaves and the region of the germ in grain contain the most ash. The animal secures the ash from the food directly by transfer. Most plants contain sufficient ash to meet the needs of the animal, corn and certain prepared foods being the only exceptions. In young animals, because of the large bone development that is taking place, in milk and egg production and the like, it is of special importance to have sufficient mineral matter supplied by the food.

Protein. — Of the three nutrients — protein, carbohydrates, and fats — the protein is considered to be the most important. This is perhaps due to two factors; first, protein is absolutely

essential to the animal body, and second, the percentage of protein is relatively small in most plants. Like the other nutrients, the protein group contains carbon, hydrogen, and oxygen, and in addition it also contains nitrogen, which is the characteristic element of the entire group. It is on the element nitrogen that the importance of this group depends. Protein enters largely into the composition of the bones, muscle, lean meat, white of egg, and the curd of milk. The only source from which the animals can procure this protein is the protein of the food.

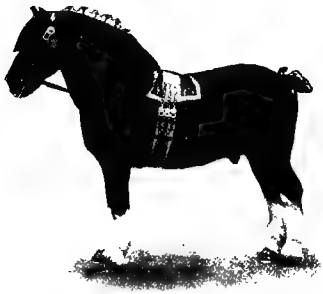

FIG. 26. — CHAMPION ENGLISH SHIRE STALLION "MAZEMORE HAROLD."

The amount of digestible protein in various foods varies within rather wide limits, corn containing only 8 per cent, while cotton-seed meal runs as high as 32 per cent, but the larger number of food materials contain rather small amounts of protein. There are comparatively few foods that are relatively rich in protein. The value of the food turns very largely on the protein which it contains. Protein is not, however, as digestible as some of the other nutrients.

Carbohydrates. — There are two sub-groups of carbohydrates — nitrogen-free extract, and crude fiber. The carbohydrate group contains carbon, hydrogen, and oxygen, but no nitrogen. The nitrogen-free extract is composed largely of starches and sugars, and constitutes the larger part of the dry-matter of most plants. Starch alone forms as much as 75 per cent of the dry-matter of corn, wheat, potatoes, and some other foods. It is easily digested, more so than any of the other three constituents, and therefore foods rich in nitrogen-free extract are ordinarily

classed as most readily digestible. Fiber or crude fiber constitutes the tough woody part of plants. The stems of all plants contain more fiber than does the leafy part. Variation in the digestibility of foods depends largely on the amount of crude fiber, which is mostly insoluble and hence largely indigestible. Crude fiber is the least valuable of the four nutrients, because of its indigestibility. Young plants contain less crude fiber than plants that have matured and formed seeds, and hence are more digestible.

Fat. — Plants also contain fat or oil. It occurs in largest quantities in the seed, and varies widely, running less than 2 per cent in rye to 30 and 35 per cent in flaxseed. Fats like carbohydrates contain carbon, hydrogen, and oxygen, but no nitrogen. The oil content of food is determined by extracting the fat by ether; hence in tables giving composition of food the fat is often designated as ether extract. A given weight of fat will develop $2\frac{1}{4}$ times as much heat energy as an equal weight of carbohydrates. If we multiply fat, therefore, by $2\frac{1}{4}$, it reduces it to the starch or carbohydrate equivalent. Fats are not so readily digested as nitrogen-free extract.

Functions of various food materials

A knowledge of the function of the various food materials will enable one to choose and balance a ration more economically, and to adapt it to the needs of the animal. A very satisfactory ration for a race horse may be entirely inadequate for a dairy cow.

Water. — The water of the food takes the place to a certain extent of the water that an animal would otherwise drink. In the case of food containing a large amount of water, the total consumption of water by the animal will be greater than otherwise. Watery foods will not, however, satisfy the animal in this respect, as it will still drink water. In many cases the large consumption of water is of advantage to the animal; this is

particularly true of the dairy cow, which, in addition to the water needed for her own body, secretes large amounts in the milk. The animal body requires much water, particularly the younger ones; their bodies are more than 50 per cent water. Again, water adds succulence to the food, which increases its palatability. The great importance of an abundance of good water for all animals is often underestimated.

Ash. — The ash or mineral matter is chiefly used in the formation of bone, but also to some extent in the tissues, blood, digestive fluids, and the like. Young animals fail to develop if given no mineral matter, and mature animals become weak and inactive if deprived of only one substance, that of common salt. Hogs, if closely confined and fed on corn alone, are likely to be weak-boned because of the lack of mineral matter in the food. If to the corn ration some food rich in mineral matter, such as alfalfa, or even wood ashes, is added, no difficulty is experienced. Hens always require more lime than is found in the food. This is strikingly illustrated when we compare the composition of eggs and corn, for example, the former containing 12.2 per cent ash, the latter only 1.5 per cent. The ash in the food of the milk cow also deserves special consideration on account of phosphoric acid, lime, and potash so abundantly found in the milk which she secretes. In short, the ash or mineral matter in the food of all animals, young and old, deserves much consideration.

Protein. — So far as is known, the proteids of the food are the only source of the proteids of the body. In other words, the muscles, the connective tissues, the blood, the skin, the hair, the horn, the hoofs, and the larger part of the tissues of the secretive and excretive organs owe their formation to the protein of the food. Since these are the tissues that largely determine the vigor and quality of the animal, and since they are formed rapidly in the early stages of growth, a normal and continuous development demands an abundant supply of protein food. In addition to this, protein is a source of fat and can serve as fuel, or

as a source of energy. The amount appropriated as fat and energy depends on the quantity fed to the animal. A pound of protein, however, is worth more than a pound of carbohydrates on the market. Then to use protein substances largely as a source of fat and energy, where cheaper substances would do fully as well and perhaps better, as we shall presently see, is not economical. On the other hand, if the protein in the food is insufficient fully to supply the needs of the animal, the very best development will not be attained. The economy of feeding, therefore, depends largely on the balance between the protein on the one hand and the remaining nutrients on the other hand. It is to secure sufficient protein and yet not to use it wastefully that so much attention is given to the proper balancing of a ration.

Carbohydrates. — Carbohydrates are used to maintain heat and in the production of fat. Formerly it was thought that carbohydrates are used for that purpose only, but it is now well established that the animal fats may have their source in the carbohydrates. Again, experiments with milk cows show clearly that milk-fat may also be derived from carbohydrates. The fact that carbohydrates can be used as heat-producers and as fat-formers, connected with their ease of digestion and cheapness of production, tends to magnify the importance of this group of nutrients.

Fat. — Fat, like carbohydrates, serves as a source of heat and of animal fat. The differences are that the supply of carbohydrates is much the larger, and the heat value of a similar weight of fats much the greater, — as we have already seen $2\frac{1}{4}$ times as great. Moreover, there seems to be experimental evidence showing vegetable fat to become deposited in the animal without change, whereas fat formed from carbohydrates involves complex transformation.

From the foregoing statements, it is evident that the water taken into the animal serves as the water of the animal body.

The ash or mineral matter taken in serves as the mineral matter of the animal body. The protein acquired may serve a threefold purpose; it must serve as the proteid supply of the animal body, as, so far as known, there is no other source; it may serve in heat production; and it may serve as a fat-former. The carbohydrates serve a double purpose, that of heat-production and fat-forming. The fat serves a similar purpose as the carbohydrates — forming fat and producing heat — and is $2\frac{1}{4}$ times as efficient as the carbohydrates.

DIGESTIBILITY OF FOOD

The value of a food depends on the digestibility of the various materials of which it is composed, and not alone on its composition as shown by a chemist. Because of the importance of the digestibility of the various food materials, and in order to get a clear conception of digestion, it will be necessary to review briefly the process through which the food materials must pass on their way from the food as such to the flesh or energy of the animal body.

Digestion. — The process of digestion is largely a process of solution, aided to a certain extent by chemical changes that take place through the influence of various ferments with which the food comes in contact as it passes through the digestive tract. The digestive organs form a canal through the body, and the food in its passage through this tract or canal is acted upon by various fluids. Each fluid has a special work to do in the process of digestion. To begin, the food is taken into the mouth, where it is reduced to fine particles in order that the digestive juices may better do their work and to put it into condition to be swallowed. During this mastication there is a digestive fluid, called saliva, poured upon the food, which moistens it and changes a part of the starch. After leaving the mouth the food passes down the esophagus into the stomach, where the digestive fluid, called gastric juice, is poured upon it and which changes a

part of the protein. When the food leaves the stomach, it enters the small intestines, where it comes in contact with two digestive fluids — the bile from the liver, and the pancreatic juice from the pancreas. The bile prepares the partly digested food for the action of the pancreatic juice and changes the fats. The pancreatic juice has a more complex function. It contains at least three distinct ferments, one changing the proteids, another the starch, and the third the fats. As the material passes along the intestines it comes in contact with a juice secreted by the walls of the intestines and which acts upon the starch, but there is no action on the proteids or fats. From the time the food enters the stomach, during its entire course along the digestive tract, in some way not wholly understood, the digested food has been absorbed and received into vessels, through which it is distributed to the various parts of the body. A part of the food materials, however, in passing through the digestive tract, escape digestion. The amount of food digested depends on the kind of food, the amount fed, the class of animal, and on the condition of the animal's health.

FIG. 27. — WRYDELANDS "SUNSHINE," CHAMPION SHIRE MARE.

Size of digestive organs. — The length and capacity of the digestive organs of the various farm animals differ widely. Among ruminating animals, — those capable of re-chewing the previously swallowed food, — the cow, sheep, and goat, the stomach is a very complicated organ. It has four divisions or sacks called paunch, honeycomb, many-plies, and rennet. The paunch is very large and may be considered as a reservoir for the storage of bulky foods. Because of this provision, ruminating animals can be fed on foods containing much more bulk than can

the pig or horse. The food during its retention in the paunch becomes thoroughly softened and undergoes some fermentation, then it is re-chewed,—called chewing the cud,— and swallowed. The stomach of the horse and pig is a single sack and has not nearly so much capacity.

The varying length of intestines and capacity of stomach in farm animals is illustrated in the following table: —

Length of intestines and capacity of stomach of farm animals

Animals	Capacity, Quarts		Total	Length, Feet Intestines
	Stomach	Intestines		
Horse	19.0	204.8	223.8	98.1
Cow	266.9	109.8	376.7	187.2
Sheep	31.3	15.4	46.7	107.3
Hog	8.5	20.5	29.0	77.1

It requires three to four days for food to pass through the digestive tract of farm animals. Since animals of the same class and in good health are fairly uniform in the amount of material they extract from a given class of food, it is practicable to make digestion trials to determine the amount of the various food materials digested and to use these figures as a basis of computation for all animals of the same class.

Digestible nutrients. — Digestible nutrients are those parts of food materials that are digested and appropriated to the animal's use. Our knowledge of the amount of the food materials that are digested is based on experimental data, and while not absolutely accurate, is sufficiently so for practical purposes. The method of determining the digestible nutrients is as follows: The animal is fed for a sufficient length of time on a certain food or combination of foods, so that the digestive organs contain only the food under test. Then for a certain length of time the animal is fed a carefully weighed allowance of some

food, the composition of which has been previously determined by a chemist. Provision is then made for collecting all excreta. By making an analysis of this waste matter, the undigested protein, carbohydrates, and fat are found. This, deducted from the total in the food, gives the digested part. The amount of each constituent digested divided by the total in the food gives the percentage digestible. This is called the "coefficient of digestibility." The grains are more highly digestible than the coarse fodders; for example, in corn the protein is 76 per cent digestible, the crude fiber 58, the nitrogen-free extract 93, and the fat 86 per cent digestible, while in timothy hay the protein is 56 per cent, the crude fiber 58, the nitrogen-free extract 63, and the fat 57 per cent digestible.

Among the various food materials the carbohydrates as a rule are the most digestible, running as high as 95 per cent in case of corn, while the crude fiber is the least digestible, and between these lie fat and protein. In general the fat is more digestible than the protein. As a rule, the digestible coefficient falls when large amounts of foods are used. If we crowd the consumption of food, the animal does not digest it as thoroughly as it would if fed smaller amounts. On the other hand, we cannot secure a greater digestibility by limiting the consumption. Animals under a starving ration do not digest any more than when fed a normal amount.

Having the composition of the food as determined by the chemist, and the digestible coefficient as determined with the animal, it is an easy matter to calculate the amount of digestible nutrients in the various food-stuffs. It is with the digestible nutrients, and not the total food materials, that the feeder is concerned in choosing a ration. A great deal of work has been done at the various experiment stations to determine the digestibility of food-stuffs. For ready reference Table II, showing the amount of digestible nutrients in a large number of foods, is published in the Appendix of this manual.

CONDITIONS INFLUENCING DIGESTION

The changes that the food undergoes in the digestive tract during digestion are beyond the control of the feeder. They proceed in accordance with fixed laws. The feeder, however, can manipulate the food or change the conditions under which it is fed so that the completeness of digestion is modified.

Palatability. — In the case of most foods, anything that adds to their palatability will promote digestion. While an agreeable flavor or taste adds nothing to the energy of a food, the more it is relished the greater will be the flow of the digestive juices, the more thoroughly the food will be acted on by them, and the more completely the nutrients will be dissolved and digested.

Palatability, therefore, is an important factor in feeding, as it promotes a more vigorous action on the part of the digestive organs, which result in a more complete digestion of the food.

Time of harvesting. — The effect on digestibility of the time of harvesting plants is great. The time to harvest a plant so as to get the maximum amount of digestible material will depend much on the part of the plant that is to be used for food. In the case of hay, much of the food material is transferred from the stalk to the seed as the plant ripens. These seeds are so small and hard that they are not digested by the animal; hence hay that is cut when ripe is not so digestible as that cut before the seeds ripen and while the food materials were yet in the growing parts. Again, the riper the plants the more crude fiber they contain, and this we have already seen is mostly undigestible. In the case of corn, it is the seed that is used as food, and in this case the plant should not be harvested till the food materials have passed from the stalk into the seed. Therefore hay plants, or those plants of which the stems and leaves are used, should be cut when green, and grain plants, or those plants of which the seeds are used, should be cut when ripe.

Grinding the food. — Grinding certain kinds of foods promotes digestion by increasing the surface exposed to the action of the

digestive juices. It is a well-known fact that when grain is fed whole, many entire grains pass through the tract. Grinding also saves the animal the energy of crushing the grains. Many experiments have been conducted, comparing the feeding of ground grain with whole grain, with the results in favor of grinding. The profit from grinding grain hinges, in part at least, upon the relation of the cost of grinding to the loss from not grinding. If the cost of grinding amounts to one-tenth the value of the grain, the probability of profit from grinding is small.

Curing food. — The method of curing food may result in a loss of a part of the digestible nutrients. The mere curing, drying, or preserving of food will not alter its digestibility. If, however, hay is cured under adverse conditions, such as exposure to rain and the like, when leaching occurs, or fermentation sets in, or when many of the finer parts of the plants are lost, then the digestibility is very much lessened.

Various processes, such as wetting, steaming, cooking, fermenting, and the like, are used with the several foods preparatory to feeding, with the view of rendering them more acceptable to the animal. When increased efficiency occurs, it is due to more complete digestion rather than to added nutritive value. It has been fairly well proved that cooking renders some parts more undigestible, particularly the protein. On the other hand, cooking certain foods changes the mechanical condition so they are more readily eaten. The advantage of cooking is greater for swine than for any other class of animals. The addition of water, in the form of wetting, soaking, or even steaming, is often advantageous because it increases the palatability and to a certain extent restores the succulence that the food lost in drying. The addition of salt will cause an animal to eat food that it would otherwise reject. The presence or absence of agreeable vegetable oils is a matter to be considered. It is difficult to understand why animals will readily eat clover and alfalfa hay, but

reject sweet clover, and why weeds, which often impart a bad flavor to the product, are sometimes readily eaten.

MAINTENANCE RATIONS AND PRODUCTIVE RATIONS

A ration may be defined as the quantity of food that will be consumed by an animal weighing one thousand pounds in twenty-four hours. In forming rations, it is necessary to take into account the purpose for which the animal is intended. For a given purpose an animal will require a given amount and kind of food. Thus a one-thousand-pound cow yielding twenty pounds of milk per day will require a certain kind and a certain amount of food. This is called a standard ration. For convenience of study, rations are divided into two general classes, — rations for maintenance and rations for production.

Maintenance rations. — A maintenance ration is one that supplies the needs of a resting animal without producing any kind of labor and with no loss or gain of body substance. We have already seen that a certain amount of the food consumed by the animal goes to support life, maintain body temperature, repair waste tissue, and to provide muscular activity of vital processes. Since the demands on the body for maintenance are largely for the production of muscular energy and heat, nine-tenths or more of the maintenance ration may consist of carbohydrates. This fact has much significance in the wintering of idle animals. Strictly speaking, no farm animal should be fed only a maintenance ration. Animals receiving maintenance rations are yielding no product. All farm animals should be producing something at all times.

Productive rations. — Productive rations may be looked upon as made up of two parts: that which is needed to maintain the animal, and that which may be applied to production after the bodily needs have been supplied. It is the food consumed in excess of the amount required for maintenance that enables the animal to produce. The question, then, is as to the quantity of

food the animal will consume and make sufficient returns for in production. The more an animal consumes in excess of the amount required for maintenance, the more it can produce. While it is true in a sense that the amount of production is in proportion to the amount of food consumed in excess of that required for maintenance, it is only within rather narrow limits that this relation holds strictly true. The individuality of the animal plays an important part. All farm animals will eat and digest more food than is required for maintenance, but the amount of product that comes from this excess of food is very variable, and in many cases this makes the difference between a profitable and an unprofitable animal as well as a successful and an unsuccessful feeder. This variation among individual animals is so great that standards for production can be used only as mere guides. The economical and profitable feeding of farm animals depends much on the feeder's observations of the animals directly in charge, to determine their capacity for the use of food.

Feeding-standards for farm animals. — A feeding-standard is a rule to which all rations should conform for a given purpose. The Germans have done much work in establishing such standards, which have long been in general use as guides in computing rations for farm animals. There is now, however, a prevailing impression among American investigators that these standards call for more protein than is needed for best results. Under conditions as they exist in this country, a reduction of the protein seems advisable, although just how much it is impossible to say. A reduction of 10 per cent has been recommended as not unreasonable.

BALANCED RATION

A balanced ration is one that contains the food nutrients in the proper proportion to meet the needs of the animal for a given purpose. Skill in balancing a ration depends much on one's knowledge of the composition and digestibility of the more

common foods. It is not now considered necessary to balance rations with the mathematical exactness that was formerly in vogue. Yet it must conform in a general way to the standard. A great number of experiments demonstrate conclusively the practicability of feeding the balanced ration. Balancing rations is, however, a tedious undertaking, as there is no mathematical formula, and one must add to or take from his trial ration until the desired standard is obtained.

Nutritive-ratio. — The nutritive-ratio is the proportion between the digestible protein in a given food and the digestible carbohydrates and fats. It is ascertained in the following manner: Multiply the digestible fat by $2\frac{1}{4}$, add the product to the digestible carbohydrates, and divide their sum by the digestible protein.

The method of calculating the nutritive-ratio of corn, the digestible nutrients of which are protein 7.9, carbohydrates 66.7, and fat 4.3, is as follows: —

Fat		Heat Equivalent		
4.3	×	2¼	=	9.67
		Carbohydrates		
9.67	+	66.7	=	76.37
		Protein		
76.37	÷	7.9	=	9.6

Nutritive-ratio 1 : 9.6

This gives a nutritive-ratio of 1 : 9.6 for corn, and it means that for each pound of digestible protein in the corn there are 9.6 pounds of digestible carbohydrate and fat equivalent. A nutritive-ratio may be distinguished as "narrow" or "wide." A narrow ration is one in which the proportion of protein is quite large, say 1 : 4.5, whereas a wide ration is one where the carbohydrates are large, say 1 : 8 or 1 : 10. These terms do not represent exact values, but are used in a general way.

To illustrate the method of calculating a ration for a given

purpose, we will assume the case of a horse weighing approximately 1000 pounds and at moderate work. From the discussion on food requirements for the horse, p. 57, we learn that the standard ration is as follows: —

Dry-Matter	Protein	Carbohydrates	Fat	Ratio
24.0	2.0	11.0	0.6	1 : 6.2

Let us choose from Table II of the Appendix such foods as will supply the conditions. For a trial ration, we will take 14 pounds of timothy hay, 10 pounds of oats, and 2 pounds of bran. The digestible nutrients in these are calculated as follows: —

Calculation of dry-matter and digestible nutriments in trial ration for a horse at medium work

Timothy Hay		Oats	
In 100 Pounds	In 14 Pounds	In 100 Pounds	In 10 Pounds
86.8 ÷ 100 × 14 =	12.152	89.0 ÷ 100 × 10 =	8.900
2.8 ÷ 100 × 14 =	0.392	9.2 ÷ 100 × 10 =	0.920
43.4 ÷ 100 × 14 =	6.076	47.3 ÷ 100 × 10 =	4.730
1.4 ÷ 100 × 14 =	0.196	4.2 ÷ 100 × 10 =	0.420

In like manner, calculate the digestible nutrients in two pounds of bran and arrange the result in tabular form as follows: —

First trial ration for 1000-pound horse at moderate work

Food	Dry Matter	Digestible Nutrients			Nutritive-Ratio
		Protein	Carbohydrates	Fat	
14 lb. timothy	12.125	0.392	6.076	0.196	
10 lb. oats .	8.900	0.920	4.730	0.420	
2 lb. bran .	1.762	0.244	0.784	0.054	
First trial ration . .	22.787	1.556	11.590	0.670	1 : 8.3
Standard .	24.000	2.000	11.000	0.600	1 : 6.2

This trial ration falls considerably below the standard in dry-matter and is too wide. We must therefore add a food rich in protein. We will try one pound of linseed meal, old process: —

Second trial ration for 1000-*pound horse at moderate work*

Food	Dry-Matter	Digestible Nutrients			Nutritive-Ratio
		Protein	Carbohydrates	Fat	
Ration as above . .	22.787	1.556	11.590	0.670	
1 lb. linseed	0.908	0.292	0.327	0.070	
Second trial ration . .	23.695	1.848	11.917	0.740	1 : 7.0
Standard .	24.000	2.000	11.000	0.600	1 : 6.2

The second trial ration is still slightly too low in dry-matter and protein, and somewhat too wide in the ratio. From these trial rations we learn the method of calculating ratios. The standard only serves as a general guide from which to estimate; then one must adapt the ration to suit his conditions. It often happens, as in our trial ration for the horse, that one will have an excess of certain nutrients and it will be of advantage to feed it even though it is not quite so well balanced because of the expense of making the change; in the case above one would have to dispose of food containing much carbohydrates and procure one rich in protein.

In cases, however, where there is a great departure from the standard, it would pay to make the change, as has been proved by many experiments at the various experiment stations and by the experience of our successful stockmen.

Other methods of computing rations. — There are two other methods of computing rations for farm animals; one is somewhat simpler than the above and the other much more difficult. In the former the ration is computed on the total amounts of

nutrients. A 1000-pound cow yielding 22 pounds of milk requires 29 pounds of dry-matter, of which at least 16 pounds should be digestible and 2 to $2\frac{1}{2}$ pounds should be digestible protein. The ration is calculated simply on the digestible matter and the protein. The other method of computing rations for farm animals is by the use of energy values of the food. In this method one must know the energy values of the various constituents; also amount of energy required to produce a unit of whatever is wanted. In other words, it is essential to know the energy required to produce one pound of beef, pork, mutton, or milk. Knowing the energy of the food and the energy required for production, the ration is calculated accordingly.

FIG. 28. — WRYDELANDS "STARLIGHT," CHAMPION SHIRE MARE.

Using balanced rations. — The nutritive-ratio may vary from the standard without serious results. Milk cows have produced good results on rations with a nutritive-ratio as wide as 1 : 8, and horses have fared well on rations with a wider nutritive-ratio. Much depends on the individuality of the animal, the conditions, and the individuality of the feeder. It must be remembered that no rules can be given that will apply in all cases, and that our feeding-standards are guides and not laws.

CHAPTER III

THE FEEDING OF HORSES

FEEDING the horse presents a problem of as wide interest as any in connection with farm animals. Practically all farmers, whatever branch of farming they may be engaged in, have occasion to feed horses. In addition to farmers, commercial firms of various kinds keep horses in large numbers, business men and sportsmen keep many horses for pleasure, all of whom have a deep interest in methods of feeding as well as the proper food. The farmer, the business man, and the sportsman each derive much pleasure in having their horses presentable at all times. The farmer's relation to his horse may not be the same as that of the sportsman, but his interest is as great and his care as painstaking.

FOOD REQUIREMENTS FOR WORK

The work horse may be compared to a steam engine in which such foods as grain and hay serve as fuel, but it differs from the engine because fire and steam are not used to convert the fuel into work or energy. In the horse the food is converted into energy in a different way.

It is of interest to note that the horse makes better use of the energy in the food than does the steam engine of the energy in the fuel. It appears that about one-third of the total food energy can be converted into useful work with the horse, while the steam engine may recover as much as one-tenth of the energy contained in the fuel.

Many experiments have been made to determine the exact relation between the amount of muscular work performed and the

amount of nutrients required per day. And as a result of such work the following standards have been suggested: —

Wolff-Lehman standard showing the amount of food required per 1000-pounds live weight for horses at light, medium, and heavy work

Condition of Animal	Dry-Matter	Digestible Nutrients			Nutritive-Ratio
		Protein	Carbohydrates	Fat	
Light work . .	20	1.5	9.5	0.4	1 : 7.0
Medium work .	24	2.0	11.0	0.6	1 : 6.2
Heavy work . .	26	2.5	13.3	0.8	1 : 6.0

These standards were arranged to meet the need of the average horse under normal conditions. They are to serve as guides, to be modified to meet conditions, and not as laws, fixed and absolute.

Regularity in feeding. — The importance of regularity in everything that pertains to the management of the horse cannot easily be overestimated. This applies particularly to feeding. Whatever feeding-stuffs are employed in the ration, the horse should be fed regularly and uniformly at all times. The horse anticipates the feeding hour, and becomes nervous if it is delayed. He neighs and coaxes for his food with great regularity. The horse's digestive system and his vital activities become accustomed to a certain order, which should be followed. To change the order for even a single meal produces more or less digestive disturbance. The horse's digestive system is not so large proportionately as that of a cow or sheep; he has no rumen, no place to store his food to be masticated at will; hence, when at work the horse must be fed regularly and often. Undue fasting is followed by taking an excessive supply of food, which in turn calls for excessive drinking with consequent digestive difficulties.

Order of supplying food. — Because of the small size of the horse's stomach, the order of supplying grain, hay, and water

assumes much importance, Investigators have shown that the stomach of the horse must fill and empty itself two or three times for each meal given. It appears that during the fore part of the

FIG. 29.—BELGIAN STALLION "ROBUSTE DE THIENSIES." Imported by J. Crouch & Son, Lafayette, Ind.

The Belgian draft horse is a native of Belgium. This breed varies widely in weight and height, stallions from Flanders weighing 2000 pounds, those from Ardennais weighing about 1200 pounds, with the height varying accordingly. In color chestnuts are the most popular, although bays, browns, and roans are numerous. The Belgians lack the heavy hair on the limbs possessed by the Shires and Clydes.

meal the material is pushed into the intestines almost as soon as it enters the stomach by the food which follows, while toward the end of the meal passage is slow and the digestion in the stomach more perfect. This being true, it would seem that the

more nutritious foods should be fed toward the end of the meal, especially since some of the very important nutrients are largely digested in the stomach and at the entrance of the small intestines.

Watering the horse. — Many feeders think that the horse should be watered before feeding, while others are equally certain that feeding should precede watering. Each of these methods is probably equally good for the horse, and the one employed will be determined by circumstances. Certain conditions may make it necessary to adopt one, other conditions the other. For example, after severe loss of water, such as occurs in consequence of long-continued, severe exertion, the animal may perhaps be allowed to drink before he is fed, otherwise he will not feed well. On the other hand if permitted to drink to excess, this method of watering affects the appetite, and the horse will not consume so much food as he otherwise would. Again, it has been very clearly demonstrated that if a horse is fed his grain first and then watered, much of the food is carried by the water into the intestines. Since the grain of the ration is rich in digestible nutrients, it should stay in the stomach as long as possible, since the digestion of one of the most important of the nutrients is more complete there. From this it would seem that the horse should be given water first of all, and that should be followed by hay, the grain being withheld until at least a part of the hay has been consumed. There are, however, very serious objections to this practice, as the horse is unsatisfied, is anxious, and very nervous till fed his grain, and should not be compelled to wait for the grain. A middle ground should be taken by watering first, feeding the grain sprinkled with a small allowance of moistened, chopped hay, if possible, and watering again after the ration has been consumed. If this practice is followed, it will satisfy the desires of the horse by supplying the most palatable part of his food early, and yet insure the retention of the grain in the stomach for a considerable time.

Salt in limited quantities should be kept before the horse at all times. While little is known from investigations on this subject, it is evident from the extreme fondness of the horse for salt that it should be regularly supplied him. It is best not to place too much before him at a time as some horses will eat it to excess.

The successful horseman will study each individual and modify the ration according to the varied needs; one horse should have a little more than the regular allowance, and the next possibly a little less, because some horses are more difficult to keep in condition than others doing the same work and under similar conditions.

In handling horses we should remember that they are very sensitive animals and that we cannot be too quiet in our treatment of them. Striking them or shouting commands at them is an inconsiderate practice; it causes the animals to lose confidence in their master, thereby rendering them less teachable, and destroys nervous energy, making them less economical producers than if they were protected at all times from these nervous shocks.

FEEDING THE WORK HORSE

The work horse has a very hearty appetite, a vigorous digestion, and responds more readily, than any other animal, to intelligent care. He should be fed liberally and frequently, the quantity given being regulated by the size of the animal as well as the amount and kind of work he is required to do. In general, the horse should be supplied with something over two pounds of provender daily for each hundred pounds of weight. Of this about two-thirds, the exact quantity depending on the severity of the labor performed, should be grain in some form. If the work is exceedingly heavy, the grain in the ration should be increased and the hay diminished; whereas, if the work is light, the grain should be diminished and the hay increased. The morning meal should be comparatively light, consisting mostly of grain. It should not possess much bulk. In many of

the larger stables in the city the mid-day meal is omitted. But most horsemen hold that some grain should be given at noon, which seems reasonable from our knowledge of the horse's stomach. In any case, the mid-day ration should not be large.

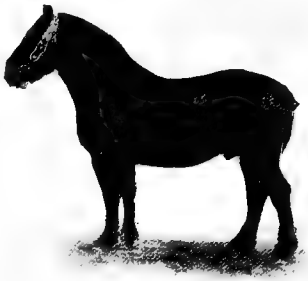

Fig. 30.—Imported Belgian Stallion. Three years old.

The heavy feeding should come at night, after the day's work is over and when the animal has ample time to masticate and digest his food. A very good practice is as follows: For the morning ration, feed one-fourth of the daily allowance at least one hour before going to work. It should be in condition to be easily and rapidly consumed, so as to be well out of the way when the animal is led from the stable. After being watered, he is ready for the morning's task. If the work is exhaustive and exacting, he should be fed after five hours of labor. When he comes to the stable at mid-day, he should have a drink of fresh, cool water, taking care that he does not drink too rapidly or gorge himself if very warm. At this time give him another quarter of his daily allowance. No greater service can be rendered the horse at this time than to remove the harness so that he can eat his meal in quiet and comfort and gain a few minutes of much-needed rest. If possible, he should have one hour to consume his meal. He should be watered again before going to work. He is now ready for the second half of his day's labor. When the horse comes to the stable in the evening, tired and warm, he should, first of all, be allowed a fresh, cool drink, care being taken as before that he does not drink too rapidly. He is now ready for the remainder of his day's allowance. Unharness at once, and when the sweat has dried, give him a thorough brushing. If for some reason the horse is forced to stand idle

in the stable for a few days, the ration should be decreased. Otherwise he will become stocky and his legs become swollen and stiff.

During cold weather a more carbonaceous ration may be used. When more food goes to furnish heat for the body, it is reasonable that a horse needs a large proportion of heat-making food. Equal parts of corn and oats by weight would be more satisfactory and ordinarily much cheaper than a larger proportion of oats.

FIG. 31.—A GOOD FARM TEAM OF GRADE BELGIANS. WEIGHT 3500 POUNDS.

In providing a ration, whether for summer or for winter use, due consideration should be given to the cost. Roughage is ordinarily much cheaper than grain, but a horse at work is unable economically to dispose of a large proportion of bulky food. If considerable time and energy must be expended in masticating rough feed, the usefulness of the horse for work is lessened thereby. The more concentrated the food, within proper limits, the less percentage of energy will be needed to make it available. The proportion of grain to roughage depends on the amount and kind of work to be performed. A horse at hard work should

never be expected to consume more roughage than grain by weight.

FEEDING THE DRIVING HORSE

The driving or carriage horse is more difficult to keep in condition than the work horse. The periods of enforced idleness, occasioned by lack of business engagements of his master or by inclement weather, are often followed by long drives and hours

FIG. 32. — A DRIVING TEAM OF SPIRIT AND GOOD FORM.

of over-exertion. This irregular work weakens the constitution of the driving horse, which generally has but a brief career. When daily driving cannot be practiced, underfeeding is considered the safe course.

In feeding this class of horses, the same general plan that has been suggested for the work horse should be followed. When

the horse is not taken from the stable during the day, the concentrates, or grain part of the ration, should at once be reduced by one-third and the normal allowance should not again be given until the work is resumed. Driving horses are usually overfed, because of the desire of the owner to keep them in the pink of condition. This overfeeding and irregular exercise are the cause of most of the ills of the driving horse. Oats leads easily among the grains. When it is fed, the horse exhibits mettle as from no other food. If at any time the animal should seem constipated, a bran mash should be given. Timothy is the preferred hay. While a certain amount of roughage must be fed to give bulk or volume to the ration in order that the digestive functions may be properly maintained, yet we must remember that a large abdomen cannot be tolerated in a driving horse. Another factor that the feeder of this class of horses must ever be on his guard against is the feeding of laxative foods, such as clover or alfalfa hay or bran, in too large quantities, for when the horses are put on the road and warmed up, they will prove very draining on the system as well as disagreeable to the driver. Style and action are prerequisites, while economy in feeding and sometimes the health of the animal are held to be but secondary. Professional drivers may not be the safest persons to advise on feeding.

WINTERING THE IDLE HORSE

On the average farm most of the work comes during the growing season. It is more economical, and perhaps advisable, that the idle horse be turned into a lot, if it is well protected, to be roughed through the winter rather than confined too closely in the barn. As winter comes on the horse will grow a heavy coat of hair, which will afford excellent protection. Such a horse may be maintained wholly or nearly so upon hay, oat straw, or corn fodder, as it has time to masticate food, and not being taxed by labor, it is able to subsist on food containing a large

percentage of crude fiber. It is better to have the digestive tract of the idle horse well distended with coarse material rather than contracted, as would be the case if grains possessing only the requisite nutrients were supplied. If the protected area is kept dry and well bedded, the horse can be comfortably wintered in this way at much less expense than by stabling. Some grain should, however, be fed at shedding-time, even if the horses are idle. Light grain feeding, together with some work, should begin six weeks before the spring work starts, to put the horse in condition.

FEEDING THE BROOD MARE

Many farmers are so situated that they may raise a team of colts each year without seriously interfering with farm operations. This is a good practice, as there is a demand for good horses for both city and farm use. A team of mares in foal can be worked until the day of foaling if the work is not too severe and the driver is careful. In fact, moderate exercise is necessary for the mare in foal. Idleness is the bane of horse-rearing, and should be avoided whenever possible. The Arabs have a saying, "Rest and fat are the greatest enemies of the horse." Mares in foal should be fed much as suggested for work horses with perhaps the addition of more protein foods, as bran and oil meal. The ration should be such as will supply the demands for energy and in addition allow abundant nourishment for the development of the foal both before and for a time after birth. A very good ration for the pregnant mare is as follows: Four parts ground oats, four parts wheat bran or its equivalent, and one part linseed meal, with bright clover or alfalfa hay for roughage.

Pregnant animals have a tendency to fatten as pregnancy advances. This must be guarded against as the mare may become so fat as to interfere with the development of the foal, cause abortion or other troubles at parturition, such as milk-fever and the like. The ration of the mare should be reduced

just before and for a short time after foaling. If she is constipative, bran mash may be given occasionally. By the use of proper foods the bowels should be kept in good condition and they should be a little loose, rather than otherwise, at the time of parturition. While the mare may be worked up to the time of foaling, she should be given a few days rest after foaling to enable her to gain her strength and give the foal the proper start. For the first few days of recuperation a hot bran mash fed once a day has both a cooling and a laxative effect on the mare, and it is very beneficial. If all has gone well with the mare and foal, the mare may be put to work at the end of one week from the time of parturition. Some dams, especially those with their first foals, fail to supply the proper amount of milk, and the young foals do not thrive. In this case the mare should be provided with food which stimulates the milk flow. Corn and timothy hay fed alone are not good milk-producing foods. The ration suggested for the pregnant mare is better, and it could be much improved if a little succulent food were fed with it, such as carrots.

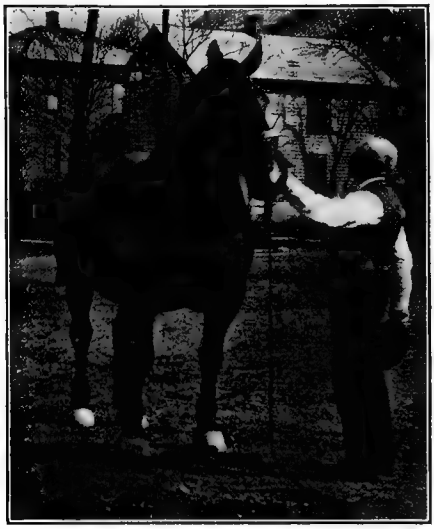

FIG. 33. — BLACK PERCHERON GELDING, FOUR YEARS OLD. WEIGHT 2460 POUNDS. Ready for market. Fed by H. D. Snyder & Sons.

When in season, good pasture grass is best. If there is an oversupply of milk, or if the milk is too rich, the food may be restricted

and the mare milked, in part, by hand; otherwise the foal will not do well.

FEEDING MULES

Mules should be fed similarly to horses. The statement is often made that a mule requires less food than a horse to do a given

FIG. 34.—A PAIR OF WELL-BRED MULES. Photograph from *National Stockman and Farmer.*

amount of work. Such is not the case. True, a mule is less likely to overfeed and gorge himself than a horse, and will make

use of coarse foods that the horse will not eat unless forced to do so by neglect. Mules are often preferred by large business concerns, not that they consume less food for a given amount of work than a horse, but that their feeding can be trusted to less skillful hands without seriously endangering the mule's health. If an extra large mess is given him, he eats what he wishes and leaves the rest; not so with the tired horse, as he will eat all the grain that is given him up to the point of seriously endangering his health. For best results the ration of the mule should be comprised of easily digested and nutritious feeds which should be varied from time to time as no animal loves a variety better than the mule. The ration should be suitable to the kind of work. For light work a small quantity of grain and a relatively large quantity of hay is best, but when the work is severe and exacting, the quantity of grain should be increased and the hay decreased. As among all other farm animals there is much difference in individuals, and the successful feeder will make a careful study of each and modify the ration accordingly, as some should have a little more than the regular allowance, others less. In all essential features the mule is very similar to the horse, and what we suggested for horses applies with equal force to mules.

SAMPLE RATIONS FOR THE HORSE

The following rations are collected from various sources and furnish a guide in determining the kind and amount of feed that should be allowed the horse under various conditions: —

Animal and Work	Weight of Horse	Ration	
		Grain	Roughage
Colt, weaning time		2 lb. oats	Hay *ad lib.*
Colt, one year old		4 lb. oats	Hay *ad lib.*
Colt, two years old		6 lb. oats	Hay *ad lib.*
Colt, two years old in training		8 lb. oats	Hay allowance limited
Colt, three years old in training		8–10 lb. oats	Hay allowance limited
Race horse		15 lb. oats	6–8 lb. hay
Hunter, small		12 lb. oats	12 lb. hay
Hunter, large		16 lb. oats	10 lb. hay
Cavalry horses	1050	12 lb. oats	14 lb. hay
Artillery horses	1125	12 lb. oats	14 lb. hay
Heavy draft	2000	12 lb. oats 3 lb. corn 6 lb. beans	15 lb. clover hay
Farm work			
Farm teams, east	1220	8 lb. oats 6 lb. corn 2 lb. bran	10 lb. hay
Farm teams, east	1230	8 lb. corn 7 lb. bran	10 lb. hay
Farm teams, east	1170	8 lb. oats 6 lb. corn 2 lb. bran	10 lb. hay
Farm teams, east	1175	7 lb. bran 7 lb. corn	12 lb. corn-stover
Farm teams, east	1000	2½ lb. bran 4¾ lb. corn 8¾ lb. dried Brewers' grains	6 lb. hay
Farm teams, east	1180	6.55 lb. corn 5.45 lb. linseed meal	8 lb. hay
Farm teams, west	1235	11.5 lb. oats	14.7 lb. alfalfa hay
Farm teams, west	1870	5 lb. bran 5 lb. shorts	25 lb. alfalfa hay
Farm teams, west	1385		19.7 lb. alfalfa hay
Farm teams, west	1420		32.6 lb. alfalfa hay

CHAPTER IV

THE BREEDING OF ANIMALS, IN GENERAL

THE breeding of farm animals is perhaps the most interesting problem connected with their propagation and care. While farm animals have been undergoing improvement from the time that we have authentic history, it is only within the last one hundred years or so that very great progress has been made in their improvement. During this period practically all of our breeds, as we now know them, have been formed, and great differentiation has taken place in the production of the various classes. Only recently have we paid much attention to the milk-producing capacity of our cattle, although cattle have been kept for milk since the beginning of history; only recently have we selected horses for strength, though they have been used in war and sport for four thousand years; and the same is true of all the specialized breeds. Formerly, breeders had no system of selection. Their standards constantly changed, so that no real progress in the development of the most valuable qualities could be made.

Shortly after the middle of the eighteenth century, Robert Bakewell of Dishley Grange, Leicestershire, England, originated a system which he practiced in the improvement of Leicester sheep, Long-horn cattle, and the English cart-horse. His method was taken up and successfully practiced by other men; and we now have as the result of their labors a variety of improved breeds, each differing from the others in the particular characters for which they have been selected and that adapt

them to special conditions and purposes. Thus we have a strain of cattle that, having been selected from generation to generation for their milk yield, have become so profuse in the secreting of milk that we call them by a certain breed name. The object sought being milk yield and through several generations selected for this one purpose, the ability to secrete a large flow became fixed and capable of transmission to the offspring. This increased milk flow is not to be understood as a new character, as all cows give some milk, but merely an increase in the ability to secrete milk in large quantities.

Like produces like. — Everything brings forth after its kind. In order that the offspring be a high-producing heifer, it is necessary that the dam and sire before her be of a high-producing strain of cattle. In other words, the offspring will bear a close resemblance to the parents in all important essentials. This Bakewell recognized, and he shocked the modest people of his time by uniting animals that possessed the characters he wished to propagate without regard to the relationship of the animals. If a cow and her son possessed the characters he wished to retain, he united them, and in this way secured an offspring possessing the desirable characters to a greater degree than either parent. It has been said of Bakewell that he regarded his animals as wax out of which in time he could mold any form that he desired to create. All farm animals have been molded to a great degree by man. It is now thought that the Percheron draft horse and the Shetland pony have descended from the same original type of horse, and that the Shorthorn and the Jersey descended from the same type of cow. In one case there was a continuous selection, whether natural or artificial, for a large animal with the result that to-day we have the ponderous draft horse; in the case of the pony the selection was for the smaller animal with the result that we have a diminutive horse. This selection has been going on for ages, and now the two types are fixed under their present conditions. Bear in mind, however, that a reversal of the con-

ditions might result in a reversal of the type. In other words, if one wished to enlarge the Shetland ponies all he need do is to feed them abundance of nutritious feed and unite the largest to the largest in breeding and in time they would no longer be known for their small size. On the other hand, if one wishes to retain the small size of the pony, or to diminish it still farther, all that need be done is to restrict the food and unite the smallest to the smallest in breeding. The same is true of any character one wishes to propagate. From this it can be readily observed that we have two forces operating. The first is that like tends to produce like, and the second that if any improvement is brought about, it is through variation.

VARIATION IS THE BASIS OF IMPROVEMENT

If characters were absolutely fixed and unchangeable, then no improvement could be secured. The size of the pony could neither be increased nor diminished and the milk flow of cattle would remain constant from generation to generation, and the offspring would be no better than the parent. Variation, then, is the basis of improvement among farm animals.

Variation universal among farm animals. — No two animals are alike. To those unfamiliar with swine, each pig of a litter may look exactly like the others, yet the trained eye readily recognizes differences and can describe each so that those with equal training may recognize them. These differences extend to all characters. Two cows of the same breed may differ widely in the richness of their milk; two steers of like breeding differ widely in their ability to fatten and the beef may also differ, the loin of one being fine and tender while the other may be coarse in grain. Of two sheep of the same breed, one may possess wool of bright luster, fine crimp, and even throughout; the other may have wool rather coarse, no crimp, and differ much in various parts of the body. There is free variation among living things.

Kinds of variation. — Since variation extends to each character, it may aid us in a clearer understanding of variation among farm animals if we consider the subject from four points of view. First, we will consider that variation may be expressed only in form and size. This is quantitative variation, having to do with degree only. Such variation is the simplest form, and we observe evidences of it on every hand. For example, of two horses of the same breed, one may be large, the other small; on the same animal one foot may be larger than the others; the two ears may not be of the same size; one eye may be larger than the other. Between two dairy cows of the same breed, one may have a very large, well-proportioned udder, the other small and irregular in shape. Illustrations of the first class are without number. The second class of variation is that which is expressed in the quality, as distinct from form and size. This is qualitative variation; that is, having to do with characters only. Evidences of this are also abundant. For example, of all the cows in existence, no two yield milk containing the same amount of fat; in fact, the individual cow varies widely from day to day in the percentage of fat contained in the milk. Again, no two pieces of beef are exactly alike in flavor, tenderness, juiciness, and the like. The quality of no two horses is alike, — one has coarse, rough hair and a thick hide, the other has smooth, soft hair and a smooth, pliable hide. The third class of variation has to do with the function or with the activity of the various organs and parts of the body, such as muscular activity, glandular secretions, and the like. There are many examples of this, such as variation in the milk flow, some cows yielding as high as 128 pounds in a single day; variation in the fertility, some cows producing only four or five young in their lifetime, while the Angus cow Old Granny (No. 1 of the Angus Herd Book) produced twenty-five, the last one in her twenty-ninth year; variation in speed, scent, and in fact all functions. The fourth class of variations has to do with deviations from

the pattern, especially as regards repeated parts, such as extra toes, extra teats on swine, and the like. This class is not so common among animals, but evidences are everywhere observed among plants, as stooling in wheat, oats, corn, and the like. It

FIG. 35. — SUFFOLK STALLION "RENDLESHAU SORCER." Three years old.

The Suffolk draft horse, a native of Suffolk County, England, is a very massive, short-legged breed, possessing clean legs and a docile, teachable disposition. In weight the stallions vary from 1400 to 1900 pounds and the mares from 1200 to 1600 pounds. The height varies from 15 to 16½ hands. The breed color is chestnut, varying from a bright to a dark shade.

is familiar in the doubling of flowers, in which the parts may be much repeated.

It will be comparatively simple to recognize variation and to make improvement in any of the breeds of farm animals if these

classes of variation are kept clearly in mind. Not all kinds of variation are desired. The qualitative variations are most sought.

PROXIMATE CAUSES OF VARIATION

The conditions that bring about variation are worthy much consideration since one, by modifying these conditions, can aid in producing variation in a desired direction. For example, if we want to increase the milk flow of cattle, the conditions that will cause them to vary in that direction are of much importance and should be well understood. In general, variation results from environment, from crossing dissimilar animals, and from use or disuse, all of which are under the control of man.

Environment. — Of all the external conditions bringing about variation in farm animals, those influences that we sum up under the term "environment" are by far the most important. As a matter of fact, it is through the ability to change the environment of animals that man is able to induce variation and improvement. Among animals in a state of nature, we define environment as those conditions of climate and food that concern the life of the animal. Among farm animals the conditions of environment are somewhat changed or enlarged, and we are accustomed to think of it as the sum of all of those conditions that are influenced through association with man. The chief factors of environment through which man seeks to control or improve farm animals are those of climate, food, and care. The environment means the "surroundings."

The *climate* and the kind of animals that exist in it are closely related. The characters that are most often affected are those that have to do with size and the external covering of the animal. The natural relation of climate to size is that animals inhabiting cold climates are usually small as compared with those of the same species inhabiting warm climates. Man modifies the natural effect of climate through the housing that he affords farm

animals; hence he can move animals from one climate to another without serious results. Many animals show ease of acclimatization to wide changes of climate.

Climate has a marked effect on the external coat of the animal. When farm animals are exposed to cold, damp weather, the hair becomes longer and thicker than if protected. This heavy coat is produced at the sacrifice of flesh. In some instances the exposure produces a double coat of hair, an upper one being long and wavy and an under one short, fine, and fur-like. The Galloway cattle furnish a good illustration.

The *food supply* is of prime importance in effecting variation and improvement among farm animals. In general, full feeding increases size. No other conditions influence development to a greater extent than the food supply. Large breeds are developed from small ones largely by increasing the food supply. In addition to the increase in size, there is also an increase in the constitutional vigor when the animal is well fed. Withholding the food supply not only arrests development but weakens the capacity for future development as well. Thus it is that animals passing through such periods of arrested development may never attain the development which they otherwise would reach. In order to secure increased development—development of productive function—the animal must be supplied with more food than is required for the performance of the normal function. Again, there is a correlation between the food supply and the kind of product. The Islands of Great Britain have developed more high grades of flesh-producing animals than any other country, and we find nutritious pastures over almost all of that country.

The *care* that farm animals receive will go a long way towards determining the extent of variation they are likely to undergo. Farm animals that are well cared for, that is, properly housed, fed, watered, groomed, exercised, and the like, cannot fail to respond to such treatment. Many a man has fallen short of

success in breeding by depending upon blood alone for improvement of his stock. He has forgotten that all of our improved breeds are the product of adequate nutrition combined with intelligent breeding, suitable environment, sufficient shelter, and kindly care.

Crossing. — The uniting of dissimilar animals is another cause of variation. Up to the time of Bakewell, cross-breeding was one of the chief means by which improvement was sought. This was before the time of pedigree books, and crossing was made easy from the fact that no record of the breeding was kept. It was also observed that the uniting of two animals that were unrelated, or that had existed under different environment, resulted in increased constitutional vigor and in many cases in greater prolificacy, and often individual improvements. The great difficulty came when they attempted to breed these cross-bred animals. The offspring of cross-bred animals varied widely, some were good, more poor, and no one could foretell which way the offspring would tend to develop. While crossing is a cause of much variation, the results are usually disappointing in the end. The fact must be recognized, however, that the abundant crossing practiced by the early British breeders gave to the animals a plasticity of conformation that prepared them for quick improvement when subjected to the Bakewell method.

FIG. 36. — SUFFOLK MARE "BAWDSEY PEARL." Three years old.

SELECTION

The purpose of selection is to modify the type to suit our purpose, to prevent as far as possible the production of unde-

sirable individuals, and to encourage the production of those individuals that meet the demand. In choosing farm animals for breeding purposes, there are at least three factors to be taken into consideration: First, the perfection of the individual as a representative of its race or type, or the individual merit of the animal as a specimen; second, the capacity of the individual to reproduce itself or to show improvement, or the pedigree of the animal; and third, the suitability of the two individuals to be mated.

Individual merit. — It is often a question as to whether we should pay more attention to the individual merit of the animal or to its pedigree. It cannot be said that they are equal, or that one is more important than the other. There are two general principles in this connection that should always be borne in mind: the offspring of an inferior individual with a good pedigree is very likely to possess merit; many of the offspring of a superior individual with a poor pedigree will, in all probability, be distinctly inferior in merit. In other words, no matter what the individual merits of an animal may be, unless he has inherited these qualities equally from his ancestors, we cannot expect him to transmit them with any degree of certainty.

Pedigree. — The capacity of the individual to reproduce itself or to show improvement depends much upon his ancestors; that is, upon his pedigree. Pedigree is a record of the ancestry of an animal; it furnishes, therefore, a guaranty of the purity of the stock. The book in which such records are kept is called a herd-book. The mere fact that the lineage of an animal is known, is a certain indication of the quality of the animal, but this fact does not indicate the capacity of the individual to reproduce itself. The knowledge of the individual quality of the animals making up a pedigree is an important factor. Characters will be transmitted in proportion to the degree with which they have become fixed in the parents. We are accustomed to

associate great length of pedigree with high breeding quality. Historical evidence goes to show that we place too high value on extreme length of pedigree. Many of our pure breeds that

FIG. 37.—HACKNEY COACH STALLION "FOUNDATION." Owned at Maplewood, Attica, N. Y.

The Hackney coach horse originated in England, in the counties of Suffolk, Norfolk, and York. This breed is noted particularly for style and high action. In height there is much variation. There are Hackney ponies under 14 hands, Hackney cobs that are larger than the ponies, and Hackney coaches over 16 hands, the weight varying accordingly. Chestnut is the most popular color, although bays, blacks, browns, and other colors are of frequent occurrence. This is the most popular breed of coach horses when high-stepping action is desired.

show a high tendency to reproduce their characteristics have secured these qualities from a comparatively short line of animals noted for their breeding qualities. It would be difficult to trace the actual influence of the parents back of the fourth or fifth parents, in a number of cases. It is the individuals making up the pedigree for the last four or five generations that are of great influence in giving any individual the power to transmit qualities; and if all of the individuals constituting the pedigree for these generations have the qualities that we recognize as good, we may count upon the animals transmitting their qualities with such a degree of certainty that it makes little difference what the individuals were back of that point.

Of late there has been much discussion as to the part each ancestor contributes in the total heritage. Galton was one of the first to answer this question. While he answered it with much hesitation, his suggestions received considerable support and have come to be known as "Galton's Law of ancestral heredity." Galton set forth the idea that one-half of the full heritage comes from the parents; one-fourth from the grandparents; one-eighth from the great grandparents; one-sixteenth from the great, great grandparents, and so on to infinity. This being true, an offspring will procure $\frac{31}{32}$ of its full heritage from the five nearest generations of ancestors.

In selection, the performance of the animal, when available, as it is in race horses and dairy cows, should also be considered. The record of performance affords very valuable information as to what the offspring will probably be like. When breeding dairy cows, if one unites two animals of low-producing strains, as shown by the records, his chance of procuring a high-producing result are not very great. On the other hand, if one unites two animals of high-producing strains, as shown by the records, his chance of procuring a high-producing offspring are very good, although not sure, as there may be a certain influence of the heritage from the very early ancestors whose records were not so

good. There is no factor of more use than the record of performance, although some breeders push it to an extreme. If one wishes to increase the performance, he must select the individuals upon their performance rather than on fancy. If animals are selected, however, wholly by performance, without regard to form, we are likely to lose the best conformation.

There is another reason for selecting animals with a pedigree and a record of performance, which is entirely a commercial one. Animals registered in a herd book and that have a record of performance back of them are more likely to reproduce themselves and will command a higher price in the market; and there is always a good market for such stock, as the supply is limited.

Mating. — In selecting animals, we must consider the suitability of the two animals to mate together. We have already seen that no two animals are alike, and since two animals are essential in the reproduction, the offspring can never be exactly like both parents. We must strike an average between the characteristics of the parents and what we expect to get in the offspring. As compared with its parents the offspring of two individuals will fall into one of the following three classes: First, a perfect combination of the qualities of both parents; this is called breeding true. Second, a preponderance of characters of either parent; this is called prepotency; and third, the offspring may exhibit none or few of the characters of either parent; this is called reversion.

Fig. 38. — Hackney Stallion "Fandango M." Owned by A. R. Gillis.

When the offspring shows equal blending of the qualities of

both parents, the mating is considered to be most successful. At the same time it is almost never fully attained. It is approached in proportion to the similarity of the parents. Uniformity of type and characteristics in a herd or flock is one of the very desirable things, for many reasons. The uniformity that is secured by reason of the equal degree of characters secured from each parent is the most desirable type of uniformity.

More often the offspring will resemble one parent more than the other, and in this case one parent is said to be prepotent over the other. This resemblance will vary from a very slight preponderance of the characteristics of one parent, up to a great over-balance, amounting almost to a complete exclusion of the characteristics of the other parent. This question of prepotency is one of the most important having to do with selection, and one which will be further discussed in the chapters on breeding the various classes of farm animals.

When the offspring shows no resemblance to either parent, but to some near ancestor, it is called *reversion;* if to some of the far removed ancestors it is called *atavism:* Examples are often seen: as, in the case of a pure Angus cow, which is naturally black, giving birth to a red calf; the case of Poland China swine, naturally black, occasionally possessing a sandy tint on the hair.

Two animals to be suitable for mating must be alike in general physical characters. Otherwise the outcome of a union cannot be foretold. When the offspring shows good qualities, the mating of the parents is considered a fortunate nick. The history of farm animals is full of such nicks. The success or failure of a stock breeder very often depends on his ability to discover these nicks and to make use of them. Some breeders become very skilful in these matters, even though they may not be able to give reasons for their choice or to instruct others in the same methods. Very often these are untaught and unread men.

HEREDITY

For our purpose, we will define heredity as the transmission or passing down of characters from parents to offspring. We have already noted two great forces underlying our breeding operations; like tending to beget like, which has to do with heredity; the other the great run of variation through which improvement is sought in our farm animals. On heredity all successful breeding operations depend. We have just noted the kinds of variation, as well as the causes that lead to their appearance, and now come to the question *whether* and to *what extent* such variations are hereditary or transmissible to the offspring.

The extent to which these variations are transmitted is a very important matter, because variations that are not retained are of no importance in breeding, though they may be of much consequence to the individual possessing them. If they are transmitted, they influence the race for good or bad, depending on whether desirable or undesirable. Practical men work on the supposition that these variations or so-called modified characters are transmitted. All recognize the necessity of the highest development of the individual for the specific purpose for which it is intended. If one is to breed the best kind of beef animals, he must unite animals of the best beef strains. If one is to breed the highest class of trotting horses, he must unite horses that can trot fast. If one is to produce cows yielding a high milk flow, he must unite animals with high records of performance. Working breeders are universally of this opinion. All of our improved breeds of animals are comparatively recent. It is difficult to see how we could have secured such development in so short a time, unless it came through the inheritance of modified characters.

Inheritance of disease. — In all of the early writings on heredity, there is much discussion on the heredity of disease, and

nearly every disease has at one time been classed as transmissible. In a good many cases, diseases seem to pass from generation to generation with regularity or even certainty and are often classed as hereditary diseases, whereas the facts are that such troubles are germ diseases and are due to infection. Again, there are diseases peculiar to certain conformations, such as a curb or a spavined hock on the horse. The peculiar conformation may be hereditary, and the animal contracts the disease because of the conformation, but the disease as such was not transmitted. The results are the same, but it is best to state it correctly.

Prepotency is the power that one parent has over the other in determining the character of the offspring. It is usually considered from two points of view; first, "race" or "breed" prepotency, when all the individuals of the race or breed are possessed of such power in transmitting their characters; and second, "individual" prepotency, when the individual possesses the power to transmit its own characters to the offspring to the exclusion of the other parent.

Breed prepotency is clearly exhibited when two distinct breeds are crossed, as the offspring will more clearly resemble one breed than the other. Among cattle, the Galloways are noted for being prepotent in color and in the polled character, for when crossed upon other breeds, the offspring are nearly all black and hornless. The Herefords are prepotent in transmitting their white face to the offspring when crossed on other breeds.

Individual prepotency is a very great factor in breed improvement. Many of the modern breeds of farm animals owe their existence to the individual characters of the animal that founded the line. Hambletonian 10 among trotting horses is an example. He sired horses who in turn sired animals of great speed, with the result that most of the Standard Bred horses trace either directly or indirectly to Hambletonian 10.

Again, the breed of American saddle horses owes much of its excellence to the individual prepotency of Denmark. The families of the various breeds of farm animals that owe their existence to the individual prepotency of the animal that founded them are almost without number, such as the St. Lambert family descended from Stoke Pogis, 1259, and the Eurotas family descended from Eurotas, 2454, among Jerseys; the Johanna family descended from Johanna, 1421, and the De Kol family descended from De Kol 2d, 734, among Holsteins; the Perfection family descended from Chief Perfection, 32144, and the Corwin family descended from Tom Corwin 2d, 2037, among Poland China swine.

Since prepotency is of so great importance in improvement among farm animals, those influences that tend to produce it in the individual are worthy of note. While many of the factors surrounding prepotency are not well understood, yet those that do aid and are under the control of man are: purity of breeding, strong constitutional development, and in-breeding. Purity of breeding strengthens prepotency in individual as well as in the breed or race. It strengthens prepotency because it makes for stability. The introduction of outside animals becomes a disturbing factor in the stability of the characters of the individual and therefore a disturbing factor in the certainty of transmission. On the other hand, each generation of pure breeding adds to the stability of the type and to the certainty of transmission.

Vigor in the individual is a very important factor when selecting for prepotency. This is sometimes lost sight of, as in selecting hens for high egg production when nothing but production is considered, and always with serious results, for without vitality all else will fail.

In-breeding aids prepotency, for it strengthens dominant characters. The more inbred the animals the more intense their power of transmission. This applies, however, to good

and bad characters alike, and will be discussed in the paragraph on in-and-in breeding (p. 92).

These three factors acting in conjunction, and when properly manipulated, give the highest degree of prepotency attainable, and all are under the control of the breeder.

The prepotency of the male is given more consideration than of the female. This is due to the fact that it is more noticeable, as the sire is the parent of many more animals than the dam. A stallion may sire fifty or more foals in a year, whereas the dam can give birth to but one. This is a fortunate view of the matter, since improvement can be much more cheaply brought about through a good sire from the mere fact that he is represented in more progeny.

Prolificacy or fecundity. — For our purpose we will assume that these terms have the same meaning, and that they refer to the fruitfulness or the number of young brought forth. This is a very important consideration in practical operations. Breeds vary widely in this respect, it being a characteristic of some to give birth to more than they can raise, whereas others are not so fruitful. Under "functional variation" (p. 73) we have noted the Angus cow Old Granny (No. 1 in Angus Herd Book). She produced twenty-five calves, the last one in the twenty-ninth year of her life. Old Fanny Cook, the English Thoroughbred mare, produced fifteen foals, giving birth to twins at twenty-two years of age. The Thoroughbred mare Pocahontas also produced fifteen living foals and lived to the old age of thirty-three years. In this connection it is interesting to note the number of performances some of the leading males of the various breeds have sired. Among Holstein cattle, the bull Hengerveld De Kol, 23,102, is the sire of ninety-eight daughters with advanced registry records; Paul Beets De Kol, 22,235, of ninety-three; and Lord Netherland De Kol, 22,187, of eighty-nine. The Jersey bull Exile of St. Lambert has ninety-four daughters in the Register of Merit. Among Standard

Bred (trotting or pacing) horses the stallion Gambetta Wilks, 4659, has two hundred and four standard performers; Onward, 1411, has one hundred and ninety-eight; Allerton, 5128, has one

FIG. 39. — "DECORATEUR," FRENCH COACH STALLION.

The French coach horse is a native of France. This breed is similar to the Hackney, but possessing more bone and substance and lacking much of the flashy action. In weight stallions vary from 1100 to 1400 pounds, with mares 100 to 200 pounds lighter. The height varies from 15 to 16½ hands. Bays and browns are the most popular colors, although there are many blacks and chestnuts.

hundred and ninety; and there are more than a score with over one hundred. The importance of this high fertility, from a profitable point of view, need not be dwelt upon.

In these cases much depended upon the opportunity. The better the sire the better will be the class of dams offered and hence the better the offspring, all of which leads to further opportunities. Another fact in this connection well worth remembering is that imported animals are seldom fertile until acclimated. In general, distance makes less difference than altitude, temperature, sunlight, and food supply.

Sterility. — One of the breeders' greatest difficulties is sterility among animals. The causes which lead to sterility are very many, some of which are well understood and are more or less preventable, while others are not so well understood and beyond control. If due to the male, then all the females put to him will be sterile, whereas if due to the female, she alone fails to breed. Some of the causes that can be easily controlled are as follows: confinement and lack of exercise; irregular supply of food and lack of uniformity in conditions; food lacking the proper nutrients or containing too much sugar; animals in too fat condition; and in-and-in breeding, close breeding, excessive breeding; and the like. Again, the tendency to sterility or lack of fertility is often hereditary. The Duchess family among Shorthorns affords a good example. This family was always known as "shy breeders," and this was considered one of its valuable attributes. The breeders argued that this diminished the numbers and kept the price very high. The results were that this most excellent family of Shorthorns disappeared because of its infertility.

Relative influence of parents. — No question in the breeding of farm animals has given rise to more discussion than the influence that each parent exerts on the offspring. As one reviews the literature on the subject, he collects the following ideas: the male controls the external and the female the internal organs of the offspring; the male controls the forward and upper parts of the body and the mental qualities of the offspring; that parent which has the stronger nervous and

sexual organization controls the characters of the offspring; the female controls the characters because of her close association with the offspring; and so on, almost without number.

So far as is now known, the parents play an equal part in their control of the characters of the offspring. This, of course, is aside from the question of prepotency discussed above, and in which case either parent is likely to dominate over the other. In general, that parent possessed of the purer breeding and whose characters are the most intensified and most stable, will control the characters of the offspring, be it male or female.

SYSTEMS OF BREEDING

The system of breeding to be employed will depend on the purpose of the breeder. In the breeding of farm animals the breeder has one of two objects in view, — the one herd improvement, the other breed improvement. These purposes are separate and distinct. In herd improvement, the object is the betterment of the individual herd. It is perhaps the cheapest and most convenient of all forms of breeding and productive of the most rapid results. In breed improvement, the object is the betterment of the entire race. It is perhaps the most expensive, and calls for much intelligence on the part of the breeder as well as much patience and painstaking labor.

Grading consists in mating unimproved farm animals with those more highly improved or with those that are purely bred. The pure-bred may be either sire or dam, but for economic reasons the sire is usually the pure-bred parent. This mode of breeding can be used only in herd improvement, and is the one to be recommended to the great mass of stockmen; and if it could be generally adopted and followed, it would add millions to American agriculture. It is the safest for beginners even though they intend to engage in the business of breeding pure-bred animals, as it will bring out clearly the strong and weak points of the breed, and after becoming familiar with the

work they may undertake the breeding of pure-bred animals with much better prospects of success.

The great advantage of grading is that it is cheap, particularly when accomplished with the male. For example, a pure-bred bull, in a herd of twenty-five cows, will make half-bloods of the entire crop of offspring, whereas if the grading was attempted in the other way, it would require twenty-five pure-bred cows and the calves would show no more improvement. Furthermore, if the improvement were accomplished with the cows, it would be in twenty-five lines, each with its shade of difference, and not in one line as would be the case were the grading done with the bull. This is a very important factor when we consider the value of uniformity among all classes of farm animals.

Crossing, as we have seen (p. 77), consists in mating two distinct breeds or families, and is a powerful means of inducing variability. Because of its strong tendency to produce variation, crossing is very seldom employed as a system of animal breeding. Attention is directed to it in this connection because it is the mode employed in breeding mules, the offspring of a jack and mare. The reciprocal cross, or the stallion on the jennet, gives an offspring called hinny. It is interesting to note that the mule more nearly resembles the jack, having long ears, large head, no hairs in mane and tail, and very small feet, whereas the hinny resembles the stallion, having a rather small head, rather short ears, hairs in mane and tail, and large feet similar to the horse.

While we have mules and hinnies of both sexes, they are sterile; that is, one cannot produce mules by mating a male with a female mule, nor will the mule breed with either the jack or stallion. The only way to produce a mule is to mate jack and mare.

Line-breeding consists in mating animals representing a single line of descent. This system of breeding is used either in

herd improvement or in breed improvement. Few of the many breeds of farm animals, as well as few of the more noted strains of the various breeds, have been formed without more or less line-breeding. Experience has shown that it is not enough to confine selection to the limits of the breed, for all breeds are exceedingly variable, and for best results one must restrict his selection to those lines that most nearly approach the object sought.

Line-breeding combines animals very similar in their character, narrows the pedigrees to few and closely related lines of descent, intensifies characters both good and bad, and thus gives stability to the strain or breed. It is a very strong factor in securing uniformity, and increasing the prepotency among farm animals.

No method is equal to that of line-breeding for the improvement of farm animals. It is conservative and safe. It is free from many of the objections that attach to other methods. There are, however, two factors that must not be lost sight of: both good and bad characters alike are intensified, and the importance of the individual in selection is great. Formerly much was said against line-breeding, but since the time of Robert Bakewell it has been a recognized factor in live-stock improvement (p. 77).

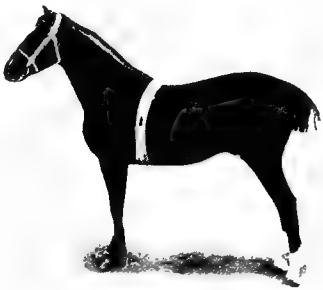

Fig. 40. — French Coach Stallion, Five Years Old. Imported by Champlin Bros., Christon, Iowa.

The chief disadvantage of this system of breeding is that the breeder is likely to select by pedigree, and thus fail to note the individuality of the animals he is mating. A line-bred pedigree is good or bad according as the animals composing it are good or bad. The breeder who selects by pedigree alone with-

out regard for merit is likely to find his herd deteriorating in a few generations, for bad characters, if they exist in the parent, will be intensified by this method of breeding just as rapidly as will desirable characters (p. 78).

In-breeding consists in mating animals closely related. It is line-breeding carried to its limits, and consequently it intensifies all the advantages and disadvantages of that system of breeding. In-breeding has been used successfully in the improvement of practically all of the present breeds of farm animals. The system was first put into regular practice by Robert Bakewell, and since that time has been employed more or less by all successful breeders.

The objects of in-breeding are twofold: First, more quickly to secure desirable characters in the offspring; and second, to render these characters more stable that they may be uniformly transmitted. Thus a certain parent, for example, a sire, is found to possess an unusual degree of excellence in some particular which he transmits to the offspring. To retain the excellency this offspring, if a female, when of the proper age is mated with her own sire, and this product, if a female, is in turn mated to the same male that was her sire as well as her grandsire. This method is resorted to for three and often four generations with the view of intensifying and perpetuating a desirable character for which the sire is especially noted.

There are three forms of in-breeding: First, mating sire with daughter, giving rise to an offspring containing three-fourths of the blood lines of the sire. This method, if followed up, produces offspring with but one line of ancestry and eliminates the characters of the dam. It is practiced when it is desired to intensify the characters possessed by the sire. Second, mating son with dam, which gives rise to offspring containing three-fourths of the blood lines of the dam. This method is practiced when it is desired to intensify the characters of the dam. Third, mating brother with sister, a method which preserves the characters of

both sire and dam. It is inferior to either of the other two in strengthening characters, and is not so safe because nothing is known of the breeding of either parent.

There are many advantages that follow this system of breeding: it intensifies characters, gives stability to the family, increases the prepotency, and favors uniformity. In-breeding results in the highest possible percentage of the desired blood being retained in the offspring, and is therefore recognized as the strongest of all breeding. It also gives rise to the simplest form of pedigree. Since the infusion of new strains shatters existing characters, no system equals in-breeding for perpetuating characters, doubling up existing combinations, as well as retaining all there is of good in the exceptional individual. Capable of producing the great improvement that it is, in-breeding is not without its disadvantages. It does not respect characters; it does not separate the good from the bad, but intensifies both good and bad alike. In-breeding, if persisted in, results in loss of fertility as well as vigor, which may quickly lead to race extinction. These are two most common defects resulting from this method of breeding, and they come about naturally. Few animals are regular breeders, and a still fewer number are both vigorous and regular breeders. Hence, when such animals are in-bred, the tendency is still further to lower both the vitality and the fertility. When practicing this method, therefore, too much cannot be made of selecting for high fertility and much vigor.

There are two situations under which it may be desirable to practice in-breeding. One is in grading, where, if we have a proved sire, one that is known to get excellent offspring, it may be entirely permissible to mate him with his own daughters rather than to procure a new sire, in which the breeding power is not known. Again, such an exchange of sires as would be necessary to prevent in-breeding often calls for a considerable outlay of time and money.

The other condition under which in-breeding is permissible is when one finds himself in possession of a very limited superior blood and is at a loss to know how to retain it. If he breeds out, the desirable characters will be obliterated. In this case, the only way he can retain the desirable characters is to

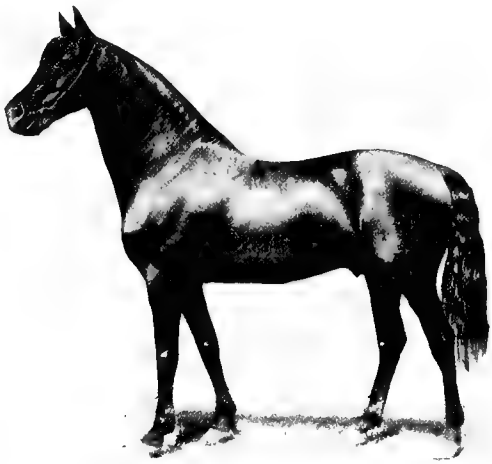

FIG. 41.—THE MORGAN STALLION, "GENERAL GATES," AT THE HEAD OF THE U. S. GOVERNMENT STUD AT MIDDLEBURY, VT.

The Morgan family of trotting horses originated in Vermont. These horses can scarcely be classed as a breed, but rather a family of the American Trotter. They are noted for their activity and endurance, but are considered by many as undersize. The average weight is from 900 to 1000 pounds, and the height 14 to 15 hands. Bay with dark points is the preferred color.

breed in. Often the risk is great, but it is the only way the desired blood can be retained. In such case it is best to strike out boldly and know the worst at once. Many breeders have found themselves in just such position and by in-breeding have not only retained the good characters but have increased

and intensified them by in-breeding, and in a few generations have succeeded in building up the best herds in the breed.

Breeding from the best. — The advisability of breeding from the best depends on the situation. When one is grading, it is advisable to procure the very best obtainable. On the other hand, when one is building up a pure herd, it is equally important to give due regard to the strain with which one is working. That is to say, in actual practice the breeder who breeds from the best without regard for blood lines is likely to bring together a confused herd, out of which nothing of note can be established. Crossing family lines brings about much the same condition as crossing the breeds, only on a more limited scale.

From this it must be apparent that if one is to secure the best results from any system of breeding whatsoever, he must have due regard for ancestral lines. He must keep the strains pure, intensify the desirable characters, thus increasing prepotency and securing uniformity. If the purpose is herd improvement, grading is practicable, as it is a cheap, quick, and conservative method, and if persisted in for a few generations, develops animals about equal to pure breds for production. If the purpose is breed improvement, then line-breeding or even in-breeding will be found to be most effective, for by these methods the ancestral lines can be kept true.

CHAPTER V

THE BREEDING OF HORSES AND MULES

While we have no data available in the United States on the number of horses and mules consumed, or used up, in a year, yet a very conservative estimate would be between four and five million, this to include export animals as well as those consumed at home. These horses must be replaced as consumed, or there will be a horse famine. There are approximately twenty million horses in the United States, of which we will assume one-half, or ten million, are mares. If we are to raise between four and five million colts, both horse and mule, it means that at least one-half, or 50 per cent, of these mares must be bred each year.

It must be remembered that the horses that supply this demand are produced on the farms. Their production is the work of the general farmer, who is primarily a grain raiser, a dairyman, or whose main business is general farming, and who raises horses because he is so situated as to be able to propagate them with but little inconvenience to his main work. Such farms usually possess three advantages: they grow large amounts of cheap food; they contain abundant range for the proper exercise of growing animals; and there is considerable team work to be done. On such farms horses can be grown with little extra labor and at a good profit.

PLAN OF BREEDING

A clearly defined plan of procedure should be thought out before the farmer makes the attempt to breed horses. To do

this a good knowledge of horses and horse-breeding should be secured. Breeding establishments and horse-producing farms should be visited. One should familiarize himself with the methods of successful horse-breeders, should note the conditions that lead to success and those that cause failure. The

FIG. 42.—"CAROLINA." The American Saddler owned by John B. Castleman, Louisville, Ky.

The American saddle horse is a native of the United States, principally the states of Kentucky, Virginia, and Missouri. This breed is noted for its easy gaits, endurance, and intelligence. The weight varies from 900 to 1200 pounds and the height from 15½ to 16 hands. Saddlers are of two classes: (1) walk-trot-canter horse; (2) the five-gaited horse; walk, trot, canter, rack, and running walk or fox trot or slow pace.

intending horse-breeder should take account of his likes and dislikes. He may prefer the light active horse to the heavy phlegmatic drafter. The horse-producer should study his conditions. Some conditions will be favorable to the production of one class, some to another. It should be kept clearly in

mind, whatever the type or class chosen, whether it is light or heavy, or for speed or draft, that none but superior horses will sell at remunerative prices. There will always be an overproduction of common horses, which will be the first to be affected by oversupply and other business depressions, and the last to be revived. The market should also be studied. In some sections the demand will be for a certain class and in other sections another class will be in most demand.

Coöperative breeding. — From observations made in localities where horses are bred in a commercial way, it would seem advisable to breed on the coöperative plan. It is apparent that the formation of horse-breeding associations in townships and counties would do much to advance the progress of the industry. Such associations should be formed of breeders who possess the same class or breed of mares. It would be the work of such an association to protect the interests of its members, provide suitable stallions each year for use on the mares owned by the members, advertise stock, attract buyers, hold sales, make exhibits at the county, district, and state fairs, hold meetings for discussion of horse-breeding matters, and educate the farmers of the locality to better methods of breeding, feeding, and developing marketable horses.

Securing stallions. — The fact that mares are often bred to unsuitable stallions is, in many instances, due more to the difficulty of finding the right horse close at hand than to indifference or carelessness on the part of the breeder. A fitting start may be made in grading up in a certain district, and in a few years no horse of the same blood is to be found to continue the good work in the right direction. The consequence is that a horse of different breed, unsuitable in many respects, is used until a more suitable sire can be secured, or happens to enter the district.

It often occurs that a stallion is unexpectedly thrust on a district by a salesman of some importing firm. A company is

formed for the purchase of the horse, and the price is usually high, as it must contain many and sometimes questionable expenses. The "company plan" of purchasing a stallion is therefore objectionable. It is much better for the farmers interested in horse-breeding to get together and choose one of their own members and send him to the importing stable or horse-breeding firm to purchase the stallion. He will have an opportunity to choose and will get one much cheaper.

Undoubtedly, any reputable breeder or importer of horses would be glad to send into any district the horse desired by a company of farm-breeders and in close accord with their requirements as regards pedigree, character, quality, size, and price. It is equally likely that the same firm would be willing, for a certain consideration in price, to replace the stallion when he could no longer be used in that particular district. If such a plan were followed persistently, each district so acting would secure much better results than at present.

SELECTING BREEDING STOCK

In the selection of breeding stock, we must keep in mind the principle of heredity that "like produces like." This applies to the brood mare as well as to the stallion. Bad qualities in the mare are as likely to appear in the colt as are bad qualities possessed by the stallion. The influence of the mare in the transmission of qualities to the foal is often very much underestimated, and frequently ignored entirely by horse-breeders. This cannot be other than a serious mistake, and the farmer who keeps worthless mares for breeding simply because he cannot sell them, will not be able to compete with his neighbor who keeps only the best brood mares, even though they both patronize the same stallion. The mare has as much influence on the colt as has the stallion. Once in a while we may get a very fine colt from an inferior mare, but such is very rarely

the case, and no man can afford to breed horses for this exceptional case.

It is a serious but common error in breeding horses to suppose that the bad points in one animal can be fully offset or overcome by the good points in the mate. The statement that the stallion controls the outward characters and the mare the internal characters has led many breeders to think that the offspring would resemble the paternal parent irrespective of the mother. Such is not the case. The foundation of successful horse-breeding is to mate two animals each of which is as nearly perfect as possible.

The breed and type.— Choose the breed which best suits the conditions, the markets, and the tastes of the breeders. There is no best breed or type for all conditions. Light horses naturally belong on land devoted to grass, to dairy industry, and to market-gardening, where but little plowing and other heavy horse work is required, and the necessity of reaching the market, the station, or the creamery requires quick-moving horses.

On farms devoted to fruit-growing and the like, where the horse work is somewhat heavier than on the dairy farm, the coach horse may be used. Coach horses are well adapted to fruit farms with one exception — they are rather too tall to be used to best advantage in tilling under trees in the orchards.

On grain farms, where there is much plowing and the work to be done is hard, heavy horses are needed. On general farms the draft horse finds his true place. Draft horses can be reared with less risk than the lighter and more active types, such as the roadster and the coachers. They do not require so much training, and can be put to light work younger. The draft horse is in great demand for city traffic. Again, the roadster and the coacher require much training before they can be marketed, if good values are to be secured. This training requires skill, time, and money, which should be taken into account. A well-bred and well-trained coach or driving team will bring a good

price, but the skill, time, and money required to breed and train them is too great for the general farmer.

Uniformity. — Each community should produce horses uniform in type. As it is now, each district produces a number of types. For this reason, buyers in search of a particular type or breed of horse do not know where to find it, and buy, here and

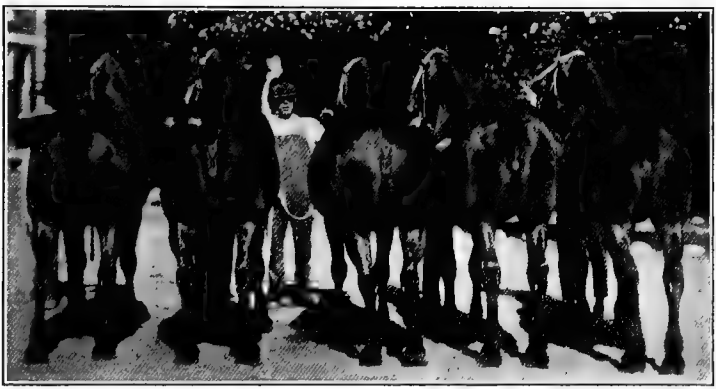

FIG. 43. — GROUP OF PERCHERON MARES. Imported and owned by J. Crouch & Son, Lafayette, Ind.

there throughout a wide territory and at a great outlay for traveling expenses, individual horses of the right type, until the lot has been gathered together. When each farmer in a district is breeding according to his individual ideas, he has to find a separate and individual market or buyer for his product, and the price paid is consequently small. Such districts may sell large numbers of horses annually, but they are of nondescript type and character. These horses neither make a name for the district as a horse-breeding center nor attract buyers willing to pay appreciative prices. The individual farmer will do better to cast in his lot with the majority of his neighbors, and breed the same type as they are breeding, even though this type

may not be the one that suits his fancy best or even the one that is best suited to the district.

Under the system suggested, the buyer of any particular type or breed should be able to go to a district noted for the production of the class of animal required and there find it in sufficient numbers, uniform in type and quality, to meet all needs. Could this be done, buyers would save much time and expense and would be ready and willing to pay better prices for the full supply of horses thus easily found.

Soundness. — It is of great importance that the stallion should be free from all forms of unsoundness or disease that are hereditary, transmissible, or communicable to the offspring. It is equally important that the mares bred to him should be sound in the same way, for not until both mare and stallion used for breeding purposes are free from unsoundness can we hope to raise the excellence of our horses to the degree possible as the result of intelligent breeding and development.

Many imported and home-bred stallions are unsound and transmit to their progeny the predisposition to like unsoundness. This is equally true of mares used for breeding purposes, as many breeders have fallen into the grievous way of considering any broken-down, halt, maimed, blind, or otherwise unsound mare fit for breeding purposes when no longer able to work.

THE STALLION

The stallion is of prime importance in horse-breeding. We have already seen that the male is concerned with many more individual offspring in a given season than the female and that his influence is much more extensive because of the increased number he influences. To secure the improvement in the horses of a given community through the females would require the use of fifty or more superior mares to accomplish the same result as might be secured by the use of a single stallion, and even then there would be less uniformity in the progeny. This has no

reference to the relative influence of the two parents over the offspring, but is simply because the stallion controls one-half the characters in the entire crop, whereas the mare controls but one. Often one has no choice of stallions when mating the mares because there is but one male in the vicinity, and this no doubt is responsible for much of the mixed breeding among our horse stock. On the other hand, usually there are several stallions available, and one must choose among them. While there are many things to be taken into account, the following are among the most important: individuality, type, soundness, and breeding.

