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10/11/21

PROF. WM. DIETRICH.

SWINE

Breeding, Feeding

AND

Management

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PREFACE.

The discussions here given are the results of a number of years of specialized study in swine husbandry in connection with a thorough study of the principles of animal nutrition. Practical farm experience was supplemented by a detailed study of experimental data and a great deal of original investigation in the subject. An attempt is made to present the subject of swine breeding, feeding and management in such a form that it can be understood by the general farmer and swine breeder; the man who is producing hogs for the pork product as well as the man who is producing pure-bred swine for breeding purposes. The student also is kept in mind, and it is hoped that the elementary form in which this subject is presented will appeal to the needs of the class room.

It is attempted to present the various subjects in logical order, or in the order in which they would naturally present themselves. The first question that arises is the selection of a breed. In order to do this intelligently the characteristics of the breeds must be known. Then something must be learned about judging in order to be able to establish a herd. Following this comes the origin of the breeds, giving the breeder an idea of the characteristics that will probably be transmitted by individuals of a breed, which will enable the breeder to develop his herd properly and then breed for improvement.

Thus Part I deals with breeds and breeding, Part II with feeding, and Part III with the general care and management of swine.

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PART I.
Swine Breeding.

CHAPTER I.

SELECTION OF A BREED.

Which is the best breed? This question, in its various forms, is the one that is usually asked first. The man who is intending to start in the business of swine husbandry seems to be impressed with the idea that the selection of a breed is the one thing above everything else that is of primary importance. Prevailing conditions have lent considerable significance to this idea. But the condition of the herd, the conditions under which it is kept, as well as the general care and management, are often of greater importance than the breed itself. Therefore, the herd that is in the best hands will make the best showing, which will usually be accredited to the breed and not to the breeder.

What is of still greater importance than this are the individuals that are selected from the breed. All breeds are composed of a wide range of individuals, ranging from very superior to very inferior, which, when used in a breeding herd, will produce results accordingly. The breeder, then, who has the best individuals of a given breed, other conditions being equal, will make a better showing than his neighbor who has a different breed but not as good individuals.

A consideration of prime importance in the selection of a breed is the likes and dislikes of the breeder. One is much more likely to succeed with animals he likes and to fail with other animals of equal merit that he dislikes.

Aside from a man's likes and dislikes, and aside from other general considerations which are applicable in all cases, there are a number of points that should be considered in selecting a breed.

TYPE OF SWINE.

Swine in general are classified in two types: First, the fat or lard hog; second, the bacon hog.

The Fat or Lard Hog.—The fat or lard hog as shown in Cut 1 is the one that has been developed primarily in the corn belt of the United States. It is a hog that has a considerable quantity of fat or lard in its carcass. To be ideal with present market requirements this hog should not carry an excess of fat. It should have different quantities of fat or lard for different purposes, but this must be laid on smoothly and evenly. The hog in general should be long, broad, deep, even in depth and width, thick in flesh, smooth and symmetrical throughout. It should also have strong straight legs of medium length, and a neck of sufficient thickness to join the head to the body smoothly.

The Bacon Hog.—The bacon hog, as shown in Cut 2, page 17, is one that has relatively more lean meat and not so much fat as the fat or lard hog. By the term bacon hog in general is meant the English bacon hog, which is produced principally in Great Britain, Denmark and Canada. He is grown primarily for the production of high class bacon. In the case of fat or lard hogs only the sides of the hog are used for bacon purposes. With strictly bacon hogs the shoulder and ham are many times also included, in which case it takes the entire half of the hog. This is cured with salt and then smoked. Since the side of the hog between the shoulder and the ham is best

CUT 1.—HOGS OF THE FAT OR LARD TYPE.

conditions and to supply the market demand, various types of swine are produced. In general, the corn belt of the United States, where an abundance of corn is produced and not very much other feed, is pre-eminently adapted to the production of the fat or lard hog. Corn is a carbonaceous feed, one that will produce fat and energy principally, and will naturally make a hog that has a greater proportion of lard. It is true that a hog cannot develop at all if it is fed nothing but carbohydrate, but corn has a little protein or muscle-forming ingredients, and consequently will allow a hog to develop the lean meat part of his carcass to a slight extent, especially if corn is fed in connection with some other feed, even though it be only grass. But with the preponderance of fat-forming ingredients in corn, the hog will naturally develop this part of its carcass excessively.

Outside of the corn belt where corn is less abundant, and other feeds are more abundant, more protein will be supplied as well as more exercise, and the conditions are more favorable to the production of bacon hogs. Feeds other than corn usually have more protein; furthermore, they are not so concentrated,—that is, do not have quite so much digestible nutrients per given bulk of feed. Such conditions will allow the lean meat, or the protein part of the carcass, to develop relatively more and the fat part of the carcass relatively less. For immediate results, however, a breed should be selected that will furnish the type of hog desired by the breeder.

LOCATION.

In organizing a swine farm and in selecting a breed, the location should be taken into consideration. The adaptability of the country for swine production is a

point of considerable importance. To be well adapted to such a purpose the season should be neither too hot nor too cold. If swine are to be subjected to such variations, the heat should be counterbalanced by providing an abundance of shade. There is no better shade than the natural shade of trees, and in cold weather comfortable shelter should also be provided.

The character of the soil should also be taken into consideration. Soil that is rich in mineral matter is better adapted to the production of hogs than one that is not. The mineral ingredients also should be of various kinds especially containing lime and phosphorus. A hog needs a variety of mineral substances for the normal working of his digestion, assimilation, etc.; also for the production of bone. If these mineral substances are present in the soil, they will be more abundant in the soil water and also in the vegetation grown on the soil. Hence the hog will develop better than he will on soil where such mineral substances are not present. It is true that these mineral substances may be supplied artificially, but this is never quite as good as when they are found in the natural state.

In selecting a breed the natural tendency of the development of swine, as caused by various conditions, should be taken into consideration. The mistake is very often made by a man locating in the corn belt to select a hog that is short, fat, and early maturing; a type of hog that is the natural product of corn belt conditions and is already overdone. Such a hog might prove a failure under these conditions, while one of another type would be much more successful. Hogs developed in the corn belt where the carbonaceous feeds are more abundant and the mineral and protein feeds are more or less deficient, have a natural tendency to become fat and to lose size and pro-

lificacy. Consequently hogs that are selected for corn belt conditions should have all of these points well developed. They should be large, rangy, strong in constitution and vitality, and should be active and prolific. A few generations of feeding may change a hog from one type to the other, and a man who has not the ability to mold a type according to his own ideals ought to select hogs to begin with that are best adapted to the conditions under which they are to be grown.

COLOR OF SWINE.

The color of the hog should have some consideration in selecting a breed. As is quite generally known, the black or dark-skinned hog is better able to withstand the direct rays of the sun than is the white hog. In other words, the white hog is more subject to sun-scald, blisters, and consequently to skin diseases of various forms, than the black hog. The reason for this apparently is that the black cuticle of the black hog absorbs the rays coming from the sun, whether they be heat rays, the light rays, or the actinic (chemically active) rays, while the cuticle of the white hog allows them to pass through.

In order to develop a possible explanation for the above mentioned fact, namely,—that a white hog cannot withstand the direct rays of the sun as well as a black hog,—it is discussed from the standpoint of the heat rays. Nevertheless, the other rays may act in a similar manner.

It is a well known fact that a black object lying in the sun becomes hotter than an object of a lighter color. The color of the hog is in the cuticle. This is also a well known fact because all hogs, either black, red, or white, are white after being dressed. The cuticle which carries the pigment is taken off in such an operation. The cuticle

of the hog, therefore, is not in the true sense of the word, a part of the animal. It is outside of its circulatory and nervous systems and it therefore does not matter much whether this part of the animal becomes heated or not. The cuticle, as well as the true skin, of the hog is of such a nature that it is not a reflector like a mirror; it is not a polished surface, but will allow the rays of the sun either to pass through it or to be absorbed. The white cuticle, since it is not a reflector, will allow the rays to pass through; the black cuticle, being dark, will act as an absorbent. The cuticle of the black hog, then, which absorbs the heat of the sun, apparently plays the double part of conductor and radiator. This part being hotter than the adjacent portions of the carcass, part of the heat will be conducted into the body of the hog, another part will be conducted to adjacent particles of air, and still more will be radiated into space. Thus the black hog gets only a part of the heat from the sun in the interior of his body, while the white hog, whose cuticle is neither a reflector nor an absorbent, gets the bulk of the heat from the sun in the living part of its carcass. This apparently is detrimental and is responsible for the fact that white hogs are not as adaptable to hot climates having a great deal of sunlight as black hogs.

In general, then, white hogs may be selected for northern climates, but the dark breeds, either red or black, should be selected for southern climates. Of course if southern climates have very little sunshine, or if the hogs are well provided with shade, the white hog will still do very well in the south. Furthermore, if the northern climates have an abundance of sunlight, the white hog would also be handicapped in such places.

weight during the first two months. This, however, is not due to the fact that he is not an economical producer. It is a well known fact that pigs in general, as they get older, make smaller gains per 100 pounds live weight. During the third month's growth, as represented, the live weight of the pig rises a little more rapidly. During the fourth month it continues to rise more rapidly, and during the fifth, sixth and seventh months it will be seen that the pig gains 50 pounds each month. Following the seventh

CUT 3.—COMPARISON OF AGES AND WEIGHTS OF HOGS.

month it takes two months, or 60 days, to add 50 pounds, and the next 50 pounds is put on in three months' time, from 10 to 13. As maturity is approached it takes the pig six months' time to put on the last 50 pounds in live weight.

Total Feed Eaten and Cost Per Pound Gain.—The second section of this cut shows the total amount of feed eaten by pigs of various ages, as shown by the figures representing months at the top of the cut. It will be seen

from this that during the fourth and fifth months of the life of the pig, he has eaten an average of about four pounds of feed per day. This is on the basis of dry feed such as corn, barley, middlings, and other grains that may be fed. Considering this in connection with the live weight given above, it will be seen that a pig eating four pounds of feed per day for one month of thirty days, will require 120 pounds of feed for the 50 pounds gained in live weight, as shown in Fig. 1 of the cut. At this rate the pig is making pork at a cost of 2.4 pounds of feed for every pound of pork produced. Figuring the feed at one cent per pound, it will be seen that pork at this time in the life of the pig can be made at 2.4 cents per pound.

Considering the age of the pig from ten to twelve months inclusive, where it takes three months to add 50 pounds in live weight, as shown in Fig. 1, it will be seen from Fig. 2 of the cut that he is eating more than seven pounds of feed daily. Assuming that he would require only seven pounds per day for three months, he would require under the conditions taken for Fig. 1 630 pounds of feed to put on 50 pounds of gain in live weight. This would be at the rate of 12.6 pounds of feed for every pound of gain made and at the prices given above for feed, the pork would have cost 12.6 cents per pound.

From this it should be quite evident what the significance of large breeding stock is, even though market hogs are sold to the best advantage when they weigh from 175 to 300 pounds. The reason that the gains are so expensive with the average hog after nine months of age is because he is approaching maturity too rapidly. Under such conditions the pig requires more for absolute maintenance because he is much heavier than he was previously, and from the curve indicating the total amount

of feed eaten in Fig. 2 of the cut, it is seen that after nine months of age the pig does not eat much more feed than previously in absolute quantity. When calculated in feed eaten per hundred pounds live weight, Fig. 3 of the cut illustrates very conclusively what happens.

Feed Eaten Per Hundred Pounds Live Weight.—Section 3 of the same cut shows that when the pig is three months old he is eating almost six pounds of feed daily per hundred pounds of live weight. This decreases quite rapidly for several months, and then more slowly, until only 2.35 pounds of feed is eaten daily per hundred pounds live weight by a pig that is 12 months old. On the basis of 100 pounds live weight this shows that the older the pig, the smaller is the quantity of feed eaten. Even though the total amount of feed required for maintenance per hundred pounds live weight does not increase, there is the factor of waste, which will be explained later, that does increase, which, together with the fact that the pig gradually eats a smaller amount as he gets older, makes the gains much more expensive. The more nearly maturity is approached the more expensive these gains become. Consequently the larger the breeding stock the earlier will be the age at which market hogs reach the desired weight and the more economical will be the gains; therefore, the greater will be the profit.

Maturity.—A hog that cannot be put into good market condition until it comes to maturity is not a desirable animal because maturity in general is not attained until about two years of age. During past decades early maturity was a point of prime significance in the minds of breeders, and this characteristic was developed to such an extent that many hogs of today are not as large or as profitable producers of pork as their ancestors were. The

breeds of today in general are of such a character that hogs may be put into desirable market condition at almost any age during early life, and the trouble in many cases is that they come to maturity too soon. With this in view it is easy to see that for most profitable pork production the time at which a hog comes to maturity should be extended as far as is consistent with good form and quality. Early maturity in general is brought about by feeding an excess of non-nitrogenous nutrients or by sudden changes from nitrogenous to non-nitrogenous feeds.

By feeding an excess of non-nitrogenous nutrients the pig does not have sufficient protein upon which to make extended growth; therefore, he will lay on fat and discontinue to grow, which will produce a developed hog at an early age. By sudden changes from nitrogenous to non-nitrogenous feeds, a relatively high rate of waste results for the time being and must be supplied first, principally from the crude protein of the ration, thus leaving but little for the growth of the pig. At the same time the pig will lay on fat from the non-nitrogenous part of the ration, which results in the same thing as above,—namely, early maturity.

PROLIFICACY.

Prolificacy is a valuable point in any breed. The brood sow that will produce twelve pigs and raise ten to a litter is more than twice as valuable as the sow that will produce seven pigs and raise five. If the one that raises five pigs per litter will pay expenses, then the one that raises ten pigs will have five pigs for the profit of her owner.

Prolificacy, although more or less an inherited characteristic, is very largely controlled by the condition of

feed and care of the sow. The term prolificacy is used to apply to the number of pigs farrowed. What is of equal importance is that the sow farrows live pigs and that she raise a large percentage of those farrowed. These points also are influenced largely by the conditions under the control of breeder and feeder. This is discussed later.

Apart from this it is believed that there is a correlation between conformation and prolificacy; that is, hogs selected in accordance with the ideal set forth in Chapter IV will produce more pigs per litter than those that are not so well formed. Three Poland-China gilts, litter-mates, placed in accordance with this standard farrowed pigs in their first litters as follows: No. 1, nine pigs; No. 2, five; and No. 3, one pig. The result with six Chester White gilts, all from the same litter, was as follows: Nos. 1, 2, 3 and 4 combined farrowed 35 pigs and Nos. 5 and 6 combined farrowed 10 pigs. This may have been partly accidental, but other instances like this have come to notice.

QUALITY.

The term quality as used in connection with swine is very often misinterpreted. It is often taken to mean everything in a hog that is good. Correctly speaking, a hog is made up of a number of individual points such as snout, jowls, eyes, ears, neck, shoulders, back, sides, ham and feet, which when put together constitute what is ordinarily called form. If these various parts have proper conformation in themselves and are properly put together, thus making a good individual, the hog is said to have good form. If the hog is fat, he is said to be in good or high condition. If he is lean, he is said to be in poor condition, provided the market hog is under consideration. In the breeding hog there is what is called

breeding condition. Hence, there are two principal points, form and condition, in a hog, besides quality.

Quality in a hog should be considered in the same sense as quality in a piece of cloth. When a piece of cloth is coarse and made of poor material, it is said to be of poor quality. When it is finely woven of high-class material, it is said to have fine or good quality. In the same sense a hog is of fine or good quality, or is coarse or poor in quality.

In general a hog is said to be good in quality when the whole appearance is that of smoothness and refinement rather than of coarseness and ungainliness. The hair should be fine; the skin smooth and fine in texture; the bone as indicated in the snout, head and legs should be smooth, and not too large, and the flesh should be fine in grain and show considerable firmness together with elasticity, which is indicative of a large proportion of lean meat.

In order to be the best kind of hog for the farmer as well as for the breeder, the hog should have these three characteristics well developed,—size, prolificacy, and quality. Along with these there are various considerations that come under the head of form as well as condition which should be duly considered, but these will be taken up later.

also be covered with black hair. It is the tendency of breeders to breed the Tamworth with the pure red color, but the policy of breeding good individuals, even if they have an occasional black spot, is sound.

In constitution the Tamworth is exceptionally well developed. The breed has more native blood in it, or in other words, is more nearly like that of the wild boar, than any other of the domestic breeds. The chest is both broad and deep and many individuals may be found which are as deep in the chest, sometimes even deeper, than in any other part of the body. This unfortunately cannot be said of any of the other breeds of swine.

Large Yorkshire Swine.—The large Yorkshire is very often called the Improved Large Yorkshire. The term "Large" is necessary to distinguish it from the Small Yorkshire or the Middle Yorkshire. These breeds are all native to England and in the home country are called Large Whites, Small Whites, and Middle Whites. The Large Yorkshire is a bacon hog, while the Small Yorkshire is of the fat or lard type, and the Middle Yorkshire is a medium between these. While the Large Yorkshire is purely a bacon hog, it is not quite such an extreme bacon type as the Tamworth. It has a little more width of body or thickness of covering of fat. The Large Yorkshire, as the name indicates, is also a rapidly growing hog, and together with its size carries considerable quality; hence it may also be considered as an early maturing hog. With good feeding it is ready for market at almost any age after reaching a desirable weight.

In form this hog is long, quite deep in the body with a snout of medium length, and ears and tail similar in form to those of the Tamworth. The legs are medium in length from the bacon standpoint. These, however, when com-

CUT 6.—A LARGE YORKSHIRE SOW.

pared with the length of legs of the fat or lard hog would be considered long. In chest capacity the Large Yorkshire is very good, but not quite as good as the Tamworth. The color is pure white except that there are occasional pale blue spots on the skin, and where these appear they are covered with white hair. At times they have several of these spots or occasionally there may be quite a number of very small pale blue spots. The Yorkshire is supposed to have an abundance of hair, but the coat is made up of rather long straight fine hair which lies close to the body. Some individuals, however, have a coat that is rather thin. One characteristic of the bacon hog is the lightness of the jowl. The Large Yorkshire has a jowl that is medium in size, but very firm and smooth; still its jowls are light when compared with most breeds of the fat or lard type. The neck of the Large Yorkshire is rather long and light, being muscular, but not fat. This is a common characteristic of bacon hogs in general. Both the shoulders and the hams, as viewed by standing at the side of the hog (horizontal dimension), are narrow, but quite long (vertical dimension). The sides are extremely long, quite deep, and well covered with lean meat. They also are very firm and good in quality.

BREEDS OF THE FAT OR LARD TYPE.

Berkshire Swine.—The Berkshire is considered an English hog. The breed was originated and developed in England and was bred there for many years before being brought into the United States. Since its introduction to this country, the breed has been continued on practically the same lines as previously, but it is said that the American Berkshire is now superior to his English relative. During the earlier

CUT 6.—A BERKSHIRE SOW.

history of the Berkshire, American breeders improved their herds by importing specimens from England, the original home of the breed.

There seem to be a few possible explanations why the American breeder should have surpassed the English breeder. First, the breeders of England who were formerly noted for the high class specimens that they bred have either died or gone out of the business, which would naturally leave breeders of less than the first rank, and if none other appeared in the field with equal ability as those that were first classed as the best, it would leave the breeders of England without their leaders, or without those who were best able to carry on the business. Second, in the United States hog breeding has reached such an extensive scale that the possibility of outstanding individuals appearing is much greater than in England, where breeding is done less extensively. Also a few outstanding American breeders have made considerable advancement.

Although the Berkshire is classified with hogs of the fat or lard type, it is universally considered as a medium between the fat or lard hog and the bacon hog. In Canada, where bacon hogs are produced almost exclusively, the Berkshire is used along with the Tamworth and the Yorkshire. In the United States, where the fat or lard hog is being produced, the Berkshire fills the bill as well, or better possibly, than any of the other breeds used for the purpose.

The Berkshire in its latest improved form is a hog that has size, prolificacy and quality well developed. All breeds show a considerable degree of variation, having individuals that are good and individuals that are inferior. Besides this most breeds that are being bred by a con-

siderable number of breeders show considerable variation in type. Every breeder, who is a breeder in the truest sense of the word, has a type of his own and breeds his hogs accordingly; hence there are good Berkshires and bad Berkshires; there are Berkshires of good type and Berkshires of bad type. The latest improved Berkshire is a hog of considerable size. One of the principal considerations that goes to make up size and especially weight is the length of body. In this the Berkshire probably excels all other breeds of the fat or lard type. Along with the length of body it has a strong well-arched back, even width and good depth of body, broad heavy hams, light smooth well-set shoulders, excellent feet and legs, standing well up on its toes. As above indicated there are many Berkshires that do not have this required length of body, and in fact many are quite short. Others are small in size, but these should not be selected.

The Berkshire in general has a short snout with a dished face,—that is, the snout turns up rather abruptly from the head. When the hog stands with his head up, the end of his snout may even be higher than the point at which it leaves the head. The tendency of breeders at the present time is to overdo the shortness of snout; it has become a fad, and the snouts of many Berkshires are so short and turn up so much that it is difficult for the hog to eat out of an ordinary trough. Other Berkshires have what is called a medium snout; they still have the dished face, but a snout that is not so short as to be useless. Some also have a rather long snout, which is not considered proper form. The snout of the Berkshire as a rule is not fine, but rather heavy and somewhat coarse, which is an indication of strength and vigor.

The general color of the Berkshire is black. However, it should have, to be strictly ideal, six white points, which means that it should have four white feet, a white snout or else some white in its face, and a white switch,—that is, the end of its tail should be white. While color markings of this nature are desirable, there is no hard and fast rule that all Berkshires should be marked just this way. Many of them have one, two, or even more black points, and some have other white markings besides those specified. Either too much white or too little white, however, is objectionable. Too much is worse than too little.

Chester White Swine.—The Chester White is an American white hog. There are different strains such as the Chester White and the O. I. C., meaning Ohio Improved Chester. Some of these hogs sometimes have a few black spots in the skin, which may or may not be covered with black hair. Some breeders of the two strains of Chester Whites think that they have different breeds of hogs. Nevertheless, when shown at the various state fairs and other shows, they show in the same class and when viewed by the general public there is no appreciable difference between the different strains.

In size the Chester White ranges from a large hog to one of medium size. They are strictly of the fat or lard type, producing a relatively large proportion of fat meat to the amount of lean meat in the carcass. The Chester White as a whole is not very long in the body, blocky in form, having heavy hams, smooth shoulders, broad back and is well filled and smooth throughout, and stands up well on its feet and legs. The snout is medium in length, the dish between the snout and the face is not sharp, but rather medium, and the snout is tapering and somewhat pointed. The ears of the latest improved type are what

CUT 7.—A CHESTER WHITE SOV.

is called fancy. That is, the ear stands upright for about two-thirds, then has a break, allowing the tip to fall over. The ear stands forward and outward. Some of the best hogs considered strictly from the fat or lard hog standpoint, are found among Chester Whites. But like other breeds it also has inferior specimens.

Some of the points of excellence considered in favor of the Chester Whites are that they are excellent feeders, growing rapidly and making good use of the feed consumed. Also that the carcasses present a whiter and more pleasing appearance than do the carcasses of black hogs. This is true because if any part of the cuticle of the white hog is left in the process of dressing, it is white and does not make as bad an appearance as a spot would in the case of the black hog. Another point that should be taken into consideration not only with the Chester Whites, but with all white hogs, is that in order to have the finest appearing carcasses and in order to have the hogs sell to the best advantage on the market, they must not be bruised or injured before being sold. The white hog will show a bruise much more readily than the black hog. Furthermore, if white hogs are to sell to the best advantage, all the hogs in the drove must be white. A few black hogs in a drove of white hogs, or the reverse, may detract more from the selling price of the bunch than they individually are worth.

Duroc-Jersey Swine.—The Duroc-Jersey, an American breed, is a red hog similar in color to the Tamworth. It, however, is not so uniformly red. The color many times, especially in older animals, is rather dark and sometimes nearly black. Many individuals are also quite light in color, approaching a pale yellow. The lighter shades are more easily

CUT 8.—A DUROC-JERSEY SOW.

maintained than the darker shades. The Duroc-Jersey in its latest improved state is quite a modern hog. Originally it was a hog of good length of body, great size, and considerable coarseness. During recent years, however, much improvement has been made in quality, but along with this has come a reduction in size, a reduction in the length of body, and possibly also a reduction in prolificacy. Changes along these lines are going on so rapidly at present that there is danger of its being overdone before the pendulum swings in the other direction.

At present the Duroc-Jerseys are rather short heavy-bodied hogs, with legs of medium length, and well placed feet, standing straight up on their toes. In quality, however, they are still somewhat coarse, having a coarse-grained flesh that is also made up very largely of fat. The hog then is one that is strictly of the fat or lard type. The snout of the Duroc-Jersey is medium in length with a slight dish in the face, the jowls are rather heavy, the ears are fancy,—that is, they are two-thirds erect and one-third drooping, and extending forward and outward. Formerly the ear of the Duroc-Jersey was decidedly coarse, large and heavy, hanging down over the eye. This characteristic is still prevalent in many individuals. In general the Duroc-Jersey is a hog that is thickly covered throughout, having a broad well-arched back, and thick side and belly. The thick covering of flesh, however, is very largely fat. The ham in some of the best individuals is broad, deep and full, but very often the ham is decidedly light. The shoulders may be very fine, smooth and well set, but these again often are very coarse and heavy. Coarseness in general is still a prominent characteristic of the Duroc-Jersey, but the process of refinement is going on so rapidly that many individuals may be said to have good or fine quality.

The points of excellence in favor of the Duroc-Jersey are its hardiness, growthiness and prolificacy. The breed is comparatively new in its present state of development and hence has considerable of the strength and vitality that is so prominent in the wild boar. In developing size at a given age the Duroc-Jersey is good, though not better than individuals of other breeds.

Poland-China Swine.—The Poland-China is a typical American breed developed under ideal American conditions. The former Poland-China was a very prolific large spotted hog of good quality. At present there are two distinct types in the breed. The principal aim of many breeders for a considerable number of years has been to develop quality, early maturity, and smoothness of form. The show yard set the standard for this type and the breeders have followed to the extent that the Poland-China in this particular strain became so much reduced in size, in length of body, and in prolificacy, that the usefulness of the breed for pork production was somewhat impaired. From the spotted hog which originally existed this strain was developed with solid black color except six white points.

Many of the breeders having recognized the fact that this strain of Poland-China is not as large or as prolific as it used to be, have developed the other extreme. They have refused to follow the standard as given above and are breeding hogs with size, growthiness, and prolificacy, irrespective of many of the fancy points. These hogs develop enormous size, but are somewhat lacking in quality. Nevertheless they are prolific and good feeders.

The fine quality strain of the Poland-China is what may be called an extra fancy type, being smooth throughout, with thick, broad, heavy sides, smooth shoulders, broad,

CUT 9.—A POLAND-CHINA BOAR.

heavy plump hams, the hams extending well down onto the hock, with short legs and upright pasterns. The bone is fine throughout, the tail fine, the head and ears very neat and attractive, and the quality of the flesh is very good. It is, however, primarily a fat-producing hog and does not have relatively as much lean meat as is required for bacon purposes. The snout is medium in length, extending forward and downward at an angle of about forty-five degrees, quite straight and tapering. The ears are fancy, being two-thirds upright and one-third drooping. The neck is short, well filled, deep and thick, carrying the upper line well forward toward the head. The back is broad, the sides are full and deep, and the body smooth throughout.

The large type of the Poland-China has more length of body, but is also longer in the legs, and has heavier ears. It has more size but is coarser grained in flesh, hence is not as good in quality.

Hampshire Swine.—The Hampshire, formerly called the Thin Rind, is an American breed in its present state of development. Originally it came from England, but lost its identity in this country through cross breeding. Later the breed was developed again in its original form and now occupies a prominent place among the breeds of America. Its recent development has been very rapid. The hog formerly was called Thin Rind on account of the fineness of its skin combined with good quality. The most characteristic feature of this hog is the white belt it has across its body including the shoulder and front legs, while the rest of the hog is black. Some individuals are all black. By breeding the belted Hampshire there is a tendency for the white belt to increase in width. When this occurs

CUT 10.—A HAMPSHIRE SOW.

and it gets too wide, the breeders usually cross with a black individual to get the white belt of the proper dimension, which is six to ten inches in width.

The breed is sometimes said to be a mean between the fat or lard hog and the bacon hog, but more generally it is considered as belonging in the fat or lard class. While it has good depth of body and smooth, firm sides, it ordinarily carries too much fat to be considered in the bacon class. In general appearance the hog is rather upstanding on legs that are fine, but of good quality and strong, with pasterns that are strong and upright. The body is deep and not very broad; the jowls are very light, the head small, the snout rather straight and medium in length. The head is narrow, the ears set close and extending forward. The shoulders are smooth and well set, the back is strong and arched, the hams are long and broad but not very thick. (The length and width of the ham are the vertical and horizontal dimensions respectively taken when the hog stands. The thickness is the third dimension.)

Cheshire Swine.—The Cheshire, or Jefferson County Hog of New York, was developed in the place indicated by its name. It is a white hog of quality. In form it is rather long and cylindrical in body, standing on legs of considerable length that are fine but strong in bone. The ears are short and upright, the snout medium in length and slender with a slightly dished face. The hog is smoothly and thickly covered throughout with flesh of good quality. It is a mean between the bacon and fat or lard types, but is more often considered as a bacon hog. It is somewhat similar except in color and snout to the Berkshire.

CUT 11.—A CHESHIRE SOW.—(Photograph furnished by New York State College.)

Essex Swine.—The Essex is classed as a small hog and is representative of the type of southern Europe. Its color is jet black. There are different shades of color represented by different breeds. The Berkshire, while black in general, is not a jet black; the Poland-China is black, which is a darker shade than that of the Berkshire, but not as black as the Essex; but the Essex is jet black and has no white on it whatever. It is a small compact hog, standing on short legs. It may briefly be described as being typical of the fat or lard type except that it is smaller in size. On account of the way the breed was established, which was largely by inbreeding, it exhibits great uniformity, but also some delicacy, and cannot stand further inbreeding.

Other Breeds.—Besides the above mentioned there are minor breeds such as the Small Yorkshire, Middle Yorkshire, English or Black Suffolk, the American or White Suffolk, Victorias by F. D. Curtis of Charleton, Saratoga County, New York; Victorias by G. F. Davis of Dyer, Indiana. The hogs of these breeds, however, are not numerous enough to warrant further discussion.

Besides these there is the mule-footed hog, which is characterized by having a solid instead of a cloven hoof.

There are two other English breeds that have come into prominence in England during recent years; they are the Large Black Hog and the Lincolnshire Curly White. The Large Blacks are a long bodied, large, rather coarse hog with heavy lopped ears. They are of the bacon type and are good feeders and good scavengers; also grazers. The latter is also considered of the bacon type, but is really more of the fat or lard type, being more compact, closer to the ground, heavier set and thicker throughout. It has a white curly coat of hair. The following cut shows the Large Black.

CUT 12.—A LARGE BLACK BOAR.—(Photograph from England.)

CHAPTER IV.

JUDGING SWINE.

Before being able to select a breeding herd properly, and much more before being able to carry on breeding operations intelligently, a man must have the ability to select the best individuals. The more of this ability he has, the better able he will be to succeed in this work.

Although the individuals of different breeds within a given type are apparently different in conformation, they are in the main essentially the same. At least the ideal toward which the different breeds are being developed is practically the same with a few minor exceptions. The points in which the different breeds of either type primarily differ are color, length and shape of snout, and the position and form of the ear. Aside from these there are a few other differences which cannot really be said to be breed differences, such as length of body, length of legs, shape of head. These same differences that are found between different breeds are also noted between individuals of the same breed. Consequently in order to illustrate the fat or lard type it would not be necessary to present more than one illustration which, with the necessary modifications about the head, would answer the purpose for all breeds of this class. However, two cuts are presented as follows, illustrating the Berkshire and Poland-China. These, as before stated, by imagining a different shaped snout and ear, will answer the purpose for all other breeds of this type.

FAT OR LARD TYPE.

The cuts below were not made from photographs, but from drawings, and an attempt was made to represent

CUT 13.—APPROXIMATE IDEAL LARD TYPE.

CUT 14.—APPROXIMATE IDEAL LARD TYPE.

the hog in as nearly ideal form as possible. To facilitate matters still further the standards of excellence used by the writer to teach swine judging at the University of Illi-

nois are presented herewith. These also have been prepared to answer the purpose for all hogs of the fat or lard and also the bacon type, and may be used for the various breeds with proper consideration of the points wherein they differ. The immediately following standard of excellence was prepared especially for hogs that are intended for breeding purposes and is not intended for judging market hogs.

Fat or Lard Hogs for Breeding.