THE MARE

The most fertile period in the mare's life is usually at four to twelve years of age. In exceptional cases, this period may be extended both ways. Just how young it is safe to breed fillies or young mares is a question concerning which there is great difference of opinion. In some cases it is perfectly safe to breed a two-year-old filly, and in many cases it is far from safe and positively detrimental to both the young mare and her offspring.

The advisability of breeding a two-year-old filly depends on at least three important factors: First, the breed. Horses of draft breeding mature much earlier than the lighter and more active breeds, so that a draft filly at two years old is often as forward as a trotting or running filly at three years of age. Second, the individual animal. There is considerable difference in the way mares mature. Usually a smoothly turned, neat, and well-finished filly makes its growth earlier than a rougher, more vigorous individual. Again, the feed and care have much to do with the early maturity of the filly. One that is kept growing continuously will mature earlier than one imperfectly cared for and which receives a set back each winter. Third, the object sought. Is the question to improve

the strain of horses with which one is breeding, or only to market the greatest possible number of animals? If the object is to improve the strain, one should never attempt to breed a two-year-old filly.

The practice in certain draft-horse producing countries, Great Britain for example, is to breed the draft fillies the spring they are two years old and allow them no work whatever that season. After weaning their foals, they are taken as three-year-olds and put to work, and not bred again until they are four years old. This system is worthy of adoption when one wishes to know the breeding qualities of his mare as early as possible; otherwise there is no advantage, as one will secure just as many colts if he waits till the mare is three years old and then breeds her.

When draft horses are wanted only for marketing, there is no reason why fillies cannot be bred at two years of age, provided they are mature, have been well grown, and their owner is willing to feed and care for them properly during their pregnancy. Nor is there any reason why they should not be bred each year thereafter. They should not, however, be put to work till over three years of age.

At about twelve years, the productive powers of some draft mares will begin to wane, although many of them are reliable breeders to about fifteen years, especially if they have been bred continuously from their maturity. Above this age, it is rarely profitable to keep them for breeding. Perhaps it is best to dispose of draft brood mares at ten or twelve years old unless they are exceptionally good breeders, in which case they should be kept as long as they will breed.

Season of the year to breed. — The natural time for foals to arrive is in the spring, and under ordinary conditions, especially on breeding farms, this is customary. However, on most farms the mare must do the season's work in addition to raising the colt. This often necessitates breeding the mares so as to have the colts arrive in the fall. With good stables, abundance of food,

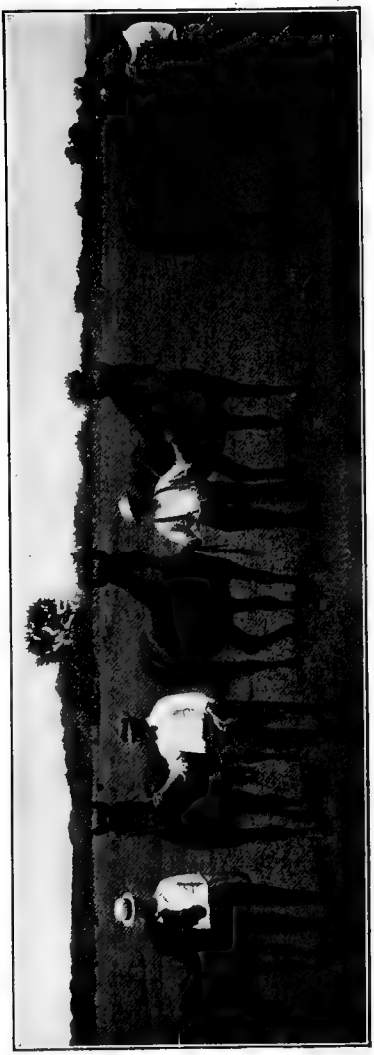

FIG. 44.—PERCHERON MARE "PRINCESS" AND FOUR OF HER COLTS. Owned by the Kansas Agricultural College.

and the necessary help, there is no reason why mares should not be made to foal in the fall if it is more convenient to have them do so. In fact, if one is forced to choose between a spring foal with no chance properly to favor the mare and a fall foal which arrives and is suckled while the mare is laid by, the latter would be more desirable. During winter, however, both mare and foal will require more attention than if bred to foal in the spring.

FIG. 45.—A CROSS-BRED COACH AND AMERICAN TROTTING HORSE. A type used by the New York police.

By fall foaling, the youngsters can be given a good start before they are set back by the short pastures and flies of midsummer.

The mare is not so likely to breed in the fall and winter as in the spring. She is often thin in flesh after the summer's work. But by increasing the food, especially the grain rations, by regular and moderate exercise, and by blanketing, the desired results can often be brought about. The bowels should be kept free from constipation by feeding moderate amounts of succulent foods.

Breeders of race and show horses take every advantage of the age limit, and therefore favor early foaling. There are also unquestionable benefits to be derived from the life in the open, and the new grass, to commend springtime for foaling, but the prejudice against fall colts is not altogether warranted, and circumstances may be such as to make it most advantageous.

According to the table (p. 108), a mare bred on January 1 should foal on December 6; one bred on March 27 should foal on March 1 the following year.

When mares should be tried. — There is great diversity of opinion as to when and how often a mare should be tried after she has been served by the stallion. It can be accepted as a general rule that if the mare is perfectly normal and healthy, she will conceive. If she is not normal or is unhealthy, she either will not conceive at all or only occasionally at best, and even then there is likely to be difficulty. We should see to it that her organs are perfectly normal and that she is in good health. We should not change her diet or her mode of life so suddenly as to upset her general health.

Some mares are shy breeders. If a mare is unwilling and it is desired to breed her, she can occasionally be brought about by hobbling her securely and then breeding her. Then she will behave more or less peaceably for eighteen to twenty-one days, when she may be bred again. There are other mares, and they are numerous, that will freely be served when they are in foal, in some cases almost up to the time of foaling.

A mare will almost invariably breed on the ninth day, or thereabouts, after foaling, and if she is healthy and has received no injuries in giving birth, it is the practice to breed her at this time. Just when mares should be returned to see whether they have conceived is a much discussed question. Mares differ greatly in the recurrence of their periods. It is best for each breeder to study the individual differences among his mares. The common practice is to return them fourteen to eighteen

Table showing period of gestation — Mares 340 days

Date of service on the left. Date of foaling on the right

Jan.	Dec.	Feb.	Jan.	Mar.	Feb.	Apr.	Mar.	May	Apr.	June	May	July	June	Aug.	July	Sept.	Aug.	Oct.	Sept.	Nov.	Oct.	Dec.	Nov.
1	6	1	6	1	3	1	6	1	5	1	6	1	5	1	6	1	6	1	5	1	6	1	5
2	7	2	7	2	4	2	7	2	6	2	7	2	6	2	7	2	7	2	6	2	7	2	6
3	8	3	8	3	5	3	8	3	7	3	8	3	7	3	8	3	8	3	7	3	8	3	7
4	9	4	9	4	6	4	9	4	8	4	9	4	8	4	9	4	9	4	8	4	9	4	8
5	10	5	10	5	7	5	10	5	9	5	10	5	9	5	10	5	10	5	9	5	10	5	9
6	11	6	11	6	8	6	11	6	10	6	11	6	10	6	11	6	11	6	10	6	11	6	10
7	12	7	12	7	9	7	12	7	11	7	12	7	11	7	12	7	12	7	11	7	12	7	11
8	13	8	13	8	10	8	13	8	12	8	13	8	12	8	13	8	13	8	12	8	13	8	12
9	14	9	14	9	11	9	14	9	13	9	14	9	13	9	14	9	14	9	13	9	14	9	13
10	15	10	15	10	12	10	15	10	14	10	15	10	14	10	15	10	15	10	14	10	15	10	14
11	16	11	16	11	13	11	16	11	15	11	16	11	15	11	16	11	16	11	15	11	16	11	15
12	17	12	17	12	14	12	17	12	16	12	17	12	16	12	17	12	17	12	16	12	17	12	16
13	18	13	18	13	15	13	18	13	17	13	18	13	17	13	18	13	18	13	17	13	18	13	17
14	19	14	19	14	16	14	19	14	18	14	19	14	18	14	19	14	19	14	18	14	19	14	18
15	20	15	20	15	17	15	20	15	19	15	20	15	19	15	20	15	20	15	19	15	20	15	19
16	21	16	21	16	18	16	21	16	20	16	21	16	20	16	21	16	21	16	20	16	21	16	20
17	22	17	22	17	19	17	22	17	21	17	22	17	21	17	22	17	22	17	21	17	22	17	21
18	23	18	23	18	20	18	23	18	22	18	23	18	22	18	23	18	23	18	22	18	23	18	22
19	24	19	24	19	21	19	24	19	23	19	24	19	23	19	24	19	24	19	23	19	24	19	23
20	25	20	25	20	22	20	25	20	24	20	25	20	24	20	25	20	25	20	24	20	25	20	24
21	26	21	26	21	23	21	26	21	25	21	26	21	25	21	26	21	26	21	25	21	26	21	25
22	27	22	27	22	24	22	27	22	26	22	27	22	26	22	27	22	27	22	26	22	27	22	26
23	28	23	28	23	25	23	28	23	27	23	28	23	27	23	28	23	28	23	27	23	28	23	27
24	29	24	29	24	26	24	29	24	28	24	29	24	28	24	29	24	29	24	28	24	29	24	28
25	30	25	30	25	27	25	30	25	29	25	30	25	29	25	30	25	30	25	29	25	30	25	29
26	31	26	31	26	28	26	31	26	30	26	31	26	30	26	31	26	31	26	30	26	31	26	30
	Jan.		Feb.		Mar.		Apr.		May		June		July		Aug.		Sept.		Oct.		Nov.		Dec.
27	1	27	1	27	1	27	1	27	1	27	1	27	1	27	1	27	1	27	1	27	1	27	1
28	2	28	2	28	2	28	2	28	2	28	2	28	2	28	2	28	2	28	2	28	2	28	2
29	3			29	3	29	3	29	3	29	3	29	3	29	3	29	3	29	3	29	3	29	3
30	4			30	4	30	4	30	4	30	4	30	4	30	4	30	4	30	4	30	4	30	4
31	5			31	5			31	5			31	5	31	5			31	5			31	5

days after the first service, and to return them each week thereafter for at least one month.

Barrenness in mares. — It often happens that mares are served normally, yet fail to conceive. Some of the causes of this difficulty are readily understood and easily prevented, while others are not so well known and are perhaps beyond the control of breeders. Mares that are not served till late in life are often difficult to impregnate at the first time. This is often noticed in mares that have spent a good part of a lifetime at hard work. In such cases it is due perhaps to the long inactivity of the generative organs. An excess of rich and stimulating foods is a common cause of non-breeding; and the dangers attending parturition are more than trebled in the case of fat animals. Milk-fever never occurs in mares that are kept actually at work and are in only moderate flesh at the time of foaling. On the other hand, barrenness may be due to poor feeding and hard work, the system being weakened by the lack of sufficient nutrition. Undue sexual excitement at the most active stage of heat is often responsible for the mare not conceiving. In addition to these, there is a long line of causes of barrenness in mares over which the breeder has little or no control, such as

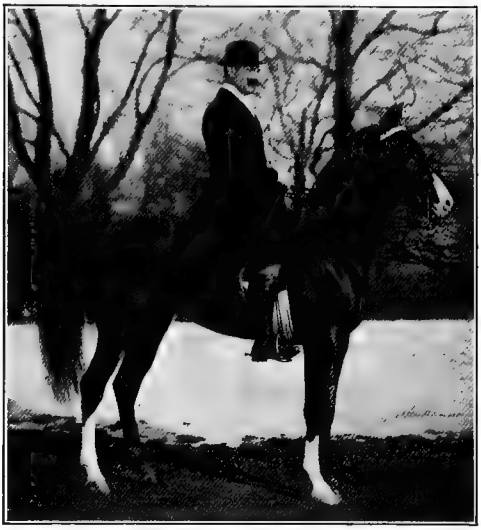

Fig. 46. — Arab Horse used as a Polo Pony.

derangement of the female organs, diseased ovaries, tumors, and the like.

Abortion in mares. — Abortion is the expulsion of the fetus at any period from the date of impregnation until the foal can survive out of the womb. It is produced by any cause operating to disconnect the union of the fetal membrane from the uterus. The mare may abort by reason of almost any cause that very generally disturbs her system, as the influence of too stimulating diet or the reverse, wet seasons, a previous miscarriage, and all circumstances opposed to efficient nutrition and respiration. The more direct mechanical causes are falls, blows, violent exertion, severe illness, large draughts of cold water or eating iced grass, ergot of rye, the smut of corn or other grain, and drinking filthy stagnant water; also, traveling on heavy muddy roads, soft plowed ground, or jumping over fences, ditches, and the like.

The prevention of abortion is the avoidance of all causes which may have a tendency to produce it. When abortion has once occurred, the greatest care in subsequent management is necessary. The breeder must avoid all causes of constipation, diarrhea, indigestion, and the like. When all measures fail and miscarriage results, all that can be done is to assist in the removal of the fetus and its membranes as in ordinary parturitions. The mare should have extra care at this time. She should have a roomy, well-lighted stall, with plenty of air and easily digested food. The mare should not be served again for a month or longer, and in no case till after all discharges from the vulva have ceased.

Parturition time. — The average period of gestation in the mare is popularly placed at eleven months, more accurately perhaps three hundred and forty days, but it may vary greatly. (See page 108.) Because of the uncertainty of the period, the mare should be closely watched from the tenth month till parturition. There are certain signs of the near approach of parturition that

rarely fail. The udder often becomes greatly distended some time before foaling, but the teats seldom fill out full and plump to the end more than two or three days before the foal is born. About one week or ten days before foaling, there is a marked shrinking or falling away of the muscular parts at the top of the buttocks back of the hips. Another sign is the appearance of the wax on the ends of the teats. This generally appears not earlier than three days before the foal comes. In some cases, however, the foal may be born without any of these signs.

FIG. 47.—A FARM GROUP OF FRENCH DRAFT HORSES. This breed was developed in France and is similar to the Percheron.

About the three hundred and thirtieth day, or when the mare begins to show signs, the work should be much lightened and the grain ration reduced, although for best results the mare should be kept at light work up to the day of foaling. Bran mash will prove very beneficial now, as it will keep the bowels in good condition and allay any tendency to feverishness. She should have a roomy, well-lighted, and ventilated box stall, thoroughly clean and freshly bedded.

If birth is easy and normal, let both mare and foal alone. They will come through the ordeal all right. It may be necessary that a caretaker be near by at night to render assistance if

need be, but the mare must not know of his presence. Most mares will not give birth to their young in the presence of persons if they can help it.

If the mare shows after a reasonable time that she cannot deliver the foal, or if examination discloses that there is an abnormal presentation (normally the fore feet appear first, then the nose), a veterinarian should be summoned at once. Do not wait too long, for her strength rapidly fails. Difficult parturition among horses is much more likely to result fatally to the offspring than among cattle, sheep, or swine.

The mare and the young foal. — After foaling, if all is normal, the mare will usually get up and tend to her foal. After she is on her feet, offer her a drink of gruel made from a pound of fine oat meal in half a bucket of water from which the chill has been taken. While the mare should be lightly worked up to the day of foaling, it is essential that she have a few days' rest after foaling; how long will depend on the condition of the mare and foal, and the financial circumstances of the breeder. Strong mares that have come through satisfactorily will be able to do light work in three or four days if need be, whereas others will need at least two weeks to recover from the shock.

Two things require attention at this time so far as the mare is concerned: she must be properly nourished, not fed too much or too little and with the right sort of food; if able, she must have light exercise or the foal will suffer.

The foods given the brood mare when nursing her foal should be such as have a tendency to produce milk. Corn and timothy hay fed alone are not good milk-producing foods. Foods rich in protein and ash, such as oats, bran, clover, and alfalfa hay, are preferred, and they could be improved by the addition of a succulent food such as carrots. Many mares are poor milk-producers at best, and they must be encouraged. Plenty of good fresh grass is one of the best aids to healthy and abundant nutrition for both mare and foal.

One should keep close watch on the mare's udder and the condition of the colt's bowels. If the colt is not taking all the milk, the udder will be greatly distended, become sore, and possibly cake, when there will be difficulty with both mare and foal. It is then necessary to milk the mare. If the bowels of the colt are loose and he is scouring, it may be due to the fact that he is getting too much milk. In that case, the mare should be partly milked by hand.

THE FOAL

It is essential that the new-born foal get the first milk from the dam. This fore-milk looks thick and yellow and is a natural purgative for the removal of the material that has accumulated in the foal's digestive tract during the last few days of its development. Its prompt removal is essential to the life of the colt. Sometimes this fore-milk, or colostrum, is drawn off as unfit for the colt, but such practice is a common cause of death to the foal two or three days after birth.

The young foal that makes its appearance normally and is bright and active needs only to be let alone as long as both mare and foal are doing well. The infant foal will be better for it. By giving proper attention to the food and exercise of the mare, the foal may be kept thriving and in the pink of condition without any special care or attention. Not all foals, however, are so fortunate. Occasionally one loses its life through want of attention at the time of birth. Occasionally foals are troubled with digestive disorders that must be attended to and remedied at once before they prove fatal. Again, they are sometimes troubled with an infectious navel disease which may be due to unsanitary conditions at the time of foaling.

It sometimes happens that the new-born foal cannot breathe — does not establish the function of respiration. In this case, steps must be taken quickly to establish respiration by blowing violently up the muzzle and into the mouth, and by briskly

rubbing the body. If breathing is slow, a few tablespoonfuls of brandy and water, given after the first few respirations, will be of material service in invigorating the low vital process.

As soon as the mare has recovered from the shock of giving birth, she should be allowed to tend the foal, for it will be phys-

FIG. 48.—HACKNEY COACH MARE, AND FOAL THREE WEEKS OLD. Owned by A. R. Gillis, Syracuse, N.Y.

ically benefited thereby. If she refuses to dry and caress it, a little flour sprinkled over the back of the foal will often attract her to it. Should she still refuse, the foal must be dried with a soft flannel, aided to find the teat, and assisted to obtain its first nourishment.

Ills of the young foal. Constipation. — Notwithstanding the purgative effects of the colostrum or first flow of milk, the young foal frequently suffers from constipation, especially if the mare has not been in good health during the latter periods of pregnancy. Then again, the dam may have something wrong with her first milk, or the young foal through weakness may not get a good draft. Whatever the cause, if the digestive tract has not been cleaned of its contents within twenty-four hours and the foal presents a droopy, listless appearance, eyes not bright, ears lopped over, something must be done to stimulate the action of the bowels. The bowels will ordinarily be stimulated actively by administering two ounces of olive oil or castor oil and an injection of warm water into the bowels. The water should be at blood heat and have added to it a little glycerine — a teaspoonful of glycerine and enough warm water to make two or three ounces, not more. Never try to fill the little foal with copious douches of soap-suds, as is often done. Plain cold water is better than soap-suds. Only a very little is needed. Inject gently into the rectum with a common two-ounce hard rubber syringe, taking care not to rupture the tender membrane. This will lubricate the passage and induce the foal to endeavor to pass the fecal matter, which is a yellowish, rather hard, waxy substance. If given as directed, the injection can do no harm, and it may be repeated every hour. In five hours, relief will usually have been gained and the appearance of the youngster will have changed greatly for the better.

Diarrhea or scours. — This disease is rather prevalent among suckling animals, and is often fatal. Although less subject to it than calves, foals often die from diarrhea within a short time after birth. The causes are not certainly known. It is ordinarily attributed to changes of an unknown character in the composition of the milk. Two facts, however, have been proved: First, that the causes of scours are many and varied; second, that their potency is increased by unclean surroundings, espe-

cially unwholesome stables. Apparent causes are the non-removal of the fecal matter; also anything that very materially affects the health or condition of the mare, such as becoming fretful when kept away from the colt for a time soon after parturition. The mare becomes feverish, the quality of her milk materially altered, and the foal coming to her hungry, gorges itself with this changed milk which induces indigestion and diarrhea. Very rich foods may stimulate the flow to such an extent that if the foal is permitted to take it all, digestive disorders and diarrhea will result. The same often happens in early spring when the mare is pasturing on a rank growth of succulent grass. Confinement in close buildings is objectionable to mare and foal alike. In both it induces a weakened condition, and leaves the system an easy prey to disease. A cold damp bed, exposure to cold rain storms, and the like are to be avoided. A passing shower may do no harm, even if cold, but a prolonged exposure to rain with a low temperature is hard on a new-born foal and often leads to disorders of the digestive organs and fatal diarrhea.

The best treatment is to avoid conditions likely to cause such disorders. If the dam is properly fed and exercised, there is very little danger. One should attend the foal at the first appearance of digestive disorders and remove the cause; even then it may be too late. If it is due to an oversupply of rich milk, the dam should be milked in part by hand. One should be cautioned against giving an astringent with a view to cutting off the discharge. The best policy in all such cases is to expel the disturber with a laxative, such as two ounces of castor oil, and later when the irritant has been expelled, to check the discharge by a weak solution of gum arabic, of slippery elm, or by well-boiled linseed tea or starch, or the like. But even this road is beset by many a difficulty.

Navel infection. — Another disease common to young foals is the so-called navel infection, or joint disease. It should be

understood that this disease is due to filth germs that gain access to the body of the foal by way of the open umbilical vein of the navel at birth. When these germs enter, they set up irritation and inflammation; pus forms and is absorbed into the circulation from the navel abscess, and other abscesses are formed in all parts of the body, notably in the joints. The foal is seen to have a swollen joint and one is likely to think the mare caused the injury; but soon other joints will be affected, and it may extend to the throat and poll. It is comparatively rare that an infected colt can be saved after the disease has reached the pus-forming stage.

FIG. 49.—BRESSARY OF PITTSFORD. ABERDEEN OF PITTSFORD. Unbeaten Shetland team of stallions.

The Shetland Pony, a native of the Shetland Islands, is the smallest breed of domesticated ponies. In height they range from 36 to 44 inches. They are built like miniature draft horses, being thick-set and strong, and so very docile as to require hardly any training. These ponies are common in the United States, where they are used for children to drive.

It has been proved that simple hygienic measures will prevent the disease. The stall in which the mare foals should have every bit of old bedding, litter, and dirt removed, and the young foal should be born only on clean fresh bedding. Perhaps it would be safer to wash the stump of the umbilical cord, which

should never be cut but allowed to break of its own accord, with a saturated solution of boracic acid and then dust it with boracic acid powder.

Feeding the young foal. — It often happens that the milk of the mare is insufficient to promote healthy, vigorous growth in the foal, and occasionally it becomes necessary to raise a foal entirely independent of the dam. In such cases the best addition or substitute for the milk of the mare is that of the cow. The milk of the mare has more sugar and less fat than the milk of the cow. One should get milk from as fresh a cow as possible, and the poorer in fat the better, as mare's milk will average only about 1.2 per cent fat, while the milk of most cows runs above 3 per cent. Do not use Jersey milk for colts, as it is too rich in fat.

A little patient effort will soon teach the colt to drink milk readily, but one must be careful not to give it too much at first. A half pint is enough for a foal two or three days old, but the ration should be repeated often. If it is necessary to feed the foal cow's milk from the beginning, the milk should be modified. To a dessert-spoonful of white granulated sugar add enough warm water to dissolve it. Then add three tablespoonfuls of lime water and enough milk to make a pint. Warm the mixture to blood heat. Let the foal have a half teacupful every hour at first. This takes time, but must be done. If the colt scours, give a dose of two ounces of castor oil and discontinue the feed for two hours. As the colt grows older, the amount of food should be increased and the frequency of feeding decreased, first to twelve, then to nine, six, and lastly four times a day. The purpose is to give the foal all it will drink, and to feed so often that it will not require much at a time.

Gruels, made by boiling beans or peas and removing the skins by pressing the pulp through a sieve, or oil meal and shorts made into a jelly by boiling, are excellent for the motherless colt.

As soon as the foal is old enough, it should be encouraged to nibble at grain, preferably ground oats. It will begin to munch in the grain and hay at three or four weeks of age, and should be encouraged to eat. It will eat only a very little at first. If it is necessary that the foal have milk after it is two months old, skimmed milk should be substituted for fresh cow's milk. Never feed a colt sour milk. Never feed milk from unclean vessels. Should there be any trouble from constipation, it will be well to add about one-half pint of oil meal per day to the ration. Oil meal can be fed with profit to growing colts, as it furnishes a large proportion of muscle-forming and bone-forming food. The effect of such a ration — sweet skimmed milk, ground oats, and oil meal — on the growth and development of a foal is remarkable, and in all cases when the foal is likely to enter winter in low flesh such a ration cannot be too highly recommended.

Many breeders advise leaving the colt in the stable while the mare is at work; others allow the colt to follow the mare into the field. Much depends on the kind of work that is to be done. Never let a colt drink from a warm mare; allow her to cool off and perhaps draw some of the milk by hand, when she may be turned into the stall with the foal with perfect safety to both mare and foal.

Weaning the foal. — Weaning is more a question of preparation than of the absolute removal of the foal from the dam; and the simplicity of the weaning process depends on the thoroughness of the preparation. If the foal has been accustomed to grain as suggested, if it has been permitted to take increasingly more as it grew, then the process will not be difficult, for as the ration increases in amount of grain it will decrease in the amount of milk consumed. When the time arrives for complete separation, there will be very little if any set back or disturbance to either foal or dam. On the other hand, if the foal must learn to eat after being deprived of its accustomed source of supply, it

will require time to get used to the new condition, and the mare will demand special care because of the removal of the colt before her milk supply has been diminished to any extent.

Foals are usually weaned at four to six months of age, depending on conditions. If the mare was bred soon after foaling and conceived, it is best to wean the foal early, so that the mare will have time to recuperate and nourish the fetus. If for any reason mare and foal are not doing well, it is perhaps best to wean comparatively early. If, on the other hand, the mare has a full flow of milk and her services are not needed, there is no reason for weaning the foal under six months of age. When dam and foal are separated, it is better for both that the separation be complete. If, after both have become reconciled to the separation, they are permitted to see, hear, or smell each other again, all that has been gained is lost, and it will be necessary to begin over again. Care should also be taken to see that the new quarters where the weanlings are confined are so constructed and arranged that they cannot injure themselves while fretting over the separation.

At this time the food and the udder of the mare require extra attention. Work the mare right along if she has been at work, but reduce her grain ration till she is dried off. When the udder becomes so full as to cause her uneasiness, part of the milk should be drawn, but she should not be milked dry. If the milk is all withdrawn each time, it will take longer to dry her.

Skimmed milk may still be given to the colt, especially if it is not in good condition to enter the winter. Clean, sound oats well ground constitute the best of all grains for the weanling. As cold weather approaches, one-fourth in weight of corn meal may be added, as it helps to produce fat and keeps up the animal heat. If to this a little oil meal, say a half pint a day, is added, the weanling will make good gains in spite of the cold weather and the fact that it has just been separated from its mother.

Do not be afraid of feeding too liberally. Many colts are permanently injured the first six months after weaning by too scanty supply of food.

BREEDING JACKS, JENNETS, AND MULES

Because of the increasing importance of the mule, it seems desirable to point out some of the peculiarities connected with its breeding. In general, the same suggestions apply to horses, jacks, jennets, and mules, yet there are a few characteristic differences.

Jacks and jennets.—In selecting breeding stock, choose those with long, thin, bony head and long, well-tapering ears, sitting gracefully on the head, and with large, flat, clean limbs, big feet deeply cupped. As to color, it should be a good black with distinctly light points. Breadth in hips and pelvis is very essential, particularly in jennet. Many jennets are so deficient or narrow in the pelvis that they have great difficulty in giving birth to their offspring. In size they should be large and well proportioned. The action should be snappy and straight away. Perhaps the most important characters are color, size, action, and boniness.

The jennet carries her foal somewhat longer than the mare, perhaps well up to twelve months. At foaling time the jennet must be closely watched. This is essential. When the colt is born, it sometimes has the membrane over its head and nostrils; if this is not torn and removed, it will smother the young foal. Usually, the navel cord is tough and does not give way or break. If it is pulsating after the colt is born, it should be tied with a silk or flax thread and then cut three or four inches from the navel. Never cut the navel before tieing. Jack colts are liable to have trouble with the navel; hence the importance of being on hand when the colt is foaled. Again, foaling jennets are often troubled with sore, tender, and inflamed udders, due to the large amount of milk they contain. When such is the case, they will not allow the colt to suck, but kick and bite it, and

FIG. 50.—CHAMPION JACK "GENERAL WOOD." Owned by C. F. Cook, Lexington, Ky.

it will starve if not looked after properly. The jennet must be carefully milked and the udder bathed in warm salt water to relieve the inflammation.

Some jennets give great quantities of milk. It is a good plan not to give much stimulating food before she is due to foal, and not have her too fat. Therefore, the food should be reduced for a short time just before and after foaling.

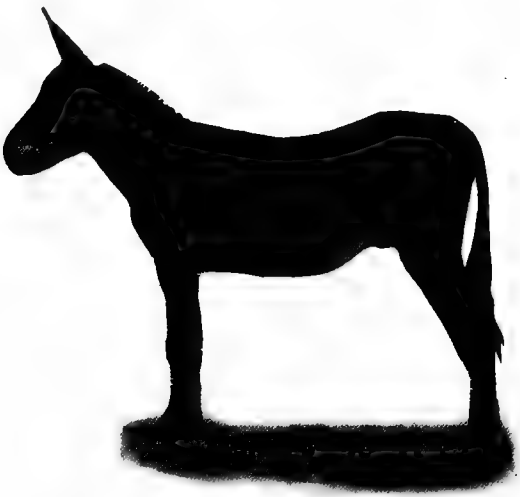

FIG. 51.—A TWO-YEAR-OLD CATALONIAN JACK. Owned by C. F. Cook, Lexington, Ky.

When it is desired to re-breed mares, we have stated that they should be mated about the seventh or ninth day after foaling, for should they fail to breed then, they are likely not to come in again while nursing the colt. On the other hand jennets breed much later, about the twelfth to fourteenth day, and if they fail to breed then, are not likely to mate while nursing.

Jack colts should be cared for and weaned much as suggested for horses. Because of the length of jack colts' limbs, they seem to be more liable to spring their fore legs when feeding on pasture than the horse colt. They are required to put too much weight on the fore legs to enable them to reach the grass, and there is a giving way in the joints; usually the knee springs in or out, but often the ankle gives way. Again when the dams are low, thus compelling the colt to stoop and suck, the fore limbs

FIG. 52. — TWO TWO-YEAR-OLD JACKS. Owned by C. F. Cook, Lexington, Ky.

are often cramped in such position as to increase their liability to injury. These difficulties are so serious that Knight gives the following advice: When short grazing is the cause of the trouble, put the colt in the stable and feed with suitable food; when caused by a low dam, the difficulty may be obviated by the colt being put in the stable and fed on modified cow's milk, or milk from the dam.

Mules and hinnies. — The mule is the product of a jack and

mare. A hinny is the product of a stallion mated to a jennet. The latter is seldom seen in this country. It resembles the mule. It is asserted, however, that the hinny takes more the characters of the horse, the head is neater and ears shorter than the mule, the hair in mane and tail heavier and the foot larger. The bray is like the horse. Hinnies are scarce because

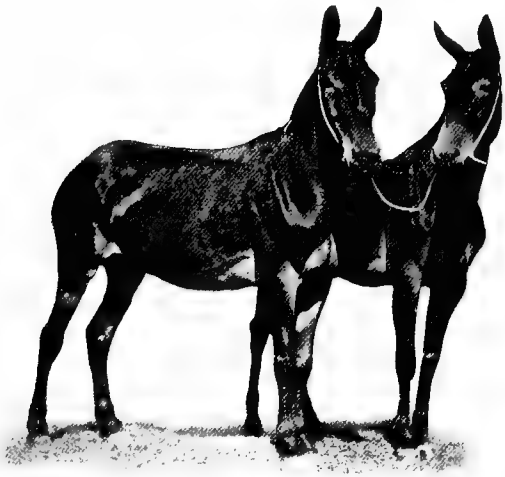

FIG. 53. — A PAIR OF PREMIUM MULES. Owned by C. F. Cook, Lexington, Ky.

the stallion has an aversion to the jennet, and will not mate with her unless he has been reared with jennets.

The jack is likewise peculiar in his habits. Jacks will not serve both mares and jennets. Nor will a jack serve a mare at all if reared along with a jennet. In the rearing of mule-breeding jacks, this is a factor of much importance and cannot be impressed too strongly. To mate with mares, in order to breed mules, a jack must be raised along with mare colts and not permitted to see or smell a jennet until well broken

and trained to mate mares properly. If permitted to serve a jennet, he will not again serve a mare, and his usefulness as a mule breeder is at an end.

It is best to have a stallion to tease the mare when a jack is to be used. Some mares are afraid of jacks and will not show signs to them, hence the importance of having a stallion as a teaser. After the mare is bred, her subsequent treatment should be the same as suggested for brood mares.

CHAPTER VI

CARE AND MANAGEMENT OF HORSES

Much attention has been given the feeding as well as the breeding of horses, yet each of these will fail wholly or in part to bring about the desired results unless animals thus fed and bred receive proper care and attention. Many a person has fallen short of success in breeding by depending on blood alone to improve the stock. He has forgotten that all of our improved breeds of horses are the product of adequate nutrition as well as intelligent breeding, suitable environment, sufficient shelter, and kindly care. To make a success with horses, one must be industrious, patient, and untiring. He must have a fidelity that is unswerving. He must have a genuine love for his work.

GROOMING

Nothing contributes so much to the beauty and the luster of the coat as grooming. As a consequence, the body receives much attention and the legs entirely too little, whereas the legs should receive the more attention. On arriving at the stable, if the animal's legs are muddy, they should be roughly cleaned by using a half-worn common broom. The animal should then be placed in the stable, fed, unharnessed, given a thorough grooming, and blanketed. The legs should not then be neglected, but be given a thorough and rapid brushing. Time spent in cleaning and rubbing the horse in the evening after the day's work is done is worth much more than time thus spent in the morning.

If the animal is working in the mud, it is desirable that the hair be clipped from the limbs. It is then all the more important that they should be thoroughly cleaned and rubbed each evening after work. The hoofs should be examined and the cleft between the sole and the frog cleaned.

Animals cared for in this way will pay for the extra care many times over in the satisfaction in having the team come from the stable in the morning in the best of spirit, as indicated by the pleasing appearance, the snap and vigor with which they lift their feet, and by the complete absence of any stiffness in the joints. Again, animals whose limbs are thus cared for will remain comparatively free from the many diseases to which the legs and feet are subject. This care will greatly increase an animal's efficiency and prolong his usefulness.

CARE OF THE HORSE'S TEETH

Occasionally a horse does not feed well, due to irregularities of his teeth. If the first, or milk teeth, are not looked after, they are likely to remain, causing the second, or permanent teeth, to grow in crooked. The young horse's mouth should be closely watched and the persistent milk teeth removed with forceps. Again, it must be remembered that the upper jaw is somewhat wider than the lower, and as the teeth are not perfectly opposed, a sharp edge is left unworn on the inside of the lower molars and on the outside of the upper, which may cut the tongue or cheeks. This condition can readily be felt by the hand, and the sharp edges when found should be filed down by a guarded rasp; otherwise the tongue and cheeks become sore, the food irritates them, and the horse will not feed well.

CLIPPING

Clipping consists in cutting the hair over the entire surface of the horse's body. Several advantages are secured from clipping;

it improves the appearance of the horse and makes his coat more easy to keep clean; a clipped horse is less liable to take cold than a long-coated one because the evaporation is more rapid and the animal does not get so warm; the natural process of shedding the hair is a draft on the vitality of the animal, the appetite is diminished and the horse runs down in flesh. Clipping accomplishes in a very short time what nature requires much time to do. From this it would seem that horses with long thick coats should be clipped. The long coat causes them to become warmer, they sweat more, and the coat holds the moisture, and then when permitted to stand, they are likely to catch cold.

If horses are to be clipped twice each year, the operation should be performed the first time soon after the hair has grown out in the fall. When thus cared for, they become used to the change before cold weather, and there is some growth of hair before winter. The second clipping should be in early spring as soon as the weather begins to get warm and before the winter coat begins to shed. Horses thus treated will be much more easily kept in presentable condition, and if protected by blankets and properly groomed, will pay many times over for such extra care.

When horses cannot be protected from the cold and wet, either in the stable or outside of it, they should not be clipped in the fall. Animals exposed to the weather grow a long coat for their own protection.

BEDDING THE HORSE

A horse at hard work needs rest at night, and much more rest is had when the animal is given a good liberal bed. The bedding should not be permitted to become foul, as this will not only lessen the comfort of the animal but promote disease as well. Of bedding materials, straw leads the list, but when high in price, may be replaced by other materials, such as shavings from the planing mill, rejected parts of corn stalks, tan bark, leaves, and

the like. Old straw is preferred to new, as it is dryer and more elastic. The more broken and bruised the straw the less its bulk and elasticity and the more of it needed.

BLANKETS

In cold climates the use of blankets is indispensable. The horse will prove more efficient and will endure much longer if reasonably protected against sudden changes in temperature, the cold rains, and heavy winds.

Stable blanket. — The proper use of the stable blanket is of first importance. It is a common practice after the day's work to hurry the horses into their stalls, unharness, blanket them at once, feed and leave them for the night; in the morning it is desired to get to work early, the horses are fed, the blankets removed, the animal's body curried a very little, the harness is put on, and in a few minutes the horses are at work. Animals thus treated stiffen in the joints, develop leg and foot diseases, and soon become useless, and may be sold or traded as part payment on others to undergo the same treatment.

The usefulness of a horse can be prolonged and his efficiency increased by proper blanketing and grooming. On arriving at the stable very warm and sweating, the horse should not be blanketed until he has ceased to steam, nor should he be left in a draft If blanketed at once, little opportunity is given for him to dry off, the blanket will become damp, and the hair remain so all night. In case the blanket is not used until the animal has ceased to steam and is somewhat cooled, which will be in a quarter of an hour, the hair will be dry and smooth the following morning. Stable blankets may be dispensed with in the hot summer months if the flies are excluded by screens or by some other means. If blankets are used at this time, they should be of light material and kept clean. As soon as the nights begin to get cool, the blankets should be resumed, as an early use will arrest to a marked degree the growth of hair. This may obviate

the necessity of clipping. In case the horse is clipped, he should be covered with an extra heavy blanket, or with two blankets, for a time.

Outdoor blanket. — The use of the outdoor blanket is as important as the use of the stable blanket. If the horse is allowed to stand outdoors, either for a short or for a long time, he should be well blanketed. If one is going to stop but a short time, the temptation is strong not to blanket the animal. The horse cools off rapidly and may chill, so that it is best to blanket if only for a moment. Again, in the spring when the weather is fair, one is likely to think that no ill will result from leaving the animal unblanketed; and yet he may chill as before. It is best, on stopping the animal, to see that he is well protected at all times.

CARE OF THE FEET

Because of the great importance of the foot it should be carefully cared for throughout the active career of the horse. Each evening after returning from work as well as in the morning before being sent out, the sole of the foot should be examined and all foreign materials removed. For this purpose a small hay hook with the point sharpened is excellent. It is very common to find foreign bodies, such as nails and stones, either driven into the wall or sole of the foot, or collected in the clefts along the frog, and it is very essential that they be removed if the hoof is to remain in healthy condition.

Occasionally the hoofs have a tendency to dry out, thus becoming hard and brittle. Such hoofs should be oiled with some good oil, as linseed or olive oil, or with hoof ointment, of which there are many kinds on the market. This will soften the wall of the hoof and make it less likely to crack or break. It often happens that a piece is worn or broken from the side of the hoof, which throws the weight of the body in such a way as to bring a strain upon the joints of the leg, which often causes deformity and disease. When such break occurs, the hoof should be leveled

with a rasp. When horses are closely confined in the stable, the hoofs grow out long, and if not trimmed, will deform the limb and make traveling difficult.

The rate of growth of the hoof is of much importance, for we are often interested to know how long it will take a crack, such as quarter-crack, side-crack, or toe-crack, a cleft, or a calk to disappear. On the average, the hoof grows one-third of an inch a month. Hind hoofs grow faster than fore hoofs and unshod ones faster than shod. While influenced to some extent by work or exercise, grooming, moisture, and food, the time required for the horn to grow from the coronet to the ground varies in proportion to the distance of the coronet to the ground. The toe, therefore, depending on its height, grows down in ten to thirteen months, the sides, six to eight, and the heel in three to five months.

Shoeing.—The horse's hoof wears off faster than it grows out, and it becomes sore. In order to prevent the hoof from wearing too rapidly the feet are shod. While there are many reasons for applying shoes, the most important are as follows: —

First, to prevent wearing away of the hoof in order that it may not get sore. Horses show need of shoeing first in the fore feet, and in some parts of the country only the fore feet are shod. For this purpose the light shoe is preferred. Second, to prevent slipping, as on ice or mud. For this purpose, when the work is hard, one needs heavy shoes with large calks, but for easy work they may be lighter. In this connection it must be borne in mind that a smooth-shod (shoes without calks) horse slips more on the ice than though he were bare-footed. There are several makes of shoes with removable calks. Third, horses are shod to modify their action.

Of the many things to be considered in fitting a shoe perhaps the most important is to keep the foot perfectly level, thus preventing undue weight being thrown on one side, and other attendant injuries. The frog should be left in its natural size and shape to serve as a cushion for the foot. Make the foot normal.

Then make the shoe fit the foot. In fitting a shoe, nothing will aid one as much as a careful examination of the wear of the old shoe. The shoe should be fitted cold or not so hot as to burn the sole when placed against it in fitting. In nailing the shoe to the foot, the nail holes should not be too near the edge of the sole, for in such case it is necessary to drive the nails too far up into the wall to make them hold. On the other hand, the nail holes should be well back, the nails small in size, and when driven, should be brought out well down on the hoof. If driven high, when the shoes are reset, or the animal reshod, the former nail holes are near the edge and serve to weaken the hoof and interfere with driving the new nails. After driving the nails, they are to be clinched in a small groove fitted for that purpose. Smooth with rasp, but never rasp the outside of the hoof as it will remove the natural protective covering. This natural covering should not be removed, as the hoof will absorb water in the wet season and dry out much more rapidly in the dry season.

TRAINING THE COLT

The colt should be taught subordination at the very start and not be allowed to become headstrong. The usefulness of the future horse will depend much on his courage and fearlessness, and it is to promote these that the colt should become familiar with man at as early an age as possible. If taken in time and properly handled, he need never know fear. A colt should never be frightened. Too many persons thoughtlessly try to make the young colt show off by doing something to startle it, by running at it, throwing sticks, "shooing" it, and the like, which should never be done if a reliable animal is to be developed. Teach the colt useful lessons only. Because colts are bright and very susceptible to training, they are often taught tricks and allowed to become mischievous — to bite, rear, kick, or anything else that may seem "cute." These very things later become a great annoyance and are very hard to overcome. One should not

make the mistake of trying to teach the colt too much at a time; he should understand each lesson thoroughly before a second is attempted. On the other hand, colts should be worked continuously day by day and not simply at the convenience of the trainer. The trainer should be gentle and firm at all times and go through with whatever is attempted.

Training to the halter. — The foal should be taught very early the uses of the halter; first to lead, then to drive. But even before haltering the youngster may be taught to "stand over," to have his foot raised, to back, and the like. In handling the colt be careful about the ears, the back of the fore legs, and the flanks, as these are often very sensitive. Catch the colt by putting one hand under the neck and the other under the hams or around the buttocks (Fig. 54). Never catch a colt around the neck only — if this is done, the colt will go backwards and perhaps fall — but instead catch him around both ends, as described; then if he attempts to go forward, press back with the hand under his neck, and if he attempts to go backwards, press forward with the hand that is around the buttocks. Colts caught in this way will let one walk up to them, whereas if they are

FIG. 54. — METHOD OF CATCHING A YOUNG FOAL.

caught around the neck, there may be difficulty in coming near them.

When ready to halter the foal, choose a strong, well-fitting halter and not a new one that smells of a lot of things that are new to the colt, but one that has recently been used. Care should be taken not to pull heavily on the nose-band at any time. Occasionally deformed face lines and necks are caused by this means. It is not necessary to drag a colt by the halter in order to suggest to him that his business is to follow. As a matter of fact, the reverse effect is usual, and the harder a colt is pulled, the harder he holds back. If, on the contrary, he is coaxed along the accustomed route, as to the water trough and back, he will soon follow promptly. If he resents, however, other means must be tried. Secure a small rope, the size of a light clothes line, about ten feet long, tie a noose or fasten a ring on one end, place this gently over the colt's back just in front of the hips with the noose or ring on the under side of the body, so that when the other end of the rope is run through the noose, the rope can be closely drawn around the flanks; pass the rope along under the body, then between the fore legs, then up through the ring in the halter. Hold the halter strap in one hand, the light rope in the other, pull gently in the halter strap, and as the colt begins to shake his head give the light rope a sharp pull and the colt will immediately step forward. Do not be in a hurry, but give the colt time to get used to the lesson. Soon he will follow wherever you lead.

After the colt understands the uses of the halter and will lead, he may be taught to drive with lines (Fig. 55). To do this successfully a surcingle properly adjusted is required. The surcingle must be provided with loops or rings on each side, placed well below the center of the body, the lines passed through these and fastened to the rings on either side of the halter; never use a bit in the mouth of a very young colt. Now the lines will pass the hind quarters low down, and thus prevent the colt from turning with his head towards the trainer. It is very

important to keep the reins low in turning to make the guiding process easy. After a little, as the colt becomes accustomed to being driven, he can be touched up with the lines, guided to the right or left, but he should be stopped often to assure him he is doing well.

Training to the uses of the bit. — It is best perhaps to train the horse to the uses of the bit when he is about two years of age. The manner in which the horse is educated to know and mind

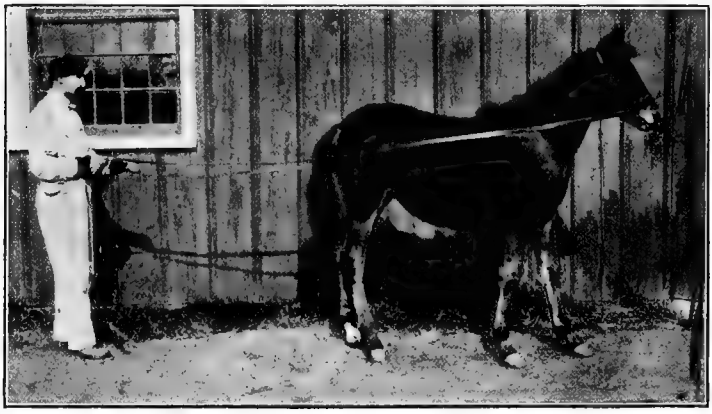

FIG. 55. — ARRANGEMENT OF HALTER AND LINES FOR TEACHING YOUNG COLT TO DRIVE.

the bit will go far towards determining his usefulness. Inasmuch as the conveyance of the master's desire to the horse's mind for execution is through the hands, reins, bit, and mouth, no progress can be made and none should be attempted until this means of communication has been well established.

Importance of a good mouth. — No factor contributes so much to the pleasure, comfort, and safety of either rider or driver as a responsive mouth in a horse — one that always obeys promptly the slightest instruction from the master. A good mouth to a

large extent is natural to the horse. Tender and bad mouths usually result from improper handling. Bad mouths are very aggravating and often the cause of many other imperfections — tongue lolling, crossing the jaws, hobbling, irregular and unsteady gaits, and the like — many of which when well established are very difficult to overcome.

Bitting the colt. — The young animal can usually be made familiar with the uses of the bit by the application of the bitting

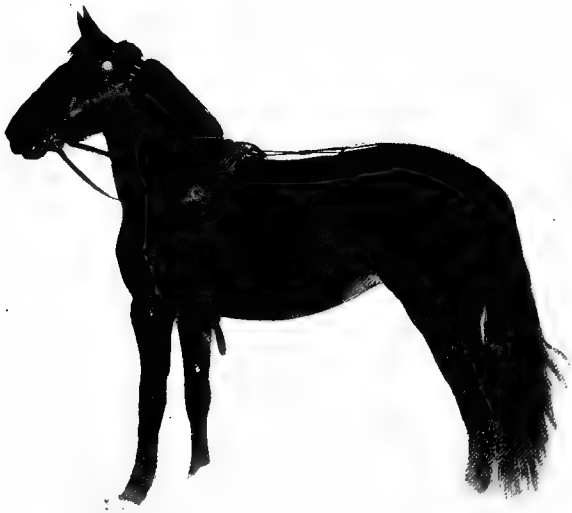

FIG. 56. — ARRANGEMENT OF "BITTING HARNESS" TO FAMILIARIZE THE COLT WITH THE BIT.

harness or "dumb jockey." This harness consists of an open bridle with a large smooth bit and check-rein, a surcingle and crupper, and two side-lines running from the bit to buckles on either side of the surcingle (Fig 56). The adjustment of the bridle is important. The length of the head-stall must be so

adjusted as to bring the bit in mild contact with the bars of the mouth. If the head-stall is too short, the bars and the corners of the mouth soon become sore, and the animal may become vicious; on the other hand, if it is too long, the bit drops down in the mouth and the animal becomes careless. With the bitting harness properly adjusted, turn the colt into the familiar open paddock to get used to having the bit in his mouth. The check- and side-reins should be left slack at first. Gradually from day to day the reins should be shortened, care being taken that they are never made so short as to place the head in an uncomfortable position, or draw the bit so tightly as to make the corners of the mouth sore. The colt should be subjected to the use of this apparatus for a few hours each day for perhaps a week or less, depending on the individual. Real lines may now be substituted for the side-reins and the colt driven until he knows how to guide this way and that; to stop at the word "whoa," and to step forward at the command "get up." Train the colt to stand absolutely still when being harnessed, saddled, or when it is desired that he should stand. A horse that is continually stepping about while one is working with him is but half trained at best.

Harnessing the colt. — After the colt has become familiar with the bitting apparatus and has learned to obey simple commands he may be harnessed. Do not use new harness, smelling of things unfamiliar, but one that has been in constant use, preferably by a horse that the colt knows. After being driven with the bitting apparatus for a time and the colt is rather tired, put him in his stall, bring the collar to him, let him smell of it if he likes, then put it right on as if he were an old horse. Now get the harness, walk up to him, and lift it gently over his back. Do not stand off and throw the harness over his back, for the loose straps hitting his back and abdomen will be resented, and he may kick. Walk behind him, put the crupper strap on, then step to the side and fasten the bands.

The harness should be of good quality and in good repair; if a part breaks, there may be trouble and the colt ruined for all time. See to it that it fits perfectly. The collar should receive attention, as it is by means of this that the horse exerts his power. The colt's shoulders are likely to be tender and easily abraded, and we must see that the collar fits him well. The collar must be kept scrupulously clean. When the colt is fleshy, we must watch to see that he does not lose flesh, and the collar, which fitted perfectly in the beginning, become too large. A breast-collar is admissible when the load is light; it must not be adjusted so high as to choke the horse nor so low as to interfere with the action of his limbs. The saddle and the crupper also need careful attention. Care should be taken to have them fit, neither too loose nor too tight, and then to keep them clean, lest they abrade the back or tail and produce a vicious horse.

Hitching double. — With the harness properly adjusted, the colt is ready to be hitched to a vehicle. Get a well-trained, gentle, but active horse if the colt is active, for it is a mistake to hitch a quick, active colt with a slow, lazy horse. The vehicle to which they are attached should be provided with a good brake. The colt should be attached to the "off side" and the team be driven at first in a closed field till the colt learns what is wanted of him. When hitching the colt double for the first few times, it is well to keep a pair of single lines on the colt's bridle which can be handled by an assistant.

Hitching single. — When the colt is desired for single use, it is often advisable to train him to go single from the first. This may be done after he has become familiar with the bit, harness, and use of the lines. When training the colt to go single, a training-cart — one with long shafts, substantially constructed, and the seat so arranged that the driver can get off and on quickly — should be employed. Such a cart can easily be constructed from the rear wheels and the axle of a buggy or carriage by fastening two long poles, — hickory or any tough, springy wood, — to the

axle, securing a cross-bar and whippletree in front, and a board seat in the rear. The shafts should be twelve or fourteen feet long, with provision at the ends for the attachment of a strap across from point to point to prevent the colt in rearing from throwing his front leg over the end of the shaft. At first a kick-strap attached to each shaft and passed over the colt's rump should be used, at least till the colt is accustomed to the shafts (Fig. 57). When the colt is first hitched, an assistant should hold him until

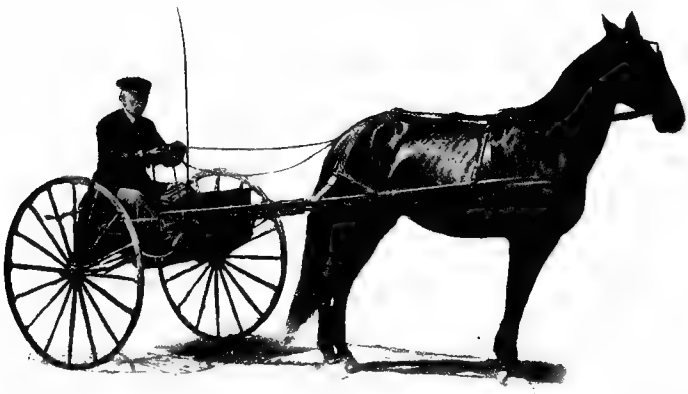

FIG. 57. — COLT HITCHED FOR THE FIRST TIME, SHOWING ARRANGEMENT OF KICK-STRAP OVER RUMP.

the driver is ready, then he should be allowed to go. As soon as he has become familiar with the vehicle he should be compelled to stand still until he is wanted to start.

Training to mount. — In training a colt to mount, one must be very careful that the colt does not succeed in throwing the trainer, for if he once succeeds in getting the man off, one will never be able to convince him that he cannot do it again. The best time to take the colt is after he has been exercised vigorously and while tired. The best place is on soft ground where he can

hurt neither himself nor the rider. Put on the saddle in the same way as we did the harness; see that it is fastened securely. Have an assistant hold the colt's head while you mount. The horse may rear, bound forward, buck, or lie down. In any event, the rider must stay on, remembering that the colt is already tired and on soft ground. It is often an endurance trial, and this is

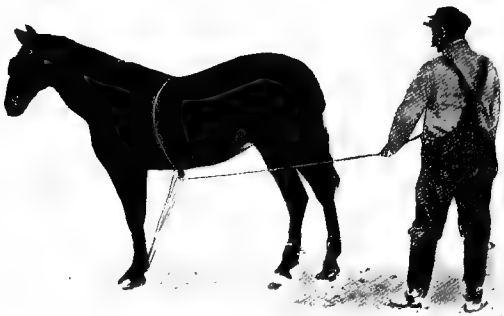

FIG. 58.—ARRANGEMENT OF THE "DOUBLE SAFETY" FOR CONTROLLING VICIOUS HORSES.

When the horse strikes or rears, the trainer pulls the safety and the horse comes down on his knees.

the reason why one must have the colt tired to begin with, for otherwise he may be able to bound and buck till the rider is so exhausted that he can no longer hold to the saddle.

HARNESS AND HARNESSING

In harnessing the horse, much care should be exercised in properly adjusting the various parts of the harness. Properly fitted harness adds much to the efficiency and comfort of the horse. This is well emphasized by the sore mouth, shoulders, neck, back, and tail produced by poorly fitted harness. The tension on these parts is rather great, and as they are very tender they are

the places likely first to show abrasion. Sores thus produced give the horse much pain and are likely to become a cause of viciousness. Sore mouth thus often provokes a horse to run away; sore shoulders and neck often provoke balking; and sore tail often provokes kicking. Since the efficiency and comfort of the horse depend so largely on the adjustment of the bit, lines, collar, saddle, and crupper, it seems desirable to discuss each of these separately.

The bit and the bridle. — When one recalls the extreme tenderness of the mouth, the cruel manner in which it is often bitted, the irritation from the sores, he can understand why a horse may lag behind till the parts become numbed, then begin to pull, holding the head to one side, going with mouth open, lolling the tongue, slobbering, tossing the head, crossing the jaws, and in many other ways showing evidence of the discomfort he is suffering.

The bit. — Bits of many types have been devised to meet the various and peculiar habits of horses, most of which have been designed to punish the horse and irritate the sensitive parts. With the punishment of the whip at the rear and a harsh and severe bit at the front the horse is between two goads, and if he does not balk, rear, plunge, or run away, he is exceptional.

A good-sized straight bit covered with leather or rubber, if the mouth is tender, cannot be improved on in most cases. One must be careful to get a bit of the proper length for the horse's mouth. Many bits are too long and are pulled out of adjustment in the mouth, so that the pressure on either side is not equal. The bit must be of the correct length for the particular animal, and properly adjusted.

Some horses work better with the jointed or snaffle bit. It gives more room for the tongue, and the pressure is more evenly distributed on the jaws than with the straight bit. Severe bits, of which there are many in the market, and which are intended for punishment, should never be used unless it is absolutely

necessary. Such bits in the hands of a novice are responsible for much of the viciousness of horses. The tendency of the nervous horse to loll his tongue can often be cured by the use of the "tongue-lolling bit." This is a straight-bar bit with a plate fastened on the bar, and is just as easy in the horse's mouth as the plain straight-bar bit except for the annoyance of the plate.

In the training and driving of high-acting horses the curb-bit may be used. A horse properly bitted with this shows himself to better advantage than with any other kind of bit. The curb-bit should be used only by those who are familiar with it, as it may become an instrument of torture in the hands of the inexperienced.

The choice of the proper bit for each horse can be determined only by trial, and if several changes are necessary, one should not be discouraged. However, when it has been determined which bit best serves the purpose, no further change should be made. After becoming used to a certain kind of bit a horse does not take kindly to a change. It makes him uncomfortable and may interfere with his action.

Head-stall. — The bridle should be so fitted to the horse's head as to let the bit rest easily in the mouth. The head-stall should be neither too long nor too short. If it is too long, the bit drops so that the rings are drawn into the mouth. The horse becomes careless and unmindful of the driver's wish. On the other hand, if the head-stall is too short, the bit is drawn upwards into the angles of the mouth and becomes a constant source of annoyance to the animal and may produce a sore mouth.

Blinds. — As to the advisability of using blinds on the bridles there is diversity of opinion. Some persons contend that they are of benefit to the horse, while others are just as certain that they are cruel. Here much depends upon the individuality of the animal. Some animals work better with them; some work

better without them. If the horse works better with blinds on the bridle, use them; if he works better with the open bridle, discontinue the blinds. If blinds are used, they should be firmly adjusted to the bridle so they cannot swing back and forth. Both should be of the same height on the horse's head, as it is very unsightly as well as annoying to the horse to have one placed low and the other high on the face.

Center-pieces, ear-bobs, and tassels. — It is said that such fixtures add to the appearance of the turnout. While fashion and custom seem to demand a certain amount of unnecessary fixtures to worry and annoy the horse, the use of them cannot be too strongly condemned.

The check-rein. — The check-rein should be properly adjusted. In common practice there are two methods of checking the horse's head — by means of the side-rein and by the over-check rein. The former is used more often on work horses, the latter on driving horses. The side-rein is used with and without check hooks at the throat-latch. This rein is not so effective in compelling the animal to hold his head up, but is much more comfortable to the horse and enables him to handle himself more efficiently. Horses checked with the side-rein are not so likely to stumble as those with the over-check rein, and will pull a much heavier load. This is because they have more liberty with the head, thereby enabling them to see the ground immediately in front and to lower the head and thus throw more power into the collar.

The over-check rein was devised for trotting horses, but has become so popular that it is used almost exclusively for driving horses. Originally it was used on the track where the surface is as smooth as a floor, and was employed only for short periods. To-day it is used on roads of all sorts and for indefinite periods. There are many strong objections to its use if drawn too tightly, — as is the tendency. It holds the horse's head in such position that he is unable to see the ground immediately in front of him, so that he is very likely to stumble. It also holds the head

in such a way that he cannot pull efficiently. This is particularly true in ascending a steep grade. The animal is unable to lower his head and hence can put little power into the collar. An animal that is stalled when thus reined can often pull the load if unreined or if the driver will ride him, thus bringing forward the center of gravity and enabling the animal to get a firmer hold on the ground and to put more power into the collar. The over-check rein is also very hard on the animal's back and front limbs in descending a grade. Again, it holds the head and neck in such an unnatural position that they soon become numbed, and the horse is seen to toss his head from side to side and to take other characteristic attitudes in search of relief.

The horse should always be reined mildly. Without the rein he is likely to become careless in his habits, shambling in his gait, and to yield to the temptation to eat grass when standing. When the animal lowers his head and neck the lines, collar, and breast-harness slip down and he is likely to become tangled in the harness and may get into difficulty.

Fitting the collar. — The service of the horse is largely accomplished by the shoulders, and it is of the utmost importance that the collar fit the neck and shoulders perfectly. Poorly fitted collars cause the horse much pain, result in sore necks and shoulders, and are a common cause of viciousness and bad habits. Because of the extreme importance of having a well-fitting collar, many makes have been put on the market, such as the leather, the sweeny, the half sweeny, the pneumatic, the steel, and the humane, each asserting superiority over the others (Fig. 59). Each has its advantages and disadvantages. No attempt is made here to favor any style or make; only general suggestions are given.

Fitting the collar is a rather difficult task. It is so firm and stiff that usually it is impossible to buckle the harness tight enough to bring it to the shape of the animal's neck, and the shoulders are therefore adjusted to the collar rather than the

collar to the shoulders, with sore shoulders as the result. To avoid this soreness, it is necessary that the stiff collar be adjusted to the shoulders of the horse for which it is intended. To do this, take the poorly fitting collar, new or old, place it in three inches of water and let it remain over night. In the morning put the collar on the horse, and with hame-straps draw it snugly to the sides of the neck; be sure that the hame-straps are properly adjusted, then work the horse moderately through the day. After soaking in this way the collar will adjust itself to every inequality of the shoulder, and the horse will seldom be troubled with soreness.

FIG. 59. — TYPES OF COLLARS: (1) common leather; (2) half sweeny; (3) steel; (4) pneumatic; (5) humane.

Every horse should have his own collar. It should fit close to the neck along its entire width and should never be tight in some places and loose in others. The hame-straps should be properly adjusted at top and bottom to suit the shape of the horse's neck. Be sure at all times that the lower hame-strap is buckled as tightly as the thickness of the neck will permit. Occasionally the careless driver fails to buckle the hames tightly, and when the horse is backed, the hames slip off the collar. This may not be noticed at the time, and the animal be compelled to pull the load with the hames resting on the shoulders.

Adjusting the hame-tug. — The adjustment of the hame-tug is also an important matter and should receive the closest attention. If the draft is too low, the action of the shoulder while walking

gives too much back-and-forward motion to the collar, which is noticeable at the hame tops. This is likely to cause sore shoulders either at the points or at the top. If the draft is too high, the likelihood of injury will be equally great. There is a proper place for the draft, varying with the conformation of the horse. When the hame-tugs are at the proper place, there will be very little motion at the top of the hames as the horse walks. Again, the tugs should be so adjusted that they are both of the same length. Often careless drivers hitch one tug longer than the other, which is very hard on the horse, and a source of much extra exertion as well as sore shoulders.

Breast harness. — For light driving, breast harness is admissible and is to be preferred for such light rigs as runabouts and buggies. In the adjustment of breast harness, care should be taken that the neck strap is not so long as to let the breast harness drop and interfere with the action of the fore limbs. On the other hand, the neck strap should not be so short as to draw the breast harness up and choke the animal. The breast harness is intended for light work only, and if the load is heavy, the horse may choke. This is particularly true in ascending a steep grade. Much care should be exercised in its use.

Fitting the back-band and crupper. — Perhaps next in importance to the bit and collar is the crupper. If the back-band or the check-rein is too short and the crupper is drawn too tight against the tail, it is likely to cause soreness; since this is a very tender part, it may lessen the reliability of the horse. A horse with a sore tail is hard to manage. At any time he may get his tail over the line, become excited through fear that the abraded part will be injured, clamp his tail down on the line, and be difficult to control. If the back-band is too long and the crupper too loose, it is likely to result in the back-band, crupper, hip-straps, and breeching all slipping off to one side of the horse, with the result that the animal may become excited and difficult to manage. It is therefore necessary that the back-band and check-rein be so

adjusted that the saddle is in the proper place on the back and the crupper fits snugly under the tail; then there will be no trouble from sore back or sore tail.

Fly-nets. — The use of fly-nets often brings much comfort to working animals. Such horses should be provided with throat-latch cloths when the bot-flies are present, as these pests are very annoying, and the animals in fighting them will often become excited, with a consequent lessening of their usefulness. Whether to use fly-nets or fly-blankets may depend on conditions. The use of the fly-blanket is not advised by many persons, but there are conditions in which it proves very desirable, particularly on horses whose color is such as to fade on being exposed to the direct rays of the sun. The fly-blanket, while very efficient in retaining the color and keeping out the flies, is not so presentable and is much warmer than the open net. Leather fly-nets are the most presentable and the most desired by horsemen. But fly-nets and fly-blankets are rather annoying to the teamster and are more or less expensive, for which reasons they are often discarded entirely.

To do away with the use of fly-nets a number of "fly-killer" preparations have been compounded. These materials are applied with a small sprayer, and to be effective must be used often. It is said that they "do not soil or injure the hair and, all things considered, are cheaper and more satisfactory outdoor fly protectors than are blankets."

Caring for harness. — The proper care of the harness should receive much consideration, as care will increase the length of its usefulness and lessen the liability of its injuring the animal. It is very important that the bearing parts be kept scrupulously clean at all times. This applies particularly to the parts in constant contact with the animal, as the collar, saddle, and crupper. It is not possible to prevent sore shoulders, sore back, and sore tail if these parts are permitted to become dirty, which they will, because of the sweat and dandruff. They must be carefully

watched and frequently cleaned. It is best to clean these parts each morning before harnessing the horses or, better still, immediately after removing the harness.

Harness should be thoroughly cleaned and oiled at least once a year, preferably in the spring. This will cause it to retain its fiber and to last longer. While there are many ways of cleaning and oiling harness, the following is as simple and effective as any: Take the harness apart and soak the parts in a wash-tub of lukewarm water containing a handful of washing soda. Let the harness soak for fifteen or twenty minutes, then scrub the parts on a board with an ordinary scrub-brush. When the leather is nearly dry, blacken with edge blackening, which can be obtained at any harness shop. Unless the harness is thus blackened or lamp black put in the oil, it will turn red. When dry, take a cotton cloth and rub the harness thoroughly. Always rub straps with the grain. This lays down the fiber and gives a smooth edge. Take a quart of neatsfoot oil, add a small quantity of kerosene, mix and warm, then give the leather two coats, using the oil freely. Hang up to dry, taking care not to hang in the sun. When the oil is well dried, sponge with white castile soap and buckle the parts together. Harness treated in this way will neither turn red nor become gummy, and if often sponged with white castile soap, can be kept looking like new.

A number of oils may be used if neatsfoot oil is not at hand, such as olive, codliver, or castor oil, all of which are considered good for harness. In case the edge blackening cannot be procured, put enough lamp black in the oil at the time the kerosene is added to turn it black. The lampblack will prevent the leather from turning red.

Harness room. — Another factor that must not be overlooked in the care of harness is the place where it is kept. It frequently happens that the harness is hung on hooks just back of the horse in the stable. There are at least two very strong objections to this practice. In the first place, gases escaping from the manure

are very destructive to the harness; and in the second place, the harness is frequently knocked down under the animal's feet and becomes soiled with manure. It is much better to have a harness room convenient to the horse stable where all harness can be kept. When it is kept in a separate room, it is much less difficult to keep in order. If one has a hanger for each horse's harness and hangs it there each time, the work will be much lighter than otherwise. A well-kept harness room will pay for itself each year because of the ease with which the harness is kept in condition and the increased time that it will last.

CHAPTER VII

DISEASES OF THE HORSE

THE horse is a robust animal and with proper care is easily kept in health. Like all other farm animals, however, he is subject to ills and accidents, many of which can be prevented if taken in time, while if they go unnoticed, may become serious and render the animal useless. Every one who owns a horse should know how to care for the simpler difficulties, and when to call for the advice of a veterinarian. This chapter will not take the place of a veterinarian; it may tell you when to call one. Now that we are giving so much attention to feeding and breeding we should also give additional thought to the difficulties and ailments.

The horse is subject to a very large number of ailments, some of which are simple and easily cared for, more of which are complicated and require skillful treatment. Little more than a catalogue of the more common ailments is given in the following pages; to discuss them fully would require a volume larger than this manual.[1]

TREATING SICK HORSES

Horses that are ailing should receive much care. In many cases good care is to be preferred to the use of medicine. In other cases rest is to be preferred to both. The aim is to hasten recovery from the ill effects of the ailment; and to be most efficient one must understand the horse thoroughly and be able

[1] The reader may consult Mayo's "Diseases of Animals" for fuller popular description and treatment.

to supply his every need. He must be careful, painstaking, and patient. The first thing to be done is to look for the cause of the trouble, and if possible, to remove it. If the disease is contagious, the ailing animal should be put away from other animals equally susceptible to the disease. Whether contagious or otherwise, the quarters should be comfortable. Note carefully the surroundings of the animal, the work it has been doing, the exercise, general care, food, water, and the source of infection if the disease is contagious.

The food should receive much attention. When the horse can eat, a small quantity of easily digestible and nutritious food should be given. The food should not contain much bulk and should be rather laxative, as sickness often brings constipation. It should be as attractive as possible, as the appetite is usually poor and sometimes lacking. When it can be prevented, medicine should not be put in the food or water, unless tasteless and odorless, as the horse is likely to refuse the food when it is important that he should have it. Natural foods, such as fresh grass, roots, bran mash, and milk, are to be preferred to prepared foods, though the use of patent stock foods may prove beneficial in certain minor ailments, when a tonic is valuable. The feed boxes should be kept clean, and if any food is left, it should be removed and not left until the next meal.

In certain ailments, it is necessary to protect the horse against the cold or from drafts. This can be done by the use of blankets. To protect the limbs, bandages may be applied. The bandage should be made from strips of woolen cloth about three inches wide and five to eight feet long. Make it into a neat roll, then apply by beginning at the lower or smaller part of the limb and wind upwards. This requires considerable patience and skill, but after a few attempts it will stay in place.

In those ailments in which the horse cannot stand, yet should remain in an upright position, a sling is used. A sling consists of a wide strip of stout canvas, placed under the animal and

supported from above by means of a chain and tackle, so that the weight of the animal may be taken off its limbs and still be kept in an upright position. It is rarely advisable to attempt to carry the entire weight of the horse. The sling should be so placed under the animal that he can settle into it of his own accord.

In other ailments, when the horse is unable to lie down for a considerable length of time, much relief may often be had by

FIG. 60. — A POLO PONY OF GOOD FORM.

arranging a "lean to." This consists of supports so arranged that the horse can lean up against or settle down on them and thus relieve his weight. The supports in a "lean to" are placed about the animal much like shafts, with the addition of a piece across in front for the chest, and another cross-bar behind for the haunches to rest upon. These supports should be covered with cloths or blankets. Animals are quick to

take advantage of such supports and will get much relief by leaning against them.

ADMINISTERING MEDICINE

In giving medicine the rule should be to give only for a definite purpose. This rule must be strictly followed or more ill than good will result. While medicine may be given in many ways, we will discuss only a few of the more simple, such as drenching, hypodermic medication, external medication, and enemas (or injection into the rectum), and counter-irritants.

Drenching. — A very convenient way to give medicine to the horse is by "drenching." The medicines are first dissolved in water or other suitable liquid. Just enough liquid should be added thoroughly to dissolve the medicine, as more than this makes the drench bulky and is unnecessary. Insoluble medicine, if not irritant or corrosive, may be given simply suspended in the water. The bottle should be well shaken immediately before giving the drench. It should be clean, strong, and have a smooth long neck. The head of the horse should be slightly elevated. To do this, place a loop in the end of a rope and introduce this loop into the mouth just behind the upper front teeth, then place the free end over a beam and draw the head up, not too high, for in such cases the horses cannot swallow. Gradually pour the medicine into the horse's mouth at the corner. If the horse strangles, lower his head.

Hypodermic medication. — Medicines are frequently given by the hypodermic syringe under the skin. In this method much smaller quantities of medicine are required to produce given effects than when given by the mouth, there is less liability to waste, and the action of the medicine is much more rapid and certain. The use of the hypodermic syringe, however, requires more skill, and one should understand it thoroughly before attempting to use it. The medicine should be sufficiently diluted, otherwise it will injure the tissue and cause severe pain. It must

be free from sediment and germs. When all is ready, the syringe should be taken in the right hand; the skin in the region of the neck and shoulder is firmly grasped with the left, and with the right the needle is quickly pushed through in a slanting direction and the medicine injected into the loose tissue beneath the skin. In older animals or those with tough skin considerable force is required to push the needle through the skin. It is of greatest importance that the instrument be perfectly clean and sterile, otherwise infection may be introduced along with the medicine.

External medication. — Medicine is often administered to the horse by applying to, or rubbing on, the skin, in the form of liniments, ointments, lotions, or salves. Applications are also made in the form of poultices and bathing. Liniments, of which there are many kinds, are solutions containing some irritating substance such as ammonia or turpentine. They should never be applied to fresh wounds or sores, but are useful in chronic cases of inflammation. Liniment is often mixed with oil and applied to the part by rubbing. Care should be taken not to apply too frequently or rub too hard, as it will blister the part.

Ointments, of which there are many kinds available, are medicines mixed with waxy material and are used to soften, soothe, and heal inflamed parts. Blisters are ointments containing irritating substance, and are used to reduce inflammation. Lotions are medicines in solution and are used to soothe, cool, and heal.

Poultices are soft, moist substances. They should be applied hot, but should not remain long, as the tissues become soft and flabby. Poultices are applied to soften and soothe and are very useful to relieve severe inflammation. In old chronic sores they soften the tissues, arrest the irritation, and hasten recovery. They should be changed frequently; and a part should seldom be poulticed for more than forty-eight hours continuously. There are many substances used in making poultices, chief of which are

flaxseed meal, bran, bread and milk, and mashed boiled turnips. Whatever the substance, it should be clean, soft, and capable of retaining heat and moisture. To keep them clean and sweet, add a teaspoonful of carbolic acid to a pint of poultice.

Bathing the parts in hot or cold water often proves very beneficial. The application should continue for fifteen minutes to half an hour. When warmed, it may be as hot as can be comfortably borne. The bathing should take place two or three times a day. It is much used and with good results in lessening inflammation, pain, and swelling of recent injuries, and the like.

Enemas, or injections, into the rectum. — Medicines are given by injections into the rectum when they cannot be given by the mouth; when they are not retained by the stomach; when it is desired to empty the bowels; to destroy small worms infecting the large bowels; and to stimulate action. Foods may also be given in this way. Six to eight quarts of warm water is sufficient for an adult horse, and if to this is added a half teacupful of pure glycerine, much better results will be obtained. Injections are best given by means of a rubber hose four feet long to which a funnel is attached. Oil the hose, insert gently into the rectum about two feet, then pour the liquid into the funnel and by raising it above the animal, it will force itself into the bowels.

Counter-irritants. — This is a class of practices applied for the purpose of setting up a local and artificial inflammation in order to cure or counteract a disease or injury. Their application requires some skill and much experience. The counter-irritants most used are liniments, blisters, and burning with a hot iron or "firing."

Blisters. — Two substances are commonly used for blisters: pulverized Spanish flies makes "fly-blister," and the biniodide of mercury makes "red-blister." Both are poisonous and should be cared for accordingly. They are made by mixing one part

by weight of the drug to eight parts of fresh lard or vaseline. For ordinary use the fly-blister is preferred, but to remove a bunch, the red-blister is most used.

Clip the hair from the area, then rub in blister with a cob from three to ten minutes, depending on the severeness of the irritation and the thickness of the skin. As a rule a light blister repeated is more effective than a single severe one. Much care should be taken to see that the horse does not succeed in scattering the blister. To this end his head and tail should be so tied that the animal cannot reach the substance. After twenty-four to thirty-six hours, or when a watery, gummy fluid exudes from the skin, the area should be thoroughly washed with warm water and soap, then wiped dry, and greased with fresh lard or vaseline.

Mustard plasters are often used when large surfaces must be treated, as in pleurisy, inflammation of the lungs, and a few other diseases. This plaster is made by stirring up finely ground mustard with warm water into a thin paste, then applied to the area and rubbed in well with a cob or stick. Mustard will prove more satisfactory than fly-blisters when large areas are to be treated, as the latter often irritates the kidneys, and as a result there is painful passage of the urine. When such symptoms appear, the fly-blister should be washed off and the part greased.

Firing. — This consists in burning the skin with a red hot iron. The firing-iron is rather heavy so as to hold heat, but has a sharp point. Firing is used to remove bunches, ring-bones, spavins, and the like. The hair is clipped from the area, the irons heated in a stove, the horse is blindfolded, a twist applied to the nose, and the opposite foot is lifted and in this way the one to be operated on is confined. At first the skin is barely touched and the lines marked, then the lines are burned to a good russet brown by drawing the hot irons through the former lines. A fly-blister is then rubbed on the fired area and the case treated

as for blistering. The horse should be given plenty of time to recover before being put to work.

There are two methods of firing in common use: One consists of making a number of parallel lines, and is known as "line-firing." The other consists in burning a number of little holes over the part to be treated, and is known as "point-firing." It is held that point-firing sets up a deeper inflammation. Occasionally both methods are combined, and after the line-firing a few points are made over the most diseased part.

LAMENESS: ITS CAUSE AND TREATMENT

The horse is used largely for locomotive power. Anything that interferes with his travel and pull materially lessens his usefulness. Of all farm animals, the horse is the most exposed to accidents and injuries leading to lameness. Lameness interferes with his usefulness more than with that of any other farm animal. A lame horse cannot work, whereas a lame cow may give as much milk, a lame pig take on fat, and a lame sheep shear as much wool as though it were sound. The causes of lameness among horses are numerous and varied. Only a few of the more important are discussed here, as a complete list would fill a volume.

Lameness due to ailments of the bones

The bones of the horse's legs are particularly subject to ailments causing lameness; this is especially true of the bones below the knees and hocks. The most important ailments of the bones likely to cause lameness are splints, ring-bones, side-bones, bone-spavin, bony enlargements, and fractures of the bone.

Splints, ring-bones, side-bones, bone-spavin, and bony enlargements.—These ailments are caused by severe strains, concussion, blows and hurts; by poorly kept hoofs; and by certain diseases of the foot as corns, cracks, quittor, and the like.

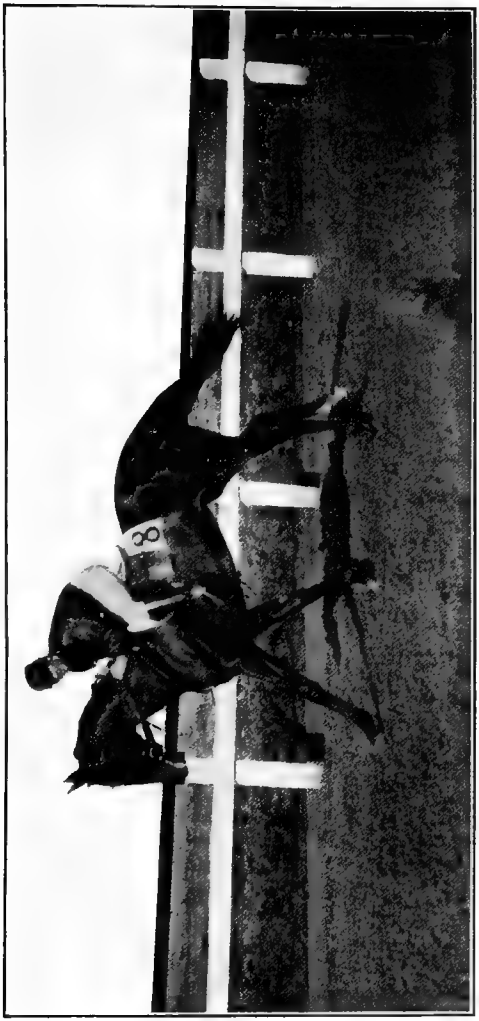

FIG. 61.—THOROUGHBRED RUNNING HORSE. Photograph from *The Horseman.*

The Thoroughbred breed of horses originated in England. This was the first of the breeds to be improved. It is noted for speed and endurance. In general appearance the animals are rather light-bodied and long-legged, resembling the greyhound. The weight and height are exceedingly variable. All colors are found, but the solid colors such as bays, browns, chestnuts, are preferred. This breed is exceedingly popular among the English.

The treatment is to let them alone as long as the horse suffers no inconvenience. If slightly lame, remove shoes and give rest. If lameness persists, try cold water bath and hand-rub thoroughly; then try astringent lotion. If still lame, try tincture of iodine. Paint on twice daily until skin becomes sore, then withhold a few days. If still lame, try Spanish-fly or red-blister. Lastly, the firing-irons may be resorted to. Such operations should be performed only by those familiar with the work.

Fracture. — A fracture is a break in a bone. Fractures are caused by blows, falls, collisions, and the like, as well as by sudden muscular contractions such as a violent effort to move a load, a quick jump, a sudden stop or too sudden start, and like causes.

The treatment of fractured bones consists in replacing the broken bones in their natural position and keeping them there without movement until they grow fast together. This is easiest accomplished by covering with two layers of flannel bandages, smoothly applied. Over this bandage place thin strips of wood, or other light material, so as to hold the bones in place, then bind with bandages. These wooden strips or splints should be as long as convenient. In the place of splints, plaster of Paris bandages can often be used to advantage. Such bandages may be obtained from the drug store or made from cheese cloth and plaster of Paris. After applying splints, they should be carefully watched to see that they do not shut off the circulation below the break. If the horse is to be maintained in a standing position, a sling and "lean to" must be supplied to rest the animal.

Lameness due to ailments of the joints

There are three classes of injuries due to ailments of the joints. These are, affections of the synovial sacs of the joint structures, or of the bones and their articular surface, and dislocations of the joints. The most important ailments of the joints likely to

cause lameness are wind-galls or wind-puffs; bog, blood, and occult spavin, and thoroughpin.

Wind-galls, blood-spavin, bog-spavin, and thoroughpin. — Wind-galls usually occur between tendons where small sacs, containing synovial fluid or joint-oil, are situated to lubricate the tendons as they play over each other. They appear in the form of soft and somewhat rounded or elongated puffs of varying size. They may be located on either side of the leg. Usually wind-galls are painless and cause lameness only under certain conditions. In rare cases they solidify into hard masses. The blood-spavin is situated in front and on the inside of the hock. It is merely a dilated condition of the vein and is soft and yielding to pressure. The bog-spavin is a round, smooth, well-defined puff situated in front and a little inward of the hock. On pressure it disappears from this joint to reappear on the outside and just behind the hock. Thoroughpin is found at the back and on the top of the hock in the part known as the "hollows" just behind the shank bone. These rarely cause lameness, but may under certain conditions. They are rather unsightly.

These ailments are usually due to strains and overexertions. In colts they may disappear. The treatment is to cause the puff to be absorbed. Rest, cold water baths, followed by hand-rubbing, will usually bring about the desired result. If they persist, paint with tincture of iodine twice daily until sore. Later try a dull red-blister, but never a sharp one.

Lameness due to ailments of muscles and tendons

Diseases and ailments of the muscles and tendons are a frequent cause of lameness among horses, the most important of which are sprains, shoulder lameness, hip lameness, knuckling, sprung knees and curb.

Sprains is the name applied to the injury of the muscles, tendons, or ligaments whereby their fibers slip or yield. It is very common, as none of the muscles or tendons are exempt

from liability to sprains. Severe lameness usually comes on suddenly after the injury. The parts become inflamed, swollen, and tender.

The usual cause of a sprain is external violence, such as a fall or a powerful exertion of strength and sudden twisting and bending of the joints.

The treatment depends on the conditions. If there is severe pain, hot baths will soften, soothe, and relax the part. If there is much inflammation, cold baths will prove beneficial. The animal should be given rest and kept quiet; hence the box stall is preferable in this case to the pasture. If the lameness persists, apply liniment and perhaps fly-blisters.

Shoulder lameness, the result of a sprain, is of common occurrence. It is by the shoulder that the horse does his work, and for this reason the part is particularly exposed to injury.

It would be difficult and not worth while to name all the forms of violence by which the shoulder may be injured. The chief causes are falls, violent efforts in starting heavy loads, balling the feet with snow, and colliding with other objects.

If not severe, time and rest will cure. When there is pain and swelling, bathe in hot water for half an hour three times daily and apply some astringent lotion. Warm wet blankets are of great service. Anodyne liniments, camphor, belladonna, either in the form of tinctures or oils, are beneficial. Lastly, try dull blisters.

Sweeny shoulder is a rapid wasting away of certain muscles on the outside of the shoulder-blade. While met with in horses of any age, it is more common in young animals. If neglected, it ruins the animal.

Sweeny is caused by straining, by severe pulling, and by jerking movements. Idle horses when put to work are most liable. The nerves or blood vessels of the affected part seem to be injured by the pressure of the collar.

The treatment is to remove the cause. Rest the horse if possible; if not, procure a perfect fitting collar. Rub and manipulate the skin and muscle. Later apply a mild liniment, and hand rub. Two months should be allowed for a complete cure. Light fly-blisters three weeks apart may be used.

Sore shoulders and neck, and galls are of frequent occurrence among horses and are due to poorly fitting collars and harness as well as to certain kinds of work when the load borne by the neck is great.

The remedy is to remove the cause. Keep the parts dry. Wash in cold or hot water, depending on conditions, three times daily, and apply white lotion. If nothing else is at hand, and the galls not bad, wash the parts in hot or cold salt water. Dust on finely pulverized air-slaked lime. Oxide of zinc ointment is good. If the parts become calloused, apply a dull red-blister, which will absorb the callous. It will be necessary to give the animal rest while applying the blister.

Curb is a thickening or bulging of the ligament on the back part of the hock, and just below the point, giving the cannon a curved, protruding outline. A curb is easily noted when viewed from the side.

The cause may be a sprain of the tendon which passes over the back part of the hock. Hocks of certain conformation, such as overbent, coarse, thick, or those too narrow, are liable to this ailment. The tendency seems to be hereditary (see discussion in Chapter IV).

The treatment for curb is to give cold bath on the first appearance of inflammation. Allow the animal to rest. Shoe the foot of the affected leg with high-heeled shoe. This will raise the heel and slacken the ligament. Apply ointments of iodine. Later the application of dull red-blister repeated in two or three weeks may prove beneficial. In cases in which animals have a natural curby hock and it does not cause lameness, it is best to let it alone.

Lameness due to capped-elbows or shoe-boils

Capped joints and shoe-boils first appear as a soft, flabby bag containing a little watery fluid.

Capped-elbows are caused by the irritation due to the horse lying on the shoe when the foot is bent back under the body.

The treatment of capped-elbows is to devise a means for its prevention. This is often difficult. The horse should be well bedded. If the heels of the shoe protrude, they should be shortened. A good method of preventing a horse from lying on the heel of the shoe is to fasten a piece of wood, say two by six inches, across the stall about one foot back of where the horse usually stands. This prevents the animal from doubling his fore feet back under the body when lying down.

Capped-knee is an enlargement on the front of the knee and is somewhat similar to a capped-elbow. Capped-knees may prove a great source of annoyance because of the unsightly blemish they constitute.

While there may be many causes of capped-knees, they are most common among horses addicted to the habit of pawing while in the stable and striking the front of the stalls with their knees, and among naturally weak-kneed animals which are subject to falling and thus bruising their knees on the ground.

The treatment is first of all to remove the cause. This, of course, cannot be accomplished among animals with weak knees, and this class is difficult to treat. The enlargements can be reduced in size by hot baths and by rubbing with liniment. A warm poultice of oil-meal or ground flaxseed enveloping the entire joint and held in place by bandages is often followed by an absorption of the enlargement.

Capped-hock is an enlargement of the point of the hock and is somewhat similar to capped elbows and knees. It is commonly caused either by the horse lying on the hock or by irritation due to the repeated hitting of the hock against a whiffle-tree or

similar object. The treatment should be much the same as that suggested above for capped-knees.

The *shoe-boil* should receive attention. It should be bathed in hot water twice daily, followed by a stimulating liniment well rubbed on the parts. In some cases, however, astringents are used in the form of poultices or pastes. An excellent astringent for such cases is a putty made of powdered chalk and vinegar,

FIG. 62.—STANDARD BRED CARRIAGE STALLION "CARMON" AT THE HEAD OF THE GOVERNMENT STUD AT FORT COLLINS, COLORADO.

and the entire swelling is then covered with a thick coating of soft clay made into a mass with water. This will dry and fall off, after which it should be reapplied.

Lameness due to ailments of the foot

Since the value of a horse depends largely upon his ability to do labor, which in turn depends largely on the condition of his feet, it is, therefore, important that the feet be kept sound;

and to accomplish this end it is necessary not only to know how to cure ailments to which they are liable, but, better still, how to prevent them.

Interfering. — This is the name given to the condition when one foot strikes the opposite leg while traveling. The inner surface of the fetlock joint is the part most subject to this injury, although it may happen along the cannon, when it is usually called "speedy cuts." The hind legs are more liable than the fore legs. As a result of interfering the skin and deeper tissues are bruised, which often causes lameness and thickening of the injured parts. It is often caused by faulty conformation; from the feet growing too long; from defective shoeing; from rough or slippery roads; from exhaustion; from high knee action; from fast work; and because the chest or hips are too narrow. The treatment is often difficult, and perhaps impossible when due to deformity or faulty conformation. When due to fatigue, fetlock- and ankle-boots may be used. Proper shoeing will often prevent interfering. The outside heel and quarter of the foot on the injured leg should be lowered enough to change the position of the fetlock joint, by bringing it farther away from the center, thereby permitting the other foot to pass by without striking, at the same time setting the shoe that is causing the injury well under the hoof.

After removing the cause, apply cold water bandage to the injured parts to remove the soreness and swelling in recent cases. In older cases, when the parts have become calloused from long-continued bruising, apply a fly-blister to the parts, repeating in three weeks if necessary.

Overreaching is the condition when the shoe of the hind foot strikes and injures the heel or quarter of the fore foot. It seldom occurs except when the horse is traveling fast. It is most common in trotting and running horses. Animals that are subject to overreaching should not be driven fast without quarter boots. It can sometimes be remedied

by shoeing treatment, the same as for interfering mentioned above.

Calk wounds. — These are wounds near the top of the hoof and are caused by sharp-shod horses either trampling on themselves or on each other. Heavy draft horses are more subject than lighter ones, and the fore feet more liable to injury than the hind ones, though they often result in the hind feet from the horse resting one foot on top of the other. The treatment is the use of boots properly to protect the top of the hoof, and shoeing the foot causing the injury with blunt calks. When the wound is not deep and soreness slight, cold water bandages and a protective dressing, such as carbolized vaseline, will be all that is needed.

Corns result from bruises of the sole. They occur on the inside half of the sole of the front feet. Corns often accompany weak flat feet, and often result from poor shoeing. The treatment is to discover the cause and if possible remove it. Give the horse rest. Horses subject to corns should be shod with wide-webbed bar shoes, as these protect the foot. As to a cure, the blood or pus that has collected needs to be removed. To do this cut a hole through the sole of the foot, allowing the fluid to escape. Wash in warm water and apply a 5 per cent solution of carbolic acid, turpentine pure or white lotion. When the discharge has ceased, apply pine tar to the opening to keep out the dirt.

Punctured wounds of the foot. — The foot of the horse is liable to wounds made by some sharp object puncturing the sole or the frog and injuring the soft tissues. Such wounds may become serious and hence should receive close attention. Tetanus or lockjaw often follows such wounds in the horse. Such wounds are caused by nails, sharp rocks, glass, wire, and the like. They often cause lameness. The treatment is first of all to withdraw the object. If pus and blood has collected, the hole must be enlarged to facilitate drainage and the sole washed with

5 per cent solution of carbolic acid. Where there is much soreness, the foot must be poulticed for a day or two. Keep the horse in a clean, dry stable, as otherwise dirt will get into the wound.

Cracked hoofs. — Cracks occur in the wall of the hoof. They are designated by three names depending on the location. A "quarter-crack" is when the crack begins at the top of the hoof and extends downward in the wall; a "sand-crack" when the crack begins at the bottom and extends upward; a "toe-crack" when the crack is in the front of the hoof. They may be due to severe work, injuries at the top of the hoof, and to a dry, weakened condition of the walls of the hoof. When the cracks extend to or from the top of the hoof, they may cause severe lameness. As the horse steps the hoof spreads and the soft tissues are pinched in the crack. Sand and gravel may get into the crack thus increasing the trouble. The treatment is to clean out the crack neatly. If "proud flesh" has formed, swab with butter of antimony. Wash with 5 per cent solution of carbolic acid, then apply pine tar to keep out the dirt and to aid in healing. Draw crack together by shoeing nails driven across the crack and clinched. Small clips can be procured for this purpose. The hoof should be kept well oiled.

DISEASES OF THE LEGS

Scratches is an inflammation of the skin, especially in the region of the heels, and by some is called "grease heel." This ailment is usually due to mud and filth. The hind heels being more exposed to the manure are more subject. The treatment is to clean the parts. First clip the hair close to the skin, bathe in warm water, then apply a warm poultice of scalded bran or linseed meal, changing twice in twenty-four hours. After scabs are removed wash, wipe dry, and apply an antiseptic as boric acid, dusting into the sores, then cover with some oily dressing as vaseline, glycerine, castor oil, or fresh lard.

Mud fever is an inflammation of the skin of the legs. It is caused by the irritation of the mud and water in the spring of the year, and occasionally by spattering urine against the fore legs in the case of geldings. The treatment is to keep the parts clean. Clip the hair, cleanse by washing with tar soap, wipe dry, then rub with vaseline, castor oil, or glycerine.

Eczema is an inflammation of the skin. It usually occurs among horses in good flesh, especially in the spring when the hair is long. It is characterized by small eruptive blisters that discharge a gummy substance. This dries about the roots of the hair, causing intense itching, especially when the animal sweats. The treatment is to clip the hair, cleanse by washing with tar soap, wipe dry, then rub the skin with some bland oil as vaseline, glycerine, or castor oil, or better still, oxide of zinc ointment.

DISEASES OF THE DIGESTIVE ORGANS

In considering ailments of the digestive organs, it must be remembered that by far the greater number of these difficulties are due to improper food or to careless feeding. Hence in the treatment of the various diseases of the digestive organs, the method of feeding as well as the kind of food should receive careful attention.

Ailments of the mouth

The mouth is subject to many injuries which may have a serious effect upon mastication and digestion. When the horse does not masticate his food, the mouth should be closely examined.

Sore mouth may result from irritating foods, injuries, and germs of diseases, from severe bits and irregular or diseased teeth, also from vicious habits. The treatment is to locate the cause and remove it. Wash the mouth thoroughly with warm water, then apply three times daily a healing lotion, such as a strong solution of alum. Do not use poisonous remedies.

The horse should be fed soft foods, such as gruels and mashes.

Abnormal and diseased teeth. — The outer edges of the upper, and the inner edges of the lower, back teeth may become sharp and cut the cheeks or tongue. With a guarded rasp, remove the sharp points, taking care not to rasp the grinding surface of the teeth.

Decayed, ulcered, split, and broken teeth should be removed. This should be done with forceps. Never punch teeth out if it can be avoided, as the tooth is likely to be broken and some of the pieces remain in the jaw where they cannot be removed, and thus cause much trouble. Occasionally, however, it will be necessary to cut a hole through the jaw bone and punch the tooth out. In all cases the opposite tooth should be filed off at least once a year.

Lampas is a swelling of the mucous membrane covering the top of the mouth. It is caused by some irritation of the mouth, and is more troublesome at teething time, after which it will disappear. The treatment is to remove the cause when possible. In very bad cases a few pricks with a suture needle, then bathing the mouth in alum water, will prove helpful. If the mouth is pricked, the horse should be fed on soft food for a time. In mild cases the feeding of ear corn will suffice. Burning lampas is cruel and injurious and should never be tolerated.

Ailments of the throat and gullet

Diseases and derangements of these organs are not common except choking, the result of the introduction of foreign bodies or of giving some irritating medicine.

Choking is the closing of the gullet with some foreign body. It often happens when the animal attempts to swallow an apple or turnip and similar objects without crushing them. Some horses choke from feeding too rapidly. The treatment is

to remove the object by getting it up if possible; if not, by pushing it down. If the object is in the beginning of the gullet, it can be worked up. To do this it is necessary to use a mouth-gag in the horse's mouth to protect the hand, then as some one presses upward and forward on the object from the outside of the gullet, pass the hand into the mouth and if possible, withdraw the offending object. It may require some effort to work the object up in this way, but it should be done if possible. If all attempts to work the object up fail, then it should be pushed down with a probang, — a smooth, flexible tube or rod. A piece of three-fourth inch rubber hose is good.

Ailments of the stomach and intestines

Because of the small size of the horse's stomach, it is often difficult to distinguish between the diseases of the stomach and intestines. While the stomach and intestines of the horse are subject to a great many ailments, we shall discuss only the more important, which are indigestion, colic, diarrhea, and constipation.

Indigestion is one of the most common ailments of the digestive organs among horses. It may be due to both the stomach and small intestines failing to digest the food properly. Some of the more important causes are the feeding of indigestible food, improper feeding, bad teeth, which prevent proper mastication of food, hard work immediately after feeding, and any cause that profoundly disturbs the system. It may occur in either mild or acute form. If the attack is mild, the animal refuses his food, lies down, and immediately after gets up, looks toward the flanks, and frequently paws the ground. In such cases the treatment is not difficult. Give the stomach and intestines a few days' rest in which to recuperate, feeding only a light laxative diet, such as bran mashes and fresh grass. Drench the horse with two ounces of Jamaica ginger, dissolved in a pint of fairly hot water, three times daily. In acute indigestion the

animal suffers much pain. The symptoms are much the same. The animal, lying down frequently, paws the ground, looks towards the flanks, stands stretched out, and shows evidence of the pain he is suffering. Treat much the same as for mild indigestion, but repeat the Jamaica ginger drench every three hours. If there is much pain, an ounce of laudanum may be given three times daily.

FIG. 63. — AN AMERICAN TROTTING BRED CARRIAGE HORSE POSSESSING GOOD FORM AND STYLISH ACTION.

Colic. — This term is often loosely applied to almost any ailment of the digestive organs that is accompanied by pain. For our purpose we shall consider it under two forms: spasmodic or cramp colic, and flatulent or wind colic.

Spasmodic colic is a violent and painful contraction of the coats of the intestines. It is caused by some irritant in the intestines, such as undigested food, large amounts of cold water when the horse is tired and warm, sudden changes in the food, such as changing from dry to green food, and similar changes. The pain is severe and often comes on suddenly. The horse

stops suddenly, looks towards the flanks, stretches, and strains as if trying to pass urine, paws the ground, kicks at his belly, throws himself down, and rolls. He sweats, and the respiration and pulse are increased in rapidity. After a time the pain ceases, only to be renewed by another attack in a few minutes. The treatment is to get the horse into a comfortable place where he can roll without injury. Inject into the rectum eight quarts of warm water, containing half a teacupful of glycerine. This should be injected slowly so as to allow the animal to retain it as long as possible. Drench with two-ounce doses of Jamaica ginger as in indigestion. Sweet spirits of niter in ounce doses is also good, as is a tablespoonful of common baking soda dissolved in warm water. To relieve the pain, give one ounce of laudanum and half an ounce of spirits of camphor mixed in half a pint of water. Rubbing the belly vigorously also relieves the pain, as do blankets rung out of hot water and applied to the belly.

In flatulent or "wind" colic the pain comes on more gradually and is continuous. The pain is due to the accumulation of gas in the stomach and intestines, resulting from the fermenting of food. Sometimes the pain is severe, other times it is not. The large intestines are often extended with gas; in fact the bloating may be severe enough to interfere with the horse's breathing. The animal acts much the same as in spasmodic colic. He often attempts to lie on the back as this seems to favor passing of the gas. The treatment is much the same as in spasmodic or cramp colic.

Diarrhea or scouring. — This is an effort of nature to remove some irritant from the bowels. The discharges are frequent, the matter thin and watery, and often characterized by a very foul-smelling odor. Often there is severe straining. Diarrhea may be caused by overfeeding, by bad food, by sudden changes in the food, by eating too rapidly, by drinking bad water, and by driving immediately after feeding. Again, some horses are

predisposed to diarrhea, especially when driven on the road. Since diarrhea is caused by an irritant, the treatment is first to locate the cause and remove it. The discharge must not be checked too suddenly. A half teacupful of castor oil, combined with an ounce of laudanum and given as a drench with a little linseed gruel, is excellent. Oak-bark tea, made by steeping the inner bark of white oak, is good for persistent cases. A teacupful of this tea combined with an ounce of laudanum should be given as a drench twice daily. Horses that are subject to diarrhea while on the road should be watered and fed as long as possible before put to work. Water sparingly immediately before and during the drive.

Constipation is the opposite to diarrhea. The discharge is not frequent, the matter hard and dry and often passed with much effort. The causes are rather numerous and varied. Constipation may be due to bad food, lack of exercise, insufficient water, improper feeding, and is often due to other diseases. The treatment is to reach the cause and remove it, then feed laxative foods, such as thin bran mashes, linseed gruels, and if possible, green grass. Injections of warm water and glycerine are good to empty the bowels. If the ailment persists, give small doses of castor oil or raw linseed oil, say one pint, and if this is not effective, repeat. This is more satisfactory than one large dose.

DISEASES OF THE RESPIRATORY ORGANS

The stable is the source of many respiratory ailments. Poorly ventilated, poorly lighted, poorly drained, and poorly kept stables are perhaps the source of more ailments among horses than all other agents combined. Pure air, light, dryness, and cleanliness are essentials to the horse's well being. These can be procured with small cost and should not be neglected in the arrangement of a stable in which to care for the horse.

Catarrh is an inflammation of the mucous membrane of the

nostrils and nasal chamber. There are two well-recognized forms; the acute and the chronic. Catarrh is often associated with distemper. Acute catarrh comes on rather suddenly. The animal appears dull. There is often a chill in the early stages, followed later by fever. The membrane is dry and rather red. Soon a watery discharge flows from the nostrils, the eyes may be affected and tears flow down the cheeks. The discharge from the nostrils becomes thicker and pus-like. The bowels are often constipated. The cause is exposure to cold and wet. The treatment is to give rest, provide comfortable quarters, blanket the animal, and feed laxative, easily digested food, such as bran mashes, linseed gruel, and grass, if in season. A few days' quiet rest, with pure air and good food, will be of greater benefit than most medication. Give a tablespoonful of saltpeter in the drinking water once daily. Often much benefit can be derived from the inhalation of steam. To do this throw a blanket over the horse's head, place under this a pail of boiling water containing a tablespoonful of carbolic acid.

Chronic catarrh comes slowly; in fact is usually due to some other disease such as a cold, though there are other causes. The animal appears much the same as in acute catarrh, the discharge being thicker, often yellowish to white. It may be discharged in lumps. In some cases it clogs, and the face may bulge from the pressure of the pus inside. Occasionally the parts become diseased and the pus cuts through and is discharged to the outside. Sometimes there is a cough. The treatment so far as rest and food is concerned is the same as in acute cases. Give the horse a tonic. Steam the head. After steaming spray the nostrils once daily with the following: two drams of boric acid dissolved in one quart of warm water. Occasionally the pus collects in one of the cavities, and it is necessary to cut open and wash out the cavity. The boric acid solution makes a good wash for this purpose. This may greatly hasten the cure.

Heaves, broken wind, asthma.—Many loosely apply the term "heaves" to all ailments where the breathing is difficult and noisy. While the veterinarians define these ailments as if well understood, yet they seem to be unable to do much for such diseases. Heaves is often associated with indigestion, or to an error in the choice of food. Overfeeding, especially with dusty or moldy hay, is a common cause. Severe work immediately after feeding may bring on the ailment. Again the tendency to the disease seems to be hereditary, hence animals thus disposed should not be used in breeding. Heaves is readily recognized by the deep, moist, grunting cough; by the peculiar movement of the flank during expiration and by the dilated nostrils which frequently discharge a thick mucus. These are more noticeable immediately after feeding or watering. "Heavy" horses are very common.

When the disease is established, there is no cure. Proper attention should be paid to the quarters and diet. Provide light, dry, clean, and well-ventilated quarters. Feed easily digested, nutritious, and not bulky food. Moisten the hay and do not feed too much. Molasses as well as carrots, potatoes, or turnips chopped and mixed with oats and corn, are a good diet. For medicine give arsenic, in the form of Fowler's solution, at first two teaspoonfuls in the food or water three times daily, gradually increasing to a tablespoonful three times daily and continuing for one month.

Roaring, whistling, thick wind. — These are due to an obstruction in some part of the respiratory tract which prevents the free passage of air. The causes are numerous and not well understood. It often follows distemper or injury to the throat. The tendency is hereditary. Some animals seem more disposed than others, especially those with long slender necks. When the disease is established, there is little that can be done by way of treatment. In certain forms of the ailment, light blistering over the larynx will give relief.

MISCELLANEOUS DISEASES

There are many ailments of the horse, more or less general in their nature. Some of them involve more than one of the systems of the animal body. Many of them are not well understood. It has seemed best, therefore, to set these ailments out by themselves and discuss under one general heading.

Wounds are injuries to the living tissue. Their causes are varied and numerous. First examine the wound to find the depth and direction and to see that there is no foreign substance in it. All foreign materials, such as dirt, hair, and the like, must be carefully washed out with water to which a little carbolic acid has been added, about a teaspoonful of the acid to a quart of water. Where there is much bleeding, this must be stopped, at least in part. If the bleeding is from an artery, it may be necessary to tie the end of the artery towards the heart. In ordinary wounds the treatment is to hasten the formation of a clot. To do this bring the edges of the wound together and bind them there. If this is not convenient, apply some material, such as absorbent cotton, to the wound; this serves to gather and hold the blood, thus hastening the clot.

Ordinary wheat flour applied to the wound is good to hasten clot formation. So is bathing in alum solutions. Cold water is also good. In large wounds it may be necessary to sew the edges together. In doing this much care must be exercised to keep everything perfectly clean. The parts must be brought together evenly so that the edges will not pucker. In stitching, if possible use silk thread, but whatever material used, it should first be dipped into a solution of carbolic acid. Make the stitches independent, tying the two ends across the wound. Place stitches one-quarter to one-half inch apart. Bathe in 5 per cent solution of carbolic acid. Protect the wound and restrain the horse so it cannot rub or bite the injured part.

Distemper, often called strangles, colt ill, catarrhal fever, or

shipping fever, is peculiar to the horse, mule, and ass, and it is common. It appears as a fever lasting a few days, with formation of matter or pus, in the air tubes, and often the formation of abscesses in other parts of the body. It usually leaves the horse perfectly healthy, but may leave it a roarer. The disease is infectious and passes from one animal to another, and few are the animals that escape it. Ordinary light cases require but little treatment beyond proper protection and feeding nutritious, easily digested food, such as bran mashes. They must have protection from exposure to cold and damp or the disease will be complicated with bronchitis or similar ailments. If the case becomes serious, more care is required. To reduce the temperature the safest and simplest plan is to inject large quantities of cold water into the rectum; or give a tablespoonful of nitrate of potassium, as a drench or in the drinking water once daily. To ease the cough and allay the inflammation of the mucous membrane, place a blanket over the head, and steam with the vapor of warm water poured over a bucket of bran and hay in which belladonna leaves or tar have been placed, as in catarrh. If the bowels are constipated, give injections of warm water and glycerine. Physic should not be given. If an abscess forms, poultice with warm linseed, changing daily, open and wash with 3 per cent solution of carbolic acid.

Influenza, sometimes called pink-eye, bilious fever, grippe, and various other names, is also peculiar to the horse, mule, and ass. It usually appears as a fever; the animal seems greatly depressed, the mucous membranes of the eyes are very frequently enlarged and inflamed, giving rise to the name pink-eye. One attack usually protects the animal from future ones of the same disease, but not always. The disease is infectious and contagious, passing from one animal to another. The treatment is to give rest, provide comfortable quarters, and feed easily digested and nutritious foods, such as bran mash, roots,

apples, good oats, and grass in season. The animal must have protection and warmth or complications will develop. If the cough is troublesome, steam the head as suggested for distemper, using a piece of camphor about the size of a walnut in a pail of boiling water and hold the animal's head over it for fifteen minutes at a time at least three times daily. To reduce the temperature, inject cold water as suggested for distemper, or give a tablespoonful of nitrate of potash, as a drench or in the drinking water once daily. If the throat is sore, rub on a little mustard once a day for a few days. Care must be taken to avoid complications.

FIG. 64.—HACKNEY MARE "KITTY GREY" IN ACTION. Owned by C. W. Watson.

Azoturia is a form of poisoning resulting from high feeding and lack of exercise. It is often called "bloody water" because of the dense reddish or brownish urine. Azoturia occurs only among horses that are in good flesh, when they are exercised after standing in the stable for a few days. It often comes on quickly, attacking the animal after traveling only a short distance. The horse becomes stiff, particularly in the hind part, and in severe cases sweats profusely, the muscles tremble, his

hind parts difficult to control, and he goes down and is often unable to rise again. This ailment varies much in severity; in some cases the animal goes lame and if stopped and blanketed, the disease passes away; in other cases the animal goes down and dies in a few minutes. The treatment in mild cases is a laxative, and graduated daily exercise. Sudden attacks will sometimes promptly subside if taken on the instant and the subject kept still and calmed by a dose of bromide of potassium in half ounce dose and sweet spirits of niter in ounce dose. If the animal does not calm, the bromide may be repeated in five hours and the niter twice daily. Blankets wrung from warm water and placed over the loins are also good to quiet the animal. After the animal has calmed, iodide of potassium in dram doses may be given three times daily in place of the bromide. The horse should be given all the water he wants, and if unable to stand, must have a thick soft bed, and should be turned from side to side at least every twelve hours. It is often necessary to draw the urine with a catheter.

Foul sheath. — Geldings are occasionally troubled by an accumulation of the material from the glands of the sheath which often hinders the free passage of urine. The sheath may become stopped up and the retained urine increase the trouble. In such cases the sheath should be well cleaned, and then greased with fresh lard or vaseline.

Diseases of the eye. — The value of sound eyes among horses cannot be overestimated. While there are many diseases and injuries to which the eye is subject, we shall consider only the three common ailments: simple inflammation, "moon blindness," and "pink-eye." Simple inflammation is usually due to an injury, or to some foreign bodies in the eye, such as hay seed, chaff, cinders, sand, and the like. Strong light irritates the eye. The eye becomes red and inflamed, the eyelids swollen, and the tears are discharged freely. The treatment is to locate the cause and remove it. Such bodies as hay seed

and chaff can be removed by wiping the surface of the eyeball with a piece of soft silk. To do this it is often necessary to put a twitch on the animal. If any substance should stick into the eye, it is best removed with the forceps. After the cause is removed, bathe the eye with cold water and apply cold cloths to reduce the inflammation. If this does not reduce the inflammation, bathe three times daily with hot instead of cold water. Follow this by applying a few drops of a solution of boric acid, a teaspoonful to a cup of water. This may be applied with a medicine-dropper.

In some parts of the country, moon-blindness is a very common disease of the eye among horses. Its causes are not known, though the disease tends to be hereditary. The eye behaves much as in simple inflammation. The eye becomes red and inflamed, the tears are profuse, the lids swollen and kept partly closed to shield the eye. In a week or two the inflammation goes down, the eye clears up, save there remains around the iris a yellow band. In a few weeks the attack comes on again. These attacks continue until the animal becomes permanently blind. The sight can, however, be prolonged by careful treatment. When the attack comes on, keep the animal in a moderately dark stall and treat as in simple inflammation. Bathe with hot water and apply boric acid solution. In addition give internally as a drench one teaspoonful of iodide of potassium. Continue for five days, then withhold five days, and repeat.

Pink-eye, as we have seen (p. 178), is a sort of influenza. The disease affects the entire system and is contagious. The treatment is to isolate the horse and disinfect his stall. Bathe with hot water and apply boric acid solution as in simple inflammation. In addition give internally as a drench a heaping teaspoonful of nitrate of potassium, twice daily, as this stimulates the kidneys and reduces the fever.

PART TWO — CATTLE

CHAPTER VIII

CHOOSING CATTLE — JUDGING

In the choice of a cow, one must cultivate the same general faculties as in the choosing of a horse. Familiarity with what is wanted, powers of observation, and good judgment are equally as important in the choice of a cow as in that of any other animal. These can be gained only by study and practice. The importance of these faculties cannot be overestimated in the choice of a cow, either for the dairy or for beef.

TYPES OF CATTLE

There are two distinct types of cattle: first, the dairy type, adapted to the production of milk; and second, the beef type, employed for the production of beef. These types are controlled by the demands made on the body of the animal. For example, in milk production the udder is perhaps as important an organ as any, whereas in beef production it is needed only to sustain the young. Again, in the case of beef production it is very important that the animal take on flesh and that the body be plump and full, whereas in the production of milk this would be considered an objection, as the food should go to the production of milk and not to fat. These two types are of necessity widely different and one can no more have maximum milk production and maximum beef production in the same cow than he can have maximum speed and maximum force in the same horse, or in the same machine.

The dairy type. — When we reflect upon the purpose for which dairy cows are kept, the type becomes apparent. They are useful for the milk they can secrete, and not for the flesh of their bodies; and as the food should go to produce milk and not fat, therefore the body will be spare and not fleshy. The secretion of milk takes place in the udder and allied organs; therefore, the rear development will be large. Furthermore, we cannot have large production without a large factory; thus a large secretion of milk calls for a large digestive tract, which adds to the rear development (Fig. 65).

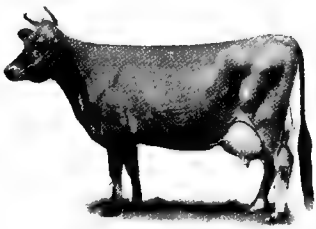

FIG. 65. — JERSEY COW "TORMENTOR'S LASS." Owned by Hood Farm, Lowell, Mass. Dairy type.

In general appearance, the form of the dairy cow resembles that of a triple-wedge. Viewed from the side, she shows greater depth of body behind than in front. Viewed from the rear and top, she gradually widens from the chest to the hips. Viewed from the front and top, she gradually widens from the withers backward and downward to the abdomen. While this is the desired form and many superior cows possess it, yet exceptions occur, and many heavy milkers are not associated with this form. Fleshiness, however, is distinctly objectionable in the milking cow.

FIG. 66. — ANGUS STEER. Grand champion at the International Live Stock Exposition, 1909. Beef type.

The beef type. — In the beef type, the food goes to the production of flesh; hence a tendency to fatten is desired. The

quality of the flesh in different parts of the body varies widely. In the meat-market, flesh forming certain parts of the body is worth many times that from other parts. We demand therefore in the beef type not only an animal with a tendency to take on fat, but this tendency must be accelerated in the region of the valuable cuts.

In general appearance, the form of the beef type resembles that of a brick set on edge. Viewed from the side, the top and bottom lines are parallel. There is no wedge shape; the animal is as deep in front as behind. Viewed from the rear and top, the withers and chest present an appearance almost as wide as the hip and rump. The animal is compact and broad of back from shoulders to hips. Cattle of the beef type are often referred to as "blocky," indicating compactness and squareness of form (Fig. 66).

HOW TO ESTIMATE THE AGE OF A COW

The age of a cow is a very important factor in determining her present and prospective value. Familiarity with the characters that indicate age, therefore, are often extremely useful. As in the case of the horse, a knowledge of these characters is not difficult to secure, but skill in their application depends much on continued practice.

General consideration. — In estimating the age of a cow, the order of the appearance of the permanent teeth furnishes the best index, especially from two to five years of age. There are, however, other general considerations that aid in estimating age, especially in the case of young and very old animals. Size is the principal factor in determining the age up to a year and one-half. In old animals the top of the head becomes more prominent, the sides of the face more depressed, and the hollows above the eyes deeper. With age the backbone becomes more prominent and often strongly curved downward.

Examination of the teeth. — While the order of the appearance

of the permanent teeth and their method of wearing are considered the most accurate means of estimating age among cattle, yet they are not absolutely accurate nor are they as dependable as in the horse. Teeth in cattle vary in much the same manner as in the horse. See page 8 for variation in teeth among horses.

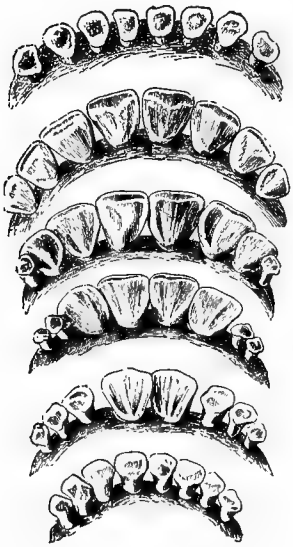

FIG. 67. — COWS' TEETH ARRANGED ACCORDING TO AGE. Lowest row represents a 15 months' old mouth, second row 18 months', third row 27 months', fourth row 36 months', fifth row 45 months', and the top row represents the teeth of a ten-year-old cow. — WALLACE.

As in the horse, there are two sets of teeth, — first, the temporary or milk teeth, and later the permanent teeth. The latter differ from the former in their greater size. This replacement of the temporary by the permanent is made necessary by the increased size of the jaw as the animal grows older.

The calf is often born with the central pair of milk teeth, and the remaining pairs appear within the first month after birth. The calf is provided with four pairs of incisor teeth. There are incisors in the lower jaw only, the upper being provided with a cartilaginous pad.

When the animal is approximately eighteen months of age, the middle pair of milk teeth is replaced by permanent ones, which are fully twice as broad as the milk teeth, hence easily recognized (Fig. 67). The intervals between the appearance of the succeeding pairs varies much according to the conditions, but can be stated as approximately nine months, perhaps more rather than less. In general the age of the animal at the time

each pair is up and in full wear may be estimated as follows: —

First or middle pair of permanent teeth	18 months
Second or first intermediate pair of permanent teeth . .	27 months
Third or second intermediate pair of permanent teeth . .	36 months
Fourth or lateral pair of permanent teeth	45 months

If there is a variation for this table, the cow is likely to be older rather than younger than the teeth indicate according to the ages. In fact, some authors say the first pair of permanent teeth appear at two years of age; the second pair at three; the third pair at four; and the fourth pair at five years of age.

The permanent teeth of the cow differ in many respects from those of the horse. After they are up and in wear there is comparatively little change for a few years. They are never firmly fixed in the jaw, as are the permanent teeth of the horse.

As the animal grows older the teeth become narrower, and by the ninth year there is much space between them. They shrink away from each other and often become more or less discolored and finally drop out one by one.

Examination of the horns. — The horns of cattle are often used in estimating the age. During the first two years the horns grow rapidly, and in this time they make approximately their entire growth. After two years of age, the growth is slow, and each year's addition is marked by a more or less distinct ring. The first ring does not make its appearance until the animal is approximately three years old. The age is estimated, therefore, by adding two to the number of rings present.

CHOOSING A DAIRY COW

The dairy cow is desired for her ability to secrete milk at a profit. In estimating the value of a dairy cow there is no method so satisfactory as the actual record of her performance as determined by the scales and the Babcock test. Having

a record of the quantity of milk, the percentage of fat, and the approximate food consumed, the value of a cow for dairy purposes may be determined very accurately. If in addition to her own record, we have a record of the performance of both her dam and her sire's daughters, we can speculate with some degree of certainty her prospective production, as well as that of her daughters and her sons' get. Such records, however, are seldom available, and in their absence we estimate the production by those signs that most certainly indicate it. While these signs are not always true indications of high production, yet in the absence of more accurate information they are the best we can do.

As in the choosing of a horse, it is essential that we examine the animal in systematic order, otherwise some very valuable character may go unobserved. Perhaps the most convenient and simplest method is to note the general appearance of the animal first, that is, the form or shape, weight, quality, and constitution, and if these are satisfactory, then make a more detailed examination, studying each character in relation to milk production.

General characteristics in dairy cows

By carefully observing the general appearance of the dairy cow, one can gain a fair knowledge of her desirability. Very often the general features are not given much consideration and we pass to a detailed examination, with the result that many very important characteristics go unconsidered. Some persons have such an accurate "eye" for appearances that they are able to judge a cow very surely by a general look; but for most people this method is unsafe.

Form. — The general form should be considered from two points of view: First, with respect to angularity; second, freedom from beefiness. It will aid us to gain a clearer under-

standing of the form among dairy cows if we will remember that there is extra heavy demand made upon four systems. These are the milk-secreting system, the digestive system, the circulatory system, and the nervous system. It is because of the extreme activity of these centers that the dairy cow is inclined towards a given form. The milk-secreting organs and the digestive organs having an undue amount of work to do tends towards extreme development, while the other parts, because of their inactivity, are inclined to be narrow.

The typical form of a dairy cow is that of a triple wedge, as already indicated. Viewed from either side she should show greater depth of body behind than in front. The shoulder should be lower than the hips and the floor of the chest higher than the bottom of the udder. If a straight edge were laid along the back and allowed to project forward, and a second straight edge placed along the under line touching the bottom of the udder, the abdomen, and the floor of the chest, and allowed to project forward, it should meet the one from the back a short distance in front of the animal. Viewed from the rear and top the dairy cow should gradually widen from the chest to the hips. Straight edges placed along either side and projecting forward should meet a short distance in front of the animal. Viewed from the front and top she gradually widens from the withers backward and downward (Fig. 68). This illustrates the typical dairy form and the one towards which most good milk cows tend, though it does not follow that a cow, to be a good dairy animal, must be of this type. Occasionally a good milker can be found not of this form, but since most good milk cows tend towards this shape, and in the absence of more accurate data, such as the actual records, the choosing of animals possessing such configuration is to be recommended.

If the cow tends naturally to take on fat, she is worth just so much less as a milk cow. The dairy cow should be spare. There should be an absence of fleshiness throughout, partic-

ularly in the region of the shoulders, the back, the rump, and about the tail-head, places likely first to show fat among animals possessing such a tendency. While this is the form ordinarily

FIG. 68.—GUERNSEY COW "DOLLY DIMPLE." Sired by Yeoman. She gave 18,459 pounds of milk containing 907 pounds of fat. World's record for the breed. Bred and owned by F. L. Ames, North Easton, Mass.

The Guernsey dairy cattle originated on the island from which they take their name, one of the Channel Island group. They possess similar characteristics to the Jerseys, but are somewhat larger, and the milk is hardly so rich. The weight will run 900 pounds and upward. The color is either yellowish, brownish or reddish, fawn, and white.

possessed by the best producers, here too exception can occasionally be found. A cow may be found that is so efficient with her food that she can take on fat and in addition secrete more milk than another and less efficient cow can secrete alone,

be she ever so spare. But in the absence of more accurate information, the spare form is to be preferred.

Quality. — The quality is a very important factor in the choice of a dairy cow. It is well determined by the condition of the skin, hair, and bone. The skin should be soft, mellow, oily to the touch, and comparatively thin. Care must be exercised in respect to the thinness of the skin, as a thin, papery skin as such is usually associated with weakness of constitution. The skin lining the ear, as well as that in the region of the udder, inside the thighs, and at the root of the tail, should be of a golden color and the secretions abundant. The hair should be soft, silky, and comparatively short. Black hairs will usually be harsher than white hairs, even on the same animal. While many good milking cows are loose in form, possessing an open conformation, yet the bone should be dense and of fine texture. Dairy cows possessed of a tight, heavy skin, coarse, harsh hair, and of a heavy, rough, coarse bone are deficient in quality.

Constitution. — Because of the peculiar conditions under which most dairy cows are kept, the constitutional vigor deserves much attention. Vigor is estimated by the expression, by the condition of the hair and hide, and by the chest capacity. The expression of the eyes, ears, and head should be mild and lively, and the animal should be on the alert. The chest capacity should be large, particularly across the floor. A good way to note the width of the floor of the chest is to place the hand along the chest between the front legs, as the width between the front legs should be great. Narrowness between the front legs is objectionable for the reason that it indicates lack of constitution.

Temperament. — The dairy cow should have a good temperament. Among cattle there are two divisions of temperament: the nervous and lymphatic. In a cow of the former temperament, the nervous organization is strong and well developed, while a cow of lymphatic temperament is sluggish in disposition

and inclined to fatten. Hence, for the dairy we desire a cow of nervous temperament, one that is sensitive and active, possessing greatest vitality, and that is capable of giving all organs the greatest producing powers.

Detail characters of a dairy cow.

Having considered the general appearance of the dairy cow, we should pass to a more detailed examination of her characters before choosing. In order that none of these characters go unobserved, they should be considered in order.

The *head* of a dairy cow should be long, lean, and feminine in appearance. There should be freedom from coarseness and heaviness. The face should be prolonged, lean, and the features distinct. The poll should be prominent and the forehead broad. The eyes should be mild, bright, and full. The nostrils should be large, permitting of the free passage of air. The ear should be of medium size, fine quality, and of an orange color inside. The horn should be rather small and free from coarseness, especially at the base.

The *neck* should be rather long, slim, and fine, carrying the head gracefully. There should be freedom from fullness and heaviness. The windpipe should be rather prominent, especially up near the throat. While the neck should have a neat attachment at the head and shoulders, yet it should not blend so smoothly as in beef cattle because of the lack of flesh. The animal should not have a "bull neck."

Fore-quarters. — The shoulders should be prominent, free from beefiness, and rather angular. The withers should be lean, thin, and refined. Both withers and shoulders should be free from meatiness and heaviness. The legs should be straight and short with fine shanks (Fig. 69).

Body. — The producing powers of the dairy cow depend largely on the depth and volume of the barrel. We have already noted the importance of the digestive, circulatory, and respiratory

systems in the dairy cow. In order that these systems perform their functions most efficiently it is necessary to provide them ample room. The chest should be deep, with large heart girth, and broad on the floor, particularly as noted between the fore legs. The ribs should be long and sufficiently arched to provide a capacious body. The abdomen should be large and deep, indicative of much capacity, and should be well supported. The back should be lean, backbone rather prominent and strong. In many good dairy cows there is much distance between the spinal processes, and the cow is said to be "open jointed." The loin should be broad, although the space between the last rib and hip may be rather open.

FIG. 69. — GUERNSEY COW, "IMPORTED HAYES ROSIE." Dam of "Yeoman." Owned by F. L. Ames.

Hind-quarters. — As a whole, the hind-quarters in a dairy cow should be wide, long, and deep. There should be freedom from fullness and meatiness, particularly at the tail-head. In many very good cows there is a slight raise from the hips to the attachment of the tail. The hip bones should be rather sharp, prominent and wide apart, thus giving ample room for the generative organs. They should not be lower than the spine. The rump should be long and wide, with the thurls and pin-bones high and wide apart. From the points of the hips to the tail-head there should be a marked hollow, due to the absence of flesh. The thigh should be outcurved and thin, as this provides room for the udder. A thick thigh and a full twist are decidedly objectionable in a dairy cow. The legs should be comparatively short.

Udder. — Too much stress cannot be placed on the importance of thoroughly examining the udder when choosing a dairy

cow. If one can say that one organ is more important than another, the udder is perhaps the most important organ in the dairy cow. The udder should be considered from two points of view: the size and form, and the quality.

The udder should be large. In form it should be moderately thick, attached high and full behind, extending well down, though not pendulant, and extending far in front. The quarters should be comparatively even, with the teats of convenient size and well placed. The length of the udder is important since it gives a long line of absorption. It should be approximately thirty inches from the attachment at the back to where it joins the belly.

More important than the size and form of the udder is its quality. Many persons have purchased a cow because of her large udder, only to learn that it was large because fleshy and not because of containing much milk. Perhaps the best way to determine this is to see the udder milked out. When empty, the udder should almost lose its form. It should appear to consist of folds of soft, pliable, and loose skin. The importance of this cannot be overestimated. Those of large experience can determine by the touch whether the udder is large because fleshy or large because filled with milk. When filled with milk, the udder yields to pressure somewhat as a sponge when filled with water. On the other hand, when large because fleshy, the yielding is more like soft rubber. There is a characteristic difference which can be learned only by experience.

While there are many defects of the udder, the most common are small front quarters, with the teats much higher above or close to the hind ones; fleshy udders which reduce but little with milking and yield a small flow; udders entirely deficient in size and often with very unequal quarters. One must be on the alert for small teats, so deficient in size as to be very inconvenient when milking.

The *milk-veins* should be large, tortuous, long, and branching. These veins are considered important as they indicate the amount of blood that has passed through the udder. The veins usually lack development in heifers with their first calf. In a cow that has recently dropped her calf, the milk veins should be very prominent and full, extending well forward, and much crooked, passing into the body through large holes called "milk wells."

Milk signs. — In the cow, as in the bull, there are a considerable number of so-called milk signs that are relied upon more or less in the choice of a dairy animal. First among these is the "open" organization. It is said that an animal in which the joints of the skeleton are loosely knit is likely to have good powers of secretion and assimilation. This loose-jointedness or lax organization is well indicated by the distance between the vertebræ in the spinal column, and this open or loose chine — the jointing of the spinal column — is taken to indicate good capacity to secrete milk. When the edges of these spinal processes are very prominent on either side, it is called a double chine, and this is supposed to be even a better indication of milk production. A long tail is also thought by many to indicate good powers of secretion, and we find many cattle judges who criticize the animal if the tail does not reach to the hock and the longer the better.

FIG. 70. — GUERNSEY BULL "YEOMAN." Sire of Dolly Dimple. Owned by F. L. Ames.

On the back of the thighs and above the udder, it will be observed that the hair runs in the opposite direction from that on the other parts of the body. This up-growing hair upon the rear of the udder, thighs, and perineum constitutes what

is called "the escutcheon" or "milk mirror." It is asserted that the larger the area covered by this up-growing hair, the better producer the cow will be. Guenon, a Frenchman, held that the shape of the escutcheon was indicative of the quantity of milk and that the size was an index of the length of milk flow. Another character which Guenon associated with large production was the "thigh ovals." These are circular patches of hair often found on the rear of the udder and just above the hind teats. They are not present in all udders, but their presence is considered to indicate large milk production.

There are many more of these so-called milk signs which have from time to time and by different men been considered to be a true index to the value of a dairy cow as a milk producer. While it is no doubt true that many large-producing milk cows have possessed all of these signs, it is also true that many more and higher producers have been lacking in them, one and all.

CHOOSING BEEF CATTLE

In beef production there are two classes of cattle to be considered: the breeding animals and the fattening animals. We are concerned here in the selection of cattle to fatten for beef. The beef animal at various times in his life is designated by three names: store animal, feeding animal, and fat animal. Cattle are spoken of as store animals when merely being carried along, as through the summer, or winter, and before feeding begins; they are called feeding animals during the process of fattening; and fat animals after they are "finished" and ready for market.

For fattening purposes steers are preferred to heifers. All things being equal, steers will feed out better than heifers. This is due in part to the fact that steers are quieter in the feed lot than are heifers. The females are often restless for three or four days every three weeks on account of their periods of heat. For this reason it is objectionable to have even a few

heifers in with a lot of steers as they disturb the steers at such times. Furthermore, too, the market discriminates against heifer beef, and the butcher will not pay as much for a drove of heifers as he will a lot of steers.

General characteristics of beef cattle

In choosing feeding cattle one should note carefully their general appearance. The form, the quality, the condition, the uniformity, and the age are each important, and should receive due consideration.

Form of the feeder. — In form the feeder in general should resemble a brick set on edge. It should fill out a parallelogram. The top and bottom lines should be parallel. The shoulders and chest should be almost as wide as the hips and rump. Feeders should be "blocky," indicating compactness and squareness of form. Those with long bodies are termed "rangy," while those with long legs showing too little depth and fullness of body are termed "leggy," both of which are objectionable in a feeder. Steers standing high from the ground, light in the flanks, and shallow in the heart girth rarely make good feeders.

The quality of the feeder. — Quality in feeders is determined in the same way as in dairy cattle, that is, by a soft, mellow hide, silky hair, and a fine bone. The condition of the skin is thought to be an important indication as to the probable feeding qualities of a steer. If the skin is mellow and elastic to the touch, it indicates good "handling." Animals possessed of such skins usually fatten rapidly, whereas those with heavy stiff skins often fatten slowly.

The food influences the handling to a marked degree. When liberally fed, especially on oily laxative foods, the skin is soft and elastic and the hair usually silky and fine. On the other hand, if scantily fed or with improper foods, the skin often becomes tightly attached to the body, and it feels dry

and paper-like. Feeders possessed of rough, coarse hair, tight, harsh skin, rough, heavy bones with coarse joints, prominent hips, and rough, open shoulders are objectionable as feeders.

Condition of the feeder. — In inspecting a lot of cattle with a view to choosing feeders, it is important to note their condition in respect to thrift and fleshiness. The indications of thrift are a good coat of silky hair; soft, pliable skin; a clean and mild eye; absence of discharge from the nostrils; and the dung or excreta of proper consistency, neither too loose nor too hard and dry. Thriftiness is of much importance if steers are to make economical and profitable beef-producing animals.

Other things being equal, the thinner the steer at the time of beginning the feeding operations, the more rapid and the more economical as well as the more profitable the gains will be providing, of course, that the animal is thrifty and that he has not been stunted in his growth. If the animal has been stunted, it is likely to prove a disappointment in the feed lot.

Uniformity among feeders. — Cattle chosen for feeding purposes should be of uniform age, color, type, breeding, condition, and quality. While such uniformity will not add to their ability to take on flesh or to make economical gains, yet it will add very materially to their general appearance when on the market. Such a lot of fat steers will command a much higher price than a similar lot of mixed colors, or of mixed types, or of mixed breeding, or even of mixed ages.

Detail characters of beef cattle

Beef cattle are as a rule not so well trained as are dairy cattle, and it is not so possible to handle them effectively, yet a consideration of details is essential if one is to make a success of choosing animals to feed for beef production.

The *head* is usually considered a good index in the choice of a feeder. It should be broad and short, as such accompanies a

low-set, thick, and wide body; whereas a long, slim face is usually associated with a long, slim body. The face and cheeks should be full and deep with a broad, strong lower jaw. The nostrils should be large, indicating that there is an abundant lung capacity. The eyes should be large, prominent, and mild, indicating a quiet temperament. The feeder should be quiet, as a restless, nervous animal usually proves unsatisfactory. The forehead should be somewhat prominent and covered with a mass of wavy hair. The ear should be of medium size, pointed, and covered inside and out with fine silky hair, and should be neatly attached to the head. If horns are present, they should be of fine texture and free from coarseness.

The *neck* should be short and thick, tapering gradually from the shoulders to the head. It should be neatly attached to the head and smoothly blended with the shoulder.

The fore-quarters. — The shoulders should be well laid in, smoothly covered with flesh, compact, and blending neatly with the body. The crops or withers should be full, thick, and broad. Both shoulders and crops should be covered uniformly with flesh. Rough, angular shoulders, unevenly covered with flesh, are among the most common defects of feeding cattle.

The body. — The chest should be wide, deep, and full, with light development of brisket, yet sufficient to fill out the squareness of the body. Narrow-chested animals are as a rule poor feeders. The ribs should be well sprung and long, giving an abundance of room for the vital organs, such as lungs and heart, and to provide large digestive capacity. The back should be broad and straight from the shoulder to the tail-head and covered with thick, even flesh. The loin should be wide and joining the body to the hind-quarters, with little or no departure from a straight line.

The hind-quarters. — As a whole the hind-quarters in the feeder should be wide, long, and deep. The hips should be wide and in proportion with the other parts, but not prominent. The

rump should be long from the hips to the tail-head, with pin-bones and thurls rather high and wide, but not prominent. The rump should be level and free from hollowness. The thighs should be full and fleshed well down to the hock, with twist full.

The fat steer. — In choosing a fat steer, one must keep in mind the demands of the butchers. They desire a steer to dress with a relatively small percentage of offal; with a relatively large percentage of meat in the region of the valuable cuts; and an animal that is in the proper condition to slaughter, that is, neither over nor under fed. Fullness at the base of the tongue and just in front of the point of the shoulder, a full twist, a large mellow cod (scrotum), a full, thick flank that stands out and rolls as the animal walks, fullness at the tail-head and along the rump, indicate that degree of fatness essential to the highest quality of beef.

CHAPTER IX

FEEDING DAIRY CATTLE

PERHAPS no other question in connection with the propagation and care of farm animals has received so much consideration as that of feeding the dairy cow. Many and difficult are the problems involved. To catalogue and discuss them all would require a work larger than this manual. It is not, therefore, in this connection, proposed to enter into an elaborate discussion, but only to call attention to some of the more important items in connection with the most successful practice.

FOOD REQUIREMENTS FOR MILK

The quantity of food required by a milking cow depends on many factors, chief of which are the kind of food, the quantity of milk yielded, the quality of the milk, as well as the individuality, the weight and age of the animal.

We have already observed, in connection with feeding the horse, that foods vary widely in the amount of energy they contain. In addition to this they also vary greatly in their influence upon milk secretion; that is to say, certain foods act favorably on the secreting glands, whereas other foods tend towards the production of fat. The exact action of the foods influencing secretion is not understood, nor is their ultimate effect upon the animal definitely known. Chief among the foods tending to economize milk production are succulent foods, such as green forage crops, silage, and roots; by-products such as bran, brewers' grains, and dried distillers' grains, and the leguminous hays, such as clover and alfalfa.

The quantity of food which the milking cow requires will be influenced by the amount of milk which she yields. This was taken into account by Wolff and Lehman in their standard. Thus we notice that a 1000-pound cow yielding 11 pounds of milk daily requires 25 pounds of dry-matter, whereas one yielding 22 pounds of milk per day requires 29 pounds of dry-matter in her ration: —

Wolff-Lehman standard, showing the amount of food required per 1000 *pounds live weight for the growing and the mature cow yielding varying quantities of milk*

Condition of Animal		Dry-Matter	Digestible Nutrients			Nutritive Ratio
			Protein	Carbo-hydrates	Fat	
Growing Cattle, Dairy Breeds						
Age, Mo.	Weight					
2–3	150	23	4.0	13.0	2.0	1 : 4.5
3–6	300	24	3.0	12.8	1.0	1 : 5.1
6–12	500	27	2.0	12.5	0.5	1 : 6.8
12–18	700	26	1.8	12.5	0.4	1 : 7.5
18–24	900	26	1.5	12.0	0.3	1 : 8.5
Milking Cows, when yielding Daily						
11.0 lb. of milk		25	1.6	10.0	0.3	1 : 6.7
16.6 lb. of milk		27	2.0	11.0	0.4	1 : 6.0
22.0 lb. of milk		29	2.5	13.0	0.5	1 : 5.7
27.5 lb. of milk		32	3.3	13.0	0.8	1 : 4.5

These standards were arranged to meet the need of the average farm cow under normal conditions. They were not intended to be absolute and fixed, but to be varied in practice as circumstances suggest. Of late years they have been subjected to

much criticism by investigators in the United States, who feel that they call for more protein than is needed, especially by those animals giving a rather large flow of milk rather poor in butter-fat. These investigators object to the fact that the standards do not take into account the quality as well as the quantity of the milk.

FIG. 71.—HOLSTEIN-FRIESIAN BULL "KING SEGIS" AT SIX YEARS OLD. The sire of fifty A. R. O. daughters owned by H. A. Moyer, Syracuse, N. Y.

The Holstein-Friesian breed of dairy cattle originated in Holland. While the Jersey is noted for the quality of milk, the Holstein is noted for the quantity or the large flow of milk. It is often spoken of as "the milk cow." In size they are the largest dairy breed, mature bulls weighing 1700 to 2200 pounds, the cows 1400 to 1800 pounds. The color is black and white. In America this breed is very popular for milk production to supply the cities.

The quality of the milk as well as the quantity has an influence on the amount of food required by a milking cow. For example, the daily production of 22 pounds of 3 per cent milk involves the elaboration of approximately 2.5 pounds of milk solids, whereas if the milk contained 6 per cent fat, it

would require approximately 3 pounds of milk solids, or an actual secretion of one-half pound more solid matter in the milk. Thus the cow yielding the 6 per cent milk would require more food than the cow giving only 3 per cent milk.

Haecker has conducted many experiments in an endeavor to gain some knowledge of the relation between the percentage of fat in the milk and the food required to produce the same. From these experiments he has calculated the nutrients — protein, carbohydrates, and fat — required for the production of a given amount of fat, and using this as a basis, has constructed standards for milk production: —

HAECKER'S FEEDING-STANDARD — MATURE COW [1]

Table showing food of maintenance per 100 *pounds live weight and nutrients required for the production of* 1 *pound of milk testing a given per cent of butter-fat*

	Protein	Carbohydrate	Fat
For maintenance . .	0.0700	0.700	0.0100
Milk testing 2.5 . .	0.0362	0.164	0.0124
Milk testing 3.0 . .	0.0397	0.181	0.0136
Milk testing 4.0 . .	0.0467	0.214	0.0159
Milk testing 5.0 . .	0.0537	0.247	0.0182
Milk testing 6.0 . .	0.0607	0.280	0.0206
Milk testing 6.5 . .	0.0642	0.296	0.0217

To illustrate the method of using the table to determine the amount of food required in milk production, choose the case of a 1000-pound cow yielding 22 pounds of milk daily. Let us assume that in one case it contains 3 per cent fat and in a second that it contains 6 per cent.

[1] Minnesota Agricultural Experiment Station Bulletin No. 79.

From the table we learn: —

	Pro.	C. H.	Fat
Nutrients for 1 lb. of 3 per cent milk . . .	0.0397	0.181	0.0136
Nutrients for maintenance 100 lb. weight .	0.0700	0.700	0.0100

For cow weighing 1000 pounds and yielding 22 pounds of 3 per cent milk: —

	Pro.	C. H.	Fat	Ratio
Nutrients for 22 lb. 3 per cent milk .	0.87	4.00	0.30	
Nutrients for 1000 lb. maintenance .	0.70	7.00	0.07	
Haecker ration required	1.57	11.00	0.37	1 : 7.5

For cow weighing 1000 pounds and yielding 22 pounds of 6 per cent milk: —

	Pro.	C. H.	Fat	Ratio
Nutrients for 22 lb. 6 per cent milk .	1.34	6.16	0.45	
Nutrients for 1000 lb. maintenance .	0.70	7.00	0.07	
Haecker ration required	2.04	13.16	0.52	1 : 7.0
Wolff-Lehman standard . . .	2.50	13.00	0.50	1 : 5.7

Thus we see that even though the flow was 22 pounds in either case, the food required is much greater in the case of the milk rich in fat. By comparing these with the Wolff-Lehman standards we note that they are approximately the same, except in the case of the protein. According to Haecker the protein required, even in the 6 per cent milk, is much less than that called for in the Wolff-Lehman standard.

While no doubt some such formal standard as the Wolff-Lehman or the Haecker should be followed in calculating the amount of food required for milk production, yet it is well to remember that there are many difficulties encountered in feeding dairy cattle that standards cannot decide. Chief among these are the digestibility of the food and the individuality of the animal. Our methods of arriving at the digestibility of foods are crude, and foods vary widely in their digestibility, and either of these difficulties may seriously interfere with such close figuring as is recommended in the Haecker standards; that is to say, the digestive values assigned the foods may easily be so erroneous as to offset any saving that seemingly occurs from such calculation.

The individuality of the cow is a factor which standards cannot take into account. Cows vary widely in the amount of food they will consume for the production of milk, some requiring twice as much food to produce a given product as others. Some hold that this variation is due to the fact that the cow will consume the feed, though she does not need it, and that by limiting her ration she can often be made to produce at a profit. That there is a vast difference among individuals in the amount of food required for a given product must not be lost sight of if one is to succeed in the dairy business.

FIG. 72. — HOLSTEIN-FRIESIAN COW "DICHTER CALAMITY." Owned by John Arfman.

The age of the animal also has an influence on the amount of food required for milk production. This subject has also been investigated by Haecker. His experiments show that the heifer requires considerably more nutrients for the production of a given amount of fat than the mature cow. From these experi-

ments he constructed a standard similar to the one for mature cows: —

HAECKER'S FEEDING-STANDARD — HEIFERS [1]

Table showing food of maintenance per 100 *pounds live weight and nutrients required for the production of* 1 *pound of milk testing a given per cent of butter-fat*

	Protein	Carbohydrates	Fat
For maintenance . .	0.07	0.700	0.0100
Milk testing 2.5 . .	0.0378	0.188	0.0130
Milk testing 3.0 . .	0.0443	0.218	0.0152
Milk testing 4.0 . .	0.0573	0.287	0.0197
Milk testing 5.0 . .	0.0703	0.338	0.0242
Milk testing 6.0 . .	0.0833	0.398	0.0287
Milk testing 6.5 .	0.0898	0.428	0.0310

To illustrate how these differ from the mature cow we will take the same example, that of a heifer weighing 1000 pounds and yielding 22 pounds of 3 and 6 per cent milk. While a heifer might not weigh as much as this, the figuring is on a percentage basis and the results will be the same.

For a heifer weighing 1000 pounds and yielding 22 pounds of 3 per cent milk: —

	Protein	C. H.	Fat	Ratio
Nutrients for 22 lb. 3 per cent milk .	0.98	4.80	0.33	
Nutrients for 1000 lb. maintenance .	0.70	7.00	0.07	
Heifer, Haecker ration required . . .	1.68	11.80	0.40	1 : 7.5
Mature cow, Haecker ration required .	1.57	11.00	0.37	1 : 7.5

[1] Minnesota Agricultural Experiment Station Bulletin No. 78.

For a heifer weighing 1000 pounds and yielding 22 pounds of 6 per cent milk: —

	Protein	C. H.	Fat	Ratio
Nutrients for 22 lb. of 6 per cent milk .	1.83	8.76	0.62	
Nutrients for 1000 lb. maintenance .	0.70	7.00	0.07	
Heifer, Haecker ration required . .	2.53	15.76	0.69	1 : 6.8
Mature cow, Haecker ration required .	2.04	13.16	0.52	1 : 7.0
Wolff-Lehman standard	2.50	13.00	0.50	1 : 5.7

According to this standard, the heifer needs considerably more nutrients than the mature cow, and in the case of high production calls for more nutrients than the Wolff-Lehman standards provide. This is due to the fact that she needs nutrients in building up her own body as well as for the production of milk. It is worthy of note, however, that in all these cases the Wolff-Lehman ratio is much more narrow than the Haecker ratio.

Feeding-standards merely guides. — From the foregoing discussion of the food requirement for milk it must be apparent that while one should use a standard, it should be considered only as a guide and be modified to meet the conditions, such as the individuality of the animal and the prices of foods. It is not practicable to attempt to follow standards with strict mathematical accuracy, any more than to follow them slavishly with fertilizers or with quantities of seed per acre.

EFFECT OF FOOD ON COMPOSITION OF MILK

Of all the problems connected with the feeding of dairy cattle, perhaps none has received more attention than the effect of food upon the composition and quality of the milk. There is a prevailing opinion among practical dairymen that one can improve the composition of the milk, particularly with respect to the percentage of fat, by liberal feeding. This, however, is one of the

results that careful investigations have been trying to secure for the last three decades, and so far they have met with little or no success.

It is asserted that the food may affect the milk in many ways, the two most important being its composition and its flavor. There are three ways in which the composition might be affected: First, by changing the proportion of water and total solid matter; second, by changing the proportion of fat, sugar, and proteids; and third, by changing the constituents or consistency of the fat.

Effect of food on total solids. — In the great majority of cases the conclusion of experiments is that no consistent relation seems to exist between the quantity or character of the food and the composition of the milk. In a few cases a temporary change occurred in the milk immediately after changing the food, but in most cases the milk soon returned to its normal composition. While in a very small number of experiments the milk appeared to undergo slight permanent change, yet one is forced to the conclusion that the quality of the milk cannot be changed at will by the feed. It would seem that the treatment of the cattle has a greater influence upon the character of the milk than does the food consumed.

Effect of food on the percentage of fat. — The idea prevails that it is possible to feed fat into milk. This problem has been the subject of careful experimentation. After a painstaking perusal of the work one is forced to conclude that it is not possible materially and permanently to increase or diminish the percentage of fat by changes in the amount and character of the food, providing, of course, that the animals receive sufficient nutrition in all cases. It may be possible with a cow that has been insufficiently fed and has never had a chance to develop, to feed her such an abundance of rich milk-producing food as slightly and permanently to increase the percentage of fat in her milk; but beyond this we probably cannot go.

Food and flavor of milk. — It is definitely known that certain foods, especially if fed in large quantities, impart bad odors to the milk. Chief among the foods producing such deleterious effects are cabbage, turnips, onions, silage, wild leeks, and the like. It is held that such odors may be imparted to the milk in two ways: First, by transference through the animal, and second, by absorption from the air of the stable. Concerning many of these points we have little definite evidence, and there is great difference of opinion as to what odors are absorbed from the air and what are transferred through the animal. There can be little doubt, however, but that the feeding of certain foods before milking imparts certain flavors to the milk, and that such flavors are not detected when the food is given after milking. It is advised particularly that silage be not fed just before milking.

Order of supplying food. — Because of the supposed ill effect of some foods in giving odors to the milk, the order of supplying certain of these foods assumes much importance. In the case of cabbage, turnips, and the like, it is perhaps best that they be fed after milking. In the case of hay, which is likely to contain more or less dust, it is perhaps best to feed this after milking also, and in either of these cases it would necessitate the feeding of grain first. Perhaps the ideal way, when the food is of such a nature to permit, is to feed the grain and succulent food together, sprinkling the grain over the succulent food, and then when these are both cleaned up, to feed the hay. A good order for the day's work is as follows: In the morning milk first, then feed grain, then silage, clean stable, water, feed hay, groom the animals, then on pleasant days turn out for an hour or so. In the afternoon water, clean stables, feed grain, milk, feed silage, arrange bedding, and lastly feed some long hay. Sufficient attention is not given to the day's program, in the dairy business.

Effect of food on quantity of milk. — Occasionally the state-

ment that we cannot increase the percentage of fat in the milk by feeding is taken to mean that we cannot increase the total fat yield. This, of course, is not true. We can very materially increase the total yield of fat by increasing the total flow of milk by liberal feeding. This is demonstrated on every hand. On the farms where no succulent food is fed during the winter and very little grain, it is well known that the cows will give a much larger flow when turned to pasture in the spring. On the average the percentage of fat will remain the same.

WATERING THE MILKING COW

The milch cow requires a liberal supply of water. She not only has the demands of her body to meet, but must supply that in the milk as well. When we recall that cows have yielded over 129 pounds of milk in a single day, we can see the urgent need of a large supply of water. The question is often raised as to methods of watering: whether to make provisions for a constant supply of water, or to supply the animal at certain intervals, two or three times daily. It has been fairly well proved that cattle provided with water constantly give a slightly larger yield than when watered twice daily, though the difference is not marked. This observation has led to the placing of small troughs or vessels in the stable immediately in front of the animals (Fig. 73). If these vessels can be kept clean and free from odor, the practice is a good one. In many instances, however, these individual watering devices are traps of filth and foul-smelling water, and produce anything but good results.

There are two factors that must not be lost sight of in watering the milking cow: regularity and temperature of water in winter. Whatever method of watering is employed, the animal should be watered regularly and uniformly. When we recall the large amount of water necessary to meet the needs of the high-producing cow, it becomes apparent that she should not be compelled to drink ice-cold water. There are many objections to

such practice; in the first place it requires much food to heat this water up to the body temperature, and the animal will not drink the required amount. Such large drafts of cold water may

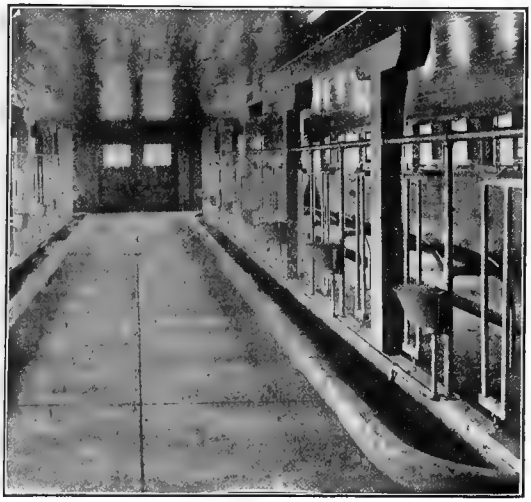

FIG. 73.—INTERIOR VIEW OF DAIRY BARN, SHOWING FEEDING ALLEY, MANGERS, AND INDIVIDUAL WATERING DEVICE. Bowen & Quick, Auburn, N. Y.

cause indigestion and in some cases may lead to abortion. To take the chill off drinking water in winter is now an accepted practice with progressive dairymen.

FEEDING THE MILKING COW

Since the quantity of milk produced by a cow depends largely on the amount and character of the feed supplied, it is of the utmost importance that the feeding be given careful consideration. Developing the milking cow calls for skill second to none other among farm animals. The milking cow should be fed liberally, frequently, and regularly, the amount given being regu-

lated by the size of the animal and by the quantity as well as the quality of her milk. We may say, in general, that a good dairy cow in full flow should receive approximately two and one-half pounds of dry-matter for each hundred pounds of weight. Of this, at least one-half to two-thirds should be digestible matter. Cows giving very large yields may be fed considerably larger quantities to advantage, while the low-producers should receive less. The reader may recur to the general discussion of food requirements as detailed on pages 203 to 210.

Feeding dairy cattle naturally divides itself into two parts: the summer period when the cows are at pasture, and the winter period when they are stabled and fed their entire ration.

Summer feeding of dairy cattle. — Pasture is one of the essentials of successful dairy farming. The favorable influence of early spring pasture on the secretion of milk is well known. The flow is materially increased, as is the total yield of fat, though the percentage of fat is perhaps not materially altered. True, some years the percentage of fat seems to increase, but other years it decreases in the same animal; and the food is probably not the cause.

As a rule, in the early part of the pasture season, the cows will obtain sufficient food from the pastures alone, but later in the season it will often be necessary to supplement the pasture. This may be done by soiling, — cutting the forage and feeding it to the cattle green, — with silage, or with grain.

Experiments seem to indicate that the feeding of grain to cows on pasture is profitable only when there is scarcity of pasturage. In fact, they will consume but little while the pasture is abundant and nutritious. It would seem wise, however, in case the animals eat it, to provide a few pounds of wheat bran or bran and oats mixed particularly in the case of heavy milkers, as this will insure maximum production.

Protecting cows from flies. — The marked falling off in the milk flow of the dairy cow in the late summer and fall is looked upon

as unavoidable and is attributed to the worry of the stock by flies. This conclusion is not borne out by the experimental data available. Many experiments have been conducted to determine to what extent the worry caused by the flies affects the yield of milk and fat. In these experiments the flies were excluded from the animals at intervals and a careful record kept of the production. These records show that the flies had very little if any effect upon the yield either of milk or fat. The failure to provide an abundance of succulent forage to supplement the parched pastures, thus compelling the animals to graze over large areas in the hot sun, seems to be the principal factor in causing a decreased production in the later summer.

Winter feeding of dairy cattle. — Winter feeding is the most expensive, and the profit to be derived from a dairy cow will depend, in a large part, upon the economy of the winter ration. This does not mean that she should be fed sparingly; on the other hand, the good dairy cow should be fed abundantly with a variety of nutritious feeds. Feed a variety whenever possible. A good dairy cow should make economical use of seven to ten pounds of grain per day, and fifteen to twenty pounds of dry forage, or better still, thirty to forty pounds of succulent food and five to ten pounds of dry forage or hay, the exact amounts to be varied to meet conditions.

Fig. 74. — Holstein-Friesian Cow "Daisy Pauline Paul 2nd." Owned by John Arfman.

Grain, or concentrated feeds. — The more common grains fed to dairy cattle are the cereals — corn, oats, wheat, barley, and rye — and the mill refuse, of which there is an almost endless variety upon the market. The amount of grain that can be fed with profit to a dairy cow will depend on the price of the food, the yield of the cow,

and the price obtained for her products. Some have suggested the feeding of as many pounds of grain per day as the cow produces pounds of butter-fat per week. In determining the amount and kind of grain it is necessary to take into account the forage that is to go with it. For example, in many dairies it is felt that bran may be replaced ton for ton by carefully cured alfalfa hay, or by five tons of pea-vine silage when not too succulent.

Dry forage. — The more common dry forage crops fed to dairy cattle are clover, alfalfa, or mixed hays and corn stalks. Occasionally pure timothy hay is fed, though this is not to be recommended, particularly if cut late. Straws of the various small grains are also used, but they are even more worthless as a dairy cow feed than is timothy hay. Hay cut early is more valuable ton for ton, though the yield obtained per acre will not be so great. It is preferable to feed the hay long, if fed in connection with silage. The exact amount of dry forage that should be fed cannot be stated, as it will depend on the amount of grain and whether or not silage is being used. Let the rule be to feed all the hay the animal will eat with relish.

Succulent feeds. — Some kind of succulent food should be fed the dairy cow during her entire lactation period. The common succulent foods used in feeding dairy cattle are silage, roots, or tubers. Silage is preferable, but if the herd is not large enough to warrant the construction of a silo, roots make a good substitute. The amount of succulence it is profitable to feed will depend much on the attendant conditions. Thirty to forty pounds serve most conditions. If the supply is limited, it is perhaps best to make it last throughout the winter period; that is to say, if one has enough succulent food to feed twenty pounds throughout the season or forty pounds for half the season, it would be preferable to feed the twenty throughout the season. This again might be modified by conditions; for

example, if one had a few cows only and fed but twenty pounds per head and day, the silage would be likely to spoil on top, in which case it would be necessary to feed it faster.

There are many ways of procuring succulent foods, such as preserving green foods in the silo, raising of roots and tubers, procuring refuse from the breweries, distilleries, and sugar factories, and soiling.

Silage. — Green food preserved in the silo is coming to be a very common succulence for the dairy cow. While there are many green plants, such as alfalfa, clover, cowpea vines, and the like, preserved in this way, yet corn is by far the most important silage crop. No other plant will furnish nearly so much silage per acre as corn. All silage contains a very high percentage of water, and for this reason is bulky. As a succulent food for milking cows, good corn silage is hard to improve on. It is very palatable, readily digestible, and stimulates the flow of milk second only to grass.

Roots and tubers. — When the construction of a silo is not convenient, one can procure a very good succulent food by raising roots and tubers. While there are many roots and tubers, such as potatoes, beets, flat turnips, rutabagas, and the like, that may be grown, mangels are by far the most important root-crop as a succulent food for cattle. These roots all possess a very high percentage of water, even more than silage. As a succulent food for the milking cow they are excellent, being palatable, almost entirely digestible, and stimulating the flow of milk. While the amount that may be fed varies according to conditions, the same as in silage, one may feed from 35 to 50 pounds daily per 1000 pounds of live weight.

Soiling. — As we have already seen, soiling consists of cutting green crops and feeding them fresh. Successful and economical soiling means furnishing to the milking cow a supply of green forage during the growing season. It means that crops and areas must be so arranged that one green crop will

succeed another during the entire season. There are many advantages of soiling, such as increased food production from a given area, providing three times that of pasturage; less waste, as the cattle are not constantly tramping and lying on the forage; greater variety of food, as the succession of crops provides many changes; increased milk and butter production when prices are high, as in the fall; less discomfort of animals, as they are fed in the cool stables; and less fencing required. One great objection is the increased labor; such as preparing the soil for the crops, seeding every few days, cutting the crop of green material and hauling to stables, — the food being green and heavy, — and the extra labor of carrying for the cattle in the stable.

Soiling crops vary widely in their composition and as a succulent food for the milking cow. As a rule, they contain more waste than silage. They are very palatable, readily digestible, and stimulate the flow of milk. It is customary to feed somewhat larger quantities of soiling crops than of silage, 60 pounds being considered a fair daily allowance for a 1000-pound cow. In addition she must have her grain ration, the same as when silage is fed, and a small allowance of hay of good quality, clover, or alfalfa when possible. Instead of choosing coarse grains, such as bran, distillers' dried grains, and the like, it is preferable to feed the more concentrated, such as middlings, oil meal, corn meal, gluten meal, and the like.

When soiling is practiced, the area required to the cow and the rotation of crops are interesting problems. Both vary widely in different sections of the country, but on the average one acre should support two cows, when grain and some hay is fed in connection, as suggested. While the crops to be used in rotation vary as does the time of planting, yet the following examples will serve as a basis to be varied according to conditions: —

Examples of rotation of soiling crops, showing kind of forage, seed to acre, time of seeding, approximate areas, and time of cutting for a herd of 10 cows, allowing 60 pounds of forage a cow daily or 600 pounds a day in all, for different sections of the country

NEW YORK — WING'S SOILING SYSTEM AS BASIS

5 MONTHS — MAY 15 TO OCTOBER 15 — 10 COWS — 60 POUNDS PER COW DAILY

Kind of Crop	Seed per Acre	Time of Seeding	Area	Time of Cutting
Rye	2 bu.	Fall	1 acre	May 15–May 31
Wheat [1]	2 bu.	Fall	½ acre	June 1–June 10
Red clover	20 lb.	Spring	½ acre	June 11–June 20
Mixed { Clover Timothy Red top	10 lb. 10 lb. 15 lb.	Spring	1 acre	June 21–July 10
Mixed { Oats Vetch	2 bu. 1 bu.	Spring	½ acre	July 11–July 20
Mixed { Oats Peas	1½ bu. 1½ bu. Canada peas	Spring	½ acre	July 21–July 31
Corn, early flint	10–20 lb.	Spring	½ acre	Aug. 1–Aug. 15
Corn, medium dent	10–20 lb.	Spring	½ acre	Aug. 16–Aug. 31
Second cutting, clover and grasses				Sept. 1–Sept. 10
Corn, late, "Mammoth Evergreen"	10–20 lb.	Late spring	½ acre	Sept. 11–Sept. 30
Mixed { Barley Peas	1½ bu. 1½ bu.	Aug. 1–10	½ acre	Oct. 1–Oct. 15

[1] Where alfalfa will do well it should be used instead of wheat.

ILLINOIS — FRASER'S SOILING SYSTEM AS BASIS

5 MONTHS—MAY 15 TO OCTOBER 15—10 COWS—60 POUNDS PER COW DAILY

Kind of Crop	Seed per Acre	Time of Seeding	Area	Time of Cutting
Rye	2 bu.	Fall	1 acre	May 15–May 31
Alfalfa	20 lb.	Spring	½ acre	June 1–June 10
Red Clover	20 lb.	Spring	½ acre	June 11–June 20
Mixed: Clover	10 lb.	Spring	1 acre	June 20–July 1
Mixed: Timothy	10 lb.			
Mixed: Red top	15 lb.			
Mixed: Oats	1½ bu.	Spring	½ acre	July 1–July 10
Mixed: Peas	1 bu.			
Corn, early (2d cutting alfalfa)	10–20 lb.	Spring	1 acre	July 11–July 31
Corn, medium (2d cutting clover)	10–20 lb.	Spring	1 acre	Aug. 1–Aug. 31
Corn, late	10–20 lb.	Spring	1 acre	Sept. 1–Sept. 30
Rape	10 lb.	June	½ acre	Oct. 1–Oct. 15

WISCONSIN — CARLYLE'S SOILING SYSTEM AS BASIS

5 MONTHS—MAY 15 TO OCTOBER 15—10 COWS—60 POUNDS PER COW DAILY

Kind of Crop	Seed per Acre	Time of Seeding	Area	Time of Cutting
Rye	2 bu.	Fall	½ acre	May 15–May 31
Alfalfa	20 lb.	Spring	½ acre	June 1–June 15
Red clover	20 lb.	Spring	½ acre	June 15–June 25
Mixed: Clover	10 lb.	Spring	½ acre	June 25–July 4
Mixed: Timothy	10 lb.			
Mixed: Red top	15 lb.			

WISCONSIN — CARLYLE'S SOILING SYSTEM AS BASIS — *Continued*

5 MONTHS — MAY 15 TO OCTOBER 15 — 10 COWS — 60 POUNDS PER COW DAILY

Kind of Crop	Seed Per Acre	Time of Seeding	Area	Time of Cutting
Mixed { Oats . . .	1½ bu.	April	½ acre	July 4–July 31
Mixed { Peas . .	1 bu.			
Corn, early (2d cutting alfalfa) . .	10–20 lb.	Spring	1 acre	Aug. 1–Aug. 31
Corn, medium (2d cutting clover) .	10–20 lb.	Spring	1 acre	Sept. 1–Sept. 30
Rape . . .	10 lb.	June	½ acre	Oct. 1–Oct. 15

FEEDING FOR HIGH PRODUCTION

Those who are raising breeding animals are often interested in high records of production. As we have already seen, the major dairy breeders' associations — Holsteins, Jersey, Guernsey, and Ayrshire — encourage this by establishing registers in which only those animals that make certain records may be recorded. The feeding of a cow in order that she may make an "advanced registry record," as it is often called, is a different problem from that of feeding a cow in a commercial dairy. In this case, all is sacrificed for a high record of production. The high record serves as an advertisement, and the breeder is enabled to sell his animals at a much higher price than otherwise.

While the methods of feeding as well as the food used by the different breeders vary widely (in fact no two are the same), yet the general procedure is somewhat as follows: have the cow very fat at calving time. To do this she should be dried off some time before calving and receive extra care and feed. It is true that a very fat cow is more subject at calving time to difficulties, such as milk fever, garget, difficult parturition, and

the like, but these will be cared for by a painstaking and familiar attendant. The argument here is that the cow will use this extra body fat to repair the waste of the body, thus enabling her to use a larger part of her food in the elaboration of milk, some going so far as to say that a part of the extra fat is used in the manufacture of the milk. While just what processes take place in the animal's body are not known, yet it is true that such an animal will produce more than as if she were in average condition.

When extreme high production is sought, the cow is fed and milked four times daily. The time varies somewhat, but the more common is 5 A.M. and 11 A.M.; 5 P.M. and 11 P.M. The reason for choosing these hours is that the 5 A.M. and 5 P.M. feeding and milking are at the same time the rest of the herd is being fed and milked. Everything about the stable should be quiet, and the milking carefully and well done (see page 260). The feeds composing the rations vary widely, no two breeders using the same. In all cases, however, the secret of success is variety. Sometimes the grain part of the ration is composed of a half dozen or more different kinds of grains; the dry forage of two or more kinds of hay and three or four kinds of succulent foods. The amount given is limited only by the appetite of the cow.

FEEDING THE HEIFER

As the time of calving approaches, the feeding of the heifer should receive careful attention. Do not feed too stimulating or decayed foods, as they are likely to cause abortion. Clean sweet clover or mixed hay or corn stalks and corn silage or roots with a small allowance of grain, such as ground oats, bran, shorts, or corn, will prove very efficient. Just previous to calving it is best to discontinue the feeding of grain, or at most only a couple of pounds per day, and not increase again till the heifer freshens. Immediately after calving, a warm thin gruel

consisting of oatmeal or bran should be given. Feed sparingly with rather loosening foods for a few days or until the dangers of milk fever are over. Then increase the ration gradually until she is receiving a full feed.

It must be remembered that the heifer is doing double duty: in addition to elaborating milk, she is growing rapidly, and if bred, she must supply the fetus; hence the importance of extra care and, above all, liberal feeding. To meet the requirements of her growing body, the developing fetus, and the milk a good supply of protein must be furnished. Protein the young growing heifer must have if she is to develop into a high-producing cow. The treatment given the heifer will largely determine the usefulness of the future cow. Heavy feeding should continue throughout the entire lactation period, which should be extended as long as possible, for the developing of a persistent milking habit is favored by a long continuance of the first lactation period.

FIG. 75. — HOLSTEIN-FRIESIAN COW "BETTY LYONS NETHERLAND." Owned by H. A. Moyer, Syracuse, N. Y.