STANDARD OF EXCELLENCE.		Perfect Score
SIZE—In good flesh; weight at 6 months, 200 lbs.; 1 year, 400 lbs.; 2 years, 800 lbs.		15
UTILITY—Sow prolific; motherly and lactatious. Boars masculine; prepotent		8
STYLE—Attractive		2
ACTION—Spirited, straightforward, regular, free and easy		2
FORM—Long, deep, broad, smooth, symmetrical, compact, standing squarely on legs of medium length		6
CONSTITUTION—Chest capacious; brisket advanced and low; front legs set well apart; ribs well sprung; flanks full and well let down		7
QUALITY—Thick even covering of firm flesh that is fine in grain; hair fine; bone fine but strong; skin smooth and fine; free from lumps and wrinkles; general refinement, but not delicate		4
CONDITION—Thrifty; well fleshed, with large amount of lean meat and considerable fat, but not excessively fat		4
DISPOSITION—Quiet, gentle		1
COLOR—According to breed		2
COAT—Abundant, fine, straight, bright, smooth, evenly distributed, lying close to the body		3
SNOUT—According to breed		1
EYES—Full bright, not obscured by wrinkles		1
FACE—Dished according to breed, broad between eyes and ears, smooth		2
EARS—Fine texture, medium size, neatly attached, carriage according to breed		1
JOWLS—Firm, smooth medium size, not pendulous		1
NECK—Medium length, deep, moderately thick, joining head to shoulders smoothly		2
SHOULDERS—Long, full, especially at lower end, compact, smooth, not too heavy		4
BACK AND LOIN—Long, broad, strong, even width, thickly and evenly fleshed		8
SIDES—Long, broad, thick, firm, full, even width, free from wrinkles and flabbiness; ribs long, carrying fullness well down		6
BELLY—Straight, even, not flabby, proportionate in width		2
RUMP—Long, wide, even width, thickly and evenly fleshed, rounding from loin to root of tail, not too drooping		3
HAMS—Broad, especially at upper end, long, full; well fleshed and plump, not too fat		7
LEGS—Straight, strong, tapering, medium length, set well apart; bones smooth; joints clean; pasterns upright; feet medium size, not sprawling, squarely placed		7
TAIL—Good in quality, with size and length		1
Total		100

In the standard of excellence given the hog is considered by means of twenty-five different points. An attempt was made to have these various points represent the principal characters of the hog as nearly as possible, or the characteristics that in breeding operations are transmitted from parent to offspring more or less independently. First the general characteristics are given and these are followed by the individual points that go to make up form.

Under size it is specified that a six months' old hog should weigh 200 pounds, and that it should weigh 400 pounds at one year and 800 pounds at two years of age. It is assumed that the hog will come to maturity at about this latter age. This, however, should not be taken as a hard and fast rule. Some hogs under the best of conditions will weigh more than the above specified amounts, and others will weigh considerably less. The conditions under which the hogs are kept and the systems that are used in feeding are not yet as well developed as they should be, consequently there is considerable variation in the size of hogs. This difference also is greatly modified by the way hogs are selected for breeding purposes through several generations. When a hog is perfect in weight, or is as large as desirable, it is given a score of 15 points on the basis of 100, which is the total score for the animal. This is apportioned among the various points or parts of a hog in accordance with what that individual point should be considered worth as part of the entire hog in order to have as nearly a perfect hog as possible. The size is given first consideration because the size of a hog is perhaps the one point that is most striking and first noted by the average man.

After **Utility**, **Style** is taken up for consideration and the hog should present an attractive appearance; he should be erect in carriage, active and alert in appearance, which is an indication of strength, vigor and vitality. In **action** he should be able to get up on his feet and walk freely and easily with feet moving straight forward as he strides. That is, his action should be spirited, straightforward, regular, free and easy.

The form of the hog is of primary importance. This fifth point is considered only in a general way at this time. The latter part of the score card, or standard of excellence, gives the individual points which, when properly made in themselves and correctly put together, make up form. In general, however, the form of a hog should be long, deep, broad, smooth, symmetrical and compact, standing squarely on legs of medium length.

The length of a hog very often is not given due consideration. Furthermore, a mistake is frequently made as to the proper proportion of the length of the various parts. In Cuts 13 and 14 length is very nicely illustrated. A hog should have the greatest part of its weight in the places that are of most value. The back, loin, hams and sides are the most valuable parts of the hog; hence he should have the greater part of his length from the shoulders back. The shoulders, neck and head are parts of lesser value, therefore the lighter these parts of the hog in proportion to the rear part, retaining at the same time strength, vigor and vitality, the more valuable will be the animal. The length of the hog then should be considered two-fold: First, the total or absolute length which comes primarily under the head of weight or size; second, the proportion of length from the rear of the shoulder to the rear end of the hog as compared with the

length from the rear of the shoulder to the front end of the head. The middle of the hog, or the part between the shoulders and hams, should be long, and the rear part of the hog should have considerable length; that is, the rump or part from the loin to the root of the tail should be long. In other words, the ham should be broad (the breadth of the ham is taken to be the horizontal dimension of this part of the hog when it is viewed from the side).

Aside from length of body the hog should have depth. That is, the hams and shoulders should be long and the sides should be broad or deep which, together with thickness of these desirable cuts, furnishes great weight. The shoulders should be long, but the hog should also be deep in the chest so as to make him more symmetrical and to give him great chest capacity which contains his vital organs and determines constitution.

The hog should be broad, because with breadth comes a good pork loin as well as a thick side. The breadth also should be well carried down and not be only in the back; he should be smooth, symmetrical and compact, so as to furnish the best carcass possible and present the best appearance, as well as to have the greatest weight possible. He should stand squarely on his legs and be able to carry his weight at all times, even when he goes to market. The legs should not be too short because short legs very often indicate smallness of size. Neither should the legs be too long because under such conditions the hog would have too much the appearance of ranginess and not be considered of the fat or lard type.

The **constitution** of the hog should be as good as possible. That is, his chest should be capacious. This is indicated by having the brisket well advanced and low

down so that the lower wall of the chest is on a level with the under line of the balance of the body. The flanks both rear and front should be full and well let down. This also is an indication of good constitution. Very often the mistake is made by judging the constitution of a hog with a tape line, considering that the individual which has what is called good heart girth has good constitution. In such cases allowance is not made for the differences in size and differences in condition, as well as very often differences in conformation. The hog may have a very thick heavy shoulder and have a great deal of fat on the outside of the body which would give him considerable heart girth, and at the same time he might be very weak in constitution. He might have a small chest capacity which would not leave sufficient room for the vital organs to be of proper size and to do the work that they should.

The **quality** of the ideal hog should be what is called good; that is, the hair should be fine, the bone fine and strong, the skin smooth and fine with a thick covering of firm flesh that is fine in grain, which should be free from lumps and wrinkles, and the hog should have general refinement but not be delicate. Quality, as previously stated, is very often overdone; that is, intensified to such an extent that the hog becomes delicate. Delicacy is indicated by over-refinement which may sometimes be observed by the hog being too small, having a pointed snout and a very fine tail, as well as having general fineness throughout.

The hog for breeding purposes should be in proper **condition**. He should not be in market condition. For breeding purposes, as the standard of excellence specifies, the hog should be thrifty, well fleshed, but not ex-

cessively fat. One of the laws of breeding is that animals will acquire characteristics. That is, if animals are bred and developed for a number of generations under certain conditions, they will become adapted to these conditions and will produce results according to the conditions under which they have been kept. Consequently, in order to get the best possible results, the breeding hog should be in as high condition as is possible without injuring him in any way for breeding purposes. The higher the condition of the breeding stock, the greater will be the possibility of getting the best results from the offspring; but when the condition of the animal is overdone, or when an animal is fattened to such a degree that either his prolificacy or his other breeding powers are impaired, it is going one step too far.

Different breeders are able to maintain their animals in a different degree of condition without impairing their usefulness. Breeding condition, as maintained in the herds of some breeders, is what is commonly termed very thin flesh for a hog. With other breeders, the ideal breeding condition approaches nearly, in the amount of fat carried, the condition that is ideal for a market hog. With the development of the system of feeding, as worked out at the Illinois Experiment Station, it is thought that the breeding condition of a hog may be considerably raised from what the average is throughout the country without impairing the breeding powers of the animal, and that the flesh and fat-producing characteristics of the offspring may be greatly improved.

In **disposition** the breeding animal should be quiet and gentle so that it can be handled at all times, both during the breeding and farrowing seasons.

In **color** the hog should be according to that specified for the breed. The **coat** should be abundant; that is, he should have sufficient hair to be protected as much as possible from the cold of winter and the heat of summer. The coat of a hog at best does not afford him a great deal of protection, consequently it is all the more important that he have an abundance of hair. This should be fine, which is an indication of good quality. It should be straight, bright, smooth, lying close to the body, because then the hog will be thrifty and in good condition. It should be evenly distributed in order to present a good appearance and have the hog equally protected at all points of his body.

The **snout** is another point in which the various breeds differ and should be judged according to the breed. The **eyes** should be full, bright and not obscured by wrinkles. They should be well developed and open because very often, if obscured by folds of fat, the hog is not able to see. The **face** as specified should be dished according to the breed, but in general is should be broad between the eyes and ears and also smooth. Some breeds are not very broad between the ears and some are considerably broader than others, but in general width between the eyes is an indication of intelligence. The **ears** should be fine in texture, medium in size and neatly attached, which is an indication of good quality. They should be carried according to the breed as specified previously.

The **jowls** should be firm and smooth, medium in size and not pendulous. In breeding animals considerable stress is sometimes laid upon the correlation between various points. Many breeders have correlated the feeding quality of swine with the size of the jowls, thinking that a hog with large jowls is a good feeder. If the truth of

the matter will be considered, however, it can easily be seen that there is no correlation between the size of the jowl and the ability of the hog to produce pork. The hog's digestive apparatus is more the determining factor in this regard. Some breeds, such as the Tamworth and the Hampshire, have very light jowls, and some individuals in these breeds have practically no jowls at all, but still they are just as good feeders as hogs of other breeds with very heavy jowls. The jowls should be firm so as to have sufficient lean meat of good quality. They should be medium in size because this is one of the cheapest cuts of the carcass; hence it is more desirable to have the greater weight in the better cuts. Still the jowls should be sufficiently large to give the hog a symmetrical and well-balanced appearance. They should not be pendulous because this would render the hog more or less unsymmetrical and be an indication of poor quality.

The **neck** is the junction between the head and shoulders and should have sufficient length, depth and thickness to be useful, and attractive in appearance. It should not be unduly thick because this again is one of the cheaper cuts in the carcass. It should join the head and shoulders smoothly to give the hog the best possible appearance.

The **shoulder** should be long and full, especially at the lower end, because this end of the shoulder is one of the points that is especially weak in a great many individuals of different breeds. While the length of shoulder is not necessarily correlated with the depth of the chest or constitution, still it will give the hog a more symmetrical appearance and increase his weight if the shoulder is well developed and long enough so that the lower end of it is even with the under line of the body. It should be com-

pact and smooth so as to give the hog a symmetrical appearance with respect to a smooth, well-balanced carcass. It should not be too heavy because the shoulder is a comparatively cheap cut.

The hog should have a long **back** and **loin** as well as a long body, because the back and loin is one of the most valuable cuts. It is the place where the pork chop and the pork roast are obtained. This also should be broad because with the breadth of the back the size of the pork chop is materially increased. The breadth should still be maintained even if the hog is not in high condition. The back and loin perhaps may be more improved in breadth by high condition than any other part of the hog; consequently it is very desirable that the hog have good breadth even in moderate flesh, in order to have as much lean meat in the back and loin as possible. The back should be strong; that is, it should either be straight or, better still, arched, so that the hog will present an attractive appearance at all times and will not "go down in the back" or allow the back to sag at any time, especially during periods of pregnancy. The back should be even in width; that is, it should be as broad in the rear as it is in the front for obvious reasons. With many hogs there is a tendency for the back to taper towards the rear, and sometimes they are especially narrow at the loin. The hog as a whole should be even in width. It should be evenly and firmly fleshed which gives a smooth, well-proportioned carcass.

The **side** of the hog should be long, deep and thick so as to have as much weight as possible in this cut, which is one of the most valuable in the entire hog. To contain sufficient lean meat and to be of good quality it should be firm and free from wrinkles and flabbiness. It

should be even in width, the ribs should be long and carry the fullness well down to give the hog a symmetrical well-balanced appearance and as much weight as possible.

The **belly** should contain as much lean meat as can be obtained and should be straight and even, but not flabby or contain too much fat. In width it should be properly proportioned to the width of the hog in general. The belly of course never is quite as broad as the remainder of the body, but many times the belly is decidedly narrow. This is an objection in a brood sow for various reasons, among which is that a narrow belly would not give sufficient udder for the proper nourishment of the litter.

The **rump**, which is the part from the loin to the tail, should be long. With length in the rump there usually also is associated width of ham, both of which are desirable and valuable cuts. The rump should be wide, which increases the weight of this part as well as the thickness of the ham. It should be even in width and thickly and evenly fleshed so as to give the hog the best possible appearance and the carcass weight. It should be rounded from the loin to the root of the tail and the tail should not be set too low, all of which adds to the beauty and usefulness of the animal.

The **hams** should be broad throughout, especially at the upper end, deep, full, well fleshed; plump but not too fat. A ham of this nature is one that gives the hog strength of back and is one the market demands. It should be oval shaped when cut out and have sufficient lean meat to give it thickness. The ham that contains too much fat is not desirable. Sometimes the ham of a hog has an undue amount of fat immediately above the hock as well as over the entire ham. This is an undesirable

characteristic because when a ham has too much fat, it cannot be sold entire and must be skinned. In such a case the ham will sell at a lower price.

The legs should be as indicated in the standard of excellence (page 53), which gives the hog good action and strength to carry his weight, and is also an indication of good quality. The tail should be of good quality and have considerable size and length, because a tail that is too small and fine may be an indication of over-refinement and delicacy.

Having considered the fat or lard hog for breeding purposes, as above outlined, it is well now to consider the fat or lard hog that is intended for market purposes.

Fat or Lard Hogs for Market.

STANDARD OF EXCELLENCE.		Perfect Score
FORM—Long, deep, broad, smooth, symmetrical, compact, standing squarely on legs.....	7	
CONDITION—Thrifty, well fleshed with lean meat and fat but firm.	12	
QUALITY—Thick even covering of firm flesh that is fine in grain; hair fine; bone fine, but strong; skin smooth and fine, free from lumps and wrinkles; general refinement, but not delicate.	10	
STYLE—Attractive	1	
ACTION—Spirited, straightforward, regular, free and easy.....	2	
CONSTITUTION—Chest capacious; brisket advanced and low; front legs well set apart; ribs well sprung; flanks full and well let down	5	
COAT—Abundant, fine, straight, bright, smooth, evenly distributed, lying close to the body.....	0.5	
SNOUT—Medium length, not coarse.....	0.5	
EYES—Full, bright; not obscured by wrinkles.....	0.5	
FACE—Broad between eyes and ears, smooth.....	0.5	
EARS—Fine texture, medium size, neatly attached.....	0.5	
JOWLS—Smooth, firm, medium size, not pendulous.....	1	
NECK—Medium length, deep, moderately thick; joining head to shoulders smoothly	2	
SHOULDERS—Long, full, especially at lower end, compact, smooth, not too heavy.....	7	
BACK AND LOIN—Long, broad, strong, even width, thickly and evenly fleshed	15	
SIDES—Long, broad thick, firm, full, even width, free from wrinkles and flabbiness ribs long, carrying fullness well down.....	12	

	Perfect score
BELLY—Straight, even, not flabby; proportionate in width.....	2
RUMP—Long, wide, even width, thickly and evenly fleshed, rounding from loin to root of tail, not too drooping.....	5
HAMS—Broad, especially at upper end, long, full, well fleshed and plump; not too fat	12
LEGS—Straight, strong, tapering, medium length, set well apart; bones smooth; joints clean; pasterns upright; feet medium size, not sprawling, squarely placed.....	4
TAIL—Good in quality, with size and length.....	0.5
Total.....	100

With the exception of a few points this standard of excellence is essentially the same as the preceding. It will be noticed that not quite as many points are given, and therefore the values given to the various points are somewhat different. Besides this, the value given to some of the points is considerably different. The principal points of difference are as follows: The market hog has considerably more value attached to **condition**; that is, the prime hog for market is much higher in condition (more fat meat on the body) than the breeding hog. In **quality** also the market hog is given greater value. This is true because when the hog is in prime condition for market quality shows up to better advantage and is also considerable of an improvement over what is seen in many breeding animals. The market calls for as much quality as possible, while the breeder can sometimes sacrifice some of this to good advantage provided he can gain in other characteristics, such as size, prolificacy and growthiness.

In **constitution** greater value is given to the breeding hog than to the market hog. The packer does not care how little constitution the hog has provided it can walk across the scales and into the slaughter pens comfortably, but the breeder wants as much constitution as possible for various reasons. **Coat, snout, eyes, face and ears** are

minor points from the market standpoint and are given but small value.

In **back** and **loin** the market hog is given much greater value than the breeding hog. This point is as much, or perhaps more, responsible for the price at which hogs sell on the market than any other. It is the one point that is most apparent, and it also is the one point that can be most improved by condition. Hence the market hog has much more emphasis placed on back and loin, and the breeding hog relatively less. However, the breeding hog should have a good back and loin in every respect, though it does not have so much width because it is not so fat.

For the **sides** the market hog is again given considerably more value. This also is right on account of the higher condition of the market hog. He also has a little more value attached to the **hams** because they are better filled out on account of the higher condition. In **legs** the breeding hog has nearly double the value the market hog has. If the market hog has sufficient strength in legs to walk across the scales, it is enough for his purpose, but the breeding hog needs a great deal more. He must be able to do duty as a breeder as well as to roam over pastures and fields to gather part of his feed and to get exercise.

BACON TYPE.

The two score cards which follow were made for bacon hogs, one for breeding and the other for market purposes. With the explanations given above these need no further discussion except to state that the bacon hog is one that is developed primarily for its sides and that the weight of the market bacon hog should range in general between 160 and 220 pounds live weight. The breeding animal of

course should be as large as possible because, as previously stated, the larger the parent stock, the earlier will be the time at which the offspring will reach the desired weight and the greater will be the profit from such breeding operations.

Bacon Hogs for Breeding.

STANDARD OF EXCELLENCE.

	Perfect Score
SIZE—In good flesh; weight at 6 months, 200 lbs.; 1 year, 400 lbs.; 2 years, 800 lbs.....	12
FORM—Long, deep, medium width, smooth, standing squarely on legs	8
CONSTITUTION—Chest capacious, brisket advanced and low, flanks full and well let down.....	8
QUALITY—Even covering of firm flesh that is fine in grain and without flabbiness or wrinkles; hair fine; skin smooth and fine; bone fine but strong; general refinement, but not delicate.....	5
CONDITION—Thrifty; deep, uniform covering of firm flesh.....	5
STYLE—Attractive	1
ACTION—Spirited, straightforward, regular, free and easy.....	2
DISPOSITION—Quiet, gentle	2
COLOR—According to breed.....	1
COAT—Abundant, long, straight, silky.....	2
SNOUT—According to breed.....	1
EYES—Full, bright, smooth.....	1
FACE—Slim, broad between eyes.....	2
EARS—Trim, according to breed.....	1
JOWLS—Light, neat, firm.....	2
NECK—Medium length, light, muscular, but not arched.....	3
SHOULDERS—Smooth, compact, long, not wide, same fullness as back and hindquarters.....	5
BACK—Strong, long, smooth, medium and uniform in width.....	8
SIDES—Long, broad and uniform in width; smooth firm; even with shoulder and ham; uniform spring of rib; not too fat.....	12
BELLY—Straight, firm, thick, free from flabbiness.....	4
RUMP—Long, even, slightly rounded toward tail, same width as back	2
HAMS—Firm; broad at upper end, tapering, not too thick and fleshed well down toward hocks.....	6
LEGS—Straight, strong, tapering, bones smooth; joints clean; pasterns upright; feet medium size, not sprawling, squarely placed.	6
TAIL—Rather large and long, smooth	1
Total.....	100

Bacon Hogs for Market.

STANDARD OF EXCELLENCE.

	Perfect Score
WEIGHT—Score according to size.....	7
FORM—Long, deep, medium width, smooth, standing squarely on legs	8
QUALITY—Even covering of firm flesh that is fine in grain and with- out flabbiness or wrinkles; hair fine; skin smooth and fine; bone fine but strong; general refinement, but not delicate....	8
CONDITION—Thrifty; deep, uniform covering of firm flesh; fat on outside about 1½ inches thick	10
STYLE—Attractive	1
ACTION—Spirited, straightforward, regular, free and easy.....	2
CONSTITUTION—Chest capacious, brisket advanced and low, flanks full and well let down.....	4
COAT—Abundant, long, straight, silky.....	1
SNOUT—According to breed.....	1
EYES—Bright, open, smooth.....	1
FACE—Slim, broad between eyes.....	1
EARS—Trim, medium size.....	1
JOWLS—Light, neat, firm.....	2
NECK—Medium length, light, muscular, but not arched.....	2
SHOULDERS—Smooth, compact, long, not wide, same fullness as back and hindquarters.....	6
BACK—Strong, long, smooth, medium and uniform in width.....	9
SIDES—Long, broad and uniform in width; smooth, firm; even with ham and shoulder; uniform spring of rib; not too fat.....	14
BELLY—Straight, firm, thick, free from flabbiness.....	6
RUMP—Long, even, slightly rounded towards tail, same width as back	3
HAMS—Firm; broad at upper end, tapering, not too thick and fleshed well down toward hocks.....	8
LEGS—Straight, strong, tapering; bones smooth, joints clean, pas- terns upright; feet medium size, not sprawling, squarely placed	4
TAIL—Rather large and long.....	1
Total.....	100

CHAPTER V.

ESTABLISHING A BREEDING HERD.

In selecting foundation stock for a breeding herd various considerations are necessary, and the breeder has several alternatives. One of the first questions that presents itself is as to whether market hogs are to be produced exclusively, whether market hogs and breeding hogs are to be produced together, or whether the business is intended primarily for the production of pure-bred stock for breeding purposes. Another question that would naturally arise is the amount of capital available for the establishment of such a business. It is highly important that this matter be given the most serious consideration. Much depends on it.

The next question of primary importance should be the selection of the individuals. In order to do this properly a man must be able to judge swine, and to be able to do this to the best possible advantage he must be a good judge of pigs. He must be able to recognize the desirable and undesirable characteristics of the pig before it has advanced very much in age and size. It is true that it is much more difficult to recognize the good and bad points in a small pig than it is in the hog that has reached considerable size, but the man who has developed such ability has an advantage over the man who has not this ability that can hardly be estimated. The man, therefore, who is able to judge pigs correctly under three months

of age has an asset which will afford him unlimited opportunity as a breeder.

THE GRADE HERD.

A good pure bred animal would be the best, of course, for all purposes, for the production of purely market hogs as well as for the production of pure bred animals for breeding purposes. But the man with limited means, and perhaps also with limited knowledge as to the value of different animals, will be able to succeed and succeed well by starting a herd with grade stock. Grade sows may be bought in various places; by private sale direct from the breeder, in local markets, and sometimes at auction. Wherever they are bought, they should be bought primarily for the use to which they are to be put, namely, they should not be in market condition when they are to be put in the breeding herd. If such sows are properly selected and bought at reasonable prices, and it very often happens that they can be bought at a figure but little above the market price at the time, they may be put in the herd and mated with a pure bred sire to very good advantage. Such breeding, if properly done, will afford the man with limited means an opportunity to get a good start and at the same time will not be very expensive. By mating one or two pure bred sows with his pure bred sire, and continuing with his grade herd, he can gradually work into a pure bred herd. A good individual, whether it be a grade or pure bred, is always better than a poor individual of similar breeding, and it is often true that a good grade is better than a poor individual of a pure bred strain. The man, then, who has a well selected grade herd and is producing hogs for the pork market will succeed a great deal better than the man who is producing

pork hogs from a pure bred herd that have not been as well selected.

THE PURE BRED HERD.

The Public Sale.—There are several ways by which animals may be purchased for breeding purposes. The public sale very often affords an excellent opportunity. It is true that the best individuals at a public sale often sell for such substantial prices that the average breeder cannot afford to buy them. But animals that sell for the highest prices at public sales are not always the best; indeed, frequently the best animals from the standpoint of individuality except the best individuals from the best herds, sell for the lowest prices, or at least very much cheaper than the price at which they could be bought at private sale. At a public sale animals very often sell on their pedigrees, whether the individual is good or bad. It is not necessarily true, and in fact is never true, that all animals with good breeding are good individuals. The pedigreed scrub (a pure bred inferior individual) is the worst kind of scrub because, if such an animal had a long line of good breeding back of him, he has many of the bad characteristics of previous generations combined and firmly fixed within him and is almost sure to transmit such characteristics. The offspring from such pedigreed scrubs will be likely to be poor individuals, even though the animals have the best kind of breeding and sell at high prices. Thus the public sale is more or less of an uncertainty and may or may not afford the best opportunity for securing herd specimens.

Private Sale.—Another means of getting specimens for a breeding herd is by private sale. The purchaser may visit the breeder and secure individuals he desires, if he

can afford to pay the price asked. In the hands of the best breeders, however, the best individuals may be either not for sale or may be comparatively high-priced. The advantages and disadvantages of this practice are as follows: If the purchaser has developed exceptional ability as a judge and is able to recognize the good and bad points in a pig under three months of age, he has a good opportunity. He may go to the herd of a prominent breeder, or to the herds of breeders less prominent, and if they have not the ability to judge to the same extent that he has, he may be able to select and purchase the best individuals in the herd. The breeder very often refuses to part with the best individuals from his viewpoint because he needs them for the maintenance and improvement of his own herd. The man buying specimens for the establishment of a herd still has an opportunity to succeed even if he starts with individuals of less than first grade. He can gradually improve his herd year after year, but the higher up the scale he can start, the greater should be his success.

Bred Sows.—Another means of getting herd specimens is by buying bred brood sows either at private or public sale. Such sows if properly selected may have outstanding individuals in their litters. They may be bred to noted herd boars which are not for sale, and if they are good individuals will produce good pigs to the extent to which good individuals ordinarily appear from such breeding. Such sows may also be bred to young boars that have not as yet demonstrated their ability as producers, but still a good judge will be able to recognize in them possibilities to produce offspring of great merit. These very often may be bought at a reasonable price

and for much less money than those that are bred to herd boars that have won a great reputation.

The Herd Boar.—In buying a herd boar the breeder has the same opportunity of selection while the -pigs are young that he has in buying the sows. In buying old and tried sires the probability is that if he wants to buy the best, he has to spend an enormous sum of money to get one. Sires of other than strictly first grade very often can be bought at a very reasonable figure. On account of the small size of the herd and to avoid inbreeding they must be disposed of. Another means of getting outstanding herd specimens is, after having sows in the herd, to have one of them bred to some noted sire. This may be rather expensive, but if such animals are properly mated, good individuals are likely to be obtained.

Additional Herd Specimens.—After having obtained the foundation stock for a herd, additional herd specimens may be obtained by selecting the best offspring. This of course will not add new blood to the herd, and the breeder still will be obliged occasionally to buy new specimens. But after having obtained a good start with a herd of first rank, it is best to depend in the main upon one's own herd for the selection of outstanding herd specimens. This is especially true because of the disinclination of the best breeders to sell their best individuals.

Requirement for Success.—As will be readily recognized, the principal requirement for success in the process of establishing a high-class herd and improving it thereafter is one's ability to select the proper animals. After having established a herd, the great work of feeding the hogs presents itself, and before pure bred animals can be sold successfully for breeding purposes, good individuals must be produced and a reputation must be established.

To get the individuals proper mating, feeding and care are absolutely necessary. To gain a reputation advertising is resorted to and there is said to be no better advertising than to be able to win at the big shows.

If sufficient capital is available, and one has not the necessary judging ability, he can buy noted outstanding herd specimens both in sires and dams, and thus be able to sell pure bred stock. This, however, is not the test of the true breeder, but is more in the nature of a dealer's method of doing business. A true breeder is one who can judge accurately as to future requirements and can mold the type and improve the breed in accordance with such ideals.

CHAPTER VI.

ORIGIN OF THE BREEDS.

In order to be able to breed swine intelligently, a man must not only know the characteristics, but he must be familiar with the origin of the breeds as well as with the way they were developed. With this knowledge of the breeds during their past history he will be better able to judge what characteristics are likely to be transmitted or what may be expected in the future development of the breed. The principal breeds of swine today originated in two places—Great Britain and the United States. The conditions in the two countries in which the breeds originated are widely different and must be considered separately.

ENGLISH BREEDS.

Swine in general, as found by modern civilization, existed in two types: First, the type of wild boar as found in central and northern Europe and called *Sus Scrofa*; second, the type found in southern Europe which is called *Sus Indica*. The latter as found in the early part of the present state of civilization, was a highly improved hog; the former existed and still exists to some extent in a wild state. These two types are characteristic of hogs in general, those of the north being rather large, coarse, rangy and active, while those of the south are small, fat, plump, early-maturing and inactive.

The Wild Boar.—The wild boar is characterized as being strong, vigorous and active, requiring four or five

years to reach maturity and then to live to be twenty or thirty years old. His head is long, his tusks are large, and his forequarters heavy. In constitution he is most excellent, having great chest capacity, being both deep and broad in this part of his body. In quality, however, he is coarse. The size and condition are variable, depending very largely upon location, feed, and the season. In color he is a rusty gray when young which turns to a dark brown as he grows older. In aged animals the ends of the hair become gray, producing a hazy gray color. They have an abundance of hair with a long snout and small pointed ears that stand erect. The jowls are very light, the neck is heavy, the shoulders heavy and well developed, the back and loin short, the hams very light, and the legs are long. The sows are said to breed only once per year and to produce from five to six pigs per litter. They suckle these three or four months, and then give them protection for two or three years.

Sus Indica.—The *Sus Indica* type is best illustrated by the domestic breeds of southern Europe known as Neapolitan, Siamese and Chinese. These are more or less similar in characteristics; they are small, early-maturing, fat and plump, as above designated. They are the ideal of the fat or lard type except that they are smaller than this type as considered from the present market requirements. They are very fine in quality, are delicate in constitution, and usually have the fattening tendency developed to a marked degree. On this account also they are quiet and gentle in disposition. They have a very light coat of hair, jowls that are full, with a short, thick, heavy neck. The shoulders and hams are well developed, producing a short, thick, blocky hog which stands on short legs of fine quality.

In color these three breeds are somewhat different. The Neapolitan is black, slate or ash color, and sometimes a dirty white and more or less spotted. The Siamese is of a dark slate or rich plum color. The Chinese may be either white or black, or a mixture of both, with white predominating. These three breeds, and possibly others, which illustrate the *Sus Indica* type, apparently have been bred for many centuries in southern Europe.

Production of Breeds.—In comparing this hog (*Sus Indica* type) with the northern type of animal, the *Sus Scrofa*, the question naturally arises what was the first origin of these two types of hogs. The assumption is that these two types naturally trace back to the same ancestry. The difference in them, then, is the result of environment as produced in different localities. The hogs of the south have an abundance of food which, together with the environment under which they live, would have a tendency to develop the qualities of early maturity and fat-producing tendency and also to reduce the size. Those of the north where food is more scarce would develop to the other extreme.

The northern civilization of Europe in its present form is much more recent than that of the south. The northern hog, therefore, is comparatively a modern hog. Considering that he is the natural outgrowth of the wild boar of the *Sus Scrofa* type which was found in northern Europe, it can readily be seen that this would produce a hog materially different from the highly improved types found in the south.

During the early history of Great Britain conditions were especially adapted to the production of different breeds. Transportation facilities were inadequate, telephone and telegraph communication were unknown, and

the people were more or less isolated by communities, especially in the sections of the country where they were, by topographical nature, cut off from the other parts of the country. Conditions in different localities of an island country like Great Britain are decidedly different and the likes and dislikes of the people in different localities probably were different, some perhaps preferring white hogs, some black hogs, some even red hogs, others hogs of the bacon type and still others hogs of the fat or lard type. Thus the isolated communities in developing their live stock produced various types of swine which resulted in the foundation stock for the different breeds as found in recent years.

AMERICAN BREEDS.

The breeds that originated in the United States are called the American breeds and were developed under entirely different conditions from those in Europe. In this country breeds were, comparatively recently, imported from all parts of the world and in some cases very many crosses of these imported breeds were used to establish a new breed. In other cases comparatively few were used. These were developed under different conditions of feed, care and environment, and in some cases under conditions that were ideally adapted to the production of new and distinct breeds. Thus there have been brought forth in Great Britain and in the United States a considerable number of breeds of swine which are separate and distinct one from another and most of which are very good.

CHAPTER VII.

DEVELOPMENT OF THE BREEDS.

The characteristics of a breed are determined by the foundation stock and by the methods adopted in its development, which includes variation and selection, feed, care, environment, etc.

THE TAMWORTH.

The Tamworth apparently is the closest relative of the European wild boar, the *Sus Scrofa*. It is said to have originated as a breed in Ireland and was brought to England about 1812 by Sir Robert Pell, secretary to Ireland at that time. Judging from the characteristics of the Tamworth as discussed in Chapter 3, it is quite evident that this breed is a direct descendant of the wild boar. History relates that no crosses were made with other breeds. It was developed by selection, feed and care. Between 1847 and 1880 the breed was practically obscured because there was no particular demand for a hog of this type, but at the latter date a demand for English bacon was developed and the Tamworth hog, being especially well adapted to this purpose, was again brought forth. Thus it would seem that the Tamworth, in its present state of development, is a recent hog which at the same time contains many characteristics of the wild boar. It has size, constitution, ruggedness, strength, vitality and activity all combined. During the latter period of development also the Tamworth was kept entirely pure. Thus the entire history of the Tamworth is one of de-

velopment by selection, improved care and feeding, and it is in the truest sense of the word a pure breed. On this account the individuals of the breed are quite uniform and their power to transmit their characteristics to their offspring is very great.

LARGE YORKSHIRE.

The Old Yorkshire.—As discussed in the preceding chapter, the various sections of Great Britain produced different breeds of swine. The names of many of these are the names of the respective localities. One of these breeds originated in England was called Old English. This furnished the foundation stock for the development of the Yorkshire. Highly improved Chinese boars from the southern country were imported to use on these Old English sows to produce what is called the Old Yorkshire. These were characterized by having great size, being slow to mature, and having a form that was made up of a long head on a very long body which was somewhat narrow with a weak loin and standing on long legs. In constitution, however, they were very good. In quality they were rather coarse and inferior, both in flesh and bone. The color was white and the coat long, coarse and curly with pale blue spots on the skin which were covered with white hair. They also had large, heavy ears.

The Leicester.—In another locality of England was found what was called the Leicester breed of hogs. These were similar in breeding to the Yorkshire and they were also white in color, large in size, but with small heads and erect ears. In quality they were better throughout than the Old Yorkshire.

Small Yorkshire.—In still another section of England was produced the Small Yorkshire. These originated in

a manner similar to the Large Yorkshire, namely, by Chinese crosses on Old English sows, but they were bred and selected with an entirely different type in mind, being small in size with a short head, compact body and short legs. In quality they were good and in color white.

Then came the Middle Yorkshire which is a cross between the Large Yorkshire and the Small Yorkshire.

Method of Procedure.—The first step in the development of the Large Yorkshire was by using the Leicester on the Old Yorkshire. This strain of hogs, as above seen, was similar in breeding to the Old Yorkshire, but was better in quality. Since they were developed in different localities, it cannot be said they are so closely related as to make this inbreeding.

PEDIGREE OF DEVELOPMENT OF LARGE YORKSHIRE.

In 1860 the Leicester cross of the Old Yorkshire was further improved by selecting the largest sows of this breed and mating them with the boars of the Small Yorkshire breed or Small Whites. These were then bred among themselves, taking care that they were not too

closely related. By proper selection the size and constitution of the larger hog was combined with the symmetry and tendency to fatten of the smaller hog, thus producing a large, early-maturing hog, with good quality and at the same time retaining constitution, vigor and activity. Following this, improvement was made by selection and by care and feeding. To summarize this method by which the Large Yorkshire was developed the pedigree form on page 80 may be of assistance.

THE BERKSHIRE.

The Berkshire originated in Berkshire County, England, as a result of the work of breeders in one of the previously mentioned isolated communities. This is what is called the Old English Berkshire. It was a hog of great size, and in form was long and deep in body with good constitution and well filled hams. The quality of the meat was said to be better than that of any other breed in England at the time. They were rather poor feeders, however, attaining maturity at from two and one-half to three years of age. In color they were buff, sandy, or reddish brown spotted with black. The coat was made up of rather long curly hair and some bristles. The ears were heavy and hung down over the snout, the shoulders were thick and heavy, the back broad, the sides flat, the hams thick and heavy, and the legs very strong.

This foundation stock of the modern improved Berkshire was improved by crossing with individuals of the Neapolitan, Siamese and Chinese breeds which, as will be remembered, belong to the *Sus Indica* type and are found in southern Europe. Thus the modern Berkshire being a cross between hogs of the southern type and the original English Berkshire which was somewhat of the *Sus*

Scrofa type, is essentially a cross between hogs of entirely different types. Improvement of this character (cross-breeding) was completed as early as 1780. Even though the small type of hog was used, the offspring were selected so that the resulting Berkshire had the size of the northern hog combined with the quality and the early-maturing characteristic of the southern hog. The modern Berkshire also retained the good characteristic of having the large proportion of lean meat that was present in the original Berkshire.

Since the Berkshire after its original improvement was a cross between hogs of two entirely different types, and on account of the laws of breeding according to which the characteristics of the ancestors may reappear in the offspring, especially when such are not easily blended, it was found that the tendency of the Berkshire was to revert toward the original type of the Old English Berkshire. Consequently an occasional out-cross with the Neapolitan, Siamese and Chinese was made as late as 1842 to counteract this continual outcropping of the characteristics of the Old English Berkshire. The latter improvement was made entirely by selection, care and feeding.

The breeder who would succeed best with the Berkshire must bear in mind the manner in which the breed was developed and know how to select individuals that will not develop according to either extreme, the Old English Berkshire or the southern type of hog as illustrated by the Neapolitan, Siamese or Chinese.

Berkshires were imported into the United States in 1823. At that time it was a well developed and highly improved breed in England. The next importation came in 1832, and in 1839 a large consignment was brought

over. The conditions in this country at that time were crude, being very largely those of the frontiersman, and hogs were allowed to shift for themselves to a great extent. Under such conditions, the highly improved hog, as he was when he landed, would naturally have a tendency to degenerate and breed and develop largely according to the conditions under which he was kept, therefore would not be as good as the original. Thus when compared with the originally imported hog, this Berkshire created an unfavorable impression which caused a prejudice against the breed that was very difficult to overcome. The good quality of the Berkshire meat, however, maintained the breed, and further importations followed in 1865 and later.

During recent years more improvement was made in this breed in the United States than in England and not so many were imported. The prejudice against the breed has largely been overcome and it now holds its place among the standard breeds.

THE CHESTER WHITE.

Original Foundation Stock.—The Chester White is a product of the United States. In 1818 two fine white pigs which had occasional blue spots on the skin were brought from England by Captain James Jeffrey to Chester County, Pennsylvania. These were said to be large in size, had large ears, neat head and snout, broad back and loin, excellent hams and short legs. Very recently an English authority has said that the Lincolnshire Curly White hogs of England that have but recently come to notice, probably are the foundation stock of this breed. They are similar in characteristics and the two pigs originally imported may have been of this breed.

English China hogs also, which are the English development of the original Chinese hog, were brought to Delaware County, Pennsylvania, by Harry Atwood about the same time. These in general were white hogs, but had black, blue or sandy spots. In form they were deep in body, a little low in the back and large in front, tapering towards the rear. They had short heads, heavy lopping ears, heavy jowls, broad back and loin, and short legs. They were excellent feeders and could be put in market condition at an early age.

These two breeds, together with their offspring, were crossed among themselves and also upon other large, slow-maturing, white hogs that were supposed to have been brought to Chester County about 1812 by the Quakers. By careful selection and breeding, together with what could be produced by feed and care, the Chester White was produced. The black, sandy, and blue spots were eliminated, leaving an all-white hog that ranged in size from medium to very large. A 1,300-pound specimen was exhibited at the Centennial at Philadelphia, in 1876. They were long in body, rather coarse in quality, but quiet in disposition. Their coat was somewhat thin and made up of straight hair in general, but a little waviness was not considered objectionable. The head was short, the face broad, the ears thin and projecting forward but lopped over at the points, the jowls were large, the neck short and thick, the back broad, the hams full and deep, the legs short and set well under, and the tail small.

After being developed the Chester White was a very popular breed. It was one of the oldest pure breeds in this country and was able to "hold its own" with such imported breeds as the Berkshire, Suffolk and Essex. Dur-

ing the early history of the Chester White, following its establishment as a distinct breed, it was crossed to some extent with black breeds, which resulted in spotted hogs being produced. These spots were again eliminated, however, leaving the Chester White as a white hog. The popularity of this breed during its early history created a great demand for Chester Whites. They were shipped throughout the country as well as to Canada and to the West Indies.

Some unprincipled breeders who did not have the future good of the breed at heart, sold not only pure bred individuals, but all white hogs that could be obtained, whether pure bred or not, as pure bred Chester Whites. These, of course, would not breed true to type and color, and many times produced black or spotted pigs, which resulted in a very severe set-back to the breed. It has perhaps not recovered to the present time from the unpopularity it obtained at that time on account of a few breeders who were in the business for the money they could make rather than for the good of the breed and honesty in their own business. One breeder is said to have bred and raised a few individuals between 1866 and 1877 and to have shipped annually, for breeding purposes, as high as 2,500 to 2,900 hogs. Further improvement was made by selection toward reducing the coarseness and improving the quality.

Todd's Improved Chester.—In 1833 Joseph Haskins brought to Wakefield, Ohio, from Massachusetts, a Byfield boar. This was an early hog of that country probably the result of various crosses of different breeds. It was a large, slow-maturing hog, but a splendid individual. Its color was white and its legs rather long. Mr. Haskins also brought with him a sow of what was called the Otterdale breed, which was probably of similar origin.

The following year, 1834, Kneeland Todd brought to Ohio from Connecticut a Norfolk Thin Rind boar, which was imported from England by William K. Townsend in 1833. Mr. Todd also brought a white sow of the native grass breed from East Haven, Connecticut. These were noted for their early-maturing and good feeding characteristics and the excellent quality of their meat. These two men, together with a twin brother of Mr. Todd's, bred their respective herds with great care, and then crossed the best of the two herds, which were then said to be the best in the state.

In 1848 a man by name of Joel Mead had some very fine specimens of pigs, known as the large grass breed, at the county fair at Norfolk, Ohio. Mr. Todd bought the best boar pig from this herd to use upon his own herd. The pigs of this mating were said to weigh 365 pounds at nine months of age and were able to win from all other hogs shown at that time.

At a still later date, about 1862, a boar called Normandy, which probably was of French origin, was brought into the herd. This boar was very characteristic in type. In color he was pure white, very stylish in appearance, medium in quality, had a coat of fine curly hair, a face that was rather sharp and a little long, a strong neck that was short and thick, a most excellent back and loin as well as hams, and short straight legs, standing well up on his toes, and a light, fine tail. By using this hog, as well as the boar of the grass breed already mentioned, on the original herds, the Todd strain of the Chester Whites was produced.

In 1865 Mr. Todd also used a boar sired by a pure Chester White of Chester County, Pennsylvania, from one of his sows. In 1867 Mr. S. H. Todd, a son of the

twin brother of the original Mr. Todd, crossed these hogs on the original Chester Whites from Chester County, Pennsylvania, using six or seven crosses. This produced what is known as Todd's Improved Chester. It was an excellent white hog of very uniform type. The name Todd was later dropped and only the term Improved Chester White used. This then is a cross between the original Chester White of Pennsylvania and the Todd Chester as originally produced in Ohio. The former contained the blood of English pigs as well as that of the early white hogs of Pennsylvania, while the latter contained the blood of the early white hogs of Connecticut and Massachusetts, and the white boar Normandy presumably of French origin, together with the blood of the original Chester Whites.

Ohio Improved Chester (O. I. C.).—This strain of the Chester originated in the hands of L. B. Silver, who was said to be a close student of animal form and characteristics and who bred for improvement in swine. He selected the Chester White with which to make his improvement and obtained the foundation stock for his herd from Chester County, Pennsylvania, selecting only what he considered to be the best individuals and as large a number as available. He had in mind the development of as nearly an ideal hog as possible for the production of pork. His idea in selection was to correct as far as he could all the weak points in the different individuals used in the breeding herd.

After having established and developed his herd they were called the Ohio Improved Chesters (O. I. C.). They were said at the time to be a better hog than the original Chester White, having more quality, more uniformity, and better form. During recent years, however, whatever

difference there may have been between the different strains has disappeared. And even though there are different record associations for the two strains, they are considered in general as hogs of the same breed, and the tendency at the present time is for the two factions to combine. Indeed, each year marks progress in this direction.

THE DUROC-JERSEY.

The origin of the Duroc-Jersey is not definitely known. Red hogs were, at an early date, found in different parts of the world; as already stated, the Tamworth found in Great Britain was of this color. Many of the early Berkshires found in England also had considerable red on them. Red hogs were also known to exist in northern Africa from whence negro slaves were imported to this country. Red hogs were bred in New Jersey as early as 1820. They were simply called Red Hogs at first, but later were called Jersey Reds. Since the Tamworth was not considered a valuable hog at this time, it is not probable that it entered into the development of the Jersey Red. And since the latter hog also was somewhat similar in characteristics to the original Berkshire, it is possible that they were related to the Old English Berkshire. Red hogs were also bred about the same time in Saratoga County, New York. These received the name of Duroc. About 1830 red hogs were also bred in Connecticut and were called the Red Berkshires, and some of these were brought to New York and crossed with the Durocs. In Vermont the same type of red hog was being bred, but there it was called the Red Rock. About 1837 four red shotes were said to have been imported from Spain and taken to Kentucky. These may also

have entered into the development of the Duroc-Jersey in the southern part of the United States.

Durocs.—About 1877 the breeders of red hogs in New York state agreed upon a standard of excellence and this was also adopted by the Connecticut and Vermont breeders. This type of hog known as the Duroc was medium in size, very compact and close to the ground. They were good in constitution, medium in quality, and of a cherry red color. They had a rather small head, light ears and short thick neck. The shoulders were full but smooth, the back and loin were strong and wide; the rump also was wide, the hams plump and full, and the legs short and straight.

Jersey Reds.—The characteristics of the Jersey Reds bred in New Jersey were as follows: In size they were large and growthy, being able to furnish a dressed weight of 800 pounds at one and one-half years of age, and 1,300 pounds live weight at two years. They were, however, slow to mature. In form they were long in body, in constitution they were good, having good chest capacity, but in quality they were coarse. The bones were coarse and the hair inclined to bristles on the back, while the flesh was coarse-grained. The color in general was from red to dark red. Occasionally, however, they were sandy and often patched with white. The snout was long, and the head small in proportion to the size and length of body. The ears were large and lopped over, and the legs long, giving the hog an upstanding, rangy appearance. The tail was heavy and bushy. The hog was considered especially valuable for its size, strong constitution, and capacity for growth.

At a later date, about 1883, the breeders of these two different types of red hogs joined forces and adopted a

common standard of excellence with Duroc-Jersey as the name for the breed.

THE POLAND-CHINA.

The Poland-China is an American breed and was developed in Butler and Warren counties in southeastern Ohio between the Big Miami and the Little Miami Rivers. The breed was developed under ideal conditions between the years 1835 and 1840.

Origin of Poland-China Foundation Stock.—The United States did not have a wild hog similar to the wild boar of Europe. The so-called wild hog, or razor-back, of the United States is simply a degeneration of the hog originally domesticated. De Soto brought swine to the United States from Spain in 1538. Nova Scotia and New Foundland received hogs from England in 1553. Canada got hogs from France in 1608, and English pigs were taken to Virginia in 1609. The climate, especially in the southern states, was very favorable to the production and development of swine, and the pigs that were bred in this country were allowed to roam in the forests to a greater or less extent. They increased so rapidly that eighteen years after Jamestown was founded it was said that the city had to be palisaded to keep the hogs out. Many of these were allowed to breed in the forests and naturally reverted in form and other characteristics toward their ancestor, the wild boar. This was especially true when they were kept under native conditions. Others that were kept domesticated developed from time to time in different places in the eastern states and were the beginnings of the so-called local breeds that were later used in establishing the Poland-China breed.

Prior to the time the Poland-China was established,

the western part of the United States, now the central part, was being settled. Immigrants came from different countries, as well as from the eastern states, and settled in different sections of the West. Hogs were brought from nearly all sections of the world where good hogs were being bred. These in some cases, after being brought here, were bred pure, but in most instances were crossed, which established types of swine in this country in a somewhat similar manner to the breeds that were originally developed in England. But these different types that were developed in the United States cannot be called breeds because they were a mixture of several breeds and not bred long enough to establish a uniform type. Consequently they were more of the nature of mongrels.

Cincinnati at that time was the western metropolis and was the center of the pork packing industry. Conditions in the country around that metropolis, including the climate, soil, etc., were admirable for the production of swine. Feed was abundant and cheap, and the hogs were able to gather a good share of their living during the summer season in the forests. The climate was warm, which did not necessitate very much expense for shelter, and shade and water were abundant, which improved the conditions for pork production. The roads, however, were not well developed. Railroads were practically unknown, and wagon roads were poor and few in number. Hogs, therefore, were developed in such a manner that they could walk to market. This again was favorable for the production of a good type of hog. The inhabitants were of a thrifty, industrious sort, and consequently took good care of their stock. They came to this part of the country from various sections of the older states, north,

east and south, as well as from foreign countries, and brought with them their native hogs. These were further developed, other hogs were imported, and finally all of these were blended together in what is now called the Poland-China. Some of the more prominent types of hogs that were brought to the Miami Valley and used in establishing this breed are as follows:

The Poland Hog.—This hog was developed about 1838 in Chester, Butler County, Ohio, by a man from Poland whose name was Asher. He claimed that they were imported from England and at the time called them the Sandy Berkshires of England. They were, however, later called the Poland Hogs. These hogs were noted for their large size, early maturity, and vigorous growth. In form they somewhat resembled the Berkshire except that they were deeper in the body, flatter in the sides, and stood on shorter legs. Their color was either red or bright sandy, with small black specks all over the body. In constitution they were very good and, as indicated by their prepotency in transmitting their color, they may have been bred in this form for a considerable length of time. To show that this type of hog was not a Polish or a Russian hog it need only be mentioned that these were said to be small as well as large, reddish brown or yellowish in color, with a broad brown stripe along the back. In prolificacy also they were not good while the Poland hog was very good. The Russian hog also was a poor feeder.

Russian Hog of the United States.—This was a large, white, slow-maturing hog, as described about 1840 in Ohio. It had good action, long body and coarse quality. It had a long head, long coarse hair, and ears that were longer and narrower than those of the average hog of the country. These were also pointed and projected forward.

They had long legs, thick shoulders, flat sides, hams that were only medium, and a poor back and loin. This was rather narrow and sharp and is the cause of the sharp back that was so prominent in many of the Poland-China hogs in later years. In prolificacy, however, they were good, having from nine to twelve pigs to a litter.

The Byfield.—This type of hog traces its origin to eastern Massachusetts, where it was developed originally from a single hog of outstanding individual merit, selected from a bunch of market hogs. In about 1842 this hog was designated as having great size, good length of body, good constitution, thin coat, short snout, dished face, and heavy lopped ears pointing toward the nose. The jowls were large, sides long and flat, and the back broad. In color it was white.

The China Hog.—This hog was brought to the Miami Valley by the Quakers of Pennsylvania in 1816. These hogs were mixed in color, being mainly white, but some individuals had sandy spots which in turn had black spots within them, indicating that they were considerably mixed. They had the early-maturing and fattening tendencies well developed, were fine in quality and quiet in disposition. This is one of the temporary local strains developed from the original Chinese swine.

The Irish Pig.—These were rather small and compactly formed pigs with good length of body and a good middle. They had thin coats, pointed upright ears, good hams and legs. Irish pigs were brought to the United States and were crossed with other imported pigs, especially those from England such as the Berkshire, Suffolk, Yorkshire, and English China. This produced what was called during earlier times in the United States the Irish Grazer, which was later taken to Ohio and helped to develop the Poland-China.

Irish Grazier.—This pig probably has its peculiar name because its foundation stock was the Irish pig and because of the fact that it was allowed to roam and get a large share of its living by grazing. These pigs were white in general, but had a few black spots. They were very early-maturing hogs with a tendency to take on considerable fat. They had a fine coat, upright ears, light jowls, all of which helped to give the Poland-Chinas their fine coat and symmetrical form.

Berkshires.—The Berkshire was also introduced into the Miami Valley between 1835 and 1840 and used in developing the Poland-China. Many of the hogs used during the early part of this period were white, but with the Berkshire came the solid black hog with six white points. This probably is responsible to a considerable degree for the present fancy color of the Poland-China.

Development of the Breed.—The above mentioned types of swine were taken to the Miami Valley, together with still other of the early hogs of the country, and all bred together, which furnished the original Poland-China. Many of these, as will be seen, were composite breeds, which in turn were made up of a considerable number of other types and breeds, all of which had a tendency to destroy type and break up the entity of the hog into the various characters of the race to such an extent that the possibility of the Poland-China reverting toward any particular type is largely eliminated.

The development of the Poland-China cannot be accredited to any one man, but to the farmers of the Miami Valley in general. The packers of Cincinnati also took great interest in developing the hogs of the country so as to have the best possible pork product. In many instances the packers bought at their own expense considerable

numbers of high-class boars of various breeds, importing and distributing them among the farmers.

At this time one of the most prominent breeders of Poland-China swine was John Harkrader of Warren County. Another man of considerable influence, but more along the lines of showing and advertising, was David Magie. The latter's particular stronghold was the show ring. He also bred Poland-Chinas, but bought or borrowed a good many of his individuals for the show from the herd of Mr. Harkrader. He was a past-master in developing and showing a herd to the best advantage. To him probably may first be accredited the art of washing hogs before being taken to the show ring. This was at the time a trade secret of his, and gave the impression that his hogs were much better bred and much better in quality. Consequently he established a great reputation and sold a great many hogs. Furthermore, on this account an attempt was made to call this particular new breed of hogs the Magie Hog.

At the convention of swine breeders which was held at Springfield, Illinois, in 1870, this name was agreed upon, but some breeders wanted the name of Miami Valley adopted, which should indicate the point of origin of the breed. Two years later, in 1872, when the convention of swine breeders was held at Indianapolis, another effort was made to adopt the name of Miami Valley, but the influence of the western breeders prevailed and the name of Poland-China was adopted. While the Poland hog and the China hog were used in the development of this breed, it cannot be said that they were any more prominent than many other so-called breeds or types that were used.

When first established the Poland-China breed was a large spotted hog, rapid growing and of good quality. Be-

fore the name Poland-China was finally adopted, it was called Large Spotted Hog, and was also known by various other names in different parts of the country as follows: Magie, Butler County, Warren County, Miami Valley, Poland, China, Great Western, Shaker, Union Village, Dick's Creek, Gregory's Creek, and Moore. As the development of the Poland-China proceeded the color was changed from spotted to solid black with six white points. The quality, smoothness, and compactness were improved, which resulted in loss of size, growthiness and prolificacy to such an extent, as previously outlined, that the usefulness of the breed was considerably impaired. It cannot be said that the Poland-China during later years is any better for the production of pork than it was after being first established. This also had the effect of developing the other extreme, which is now called the large type of Poland-China. The latter was produced by selection and breeding.

The Ohio Poland-China record was first established in 1877 and since that time the American, Central, Standard, and Southwestern records were established. During recent years the Central and the Ohio records combined to form what is now called the National Poland-China Record.

THE HAMPSHIRE (THIN RIND).

The history of the Hampshire as bred in the United States today traces back through Canada, and through Hampshire and Essex to Cambridge, England. As stated in Chester White history, Norfolk, England, also had hogs of this character, because the Norfolk Thin Rind was imported to the United States in the development of the Chester White. The characteristics of these "sheeted pigs," as they were called in Essex and Cambridge, were

as follows: They were a large hardy hog with good constitution, thin skin, and of good quality. They were rapid growers, good feeders, black in color, with a white belt running around the front part of the body, including the shoulders and front legs. In prolificacy they were very good.

Holland also had a belted breed as early as 1700. These, however, were slightly different in form from the American Hampshire. They were heavier in weight, longer and deeper in body, and had a head that was somewhat longer.

The original name of the Hampshire hog in the United States was McKay Hog, a name given to it in honor of the importer who brought the hogs from England to Massachusetts about the year 1800. In 1830 this type of hog was also brought to New York from Canada and they were then known as the Hampshire. They were also called the Ring Middle Hog. The Hampshire found its way to the western states about 1835. Henry James of Boone County, Kentucky, upon his return from the east, reported having seen some exceptionally fine hogs. Not being interested in this class of live stock himself, he did not do anything further than to report the facts. In 1835 a consignment of fourteen or fifteen of these hogs was bought by Major Garnett of Boone County, who had them sent to Philadelphia; from here they were driven or hauled in wagons to Pittsburg, and from there taken by steamer to Kentucky. From this point they spread to Ohio, Indiana, Illinois, and other states, and were known as the Belted Breed. After this they were crossed with other breeds of the country to the extent that in 1861 it was said that it was doubtful whether a Hampshire could be found pure. Later, however, it was again developed

in its original form and was given the name of Thin Rind. They were given this name probably by the packers because they had a thin, soft and mellow skin.

The American Thin Rind Association was incorporated by six Boone County farmers in 1893. At this time only twelve herds were eligible to registry. There was not much demand for hogs of this kind; hence they were selected very carefully and only the individuals recorded that were the best of the breed. During recent years, however, since 1900, the breed has been boomed considerably. The herds being so carefully selected, the breeders made exhibitions at some of the big hog shows, notably the International Live Stock Exposition of Chicago, which gained for them an enviable reputation. Because they had selected so closely, their hogs presented a very fine appearance and were greatly sought after by the packers. This resulted in great advertisement for the breed and set on foot an unusual boom. The result of this, which is going on at the present time, is that there is such a demand for hogs of this breed that they cannot be selected as carefully as formerly and more breeders are coming into the field, some of whom may be lacking in judging ability and are selling poor individuals for breeding purposes as well as the best. The result of this will be inevitable; the breed will be unable to maintain the reputation that it has gained during recent years.

CHESHIRE OR JEFFERSON COUNTY SWINE OF NEW YORK.

This breed originated, as indicated by the name, in Jefferson County, New York. It was produced originally by Mr. A. C. Clark, by crossing Yorkshire boars on sows from Cheshire, England, and also by using the Improved

Large Yorkshire and Suffolk hogs on the native white stock of the country. Between 1850 and 1865 Mr. Clark was the leading breeder. Following this time other breeders took it up and the type was slightly changed, but later, about 1884, the various breeders got together, perfected an organization, and adopted a standard. This breed is bred today primarily in York State.

ESSEX SWINE.

This is another English breed originating in Essex County, England. The foundation stock was the old Essexshire hog, which was probably developed, as previously outlined, in one of the isolated local communities. It was a large hog, rather gaunt and slab-sided in form, with a short head; coarse in quality, restless in disposition, and varying in color, being principally black with white snout, white legs and shoulders; somewhat comparable to the color of the Hampshire. The early development of the Essexshire was under the direction of Lord Western about 1830. Neapolitan hogs were imported from southern Europe and crossed upon the old Essex hog, but this line of breeding was unsuccessful on account of inbreeding being practiced. Following this the Essex was crossed on the native stock such as Sussex and Berkshire swine. The Neapolitan cross, however, did one noted thing for the breed. It entirely obliterated the white of the old Essex hog and left a hog with a black color similar to the Neapolitan.

Following the work of Lord Western came Fisher Hobbs. He continued to improve the herd of Lord Western, which finally resulted in the modern improved Essex. The improvement at this time was effected entirely by selection, proper breeding, care and feed, and the breed

finally was called the Improved Essex, which is the black, plump, fat hog of today known by that name.

LARGE BLACKS AND "LINCOLN."

The Large Blacks and the Lincolnshire Curly Whites of England are the production of isolated communities, as previously outlined.

CHAPTER VIII.

METHODS OF BREEDING.

In the practice of swine breeding there are three principal methods in vogue,—breeding pure-bred hogs, grading, and cross breeding.

PURE BRED SWINE.

The pure bred hog is one whose sire and dam are both pure bred. During the earlier history of the breeds, a pure bred animal was one from a herd or strain that had been bred along certain lines for a considerable length of time. Also when the breeds were being developed, various record associations used to accept for record an animal that was produced from stock without any particular breeding by a number of crosses with a pure bred sire. This was considered essentially a pure bred animal. While it is true that such a system never would eliminate the last trace of unimproved blood, an animal bred in this way is for all intents and purposes as good as a pure bred animal. At the present time, however, in order to be considered pure bred an animal must be recorded in some one of the various records.

The practice of pure breeding in itself consists of various degrees of breeding as follows: Out crossing, Line breeding, Close breeding, and Inbreeding.

Out Crossing.—This consists in the mating of animals that are both pure bred and of the same breed, but not or very remotely related. This is considered a good kind of

breeding, but by many breeders it is not considered to be as good a practice as line breeding because there seems to be a tendency toward greater variation.

Line Breeding.—Line breeding consists in mating animals that are pure bred and of the same breed which are bred along similar lines or of the same family. By many breeders this is considered the best form of breeding. It brings together animals that are similarly bred, and consequently more or less similar in type. This then will be more conducive to the establishment and development of a particular type of swine than where out crossing is practiced.

Close Breeding.—This is one degree closer than line breeding; that is, it consists in the mating of animals that are more closely related, but still not close enough to be considered in the next class, namely, inbreeding. This method of breeding is successfully practiced by a great many breeders. If the animals are properly selected so that they have no weak points in common which may be transmitted and fixed in the offspring, it is a good practice because it has a greater tendency to fix points, either good or bad, than either out crossing or line breeding. If the animals are so mated that they have only good points in common, these will naturally be more readily transmitted to and more permanently fixed in the offspring.

Inbreeding.—Inbreeding involves the mating of parent and offspring or brother and sister. This form of breeding may be successful, and occasionally is successful, but it is considered in general by the swine breeders of the country as a poor practice. While experimental data on this point are lacking, it is not definitely known just what may be expected from such breeding operations. However, the general opinion among breeders is that inbreed-

ing will result in loss of size, vitality, and thriftiness in the offspring. The pigs may be farrowed weak and die before very long, or if they live they may not grow as rapidly and develop size as they should; hence they will be less profitable.

Occasionally it is recognized that inbreeding results in the production of outstanding individuals. This being true, it is well to consider what is the probable composition or make-up of the pigs of a litter, whether by inbreeding or out crossing.

Character of Offspring.—As previously noted under the subject head of swine judging, a pig is made up of a number of individual parts and general characteristics that are called characters. That is, the pig has individual parts such as snout, head, ears, feet, legs, shoulders, etc. Then it has general characteristics such as quality, color, form, proportion of lean to fat meat, etc., all of which may be taken as separate considerations which, when properly put together, make up the individual. If it can be imagined that all of these characters were dissected, or taken separately and then put together, it can easily be seen that the complete hog as finally made will be good or bad in proportion as the various parts which go to make up the individual are good or bad.

In general it is said that a pig receives one-half of its characters from its immediate parents, one-fourth from its grandparents, one-eighth from its great-grandparents, and so on backward. From this it can easily be seen that often pigs from the same litter are not necessarily related in every particular. Certain characters represented by different pigs may have originated from entirely different sources ranging back of the immediate parents through the grand-parents, great-grand-parents, and so on

indefinitely. This is quite evident from observation of pigs of the same litter, some of which may be entirely different in general form, quality, etc., from the rest of the litter. This being true, it is clearly evident that inbreeding,—as for instance, when brother and sister, because they happen to belong to the same litter, are mated, is not necessarily inbreeding in the strictest sense of the term because the pair may not be closely related in respect to all the characters. Granting that inbreeding, because of mating individuals whose characters are related, results in the production of inferior offspring, such matings may still produce outstanding individuals, while at other times, which would happen more often, they would produce very poor results. However, it has not as yet been demonstrated that the mating of individuals all of whose characters are closely related necessarily produces inferior offspring. Such being the facts, it is quite clear that proper breeding consists primarily in the mating of good individuals. In general the best individuals of the breed should be used for breeding purposes, and the more closely they are related the better they should be selected because the more likely they are to combine and transmit their characteristics to the offspring. If a sire and dam both have weak points in common, these will be combined and transmitted to the offspring. If they have strong points in common, they will be transmitted likewise.

GRADING.

The method of grading as a form of breeding consists in mating animals one of which is pure bred and the other a scrub, grade, or cross bred animal. The sire usually is the pure bred. The dam may be of any breeding other than pure bred. Thus if a man starts with a herd of scrub

sows and uses a pure bred sire, he has grade pigs. If he uses these pigs for several generations, each time using a pure bred sire, he has pigs that are called high grades. For the production of pork hogs a high grade is almost, perhaps practically, as good as a pure bred. Furthermore it is true that a good grade properly selected and well bred is better than a poor pure bred.

CROSS BREEDING.

Cross breeding consists in mating pure bred animals that are of different breeds. This form of breeding as practiced for the production of market hogs is advocated by many as the best form of breeding, which however cannot be substantiated by evidence or by a thorough study of the practice. Cross breeding, as generally practiced, has nothing in its favor and everything to be lost, while pure breeding or grading has everything in its favor to be gained and nothing to be lost. The cross bred individual may be as good as the pure bred or the grade, but he is no better, and where the pure bred or grade may be steadily improved year after year, the cross bred cannot be improved and individuals produced by such practice may even deteriorate from one year to the next.