SAMPLE RATIONS FOR THE DAIRY COW

The following rations are collected from various sources, and furnish a guide in determining the kind and amount of feed that should be allowed a dairy cow. They apply to a 1000-pound dairy cow yielding 22 pounds of average milk: —

No.	Ration		Ratio
	Grain	Forage	
1	3 lb. corn meal 3 lb. oats 2 lb. linseed meal	20 lb. hay	1 : 6.7
2	3 lb. corn meal 3 lb. wheat bran 2 lb. cotton-seed meal	10 lb. hay corn stalks ad lib.	1 : 7.6
3	3 lb. oats 3 lb. wheat bran 2 lb. gluten feed	50 lb. roots corn stalks ad lib.	1 : 6.9
4	3 lb. middlings 3 lb. dry brewers' grains 2 lb. linseed meal	40 lb. corn silage corn stalks ad lib.	1 : 7.3
5	2 lb. oats 4 lb. wheat bran 2 lb. gluten meal	40 lb. corn silage hay ad lib.	1 : 6.8
6	3 lb. oats 2 lb. wheat bran 1 lb. linseed meal 1 lb. cotton-seed meal	50 lb. corn silage hay ad lib.	1 : 6.6
7	2 lb. oats 2 lb. wheat bran 2 lb. corn	30 lb. corn silage clover hay ad lib.	1 : 7.4
8	2 lb. oats 2 lb. corn 2 lb. cotton-seed meal	25 lb. corn silage 5 lb. clover hay corn stalks ad lib.	1 : 6.6
9	4 lb. wheat bran 2 lb. corn meal	30 lb. alfalfa silage clover hay ad lib.	1 : 5.0
10	4 lb. oats 2 lb corn meal	20 lb. alfalfa hay	1 : 4.4
11	2 lb. wheat bran 4 lb. cotton-seed meal	20 lb. hay 10 lb. cotton-seed hulls	1 : 8.2

No.	Ration		Ratio
	Grain	Forage	
12	4 lb. wheat bran 2 lb. cotton-seed meal	30 lb. corn silage cotton-seed hulls ad lib.	1 : 7.8
13	6 lb. wheat bran	40 lb. corn silage cowpea hay ad lib.	1 : 5.9
14	3 lb. wheat bran 3 lb. cotton-seed meal	10 lb. cowpea hay sorghum cane ad lib.	1 : 5.1
15	3 lb. cotton-seed meal	15 lb. alfalfa hay cotton-seed hulls ad lib.	1 : 4.7

Grain Mixture for Calf Ration

3 parts corn meal
3 parts ground oats
1 part wheat bran
1 part linseed meal

Age, Mo.	Grain Mixture, Lb.	Summer	Winter
6	2	pasture	clover hay
12	4	pasture	clover hay
18	6	pasture	clover hay

CHAPTER X

BREEDING DAIRY CATTLE

THE breeding of dairy cattle offers a greater field of operation than any other in connection with the propagation of farm animals. Perhaps in no other class is variation so great or improvement so easily accomplished as in the improvement of dairy animals, providing proper methods are used. The increasing population is making increasing demands for milk and its products, — butter and cheese; — and while the supplying of this demand, particularly in our large cities, is a very complex problem, improvement in the production of dairy cattle cannot be said to be a difficult task. In the past we have bred dairy cattle without regard to their record of production. In fact records of production were wanting, as none such were kept. True, we have kept pedigrees of our dairy cattle for many generations, but these pedigrees tell us only: the color, the date of birth, the owner and his address, the sire and the dam, none of which supplies us with information as to the merits of the cow. What is equally true, we have estimated production of dairy cattle from time immemorable by saying one cow gives so many quarts, another so many quarts more, and still another so many quarts less; but such estimation is almost worthless because of the great variation in the yield of individual cows from day to day. Perhaps two days a week a cow will yield 15 quarts, the other five days only 10 quarts; and in our estimation we are likely to remember the 15 quarts and

forget the 10 quarts. Again, for many years we have kept a more or less accurate record of the show-yard career of our leading dairy animals, but this in turn gives us no information as to their producing powers, for it is now well known that animals with brilliant show-yard careers are not among the best producers.

FIG. 76.—AYRSHIRE COW. Grand Champion National Dairy Show, 1907. Photograph from *National Stockman and Farmer.*

The Ayrshire dairy cattle originated in the county of Ayr, Scotland, where they are used chiefly in cheese-making. They are trim and neat in appearance. In weight the cows run about 1000 pounds and the bulls 1500 pounds. The color includes red, brown, and white.

As has been noted in the chapter on general breeding, variation is the basis of improvement. Without variation there can be no improvement, and when great variation exists much improvement is possible. Dairy cows vary widely both in respect to the quantity and the quality of their milk. To

illustrate the variation in the quantity, we may compare average production of all cows in the United States with two of the high-producing ones. It should be borne in mind that this is not a comparison of the poorest and the best, as we have no record of the poorest cows :—

Average yearly production per cow in the United States

Year	Milk Lb.	Butter Lb.	Year	Milk Lb.	Butter Lb.
1850 . . .	1436	61	1880 .	2004	85
1860 . . .	1505	64	1890 .	2709	115
1870 . .	1772	75	1900 . .	3646	155

Production in one month

Name	Milk Lb.	Butter Lb.
De Kol Queen La Polka 2d . . .	3377	145
Colantha 4th's Johanna	2874	138

From the table we note that the monthly record of our high-producing cows is approximately equal to the average yearly record of all cows in the United States. Colantha 4th's Johanna yielded 27,432 pounds of milk in one year, or approximately eight times that of the average cow.

MILK-RECORDS

Record of performance among dairy cattle constitutes the only method of determining their value. Without such records, we would not be able to choose the very high- or the very low-producing, or the profitable from the unprofitable animals. At

present, many dairy herds possess cattle producing at a loss — not yielding sufficient milk to pay for the food consumed — yet in the absence of accurate records the fact goes unobserved and the owner does not know the profitable from the unprofitable animals. No person is able to go into a herd of ten cows and pick out all the best by examination. Records are absolutely necessary to determine profit and loss.

Method of keeping records. — Records are more easily kept than is generally supposed. The time and cost of keeping a record of the amount of milk and butter-fat yielded by each cow is quite insignificant, especially when compared with the value of such records. The materials needed are a pair of scales, a hand Babcock tester with outfit, and a blank milk-sheet. The scale should be graduated to tenths of a pound instead of ounces, as the records are much more easily added. Chatillon's Improved Circular Spring Balances are ordinarily used. The scales should be hung in a convenient place and each cow's milk weighed separately and set down on a Record-Sheet, similar to table on p. 231.

Once each month the milk from each cow should be tested for the percentage of butter-fat. To do this, one should take a careful sample of the milk for two successive days. The sample need not be large, but the quantity should be in proportion to the flow. One-half pint saved from the two days' milking is sufficient. This should be placed in a jar and covered to prevent evaporation. In warm weather it is necessary to put some sort of preservative into the milk, otherwise it will sour, and in that case cannot be tested. For each cow there should be a jar with her name pasted upon it, thus avoiding any possibility of getting the samples mixed. By placing the percentage of fat thus obtained on the record-sheet beneath the flow, one has a complete record of each animal each month. By multiplying the total milk by the per cent of fat, one gets the total amount of fat. This completes the record for the month.

Daily Milk-Record

Name of Cow	Rose		Beauty		Alpha		Linda		Whitie		Blackie		Queen		Roanie	
July	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.
	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.
1																
2																
3																
4																
5																
6																
29																
30																
31																
Total milk																
% fat																
Total fat																

The length of time required to weigh the milk and take the sample will depend much on the activity of the one doing the work. On the average it will require less than one-half minute a day for each cow to weigh the milk and set the weight down on the record-sheet. On the two consecutive days that the samples are taken, it will require the same time daily to the cow as weighing and making the record. Then an hour or two once a month is all that is required to make the Babcock test for percentage of fat. With this length of time, one can obtain a reasonably accurate record of the performance of every cow in his herd.

Value of milk-records. — The highest degree of success cannot be attained unless we know the production of each individual cow. In addition, such records serve a much larger usefulness because they enable us to mate the animals more judiciously. Not only are the low-producers unprofitable in themselves, but in the absence of a record of their production, they are propagated, and their offspring in turn prove unprofitable.

TESTING MILK FOR BUTTER-FAT

The materials needed in testing milk for butter-fat are a centrifugal tester, test-bottles, a 17.6 c.c. (cubic centimeter) pipette to measure the milk, a 17.5 c.c. acid measure, and sulfuric acid, all of which can be purchased for about five dollars from any dairy supply company (Fig. 77). They may be ordered of a hardware dealer. Sulfuric acid is sold at any drug store.

Sampling the milk. — The milk to be tested should be thoroughly mixed just before sampling. To do this, pour back and forth between two vessels several times. With the pipette, measure out 17.6 c.c. of milk and place in the test-bottle. To do this, suck the milk up above the 17.6 c.c. mark. Quickly place the index finger over the upper end of the pipette, then

by releasing the pressure allow the milk to run down to the 17.6 c.c. mark. Place the point of the pipette into the test-bottle neck, holding both pipette and bottle at an angle, then remove the finger to allow the milk to flow into the bottle. To be sure that every drop is out of the pipette blow through it into the test-bottle. The sampling should be done in duplicate to make sure of the results.

Using the acid. — Much care should be exercised not to spill the sulfuric acid on the hands, clothing, or floor. Should any be accidentally spilled, pour on plenty of water, then add a little lime or baking soda. Always keep water and lime at hand for this purpose.

After all the samples of milk to be tested have been measured, the acid should be added. To do this, fill the acid measure to the 17.5 c.c. mark and gradually pour into the test-bottle, holding the bottle in a slanting position. By turning the bottle the acid will carry down all particles of milk left in the long neck. Hold the bottle by the neck and give it a circular motion for a few moments, thus mixing the milk and acid until no milk or clear acid is visible. The contents of the bottle should be dark colored and hot. Do not allow the bottle to stand too long before mixing or the test will not be clear.

Whirling the bottles. — The bottles and machine should be hot; and if not a steam machine, use boiling water to warm up the machine. Place the bottles in the machine so that each will have another directly opposite to keep the machine in balance. Whirl five minutes. Then stop, and with the pipette or cup with small spout, add hot water to each bottle until the contents come up to the bottom of the neck. Whirl two minutes. Add hot water sufficient to bring the top of the fat nearly to the top of the graduation on the neck of the bottle. Whirl one minute. The fat should form a clear column free from black or white patches in the neck of the bottle.

Reading the percentage of fat. — Keep the fat warm. Hold

FIG. 77.—APPARATUS NECESSARY FOR KEEPING RECORDS AND TESTING MILK FOR PERCENTAGE OF BUTTER FAT.

the bottle by the upper end of the neck, letting it hang in a perpendicular position on a level with the eye. Read the mark at the top and bottom of the column of fat. The difference between these is the percentage of fat in the milk. For example, if the top reading is 8.2 and the bottom 5.0, then the milk tests 3.2 per cent.

Much care should be exercised in cleaning the test-bottles as they should be perfectly free from dirt when used.

TESTING ASSOCIATIONS

In those sections of the country in which dairying is extensively practiced, the forming of testing associations will prove very advantageous. Cow-testing associations are organizations of farmers having for their object the determination of the production of the individual cow in the herd. While the methods of procedure of these associations vary widely in different localities, yet the following plan gives a general idea and may be modified to suit the conditions.

General plan. — A number of dairymen, twenty to twenty-five, having a total of 300 to 600 cows, effect an organization, elect officers, adopt a constitution and by-laws, and give the officers power to employ a man to do the testing. This tester visits each of the herds once a month, weighs the milk of each cow for a period of twenty-four hours, takes samples of the same and tests for percentage of fat. In some cases the tester weighs the feed of each cow and figures the cost of the ration. The tester makes a complete record of the amount of milk, the percentage of fat and total fat, and the food consumed, for each cow in the herd, leaves a copy of this record with the dairyman, and proceeds to the next herd, to return again in about one month. In addition he gives all the helpful suggestions possible, such as the successful practices of the other members of the association. The entire cost to the

dairyman is approximately one dollar per cow in addition to boarding and providing passage for the tester.

RECORDS OF PERFORMANCE AND OF BREEDING

In order to mate dairy cattle judiciously, it is absolutely essential that we know not only something of the performance of the animals thus mated, but the records of production of their ancestors as well. Such records enable us to mate the best with the best, and in so doing improve the strain with which we are working.

In all breeding operations, it must be remembered that like produces like, with the trend of the race downward. That is to say, the offspring will resemble the parents in general, though on the average they will be slightly inferior. While on the average the offspring are inferior to their parents and while in general they resemble their parents, yet individual offspring will vary widely, some far superior to their parentage, while others will be equally as inferior. This is where the successful breeder is able to mold the destiny of his herd by selection. Possessing a record of the production of each individual, inferior and superior alike, he mates the superior to the superior and discards the inferior.

In this connection it may be well to call attention to a rather widespread but incorrect idea. We have certain breeds of dairy cattle that are recognized as heavy milkers but rather low testers, and we also have high testing breeds but rather light milkers. Many a breeder of dairy cattle has fallen into the grievous error of thinking that if he mates a heavy milker with a high tester, the offspring should give a fairly heavy flow of milk with a liberally high test. Such breeders have forgotten that the drag of the race is downward, and that by crossing a heavy milker but low tester on a high tester but light milker, that on the average the offspring will be both a light milker and a low tester.

The individual animal the unit of improvement. — In the improvement of dairy cattle by breeding, the individual must be considered as the unit. This applies to sire and dam alike. The longer the line of high-producing ancestry, the more certain are we that the offspring in turn will be a high producer. The importance of this individual record of performance backed by ancestors with similar records cannot be overestimated. Having satisfied one's self as to the individual excellency of both sire and dam, he must even then be prepared to accept some low-producers, for such is the law of chance, which accompanies all breeding operations. One may, however, rest assured that on the average the offspring of individuals thus carefully selected will be equal to their parents, and that he will be rewarded by obtaining a few that will exceed the records of their parents.

PLAN OF BREEDING

If one is to succeed in breeding dairy cattle, he must proceed according to some well-adapted plan. Before deciding on a plan, one should familiarize himself with the details of the business. This can best be done by visiting and making a study of dairy farms both successful and unsuccessful. Compare all farms thus observed, note the difference, the causes that led to success on one, and to failure on the other. No suggestions can be given as to a working plan, as all will depend on the local conditions. The intending breeder should take into account his likes and dislikes. Some may prefer the heavy milking breeds, others the high butter-fat-producing breeds. It should be kept clearly in mind, whatever the class or breed chosen, that none but superior cattle are to be considered if highest success is to be attained.

Raise the heifer calves from the best cows. — Many dairymen are not raising their heifer calves. They are sold for veal, whether from high- or low-producing cows. Near large cities

the dairies are so crowded for room that there is often not space enough to raise these calves; yet when possible provision should be made for perpetuating the high-producing cows. The practice of buying all the cows has a tendency to lower rather than raise the average production of the herd, for the reason that few of the high-producing cows are for sale, and the dairyman is obliged to take rather inferior producers to supply his customers with milk.

Coöperative breeding. — A very successful method of improving the dairy cattle of a community is to breed them on the coöperative plan. In the localities where cow-testing associations exist, this is a very easy matter. It is also apparent that the formation of cow-breeding associations, in connection with cow-testing associations, would do much to advance the progress of the dairy industry. Each association should have for its object the production and improvement of high-grade and pure-bred dairy cattle, and should be formed of breeders who possess the same class or breed of cattle. It would be the work of such an association to protect the interests of its members, provide suitable bulls each year for use on the cows owned by the members, advertise stock, attract buyers, hold meetings for discussion of cow-breeding matters, and educate the farmers of the locality to better methods of breeding, feeding, and developing high-producing dairy cows.

FORMATION OF THE DAIRY HERD

Perhaps one of the most-discussed questions in the formation of a dairy herd is whether to begin with pure-bred or grade cows. By purely bred animals are meant those that are recorded in the herd books of their respective breeds; by grade is meant the produce of a pure-bred sire upon a native or common dam. Opinions differ widely as to which is the more profitable. Pure-bred animals are much sought for breeding purposes; their offspring are therefore more valuable and com-

mand a higher price than do the offspring of grades. Therefore, if the value of the calves is taken into consideration, a pure-bred herd is a more profitable one, other things being equal, than a grade herd. On the other hand, by the grading-up process, that is, by continually selecting and breeding the cows that are the best producers to a pure-bred bull, it is entirely possible and by no means difficult to establish a herd of grade cows that will equal in the production of milk any herd of pure-bred animals. If, therefore, milk-production alone is sought, a grade herd may produce as largely as a pure-bred; but if the offspring is taken into consideration, a purely bred herd certainly has an advantage over a grade herd of equal productive capacity.

The enterprising and progressive owner will hardly be content with grades only. In the beginning, his bull will be pure-bred; presently he will want a pure-bred cow to match, then one or two more. Thus he will be steadily and properly working towards a pure-bred herd and gaining in knowledge and experience at the same time. This will be found a much better plan, especially with the beginner or those unaccustomed to handling registered stock, than to purchase a pure-bred herd in the beginning.

GRADING-UP THE HERD

We remarked just above that by the grading-up process it is entirely possible and by no means difficult to establish a herd of grade cows that will equal in the production of milk any herd of pure-bred animals. This may seem a bold statement, but it is the one that it is desired to impress on the average dairymen. While the methods of accomplishing this vary greatly, careful selection and judicious mating furnish the key to the situation. There are no secrets in herd improvement. In this discussion it is proposed briefly to indicate the lines along which an attempt to breed up and improve a

herd of common cattle is most likely to prove successful. For it must be remembered that the large majority of dairymen seeking to improve their herds must depend largely on the individual animals they have already on hand, as the basis from which to start the improvement.

The first essential is a record of the performance of each cow comprising the herd. In herd improvement it is fundamental, and without it advancement cannot be made. No one, not even the experienced dairymen, can afford to do this upon guesswork alone.

The second essential is the selection of a suitable bull. Three factors in order of their importance are: his pedigree based upon a record of performance, his individuality, and his ability to get uniform offspring. Greatest improvement is not possible with any one of these factors wanting.

The first generation.— If the sire has been well chosen, the calves in the first generation are likely to be an even and uniform crop, even though their dams be of mixed breeding. If the sire be a pure-bred, the first crop of calves will be half-bloods. If convenient, all of the heifer calves should be retained. A great advantage in the rapid improvement of a herd of cows under this grading-up process is the ability to raise a large number of individuals up to the time that they begin to produce, so that a greater number may be available from which to select. If often happens, however, that the circumstances of the owner do not admit of rearing a large number, and some selection must be made at the time of birth.

Select heifer calves from high-producing dams. — If some calves must be discarded, owing to lack of facilities for rearing them, let it be those from the low-producing dams. Retain the heifers from the high-producing cows. This is in keeping with our law that "like produces like." Some have recommended retaining the heifer calves from those cows that show variation, particularly toward improvement, basing their argument on

the fact that such an animal is not likely to be prepotent, and that such being the case, the calves more nearly resemble the sire. There may be two objections to this. In the first place, animals that show much variation are as likely to vary toward the bad as toward the good; and in the second place, if the dam has at some time made a low record, as she probably has if she shows much improvement, it means that we are oftentimes selecting our heifer calf from a low-producing dam. Such a course is as likely to lead to failure as to success. There are many experiments and an abundance of experience going to show that greatest success is attained by retaining the heifers from the high-producing dams and discarding those from the low-producers.

The second generation. — There are many perplexing questions arising in the second generation of this grading-up process. In the first place, there is the question of the sire. If the original sire was young at the time of his purchase, there will be a number of his half-blood offspring ready to breed while he is still in the height of his power. If the bull has proved a good one, the owner does not wish to sell him, and he does not feel able to buy another to breed the heifers. The owner is at a loss to know what to do, as he has heard much against the practice of in-breeding. In a majority of such cases, if the sire is vigorous, he is the very best bull to breed to a lot of high quality, uniform, and half-blood heifers, if it is desired to receive greater uniformity as well as greater average production, even though he be their own sire. On the other hand, suppose the owner wishes to change bulls and procures an animal equal in productive capacity, but of slightly different type from the original sire. In all probability these second-generation calves, even though they are three-fourth blood, will not be nearly so uniform a crop as the first-generation or half-blood calves. Experience has shown that the second generation is not nearly so uniform as the first, and frequently shows little if any increase in average

production, although a few individuals may show marked improvement. This will prove the skill and patience of the breeder.

Continued judicious selection the means of improvement. — The few individuals of the second generation that show the marked improvement are the ones to be relied on to carry the herd forward in the improvement. Their female offspring will in turn show many inferior to themselves, with only a few superior ones. It is the continued and judicious selection from the high-producing and the discarding of the low-producing that improves the general average of the herd. As generations come and go, characteristics of the pure-bred sire will become more and more fixed and uniform. Reversions towards the low production of the common-bred ancestors will be less and less frequent. The herd will be practically pure-bred from the standpoint of the capacity of the individual animals to reproduce their characteristics, although they can never become eligible to registration in a herd-book.

This plan of grading-up has been successfully practiced in the improvement of a large number of herds of dairy cattle, and is entirely within the reach of any one. As an example of this plan there is shown in the table (p. 243) the improvement that was secured in the case of a herd descending from a single inferior cow.

The table shows a very rapid improvement for the first two generations, and for the next three it just about holds its own. There are two reasons why the third, fourth, and fifth generations do not equal the second: first, because they contain many heifers which have not yet reached maturity and serve to pull the general average down; and second, there are a large number of animals taken into account.

While the plan has been applied to the improvement of a herd starting with a common cow, it should be remembered that the same principles apply equally well to any herd. There are very

Table showing improvement in descendants of an inferior cow by pure-bred bulls. The number underneath each animal indicates her average yearly record in pounds of fat; the years show the number of years in milk

	First Generation 3 Animals	Second Generation 5 Animals	Third Generation 10 Animals	Fourth Generation 9 Animals	Fifth Generation 2 Animals
Glista 4 yr.–199 lb.	Glista 2d 1½ yr.–177 lb	G. Netherland 5 yr.–286 lb.	G. De Kol 6 yr.–303 lb.	G. Gamma 7 yr.–324 lb.	G. Mu 4 yr.–275 lb.
				G. Iota 5 yr.–388 lb.	
				G. Omicron 3 yr.–299 lb.	
				G. Taw 3 yr.–205 lb.	
			G. Alpha 9 yr.–312 lb.	G. Pi 2 yr.–197 lb.	G. Omega 1 yr.–293 lb.
				G. Phi 1 yr.–231 lb.	
			G. Epsilon 7 yr.–310 lb.	G. Nu 3 yr.–290 lb.	
	Glista 3d 3 yr.–236 lb.			G. Upsilon 2 yr.–163 lb.	
		G. Beta 9 yr.–301 lb.	G. Lambda 4 yr.–292 lb.	G. Chi 2 yr.–209 lb.	
			G. Carolata 1 yr.–202 lb.		
	Glista 4th 5 yr.–272 lb.	G. Delta 7 yr.–338 lb.	G. Rho 3 yr.–276 lb.		
		G. Theta 5 yr.–289 lb.	G. Psi 2 yr.–251 lb.		
			G. Xi 1 yr.–180 lb.		
		G. Eta 6 yr.–306 lb.	G. Sigma 3 yr.–267 lb.		
			G. Corinne 1 yr.–185 lb.		
Average. 199 lb.	245 lb.	306 lb.	288 lb.	280 lb.	278 lb.

few herds, even the best, in which the intelligent application of these principles will not result in marked improvement.

THE DAIRY BULL

The bull is of prime importance in breeding dairy cattle. We have already observed that the male is concerned with so many more individual offspring that his influence is much more extensive because of the increased number he influences. To secure the improvement in a herd of cattle through the females would require the use of twenty-five or more superior cows to accomplish the same results that might be secured by the use of a single bull, and even then there would be less uniformity in the offspring. This is due merely to the fact that the bull controls one-half the characters in the entire crop and not to any special prepotency on his part.

Choosing a dairy bull. — In choosing dairy bulls, it may be noted that they have many points in common with the dairy cow, particularly features of type, such as were fully discussed in the chapter on choosing a dairy cow, page 189; but it is a much more difficult task to choose a bull than it is to discriminate between cows.

The first and most important attribute is good pedigree, based on a record of performance. Not only should the dams in the pedigree have good records of performance, but the males should also be getters of performers. The longer the line of high-producing ancestry, the more certain are the offspring to be high producers.

After having satisfied ourselves with respect to the pedigree, as based on records of performance, then we may take into account the individuality of the bull. In no case should one sacrifice individuality, no matter how perfect, for performance. It would be unpardonable to choose a bull, if he was so weak as to be unable to propagate his kind. The constitutional vigor and prepotency are indicated to a certain extent by the

individual. The bull should possess a masculine appearance. The features of the head should be strong, with the eyes mild and clear. The chest should be deep, the heart girth large, the hide loose and pliable, and the hair fine and silky, as these are associated with constitution, vigor, and thrift.

FIG. 78.—JERSEY BULL "HOOD FARM TORONO." Sire of ten daughters in the Register of Merit. Owned by Hood Farm, Lowell, Mass.

The Jersey breed of dairy cattle, a native of the Island of Jersey, one of the Channel Islands, near England, is unexcelled in the quality and richness of the milk. By many it is considered the "butter cow." In size the animals are small, weighing 700 and upward. The color is fawn, being of many shades, yellowish, reddish, grayish, brownish, and silver fawn. This breed is popular in the United States.

Uniformity of get. — The importance of uniformity among the calves sired by a bull is of much importance. At the present time, lack of uniformity among our dairy cattle is one of the most noticeable defects. This is due in a large measure to our

utter lack of system in breeding. When once we have decided on the breed, there should be no further change. Were this done for a few generations, until certain breeds became identified with certain localities, then we could depend on uniformity of the entire crop of calves sired in any given season.

Number of cows to the bull. — The number of cows that it is safe to breed to a bull in a season depends much on the breed. The bulls of the heavy phlegmatic beef breeds are not so prolific as the lighter more active dairy breeds. The same is true among the various dairy breeds, but to a less marked extent. It is entirely safe to count on a bull serving twenty-five cows, and when the bulls are exceedingly strong and vigorous, they may far exceed this number.

THE DAIRY COW

While all dairy cows must be bred in order that they may freshen, the cows to which we look to replenish the herd should be carefully selected. The first and by far the most important factor to take into consideration is pedigree based upon the record of performance. After having satisfied ourselves as to the performance, then we may look to the individuality, as suggested in the chapter on choosing a cow (p. 189).

Productive period in dairy cattle. — The most fertile period in the cow's life is usually from two to eight years of age. In exceptional cases this period may be extended both ways. Just how young it is best to breed heifers is a question concerning which there is great difference of opinion. Some argue that secreting milk is a kind of habit, and the sooner the young animal becomes accustomed to it the better it is for her; whereas others say that the cow should not be bred until she gets her growth, contending that the demands made on the young animal by the growing fetus and her own growth are too severe, and that she is likely to be stunted.

The advisability of breeding a heifer so as to have her drop

the calf at two years of age depends much on the individual. If she is vigorous, healthy, and well grown, it will probably be better to breed her rather young, and encourage the milking habit from the beginning. Once giving milk, keep her at it as long as possible, for the cow that dries off after secreting milk a few months is unprofitable at best. Do not breed her a second time till rather late, as the effect of the animal again becoming pregnant is to decrease the flow of milk. This practice has much to recommend it. In the first place, unbred heifers are in heat two or three days every three weeks, and these constant recurring periods are as much of a check on the growth of the heifer as that of the growth of the fetus. Again, if the cow is let run in this unbred state, the reproductive organs are likely to become deranged and the animal barren. The animal bred young in life will prove a more regular breeder. The condition of pregnancy seems to have a marked stimulating effect on the system of the heifer. The assimilation is much better, and if provided with an abundance of nutritious food, she will make a greater growth during pregnancy than otherwise. It is easier to develop the milk-secreting organs at this early period. Therefore, if the heifer is thrifty and well grown, it would seem best from a practical point of view to breed her young.

At about eight or ten years of age, the productive powers of most dairy cows begin to wane, although many of them are reliable breeders well into the teens. Above twelve years of age, however, it is rarely that they will breed, and when an animal of this age persistently fails to conceive, it is perhaps best to dispose of her as the chances of her propagating are exceedingly remote.

Season of the year to breed. — The natural time for calves to arrive is in the spring. Under ordinary farm conditions this is the customary time for having the cows drop their calves. There are many advantages in having the calves come at this time. The pregnant cow can be turned to grass, which is the

natural food for pregnant animals, and need not receive so close attention as would be necessary were she confined to the stable and fed dry foods. The warm weather approaching, the calf is more easily cared for than in the winter. There is natural grass for the calf to feed on, and nothing is better.

Fall calving is much to be preferred on dairy farms or where high production is desired. There are many reasons for this. By having the calves dropped in the fall the cows are giving their maximum yield when the price of dairy products is high. While the calf is more trouble to care for in winter, this is the idle season, and more attention can be given it. Again, on the average the flow can be kept up longer, and the total production made much more when the cow freshens in the fall. This is due, in part, to the fact that she is turned to pasture just as her flow begins to wane, which causes it to rise again. On the other hand, if the cow freshens in the spring, the animals give their maximum yield when the price of dairy products is low, and then the dry fall coming on cuts their flow, then later they are put on the dry food of winter, which still further reduces the yield, so that at the time dairy products are high, the animals are giving very little or no milk at all.

A cow bred Jan. 1 should calve Oct. 10, or one bred June 23 should calve April 1, according to the table on next page.

Parturition time.—The average period of gestation in the cow is properly placed at nine months, more accurately perhaps two hundred and eighty-three days, but it may vary either way. A calf born at the two hundred and fortieth day may live, and a case is reported where a thrifty calf was dropped on the three hundred and thirty-fifth day. Because of the uncertainty of the period, the cow should be closely watched from the eighth month until calving. There are certain signs of the near approach of parturition that rarely fail. The udder becomes enlarged, firm and resistant to the touch, with more or less swelling in front, and secretes a milky fluid; the vulva becomes enlarged and swollen,

Table showing period of gestation. Cows, 283 days

Date of service on the left. Date of calving on the right in each double column

Jan.	Oct.	Feb.	Nov.	Mar.	Dec.	Apr.	Jan.	May	Feb.	June	Mar.	July	Apr.	Aug.	May	Sept.	June	Oct.	July	Nov.	Aug.	Dec.	Sept.
1	10	1	10	1	8	1	8	1	7	1	10	1	9	1	10	1	10	1	10	1	10	1	9
2	11	2	11	2	9	2	9	2	8	2	11	2	10	2	11	2	11	2	11	2	11	2	10
3	12	3	12	3	10	3	10	3	9	3	12	3	11	3	12	3	12	3	12	3	12	3	11
4	13	4	13	4	11	4	11	4	10	4	13	4	12	4	13	4	13	4	13	4	13	4	12
5	14	5	14	5	12	5	12	5	11	5	14	5	13	5	14	5	14	5	14	5	14	5	13
6	15	6	15	6	13	6	13	6	12	6	15	6	14	6	15	6	15	6	15	6	15	6	14
7	16	7	16	7	14	7	14	7	13	7	16	7	15	7	16	7	16	7	16	7	16	7	15
8	17	8	17	8	15	8	14	8	14	8	17	8	16	8	17	8	17	8	17	8	17	8	16
9	18	9	18	9	16	9	16	9	15	9	18	9	17	9	18	9	18	9	18	9	18	9	17
10	19	10	19	10	17	10	17	10	16	10	19	10	18	10	19	10	19	10	19	10	19	10	18
11	20	11	20	11	18	11	18	11	17	11	20	11	19	11	20	11	20	11	20	11	20	11	19
12	21	12	21	12	19	12	19	12	18	12	21	12	20	12	21	12	21	12	21	12	21	12	20
13	22	13	22	13	20	13	20	13	19	13	22	13	21	13	22	13	22	13	22	13	22	13	21
14	23	14	23	14	21	14	21	14	20	14	23	14	22	14	23	14	23	14	23	14	23	14	22
15	24	15	24	15	22	15	22	15	21	15	24	15	23	15	24	15	24	15	24	15	24	15	23
16	25	16	25	16	23	16	23	16	22	16	25	16	24	16	25	16	25	16	25	16	25	16	24
17	26	17	26	17	24	17	24	17	23	17	26	17	25	17	26	17	26	17	26	17	26	17	25
18	27	18	27	18	25	18	25	18	24	18	27	18	26	18	27	18	27	18	27	18	27	18	26
19	28	19	28	19	26	19	26	19	25	19	28	19	27	19	28	19	28	19	28	19	28	19	27
20	29	20	29	20	27	20	27	20	26	20	29	20	28	20	29	20	29	20	29	20	29	20	28
21	30	21	30	21	28	21	28	21	27	21	30	21	29	21	30	21	30	21	30	21	30	21	29
22	31		Dec.	22	29	22	29	22	28	22	31	22	30	22	31		July	22	31	22	31	22	30
	Nov.	22	1	23	30	23	30		Mar.		Apr.		May		June	22	1		Aug.		Sept.		Oct.
23	1	23	2	24	31	24	31	23	1	23	1	23	1	23	1	23	2	23	1	23	1	23	1
24	2	24	3		Jan.		Feb.	24	2	24	2	24	2	24	2	24	3	24	2	24	2	24	2
25	3	25	4	25	1	25	1	25	3	25	3	25	3	25	3	25	4	25	3	25	3	25	3
26	4	26	5	26	2	26	2	26	4	26	4	26	4	26	4	26	5	26	4	26	4	26	4
27	5	27	6	27	3	27	3	27	5	27	5	27	5	27	5	27	6	27	5	27	5	27	5
28	6	28	7	28	4	28	4	28	6	28	6	28	6	28	6	28	7	28	6	28	6	28	6
29	7			29	5	29	5	29	7	29	7	29	7	29	7	29	8	29	7	29	7	29	7
30	8			30	6	30	6	30	8	30	8	30	8	30	8	30	9	30	8	30	8	30	8
31	9			31	7			31	9			31	9	31	9			31	9			31	9

and discharges a stringy mucus; the belly droops and the muscles on each side of the root of the tail "fall in," leaving deep hollows. Later the cow becomes uneasy, ceases eating, lies down and rises again, switches her tail, and may bellow or moan. Soon the labor pains come on, the animal arches her back, lowers her croup, draws the belly up, and straining is more or less violent and continuous. Soon the clear water-bags protrude between the lips of the vulva, though blood may precede them. The water-bags come rapidly, hanging downward toward the hocks, pull at the fetus, and aid in dilating the womb. In this manner these bags aid materially and should not be ruptured until they do so naturally. The after-pains come on later and expel the afterbirth which should not be left longer than twenty-four hours.

Fig. 79. — Jersey Cow "Jacoba Irene." She gave 17,253 pounds milk containing 953 pounds fat. The world's record for the breed. Owned by A. O. Auten, Jerseyville, Ill.

For difficult parturition and removal of afterbirth, see page 334. Directly after calving, give a warm gruel of oatmeal, wheat bran, or shorts. Increase the grain ration gradually until on full feed.

THE CALF

The young calf that makes its appearance normally and is bright and active needs only to be let alone as long as both cow and calf are doing well. Not all calves, however, are so fortunate. Occasionally one loses its life through want of attention at time of birth. It sometimes happens that the new-born calf cannot breathe — does not establish the function of respiration. Steps must be taken quickly to establish respiration.

If detached membranes cover the air passage, remove them. Wiping out the nose deeply with a feather, or even with the finger, excites sneezing and starts breathing. Blowing violently into the nose and mouth has a similar effect. Slapping the chest with the palm of the hand or with a towel dipped in cold water is good to start breathing.

As soon as the cow has recovered from the shock of giving birth, she should tend the calf, for it will be physically benefited thereby. If she refuses to lick and caress her calf, a little flour sprinkled over the back of the latter will often attract her to it. Should she still refuse, the calf must be dried with a cloth or wisp of straw, and if necessary, assisted to get its first meal.

It is especially important for the calf that it get the first or colostrum milk of the dam. This milk is rich in mineral matter and ash, is a powerful laxative, and is effective in removing the fecal matter from the alimentary canal, and in addition serves as a tonic. The calf should be allowed to suck the dam a few times; some recommend until the milk is fit for human consumption, usually about the eighth or ninth milking, while others recommend separating them on the second day, providing the calf is strong and the cow's udder in good shape, as the cow is more easily reconciled to the separation, and the calf can be taught to drink more easily than if it has sucked the cow for some time. If, however, the calf is weak, it is better to have it with the cow, as it will feed oftener and grow stronger; or if the cow's udder is inflamed, the calf will help to bring it back to the proper condition. The calf may be placed in a near-by pen and in sight of the dam, as it is thought she will be less excited and not attempt to "hold up" her milk.

Feeding the dairy calf. — On account of the high price of milk it becomes necessary to feed the dairy calf by hand. This calls for extra labor and sometimes entails extra difficulties, but if proper precautions are taken, these may in a large measure be avoided.

Teaching the calf to drink. — When the calf is taken from the cow, it may not drink at first, but after the omission of a feed it becomes hungry and as a rule can be taught to drink very easily. A calf is much more tractable when hungry. The calf will not learn to drink any younger by being forced to breathe

FIG. 80. — IMPORTED BROWN SWISS BULL. A first prize winner. Owned by Sedgley Farms, Hinsdale, Ill.

The Brown Swiss cattle, natives of Switzerland, are classed as dual-purpose; that is, they yield a fair quantity of average quality milk and the steers when fattened make average beef. In size the bulls weigh from 1500 to 2000 pounds; the cows 1200 to 1500 pounds. The color is usually light or dark brown, fading to gray along the backbone to the tail and about the belly.

the milk into its lungs. It should be remembered that instinct teaches the calf to look up for its food, and the feeder must change this by teaching the calf to look down. There is great difference among breeds as well as among individuals in the ease with which the calves are taught to drink from the pail. Some are taught to drink at the first trial with little or no sucking of

the fingers, whereas others require much more persistent effort and considerable patience as well as common sense.

Danger of overfeeding. — When feeding by hand, there is much danger of overfeeding and gorging the calf's stomach, thereby causing digestive disorder, scours, and death. When permitted to run with the cow, the calf sucks many times daily, — ten to twenty, — taking only a little milk at a time. When removed from the dam and left from eight to twelve hours, it gets exceedingly hungry, and when offered milk in large quantities, will gorge itself and bring digestive disorders that may prove fatal. If there are two or more calves in the same pen, it will be very necessary to fasten them, so that in case one gets through drinking before the others it cannot rob them of their supply, for if it should, it may prove fatal.

The calf on whole milk. — For the first few weeks, the calf should be given the milk from its own dam rather than from another cow, as changing from one to another is likely to throw the digestive system out of balance, and result in digestive disorders such as scours, colic, and the like. When convenient, it is best to feed the calf three times a day for the first few days. The milk should be fed from a clean pail, directly after milking, while still at the body temperature. The amount of milk fed should be carefully regulated. A good plan with the average calf is to give four pounds — two quarts — of whole milk three times daily. If the cow's milk tests high in butter-fat, it is advisable to feed that part of the milk which is first drawn from the udder, as it possesses a lower fat content, and is less likely to cause digestive disorders. In a state of nature, a calf gets milk containing about 3 per cent fat, whereas some of our improved breeds give almost twice that amount. The amount fed should be increased gradually, taking much care to avoid overfeeding. In case scours develop, the feed should be immediately reduced.

The calf on skim-milk. — Whole milk, being rather expensive, should not be fed longer than is necessary. The time for begin-

ning to substitute skim-milk will vary according to conditions. In general the change should begin when the calf is four weeks of age. This change should be made gradually, so that the calf may adjust itself to the new feed without trouble. A good plan is to increase the skim-milk one pound each day and decrease the whole milk by the same amount, and thus requiring about one week to make the complete change. The skim-milk should always be sweet and as nearly the same from day to day as is possible. The amount fed may be gradually increased to 20 pounds daily, but it is not considered advisable to feed more than that amount.

When two or three weeks old, the calf should be taught to eat a little grain. This is best accomplished by placing a handful in the pail immediately after the calf has finished drinking the milk. It is not a good practice to put the grain in the milk, as the calf will swallow it with the milk and not learn to masticate it properly. After the calf has learned to eat the grain, a box should be provided in which to feed the grain. If for some reason the calf fails to eat the grain, it must be removed and not left in the box to decay. The grain should be kept fresh and clean. At six weeks of age, the calf should be eating one pound daily of the following mixture: 3 parts corn meal, 3 parts ground oats, 3 parts wheat bran, and 1 part linseed meal.

The young calf should be taught to eat hay along with the grain. If sweet nutritious hay is put within its reach, it will soon learn to eat it. Whole hay is preferred to chopped. Among the various hays, alfalfa holds first place, but if not available, bright clover hay of fine quality is excellent for the calf. The hay should not be overripe, as such hay contains too much crude fiber and is coarse and woody. The calf may have all the hay it will consume, providing it gets grain and skim-milk in addition. It is doubtful whether it is advisable to feed silage or roots while the calf is getting skim-milk.

Fall calves may be turned to grass the following spring,

but grain feeding should also be practiced, as stronger and larger calves will result. Later in the summer, when the grass is short and dead, the flies bad, and weather very warm, some green feed, if available, would be a valuable addition. After the first or second month the calves should have access to cool, clear water, as the milk furnished will not be sufficient for them to drink, particularly if the weather is hot and the flies troublesome.

Milk substitutes for raising calves. — Whole milk is the natural food for the calf. On it the average calf will thrive better than on any other food. Because of the high price of milk many substitutes for milk as a calf food have been put upon the market from time to time. From a careful perusal of the literature, both with respect to experiments and practice, it seems that skim-milk, grain, and hay make the best substitutes for whole milk in raising calves. Skim-milk, however, is seldom available, and this has led to trying the substitutes found upon the market. While skim-milk, grain, and hay are the best substitutes for whole milk, it is true that healthy calves can be raised without milk of any kind after the first four weeks. In general calves so raised will be inferior in size, but they can be brought through strong and healthy.

Removing horns from young calves. — When dairy cattle are desired without horns, the removal is very easily accomplished while the calf is very young. As soon as the horn can be located by examining the head with the hand, clip the hair away from the budding horn. Wrap a stick of caustic potash in paper to protect the hand, dip the end of the stick in water, and rub this upon the tip of the horn until the skin or scurf begins to loosen up and gets red, taking care all the time that none of the potash comes in contact with the skin surrounding the horn. In a few days the place will scale over. One application is sufficient.

Castrating the male calf. — The age at which castration is permissible varies, but usually is performed during the second or third month. If done in early life, there is less danger of

complications, as the organs are not fully mature; and if let go too long, the animal becomes "staggy" in appearance and will not make as good a feeding calf as otherwise. Castrating a calf at so early an age is not a difficult task. The operation may be performed with the calf standing, if one is provided with "stocks" to hold him; or in the absence of stocks, by throwing the calf upon his side and holding him firm. When ready, hold the testicle in the left hand, and with a sharp instrument in the right make a good free incision, remembering that there are two thick coats that must be cut through. Now the testicle may be removed by simply cutting it off, though this may be followed by a hemorrhage. To avoid this, take the cord in the left hand, having the cord between the thumb and the index finger. Now twist the testicle several times with the right hand and push with the left hand towards the body of the animal. This will do away almost entirely with the bleeding. If, however, this seems too difficult, scrape the cord in two instead of cutting. Let the animal up, and in a few days he will be all right again.

CHAPTER XI

CARE AND MANAGEMENT OF DAIRY CATTLE

THERE are many factors to be considered in the formation and management of a dairy herd, some of which are personal in their nature and do not lend themselves readily to discussion, while others are more general, of interest to all, and may be discussed intelligently. The two most important factors in a dairy herd are of course the owner and the cows. A discussion of the qualities of a good dairyman, further than that he should be in love with his work, have faith in it, be industrious, and painstaking in selecting, breeding, and caring for his stock, is a difficult task, as all kinds of men on all kinds of farms are making a success with dairy cattle, whereas other men similarly placed are constantly failing of success. The cow, on the other hand, with her desirable and undesirable qualities more easily defined and more uniform in their nature, may be intelligently discussed.

SANITARY MILK PRODUCTION

By sanitary milk is meant a clean, wholesome product produced under healthful conditions. The principal factors to be considered in its production are the cows, the stable, the milk-house, the milking, and the cooling and storing of the milk.

The cow. — In the production of clean milk, extra care must be given the cows. They must be curried daily to remove the loose hair and dirt. The udder and rear parts of the animal should be clipped, thus removing the long dirt-catching hair and rendering the parts much more easily cleaned. The udder

should be wiped with a damp cloth just before milking. Hay should not be fed previous to milking, as it fills the air with dust. Care should be taken to feed clean, nutritious foods and such as will not contribute an undesirable flavor to the milk. The drinking water for the cows should be clean, fresh, and the tanks protected from possible contamination. Furthermore, the cows should be healthy. One cannot produce sanitary milk and keep diseased cows. Each animal composing the herd should be tested for tuberculosis once each year and the diseased cases removed.

FIG. 81.—BROWN SWISS COW "VOGEL." Owned at Sedgley Farms, Hinsdale, Ill.

The stables. — If one is to produce sanitary milk, the stable must be kept clean. This applies to dust, cobwebs, and the like, as well as to the manure and litter. Much light and good ventilation are essential. The floors should be of cement. The gutters and litter should be cleaned out twice daily, and the material hauled to the field, or placed in a protected water-tight pit outside the barnyard and of sufficient distance to prevent odors from reaching the stable. The covered shed, if one is used, and stable-yard, must be clean and well drained. It is a rather common practice to house other animals, such as horses or sheep and sometimes swine, in the same stable with cattle. If sanitary milk is to be the product, no other animals should be placed in the same stable with the cows.

The cows should be bedded liberally, particularly if the floor is of cement. The bedding should not be permitted to become foul, as this not only lessens the comfort of the cattle, but makes it more difficult to keep them clean and it promotes disease. Old straw makes the best bedding material, but when high in price, it may be replaced by many other materials, such as shav-

ings from the planing mill, — which make a clean and sweet bedding, — by tan-bark, by leaves, and the like.

Milk-house. — Preferably the milk-house should be separate from the barn and located at a safe distance from all sources of

FIG. 82. — A DEVICE FOR COOLING MILK. Milk cooled immediately after drawing will keep sweet much longer than otherwise.

contamination, yet convenient to the cows. It should be divided into two rooms, one for heating water and cleaning the utensils, and the other for weighing, sampling, cooling, and storing the milk. The milk-house should be well lighted and well ventilated, the floors should be constructed of cement, and the walls

and ceiling made tight and smooth in order that they may be easily cleaned. The windows and doors should be screened to exclude the flies.

The *utensils*, such as the milk-cooler, the pails, cans, strainers, and the like, should be thoroughly cleaned by first soaking in warm water, then washing in boiling water containing some cleaning material, rinsed in clean hot water, and then sterilized with steam. After thoroughly cleaning, they should be inverted in the pure air, preferably in the sunlight.

Milking. — The milker should be cleanly in his habits, and should milk with dry hands. A small-top milk pail should be used to exclude the dirt as far as possible. As soon as each cow is milked, the milk should be taken directly to the milk-house and there weighed, a record made of the weight, a sample taken to test for the fat, then it should be strained, and immediately run over a cooler, reducing its temperature as low as possible (Fig. 82). The milk should then be kept at as low a temperature as possible. A good plan is to set the cans in a vat containing ice, and cover the vat with a lid. If this is not convenient, set the cans in running well or spring water. During transportation cover the cans with a blanket. In summer the blanket should be wet, in winter dry.

MILKING MACHINES

Perhaps the most important factor retarding the development of dairying is the difficulty of securing milkers who can be depended on to do their work satisfactorily. In general the size of the dairy is restricted to the number of cows that the owner can attend to at such times as his help fails him. If the question of milking the cows, without being so dependent on hired help, could be satisfactorily solved, the number of animals kept on many dairy farms would increase up to the limit of the acreage to feed the animals. Any possibility, therefore, of milking cows by machinery is likely to appeal strongly to the dairy farmer.

There are now machines on the market that will milk cows. There are, however, many questions relative to their use that cannot be answered with much positiveness; chief of which are the efficiency with which they milk, the effect on the cow, the effect on the milk, and their economy.

It is well known that one milker may secure more milk than others from the same cow, and that after a cow has become accustomed to a milker, a change results in a decrease in the production. It may be expected, therefore, that the immediate effect of changing from hand to machine milking will be attended by the same results. The question as to the practicability of machine milking is, therefore, whether or not cows can be milked satisfactorily by this method for an extended period of time. Furthermore there comes the question of the effect upon succeeding generations, whether the machine milking will have a tendency to discourage the transmission of milking qualities. The milking machine is of so recent invention that there are not data enough at hand to answer these questions. The data available go to show that by taking the year through, the average cow yields approximately as much milk to the machine method as to the hand method of milking, particularly if she is stripped by hand after the machine milking.

Mechanically, the machine seems to do its work efficiently. There are, however, certain difficulties encountered which hinder the working of the machine and over which it can have no control. Chief among these are the shape, size, and other peculiarities of the cow's udder and teats. The quality of the udder as regards fleshiness or flabbiness and unevenness of the quarters, teats abnormally small, warty, those that milk down, and those that are very close together, are likely to give much difficulty.

The effect of the machine on the milk, particularly the bacteria content, depends much on the manipulation of the apparatus while in operation as well as its care between the milk-

ings. If the teat-cups slip from the teats while the machine is working, many germs are likely to be drawn into the milk pail. The machines are provided with air filters, and the efficiency in keeping the germ content low depends much on the condition of these filters. The milk in its passage from the teats to the pail

FIG. 83.—DUTCH BELTED BULL "AUTEN." A first prize winner. Owned by R. F. Sanders, Bristol, N. H.

The Dutch Belted breed of dairy cattle is a native of Holland. The cows are fair milkers, producing milk of average richness. The size is much smaller than the Holsteins, the bulls weighing 1400 to 1800 pounds and the cows 1200 to 1500 pounds. The color is black, with a white belt around the body.

must pass through the teat-cups and a few feet of rubber tubing. These teat-cups and tubing are likely to crack, and these minute cracks become laden with germs, which are hard to wash out, and if the rubber is steamed sufficiently to kill the germs, it soon wears out. To obviate this difficulty it is recommended to keep the teat-cups and rubber parts in a 10 per cent solu-

tion of common salt. This treatment proves very effective. If, therefore, the workman is skilled in the manipulation of the machine and cares for it properly, the germ content of the milk can be kept low and a clean product secured. The available data seem to indicate that the machine has no effect on the fat content of the milk, particularly if the cows are stripped by hand, as is usually advisable.

MANAGEMENT OF THE BULL

The bull calves must be removed from the heifers when four to six months old. In rearing a bull, accustom it to being handled from calfhood. From the very beginning it should be gently but firmly managed and not fondled or permitted to frolic. Give it kind, quiet, firm, and unvarying treatment. Always keep it under subjection, that it may never know its strength and power. Place a ring in its nose before it is a year old. This ring should be frequently renewed, in order that it be always strong. If this is neglected, the ring will come in two when most needed. Always lead and handle the bull with a staff. The bull should never run loose in the yard or pasture. It should be provided with abundant and regular exercise. At such times it should be under restraint and full control. For exercise, some recommend placing the bull in a tread-power and use the power thus generated to grind the grain, run the fodder cutter or cream separator, and the like, but this does not seem practicable. A very good plan to provide exercise for the bull is to arrange a wire overhead and attach the bull's halter strap to it. This will enable him to take exercise at will and still keep him under control. As age and strength increase, a second ring should be placed in the nose in which to attach a strap, chain, or rope to supplement the staff when the animal is let out for service. Let there always be a double hitching device, so that the bull may never by accident find himself free when he should be tied. In the management of a bull, it is

well to remember that one physically tired may be depended on to be quiet and easily managed; hence the importance of much exercise.

When possible, it is much better to keep the bull in the presence of the herd than stabled by himself, in a lonely place, as is so often the case.

It is a common practice among dairymen to use immature bulls and to dispose of them before their merits as sires are known. This is because bulls of some age are likely to be vicious and dangerous. Many a good bull has been sold for beef only because he was not easily managed and it was thought desirable to dispose of him before some one was injured. A bull that is known to get good offspring should be kept as long as he is useful as a sire.

Ringing the bull. — Many neglect to ring the bull calf under the erroneous impression that it is a difficult task. On the other hand, it is very easy. All one needs to do is punch a hole through the membrane between the two nostrils, insert the ring, and screw it together. If one has a bull-ringing punch to make the hole, it is much easier, but in the absence of the punch the hole may be made with a knife, placing the ring in as the blade is drawn out. To restrain the calf it must be tied up securely by the head. The ringing of an older bull is more difficult because of the difficulty of restraining him.

THE DAIRY BARN

The dairy cow is perhaps the most difficult of farm animals to stable properly. The purpose for which she is kept, that of supplying milk; the use to which the milk is put, that of human food; the condition in which it is used, being raw; the place from which it is drawn, being exposed to greatest filth; the manner in which it is drawn, by hand and often by unclean milkmen; and the condition of her dung or manure, as well as the fact that if maximum production is to be obtained, she

must be fairly warmly housed, yet provided with an abundance of light and much fresh air; — all serve to complicate the problem of providing suitable quarters for the dairy cow.

There are certain fundamentals that should be provided in every building in which the dairy cow is stabled. Chief among these are light, ventilation, sufficient room, smooth and light walls and ceilings, a good floor, a comfortable and convenient tie, and properly constructed mangers.

FIG. 84. — DAIRY BARN, NEW YORK STATE COLLEGE OF AGRICULTURE MILK-HOUSE IN THE FOREGROUND.

Light in abundance should enter the dairy barn. — Sunlight is nature's disinfectant. With sufficient light and proper ventilation, germ diseases are not likely to occur. It is said that direct sunlight will kill the growing tuberculosis germ in a very few minutes. Hence, cattle kept in well-lighted and well-ventilated quarters are not so likely to contract this much dreaded disease. Again, light shows dirt and makes it easy to keep the barn clean. Dark stables are likely to be dusty or dirty and damp, thus providing conditions for germ growth. In addition to freedom from germ disease, health, cleanliness, and the like, a barn in which the sun shines freely furnishes a cheerful place in which to work.

Sunlight, the most efficient disinfectant as well as the most powerful of all medicines, is free, and provision for its admittance into any cow barn need cost but little. Window glass is inexpensive. Old barns that are dark and dismal may easily be provided with sufficient light by cutting holes in the walls and putting in windows. Best results are obtained by cutting the windows long from top to bottom and low, as more direct sunlight will fall on the floors.

Ventilation essential to health. — The importance of pure air in a cow stable cannot be overestimated. It is essential to the well being of the herd; without it, disease will surely work destruction. While there are many methods of ventilating a dairy barn, the King system in some of its modified forms is admitted to be the most efficient. If in addition the windows are arranged as suggested on page 268, ample ventilation can be procured.

King's system of ventilation. — While there are many methods of arranging this system, it consists essentially of two parts: the inlets and the outlets, in the form of flues. This system will not work if the walls of the barn are full of cracks or the floor is made of loose boards. The floor, walls, ceilings, and windows must be so constructed as to prevent any large quantity of air from leaving or entering.

The inlets must be so constructed as to meet two conditions; first, they must admit the fresh air near the ceiling, where the barn air is warm, in order that the fresh air may mingle with the warmest air of the stable and raise the temperature before descending to the floor, thus not allowing the animals to lie in cold air. In the second place, they must not permit the warm air to pass out instead of the cold fresh air to come in. This is accomplished by constructing the inlet flue so that it begins near the ground on the outside and ends near the ceiling on the inside. All that is necessary is to have the outer end of the flue several feet lower than the inner end.

The inlets should be numerous, of small size, and constructed on all four sides of the stable in order to take advantage of the wind, regardless of the direction from which it blows. In this way a large quantity of air is admitted and evenly distributed throughout the stable. A convenient size for these inlets is 4 × 12 inches, as this permits the flue to be built between two

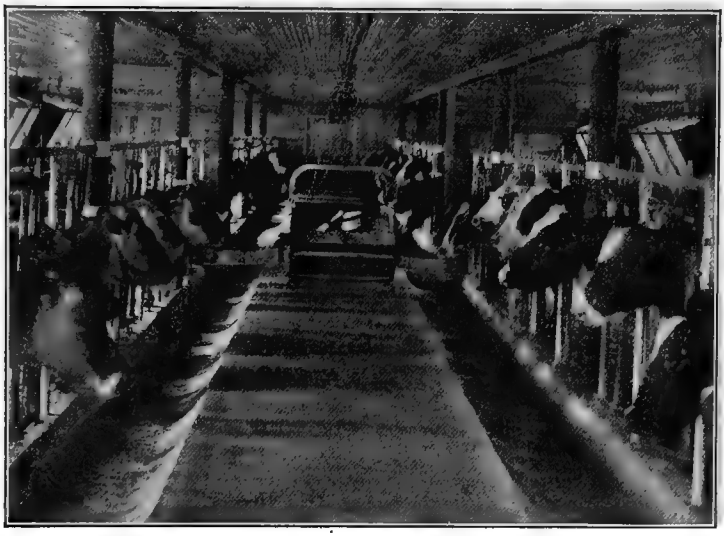

FIG. 85.—INTERIOR VIEW SHOWING FEED-CARRIER, FEED ALLEY, MANGERS, AND STANCHION OF THE DAIRY BARN, NEW YORK STATE COLLEGE OF AGRICULTURE AT CORNELL UNIVERSITY, ITHACA, N. Y.

4-inch studdings. There should be one such flue to each three cows. The flues should be lined with building paper, and this covered with matched lumber. All openings, and especially the outside ones, should be securely covered with heavy wire netting.

The outlets must be so constructed as to meet three conditions. First, the ventilators should reach to near the stable

floor in order to remove the air from that point. This is desirable because the refuse gases from the animals being heavier than the other air of the stable remain near the floor. The animals not only lie down, but they breathe the impurities from the floor when standing. The colder air is at the floor, and it is desirable to remove this, particularly in the winter, in order that the warmer air at the ceiling may move downward. In the second place, these ventilators should be provided with an opening near the ceiling for the removal of the warm air when the stable becomes too warm, particularly if the animals are to be kept in the stable most of the time. This opening must be provided with a door or slide to be closed or opened at will. In the third place, it is important that these ventilators be so constructed as to afford as little inconvenience as possible, particularly when they extend through the hay loft, where they are sometimes in the way of the hay fork. The ventilating flue should be as large as convenient. The essentials of a good ventilating flue are similar to those of a good chimney. In addition to their being of air-tight construction and as straight as conditions will permit, it should rise above the highest part of the roof so as to get the full force of the wind.

Window ventilation. — If it is not possible to install the King system in one of its many forms, the windows can be so arranged as to form a fair system of ventilating the cow stable. To do this, hinge them at the bottom, allowing the top to open inward. Place a board edgewise along each side of the window, so that the air will not enter at the bottom and blow directly on the animals when the window is open. By leaving several of the windows open an inch or two at the top they will provide fair ventilation without producing serious drafts. When this plan is employed, it is best to open the windows on the side of the barn away from the wind and to regulate the size of the opening according to the severity of the weather.

Floors are best made of cement. — While many objections have

been raised to the use of cement, such as its cost, its being cold and damp, injuring the cattle and the like, it is nevertheless the most desirable material from which to construct floors for the cow stable. The gutters and mangers should likewise

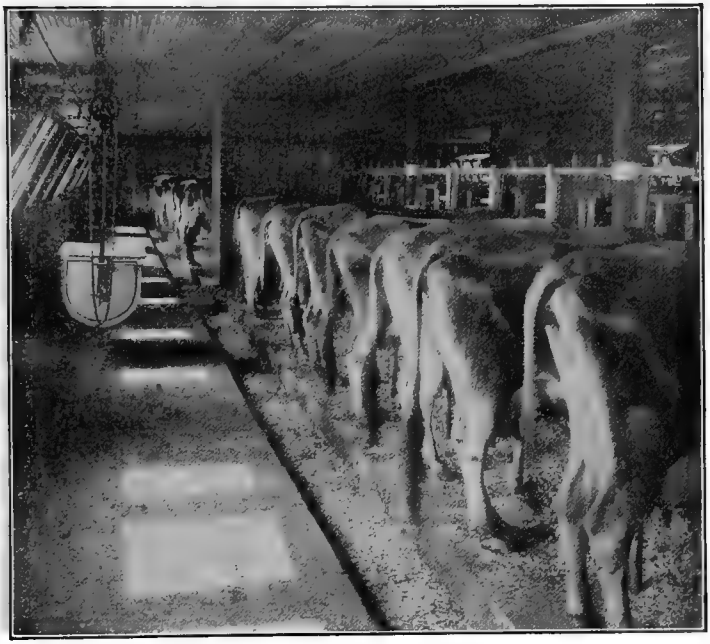

FIG. 86.—INTERIOR VIEW OF DAIRY BARN SHOWING LITTER-CARRIER, GUTTER, AND ARRANGEMENT OF WINDOWS. NEW YORK STATE COLLEGE OF AGRICULTURE.

be laid in cement. Cement has two very great advantages over all other materials: it is easily kept clean, and if properly put down, is durable. If desired, plank may be laid over the cement where the cows stand. This, however, is not necessary, as cement can be made dry and fairly warm by

placing a layer of some non-conducting material, such as building paper, an inch or so beneath the surface. This may be done as follows: lay the cement as usual until within one and one-half inches of the desired thickness. Now lay down one thickness of heavy building paper, leave a strip at least six inches wide, along the edge next to the gutter. Paint this building paper with asphaltum paint, then lay down another thickness of the paper. Spike this paper down, leaving the heads of the spikes sticking up about one-half inch above the paper. Put on the remainder of the cement and proceed as though the paper was not there. This paper need be put only where the cattle lie. Figs. 85 and 86 show good cement construction.

Watering device. — There are many devices on the market for keeping a constant supply of water before the animal. The question of their use depends largely on the ease of keeping them clean. In many cases they are provided with tops which the cow soon learns to raise and which fall down and cover the device when she is not drinking, but these do not keep the water clean. The cow with her mouth partially full of grain or hay often opens the lid and slobbers the grain into the water. This material soon decays and the device becomes a trap for foul-smelling water. Perhaps the safest and most convenient plan is to have a large tank located near by. This can be easily cleaned, the water kept fresh and cool in summer, and the chill easily driven off in winter.

THE SILO

The silo has passed the experimental stage, and the economy as well as the practicability of preserving fodder in it has been fully demonstrated. Silage is a valuable food, and is relished by all classes of farm animals, but is more particularly adapted to ruminating animals like the dairy cow. In fact, in order to secure maximum production, some kind of succulent food is necessary, and ordinarily silage will be found the most efficient

as well as the most economical form of succulence that can be provided.

The fundamental principle in the preservation of green forage when placed in a silo is the exclusion of air. To prevent the air from reaching the silage, the silo must be constructed with air-tight walls. These walls must be rigid enough to prevent springing out of shape by the pressure of the silage, for in this case air will enter next to the wall. The pressure is greatest from the second to the sixth day after filling. The silage at this time begins to heat and settle, and if the walls are not sufficiently rigid to prevent any bulging, a considerable loss of silage is likely to result. The walls should be perpendicular, and the diameter the same from the bottom to the top.

The size of the silo. — On being exposed to the air, silage spoils rapidly, and to avoid this must be fed off at the rate of one and one-half to two inches daily in the winter and three inches in the summer. A good plan is so to construct the silo that the horizontal feeding area for each cow will be approximately six square feet daily. If we feed six square feet off the top and two inches down, this means one cubic foot to the cow. The approximate weight of a cubic foot of silage is forty pounds, though this varies much between the top and the bottom. As this is about the proper quantity to feed daily, it becomes evident that six square feet is the proper area for each cow.

Fig. 87. — Dutch Belted Cow "Echo 2." A first prize winner. Owned by R. F. Sanders, Bristol, N. H.

The table that follows gives the capacity of a silo of various widths and depths; also the area required to fill it, and the approximate quantity that should be fed daily to lower the

surface two inches per day, based on an average weight of forty pounds to the cubic foot. By examining the table one can get an idea of the size desired; also the economy of increasing the depth:

Approximate capacity in tons of round silos of different diameters and depths and the area required to fill them as well as the amount that should be fed daily

Inside Diameter Feet	Height Feet	Capacity Tons	Acreage to fill 10 Tons to Acre	Amount that should be fed Daily
10	28	42	4.2	525
10	32	51	5.1	525
10	36	61	6.1	525
12	30	67	6.7	755
12	34	80	8.0	755
12	38	94	9.4	755
14	30	91	9.1	1030
14	34	109	10.9	1030
14	38	128	12.8	1030
16	30	119	11.9	1340
16	34	143	14.3	1340
16	38	167	16.7	1340
16	42	193	19.3	1340
18	36	196	19.6	1700
18	40	229	22.9	1700
18	46	282	28.2	1700
20	36	243	24.3	2100
20	42	300	30.0	2100
20	50	382	38.2	2100
22	36	292	29.2	2300
22	42	366	36.6	2300
22	50	469	46.9	2300

Filling the silo. — Occasionally the construction of a silo is criticized, whereas the fault may be found in the method of

filling. It is essential to the preserving of silage that it be well packed, keeping it level and thoroughly tramped. This very important task is often intrusted to a lad who spends his

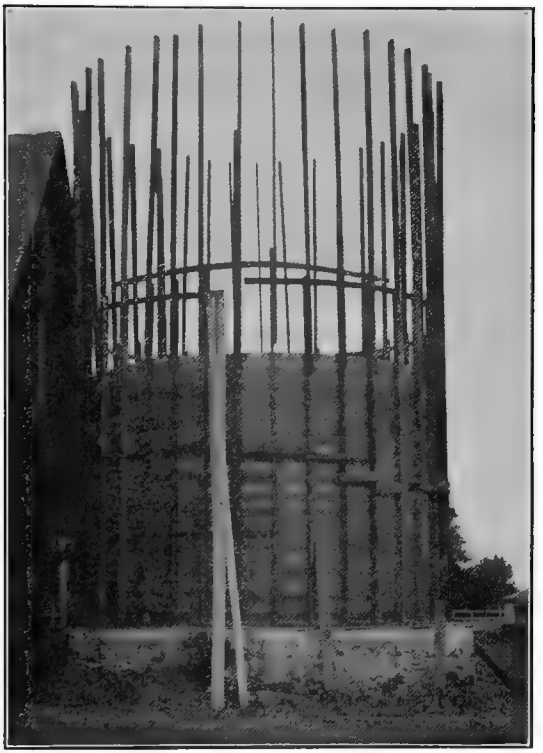

FIG. 88.—SILO IN THE PROCESS OF CONSTRUCTION BY FARM LABOR. This silo, 16 feet in diameter and 30 feet high, was completed at a cost of one dollar for each ton capacity.

time in standing in the breeze of the blower, with the result that the silage comes out of the silo somewhat molded the following winter.

In filling with corn there is a tendency toward an uneven distribution of the ears; these, being heavier than the other parts of the plant, are blown to the opposite side of the silo. To obviate this, many devices are employed, perhaps the most simple of which is a long bag open at both ends and fastened to the end of the carrier. By means of a small rope attached to this bag the corn may be deposited in any part of the silo desired.

CHAPTER XII

FEEDING BEEF CATTLE

FEEDING beef cattle differs considerably from feeding dairy cattle, as well as from feeding horses. In the case of horse feeding, the product sought is energy in the form of work; in the case of dairy cattle the product is milk; whereas in the case of beef cattle the product is flesh. This calls for special methods of feeding, special foods or food combinations, and special management. Much discussion was devoted (in Chapter IX, page 203) to the production of milk in which it was treated largely as an independent industry because of the fact that the successful dairymen have time for little if anything else; whereas beef production is not a special industry and does not require all of the feeder's time, and on the average is conducted successfully only in connection with grain farming. Among successful beef producers, beef-raising is regarded as a convenient way of marketing grain, as well as a means of conserving soil fertility, and hence the ability to grow more grain to feed more stock and also a profitable means of utilizing much coarse forage which otherwise would be largely wasted.

ESSENTIALS OF FEEDING CATTLE

In feeding beef cattle one of the most important factors is the kind of cattle, for on the choice of them will turn in a large measure the possibility of success. In considering the cattle with a view of estimating their profit as beef producers, there are a number of essentials to be taken into account.

Chief among these are the age, form, condition, quality, uniformity, and the price.

Age at which to feed cattle. — In recent years no question has been more discussed, or the object of more experimentation among cattle feeders, than the most profitable age at which to fatten cattle. This interest has been due in part at least to the fact that writers on agricultural topics strongly advised feeding young cattle, whereas the professional feeder, whose livelihood depends upon his success, has shown a decided preference for older cattle. To secure some idea of the age at which gains can be made most cheaply, let us examine the composition of the body of an old and young steer. In Jordan's "Feeding of Animals," we note the composition of the body of an aged fat steer and of a fat calf to be as follows: —

	Water Per Cent	Ash Per Cent	Protein Per Cent	Fat Per Cent
Aged fat steer . .	49.5	4.4	15.6	30.5
Fat calf . . .	64.6	4.8	16.5	14.1

From this we observe that the body of the fat calf contains 15.1 per cent more water and 16.4 per cent less fat than that of the aged fat steer, the ash and protein being practically the same. This would seem to indicate that the aged steer in fattening required considerably more solid food, particularly those foods rich in fat, whereas the calf requires less fat, and less dry-matter to the pound of gain. As water is cheaper than fat we would expect the calf to make the cheaper gains, and such is the case.

Not only does the age influence the cheapness of the gains, but it affects the rate of gain as well. Here, too, the younger animal has the advantage; that is to say, all things being equal, the younger animal will make more rapid gains for 1000 pounds

live weight than the aged one. This is due in part no doubt to the fact that the younger animal's digestive organs are likely to be in better condition, the teeth are sounder, the glands more active, so that the food is better masticated, more thoroughly digested and assimilated than in the aged steer.

FIG. 89. — THE NOTED SHORTHORN BULL "AVONDALE." Owned by Carpenter & Ross, Mansfield, Ohio.

The Shorthorn, a native of England, is the most popular beef breed all over the world. Though not so early maturing, they attain the largest size of any of the beef breeds, cows weighing around 1500 pounds, bulls 2200, and finished steers from 1200 to 1500 pounds. The bulls are noted for the excellency of their get when bred to native cows, while the finished steers are noted for their good quarters. In color they are red, white, and roan.

Form for feeding cattle. — The form of the steers must be such as to meet two conditions: those demanded by the cattle feeder, and those demanded by the butcher. The cattle feeder wishes an animal that will make rapid and economical gains in the feed lot, while the butcher wishes one that will dress a rela-

tively high percentage of edible meat, particularly of the high-priced cuts, such as prime of rib, porterhouse, sirloin, rump, and round, which are taken from the back, loin, rump, and quarters. In general the form that best fills these conditions will be low set, deep, broad, and compact, rather than high up, gaunt, narrow, loosely made. The cattle should be low set, standing on short legs, as animals of this form are likely to prove good feeders capable of maturing early. The top and bottom lines should be straight and nearly parallel, the flanks should be low, thus giving much depth and great capacity.

Cattle possessing such a form are likely to prove rapid and economic producers while in the feed lot, thus making a profit for the feeder, and when slaughtered to dress a relatively high percentage of edible meat, particularly of the high-priced cuts. Such an animal should dress out 55 to 60 per cent or better with approximately one-half of the edible meat in the region of the valuable cuts, and this will sell for about 75 per cent of the value of the entire carcass, leaving the other half from the region of low-priced meat to bring the other 25 per cent of the valuation.

Condition of feeding cattle. — In considering steers to feed, their condition should be carefully scrutinized from two points of view: their thrift, and the amount of flesh they possess. Feeding cattle should be thrifty but not coarse. Thrift is indicated by a wide, deep chest, by fullness in the heart girth, by depth and breadth of body, and by good handling quality. While the cattle should not be coarse, too much refinement is likely to prove disappointing, as it often means delicacy or lack of thrift, and no animal lacking in thrift should find its way into the feed lot.

To make rapid and economic feeders the cattle should not possess much flesh at the beginning of the feeding period. All things being equal, the thinner the steer at the beginning of the feeding process the more rapid and economical gains it

will make, providing there is no lack of thrift. It is easily possible, however, for a steer to be so low in flesh as to lack thrift. Such animals require time to get back into normal condition, and there is a possibility of their being stunted permanently. If we examine the bodies of the thin and fat steer, it may give us an insight as to why the animal gains in flesh more rapidly and on less feed when in a thin condition. In Jordan's "Feeding of Animals" we note the composition of the bodies of such steers to be as follows: —

	Water Per Cent	Ash Per Cent	Protein Per Cent	Fat Per Cent
Thin steer . . .	66.2	5.9	19.2	8.7
Fat steer	49.5	4.4	15.6	30.5

It seems that the body of the thin steer contains a relatively high amount of water and low fat, whereas the fat steer's body contains a relatively small amount of water and high fat content. This may have a bearing on the fact that a thin steer gains more rapidly and on less feed than a fat one, and also on the fact that as the full feeding proceeds the gains are made less rapidly and require more feed.

Quality of feeding cattle. — Quality should be considered from two points of view: general quality, and handling quality. By general quality is meant that general refinement of external form found in the neat head, fine horn, dense bone, smooth outline, and compact body. This quality is affected by nothing so much as breeding. General quality and good breeding are closely associated, well-bred animals being likely to possess quality, whereas it is often wanting in the common-bred steers. The importance of general quality in feeding cattle cannot be overestimated, as steers possessing it will give higher profit to both

the cattle feeder and the butcher, not because such animals will necessarily make more meat from a given amount of food, but because they will dress out better and bring a higher price on the market.

Good handling quality indicates that the steer is a good feeder. By good handling quality is meant a fine silky hair and a loose mellow skin. These are associated with thrift and the ability to take on flesh rapidly and economically, whereas a heavy stiff hide is considered to indicate slower fattening. The previous care that the steers have received has a marked influence on the hair and skin, and hence on the handling quality. The importance of good handling quality is not to be overlooked if one is to succeed in feeding cattle.

Uniformity in feeding cattle. — Feeding cattle should be uniform in age, weight, color, type or form, condition, breeding, and quality. As we have observed, young steers gain more rapidly than aged ones, and, as we shall see, aged steers fatten more rapidly than young ones; hence it is not likely that a lot of steers of mixed ages would all be ready to market at the same time. If some of the animals are fat, while others are only half fat, they will not command as high a price on the market as though they were uniform in flesh. Not only must they be uniform in flesh, but they must be approximately uniform in weight if the highest price is to be obtained. Butchers and packers desire cattle uniform in weight, so that the cuts of meat will run uniform, as their trade demands. While uniformity of color does not add to the animal's capacity to take on flesh economically or to his ability to dress out well, yet the butchers desire such similarity and are willing to pay for it. The cattle should be uniform in type or form. If they vary in type, the weight of the cuts of meat will likewise vary, and to this the butcher objects. The butcher also demands animals equal in condition and quality, to meet the demands of his trade calls.

FOOD REQUIREMENTS FOR BEEF

The quantity of food required to fatten a beef animal depends on many factors, chief of which are the kind of food and the age, weight, and condition as well as the individuality of the animal. Some foods promote the formation of flesh and bone, and as a result the animal tends to grow, whereas certain other food encourages fat formation and the animal tends to fleshen rather than to grow. The age, weight, and condition also have much influence on the amount of food required to fatten the animal.

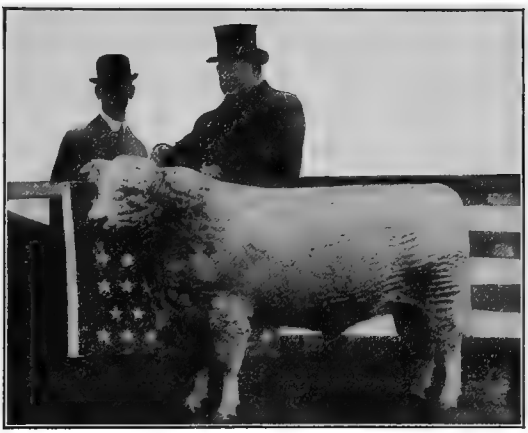

FIG. 90.—A PRIZE WINNING SHORTHORN BULL. Owned by Carpenter & Ross, Mansfield, Ohio.

The younger the animal the less food will be required to produce a given gain in flesh. The thinner the animal, providing it is thrifty, the less food will be required to produce a given weight. Perhaps most important of all is the individuality of the steer. Some steers will gain three pounds daily, while others receiving the same amount and kind of food will gain but one pound. The only method of distinguishing the animal that makes three

pounds from the animals that make but one is by external appearance. The external indication of a good feeder is a low-set form, being deep, broad, and compact, with low-down flanks, showing that the animal possesses great capacity for digestion and assimilation (p. 278–279).

No definite quantities can be given that will apply to all animals, to all conditions, and to all foods. The Wolff-Lehman standards furnish us a guide to be modified by the judgment and experience of the feeder: —

Wolff-Lehman standards, showing the amount of food required per 1000 *pounds live weight for both the growing and fattening beef animal*

Condition of Animal		Dry-Matter	Digestive Nutrients			Nutritive Ratio
Growing Cattle Beef Breeds			Protein	Carbo-hydrates	Fat	
Age, Mo.	Weight					
2–3	160	23	4.2	13.0	2.0	1 : 4.2
3–6	330	24	3.5	12.8	1.5	1 : 4.7
6–12	550	25	2.5	13.2	0.7	1 : 6.0
12–18	750	24	2.0	12.5	0.5	1 : 6.8
18–24	950	24	1.8	12.0	0.4	1 : 7.2
Fattening Cattle						
First period . .		30	2.5	15.0	0.5	1 : 6.5
Second period .		30	3.0	14.5	0.7	1 : 5.4
Third period . .		26	2.7	15.0	0.7	1 : 6.2

WINTERING STOCKERS AND FEEDERS

Large numbers of feeding cattle are purchased in fall and early winter for the special purpose of economically disposing of such roughage as corn stalks, straw stack, second-class clover hay, clover chaff after the seed has been removed, and the like. Wintering cattle with a view to fattening the following summer on pasture is a very convenient way of converting such feeds into cash. The cattle feeder is now confronted with the question

as to how well he shall winter these animals. That is to say, he is often at a loss to know whether to feed a small allowance of grain along with the roughage or to feed the roughage alone. If he feeds the roughage alone, it is doubtful whether the steers can be wintered without loss in weight, unless the roughage is of good quality and a legume, such as clover, alfalfa, or cowpea hay. On the other hand, if he feeds grain, then comes the question as to how much shall be fed, for it is well known that if steers are grained too liberally through the winter, they will not do so well the following summer on pasture.

While different systems of feeding should undoubtedly be recommended for cattle of various ages and quality, there are at least three conditions that should be kept clearly in mind: first, cattle wintered on roughage alone, providing they retain their thrift, will make more economical beef producers the following summer on pasture than when they receive grain along with the roughage; second, cattle wintered on a too liberal grain ration may fail to make a profit the following summer on pasture; and third, other things being equal, cattle wintered on a ration containing a liberal supply of protein, particularly if this protein is contained in the roughage, as clover, alfalfa, or cowpea hay, will make greater and more economical gains during both winter and summer than if this nitrogenous roughage is wanting. It is true that animals receiving this nitrogenous roughage will not finish or fatten so quickly, but they will make gains more economically, and the quality of the flesh will be better than otherwise. From practical experience, therefore, it would seem best to provide considerable protein in the ration of the wintering stocker or feeder. If this protein is lacking in the roughage, in which it should be provided if possible, then supply the needed protein by feeding such grains as cotton-seed meal or linseed-oil meal in rather limited quantities in the grain ration. In case the grain is fed no suggestions can be given as to the exact

amount, but when one is simply wintering the steers without any attempt to fatten them, the maximum amount should not exceed six pounds daily, and perhaps better results can be obtained by feeding two to four pounds daily.

Roughage increases feeding capacity. — It is conceded by experienced cattle feeders that roughing steers preparatory to putting them on full feed requires much skill. The feeding of an abundance of roughage encourages the enlargement and development of the digestive organs, thus increasing the capacity for handling more concentrated feeds later on. This, of course, gives the thin animal a large paunch, which must certainly be reduced before the animal is ready for market. A large-paunched steer is not wanted on any fat-cattle market. From this it would seem that before beginning to feed, or in the early part of the feeding process, the enlarging of the paunch should be encouraged in order to increase the capacity, while the latter part of the feeding period should be devoted to reducing this paunch and smoothing up the steer.

SUMMER FEEDING ON PASTURE

Fattening cattle in the summer on pasture is usually more profitable than winter fattening. By such feeding the labor is reduced to a minimum, there is no handling of bulky foods, no bedding to provide, no lots to clean of manure, and no outlay for an extensive plant, such as sheds, lots, and the like. Approximately the only labor in summer fattening is that of feeding the grain, when such is fed.

There are two methods of fattening beef cattle on pasture: pasturing alone with no grain, which is called "grass fattening"; and feeding grain, often all they will eat, in connection with the pasturage. Which of these methods should be employed will depend on conditions. When land is cheap and there is an abundance of pasture, one may secure fairly good returns from pasturing without grain. On the other hand, if

the pasture is limited, the land high in price, and one has the grain, no doubt it will be more profitable to feed grain in connection with the pasture. The previous treatment of the cattle may likewise have an influence. To get good results from fattening cattle on pasture alone, the cattle should be wintered very largely on roughage and should be rather thin in flesh though not lacking in thrift. Cattle that are accustomed to grain and in the habit of depending on it very largely for their nourishment will shrink heavily if the grain is refused them. While cheaper gains can usually be made from pasturing alone, the cattle cannot, as a rule, be made very fat, and hence will not command a high price on the market, which will often offset the advantage of cheap gains. There are, however, many experienced cattle feeders who rely on grass fattening, particularly on the edge of the corn-belt. Cattle feeders in the corn-belt will, as a rule, secure greater returns from a liberal grain feed in connection with the pasture.

How to turn to grass. — As cattle are very subject to bloating if turned to succulent grass, especially if wet with dew or rain, much care should be exercised. This is particularly true on clover or alfalfa. If it is convenient, one should turn the cattle out for an hour or so in the afternoon and then take them up for the day, turning them out the following day at noon and leaving a few hours longer, then taking them up again, when on the third day they may be allowed to remain.

Feeding grain to cattle on pasture. — The amount and kind of grain that should be fed to fattening cattle on pasture will depend much on the previous treatment, age, condition, and quality of the cattle as well as the time of marketing them. Young stock, that are to be made thick fat, will need grain continually throughout the summer. Older cattle, that are not intended for market until fall, may well have their grain withheld until the pasture begins to get short, say along in July. On the other hand, many cattle feeders prefer to "warm the cattle up"

in the feed lot before going to grass, and then to finish them on pasture, disposing of them by the middle of July before the hottest of the weather and just about the time the pasture begins to fail. Under this system it would be necessary to feed grain liberally from the beginning of the pasture season. While this method has much to commend it, there is the serious objection of turning cattle to succulent pasture when they are receiving a liberal supply of grain. On account of the very succulent grass so early in the spring such cattle "drift" or shrink considerably, even though the grain is continued. This drift is so serious that if the cattle are intended for market by, say, the middle of June, it will be more profitable on the average to finish them in a dry-lot. In addition to the disadvantage of the heavy drift it is poor economy to turn cattle to pasture before the grass gets a good start; this is particularly true if the grass was closely cropped the preceding fall.

There is difference of opinion as to the kind of grain that should be fed cattle of the various ages on pasture. In some cases perhaps corn alone cannot be improved on, particularly if there is some leguminous grass, as clover or alfalfa, in the pasture. Some contend that with young stock especially, it is advisable to supplement corn with a food rich in protein, as linseed or cotton-seed meal, whereas in the experience of others the addition of this extra protein food has caused the young stock to grow and not fatten so readily as if the extra food was withheld. Among this class of cattle feeders, when they supplement corn, it is more likely to be for the older cattle.

The pastures. — There are two general plans for providing pasture land: permanent pastures; and pastures in rotation with other crops. Permanent pastures are rapidly disappearing from those sections of the country suitable for growing grain, because of the increased value of the land for grain raising, but there are vast areas unsuited for grain growing which can be very profitably utilized for permanent pasture. In fact much

of the land east of the Sciota, south of the Ohio, and west of the Missouri rivers is suitable for permanent pasture. This cheap land, much of it, could be laid to permanent pastures and yield a very creditable return as pasture for beef cattle. In fact, if conditions continue in the future as in the past, much of our beef must come from these cheap outlying lands. The grains grown on the grain farms are rapidly becoming too valuable as food for human consumption to permit of their being fed to animals.

No definite suggestions can be given as to the choice between permanent pastures and pastures in rotation further than to say that all depends on the location. If those farms or parts of farms that are unsuited for growing grains can be laid to permanent pasture, it will, on the average, be profitable to do so. Each of these systems has certain advantages. For example, permanent pasture simplifies the fencing, provides the water supply, the shade, and the feed racks or bunks, while pastures in rotation give a much better opportunity to distribute the manure to all parts of the farm. Permanent pastures even if seriously affected by drouth are not likely to be a failure, while pastures in rotation occasionally do fail. Properly managed permanent pastures will increase in value with age.

The pasture crop is perhaps the most neglected of farm crops at the present time. Many pastures that are now supporting one animal to two or three acres can with proper care be made to support twice the number. First, secure a good stand. Many pastures do not now possess more than one-half a crop. Bluegrass should form the basis of all permanent pastures in the East, but should be reënforced by white clover, orchard-grass, and red-top. The pasture should be harrowed and reseeded each spring until a stand is secured. Second, keep down the weeds. Animals eat the grass and leave the weeds. To obviate this, pastures should be mown twice each year. This not only keeps the weeds down, but keeps the pasture in such

condition that the animals will feed more evenly over the entire field. Animals are likely to feed where the grass is rather short and tender, and leave the ranker growth. Third, drain pastures well. This is often entirely neglected, and the parts of the farm that are too wet to grow crops are left to pasture. Fourth, top-dress permanent pastures with manure when convenient. Often corn stalks or straw scattered over the north

FIG. 91.—FATTENING STEERS ON PASTURE. FEEDING CLOVER HAY TO SUPPLEMENT THE PASTURE.

slopes when the land is broken will materially improve the pasture. Another factor which often reduces the total yield of a pasture is the fact that the grass is pastured too early in the spring, which hinders the growth of the young plants before they get a good start, whereas if they were left a week longer, they would return a much greater total yield. Pastures thus treated will increase in value with age, as has been practically demonstrated, as far east as Central New York and as far west as

Western Missouri, where there are permanent pastures varying in age from one-third to one-half of a century, and are now supporting one animal to each acre from four to six months each year without extra feed, and supporting two animals an equal length of time when grain is fed in addition. (Fig. 91.)

WINTER FEEDING IN DRY-LOT

While feeding steers in the summer time on pasture may be the most profitable for those cattle feeders possessing the pasture, there are many farms, especially in the corn-belt, lacking in pasture and yet possessing an abundance of grain and dry forage that the farmer desires to convert into beef. On such farms winter feeding in the dry-lot is the common practice. This system of feeding beef cattle is not without its advantages. For example, the feeding is done at a time of a year when there is little other work, and if the cattle are measurably protected from the wind and rain, they suffer less from the weather than from the heat of summer, and especially if the flies are troublesome. When the steers are purchased in the fall and fattened during the winter, the cattle feeder has his money tied up a much shorter period, resulting in correspondingly quicker returns. Furthermore, such a system affords a very convenient method of converting the previous crop, grain and dry forage, into ready cash to finance the farm the coming season, as the steers are marketed and out of the way before farm work begins in the spring.

Feeding grain to cattle in the dry-lot. — The amount and kind of grain that should be fed to fattening cattle in the dry-lot will depend much on the age, condition, and quality of the cattle as well as upon the kind of dry forage. Young stock will need a heavy grain ration from start to finish if they are to be made fat, whereas older cattle may be fed grain rather sparingly at first, gradually increasing to a full grain feed sixty days before marketing. With the older cattle already having their

growth, they have but to fatten; whereas with younger cattle there is continued growth, and to fatten them requires an extra effort, as increasing the grain in the ration. With steers rather rough and coarse in quality that cannot be made prime in any event, there is not the necessity for the heavy grain ration required by steers of finer quality that can be made prime and thus command a premium on the market. This heavy grain ration for the steers of finer quality is likely to increase the cost of gains, making them even more expensive than the lighter grain ration for the coarse steers, but the extra premium commanded on the market will make the finer bred steers the more profitable. The amount of grain that can be fed economically to fattening cattle depends much on the kind of dry forage. On the average animals receiving a leguminous forage, such as clover, alfalfa, or cowpea hay, will make economical use of a larger grain ration than when other forage, such as timothy, red-top, corn stalks, and the like, is fed. In fact, fattening farm animals will make more economical use of a larger grain ration if the grain also contains a high percentage of protein. The length of the fattening period will also have much to do with the amount of grain that should be fed. If it is intended to market the steers in 100 days or less, they will have to be full-fed grain from the beginning if they are to be made reasonably fat, whereas if the feeding period is to last 150 days or more, the cattle may be fed grain rather sparingly at first.

As to the kind of grain to feed fattening cattle, this likewise depends largely on the cattle and the kind of dry roughage. When rather young steers are being fattened, it is the common opinion that a more nitrogenous ration should be used; hence it is considered the better plan to provide much protein for the young animals, whereas in the case of older and more mature cattle the grain ration often contains less protein. While this plan is usually recommended, it is well to remember that a ration rich in nitrogenous material has a tendency to

keep the young cattle growing rather than to fatten them. While it is true that young stock thus fed will make gains more rapidly and more cheaply, the cattle will oftentimes lack in finish because they have been growing rather than fattening. The kind of roughage determines, in part, the kind of grain that should be fed. When the cattle are being fed a dry roughage containing much protein, as clover, alfalfa, or cowpea hay, the grain may contain a correspondingly less amount of protein. On the other hand, when the dry forage lacks the protein, the deficiency should be made up by feeding a grain rich in protein, as cotton-seed or linseed meal. In addition, the length of the fattening period will have an influence on the kind of grain to feed. If the period is short, it will be necessary to feed very fattening foods, such as corn and cotton-seed meal, from the beginning; whereas if the cattle are to be fed 150 days or more, they may be given foods containing less fat during the early stages of the feeding period.

BABY-BEEF

By baby-beef is meant fat cattle between one and two years of age and weighing from 800 to 1100 pounds. Of recent years much has been written concerning the advantages of producing this class of beef. A general perusal of the recent literature on beef production would lead one to think that it is far more profitable to produce beef from young animals than from animals possessing some age, and yet the practical cattle feeder has continued to employ two-year-old cattle in his feeding operations. The experiment literature has in a large measure fostered the idea that beef could be more profitably produced by feeding younger cattle. These recommendations are based largely on the fact that the younger animal will make much more economical gains than older animals. There are, however, many factors besides economic gains entering into profitable beef production.

Cattle used in baby-beef production. — First of all, the cattle must be young. They must be well bred and of fine quality, as such cattle can be finished for the market at a much younger age than the plainer kinds. The cattle to be used in the production of baby-beef should not be permitted to lose their calf fat. They must be kept fleshy from start to finish, for if once they get run down in flesh, it is very difficult to make them prime under eighteen months of age.

Feeding for baby-beef production. — If young animals are to be made fat, they must be fed liberally on fat-producing feeds, particularly grain. Heavier grain feeding is required in the production of baby-beef than of older beef. Calves and yearlings have a tendency to grow rather than to fatten, and to overcome this they must be fed a heavy ration of grain, a fact not to be lost sight of in figuring the cost. In the beginning the calf should be fed considerable quantities of dry forage, such as clover, alfalfa, or cowpea hay, as such foods have a tendency to increase the digestive capacity of the calf, thereby enabling it to handle large quantities of grain later on. If heifer calves instead of steers are fed, they will finish more quickly and hence should be marketed earlier. The younger the prime heifers are at the time of the marketing, the less discrimination in price the butcher will make between them and steers. In feeding for baby-beef, the most common mistake is to market the animals before they are fat enough. There is little likelihood of getting them too fat to meet the demands of the market.

Advantages of baby-beef production. — The production of baby-beef has two very distinct and outstanding advantages over that of older beef. First, young animals require less food for a given gain than older animals. Second, the same capital invested in young animals produces more meat than in older animals. During recent years these two advantages have been much heralded by experimenters, and while at first sight they may

seem to be the beginning and the end of beef production, they are nevertheless far from it. While, possibly, each advantage has been exaggerated, they are both certainly true, and since there is an abundance of experimental data to prove them, we will let them stand as unimpeachable.

Disadvantages of baby-beef production. — The production of baby-beef is not without its disadvantages, most of which have been lost sight of because of the lack of practical knowledge on the part of its exponents. Chief among the disadvantages are: first, the difficulty of obtaining cattle possessing sufficient quality to make choice baby-beef. Second, the marked difficulty in making the younger animals fat, it requiring a heavy grain ration. Third, since much baby-beef finds its way to market lacking in finish, it fails to command a high price. Fourth, cattle possessing sufficient quality being scarce, the cost price of such animals is high and because they lack finish on the market the selling price is low; hence the margin between cost and selling price is small. Fifth, the initial weight of the calf is small; hence in the production of baby-beef the cattle feeder cannot depend for his profit on the advance in value to the hundredweight on the initial weight. From the foregoing it must be apparent that there are many questions involved in the production of baby-beef, and that the profit is not in proportion to the cheapness of the gains.

FEEDING CATTLE FOR THE LOCAL MARKET

Feeding cattle for the local meat market varies greatly from feeding for a large central market. The agricultural writers and practically all of the experiment literature give advice on feeding cattle by the car-load and for the large central market, yet according to the best figures obtainable nearly one-half the cattle slaughtered in this country are slaughtered by local butchers.

The local butcher in small places cannot charge enough for

meat to warrant his paying a high price for the cattle he kills; hence he usually purchases plain butcher cattle. As a rule, the local slaughter houses are not equipped to handle heavy cattle; the cuts of meat are usually retailed in small amounts; therefore, the local butcher demands a rather small animal, weighing from 600 to 1000 pounds. The local butcher cannot pay for high finish. Thick fat cattle carry too much waste. Grass-fat cattle can be made to carry sufficient flesh for the local butcher. While no consumer, rich or poor, wishes to pay for waste fat, yet highest quality of beef is impossible without considerable quantities of such waste. There is, however, no demand in the local market for beef carrying waste fat, no matter how excellent its quality.

Fig. 92. — A Steer that made exceedingly Large Gains for a Six Months' Feeding Period.

From the foregoing it is apparent that the cattle feeder who plans to feed cattle for the local market and make a profit should procure heifers, young cows, or low-grade steers as his feeding stock, since such cattle can be purchased at a low price. These cattle must be fattened as economically as possible, largely on dry forage or on pasture, and then sold before they become too fat to meet the demands of the local market. This class of butcher cattle can be very profitably produced on farms lying east, south, and west of the corn-belt. Perhaps the greatest handicap to profitable beef production in these regions is lack of suitable pasture land. That much of the land in these regions can be made to grow pastures suitable for the profitable production of this grade of beef no longer admits of doubt (page 286).

HOGS FOLLOWING GRAIN-FED CATTLE

Among grain-fed cattle, hogs are considered indispensable to profitable beef production. Cattle receiving a rather heavy grain ration fail to digest the grain completely, and hogs, if given a chance, will pick up this grain and convert it into pork. So great is the saving thus effected that beef production is seldom profitable without the hog. The principal questions in connection with hogs following grain-fed cattle are: the kind of hogs to use, the number of hogs to a steer, the advisability of feeding the hogs grain in addition to what they get from the droppings, and the gains that the hogs may be expected to make.

The most satisfactory hog to follow grain-fed cattle is one weighing approximately 100 pounds and thin in flesh. If the hogs are too heavy or too fat, they do not make good rustlers, and will fail to find all the droppings, especially in pasture. On the other hand, it is not good practice to use pigs too young because of the danger of injury from the cattle. Brood sows are oftentimes used to follow cattle. They are not likely to be good rustlers, however, and will fail to find many of the droppings, especially if heavy with pig.

The advisability of feeding grain in addition to that obtained from the droppings will depend much on the conditions. If the price of cattle is high and that of hogs low, one would prefer to allow the hogs only what they gather from the droppings; whereas if the price of hogs is high and cattle low, then it would no doubt be more profitable to feed the hogs in addition, especially since hogs are more economical feeders than cattle. The great majority of cattle feeders use grain in addition to that secured from the droppings.

The number of hogs to follow each steer will depend on two conditions: the form in which the grain is fed, whole or ground; and whether extra grain is fed in addition to that obtained

from the droppings. When grain is fed extra, the number of hogs to each steer will depend on the amount of grain thus fed. The common practice is to put a 100-pound hog behind each steer and feed grain in addition. If, however, grain is not fed in addition, one hog to two steers will be sufficient to pick up the grain of the droppings when the grain is fed to the steer in the whole form, and one pig to four steers when the grain is fed in the form of meal. There is much less available material for the hogs when the grain is fed in the form of meal than when fed as shelled or ear corn.

The gains that may be expected from hogs following steers will depend on the method. When meal is fed, the gains will be less than when the grain is fed whole; and when grain in addition is fed, the gains will depend entirely on the amount of grain that is fed to the hogs. When one 100-pound hog is placed behind each steer and grain fed in addition, as is the common practice, the cattle feeder expects to secure at least one pound gain on each hog daily for a period of 100 days. By this time the hogs are weighing over 200 pounds and are too heavy to make good rustlers, so they are withdrawn from the feed lots and another drove of 100-pound hogs placed with the cattle. The 200-pound hogs may be marketed at once or fed extra grain for two weeks, by which time they average better than 225 pounds each when they are put on the market.

GETTING CATTLE "ON FEED"

There is no more important question connected with cattle feeding than that of getting the cattle on a full feed of grain, meaning by full feed all the grain they will consume. Opinion differs widely as to the time that should be required, some very successful cattle feeders employing the so-called short method, that is, getting the cattle on full feed in one to two weeks, whereas others equally as successful employ the long method, taking one to two months. Which of these methods

one should choose will depend somewhat on the length of the feeding period and the amount of grain that the cattle feeder plans to feed.

LENGTH OF FEEDING PERIOD

The length of the cattle feeding period is extremely variable, ranging from ninety days to fifteen months. Either of these extremes or any intervening time may be profitable under certain conditions. There are several factors affecting the length of the feeding period, chief of which are the kinds of foods, the quality and condition of the cattle, and the age of the cattle. If the cattle feeder wishes to feed a relatively large proportion of dry forage and a small amount of grain, the fattening process will be slow and the feeding period prolonged; whereas if he wishes to feed a maximum amount of grain and a correspondingly small amount of dry forage, the fattening process will be accelerated and the period shortened. If the steers are rough and of such poor quality that they cannot be made prime, the feeding period may be of shorter duration than if the steers are of finer breeding, and of good quality; the extra finish requires much time, but it is considered profitable because of the premium commanded in the market. Furthermore, the age of the cattle affects the length of the feeding period, as in common practice it requires from ninety to one hundred and fifty days to finish mature cattle and approximately fifteen months to finish calves, with intervening ages ranging between these extremes.

MARKETABLE CONDITION

The cattle feeder is often at a loss to know just when to market his cattle. The problem is complicated all the more by the fact that the finishing process is a very expensive one, and yet this extra finish is what commands the premium of the market. The butcher at the large central market demands excessive fatness, and for it he is willing to pay an extra price, whereas the

local butcher fails to appreciate such finish and may even discriminate against it, saying that his patrons will object to the waste fat. Much depends on the market also; if there is a light demand and a heavy run of extra fat cattle, the butchers will

FIG. 93. — ABERDEEN ANGUS BULL. Owned by J. S. Goodwin, Naperville, Ill.

The Aberdeen Angus breed of beef cattle developed in northeastern Scotland. Like the Hereford, Angus mature early, but lack the size of the Shorthorn, cows weighing around 1400 pounds, bulls 2000, and finished steers 1000 to 1400 pounds. The steers are unexceled for fattening in the feed lot and are held in high esteem by the butchers, although if made too large they are likely to become coarse. They are all black and hornless.

take advantage and bid down the price, whereas if there is a light run and a heavy demand for cattle showing much finish, the butchers will bid up the price accordingly. Therefore, the question as to when the cattle are ready for the market cannot be answered without a knowledge of, first, the age of the cattle;

second, the quality of the cattle; third, the relative cost of putting cattle in prime condition compared with the cost of merely "warming them up"; and fourth, a knowledge of the condition of the market.

The more prominent indications of a finished steer are fullness at base of tongue, a roll of fat in front of the point of the shoulder, a full thick flank that stands out as the animal walks, a large mellow cod, a full twist, and fullness at the tail-head.

When to market cattle.—As to where and when to buy feeders, no definite statement can be made. The demand for extra prime beef, such as is used by the high-grade hotels and restaurants, is fairly good every month. There is an extra demand for such beef during the Christmas season, beginning about November 20 when the Christmas order for export beef begins to come and continuing to about the middle of December. There is good demand for prime baby-beef the year round, with an extra call during the Christmas season. Export cattle are in greatest demand in the winter and spring months; Canada supplies the demand in the late summer and fall. Common cattle are in greatest demand in the spring months, as after the first of July they come into competition with the cheap western range cattle.

SHIPPING CATTLE

There are some precautions that should be taken in getting cattle ready for shipment. The object sought is to ship the cattle with as little "drift" or loss in weight as possible. While there are those who manage the cattle in such a way as to induce them to drink an unusual amount of water when they reach the market, thus securing an abnormal fill, such practice is far from commendable. Cattle buyers are always on the lookout for such cattle and discriminate heavily against them. On the other hand, it is perfectly legitimate for the cattle feeder to take such precautions as will insure his animals against the likelihood of scouring and to prevent abnormal shrinking in weight.

Preparing cattle for shipment. — Since there are certain foods that have a tendency towards loosening the bowels, such should be withheld for at least 24 hours before shipment. Chief among the foods likely to scour cattle are shelled corn, corn meal, oil meal, clover, alfalfa, cowpea hay, and green grass. In fact, a full grain ration of any kind is likely to loosen the bowels. Therefore, for 24 hours before shipment the cattle should be shut up in a dry lot, fed grain sparingly, but may have all the timothy hay they like. Oats make a very good grain to feed at this time. Water should be withheld four hours before shipment.

The car in which the cattle are to be shipped should be well bedded with straw. If in addition to these precautions it is not overloaded, the cattle should arrive at the market fresh and clean. Cattle thus treated will make a normal fill. Several car loads of cattle thus treated have been shipped a 36 to 40 hour journey without unloading on only a 3 per cent drift or loss.

Drifting cattle for the local market. — When the fat cattle are sold on the local market instead of shipping, it is customary in some localities to sell them on a 3 per cent drift, taking the weight at the farm. From the fact that cattle can be shipped 40 hours on a 3 per cent drift, this would seem to be the maximum that should be allowed the local buyer, and this should be on weights taken at the farm where the animals are fed.

SAMPLE RATIONS FOR FATTENING CATTLE

The following rations are collected from various sources and furnish a guide in determining the kind and quantity of feed that should be allowed fattening cattle. They apply to 1000 pounds live weight: —

Age and Weight of Cattle	Ration		Food per Pound Gain	
	Grain	Dry Forage	Grain	Dry Forage
Calves 457 lb.	22 lb. shelled corn 3 lb. cotton-seed meal	12 lb. clover hay	5.9	2.9
Calves 534 lb.	18 lb. shelled corn 2.5 lb. cotton-seed meal	5 lb. clover hay 18 lb. corn silage	5.8	1.4 [1] 5.3 [2]
Calves 508 lb.	18 lb. shelled corn 3 lb. cotton-seed meal	4.5 lb. clover hay 19 lb. corn silage	5.3	1.1 [1] 4.8 [2]
Yearlings 685 lb.	21 lb. shelled corn 3.5 lb. cotton-seed meal	11 lb. clover hay	7.3	3.2
Yearlings 854 lb.	19 lb. shelled corn 2.5 lb. cotton-seed meal	4.5 lb. clover hay 18 lb. corn silage	7.9	1.7 [1] 6.8 [2]
Yearlings 799 lb.	17.5 lb. shelled corn 2.5 lb. linseed-oil meal	11 lb. prairie hay	8.1	4.6
Yearlings 808 lb.	19 lb. shelled corn	11 lb. alfalfa hay	7.7	4.7
Yearlings 777 lb.	17.5 lb. shelled corn 2.5 lb. linseed-oil meal	15 lb. cornstalks	8.0	5.7
Yearlings 788 lb.	17.5 lb. shelled corn 2.5 lb. linseed-oil meal	15 lb. sorghum	8.7	6.4

[1] Clover hay. [2] Corn silage.

Age and Weight of Cattle	Ration		Food per Pound Gain	
	Grain	Dry Forage	Grain	Dry Forage
Two-year-olds 966 lb.	18 lb. shelled corn 3.2 lb. cotton-seed meal	9.5 lb. clover hay	8.9	4.1
Two-year-olds 1010 lb.	16 lb. shelled corn 3 lb. cotton-seed meal	4 lb. clover hay 15 lb. corn silage	7.6	1.5[1] 5.8[2]
Two-year-olds 975 lb.	10 lb. snapped corn	18 lb. prairie hay	7.4	15.2
Two-year-olds 979 lb.	10 lb. snapped corn	12 lb. prairie hay 10 lb. alfalfa hay	4.7	10.5
Two-year-olds 977 lb.	10 lb. snapped corn	22 lb. alfalfa hay	4.6	10.7
Two-year-olds 893 lb.	20 lb. ear corn	10 lb. clover hay	9.5	4.0
Two-year-olds 896 lb.	21 lb. ear corn 2 lb. linseed meal	5 lb. shredded stalks 3 lb. oat straw	10.5	3.9
Two-year-olds 1017 lb.	18 lb. shelled corn	7 lb. timothy hay	9.3	3.4
Two-year-olds 1054 lb.	16 lb. shelled corn 5.4 lb. cotton-seed meal	8.8 lb. timothy hay	10.0	3.9

[1] Clover hay. [2] Corn silage.

Age and Weight of Cattle	Ration		Food per Pound Gain	
	Grain	Dry Forage	Grain	Dry Forage
Yearlings 774 lb.	14 lb. shelled corn 3.1 lb. gluten feed	Pasture	7.9	
Yearlings 723 lb.	14 lb. shelled corn 3.5 lb. linseed meal	Pasture	7.0	
Yearlings 734 lb.	14 lb. shelled corn 3.5 lb. cotton-seed meal	Pasture	7.5	
Yearlings 730 lb.	16 lb. shelled corn	Pasture	7.2	
Two-year-olds 859 lb.	11 lb. shelled corn 2.8 lb. cotton-seed meal 2.8 lb. wheat bran	Pasture	7.8	
Two-year-olds 940 lb.	16 lb. shelled corn 2.5 lb. gluten feed	Pasture	8.7	
Two-year-olds 933 lb.	16 lb. shelled corn 2.5 lb. linseed meal	Pasture	8.3	
Three-year-olds 1269 lb.	12 lb. shelled corn 2 lb. cotton-seed meal	Pasture	9.6	
Three-year-olds 1251 lb.	14 lb. shelled corn	Pasture	10.1	

Sample rations for wintering cattle with no attempt to fatten them

Weight of Cattle	Ration for Each Steer		Gain per Day lb.
	Grain	Dry Forage	
736 lb.	none	16 lb. timothy hay	0.4
707 lb.	none	20 lb. whole cornstalks	0.2
667 lb.	none	15 lb. shredded cornstalks	– 0.1
743 lb.	none	44 lb. corn silage	1.0
771 lb.	none	10 lb. cornstalks 10 lb. clover hay	0.7
788 lb.	none	20 lb. cowpea hay	0.5
765 lb.	4 lb. shelled corn	16 lb. timothy hay	0.6
767 lb.	4 lb. shelled corn	9 lb. cornstalks 9 lb. clover hay	0.9
783 lb.	4 lb. shelled corn	19 lb. cowpea hay	1.5
[1]	6 lb. shelled corn	17 lb. timothy hay	1.4
	6 lb. shelled corn	19 lb. clover hay	1.9
	6 lb. shelled corn	17 lb. alfalfa hay	1.6
	6 lb. shelled corn	17 lb. cowpea hay	1.3
	6 lb. shelled corn	9 lb. cornstalks 9 lb. clover hay	1.6
	6 lb. shelled corn	8 lb. wheat straw 8 lb. clover hay	1.3

[1] Weight approximately as above.

CHAPTER XIII

BREEDING BEEF CATTLE

THE breeding of cattle for the production of beef should receive more attention from the general farmer than is being accorded it at the present time. During the past decade the breeding of beef cattle on the common farms has been on the decline, especially in the north and central part of the country. Formerly, in traveling over this section, it was not an uncommon sight to see large herds of well-bred beef cattle grazing, often on permanent pasture, while at present such a herd is so uncommon as to elicit much comment. As has been pointed out in the discussion on purchasing feeding cattle, the reasons for this decline in beef breeding are many, the chief one being that there is more money to be made in other branches of farming. Along with this decline in breeding there has been an increase in consumption, until the problem of supplying the demand for beef has taken on a serious aspect. The remedy for this is only to breed more and better beef-producing animals. No doubt other branches of farming are more profitable for that section of the country lying west of the Sciota, north of the Ohio, and east of the Missouri rivers, yet such may not be true of the immediate surrounding territory. In this outlying territory there is land not well suited to growing grain that with proper management can be turned to the profitable production of beef cattle (pages 276, 290).

The chief defect of the common cattle is their lack of quality and uniformity. This is due both to the lack of good blood and

to the indiscriminate admixture of the blood of the several breeds of both beef and dairy types. Proof of this is not wanting. In traveling about the country one notes a great variation in the type, form, and especially the color of the animals in each herd. In many small herds one often sees red, white, black, brindle, and all conceivable combinations of these colors, as well as in-

FIG. 94. — HEREFORD COW. First prize winner, International Live Stock Show.

The Hereford beef cattle originated in the county from which they take their name in England. In size this breed is a close second to the Shorthorn. Herefords are noted for their early maturing qualities and for their good grazing qualities; on the ranges they are often preferred to the Shorthorn. This breed lacks the full quarters of the Shorthorn. The color is red, with white markings. Herefords are often called "White Faces."

dividual animals that conform in a measure to the strictly beef form, others of the dairy form, with all gradations between the two. There is lack of uniformity in all respects. Before any community can improve its cattle, it must decide upon a plan, and each person must proceed largely along the lines of this well developed idea.

PLAN OF BREEDING

Before deciding upon a plan of breeding beef cattle one should make a careful study of his conditions; he should visit farms where beef cattle are successfully bred, noting conditions and comparing with his own. Such improvement as he may be able to bring about must be upon the common native cattle of the community. To dispose of the native cattle and purchase well-bred uniform cattle would be very expensive and in most cases very unprofitable. The task is then to adopt some plan of breeding that will result in an improvement of the native stock. In most cases this can be most profitably accomplished by the grading-up process; that is, by the use of pure-bred bulls on the native common females.

Coöperative grading-up. — A very successful plan to improve the beef-producing qualities of the cattle of a locality is by the coöperative grading-up method. The formation of beef-breeding associations throughout a given locality would do much to advance the progress of the industry. Each association should have for its object the production and improvement of high-grade and pure-bred beef cattle, and should be formed of breeders who possess the same class or breed of cattle. It would be the duty of such an association to protect the interest of its members, provide suitable bulls each year for use on the cows owned by the members, advertise stock, attract buyers, hold sales, call meetings for the discussion of beef breeding and feeding matters, and to educate the farmers of the locality to better methods of caring for live-stock.

Raise heifer calves from best cows. — Because of the excellency of the heifer calves from the good cows, the cattle feeder is tempted to fatten them for beef. This should not be done. They should be reserved for breeding purposes. Many cattle breeders are actually reducing the quality of their beef-producing herd by fattening the best calves and reserving the poorer ones for breeding because they will not make good feeders.

SELECTION OF BREEDING STOCK

The best cattle should be retained and propagated and the poorer animals discarded. In a very few generations, by employing such a method, the common cattle of the country could be greatly improved. It is the application of haphazard methods that has resulted in the lack of character that exists among our common native cattle.

The breed. — Choose the breed that best suits the conditions, the markets, and the fancy of the breeders. There is no best breed of beef cattle for all conditions. There is much variation in the temperament, size, and quality of product among the leading beef breeds. Whether Shorthorns, Herefords, Angus, or Galloways should be chosen depends on the attendant conditions and the personal preference among the breeders and feeders. The Shorthorns have excellent hind-quarters and nick well with the common cattle as well as other beef breeds. The Herefords mature early and are excellent grazers. The Angus mature fairly early, produce a high quality of beef, and are much sought on the markets. They are hornless though rather nervous. The Galloways produce high quality beef, are hornless, and often possess good coats of hair; the hides are much sought for tanning, and are used in manufacturing coats, robes, and the like. The breed itself is never so important as is the individuality and the uniformity.

FIG. 95. — CHAMPION HEREFORD BULL "DALE." Photograph from *National Stockman and Farmer.*

Crossing. — For the propagation of animals intended solely for beef many experienced cattle breeders and feeders prefer a Shorthorn-Hereford cross, contending that the cross-bred steer in-

herits the good grazing and early maturing qualities of the Hereford and the desirable hind-quarters of the Shorthorn. But it must be understood that this cross-bred offspring should not be used for breeding, no matter how excellent an individual, for the second generation is very likely to inherit the poor qualities or other qualities of both ancestors.

The dual-purpose cow. — By dual-purpose cow is meant one capable of yielding a good flow of milk, and in which the offspring will make a fair quality of beef as will the cow when dried off. This is the so-called "farmer's cow," concerning the profitableness of which there is much discussion. Because of the high price of land over much of the grain belt, it is no longer profitable to keep a cow merely for the calf she raises. This has led to the opinion that it is possible to develop a strain of dual- or double-purpose cattle, one that while raising a calf that would make a fair quality of beef would also yield milk sufficient to pay for her keep.

The demand for such double-purpose animals has led a few of the breeders, of at least three of the established breeds, Shorthorn, Red Polled, and Devon, to endeavor to breed such animals. In the breeding of such cattle there are two very pertinent questions to be considered: First, the amount of milk or butter-fat that should be expected; and second, the degree of excellency in beef production that should be sought among the offspring. These questions assume much importance, for, as we have already seen, the type suited to the production of milk is ill adapted to the production of beef, and the type that takes on beef economically is not likely to make good milkers. Dual-purpose cattle breeders vary widely in their opinion as to the amount of milk and fat that should be expected as well as the excellency sought in the calves. While the flow and fat required to make a profit will vary according to conditions, yet if one can secure 5000 to 7000 pounds, yielding 200 to 250 pounds of butter-fat yearly, and a calf of sufficient quality to reach a weight of 350 pounds

by the time it is 6 months of age, there should be no difficulty in realizing a handsome profit, providing, of course, that the products are marketed to advantage (Fig. 96).

Instead of procuring dual-purpose strains of cattle, some persons suggest breeding the dairy cows to a beef bull, thus producing a half-blood beef animal. They recommend the following plan: Since a good cow, properly cared for, may be profitably milked for a period of six to eight years, during which time she is likely to produce three or four heifer calves, only one-third to one-fourth of the cows need be bred to a dairy bull; or the breeding of the entire herd to a dairy bull once in three or four years is sufficient to maintain the dairy herd. All other calves are available for beef production and should be sired by a beef bull. Such a plan is likely to encounter practical difficulties that would render its serviceability doubtful. It would no doubt result in the production of calves of little value to maintain a dairy herd and with doubtful value as feeding cattle. It would also be extremely hazardous to attempt to maintain a dairy herd with only one-fourth to one-third of the calves to select from.

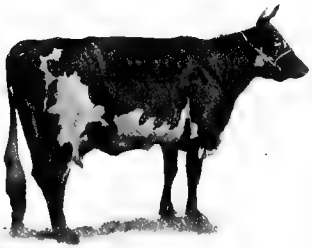

Fig. 96. — The Shorthorn Cow "Rose of Glenside." The dairy type. From March, 1909, to March, 1910, she gave 18,072 pounds of milk containing 625 pounds of fat. Owned by May & Otis, Granville Center, Pa. Example of a dual-purpose cow.

Uniformity. —Lack of uniformity is one of the greatest faults connected with breeding common cattle. As it is now, each locality is producing cattle of a number of types and breeds. Such cattle are not desirable feeding animals, as they will not finish or fatten evenly and must be sent to market lacking in uniformity in type, color, weight, quality, and con-

ditions. Mixed droves of cattle of this kind are not desired on any market, and hence are discriminated against and must sell for an exceedingly low price. On the other hand, if each farmer in the locality would conform with the majority of his neighbors and coöperate in propagating the same breed, even though this breed may not be the one that suits his fancy best or even the one that is best suited to the district, until the community became noted for the production of such a breed, then a cattle feeder in search of any particular type should be able to go to the district noted for the production of the breed required and there find cattle in sufficient numbers to meet all needs.

THE BEEF BULL

To the bull we must look for the improvement of the common cattle. To secure the improvement in a herd of cattle through the females would require the use of forty or more superior cows to accomplish the same results as might be secured by the use of a single bull, and even then there would be less uniformity in the offspring. This is because the bull controls one-half the characters of the entire crop of calves. This has led to the assertion that "the bull is half the herd." This assertion is misleading in a way, for when it comes to herd improvement, he is even more than one-half the herd.

The cost of a bull. — Among dairymen who keep a record of the production of their cows, there is a fair knowledge of the value of a good bull, while those who breed feeding cattle seem to lack such information, or at least ignore it entirely. From this it must not be inferred that one should pay a fancy price for a beef bull. Many general farmers are depending on practically worthless grade and scrub bulls to head the herds of grade cows. Properly cared for, a bull should sire forty calves in a season. Suppose the bull is of sufficient quality

to increase the value of each calf $5, a very conservative estimate, then he makes $200 with his first crop of calves. One-half of this sum will bring a very desirable bull of any of the leading beef breeds into any locality. Such a bull introduced into a locality can be made to pay for himself the

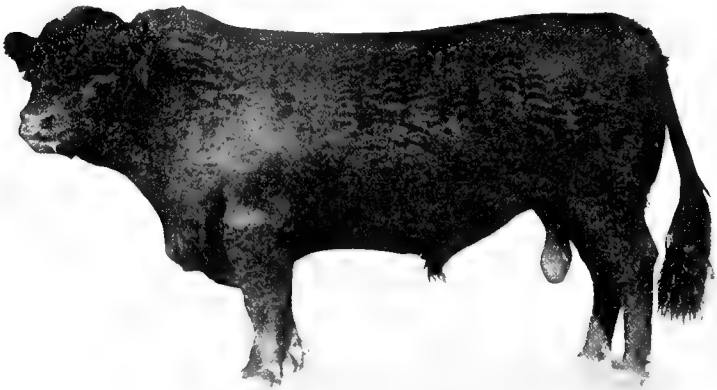

FIG. 97. — GALLOWAY BULL. First prize, Illinois State Fair. Owned by C. S. Hechtner, Clariton, Ia.

The Galloway breed of beef cattle originated in southwestern Scotland, adjacent to the sea, where the breed developed much hardiness. Though neither so early maturing nor so large as the Angus, the flesh is of good quality. This breed is particularly noted for its fine coat of hair, which seems to be composed of two parts, a very fine, short under growth and a long, wavy outer growth. The hides are often used to manufacture coats, robes, and the like. All animals are black and hornless.

first year. When once a desirable bull is procured, he should be retained as long as he remains a true breeder. Bulls possessing some age are likely to be difficult to control, and many an excellent sire has been sold for beef simply because the owner was afraid he would injure some one.

THE BEEF COW

While all common cows must be bred in order that they may freshen, yet the cows to which we look to replenish the herd should be carefully selected. The heifer calves from the best cows should be retained for breeding. By using a good pure-bred sire and retaining the best heifers to replenish the herd, in a few generations one can have a herd of cows equal to any pure-bred herd for the production of feeding cattle.

The production-period in cattle. — As in the dairy cow, the most fertile period is two to eight years of age. In exceptional cases this period may be extended both ways (see page 246).

Season of the year to breed. — While it seems desirable to have dairy calves dropped in the fall, it is equally desirable to have beef calves dropped in the spring. With dairy cattle, a somewhat larger flow can be obtained when calves come in the fall. With beef cattle the milk flow is not so important. Cows may be wintered more cheaply when not in milk, requiring less room, less careful attention, and less food. Calves dropped in the spring get a good start on pasture. They need be carried over but one winter, as they can be fattened or finished the following fall when approximately eighteen months of age, if it is so desired; or if desired to fatten them during the winter, they can be finished the second winter and put on the market at two years of age. Fall-dropped calves are more trouble to care for during the winter, although the advocates of fall-dropped beef calves say that better steers can be produced and developed by fall calving, as the cow in the fall

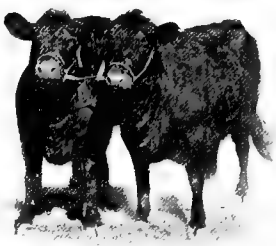

Fig. 98. — Galloway Heifers. True to type. Owned by C. S. Hechtner.

is in better condition; they also say that the increased flow of milk caused by turning the cow to pasture in the spring is a good thing for the calf, and that the fall-dropped calf is better able to endure the heat and flies the following summer. After a careful consideration of both practices, the writer thinks it desirable to have the beef calves dropped in spring.

A very important factor in the breeding of calves for feeding is to breed the cows in such a way that the calves will be as nearly uniform in age as possible. This applies to both fall and spring bred calves that are intended for feeding. Farmers who possess only a few cows have them freshen at intervals throughout the year in order that they may be well supplied with milk the year round. This, of course, makes the calves of unequal age, and they are not so desirable as feeding cattle.

The pregnant cow. — The pregnant cow should receive some attention, particularly when she is to drop her calf in the spring. Cows are often carried through the winter on a ration of dry forage, such as corn stalks with no grain in addition, with the result that they are in very poor condition at calving time. This often leads to trouble at parturition time, the cow being so weak she cannot bear the calf, which is likely to be very small, thin, and weakly. The cow may not have milk for it at first, or if she does, it will be thin and scant. Such a condition must be avoided if profitable feeding calves are to be propagated. If the pregnant cow may have succulence in the shape of corn silage, with clover, alfalfa, or cowpea hay in addition, no grain need be fed. These feeds should be free from mold. On the other hand, if non-nitrogenous dry forage is to be fed, she should have grain in addition. Corn and wheat bran with a small amount of linseed meal as a conditioner cannot be improved upon. This may be fed at the rate of six pounds daily per 1000 pounds live weight. Shelter from the storms and rain should be provided; for this a common shed open to

the south is sufficient except in very cold climates. Pregnant cows thus cared for will come through the winter in good condition and give birth to a strong thrifty calf that, if bred right, will make a profitable feeder.

Cow with calf at foot. — The cow that is to suckle her young need not receive the extra care that must be accorded the dairy cow. When the calves are dropped in the spring and the pasture is of good quality and abundant, the cows and calves will require very little attention during the pasture season. If, however, the pasture becomes short in late summer and fall, extra feed, such as clover, alfalfa, green forage, or grain of some kind, should be given. Cows and calves at pasture should have free access to fresh water. Salt should be supplied at regular intervals or kept before them at all times. Shade of some kind should be provided in the absence of trees.

As soon as convenient the calves should be taught to eat grain. This may be done by arranging a small pen with small gates or passages through which the calves may enter but the cows cannot. The pen may be placed near the water tank. By all means calves should be taught to eat grain before being weaned, as this will prevent shrinking at weaning time. For suckling and weanling calves, the following grain mixture proves satisfactory: 3 parts of corn meal, 3 parts ground oats, 3 parts of wheat bran, and 1 part of linseed meal.

When the calves are dropped in the fall, the cow and calf will require more careful attention; this, however, comes during the winter when there is little urgent work on farms where cows are thus kept. The object sought is so to feed and manage both cow and calf that they may be brought through the winter in a healthy and thrifty condition; the cow in order that she may properly nourish the suckling and be in condition to breed again when so desired, the calf in order that it may make a profitable feeding animal, as its future development depends

much upon its growth during the first six months of its life.

If possible, the cow should have some succulent food, as corn silage, as such food improves her physical condition and encourages the milk flow, thereby giving the calf a more liberal supply. Clover, alfalfa, cowpea, or mixed hay should constitute at least a part of the dry forage, with some grain fed in addition. For the grain, a mixture of corn and bran with a little linseed meal added cannot be improved upon, and if a leguminous dry forage with silage is fed, a small amount of this grain, say four pounds daily, will prove ample to keep the cow and calf in thriving condition. If the dry forage consists of non-leguminous plants only, such as prairie or timothy hay or corn stalks, then a somewhat larger grain ration should be fed and the proportion of linseed meal may be increased. Protection from the storms and rain must be provided. While a common shed open to the south will serve where the mercury seldom goes below zero, it is not sufficient in colder climates, particularly if very moist. On the other hand, the quarters must not be dark, damp, and poorly ventilated, as such is the ideal place for the propagation of all kinds of calf ills. The quarters should be measurably protected, well lighted, well ventilated, and dry. Cows and calves thus cared for will come through the winter in a thrifty and healthy condition. As on pasture, the calves should be taught to eat grain as soon as convenient and by all means at least one month before weaning.

The calf that is permitted to suckle its dam can be raised with little extra care. It should have attention at birth to see that the function of respiration is started, and that it gets some of the first or colostrum milk of the dam. If the calf scours badly, some of the dam's milk should be drawn off, remembering that the last milk is richer in fat, and is the part likely to cause the trouble. After the calf gets a start by proper

feeding of the dam, both cow and calf can be kept in healthy condition.

Male calves should be castrated before they have reached the age of three months, and this may be done any time after the calf is one week old. If hornless animals are desired, the horns should be removed with caustic potash as soon as they begin to appear (page 255).

Calves should be weaned at five to eight months of age. Weaning is rather a question of preparation than of the absolute removal of the calf from the cow, and the simplicity of the weaning process depends on the thoroughness of the preparation. If the calf has been accustomed to the grain as suggested, if it has been permitted to take increasingly more as it grows, the process will not be difficult, for as the ration increases in the amount of grain it will decrease in the amount of milk. With such precaution, there will be very little if any set-back or disturbance to calf or dam. On the other hand, if the calf must learn to eat after being deprived of its accustomed source of food supply, it will require time to get used to the new condition, and the cow will demand special care, because of the removal of the calf before her milk supply has been diminished to any extent.

Weanlings should be well cared for during their first winter if they are to make profitable feeding cattle. They should have snug quarters, with opportunity for exercise, and be well fed. Weanling calves are often let run with the stock cattle and compelled to subsist entirely on dry forage, with the result that they run down in condition and sometimes are stunted, from which they never fully recover. A calf that is once stunted will not make a good feeding animal. On the other hand, if these weanlings are fed a liberal allowance, say four pounds daily per head, of the grain mixture suggested for the sucking calf, with clover, alfalfa, cowpea, or mixed hays in addition, they will come through the winter strong and thrifty

and will give a good account of themselves when fattened the following summer.

Calves cared for as suggested should reach a weight of 375 to 450 pounds by the time they are six months of age. While such calves make very excellent beef when well fed, they are nevertheless very expensive, for the breeder must keep the cow one year for the production of this 400-pound calf. No exact figures can be given as to the cost, for much will depend on the conditions. It is true that formerly many calves were thus raised in the grain belt, whereas at the present time practically none are so raised. It would seem then to be no longer profitable on land suited for grain growing. In view of recent developments it seems unlikely that the price of beef will go high enough to make it a profitable industry. That producing such calves can be made a profitable industry in the outlying territory of cheap pasture lands, however, admits of no doubt.

Feeding the beef calf. — If the cow's milk is desired, the calf should be weaned on or before the ninth milking, when the milk becomes fit for human consumption. As a rule the earlier the calf is weaned the more easily it can be taught to drink from the pail. On the other hand, it is better for both cow and calf to have the calf suckle as long as possible. The beef calf can be taught to drink and changed from whole to skim milk much as suggested for the dairy calf (pages 251 to 255).

There has been much discussion from time to time, among beef producers, as to the possibilities of the skim-milk-fed calf as a beef-producing animal. In fact, the skim-milk calf as a beef producer is not likely to be considered seriously by the experienced beef producers of the middle West. To these men the skim-milk calf means a stunted, pot-bellied animal with papery skin, lacking in quality and thrift, a fit subject for ridicule, but hardly worth while in the feed lot. That these experienced men are justified in their opinion there can be no doubt, for the average skim-milk calf has not much to recom-

mend him as a beef-producing animal. On the other hand, conditions are rapidly becoming such that we are obliged to rely, in part at least, on these skim-milk calves for the country's beef supply. Furthermore, it has been proved that by giving the skim-milk calf proper care a fair kind of beef-producing animal may result. Such a calf should have extra care and be encouraged from the beginning, for it must be remembered to attempt to make beef from a stunted calf will prove an unprofitable venture. They must be kept strong and thrifty.

CHAPTER XIV

CARE AND MANAGEMENT OF BEEF CATTLE

THE ability to fatten cattle rapidly and quickly is to be increased and strengthened by careful study and experience. All that may be spoken or written will not make one successful, nor cover his defects, if he does not take kindly to the work. Study, observation, and especially practice add to the ability of the cattle feeder. The ability to carry a steer through a one-hundred-and-eighty-day fattening period without once getting him "off feed" is the end to be attained.

The importance of regularity in everything that pertains to the management of feeding cattle cannot easily be overestimated. This applies particularly to administering feed and water. Cattle anticipate the hour of feeding and become nervous if it is long delayed; they bellow, coax, and become much excited, all of which operates against the economical production of beef.

Sudden changes in the food are to be avoided, as the digestive system is unable to accommodate itself at once to such changes, and digestive disorders are likely to follow. Such shifts sometimes result in scours, other times in colic, and in fact may result in various kinds of indigestion. When necessary to change from one food to another, the transfer should be made slowly and gradually, replacing the old with the new.

Scouring is very disastrous and should be carefully avoided, as a single day's laxness may offset a week's gain. The inexperienced feeder is likely to overfeed because of the

desire to push the cattle to better gains, which not only often induces scours, but has a tendency to throw the cattle off feed. Cattle of about the same size and strength should be fed in the same lot or pasture, while weak animals and those unable to push their way to the feed-rack and get their share should be placed where they can be supplied in quiet. Strong animals often push the weak away from the feed-troughs, which not only prevents the weaker from feeding, but enables the stronger to get an overfeed, resulting in scours or other digestive disorders. Unwholesome food, or a fault in the feeding mixture, may result in scours.

At a glance, the successful and experienced cattle feeder recognizes the shortcomings among his fattening cattle. By going through the feed lots, noting the condition of the manure or droppings, their general appearance and odor, by noting the feed-boxes and the general conduct of the cattle, he is able to discern their needs, and governs himself accordingly. The droppings of the steers are an excellent index to the progress of fattening cattle. While these droppings should never be hard, they should, however, be thick enough to pile up and have that greasy or bland appearance that indicates a healthy action of the liver. The droppings from steers that are not fattening well, or suffering from indigestion, have a disagreeable odor. Sour-smelling odors, and thin watery droppings indicate something wrong with the feeding cattle.

The behavior of the cattle is a further index to their general thrift and progress in fattening. Their quiet pose while ruminating; their peculiar loud breathing when lying down, due no doubt to the cramped position of the internal organs because of a well-filled paunch; the quiet and prominent eyes; their manner of approaching the feed-box; the way in which they feed; their mellow skin and oily coat; and in fact each movement, gives the experienced cattle feeder a clew as to their general condition.

FARMS FOR FATTENING CATTLE

While cattle feeding may be conducted on any farm, there are two general types of farms on which it is likely to prove the more profitable. First, grain farms that grow large quantities of dry forage incidental to the grain and which would be otherwise largely wasted; second, pasture farms, where for some reason grain cannot be successfully grown and where the land is suitable for pasture.

EQUIPMENT FOR SUMMER FEEDING

In considering the profits likely to result from steer feeding, among the first items to be taken into account is the equipment. While the equipment for beef production is not nearly as extensive as for milk production, there are, nevertheless, a few necessities to be provided. Since the equipment for summer feeding on pasture differs from that of winter feeding in the dry-lot, each will be considered separately.

The necessary equipment for summer feeding on pasture consists of the pasture, the feeding-boxes or bunks, water, shade, and salt.

Pasture. — The importance of properly managed pastures cannot be overestimated. The general management, such as the importance of a good stand of grass; of keeping down the weeds; of providing suitable drainage; of top dressing with barnyard manure when convenient; and of not turning to pasture too early in the spring, was discussed on pages 284 to 289. It was there shown that many pastures that are now supporting one animal to three or four acres could, with very little extra care, be made to support an animal to the acre without feed in addition, or two animals to one acre by the use of additional feed, such as is commonly practiced in the beef-producing localities of the central West.

Feed-bunk.—While any kind of durable box or trough, slightly elevated, may be used in feeding grain, a feed-bunk similar to those illustrated in Fig. 99 will prove the most efficient. These feed-bunks are three feet wide, fifteen feet long, inside dimension, and two and one-half feet high. They are constructed as follows: From a 4″ × 4″ scantling cut six posts two and one-half feet long, bevel off the top of each so as to shed water and prevent the sharp corners from injuring the cattle. Cut three 2″×12″ plank sixteen feet long and six 2″×4″'s four feet long. Place two of the 2″ × 4″'s, edges up, on a level place, in such a position that when the sixteen foot plank are placed upon them, the plank will project over one inch on either end, thus leaving the 2″ × 4″'s fifteen and one-half feet apart, inside dimensions. Spike or, better still, bolt the three 2″ × 12″ plank to these 2″ × 4″'s, leaving six inches clear on either end of the 2″ × 4″'s. Place a third 2″ × 4″ under the three planks two inches to one side of the middle, and spike or bolt fast, leaving six inches on either end of the 2″ × 4″ projecting as before. Cut two 2″ × 8″ plank sixteen feet long and place one, edge up, either side of the platform, thus making a box; spike fast to the 2″ × 12″'s and to the 2″ × 4″'s. Elevate the box thus constructed, and with six 8″ bolts, bolt fast to the 4″ × 4″ posts, thus making a bunk as illustrated in Fig. 99. Cut two 2″ × 6″'s approximately three feet long for the ends. This should be accurately measured in order to fit tightly. Place the remaining three 2″ × 4″'s under the box on the opposite side of the 4″ × 4″ posts, bolt and spike all together. Invert the bunk and batten the cracks with 1″ × 3″'s, otherwise the timber in the bunk will dry out, leaving cracks through which the grain will leak. This bunk can be materially strengthened by placing three 4′ rods across, one at either end and one in the center. One bunk of the dimensions given will be sufficient to accommodate fifteen to twenty cattle, depending on their size. Any kind of lumber may be used, but oak is the more durable

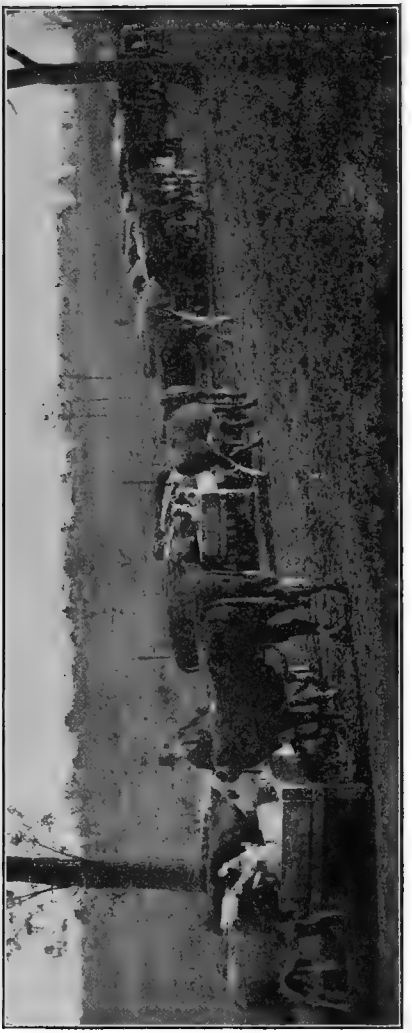

FIG. 99.—FEEDING GRAIN TO STEERS ON PASTURE. Note the feed-bunk.

and will make a stronger bunk. Such a bunk can be moved from place to place.

The *self-feeder* is a feed box or bin holding a large amount of grain and so arranged that part of the grain is accessible to the cattle at all times. The great advantage stated for self-feeders is that they save labor. They have been used with varying success, some cattle feeders using them continuously, others using them one or two years and then abandoning them. In some localities the self-feeder is common, in others not known.

Shade. — When there are trees in the pastures, the matter of shade need receive no attention, but in the absence of natural shade, some provision should be made for it especially during the hot, dry weather when the flies are troublesome. Droves of fattening cattle occasionally become so excited, due to the excessive heat and flies, that they bunch up or stampede and sometimes injure each other, or whoever comes in their way.

Water. — Fattening cattle must be supplied with an abundance of fresh water at all times. Many pastures throughout the country are not thus supplied. As a rule beef cannot be produced economically on such farms. The hotter and dryer the weather, the more the cattle need, and this is just the time there is likely to be a shortage. In the absence of running water, perhaps the most efficient source is a good well, equipped with a wind pump. When the water is pumped by hand and the drove of cattle large, the water supply is likely to be deficient. It is also important that the water be fresh and clean. Hot, stale, and muddy water, laden with mosquito larvæ and other impurities, is not fit for cattle to drink. Something better than mud-holes should be supplied.

Salt should either be kept before the feeding cattle at all times or supplied them regularly twice each week. A very good plan is to cut a common salt barrel in two at the middle and place one-half where the cattle can have free access to it. This should be under a shed, as rain dissolves the salt.

EQUIPMENT FOR WINTER FEEDING

The equipment for feeding cattle in the winter deserves special attention; not that it is difficult or expensive but that the proper kind of equipment is often neglected and much money expended for items that are not only unnecessary but positively objectionable. The most particular item is that of efficient shelter. Other items are the feed-lot and its location, the racks from which to feed dry forage, and the like.

Shelter for winter feeding. — While it is essential to provide warm winter quarters for the dairy cow, because she is thin in flesh and because of the nature of her product, such warm quarters are not necessary for the fattening steer. The fattening steer possesses a coat of fat or flesh which serves to protect him from the cold, and when on full feed the heat generated in the body by masticating, digesting, and assimilating the food is sufficient to maintain the body temperature. No doubt the needs of the fattening animal are such as to make a reasonable amount of cold air beneficial rather than detrimental. But it is very desirable that the fattening steer be kept dry and provided with a comfortable dry bed. Dry quarters are far more important than warm quarters. A structure which protects the animals from the rain and snow and provides them with a dry comfortable bed is sufficient.

Waters, who has thoroughly investigated the shelter problem, concludes his work as follows: "Apparently then the only shelter required for cattle of this class is that which will protect them from rain and snow and break the northwest winds and furnish a dry place in which the animals may lie down. It is more important that the fattening animal lie down regularly and during a large portion of the time than that he be protected from the cold. An abundance of sunshine and fresh air, a comfortable place in which to lie, and freedom from external

disturbances furnish ideal conditions for rapid and economic gains."

The feed-lot.—Relatively too little attention is given the feed-lot. In choosing the location of the lot, consideration should be given to drainage and the natural protection. A south slope is the most desirable, as the water will drain off quickly after a rain, and the full benefit of the sun's rays will be received. A muddy lot is one of the greatest objections to winter feeding. Over much of the grain belt the soil is rather impervious to water, which is held at the surface. The cattle in walking mix the water with the soil, which is often clay, thus making a most disagreeable mud.

The only known corrective for such lots is to pave them, or at least in part, particularly where the animals must lie and where the feed-bunks and racks are placed. For this purpose various materials are used, chief of which are cobble stones, bricks, cement, and plank. Before laying the pavement a grade should be established slightly higher than the surrounding surface, to eliminate the surface water. The grade should have a slope of at least one inch to six feet. The surface should then be covered with six inches of gravel rolled and tamped down solid; over this place a one-inch covering of fine sand on which the brick or cobble stone may be laid. Roll, or better still, tamp down solid. Over this should be placed a cement mortar of the consistency of cream made by thoroughly mixing one part clean sharp sand and one part of Portland cement. This mixture should be thoroughly swept into the joints and cracks. A second coat of the cement mortar may be laid in ten days to insure the complete filling of the cracks and joints. A feed-lot thus paved will be free from mud, can be cleaned with team and scraper, and makes a very desirable place on which to feed cattle.

Platform for feed-bunks. — On soils that are porous and from which the water drains off rapidly, the mud gives little incon-

venience except about the feed-bunks, dry-forage-racks, and water-tank. About these and extending back six feet, may be placed a few loads of coarse gravel or, better still, a pavement similar to that described above, or a plank platform. Whatever the material used in construction, it should be so arranged that the farmer may drive alongside the bunk or rack with a load of feed. Such platforms will save feed bills enough each year to pay for their construction, to say nothing of the extra annoyance caused by the mud in case they are not used. The same feed-bunks suggested for feeding on pasture may be moved to the lot and used for winter feeding as well. As a rule, it is not desirable to place the feed-bunk under the shed except when the winters are extra severe.

Dry-forage-rack. — It is not advisable to have the feed-bunks and the dry-forage-racks combined, since the litter from the dry forage falling upon the grain renders it distasteful to cattle, particularly when on a full grain ration. Neither is it advisable to construct such racks under the shed except where the climate is very disagreeable, though they should be placed to the south of the shed or barn to protect them measurably from the winds and driving storms. The form and shape of the dry-forage-racks will depend on the condition in which dry forage is fed, corn stalks calling for one form, hay for another, and chopped hay or shredded fodder for still another. As these racks are likely to be permanent, they should be constructed to meet the particular conditions under which they are to be used.

Water-tanks. — A liberal supply of fresh water is as essential for winter feeding as for summer feeding. While water is likely to be more plentiful in winter than in summer, it is often allowed to freeze for days at a time, so that the cattle are wholly deprived of a supply and often compelled to eat snow or lick the ice to get the water needed for their bodies. In very severe weather cattle are not likely to drink much ice water; this observation has led the rather careless cattle feeder to think the

cattle do not need much water at such times. This is a mistaken idea, as fattening cattle need a liberal supply of fresh water at all times, even though they will not consume as much as in the hot, dry weather of mid-summer.

FIG. 100.—RED POLLED BULL "CREMO." A very noted prize winner, owned by Frank Davis & Son, Holbrook, Neb.

The Red Polled cattle, natives of Norfolk and Suffolk counties, England, are classed as dual purpose. They give good returns in both beef and milk, but do not equal the beef cattle for beef or the milk cattle for milk. In size the bulls range from 1500 to 2000 pounds, the cows 1200 to 1400 pounds. The color is always red, and the horns wanting.

When the water-tanks are not too large, a very good way to prevent freezing, except in very severe weather, is to encase the tank in a box or frame and fill this frame with litter from the horse stable. The frame should be so constructed as to permit the use of a layer of this manure at least one foot thick all around the tank. By covering all, both frame and tank, with a large lid which is to be shut down at night, and

during a part of the day when the weather is severe, there is not much likelihood of the water freezing. A little labor spent in constructing such a frame will save many times its cost in food, as it requires considerable heat to warm up the ice water that cattle drink.

CHAPTER XV

DISEASES OF CATTLE

CATTLE are very subject to certain diseases which render their usage for domestic purposes questionable. Milk from diseased cows, or meat from diseased carcasses, may endanger the lives of those who consume it. While these diseases are properly classed as incurable, it should be remembered that they are communicable germ diseases and are therefore preventable. Therefore, some space will be devoted to their prevention. In addition to these diseases, cattle are subject to a number of ailments, some of which are simple and easily cared for, but more of which are somewhat complicated, requiring skilled treatment.

The sick cow should receive much care, as in many cases good care is to be preferred to the use of medicine (see page 151). This chapter is intended merely to serve as a guide and to make suggestions; it is not designed to take the place of a good veterinarian, who should always be called in case of serious difficulty or doubt. The dosages here advised, except when otherwise noted, are for mature animals.

DISEASES OF THE GENERATIVE ORGANS, AND DIFFICULTIES OF PARTURITION

There are few diseases to which cattle are subject that are of wider interest than those of the generative organs. This is particularly true of those herds that are being kept for breeding purposes and when the principal product is the offspring.

Cattle are particularly subject to a contagious form of abortion which destroys many young before they can live out of the womb. The principal diseases or difficulties are barrenness; abortion, both contagious and non-contagious; difficult parturition; retention of the afterbirth; milk-fever; garget.

Barrenness in cows. — It often happens that cows are served normally, yet fail to conceive. Some of the causes of this difficulty are readily understood and easily prevented, while others are not well understood and are beyond control of the breeder. An excess of rich and stimulating foods is a common cause of non-breeding, especially if the animals are denied exercise. The dangers attending parturition are often more than trebled in the case of fat animals. This excessive fat, however, may be of much advantage once these dangers are past. On the other hand, barrenness may be due to poor feeding, the system being weakened by the lack of sufficient nutrition. Undue sexual excitement at the most active stage of heat is often responsible for the cow not conceiving. Cows that for some reason have missed a season are often difficult to impregnate. Animals that are too closely inbred are also likely to be barren. In addition to these, there is a long line of causes of barrenness in cows over which the breeder has little or no control, such as derangement of the sex organs, diseased ovaries, tumors, and the like.

Abortion in cows. — Abortion in cows is either contagious or non-contagious. Because of the great differences as to cause and subsequent treatment, we consider them separately.

Non-contagious abortion. — This is produced by any cause operating to disconnect the union of the fetal membrane from the uterus. A cow may abort by reason of almost any cause that very generally disturbs her system, as from the influence of a too stimulating diet or the reverse, as when the nourishment is so deficient that the fetus dies in the womb; damp, unhealthy stables; worms in the bowels, lungs, or liver; indigestion of all

kinds; the drinking of putrid, stagnant water; of ice water; the eating of iced grass; of ergot, of smuts on corn or other grains; and severe illness. The more direct mechanical causes are falls, strains, violent exertion, and blows; also traveling on icy ground, muddy roads, or jumping over fences, ditches, and the like.

The prevention of non-contagious abortion is the avoidance of all causes that are likely to produce it. All causes of excitement, of constipation, of diarrhea, of indigestion, and the like must be avoided. With cattle, non-contagious abortion may often be prevented, although the first signs have appeared. So long as the fetus has not perished, the waters not discharged, nor the water-bags presented, attempts should be made to check the progress. Place the cow alone in a quiet stall and check the labor pains if possible. To do this, laudanum given in one ounce doses for small cows and two ounce doses for large ones is good. Repeat the dose in three or four hours should the labor pains recur. When all measures fail and miscarriage results, all that can be done is to assist in the removal of the fetus and its membranes, as in ordinary parturition.

Contagious abortion in cows.—Though not well understood, contagious abortion is known to be due to an organism. The germ producing the disease is conveyed by infected bulls, by the tongue or tail of infected animals, or by the external genital organs coming in contact with the wall, fence, rubbing post, litter, or floor which has been previously soiled by an infected animal.

Cows should be kept in fair flesh and in vigorous condition. The method of preventing contagious abortion differs from non-contagious only in the separation of the infected animals and in free use of disinfectants. When a cow shows signs of aborting, or when she has aborted, she should be separated from the other cows and the stable or stall she occupied thoroughly disinfected. For this purpose, use a 5 per cent solution of carbolic acid or a

1 to 1000 solution of corrosive sublimate. All litter and the dead fetus should be burned. After the cow has aborted, she must be kept thoroughly clean by use of a disinfectant. Dissolve 1 dram of corrosive sublimate, 1 ounce each of alcohol and glycerine, shake this up in a gallon of water, and use as an injection into the vagina and wash the parts about the vulva and root of the tail. Disinfect the animal each day as long as the discharge continues. Do not breed aborting cows for two or three months. For two days before breeding, the vagina should be washed out with the sublimate-alcohol-glycerine-solution, but on the day of breeding warm water only should be used as the corrosive sublimate will destroy the semen. The disease seems to run out and disappear from the herd after a time.

The best methods of combating contagious abortion are cleanliness, the free use of disinfectants, isolation of infected cows, and precautions against using infected bulls. Many preventive remedies have been suggested, of which the following is as good as any: Mix one pound of pulverized hyposulfite of soda, one pound of sulfur, and ten pounds of common salt. Give a small handful to each pregnant cow two or three times a week.

Difficult parturition. — There are a number of causes of difficult parturition among cattle. Cows, however, have an advantage over mares, in that the fetus and fetal membranes are more strongly attached and not so likely to be disconnected and may, therefore, be left alone longer with practically no danger to the young. Among cows the maxim may be: Do not interfere too soon. Bruising, tearing of the passages, and bleeding from the uncontracted womb may follow the too rapid extraction of the calf. If there is no obstruction, let the calf be expelled slowly by the unaided efforts of the cow.

If, however, after the cow has labored some time, there seems to be some mechanical obstruction, she should be examined. As this is likely to be much of a task, the operator

should prepare himself for it by dressing in a shirt from which the sleeves have been cut off at the shoulder. This avoids danger of soiling the clothing or of exposure, as is the case when the shirt is removed, and yet leaves the whole arm free for the work. The hand and arm should be smeared with oil, lard, or vaseline. This grease should be fresh, neither salted nor rancid, and should be purified by boiling or rendered antiseptic by the addition of a tablespoonful of carbolic acid to the pound of grease. This should always be done, as it protects both the cow and the operator from infection.

After the labor pains have lasted some time without any signs of the fetus, the hand should be introduced to examine; if the water-bags have burst and neither feet nor head appear for some time, if one fore foot only and the head appears, or both fore feet without the head, or the head without the fore feet, and if one hind foot appears without the other, make very careful examination. In normal presentation the fore feet, hoofs down, should first appear, then the nose. In any of these abnormal presentations, secure the presented limb or head by a rope with a running noose, so that in case it should slip back into the womb it will not get lost during the examination, but may be retained in the vagina or easily brought up again. This examination can be made much easier if one turns the cow with head down hill, as the internal organs gravitate forward into the belly of the cow thus making more room in which to bring up the missing limb or head and to manipulate the fetus. In case the cow is lying down, turn her on the side opposite to that on which the limb is missing, so that there may be more room to arrange the fetus or to bring up the missing member.

Do not attempt to arrange the fetus, limb, or head, during the labor pains, but wait until the pain has ceased and then straighten out the part before the next pain comes on. One must be patient and painstaking, remembering that the fetus

will not come until properly arranged, and when so arranged, it is likely to come fairly easy. The task is all the more difficult because it is very trying on the arm of the operator, as the arm of the strongest man is likely to become numb working in such positions. If the passages have lost their natural lubricating liquid and become dry, smear the interior of the passages, the womb, and the surface of the calf as far as can be reached with fresh lard or sweet oil. In pulling on the fetus, draw only while the cow is straining. When pulling, draw downward toward the hocks as well as backward, as the natural curvature of both fetus and passages are thus followed and the extraction of the fetus rendered easy. If the pains of the cow are violent and long continued, they may be checked by pinching the back or by placing a tight surcingle around the body in front of the udder. If the pains continue, one to one-and-one-half ounces of chloral hydrate in a quart of water may be given to check them.

Retained afterbirth. — The cow of all farm animals is especially subject to this difficulty. When the afterbirth is retained it decomposes and is discharged as a yellow or reddish fluid, having an extremely offensive odor. This discharge is most apparent when the cow is lying down and while she ruminates. The rear parts of the cow, rump, tail, and vulva are soiled by the discharge, which often contains lumps of decomposing material. To avoid this, the afterbirth should be removed within twenty-four or thirty-six hours after calving. To do this, a simple method which is often effective is to hang a small weight, not to exceed one or two pounds, to the hanging portion of the afterbirth and allow this by its constant dragging and by its jerking effect as the cow moves along to pull the membranes from their attachments and to stimulate the womb to expulsive contractions. In neglected cases when the hanging mass is already badly decomposed this cannot be done, as the membrane is liable to tear under the added weight, leaving a part of the material in the womb. If the bowels are constipated, a physic

consisting of one ounce of ginger given with a quart of sweet oil will prove advantageous. If the afterbirth remains, it is necessary to remove the membrane by hand. This should be done within twenty-four hours after calving, since the mouth of the womb may be so closed that it becomes difficult to introduce the hand. The operator had better dress as suggested for difficult parturition (p. 334). The arm should also be greased as suggested for that operation, as otherwise the operator may become infected from the decaying membrane. It is a good

FIG. 101.—RED POLLED HERD. Owned by Frank Hartlin, Strasburg, Ohio.

plan to wind the free portion of the hanging membrane around a small stick and roll up until it reaches the vulva. An assistant should hold the tail and membrane to one side while the operator introduces the greased arm which he passes along until the places of attachment are reached. These places of attachment will be found to resemble mushroom-shaped bodies and are detached one by one by pushing the hand between the membrane and the womb and slipping the membrane from the heads of these bodies, taking care not to rupture the womb. As the membrane is released, the assistant should keep rolling it up on the stick.

After the whole membrane is removed, it may be well to disinfect the womb with a two per cent solution of carbolic acid.

Eversion of the womb. — This ailment is commonly called "casting the wethers," and is rather common among cattle. It often follows difficult parturition, the cow continuing to strain until the womb is forced out and hangs in a large mass from the vulva. The womb can be instantly recognized from the other membranes by the presence of the mushroom-shaped bodies, each two to three inches in diameter and attached by a narrow neck. There are a large number of these bodies, fifty to one hundred.

The displaced womb should be carefully washed with cold water containing a one per cent solution of carbolic acid. The cold is useful to drive out the blood and reduce the bulk. Now with the closed fist planted in the rounded end of the largest horn of the womb, push back so as to reinvert the womb into place. This must be done gradually. The cow will strain while this is being done, but the womb is to be firmly held until the straining is over. This straining may be overcome in part by pinching on the back.

The holding of the womb in place is the next point. This is perhaps best accomplished by the use of a rope truss. This truss can be made from a long one inch rope. Double the long rope at its middle and place over the neck of the cow; bring the ends, one on either side of the neck, down between the fore legs, twist them together to make firm, carry back between the hind legs and up to the vulva, here cross them and tie firmly with a string, then, just before the tail is reached, cross back and tie firmly, thus making a ring which when drawn tight will press the vulva; then carry the ropes forward along the back and tie into the middle of the rope at the top of the neck. The rope should be drawn so tight that the rope ring is made to press firmly all around the vulva.

Milk-fever. — This disease is also known as parturition

apoplexy and parturition fever. There is, however, very little if any fever connected with the disease, as temperature is usually below normal. High-producing, fleshy, aged cows that have been closely confined are likely to be attacked. In fact, the best and heaviest milkers are most subject to the disease. It is more likely to occur when the birth has been comparatively easy and quick, and from one to ten days after calving. There is a sudden dullness, hanging back in the stall, drooping of the head, uneasy movement of the hind limbs, unsteady steps; and the cow staggers, lies, or falls down and is unable to rise. At this time there may be some temperature. At first the cow lies with her head turned around with nose resting on the right flank; later she may stretch full on her side. She soon becomes unconscious, the eyes are glazed, their pupils widely dilated and their lids not movable when the ball of the eye is touched with the finger. Treatment must follow quickly or she will soon expire.

While this disease was formerly considered very fatal, with the air-treatment it is seldom so. This air-treatment consists simply of injecting air into the udder and carefully kneading the udder at the same time. Care must be taken that the air be sterile. There are Schmidt-Kolding sterile-air milk-fever outfits on the market with which to force the air into the udder, yet if one of these is not near at hand, a very convenient apparatus can be made from a common bicycle air-pump and a milk-tube. In fact, this simple apparatus will prove as efficient as any. Attach the milk-tube to the pump, insert the tube into the teat and as the air is pumped in, knead the udder well. In two hours milk the air out, rest a few minutes, and pump up again. This may be repeated every two hours until the animal is relieved. If the animal is badly bloated, puncture the paunch in the left loin with a canula and trocar as suggested for bloating (page 351). This treatment should be pursued while there is life, irrespective of how low the cow may seem. Do not let the

cow die. In case the milk-tube is not at hand, use a medicine dropper to get the air into the udder. If the canula and trocar are not at hand, stick a knife into the paunch. This is recommended only in the absence of something better. Many a cow has been saved by these crude methods.

Garget is perhaps one of the principal forms of mammitis, of which caked-udder is a second. The udder often becomes highly inflamed soon after the young is born, and occasionally before when the glands are active, congested with blood, and the udder over-distended with milk. In addition to this, inflammation of the udder is often due to mechanical injuries such as blows, kicks, scratches, and being horned by other cows; and especially by germs entering the udder.

The treatment is to relieve the congestion by drawing the milk frequently. This should be done before calving if the udder is distended. After the milk is drawn gently but thoroughly, rub the udder. Bathe the parts with hot water for fifteen minutes at a time, rub dry, and apply an ointment made as follows: Dissolve two tablespoonfuls of gum camphor in a teacupful of melted fresh lard. This can be greatly improved by the addition of one ounce of the fluid extract of belladonna. The udder should be bathed three times daily and the ointment well rubbed in. It is often advantageous to support the udder by the use of a wide piece of cloth with holes cut for the teats and this held in place by arranging a band over the back. When the trouble is due to germs entering the udder, a two per cent solution of carbolic acid should be injected into the udder; leave this in ten to fifteen minutes; milk out and bathe as before. This solution may be injected by fastening a milk-tube on a syringe with a small rubber tube.

ILLS OF THE YOUNG CALF

The young calf, even though it establishes the function of respiration and gets its first meal without difficulty, is still

subject to many ills, chief of which are digestive disorders of some kind. These digestive defects are likely to be more numerous among dairy calves or those that are weaned while young and fed from the pail. This is often due to the difficulty in keeping the conditions just right: the milk may get cold, the pails may be unclean, the calf may drink too fast, and many other irregularities.

Constipation. — Notwithstanding the purgative effects of the colostrum or first milk, the young calf occasionally suffers from constipation, especially if the cow has not been in good thrift, or has been fed on dry innutritious foods during the latter periods of pregnancy. Whatever the cause, if the calf is costive, straining violently without passing dung, lying down and rising at once as in colic, and failing in appetite, no time should be lost in giving relief. First remove the cause, if it can be located. The bowels will ordinarily be stimulated to action by administering one to two ounces of olive or castor oil. An injection of warm water into the bowels will prove helpful. The water should be at blood heat and have added to it a little glycerine, — a teaspoonful of glycerine and two or three ounces of water. It is not advisable to inject too much, or to use soap suds as is often done. Inject gently into the rectum with a common hard rubber syringe, taking extra care not to rupture the tender membrane. This will induce the calf to try to pass the fecal matter and in addition will lubricate the passage. The injection may be repeated every hour.

Diarrhea or scours. — This disease is prevalent among calves and occurs in two forms: simple; and contagious or "white scour." The causes of simple diarrhea are many and varied; bad food, over-feeding, and too rapid feeding are the most common. The surroundings of the calf often bring on the disease. Calves kept indoors are more liable to attacks than those in the open air and having exercise, pure air, and sunshine. Closely crowded, filthy, foul smelling buildings are likely to

bring on an attack. Whatever the cause, it should be removed and the case treated at once, as the calf is not likely to live long if the diarrhea continues. Perhaps the first thing to do is to reduce the feed from one-half to two-thirds. In treating, one must keep in mind the nature of the disease, that it is caused by an irritant in the stomach or bowels which must be removed before a cure can be effected. For this reason one should be cautious about giving an astringent with a view to cutting off the discharge. The best policy in all such diseases is to expel the disturber with a laxative, such as one to two ounces of castor oil. Later when the irritant has been removed by the oil, check the discharge by a weak solution of gum arabic, or by adding a little lime water, not to exceed one-third to the milk each meal, or by adding parched flour to boiled milk, or by the essence of Jamaica ginger well diluted with hot water, and in persistent cases by the use of such astringent as oak bark tea, which is made by stripping the inner bark of white oak.

White scour is a violent and deadly form of diarrhea, frequently attacking young calves. This may appear immediately after birth and is likely to show itself within the first or second day. It often occurs as a contagious disease, attacking all the calves that are dropped in the stable for some time. For this reason it is often called "contagious scours." The disease is caused by a germ that enters in most cases through the navel. The calf appears dull and weak, the eyes are sunken, the belly retracted, the breathing is short and rapid, the temperature very low, and the calf soon becomes unconscious. The discharge from the bowels is rather profuse, of a yellowish white color and very offensive odor. As a rule the calf dies within twenty-four to thirty-six hours.

As there seems to be no treatment, we must rely on prevention. A week before calving the pregnant cow should be placed in comfortable quarters where no sick calves have been confined. This seems to be the only safe course, for after the

disease breaks out in a stable, often the most thorough disinfecting fails to stop future calves from infection. As soon as the calf is dropped, the cord should be tied close to the navel and the parts thoroughly wet with a twenty per cent solution of carbolic acid, or better still, with a solution of the tincture of iodine. Fresh milk, diluted with lime water, not to exceed one-third, in which a teaspoonful of dried blood has been dissolved, should be given the calf in small quantities and at frequent intervals. The stable in which the first attack occurred should be thoroughly disinfected, and to do this perhaps nothing is better than corrosive sublimate; however, if this seems undesirable and ordinarily disinfectants are used, they should be used strong and flushed into every nook and corner of the stable.

TUBERCULOSIS

Perhaps no disease to which cattle are subject is more discussed than tuberculosis. This is due in a large measure to the use of cattle to provide food for the human race. There are perhaps few diseases so common among cattle as tuberculosis, particularly among those animals that are kept closely confined.

Tuberculosis is a communicable germ disease, and is, therefore, preventable. The disease is caused by a small germ or bacterium known as *Bacillus tuberculosis*. This germ is, of course, invisible to the naked eye.

Methods of infection. — As tuberculosis is a communicable germ disease, the methods of infection should receive much attention. This can be made clear by considering from two points of view: first, how the small germs escape from diseased animals; and second, how sound animals become infected. All diseased animals possess the germ. This germ escapes when the tissues it has destroyed are being discharged from the body. Thus, if the lungs are affected, the animal on coughing dislodges the germs, which may be forced directly out of the body or lodged in the mouth, when they leave the body with the saliva.

In the cases in which the germs are found in the saliva they are left in the watering troughs, on the bottom of the mangers, on the grass, on other animals when licked by diseased ones, and in fact spread wherever the diseased animal goes. If the disease happens to be in the glands of the intestinal walls, the germ

FIG. 102. — DEVON BULL "DARKS MAJESTY." Owned by Stockwell and Gifford, Sutton, Mass.

The Devon cattle originated in the counties of Devon and Somerset, England. They are variously classified, sometimes as beef cattle, at other times as dual-purpose animals. They tend more toward beef than milk. The animals are symmetrical and trim. In size the bulls weigh from 1500 to 2000 pounds, the cows from 1300 to 1500 pounds. The color is red, although the shade is often light.

escapes with the dung. If the glands of the udder are diseased, the germ passes out with the milk. If the disease is located in the glands of the skin, the germs may escape through the openings of the skin.

When the germs have escaped into the watering troughs, mangers, on the grass, and the like, they are readily taken up by

healthy cattle. In case the germs escape in the milk, whatever feeds upon it is liable to infection. The length of time that will pass after infection and before the disease visibly appears varies widely, even to months or years. The length of time the animal may possess the disease varies equally as much. With some it may prove fatal in a few months; others may carry it for years.

The tuberculin test. — Often it is not possible to tell by a physical examination which animals are infected with tuberculosis and which are not. The most accurate means of detecting the disease in cattle is by noting the temperature of the animal following the injection of a small amount of tuberculin beneath the skin. The tuberculin is prepared by sterilizing, filtering, and concentrating the liquids in which the tubercle bacillus has been allowed to grow. It contains the cooked products of the growth of these germs, but not the germs themselves. Hence when this liquid is injected under the skin of cattle, it is absolutely unable to produce the disease, but it sets up a characteristic reaction or symptoms.

Any intelligent owner of cattle, who will make a little effort to familiarize himself with the test and its limitations, can use it on his own cattle with safe results. It does not require the trained veterinarian. The operator must, however, be familiar with the method, be very careful, painstaking, and patient.

The testing outfit. — The testing outfit consists of five things: (1) tuberculin, (2) syringe, (3) thermometer, (4) disinfectant, (5) vaseline.

1. Tuberculin. — Tuberculin can be procured from the experiment stations in the various states. If the Experiment Station fails to provide it, the Bureau of Animal Industry, Washington, D.C., can tell where to secure it.

2. Syringe. — A hypodermic syringe of 6 c.c. to 10 c.c. capacity, such as is commonly used to inject liquid vaccine, is

necessary. This syringe should be provided with short, stout needles, well reënforced at the base.

Any druggist will procure the syringe and needles and show how to use them.

3. Thermometer. — A guaranteed clinical thermometer is necessary. If a large number of animals is to be tested, it will facilitate matters to provide two or three thermometers. Any druggist will provide a thermometer and show how to adjust or shake down and how to read it. A string should be tied around the thermometer, at the other end of which should be fastened a wire hook, or a small bull-dog clamp. After inserting the thermometer in the rectum, the clamp or wire hook is fastened to the long hairs at the base of the tail, or the wire wound around the tail so that if the thermometer is thrown out, it will not be broken by dropping to the ground. Cows are likely to void dung soon after the insertion of the thermometer, and unless this precaution is taken, the thermometer is very likely to drop to the floor before many temperatures are taken.

4. Disinfectant. — A small bottle of strong carbolic acid (95 per cent), to be used in disinfecting the syringe before beginning the test and to disinfect the needle-point before injecting each animal, is essential. This can be procured at any drug store.

5. Vaseline. — A small can of vaseline or lard should be provided to grease the thermometer before insertion. A vaseline jar also affords a safe and convenient place to keep the thermometer between times of taking temperature.

Directions for making the tuberculin test. — While making the test is not difficult (in fact easier done that told), one should be exceedingly careful, going about the work methodically and keeping everything neat and clean. The test may be divided for convenience into five essential parts: (1) keeping records, (2) taking the normal temperature, one day, (3) injecting the tuberculin same day, (4) taking temperature

after injection, second day, (5) interpretation of the temperature records.

It is very essential that the animals be well known or numbered, for in no case should they get mixed. It is not advisable for the beginner to attempt to test more than twenty animals at one time.

Cattle suffering from such diseases as garget, retained afterbirth, and the like, or those that are in heat or far along in pregnancy, should not be tested.

1. Keeping records. — An accurate record of each temperature must be kept. To do this procure a large sheet of paper, writing the names or number of each animal down the left side, and the hour at which the temperature is taken across the top. As each temperature is taken, record it under the hour and opposite the name.

2. Taking the normal temperature. — On account of the variation in temperature it is essential to take the temperature of each animal at intervals of two hours until at least four temperatures are taken, before the tuberculin is injected. These temperatures must be carefully recorded to compare with the temperatures of the same cow after injection. After becoming familiar with the method of reading the thermometer, shake it down, smear it with vaseline and insert full length into the rectum. Attach the thermometer to the base of the tail by means of the clamp of wire, and allow to remain in the rectum for three minutes. Withdraw the thermometer, read the temperature, record on the sheet at once, shake the thermometer down, and proceed as before.

Because of the ease with which variations in temperature are caused, it is important to keep the animals that are being tested under normal conditions. They should be fed, watered, and milked as usual.

3. Injecting the tuberculin. — This is preferably done in the evening, say eight hours before the time of milking in the morn-

ing. For example, if the cows are milked at 6 A.M., inject the tuberculin at 10 P.M. The syringe should be disinfected by drawing it full of carbolic acid, emptying it, and then rinsing in boiling water before beginning the injection. In addition to this, just before injecting each animal, dip the needle in strong carbolic acid to disinfect it. Carefully fill the syringe through the needle from the bottle of tuberculin. Set the burr on the piston-rod of the syringe so that not more than the dose intended can be injected. The druggist will show how this is done when the syringe is purchased. The size of the dose will be stated on the tuberculin bottle. With the cow restrained in a stanchion, or tied short in a stall, take hold of the skin with the left hand along the side of the neck where it is thin and loose and with the syringe in the right hand quickly insert the point in the pocket thus formed and inject the dose. Occasionally some force is needed to insert the needle into the skin. Before injecting another cow, see that the syringe is working properly and the needle is in good shape.

4. Taking temperature after injection. — Begin taking temperatures eight hours after the injection of the tuberculin and continue every two hours until six temperatures are taken, and continue those cases showing a rise in temperature. For example, if the tuberculin was injected at 10 P.M., begin taking temperatures at 6 A.M., then at 8 A.M., 10 A.M., 12 M., 2 P.M., and 4 P.M., and make a careful record of each temperature as taken. When an animal shows a rise above 103, it is well to take the temperatures at more frequent intervals.