As an example it may be assumed that a breeder through ignorance, negligence, or otherwise, may fail to get good results from the practice of either pure breeding or grading. He may change his policy and adopt cross breeding, using the sows that he has in his herd and mating them with a sire of another breed. The pigs that will be produced from such mating are cross bred. It is a well known fact that these pigs cannot be used further in the process of breeding because if cross breeding is carried further than the first generation the offspring

deteriorates very rapidly. Pigs of this character may be mated with pure bred sires that are not related to them, but this then is not cross breeding, but grading. In order to continue the process of cross breeding, the breeder will use his original herd of sows as well as the original sire and produce pigs year after year, selling the entire offspring. Such a man cannot be called a breeder in the true sense of the word, but only a multiplier of swine. As soon as the brood sows become old enough to be useless, they must be replaced and in order to do this it will be necessary either to keep a few pure bred animals on hand and breed pure bred sows, or else go to a breeder of pure bred swine and buy the necessary animals for his breeding herd. In case such a man attempts to breed his own animals for his breeding herd that are to be used in cross breeding operations, he will not breed pure bred animals on a very large scale, but only enough to supply the necessary breeding stock. In such a case he has no opportunity at all for selection; he will have to keep the entire number of individuals produced. In case he supplements his breeding herd with animals purchased from a breeder of pure bred hogs, he will not get the best individuals because he cannot afford to pay the price at which these sell. He will have to take second rate individuals and possibly even poor individuals which should be classed as pedigreed scrubs. These, in transmitting their own characteristics, will produce animals that are not good individuals.

Thus the man who practices cross breeding loses the opportunity of selection, hence the possibility of improving his herd, because he must use in his breeding herd inferior breeding animals. He cannot hope to purchase as good stock as the man uses who breeds either pure or

practices grading in his herd because such animals usually are not for sale, and if they were he might not be financially able to purchase them. The only advantage that can be cited in favor of cross breeding is that the pigs from such breeding are not likely to be inbred. Hence they usually are fairly good individuals and, as already said, may be as good as pure bred animals. Of course a good cross bred pig is better than a poor pure bred pig or a poor grade. To illustrate this, as well as breeding in general, Cut 15 is presented.

SWINE BREEDING.

The cut on page 108 is not made from any experimental data, or from any records whatever, but is simply an off-hand drawing evolved in the mind of the writer to illustrate different degrees of breeding. The vertical dimensions of the diamond-shaped figures represent degrees of variation in a breed, or in a herd, and the distance of these above the base line the degree of improvement. The dots within the figure represent the individual pigs, as for instance the crop of pigs that is produced in one season or the pigs of a breed. The horizontal line through the diamond-shaped figure is to represent the average of the herd or of the breed. The dots at the upper side of the axis of the diamond are to represent the pigs that are better than the average, while the ones below the axis represent those that are poorer than the average.

It will be seen that the greatest number of the pigs are similar in characteristics to the average of the breed or herd, that those which are either better or poorer become fewer in number as the distance from the center or average is increased. As will be seen, there are a compara-

CUT 15.—ILLUSTRATING DEGREES IN SWINE BREEDING.

tively small number of either outstanding good individuals or outstanding poor individuals. These are represented by the dots in the upper and lower points of the diamond, respectively.

Figure No. 1 in the cut represents the wild hog in its native state. It occupies the position on the base line, or the starting point from which improvement in the several breeds was made.

Figure 2 represents the razor-back, or the hog that was once domesticated and then allowed to revert toward its original state, such as are found in the forests of the southern states of this country.

As represented the razor-back is a hog of higher grade than the wild boar. The average razor-back is practically equal to the best individuals of the wild hog, while the poorest razor-back is somewhat inferior to the average wild hog.

Figure 3 is supposed to represent the scrub. This shows a considerably wider degree of variation than the razor-back. The best scrub is very much better than the best razor-back, and the average scrub even is a little better than the best razor-back, while the poorest scrub, as represented by the lower part of this diamond, is almost as good as the average razor-back.

Figure 4 represents the grade hog. This again shows a wider degree of variation and shows that the best grade is very much better than the best scrub. The average grade is also considerably better than the average scrub, while the poorest grade is a little better than the poorest scrub.

Figure 5 shows the pure bred hog. This as will be seen shows the widest degree of variation, the best pure bred being very much better than the best grade, while the poorest pure bred is not very much better than the

poorest grade. This probably is true because pure bred animals with the widest possible variation are bred. The impression seems to prevail in the minds of many breeders that a hog with a pedigree, or the pure bred hog, must necessarily be a good individual. Many breeders make a practice of selling for breeding purposes all the pure bred hogs produced in the herd. Consequently the poorest pure bred individuals are used for breeding purposes. This is not true for any other class of breeding. The man who practices grading, or breeds from scrubs, makes a practice of selecting only the best individuals. This is also true to a greater or less extent with cross bred hogs.

Thus it is seen that if success is to be attained with pure bred hogs, they must be selected just as closely as hogs with no pedigree, or of any other form of breeding. If good results are to be obtained, outstanding individuals must be taken to use in the breeding herd. The best individuals, those that may be considered really outstanding, or the ones that bring about improvement in the breed, appear only occasionally and sometimes very rarely, as will be seen from the diamond-shaped figure where the number of individuals in the upper point are very few as compared to the total number produced.

It will be seen by comparing figures 5 and 4, which represent pure bred and grade respectively, that a man may succeed better with the best grade than with the average pure bred. This of course will apply only to the production of market hogs. The poorest pure bred individuals are very much poorer as individuals than the average grade.

Figure 6 in the same cut represents the cross bred hog that is used for market purposes. This does not show

so wide a degree of variation as the pure bred, which has already been explained, namely, that cross bred hogs are more carefully selected for breeding purposes. The best cross bred is equal in value for pork production to the best pure bred, but is no better. The average cross bred hog appears often to be a little better than the average pure bred. This is true only on account of selection. The average pure bred as a whole, where the poorest individuals are used for breeding purposes, is not as good as the average cross bred where the animals are more closely culled. The poorest cross bred pig, however, even when used for market purposes, is not much if any better than the poorest pure bred.

The last figure of the cut, No. 7, is supposed to represent the cross bred hog when used for breeding purposes. As will be seen this is no better than the scrub. When cross breeding is carried further than the first generation, the individuals themselves and the results that may be obtained from them are no better than hogs that are scrubs.

To gain an idea of the results that may be obtained through a series of years, figures numbered 6 and 7 must be considered together in comparison with figures 1 to 5. As previously stated, the practice of selection in grades or pure breds may be followed year by year, while this opportunity is entirely lacking in cross breeding operations. For instance, suppose a man is producing a crop of one hundred pigs either annually or semi-annually. One half of these, or fifty, will be female and the remainder males. Of these fifty sows a few will appear that belong in the upper part of the diamond-shaped figure. Possibly he may have one that belongs in the extreme upper point, but such a one will appear only

occasionally, perhaps not more than a few times in a life time. Selecting this individual whenever it appears, and as many more as may be necessary for a breeding herd that are the best in the crop, and mating these with a sire that has been equally well selected either from the same herd or from a herd of some other breeder, it can easily be seen that the average of the herd the following year will be distinctly better than the starting point, or the average of the first year. Thus the next or second crop of pigs will be better. While the same degree of variation will exist in this crop, the average of the pigs will be higher. This may be illustrated by going from the wild hog to the razor-back. The following year another step may be taken in advance by going from the razor-back to the scrub, and this method of improvement may be continued from year to year, going from the scrub to the grade, and from the grade to the pure bred. Improvement may be made indefinitely. This improvement may be made in any one, or in all, of the various points, such as producing individuals of prolificacy, greater vitality, and greater thriftiness; sows that produce more milk, sows that are better mothers and will raise a larger percentage of their litter, individuals that have the ability to add more fat, as well as those that have the ability to digest and assimilate more feed and produce greater and cheaper gains.

Thus it will be seen that the opportunities of the breeder who practices either grading or pure breeding are unlimited, while the man who practices cross breeding has no opportunities for improvement whatever. The only excuse for the latter method of swine breeding is that there is no possibility of the hogs being inbred, and this is somewhat of a reflection upon the intelligence of the

breeder. For a man who is in the business of swine breeding would not like to admit that he did not know enough about his animals to know whether or not they were being inbred. Nevertheless, a man who practices pure breeding or grading and does not make a thorough study of the business may be deceived. He may buy year after year pure bred sires from different sections of the country and of course from different breeders. But without making a close study of the pedigrees, it may be possible for him to buy, unknowingly, sires during successive years that are very closely related, which, of course, would be likely to produce disastrous results in his breeding herd. This could be avoided by cross breeding, but also equally well by pure breeding and grading, if the breeder understands pedigrees, and by the latter method he could improve his herd while by the former he could not.

PART II.
Swine Feeding.

CUT 16.—LITTER-MATES FED DIFFERENT RATIONS.

This cut shows two pigs as they appeared after three months and thirteen days of feeding. They were litter-mates and were as nearly alike as "two peas in a pod" when weaned. The smaller pig is from a lot where ground corn and water were fed, and the larger pig is from a lot where mineral matter and clover pasture were supplied in addition to ground corn and water. Both lots were fed as much as they would eat readily.

CHAPTER IX.

WHAT IS A HOG?

This to the casual observer seems like the question of a simpleton, but nevertheless it has a great deal of meaning. For, in order to be able to feed a hog properly, a man should know what kinds of material the hog is made up of, and also the amounts of the various kinds of material entering into the construction of the body.

The composition of a hog, or the structure of his body, may be compared to a brick house. Such a house, for instance, is composed of brick, mortar and lumber. In order to have the house constructed most economically, only enough of the various kinds of material should be delivered to the place where the house is being built so that the entire quantity can be used and nothing left over. If twice as many bricks were hauled to the ground as could be used, the house could still be built and the remainder be hauled away and considered waste. If more lumber were bought than necessary, the excess could be used for fuel which would be wasteful. If more mortar were made than could be used to lay the brick, it would soon become hard and be wasted.

If such a house were to be built, a layman would consider it unwise to undertake the task himself. It might be possible for him to build some sort of a structure, but if it were done by trained masons and carpenters, it would be infinitely better.

The making of a hog may be compared to the building of a brick house. In order to build such a house most economically and most durably it must contain good material and the proper amount of the various materials that enter into the structure. These must also be properly used.

Thus in the making of the body of a hog, if the best results are to be obtained, the proper kinds of materials must be brought into the structure, as well as the proper amounts of the various kinds of these which must be handled by the mechanism of the animal in the best possible working condition. It is true that the animal can substitute to some extent and use carbohydrate in place of ether extract; fat when obtained direct from the feed to a slight degree in place of carbohydrate; and can use protein to some extent in place of carbohydrate or fat for energy and heat production. He cannot, however, substitute anything for the protein that is used for the regular protein metabolism, neither for the water or the mineral matter that is necessary for the proper making of the animal body. Thus if a man who knows little or nothing about feeds, about animals, and about feeding, can feed hogs and obtain a fair degree of success how much greater ought not such success to be if the man were properly trained in these respects? The principal constituent parts of the body of a hog are water, protein, fat, and ash or mineral matter.

WATER.

About one-half of the live weight of the hog is water. The amount of water, however, in the carcass depends considerably on the condition of the animal. A thrifty, growing hog that is not very fat will contain proportion-

ately more water than a hog that is very fat or in prime condition for market. Generally speaking, hogs with this degree of variation will contain from 42 to 58 per cent of water. In order to have a hog develop to the best possible advantage, he must have sufficient water to supply this amount, and besides he must also have water for the general working of his internal mechanism. The latter is of the greater importance. Water is very essential in the excretion of waste products, such as the waste nitrogen resulting from the protein metabolism which is excreted as a part of the urine. As to the distribution of water in the body, it is found everywhere, but more extensively in the softer tissues; the hard tissues such as the bone containing a relatively smaller quantity.

PROTEIN.

The vital or working parts of an animal body are composed principally of protein. Thus it is seen that as long as an animal lives and works it needs protein not only to build up new tissue during the growing period, but also to maintain the protein metabolism* during idleness and during periods of work. Peculiarly as long as the animal lives this part of his mechanism is working all the time, and as far as experimental data show, he needs as much protein when he is at rest as when he is at work, showing that the mechanical work an animal does is done at the expense of nutrients other than protein, consequently carbohydrate and fat. Since the latter nutrient is found in feed stuffs only in limited quantities, and since also his internal mechanism can handle only a limited quan-

*Metabolism means the process involved in the changes that food substances undergo in the animal body after they are digested and taken into the system. This is similar in part to what is meant by assimilation.

tity of this, when taken in as a feed from external sources, the nutrient carbohydrate is the principal source of energy.

The amount of protein in the carcass of a hog varies somewhat with the condition of the animal, but not to the same extent as the amount of water present. As the hog grows, especially during the growing period as contrasted with the fattening period, he is, under normal conditions, always adding protein to his body. At the same time he is adding other tissues, particularly fat. But during the fattening period he will add relatively more fat, and consequently the fatter the hog the smaller is the relative amount of protein contained in the same.

In general the carcass of a hog contains from 12 to 15 per cent of protein. The principal protein tissues are the lean meat or muscle tissues. Besides this, however, protein is quite widely distributed throughout the body, such as in the fluids of the body, the cells which contain the fat, the bones, and the hide, hair and horns. All parts of the body, then, contain protein, but the muscle or the lean meat is made up primarily of protein.

In order to allow a pig to build up the protein part of his body he must have protein as a food. Protein metabolism cannot be supplied by any other food nutrient. This is one of the laws of nature; consequently a hog may be allowed to starve to death with a full stomach. That is, if he were given all the carbohydrate, all the fat, all the water, and all the ash or mineral matter that he could eat, he would still starve to death unless he had protein to supply the protein metabolism or the part of his mechanism that has to do with the construction and maintenance of lean meat or protein tissues. To expect a hog to live and thrive without protein would

be comparable to trying to build a brick house without mortar.

FAT

The fat or lard hog usually is considered as being primarily adapted to the production of fat. A great many times, however, he has too much fat for his own good as well as for the demands of the market. The amount of fat contained in the carcass of a hog will vary greatly in accordance with the condition in which the hog is found. This ranges approximately from 24 to 42 per cent. Thus it is seen that a hog in normal flesh, or in growing condition, is made up of about one-fourth fat and three-fourths of other material. When in very high condition, or ready for market, he will be made up of about two-fifths fat.

The purpose of the fat in the living animal body is two-fold: First and primarily, it is the storehouse or means of storage of fuel, namely, the fat. Thus the animal provides itself for possible emergencies. If it is compelled to go without food for days or even a few weeks, it has a readily available food supply. If the time is too long between meals, it will also draw upon the store of fat. This, however, cannot supply the demands for protein, but only the carbohydrate and the fat metabolism. The protein metabolism must be supplied from the protein of the ration or from the protein tissues of the body. Second, some fat gives the animal better form and protection from bumps and cold.

ASH OR MINERAL MATTER.

This constituent of the hog is found chiefly in the bones. However, considerable ash or mineral matter is found in other parts of his body, such as in the blood, and in his digestive processes in general, as well as in the cells

throughout the body. Approximately two to three per cent of the live weight of the hog is composed of this kind of material. The ash or mineral matter in general of any vegetable material is that which is left after it is burned as, for instance, the ashes taken from a wood stove. Bones are made up principally of two kinds of material, namely, ash or mineral matter and protein. To demonstrate to one's own satisfaction the amount of these two substances present, the bone may be put into a fire and thoroughly burned. This will take out the vegetable matter, such as the protein and leave the mineral matter. The bone after being taken from the fire will be brittle, light and porous, which is the mineral matter of the bone. If the mineral matter is to be taken out and the protein left, the bone should be placed in some acid for a time which will dissolve the ash and leave the protein. The bone in this condition will be soft and pliable. There are various kinds of mineral substances in the general ash of the body, all of which must be supplied for the proper development of the animal.

CHAPTER X.

BUILDING MATERIAL.

In order to furnish the hog with the desired material for the construction of his body, it must be known where and in what form these are to be obtained.

FOOD NUTRIENTS.

Since nutrients rather than feeds is the basis of consideration, and is somewhat of a departure and more or less unfamiliar, it is deemed advisable to discuss this matter in detail at this point.

Nutrients are the ingredients or compounds of a feed or of feeds such as may be used by the animal, as, for instance, protein, carbohydrate and ether extract or fat. It should be remembered that a feed must be eaten and digested so as to separate it into its various constituent parts, the nutrients, before they can be used. Digestible nutrients are those portions of the nutrients that are absorbed from the alimentary tract and not passed out in the feces.

Coefficients of Digestibility.—By coefficient of digestibility is meant the per cent of a nutrient that is digested. The total quantity eaten minus that appearing in the feces divided by the total quantity, gives the coefficient of digestibility or the per cent digested. According to the above definition, the undigested portion of feed stuffs is all found in the feces; hence in determining the coefficients of digestibility the feces only and not the urine

need to be considered. This may be collected in various ways as follows:

By keeping the pig in a small pen which has a smooth floor where the droppings can be gathered without much waste. The objections to this method are that if the attendant is not present at all times the pig may get a considerable portion of the droppings on his feet and body and more or less of it may be lost. Also the solid matter may become mixed with the urine which would detract somewhat from the results obtained.

Pigs may be kept in small comfortable pens and have bags attached to them to catch the droppings as they are voided. In such cases barrows should be used in order that the urine will not interfere. This bag if properly arranged affords an opportunity to save practically all the feces that are voided. However, a pig that is put into such a harness is more or less under abnormal conditions and cannot be expected to do normal work, at least for a considerable length of time during which he is becoming accustomed to this apparatus.

A pig may also be kept in a crate which is just large enough for him to stand up or lie down in conveniently. In such a case barrows are also used and the crate is so arranged that the urine runs forward at least to the center of the crate. The solid excrement falls at the rear end and may be gathered without much difficulty. The objection to this is that the pig must necessarily be confined to a very small place, which again is not normal, or is not the same condition that is usually afforded to pigs in the process of pork production. The results obtained in such close confinement, therefore, cannot be said to apply directly to conditions that are more nearly in accordance with nature.

One important consideration in connection with determining coefficients of digestibility is the manner in which the different feeds are used for which the coefficients are to be determined. This is usually done by either feeding a particular feed separately or by feeding several feeds in combination. If the feeds are fed separately, then the coefficients of digestibility for the various nutrients of the feed are as already stated, namely, the total quantity of dry matter passed out in the feces is to be subtracted from the total quantity eaten. This remainder divided by the total quantity eaten is the per cent digested, or the coefficient of digestibility. This can be done with a number of feeds, such as corn and other ordinary grains, but it cannot be done in a case where roughages or where nitrogenous concentrates are fed. Roughages are not sufficiently palatable to be used as a single feed. Nitrogenous concentrates are so rich in protein and contain so little carbohydrate that a pig cannot be fed on such a feed alone. In order to get the coefficients of digestibility then for feeds like these, it is necessary to feed them in combination with other feeds.

In such cases corn, or some other feed that can be used singly, is fed to the pig first as a single feed and the coefficients of digestibility are determined for it. The corn, or whatever other feed may be used in such a process, is called the basal ration. Following this a feed that cannot be fed alone as, for instance, soy-beans, is fed in connection with the corn. The coefficients of digestibility for soy-beans are then calculated. The coefficients that were obtained when corn alone was used are applied to the corn part of the combined ration which determines what part of the feces of this ration should be accredited to the soy-beans. This then is subtracted from the total

amount of soy-beans in the ration, and the difference divided by the total amount fed, which is supposed to give the coefficient of digestibility for soy-beans. While in some cases this may be accurate, it is usually inaccurate.

Recent experiments by the writer have shown that combinations of feeds in general are digested much more thoroughly than single feeds, the difference being so great that the coefficients of digestibility for some of the nutrients of nitrogenous concentrates is far greater than 100 per cent, indicating that the supplemental feed exercises a favorable influence upon the extent to which the basal ration is digested. With this in view, it is obvious that the coefficients of digestibility for the nutrients of the feeds that are determined by calculation are not accurate; furthermore, where the coefficients for a single feed have been determined directly, they are not as high as when used in combination with other feeds.

By using several different kinds of concentrated feeds in various proportions it was shown that the coefficient of digestibility for carbohydrate is practically constant, and that a pig digests 90 per cent of this nutrient. The coefficients for the other nutrients vary considerably. Crude protein ranges from 67 to 85 per cent and ether extract from 60 to 90 per cent. Thus it is seen that the digestible nutrients given in the succeeding tables, since they are made up from average coefficients of digestibility, may not be absolutely accurate, but they are the best available. Furthermore, as determined by the writer, these are much more nearly accurate than many other conditions of a practical nature that determine results in swine feeding.

Protein.—Protein is the general name for the nitrogenous compounds that are used by the animal body for

the production of the lean meat or muscle tissue, and, to a lesser extent, bone tissue of the body. Bones, as is well known, are made up largely of mineral matter. Feeds that contain a considerable quantity of protein are called nitrogenous feeds because nitrogen is the distinguishing element of protein. It must be remembered, however, that nitrogenous feeds in general also contain more or less of the other nutrients.

For a thorough understanding of the term protein, a further exemplification of the above definition is necessary. Total nitrogen compounds ($N \times 6.25$) are called crude protein. This includes all the nitrogen compounds of feeds. Sometimes they are simply called protein for the sake of brevity. True protein, or what is correctly meant when the word protein is used alone, includes only those nitrogenous compounds that can be used for the construction of the lean meat or muscle tissue of the body and otherwise to supply the general protein metabolism. Subtracting the true protein, or protein from the crude protein, there is left what is called non-protein. This is also a nitrogenous substance, but cannot be used by the animal body to supply protein metabolism or the purposes for which true protein is used. Protein is present to a greater or less extent in almost all feeds, but is found most abundantly in nitrogenous feeds.

Carbohydrate.—Carbohydrate nutrients are those used by the animal body for the production of energy; second (during cold seasons or in cold climates), for the production of heat, and third, for the production of fat. This substance is found in most feeds, but occurs in largest quantities in those classified as carbonaceous. Starches and sugar are popularly used examples of carbohydrate as discussed in stock feeding.

Fat or Ether Extract.—The nutrient known as fat, or ether extract, is found to a greater or less extent in all feeds. These compounds are used by the animal body for the same ultimate purpose as the carbohydrate nutrients. The term ether extract is usually used instead of fat because ether is used in extracting the fat from the feed stuff when determining how much it contains. The extract when thus obtained has other materials in it such as wax, chlorophyll, etc., and is not pure fat; consequently is called ether extract.

Mineral Matter.—The mineral nutrients are such substances as common salt, lime, potash, the phosphates, etc. These are necessary for the construction of bone as well as for the proper working of the other functions of the animal body. All feeds contain some mineral matter; some feeds contain a considerable quantity, others a very small quantity. Different soils contain varying quantities of mineral matter, and vegetation grown on these soils will have varying quantities of mineral matter contained in it in accordance with the soil upon which it grows. Ground water also contains more or less mineral matter in accordance with the quantities in the soil.

DRY FEEDS

Feeds in general, such as corn, rye, oats, barley, skim milk, grass, roots, etc., are usually considered as the primary sources of the necessary building material for the hog, as well as for other animals. Some feeds, such as corn, rye, barley, etc., are made up largely of carbohydrate material and are called carbonaceous feeds. Besides containing carbohydrate they also contain some of the other food nutrients, such as protein, ether extract or fat, and mineral matter; also some water. It is very fortunate

that all feeds, especially corn, contain some protein. If this were not true, hogs fed on corn alone would die on account of protein starvation. Other feeds contain a considerable quantity of protein material and are classified as nitrogenous feeds. Most of these contain other nutrients, such as carbohydrate, ether extract, mineral matter and also water.

Since protein is present in all feeds, there is not much danger of a pig being starved to death when he is given all the corn, for instance, that he can eat, but the carbohydrate feeds do not contain sufficient protein to allow the pig to develop as he should. Consequently in order to supplement the protein found in the carbohydrate feeds, nitrogenous feeds are resorted to. These are feeds such as skim milk, soy-beans, cow-peas, clover and alfalfa. The latter are roughages and on this account will not furnish sufficient protein for the maximum development of the hog which is not adapted to eating very large quantities of feeds of this class.

CLASSIFICATION AND COMPOSITION OF FEEDS.

There are two general classes of feeds, namely, concentrates and roughages. Concentrates are feeds that contain a comparatively large per cent of digestible nutrients and a comparatively small per cent of undigestible material, or, in other words, are the feeds that are not bulky. Roughages or bulky feeds are the opposite of concentrates; those containing relatively large proportions of undigestible material. Aside from this, feeds are classified according to the amounts of the various digestible nutrients they contain; those that are composed largely of carbohydrate material are called carbonaceous feeds, and

those that contain considerably more protein than is found in carbonaceous feeds are called nitrogenous feeds. They are called nitrogenous because nitrogen is the principal distinguishing element of protein as compared to the composition of carbohydrate. The latter is composed of carbon, hydrogen and oxygen, while the former also contains nitrogen and sometimes sulphur. Many nitrogenous feeds contain much more carbohydrate than protein.

CARBONACEOUS CONCENTRATES—DRY FEEDS.

	Digestible Nutrients Per 100 lbs.				
	Water	Crude protein	Carbohydrates	Ether extract	Mineral matter
Corn	13.0	7.0	66.0	3.0	1.4
Rye	11.6	8.1	69.7	1.3	1.9
Barley	10.9	8.3	64.8	1.6	2.6
Wheat	10.5	8.9	69.2	1.7	1.8
Oats	11.0	8.4	48.3	4.2	3.0
Kafir corn	9.3	7.8	57.1	2.7	1.5
Rice	12.4	4.8	72.2	.8	.4
Germmeal	8.1	9.0	61.2	6.2	1.3
Hominy chops	11.1	7.5	55.2	6.8	2.5

GREEN FEEDS.*

Potatoes	78.9	.5	16.4	.1	1.0
Artichokes	79.5	2.0	16.8	.2	1.0
Sugar beets	86.5	1.1	10.2	.1	.9
Mangel wurzels	90.9	.1	5.7	.1	1.1
Turnips	90.5	.2	6.5	.1	.8
Pumpkins (field).....	90.9	1.0	5.8	.3	.5

*Under certain conditions these may become roughages.

A few of the most common feeds are given in the accompanying tables which were also simultaneously pre-

pared for an Illinois Agricultural Experiment Station publication. The digestible nutrients given for these were obtained from various sources; some from the analyses of the Illinois Agricultural Experiment Station, some from the work of Armsby of Pennsylvania, and some from

 NITROGENOUS CONCENTRATES—DRY FEEDS.

	Digestible Nutrients Per 100 lbs.				
	Water.	Crude protein	Carbo-hydrates.	Ether extract.	Mineral matter.
Soy bean (grain)	10.8	29.6	22.3	14.4	4.7
Canada field pea (grain)...	10.5	18.0	59.8	.6	2.6
Cowpea (grain)	14.8	18.3	54.2	1.1	3.4
Tankage	7.	48.0		12.0	11.7
Meat scrap	10.7	66.2	.3	13.7	4.1
Bloodmeal	8.5	52.3		2.5	4.7
Oilmeal O. P.....	9.2	27.5	32.8	7.1	5.7
Oilmeal N. P.....	10.1	29.3	38.7	2.9	5.8
Gluten meal	8.2	21.6	43.0	11.9	.9
Dark feeding flour	9.7	13.5	61.3	2.0	4.3
Red dog flour	12.0	14.0	66.0	2.0	3.3
Wheat middlings	12.1	11.4	54.5	3.4	3.3
Wheat shorts	11.8	12.2	50.0	3.8	4.6
Buckwheat middlings	13.2	22.0	33.4	5.4	4.8
Buckwheat shorts	11.1	21.1	33.5	5.5	5.1

 LIQUID FEEDS.*

Skimmilk	90.6	2.9	5.2	.3	.7
Buttermilk	90.1	3.9	4.0	1.1	.7

*Under certain conditions these may become roughages.

general feeding tables such as are given in "Feeds and Feeding" by Henry. In these tables, however, water and mineral matter are not considered as digestible nutrients. According to data obtained by the writer, it seems ad-

visible to also classify water as a nutrient and assume, since the pig requires more than is present in ordinary feed stuffs, that the entire quantity is digestible. Hence in the accompanying tables the entire water content is given under the head of digestible nutrients. The mineral matter included in the table under this head is also the total ash content of the feeds obtained from composition tables:

NITROGENOUS ROUGHAGES—DRY FEEDS.

	Digestible Nutrients Per 100 lbs.				
	Water	Crude protein	Carbo-hydrates	Ether extract	Mineral matter
Alfalfa hay.....	8.4	7.0	37.3	1.4	7.4
Clover hay (red).....	15.3	5.4	38.2	1.8	6.2
Wheat bran.....	11.9	10.2	41.2	2.9	5.8

GREEN FEEDS.

Alfalfa	71.8	3.0	11.2	.4	2.7
Clover (red).....	70.8	2.2	14.8	.7	2.1
Cowpeas	83.6	1.8	8.7	.2	1.7
Soy beans.....	75.1	3.2	11.0	.5	2.6
Vetch		...		...	...
Clovers other than red....		...		...	...

CARBONACEOUS ROUGHAGES—GREEN FEEDS.

Rape	84.5	1.5	8.1	.2	2.0
Bluegrass	65.1	3.0	19.8	.8	2.8
Oat fodder.....	62.2	2.6	18.9	1.0	2.5
Rye fodder.....	76.6	2.1	14.1	.4	1.8

The green feeds that are specified under the head of carbonaceous concentrates contain a great deal of water. It is evident that, if fed in large enough quantities to compel the pig to take more water than his system demands, these feeds would become roughages in the sense

that the pig would be compelled to take more bulk in the form of water than would normally go with the proper quantity of nutrients other than water. This would have a tendency to distend the capacity of his digestive apparatus. An excess of water, however, would have detrimental effects upon the pig.

The liquid feeds specified under the head of nitrogenous concentrates may likewise be considered either as concentrates or roughages, the same as the green feeds given under the head of carbonaceous concentrates.

The nitrogenous roughages are given under two subject heads, dry feeds and green feeds. The dry feeds are roughages because of the large quantity of crude fiber they contain. The green feeds also contain the crude fiber, but relatively less than the dry feeds because they at the same time contain a large quantity of water. This, of course, plays an important part in the metabolism of the animal body, and may take the place of water that is fed as such in connection with dry feeds.

The carbonaceous roughages are all in the form of green feeds and may be considered in the same light, as far as water is concerned, as the green feeds under the head of nitrogenous roughages.

WATER.

Water, as already stated, is not generally considered a food nutrient, but recent developments in the experimental work of the writer at the Illinois Agricultural Experiment Station attach enough importance to a definite quantity of water in a ration that it seems advisable to classify it also as a nutrient.

Water is necessary in the metabolism of the animal body and is present to a greater or less extent as a part

of all feeds. Those classified as dry feeds contain a comparatively small per cent of water, ranging from 8 to 18 per cent, while the succulent feeds, such as grass and roots, may contain as high as 85 to 90 per cent of water. The liquid feeds such as skim milk and buttermilk also contain a large per cent of water—from 85 to 90. In order that a hog may develop properly, he must have a sufficient amount of water. If this is not present in sufficient quantities in the feeds used in the ration, and it usually is not except in the liquid feeds and roots, it must be supplied as such.

AIR.

Aside from the dry feeds and from water, there is a third source from which the building material for the animal body is obtained. This is the oxygen from the air. While great stress has been laid upon dry feeds, and a great amount of experimental work has been done to determine the value of dry feeds of different kinds, very little has been done to determine the value of water, and nothing has been done as regards the value of air in the nutrition of the animal body, although pure air has always been considered essential for the health of the animal. Nevertheless, it is known that an animal can live for weeks without any dry feeds; it can live for several days without any water; but it cannot live for more than a few minutes without air. From this it would seem that these sources of food supply have been considered in reverse order. If an animal can live but a few minutes without air, or a supply of oxygen, should not this point be given primary consideration? And if it can live but a comparatively short time without water, this should also be given more consideration than has been done in the past.

CHAPTER XI.

COMMON PRACTICE OF FEEDING.

FEEDS.

In the common practice of swine feeding hogs are supplied with feeds of which there are a large variety, as indicated by the table in the preceding chapter. A hog is required to take these feeds, and convert them into the tissues of his body. The gap between the raw feeds and the finished product in the form of animal tissues is very great. The processes necessary for such operations would be comparable to the building of a frame house from the trees of the forest. An ordinary house contains several classes of material such as soft wood and hard wood. In order to supply this, pine trees and oak trees must be cut down, sawed into logs, taken to the saw-mill and cut up into lumber, and this must then be finished and made into various forms in different ways to get it into proper shape for use in the construction of the house. It would be a rather crude process for a carpenter to build such a house from only the trees of the forest. If a large number of houses were to be built, it would be possible to select trees properly so as to have the right proportion between the amount of soft and hard wood, but the carpenter is not supplied with the necessary manufacturing processes to render the material in the raw state suitable for use in house construction.

The stomach of the hog is the manufacturing plant for the animal. It takes the raw material, or the feeds as

they are supplied, and converts them into their constituent parts or food nutrients, such as water, protein, carbohydrate, ether extract or fat, and mineral matter. These can then be used for the structure of the various body tissues.

When feeds are used as the basis of swine feeding, it can easily be seen that there is danger of supplying more of one class of material, or one nutrient, than the pig can use to the best advantage, and at the same time supply too little of some other nutrient. Consequently the foundation upon which the common practice of swine feeding is built is not as good as it should be. Nevertheless, through a long series of years it has come to be commonly known that certain feeds, when used under certain conditions, will produce desirable results and others will not. Conditions, however, are so numerous and so variable, and the requirements of the animal body seem to be so exact and to have never been accurately determined, that the common practice of swine feeding does not as a whole give as good results as it should.

WATER.

With this system of feeding the pig is usually given free access to water. He is allowed to drink as little or as much of this as he will, and very often is allowed to use it as a wallow, thus helping to keep the animal cool during the hot weather. For such purposes it is very essential that the water be pure and wholesome. Very often the hog is considered as a scavenger and is required to drink filthy and unwholesome water, which of course is not conducive to the best results.

PASTURE.

Pasture plays a very important part in the common practice of swine feeding. Besides getting fresh and

palatable feed the pig in such cases harvests the crop which saves considerable expense. He also usually gets a greater variety of feed as well as different mineral substances that may be gathered from the soil in different places. While the feed gathered from the pasture in the form of grass, plants of various kinds, etc., is of the nature of a roughage, still the pig can use a considerable quantity of this even though he is primarily adapted to concentrated feeds. In fact, he will do better with some roughages in his ration than he will to be confined entirely to concentrates, especially if the former are gathered from the pasture. The pasture exercises a considerable influence besides the feeds it supplies.

SUMMER FEEDING.

Pigs, ordinarily, under the common practice of feeding, are farrowed in the spring. They are then developed during the summer season, and sold the following fall or winter, or else carried over and sold the next season. It has been found by experience that a growing pig can be developed well during the summer season, but that feeding a young pig during the winter season is only rarely successful. A hog may be fattened to very good advantage during the winter.

WINTER FEEDING.

The reason that winter feeding is not as successful as summer feeding is indicated at least in part by the recent experimental data of the writer. This is especially true in the corn belt of the United States where corn, a carbonaceous concentrate, is the principal feed. This may be used in summer feeding to fairly good advantage. The pig under such conditions will get the nec-

essary carbohydrate from the corn and will get a little protein, probably sufficient for maintenance. Then if he has access to pasture, he will get more or less mineral matter and protein from the soil, herbs and grasses of the pasture. In case clover or alfalfa is available considerable protein will be obtained. These will supplement the carbonaceous concentrate sufficiently well so that good results are possible. During the winter season, when pasture is not available and the growing pig is required to develop on corn alone, he cannot progress satisfactorily.

Another series of data show that a given and definite amount of water is very essential for the proper development of the pig. During the summer season when the weather is warm, and many times hot, the pig will drink a considerable quantity of water. On hot days he will even drink too much. During the winter season, with the other extreme of temperature, the pig will not drink enough water for normal development. Furthermore, when pigs have access to pasture they will take a considerable amount of exercise which is conducive to good respiration; hence they take in an abundance of oxygen. During the winter season when the weather is cold the pig will take less exercise, so that this source of food supply will be greatly curtailed and the pig will suffer accordingly. Consequently, lack of a sufficient quantity of protein, of water, and of oxygen is apparently the most serious handicap to the winter feeding of pigs. If these can be supplied pigs apparently can be fed with equal success in winter as in summer except in very cold climates.

HOGGING DOWN CORN.

This practice, consisting of letting the pigs eat the corn from the stalks in the field, has become quite common

during recent years because it saves labor. It has its advantages and disadvantages. The advantages are that it saves the labor of gathering the corn for the pigs, furnishes the grain to them in its natural and therefore most palatable form, and distributes the manure on the field, thus saving all of it and saving the expense of hauling it out. The disadvantages are that the corn in this form is not always available at the proper time. Corn cannot be used successfully as an exclusive feed for swine except during the fattening period, which should not occupy more than about eight weeks at the close of the feeding period. During this time, corn may be given in this manner to good advantage, but when fattening hogs are allowed free access to a corn field, they are likely to waste a considerable quantity. If younger pigs are allowed to run with the fattening hogs to pick up the part that the older hogs waste, this may be saved, but growing pigs will not develop properly under such conditions.

If a pig or a growing hog is allowed free access to the corn field there is great danger that he will eat more than he can use to the best advantage. The hog must have a suitable quantity of protein as well as mineral matter, besides the carbonaceous concentrate, corn. If he eats too much corn, he will have a decidedly unbalanced ration and will not develop as he should. If at the same time he is given free access to nitrogenous concentrates like soy-beans or peas, he may eat either the corn or the nitrogenous concentrate, according to the way he has been trained or as his appetite dictates. Hence he will not do well in either case because neither one nor the other of the two above mentioned feeds will allow the hog to develop normally. It is only by furnishing the proper quantity of the various food nutrients per hun-

dred pounds live weight that the best results can be obtained.

WORK OF EXPERIMENT STATIONS.

The experiment stations of the world, and especially those of the United States, have done a great deal of work along the line of swine feeding. The major part of this work has been in the nature of short feeding trials to test the value of different feeds and different rations. Considerable of this work also was directed along the lines of the analysis of feed stuffs and to determine the coefficients of digestibility for the feeds. In the main, the results of this work as a whole are good, but very often such results are greatly influenced by the conditions under which they were determined. In such cases, if they are to be used correctly, they must be properly interpreted. A few examples may be cited in this connection as follows:

The American experiment stations have determined that skim milk has a value that is considerably greater than was determined by Danish experiments. In the American experiments 4.75 pounds of skim milk is equal to 1 pound of grain, while in the Danish experiments it requires 6 pounds of skim milk to equal 1 pound of grain. The question naturally arises, Is there any difference in the skim milk of different countries when it has been obtained by similar processes, namely, by centrifugal means of separation? By studying the data from which these results were obtained it is seen that in the American experiments the skim milk was usually fed as a supplement to corn, while in the Danish experiments small grains, such as rye and barley, were used.

There are a few fundamental principles that are necessary to get good results from any system of swine feeding. One is that the pig must have a certain amount of protein, more than is found in corn. In other words, he must have a more nearly balanced ration than corn can supply. Secondly, he should have a variety of feeds because the greater the number of feeds in a ration the better will be the results obtained from its use. When skim milk was used in the American experiments in addition to corn, it furnished the protein and also improved the ration very greatly by way of variety. Corn is a carbonaceous concentrate and skim milk in limited quantities is a nitrogenous concentrate. Thus by the addition of skim milk to this otherwise corn ration, very much better results are possible which would naturally be accredited to the milk. Aside from this, by comparing corn with corn and skim milk, the latter ration is double in efficiency so far as variety is concerned.

In the Danish experiments where several small grains were used, neither one of these differences is so great. The small grains, such as barley and rye, contain more protein than corn; hence the addition of the protein in the skim milk was not so effective. Where several small grains are used in the basal ration, the addition of skim milk does not improve the ration so greatly by way of variety. Consequently it is easily seen how results like these must be properly interpreted before they can be used to the best advantage.

American experiments also show that cow-peas are equal in food value to corn. Cow-peas are a nitrogenous concentrate and corn is a carbonaceous concentrate. Neither one of these two feeds used separately produces a well balanced ration. In the one case there is too much

protein and in the other too much carbohydrate. Thus in a test of this kind there is simply a balance between two evils, one of which is as great as the other.

Another American experiment has shown that rape is a better feed for swine than clover. Here again the conditions under which the results were determined are of the greatest importance. In this particular case the basal ration, or the feeds that were used supplementary to pasture, was made up of middlings and skim milk. Middlings and skim milk are both classified as nitrogenous concentrates and when fed in connection with clover pasture, three nitrogenous feeds were used in the ration. When fed in connection with rape, two nitrogenous and one carbonaceous feed were used, the rape being carbonaceous in nature. In the former case it is quite evident that an excess of protein was fed and a deficiency of carbohydrate which clearly would not produce as good results as in the latter case where the ration was more nearly balanced.

Thus very many results from experimental data need proper interpretation. In the main, however, much valuable work has been done by the experiment stations of the world, which needs only a little more study and a little more supplementary experimentation to put the entire system of swine feeding upon a much firmer foundation.

CHAPTER XII.

THE WOLFF-LEHMANN STANDARD.

Several decades ago the German scientists, whose names are represented in the title, worked out the above named feeding standard. The foundation for this apparently is the nutritive ratio of the ration and the appetite of the pig. By nutritive ratio is meant the relation in energy value between the protein on the one hand, and the carbohydrate and fat on the other. The way it is obtained is as follows:

NUTRITIVE RATIO.

Since the fat of ether extract furnishes 2.25 times as much energy as either the protein or the carbohydrate, this nutrient is always multiplied by 2.25 in order to reduce it to the equivalent of the other two nutrients. To this is added the carbohydrate of the ration, and the sum is then divided by the protein, the quotient being the nutritive ratio. Thus supposing that a certain ration contained 2 pounds of protein, 8 pounds of carbohydrate and 1 pound of fat or ether extract the problem would be solved as follows:

Fat

$1 \times 2.25 = 2.25$ of carbohydrate or protein equivalent of fat.

$2.25 + 8 \text{ lbs. of carbohydrate} = 10.25.$

$10.25 \div 2 = 5.125.$

The nutritive ratio of the above ration then is 1:5.125 and is read 1 to 5.125.

REQUIREMENT OF NUTRIENTS.

This standard calls for certain definite quantities of dry matter, and of the nutrients protein, carbohydrate and

CUT 17.—GRAPHIC SCHEME FOR PIG FEEDING.

ether extract, at different stages in the life of the pig, which can be shown to best advantage by means of

curves as shown in the cut, 17. The horizontal spaces in the illustration as indicated by the numerals at the top of the cut, represent weeks and months, as shown, from the ages of 3 to 9 months. The vertical spaces, as represented by the numerals at the left, give the values of the different curves in pounds of dry matter, protein, carbohydrate and ether extract, required daily per hundred pounds live weight. It will be seen from this cut that the curves start at a comparatively high point and end at a comparatively low point. They do not fall gradually between these two points, but decline rather slowly at first, then more rapidly, then again more slowly toward the close. The fluctuations of the curves in this standard are practically in harmony with the curve which shows the total amount of feed eaten by pigs when fed according to the dictates of their appetites, as shown in the third section of the cut on page 24. This shows that a pig when young will eat a comparatively large quantity of feed, and that he gradually eats less per 100 pounds live weight as he gets older, and that the curve fluctuates with greater rapidity at different times practically the same as the curves in the Wolff-Lehmann standard as given above.

THE STANDARD AND THE PIG.

The manner in which this standard is used is to mix the feeds of the ration according to the nutritive ratio specified therein, trying at the same time to supply the total amount of dry matter called for by the standard, and then to feed the pigs as much of this as they will readily eat. By using this system of feeding for a number of years, the writer has shown that when ordinary feeds are used in a ration of this character and mixed according to the nutritive ratio specified by the standard,

the pigs when put nearly on full feed will eat practically the quantities of digestible nutrients called for by the standard. Apparently, then, the standard was built up on the basis of the appetite of the pig. But the appetite of the pig is more or less abnormal and determined very largely by feeding and environment, not only at the time, but also through several previous generations.

RESULTS FROM USE OF STANDARD.

This standard has been widely used by different experiment stations during late years, and has also been adopted by many private feeders of swine. The results obtained by its use are not always satisfactory, and where thoroughly tested are not so good as can be obtained by other systems of feeding. The reason for this, as determined by the writer, are two-fold: First, some pigs whose appetites are well developed may eat too much when fed in such a manner. They may eat more than they can use to the best advantage for tissue building, which is detrimental to the pig thereafter by establishing the factor of waste. Second, the amounts of the various nutrients of the ration, according to this system of feeding, are not fed in accordance with the requirements of the laws of nutrition according to which the greatest and most economical gains are produced; consequently the best results are not obtainable.

CHAPTER XIII.

AUTHOR'S METHOD OF FEEDING.

Since the common practice of swine feeding needs further development, and since the Wolff-Lehmann standard does not give maximum and most economical gains, a new method of feeding has been developed. This work was started by the writer in 1898 at the Wisconsin Agricultural Experiment Station, continued for several years by practical swine growing on the farm in which scientific data were put into practice, and then continued in an experimental way since 1903 at the Illinois Experiment Station, and is still in progress. Although this new standard has not yet been definitely developed in every detail, sufficient headway has been made and enough facts of importance have been determined to warrant a discussion of this new system of feeding.

FACTORS IN FEEDING.

In the cut on page 148, taken from a prospective bulletin manuscript as well as part of the discussion relative thereto, the vertical lines represent the age of the pigs in weeks as shown at the top. A D represents the live weight from the time they were 17 weeks old, when the experiment started, up to the close when they were 46 weeks old. As the feed is calculated in per cent of live weight, and in order to make the illustration more simple, this is represented as constant. The space between the curves L and A represents the total amount of feed eaten daily in per cent of live weight multiplied by

CUT 18.—PIG-FEEDING DATA IN LINES.

100. It shows that the pigs ate the most feed when they were 23 weeks old, and that there was a marked reduction in the amount of feed eaten after the thirty-first week. The division E A represents the part of the ration used for maintenance, which, according to the maintenance experiments of the writer, is a constant quantity.

Maintenance Requirements.—The amount of feed required by a pig for maintenance has never been accurately determined. The writer, however, by means of several experiments of an empirical nature, as well as two digestion and metabolism experiments that were quite complete, has determined approximately how much of the various food nutrients are required daily by a pig for maintenance.

It has been found that a pig requires daily as a maintenance ration per hundred pounds live weight, .1 pound of digestible crude protein, .4 pound of digestible carbohydrate, and .04 pound of digestible ether extract. It has further been found that the maintenance requirement is the same, when considered in per cent of live weight, for pigs of different ages and different weights, as well as for pigs of different breeds and of different conformation. This is contrary to the idea universally held, namely, that the older the pig, the more he requires for maintenance. While it is true that as the pig increases in age and size he requires more in absolute quantity in accordance with his weight, yet the fact that the gains are more expensive as the pig advances in age is not because he requires more for maintenance. It is caused by an increase in the factor of waste and a decrease in the amount of feed eaten daily per hundred pounds live weight.

Factor of Waste.—When a pig is fed more than a certain quantity of food nutrients, especially protein, he does

not use the excess over and above this quantity as economically for producing gains in live weight as when fed a quantity below this amount. The portion that is lost on account of this less economical use is what is called the factor of waste. When an animal is once put under such conditions, the habit of wasting apparently is more or less permanently established.

On account of the tendency of the animal body to establish nitrogen equilibrium there is a constantly increasing quantity of crude protein wasted (excreted without having served any purpose in the body whatever). This also consumes considerable energy and possibly causes physiological disturbances which, together with the carbohydrate and ether extract that may also be wasted, along with the crude protein, makes up the factor of waste represented in the drawing by G E. It will be noticed that at the point when the pigs were 33 weeks old, the feed used for maintenance plus the feed used to supply the factor of waste is equal to the total amount of feed eaten. This left no feed to be used for putting on flesh and fat and the result was that the pigs made no gains in live weight at this time. They remained stationary throughout the period of one week. This is a point where nitrogen equilibrium (an equality between the amounts coming in and going out) probably was either established, or exceeded.

It is supposed that at birth the factor of waste is absent or at least at the lowest possible point and that in this experiment it was constantly increased up to the point H. But if the facts of the case were known, as already indicated, it is probable, and very likely, that the curve GH would run at a higher level than is here represented, and that it had reached its highest point some-

where between M and S and then gradually descended to H.

This would leave a smaller part of the ration available for making gains than is represented in the cut. It will be noticed that at the point S, when the plgs were 31 weeks old, they "went off feed," and after this time ate but little more than was necessary for maintenance and for waste. At the points V and X the curve for feed eaten actually runs below the curve for the feed required for maintenance and for waste. The result was that the pigs lost in weight.

In order to illustrate the factor of waste the following example taken from proposed bulletin manuscript, is given: Suppose that a young man from the country with economical and good moral habits goes to the city to take up his life's work and receives a salary beginning at \$50 per month. Going from the country, where the opportunities for spending money are limited, and going from a family where such young man has received economical training, he will be able in the city on a salary of \$50 per month to live on about half of this, or \$25 per month, spending about \$15 per month for room and board and \$10 per month for clothes and incidental expenses. This will allow him to "lay by" \$25 per month, which will start a bank account at the beginning and which will gradually be increased month by month. But as time progresses and this man becomes acquainted more and more, he will gradually take up the mode of living that is practiced by his associates, will go into more and better society, will wear better clothes, board at a higher priced boarding house, live in a better room, and spend more for transportation in going to and from his work, etc. This will gradually but surely increase his living expenses so

that the \$25 per month that was set aside at the beginning with which to increase his bank account will gradually be cut down, and before very long there will come a time at which he will have established a money equilibrium, or, in other words, the total receipts from his salary will just balance his total expenditures, which will result in zero as far as increasing his bank account is concerned. In order now to further increase his bank account, his salary must be raised, say to \$75 per month. This for the time being will again allow him to set aside \$25 per month, but as time again progresses his expenses will naturally increase so that before many years have elapsed he will again have established an equilibrium between his income and expenditures. In order to allow a further increase in said bank account the salary must again be increased to, say \$100 per month. The process will here be repeated, allowing an increase in the bank account at first and again establishing an equilibrium later on. This illustrates the tendency in the animal body toward nitrogen equilibrium, namely, to excrete as much nitrogen as is taken in in its food.

The establishment of the factor of waste, or the higher rate of living in the case of the young man, is not an absolute necessity, but the natural result of prevailing conditions. Thus also a pig, apparently, does not necessarily have to establish the factor of waste, but usually does under prevailing conditions of high feeding because either too much is fed, or the amount fed to a bunch is not equally distributed, resulting in an excess for those eating the most; or, the environment may be changed so that the pig cannot use a constant quantity and is fed the same as usual.

If the pig requires .1 pound of protein per day per

hundred pounds live weight, to supply its normal protein metabolism, and is getting .6 pound in its ration, it will be able to use for storing up in its body .5 pound, provided there is no waste. Obviously, however, this does not necessarily make .5 pound of protein tissue in the body. This is comparable to the bank account in the illustration used. However, on account of the tendency of the animal body, under prevailing conditions to establish nitrogen equilibrium, this .5 pound that at first was used to increase the store of protein and thereby add to the live weight of the pig, will gradually be decreased. After feeding this constant quantity of .6 pound for some time there will be a tendency to establish nitrogen equilibrium so that the animal will be excreting as much protein as is eaten without storing any of it in its body. In order to further increase the store of protein in the body, it is necessary to increase the amount of feed exactly similar to the increase in the salary of the man in the illustration given.

Suppose now that the pig has come to a point of nitrogen equilibrium by eating .6 pound of protein per hundred pounds live weight daily. As it gets older the pig normally eats a smaller quantity of feed per hundred pounds live weight daily, which naturally also decreases its protein supply. In order to show what will take place under these conditions, the case already used as an argument will again be taken up at the point at which it was left, namely, granting that the young man has come to a monetary equilibrium when he is receiving a salary of \$100 per month. If now his salary is cut down to \$75 per month, what will take place? The man, having become accustomed to living at the rate of \$100 per month, will, on this reduced salary, at least for some time, draw upon

his bank account to supply the deficiency. But knowing that his bank account under these conditions will eventually become obliterated, he will, or at least he should, gradually accustom himself to living less extravagantly, finally reaching an equilibrium at \$75 per month. This then will eliminate the factor that is drawing upon his bank account, and if he is of an economical disposition, he will reduce his living to a little less than \$75 per month, again enabling him to add to his store in the bank. The amount he can save, however, will not be as great as it was at the beginning of the period when his salary was increased from \$50 to \$75 per month, because it is a difficult matter to reduce the expense of living, after it has once been set up, to the point where it was before such extravagant habits were learned. If now his salary is reduced to \$50 per month, or the point at which he started, the same process of drawing on his bank account to supply the deficiency will be repeated, and it will be with exceedingly great difficulty that it will be possible for this man to return to his former basis and be able to lay up any of his salary at this time.

The same thing apparently takes place in the protein metabolism of the pig. The pig being accustomed to metabolize for maintenance and waste .6 pound of protein per day, which is received in its ration, will, when this is reduced to a smaller quantity, use more for these purposes than is received and consequently will reduce its store of protein tissue in the body. However, after being fed a reduced quantity for some time, this factor of waste is gradually reduced, the pig again reaching a point of nitrogen equilibrium on the reduced quantity of feed. This may be continued as in the case we have used, but under normal conditions it will never be possible to bring the

pig back to a point where it will be able to use for making protein tissue as much of the protein of its feed as it was able to use prior to the time at which it was fed the maximum quantity.

It has been found that the influence of this high protein feeding will, under normal conditions, continue in the metabolism of the pig indefinitely, and that the factor of waste, when once established, is eliminated with very great difficulty. Consequently the pig, after having once been fed an excess of protein, is not as economical a meat producer as it was before that time, unless this factor of waste is eliminated or materially reduced.

If the factor of waste is once established, it can be materially reduced by feeding the pig for a considerable length of time a smaller quantity of feed, especially protein. Perhaps the best way to do this is gradually to reduce the feed during a period of about four weeks. If the reduction is too rapid, the pig will, on account of this tendency or habit that was established by previous feeding, continue to metabolize and waste material in accordance with the amount of feed previously eaten. If not enough is present in the ration to supply this rate of excretion that was established, the tissues of the body will be called upon to supply the deficiency. This results in the breaking down of the protein tissue with a tendency to reduce the vitality of the pig, and at the same time check the amount of gains being made.

Feed Available for Making Gains.—The amount of feed that is available for making gains depends upon the two mentioned factors,—first, the factor of maintenance will have to be supplied; second, the factor of waste will consume what is necessary for it. If a pig is able to eat and digest more than is used to supply these two factors,

it can use the remainder for tissue building or for making gains in live weight.

REQUIREMENT OF NUTRIENTS.

According to the author's system of feeding, the pig is fed certain quantities of digestible nutrients per 100 pounds live weight daily as follows:

CUT 19.—WATER REQUIREMENT OF MARKET PIGS.

Water Requirement.—In the above cut as well as in those on pages 157, 158, 159 and 160, the weeks are indicated at the top. The second line shows that the pigs are two months old at the beginning, the time at which they are weaned. Thus the horizontal spaces represent time; the vertical spaces as shown by the figures at the left represent pounds. The value of the curve at any particular age of the pig is obtained by taking the amount in pounds, as indicated at the left, for the point at which the curve crosses the vertical line indicating the age of the pig.

This cut shows the total amount of water required by the growing and fattening. Starting at two months of age it should have 13 pounds daily, including that of the dry feeds, per hundred pounds live weight. This is gradually reduced to 10 pounds at about five and one-half months of age and then to 5 pounds at eight months of age.

For pigs that are being developed for breeding purposes the water curve should run during the same time from 13 pounds to about 9 pounds, as shown in the cut inserted below. After this it should remain about constant.

CUT 19A.—WATER REQUIREMENT OF BREEDING PIGS.

By giving the pigs dry feed or a thick slop and then free access to water they do not do as well as in cases where the specified quantities of water are mixed with most of the dry feeds in the form of slop. During the cold weather of winter the pig under such conditions will not drink enough and during the hot weather of summer it might even drink too much, but the latter is the lesser of the two evils.

While the pig requires certain definite quantities of water, as already outlined, when fed the required amounts of other digestible nutrients, it may, under other systems of feeding, require different quantities of water, in accordance with the manner of feeding. It has been found that when a pig is fed large quantities of protein it also needs large quantities of water. The water apparently is necessary in protein metabolism as well as to excrete the waste products.

Protein Requirement.—The following cut shows the amount of digestible crude protein required by market pigs daily per 100 pounds live weight, for maximum and most economical production. The curve starts at .6

pound at the beginning of the feeding period, and rises to .7 pound during the first seven weeks. Following this it declines to .6 during four weeks' time, then maintains a level of .65 pound for the next seven weeks. After this the greater part of the nitrogenous feeds is removed from the ration during four weeks' time and the pigs are finished principally on corn with just a little of some other feed added.

CUT 20.—PROTEIN REQUIREMENT OF MARKET PIGS.

The amount of protein shown above need not be taken as absolute, but should be modified to suit the length of the feeding period. As practiced by the writer, the market pig is fed for six months, from the third month to the ninth month of its life, according to this formula. Thus the pig is eight months old at the close of the feeding period. With this practice the last eight weeks is considered the fattening period, and the first 18 weeks the growing period. This growing period is divided in the middle by a period of four weeks, during which the protein curve drops for the purpose of reducing the factor of waste. With a short growing period a continuous increase during the period would be all right, but when a comparatively large quantity of protein is fed, for a considerable length of time under practical conditions, the factor of waste apparently becomes so great that feeding is relatively more unprofitable.

It must be remembered that the quantity of protein

given above is intended for growing and fattening pigs that are to be finished for market by the time they are eight months old. Pigs intended for breeding purposes should not be fattened to the same extent that market hogs are and should not be fed so much protein because this sets up the factor of waste, making them more unprofitable afterwards. The protein requirement of such pigs is shown in the following cut:

CUT 20A.—PROTEIN REQUIREMENT OF BREEDING PIGS.

This curve starts with pigs at the same age as the one above and takes them past a year of age. About this time it is assumed that the young sows will farrow and must be fed with reference to this. After farrowing and raising their litters they will be considerably reduced in weight and can then be started on a somewhat higher quantity of protein than they received immediately before farrowing. This then should be reduced again to about .2 pound or less at two years of age when they reach maturity.

A pig seems to be very sensitive to the amount of protein fed, especially during early age, and is very easily stunted by an excess. It may even be overfed before it is weaned so that its final live weight will not be as great as it would be if it were not overfed at this time.

CUT 21.—CARBOHYDRATE REQUIREMENT OF MARKET PIGS.

Carbohydrate Requirement.—The above cut shows the amount of digestible carbohydrate required by pigs that are being fed for market. It will be noticed that pigs from the third to the sixth month of age, inclusive, should have from 2.4 to 2.8 pounds of digestible carbohydrate daily per hundred pounds of live weight. During the last eight weeks of the feeding period the pigs may be put on nearly full feed on a ration that is primarily carbonaceous in nature. Pigs with a low degree of vitality cannot take this much.

Pigs intended for breeding purposes should have less carbohydrate than those that are fed for market, as shown in the cut inserted below:

CUT 21A.—CARBOHYDRATE REQUIREMENT OF BREEDING PIGS.

The latter part of this curve as well as the latter part of the protein curve showing the protein requirement of breeding pigs have not as yet been as thoroughly worked out as the other points mentioned, but are believed to be essentially correct.

Ether Extract Requirement.—As determined by the writer, pigs will make larger gains if they are given a little more fat in their ration than ordinarily is present in the common feeds of the farm. Soy-beans contain more than the ordinary amount of fat or ether extract; consequently if this feed is used in a ration, it will be better than when other feeds not containing as large a quantity of fat are used.

Mineral Matter Requirement.—Since the amount of mineral matter present in the soil, in the water, in the vegetation and in different feeds, as previously stated, is so decidedly variable, and since there is no standard for the requirement of mineral nutrients by the pig, it seems necessary, in order to get best results in pig feeding, to give the pig free access to a variety of mineral substances so that he can supply, according to the dictates of his appetite, whatever is deficient by way of mineral substances in his feed. In order to supply these mineral substances the results on the Illinois Experiment Station farm seem to be quite satisfactory if the pig is given free access to salt, charcoal, ground lime stone, bone meal, wood ashes, clean soil and soft coal cinders. These, with the exception of the last two, are kept in different compartments of a trough before the pigs at all times.

THE PIG AS A MACHINE.

In order to illustrate further the efficiency of the animal body as a machine for converting feed into pork, attention as directed to a farm operation with which all are familiar.

Suppose a field of wheat in the shock that is to be threshed with a steam thresher and sheaves of wheat are to be used with which to fire the engine. After the engine

has been fired and everything is in readiness to begin threshing, this may be compared to the process of swine feeding. The wheat that is used in the engine for fuel represents the feed used by the pig for maintenance and to furnish the energy for digesting and assimilating the feed, also to excrete the waste products. The grain that goes into the sack represents the gains made; the grain that blows over, the waste; and the straw, the feces. When the machine is run empty, the wheat used as fuel in the engine represents the actual quantity of feed used for maintenance, after eliminating the factor of waste. As grain is fed into the machine, more fuel is required in the engine; some to handle the material that is being fed into the separator, besides that to run the machine itself.

When grain is fed into the separator only in small quantities, the effectiveness of the machine is greatest; that is, under these conditions more of the grain is saved. As the machine is being crowded toward the upper limit of its capacity, more grain is left in the straw, and more passes across the sieve, because a larger part of the sieve becomes clogged, allowing a smaller quantity of grain to pass through into the sack or wagon. More grain is also required to furnish the necessary fuel in the engine. Now, as the upper limit is reached so that the engine is pulling a full load and the sieves have become largely clogged so that a considerable portion of the grain goes into the straw stack, and the amount of grain fed into the separator is again reduced, the machine gradually becomes more effective; that is, as a smaller amount of grain is fed into the separator, less fuel is required in the engine, more grain is threshed out of the straw, and more of the material that has clogged the sieve is gradually rattled out, allowing more of the grain to pass through into the

sack. But it takes considerable time for all the material that has clogged the meshes of the sieve to shake out so as to allow the machine to become as effective as it was at the beginning. From this it is seen that the grain thresher is more effective when not crowded to its fullest capacity. It is also more effective when the moderate quantity thus handled is approached from below than when it is approached from above. These same processes can be traced in pig feeding, only that it takes longer in case of the pig to eliminate the factor of waste.

Beyond a certain point, depending on the relation of maintenance ration to full ration, the animal body is more economical with the feed eaten when it is fed a smaller quantity than when it is fed a larger amount of feed, because the factor of waste, due to excessive feeding and the tendency toward nitrogen equilibrium, which is present under prevailing conditions, in the animal body becomes larger as the amount of feed eaten is increased. Add to this the great quantity of feed required for digestion and excretion of the waste products, and it is readily seen how the ration becomes less effective with the increase in the amount of feed eaten. On account of this tendency toward nitrogen equilibrium, and the difficulty with which the factor of waste is eliminated, the ration fed to the animal is more effective when the proper quantity of feed has been approached from below than when it has been approached from above, similar to the grain thresher.

VARIETY IN RATION.

It is important that the ration for swine be made up of more than one or two feeds. While a perfectly balanced ration, so far as protein and carbohydrate are concerned, can be made up from two feeds, as corn and soy-beans

for instance, such a ration is never as good as one that contains more feeds. The greater the number of feeds the better the ration. This is true because different feeds contain different materials, some of which probably are not as yet differentiated from the regular classes of nutrients, but at the same time are necessary in the metabolism of the pig. In order to be sure to supply these as nearly as possible, and in order to make the ration palatable, it is always better when it contains a large number of feeds rather than a small number.

THE APPETITE OF THE PIG.

The total amount of digestible nutrients needed by a pig, or rather the total amount that he can use to the best advantage, is determined very largely by the pig's appetite. A pig that is put on full feed seemingly will not make the gains in live weight that he would if he were fed a little less than this. However, the amount of feed that will be eaten depends largely upon the extent to which the pig's appetite has been developed, which is determined by the way he has been bred and by his ability to use the digested material. The latter depends upon various conditions. While the quantities of digestible nutrients specified previously are given as the amounts necessary to produce the best results, it is not necessarily true that all pigs will eat this quantity. In fact, under certain conditions, they could not eat this much under any consideration. At other times this function of the pig will be developed to such an extent that he may use to the best advantage even considerably more. In order to develop a pig's appetite he should never be overfed. If once he is overfed, he will probably never again eat as much as he would if this had not happened. Furthermore, the

amounts of feed that can be consumed profitably by a pig will depend very largely upon the character of the ration. A bulky ration fed during the early part of a pig's life will increase his capacity so that later in life he can eat more than would be possible if he received only concentrated feeds at first. Again, if too much protein is fed early in life, it will limit the total amount of feed that is eaten and therefore allow the capacity of the pig to be relatively decreased.

Two bunches of pigs may eat the same quantity of feed at the same time and may produce entirely different results. This may be due to the extent to which the appetite of the pigs in the different lots has been developed. If one bunch of pigs eats its feed with greater avidity, it will do better on the feed than the other bunch that has practically all it can eat on the same quantity of feed. That is, the margin above the amount of feed that is given, to the amount that would be eaten if the pigs were put on full feed, is of considerable importance. As already stated, a pig will make better gains if fed small enough quantities so that he will leave the trough with his appetite not quite satisfied. At the same time he should be so fed and trained that he will eat enough for maximum development. Other factors that exert a considerable influence on the extent and economy of the gains made are the influence of environment and the influence of previous generations.

INFLUENCE OF ENVIRONMENT.

The influence exerted by environment upon animals is of considerable importance. A pig will behave in accordance with the conditions under which he is kept. If he is allowed to roam over a large pasture he will, if conditions

are favorable and if he has been properly trained, take sufficient exercise to stimulate the various functions of the animal body to their greatest usefulness. That is, the pig under such conditions will be able to eat and digest more, and will be able to use the digested material to better advantage, than if such exercise were not taken. The amount of exercise taken by pigs also is determined very largely by various conditions and is also a matter of training. It is thought that the principal means by which exercise increases the development of the pig is that it increases the amount of oxygen taken in and also stimulates the digestive organs to better action.