5. Interpretation of the temperature records. — The temperatures after injecting the tuberculin must be carefully studied and compared with those taken the day before. In typical cases of tuberculosis, an elevation of temperature usually comes on gradually, although in the more pronounced reactions, when the temperature goes above 105.5 degrees, the rise is often rapid. This elevation usually occurs between the eighth and sixteenth

hours after injection. It should remain practically at a maximum for two hours or more and gradually subside. When it reaches 104 degrees or more and is maintained for some hours, the animal is regarded as tubercular, if no fever was shown before the injection. Sudden rises for a short time only do not indicate a reaction. The rises of less than 1.5 degrees do not indicate a reaction. In all cases of doubt, the animal should be separated from the herd and retested not sooner than four to six weeks (the test will not give reaction under this time).

Retesting. — A single test of a diseased herd cannot be relied upon to detect every tuberculous animal. If animals are found by the first test to be affected, they should be tested again in four to six weeks. Even in those herds in which no reacting animals are found, it is a good plan to test once each year.

Tuberculin not infallible. — While tuberculin is the best method known for detecting tuberculosis, it is not infallible. On the average if properly handled, it will detect 97 per cent of the cases. In some cases, especially when the animals are badly diseased, it fails to react, and in a very few cases it seems to cause a rise of temperature in healthy animals.

Prevention of tuberculosis. — In the beginning of this discussion it was stated that tuberculosis is a communicable germ disease, and therefore preventable. In order to prevent, infected animals must not be brought into healthy herds, for as we have observed diseased animals spread the infection wherever they go. Much space has been given to methods of locating the disease in order that those herds already free may not be infected by the addition of an infected animal. If a herd is known to be healthy, never bring a new animal into the herd until it has been tested, and if there is the slightest doubt about its being tubercular, it should be excluded.

If in addition to the tuberculin test and the exclusion of all diseased animals, the quarters where the cattle are kept are well ventilated, and well lighted, admitting the direct rays of the sun,

the chance of the herd's being infected is very slight. Since the trouble and expense of making the test are so slight, it is well worth while to make it in order to have the assurance that the herd is entirely free and there is absolutely no danger in the consumption of their products, either milk or meat.

Eradication of tuberculosis. — The eradication of tuberculosis, once it gets a foothold, is not so easy or at least not so inexpensive. There is of course no cure for the disease, so other methods of eradication must be sought. It has been suggested that all diseased animals be slaughtered, but this would mean untold waste and were it enforced, might lead to a national calamity, for it is doubtful if the nation could spare all of its tubercular cattle at one time. There is one plan, however, which, if it could be employed, would seem to bridge the difficulty and in a few generations would result in bovine tuberculosis being practically swept from the land. This plan, however, requires extra labor, as well as the expense of extra equipment, and its employment is purely economical; but since, from the nature of the disease and the importance of the animals concerned, it seems to be the only avenue of hope, the plan is here given.

The Bang method of eradicating bovine tuberculosis. — This method, recommended by Dr. Bang of the Copenhagen Veterinary College, is being successfully employed in Denmark. The object of the method is to replenish a tuberculous herd with as little loss as possible. The original method has been modified from time to time and at present stands thus: Immediately after testing the herd divide it into two parts, placing the sound animals in one and the diseased animals in the other, thus making two herds, one diseased, the other sound. At once remove the sound herd to new and uninfected quarters, and keep it away from the infection. The difficulty of this is that it means two sets of equipment, barn, lots, pastures, and the like; for if the plan is to succeed, the sound herd must be kept entirely away from the infected barn, lots, and pastures. They must even have

different care takers. Since calves at birth are free from tuberculosis, those from the diseased herd may be put with those from the sound herd. No animals should be admitted to the sound herd without first being tested and the sound herd itself should be tested once each year, and if any animals react, they are to be put with the diseased herd and the stable thoroughly disinfected with corrosive sublimate.

If dairy cattle, the milk from the tuberculous herd must be handled in entirely separate utensils and pasteurized at 185° F., after which it is considered harmless both for stock and human food.

This method, though it involves much expense, seems to be the only feasible one for the eradication of bovine tuberculosis. It is being successfully conducted on several farms in this country at the present time. The painstaking and careful cattle owner can eradicate tuberculosis from his herd in a very few years by the Bang method, or some modification, if he so desires.

BLOATING IN CATTLE

Bloating, or "hoven," is the distention of the paunch or rumen with gas. It is liable to occur when cattle are first turned to young clover or alfalfa, especially if the growth is rank, as they eat it so greedily that gas formation results. Turnips, potatoes, and cabbage may likewise set up fermentation, which proceeds rapidly; the gas does not escape, and soon the rumen becomes distended to a large size. Bloating is easily recognized by the distension of the rumen, particularly on the left side, that part bulging outward and upward very noticeably, and when struck with the tips of the fingers, giving a drum-like sound. Breathing is very difficult, the animal reels, and soon may lie down or fall.

The treatment varies according to the severity of the case. In mild attacks, driving the animal at a walk often gives relief, or dashing cold water by the bucketful against the sides may suffice.

If the animal is bad, it may be necessary to put a gag in the mouth as follows: Take a piece of inch rope, smear it with pine tar, wagon grease, or other unsavory substance, place it in the animal's mouth as a bit, and fasten by tying around the horns; or, take a stick the size of a fork handle and eight or ten inches long, place this in the mouth as a bit and secure with a string by tying around the head. It will try to dislodge these objects by movements of the tongue, jaws, and throat, thus stimulating the secretion of saliva and swallowing, which opens the esophagus and permits the gas to escape. At this time a little salt thrown

FIG. 103. — DEVON HERD; "SALLY" IN THE CENTER, HER TWO-YEAR-OLD BULL CALF TO THE RIGHT, AND HER YEARLING CALF TO THE LEFT. Owned by L. P. Sisson.

into the mouth often proves advantageous. In severe cases, however, the gas must be allowed to escape without delay, and this is best accomplished by the use of a trocar and canula. On the left side, about halfway between the last rib and the hip, make an incision through the skin about three-quarters of an inch long with a sharp knife; through this incision insert the trocar and canula, directing downward, inward, and slightly forward, and thrust the point into the paunch. If this happens to be a fat animal, it will be some distance through, but thrust it home. Remove the trocar, leaving the canula in place, through which the gas

may escape. This should be left in place as long as the gas is generating. In the absence of a trocar, a sharp knife may be thrust through to let the gas escape. Do not let the animal die of bloating. Give internally two ounces of aromatic spirits of ammonia in a quart of cold water. Repeat every half hour. Turpentine in two-ounce doses is also good, but it must be well diluted with milk to prevent injuring the animal. After bloating has subsided give physic; one pound of Glauber's salt is good.

Since there is danger of bloating in turning cattle to luxuriant pasture, especially if wet with dew, they should always be well fed and turned to pasture in the afternoon when the grass is dry. Some advise taking them up the first night, feeding them well the next morning, and not turning in pasture again till afternoon. A little dry hay put in the pasture is excellent to prevent bloating, as the cattle seem to crave it.

IMPACTION OF THE RUMEN

This difficulty often occurs among cattle and is due to the filling of the third stomach with indigestible material, such as frozen grass, weeds, or foreign materials. The animal refuses to eat, stands with back slightly arched, breathes rapidly, and may bloat, though not always. Often the mass of undigested food can be felt on the left side. The animal on lying down usually lies on the right side.

For treatment give a mild purgative, three-fourths to one pound of Epsom salts and two ounces of ginger dissolved in warm water, and administer in the form of a drench. Feed gruels and bran mashes if the animal will eat, and allow plenty of water. To aid the bowels in moving one may give an injection of warm water.

Cattle off feed.—Often cattle are thrown "off their feed" by overfeeding, by irregular feeding, or by consuming indigestible things such as frozen grass, weeds, and perhaps by eating foreign

matter, particularly if it be salty. Such animals are simply indisposed, do not eat, and stand around with a dejected look. If no attention is given them, they may remain in this condition for some time. This is to be avoided if possible, as animals that are not doing well are sure to prove unprofitable. The treatment is to give pound doses of Epsom salts dissolved in warm water to which a little ginger has been added. If they will eat, give gruels or mashes, and allow all the fresh water they will drink.

DEHORNING

In case the horns were not removed when the calf was small, as suggested on page 255, and it is desired to remove them later, it will be necessary to remove them with either a saw or a pair of dehorning clippers. The animal must be confined in a chute or stocks made for such purposes, a rope placed around the head, which should be pulled to one side and held firmly while the horn is removed. Whether sawed or clipped, remove the horn so close to the head as to take a ring of hair off at the base of the horn, otherwise the horn will grow out as a stub. If in fly time, apply tar to keep the flies away. The bleeding will stop of its own accord. The pain of the operation is slight, and whenever animals are disposed to be vicious the horns should be removed. It is not a good plan to dehorn when the flies are bad, nor should dehorned animals have access to straw or hay stacks where they can get the chaff into the wounds.

VICES OF DAIRY CATTLE

There are a few bad habits or vices to which dairy cattle are subject. They are often serious and lessen the usefulness of the animal. Most of them, however, can be remedied with a little patient effort, or by the arrangement of inexpensive apparatus.

Kicking cow. — To prevent a cow from kicking, procure a half-inch rope long enough to reach around the cow's body and

tie; place the rope, with slip noose on one end, around the body of the cow, just in front of the udder and back of the hip bones. Draw tight and tie. Repeat each milking, always treating the cow gently. After a time one need only lay the rope over the cow's back. Finally the rope may be discarded.

Another method recommended by some is to take a hame strap and buckle the two hind legs together, but this is not efficient as she is likely to get one leg loose or throw herself endeavoring to do so.

When the cow is tied by the stanchion, the experienced milker will be able to milk almost any cow by crowding her over as far as the stanchion will let her go, then by placing his knee in front of her hock and his head in her flank she is not likely to try to kick; in fact she cannot, if the milker understands holding her in the proper position.

Sucking cow. — Occasionally a cow develops the habit of either sucking herself or another cow. While there are many ways of preventing this, perhaps as efficient way as any is to procure a stiff piece of old leather, say one and one-half inches wide and eight inches long, drive through this several eight-penny wire nails with the ends filed down to a point and fasten to the nose-band of a common halter and place this halter on the sucking cow. With this she cannot reach her own teats or those of any other cow without injuring the flanks, and she not likely to try more than once.

PART THREE — SHEEP

CHAPTER XVI

CHOOSING AND JUDGING SHEEP

FAMILIARITY with what is wanted, powers of observation, and good judgment are equally as important in choosing sheep as in choosing cows or horses. These can be gained only by careful study, and more especially by practice, as sheep are often deceptive. The importance of these faculties cannot be overestimated in the choice of any class of farm animals.

The wool-covering of the body of the sheep makes an examination of the form rather difficult. The wool is often so trimmed as to deceive. An expert trimmer, possessing much skill with the shears, can give a rather inferior sheep the appearance of a plump full form; thus animals with sway backs, narrow, flat ribs, narrow, peaked rumps are often so trimmed as to conceal such defects. To facilitate the inspection and hasten the work, to avoid being deceived and to enable the examiner to discover all defects, the following method of examining sheep is suggested: —

After noting the general appearance, the age, the teeth, the eyes, and the like, then, with the open hand, as shown in the illustrations (page 369), proceed to a detailed examination. Do not depend on the eye alone, but fortify it with the touch, carefully noting each character as described under detail examination (page 368). During this examination keep the fingers and thumb together and the hand flat. Never stick the fingers into the wool. When it is desired to examine the wool, open up the wool with the hand flat (Fig. 121).

Catching and holding sheep. — There are two places to catch sheep: First, the hind leg above the gambel joint; second, by

FIG. 104. — DELAINE MERINO RAM "BEACON." A prize winner, owned by C. Marshall, New London, Ohio.

The Delaine Merino sheep are of American Merino ancestry, bred mainly by selecting from varieties free from folds. This breed resembles the American Merino except lacking the heavy fold, and the fleece is not so heavy. There are several families of Delaines, such as National, Standard, Dickinson, and Black Top. Rams shear from 12 to 20 pounds, the ewes from 8 to 15 pounds of strong, fine wool. In weight the rams vary from 130 to 200 pounds, the ewes from 100 to 140 pounds. This breed is popular in the United States.

placing the hand underneath the jaw and around the neck. Do not catch a sheep by its wool, as this not only pulls and injures the wool, but leaves a black mark or bruise on the body which

interferes very much with the sale of the carcass of mutton. If the shepherd's crook is used in catching the sheep, the aim should be to catch above the gambrel joint, as there is danger of injuring the leg if caught below this joint.

To hold a sheep, stand on the left side and place the left hand under the animal's jaw, keeping the right hand free to place behind the sheep in case it attempts to move backward. Do not attempt to keep the sheep from moving backward by pulling on the head or the wool, as either of these methods will be quickly resisted, which will result in injury to the wool and carcass. Gently place the right arm around back of the thighs, and the sheep will stop the backward movement at once. Likewise do not attempt to keep the animal from going forward by pulling on the wool, but place the left hand gently under the jaw.

HOW TO ESTIMATE AGE OF SHEEP

The age of sheep is a very important factor in determining their present and prospective value. Familiarity with the characters that indicate age are, therefore, often extremely useful. As in the case of the horse a knowledge of these characters is not difficult to secure, and skill in their application depends much on continued practice.

In estimating the age of sheep the order of the appearance of the permanent teeth furnishes the best index, especially from one to four years of age. There are, however, other general considerations that aid in estimating the age, especially in the case of young and very old animals. Size is the principal factor in determining the age up to one year. In very old animals the poll becomes more prominent, the sides of the face more depressed, and the hollows above the eyes deeper. With age the backbone becomes more prominent and often strongly curved downward, the sheep loses its plumpness, and in many ways shows the effects of age.

Examination of the teeth. — While the order of the appearance of the permanent teeth and their subsequent method of wearing are considered the most accurate means of estimating age among sheep, they are not absolutely accurate nor are they as dependable as in the horse. Teeth in sheep vary much according to the conditions, as in the case of the horse (see page 8).

Sheep, like cattle, are provided with two sets of teeth; first, the temporary or milk teeth, and, later, the permanent teeth. The permanent teeth differ from the temporary in their greater size. The replacement of the temporary teeth by the permanent is made necessary by the increase in size of the jawbone as the animal becomes older. As in the case of cattle, sheep have incisor teeth in the lower jaw only, the upper being provided with a cartilaginous pad. The number likewise is the same, eight in either case. The lamb is often born with one pair of milk teeth and the others soon make their appearance. These milk teeth are narrow and peg-like in appearance. When the animal is approximately fifteen months of age, the middle pair of milk teeth is replaced by permanent ones, which are fully twice as broad as the milk teeth, hence easily recognized (Fig. 105). The interval between the appearance of the succeeding pairs varies according to conditions, but can be stated as approximately eleven months. In general the age of the animal at the time each pair is up and in full wear may be estimated as follows: —

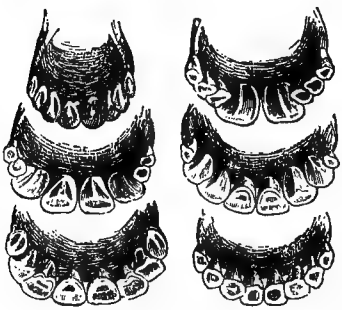

FIG. 105. — SHEEPS' TEETH, ILLUSTRATING AGE.

12 months. — 15 months.
26 months. — 37 months.
48 months. — 8 years.

First or middle pair of permanent teeth	15 months
Second or first intermediate pair of permanent teeth . .	26 months
Third or second intermediate pair of permanent teeth .	37 months
Fourth or lateral pair of permanent teeth	48 months

After the teeth are up and in wear, there is comparatively little change for a time, but as the animal grows older the teeth become narrower, and by the eighth or ninth year there is much space between them. They shrink away from each other, become more or less discolored, and finally drop out one by one.

TYPES OF SHEEP

There are two distinct types of sheep: the wool type, adapted for the production of much wool, and the mutton type, adapted for the production of meat. These types are controlled to a considerable extent by the demands made upon the body of the animal. Thus in the case of wool production as much skin surface as possible is desired, and the skin is thrown into folds. Large wool yields depend much on the constitution, the vigor, and the condition of the skin; hence much consideration is given these characters in choosing wool sheep. Likewise much attention is paid the skin secretions, which should be oily in appearance This oil is commonly called "yolk." The wool should be fine, with a natural bright luster and a clean white color. On the other hand, the mutton type calls for a form similar to that of beef cattle. The carcass is the product, and a plump full body is desired. The energy of the food should go to the production of mutton and not of wool. These two types, therefore, are of necessity widely different, and one can no more expect maximum wool production and maximum mutton production in the same sheep than he can have greatest milk flow and greatest yield of beef in the same cow.

The fine-wool type. — There are three important breeds of

fine-wool sheep, the American Merino, the Delaine Merino, and the Rambouillet. The fine-wool, or Merino and Rambouillet type, may be compared to that of the dairy cow. The body is spare, lacking in fullness, in breadth of back, and in general thickness throughout. The wool is rather short, very thick over the entire body, and exceedingly fine.

FIG. 106. — CHAMPION MERINO RAM. A type. Photograph from *National Stockman and Farmer*.

Owing to the difference in type, as shown by the folds or wrinkles on the neck and over the body, fine-wooled sheep are divided into three classes. Class A, Merino, represents the class or type with very heavy folds; Class B, Merino, has a smoother body; Class C, Merino, has a smooth body with only a few or no folds at all about the neck and breast.

There are three classes of fine-wool sheep, grouped according to the folds or wrinkles on the neck and body. By common consent these forms are distinguished by letter as follows: *Class A.* — Merino, representing those with heavy folds at the neck and over the body and hind-quarters, and possessing an

abundance of yolk or grease (Fig. 106). *Class B.* — Merino, representing those with fewer and smaller folds on neck and body and carrying less yolk in the wool (Fig. 107). *Class C.* — Merino, representing those with comparatively smooth bodies, possessing less yolk than Class B, though the wool is, as a rule, somewhat longer (Fig. 108). Of the three classes *A* is perhaps the heaviest shearer, a case being reported of an animal shearing 36 per cent of his gross weight.

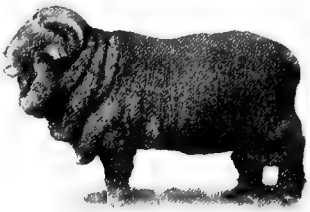

FIG. 107. — CHAMPION MERINO RAM. B type. Photograph from *National Stockman and Farmer.*

The mutton type. — There are many breeds of mutton sheep, divided into two general groups, known as the medium-wool and the long-wool; each, however, in the main possesses the characteristic mutton type. The mutton type resembles the beef type. The animals are low-set, compact, and blocky in appearance.

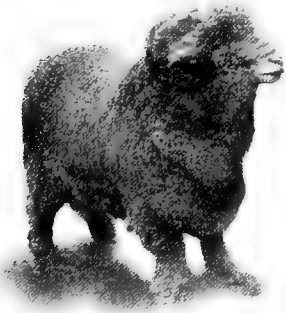

FIG. 108. — DELAINE MERINO RAM "VICTOR." C type. First prize yearling ram at four State fairs, 1909. Bred and owned by W. N. Cook and Son, New London, Ohio.

CHOOSING SHEEP

In choosing sheep, whether for the production of mutton or fine wool, they should be carefully examined. It is essential that the examination be systematic. Perhaps the most convenient and simplest method is to note, first, the general appearance, the form, weight, condition, quality, and constitution, and if these are satisfactory, to make a more detailed examination.

General appearance

By carefully observing the general appearance of a sheep, one can gain a fair knowledge of its desirability. Very often the general appearance is not given much consideration, with the result that many important characters go unobserved. Before proceeding to a detailed examination one should carefully note the form; this applies with equal force when selecting for mutton or wool; if for mutton, the weight and condition are important and the quality as well as the constitution are of vital importance to both types and should receive much careful attention.

The *form* will vary according to the object sought. In the fine-wool sheep the form may differ materially from that desired for mutton. *Class A*, fine-wool, should have very heavy folds over the entire body. Great depth of body is often more sought than width, and the animals are often quite angular in appearance. The form sought is that which indicates great vitality and gives much surface for the production of wool. Fine-wool sheep are therefore often high-standing; deep of chest, though narrow; long of body, though well supported; light in the hind-quarters with skin fold varying according to the class.

On the other hand, the form of the mutton sheep should be comparable to that of the beef animal. They should be low and condensed in organization. The top and bottom lines should be parallel, the shoulders and chest almost as wide as the hips and rump. The body should be short and thick, as long bodies lacking in depth and fullness are objectionable to the sheep feeder and to the butcher. The region of valuable cuts of mutton are the same as those of beef, that is, along the back, loin, rump, and thigh; hence these regions should be exceedingly strong and well developed.

Condition and *weight.* — Since the weight depends much on the condition of the sheep, they will be considered together. As weight is a breed characteristic, no definite figures can be suggested, but the animals chosen should be fairly large for the particular breed to which they belong. Among wool sheep the condition should be such as to indicate thrift and health; excessive fleshiness is not essential. In general, the condition must be determined by the touch, as the wool often deceives the eye. Among mutton sheep a fair amount of flesh is desirable, even in the breeding stock, as the tendency to fatten quickly is a very important consideration in this type.

Quality. — Sheep possessing much quality are desired for both mutton and wool production. With sheep, as with other farm animals, quality is determined by the bone, skin, and hair. The bone should be dense, clean, and of fine texture. The skin should be soft, pink in color, and comparatively thin. Care must be exercised in respect to the thinness of the skin, as a thin paper skin is often associated with weakness of constitution. The hair on the ears, face, and legs should be soft and silky. These are important features in sheep intended for wool or for mutton, for breeding or for feeding. Sheep possessing a tight, heavy, pale skin, coarse, harsh hair about the face and on the legs, and heavy rough, coarse bone are deficient in quality.

The *constitutional vigor* deserves much attention, for in its absence the wool will be of poor quality and the mutton sheep an unprofitable animal. Vigor is estimated by the general expression, by the condition of the skin, and by the chest capacity. The expression of the eyes, ears, and head should be mild and lively, and the sheep should be on the alert. The skin should be deep pink and not pale. The chest capacity should be large. A good way to estimate the chest capacity among sheep is to note the distance between the front legs along the floor of the chest. If the distance between the legs is small, it

denotes a narrow chest. A narrow chest is always objectionable, as it may indicate lack of constitutional vigor.

Uniformity. — The importance of uniformity in a flock of sheep chosen either for wool or mutton cannot be overestimated. They should be uniform in type, size, and breeding. While such uniformity may not add to the production of wool or to the ability to take on flesh, it materially improves their general appearance and increases their market value. Either the butcher or the sheep breeder will pay more for a uniform flock than for one in which such regularity is wanting.

Detail characters of sheep

A detailed examination of the characters of sheep is of greater importance than that of any other class of farm animals. This is due to the wool covering many defects. In order that none of the characters be overlooked, they should be considered in order.

The *head* should be short, with strong jaws and large nostrils. The mouth should be examined to note the age and whether any teeth are missing. Sheep with missing teeth are undesirable at any price, either for mutton or wool. The eyes should be mild, bright, and prominent; the forehead broad and full. The ears should be refined, short, and active. Coarse, leathery ears are objectionable, as they indicate poor quality. The horns, if present, should be strong, rather angular at the base, and have a spiral shape turning backward and around, sometimes making two complete turns (Fig. 110).

Neck. — With the flat hand note the length and fullness of the neck. Among mutton sheep the neck should be full, short, and neatly attached to the head and shoulders. In fine-wool sheep it may possess some length, deep folds, and lack the fullness, though it should be neatly attached at both head and shoulders (Fig. 111).

Shoulders. — Among mutton sheep the shoulder should be

FIG. 109. — JUDGING SHEEP. NOTING THE GENERAL APPEARANCE.

FIG. 110. — DETERMINING CONDITION OF TEETH, AND THE AGE.

FIG. 111. — NOTING FULLNESS OF THE NECK.

FIG. 112. — FULLNESS OF THE SHOULDER.

FIG. 113. — WIDTH OF CHEST.

FIG. 114. — WIDTH OF BODY.

full, neat, and closely rounded along the sides and over the top. Sharp, angular shoulders are very objectionable. They should be smoothly curved with flesh (Fig. 112).

Chest. — With the flat hand note the capacity of the chest as follows: kneeling on the left side of the animal, place the left hand on the floor of the chest, between and just back of the fore legs, at the same time placing the right hand on the back just to the rear of the shoulder-tops. In this position one can note lack of depth as well as the narrowness of the chest at both top and bottom. Next note the heart girth and width of chest by placing one hand on either side at the same time. The importance of a wide, deep chest, indicating great vitality, cannot be overestimated. In no other way except by the touch can these dimensions be determined, as the wool covers the parts so completely (Fig. 115).

Body. — With the hands in the same position, one either side of the animal, note the width of the body. Next place the flat hand on the back at the shoulder-tops and note the width and straightness of the back from the shoulder-tops to the tail-head, by pressing down gently as the hand is drawn to the rear. In so doing one must observe that the sheep does not move his back as the hand is passing over and make the back appear swayed when in reality it is not. Since the back, loin, and rump contain the valuable cuts, a close examination of this region is important, and, as in the chest, this can be noted only by the touch (Figs. 114 and 117).

The *rump* should be long, wide, and level. This can be ascertained only by the touch. The fleshiness should be carried well down to the hock, and the twist should be plump and full (Figs. 118 and 119).

The *leg of mutton*, which includes the rump also, is the most valuable cut of mutton; therefore, the thigh should be heavily meated. This can be determined only by the touch, and to do this one places the left hand around the leg at the flank and the right around the rear at the thigh (Fig. 120).

FIG. 115. — DEPTH OF CHEST.

FIG. 116. — FULLNESS AT SHOULDER TOPS.

FIG. 117. — DETERMINING FULLNESS OF BACK.

FIG. 118. — WIDTH OF HIPS.

FIG. 119. — WIDTH OF THIGHS.

FIG. 120. — CONDITION OF LEG OF MUTTON.

The *legs* should be carefully observed. Sheeps' legs are at best far from straight. As a rule, the fore legs of fine-wool sheep are too close together, the knees often almost touching. This is objectionable, for, as we have already observed, fore legs placed close together indicate a narrow chest, which in turn signifies lack of constitutional vigor. Fine-wool sheep also have very crooked hocks, which is equally as objectionable. Often the legs below the hocks are carried too much under the body, the shanks being too slanting. The toes are often neglected and let grow out too long, which throws the legs still farther out of their proper position.

Examining the fleece

In the examination of the wool the chief factors to consider are the quantity, the quality, and the condition. In considering the quantity the entire body must be examined. To note the quantity along the belly and arm pits, the sheep should be turned up and placed on its rump. To turn the sheep, stand on the left side of the animal, place the left arm around under the neck at the shoulder points, with the right hand reach under the sheep, seize the right hind foot, gently lift the animal off his feet, and place him on his rump, belly up. One should have a mat or gunny sack on which to place the sheep to prevent soiling the wool of the rump, particularly if in the show ring. With the sheep in this position, the wool along the belly and arm pits can be carefully noted. These places should be densely covered, though such is seldom the

Fig. 121. — Examining the Fleece for the Finest of the Wool.

case among many of the mutton breeds. In considering the quality, the best method is to open the fleece along the side just back of the shoulder and in the region of the thigh. With the hands placed in a flat position, open the wool just back of the shoulder (Fig. 121). It is in this region that the finest and soundest wool of the fleece is found. With the hands in like position, open the wool along the thigh (Fig. 122). In this region the poorest and coarsest wool of the entire fleece is to be found.

Fig. 122.—Examining the Fleece for the Coarsest of the Wool.

Quantity of fleece. — The chief factors to be considered in determining the quantity of fleece are the density and length, and the evenness of both over all parts of the sheep's body.

By *density* is meant the closeness of the fibers or the number of fibers that grow on a square inch. As a rule the greater the number, the finer the fibers will be; hence the fleece will not only be heavier, but more valuable as well. A dense fleece is desired, as it affords the animal more protection than one that is loose and open; hence sheep with dense fleeces suffer less from catarrhal and other diseases. A dense, oily fleece is impervious to rain, snow, and wind, as well as dirt, dust, and pieces of hay. On the other hand, the loose open fleece becomes saturated with water on exposure, the sheep catch cold, suffer from catarrh, running at the nose, scouring, and various other diseases, and the fleece becomes loaded with dust, dirt, and chaff.

The *length* of the fleece is one of the important features in considering the quantity. The length is a breed characteristic, and the only suggestion that can be made is that it should be

long for the particular breed concerned. The length will vary from approximately two inches in the case of the fine-wool to twenty and even more inches for a single year's growth in the case of some of the long-wool breeds.

Quality of fleece. — The chief factors to be considered in determining the quality of the fleece are the softness, crimp, and the soundness. Quality and quantity are not associated; that is to say, as a general rule the shorter-wool breeds of sheep possess the finest quality of wool. As stated, the finest quality of wool is located over the heart region and the poorest quality on the thigh.

The *softness* is estimated by pressing the fleece with the closed hand. The amount of oil or yolk influences the softness to a considerable extent; also the management, the kind of food, and the nature of the soil. Providing the sheep suitable quarters, feeding foods rich in fat, and pasturing them on clay soils, all have a tendency to increase the softness of the fleece. Chalky soils, on the other hand, are noted for emphasizing harshness of the fleece. Harshness is due in a large measure to the absence of yolk, which results from exposure, lack of proper food, ill health, and the like.

Crimp refers to the folds or spirals of the fiber. The crimp should be fine, close, and regular from one end of the fiber to the other, as this indicates wool of finest quality. If the crimp is irregular, short and close in places, long and wavy in others, the fiber is probably unsound. In all coarse wool, the crimp is open and wavy.

Soundness indicates that the fiber should be strong from end to end, as it usually will be if the crimp is fine, close, and regular. To furnish an additional guide in locating unsoundness, remove a small lock of the wool and stretch evenly and gently until the strength becomes apparent. If the fibers each break in approximately the same place, it indicates an unsound place in the wool. When such break occurs near the

bottom, it is spoken of as "weak bottoms"; when near the middle, "weak middles," and when near the top, "weak tops." If the fibers are resistant, each breaking in a different place, and the crimp fine, close, and even, the fiber is sound.

Condition of the fleece. — The chief factors to be considered in determining the condition of the fleece are its purity, luster, brightness, and the oil or yolk. The condition of the fleece is influenced by breeding, feeding, and management, some breeds possessing much brighter wool than others, some foods produc-

FIG. 123. — AMERICAN MERINO EWES. Owned by W. M. Staley, Marysville, Ohio.

The American Merino developed from the Spanish Merino, although they have been much improved in America. This breed is noted particularly for the strong, fine, and heavy fleece. Ewes shear from 10 to 15 pounds, while rams easily attain 20 pounds of fine wool. In weight the ewes reach 100 pounds and up, while the rams weigh 130 pounds and up, often attaining 200 pounds. This breed is very popular in the United States.

ing more yolk than others; and providing suitable quarters and giving proper care keeps the wool much more clean than otherwise.

Purity refers to the freedom of the fleece from foreign material. In the absence of proper management, where sheep are long exposed to conditions opposed to thrift, the wool has a tendency to revert to its original form. Hairs and dead fibers, often called "kemp," make their appearance. The fleece that is loose and open often accumulates much chaff, pieces of

hay, and the like. This foreign material is very injurious to the fleece, as it is difficult to remove, does not absorb dyes, and interferes in the manufacture of cloth.

Luster refers to the glistening appearance of the fiber. On being held in the light the fiber appears as if it were varnished. Luster is independent of oil, as fibers possessing a small amount of oil or yolk may be very lustrous, while other fibers possessing much oil may be rather dull. The significance of this luster is that wool possessing it more readily takes delicate dyes.

Brightness refers to the color of the fibers. Wool is spoken of as bright or dark, the former signifying a clear white color, the latter signifying the darker colors.

Yolk refers to the oil or grease that is found in the wool. This oil is readily recognized by running the hand over the wool. The various breeds differ widely in the amount of oil secreted and the amount is influenced by the food. Yolk is desirable as the fleece is much softer, more compact, as well as brighter and cleaner, and in addition it indicates thrift in the sheep. Excessive quantities of yolk are of no advantage, and may be a source of direct loss, especially in the manufacturing of woolens.

Summary.—In the examination of wool, therefore, one must consider first the quantity, second the quality, and third the condition. Under quantity note the covering over the entire body, including the belly and arm pits, also the density and length which should be even over the entire body; under quality note the softness, crimp, and soundness; and under condition note the purity, luster, brightness, and yolk.

CHAPTER XVII

FEEDING SHEEP

SHEEP are among the most difficult of farm animals to feed. Thorough familiarity with their habits is essential to success. No other farm animal is less understood by the masses of American farmers. A knowledge of their peculiar characteristics can be gained only by a careful study and much experience in handling the animals. Sheep are naturally very timid in their disposition, very dainty feeders, and are easily frightened out of their appetite. A sudden noise or disturbance of any kind, as the bark of a dog, will often greatly frighten them and sometimes create a stampede or panic in the entire flock. Sheep have a natural aversion for strange dogs, and one coming near the flock will cause the sheep to run, which excites the dog to the chase, not necessarily because he is a vicious dog but because of his nature to give chase to whatever flees from him. In the excitement of the chase, the dog may tear the skins of the sheep with the teeth, sometimes inflicting fatal wounds. Sheep thus chased may die of exhaustion, and the entire flock will shrink badly in weight. In most cases if the sheep would stand their ground, the dog would not give chase. As goats do not ordinarily run from dogs, one or two placed in the flock often prevents the sheep from becoming frightened. The difficulty is to get the goats to stay with the flock. It may be necessary to raise the goats with the flock to teach them to remain with it at all times. It is very apparent that if sheep are to be profitable, they must be kept free from all

such excitement, and all unnecessary noise must be avoided. To avoid startling the sheep, herdsmen often make it a practice to whistle or talk to them as they approach.

Sheep are the most susceptible of farm animals to the ravages of parasites, both internal and external. These parasites in some one or more of their many forms are responsible for the larger number of failures in this country. No part of our land is free from them all. In certain localities one form will be the more destructive, in other localities another form is to be dreaded. For example, in the corn-belt the stomach worm (*Strongylus contortus*) is by far the most serious, while in the far West, scab is the more troublesome. As a rule little attention is given these parasites; the flock becomes infested, many of the sheep become ill and die, and the others fail to thrive, and sometimes the owner does not know what causes the trouble.

Sheep possess a very dainty appetite. The food must be attractive when placed before them or they are likely to refuse it. Any food left in the feed boxes must be removed as soon as the sheep are through feeding. If such food is left, it undergoes slight change, becoming sour, and when the fresh food is placed in this, the sheep refuse it entirely. Sometimes the trough in which the grain is fed is placed beneath the hay-rack in such a way as to collect the dust, dirt, and chaff that sifts from the hay. This construction, while economical of material and space, is objectionable because the grain trough cannot be kept clean as it should be, with the result that occasionally the sheep refuse the grain.

While sheep can withstand the cold without suffering much inconvenience, they cannot endure the rain or snow that saturates their wool, nor dark, damp, and poorly ventilated quarters. Such conditions lead to colds, running at the nose, catarrh, inflammation, diarrhea, and all kinds of sheep diseases. From this it follows that if sheep are to prove profitable, they

must be kept quiet; all unnecessary excitement avoided, properly nutritious foods and suitable quarters provided.

FOOD REQUIREMENTS OF SHEEP

The quantity of food required by sheep depends on many factors, chief of which are the kind of food, and the age, weight, condition and individuality of the animal as well as the chief product sought, whether wool or mutton.

Since foods vary widely in the energy they contain as well as in their influence upon wool or mutton production, and since young animals, for an equal weight, require more food, and of a different kind than older animals, it is not possible to state exact amounts. The Wolff-Lehman standards, however, will serve as a guide to be modified to suit the foods, animal, and conditions. These standards (p. 380) were arranged to meet the need of the average farm sheep under normal conditions, and as general guides to be varied in practice as circumstances suggest.

Sudden changes in the food of sheep are to be avoided for the reason that the alimentary system, in many cases, is unable to accommodate itself at once, and digestive disorders follow. Such changes sometimes result in bloating, as when sheep are transferred from a dry to a watery diet, from the dry-lot feeding of winter to the early spring pasture where the grass is very succulent. Some pasture grasses are very likely to produce bloating, particularly alfalfa and clover. In regions of considerable rainfall and much dew, alfalfa is serious in this respect.

Fresh cool water should be available at all times. In winter, when it is exceedingly cold, sheep are not likely to drink very much, but if one is to succeed with them, they must have free access to water. Sheep are peculiar in their habit of drinking as well as eating, and if watered at intervals, do not do so well as when the water is available at all times.

Salt in limited quantities should be kept before the sheep.

It is especially useful in the spring when the grass comes, and no doubt often checks bowel troubles when the sheep have free access to it.

Wolff-Lehman standards, showing the amount of food required per 1000 *pounds live weight for both wool and mutton as well as growing, mature, and fattening sheep*

Condition of Animal		Dry-Matter	Digestible Nutrients			Nutritive Ratio
Growing Sheep Wool Breeds						
Age, Mo.	Weight		Protein	Carbohydrates	Fat	
4–6	60	25	3.4	15.4	0.7	1 : 5.0
6–8	75	25	2.8	13.8	0.6	1 : 5.4
8–11	80	23	2.1	11.5	0.5	1 : 6.0
11–15	90	22	1.8	11.2	0.4	1 : 7.0
15–20	100	22	1.5	10.8	0.3	1 : 7.7
Growing Sheep Mutton Breeds						
4–6	60	26	4.4	15.5	0.9	1 : 4.0
6–8	80	26	3.5	15.0	0.7	1 : 4.8
8–11	100	24	3.0	14.3	0.5	1 : 5.2
11–15	120	23	2.2	12.6	0.5	1 : 6.3
15–20	150	22	2.0	12.0	0.4	1 : 6.5
Mature Sheep						
Coarse wool . .		20	1.2	10.5	0.2	1 : 9.1
Fine wool . . .		23	1.5	12.0	0.3	1 : 8.5
Breeding ewes with lambs . .		25	2.9	15.0	0.5	1 : 5.6
Fattening sheep, first period . .		30	3.0	15.0	0.5	1 : 5.4
Second period . .		28	3.5	14.5	0.6	1 : 4.5

FEEDING THE FLOCK

The feeding of the flock deserves special attention. The flock is often sadly neglected; it is pastured along lanes and

highways, in woodland and marshland, or in hilly land in summer; given the protection of the woodland or straw stack; and fed at intervals during the winter; and as a result of such treatment the sheep become affected with parasites, both external and internal, many may die; all are unthrifty, and the owner becomes discouraged, selling the animals for little or nothing.

FIG. 124. — RAMBOUILLET RAM. Photograph by *National Stockman and Farmer*

The Rambouillet breed of fine-wool sheep developed in France, although tracing to Spanish origin. This breed is similar to the Delaine, but possessing more size, the rams weighing from 150 to 225 pounds, the ewes 125 to 175 pounds. The fleece is the lightest of the fine-wool sheep, the rams shearing from 10 to 20 pounds and the ewes from 8 to 12 pounds.

The flock in summer

Unlike stock cattle, the flock must receive careful attention in summer as well as in winter, particularly in those regions infested with stomach worms, — the sheep's greatest enemy.

These worms have done more to discourage the propagation of sheep than all other causes combined, especially on the fertile farm lands in the central states. These pests seldom trouble sheep in cool regions, or in cold weather. Lambs are especially susceptible to attack, the older suffering much less and being more easily managed in summer. Because of the cool weather, the New England states, northern New York, Ontario, upper Michigan, and northern Minnesota and Wisconsin are comparatively free from these pests. Only occasionally do stomach worms trouble sheep west of the corn-belt, and there they may be avoided by clearing up the watering places. Much of the cheap farm land throughout this section could be put to the profitable production of sheep.

Pasture for sheep. — Pastures for sheep need similar care to those suggested for cattle. The stand of grass, the drainage of the soil, and keeping down the weeds deserve much attention. It is even more important that they be kept free from weeds, particularly burrs of various kinds, as they are especially injurious to the wool (page 286).

Sheep thrive on pasture as nowhere else. They are particularly adapted to grazing short forage, and prefer it, as it is tender and juicy. In fact, sheep often keep parts of the pasture grazed so closely as to injure the plants, while the grass in other parts of the same field is left to grow up and seed. This can be prevented in part by mowing the entire pasture twice each year. The sheep will then pasture on the tender second growth.

Turning to pasture. — Care should be exercised in turning sheep to pasture, otherwise some of the flock may be troubled with bloat. The extent of the trouble depends much on the condition as well as the kind of grass, young succulent grass being more troublesome than older and riper grass, and alfalfa or clover more than blue-grass or orchard-grass. In regions of much dew, alfalfa is likely to be the most troublesome of all. After alfalfa becomes woody there is not so much danger from

bloating. Mixed grasses are also less dangerous. There are many methods suggested for turning sheep to pasture. The following is as good as any; when the grass is very succulent, make the change from dry forage to pasture gradually; that is, after feeding the sheep, turn to pasture say two hours during the middle of the first day, taking the sheep off the pasture before the dew falls. The second day leave them on a little longer, and by the fourth or fifth day they may remain in the pasture over night. When the sheep are familiarized with the pasture in this way, they must be carefully noted the next morning to see that none is suffering from bloat.

Tagging the sheep. — When sheep are first turned to pasture, the succulent grass often induces a more or less lax condition of the bowels. The soft dung soils the wool below the tail-head, causing the parts to become foul, and may produce troublesome and vicious sores unless given attention. Such troubles are not likely to occur when the sheep have been shorn previous to turning to pasture. If, however, it is desired to turn to pasture before shearing, the wool should be carefully clipped away beneath the tail-head and along the inside of the thighs behind.

Change in pasture. — When convenient, an occasional change of sheep from one pasture to another will prove advantageous. On farms heavily stocked with sheep there are two reasons for this: first, the change gives a chance for the fresh grass to grow, thereby preventing the sheep from cropping parts of the pasture too closely; and, second, it lessens the danger from parasitic germs by allowing the larvæ to die before finding lodgment in the sheep's body. More satisfactory results would be obtained by dividing large pastures into several small ones, and pasturing them in turn from the time warm weather sets in until the cool weather of the fall. While this system would no doubt largely enable the sheep to escape parasite infection, it involves extra equipment in the way of fencing, shade, water supply, and the like, and there may be other means of accomplishing the

desired end without the extra expense, such as by the use of sown pastures.

Providing shade. — Sheep on pasture should be given protection from the sun. They are fond of shade and will seek it,

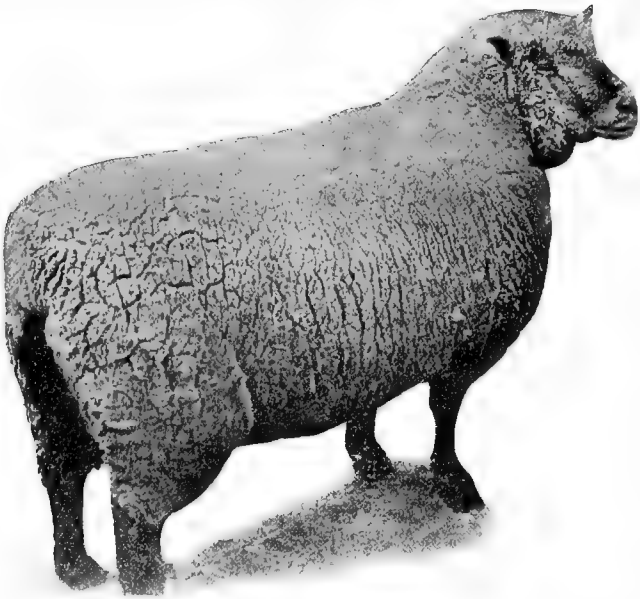

FIG. 125. — SOUTHDOWN EWE. First prize ewe, International Live Stock Show, 1909. Owned by Chas. & Jas. Leet, Mantua, Ohio.

The native home of the Southdown breed of mutton sheep is in England. This breed is noted for its rapid maturing qualities, and its delicious mutton. In outward appearance the animals are perfect. In weight the rams average about 175 pounds, and the ewes 135 pounds. As a wool breed it occupies a subordinate place, the fleece not weighing much over 4 to 8 pounds.

even though all they can find is that provided by the shade of a wire fence-post. They will spend much of the time in the shade during the heat of the day. Unlike cattle, the shade tree is not sufficient for sheep, artificial shade being much preferred. The

great objection to the shade tree as a resting place for sheep is the danger of parasite infection. (There is also danger from lightning.) There is an accumulation of droppings, which either bear or afford a convenient brooding place for such harmful parasitic germs as "grub in the head," throat worms, stomach worms, nodular disease, and the like. The droppings encourage the growth of sweet rich grass near the tree. The germs are harbored about the base of this sweet grass.

When the pasture is near the shed or barn, no better shade can be provided than to give the sheep the freedom of these quarters, which should then be slightly darkened by hanging blankets or gunny sacks over the windows. A blanket may be so hung over the door that the sheep in passing into the shed will brush the flies off their backs. The shed or barn should be kept well bedded, as this preserves the manure which otherwise would be largely wasted. Hay kept in the racks will prove advantageous, as the sheep will eat much of it and be benefited thereby. If small sheds are provided in the field, they should be placed on runners in order to move them from place to place as the sheep are changed from one field to another. This plan scatters the manure more thoroughly and does away with much of the evil caused by parasites. These shades need be only a roof and may be made of pine boards, as it is not essential that they be rain-proof. They need not be high. Such a roof sixteen feet square will provide shade for a flock of forty sheep.

The use of sown pastures. — The best way to care for the flock in summer, in order to avoid parasite infection, particularly with a flock of lambs, is to sow special pasture crops for the flock. In this way the owner may have various green forage crops coming on regularly at different times, and thus avoid having the sheep graze on the same area for any considerable time. It avoids practically all danger from the many parasites that attack sheep during the summer season. There are many plants

that may be used as green feeds for summer pasture, chief of which are rye, oats, alfalfa, clover, rape, kale, cabbage, turnips, and pumpkins.

While it is less trouble to provide permanent pastures and grow the common farm crops for the sheep, and while sheep may be maintained upon them alone, it is nevertheless essential to highest and healthiest development. Such food aids in escaping the ravishes of the parasites. Rape, kale, cabbage, and turnips add to the healthfulness and soundness as well as the quality of the wool, and pumpkin seeds are among the best vermifuges known. The owner who is to attain greatest success with sheep will find it necessary to grow such supplementary foods. They need not necessarily occupy extra land, as both rape and pumpkins may be grown in the corn field and the corn not be injured thereby ; or they may be grown similarly to soiling crops for dairy cattle (page 220). There will be extra labor connected with harvesting and feeding, but the advantage will pay many times over. It is these little things that make sheep farming profitable.

The flock in winter

In winter the flock is entirely dependent on the care of the owner, and it must receive more careful attention than during the summer. This is the season of catarrhs, running at the nose, inflammation, diarrhea, and the like. When convenient, the change from the fields to the yards should be made gradually. The flock should be yarded at night as soon as the pastures become crisp from night frosts, as frosty forage is likely to lead to digestive disorders. Hay should be provided in the lot, so that the sheep will not go to pasture hungry in the forenoon. If on permanent pasture or where there is much old grass, such yarding is not so necessary, as the sheep will feed on the dead grass in preference to the frosty succulent grass.

The winter ration. — The feeds that should enter into the

winter ration will depend on the kind available. If convenient, succulence of some kind should be provided. On farms where there are silos, nothing is better than corn silage. In the absence of silage, roots will serve, some sheep owners even preferring roots to silage. The roots suggested for late fall use, such as mangels and ruta-bagas, will serve admirably. When such succulence is available at the time of changing from pasture to dry-lot, the sheep will suffer no loss whatever. In the absence of silage or roots, a little wheat bran, oats, linseed meal, or similar grain should be fed, particularly to the ewes that are to lamb in the spring. The advisability of feeding grain when succulence is available will depend on the kind of dry forage being fed and

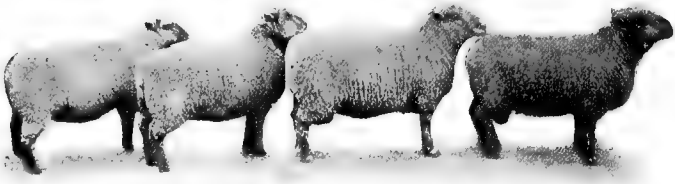

FIG. 126. — SOUTHDOWN LAMBS. A prize pen, owned by Chas. & Jas. Leet, Mantua, Ohio.

on the use to which the lambs are to be put. If winter lambs are desired, grain should be fed. On the other hand, if ewes are not to lamb until time of going to grass, and the dry forage consists of clover, alfalfa, or mixed hay, then the grain may be dispensed with at least until the sheep show signs of falling off in flesh. It may be of advantage to begin grain feeding four to six weeks before lambing time.

Exercise. — In order to keep the sheep healthy and thrifty they should take exercise daily. This often becomes a serious problem in the cold climates when the ground is covered with deep snow much of the winter season. It may be advisable to

remove the snow from parts of the lot and feed them some dry forage in some spot not too near the winter quarters.

Care of the feet. — During the winter season when the sheep are rather closely confined, it is important to watch the feet and see that the toes do not grow out too long, as they very often do at this season of the year. Long toes should be trimmed. The aim in trimming should be to keep the feet natural, so that the sheep stands squarely upon them. Lack of trimming is sometimes responsible for diseases of the feet. The toes may be trimmed with a sharp knife, a chisel and block, or better still a sharp hand pruning knife; take care not to cut them too short, for if the quick is cut, the feet will get very sore and prove very annoying. If the hind parts become foul tag as suggested on page 383.

Bedding should be used liberally, otherwise the floors will become damp and foul smelling. Sheep lying on damp, filthy beds are subject to the same ills as those exposed to draughts. Fresh bedding is of greatest importance during the lambing season, as damp, filthy quarters are particularly hurtful to lambs and will soon prove fatal to them. At this time, fresh bedding should be put down daily. This not only increases the healthfulness of the sheep-fold, but increases the quantity of valuable manure as well.

FATTENING SHEEP

Feeding sheep to fatten them differs considerably from feeding the flock in general or feeding for the production of wool; it is somewhat similar to feeding cattle for the production of beef.

Growing winter lambs

In recent years a considerable demand has developed for winter lambs, particularly in the eastern cities. Because of the forced methods of feeding adopted in pushing the lambs forward so as quickly to prepare them for market, they are spoken of as

"hot-house" lambs, a term which has misled many as to the conditions under which the animals are raised. The high price that these lambs command on the market has led many to think the demand only a fad that will soon pass. While the demand could no doubt be oversupplied, it has managed to take care of the supply and bids fair to continue to do so for some time to come, particularly all that can be supplied from Christmas to Easter. Many sheep owners have not attempted to raise winter lambs because they did not know where to find a market, not realizing that such lambs are a regular product upon the provision market and can be sold through any commission merchant. Some persons have not gone into the business because they think it difficult to prepare the lambs for market; but this is an easy task, as any one can prepare a carcass who is willing to exercise a little care.

Foundation stock. — There are two characteristics that the foundation flock must possess for the production of winter lambs: the ewes must drop the lambs in the fall and early winter, and this is perhaps the greatest difficulty in winter lamb production; and the ewes must be good milkers in order to nourish the lambs well, as they should weigh fifty to sixty pounds at ten to twelve weeks of age. All things considered, it is thought best that the sheep composing the foundation flock, for the production of winter lambs, be grades rather than pure-bred animals. The mutton breeds would, of course, produce the best lambs, but they will not breed at the proper season. The Merino bears lambs fairly early, but the lambs grow too much wool before they have size or are fat enough for the market.

The best plan is to choose a grade Merino flock. Put it on good pasture and mate the ewes with a good, vigorous pure-bred Horned-Dorset ram. The lambs of this mating will probably be dropped in January, February, and March. This crop will come too late for winter lambs. The ewe lambs should be saved for breeding and the others may be fattened for spring lambs. The

grade flock should be shorn rather early, in March or before if the quarters can be well protected for a few days. In May turn the sheep to pasture and in addition feed considerable stimulating grain, such as ground oats, or bran, and, at the same time, mate to a thrifty, vigorous pure-bred Horned-Dorset ram by turning the ram to the flock each morning, as suggested on page 407,

FIG. 127.—SHROPSHIRE RAM "DAVISON'S AMBITION." Champion, International Live Stock Show, 1909. Owned by Dr. G. H. Davison, Millbrook, N. Y.

The Shropshire Down breed of mutton sheep originated in the county of Shropshire, England. This breed is similar to the Southdown, but somewhat larger, the standard weight for mature rams being 225 pounds, with 150 for the ewes. It, also, is noted for its early maturing qualities and delicious mutton. As wool-producers this breed excels the Southdowns, bearing from 5 to 10 pounds of medium-length wool. This breed is extremely popular in the United States.

rather than letting him run with them all the time, and at the same time marking the ewes served for identification. This system of mating should result in the lambs being dropped in October, November, and December. It is not considered a

good plan to have the lambs dropped before the ewes go into winter quarters, as the lambs then entirely escape danger from stomach worms and as a rule can be taught to eat grain much younger.

After purchasing the grade Merino flock, some persons prefer to give the ewes a year's rest, shearing them in March and beginning the breeding in May. This has the advantage that the ewes are not nursed down in flesh as a result of raising a crop of lambs. Whatever system is used, the ewes must have weaned their lambs sometime previous to going to pasture, they must have been shorn for some time, and they must be gaining in flesh while mating. With such a flock thus treated, there should be no difficulty in having the lambs dropped in the late fall and early winter months.

The winter quarters for winter-lamb production. — In the discussion on care and management will be found a statement of the method and equipment for housing sheep (page 433). The term "hot-house" lambs has led many to think that extra warm quarters must be provided, some thinking that artificial heat must be used, others that the roof or side of the sheep barn should be of glass construction resembling a green-house. Not only is such extra equipment unnecessary, but if the quarters are too warm, neither the ewes or lambs will thrive. On the other hand, winter lambs cannot be grown if the ewes are exposed to the rain, snow, or storm. The winter quarters must be well lighted, well ventilated, and free from draughts. There should be sufficient window space to make the quarters light and comfortable. Artificial heat is entirely unnecessary.

Feeding the lambs. — The ewes should be fed milk-producing foods, such as wheat bran, silage, and clover hay, in order that the milk flow be large, but in addition to the dam's milk the lambs should be taught to eat grain as soon as they will take to it. Some lambs will begin to nibble grain when only ten days or two weeks old, and they should be encouraged to do so. A lamb

creep should be provided. This "creep" consists of a little pen with openings so small that the lambs may pass in and out at will, but through which the sheep cannot pass. These openings may be made of vertical slats placed seven inches apart, and the edges of the slats rounded. These must be conveniently placed for the lambs or they will fail to find them, as the young lamb is largely a victim of circumstances. The grain boxes within the creep should be flat-bottomed and placed rather low. The first feed put into the trough may be wheat bran, to which has been added a little brown sugar. At first it may be necessary to aid the lambs by placing some of this mixture on their lips. The troughs

FIG. 128.—CHAMPION SHROPSHIRE EWES. An almost perfect flock. Owned by Dr. G. H. Davison, Millbrook, N. Y.

must be cleaned daily and the food kept fresh. After the lambs have learned to eat grain, the following mixtures should be used: 50 parts of cracked corn, 50 parts of wheat bran, and 10 parts of oil meal, coarse ground. This may be varied by adding oats, barley, or gluten feed as circumstances demand. A fresh supply should be provided each day. Lambs thus cared for should grow rapidly and fatten at the same time, so that by the time they are ten to twelve weeks of age they will weigh from 50 to 60 pounds, when they should be slaughtered. The most desirable weights vary somewhat on the different markets, and the owner

should find out what weights are mostly in demand. The weight demanded will range from 45 to 65 pounds, — not more, as they will not sell for hot-house lambs if larger. The lambs must in all cases be fat, as it will not pay to ship a thin carcass to a winter-lamb market.

Dressing winter lambs. — Dressing winter lambs requires some skill, — not more, however, than dressing a squirrel, — and any one can develop the required skill after carefully reading the directions and practicing on a few lambs. The methods vary somewhat, but the following is as simple and efficient as any: Suspend the lamb by fastening a rope around the hind legs so that the head comes within a foot of the floor. With a sharp-pointed knife sever the artery and vein in the neck close above the head. It is very important to have the lamb thoroughly bled out. Bright red blood gives this assurance. It is well to hold the head, otherwise the lamb will throw blood over the operator and may soil the wool. As soon as the lamb ceases to struggle, remove the head. This can be easily done if severed at a vertebra. Place the carcass on a table. Remove the front feet and cannons at the knee. Loosen two or three inches of hide along the front of the cannons to cover the joints. Remove the hind feet at the pastern joints. Slit the skin from the tail to the brisket. Loosen and remove the skin along the

FIG. 129. — DRESSING HOT-HOUSE LAMB, SHOWING METHODS OF REMOVING THE HIDE FROM THE ABDOMEN.

Fig. 130.—Hot-house Lamb dressed and ready for Wrapping.

floor of the abdomen and for about four inches up the inside of the hind-quarters (Fig. 129). Suspend the carcass by the hind legs. Open the lamb and carefully remove the caul fat, — a sheet of fat surrounding the intestines. Save the caul fat to cover the openings, and if the weather is cold, put in warm water. Remove the intestines, stomach, and esophagus, and in warm weather the liver, heart, and lungs, though these may be left in when the weather is cold. Procure two spreaders or back-sets twelve or fourteen inches long, depending on the size of the lamb. These back-sets should have shoulders about one inch up from the pointed end to prevent them from entering the flesh too far. Insert one in the outer and upper part of the hind flank, then cross the back diagonally, entering the opposite side nearly or quite as far forward as the chest. The second crosses the first at right angles across the back. Carefully spread the caul fat over all exposed flesh, holding in place by means of tooth picks (Fig. 130). Make small slits in it over the kidneys

and pull them through. Hang the carcass in a cool place for twelve to twenty-four hours. As soon as the animal heat is given off wrap in two separate wrappers. The first may be of cheese-cloth or muslin, which should be drawn tight to prevent soiling when handling. The outer covering may be of burlap or sacking and must be well secured. The lamb is now ready for consignment to a provision commission merchant (Fig. 131). When the lambs are to be shipped a long distance, they are often crated, placing three carcasses in a crate. In warm weather ice may be put between the lambs but never in them. The lambs should be dressed, as they are ready for market, preferably sending a few each week during the season which runs from Christmas to Easter.

FIG. 131.—HOT-HOUSE LAMB WRAPPED AND READY FOR SHIPMENT.

After the lamb is removed, the udder of the ewe must be watched closely and not permitted to spoil. If necessary, remove the milk by hand for a few days.

Growing spring lambs

Because of the difficulty in getting ewes to conceive sufficiently early for the growing of winter lambs and the disadvantages of dressing and marketing, many sheep owners prefer to grow spring lambs. There is much profit in selling lambs afoot in May and June. Usually the highest prices are obtained in June, as at this time the supply of winter-fed western lambs is exhausted and the summer-fed lambs are not yet on the market in any considerable number.

The foundation stock and the management should be much the same as that suggested in growing winter lambs. The ewes should be mated in August, September, and October, as the lambs should be dropped in late January, February, and March, not later than March. The lambs should be provided with creeps and fed grain in the same manner as advised for winter lambs; for if they are to be marketed in a thick fat condition at the age of four or five months, they must be forced from the beginning. It is rather difficult to fatten lambs for the spring market if they once lose their baby fat. Lambs thus cared for should be able to make a vigorous start before grass comes and be in condition to make the most of it when turned to pasture.

Lambs dropped in February and thus cared for should make a weight of approximately eighty pounds by the middle of June. As this is the weight demanded of this class of mutton, it should be the aim of the sheep owner to supply it. When there are several lambs or when one is located convenient to market, it may be advisable to make two drafts, selling the larger and fatter ones say the first of June and the remainder of the lamb flock the latter part of the month.

Feeding lambs in the fall

Lambs may be fattened at almost any season, but ordinarily the fattening period extends from September until the follow-

ing May. Fall feeding is extensively practiced both by the farmer who raises his own lambs and by the sheep feeder who buys his lambs either locally or from the western range and fattens them in seventy to one hundred days. Fall feeding is practical on pasture, either permanent or sown, when supplemented by feeding grain. The various pastures that may be used for this purpose are the same as those suggested for the flock in summer (pages 382 to 386).

Getting the lambs on full feed. — Much care must be exercised in getting a flock of lambs on full feed, particularly if they are from the range and not familiar with grain. Furthermore, many of the plants used in fall pastures for fattening lambs are likely to produce bloating, and for this reason much care must be exercised in turning the flock to pasture, particularly if the grass is composed of alfalfa, clover, or rape plants. These are most excellent crops for fattening lambs in the fall, but due care must be exercised in turning on the sheep. The grain should be fed sparingly at first and gradually increased from day to day until the full amount is being fed. Most satisfactory results can be obtained by feeding the grain twice daily. Care must be exercised never to feed more than the lambs will consume; or if there is any grain remaining, it should be removed before a new supply is placed in the troughs.

Lambs thus cared for should make rapid and economical gains. Under such feeding, 60-pound lambs should attain a weight of 85 pounds in 75 days and be sufficiently fat for the market. Thus, lambs put on feed September 1 would be ready for the market November 15. As suggested in the case of spring lambs, when the flocks are sufficiently large and the sheep feeder is located conveniently near to market, it will, as a rule, pay to make two drafts, selling the fattest at the end of about 75 days and the remainder of the flock in 90 to 100 days. This keeps the two flocks more even and avoids holding those already fat for the slower maturing ones to

fatten, and avoids selling a few thin in flesh after the majority have fattened.

Fattening lambs in winter

By far the greater number of lambs are fattened during the winter season. The methods employed differ fundamentally in different localities. In the West little or no attention is paid to shelter, and exercise is considered essential; in the corn-belt much attention is given to the shelter, at least to protect the lambs from the rain, snow, and storm, and to provide them dry footing and exercise; in the East, where lamb-feeding is rapidly developing, shelter is considered essential, though exercise under the methods employed is likely to prove fatal, and the sheep must be kept absolutely quiet or trouble will result.

Feeding in the semiarid West. — Large flocks of lambs are shipped from the ranges to points where alfalfa hay is available. Here the sheep are confined in corrals which are divided into lots containing approximately 500 head. No shelter is provided other than that furnished by the fence or the alfalfa hay which is often stacked near by. Rain and snow storms are rather infrequent, and it is felt that the loss occasioned by the lack of protection is less expensive than shelter. These corrals provide accommodations for many thousands of sheep. To save labor in feeding, the lots are arranged in rows with feeding lanes between. In these lanes the hay is stacked and fed out each morning and evening. Sometimes the fence has a space between the first and second boards large enough for the sheep to introduce its head, and the rack is arranged on the stack side of the fence. In each lot are placed rows of grain troughs sufficient to accommodate the entire flock. These lots are provided with water, often pumped by windmills, though sometimes by hand or with an engine. Salt is kept before the animals at all times. In this way five men can care for 10,000 or 12,000 head of sheep.

Feeding in the corn-belt. — In the corn-belt the practice is entirely different; in the West sheep are fed in larger numbers and by few men, while in the corn-belt few sheep are fed by great numbers of farmers. Here feed, both grain and hay, is very abundant, but the climate is the objectionable element. Sheep need dry coats and dry footing. The dripping skies of the corn-belt makes this impossible without providing shelter from the rain and snow. Hence, before attempting to feed lambs ample provision must be made to shelter them.

Much care should be exercised in getting the lambs on full feed. The lambs may be fed hay liberally, but the grain must be fed sparingly, beginning with one-fourth pound to the head daily and gradually increasing the ration to one pound by the time the sheep have been on feed three weeks, and continuing until they are getting all they will consume. The lambs should not be fed more grain than they will clean up at each feeding. As the grain is increased, less hay will be required. Lambs thus cared for should make a gain of 25 to 30 pounds in 100 days, when they should be fat and ready for the market. If desired, two droves of lambs may be fed each winter, purchasing the first drove in November and fattening by the last of January, immediately purchasing a second and fattening by the first of May. This system is extensively practiced when feeds are comparatively low and mutton high.

Feeding in the East. — During the recent high price of mutton many lambs have been fed in the eastern part of the United States, and the methods are peculiar to the East.

The feeding pens are usually rectangular in shape, with hay-racks and grain-troughs the entire length of either side. These grain-troughs are protected with vertical slats so arranged that there is just room for one lamb to feed in each opening, and there are just as many of these openings as lambs and not one more. When the lambs are feeding, they are packed solid along either side of the pen. The space allowed each pen is approximately

twice the room on which they stand while feeding. Water and salt are supplied in this pen, and the lambs do not leave it from the time they are put in until they are finished and ready for the market. The lambs are put on full feed in about three weeks and forced until fat.

FIG. 132.—HAMPSHIRE RAM. Champion, International Live Stock Show, 1908. Photograph from *National Stockman and Farmer.*

The native home of the Hampshire Down breed of mutton sheep is in Hampshire County, England. This breed is noted for its large size and its mutton qualities. Mature rams should weigh about 240 pounds and the ewes 180 to 200 pounds. In general appearance this breed is somewhat coarser than either the Southdown or the Shropshire, but in quality of the mutton is not inferior to either. As a wool producer the breed does not rank high, the average yield being about seven pounds, which is inferior in quality to wool of either the Southdown or the Shropshire.

Two factors deserve special attention, and they are at variance with accepted ideas. First, there must be no more feeding space than lambs; and second, the lambs must be prevented from being excited. A violation of either of these will prove fatal in

this method of feeding. Formerly those engaged in lamb feeding lost many lambs without apparent cause. They were the thriftiest and fattest lambs, and the loss was often very heavy, for when one lamb died, others were sure to follow. This led to experimentation which brought out the following facts: the lambs died of apoplexy, the result of overeating or of excitement. When one lamb died, this left an extra feed space, another lamb overate and died of the same cause. When the feed space was closed as a lamb was removed and the amount fed was cut down accordingly, and when the animals were kept perfectly free from excitement, no fatalities occurred. In all other respects, such as the feeds used, watering, salting, and the like, the lambs were treated the same as suggested for corn-belt feeding.

SAMPLE RATIONS FOR FATTENING SHEEP

The following rations are collected from various sources, to furnish a guide in determining the kind and amount of feed that should be allowed fattening lambs. In all cases the rations are calculated for 100 head:

Weight of Lambs	Ration		Food per Pound Gain	
	Grain	Dry Forage	Grain	Dry Forage
55 lb.	92 lb. corn 13 lb. oats	110 lb. mixed hay 112 lb. roots	4.7	4.7 5.0[1]
56 lb.	49 lb. bran 37 lb. linseed meal 37 lb. cotton-seed meal	147 lb. hay 143 lb. roots	4.5	5.4 5.3[1]
111 lb.	140 lb. speltz 10 lb. bran	180 lb. clover hay	3.5	4.2
110 lb.	140 lb. soy beans 10 lb. bran	180 lb. clover hay	3.5	4.7

[1] Roots.

Weight of Lambs	Ration		Food per Pound Gain	
	Grain	Dry Forage	Grain	Dry Forage
109 lb.	93 lb. corn 45 lb. gluten 10 lb. bran	180 lb. clover hay	3.2	4.2
109 lb.	135 lb. corn 10 lb. bran	180 lb. clover hay	3.2	4.2
82 lb.	149 lb. shelled corn	104 lb. clover hay	4.8	3.3
80 lb.	81 lb. shelled corn 81 lb. bran	107 lb. clover hay	6.4	4.2
85 lb.	64 lb. shelled corn 64 lb. wheat	124 lb. clover hay	5.1	5.1
83 lb.	164 lb. oats	140 lb. clover hay 100 lb. roots	5.2	4.5 3.1[1]
83 lb.	132 lb. corn 33 lb. oil meal	110 lb. clover hay	4.8	3.2
76 lb.	87 lb. shelled corn 87 lb. peas	183 lb. corn fodder	5.3	5.8
76 lb.	154 lb. shelled corn	188 lb. corn fodder	5.6	6.8
89 lb.	94 lb. shelled corn 94 lb. oats	95 lb. hay	4.9	2.5
74 lb.	211 lb. wheat screenings	72 lb. timothy hay	7.2	2.5
76 lb.	189 lb. barley 14 lb. oil meal	72 lb. timothy hay	5.8	2.2
62 lb.	97 lb. cotton-seed meal	97 lb. cotton-seed hulls	3.4	3.4
89 lb.	67 lb. corn	290 lb. alfalfa hay	2.2	10.0
80 lb.	80 lb. corn	Pasture	1.7	
81 lb.	78 lb. oats	Pasture	1.9	
80 lb.	77 lb. barley	Pasture	2.0	
75 lb.	65 lb. corn 24 lb. oats	Pasture	1.5	

[1] Roots.

CHAPTER XVIII

THE BREEDING OF SHEEP

THERE are fewer sheep bred in America than of any other of our farm animals. This is due in a large measure to the average American farmer's lack of knowledge in propagating sheep. He is wont to treat them as swine, and under such care sheep fail to thrive. Sheep breeding is a very profitable branch of farming in England and France, where entire farms are devoted to the industry. These farms are profitable because in charge of a competent flock-master, who does no other work, but makes a very careful study of the needs of his flock and supplies every want. On many of these farms the soil was formerly very poor, but through sheep farming they have been restored to fertility, and at present many of them grow very luxuriant crops of forage.

In America conditions are somewhat different, though there is no reason why our cheap pasture lands cannot be made to yield a handsome profit if slowly converted into sheep pastures. Lack of suitable labor is the greatest drawback to sheep farming in America. We have no flock-masters, as do the English, and the average American seems to be too nervous and unsteady to tend sheep with perfect assurance of success. Properly cared for, sheep are among the most profitable of farm animals, and restore fertility to the land as do no other animals. Every farm devoted to general agriculture should possess a small flock. While they will need considerable care, on such a farm, the food they consume will be largely that which otherwise would be wasted.

At present, the farmer should start with a small flock, increasing it gradually as he learns its habits and needs. The unexperienced should begin with a grade flock of ewes, which should be mated to a pure-bred ram. The sire is as important in the flock as in the herd of dairy cattle. The second year a few pure-bred ewes, of the same breeding as the ram, may be purchased; and with these as a basis, start a pure-bred flock. Some of the best flocks in America have been started in this way.

PLAN OF BREEDING

A clearly defined plan should be outlined before the farmer makes an attempt at breeding sheep. The intending sheep breeder should make a careful study of successful sheep farms, noting the conditions wherein his differs, and the modifications that must be adopted. The farmer who rushes into sheep breeding blindly because the price of wool or mutton seems to warrant it is likely to pay dearly for his experience.

Coöperative breeding. — The value of united effort cannot be overestimated in breeding sheep. This does not mean that the farmers should be partners from a financial point of view, but all should help to advance the interests of each other's flock. Free conversation on all matters relating to the flock will prove of common advantage; the owner will improve in sheep knowledge, and the flock improve in excellency. There are many things that a few sheep breeders would be able to do that one alone would hardly undertake, and not least among these is the purchasing of a pure-bred ram of much excellency. The influence of such a ram is left in the flocks of several breeders, and uniformity is promoted. The old saying, "in unity there is strength," applies to the sheep industry, as to others.

CHOOSING BREEDING STOCK

In choosing the foundation flock, the farmer must have in mind the demand that he means to supply, wool or mutton, and

if mutton, whether he means to raise hot-house lambs or older mutton. He should bear in mind that in general "like produces like" and that "blood will tell." This applies to the ewes as well as to the ram. Bad qualities of one are as likely to appear in the lambs as bad qualities of the other. Even after using the greatest care in finding the breeding stock, the breeder must be prepared to expect many lambs inferior to both parents.

The *type* or breed should depend on the individual preference of the breeders. The advisability of selecting wool or mutton sheep will depend on the conditions. Mutton is preëminently adapted to the corn-belt, although a great many wool sheep are found there. Where hot-house and early spring lambs are to be produced, Merino and Horned-Dorset blood must predominate. Where the grazing land is much broken, some breed other than the pure mutton is likely to give best results. For such lands a good grazing breed is demanded. Whatever breed is chosen, there should be no further change, for it is indiscriminate and zigzag crossing that has produced our present common stock.

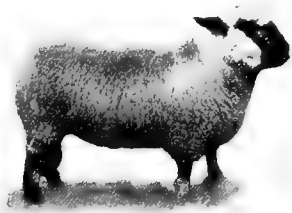

Fig. 133. — Hampshire Ewe. Champion, International Live Stock Show, 1908. Photograph by *National Stockman and Farmer*.

Uniformity. — In choosing the foundation flock of breeding ewes, no single factor is of greater importance than uniformity. The ewes should be uniform in type, weight, quality, and breeding. Such a flock will cost slightly more than one not uniform in these characters, but will prove much the more profitable in the long run. As we have already observed in the discussion of mutton production, uniformity is a market requirement, and when it is wanting in the breeding ewes, it will also be lacking in the crop of lambs. When one is producing wool, an even, uniform clipping is to be desired. Furthermore, if the breeder

wishes to sell his surplus ewes for breeding purposes, they will command a much higher price if uniform in all features, both because of their intrinsic worth, and because of their improved general appearance.

The ram

The ram is by far the most important member of the flock. Successful sheep breeders rely on him for much of the improvement of the flock. What has been said about the stallion (page 102) and the bull (page 244) also applies here.

The ewe flock

If the farmer is just beginning, the best time to purchase the foundation ewes is in the early fall; the best place to purchase is in the locality in which the flock is to be kept. Breeding ewes on the large markets are often discarded from other flocks or from the western ranges. Such ewes are usually sent to market because of their age or failure to breed, and are to be avoided when possible. Local ewes will give much better satisfaction when they can be procured; they are adapted to climatic conditions and parasite dangers. Western ewes do not resist parasites as do native ewes. By purchasing the flock in the early fall, the new owner has time to become familiar with it before winter; he can see to the mating, and thus know exactly what time to expect the lambs.

In choosing foundation ewes, too much attention cannot be given the individual animals. They should each be carefully considered. If purchased on a large market, the condition of their teeth should be especially noted, as a ewe without teeth, even though she breeds, is likely to give much trouble at lambing time. Moderately heavy fleeces are to be preferred, as they indicate stronger sheep and greater feeding capacity. When possible the condition of the udder should be noted, as many ewes have spoiled udders and imperfect teats.

THE BREEDING OF THE EWES

Productive period. — There is a strong tendency on the part of beginners to breed yearling lambs, particularly if they are well grown. The yearling ewe should not be bred, as the drain on her system weakens her condition and leaves her an easy prey to parasite infection. Furthermore, if breeding the yearling is persisted in, it will lessen the size of the ewe. The ewe may remain in the breeding flock as long as she continues to breed true. She will be unreliable after her teeth drop out, as it is difficult for her to nourish the fetus in winter when dry forage is the main feed. Unless a valuable ewe, a better plan is to fatten her as soon as she begins to lose her teeth. Ewes vary widely in the age at which they stop breeding, some being unreliable at four or five years, while others will continue to breed until eight years, and even longer.

Season to breed. — The season to mate the ewes will depend on the time the lambs are wanted. In this country, on the average farm, the breeding season begins in September or October. To encourage breeding early, the ewes are often fed a very stimulating ration, a practice sometimes spoken of as "flushing"; and some owners hold the ewes while the ram serves them, then in a few days the ewes come around naturally, when the ram serves them again in the natural way. When spring lambs are to be produced, the mating must be done in August, September, and October, as the lambs should be dropped in January, February, and March. To get the lambs to mate in August requires similar treatment to that suggested for winter lambs (page 389). On the average farm the mating should all be done before Christmas, as lambs dropped after the middle of May are not likely to thrive without much extra care.

Method of mating. — The common practice is to let the ram run with the flock during the breeding season. This is not a wise practice. A better plan is to keep him away from the ewes,

Table showing period of gestation — Ewe 150 *days*

Date of service on the left. Date of lambing on the right in the double columns

Jan.	May	Feb.	June	Mar.	July	Apr.	Aug.	May	Sept.	June	Oct.	July	Nov.	Aug.	Dec.	Sept.	Jan.	Oct.	Feb.	Nov.	Mar.	Dec.	Apr.
1	30	1	30	1	28	1	28	1	27	1	28	1	27	1	28	1	28	1	27	1	30	1	29
2	31		July	2	29	2	29	2	28	2	29	2	28	2	29	2	29	2	28	2	31	2	30
	June	2	1	3	30	3	30	3	29	3	30	3	29	3	30	3	30		Mar.		Apr.		May
3	1	3	2	4	31	4	31	4	30	4	31	4	30	4	31	4	31	3	1	3	1	3	1
4	2	4	3		Aug.		Sept.		Oct.		Nov.		Dec.		Jan.		Feb.	4	2	4	2	4	2
5	3	5	4	5	1	5	1	5	1	5	1	5	1	5	1	5	1	5	3	5	3	5	3
6	4	6	5	6	2	6	2	6	2	6	2	6	2	6	2	6	2	6	4	6	4	6	4
7	5	7	6	7	3	7	3	7	3	7	3	7	3	7	3	7	3	7	5	7	5	7	5
8	6	8	7	8	4	8	4	8	4	8	4	8	4	8	4	8	4	8	6	8	6	8	6
9	7	9	8	9	5	9	5	9	5	9	5	9	5	9	5	9	5	9	7	9	7	9	7
10	8	10	9	10	6	10	6	10	6	10	6	10	6	10	6	10	6	10	8	10	8	10	8
11	9	11	10	11	7	11	7	11	7	11	7	11	7	11	7	11	7	11	9	11	9	11	9
12	10	12	11	12	8	12	8	12	8	12	8	12	8	12	8	12	8	12	10	12	10	12	10
13	11	13	12	13	9	13	9	13	9	13	9	13	9	13	9	13	9	13	11	13	11	13	11
14	12	14	13	14	10	14	10	14	10	14	10	14	10	14	10	14	10	14	12	14	12	14	12
15	13	15	14	15	11	15	11	15	11	15	11	15	11	15	11	15	11	15	13	15	13	15	13
16	14	16	15	16	12	16	12	16	12	16	12	16	12	16	12	16	12	16	14	16	14	16	14
17	15	17	16	17	13	17	13	17	13	17	13	17	13	17	13	17	13	17	15	17	15	17	15
18	16	18	17	18	14	18	14	18	14	18	14	18	14	18	14	18	14	18	16	18	16	18	16
19	17	19	18	19	15	19	15	19	15	19	15	19	15	19	15	19	15	19	17	19	17	19	17
20	18	20	19	20	16	20	16	20	16	20	16	20	16	20	16	20	16	20	18	20	18	20	18
21	19	21	20	21	17	21	17	21	17	21	17	21	17	21	17	21	17	21	19	21	19	21	19
22	20	22	21	22	18	22	18	22	18	22	18	22	18	22	18	22	18	22	20	22	20	22	20
23	21	23	22	23	19	23	19	23	19	23	19	23	19	23	19	23	19	23	21	23	21	23	21
24	22	24	23	24	20	24	20	24	20	24	20	24	20	24	20	24	20	24	22	24	22	24	22
25	23	25	24	25	21	25	21	25	21	25	21	25	21	25	21	25	21	25	23	25	23	25	23
26	24	26	25	26	22	26	22	26	22	26	22	26	22	26	22	26	22	26	24	26	24	26	24
27	25	27	26	27	23	27	23	27	23	27	23	27	23	27	23	27	23	27	25	27	25	27	25
28	26	28	27	28	24	28	24	28	24	28	24	28	24	28	24	28	24	28	26	28	26	28	26
29	27			29	25	29	25	29	25	29	25	29	25	29	25	29	25	29	27	29	27	29	27
30	28			30	26	30	26	30	26	30	26	30	26	30	26	30	26	30	28	30	28	30	28
31	29			31	27			31	27			31	27	31	27			31	29			31	29

bringing them to him each morning while it is cool. The ewes should be placed in a small pen and the ram turned in, when he will single out those ready to be mated. As soon as mated, the ewe should be marked and placed in a quiet pen, where she should remain for about two days before returning to the flock.

FIG. 134.—CHAMPION OXFORD RAM. Photograph from *National Stockman and Farmer*.

The Oxford Down breed of mutton sheep originated in Oxford County, England. This breed is similar to the Hampshire except in size, when it occupies first rank, rams weighing 275 pounds and the ewes 200 pounds. When large mutton is desired, this breed is unexceled. In wool production it excels the Hampshires, shearing from 5 to 10 pounds of combing wool.

One service is sufficient. The ram will search out another, and she should be treated likewise. The ram should not be permitted to serve more than four in a single morning; if more are ready, return them to him in the evening. All ewes that are

served in the same week should receive a similar mark. Those served one week may be marked on the back, or top of head, with red paint, the second with black, those served during the third week with green, and so on, using a different color each week. By this method one can tell the week the ewe was served, when the lamb may be expected, and when the entire flock of ewes has been mated.

Managing the ram. — During the day the ram should be kept in a quiet cool place, and out of sight of the ewe flock. He should be fed liberally on stimulating food, such as oats, bran, and clover or alfalfa hay. In the closed season, when not in use, he should have the run of a paddock. In summer this should contain sufficient grass for much of his feed, although he should be fed grain in addition. In winter he should be treated much as the flock, but kept in a quiet place and away from all unnecessary noise and excitement.

The pregnant ewe. — The proper care of the ewe flock during pregnancy will do much to lessen the difficulties at parturition time and subsequently. The ewes must be kept in fair flesh, neither too fat nor too thin. The wool deceives, and one is likely to think the ewes in good condition when in reality they may be thin. Being thin, the ewe has no milk, and will not own the lamb, which must be raised by hand, — a very difficult task, and entirely impracticable when there are many lambs. On the other hand, if the ewes are fed abundantly on oats, wheat bran, and clover or alfalfa hay, the lambs get so large that there is much trouble in giving birth. In such cases, ewes are likely to perish at lambing time, although such as do survive will raise thrifty, vigorous lambs. Better results will follow taking a middle course.

The pregnant ewe flock should be liberally fed such foods as will develop bone and muscle, but not to excess. If the dry forage is cornstalks, then feed wheat bran and oats for the grain part of the ration; and if the dry fodder is clover or alfalfa hay,

then cracked corn may constitute the grain. If at all possible, succulent food, either roots or silage, should be provided, as such food serves to keep them in good physical condition, and to encourage the flow of milk.

FIG. 135. — SUFFOLK EWE. A prize winner. Photograph from *National Stockman and Farmer*.

The Suffolk Down mutton sheep originated in Suffolk County, England. They are similar in many respects to the Hampshires, though perhaps a little under them in weight. They are inferior to the Hampshire as wool producers, shearing only 5 to 7 pounds of fair-quality wool.

Lambing time. — The period of gestation in the ewe is popularly placed at five months, more accurately 150 days (page 408). Previous to the lambing time the sheep owner should make ready for this eventful season. The ewes should be neatly tagged, all wool being removed from the udder, as otherwise a

lamb might nurse a tag instead of a teat. A number of small panels three feet high and four feet long, made from light wood, should be provided. Two of these panels should be hinged together like the letter L, so that when placed in the corner of the barn they make a pen four feet square. Enough of these should be provided so that a row of four-foot pens may be placed along the side of the barn or shed. When not in use, these panels may be folded up and laid away. As soon as a ewe has lambed, she and her lamb should be placed in one of these small pens, thus preventing the lamb from straying away, as it is very likely to do if not restrained.

Ewes that have been well cared for during pregnancy are likely to have a good supply of milk. They should be separated from the flock at once, and given extra care. For a time they should be sparingly fed on grain, as it is not considered best to force the milk flow until the lambs are able to take care of it without danger of digestive disorders, such as scouring. The grain ration may consist of 50 parts chopped corn, 50 parts wheat bran, and 10 parts linseed meal. For dry forage, clover or alfalfa hay is preferred, and if possible a small amount of silage or roots should be fed, as in the case of the pregnant ewe.

Difficult parturition. — Ewes that are not properly fed during pregnancy, and are thin and weak, often have difficulty in delivering the lamb. Young ewes, even though well kept, often have trouble in dropping their first lamb. Whenever there is difficult parturition, an attendant of experience should be near by to render assistance. When the ewe shows signs of lambing, such as teats filling out to end, the vulva swelling and becoming deeply colored, and in some cases the ewe looking for her lamb before it is born, she should be placed in a pen away from the flock, and closely watched. In natural parturition the lamb comes with front feet first and nose just between. Non-interference is recommended until it is evident the ewe needs aid. The head and shoulders are the hardest part to deliver, and after these are

through, there is not likely to be further trouble. In wrong presentation it is usually necessary to place the parts in the right position before the lamb can be delivered. The method is much the same as that suggested for difficult parturition in cattle (see page 334). In such cases the attendant is fortunate if he possesses a small hand, which should always be annointed or greased before attempting to manipulate the parts. Forceps are sometimes used, because of the small size of the opening, but their manipulation requires some experience, though their use is to be recommended in preference to permitting both ewe and lamb to die unaided. In all manipulations extra care should be taken, drawing gently, during labor pains only. The traction should be downward as well as backward.

After delivery, if the ewe is weak, there is nothing better for her than a drink of warm oatmeal gruel. If she will not drink without aid, the gruel may be given from a long-necked bottle, similar to drenching. This may be fed three or four times daily until she gains strength.

THE LAMBS

Young lambs are very delicate things, and their treatment the first few hours after birth will go a long way toward determining the kind of sheep they are to make. If they make their appearance naturally, and get their first meal unaided, they are not likely to give much trouble. Not all lambs are so fortunate. Occasionally one is born without difficulty, but fails to establish respiration, — does not breathe. In such cases assistance must be given at once, or the young lamb perishes. Respiration may be established by blowing into the mouth and nostrils, by rubbing the lamb, or by gently slapping the sides with the open hand. Other lambs may establish respiration, but be so weak they cannot find the maternal teat, and perish in a few hours if not assisted to the first meal.

The first meal. — It is very essential that the lamb get the first

milk of the ewe. When the lamb is too weak to move, it must be assisted. To do this, gently set the ewe on her rump, as though you were going to shear her. Place the lamb on its side under her hind limbs, with one hand open the lamb's mouth, and with the other milk a small quantity of the dam's milk on the lamb's tongue, at the same time placing the teat into the lamb's mouth, when it will usually begin to suck at once. The ewe and lamb should be watched closely to see that the lamb gets its second meal, for it may be necessary to aid it a second time and even a third (Fig. 136).

FIG. 136.—METHOD OF TEACHING HELPLESS YOUNG LAMB TO SUCK.

If the ewe perishes during the parturition, and there is no other ewe the lamb can be put with, it will be necessary to give the lamb its food from a bottle with rubber nipple. Modified cow's milk should be given. Feed the milk at about body temperature, 103° F., giving a very small amount, but often, every two hours at first.

A chilled lamb. — Occasionally lambs get separated from their dams and become chilled. This is very likely to happen unless ewe and lamb are confined to a small space. A hot bath is the best thing for a chilled lamb. Immerse the lamb in water as hot as one can bear the hand. Keep the water hot by adding more of it, taking care not to scald the lamb. When warmed,

wipe dry with flannel cloth and restore to the dam. Aid the lamb to get its first meal, and watch closely. Sometimes a few drops of whisky in warm water is given chilled lambs. It is surprising how much a hot bath will revive cold wet lambs, and the method is worth trial, no matter how limp the lamb.

It is a good plan to make some provision in advance, to care for twin lambs; for often one will chill while the dam is nursing the other. To do this provide a box, say two feet square and eighteen inches deep, placing five inches of bran in it. While the ewe is nursing one lamb, the other may be placed in the warm bran, and all covered but the nose; this will keep the lamb warm and help to dry it. After a time return to the ewe. In licking off the bran she will own it. In the absence of the bran, a jug of hot water may be placed in the box with the lamb, and a blanket thrown over the top of the box.

A disowned lamb. — Occasionally a young ewe, or an old one very thin in flesh, will neglect or disown her lamb, and refuse to care for it. Usually the ewe will take to the lamb if she is held while the lamb nurses. To hold the ewe, a small stanchion should be constructed. The stanchion may consist simply of two green stakes, one and one-half inches in diameter, driven into the ground and held at the top with a piece of rope or strap. Sometimes a little meal placed on the lamb will induce the ewe to nurse it and to claim it.

Occasionally a ewe will lose her lamb, and have her udder filled with milk. At the same time, there may be other ewes in the flock with twins, and it is a good plan to give one of the twins to a ewe that has lost her lamb. Sometimes difficulty is experienced in getting her to own it. The ewe may be placed in a stanchion; if she still refuses, the lamb may be washed to remove its odor, then some of the ewe's milk placed on its head and back, at the same time placing some of the ewe's milk on her own nose, when she will often own the lamb.

Lamb ills

Having made its appearance into the world, with or without difficulty, the lamb is still subject to many troubles, chief of which are diarrhea, constipation, sore mouth, and contagious sore eyes. The extent of these troubles will depend largely on the care given the ewe while she is nursing the lamb. By proper management these troubles may be materially reduced, and in many cases entirely avoided. The ewes should be kept in dry, well ventilated, well lighted quarters, permitted to take exercise in a dry or well bedded lot, and fed healthy, nutritious foods.

Constipation may be caused by the lamb getting too much milk, or to difficult teething, in which latter case the gums should be rubbed until the teeth are through. When constipation prevails, reduce the ewe's grain ration. It may be necessary partly to milk the ewe. If this does not afford relief, inject in the rectum a small amount, not to exceed two ounces, of warm water, to which a little glycerine has been added. Do not inject too much, and do not use soap suds.

Diarrhea is often caused by overfeeding. When the lamb is troubled with diarrhea or scouring, the treatment is to milk the ewe, in part, remembering that the last milk is the richer in fat, the element causing the disturbance. The ewe's grain ration should be reduced. If the ewes are running on pasture, feed some timothy hay scattered on the grass or placed in racks conveniently located. If the scours persist, or if the discharge is white, then a mild, healing laxative and tonic should be given. Mix one-fourth ounce of common cooking soda, one ounce of sulfate of magnesia, and as much ground ginger as can be taken up on a penny, with one-half pint of gruel, and give as a drench. In four hours follow with a dose of one ounce of linseed oil.

"*Pinning*" is due to an accumulation of excrement at the vent and tail in such a manner that the proper function of the bowels cannot be performed. The treatment is to remove the filth from the parts, and dust with powdered chalk.

Sore mouth.—Often lambs are troubled with a kind of contagious sore mouth, which affects the teats of the ewes as well. These sores form scabs along the edges of the mouth, and small sores on the teats of the ewe. This often becomes so serious as to interfere with the thrift of the lamb. The treatment is to rub off the scabs and apply undiluted coal-tar dip, of which there are many kinds on the market, such as are mentioned on page 426. This will effect a complete cure.

Sore eyes. — Like sore mouth, this is a contagious disease; and, while often interfering seriously with the thrift of the lambs, is very easily cured. One of the coal-tar dips diluted with forty parts water used as a wash will work a rapid cure. It is well to see that a little of the diluted dip gets into the eyes; this may start the tears, but it has the desired effect.

General care of lambs

Feeding the lambs. — Lambs early begin to nibble at hay and grain, and advantage should be taken of this to encourage them to eat solid food. During lambhood the digestion is more thorough, and lambs make larger gains from a given quantity of food, than at any other time. Encourage the lamb to eat food in addition to that furnished by the dam. Furthermore, this extra feeding renders weaning a very easy task. At the age of ten days to two weeks lambs will begin to eat grain, and special provision should be made for them. For this construct a creep (page 392). Grain should be put down twice daily, and no more than the lambs will consume, as it will become stale if left in the boxes. Lambs that have been well fed in every way always mature to be much larger and stronger with heavier fleeces than the others.

Weaning the lambs. — Weaning is more a matter of preparation than of actual separation. When lambs have been accustomed to grain as suggested and when they can have access to the creeps after the ewes are removed, there will be very little

shrinkage. When practicable, the ewes should be removed, leaving the lambs in their accustomed place. All things considered, it is better that the separation be complete. The ewes should be carefully watched to see that none suffer from caked udder. The age at which lambs should be weaned will depend on the

FIG. 137. — HORNED DORSET RAM. First prize and champion ram at four State Fairs, 1909. Owned at Heart's Delight Farm, Chazy, N. Y.

The Horned Dorset, a native of Dorset County, England, while noted for the production of both mutton and wool, is more especially noted for prolificacy and the production of lambs at any season of the year. No breed excels the Dorsets in the production of winter lambs. As a breed the animals are hardy and good grazers. The rams average 200 pounds and the ewes 160 pounds. They shear from 5 to 10 pounds of wool. This breed is popular in the United States.

object sought. When spring lambs are sought, the lambs may run with the ewes until sold, but for other lambs it is better to wean at three or four months of age. In such cases the lambs should be weaned and removed from the old pastures before

there is danger of parasite infection. As soon as weaned, the lambs should be placed on sown pastures as suggested in the discussion on feeding the flock in summer (page 381). While this is often neglected, it is very important, for after the young lambs once become infected with germs, they are not likely to thrive, and will prove a failure. Some forethought is required in arranging and sowing the pastures, but if sheep farming is to prove profitable, it is very essential, especially throughout the corn-belt and those regions subject to parasites.

Castrating male lambs. — The male lambs should be castrated at ten days to two weeks old, as they will suffer less if operated at this time. Lambs intended for hot-house trade should not be castrated, as the exposed testicles add to the appearance of the carcass when on the market. The operation is not difficult, and there is practically no danger of injuring the lamb. An assistant should hold the lamb in such a position as to expose the scrotum. Sever the end of the scrotum, pinch the testicle out, and remove with the adhering cords. The scrotum may be rubbed with a mixture of tallow and turpentine, half and half, and the lamb returned to the dam.

Docking the lambs. — Unless the lambs are to be sent to market under three months of age, they should have the tail removed. The tail is of no use to the sheep and is likely to become foul. Docked lambs thrive better than undocked, and they present a fuller and squarer appearance. The lambs should be docked at ten days to two weeks of age, or even younger if strong. This may be done by severing the tail with a sharp knife, cutting from the under side, by the use of a mallet and sharp chisel; or, better still, by the use of docking pincers. These pincers resemble the ordinary shoeing pincers and may be made by any blacksmith. The edges should be rather thin, with the back heavy in order to hold heat, for by heating them to redness and then severing the tail the stump will bleed but little, whereas if the tails of lambs in very good condition are severed with a

sharp instrument, such as a knife or chisel, a few of the lambs may bleed to death. Bore a hole of sufficient size to admit the lamb's tail in a board, and when ready for use, heat the pincers to redness, pull the tail through the hole to protect the lamb's rump, and sever the tail quickly.

Wing suggests to make the pincers large enough to admit a grown ram's scrotum, and when it is desired to castrate such a ram, protect the body with a board as before and hold up the scrotum and slowly sever with the pincers heated to redness.

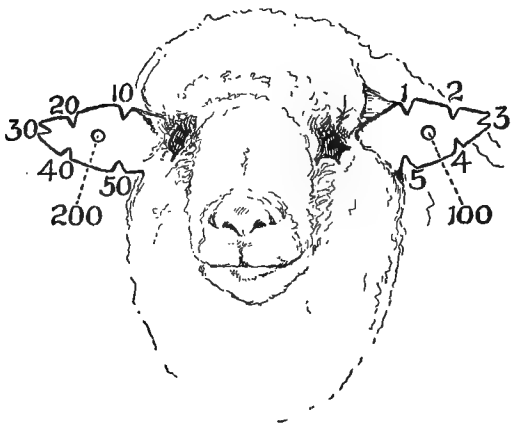

FIG. 138. — METHOD OF MARKING LAMBS FOR FUTURE IDENTIFICATION, OR UNTIL PERMANENT TAGS CAN BE INSERTED INTO THE EAR.

Marking lambs. — To avoid errors and mistaken identity the young lambs should be marked as soon as possible after birth. Identifying unmarked lambs is a difficult task and one which experienced flock-masters are often unable to do, hence the importance of marking the young lamb. The young lamb's ear is very tender and will not carry a label until well grown, so a temporary marking must be used. There are two

successful methods of marking sheep, — by the use of waterproof ink, and by notching the ear. Procure a small brush and some waterproof ink, or regular sheep-marking fluid, and place on the lamb the number on the ear tag of the ewe. If this method is used, it will be necessary to renew the number, as it will fade as the lamb grows.

Some persons prefer to notch the ear of the lamb, as it is likely to be more permanent. The ordinary ear punch is used to mark the ear, and the following method is as good as any: — The first lamb would have one notch in the top of the left ear next to the head; the second, one notch in the middle; the third, one notch in the end; the fifth, one notch on the lower side, and so on, up to 400. Then when permanent ear markings are desired, they may be inserted when convenient and the record inserted in the flock book. (See Fig. 138.)

CHAPTER XIX

CARE AND MANAGEMENT OF SHEEP

THE ability to care for sheep successfully is a faculty to be increased and strengthened by careful study and experience. All that may be written is of no consequence without practice. The timidity of sheep, dainty appetites, inability to endure dampness, draughts, mud lots, as well as their liability to parasite infection, must be well understood by those who expect to make sheep growing profitable. The knowledge is very easy to obtain, and methods of combating are not difficult, but they demand persistent effort on the part of the sheep owner.

Sheep may be successfully grown on any general farm or where there is an opportunity for changes in grazing. When the farm has the equipment and is conveniently located to a railroad leading to one of our larger cities, winter-lamb production may be most profitable, whereas if the farm lacks equipment and has much cheap grazing land, some other form of sheep production would doubtless yield the greater profit. Each farmer must make a careful study of his conditions, such as location, facilities for shipping, demands of his market, condition of the soil, and the like, then lay his plans accordingly.

Wherever the farm, whatever the conditions, whenever sheep growing is to be practiced, ample provision must be made for change in pasture. Sheep may live, or at least the older ones may, without change, but if put into a pasture in the spring, and compelled to remain there until fall, they will never attain the size they would have attained had there been a frequent change of pasture. Where sheep are thus pastured, the lambs

often perish as a result of parasites. Sheep profit by a change of pasture even if, so far as the pasture is concerned, the change is from a good to a poor one.

DIPPING SHEEP

Dipping the sheep is an essential part of sheep growing. No farmer should attempt to raise sheep without planning to dip the sheep, not only upon their arrival at the farm, but twice annually thereafter. Fortunately the process is very simple as well as inexpensive.

Importance of dipping. — There are two essential reasons why all sheep should be dipped: first, to free them of ticks; and second, to free them of scab germs. It is absolutely impossible for lambs infected with ticks or other parasites to thrive. A good dip cleanses the skin, increases the quantity and improves the quality of the wool. From this it is apparent that all sheep, whether foundation stock or lambs intended for fattening, should be dipped immediately upon their arrival on the farm.

Fig. 139. — Horned Dorset Ewe. Owned by Heart's Delight Farm.

Sheep ticks can be entirely overcome by dipping. Sheep ticks inhabit no other farm animals, and once eradicated, there is no possible chance of their reappearing unless brought to the flock on infested sheep, or carried in some manner, as in the clothing of shearers, from an infested flock.

Sheep scab can likewise be prevented by dipping. This scab is caused by a minute parasite, too small to be seen by the naked eye, which irritates the skin, causing a watery exudate. This exudate forms a crust beneath which the scab mite burrows,

greatly irritating the animal, causing loss of flesh, intense itching, loss of wool, and frequently results in death to the sheep. Sheep affected with scab are uneasy, pawing with the foot and biting at the affected parts, which are usually along the neck and shoulders. If such an animal be carefully examined, the wool and skin will appear abnormal at the affected parts. A slight exudate is noticed which later forms a scab, which rapidly spreads. The mite is transferred from one sheep to another and soon the entire flock is affected.

Common places for sheep to become infected with the scab mite are in the stock-yards, railroad stock-pens, and in stock-cars, unless well disinfected. As they multiply very rapidly, a few parasites gathered up in this way will soon run through an entire flock. When once the sheep become affected and scabs formed, the disease is hard to eradicate. If taken in time, prevention is very easy. Hence the importance of dipping all newly purchased sheep before they infect the farm or the flock.

The dipping vat. — The nature of the dipping vat or tank will be determined largely by the size of the flock. For a small flock such as is kept on the average farm, a simple trough of wood, metal, or concrete, 16 inches wide at the top and 6 inches at the bottom, 4 feet deep, and 8 to 12 feet long, will prove ample. The vat must be narrow so the sheep cannot turn around; must be deep so they can be plunged clear under and no spot escape the dip; and the longer the vat, the quicker the dipping can be performed, as each animal should remain in the dip at least one minute. The end of the vat at which the sheep enter should be perpendicular, so that they may be made to jump in the dip and thus be completely submerged. At the other end, there should be a gradual incline up which the sheep can walk. Here an incline platform should be constructed, so that the drippings of the dipped sheep may be returned to the vat, otherwise much of the dip will be wasted, particularly if the wool is long. On farms

where sheep are to be kept continuously the vat should be constructed in the ground. This will facilitate getting the sheep in and out, and in many clay soils will last a lifetime. In the absence of such a vat, do not neglect to dip the sheep upon their arrival at the farm, for trouble will surely follow. In the absence of anything better, use an ordinary water-trough, one man holding the sheep by the forelegs, another by the hind legs, and

FIG. 140. — CHEVIOTS. True to type. Owned by G. W. Parnell.

The Cheviot breed of sheep originated in Scotland. The breed is noted for the production of wool and mutton. The sheep are comparatively small, but very hardy and excellent grazers. In appearance the animals are neat and trim. Mature rams average about 175 pounds and the ewes 150 pounds. They will shear from 6 to 11 pounds of medium-length wool.

dip backs first. See that the head is immersed. The dip will run down the legs when the sheep are permitted to stand. This is crude but to be preferred to no dipping and the farm becoming infested with ticks and scab, which it surely will if dipping new arrivals is neglected.

How dips are used. — The dip must be hot. The best temperature is that which a man can endure with the bare arm.

If the dip is too hot, it will scald; if too cold, it will be less effective. The water may be heated in a large kettle and kept hot by throwing red-hot irons or heated stones into the tank. This is a very convenient way to heat the dip if any remains in the tank. The water should be softened by the addition of enough concentrated lye to give it an oily feeling like soap suds, or by the addition of wood ashes.

The best dip to use is some one of the coal-tar preparations, as Zenoleum, Naptholeum, Daytholeum, Milk Oil, and the like. These are fairly cheap, very effective, cleansing to the skin, healing to diseased eyes and mouth, pleasant to use, and sure death to all forms of parasite life. The direction given on the cans in which the coal-tar comes is to use at a strength of one part of dip to 100 parts water. While this is strong enough to kill ticks, it is not sufficient to remove scab germs. When the sheep have first arrived or when dipping for scab, use one part dip to 40 parts water.

When dipping for ticks, one minute is sufficient length of time for the sheep to remain in the solution. When dipping new arrivals or for scab, the sheep should remain in the dip two minutes and the head should be immersed twice. With the dip hot, the water softened, the dip used at a strength of 1 to 40, and the sheep left in for two minutes, all external parasitic life will be destroyed. If scab is suspected, the dipping should be repeated in eight to ten days, as the dip will not kill the eggs, and a second dipping is essential completely to eradicate the scab mites.

Frequency of dipping. — All sheep arriving at the farm should be dipped before they infect the lots. In addition to this the entire flock should be dipped at least once a year, and it will be the better for it if dipped twice annually. One dipping should take place soon after shearing, as less dip will be required. It should not, however, follow too closely after shearing. A pleasant day should be selected, and the sheep should be well protected until dry. It will take them several hours to dry

out. At this time it should not take more than one quart of the mixture to a sheep, whereas if the sheep is not shorn, it will take approximately one gallon. The second dipping should be in the fall, some fair day just before the sheep are placed in their winter quarters. This second dipping will pay because of its invigorating influence, even though the sheep are free from ticks. By all means, the sheep should be dipped at once on the outbreak of scab unless in the very severest of winter weather.

SHEARING SHEEP

Formerly it was the custom to wash the sheep before shearing and shear later in the season than at present. This was in the days of the spinning wheel and hand loom. The practice of washing the wool was continued somewhat later, for it was thought that it prepared the wool for the manufacture. This it did not do, but it did render the wool lighter by removing the natural oil and hence was a distinct disadvantage to the farmer.

Washing sheep. — At the present time comparatively few sheep are washed before shearing, though in some localities it is still profitable, as buyers discriminate against unwashed wool. The washing is usually done in a brook. The water should be about waist deep, the bottom of the brook sandy, gravelly, or rocky, and free from mud, and the shore firm, clean, and grassy. There should be sufficient current to carry the dirt away when pressed out of the wool. A small inclosure near the shore restrains the sheep; one man catches the sheep, a second tags them and removes the filth from the hind-quarters, while the third man washes. The washer leads the sheep into the water beyond its depth. The sheep is easily handled. Attention should be given all parts of the fleece. The wool is pressed between the open hands, which removes the dirt and discolors the water. When no further discoloration can be produced, the sheep is removed to the shore. The animal should be held

until slightly drained to prevent it from falling as a result of the weight of the water in the fleece. The flock should then be kept in a clean place for at least one week to permit the yolk or oil to be replaced.

When to shear. — The time for shearing will depend somewhat on the conditions. If winter lambs are sought, the shearing should be done in March or before, whereas if there is no hurry about the lambs and the sheep are not well protected, the wool may be left on until warm weather. With the coming of warm weather the wool must be removed or the sheep will not thrive. When at all practicable, early shearing is to be recommended, as the sheep will do much better. If troubled with ticks, they will leave as soon as the sheep are shorn, though in this case it is well to see that the ticks do not go to the lambs. The amount of wool taken off will be greater if the sheep are shorn regularly in March or April than if shorn in June. Where washing the wool is practiced, the sheep cannot be shorn until warm weather as it is unsafe to wash the animals in the late winter or early spring.

Hand shearing. — Hand shearing requires much skill and considerable practice. A good man will shear from 40 to 100 sheep in a day, using common hand shears. Many experts shear upon the floor, though some prefer a platform. The work should be done in a light, airy place. While each shearer has his own method, it is some modification of the following: The sheep is placed on its rump with its back to the shearer supported by the left arm, with the shears in the right hand. The wool is then removed from the brisket and neck down to the shoulders. The fleece is then opened down the abdomen and first clipped on the left side as far around as the back bone and then on the right side in a similar manner, all the time exercising much care in keeping the fleece together. Care must be exercised not to cut too deep at one stroke or the sheep will not be smooth. The points of the shears must be kept close to the hide, otherwise a

second stroke will be necessary, which injures the wool and takes much time.

In some regions it is customary to tie the fore and hind legs of the sheep to a board in such a manner that the animal cannot kick, placing it on a low platform, and in this position relieving it of its wool. Such practice is condemned by all experienced sheep owners.

For the beginner to shear a sheep by hand is really a very difficult task, and if the sheep be a fine-wool, the task is still greater.

Machinery shearing.—Shearing sheep with a machine is a very much more easy task than shearing by hand, and the beginner can do very much better work with it. On the market there are both hand and power machines, but on the average farm the hand machine is, of course, the one to use. To operate the machine requires two men or a man and boy, — one to turn the machine, the other to shear the sheep. If available, the beginner should take a coarse-wooled sheep, as the fine-wools are more difficult to shear. With a rather coarse-wooled sheep one can follow the directions and shear the sheep, even though he has never seen the operation. Most sheep are now shorn by a machine.

With the sheep before you and facing to the left, grasp it by the right hind leg with the left hand and gently but firmly place it on its rump, in an upright position, the shoulders resting against the shearers knees, with the machine to the right. It is important to remember that the sheep should always be turned to the right. With a little experience this can be done with the feet, leaving the hands free for the real work. Another essential always to be borne in mind is to hold the sheep in such a way that the skin is stretched tight on the part of the body that is being sheared. Never place the left hand in front of the shears, as you will surely cut the sheep (if you are right-handed).

With the sheep held firmly between the knees, part the wool at

FIG. 141. — SHEARING SHEEP BY MACHINERY, SHOWING POSITION OF THE SHEEP, SHEARER, AND THE MACHINE.

FIG. 142. — POSITION WHILE SHEARING ABDOMEN.

FIG. 143. — POSITION WHILE SHEARING LEFT HIND LEG.

the forward end of the brisket and run the shears down as far as the pit of the stomach. Clip the wool from the floor of chest, as in illustration (Fig. 141). Place the front legs behind the left arm and run four swaths down the right side from the fore legs to the flank. Next run the shears across the belly from right to left, clipping the wool from the belly and flank, as in illustrations (Figs. 142 and 143).

Fig. 144. — Position while shearing Neck.

Straighten up the sheep, resting the head against the knee as at first, take hold of the sheep as in illustration (Fig. 144), and clip the wool along the under side of the neck, starting the shears at the brisket, and run upwards, coming out just below the ear. Clip the wool from the neck. as in illustration (Fig. 145), With the feet turn the sheep slightly to the right, the sheep's feet pointing towards the machine, and clip the wool from the side and the back, as in illustrations (Figs. 146, 147).

Fig. 145. — Position while shearing Left Shoulder.

Turn the sheep to the right so that its back rests next to the machine and clip the other side, as in illustrations (Figs. 148, 149, and 150). Take extra care all the time to keep the hide stretched tightly where the shears are working, otherwise the sheep will not be smooth, and in addition there is danger of cutting the skin.

Fig. 146. — Position while shearing Left Side.

Fig. 147. — Position while shearing Rump.

Fig. 148. — Position while shearing Right Shoulder.

Fig. 149. — Position while shearing Right Side.

Fig. 150. — Position while finishing Sheep.

Fig. 151. — Position of Wool when Finished. Cut ends out and loose pieces within.

Gather up the wool, as in illustration (Fig. 151). With a little practice the task of shearing with a good machine will be more easily accomplished than it is to explain.

Tying the wool. — The fleece is rolled with the belly and loose ends inside, the cut ends out. All very dirty pieces should be removed and never tied up in the wool. Special wool twine should be used to tie the fleece, as binder twine greatly injures the wool, for small bits of the fiber often get into the fleece and, not taking the dyes, must be picked out by hand. There is no need of a wool-box for tying a compact bundle, as buyers prefer the fleece loosely tied.

For those who prefer the wool-box, a very convenient one is made as follows: Secure five pieces of boards; three, each one foot square, the other two each three feet long and one foot wide. Of the three pieces one is to serve as the bottom of the box, the other two as the ends, and they should be hinged together accordingly. The other two boards are likewise hinged to the bottom piece, so that when all are raised, they form a neat wool-box.

Later the wool is packed in large sacks for shipment. In filling the large bags care should be exercised to see that the wool is well packed and the corners all well filled. After being packed full the bags are sewed at the top. If stored, the wool should be put in a dry place where there is no danger of mice cutting the bags and building nests of the wool.

PRACTICAL SHEEP BARNS

Proper shelter for the flock adds greatly to its comfort and thrift. It need not, however, be either elaborate or costly. In the sheep barn there are several factors that must be provided for, but extra warmth not being one of the factors, the rest is comparatively simple and inexpensive. Chief among the factors for which provision must be made are ventilation without draughts, sunshine, drainage, convenience for feeding, ar-

rangements for separating the ewes at lambing time, storage for grain and hay, and, if possible, a root cellar.

The ventilation of the sheep barn should receive careful consideration. This must be so arranged that there are no draughts, as such will result in colds, running at the nose, catarrh, and like troubles. Many experienced sheep owners prefer to ventilate the sheep quarters by placing doors across one side of the barn. These doors are divided in halves horizontally, the lower part of the door swinging as an ordinary gate swings, while the upper half is hinged at the upper edge. The top half is opened by lifting to a horizontal position and held by props or pendant chains. By raising the upper halves and closing the lower, the ventilation can be made so thorough that the inside air is as pure as that on the outside, and since the doors are all on one side of the barn, there is freedom from draughts. If the sheep have the run of these quarters in summer, it is well to open both top and bottom doors, arranging a slat door on the inside to restrain the sheep. During the heat of summer, a blind is fastened over the windows and doors to keep out the sun's rays and slightly to darken the quarters, as sheep prefer this to the daylight.

An abundance of sunshine is essential to the well being of the breeding flock in winter. Sunshine is nature's greatest disinfectant, and keeps the quarters light and cheery. If the row of doors arranged for ventilation is on the south side of the quarters, as it should be, it will admit sufficient sunshine on days when the doors can be kept open. It is often necessary to close them on account of the severity of the weather, just after shearing, or just after dipping, and in such cases extra windows are very convenient. These may preferably be placed along the south side between the doors, as then they will serve their maximum efficiency.

In selecting a site for the sheep barn, due consideration should be given to drainage. Sheep cannot survive damp and muddy footing. Wet floors and muddy lots are to be avoided. If

possible, select ground from which there is a little slope in all directions, facing the barn to the south and arranging the lots on the south slope. It would be of much advantage to have the place protected on the north and west by a grove or bluff.

In arranging the sheep quarters, convenience of feeding must be kept in mind. This factor is often complicated by the desirability of having provision for separating the ewes at lambing time. As a rule, it is more difficult to feed the sheep in two lots than in one. This difficulty can often be overcome, in large

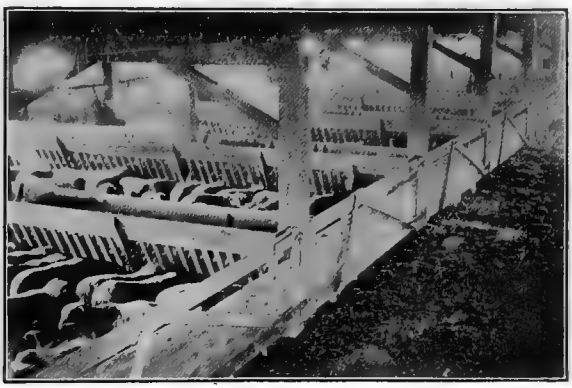

FIG. 152.—SHEEP BARN; INTERIOR VIEW, SHOWING ARRANGEMENT OF FEED-RACK AND METHOD OF DIVIDING THE PENS.

part at least, by using the feed-rack as a partition for the two pens. Such an arrangement also saves the material otherwise necessary for the partition. To facilitate labor in feeding, ample provision should be made for storage of all feed, hay, and straw in the loft, grain in a bin on the ground floor, and if possible, a cellar for the storage of roots. Where convenient, water should be placed in the barn.

The size of the sheep barn will depend entirely on the number of sheep in the flock. Experienced sheep owners do not agree as

to the amount of space required, some stating that ten square feet is sufficient, others that they desire eighteen square feet for each animal. In practice, twelve square feet of floor space will be ample for each breeding ewe.

The feed-racks. — Movable feed-racks are to be preferred. They should be comparatively long and narrow and, as suggested, may be used as partitions between the pens, thus economizing on material, and the racks may be used in different places if desired. A very good combination hay-rack and grain-trough is made as follows: With $1'' \times 8''$ boards for the bottoms and $1'' \times 4''$ boards for the sides and ends, construct two grain-troughs. Place these side by side and fasten together. Or make one shallow trough 16 inches wide and put a partition in it longways, thus making two shallow grain-boxes. With $2'' \times 4''$ scantling and $1'' \times 10''$ boards construct a frame 2 feet wide at the top and as long as the grain-troughs, to serve as the top of the hay-rack. Now on the center partition of the grain-boxes nail $1'' \times 2''$ slats 30 inches long, placing them V-shaped and nail to the frame above, thus making a hay-rack. These slats may be placed 7 inches apart in order that the sheep may thrust their heads clear into the rack to feed. If the slats are placed closer together, say 3 inches apart, as is often the case, the sheep pull the hay through the cracks and drop much of it under their feet. We now have a combination grain- and hay-rack which, when properly braced, makes a very efficient feed-rack for the breeding flock. When it comes to forced feeding, as in fattening lambs, such a rack has the objection that more or less dirt filters down into the grain-troughs, and the sheep with their dainty appetites do not feed as well as when the grain-troughs and the hay-rack are separated.

Quantity of bedding. — Bedding should be used very liberally in both the sheep barn and at least a part of the lot. A fresh supply should be put down every few days. There is much disagreement among experienced sheep owners as to the frequency

of cleaning the sheep barn. Some state that they would rather keep adding fresh bedding and not remove the litter from the time the sheep go into the winter quarters in the fall until turned to pasture in the spring. Their chief objection to remov-

FIG. 153.—LEICESTER YEARLING EWE.

The Leicester breed of sheep developed in Leicester county, England. The breed is noted for the production of mutton and wool. In weight, the rams average 225 pounds and the ewes 175 pounds. This breed produces a fine grade of long wool, the wool averaging 6 to 10 inches in length and the fleece 5 to 10 pounds in weight.

ing the litter is the foul odor and the annoyance occasioned the sheep at the time the litter is removed. There are others, however, who insist that the sheep barn should be cleaned out just

previous to lambing time. The work should be done rapidly so as to annoy the sheep as little as possible. After the manure has been removed it is a good plan to scatter some air-slaked lime over the floor. This serves as disinfectant and deodorizer. Fresh bedding may then be put down, and the barn will be clean and pure for the advent of the lamb crop.

The sheep lot. — If possible, the sheep should at all times, except in the very severest of winter weather, have free access to a small lot. If this is dry and a part well bedded, the sheep will spend much of their time outside and will be much benefited thereby. Above all things the lot should not be muddy. Where sheep are allowed to wallow in the mud, trouble from foot-scald is likely to result; particularly is this true if there is much sheep manure mixed in the mud. Foot-scald is usually known as foot-rot. This disease is hard to eradicate. The sheep lot is very much easier kept free from mud than the fat steer lot, and it will pay the sheep owner well to take ample precautions.

A straw stack in the sheep lot has many advantages, such as keeping the sheep out of the wind, providing them a clean place to lie; and they will eat of the straw to some extent. It has the disadvantage, however, that the chaff gets in the wool, and for this reason is objected to by many good sheep owners. Yet ewes and lambs delight in lying alongside such a stack, and they will be found there more often than in the barn, except in very severe weather.

CHAPTER XX

DISEASES OF SHEEP

THE common diseases of sheep are not numerous, but they are mostly incurable. This is particularly true of the ravages of internal parasites. Prevention is better than cure. There seems to be no good reason why nearly every contagious and infectious disease to which sheep are subject cannot be eradicated in two or three years with proper precautions, yet these diseases result in nine-tenths of the failures in this country. It seems that farmers cannot realize that diseases so easy to prevent will work such destruction once they break out in the flock. In this Manual much has been made of the importance of dipping all sheep immediately upon their arrival at the farm and thus preventing an outbreak of any kind of external parasites; also of the absolute importance of frequent changes in pastures, especially with the lambs, in order to prevent internal parasites. In addition, there are the hygienic conditions, such as proper shelter and dry lots, that must receive careful attention.

TREATING SICK SHEEP

Sick sheep should be removed from the flock at once, not only that they may receive extra care and attention, but to prevent a spread of the ailment in case the disease should prove contagious. The sick animal should be removed to comfortable quarters and given the benefit of good care, for in many cases good care is to be preferred to medicine. The food should be given careful consideration. The general management, the food, and the methods of administrating medicine should be much the same

as suggested on page 161, modified to meet the attendant conditions.

For convenience in discussing the common diseases of sheep, we may divide them into four classes: those due to external parasites, as scab, foot-rot, sore eyes, sore teats, tick, lice, and the like; second, those due to internal parasites, as stomach-worms, tape-worms, and the like; third, derangement of digestion, due to improper feeding; and fourth, other diseases, as caked udder, garget, catarrh, and the like.

EXTERNAL PARASITES

The cure for external parasites is dipping. When done as suggested in pages 423 to 427, it will completely eradicate such parasites as ticks and lice as well as the pests that cause scab, foot-rot, sore eyes, and sore teats. The prevention of any of these parasites is a very simple matter.

INTERNAL PARASITES

Treating internal parasites is much more difficult. In many cases the parasites are located where medicine cannot reach them, as in the brain or liver; and even when located where medicine can reach them, as in the stomach, the medicine is of very little value as it is so diluted with digestive juices by the time it reaches the worms. The only practical treatment is prevention. This involves some trouble, and in order to make the necessity for such clear, we will consider a case in detail. Of course, dipping is of no avail for the internal parasites.

The stomach-worm. — This worm (*Strongylus contortus*) is a small, thread-like worm about three-fourths of an inch in length. It lives in the fourth stomach, and especially afflicts lambs, attacking them at any age after they begin to nibble grass until cold weather in the fall. This stomach-worm is by far the most destructive of parasites, doing more damage than all others combined. When the fourth stomach of the lamb becomes filled

with these small worms, digestion is greatly interfered with, the lamb looks dejected, the skin loses its pink color, the wool appears

FIG. 154. — COTSWOLD RAM. Owned by F. W. Harding, Waukesha, Wis.

The Cotswold, a native of England, is noted for the production of both mutton and wool. The animals are rather large, rams averaging 250 pounds and the ewes over 200 pounds. The breed is noted for the production of very long wool of fine quality. The wool averages 10 to 14 inches in length and 6 to 10 pounds in weight. This breed is extremely popular in the United States.

dead, and the animal takes on a starved appearance. Scouring is more or less frequent. The best evidence, however, that the lamb is afflicted with stomach-worms is the presence of the small worms in the droppings. Older sheep also become affected, but seem to withstand the ravages of the worms better than lambs, due no doubt, in the lambs, to the more tender condition of the stomach wall and to the milk diet.

The life history of these small worms seems to be simple and to furnish a clew to the means of prevention in lambs. The worms become mature in the body of the older sheep and, laden with eggs about to hatch, pass out with the excreta. Just what the worms do outside the sheep's body is not known. When it is moist and warm, in some way the worms find their way into the lamb's stomach. Perhaps the small worm is taken in while eating, perhaps by drinking surface water. We know that warmth and moisture are necessary for the transfer, hence there is little danger in the North, on mountain uplands, and but little danger in the dry regions of the West. The method of prevention is to remove the lambs and place them on fresh or preferably sown pastures before there is danger of infection. Lambs receiving no other food than grass and the dam's milk are much more likely to be attacked than those fed grain in addition, particularly if the grain contains linseed-oil meal. The only safe way, however, is to remove the lambs to new pastures before infection.

In case lambs become infected, treatment should be resorted to, though many practical sheep owners state that the treatment at best is not satisfactory. Circular No. 35, the United States Department of Agriculture, Bureau of Animal Industry, reports that satisfactory results were obtained from the use of coal-tar, creosote, thymol, and gasolene. The following is taken from the circular, as it gives a general idea of the treatment for other worms as well:—

Coal-tar Creosote. — Excellent success in treating sheep,

goats, and cattle for the twisted wireworm (*Strongylus contortus*) has been obtained with a 1 per cent solution of coal-tar creosote. The medicine is easily prepared and inexpensive. It may be purchased of a druggist in small quantities of 1 ounce, or in pound bottles. One ounce is sufficient for about 20 adult sheep, and the cost of the treatment is less than one-half a cent per head. If creosote is called for at the drug store, beechwood creosote will be usually dispensed. This is more expensive than the coal-tar creosote and not so satisfactory in expelling worms.

A 1 per cent solution of coal-tar creosote is made as follows: —

Coal-tar creosote	1 ounce
Water	99 ounces

99 ounces = 6 pints and 3 ounces

Twisted wireworms taken directly from the stomach of sheep or cattle die in one-half to one and a half minutes when immersed in this solution.

If, in drenching, this liquid enters the lungs, the animal may succumb in a few minutes. If the dosing is performed carefully, as much as $6\frac{2}{3}$ ounces may be given to a full-grown sheep without fatal results. In some cases, however, the animal shows ill effects, from which it usually recovers within half an hour. Six ounces were given to a number of sheep without the slightest ill effects. The following table gives the doses of the 1 per cent mixture which were used in about 400 cases without ill effects: —

Lambs 4 to 12 months old . . .	2 to 4 ounces (about 60 to 120 c.c.)
Yearling sheep and above . . .	3 to 5 ounces (about 90 to 150 c.c.)
Calves 3 to 8 months old . . .	5 to 10 ounces (about 150 to 300 c.c.)
Yearling steers	1 pint (about 480 c.c.)
Two-year-old cattle and over . .	1 quart (about 960 c.c.)

Sheep, goats, and calves which received this treatment showed a marked improvement a few days after receiving a single dose.

If an overdose is given by mistake, and if the sheep appears severely affected by it, the animal should be placed in the shade. Even in some cases of very severe overdoses, where the animal is

given up for dead practically, it may entirely recover in an hour or so.

Coal-tar Creosote and Thymol. — If, in addition to the stomach-worms, the animals are suffering from a severe infection of bowel worms, such as the hook worms, better results are obtained in the treatment when powdered thymol is added to the creosote. In cases of this kind, the creosote solution is prepared, as already directed, and 30 to 80 or even 100 grains of thymol added to each dose after it has been measured, giving 30 grains to lambs, 50 to yearlings, and 70 to 100 grains to older sheep, according to size.

The tape-worms. — The digestive tract of sheep is occasionally infested with tape-worms. There are several kinds of tape-worms, but only two infesting sheep in this country. The common one (*Tænia expansa*) varies in length from ten to twenty feet and in breadth from one twenty-fifth of an inch at the head to one-half an inch at the tail. The life history is somewhat similar to that of the stomach-worm. Sheep become infested in the same way, the most common source being old infested sheep pastures and the most susceptible animals being those rather run down in flesh.

The best method of combating tape-worms is prevention by changing from one pasture to another and by the use of sown pastures, as suggested in the discussion on summer care of the flock (page 382). Wing recommends liberal feeding of pumpkins in the fall. Pumpkin seeds are well-known vermifuges. By the frequent use of sown pastures and the feeding of pumpkins almost every fall he reports entire freedom from this disease. Tape-worms are easily prevented but very difficult of eradication.

In case the sheep are affected with tape-worm, treatment should be given, though the results will depend in a large measure upon the degree of infection. From Bulletin No. 19 and Circular No. 35, Bureau of Animal Industry, we take the fol-

lowing: Dissolve one ounce of copper sulfate in two quarts of boiling water. Use only copper sulfate of a uniform blue color. Avoid that which is in conglomerate lumps with white patches and covered with a white crust. The owner is cautioned against guessing at the weights and measures, for this is likely to result in too strong a solution, which will kill the animal, or in too weak a solution, which will fail to be effective. Prepare the animals for treatment by fasting from twenty to twenty-four hours. The dose is as follows: —

Age of Animals	Tablespoonfuls	Cubic Centimeter
Lambs 3 months old	1	20
Lambs 6 months old	2	40
Sheep 12 months old	3	60
Sheep 18 months old	4	80
Sheep 24 months old	4½	90

The medicine is given in the form of a drench as suggested for stomach-worms. If, after dosing, any of the sheep seem to be suffering from an overdose, indicated by lying apart from the flock, not feeding, manifesting a painful, excited look, and a spasmodic movement in running, walking with a stiff gait, or purging with a dirty brown discharge, take the affected animal from the flock to a shady place and dose with laudanum and milk. For a lamb four to six months old, give a tablespoonful of laudanum in a tumbler of milk. Repeat half the dose in two or three hours if necessary.

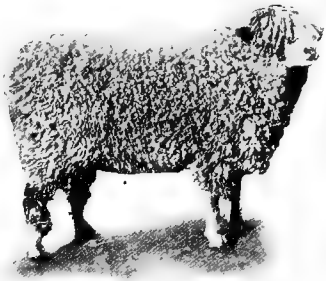

Fig. 155. — Champion Cotswald Ram. Photograph from the *National Stockman and Farmer*.

After treating, the sheep should not be allowed water for several hours.

Each animal in the flock should be treated at the same time. While some sheep may be able to withstand the presence of the parasite, they serve as a source of infection. While the tapeworms are being voided, the flock should be confined to one place, and the droppings with the segments of worms destroyed.

DIGESTIVE DISORDERS

Among sheep, digestive disorders arising from overfeeding, from irregular feeding, and the feeding of food too dry and woody, are of rather common occurrence. First of all, however, we will consider bloating, as it may be of frequent occurrence, unless extra care is taken, when turning to clover, alfalfa, and rape pasture.

Bloating. — When bloat occurs among sheep, treatment to be of any avail must be prompt, as the gas generated often causes death from suffocation in a very few minutes. If the animal is in much distress when found, the paunch should be punctured where the distension is greatest, in order that the gas may escape. For this a trocar and canula is best, but in the absence a long-bladed pen knife will serve. After relief has been had, disinfect the wound. If there was not sufficient time to remove the wool from the spot before the puncture, it should be removed now and a little pine tar applied to repel the flies. (See page 351.)

If the bloating is not so severe, relief may be obtained by tying a stick or corn cob in the mouth similar to a bit, thus holding the mouth open, and the sheep, in rubbing the cob or stick with the tongue, often struggles in such a way as to prevent further bloating. If the sheep are noticed when first distressed, give them three tablespoonfuls of raw linseed oil to which has been added a teaspoonful of turpentine. Slowly pouring cold water over the

distended paunch often gives relief by stopping the accumulation of gas.

Constipation. — In winter when the ration is composed largely of dry woody food, sheep often suffer from impaction, which often leads to constipation and in some instances to inflammation of the bowels. This condition of the digestive tract materially weakens the animal, and it becomes susceptible to various ailments. All tendencies to impaction, constipation, inflammation, and the like should be avoided by feeding daily some laxative food, such as roots, silage, oil meal "pea size," along with the dry food. If sheep growing is to prove profitable, some such foods must be used.

When impaction occurs, it may be relieved by giving Epsom salts. The size of the dose should vary somewhat according to the size of the animal; a 150-pound animal may be given from 4 to 6 ounces dissolved in a pint of hot water. If not relieved within 10 hours, repeat the dose.

Disorders caused by overfeeding. — As indicated in the discussion on feeding lambs in winter (page 399), digestive disorders due to overfeeding are likely to prove fatal. Occasionally fatalities will occur from this cause on the best regulated farms. Many remedies have been suggested to relieve such disorders, but they fail. Death is almost sure to follow, no matter what may be done. In fact, among sheep suffering from apoplexy, the result of overfeeding, little time will be given to do anything. The lambs die in a few minutes. This sometimes can be impressed only by experience. The lambs will seemingly be in the best of condition, when, for some reason, one gets an overfeed, and fatal results rapidly follow. It is usually the largest and strongest lambs that are attacked, as they are the ones likely to crowd the smaller ones away and consume too much feed. The ration, particularly the grain, should be increased very slowly. While it is very important that the sheep be fed all they will consume, it is even more important that they be not fed more than they will

clean up from meal to meal, as this is likely to result in one or more of them overeating.

While water, salt, and succulent food of some kind are necessary to the well being of sheep, care must be exercised in feeding them, as otherwise they are likely to produce kidney and bladder troubles. Drinking too much hard water, the result of eating large quantities of salt, causes the deposit of limy substance in the bladder, which becomes washed into the urethra, where it lodges, causing stoppage of the urine, inflammation, followed by distention of the bladder, which after a time results in death. The long-continued feeding of too many mangels, rich in lime, is likely to give similar results.

OTHER DISEASES

Caked udder. — This trouble often occurs among heavy milkers. In most cases it is due to neglect at lambing time. The udder becomes greatly distended, inflamed, and swollen. The treatment is to relieve the congestion by drawing the milk, frequently. Bathe the parts with hot water and apply camphor ointment, as in caked udder among dairy cattle. Some prefer an ointment made of lard and turpentine, equal parts. The ointment should be well rubbed in and applied three times daily.

Garget often proves serious in certain localities. It is said to be due to mechanical injuries, such as a blow, a scratch, or the udder being horned; to the udder becoming distended with milk; and to germs entering the udder. The udder becomes hard, distended, and the milk is often watery and may contain blood. The treatment usually recommended is the hot water bathing and the camphor-belladonna ointment treatment, as suggested for cows (page 340).

Among sheep, however, garget seems to be due to other causes as well, and when such is the case, the above treatment often fails of relief. A typical case is somewhat as follows: A strong ewe

lambs without difficulty, the first milk comes, and the lamb as well as the ewe is doing nicely. The owner, in order that the ewe may give an abundance of milk, places the ewe on a full

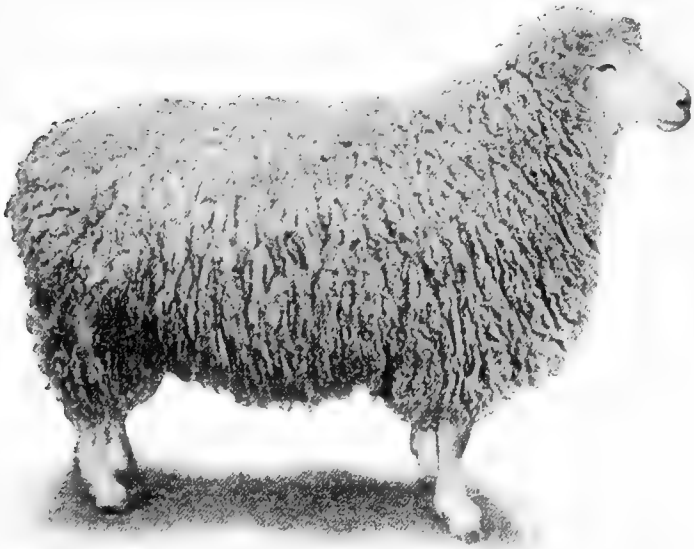

FIG. 156. — LINCOLN RAM CHAMPION AT INTERNATIONAL LIVE STOCK SHOW, 1906. Photograph from *National Stockman and Farmer*.

The native home of the Lincoln breed of sheep is in the county of Lincoln, in England. This breed is particularly noted for its large size and great length of fleece. In weight the rams average about 300 pounds and the ewes 275 pounds. The wool often attains a length of 18 to 20 inches, and at shearing time gives a fleece weighing 10 to 12 pounds, for the ewes, and 12 to 20 pounds, for the rams.

grain feed at once, perhaps feeding corn alone, as the grain; in a few days milk secretion stops, the sheep has fever, the flesh of the udder is red, and on pressure is dented with the hand. The sheep seems in great distress and may soon die. If she lives, the udder

never regains its consistency and after a time sloughs off, leaving a slow healing sore. In such cases, physicking the animal and treating the udder are of no avail. There seems to be a relation between the disease and the food supply. The grain part of the ration seems to have been increased too rapidly immediately after lambing. When the grain ration was increased more slowly and when it contained oats and linseed meal, no such difficulty was experienced. From this it would seem that the treatment should be prevention by increasing the grain ration slowly after lambing.

PART FOUR—SWINE

CHAPTER XXI

CHOOSING AND JUDGING SWINE

SWINE are grown for a single purpose, that of pork production; yet the successful swine breeder will give the selection of his animals much serious consideration. In choosing swine, as in all classes of meat animals, the butcher's preference must be the leading guide. The butcher's preference is determined by the demands of the market. Uniformity in size and quality is the most urgent demand.

TYPES OF SWINE

There are two distinct types of swine: the lard type, noted for the production of thick fat; and the bacon type, known for the production of bacon.

The *lard type* far outnumbers the bacon type in America. As a type, the lard-hog has reached its highest development in the corn-belt of the United States. This is often called the American type of hog, and is not looked upon with favor by people of other countries because of its extreme fat development.

The lard-hog should be compact, with the body very wide and deep. The shoulders should be full although not coarse, with the hind-quarters or hams carried out straight to the tail-head and well fleshed down to the hock. Since the valuable cuts lie along the back, rump and quarters, the general conformation of the lard-hog should be similar to that of the fat steer. The flesh covering should be thick and evenly distributed throughout the body, particularly over the shoulders and quarters. The size

and weight are determined largely by the market conditions. Formerly very heavy hogs were in demand, but at the present time pigs weighing from 225 to 250 pounds will command the highest price, all other conditions being equal.

The *true bacon type* of hog is little grown in the United States. Denmark, Great Britain, and Canada furnish most of this class of pork. In recent years the American breeders, particularly those east of the corn-belt, have given this class of swine some active consideration, but its production is not likely to make much headway in America. We prefer the rapid-fattening, heavily fleshed, and early-maturing lard type. In contrasting the general appearance of the bacon type with the lard type, we note that the body of the former lacks the width of the latter, the shoulders and hams are lighter and longer, the body is somewhat longer, and the animal stands on somewhat longer legs. The weight of the bacon hog is not so great as of the lard type, American markets preferring 155 to 195 pounds and the Danish markets 160 to 220 pounds.

Because of the extreme difference in type we will consider the desirable features of the lard- or fat-hog first and then contrast with it the bacon type, first pausing to discuss the age.

AGE OF SWINE

In choosing other classes of farm animals age enters largely into the choice, but in market hogs it is seldom considered except in the case of old sows and stags. The weight and condition of the animal determine the value. As in other farm animals, the age is indicated to a certain extent by the teeth, but the difficulty of catching, holding, and examining is so great that the teeth are seldom, if ever, used to determine the age of swine. Among breeding stock the matter of age is of considerable importance, but even here it is estimated more by a general examination than by any specific character. The older the boar the coarser and heavier the "shields" — outside of shoulder — and the longer

or larger the tusks as well as the larger and more wrinkled the body throughout. The older the sow the more pendulent the belly, the coarser and more wrinkled she becomes.

CHOOSING LARD-HOGS

The lard- or fat-hog is desired for full shoulders and heavy hams. These points must be kept clearly in mind. The

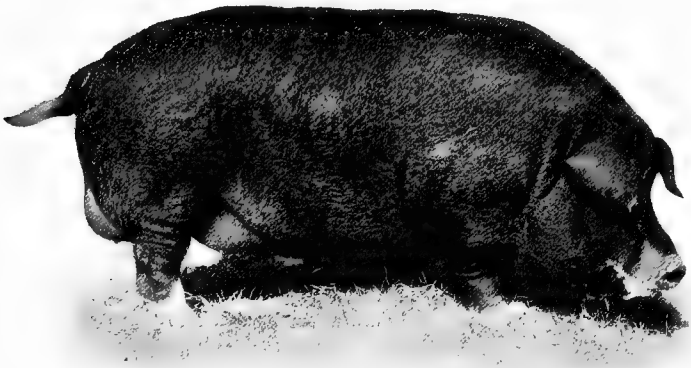

FIG. 157. — POLAND CHINA YEARLING BOAR. First prize, Wisconsin State Fair, 1908.

The Poland China breed of swine originated in Warren and Butler counties in southwestern Ohio. The breed is noted particularly for its early maturing qualities and for the ability to take on fat economically. This breed represents the extreme development in lard production, and because of this it lacks in fecundity and prolificacy. In size the breed is classed as a middle-weight. The color is black with white markings, the ears drooping, and face straight. The breed is very popular in America.

sides and especially the belly produce a cheap grade of meat, and there should be a minimum of these parts with maximum loin, rump, and quarters. In choosing lard-hogs, or any other for that matter, the most convenient and simplest method

is to note the general appearance first, then pass to a more detailed examination.

General appearance of lard-hogs

By carefully noting the general appearance of a hog one can gain a fair knowledge of its value. Carefully view the hog or the drove of hogs from a distance before moving up closely to the animals. This gives one a good knowledge of their uniformity, temperament, and their general form. The butcher will base his estimate of their value largely on the uniformity and form, and the feeder will base his estimate mostly on their temperament, as a mild-tempered pig is likely to be a good feeder. Such an examination will give one a good idea of the weight, quality, and constitution, all very important factors in swine growing.

The *general form* of the fat-hog is of primary importance. It should be compact, with the body deep, broad, smooth, and symmetrical. The length should be medium, as a too long back is likely to result in weakness just back of the shoulders. As with the steer, the hog should have the larger part of its weight in the region of the most valuable cuts; that is, along the back, loin, and hams. While the fore-quarters, neck, and head are parts of lesser value, they must show much development in order to insure constitutional vigor and vitality, which is largely controlled by chest capacity. The chest, therefore, should be broad, deep, and carried well forward. This development gives the hog a parallelogram development similar to that desired for beef cattle.

The weight and condition. — The weight will depend largely on the condition, and as these determine the market value they will be considered together. Formerly heavy hogs, those weighing from 400 to 500 pounds, commanded the highest price, but at the present time the market demands a much lighter hog. While market demands are exceedingly variable, in

general the most desirable weight is from 180 to 275 pounds, though heavier hogs sometimes command a premium on the market. Very heavy hogs are often spoken of as "fat backs" because of their broad, heavily fleshed backs. A lard pig in good condition should weigh from 175 to 200 pounds when six months old, and 350 to 400 pounds when one year old. Some hogs under the best of conditions may weigh much more, many others will weigh much less, but those are the weights one can reasonably hope to attain.

Quality. — The indications of quality are fine hair, freedom from bristles, and a comparatively light, dense, and clean bone. Fineness of the parts in general is an evidence of quality. This is often overdrawn, as too much fineness leads to delicacy, which is sometimes observed in the hogs being too small, facial features too fine or small, and the bone fine to the point of weakness. On the other hand, hogs with coarse bone, coarse hair, and coarse hide are likely to be poor feeders, and the butcher objects to them because of the large percentage of offal which they dress. The quality of bone, hide, and hair should lie between these two extremes. In addition to being rather fine and free from bristles, the hair should lie close to the body and the skin be free from wrinkles and undue roughness caused by scurf.

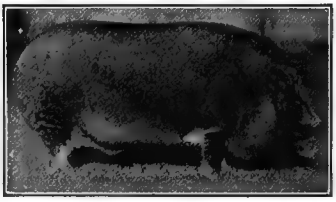

FIG. 158. — POLAND CHINA BOAR. Sold for $5000.

Constitution. — The indications of a good constitution and much vigor are a deep, broad, and well-advanced chest, thus giving capacious chest capacity and good heart girth. The chest should be deep from the top of the shoulder to the brisket, which should be placed low down; it should be wide, as indicated by much width between the front legs, and the brisket should be well advanced between the front legs. The real

width of the chest is often difficult to estimate, as the external width depends much on the thickness and the way the shoulders are attached; thus an animal wide from shoulder to shoulder might have a small chest capacity, which would not leave sufficient room for the organs to do their work as they should. The flank, both front and rear, should be full and well let down, as this also indicates good constitution.

Uniformity. — One of the most important general considerations in choosing a herd of swine, either for breeding or feeding, is the uniformity. While this adds nothing to their ability to make economic gains, it does add materially to their selling value. This is one of the most neglected factors in American pork production. The first thing the commission merchant does on receiving a mixed drove of hogs is to separate them into bunches uniform in all important characters, as age, weight, and condition. The butcher will very often pass by a mixed drove of hogs, even though they are of good quality and in good flesh, refusing to place a bid on them merely because he lacks the facilities for handling such mixed lots. Separate them into uniform droves, and he is attracted to them at once and will pay an extra premium for the same stuff he refused to bid on before.

Uniformity in color is perhaps not so essential as age, weight, and quality, although a drove alike in color will command a better price than mixed droves. White is not considered well adapted to southern conditions, as it is likely to sun-scald or blister, and this introduces skin diseases of various forms. Formerly, by far the larger part of the hogs sent to the market were black, but recently blacks have been decreasing and reds increasing, with the whites remaining practically stationary. From information gathered from the ten largest packing houses in the United States, the color ran as follows: black, 55 per cent; red, 35 per cent; white, 10 per cent; all others, 5 per cent.

Detail characters of the lard-hog

Since the individuals are small and the drove often composed of a large number, the beginner is likely to neglect the detail examination, with the result that many poor individuals find their way into the beginner's herd. Individuality among swine is just as great as among fat cattle. The breeder or feeder in choosing his swine should carefully observe each character, and in order that none go unnoticed they may be considered in the following order: —

The *head* should be short and broad. No facial character among any class of farm animals is more variable than the hog's snout. In some breeds, notably the Tamworths and Hampshires, the snout is very long and straight from the ears to the tip of the nose; in other breeds, as the Yorkshires, it is long and dished; while in others it is short and straight, as in the Poland China; and in still others it is short and very much dished, as in the Berkshires. The eyes should be wide apart, clear, and prominent. Folds of fat about the eyes, while rather common, are very objectionable. In heavy fat-hogs these patches of fat are often so prominent as entirely to close the eye. The ears should be of medium size for the breed and fine in texture. The way the ear is carried depends on the breed, being erect in the Berkshire and Yorkshire; half drooping in others, as the Poland China and Duroc Jerseys; and wholly pendent in still others, as the Chester White breed. Whatever the carriage, ears should be neatly attached to the head. Large and coarse ears are usually associated with heavy coarse bone and are, therefore, objectionable on any breed.

The *jowls* should be firm, smooth, of medium size, and not pendulous. Jowls that are flabby, owing to the excessive amount of fat, are very objectionable. They should be firm, indicating an intermixture of lean meat. The size of the jowls is rather a breed characteristic, being rather large in the Poland China

and Berkshire, and rather small in the Tamworths and Hampshires. The statement is often made that large jowls indicate great feeding capacity. This is not true, as Tamworths and Hampshires feed as well as Poland Chinas or Berkshires. The medium-sized jowls for the breed are to be preferred. They should be free from heavy folds and not pendulous and loose.

FIG. 159. — PRIZE BERKSHIRE SOW. Owned at Hood Farm, Lowell, Mass.

The native home of the Berkshire breed of swine is in England. Like Poland China, this breed is noted for its early maturity and for its ability quickly to attain marketable condition. This breed lacks the extreme fat development of the Poland China, and for this reason the quality of the meat excels the Poland China. In prolificacy and fecundity the breed ranks fair. In weight the animals are classed with the middle-weight breeds. The color is black, with white markings, ears erect, and the face dished. The breed is very popular in America.

The *neck* should be of medium length and possess sufficient width and depth to swell smoothly into the shoulder-vein and pass back without any noticeable depression. It should narrow toward the nape and join smoothly with the cheeks. It should join the head and shoulders smoothly without undue thickness, as a neck too thick and too heavy is objectionable because it

indicates general coarseness and increases the relative percentage of cheap meat.

The *shoulders* should be long, full, and level on top. They should be long, extending down even with the underline of the body. While long shoulders are not necessarily correlated with a deep chest or constitutional vigor, they give the hog a more symmetrical appearance. They should be full, especially at the lower end, which is often a weak point, and just forward of the shoulders in the region known as the shoulder-vein. The shoulders should not be too heavy, as it is a comparatively cheap cut, nor should the skin be too thick and heavy, as such indicates reversion to ancestral types, because these parts were abnormally developed in the wild hog as a protection in fighting.

The *back* and *loin* should be of moderate length, straight, broad, and evenly fleshed throughout. They should be very carefully considered, as the back and loin furnish some of the most valuable cuts. Here pork chop and pork roasts are secured. The back should be strong, and this can best be obtained by moderate length, as a too long back is likely to be weak, particularly just back of the shoulders. It should be straight or, better still, slightly arched, gradually rising from the neck to the center of the back, and from there sloping very gradually to the tail. There certainly should be no depression or sway in the back from the shoulder to the tail. The back should be broad, and this breadth should be evenly maintained from the shoulder to the tail. It should be as broad on the rear as it is in front. Tapering towards the rear — that is, narrower across the loin and rump than across the shoulders — is objectionable. The flesh covering should be even and firm, giving a smooth carcass when slaughtered.

The *sides* should be as long as possible and yet maintain sufficient strength of back, which is best accomplished by medium length. They should be deep and thick. The ribs should be well arched and continue low down, giving great feeding

capacity. The underline should run straight from front flank to rear flank, giving the side an even width throughout its entire length. Sides should be firm and smooth, and free from wrinkles and flabbiness. Wrinkles and creases, particularly just back of the shoulders, are of common occurrence and are usually objectionable, as they indicate uneven fattening and poor quality of flesh. While the development of the shoulders and hams is usually much greater than the sides, thus leaving a marked depression just back of the shoulder and in front of the hams, this should not be; the sides should be even with the hams and shoulders and carry the fullness well down, giving the animal a symmetrical and well-balanced appearance.

The *belly* should be low, giving the side good depth and indicating great feeding capacity; it should be straight from fore to rear, giving an even cut to the sides, and it should be firm and smooth, as wrinkles indicate lack of lean and general flabbiness. The width of the belly should be in proportion to the hog in general. A very narrow belly is objectionable.

The *hips* should be as wide as the body in general and smoothly covered with flesh. Narrow hips are very objectionable, as this is the region of valuable meat. The hips should be so smoothly covered that their location is not apparent to the eye. It is commonly held that the hips should be rather low, as a very high hip is not likely to be well covered.

The *rump* should be long, wide, and fairly level. It should be long so as to increase the length of the ham. The width should be carried back proportionately with the back, as a peaked rump is very objectionable. Narrow, peaked rumps mean thin hams, which do not sell well on the market. As a rule hogs droop considerably from the hips to the tail; nevertheless the nearer the rump approaches the level, the better the cuts of meat will be; for this reason extremely drooping rumps are to be avoided. The rump should be evenly and smoothly fleshed from hips to tail.

The *hams* should be wide, deep, and plump. Viewing the pig from behind, the hams should be wide from between the legs to the outside; viewing from the side, they should be deep, that is, long from the tail downward and fleshed well down to the hock. Such a conformation will give a long, wide, and plump ham when slaughtered. Often the hams lack fleshing above the hocks, the region being bare and thin, which results in a poor ham when slaughtered. The flesh should be firm, indicating that there is not too much fat, as very fat hams are not desired on the market. Extra fat hams sell at low prices.

FIG. 160.—CHAMPION BERKSHIRE PIG.

The *legs* should be straight, strong, tapering, and well placed. Knees that are considerably bent, or "bucked knees," and hocks that are very much cramped, are common defects among swine. Crooked knees, those which come too close together, and hocks too close, are all too common. Another very serious objection, particularly among fat-hogs, is the tendency of their pasterns to break down, leaving the animal to walk on the dew-claws. Although common, and often among the very best bred hogs, this is very serious and always to be guarded against. Sometimes the underline slants upward from the front to the hind flank, due to the hind legs being longer than the fore legs. This should not be.

The legs should be short, strong, and placed wide apart, and when the hog walks, the hind and fore legs should pass forward in a straight line. Although inward and outward movements of the legs are common, they are objectionable and account for the awkward gait of many hogs. This is a common defect among well-bred swine.

CHOOSING BACON-HOGS

The bacon-hog differs materially from the fat- or lard-hog, particularly in type and flesh covering. The bacon type originated to meet the demand for lean meat. Excessive fatness is objectionable in this type and does not bring as high price as when the lean and fat are well interspersed, giving the meat a marbled appearance. The bacon-hog is extensively grown in the Old World and Canada, but has never become popular in the United States, although considerable bacon is produced in the Eastern States.

In general appearance, the bacon type differs from the lard type in the animals being more upstanding, much longer of limb, the bodies considerably longer and not so wide, and the hams and shoulders much lighter. The animals lack the heavy flesh covering of the lard type.

Condition. — The flesh is not so thick as on the lard type of hog, rarely exceeding one and one-half inches, but it must be firm, smooth, and even over all parts. It should be firm, as this indicates the presence of lean meat; it should be smooth and free from wrinkles and seams, as smoothness indicates even fleshing and good quality; and the flesh covering should be even over all parts of the body in order that the cuts of bacon may be uniform.

The *form* should be long, level, and deep. It should be long in order to give length to the side cuts; it should be level and free from sway back; and it should be deep in order to increase the percentage of side meat. The shoulders and hams should be light and the animal of uniform width from the shoulders to the hams. Width is not sought, but both length and depth are of prime importance. The form should appear trim and neat, and the animal be free from all coarseness in hair, hide, and bone.

The *shoulders* should be smoothly laid-in before, behind, and

on top; compact, indicating quality and firmness; and they should be light, lacking the bulge of the lard-hog. The shoulder should fit closely to the body and not show more width on the back; it should be free from coarseness; and the fleshing should

FIG. 161. — LARGE YORKSHIRE, OR LARGE WHITE, SOW. Photograph from *Farmers' Advocate.*

The Large Yorkshire or Large White breed of swine developed in England. This breed is noted particularly for its bacon qualities. The quality of the meat is unexcelled, being well marbled; that is, the fat and lean are well mixed, although the animals are rather late maturing. In size the breed is classed as large. The breeding qualities are excellent. The color is white, the ears inclined to droop forward, and the face dished.

extend well down the legs, indicating muscular development and giving a long shoulder cut.

Sides. — Among bacon-hogs the sides are of prime importance, as the choicest bacon comes from this region. It is, therefore, essential to have as much as possible of the desired weight in this region. The sides should be long, smooth, and level. From shoulder to ham should be as long as possible without increasing weakness, thus giving long side cuts; they

should be smooth and free from wrinkles and seams; and they should be level from shoulders to hips. A swaying back or a too pendulous belly are very objectionable.

Hams. — The rump should be long, and the fleshing should be carried well downward toward the hock. Fullness and plumpness are not essential, while good length, with smooth muscular development, is of prime importance. The fleshing should be firm and tapering towards the hock, thus giving a neat and trim "gammon," which is a cut very similar to the ham.

CHAPTER XXII

THE FEEDING OF SWINE

UNLIKE cattle feeding, in which it is the common practice for the animals to be bred on cheap land and later shipped to the corn-belt to be fattened, swine are largely bred and fed on the same farm. The swine feeder must breed and grow his own stock. The dangers from hog cholera and other swine plagues are too great to make the buying of feeding swine in the open market practicable. The breeding herd does not require much space, and in addition the sows are very prolific, thus making it possible for a comparatively small number of sows, maintained on a small area, to produce many stock hogs. Swine feeding, therefore, is inseparable from swine breeding.

FIG. 162.—LARGE YORKSHIRE, OR LARGE WHITE, SOW. Photograph from *Farmers' Advocate.*

No farm animal equals the hog in turning food quickly into marketable meat; and none has yielded more profit to the average American farmer. In health no farm animal is more easily cared for than the hog; it requires little shelter and will eat almost any article of food placed at its disposal. From this it would seem that the hog is the most economical meat producing animal. This is true during health. The effort should be, then, so to feed and manage the herd as to keep it in good thrift at all times.

FOOD REQUIREMENTS FOR SWINE

The food required for a given gain among swine varies with the kind of food and the age and weight of animals. Foods vary largely in the energy they contain. The older and the larger the animal the more food required for a given gain. Wolff and Lehman, after much experimentation along this line, have given us the following standards: —

Wolff-Lehman standard, showing the amount of food required per 1000 *pounds live weight for both growing and fattening swine*

Condition of Animal		Dry-Matter	Digestible Nutrients			Nutritive Ratio
Growing Swine Breeding						
Age, Mo.	Weight		Protein	Carbo-hydrates	Fat	
2–3	50	44	7.6	28.0	1.0	4.0
3–5	100	35	5.0	23.1	0.8	5.0
5–6	120	32	3.7	21.3	0.4	6.0
6–8	200	28	2.8	18.7	0.3	7.0
8–12	250	25	2.1	15.3	0.2	7.5
Growing Swine Fattening						
2–3	50	44	7.6	28.0	1.0	4.0
3–5	100	35	5.0	23.1	0.8	5.0
5–6	150	33	4.3	22.3	0.6	5.5
6–8	200	30	3.6	20.5	0.4	6.0
8–12	300	26	3.0	18.3	0.3	6.4

As with the standards for horses, cattle, and sheep, these are arranged to meet the need of the average farm hogs under normal conditions. They are not intended to be absolute.

PREPARING FOOD

Foods for swine are often prepared by grinding, soaking, or cooking. There have been many experiments to determine the efficiency of each of these methods. These tests give more or less contradictory results, and it is difficult to determine from a perusal of the literature to what extent the food is rendered more efficient by such preparation. There can be little doubt, however, but that each of these methods increases the efficiency of certain foods under given conditions.

Grinding feed. — The advisability of grinding feed for swine depends much on the kind of food and to some extent on the age of the animals. Most of the experiments have been with the grinding of corn, and the results have been varying. With smaller and harder seeds and grains, such as peas, beans, millet, and the like, there is a much better showing in favor of grinding. The Canadian Central Experimental Farm conducted experiments which show a saving of 17 per cent in favor of grinding these smaller and harder seeds. The same may be true of corn when the grain is very hard and dry.

Grinding some foods increases the palatability and thus favors larger consumption. Swine fed ground food in the form of mash are not likely to masticate it, but simply swallow it, and in case the grain is not ground fine, the coarse particles are not so readily or thoroughly digested. In masticating their own grain swine will usually reduce it to rather fine particles, particularly if fed in the natural state. Thus it would seem that if the grain is to be ground, it should be ground fine.

Soaking the feed.—It is a rather common practice to soak whole grains and to wet meals before feeding. Soaking is a less expensive process and in many instances may be as good as grinding. One rather strong objection to feeding soaked grains, especially when the animals are used to eating the grains whole, is that they are likely to swallow the grains entire without mas-

tication. Soaking or wetting is, however, a very cheap method of preparing hard grains for swine, by rendering them more palatable and adding succulence.

Grains should be soaked long enough to make them soft. They should not be permitted to sour. While sour food, as such, is not injurious to swine, there is risk of feeding it one time sour and the next time sweet, as digestive disorders will surely follow a changing from one to the other.

Cooking the feed. — As a general practice, cooking food for swine is no longer regarded as profitable. In fact, cooking certain foods renders some of the nutrients less digestible. Cooking feeds for swine, however, has many advantages, chief of which are that it softens small and hard seeds; increases the succulence and to some extent the palatability of certain dry grains, such as peas and beans; reduces the water content of certain other feeds, such as roots and tubers, which contain more water than swine can economically use; and renders foods more uniformly mixed. Furthermore, cooked foods do not sour so readily, and the hard grains or particles of feed become thoroughly softened. It is considered best to put a variety of foods into the cooker. This serves a double purpose: since the small grains usually contain more protein, they form a more nearly balanced ration; and they add variety to the ration, and thus increase the palatability.

MAKING UP A RATION

The ration is ordinarily not given much consideration in swine feeding, but at the same time it is of great importance. The several factors considered in determining the desirability of a ration for other farm animals are of equal importance in swine feeding. The dry matter, digestible nutrients, protein, palatability, variety, suitability, and cost of foods should be carefully considered.

Feeding capacity among swine. — As with steers, it is desirable

to develop capacity while the animals are young. A rather bulky ration fed during the early part of the pig's life will increase the feeding capacity so that later in life he can consume more than would be possible if he received only a concentrated ration at first. Furthermore, there is great danger of overfeeding a pig; and if concentrated foods are used, this danger is greatly increased. If once a pig is overfed, he will never consume as much feed thereafter as he otherwise would.

Young animals grow much more rapidly than older ones. The young pig should be encouraged to consume as much as he can use to the best advantage. If the animal is fed too small an amount at this time, he not only fails to develop capacity, but does not make the most of that period of his life when he is the most economical producer.

Later, as the time approaches for fattening and after the capacity has been developed, the animals should be put on a full feed of rather concentrated food. This change should be made gradually, as swine cannot endure a sudden change without disorders following.

Giving swine their feed. — When foods are fed in the form of mash, there is always much crowding about the trough, which makes it very difficult for the feeder. To avoid this crowding, place the trough alongside the fence and parallel to it, so that the feeder may approach the trough from the outside and the animals from the inside. A very good plan is to hang a panel immediately above the trough, suspended from either end of the upper side. By placing a latch in the center of the lower side of the panel, it may be swung in and fastened to the side of the trough in the lot, thus shutting the swine out of the trough and giving the feeder an opportunity to put in the feed. The panel may now be swung back and fastened to the outside of the trough, giving the swine access to the entire meal at once. If there is more than one trough in the lot, the feed should be placed in all before any of the panels are swung back.

Salt in limited quantities should be kept before the swine at all times. A very good plan is to provide a shallow strong box, with slats nailed across the top, so the pigs cannot lie in the box, then place charcoal and salt in the box. The box should be placed under a shed and in a clean place. It is best not to place too much before them at a time, but to keep renewing the supply often, as this keeps the food clean and sweet.

Fresh, cool water should be available at all times, even though the animals are being fed mash or slops. The trough should be so arranged that the hogs cannot lie in the water and thus litter up the trough. During the winter, hogs often fail to drink a sufficient amount of water and fail to do well simply for this reason. To obviate this difficulty, the chill should be driven off the water and the supply should be fresh.

FEEDING THE BREEDING HERD

Feeding the breeding herd differs so essentially from the fattening of swine that it is desirable to treat each separately. In feeding the herd the object is to keep the animals in a healthy and thrifty condition. Flesh formation is to be encouraged and fattening discouraged. If the breeding herd is permitted to become too fat, the animals fail to breed regularly, the litters are small, and the dangers from difficult parturition are increased. Feeding the breeding herd naturally divides itself into two parts, summer and winter feeding. Each of these divisions calls for widely different practices. Furthermore, the common practice of breeding swine so young makes it necessary to consider feeding the younger animals separately from the older ones, as the young and growing breeding animal calls for very different foods from the older and mature ones.

Feeding the herd in summer

It is the common practice to confine the breeding herd in too crowded quarters. This close confinement and a too exclu-

sive grain feeding account for much of the shy breeding among many of the more prominent breeds. Hogs will live and breed under such confinement, but greatest success cannot be attained under these systems of management. Another serious mistake is the too liberal use of corn. While no food equals corn for fattening swine, it is not a good grain for the breeding animals, and its too exclusive use is a common cause of barrenness or of small litters.

FIG. 163. — DUROC JERSEY BOAR. First prize, Wisconsin State Fair, 1908.

The Duroc Jersey breed of swine is a native of the United States. This breed, like the Poland China, is noted for its fat production and early maturing qualities. The breeding qualities of the breed are considered good, as the sows are fairly prolific. In size the breed is classed as medium. The color is red, the ears drooping, and face straight. The breed is increasing in popularity in America.

Ample room should be provided. Nothing is better than pasturing or soiling. Soiling is likely to involve too much labor on the average American farm, but in such cases there is usually an abundance of pasture. Sometimes hogs are denied the run of a pasture because they require a rather tight fence, and if

not properly ringed are likely to root up the sod. While hog-tight fencing is expensive, it must be remembered that greatest success cannot be attained without pasture. In most localities, woven wire will prove the most effective in restraining the herd. It need not be high, although all things considered, the four-foot fence with a barb-wire on top will be found the most practicable.

With an abundance of pasturage, the breeding herd need receive no grain until a short time before farrowing, when grain should be fed sparingly in addition to the pasture. The well-fed sow will be more quiet at farrowing time and be less likely to injure her pigs than will the lean gaunt one lacking in milk. When grain is fed, the kind will depend somewhat on the kind of pasture; but as a general rule nothing is better than wheat bran or middlings, as it is rich in protein and mineral matter, two elements much needed by the developing pigs. Furthermore, bran stimulates the flow of milk, which is very essential for the sow with a large litter.

Ringing to prevent rooting. — Nothing is more natural than for swine to root, and if the pastures and meadows are to remain uninjured, the animals must be restrained by placing rings in their noses. This applies particularly on permanent pastures. On clover or alfalfa pastures, there is not so much danger of the sod being injured, as swine seem to get a more nearly balanced ration and do not have the desire to root up the sod as on blue-grass, red-top, timothy, or any non-leguminous pasture plant. The object should be to ring whenever the swine begin to injure the pastures. The operation of placing the rings in the nose is not difficult, a hog ringer, some rings, and a short

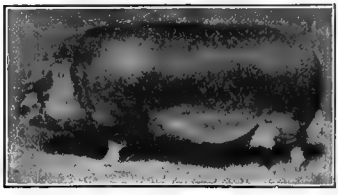

Fig. 164. — First Prize Duroc Jersey Boar. Wisconsin State Fair, 1908.

rope being all the apparatus that is necessary. Tie a small loop in one end of the rope, slip the loop into the animal's mouth and draw the head up. With the ringer pincers, firmly insert the rings into the nose, but not too deep, for if set so deep as to bind or pinch the muscle inside the ring, they will always be an annoyance to the animal. One or, in the case of old brood sows, at most two rings are all that are needed for each animal.

Pasture for swine. — Swine may be turned to any pasture land that is available, — permanent or sown pasture. When properly ringed, they are no more injurious to pastures than any other farm animal. Swine thrive much better when they have access to green forage plants. Since the common pasture plants are not available before warm weather, it is often of advantage to provide an earlier forage. Rye sown somewhat early in the fall makes an excellent substitute for pasture grass, early the following spring. Among the permanent pasture grasses, blue-grass comes on very early and provides much succulence throughout the season. Clover, alfalfa, and cowpeas are unexcelled as swine pasture in the regions where they thrive. For a quick growing crop, rape is probably to be accorded first place.

Roots for swine. — Roots are valuable as a food for swine during the late fall and winter months. They are mainly desired because of their stored succulence and to serve as a substitute for pasture. In the United States, roots have not been so commonly used as in Canada or the Old Country, though of late years they have increased in favor, and their usefulness, especially in the corn-belt, is being recognized. Sugar-beets, mangels, rutabagas, turnips, and carrots are grown as food for swine. Of these, many prefer mangels largely because of their high yield per acre, although they will not give as good results as sugar-beets.

The Jerusalem artichoke, a tuber belonging to the sunflower family, is often grown as a succulent for swine. This tuber is highly esteemed for fall, winter, and spring use. It is planted

in much the same way as the potato and grows from the eye of the tuber, which may be planted whole, or cut, usually whole if planted in the fall and cut if planted in the spring. By removing the hogs before all the tubers are secured, this crop may be grown successively for many years without replanting.

FIG. 165. — CHESTER WHITE BOAR. Photograph by C. S. Plumb.

The Chester White breed of swine first became prominent in Chester County, Pennsylvania. This breed is noted for its fat production. The breeding qualities rank high. It may be regarded as one of the most prolific of the fat-producing hogs. In size the breed is classed as the largest of the middle weights. The color is white, the ears drooping, and the face straight.

Many swine breeders and feeders do not grow artichokes because of the opinion that when once established they are difficult to destroy. This is not true. To destroy the crop, let the hogs root out every tuber, then plow and plant to corn or some other cultivated crop.

Pumpkins and squashes are much relished by swine in the late

fall and early winter. The custom of planting the pumpkins in the corn results in being able to grow them at almost no expense; and their keeping qualities add to their value as a succulent food for winter feeding. In addition to their succulence the seed is very rich in protein; thus they make a very good supplement for corn. Pumpkin seeds are a natural vermifuge. When many pumpkins are fed, the animals should be watched closely to see that they do not get an overfeed of seed and digestive disorders follow.

Feeding the herd in winter

More care must be given the feeding of the herd in winter than in summer; although if roots or other succulent food has been provided, the matter will be less difficult than if the feeder is obliged to rely entirely on dry feeds. The cheapness and the great abundance of corn really adds to the difficulty of wintering the herd. The great temptation all through the corn-belt is to feed a too exclusive corn ration. This difficulty is increased by the fact that no food equals corn in the fattening of swine; and the majority of swine feeders let the herd run with the fattening swine, with the result that the breeding herd gets so fat that its breeding powers are materially lessened, the sows often become barren, and those that do breed farrow small litters of pigs lacking thrift and vigor.

To avoid such difficulties, the herd must be separated from the fattening swine and fed a growing ration rather than a fattening ration. The object should be to keep the herd thrifty, but not fat. This can best be done by feeding such grains as wheat bran, middlings, and the like, also roots, pumpkins, and skim-milk for succulence. Alfalfa, clover, or cowpea hay in small quantities may be fed with profit. Hay should be fed from a rack and not thrown upon the ground, as the animals will tramp it under their feet. When the hay is clean and sweet, and slightly salty, the swine will eat it and be much benefited thereby.

When the grain is fed in the form of meal, better results will be secured by mixing with water, or better still skim-milk, and fed as a mash. If skim-milk is used, much care should be taken not to feed the animals too much, as they will take on flesh rapidly and may become too fat. A very good mixture is made by using one part meal to five parts of water or skim-milk.

Another common mistake is confining the herd too closely in the winter season. The quarters become very muddy. While it is not possible to keep swine from rooting when the ground is soft or from wallowing when the weather is warm, they should be given sufficient room for exercise, and provided with quarters free from mud where they may eat and sleep, although the platform on which they feed should be separated from the one on which they sleep.

Feeding the young and old herd. — Since the young animals are building bone and flesh for their own bodies, they need a more nitrogenous ration than the older animals that have attained their growth and need only enough protein to supply the waste. While the feeding of the young herd will depend much on the age at which the animals are bred, it may be said in a general way that the young herd needs a narrower ration than the old herd. Thus if the feeder has only sufficient skim-milk for a part of the herd, it would prove more profitable to feed the young herd the milk in connection with the grain and give the old ones water with their other food. In this way the younger animals will get the necessary mineral matter. The importance of well-chosen nourishment for the young herd cannot be overestimated.