If a pig is kept in small "quarters" and cannot take the necessary exercise, he will be likely to lie around a great deal, and lying in the position that a pig naturally takes when out of "order," namely, on his abdomen, interferes greatly with proper respiration. This cuts off to a large extent one important, if not the most important, food supply, namely,—oxygen. The pig under such conditions, therefore, cannot utilize as much feed as he could under conditions where plenty of exercise is obtained, and cannot make as large or as economical gains. Furthermore, he will not be as healthy and may very easily be overcome by diseases of various kinds.

If pigs are changed from lots where they have had considerable exercise to lots where they do not have so much, their feed must be correspondingly reduced. Hence they will also make smaller and usually more expensive gains. If the weather conditions are such, as for instance, when it is very cold, that the pig does not take the usual amount of exercise, the ration should also be reduced correspondingly. Other conditions of environment may also necessitate changes in rations.

Thus it is seen that a pig is subject to the environment under which he is kept and is always subject to a considerable extent to habit or training. If a pig has gotten into the habit of taking considerable exercise, he will be a much better pig than if he is trained to keep quiet. This, of course, is more important during early life than during the fattening stage. However, it is believed that even a fattening hog will do better with a certain amount of exercise.

INFLUENCE OF PREVIOUS GENERATIONS.

Under this head may be considered very properly the subject of breeding in so far as it applies to the acquisition of different characteristics. It is generally recognized that if pigs are selected and bred for a number of years along certain lines, they will produce results accordingly. That is, if pigs are bred to a small type, they will not make as large gains as those that are bred to a larger type. Again, certain conditions produce hogs of the fat or lard type, while other conditions produce bacon hogs, etc. The influence of various conditions under which previous generations were kept is then transmitted to the offspring in the form of acquired characteristics, and a pig will produce results largely in accordance with the manner in which he has been bred.

The influence exerted by the immediate ancestors is not so generally recognized. It, however, seems to be a fact that the manner in which a pig develops depends very largely upon the conditions under which the dam was kept as well as on the manner in which she was fed. A sow that has been improperly developed is not likely to produce either as many or as good pigs as one that was properly developed. The sire also exerts his influence.

FEEDING TOO MUCH AND TOO LITTLE.

There is great danger of over-feeding a pig. If once he is over-fed, he will never, as already stated, eat as much feed thereafter as he otherwise would. Furthermore, the effect of over-feeding is very great and carried along for a considerable length of time in the form of the factor of waste.

The period of greatest growth is with the young animal. As the animal gets older he gradually loses this power of growth. The feed required for maintenance, as already learned, is a constant quantity, and in general as a pig gets older, he eats a smaller quantity of feed daily per hundred pounds live weight. In order to get the best possible results, a pig must eat as much as he can use to the best advantage. If too little feed is consumed, the factor of maintenance, or the feed required for maintenance, becomes relatively greater and consumes more of the ration. If the pig is fed too small a quantity when he is young, he cannot eat as much later in life as is consistent with the largest and most economical gains, for various reasons. First, he naturally eats a smaller quantity of feed as he gets older; consequently, if he is not given as much as he can use profitably when he is young and able to digest a large quantity, the period is passed during which he can consume a large quantity of feed. Secondly, if he is fed either too small a quantity of feed when young, or if the ration is fed in too concentrated a form, or if too much protein is fed (which is very largely the limiting factor because the part of his internal mechanism which handles this nutrient cannot handle more than a limited quantity), the capacity of the pig's digestive apparatus gradually adapts itself to the quantity of feed consumed. It therefore under such conditions becomes relatively

smaller so that the pig cannot consume as much feed later in life as is consistent with the most profitable results to the feeder.

Therefore, if the largest and most economical gains are to be obtained, the pig must be fed as much early in life as he can use to the best advantage, and at the same time be fed a ration of such form that the capacity of the digestive apparatus will be relatively increased so that later in life, when he naturally would eat a smaller quantity, he may be induced to eat more.

LARGE GAINS AND ECONOMICAL GAINS.

It is commonly supposed that the larger the gains made by pigs, the greater is the profit from such feeding operations. This, however, is not necessarily true. The two do not always go hand in hand. This is usually true for short periods of feeding, but not always in the long run; for, if a pig be fed more than he can use to the best advantage, he will establish a high factor of waste, which will make the gains more expensive, even though they are as large as could possibly be obtained.

In order to derive the greatest profit, pigs must be fed so that the gains are both large and economical. A pig should not be allowed to establish a high factor of waste, and the feeds should be selected so that they are best adapted to the needs of the animal. That is, during the growing period the pig should have considerable protein, as well as the other nutrients, so it can add lean meat to its body and gain in bone and fat. Later in life, when the factor of waste has become high and the pig should fatten, the gains can be made more economically on carbohydrate feeds; but, at the same time, sufficient protein should be fed to stimulate the digestive and

assimilative functions to their greatest and most economical action as well as to supply protein metabolism.

SELECTION OF FEEDS.

Feeds should be selected primarily with the end in view of furnishing the proper quantity of digestible nutrients in a palatable form as follows: Water, protein, carbohydrate, ether extract, mineral matter and also bulk. While some feeds may have values other than those of the content of digestible nutrients, it is considered that if a pig is properly fed these become of minor importance. Home-grown feeds should be used where possible, but when these are not available commercial feeds may be substituted. While many of the commercial feeds are all right and as good, perhaps, as those that may be grown on the farm, the profit in general is greater from home-grown feeds. Furthermore, the supply of commercial feed is limited and available only to a comparatively small number of feeders.

Pasture should always be made use of whenever available because it not only furnishes feeds in the most palatable and cheapest form, but also mineral matter, and provides exercise. The latter perhaps is of the greatest importance and when not available on pasture it should be supplied by some other means.

A variety of feeds should be grown which should be properly selected from the different groups, being sure to include enough of the nitrogenous concentrates to supply the necessary amounts of protein for the proper development of the pig. Some of the carbonaceous concentrates such as corn, rye, barley or rice, may be grown in almost any country where swine are produced. Nitrogenous roughages such as clover and alfalfa may also be grown in almost all places. Among the nitrogenous concentrates

skim milk may be secured almost anywhere, and soy beans or cow peas can be grown in the warmer climates, while Canada field peas will thrive in cooler countries.

The carbonaceous feeds in general must be used to make up the carbohydrate part of the ration, and the nitrogenous feeds to furnish the bulk of the protein. All carbonaceous feeds contain some protein and almost all nitrogenous feeds contain some carbohydrate; consequently, in the selection of feeds for a ration they should be combined in such quantities that the proper amount of digestible nutrients is supplied.

Water is found to a greater or less extent in all feeds. Those classified as dry feeds usually contain only a small quantity, about 8 to 18 per cent. Other feeds such as liquid feeds and succulent feeds contain as high as 85 to 90 per cent. However, since these sources of water, except that of the liquid feeds, are not sufficient, the pigs must be fed water directly as such. In order to get best results it is undoubtedly necessary, as shown by experimental data, to feed the right quantity of water as well as the right quantity of the other nutrients.

While the pig is an animal primarily adapted to the use of concentrates, and under five or six months of age apparently cannot assimilate as much as he can digest, best results are obtained if he is not fed more than he can finally use for the construction of body tissue and for necessary energy and heat production. In order to limit the nutrients to the amount that the pig can most profitably use, roughages may be introduced into the ration at this time. These serve a double purpose: First, they satisfy the appetite of the pig; second, they have a tendency to increase his capacity so that later in life, when he otherwise would not eat as much as he could

profitably use, he will be able to consume a larger quantity of nutrients. Roughages may also be used in considerable quantities by pigs that are simply being maintained. In such a case these feeds maintain the capacity of the digestive apparatus and satisfy the appetite. If too much concentrated feed, and especially protein or crude protein, is eaten, the factor of waste is set up which makes feeding much more unprofitable and may even prove fatal or result in developing permanent runts.

METHOD OF CALCULATING RATIONS.

According to the method of calculating rations here outlined, the pig is fed certain definite quantities of digestible nutrients daily per hundred pounds live weight, aside from the fact that it is necessary to maintain a certain relation between the concentrates and roughages of the ration.

Method of Procedure.—As an example for calculating a ration, which was also taken from manuscript that was being prepared for an Illinois Agricultural Experiment Station circular, the following may be taken: Suppose that a bunch of pigs were to be two months old and were to weigh 685 pounds, and that the curves in the preceding cuts were to show that at this time the pigs required daily per hundred pounds live weight, 12 pounds of water, .6 pound of digestible crude protein, and 2.2 pounds of digestible carbohydrate. Multiplying these quantities respectively by the total live weight, namely, 685 pounds, and pointing off to the proper figure, we find that this bunch of pigs will require a total of 82.2 pounds of water, 4.11 pounds of digestible crude protein, and 15.07 pounds of digestible carbohydrate per day. Suppose that alfalfa, corn, barley, skim milk, soy beans, and water are to be

used to make up this ration. To facilitate matters a table should be constructed specifying the amounts of digestible nutrients present in these feeds from one to nine pounds inclusive, as follows:

DIGESTIBLE NUTRIENTS PER POUND FEED.

CORN.						BARLEY.					
Lbs.	Wat.	Pro.	Car.	E. E.	M. M.	Wat.	Pro.	Car.	E. E.	M. M.	Lbs.
1	.13	.07	.66	.03	.01	.11	.08	.65	.02	.03	1
2	.26	.14	1.32	.06	.02	.22	.16	1.30	.04	.06	2
3	.39	.21	1.98	.09	.03	.33	.24	1.95	.06	.09	3
4	.52	.28	2.64	.12	.04	.44	.32	2.60	.08	.12	4
5	.65	.35	3.30	.15	.05	.55	.40	3.25	.10	.15	5
6	.78	.42	3.96	.18	.06	.66	.48	3.90	.12	.18	6
7	.91	.49	4.62	.21	.07	.77	.56	4.55	.14	.21	7
8	1.04	.56	5.28	.24	.08	.88	.64	5.20	.16	.24	8
9	1.17	.63	5.94	.27	.09	.99	.72	5.85	.18	.27	9

DIGESTIBLE NUTRIENTS PER POUND FEED.

SOY BEANS.						SKIMMILK.				ALFALFA.					
Lbs....	Wat....	Pro....	Car....	E. E....	M. M....	Wat....	Pro....	Car....	M. M....	Wat....	Pro....	Car....	E. E....	M. M....	Lbs....
1	.11	.30	.22	.14	.05	.91	.03	.05	.01	.08	.07	.37	.01	.07	1
2	.22	.60	.44	.28	.10	1.82	.06	.10	.02	.16	.14	.74	.02	.14	2
3	.33	.90	.66	.42	.15	2.73	.09	.15	.03	.24	.21	1.11	.03	.21	3
4	.44	1.20	.88	.56	.20	3.64	.12	.20	.04	.32	.28	1.48	.04	.28	4
5	.55	1.50	1.10	.70	.25	4.55	.15	.25	.05	.40	.35	1.85	.05	.35	5
6	.66	1.80	1.32	.84	.30	5.46	.18	.30	.06	.48	.42	2.22	.06	.42	6
7	.77	2.10	1.54	.98	.35	6.37	.21	.35	.07	.56	.49	2.59	.07	.49	7
8	.88	2.40	1.76	1.12	.40	7.28	.24	.40	.08	.64	.56	2.96	.08	.56	8
9	.99	2.80	1.98	1.26	.45	8.19	.27	.45	.09	.72	.63	3.33	.09	.63	9

By the use of this table tenths of pounds, unit numbers of pounds, and ten times unit numbers of pounds of vari-

ous feeds may be added to the ration by reading the quantities of nutrients correctly with respect to the decimal point. To get the nutrients for unit numbers of pounds read direct as given in the table, for tenths of pounds read with the decimal point one place to the left, and for ten times unit numbers read with the decimal point one place to the right. This simplifies matters by eliminating the multiplications at each operation. The abbreviations at the heads of the columns in the preceding tables stand for the following: Wat., Water; Pro., Crude Protein; Car., Carbohydrate; E. E., Ether Extract, and M. M., Mineral Matter.

Pigs two months old can use but a limited quantity of a roughage like alfalfa; consequently in making up this ration not much can be used at this time. Suppose that corn and barley are to be used in the proportion of 2 parts of corn to 1 part of barley, and that but a limited amount of skim milk is at hand. In order to make up this ration, then, the following is evolved:

The total amount of nutrients required per day for the bunch of pigs weighing 685 pounds, as determined above, is as follows:

Water.	Protein.	Carbohydrate.
82.2	4.11	15.07

In order to get these quantities the following amounts of feeds are necessary. These are obtained by first putting down the desired amount of the roughage (alfalfa), with its water, protein and carbohydrate; then the carbonaceous concentrates (corn and barley) and the skim milk. Have enough of these so that the carbohydrate when added will be nearly equal to the required quantity. Next list the nitrogenous concentrate (soy beans) in sufficient amount to bring up the protein as well as the

carbohydrate to the required amount. If this does not come out right the first time, it can easily be adjusted by means of the preceding table. When this is done, add sufficient water to bring up this part of the ration to the standard:

			Water.	Protein.	Carbohydrate.
Alfalfa	.3 lb. =		.024	.021	.111
Corn	10.0 lb. =		1.300	.700	6.600
Corn	2.0 lb. =		.260	.140	1.320
Barley	6.0 lb. =		.660	.480	3.900
Skim milk	40.0 lb. =		38.400	1.200	2.000
			<u>38.644</u>	<u>2.541</u>	<u>13.931</u>
Soy beans	5.0 lb. =		.550	1.500	1.100
Soy beans	.2 lb. =		.022	.060	.044
			<u>39.216</u>	<u>4.101</u>	<u>15.075</u>
Water	43.0 lb. =		43.0		
			<u>82.216</u>	<u>4.101</u>	<u>15.075</u>

The above mentioned quantities of feed, then, namely:

Alfalfa	1.0 lb.	Skim milk	40.0 lb.
Corn	13.1 lb.	Soy beans	6.3 lb.
Barley	6.6 lb.	Water	43.2 lb.

should be fed to these pigs for one day when they are two months old. In order to get the increase specified by the curves in the preceding cuts, under "Requirement of Nutrients," an estimate must be made as to what the pigs will weigh at the close of the week. Suppose that it is estimated that the lot will gain 65 pounds this week, making its total weight at the close of the week 750 pounds. This estimated live weight then should be multiplied by the increased quantities that are necessary at the end of the week as follows:

Water.	Protein.	Carbohydrate.
11.7	.615	2.22

Multiplying these by the estimated live weight the following is obtained as the requirement of nutrients at the

close of this and the beginning of the following week of the feeding period:

Water.	Protein.	Carbohydrate.
87.75	4.6125	16.65

To get these quantities, take the total amount of nutrients fed at the beginning of the week and add enough feeds so that the nutrients of the feeds will bring the total amount up to the quantity stated above, which is required at the end of the week. Proceed the same as above, namely, add the roughage first, the carbonaceous concentrates next, then the nitrogenous concentrates, and lastly the water. By so doing the following will be obtained:

		Water.	Protein.	Carbohydrate.
		82.216	4.101	15.075
Alfalfa	.7 lb. =	.056	.049	.259
Corn	1.0 lb. =	.130	.070	.660
Corn	.1 lb. =	.013	.007	.066
Barley	.6 lb. =	.066	.048	.390
		82.481	4.275	16.450
Soy beans	1.0 lb. =	.110	.300	.220
Soy beans	.1 lb. =	.011	.030	.022
		82.602	4.605	16.692
Water	5.2 lb. =	5.2		
		87.802	4.605	16.692

These quantities of nutrients correspond very closely to those above that were calculated as the requirement of nutrients at this time.

The above mentioned quantities of feed that were used to get the additional nutrients should be added to those fed at the beginning of the week, and the totals are the quantities to be fed at the close of the week. By adding these the following are obtained.

Alfalfa	.3 lb.	Skim milk	40.0 lb.
Corn	12.0 lb.	Soy beans	5.2 lb.
Barley	6.0 lb.	Water	43.0 lb.

This is the total quantity to be fed per day at the close of the week. The quantity of feed fed on the first day of the week may gradually be varied to that fed on the last day. Thus there will be a constant increase fed from day to day.

To determine the quantity of feed necessary for a bunch of pigs at any time between the ages of two months and nine months, the same method is followed as given. The vertical lines in the cuts indicate the age of the pigs and the stage of the period of feeding. The point at which these intersect with the curves for the various nutrients indicates the amount of these in pounds as specified by the horizontal lines. Multiply these quantities by the total live weight and proceed according to the directions already given.

As is clearly evident this method of feeding is intended for pigs that have been well fed from the time they learned to eat. If a feeder has a bunch of pigs that have not been well fed, it may be necessary, in order to get the best results, to start back a little farther than at the point in the above cuts, pages 156 to 160, indicated by the age of the pigs in question.

In order to furnish variety and get large and economical gains, as large a number of feeds should be used in the ration as possible. The greater the number of feeds the better will be the ration. Of course, the greater the number of feeds, the greater will be the amount of work in calculating the ration. In the above calculated ration corn and barley are used for the sake of variety, both being carbonaceous concentrates. The proportion of these two feeds may be governed to some extent by the amounts available. Skim milk is likewise a feed of the same class as soy beans.

The alfalfa is used primarily for furnishing bulk. At the beginning of the period, with the pigs two months of age, they will not be able to use a very large quantity of this. As they grow, however, during the next two or three months they will be able to take more and the quantity in the ration should be increased so that the appetite of the pigs is nearly satisfied. After four or five months of age it will be necessary to gradually decrease the alfalfa in order to make room for the gradually increasing quantity of the protein and carbohydrate nutrients. The reduction in the amount of water will also help to make possible the increase in protein and carbohydrate.

If the alfalfa above mentioned is fed in the form of meal, it might be mixed with the balance of the feeds in the slop. But this is an expensive form in which to feed alfalfa. In the summer time pigs may be allowed to eat it from the pasture. In winter the alfalfa may be chopped as fine as possible with an ordinary fodder cutter, and then mixed with a little meal and sufficient hot water or steam to thoroughly wet it. This will be eaten very readily if fed while the pigs are hungry. However, it takes training to accustom a pig to eat any feed. If bran is used as a roughage, it may be mixed into the slop.

COMPOUNDING RATIONS.

This is a subject that ordinarily is not given very much consideration, but at the same time it is one of the greatest importance. One of the advantages that is usually accredited to ground corn as compared with whole corn should be accredited to the subject under discussion, namely,—combining the feeds of a ration. This permits of a better distribution of the protein which produces better results; hence ground corn, which is better adapted to the

purpose, very often produces better results than whole corn. If an excess of feed, especially of protein, is fed, and the factor of waste is established, it is decidedly harmful both to the pig and to the gains in live weight that may be made. It seems to be a comparatively easy matter to feed a pig to death on nitrogenous feeds. This nutrient very often is found in feeds that are highly concentrated in this regard and also are very digestible, thus enabling a pig easily to eat an excess. Furthermore, a pig has the power to digest more of this nutrient than he can assimilate. Consequently, if a pig is put on full feed on nitrogenous concentrates, he may eat enough to kill, or at least seriously to injure him. If he eats a little less, or not enough to kill him, he may eat enough so that he will become permanently stunted or runty.

If nitrogenous concentrates are fed separately to a bunch of pigs, those that get to the trough first, or those that are largest and strongest and can crowd out the smaller or weaker ones, are likely to eat too much. Cases have come to notice where breeders thought they had hog cholera in their herds when probably it was nothing but over-feeding on protein in this form. It was noticed that the largest and best pigs were the ones that would die. This is true, because they are the ones that would eat the largest quantity, hence get the greatest excess, which resulted fatally.

In order to overcome these difficulties, it is very essential that each pig in a bunch receive its proportionate share of the ration, especially of the nitrogenous concentrates. For this reason it is advised that the feeds of a ration be combined in such a manner that this difficulty is reduced to a minimum. The nitrogenous concentrates should be diluted with the carbonaceous concentrates as

well as with the bulky feeds and the water. In this connection, a good way to feed is to grind all the grains that are used and mix these with the liquid feeds, such as milk or water, into a slop. If this also contains the right proportion of roughages to put the pig nearly on full feed, and at the same time have no excess of protein, large and economical gains will be obtained.

The compounding of the ration in itself does not need any consideration in the present connection. Therefore, any means that may be adopted by which the individual pigs in a lot get the right quantity of the various food nutrients will produce desirable results. If the protein part of the ration can be properly distributed among the individual pigs of a drove, as for instance soy beans or peas, and if the pig can be induced to drink the right quantity of water, then the carbohydrate part of the ration, the corn, or other sort of grain, may be fed separately. As a means of getting a good distribution of protein in the form of soy beans or peas, it is suggested that these may be scattered on a large feeding floor or on a considerable space of pasture, and the drove of pigs allowed free access to them. If the right quantity has been weighed out and given to the bunch of pigs, which are of equal size and eat with the same rapidity, this will be about equally distributed because while the individual pigs are hulling and grinding this feed, all have a fairly good opportunity to get their proportionate allowance. A considerable proportion of the straw, if it was properly harvested and preserved, will also be eaten.

GRINDING GRAIN.

Grinding grain is a subject that has been widely discussed and also has been the cause of a great deal of experimentation. It is a well known fact that if a pig is fed

ground feed in the form of slop, he does not masticate it, but simply swallows it. If ground corn then is fed, and if it is not ground into fine meal, the pig will simply get the particles of corn into his stomach, which cannot be as readily or as thoroughly digested as would be the case if it were finely ground. The pig, in masticating his own grain, will usually reduce it to a fine meal. Thus if grain is to be ground, it should be ground finely.

Effect on the Distribution of Protein.—In general the results seem to indicate that ground grain produces slightly better results than whole grain. As already stated, one of the principal reasons for this is that when ground grain is fed in the form of slop, the protein part of the ration, which under such conditions is mixed with these, is more evenly distributed.

Effect on Palatability.—This is another consideration which should be taken up in connection with the feeding of ground and whole grain. As already pointed out, the pig during the early part of his life, or under five or six months of age, can eat and also digest more than he can properly assimilate. Later in life, or after six months of age, the difficulty is that he does not eat enough, or as much as he can digest and assimilate to the best advantage. The method, then, according to which grains are prepared has considerable influence on the amount of feed that may be eaten. This apparently has a greater influence than the fact that such grain has been ground or not ground. Another influence exerted by the grinding of corn, then, as well as of other grains, is in rendering it more or less palatable.

Any form in which grain can be fed so that the pig will eat more nearly the right quantity, in accordance with that which he can use to the best advantage, will

produce the best results. If a young pig on full feed will eat more of ground grain than of whole grain, that is, if the ground grain is more palatable than the whole grain, and if a pig of such an age already eats enough of whole grain, then the ground grain under such conditions, would be a decided disadvantage, for the pig would eat too much. However, if he were given the right quantity grinding would then be an advantage because the ration would be more palatable and would be eaten with greater relish. In other words, the pig would be more hungry when leaving the trough, consequently would use what he had eaten to better advantage than if he were fed the same feed in such form that his appetite was satisfied when he had finished eating.

Later in life the pig, when ordinarily he eats too small a quantity, if the ration can be made more palatable by grinding, it is much better because the quantity of feed eaten at this time is an important factor. The more a pig may be induced to eat and to eat with relish, after passing the time during which he can eat too much, the greater and more economical will be the gains that he will make.

Effect on Water Supply.—Another influence of considerable magnitude in the grinding of grain is in the amount of water supplied to the pig. During the winter, when the pig ordinarily does not drink enough water, he may be directly benefited by ground grain because this is usually fed in the form of a slop. Thus the pig is compelled to drink water and take more nearly the right quantity.

Hard and Small Seeds.—Thus it is seen that while the grinding of grain may not have any influence in itself, it does exert considerable influence in various directions

as already noted. There are some cases, however, in which feeds may be ground to good advantage for the sake of having them ground. For instance, when corn has become very dry and hard and cannot be easily masticated, it is made palatable when ground. Some seeds are so small and at the same time so hard that the pig cannot masticate them as well as he should. In such cases it is decidedly beneficial to have them ground. In general the small grains give better results when ground while corn may under some conditions give equally good and possibly better results when fed whole, according to a number of conditions.

SOAKING FEEDS.

Many times grains are soaked rather than ground. This is a less expensive process and in many instances may be as good as grinding. The objections to it, however, are that if the pig is not properly trained to masticate soaked feeds thoroughly, he may swallow them as he would swallow the feed if he were eating slop. That is, the whole grains in a soaked form would be taken into the stomach without being masticated. It can easily be seen that in such a state the feed would not be as thoroughly digested and the results would not be as good as if the grain were fed dry and masticated.

If grains are to be soaked, they should be soaked sufficiently long to make them soft. Care should be taken, however, not to let the material sour. While sour feeds in general are as good as sweet feeds, provided they are not too sour, there is great danger in changing from one to the other. If sour feeds are to be used, they should always be sour, and if sweet feeds are to be used, they should always be sweet. This is a point of considerable

significance and is the cause of a great many of the troubles encountered in swine feeding.

COOKING FEEDS.

Experiment stations have long ago determined that cooked feed in general is no more valuable for swine than feed in the raw state. If anything, cooking renders some of the nutrients more undigestible. Cooking, however, has some advantages as follows:

Effect in Compounding the Ration.—Many times cooked feed can be mixed more thoroughly into slop with other feeds, hence will be better, not because it is cooked, but because more uniform slop is obtained in which the protein is more evenly distributed. For instance, if ground corn is used raw to be mixed into slop with various other constituents, the corn, if it is not ground into a fine meal, will soon settle to the bottom, and the nitrogenous feeds may be distributed through the other part of the ration. If great care is not taken in feeding such slop, some of the pigs will get too much protein and others too much carbohydrate, which will have detrimental results. By cooking the ground corn, the particles will more nearly float and the slop as a whole will have a much more uniform consistency.

Cooking also may apply to small and hard seeds the same as soaking. Furthermore, cooked feed has the advantage that it does not sour so readily and does not take as long for the grains or particles of feed to become thoroughly softened.

Effect on Variety and Protein.—Another advantage in cooking which is especially true in the case of practical feeders throughout the corn belt is in furnishing greater variety of feeds as well as supplying more protein in the

ration. Instructions that usually go with feed cookers, as they are sold by agents traveling through the country, are that when corn is put into the cooker there should be some other grains mixed with it such as barley, oats or rye, or any other feed that is available. This serves a double purpose: First, the small grains usually contain more protein than corn and thus will add protein to the ration, making it a more nearly balanced ration, which will produce better results than when corn is fed alone. Second, the greater the number of feeds, the better will be the ration on account of variety because the greater will be the possibility of furnishing the pig with the various nutrients, especially the mineral substances that the system demands.

Effect on Water Supply.—Perhaps the greatest advantage to be gained from cooking feed is in the addition of water to the ration. It has long been known that cooked feeds are especially advantageous during the winter season. As determined by the writer, when pigs are fed dry feeds during this time of the year, and given free access to water, they will not drink enough for the proper working of the internal mechanism, hence will not make as large or as economical gains as is possible. By cooking the feed, the water is driven into the grains or particles of grain, as well as other dry feeds that may be used. This also usually is fed in connection with water in a trough. Thus if a pig is fed this cooked feed he is compelled to take more nearly the right quantity of water; consequently will produce better results. Good results are also possible if the proper quantity of water is fed in connection with dry feeds. Furthermore, cooking may have an advantage in the case of some feeds by taking water out. This is especially true of potatoes, mangel

wurzels, turnips, etc. Adding meal to such a ration improves it still further. Feeds like these which contain from 85 to 90 per cent of water, carry with them more water than the ordinary pig can use to the best advantage. If these are cooked, and part of this water driven out, the ration will be more nearly balanced.

CHANGES IN RATIONS.

Effect on Coefficient of Digestibility.—Some of the most recent experimental data show that a pig is very subject to changes in his ration. The last digestion and metabolism experiment conducted by the writer seems to show that a pig, when fed a certain ration for a considerable length of time, will digest this more thoroughly after a few weeks than at first. That is, the coefficient of digestibility gradually rises; consequently if the pig is to produce the best results from a given ration, he must be fed this for a long enough time to become used to it.

Effect on Protein Metabolism.—Aside from the effect on digestibility, as previously noted, when the factor of waste is once established it has a tendency to continue at that rate indefinitely, and is very difficult to eliminate or even to reduce. In order to change from a ration that is high in protein to one that is low in protein, four weeks' time should be consumed. If the time during which such a change is made is too short, the pig, on account of the tenacity with which the factor of waste is maintained, will metabolize and excrete more than is received in its ration. This will result in a breaking down of the protein tissue of the body, and in loss of vitality; possibly also in loss in live weight. At any rate the pig will make smaller gains under such conditions.

In the case of breeding animals the loss of vitality un-

der such conditions is a very important factor. This is especially true with brood sows and seems to be one of the reasons for the fact that show sows are frequently either barren or very difficult to get with pig. The show animal, according to the customs and demands of the show ring, is usually put in very high condition, which means that she is fed the greatest possible quantity of feed that she may be induced to eat. This usually contains a large quantity of protein which will set up a high factor of waste. After the show such an animal is reduced in flesh because she is too fat for any good use for breeding purposes. By this process of reduction of feed the protein is reduced and, when too great, will result in a breaking down of the protein tissue of the body and it is more than likely that the generative organs will be affected as soon, or possibly sooner than the other organs, because they are not as constantly in use, hence probably not as stable. This then impairs that part of the animal for which he is being kept. If the feed is not artificially reduced for such an animal, it has been naturally reduced even before such a sow has gone to the show ring. Because, as already noted, when a pig increases in age and approaches maturity, the quantity of feed that is naturally eaten is greatly reduced. Thus the factor of waste that was established previously may have consumed a large part of the protein tissue of the body of such an animal before she appears in the show ring. This has already rendered her barren, or placed her in a condition where it will be difficult for her to perform her maternal functions.

Changes in general that are to be made in a ration, therefore, should be made very gradually, both in the quantity of nutrients or the total amount of feed that is

given, as well as in the kinds of feeds that enter into the ration.

Effect on Habit.—The pig will eat feed largely in accordance with the way he is trained. As, for instance, a pig that is fed upon nothing but slop during the early part of his life, when changed to dry or whole grain, will not eat it immediately. Pigs that have been accustomed to certain definite feeds will not relish and may not eat for a time new feeds that may be given them. Thus if pigs are fed on corn, barley and skim milk for a time, soy beans when added will not be relished by them and the ration will not be eaten as readily, will not be as thoroughly digested, and will not produce the results that it should. Therefore, a pig may be thrown off feed on a total quantity that is less than he ought to consume to the best advantage, and less than he will consume later after he has become accustomed to the new feed.

Thus the amounts of the various kinds of feeds that are to be eaten by a pig, or the kinds of feeds that will be eaten at all, are largely a matter of training. Pigs may be trained to eat feeds of various kinds, as well as to eat different proportions of concentrates or of roughages. Since the total quantity of feed eaten and the manner in which it is eaten are such very important factors, it is highly desirable that changes in a ration be made in such a manner that the pig will at all times eat the required amount with a decided relish. That is, changes should be made very gradually, and the more gradual the better.

GIVING THE PIG ITS FEED.

It used to be said that the man who could do nothing else could still be a farmer. Also that the farmer who did not know much about any other branch of farming could

feed pigs. Swine feeding from this point of view is put upon the basis of taking a basket of corn and throwing it across the fence into the feed lot. This, however, is not even the first principle of practical and successful swine feeding.

A bunch of pigs should be given their feed in such a manner that each individual pig gets its proportionate part of the various food nutrients of the ration. Furthermore, the ration should supply the pigs the required amounts of each of the different nutrients. Various conditions, as already noted, may modify the total amount of feed that might be consumed by the particular bunch of pigs in question, to the best advantage.

In general, pigs should be fed in small droves and these should be made up of individuals of the same age, as well as of the same size. As already learned, the requirement of a pig gradually changes as he grows older and heavier; consequently, if pigs are to be fed together, they should be of the same size and age in order to require the same quantity of feed. If pigs of different sizes are fed together, the larger ones are likely to get more than their proportionate part because they will crowd the smaller ones away from the trough. Any system of feeding according to which the pig may be given its feed that will fulfill these conditions, is a good system. The several methods of administering the ration may be considered as follows:

The Feed Trough.—This may be set in the fence parallel to the fence so that the feeder can approach the trough from the outside and the pigs from the inside of the feed lot. A panel may be placed immediately above the trough and hung at either end of the upper side. By having a latch slipping crosswise at the center of this

CUT 22.—FEED TROUGHS FOR SWINE.

panel, it may be swung in and fastened, shutting the pigs out of the trough and giving the feeder an opportunity to put the slop into it. After the feed is in the trough and all the pigs are present, the panel may be swung back, giving the pigs access to the feed. In such a case not more than ten or fifteen pigs should be fed together, or as many as can conveniently get to a trough of moderate dimensions.