FATTENING SWINE

Feeding swine for fattening differs essentially from feeding the breeding herd. In fattening, the sole object is the economic production of pork. As a rule the animals are forced to the limit of their ability as feeders, fattened and marketed under one

year of age. In this respect pork production is somewhat similar to beef production. The same general factors apply in both cases. Pork production is as much of a business as beef production and should be conducted accordingly.

Feeding the lard-hog

If light hogs are to be the product, the fattening process will begin much earlier in the life of the animal than if heavy hogs are to be produced. If lard-hogs are to be produced, the feeds will be much different from those required if bacon is to be the product. In the lard-hog, thick fat is desired, while in

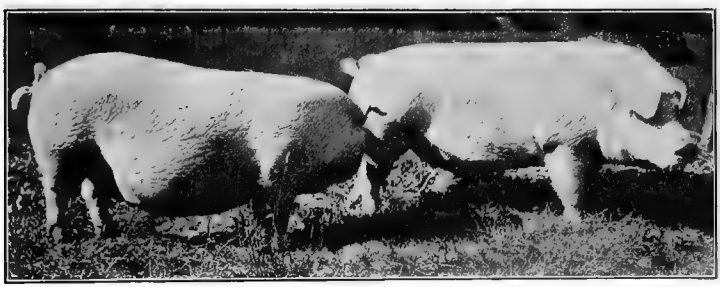

FIG. 166. — CHESTER WHITE PIGS. Prize winners at Wisconsin State Fair in 1908.

the bacon-hog the flesh covering is rather thin and well interspread; that is, the lean and fat are placed in layers, giving the meat a marbled appearance, when cut crossways. In the lard-hog, fattening foods are to be fed, while in the bacon-hog fleshing foods should be used.

Feeding the lard-hog in summer. — As a rule, swine should be fed in comparatively small droves. It is very important that the drove be made up of individuals of the same age as well as the same size. If a few of the individuals are larger and stronger, they will crowd the smaller and weaker ones back and get more than their allotment of the food.

Whatever food-stuffs are used, the swine should be put on full feed slowly. Much care should be exercised not to throw them off their feed in the beginning, as it will take some time for animals to recover. For best results swine should never be fed more than they will clean up at each meal. Fattening swine make better returns for the food consumed when their appetites are kept keen; they wait eagerly for their food and relish it much better than when overfed. If convenient, they should be fed both mash and dry grain. Nothing makes a better food for swine in the fore part of the fattening period than meal and skim-milk mixed in the proportion of one part of meal to five of milk. As the period progresses the portion of meal should be gradually increased until towards the close the proportion may be one part to three parts of skim-milk. If the skim-milk is not available, water may be used to make the mash. If water is used, the mash should be fed much thicker, using only enough water to mix the meal, as it is useless to fill the fattening animal up on water and thus prevent the consumption of nutritious foods. When such is the case, some linseed meal should be used, say 10 per cent of the meal. In either case, dry grain should be fed in addition.

Swine will make much better returns for the food consumed if they have access to green forage. Where fattening hogs are turned to pasture, it must be so arranged that they need not graze over too large an area. If at all convenient, it will be more profitable to cut the green forage and feed to the hogs. In this way a smaller area will support a larger number of hogs, and the swine need not rustle to get the much needed succulence. The number of hogs that may be pastured on an acre will depend on the age and size of the animals, the quality and kind of crop, and other conditions. For an average it may be said that an acre of blue-grass will support eight to ten hogs for two months or more in the spring, and for two months in the fall; red clover should support six to ten hogs for three or four

months; alfalfa from ten to fifteen for five months; cowpeas six to eight for two or three months; and artichokes should support from six to ten hogs to the acre for a considerable length of time in the late fall. Clover, alfalfa or cowpea pasture is to be preferred. Alfalfa in those sections where it will thrive is regarded as the leading pasture plant for swine. It should not be grazed so closely as to make mowing unnecessary. To keep alfalfa in the best condition it should be mowed from one to three times in a season. These estimates are to be modified according to conditions.

It is very important that fattening swine be provided with shade and an abundance of cool, fresh water. The sebacious glands of the hog are very rudimentary, and the animal cannot perspire and therefore must keep cool by radiation. This is one reason why hogs desire mud wallows, and for best results these must be provided, particularly for thick, fat animals, which suffer greatly with the heat during the warm summer months. To avoid the extreme heat of summer, many swine feeders plan to have the animals fat by the first of July, when they are sold.

Feeding the lard-hog in winter. — When roots or other succulence is available for winter use, much better results can be obtained than if dry feed alone must be depended on. Sugar-beets, roots, turnips, potatoes, artichokes, and pumpkins are often used. No succulence exceeds skim-milk for winter feeding. In the absence of any other succulent food, mashes should be made, as suggested for summer feeding. For best results, mash or succulent food, grain, and a small amount of dry forage should be fed. Sweet, clean clover or alfalfa hay should constitute the dry forage. It should be fed from a rack.

Care should be exercised in providing dry quarters and lots as free from mud as possible. The warmth of the quarters best suited for fattening swine may depend somewhat on the feeds used. When corn, in one of its many forms, as ear corn, shelled corn, corn meal, and the like, constitutes the major part of the

ration, the quarters need not be so warm as when an abundance of more succulent food is fed, such as skim-milk. It has been proved that for best results, when skim-milk or other very succulent food is freely employed, the quarters should be rather warm yet very well ventilated and well lighted. Fattening swine are not likely to spend much time in poorly ventilated, dark, and foul-smelling quarters. They prefer the cold to

FIG. 167.—VICTORIA SOW. First prize, Ohio State Fair. Photograph by C. S. Plumb.

The native home of the Victoria is in the United States. It is somewhat similar to the Cheshire, perhaps tending more towards the lard type. The breeding qualities are fair, the sows producing medium-sized litters. In size the breed is classed as small. The color is white, the ears erect, and the face dished.

such places, and for this reason swine are often known to build a nest or bed out in the open lot, illustrating that they prefer exposure to foul quarters. When sweet, well lighted, and well ventilated quarters are provided, swine will be found to occupy them except when feeding and taking exercise. Hogs are not dirty animals by nature, except as they like to wallow in warm weather.

During the cold winter season, swine often fail to drink sufficient water to meet their needs. This often seriously interferes with their fattening. To avoid this difficulty, they should be encouraged to drink water. That contained in skim-milk, slop, or other succulence is not sufficient. When it is at all possible, the chill should be taken off before the water is offered the animals. Swine compelled to eat snow or lick ice to get water will surely fail to fatten profitably. The importance of this cannot be overestimated, for in addition to not gaining rapidly the system becomes weakened and the animals contract diseases more readily.

Feeding the bacon-hog

In the production of bacon, the foods must differ from those used in feeding the fat-hog. In some cases the same food stuffs may be used in part, but the mixture must be varied. Corn, the mainstay in the production of the fat-hog, cannot be used with success in larger proportions than one-third of the grain ration. A larger proportion is likely to produce an undesirable quality of bacon. The foods very largely used are shorts, oats, peas, barley, and skim-milk. Barley is perhaps the food most used, especially in Canada, where bacon production finds much favor. It is often fed ground or soaked. Usually it is fed in connection with small amounts of other food, as peas, oil meal, finely ground oats, tankage, and the like. Peas are used to a considerable extent in the production of bacon in Canada. "Canada pea-fed bacon" has good market reputation. Among some large bacon feeders, however, peas are not held in high estimation, the statement being made that they give dry, rather hard, and flavorless bacon. Oats are often objected to because of their hulls, which contain little nutrition and much crude fiber; yet when the price is low, they are extensively used. Crushing the oats is considered the best method of preparation.

Skim-milk is held in high esteem by the bacon feeder; therefore localities devoted to dairying other than market milk are admirably adapted for the production of bacon. It may be fed in the same proportion as to the fat-hog, — that is, three to five parts milk to one of meal.

Summer feeding on pasture. — Clover, alfalfa, cowpeas, or rape are excellent pastures for bacon production. Less protein-rich grain or less skim-milk is required when the swine have access to such ranges. No cheaper or more economical gains can be obtained than from a light grain ration when the animals have these pastures.

Winter feeding in dry-lot. — Bacon production during the winter season is approximately 25 per cent more costly than feeding on pasture. For best results, some succulent food should be supplied. This may be furnished by growing roots, such as sugar-beets, mangels, turnips, and the like, and storing them for winter use. When the animals are confined to a dry-lot, more protein-rich food is required, which calls for larger amounts of oil meal, shorts, tankage, or skim-milk, most of which must be purchased. This balancing is very essential in the production of bacon, as quality is what commands the extra price. The lean and fat must be well interspersed, and this can be secured only by properly balancing the ration.

SAMPLE RATIONS FOR SWINE

To give sample rations for horses, cattle, and sheep is a comparatively simple matter, but such is not the case with swine. The composition and amount of the ration are influenced by the age and weight of the animal. For 100 pounds live weight, the younger the animal the more food required, and in addition it should contain more protein than for the older animal. To illustrate the ration for fattening swine of increasing size the following data is made up from Bulletin 106 of the Iowa Experiment Station: —

Amount of Food consumed per Hog

Kind of Grain	Average Daily Feed per Hog, Pounds. Periods of Four Weeks Each					Whole Time
	1	2	3	4	5	
	Hogs weighing 40 Pounds at Start and 140 at Close					
Dry ear corn [1] . .	2.4	2.8	3.0	4.0	4.6	3.4
Soaked shelled corn	2.4	3.0	3.1	3.7	4.1	3.2
Dry corn meal . .	2.3	2.9	3.4	4.5	5.0	3.6
Soaked corn meal .	2.6	3.2	3.5	4.9	5.6	4.0
	Hogs weighing 50 Pounds at Start and 150 at Close					
Dry ear corn [1] . .	3.0	3.4	3.8	4.5		3.7
Soaked shelled corn	3.1	3.9	4.1	4.8		4.0
Dry corn meal . .	3.0	3.6	3.9	4.6		3.8
Soaked corn meal .	3.2	4.2	4.5	5.2		4.3
	Hogs weighing 100 Pounds at Start and 290 at Close					
Dry ear corn [1] . . .	3.8	5.2	6.7	7.8	7.3	6.2
Soaked shelled corn	3.6	5.1	5.8	7.3	7.0	5.7
Dry corn meal . .	3.6	4.3	5.8	7.2	7.0	5.6
Soaked corn meal .	4.1	6.3	6.7	8.4	8.4	6.8
	Hogs weighing 200 Pounds at Start and 365 at Close					
Dry ear corn [1] . . .	7.5	9.3	7.7			
Soaked shelled corn	7.6	9.7	8.6			
Dry corn meal . .	7.3	9.9	9.9			
Soaked corn meal .	8.1	9.6	9.9			

To give an idea of the ration for fattening swine when a supplement is used in connection with corn, the following data

[1] The weight of the cob has been deducted from the figures for shelled corn.

are taken from Bulletin 65 of the Missouri Experiment Station: —

Feed and Gains in Weight, 90 days

Ration	Initial Weight	Final Weight	Daily Grain Per Head	Daily Gain Per Head
Corn meal 5 parts, linseed-oil meal 1 part	116	260	5.6	1.5
Corn meal 10 parts, linseed-oil meal 1 part[1]	131	209	7.6	1.5
Corn meal 10 parts, linseed-oil meal 1 part	118	209	5.3	1.5
Corn meal 2 parts, wheat middlings 1 part	114	226	5.3	1.2
Corn meal 4 parts, wheat middlings 1 part	117	213	5.0	1.1
Corn meal 2 parts, ground oats 1 part	120	173	3.7	0.6
Corn meal 4 parts, ground oats 1 part	111	166	3.8	0.6
Corn meal 4 parts, wheat bran 1 part	111	188	4.4	0.9
Corn and cob meal	112	135	3.0	0.3
Corn meal	115	183	4.2	0.8
Soaked shelled corn	115	172	3.6	0.6
Shelled corn, bone meal[2]	114	153	3.0	0.5
Shelled corn	115	152	3.0	0.4

[1] Sixty days.

[2] 6.2 pounds bone meal per head in ninety days.

CHAPTER XXIII

THE BREEDING OF SWINE

As previously stated, pork production differs from beef production in the fact that swine are bred and fed on the same farm, whereas feeding cattle are frequently bred on the cheap lands and shipped to the corn-belt to be fed. Since swine are reared and finished in one place, if success is to be attained, the feeder must be a breeder as well. Many good swine feeders often fail to exercise proper judgment in breeding. Breeding swine is as much a business as feeding swine, and should be conducted with that understanding. When the price of hogs is high, the tendency is to rush into swine raising, forgetting the advantages of good quality, with the result that in a few months the hog market is glutted with animals of inferior quality which, of course, command only a low price. This is discouraging, and the enthusiast of a few months quits the hog business. With proper management, no line of farming will prove more profitable than pork production, especially if continued over a long series of years.

PLAN OF BREEDING

Before beginning to breed swine, one should decide on a plan. Before formulating the plan one will have to decide upon the kind of hog he is going to breed. Some will wish to breed market hogs only, others breeding hogs only, while still others may wish to produce both market and breeding hogs. When market hogs only are to be produced, grades may prove as profitable as

pure-bred animals, especially if much care is taken in the production of the grades and a pure-bred boar is used. On the other hand, if breeding hogs are to be produced, pure-bred animals only can be grown with profit. This calls for much knowledge of the principles of breeding, such as selection, mating, and the like. Another question that will also modify the plan is the amount of capital available for the establishment of the business. When the capital is small and the experience wanting, the grade herd is to be preferred. The beginner may well

FIG. 168. — CHAMPION HAMPSHIRE SWINE. Bred and owned by John Goodwin, Potomac, Iowa.

The Hampshire breed of swine was developed in the United States. Like the Poland China, this breed is noted for its early maturing and economic fattening qualities. As breeders the sows rank high. In size the breed is classed with the middle weights. The color is black, with a white belt about the body. The breed is increasing in popularity, and animals of the breed are in much demand by the packers.

start with not more than two or three sows, in pig when purchased, as he can acquire much valuable experience with even so small a number, while his risk will not be great. The second year he may add to the number of sows, secure a suitable and pure-bred boar, and each succeeding year carefully increase the number of sows bred. In this way, one should soon find himself in possession of a large herd, and of sufficient knowledge to put it to profitable use.

Coöperative breeding. — Pure-bred boars are likely to be costly, and to get the most out of them should be kept in constant use. Since the average farmer does not possess sows enough to get the maximum use of the boar, it is often a good plan for a number of farmers to coöperate in the purchase of a boar. Such coöperation not only reduces the cost of service, but aids in increasing the uniformity of the animals in a locality. Furthermore, when a number of farmers coöperate in the purchase of a hog, a much better animal can be secured than if each purchases in his own account.

SELECTING BREEDING STOCK

Many practical questions enter into the selection of swine for breeding purposes. As a general rule, the animals chosen should be rather large for the breed to which they belong. In the past few years there has been a tendency to reduce the size of market hogs, and this has extended to the brood sows, with the result that many of the sows now used for breeding are decidedly too small for the farrowing and raising of two large and strong litters of pigs each year. Probably the greatest fault of improved swine breeding is the striving for too great refinement. If large litters of strong pigs are to result, the sows must possess much size and length and a good constitution, as shown in sufficient width and depth of the chest region.

The type. — A consideration of prime importance in the selection of a breed or type is the likes and the dislikes of the breeder. One is much more likely to succeed with the animals he likes and to fail with other animals of equal merit that he dislikes. Other than this there is little to choose, as each breed has its weak and strong points. In some sections, however, certain breeds will remain the most popular because of their adaptability to the climate. Thus in certain parts of the United States, especially the West and South, white hogs are not looked on with favor because they are more liable to be sun-scalded, to have scurvy

and often mangy skins. Again, in the corn-belt, bacon types doubtless will never be most popular because the available food is not such as to produce bacon.

Uniformity. — In selecting animals for the breeding herd it is very important that they be similar in age, size, color, condition, and quality. The importance of this similarity among market swine cannot be overestimated. To get animals that will remain uniform, it is essential to know something of the herd from which they come. A herd noted for its uniformity is likely to produce animals that are uniform. In addition to the uniformity, the herd should be prolific. The sows should farrow and raise two litters of six or more pigs each year. Prolificacy is hereditary. A prolific herd is likely to produce prolific animals.

THE BOAR

The boar is sire of the pigs from many dams, and his general influence, therefore, is much greater than that of any sow can possibly be. Therefore, for general improvement the boar should be largely relied on, as he can effect change either for good or bad much more rapidly than the sows. The boar should be the best that the number and quality of the sows or the circumstances of the breeder will permit. The ordinary breeder cannot afford an extremely high-priced boar and is compelled to do the best he can with the money at his command. This may be a blessing in disguise, for it should be the work of the ordinary breeder to grow market hogs, and when the boar is used to sire market hogs, there is a limit beyond which one cannot go and realize a profit from swine breeding. Only the man who is breeding show animals can afford to pay a large sum for a boar and make a profit on his investment. In any event, however, the animal that is chosen should be a pure-bred, for if not pure-bred he cannot be depended on to stamp his own qualities on his offspring. If the boar should be put to service

too immature, he cannot be expected to get vigorous pigs. He should not be used before eight months of age, and it will be more profitable in the long run to defer using him until one year of age. When once a satisfactory boar is found, he should be kept in service as long as he gives satisfaction. When of no use as a boar, he should be castrated, and fattened for the market.

THE SOWS

As suggested for the boar, when at all possible the sows that are to form the foundation herd should be chosen on the farm where raised. This personal inspection may call for an extra outlay in expense, but it will be well worth while, as it enables one to know the herd from which they sprang and in this way gain an idea as to the kind of offspring that may be expected. Furthermore, if the sows are purchased from a successful breeder, the beginner can get much information as to the care and management of swine.

The age at which to purchase foundation animals is a much-discussed question, many preferring to buy as soon as the pigs are weaned, since usually they can be purchased more cheaply, others preferring to wait until the animals are bred and to purchase sows in pig. Purchasing sows already in pig will save to the beginner a considerable outlay at the start, and, all things considered, it is perhaps the most desirable time to acquire them.

A good brood sow is a roomy animal, with rather long deep body and well-developed pelvic region. The back should be strong and well supported, as a weak or sagging back is very objectionable in breeding or market swine. There should be evidence of thrift and constitutional vigor, as these indicate prepotency. A good brood sow will have many of the characteristics of a good milk cow. She should be motherly, with a gentle quiet disposition; she should be a good milker, thus

providing much nutrition for her offspring; and she should be prolific in farrowing healthy, quick-growing pigs. She should have six or more functional teats on either side. When inspecting the teats, one should see that there are no blind teats either in the front or in the rear.

Productive period. — On the average farm, sow pigs are bred too young. Well-kept sows will often breed as young as three months of age. They should not, however, under any consideration, be bred under six months, eight months being as young as it is proper to breed them. Sows bred too young will remain not only underdeveloped, but small litters of weak pigs will result. There is a rather widespread and growing practice of breeding sows at six to eight months of age, raising one litter of pigs and then fattening the sows for market. This is not good practice, for once a good brood sow is found she should be kept as long as she continues to breed true and do well. Some sows will remain productive until five or six years of age, while others will become clumsy or vicious before that time.

Season to breed. — Throughout the United States the main crop of pigs should come in the warm days of March to May, and the second crop in September to November. Since the period of gestation in sows is approximately 112 days, this means that they should be mated in December, January, and February for the first crop and in June, July, and August for the second crop. As a general rule in the northern states, a sow should not be bred so as to farrow her pigs in the spring before March, nor later in the fall than October. Both early spring litters and those of early fall will pay the best on the average, as the care of the pigs in the mild season is not so difficult, and such pigs are likely to make larger and more economic gain than litters farrowed in the hot days of summer or the cold days of winter.

Method of mating. — As a rule sows come around every three

weeks; hence if the sow has been mated and for some reason has failed to conceive, she should make the fact known in 20 to 21 days after coupling. A careful record should be kept of the date of mating so that the probable time of farrowing may be known.

Often one wishes to mate a large heavy boar to a small sow or a small short-legged boar to a large sow, and to facilitate this

FIG. 169.—CHESHIRE PIG OF GOOD TYPE OWNED AT NEW YORK STATE COLLEGE OF AGRICULTURE AT CORNELL UNIVERSITY, ITHACA, N. Y.

The Cheshire breed of swine originated in New York. The breed is noted for occupying a position between the true lard and the true bacon types. It is rather slow maturing, but the quality of flesh is unexcelled. The breeding qualities are excellent. In size the breed is classed as small. The color is white, the ears erect, and the face slightly dished.

the construction of a breeding-crate will be found extremely useful, if not a necessity to insure a successful service. This crate is simple, resembling a strong shipping-crate with one end out. A very convenient size is 6 feet in length, 2 feet 4 inches inside width, and 3 feet high. The frame should be constructed of $2'' \times 4''$ scantling, closed in front and open

behind. Through the scantling, on either side of the crate, should be bored $1\frac{1}{4}''$ holes, so that an inch iron bar may be slipped behind the sow above the hocks to prevent her from backing out of the crate. On the inside, on either side of the crate, $2'' \times 4''$ strips should be fastened, placing the front end about where the sow's head comes, and then extending to the rear and bottom. These strips are for the boar's front feet to rest upon, thus holding his weight from the sow. When mating a small boar to a large sow, a small platform may be constructed and placed in the crate for the boar's hind feet to rest upon; or the sow may be placed in a pit.

The pregnant sow. — The pregnant sow may be permitted to run with the herd to within two weeks of farrowing time, when she should be separated and given special attention. In the case of ill-natured sows, they should receive extra care during the entire period in order to familiarize them with the herdsman. Brood sows should be trained much as dairy cows. During the last two weeks of pregnancy, the sow will need less exercise than formerly, but should have the best possible attention as to feeding. She should be well nourished up to a few days before farrowing, when the feed may be slightly reduced. Sows that are well fed before and after farrowing are less likely to injure the pigs, as they will usually lie quiet. This does not mean to overfeed, as this will bring troubles at pigging time; but it does mean that the sow should not be compelled to go far afield to find her food. If at all possible, succulence of some kind should be provided; in summer nothing is better than clover or alfalfa pasture, and in winter roots may be fed with good results.

If the sow is due to farrow in winter, the quarters should be warm, comfortable, well ventilated, protected from dampness, and so arranged that they may have plenty of sunlight. The floor may be of earth, but should be dry and hard and free from dust. The sow's bedding need not be great in quantity, enough

Table showing period of gestation in swine — Sows 112 *days*

Date of service on the left. Date of farrowing on the right in each double column

Jan.	Apr.	Feb.	May	Mar.	June	Apr.	July	May	Aug.	June	Sept.	July	Oct.	Aug.	Nov.	Sept.	Dec.	Oct.	Jan.	Nov.	Feb.	Dec.	Mar.
1	22	1	23	1	20	1	21	1	20	1	20	1	20	1	20	1	21	1	20	1	20	1	22
2	23	2	24	2	21	2	22	2	21	2	21	2	21	2	21	2	22	2	21	2	21	2	23
3	24	3	25	3	22	3	23	3	22	3	22	3	22	3	22	3	23	3	22	3	22	3	24
4	25	4	26	4	23	4	24	4	23	4	23	4	23	4	23	4	24	4	23	4	23	4	25
5	26	5	27	5	24	5	25	5	24	5	24	5	24	5	24	5	25	5	24	5	24	5	26
6	27	6	28	6	25	6	26	6	25	6	25	6	25	6	25	6	26	6	25	6	25	6	27
7	28	7	29	7	26	7	27	7	26	7	26	7	26	7	26	7	27	7	26	7	26	7	28
8	29	8	30	8	27	8	28	8	27	8	27	8	27	8	27	8	28	8	27	8	27	8	29
9	30	9	31	9	28	9	29	9	28	9	28	9	28	9	28	9	29	9	28	9	28	9	30
	May		June	10	29	10	30	10	29	10	29	10	29	10	29	10	30	10	29		Mar.	10	31
10	1	10	1	11	30	11	31	11	30	11	30	11	30	11	30	11	31	11	30	10	1		Apr.
11	2	11	2		July		Aug.	12	31		Oct.	12	31		Dec.		Jan.	12	31	11	2	11	1
12	3	12	3	12	1	12	1		Sept.	12	1		Nov.	12	1	12	1		Feb.	12	3	12	2
13	4	13	4	13	2	13	2	13	1	13	2	13	1	13	2	13	2	13	1	13	4	13	3
14	5	14	5	14	3	14	3	14	2	14	3	14	2	14	3	14	3	14	2	14	5	14	4
15	6	15	6	15	4	15	4	15	3	15	4	15	3	15	4	15	4	15	3	15	6	15	5
16	7	16	7	16	5	16	5	16	4	16	5	16	4	16	5	16	5	16	4	16	7	16	6
17	8	17	8	17	6	17	6	17	5	17	6	17	5	17	6	17	6	17	5	17	8	17	7
18	9	18	9	18	7	18	7	18	6	18	7	18	6	18	7	18	7	18	6	18	9	18	8
19	10	19	10	19	8	19	8	19	7	19	8	19	7	19	8	19	8	19	7	19	10	19	9
20	11	20	11	20	9	20	9	20	8	20	9	20	8	20	9	20	9	20	8	20	11	20	10
21	12	21	12	21	10	21	10	21	9	21	10	21	9	21	10	21	10	21	9	21	12	21	11
22	13	22	13	22	11	22	11	22	10	22	11	22	10	22	11	22	11	22	10	22	13	22	12
23	14	23	14	23	12	23	12	23	11	23	12	23	11	23	12	23	12	23	11	23	14	23	13
24	15	24	15	24	13	24	13	24	12	24	13	24	12	24	13	24	13	24	12	24	15	24	14
25	16	25	16	25	14	25	14	25	13	25	14	25	13	25	14	25	14	25	13	25	16	25	15
26	17	26	17	26	15	26	15	26	14	26	15	26	14	26	15	26	15	26	14	26	17	26	16
27	18	27	18	27	16	27	16	27	15	27	16	27	15	27	16	27	16	27	15	27	18	27	17
28	19	28	19	28	17	28	17	28	16	28	17	28	16	28	17	28	17	28	16	28	19	28	18
29	20			29	18	29	18	29	17	29	18	29	17	29	18	29	18	29	17	29	20	29	19
30	21			30	19	30	19	30	18	30	19	30	18	30	19	30	19	30	18	30	21	30	20
31	22			31	20			31	19			31	19	31	20			31	19			31	21

only to provide a clean and dry nest. Sometimes pigs are lost when the nests are too deep. If convenient, the nest should be so situated that the sun can warm it during a portion of the day. Straw, chaff, leaves, or hay make good nests. When at pasture the sow will build her own nest, in which case she gathers grass and leaves and provides a very shallow place. When the sow is to farrow in the hog-cot or pen, the little pigs may be kept from danger of being crushed by the mother by a fender made of a pole or scantling securely fastened, say eight inches from the floor and the same distance from the wall. The young pigs soon learn the protection furnished by this device when the mother lies down.

Farrowing time. — For several hours before farrowing, the sow will be very restless and spend much of her time in collecting material and making it into a nest. At this time the feed should be reduced. The signs that indicate the near approach of parturition are a distended udder, an enlarged vulva, and a relaxation of the muscles on either side of the tail. During the summer season the pigs will of their own accord usually find their way to the teats and begin nursing; but in the winter season the young pigs often need assistance in finding the teats, otherwise they may become chilled and perish. If for any reason the pigs become chilled, they should be treated similarly to that suggested for chilled lambs (see page 414). Occasionally a sow will be found that is very nervous and unquiet at farrowing time, and it will be necessary to keep the pigs from the teats to prevent the youngsters from being crushed. When such is the case the pigs should be kept warm, as suggested for lambs. When permitted to nurse, care should be taken to see that the

Fig. 170. — Prize Cheshire Boar.

young ones do not overfeed and that each pig receives its share. Extra attention should be given the pigs at the time they make their choice of teats, to see that the weaker pigs get their share, as they usually continue to use the teats first chosen. The stronger pigs, however, are very likely to take a few pulls at the teats of their less robust mates. To reduce this difficulty, each sow and litter should be placed in a lot by themselves.

Brood sows, like all other farm animals, often need assistance at farrowing time. Difficult parturition among sows should be handled much as suggested for difficult parturition among sheep (see page 412). Feeding a heavy corn ration to the pregnant sow is likely to increase the troubles at farrowing time. A better plan is to use food containing more protein and mineral matter, as such foods strengthen the sow, while corn has a tendency to produce fat and thus to weaken her.

The brood sow eating her pigs. — The causes that induce a sow to eat her own young are perhaps numerous, though not well understood. This abnormal appetite may be due to the failure to remove the afterbirth promptly. If left in the farrowing pen, the sow scents it and is likely to devour it; and since the scent of the young pigs is similar, they too may be eaten. If the sow has not been properly fed during pregnancy, if the ration lacks flesh-producing and bone-making material, she may have an appetite for blood.

Sows that have access to clover or alfalfa pasture in summer, or those that are provided with roots in winter, seldom eat their pigs, especially if a box of charcoal and salt is kept before them at all times. When the sow possesses the abnormal appetite, it has been recommended to feed her pork, preferably salt pork. The salt pork causes her to drink water, which allays the fever. The assertion is made that when the appetite is satisfied she will leave the pigs alone.

The sow after farrowing. — The sow is in a feverish condition after farrowing and should be provided with an abundance of

lukewarm water. Never give her ice-cold water. In a few hours she will show signs of wanting to eat, when she should be given a little thin mash or gruel made from shorts, bran, or oatmeal. This should be given warm, in cold weather. For the first week the feed should be light, consisting mainly of mashes, but no corn should be given at this time. Milk-producing foods, such as skim-milk, shorts, bran, oat meal, and a little clover or alfalfa hay, should be given, while fattening foods, such as corn, are to be avoided.

Occasionally the sow's udder is injured on account of an unusual development of the pig's teeth. This condition causes the sow to withhold her milk, produces a bad temper, and often excites her to injure the pigs. When such is the case, take the pigs under the arm and hold the mouth open with one hand while the sharp teeth are broken off with small pincers. To do this remove the pigs out of hearing distance from the sow, as she is likely to object and create a disturbance.

THE PIGS

The pig that is safely born and within a few minutes gets a firm hold of a teat full of milk, has made a good start in life. Not all pigs are so fortunate, and many perish for want of care at farrowing time. When at all convenient, one should be near by to give assistance if need should arise. Often pigs must be assisted to find the teat, especially in cold weather. Sometimes the sow is nervous, and the pigs should be removed as farrowed, otherwise she may crush them; and sometimes it is necessary to help dry the pigs to keep them from chilling.

The first meal. — It is important that the young pig get his stomach full of the first milk of the sow. This should be accomplished within a few minutes after farrowing, otherwise the pig's strength will rapidly decrease. If for any reason the sow has no milk for the pigs and it is desired to raise them by hand, they should be given a very small quantity of cow's milk warmed to

body temperature. This may be given from a bottle and nipple. Great care should be taken not to feed the little fellows too much at a time, but they should be fed often, every two hours for a while, then every three hours, then every four hours, and later they should be fed four times daily. This involves much work, but is essential if the pigs are to be raised, as hand-fed pigs often die from overfeeding following a long period during which they received no food whatever.

Pig ills. — The young pig is very subject to digestive disorders, the result of overfeeding, underfeeding, or otherwise

FIG. 171. — GROUP OF ENGLISH SMALL YORKSHIRE OR SMALL WHITES.

The Small Yorkshire, or Small White, was developed in England. This breed is noted for its fattening qualities, not particularly early maturing. The breeding qualities are only fair, the sows medium in fecundity. In size the breed is classed as small. The color is white, ears erect, and face greatly dished.

improperly feeding its dam. The brood sow should be fed in such a way as to encourage a good flow of only medium rich milk. If her food is too rich, consisting of skim-milk, linseed-oil meal, corn, and the like, the pigs are likely to be attacked with thumps, diarrhea, or constipation. On the other hand, if the sow is underfed, the pigs are likely to suffer. A better plan is to feed the brood sow regularly on a ration consisting of moderately rich food, such as mashes made from ground oats, shorts, and bran.

When the pigs are troubled with thumps or scours, cut down on the ration of the sow; and if the pigs are valuable, it may be well to milk the sow at least in part by hand, remembering that the last milk drawn is the richer in fat.

Feeding the pigs. — At about three weeks of age, the pigs are likely to begin to nibble at their mother's food, to bite at the grass, and perhaps try to root. This indicates that they are acquiring an appetite, and they should be encouraged to take food other than that supplied by the mother. Place a small trough in one corner of the lot or pen, and arrange a fence across the corner so the old sows cannot have access to it, but the young pigs can. Into this trough a little sweet milk may be poured three times daily. Do not provide more than the pigs will drink at once, and never leave the milk to sour in the trough, as digestive disorders and death are sure to follow. In a few days replace the milk with a small amount of bran and shorts, scalded and made into a gruel. Later corn soaked for 24 hours may be placed in the trough. For best results the young pigs should be fed a variety. Whatever food-stuffs are used, care must be taken not to feed more than they will clean up. Pigs fed in this way will make a much more rapid growth than if the extra trough had not been provided.

Weaning the pigs. — With pigs fed as suggested above, the weaning process is easy and simple. As the pigs learn to rely more on the extra food, the mother's milk-producing food should be cut down so that she will not be in the height of her flow when the pigs are taken away. The age to wean pigs varies: with the youngsters that have made a rapid growth they should be weaned at about eight weeks of age; or in case the pigs and mother are not doing well, it may be wise to wean at a much younger age even though the pigs are small. As a general rule, it is safer to say the best age for weaning is between seven and ten weeks. Some advise turning out the most thrifty pigs first, leaving the weaker ones to nurse a few days longer, the state-

ment being made that in this way there is no danger of the sow's udder spoiling, as the weaker ones will take the milk. This practice is of doubtful merit; it is perhaps best to take the sows entirely away from the pigs, thus leaving the youngsters in their own pen. If the sows have previously had their food reduced as suggested and the pigs are fed extra, this will surely give best results.

Castrating the pigs. — The boar pigs not desired for breeding purposes should be castrated. This should be done rather early in order that the pigs may recover from the resulting soreness before weaning, say from three to six weeks of age. At this age, the operation is very simple. Have an assistant hold the pig by the hind legs, placing the pig's back against the assistant's breast, and holding the hind legs apart in such a way as to expose the scrotum. Simply slit the end of the scrotum and remove the testicles by pulling them out; smear a mixture of fresh lard and turpentine half and half on the scrotum, and let the pig go. With ridglings and hernia there is more danger and more care should be used. A ridgling is an animal in which one or both testicles have not descended into the scrotum.

Marking pigs. — When one is breeding pure-bred animals, some system of identification is necessary, as even an expert cannot identify pigs when they are reared in large droves. The method suggested in Fig. 172 is very good.

Pigs after weaning. — Many pigs are stunted for want of proper care the first month after weaning. If in summer, they are frequently turned out to hot dry pasture to forage for themselves; or if in winter, they are placed in close, dark, cold and muddy quarters, and they are likely to fail to develop. Animals thus treated, of course do not make satisfactory gain. For best results, if in summer, the pigs just weaned should be provided with shade, a clean mud wallow, and receive grain in addition to the pasture; if in winter, dry, well lighted, well ventilated, and protected quarters should be provided, and if at

all possible the animals should receive succulent food in the shape of roots in addition to the grain, which grain should not consist entirely of corn.

The breeding hogs and the fat hogs may run together until three months of age, when the breeding animals should be taken out. At this age the sows will begin to show up, so that those likely to make the best animals may be chosen for breeding. If later on some of the sows not chosen should show good form, they too may be taken out of the fat herd. Those animals chosen for breeding should be fed a nitrogenous ration. In addition, they should be permitted to take abundance of exercise. If they are confined too closely and fed a fattening ration, their breeding powers are likely to be weakened.

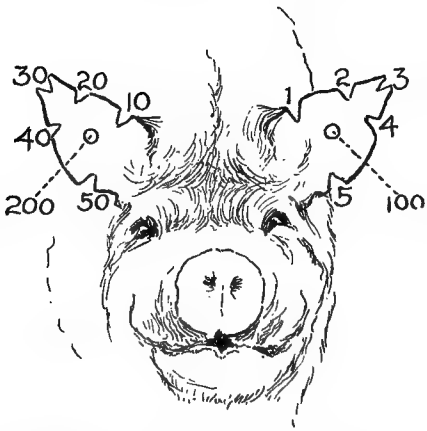

FIG. 172.—METHOD OF MARKING PIGS FOR FUTURE IDENTIFICATION, OR UNTIL PERMANENT TAGS CAN BE INSERTED INTO THE EAR.

CHAPTER XXIV

CARE AND MANAGEMENT

ASIDE from the various practical points on care and management discussed in the chapters on feeding and breeding, special attention is now given to sanitation and equipment. Many of the common diseases that often prove so very fatal to swine are due entirely or in a large measure to carelessness or indifference in management. It is well known to swine breeders that few hogs are free from lice. These vermin are blood suckers, and in a very short time they produce a weakened condition of the animal, thereby rendering it far more susceptible to other diseases; even cholera is more virulent and more deadly when the herd is infested with lice.

DIPPING SWINE

To free the hogs from lice or other vermin, all newly acquired hogs should be dipped immediately upon arriving at the farm in much the same way as suggested for sheep (see page 423). The hogs should not be permitted to infect the quarters or lots before dipping. The same dipping-vat as that suggested for sheep may be used, as well as the same coal-tar preparation, although the solutions may be used somewhat weaker for swine. All stock hogs should be dipped at least twice each year, or whenever they become infested with lice (Fig. 173).

Good results are reported from the use of a self-dipping device. This device consists of a shallow vat about ten inches deep and eight to ten feet square. It is built of two-inch plank and placed

near by or convenient to the well or large water-tank. The vat is filled about three-fourths full of water and one quart of dip added. The dip is renewed about once in two weeks and the water supplied as needed. During the muddy season the tank should be cleaned and a fresh start made. The liquid may be removed in a few minutes with a scoop shovel. The hogs

FIG. 173. — HOG-DIPPING EQUIPMENT. Dipping-vat set in ground.

wallow in this at will, and they do not seem to mind the dip; when the water is fresh they often drink small quantities of the liquid. This keeps the hogs free from lice and skin diseases and helps to keep down worms, cholera, and other swine plagues.

SHELTER FOR SWINE

Some one has fittingly said, "The hog does not need a palace or an upholstered cage, nor does he prosper in a dungeon." Occasionally much money is uselessly expended in the construction of a large and expensive building which is in use only a part of the year; more often, however, swine are housed in a hole in the straw stack or in a shed constructed from fence rails or poles and covered with straw or fodder. Such places are dun-

geons. There is no ventilation, they are dark and damp in wet weather, and soon become filthy dens of infection.

As with the barn for other farm animals, the hog barn should be well ventilated, well lighted, well drained, and dry, serviceable, and sanitary. Any structure that answers these conditions will prove fairly satisfactory. Convenience and adaptability should be considered in constructing the hog-house. In general, hog-houses are of two types: large houses, or those accommodating a considerable number of hogs; and small individual houses or cots.

The large hog-house. — There are almost as many types of large hog-houses as there are swine breeders or feeders who have built them, each having its advantages and disadvantages. When properly constructed, the large hog-house is serviceable, sanitary, and convenient; but, if properly constructed, they are expensive, especially since they are only used a part of the year. It is difficult to locate them accessibly to the pastures, particularly in case sown pastures are used, as they are likely to be on various parts of the farm. Furthermore, when many sows are housed in close proximity to each other, if one is disturbed or molested in any way, all the others are likely to become fretful; and when feeding is begun in one part of the house the other animals become uneasy and often injure their litters.

The individual hog-house. — Of late years the small individual hog-house has become very common. These small houses are constructed on runners so they can be moved from one field or lot to another. They are well adapted to accommodate a sow and her litter, and a few of these "cots," as they are often called, set side by side afford excellent shelter for a drove of hogs. The Wisconsin Agricultural Experiment Station has issued a bulletin devoted chiefly to the construction of these small houses, and from which we quote: "The portable hog-house is easily and economically constructed; it can be easily moved and located wherever desired; it is useful to the general farmer

and to the breeder of pure-bred stock; and of all systems of housing swine it is the most natural and sanitary. Only the simplest workmanship is necessary to build the portable house, and much old lumber can be worked into it.

"The portable house is peculiarly advantageous, since it can be readily moved. The renter who finds it impossible to provide expensive quarters for his hogs can well afford to construct portable houses, which can be retained as personal property. It is useful on any sized farm as the number can be regulated to the size of the herd. With separate paddocks to accommodate swine of different ages and sexes the portable house is practically a necessity. Swine will never pile up in a damp, poorly ventilated quarter and come out steaming in the cold morning air, unless compelled to do so. Where a large number of animals are continually housed in one hog-house, the surroundings are sure to become more or less filthy and unsanitary. If feeding is done on the inside, it keeps a portion of the floor wet, and gives the entire building an offensive disagreeable appearance. On the other hand, by using the portable house, moving it occasionally to a fresh piece of ground, and feeding the hogs at different places, one avoids those unsanitary conditions. These portable houses can be built to accommodate from four to six mature animals or ten to twenty shotes. This method of housing keeps them much cleaner and more thrifty than when allowed to congregate in large numbers, and individuals of a herd showing evidence of a contagious disease can be readily isolated."

The A-shaped individual hog-house. — These portable houses are usually constructed of two types, the A-shaped and the shed-roof-shaped. A convenient size for the A-shaped house is eight feet square and seven feet high. It may be constructed with or without a wood floor, as desired. If one has paved or very dry lots where the cots are to remain in winter, perhaps they will give better satisfaction without the wood floor. On the other hand,

if the lots where they are kept for winter use are muddy, a wood floor should be provided. A ventilator should be provided, which may be made by sawing off the ends of two roof boards and covering the hole thus formed with a V-shaped hood (Fig. 174). In order to provide light a window-glass ought to be placed in the front above the door and a second in the rear. A door two feet wide and two feet and six inches high should be provided at one end. The door itself may be suspended by a rope and arranged to slide up and down as it will need to be used only in very cold weather. For summer use a gunny sack may be hung over the door, as this will serve to brush the flies off as the hog enters and to keep the cot cool. To facilitate moving from lot to lot, the structures should be placed on runners. If brood sows are due to farrow in very cold weather, these cots can be made very comfortable by standing fodder or placing straw about them.

FIG. 174.—A-SHAPED INDIVIDUAL HOG-HOUSE.

The shed-shaped individual hog-house.—In Fig. 175 is shown the front elevation of a shed-roof hog-house eight feet wide, twelve feet long, and seven feet high in front and three behind, which is sometimes preferred to the A-shaped house. It is provided with doors in the rear, the same size as the lower front doors, and placed diagonally opposite, so that by opening all the doors it makes a cool house in summer. On the other hand, by closing the lower doors and opening the upper doors, for ventilation, it makes a warm house for cold winter weather. The upper front doors are arranged with wooden ratchets on the back side,

which holds them in any desired position. By having the hinges on the top, the storm and hot sun cannot enter and yet by adjusting the opening, air may circulate freely without causing a draft on the animals. These top doors are very important. It is a serious mistake to build these houses with but one opening, as is sometimes done. There is no ventilation whatever, and the house in warm weather becomes a suffocating quarter.

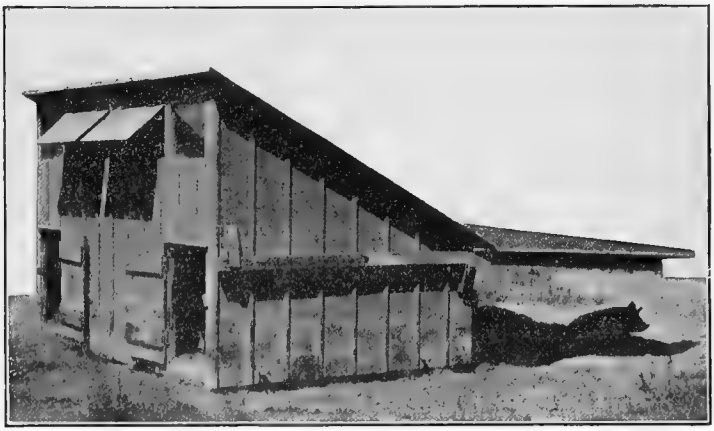

FIG. 175. — SHED-SHAPED INDIVIDUAL HOG-HOUSE, WITH SHADE ATTACHED.

The illustration of the shed-roof portable hog-house shows a shade at the rear under which the pigs can lie in comfort. This shade is five feet wide, made of inch boards placed upon removable supports which rest on cleats nailed to the ends of the house (Fig. 175).

Disadvantages and advantages. — The individual hog-house has the disadvantage of requiring more labor to feed and care for the herd. With each sow and litter in a pen or cot by themselves it takes considerable time to make the rounds, and this must often be done in the storm. Furthermore, vicious sows are more difficult to attend, and the feeder is often obliged to enter

the cot to arrange the bedding and clean the quarters. These small houses, however, are very inexpensive and very efficient, and all things considered, answer the general farmer's conditions much better than the large and expensive hog-house.

THE HOG LOT

The lot in which hogs are quartered should be such as can be kept clean. A filthy and carelessly kept lot encourages disease by providing lodgment for the germs; and constant cleanliness is the most effective means of preventing germ dissemination. Where disease germs have once been established, an absolutely thorough disinfection is essential to eradicate them. To facilitate cleanliness and disinfection, at least a part of the lot should be paved with brick, stone, or concrete. On this pavement the cots may be placed during the winter season and on it the feeding may be done.

Hog-wallows. — Some very successful breeders heartily favor hog-wallows, while others equally as successful are much opposed to their use. Those who are outspoken in opposition to the wallow have perhaps been influenced from infections due to a filthy wallow, or from infections at the time of an outbreak of cholera. There can be no doubt that filthy wallows are often a source of danger, nor can there be any doubt that once a cholera hog wallows in the water, however clean, all other hogs wallowing in or drinking this contaminated water are likely to contract the dreaded disease.

On the other hand, with the healthy herd there can be no objections to a clean mud wallow, and there are many advantages to be derived from it. During the heat of summer the hog cools mainly by radiation, and a cool mud bath is very soothing; it cleans the scurf from the skin and enables the hog to find protection from the flies. This wallow or mud bath should be so arranged that fresh water may be added as needed, and to insure absolute freedom from all germ life a quart of coal-tar dip may be poured in the wallow occasionally (see also page 504).

CHAPTER XXV

DISEASES OF SWINE

While swine are not ordinarily considered as being subject to so great a variety of diseases as horses, cattle, or sheep, they are very often attacked by ailments far more serious than afflict any other class of our farm animals. Chief of these diseases are cholera, swine plague, and tuberculosis. Throughout the corn-belt of the United States, the loss caused by these diseases among swine is not equaled by any other class of diseases to which farm animals are subject. These very deadly diseases are all contagious or infectious and therefore, with proper sanitary methods, can be prevented, although when the animal once becomes afflicted, there is no cure. It is the ravages caused by these diseases that makes pork production such a hazardous business. Sometimes the swine breeder or feeder will have a drove of swine ready for the market when they will contract one of these diseases and the entire herd be taken in a few weeks.

Quarantine lot. — On every farm where hogs are kept in considerable numbers, a small quarantine lot should be provided. This lot should be located at some distance from the other lots, it should be tightly fenced and at least a part of it should be paved. When a new animal arrives, it may be dipped as suggested (page 503) and then placed in this quarantine pen for at least three weeks. Cholera or any other diseases will be apparent before this. If all is well, it may then be turned with the herd. Such a pen could be used by any of the animals of the herd that may become sick, as all ailing hogs should at once be

separated until the nature of the disease is determined. Such a lot set apart for this purpose may prevent outbreaks of very serious diseases.

HOG CHOLERA

Hog cholera is an infectious disease of swine. It exists in all sections of the United States, but is particularly prevalent in the corn-belt. In that section it is the most dreaded disease to which swine are subject. Not so many animals are condemned at the large packing houses because of this disease, as of tuberculosis, but this is due to the nature of the disease. With cholera the hogs die or recover quickly, while with tuberculosis they may linger for months. Cholera varies in its virulence; sometimes comparatively few hogs that have it will die, while at other times nearly every animal in the entire herd will succumb to the disease. When the disease once appears, it spreads very rapidly, not only among the animals of a herd, but across the country from one farm to another.

Manner of spreading the disease. — Cholera is a germ disease and may be spread in many ways. These germs are very hardy and vigorous. They are able to live for a long time in the water of ponds and streams; they may live in the soil for at least three months and in accumulations of straw and litter for a much longer time. The hog, taking in these germs either by inhaling with the breath or by ingestion with the food, is likely to contract the disease. Only the very smallest particle is necessary to convey the germ. Thus, an attendant passing from a lot of infected hogs to a lot of healthy ones may carry the infection on his shoes; dogs, chickens, pigeons, and even birds are known to have carried the germs. The wind blowing particles of dust from place to place will also carry with it sufficient of these germs to produce the disease. A cholera hog having access to a stream may contaminate the water sufficiently to infect animals miles below.

Prevention of the disease. — Up to the present time, there has not been discovered any means by which hog cholera can be cured, the only safeguard being prevention. All that is necessary to prevent the disease is to keep the germs of the disease away from the herd. In the vast majority of cases the germ is transported mechanically, in the bodies of sick hogs and on the feet of men or animals, including birds. It follows, therefore, that the chances of an outbreak of hog cholera will be greatly lessened, if not completely avoided, if the herd is protected from these sources of infection. To do this the herd should be placed on a part of the farm that will be least accessible to men or animals from other farms. The hogs should be confined to a dry lot free from running water or wallows, unless one is constructed as suggested on page 509, and the disinfectant added every two weeks. Careful attention should be given the feed and water. The hogs should be provided with shade and clean dry sleeping places.

If at any time any of the animals show signs of sickness, they should be separated from the healthy ones. Air-slaked lime should be scattered about the lot, and the feed troughs thoroughly disinfected or replaced by new ones. For a condition powder prepare the following: —

Wood charcoal	1 lb.
Sulfur	1 lb.
Sodium chloride	2 lb.
Sodium bicarbonate	2 lb.
Sodium hyposulfate	2 lb.
Sodium sulfate	1 lb.
Antimony sulfite	1 lb.

Completely pulverize and thoroughly mix. This powder is mixed with the feed in the proportion of a large tablespoonful to each 200 pounds weight of hogs, and given once a day. When hogs are suspected to be affected with cholera, they should not be fed on corn alone, but have, at least once a day, soft feed made by mixing bran and middlings, or middlings and corn meal, or

ground oats and corn, or crushed wheat, and then stirring into this the proper quantity of the medicine.

After an outbreak of cholera the yards and pens should be thoroughly cleaned, all dead hogs should be burned, the litter should be collected and burned, and quicklime scattered freely over the ground. The houses should be washed thoroughly with a coal-tar preparation before new stock is brought in. The troughs should be burned, or if this is not practicable, they should be thoroughly soaked in coal-tar preparation and then washed out. The lots and houses should not be used again for some time.

Prevention of cholera by immunization. — The Bureau of Animal Industry, Department of Agriculture, has developed a serum which by means of vaccination will render hogs immune to cholera. While its preparation and use are attended with difficulties, the method is briefly given here because of the feeling that if it is to prove practicable, it must be so simplified as to be used by any careful workman. Furthermore, a drove of cholera hogs affords a very good opportunity to practice, as their value is not likely to be great, especially if the attack is virulent.

In order to make the method clear it will be divided into two main parts: the preparation of the serum, and the use of the serum.

Preparation of the serum. — To prepare the serum one must first procure an immune hog with a long heavy tail, since it is at this point that the serum is drawn, and it may be necessary to clip the end two or three times in drawing the serum. This may be a hog that has recovered from an attack of cholera, as such animals are immune to further attacks, or it may be one rendered immune by the method herein described. This hog we will call the supply animal. This animal must now be hyper-immunized. This consists of inoculating him, in the muscles of the thigh, with about 10 c.c. (cubic centimeters) of virulent hog cholera blood, from which the clot has been removed by stirring or whipping with a clean stick, to the pound

live weight of hog. Thus a 100-pound hog should receive 1000 c.c. of virulent blood taken from a hog sick with cholera.

This virulent blood may be obtained by allowing the cholera hog to bleed to death, taking care to collect the blood free from particles of dirt; or it may be obtained by clipping the end of the tail and allowing it to flow slowly into a jar well protected from dirt. If the tail stops bleeding, thump it or cut the end again. After collecting the blood, gently stir it with a clean stick, or better still a glass rod to remove the clot. The clot will collect on the rod while stirring. This diseased blood from which the clot has been removed is now ready to inject into the muscles of the supply hog. This is done with a hypodermic syringe and inoculated into the inner side of the thigh after placing the pig on his back. There are two methods of inoculating, — the *slow method*, and the *quick method*. By the slow method, increasing amounts of virulent blood are injected at regular intervals, which requires so much time that it is seldom used. By the quick method, the virulent blood is all injected at one time. After the injection of this blood, the supply animal is said to be hyper-immunized.

One week after the injection of the virulent blood into the supply animal, the hog is ready to have his blood drawn for the purpose of protecting hogs from cholera. This blood may be drawn in two ways: the supply animal may be killed and the entire supply of blood taken at once, or he may be bled at the tail. The tail should be thoroughly cleaned, disinfected, and then the end is cut off and the blood caught in a clean jar. Much care should be used to keep everything clean and free from germ-laden dirt. In this way, 500 c.c. of blood may be drawn at one time. This may be repeated three times at intervals of one week, after which the blood gradually loses its protective properties and should not be used.

The blood thus collected is allowed to clot, after which it is filtered through sterilized gauze in order to get the serum or the

liquid part of the blood separated from the clot. Then add sufficient carbolic acid to make a one-half per cent solution; that is, if there is 500 c.c. of the serum, add 2½ c.c. of carbolic acid.

Use of the serum. — There are two methods of using the serum for the prevention of hog cholera: the *serum-alone* method, in which the serum only is used; and the *serum-*

FIG. 176. — FIRST PRIZE TAMWORTH SOW AT ILLINOIS FAIR.

The Tamworth breed of swine is a native of England. This breed is similar to the Large Yorkshire and is noted for bacon production. The quality of pork is unexceled, although the animals are rather late maturing. The breeding qualities are excellent, the sows being very prolific. The breed is classed as large. The color is red or sandy, the ears almost erect and the face long and straight.

simultaneous method, in which the serum and virulent blood from a hog infected with cholera are used.

Serum-alone method. — With the hypodermic syringe, inject into the arm and thigh pits 20 c.c. of serum for each 100 pounds weight of pig. That is, if the pig weighs 50 pounds, inject 10 c.c.

of the serum, whereas if the pig weighs 150 pounds, inject 30 c.c. of serum. This method gives immediate but temporary immunity lasting perhaps four or five weeks, possibly longer. It is recommended for use in herds where cholera already exists, but to be used on seemingly healthy pigs only. Pigs already sick will probably not benefit by its use, although if the animals should be infected with the disease germ immediately after the serum is injected, the immunity will last much longer than otherwise. There is no danger attending this method.

Serum-simultaneous method.—With the hypodermic syringe, inject simultaneously into the arm and thigh pits 20 c.c. of serum and 1 c.c. of virulent hog cholera blood for each 100 pounds weight of pig. The virulent blood must be obtained from a hog sick with cholera and the clot removed. Pigs treated by this method are immune for six months to one year. This is the method usually employed, but is attended with greater danger than the serum-alone method; however, the resulting immunity is much longer.

Objections to the serum method.—There are two objections to this method of vaccinating hogs to protect them against cholera: it is expensive and somewhat dangerous. It is expensive because a 125-pound hog will furnish a comparatively small amount of blood, perhaps 500 c.c. at each four bleedings and 1000 c.c. more at death, making a total of only 3000 c.c., from which the clot must be taken. Furthermore, this animal must be rendered hyper-immune, which involves much labor and expense. The process of immunization is dangerous because it requires the use of the virulent hog cholera blood containing the living hog cholera germ. When this is used without the protective serum, an outbreak of hog cholera is immediately started. With proper precautions, an attendant that takes an interest in the method can prevent serious outbreaks of hog cholera and thus reduce the risk in pork production.

SWINE PLAGUE

Swine plague is an infectious germ disease of swine. It is frequently associated with hog cholera, which it resembles. In fact, the two diseases resemble each other so very closely that it often requires a post mortem examination by an expert to distinguish between them. From this it follows that the manner of spreading the disease as well as its prevention are practically the same as in the case of hog cholera. While these two diseases cause untold loss among swine, it must be remembered that by proper sanitary methods they can be practically prevented. This calls for better treatment than is ordinarily given swine. Well-lighted, comfortable quarters; clean, dry lots free from filthy wallows, but provided with a self-dipping device; a liberal use of disinfectants in the houses and of air-slaked lime in the lots, will go a long way towards reducing the ravages of these two diseases to a minimum.

TUBERCULOSIS

Tuberculosis is most prevalent among swine in those sections where cattle are most affected. Great numbers of hogs are condemned by the large packing-houses because of this disease, more than from all other diseases combined, and the percentage is increasing year by year until at present it is thought that about three per cent are being thrown out.

Manner of spreading the disease. — The tubercular germ gains entrance to the bodies of various animals in different ways. Thus in the case of man and also cattle, the germ may be either inhaled or taken in with the food, while in the case of swine the germ gains entrance by the food alone. It is very seldom that the disease starts by the germs being inhaled. This being true, the disease should be very easily controlled in swine. The chief sources of infection among swine are the skim-milk from a tubercular cow, the grain in the droppings of a cow or steer infected

with the disease, hogs eating carcasses of animals that have died with the disease, foods containing sputum of the human affected with tuberculosis, and like causes.

Prevention consists in the avoidance of all foods containing the tubercular germs and in providing quarters similar to those suggested for hog cholera, for poorly ventilated, dark, damp, and filthy quarters furnish ideal quarters for the breeding of tuberculosis germs. The direct rays of the sun and cleanliness provide conditions impossible for the lodgment of these germs.

Care of a tubercular herd.—Tuberculosis in swine is considered as not curable. Furthermore, its detection is often difficult. A hog may be affected with the disease and not show the marks of it until after he is slaughtered. As a rule, pigs are more subject to the disease than older animals, and weak animals more liable to attack than strong and vigorous ones. The difficulty of detecting the disease renders the care of the tuberculous animal hazardous. The general signs are coughing, losing in weight rather than gaining, and a swelling of the glands about the neck. When the disease is discovered, all animals showing external indications should be immediately destroyed and the carcasses burned. The remainder of the herd should be put upon the market at once and passed upon by a government inspector. Any animals that are so diseased as to render their carcasses unfit for food will be condemned. Not all hogs affected with tuberculosis are condemned. When the disease is present only in the first stages and only a few of the organs of the body are affected, these parts only are condemned; whereas if the disease is general throughout the carcass, the entire animal is condemned.

After an outbreak of tuberculosis and the animals have been disposed of, the quarters should be thoroughly disinfected. To do this, use a five per cent carbolic acid solution, or a 1 to 1000 corrosive sublimate solution, and then whitewash with fresh lime. The pastures and lots which are exposed to the sun are not so serious a source of infection as the buildings. When at all possible,

neither the house nor the lots should be used for a time, thus giving the sun sufficient time to destroy all the germs.

WORMS

Internal worms are of frequent occurrence in swine. They inhabit both the stomach and intestines. These worms interfere with digestion; in consequence the pigs fail to thrive and become pot-bellied, rickety, profitless runts, or quickly succumb to the effects of the worms. Swine infested with worms become an easy prey to more deadly diseases because of their weakened condition.

Prevention of worms. — Well-fed swine, in general, are not subject to worms. The strong thrifty pig is usually able to resist the parasites. Hogs having free access to wood ashes, charcoal, air-slaked lime, and coal cinders are not likely to be troubled. The alkali in the wood ashes, together with the grit in the cinders, have a tendency to destroy the worms. Pumpkins, fed seed and all, in the fall also help to keep swine free from worms.

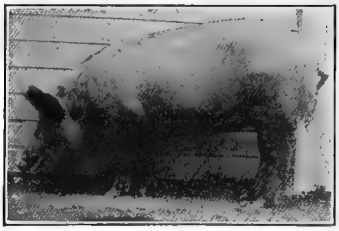

Fig. 177. — Tamworth Pig owned by University of Illinois.

Stagnant surface water, in which hogs wallow, are ideal places for the incubation and development of worms. For this reason old pens and pastures, if wet, should not be used for hogs. The pens and pastures should be well drained and all stagnant water fenced out or the ponds filled in. The drinking water should come from a deep well, and it should be kept pure by using clean troughs so constructed or protected that the hogs cannot wallow in them and fill them with filth.

Treatment for worms. — The average herd of pigs is kept under such conditions that it is desirable to dose them at least once during the year with some remedy that will destroy the

worms or drive them out of the intestines. Turpentine is the most popular remedy and perhaps the least dangerous. It is given in the mash for three successive mornings at the rate of one teaspoonful for each 80 pounds live weight of pig. Withholding all food should be practiced for a short time before giving the remedy.

Sulfate of iron or copperas is a more effective remedy, and is given as follows: Dissolve half a dram of copperas in warm water and mix in the mash for each pig for five consecutive mornings, the food being withheld for a short time before giving remedy. In very bad cases and when immediate action is desired, the affected pigs may be given 5 grains of calomel and 8 grains of santonin for every 100 pounds of live weight. The food should be withheld for at least 12 hours before administering the medicine, which is best given in a little mash. Santonin is somewhat dangerous and should be given in the proportion mentioned.

LICE

The hog louse is a common cause of lack of thrift in young pigs, and when numerous, it tends to retard fattening. It is advisable and profitable to keep swine free from lice at all ages. To this end the houses and pens should be frequently cleaned and disinfected, the woodwork whitewashed, the bedding material kept fresh, clean, and dry, and the yards free from accumulations of litter and filth. The hogs should be dipped twice each year in a coal-tar dip, 1 part of dip to 50 of warm water, and the treatment repeated in 10 days to 2 weeks.

To destroy lice, when dipping is not possible, mix equal parts of kerosene and machine oil, or one part of turpentine and two parts of machine oil, and apply to every part of the hog by means of a rag, or swab of cotton waste. It may be applied along the back, from ears to tail, with a common ma-

chine-oil can and allowed to run down the sides of the hog. Repeat the application in ten days.

SCOURS

Scours in pigs results from two causes, — improper feeding and contagious infection. Often the trouble comes from overfeeding on corn, or other rich food just after farrowing. Sudden changes in the food or feeding sour decomposing slops, or food from dirty troughs, sour swill barrels, and the like, tend to cause diarrhea.

The best treatment for scouring pigs is to feed properly the sows. The food should consist largely of rather thin mash made from bran, middlings, crushed oats, and the like, which should be fed regularly. In ordinary cases, treatment consists in giving the nursing sow parched corn or scalded milk in her food night and morning. After the trouble has been checked, a little limewater placed in the mash often proves advantageous.

The best cure for the contagious form of scours is a physic: one tablespoonful of castor oil in the form of a drench, after which the pens should be cleaned and thoroughly disinfected.

CONSTIPATION

Constipation frequently occurs among pregnant sows and other hogs when given too little exercise and too much food. Brood sows troubled with constipation are likely to farrow weak, puny pigs. This trouble seldom occurs when hogs are fed laxative foods, such as bran, linseed-oil meal, or roots, and in addition are made to take exercise. When it becomes necessary to treat the animals, a very simple method is to mix two to four ounces of raw linseed oil once daily in the food; or if more active treatment seems necessary, give four ounces of Epsom salts at one dose in the same way. Swine that will not eat the food thus medicated should be drenched. Great care should be exercised in drenching hogs or they will suffocate.

Drive the animals into a small pen where they have little room to move about. To hold the animal, secure a quarter-inch rope, place a noose about the upper jaw well back towards the angle of the lips, and elevate the head. Wait until the animal stops struggling. Pull the cheek away from the teeth so as to form a pouch into which the medicine may be slowly poured. It will flow from the cheek into the mouth, and when the hog finds out what it is, he will stop squealing and will swallow. A very easy method is to cut off the toe of an old shoe, insert the cut end into the hog's mouth, and pour the medicine into the shoe.

THUMPS

Thumps is the term applied to that ailment of young pigs which is indicated by a jerking motion of the flanks. In thumps there is usually a derangement of the digestive organs, due to overfeeding or lack of exercise. The tendency towards the disease seems to be hereditary. When once the trouble occurs, the treatment is prevention by decreasing the sow's milk-producing food until the pigs are older. Compel the pigs to take exercise by driving them from their nests. A very good method when one has the time is to place the little pigs in a lot near the mother and let them worry about getting back. They must be separated but a very short time, for they may nurse too much when turned back.

SORE MOUTH

Pigs are often troubled with sore mouth. Large white blisters occur about the mouth and snout, and later thick brown scabs appear, which open into deep cracks. These scabs extend over the face and later to all parts of the body if not treated. These sores are due to a germ, and are likely to attack pigs kept in filthy quarters. Prevention consists in providing comfortable quarters for the youngsters. Treatment is not

difficult, but should be prompt and thorough. Prepare a solution of permanganate of potash, using one and one-half ounces of the crystals dissolved in one gallon of warm water. Dip the young pig, head foremost, into this solution and hold it there a few seconds. Repeat three times, giving the pig time to catch his breath in the intermission. The treatment should be repeated for four days, after which the quarters should be disinfected.

GARGET

Inflammation of the udder is rather common among heavy-milking brood sows, and is usually caused by the milk not being removed. The udder thus becomes congested, sore, and later cakes. The treatment is to relieve the congestion by drawing off the milk. This should be done before farrowing, if the udder is distended. After the milk is drawn, gently but thoroughly rub the udder. Bathe the parts with hot water fifteen minutes at a time and rub dry and apply an ointment made as follows: Dissolve two tablespoonfuls of gum camphor in a teacupful of melted fresh lard, to which add one ounce of the fluid extract of belladonna. The udder should be bathed three times daily and then the ointment well rubbed in.

REMOVING THE TUSKS

After one year old, all boars should have their tusks removed twice a year. To hold the hog, place a noose around the upper jaw (as suggested in drenching, p. 522) and tie to a post. Then with strong nippers or sharp blacksmith's pincers remove the tusk. In older boars, when the tusks are hard and will not cut, they should be filed and then broken off as follows: after tying the boar to the post, an assistant stands astride the animal and places a stick in his mouth, takes hold of either end, and pulls back as far as he can and holds steady. With a three-cornered file notch each corner of the tusk, then put the

point of an iron wedge in one of the notches, and tap the tusk with a hammer, and it will break squarely off. The tusk may then be filed off rounding.

CHICKEN-EATING SWINE

While not a disease, chicken-eating is a vicious habit often contracted by swine kept near chicken yards. The habit once acquired is often difficult to overcome. A very good device to prevent the hogs from catching the fowls is a common four-inch ring hung before the hog's snout. This may be held in place with the ordinary hog-ring placed around the four-inch ring and into the nose, as when ringing to prevent rooting. Thus the large ring hangs in front of the hog's snout and pushes the chicken away as the hog reaches for it.

APPENDIX

AVERAGE WEIGHTS OF FEEDING STUFFS

As a rule under average farm conditions, it is not practicable to weigh each mess of food, nor is it necessary, as measuring is sufficiently accurate. The food from the measure should be weighed a few times at the beginning. To aid in approximating the weight of the various foods, the following table of weights and measures is quoted from Farmers' Bulletin No. 222: —

TABLE I

Average Weights of Different Feeding Stuffs

Feeding Stuff	One Quart Weighs	One Pound Measures
	Pounds	Quarts
Corn, whole	1.7	0.6
Corn, meal	1.5	0.7
Corn, bran	0.5	2.0
Corn and cob meal	1.4	0.7
Gluten meal	1.7	0.6
Gluten feed	1.3	0.8
Germ meal	1.4	0.7
Hominy meal	1.1	0.9
Distillers' grains, dried	0.6	1.2
Wheat, whole	2.0	0.5
Wheat, ground	1.7	0.5
Wheat, bran	0.5	2.0
Wheat middlings (standard)	0.8	1.3
Wheat middlings (flour)	1.2	0.8
Oats, whole	1.0	1.0
Oats, ground	0.7	1.4
Rye, whole	1.7	0.6
Rye, meal	1.5	0.7
Rye, bran	0.6	1.8
Barley, whole	1.5	0.7
Barley, meal	1.1	0.9
Brewers' dried grains	0.6	1.7
Malt sprouts	0.6	1.7
Linseed meal, old process	1.1	0.9
Linseed meal, new process	0.9	1.1
Cotton-seed meal	1.5	0.7

DIGESTIBLE NUTRIENTS IN FEEDING STUFFS

In calculating a ration for any class of farm animals, the digestible nutrients of the foods must be known, as it is the digestible part only that is of use to the animal. The following table, adopted from Bailey's Cyclopedia of American Agriculture, Vol. III, gives a very complete list of American feeding stuffs and their digestible nutrients: —

TABLE II

Average Digestible Nutrients and Fertilizing Constituents

Name of Feed	Dry Matter in 100 Pounds	Digestible Nutrients in 100 Pounds			Fertilizing Constituents in 1000 Pounds		
		Protein	Carbohydrates	Ether Extract	Nitrogen	Phosphoric Acid	Potash
Concentrates	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.
Corn, all analyses	89.1	7.9	66.7	4.3	18.2	7.0	4.0
Dent corn	89.4	7.8	66.7	4.3	16.5	...	...
Flint corn	88.7	8.0	66.2	4.3	16.8	...	...
Sweet corn	91.2	8.8	63.7	7.0	18.6	...	...
Corn cob	89.3	0.4	52.5	0.3	5.0	0.6	6.0
Corn and cob meal	84.9	4.4	60.0	2.9	14.1	5.7	4.7
Corn bran	90.9	7.4	59.8	4.6	16.3	12.1	6.8
Gluten meal	91.8	25.8	43.3	11.0	50.3	3.3	0.5
Gluten feed	92.2	20.4	48.4	8.8	38.4	4.1	0.3
Germ meal	89.6	9.0	61.2	6.2	26.5	8.0	5.0
Starch refuse	91.8	11.4	58.4	6.5	22.4	7.0	5.2
Grano-gluten	94.3	26.7	38.8	12.4	49.8	5.1	1.5
Hominy chops	89.9	7.5	55.2	6.8	16.3	9.8	4.9
Glucose meal	91.9	30.3	35.3	14.5	57.7	...	...
Sugar meal	93.2	18.7	51.7	8.7	36.3	4.1	0.3
Distillery grains (dried) principally corn	93.0	21.9	38.1	10.8	...	...	...
Atlas gluten feed (distillery by-products)	92.6	23.3	35.6	11.9	...	...	...

TABLE II—*Continued*

Name of Feed	Dry Matter in 100 Pounds	Digestible Nutrients in 100 Pounds			Fertilizing Constituents in 1000 Pounds		
		Protein	Carbohydrates	Ether Extract	Nitrogen	Phosphoric Acid	Potash
	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.
Wheat	89.5	10.2	69.2	1.7	23.6	7.9	5.0
Wheat bran	88.1	12.2	39.2	2.7	26.7	28.9	16.1
Wheat bran, spring	88.5	12.9	40.1	3.4	...	...	...
Wheat bran, winter	87.7	12.3	37.1	2.6	...	...	...
Wheat shorts	88.2	12.2	50.0	3.8	28.2	13.5	5.9
Wheat middlings	87.9	12.8	53.0	3.4	26.3	9.5	6.3
Wheat screenings	88.4	9.8	51.0	2.2	24.4	11.7	8.4
Dark feeding flour	90.3	13.5	61.3	2.0	31.8	21.4	10.9
High grade flour	87.6	8.9	62.4	0.9	18.9	2.2	1.5
Low grade flour	87.6	8.2	62.7	0.9	28.9	5.6	3.5
Rye	88.4	9.9	67.6	1.1	17.6	8.2	5.4
Rye bran	88.4	11.5	50.3	2.0	23.2	22.8	14.0
Rye shorts	90.7	11.9	45.1	1.6	18.4	12.6	8.1
Distillery grains (dried) principally rye	93.2	10.4	42.5	6.4	...	...	...
Barley	89.1	8.7	65.6	1.6	15.1	7.9	4.8
Malt sprouts	89.8	18.6	37.1	1.7	35.5	14.3	16.3
Brewers' grains, wet	24.3	3.9	9.3	1.4	8.9	3.1	0.5
Brewers' grains, dried	91.8	15.7	36.3	5.1	36.2	10.3	0.9
Oats	89.0	9.2	47.3	4.2	20.6	8.2	6.2
Oatmeal	92.1	11.5	52.1	5.9	23.5	...	...
Oat feed or shorts	92.3	12.5	46.9	2.8	17.2	9.1	5.3
Oat hulls	90.6	1.3	40.1	0.6	5.2	2.4	5.2
Oat dust	93.5	8.9	38.4	5.1	21.6	...	...
Rice	87.6	4.8	72.2	0.3	10.8	1.8	0.9
Rice hulls	91.8	1.6	44.5	0.6	5.8	1.7	1.4
Rice bran	90.3	5.3	45.1	7.3	7.1	2.9	2.4
Rice polish	90.0	9.0	56.4	6.5	19.7	26.7	7.1

TABLE II — *Continued*

Name of Feed	Dry Matter in 100 Pounds	Digestible Nutrients in 100 Pounds			Fertilizing Constituents in 1000 Pounds		
		Protein	Carbohydrates	Ether Extract	Nitrogen	Phosphoric Acid	Potash
	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.
Buckwheat	87.4	7.7	49.2	1.8	14.4	4.4	2.1
Buckwheat middlings	87.3	22.0	33.4	5.4	42.8	21.9	11.4
Buckwheat bran	89.5	7.4	30.4	1.9	36.4	17.8	12.8
Buckwheat shorts	88.9	21.1	33.5	5.5	...	...	...
Buckwheat hulls	86.8	2.1	27.9	0.6	4.9	0.7	5.2
Sorghum seed	87.2	7.0	52.1	3.1	14.8	8.1	4.2
Broom corn seed	85.9	7.4	48.3	2.9	16.3	...	...
Kafir corn	84.8	7.8	57.1	2.7	...	...	...
Millet	86.0	8.9	45.0	3.2	20.4	8.5	3.6
Flaxseed	90.8	20.6	17.1	29.0	36.1	13.9	10.3
Linseed meal, old process	90.8	29.3	32.7	7.0	54.3	16.6	13.7
Linseed meal, new process	89.9	28.2	40.1	2.8	57.8	18.3	13.9
Cotton-seed	89.7	12.5	30.0	17.3	31.3	12.7	11.7
Cotton-seed meal	91.8	37.2	16.9	12.2	67.9	28.8	8.7
Cotton-seed hulls	88.9	0.3	33.1	1.7	6.9	2.5	10.2
Peas	89.5	16.8	51.8	0.7	30.8	8.2	9.9
Cowpea	85.2	18.3	54.2	1.1	33.3	...	...
Soybean	89.2	29.6	22.3	14.4	53.0	18.7	19.0
Horse bean	85.7	22.4	49.3	1.2	40.7	12.0	12.9
Coconut meal	89.7	15.6	38.3	10.5	32.8	16.0	24.0
Palm-nut meal	89.6	16.0	52.6	9.0	26.9	11.0	5.0
Sunflower seed	92.5	12.1	20.8	29.0	22.8	12.2	5.6
Sunflower seedcakes	91.8	31.2	19.6	12.8	55.5	21.5	11.7
Peanut meal	89.3	42.9	22.8	6.9	75.6	13.1	15.0
Rapeseed meal	90.0	25.2	23.7	7.5	49.6	20.0	13.0

TABLE II — *Continued*

Name of Feed	Dry Matter in 100 Pounds	Digestible Nutrients in 100 Pounds			Fertilizing Constituents in 1000 Pounds		
		Protein	Carbohydrates	Ether Extract	Nitrogen	Phosphoric Acid	Potash
Roughage	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.
Fodder corn —							
Fodder corn, green	20.7	1.0	11.6	0.4	4.1	1.5	3.3
Fodder corn, field-cured	57.8	2.5	34.6	1.2	17.6	5.4	8.9
Corn stover, field-cured	59.5	1.7	32.4	0.7	10.4	2.9	14.0
Kafir corn stover, field-cured	86.5	2.3	44.8	0.8	...	...	...
Sorghum (cane)	94.2	2.5	44.3	0.9	...	...	...
Fresh grass —							
Pasture grasses (mixed)	20.0	2.5	10.2	0.5	9.1	2.3	7.5
Kentucky blue grass	34.9	3.0	19.8	0.8	...	...	...
Timothy, different stages	38.4	1.2	19.1	0.6	4.8	2.6	7.6
Orchard-grass, in bloom	27.0	1.5	11.4	0.5	4.3	1.6	7.6
Redtop, in bloom	34.7	2.1	21.2	0.6	...	...	...
Oat fodder	37.8	2.6	18.9	1.0	4.9	1.3	3.8
Rye fodder	23.4	2.1	14.1	0.4	3.3	1.5	7.3
Sorghum	20.6	0.6	12.2	0.4	2.3	0.9	2.3
Meadow fescue, in bloom	30.1	1.5	16.8	0.4	...	...	...
Hungarian grass	28.9	2.0	16.0	0.4	3.9	1.6	5.5
Green barley	21.0	1.9	10.2	0.4	...	...	...
Peas and oats	16.0	1.8	7.1	0.2	...	...	...
Peas and barley	16.0	1.7	7.2	0.2	...	...	...
Kafir fodder	27.0	0.9	13.8	0.4	...	...	...

TABLE II — *Continued*

Name of Feed	Dry Matter in 100 Pounds	Digestible Nutrients in 100 Pounds			Fertilizing Constituents in 1000 Pounds		
		Protein	Carbohydrates	Ether Extract	Nitrogen	Phosphoric Acid	Potash
	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.
Fresh legumes —							
Red clover, different stages	29.2	2.9	14.8	0.7	5.3	1.3	4.6
Crimson clover	19.1	2.4	9.1	0.5	4.3	1.3	4.9
Alsike, in bloom	25.2	2.7	13.1	0.6	4.4	1.1	2.0
Alfalfa	28.2	3.9	12.7	0.5	7.2	1.3	5.6
Cowpea	16.4	1.8	8.7	0.2	2.7	1.0	3.1
Soybean	24.9	3.2	11.0	0.5	2.9	1.5	5.3
Hay —							
Timothy	86.8	2.8	43.4	1.4	12.6	5.3	9.0
Orchard grass	90.1	4.9	42.3	1.4	13.1	4.1	18.8
Redtop	91.1	4.8	46.9	1.0	11.5	3.6	10.2
Kentucky blue grass	78.8	4.8	37.3	2.0	11.9	4.0	15.7
Hungarian grass	92.3	4.5	51.7	1.3	12.0	3.5	13.0
Mixed grasses	87.1	5.9	40.9	1.2	14.1	2.7	15.5
Rowen (mixed)	83.4	7.9	40.1	1.5	16.1	4.3	14.9
Meadow fescue	80.0	4.2	43.3	1.7	9.9	4.0	21.0
Mixed grasses and clover	87.1	6.2	42.7	1.5	...	...	...
Soybean hay	88.7	10.8	38.7	1.5	23.2	6.7	10.8
Oat hay	91.1	4.3	46.4	1.5	...	...	...
Marsh or swamp hay	88.4	2.4	29.9	0.9	...	...	...
White daisy	85.0	3.8	40.7	1.2	...	...	...
Barley	89.4	5.1	35.9	1.6	...	...	...
Prairie (native)	94.4	3.7	43.6	0.9	...	...	...
Legume hay —							
Red clover, medium	84.7	6.8	35.8	1.7	20.7	3.8	22.0
Red clover, mammoth	78.8	5.7	32.0	1.9	22.3	5.5	12.2
Alsike clover	90.3	8.4	42.5	1.5	23.4	6.7	22.3

TABLE II — *Continued*

Name of Feed	Dry Matter in 100 Pounds	Digestible Nutrients in 100 Pounds			Fertilizing Constituents in 1000 Pounds		
		Protein	Carbohydrates	Ether Extract	Nitrogen	Phosphoric Acid	Potash
	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.
White clover	90.3	11.5	42.2	1.5	27.5	5.2	18.1
Crimson clover	90.4	10.5	34.9	1.2	20.5	4.0	13.1
Alfalfa	91.6	11.0	39.6	1.2	21.9	5.1	16.8
Cowpea	89.3	10.8	38.6	1.1	19.5	5.2	14.7
Soybean-straw	89.9	2.3	40.0	1.0	17.5	4.0	13.2
Peavine-straw	86.4	4.3	32.3	0.8	14.3	3.5	10.2
Straw —							
Wheat	90.4	0.4	36.3	0.4	5.9	1.2	5.1
Rye	92.9	0.6	40.6	0.4	4.6	2.8	7.9
Oat	90.8	1.2	38.6	0.8	6.2	2.0	12.4
Barley	85.8	0.7	41.2	0.6	13.1	3.0	20.9
Oat chaff	85.7	1.5	33.0	0.7	...	...	...
Wheat chaff	85.7	0.3	23.3	0.5	7.9	7.0	4.2
Silage —							
Corn	20.9	0.9	11.3	0.7	2.8	1.1	3.7
Clover	28.0	2.0	13.5	1.0	...	...	...
Sorghum	23.9	0.6	14.9	0.2	...	...	...
Alfalfa	27.5	3.0	8.5	1.9	...	...	...
Grass	32.0	1.9	13.4	1.6	...	...	...
Cowpea vine	20.7	1.5	8.6	0.9	...	...	...
Soybean	25.8	2.7	8.7	1.3	...	...	...
Barnyard millet and soybean	21.0	1.6	9.2	0.7	...	...	...
Corn and soybean	24.0	1.6	13.0	0.7	...	...	...
Roots and tubers —							
Beet, mangel	9.1	1.1	5.4	0.1	1.9	0.9	3.8
Beet, sugar	13.5	1.1	10.2	0.1	2.2	1.0	4.8
Beet, common	13.0	1.2	8.8	0.1	2.4	0.9	4.4

TABLE II — *Continued*

Name of Feed	Dry Matter in 100 Pounds	Digestible Nutrients in 100 Pounds			Fertilizing Constituents in 1000 Pounds		
		Protein	Carbohydrates	Ether Extract	Nitrogen	Phosphoric Acid	Potash
	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.
Rutabaga	11.4	1.0	8.1	0.2	1.9	1.2	4.9
Carrot	11.4	0.8	7.8	0.2	1.5	0.9	5.1
Flat turnip	9.5	1.0	7.2	0.2	1.8	1.0	3.9
Artichoke	20.0	2.0	16.8	0.2	2.6	1.4	4.7
Potato	21.1	0.9	16.3	0.1	3.2	1.2	4.6
Parsnip	11.7	1.6	11.2	0.2	1.8	2.0	4.4
Miscellaneous —							
Rape	14.0	1.5	8.1	0.2	4.5	1.5	3.6
Cabbage	15.3	1.8	8.2	0.4	3.8	1.1	4.3
Pumpkin, field	9.1	1.0	5.8	0.3	...	...	...
Pumpkin, garden	19.2	1.4	8.3	0.8	1.1	1.6	0.9
Sugar beet leaves	12.0	1.7	4.6	0.2	4.1	1.5	6.2
Spurry	20.0	1.5	9.8	0.3	3.8	2.5	5.9
Prickly comfrey	11.6	1.4	4.6	0.2	4.2	1.1	7.5
Acorns, fresh	44.7	2.1	34.4	1.7	...	...	...
Beet molasses	79.2	9.1	59.5	0.0	14.6	0.5	56.3
Beet pulp	10.2	0.6	7.3	0.0	1.4	0.2	0.4
Dried blood	91.5	52.3	0.0	2.5	135.0	13.5	7.7
Meat scrap	89.3	66.2	0.3	13.7	113.9	7.0	1.0
Tankage	93.0	31.7	15.3	13.6	...	...	...
Dried fish	89 2	44.1	0.0	10.3	77.5	120.0	2.0
Cow's milk	12.8	3.6	4.9	3.7	5.3	1.9	1.8
Cow's milk, colostrum	25.4	17.6	2.7	3.6	28.2	6.6	1.1
Skim-milk, gravity	9.6	3.1	4.7	0.8	5.6	2.0	1.9
Skim-milk, centrifugal	9.4	2.9	5.2	0.3	5.6	2.0	1.9
Buttermilk	9.9	3.9	4.0	1.1	4.8	1.7	1.6
Whey	6.6	0.8	4.7	0.3	1.5	1.4	1.8

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