Troughs of various forms are in use and made of various kinds of material, such as wood, cement and iron. A few general considerations as to the shape and construction of a trough may be advisable. The trough should be large enough to contain the quantity of slop that is to be fed to the bunch of pigs. It should not be higher than is necessary to enable the pigs to get at the feed conveniently. It should not be so broad that it is necessary for the pigs to get into the trough with their feet in order to get the feed. The wall of the trough should not be so thick that it will be difficult for the pig to reach the feed in the same when he stands next to it, and it should be of such form that the pig can get all the feed. Along with these considerations a feed trough should be made as cheaply and as durably as possible. Very satisfactory troughs may be made by nailing two planks together in the shape of a V with pieces nailed at each end. For large hogs a 2x10 and a 2x8 spiked together make a very desirable trough. For younger and smaller pigs narrower pieces should be used. Various kinds of commercial iron troughs are on the market which are all right if not too expensive and if properly used. They are extensively used by breeders.

The Feed Yard.—Another arrangement of feeding pens is as follows: A feeding pen may be built which is

CUT 23.—A FEED YARD FOR SWINE.

separated from the pasture or the lot containing the pigs. This feeding yard may have troughs placed in it so that the pigs can get to them either from both sides or from one side, to suit the convenience of the feeder. If placed along the fence, the feed may be put into them without going into the yard. If set in the center of the yard, the feeder will have to enter the yard in order to put the slop into the troughs. At feeding time the gate should be closed, shutting the pigs out of the feeding yard. After putting the slop into the troughs, and after the pigs, which are of the same age and size, are all present, the gate may be opened and the pigs allowed to enter. Such a gate should be made wide enough so that the pigs can enter quickly without crowding and injuring one another. The cut (23) shows one kind of an arrangement, but this can be made to suit fancy or convenience. By this means a larger bunch of pigs may be fed together than by the other method outlined, but in general the smaller the bunch of pigs that are fed together the better will be the results.

Individual Feeding.—In general it is not good policy to feed pigs individually. Under such conditions more expense is involved and the pig will usually not eat as much as he will when being fed at a common trough with other pigs. Company seems to stimulate the appetite apparently because of the greediness to prevent other individuals from getting more than their portion of the ration. Nevertheless, it has been shown that by feeding pigs in individual stalls, not considering equipment and labor, larger and more economical gains can be produced, especially during the early part of their life or during the growing period. At this time the danger of the pigs not eating a sufficient quantity does not exist, at

least not to so great an extent, and by feeding them in separate stalls, the distribution of the various nutrients can be more accurately accomplished, thus preventing to a greater extent the establishment of the factor of waste, and producing larger and more economical gains.

THE NUMBER OF FEEDS PER DAY.

In general swine are fed twice per day, morning and evening. Many feeders also give them a noon feed. Conditions may modify this practice to a considerable extent. If the pigs are on good pasture and get a portion of their daily feed from the same, they have free access to feed at all times. Then if they are fed the supplementary part of their ration only twice a day, morning and evening, they are still in reality being fed three times a day or oftener. If a pig gets nothing except what is brought to him by the feeder, that is, if he is kept in a dry lot, the number of feeds per day is of greater importance.

As shown by the recent experimental data of the writer, the number of feeds may exert a considerable influence, and better results are obtained where the pig is fed a limited quantity during the early part of his life, as previously outlined, which is in three equal portions per day, morning, noon, and night. This influence is greater during the growing period than during the fattening period, and greater with concentrated than with bulky feeds.

When a pig is put on full feed, he will make no larger gains when fed three times a day than he will when fed only twice a day, but when being fed three times per day he will eat more feed. Since he eats more feed and makes no larger gains, these are more expensive. When he is young and put on full feed and fed only twice per day, he can eat more than he can use to the best advantage;

hence, by feeding three times, which will enable him to eat still more, will produce no added advantage.

Influence on Factor of Waste.—The reason for the better results obtained by the practice of feeding three times per day seems to be the influence it exerts on the factor of waste. When a pig is given his entire ration in only two feeds per day, and this is fed in a digestible form such as concentrated feeds, the pig, as usual, will digest the entire quantity eaten within a few hours after the meal. During the time the feed is being digested, the pig can use the supplies of nutrients for his vital activities, such as the production of energy, heat, tissue, etc., directly from the digested material as it comes from the stomach. After the feed has all been digested by the stomach, the pig must, between meals, draw from the material that was stored in the body for use at such a time to supply what is necessary for maintenance, waste, energy and heat.

The body is supplied with various means of storing the digested material, as it comes from the stomach, for future use. But the storage capacity for the different nutrients is limited. This is especially true of protein. The animal apparently can store but a small quantity of this. If more is digested at one time than can be taken care of by direct use and by storage, it apparently is excreted, setting up largely what is called the factor of waste. This not only results in a loss of the excess, but the animal apparently has a tendency to waste that quantity indefinitely thereafter, which becomes a very important factor when it is considered that the pig naturally eats less feed as he grows older. This allows the factor of waste to grow relatively more important as time progresses. It also takes considerable energy to excrete the waste, which energy might otherwise be used for profitable produc-

tion, all of which detracts from the desirable results to be obtained from such a practice. Consequently, if the pig cannot store enough protein or other nutrients to tide over the time between meals, when he is fed only twice per day, and thereby sets up a high factor of waste, he cannot be expected to make as large gains as he would if he were fed three times a day, because the material would not be available for making gains in live weight. Furthermore, after the time that all the stored material were used, and before the time the next supply came from the stomach, the animal would have to draw upon the fixed tissue of the body to supply the functions necessary for maintenance, waste, heat and energy production. This would reduce the store of fixed tissue already established, which would lessen the gains made during such a period.

The reason that feeding three times a day is more effective for concentrated than for bulky rations is that the concentrated ration is digested more rapidly. The period during which the bulky ration is digested is more extended and supplies the various functions of the animal directly for a longer time, consequently is more nearly in harmony with their demands. Feeding three times per day is more advantageous with the young pig, or with the pig during the growing period, than with the older pig, or during the fattening period because the younger pig can eat the more. He apparently can eat and digest more than he can use at the time and store for future use, while all that the older pig can eat is taken care of by these means.

RESULTS.

As to the results that may be obtained with this system of feeding as compared with feeding according to the Wölff-Lehmann Standard, the following may be cited:

In the first experiment, at the Illinois Experiment Station, by which this system was developed, where the pigs were fed in this way they made 28.6 per cent larger gains during the growing period than pigs that were fed according to the Wölff-Lehmann Standard. At the same time they consumed 5.4 per cent. less feed. Thus it will be seen that this system of feeding produced an advantage of about one-third in its favor. In one of the latest experiments of the series about 44 per cent. greater gains in live weight were made. Even though the development of this new standard has not yet been completed, it has been shown recently that a pig at eight months of age can be made to weigh 300 pounds and it is believed that it ought not require more than 1,200 pounds of feed to do it.

OFF-HAND FEEDING.

Without going into details, as given previously in this chapter, swine may be divided into mature hogs, young breeding hogs, between the ages of one and two years that are still growing, and growing pigs and shoters. The latter class should be subdivided into those that are being fed for market and those that are being developed for breeding purposes. The latter should have less feed than the former. The rations for all hogs should contain plenty of mineral matter. Young and growing pigs, as well as breeding hogs, need a comparatively large quantity of water while the fattening hog needs less. For mature breeding stock there is probably sufficient protein in the non-nitrogenous feeds. The rations for young and growing pigs should be made up of a mixture of carbonaceous and nitrogenous feeds, using in general from one to six times the quantity of the former that is used of the latter.

CHAPTER XIV.

FEEDING THE HERD AND THE PIGS.

In general the feeding of the breeding herd should be considered under two separate heads, as follows: Feeding the young animals and feeding the mature animals. The pig as a rule does not reach maturity until he is about two years old; consequently, young and growing pigs that are being developed for the breeding herd need to have sufficient protein in their ration that they can develop their carcasses as well as in the case of sows to produce the litter and milk for the same. Old sows need not be fed any more protein than is sufficient for maintenance and to supply what is necessary for the offspring. The remainder of the ration should be made up largely of carbohydrates.

FEEDING SOWS.

As previously learned, where the subject of feeding was considered in Chapter 13, the best results are obtained by feeding varying quantities of nutrients through the growing period. In the case of the market hog the growing period ceases at about six months of age. For the breeding animal the growing period should be extended much further. In the case of protein, the amount necessary for maximum and most economical gains increases and decreases during comparatively short periods. In order to carry this to completion with young sows that are being developed for the breeding herd, the following is suggested:

Gilts.—The young sows or gilts that are to be put into the breeding herd should not be fed in the same lot with the market hogs. As previously stated, they should have more water, less protein and less carbohydrate up to six months of age than the market pigs. This will have the effect of keeping the factor of waste low and will leave these young sows in a condition for greater usefulness afterwards. Following this time the market hogs are simply being fattened and fed only a little protein. The gilts may be given another increase in protein, and this process of increase and decrease may continue as shown in cut 20a during the growing period. The time during which a large quantity of protein is being fed should not be continued too long, as it has a tendency to carry with it a high factor of waste.

The method adopted in regard to the time when the young sow is bred may have considerable influence as to her development. There are two general systems according to which this is done. The young sow may be bred at about eight months of age so that she will farrow her first litter when she is one year old. During the period of pregnancy the sow will make some better use of her feed and will probably not divert quite as much into the channel of waste. At any rate, she will be able to utilize a little more protein. During the period of lactation the sow will naturally be considerably suckled down and be in very thin flesh, which has a tendency to reduce the factor of waste to a minimum, leaving the sow in a condition after weaning the litter to go ahead with another period of maximum growth or development.

Furthermore, the fact that a young sow is bred according to such a practice will have a tendency to increase her capacity as well as to develop her milk-giving functions.

With the increase in the capacity of the young sow she will be enabled after this to eat larger quantities of feed and with a reduction of the factor of waste, she will be in a position, after weaning the first litter, which was farrowed at the time she was one year old, to make considerable growth and complete the development of her carcass to a maximum degree. This sow then should not have her second litter of pigs until she has come to maturity at two years of age.

The argument against this practice is that by breeding a gilt at so young an age she may be checked in growth to such an extent that she will never reach the size that she otherwise would. This, however, is not considered by the writer sufficient to overbalance the points already mentioned.

The other practice that is in general vogue is to continue to develop the young sow up to the time she is about fourteen months old and then breed her to farrow the first litter at one and one-half years of age, and the second litter at two years of age, the time at which she will have reached maturity. This has the advantage of not having the growth of the sow checked as early as would be the case in suckling a litter between the ages of 12 and 14 months. There also are disadvantages that may be argued against this practice.

By feeding continuously for such a long period of time, the factor of waste may become so high that the pig is not an economical producer of pork and hence will not make sufficient gains in live weight. The capacity of such an animal may also become comparatively much smaller, which would not allow such a pig to eat sufficient for maximum growth. Furthermore, if such a young sow is not fed very carefully, her reproductive organs may be

considerably impaired so that she will not produce as large litters as she otherwise would, and she may even become entirely barren and not produce at all. Again, the milk-giving functions of such a sow are not as likely to be well developed as would be the case if she were bred earlier in life.

Old Sows.—As previously learned, the animal body uses protein primarily to supply the protein metabolism either for maintenance, for the factor of waste, or for the production of new protein or lean meat tissue. Also, the carbohydrate feeds are used most economically for the production of energy, heat, and fat tissues. Thus an old sow that has come to maturity and is adding no more lean meat to its carcass, needs only sufficient protein to supply what is needed for maintenance and for the factor of waste. If the factor of waste was not established previously or has been greatly reduced, such a sow will need only sufficient for maintenance which, as previously seen, is a comparatively small quantity. After such a sow is bred, and during the period of lactation, she will need enough in addition to develop the foetus as well as to supply milk during the period of lactation. Thus a mature sow may be fed more economically than a young and growing sow because carbohydrate feeds in general are cheaper than protein feeds.

FEEDING THE BOAR.

This member of the breeding herd may be fed in general the same as the sows. If he is young and growing, he should have sufficient protein for this purpose, and if he is mature, he needs only enough for maintenance, assuming that the factor of waste is a minus quantity, and the remainder of his ration may be made up in the main

of cheaper feeds, such as the carbonaceous feeds. In addition to this, however, the feed for the boar must be varied to some extent in accordance with circumstances.

As previously stated, the amount of protein that an animal requires is practically the same during periods of work as during periods of idleness. Consequently an animal needs more carbohydrate when mechanical work is being done than is necessary during periods when no such work is being done. The boar, however, during the breeding season may need a little more protein to supply the glands that secrete the spermatic fluid than during other seasons, as well as more carbohydrate to furnish the energy required at this time.

FEEDING THE PIGS BEFORE WEANING.

The system of feeding as outlined in Chapter 13 starts with the pig at weaning time and takes him to eight months of age, when he is in prime condition for market. The amount of gain made by the pig during this period, as well as the cost of the gains, depends in a great measure upon the way the pig was fed before weaning or during the time he was still with his dam.

A pig in general will learn to eat at about four or five weeks of age. As a rule pigs are not weaned until they are eight, and many times not until twelve weeks old. Thus it is seen that the pig is being fed for a considerable length of time when he is still with his dam. This is a period in the life of the pig that must be very carefully guarded so as not to over-feed him. As learned previously, the ordinary hog eats relatively a smaller quantity of feed as he gets older. Consequently a very young pig, during the period of lactation of its dam, will eat more than it does after weaning time. Thus it is seen

that if a pig after weaning time can eat and digest more than he can use to the best advantage, the factor of waste may also be present and possibly to a greater extent before weaning time; hence it is very necessary that the pig be fed a limited quantity or else be fed his digestible nutrients in such diluted form that it will be impossible for him to eat an excess. The milk of the dam is about 90 per cent water and the supplementary feed that is used should also contain considerable water. In general the younger the animal the more water in its carcass, and therefore the more water required in its feed.

The pig also must be fed its ration in such form that it is very digestible. It is well known that a young animal of any kind cannot eat feeds that are difficult to digest. In the case of a pig this should be especially applicable to the roughages in the dry form. There are two systems in vogue according to which pigs are fed before weaning time. These are feeding at a separate trough and with the dam.

Feeding at a Separate Trough.—With this system of feeding the litter is provided with a small pen, with an opening in it called a creep, which admits the little pigs, but not the sow. In this pen is placed a small trough in which the litter is fed. Under such conditions, when the sow is fed in her pen, the feed for the litter is put into the separate pen and thus the pigs may be fed more concentrated, more palatable, and more expensive feeds than is used for the dam and so hasten their development to the greatest possible degree.

The disadvantages of this system are as follows: It involves a little additional expense to construct a separate feeding pen for the litter with the trough and the creep. It is also a little more difficult to train the pigs to

eat here rather than to eat with the dam. There is also considerable danger that the pigs will not eat all the feed given to them which then will sour and become a source of trouble thereafter unless the trough is thoroughly cleaned immediately. This not only brings in scours, which is a usual consequence, but also results in over-feeding with its evil effects, as previously noted.

Feeding with the Dam.—According to this system of feeding the pigs are allowed to eat at the same trough with their dam. The dam in such a case is fed a ration that is also palatable to the pigs and which is at the same time in harmony with the requirements of the dam at this time. This is the period at which her energies are taxed to the utmost, and in order to produce the best results she must have a ration that is palatable and comparatively concentrated. Furthermore, she must also have considerable water in her ration, which is also in harmony with the requirements of the pigs.

The latter system is the one that is being practiced by the writer at the Illinois Experiment Station. A ration made up for such cases is based upon the total live weight of the sow plus litter. For young sows this ration contains practically 8 to 10 pounds of water, between .25 and .30 pounds of digestible crude protein, and from 1.2 to 1.4 pounds of digestible carbohydrate daily per hundred pounds live weight of sow plus litter. This ration is made up of a variety of feeds such as are available, but this is of secondary importance and must be arranged to suit the available feeds in any particular case. A small quantity of roughage like wheat bran is used, and the amount of water used must be varied somewhat as between young sows and old sows and between summer and winter. In general young sows require a little more feed,

than old sows. Indications also are that a little more water may be consumed in winter than in summer, because in summer more succulent feeds are available which supply more or less water.

Sample Rations.—The following is given simply as a guide and not as a matter of fact. This schedule has been followed in a general way at Illinois for several years. It is not considered, however, to have been sufficiently well verified at this time to be absolute but still will serve as a guide for feeding sows for a week before they farrow, and the sows and their litters after farrowing. Considerable variation is sometimes necessary in accordance with the individual that is being fed.

DAILY RATIONS FOR SOWS AND THEIR LITTERS ON FULL FEED.
OLD SOWS.

Feeds in pounds per 100 pounds live weight daily of sow plus litter on full feed.							NUTRIENTS.		
Ration.....	Corn.....	Flour middlings of Red Dog flour...	Tankage	Wheat bran.....	Skim milk	WATER.		Protein	Carbohydrates
						Summer	Winter		
1	1.2	.2	.1	.3	2	6.0	7.0	.252	1.147
2	1.2	.1	.1	.3	3	5.1	6.1	.268	1.131
3	1.4	.1	.2	.3	1	6.9	7.9	.272	1.163
4	1.4	.2	.2	.3	0	7.8	8.8	.256	1.179

YOUNG SOWS.

1	1.5	.3	.1	.2	2	7.0	8.0	.277	1.370
2	1.5	.2	.1	.2	3	6.1	7.1	.293	1.354
3	1.7	.2	.2	.2	1	7.9	8.9	.297	1.386
4	1.7	.3	.2	.2	0	8.8	9.8	.281	1.402

Other feeds will answer the purpose equally well. These rations are used in the following manner. Old sows are brought to full feed less rapidly:

YOUNG SOWS—RATION NO. 1.

Days from farrowing ing	Feeds in pounds per 100 pounds live weight of sow plus litter							
	CORN.		Flour middlings or Red Dog flour...	Tankage	Wheat bran.....	Skim milk	WATER.	
	Ground	Shelled					Summer	Winter.....
7	1.2	..	.3	..	..	..	6.0	7.0
6	1.0	..	.3	..	.1	..	6.0	7.0
5	.8	..	.2	..	.2	..	6.0	7.0
4	.6	..	.2	..	.2	..	6.0	7.0
3	.4	..	.1	..	.3	..	6.0	7.0
2	.2	..	.1	..	.4	..	6.0	7.0
1	.0	..	..	..	.4	..	6.0	7.0

FARROWING DAY.

1	..	..	..	..	..	..	5.0	6.0
2	..	..	..	..	.1	.4	5.5	6.5
3	..	..	.1	..	.1	.8	6.0	7.0
4	.1	..	.1	..	.1	1.2	6.1	7.1
5	.2	..	.1	..	.2	1.6	6.2	7.2
6	.4	..	.2	..	.2	2.0	6.3	7.3
7	.5	..	.2	.1	.2	2.0	6.4	7.4
8	.7	..	.2	.1	.2	2.0	6.5	7.5
9	.8	..	.2	.1	.2	2.0	6.6	7.6
10	1.0	..	.2	.1	.2	2.0	6.7	7.7
11	1.1	..	.2	.1	.2	2.0	6.8	7.8
12	1.3	..	.3	.1	.2	2.0	6.9	7.9
13	1.4	..	.3	.1	.2	2.0	7.0	8.0
14	1.5	..	.3	.1	.2	2.0	7.0	8.0
15	1.5	..	.3	.1	.2	2.0	7.0	8.0
16	1.5	..	.3	.1	.2	2.0	7.0	8.0
17	1.5	..	.3	.1	.2	2.0	7.0	8.0
18	1.5	..	.3	.1	.2	2.0	7.0	8.0
19	1.5	..	.3	.1	.2	2.0	7.0	8.0
20	1.5	..	.3	.1	.2	2.0	7.0	8.0
21	1.5	..	.3	.1	.2	2.0	7.0	8.0

WEEKS AFTER FARROWING—FEEDS DAILY.

4	1.2	.3	.3	.1	.2	2.0	7.0	8.0
5	1.2	.3	.3	.1	.2	2.0	7.0	8.0
6	1.2	.3	.3	.1	.2	2.0	6.8	7.8
7	1.2	.3	.3	.1	.2	2.0	6.6	7.6
8	1.2	.3	.3	.1	.2	2.0	6.4	7.4
9	1.2	.3	.3	.1	.2	2.0	6.2	7.2
10	1.2	.3	.3	.1	.2	2.0	6.0	7.0

PART III.
General Care
and Management of Swine.

CHAPTER XV.

THE BREEDING SEASON.

Nature apparently has determined that animals be born in the spring of the year, because this is the most favorable season. Since there is considerable difference in the length of the period of gestation, the period from the time the dam is bred until the offspring is born of different animals, they are bred at different times of the year. Domesticated swine, however, come in heat at any time and may be bred to suit the wishes of the breeder.

NUMBER OF LITTERS PER YEAR.

In former times most of the swine of the country were produced by having the sows farrow only one litter of pigs per year, and these were usually farrowed at the natural time, namely, the spring. During later years some breeders have adopted the policy of raising two litters a year, one in the spring and one in the fall. This has occasioned considerable discussion in regard to the policy of having a sow produce two litters a year as compared to one. It is sometimes argued that the sow cannot produce more than one good litter per year, and that if she is required to produce two, it is such a drain upon her and will reduce her to such an extent in condition and vitality that she will neither produce good pigs nor remain prolific as long as she should. From a study of the facts, this does not seem to be necessarily true.

In the production of beef cattle the cow is usually required to produce one calf per year. The period of ges-

tation with a cow is approximately nine months, and the period of lactation from nine to eleven months. Thus it will be seen that a cow for a considerable portion of each year is caring for two offspring at the same time; one is being developed within while the other is being cared for at the udder. In dairying operations this is still more intensified. Such a cow has been developed to give sufficient milk for two or three calves which is taken from her artificially and used for commercial purposes while at the same time she is producing a calf annually. In the case of a mare conditions are the same as for the beef cow except that the period of gestation is somewhat longer, and the period of lactation not quite so long.

A sow may be bred, and then may farrow and raise her litter within six months' time. Thus she can produce two litters a year and never be caring for more than one at a time. With this in view it can easily be seen then that a sow, with proper care and feed, should be able to produce two litters a year as well, or even better, than the cow can produce one calf a year. All this is borne out by the facts, namely, that if sows are properly fed and cared for after coming to maturity, they can produce two litters annually and do it apparently just as well as to produce only one. If there is any difference the advantages seem to be in favor of two litters per year, because if the sow is allowed to go over one season, or produce only one litter per year, she is likely not to be so sure a breeder as if she were bred immediately after weaning the litter.

The arguments for the statement that sows can produce only one good litter per year apparently originated from the fact that very often swine are not as well cared for as they should be and are considered only as the scavengers of the farm, allowed to get along as best they can

on what waste feed they are able to gather. Under such conditions, of course, it takes a sow the second six months to recover what she loses during the previous six months during which time she is raising her litter.

WHEN TO BREED.

The question naturally presents itself as to what time of the year a sow should be bred. This will depend upon a considerable number of conditions.

Show Hogs.—For the small number of breeders who are in the business of producing pure bred hogs for the show ring, this has been in a large measure arbitrarily determined. It is the rule of show and fair associations of the north that the age of hogs shown during the fall show season shall be counted from the first of March of each year, and from the first of September. In the south it is one month later. Accordingly a pig farrowed on or after March 1 may be exhibited during the fall show season, in the “under six months” class. Thus it is seen that a hog shown in this class, as for instance in the International Live Stock Exposition, which is held about December first, may be nine months old. This fact deceives many people, for when going around among the pens having hogs in the “under six months” class, that weigh 300 pounds, they marvel at the size of such animals, thinking that they are less than six months old, as the classification states, when in reality they may be nine months old. Likewise an animal that is to be shown in the “under a year” class must be born on or after September 1 of the previous season; hence it is anywhere from twelve to fifteen months old. On account of these rulings pigs that are produced for show purposes are farrowed as nearly as possible after the first of March or the first of September.

A pig farrowed on the last day of February would be only one day older than one farrowed on the first day of March, but would have to show in the "under a year" class as compared to one farrowed on March first being able to show in the "under six months" class. While this ought not to be such a great handicap, nevertheless it is in many cases considerable of a disadvantage because size is a point of great importance and with many judges exercises much more influence than it should, especially under such conditions as when the pigs are of different ages. For the majority of breeders the conditions that determine the time at which sows are to be bred are of an entirely different nature.

Market Requirements.—The time at which pigs for the pork market are to be marketed should be taken into consideration in determining the time at which they are to be farrowed. The market requirements in general are for light hogs during the summer season and for heavy hogs during the winter. While it is true that hogs of any description and of any weight sell at all seasons of the year, the summer season is called the light hog season because hogs of this description are in greatest demand, while the winter season is the heavy hog season because such hogs are in greater demand at that time of the year. The summer is the light hog season because at this time of the year many hogs are cut up for the fresh meat trade.

A light hog, weighing 150 to 250 pounds, makes a better and more desirable cut of fresh meat than a heavier hog would. Meat of this description finds various outlets, such as to foreign markets, to the south and east, and even back to the country where hogs are produced, a demand which is largely curtailed during the winter season because of home supply. Hogs that are produced in the

mentioned places, especially in the east and south, are usually of this type and are slaughtered during the fall and early winter to supply the home demand. After these are consumed, the general pork markets must be called upon for further supply, which creates a demand for fresh meat together with the demand that comes from the other parts of the country and which is more or less constant.

The winter season demands heavy hogs because this is the packing season and heavy hogs are better adapted to this purpose than light hogs. They are better because they contain less water in the carcass and therefore more nutrient value, and also they contain more fat. The fattened pig, except for the production of bacon, is better adapted to packing purposes than the lean pig. The older and heavier the hog, as a rule, the more fat he contains; consequently the packing season during winter calls for heavy hogs.

Pork Hogs.—The time at which a sow is bred should be such that the pigs can be taken to market at a desirable weight when the market for such hogs is the best. This naturally brings into consideration the manner in which these pigs are to be fed or the length of the feeding period. If pigs are to be well fed from the time they learn to eat so as to get them to the greatest weight in the shortest time, the sow may have to be bred at an entirely different time than would be the case if the pigs were to be fed more slowly.

The time at which the sow is to be bred will also depend in a large measure upon the available shelter. If comfortable hog houses are at hand, the sow may be bred to farrow earlier in the spring of the year than if such shelter were not at hand.

The number of litters per year also exercises an influ-

ence in this regard. If only one litter per year is to be produced, the sow may be bred to farrow when the season is most congenial, but if she is to produce two litters per year, the fall season will also have to be taken into consideration. Under the system of feeding in common practice, a winter pig cannot be as successfully handled as a spring pig. As already outlined, this apparently is due to the fact that such pigs receive too little protein and water as well as not enough exercise. Under such conditions fall pigs should be farrowed as early as possible, which would naturally also require that the spring crop be farrowed early.

Age of Gilts.—The age at which a gilt is first to be bred was discussed in Chapter 14 in connection with feeding, but in general it may be said that a sow should not produce more than two litters during the first two years of her life. These may be farrowed at one, or one and one-half years, and two years of age respectively. By this time she will practically be mature and can produce two litters per year thereafter. In general, then, the time at which a sow is to be bred is controlled by the time at which the pigs are to be marketed.

CONDITION OF SIRE AND DAM.

The condition of the sire and more especially the condition of the dam during the breeding season exercises considerable influence on the offspring. In order to produce the best results the condition of both sire and dam should be such that they are healthy, thrifty, and vigorous. As already stated, the tendency of swine is to transmit their characteristics to a greater or less extent to their immediate offspring. If a sow is too thin in flesh at the breeding season, she may not come in heat at all, or, if

too fat, she may be difficult to get with pig. Furthermore, the size of the litter, as well as the size, thriftiness and vigor of the pigs, depends in large measure upon the condition of the sow not only at breeding time, but during the entire period of gestation. It is considered that if a sow is in a state of rapid improvement at the time she is being bred, and is vigorous, active, and in high flesh during the period of gestation, she will produce the largest litter and also the best pigs.

Prolificacy.—Prolificacy, then, or the number of pigs that will be farrowed by a sow is largely a matter of feeding and care. If a sow is properly handled, she will be prolific and produce a large number of pigs per litter, while otherwise she will not. This of course is considerably influenced by selection. Hogs of proper conformation and from prolific strains will produce more pigs per litter than those selected otherwise.

USEFUL AGE OF SIRE AND DAM.

The question is often asked how long a breeding animal should be retained in a herd. This can be answered most directly and perhaps in the best way by saying that a breeding animal should be retained in the herd as long as good results are produced by it. Both sire and dam may be misused to the extent that they will not do good service for more than a few years.

The Sire.—In order that a boar may be of the greatest service, he should not be used except to a very slight extent, until he has come to maturity. He may be used on a very few sows at the age of eight or nine months, and may be used on a few more when he is one year old, but in general he should not be put to hard service until he has come to maturity at about two years of age. Even

then he should not be overworked. One service per day is considered to be sufficient when used for a considerable length of time. When used continuously the whole year, this is too much. In emergency cases, for a short period of time, two or even more services per day may be allowed in the case of a vigorous animal, provided he is allowed to rest before and afterwards.

The Dam.—A sow is useful and should remain in the herd as long as she can produce and raise a large litter. A mistake is very often made by retaining young sows year after year and selling the older ones. It is argued that after producing a litter the sow will make profitable gains, which is naturally very true, and that she can be put in market condition along with the litter to good advantage. While this is true, she is also developing into a more valuable breeding animal. When young sows are being kept year after year the practice of selection, as discussed in Chapter 8, is very largely lost because good individuals do not appear in large enough numbers so that an entirely new breeding herd of good sows can be selected year after year. Furthermore, all good appearing individuals are not good breeders because they do not produce large litters, may not give sufficient milk to nourish their litters, may not be good mothers to care for them after farrowing, etc. Thus a mature sow that has been tried should be kept in the herd as long as possible. This can be done with profit, especially when two litters per year are being produced.

BREEDING THE SOW.

The period of heat is the time at which a sow is in season and ready to be bred. It usually occurs about every twenty-one days and, if a sow is not bred, lasts for two or three days. The methods employed for serving a sow are

two—first, that which makes use of the breeding crate, and second, where the boar and sow are allowed to run together.

The breeding crate is useful when matings are to be made with sire and dam of different sizes, and especially if the difference in size between the animals is considerable. The crate is constructed so the sow is confined and cannot get away, with a platform to the rear of her, upon which the boar stands, which may be raised and lowered. While there are several different kinds of breeding crates on the market, any home-made piece of apparatus that will hold the sow in position and either raise or lower the boar, as the case may be, will answer the purpose. It is generally considered, however, that this method of breeding is more or less artificial and not productive of as good results as when the natural method is employed and the boar occupies the pasture with the sow. Under such conditions the most favorable time to copulate will be selected, thus producing better results. One of the purposes of the breeding crate is to assist an awkward and clumsy boar that cannot handle himself. This usually affords a poor excuse for such a crate. If a boar is properly fed and kept, he will usually be able to do service unassisted by a crate. If a breeder is producing pure bred hogs and constantly improving his herd, he will usually have good young boars coming on that may be used on such young gilts that are to be bred and not able to support a large old boar, thus rendering the breeding crate an unnecessary adjunct in swine breeding operations. However, a show boar that is more or less clumsy on account of high condition may be materially assisted by a crate, as may also any large or small boar that is to be used on small and large sows respectively.

CHAPTER XVI.

FARROWING TIME.

The period of gestation is approximately 114 days, or six days less than four months. With some individuals it may vary from this a few days one way or the other, even from 110 to 118 days and an occasional one will get outside of this limit; but the average is as stated. The largest number farrow at this time, and as the distance in time from this point is increased either one way or the other, the number that farrow is gradually decreased. If pigs are farrowed much earlier than this, even though it may not be more than a week, there is danger of their being farrowed dead.

FEEDING BEFORE AND AFTER FARROWING.

If the sow is properly fed and handled before and after farrowing, the difficulties that are sometimes experienced at this time should be reduced to a minimum, and in most cases there will be no need whatever for forceps such as are often found in the hands of breeders.

A good sow is one, like a good cow, that will convert a considerable portion of her feed into milk. If such a sow is heavily fed immediately before she farrows, she will produce a large quantity of milk which is likely to cause either milk fever or caked udder, and may result disastrously for the pigs after farrowing even if not to the sow herself. If after farrowing the sow is again fed too much, difficulty is experienced because at this time the pigs are small and can take but a small quantity of milk.

Consequently the sow should not be fed more than enough to enable the pigs to take what milk is produced. To obtain good results, then, the sow should be taken in hand at least one week before she is due to farrow. She should be put into the place where she is to farrow, and this should be made as comfortable and convenient as possible. Her feed should be gradually reduced, while at the same time the bulkiness and nitrogenous parts of the ration should be relatively increased. This will satisfy her appetite and supply protein to prevent the breaking down of the protein tissue of the body.

Immediately after farrowing the sow should be left as quietly as possible and not be disturbed at all during the first twenty-four hours except to give her an occasional drink of water. She needs no dry feeds of any kind during the first day, and the water that is given her should not be too cold. On the second day after farrowing she may be given a very light feed. This should be increased during several weeks thereafter. With young sows the feed may be increased so as to get them on full feed in about two weeks after they have farrowed. In the case of old sows this period should be extended to three weeks. With this practice the milk giving functions are not stimulated to so great an extent that the litter cannot take the entire quantity, and as the pigs get older and require more, more milk will be produced and the best results are possible. See pages 205 and 206.

When sows eat their pigs it may be the result of habit or of improper feeding. When fed too much it may bring about a feverish condition in the udder and body as a whole which might cause an abnormal appetite for material as found in the carcass of a young pig. If too little protein is fed the sow might take this means of supplying

the deficiency. If pig-eating has become a habit the best course is to dispose of the particular sow to the butcher.

THE LITTER.

At the time the sow farrows the attendant should be present. Sometimes slight assistance may be given that will help materially in saving a large litter. Several practices are in vogue at this time. Most breeders simply place the pigs to the udder of the dam as soon as they are farrowed, which in general is good practice and cannot be improved upon. If, however, the sow is of a nervous disposition and is restless, it may be necessary to gather up the pigs as fast as farrowed and take them away for the time being. In such a case they should be put into a dry warm place to prevent chilling, and then be taken back to the dam when she is through and has settled down and become quiet.

At about four weeks of age the pigs, since they continue to grow and since the sow's milk does not continue to increase, should learn to eat either with their dam or at a separate trough and be fed as previously outlined.

HOW MANY PIGS PER SOW.

From the foregoing it will be seen that the results obtained from a brood sow depend very largely upon the way she is fed immediately before and immediately after farrowing. If a sow is fed so much immediately after farrowing that the pigs cannot take the entire quantity of milk, it may either result in causing her to dry up entirely, or else in bringing on scours with the pigs. Other considerations, however, have an important bearing.

In case the sow farrows a small litter, or in case most of the pigs are lost after farrowing, leaving her only a few, it is good policy either to give her some more pigs

or to take these away from her, especially if she is a young sow. This is not necessarily true with old sows, but if a young sow is allowed to go through the first one or two periods of lactation with only two or three pigs, the likelihood is that she will never be able to raise more thereafter. The part of her udder suckled by these pigs will be developed and the rest of it will become dormant and not produce sufficient milk thereafter to allow a larger number of pigs to develop properly. Consequently, it is of greatest importance that young sows not only be fed properly, but that they also either be required to raise the proper number of pigs or to raise none at all. Herein lies a considerable advantage in having a number of sows farrow at the same time. This practice not only allows a proper distribution of the pigs among the various sows, but also produces pigs of the same size which will sell to better advantage when ready for market than will a bunch that is made up of individuals of various sizes. It is frequently said that a sow cannot successfully raise more than five or six pigs. But if she is properly selected, developed and fed at the time, there is no reason why she should not raise ten or twelve pigs.

HANDLING THE SOW AND LITTER.

A sow should at all times be handled with the greatest possible care and gentleness and if properly handled will be quiet and easy to manage. Her temperament should be in such a state that the attendant can go into her pen at any time, either during the time she farrows or thereafter, and handle either her or her pigs without the slightest disturbance. If properly done this is possible.

As previously noted, the influence of exercise upon the metabolism of the hog is very great and important; hence

the litter should be provided with some means of obtaining exercise. One way of doing this, especially with breeders of pure bred hogs, is to put the sow and her litter into a pasture by themselves. If the season is favorable, considerable exercise will be taken. Under ordinary farm conditions, however, pastures are not numerous enough to allow each sow and litter to have one by themselves, consequently a larger number must be allowed to run together. If in such cases the sow is kept confined with her litter during the first two weeks after farrowing, no great harm will result from the lack of exercise and the pigs will become acquainted with their dam so that after this the entire family may be let out in company with others and experience no serious difficulty. This would be true especially if the sow as well as the sow and litter combined were properly fed. If sows with their litters are let out too soon in company with others, and if they are not well enough fed, the pigs may run about and do considerable robbing; that is, the pigs of one sow that do not get sufficient milk will rob the pigs of another sow. Naturally the older and larger pigs will rob the younger and smaller ones.

BLACK TEETH.

Very often when pigs are farrowed they have what is called black teeth—that is, two long black teeth on each side of the upper and lower jaws respectively. As soon as the pigs are farrowed and take their place at the udder, they sometimes do considerable fighting, each pig striving to get the best teat. In so doing they may strike each other and start trouble by making sores on their jaws which collect dirt and disease germs, causing inflammation. At other times they injure the udder of the sow to

such an extent that she becomes restless and may not allow them to suckle at all, or perhaps will get up and trample the pigs to death. To avoid the trouble caused by these teeth they should be clipped off as soon as the pigs are farrowed. This may be done very nicely by taking the pig in the left hand, opening its mouth with the forefinger and thumb, and clipping these teeth off with a small pair of tin shears or molar pliers.

IDENTIFICATION MARKS.

Some breeders, especially those who have only a small number, can identify all the pigs by means of the various natural markings they have, such as the white points of black pigs. In the case of other breeds, where the color is solid, say black, red, or white, the pigs are not so easily identified, or at any rate it is a difficult matter to keep in mind a large number of pigs. Moreover, if sows farrow in adjoining pens and the fence is not perfectly tight, the pigs may creep back and forth and become more or less mixed up. To avoid these difficulties pigs should be marked as soon as farrowed.

Several different systems of markings are in use, but the system which consists of nicks punched in the ears is considered the best. A small leather punch will answer the purpose very well for use immediately after the pig is farrowed. When they get a little older or even immediately after farrowing a regular ear marking punch may be used to cut the nicks in the ear. A hole should never be punched through the ear because this will soon heal over and destroy the mark. The punch mark should always cut out the edge of the ear so that it appears in the form of a nick. The inner part of this should not be at a

sharp angle, but should be rounded, in which form it will be maintained much better than if cut at an angle.

EAR MARKS.

The system of ear marks in use at the Illinois Experiment Station and outlined in the cut (24) is as follows: In looking for the ear marks the hog is usually viewed from the rear which puts the right ear to the right and the left ear to the left. The thin part of the ear is called the lower part, the part next to the head is called the base and the outer part is called the tip. One nick in the base of the lower part of the right ear represents number 1. Two nicks at the same place represent number 2. One nick in the tip of the lower side of the right ear represents 3. One in the base and one in the tip, 4. Two in the base and one in the tip, 5. Two in the tip, 6. Two in the tip and one in the base, 7. Two in the tip and two in the base, 8, and one in the center part of the lower side of the right ear, 9. This is very easy to learn and to remember as, by learning the marks for numbers 1, 3 and 9, together with a few combinations, the entire system is in mind. Number 2 is made up of twice 1 and number 3 is new; number 4 is gotten by adding 1 and 3; number 5 is obtained by adding 2 and 3; number 6 is obtained by taking 2 times 3, and number 7 is obtained by adding 6 and 1, while number 8 is obtained by taking 2 times 4. Number 9 is new and number 10 occupies the same position in the left ear as number 1 does in the right ear.

To facilitate this still further, number 5 being made up of two nicks in the base and one at the tip is somewhat comparable to the figure 5. Number 7 having two nicks at the tip and one in the base is similar to the figure 7. Thus the units are represented in the lower side of the

CUT 24.—AN EAR-MARKING SYSTEM.

right ear, the tens are represented in an exactly similar manner in the left ear, and it is seen that 99 hogs may be marked with nicks punched in the lower side of the two ears.

For ordinary purposes 25 to 50 brood sows are sufficient for a breeding herd. As soon as the pigs are farrowed the entire number in the litter are given the same mark as their dam. Thus the litter is easily identified at all times and after being developed, if some of the individuals are to be retained in the breeding herd, they are given an additional nick or two in the ear so as to give them a number that is different from that of their dam. If the pigs are sold either on the open market or for breeding purposes, no further attention need be given to these nicks in the ears. Thus with a system of ear marking, as here outlined, in a breeding herd of approximately 100 sows, each can be easily and quickly identified.

According to another practice in use to some extent, all the individual pigs of a litter are given separate marks. If this be adopted as a system of marking, the foregoing method can still be used by going to the upper side of the left ear for the hundreds and then to the upper side of the right ear for the thousands. Thus with this system of nicks in the ears, 9,999 pigs may be marked so that each one can be readily identified.

CASTRATION.

Castration consists in removing the testicles of the male. In the case of pigs this is a comparatively simple operation and may be done by any one with very little instruction and practice. The best time to castrate a pig is between five and seven weeks of age. At this time the pig will be sufficiently developed to enable the breeder to select the ones that are to be retained as sires in the breeding herd, and at the same time the pigs will be small enough to render this task most easy and the shock to the pig will be the least. Furthermore, the pig is still with its dam and is probably more thrifty and in better

condition than he will be immediately after weaning, hence will receive less of a set-back than he would later in life. By the time the pig is weaned he will have had time to recover from the fright he received in being castrated and be ready to go ahead undisturbed in the process of pork production.

A Normal Pig.—In castrating a normal pig an incision is made through the skin of the scrotum and also through the membrane that encloses the testicle. This membrane is allowed to fall back and is cut loose at the inner part of the testicle so that the cords may be pulled out to some extent and then cut off. They should not be cut off abruptly, but rather scraped off. The membrane will by this time have gone back into the opening and the other testicle is removed in a similar manner.

Before making the incision, the place where it is to be made should be thoroughly washed with an antiseptic solution of some kind, such as the coal tar dips or carbolic acid. A 3 to 5 per cent solution will usually answer the purpose. After removing the testicle some of this solution should also be put into the wound and the pig given his liberty. In all operations of this kind the incision should be made low enough in the scrotum to allow any fluid from within to run out when the pig stands on his feet. A separate incision should be made for each testicle and the cut should always be vertical and never cross the median line. The knife that is used for this operation should be thoroughly clean and the hands should also be repeatedly washed in the antiseptic solution. If these conditions prevail, there is no danger of anybody losing many pigs as a result of castration.

Many people are so imbued with superstition, even at the present day, that they select a certain phase of the

moon in which to do this work. While there is no relation between the way a pig will thrive after being operated on and the phase of the moon, there is considerable relation between the condition of a pig in such a case and the weather conditions. The weather at the time of the operation should be favorable. It should not be exceedingly hot, neither too cold. It should not be very dusty or wet. In hot weather the pig is likely to become overheated while in cold weather he may lie around humped up in his nest and not get sufficient exercise for health. If the soil is very dry and dusty and the pig compelled to walk through dusty places or to lie in a dusty pen, he may get dust particles into the wound which may cause trouble. If it is very wet so that the pig is all covered with dirt, or if he gets into the mud and wallows, dirt again may get into the wound and is quite likely to form abscesses or cancerous swellings.

The pig should be handled with care even though he is only a pig. Cases are known where the pig, immediately after being castrated, lay down and died, apparently from the nervous shock or from heart failure due probably to rough treatment. The writer has known a man to castrate a large bunch of pigs single handed. In this particular case the pigs were stood on their heads in a nail keg, in which position the operator could work on them conveniently, but this manner of holding is not humane treatment and should not be practiced.

Two persons can work to the best advantage in castrating pigs. The attendant simply goes into the pen and picks up the pig and holds it in his arm, taking the right hind and front feet in his right hand and the left hind and front feet in his left hand, having the pig lie on its back in his right arm. In this position the pig may be

held across the fence and allowed to rest on the upper rail, while the operator standing outside can perform very quickly and conveniently. In the case of larger pigs, they may be laid on their back and the attendant may sit astride of their neck with the front feet as well as the hind feet of the pig in front of the attendant. The hind feet are then held, one by each hand, and pulled forward a little, which again puts the pig in a splendid position for the operation.

Mature boars cannot be held so easily and must be tied. If properly done, a man single handed can castrate the largest boar living. One way to do this is as follows: A strong small rope should be placed around the pastern of one front foot while the hog is eating or otherwise unaware of what is about to happen. With the rope securely fastened at this point, the hog may be thrown and if his front feet are kept off the ground he cannot rise. After this the rope is drawn around one hind foot, then around the other front foot, and lastly around the other hind foot. The four feet are securely tied together. In such a position the hog cannot rise, and cannot help himself and the operator may proceed undisturbed. With the hog lying on his left side, the operator standing at the back of the hog holds the knife in his right hand, and uses his left hand to hold the scrotum in position. To facilitate matters a little more, the rope with which the feet are tied may be fastened somewhere overhead to keep them slightly off the ground.

Another way to hold a large boar is by means of a rope on his snout as described later in connection with putting rings in the snout to prevent a hog from rooting.

Ruptured Pigs.—Ruptured boar pigs (those ruptured in the scrotum) may be castrated so as to make just as

good barrows as though they never were ruptured. The best way to do this is to proceed in the same way as in castrating a normal pig except that the incision is made only through the skin of the scrotum and not through the membrane containing the testicle. When the incision is made through the skin, the testicle, together with the membrane that encloses it, is taken out, while at the same time the intestine contained in this is worked back. Before beginning, however, the pig should be held with his head low and the rear part high and the intestine should be thoroughly worked back into the abdomen. After taking out the testicle, together with the membrane containing it, it is drawn out to a convenient distance and a string tied securely around the cord which is enclosed in the membrane. This string should first be thoroughly sterilized or soaked in antiseptic solution. It should be strong and securely tied. After tying it in this manner the membrane and cord are cut off to the rear of the point where tied. This removes the entire testicle, together with the membrane enclosing it. The string is then cut off sufficiently long that when the cord goes back into the body the end of the string will still hang out. Thus the incision on the outside is kept open until the cord sloughs off at the point where it is tied and the string comes out. If it is slow in coming out, it may be taken hold of and pulled out after a week or two. By this means the intestines that formerly came out through the same opening through which the cord of the testicle passed are kept within the abdomen and the pig will be as smooth and nice a barrow as though he were never ruptured.

SPAYING.

Formerly this operation upon sows was in vogue. It consists in the removal of the ovaries so that the sow will

not come in heat, which is supposed to make her a better feeder. This operation, when resorted to, should be done by a trained veterinarian, as it is quite difficult and consists in opening the abdomen of the hog at the side from which point the ovaries are removed. However, the practice in general is obsolete. The reason for this is that hogs nowadays are fattened so rapidly and taken to market at such an early age that the advantage to be gained by such a practice is not sufficient to offset the difficulties encountered. In the case of young sows that are being well fed they may not come in heat, at least not very often, by the time they are ready for market at 8 or 9 months of age. In the case of mature sows, the fattening process proceeds so rapidly that the period of heat does not occur often enough to do any particular harm.

RECORDING.

In order to be called pure bred a pig must be recorded; that is, the breeding of the pig as an individual must be on record in some one of the various swine record associations. In recording pigs the breeder writes to the secretary of the association and obtains blanks that are used for the purpose. Upon this blank the date at which the pig was farrowed, as well as the number of pigs in the litter, the sire, the dam, etc., are entered. A space is also provided for the natural marks that occur on some breeds, such as the white markings on some black breeds. Upon filling out one of these blanks for each pig, and sending it to the secretary of the association, together with the fee that is charged for recording, the pig is recorded and may be sold as a pure bred. The fee charged for recording usually is from 50 cents to \$1 for young pigs and somewhat higher for older pigs.

A great mistake is often made by regarding all registered pigs as good individuals. This is not necessarily true and in fact is very seldom true. As stated in Part I., there is the same degree of variation with pure bred pigs that there is with scrubs and grades, and the breeder who is to succeed must be just as careful in selecting his individuals from registered pigs as he would be in selecting his individuals if he were simply producing pork hogs for the market from scrubs or grades.

If only the best individuals were recorded, the buyer would be safeguarded when buying a registered pig, but many breeders, especially many of those who have developed a big reputation, have placed on record and sell for pure bred purposes more than the best individuals. Besides this different breeders have different types in mind, and what is considered a good individual by one breeder may not be so considered by another.

Herd Records.—In order to keep herd records of pure bred individuals as well as of the offspring, various private herd records are in use. One that was designed by the writer and is in use at the Illinois Experiment Station is shown in cuts 25 and 26.

The first cut represents the form that is used to keep the record of the herd boars and the breeding of the sows. The first part of this book is given up entirely to pages of this kind wherein a record is kept of herd boars. A greater part of the rest of the book is given up to pages of this character alternately with pages represented in cut 26.

As will be seen this gives an opportunity to keep a complete record of the breeding of the litters as well as of the individual pigs of the litter. It also provides for four litters on one page which does not necessitate so

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CUT 25.—FORM FOR KEEPING RECORDS OF BREEDING SWINE

Sire				Sire			
Breeding date		Breeding date		Breeding date		Breeding date	
Notes--(Breeding)		Notes--(Breeding)		Notes--(Breeding)		Notes--(Breeding)	
Parrowing date		Parrowing date		Parrowing date		Parrowing date	
Gestation ---- days		Gestation ---- days		Gestation ---- days		Gestation ---- days	
Par mark of litter		Par mark of litter		Par mark of litter		Par mark of litter	
Name and Number		Name and Number		Name and Number		Name and Number	
To Whom Sold		To Whom Sold		To Whom Sold		To Whom Sold	
1		1		1		1	
2		2		2		2	
3		3		3		3	
4		4		4		4	
5		5		5		5	
6		6		6		6	
7		7		7		7	
8		8		8		8	
9		9		9		9	
10		10		10		10	
11		11		11		11	
12		12		12		12	
13		13		13		13	
14		14		14		14	
(not obtained)		(not obtained)		(not obtained)		(not obtained)	
Order of Parrowing-as given		Order of Parrowing-as given		Order of Parrowing-as given		Order of Parrowing-as given	
Notes (Parrowing)		Notes (Parrowing)		Notes (Parrowing)		Notes (Parrowing)	

CUT 26.—SCHEME FOR DETAILED RECORDS.

frequent a transfer of the record of the dam as when only one litter is provided for on a page. The latter part of the book is given up entirely to pages illustrated in the latter cut for the purpose of recording litters the dams of which are not to be transferred from their original position.

CHAPTER XVII.

WEANING THE PIGS.

Several methods of weaning pigs are practiced as follows: First the pigs are allowed to run with the sow until they either wean themselves or the sow by refusing to allow them to suckle any longer weans them herself. Second, at weaning time the majority of the pigs are taken away from the dam and put into a place by themselves where they are fed, while a few of the smaller ones are left with the dam gradually to drain the udder, thus allowing the sow to dry up without any difficulty. Third, the pigs are all taken away at the same time, or rather the pigs are left in their pen and the sow is taken away.

SELF WEANING.

According to the first practice two litters per year cannot be produced, as the pigs will not be weaned sufficiently early to allow a second litter to be produced before the close of the year. This method, as well as any other, has its advantages and disadvantages. The advantages are that the pig is not weaned so early and his demands for milk, which is the natural food for young animals and is always the best, are satisfied for a longer period than when the pigs are weaned earlier. The disadvantages are that the pig may depend too much upon this source of food supply, and therefore may not eat enough outside to develop as well as he should. Then, too, as the pigs get older, the larger ones of the litter may

crowd out the smaller ones which will allow the larger ones to develop as they should, but the smaller ones will become runty or stunted and unable to make satisfactory gains thereafter.

REMOVING A PART OF THE LITTER.

In regard to the second practice, the arguments as seen by the writer are unfavorable. If part of the pigs are weaned or taken away from their dam and fed properly, they will get along and develop all right, but the little ones that are left with the dam for the assumed purpose of drying up the sow gradually will not develop as they should. As previously stated, the pigs as soon as farrowed take their places at the udder of the dam. These places they will hold through the lactation period except when they are crowded away by larger pigs of the litter or by pigs of another litter. Usually the pig has only one, but sometimes two teats of the udder. When the smaller pigs are left with the sow after the larger ones are taken away they will naturally keep their own places at the udder. If the dam is to furnish milk for these pigs she must necessarily be fed, and while she is supplying milk from the parts of the udder occupied by these pigs, she will also have it in the rest of the udder. Because the pigs have been accustomed to their respective places, they will drain only this part of the udder which will result in an oversupply of milk in the greater part of the udder and may produce either a caked udder or milk fever, and result disastrously for the pigs that are left as well as for the dam herself. If the little pigs that are left with the dam in such a case make an attempt to perform their duty as intended and try to drain the udder, they will likely get such a great quantity of milk and get it in such a con-

dition that it may upset their digestive apparatus to the extent that they may die.

REMOVING ALL THE LITTER.

The third method cited for weaning pigs is considered the best. By this means all of the pigs of a litter, as well as all of the litters of the particular time of the year, are taken from their dams at the same time. They can all be put on feed at the same time, they will be of the same age, and can be fed to better advantage in lots, and will develop so as to produce an even bunch of hogs which will sell to better advantage. The sows also being weaned at the same time will come in heat during a comparatively short period and, having sufficient boars available, they may be bred again to farrow the next series of litters within a comparatively short time, so that this process can be continued indefinitely. Furthermore, it is thought that a sow will breed more readily immediately after weaning the litter than she will at any other time.

This system of weaning pigs is put into practice as follows: At weaning time all the sows, together with their litters, are brought to their respective places and not given any feed on the morning of the day that the pigs are to be weaned. The pigs are allowed to drain the udders thoroughly and the sows are then taken away to a dry lot or pasture without much grass. They are given free access to water, but no feed during the first day and only a little feed on the second day. By this means the sows are made to dry up, and then they are put on full feed to get them in the best condition for breeding. The pigs are kept in their respective places or divided up into lots and taken to their regular feeding pens where they are immediately put on feed as outlined in Chapter 13.

OUT 21.—PROLIFICACY AND MILKING QUALITIES.

The sow shown in the cut (27) farrowed and raised eleven good pigs at her first litter, and during four years' work was not injured by having her pigs weaned by the method here described. The largest number she ever farrowed was twenty large and well developed pigs.

CHAPTER XVIII.

SHELTER FOR SWINE.

The hog in his native state is surrounded by natural conditions. He inhabits the forests where there is an abundance of shade to temper the heat of summer; and where there are thickets which afford him shelter from the cold of winter and especially from the cold winds; where there is an abundance of water to drink and to wallow in; where the soil may be selected to contain sufficient mineral matter for the development of the bone tissue of his carcass, and where the feed in the form of vegetation is such as may be selected to suit the fancy of the animal. The wild boar, however, is not an economical producer of pork. The domestic hog has been very greatly improved in this regard by selection, feeding and shelter. In order to bring about the greatest possible development of the modern improved hog, he must have proper shelter. Such shelter, however, must be as nearly as possible in harmony with the conditions of nature and at the same time supply the conditions that are conducive to the greatest growth and most economical production of pork.

In order to be best suited to the use for which it is intended, a hog house should furnish certain fundamental conditions as follows: It should be serviceable, sanitary, and supply the conditions that are necessary for maximum development. The soil upon which the house stands should be well drained to furnish dryness; the building should be well lighted and be built so that the direct

rays of the sun fall upon the floor of the pens occupied by the pigs; it should be constructed to be shady and cool during the heat of summer; it should protect the pigs from cold winds and drafts during the winter, and at the same time afford a moderate degree of warmth; and it should be located so that the pigs may have access to pasture which not only supplies considerable food and also mineral substances for the development of bone, but also gives an opportunity for exercise which exerts a profound influence upon the metabolism of the animal.

Any kind of a house that will supply these fundamental conditions and at the same time satisfy the convenience of the feeder or breeder is best adapted to his needs. Hog houses in general are of two types: large houses or those accommodating a considerable number of hogs, and individual houses or cots which, as in the case of the individual pens of large houses, accommodate one sow and her litter.

THE LARGE HOG HOUSE.

The building shown in the cut (28) is presented as an example of a hog house of this type. This building was designed by the writer and first built by the Illinois Experiment Station upon its farm, where it is now in use. Since that time it has been copied by a considerable number of farmers, breeders and experiment stations throughout the country. This house was constructed to afford as nearly as possible all the conditions that are considered necessary in a building of this nature.

Serviceableness.—This house is constructed with pens arranged on each side of a wide alley, which will permit the passage of a wagon, and adjoining the feed room, scale, etc., so that the attendant can care for the largest

CUT 28.—HOG HOUSE AT THE ILLINOIS EXPERIMENT STATION.

number of hogs and do the greatest amount of work with the smallest amount of labor. It is built so that it can be used for farrowing purposes during the winter season as well as during the summer, and when not in use for this purpose it may be used as a place for feeding hogs. Thus the building can be put to use the entire year.

Sanitation.—In order to provide perfect drainage, unless the soil is naturally well drained, a tile drain should be laid away from the hog house about every twenty feet, or from a point between each two pens. This drain should run away from the building at right angles, draining the pens to the outside, also affording a means of disposing of the flush water that may be used on the inside. After reaching the outside of the pens, which are next to the house, the tile may be run in any direction that is most convenient. Any other system of laying the tile that will afford as good drainage will be just as satisfactory. The opening of the drain should be placed between the two pens at the point where the doors lead to the outside. If the pens are sloped a little to this point and the opening to the drain covered with a perforated iron plate, the pens may be flushed with water at any time and the excess will easily run off. This is especially advantageous during the hot weather of summer, for cooling the house and for the purpose of scrubbing the pens.

In order to have the building free from drafts during winter it should be tightly enclosed at all points, especially near the floor of the pens where the pigs lie in their nests. This means that the doors leading from the pens on the inside of the hog house to the exterior should be well fitted. For purposes of warmth such a building should be constructed in accordance with the latitude in

which it is built. Ordinarily for latitudes north of central Illinois such a building should have more than one thickness of boards for the wall. It is suggested, in order not to provide places for rats and mice, that the building be first sheeted on the outside of the studding, over which the siding is nailed with paper between. If then the roof is made equally warm, it will be comfortable in seasons that are not exceedingly cold on account of being far north, without any artificial heat. Ventilation is provided by opening the upper part of the windows in the upper part of the building.

Sunlight is one of the most important considerations, both for warmth and sanitation. The building represented in the illustration stands east and west with the windows on the south side. If sufficient windows are provided, when the sun is shining, the building will be comfortably warm during the winter season. Besides furnishing warmth, sunlight is a very strong disinfectant. The direct rays of the sun will destroy all disease germs very quickly, and a sufficient amount of light, even though the rays are not direct, will destroy practically all disease germs, but not quite so readily. By having a building of proper width and windows of proper height in accordance with the width, the greatest benefit can be obtained from the sun both in warmth and in the destruction of disease germs as well as to furnish dryness to some extent.

The house shown in Cut 28 is 30 feet wide with an 8-foot alley running lengthwise through the middle, the pens being on each side of this. The upper part of the windows in the lower part of the building which is on the south side of the alley are 5 feet 6 inches from the floor. The lower part of the windows in the upper part are 8

feet above the floor. With this arrangement the direct sunlight falls in the pens occupied by the pigs during the farrowing seasons in late fall and early spring. With the windows made as long and set as low as shown above, the maximum amount of sunshine is obtained at these times. Thus, when the weather is quite cold, pigs can be farrowed in such a house under conditions that are warm, sanitary and convenient. If a building is constructed on this plan, it will answer the purpose for most all latitudes, because farther south pigs are farrowed earlier and farther north later. If, however, the building is to be made narrower, the upper windows should be lowered a little to get the maximum amount of sunlight on the floor of the pens at the proper time.

With the windows arranged as suggested, there is no direct sunlight in the pens during the summer. This together with the arrangement of wire partitions, as shown in the cut on page 251, and the doors and windows, make the building cool and comfortable for summer use. At such times the doors at the ends of the building, the doors leading from the pens to the outside, and the upper part of the upper windows are opened, allowing the hot air to pass out while the cool air coming in near the ground can circulate freely over the entire bottom of the building. It is not obstructed because the partitions are all of wire, as will be outlined later.

Farmer's Bulletin 438, U. S. Department of Agriculture, issued April 15, 1911, gives sunshine tables for the purpose of locating windows in houses of this kind. These are helpful, but in the cut used to illustrate this, the upper windows seem to the writer to be too short for maximum usefulness and too high for late fall farrowing. The maximum sunshine for the short windows is had only from 10 a. m. to 2 p. m.

PLAN OF THE HOUSE.

Cut 29 shows the ground plan of the hog house already described slightly modified. The building is approached by means of an alley at the near end. The hog house is represented by the figure O S T U. X Y is the alley running lengthwise through the middle of the building; R represents the doors at each end of the building and one between the part of the building containing the pens which are occupied by the pigs and the rest of the building. The front end of the building is given up to the office, feed rooms, scale, etc. G represents the office, C the bins for the storage of feed, F the feed mixing room, I the small bins from which the feed is weighed out directly to the pigs. E represents the water heater where the water is heated for mixing the slop during the winter season; H shows the hydrant from which the water is obtained. This is connected with the water system of the farm. D represents the platform scale which is used for weighing the pigs and this is provided with a door Q, which may be opened as shown in the cut, so that the pigs coming down the alley will naturally go onto the scales. The scale also is provided with a small door at the other end leading through the door P in the building to the lot on the outside. A door at J leads from the feed room into this lot through which feed may be carried as it is taken to the pens adjoining the hog house on the outside or to nearby pastures.

B is an alley leading from the house to a small yard at the north side of the building. The pens in the house are represented by the figure A. These are ten feet wide and eleven feet deep. These dimensions are not absolutely necessary, but are arranged, as already stated, for the greatest convenience. If the house is narrower or wider,

CUT 23.—PLAN OF HOG HOUSE AT THE ILLINOIS EXPERIMENT STATION.

or the width of the alley of a different dimension, the depth of the pens may be changed accordingly. The width of the pens is taken arbitrarily at ten feet because this is a convenient size and affords room for the feed trough and a sleeping place at one side of the pen, and the doors leading to the alley on the inside and to the pens on the outside of the house on the other side. The doors leading to the inside are represented by N and those leading to the outside by M. L shows the arrangement of the feed troughs. These, as will be seen, are placed at the side of the pen along the alley. Immediately above the trough is a swinging panel as shown in the cut, page 251. This panel may be swung in at the bottom and fastened with a latch that is seen across the center of the panel, thus shutting the pigs away from the trough while the feed is being put into it. After the feed is in, this panel is swung back and the pigs given access to the slop.

K in cut 30, page 248, represents the fender. This is a two-inch tubular iron bar set on posts of the same dimensions in concrete in the floor. The purpose of the fender is to prevent the sows from overlying their pigs or crushing them to death against the walls. This bar is placed about ten inches above the floor and six inches from the wall. It is not necessary to have this extend all the way around the pen because the sow will necessarily make her nest in this corner. The front part of the pen is occupied by the trough and the side of the pen, apart from the place where the fender is, is taken up by the doors, one leading to the alley and the other to the outside. A shows the pens on the outside of the house, which are of the same width as the pens on the inside and are of convenient length. These give the pigs an opportunity to

get out of doors for more exercise and more sunlight. They also open into the lane which leads to the pastures.

INTERIOR VIEW.

Cut 30 shows the interior of the hog house here described. As will be seen all the inside gates, partitions and fences are made of wire woven on tubular iron frames in the form of panels. The panel immediately above the trough which is swung back for the purpose of putting the feed into the trough, is hung at the top. The upper bar projects at either end of the panel, one end of which rests in the iron post, as shown, which stands between the gate leading into the pen and the trough; the other end rests in a notch of the post supporting the roof of the building. The gates leading into the pens are hung and latched so they can be easily opened by the attendant. The wire panels between the pens are made just long enough to reach from the post to the edge of a studding and are held in place by narrow cleats nailed on the side of either end. These panels can be taken out if desirable so that the entire side of the hog house can be thrown together. This, however, is not often necessary in the ordinary use of the building. Sometimes it is found convenient to throw two or three pens together into one when a large bunch of sows or pigs is fed in one drove.

The advantages of wire fences and partitions over wooden ones are as follows: The light coming through the windows at midday when the sun shines in directly or during both the forenoon and afternoon when the sun is not shining directly into the building, is not obstructed and can fall directly upon the floor of the pens. Even early in the morning or late in the evening, when the sun shines through the windows at the ends of the building,

FIG. 3a.—INTERIOR VIEW OF HOG HOUSE AT THE ILLINOIS EXPERIMENT STATION.

the light can pass through the wire partitions, and still strike the floor of some of the pens.

Wire partitions also afford better sanitation; there are no cracks or crevasses for disease germs to lodge in and no dirty places in which they can grow and develop. Thus the building is both warm and sanitary. Furthermore, as already stated, the wire partitions allow free and perfect circulation of air over the entire floor, where circulation is necessary. Pigs during hot weather cannot be kept too cool and the circulation of the cool air should be on the floor where they live.

Another and one of the most important points in favor of wire partitions is that the pigs are always visible to the attendant, who can see when anything goes wrong in any of the pens and render immediate assistance. The pigs occupying different pens are also in view of each other as well as in view of the attendant. Thus when any of the sows are taken in from the pasture and put into their respective pens during the farrowing season, they do not become estranged to so great an extent and therefore are not as likely to fight and injure each other when put back into the pasture after farrowing. The sow also can see what is going on in the house. If a sow in an adjacent pen steps on one of her pigs, causing it to squeal, the sows in the other pens do not necessarily become frightened and jump up and perhaps injure their litters. Also at feeding time the various sows can see where the feeder is at work and will not be so restless and uneasy, climbing up to the top of the pen with their front feet in anticipation of feed, thus injuring their pigs.

The wire gates, panels, iron posts and fenders used in this hog house were not ordinary stock goods at the time this house was built, but were made to order in Michigan.

The Floors.—A hog house should be supplied with floors that are well adapted to the pig as well as being the most economical and durable. The floor of nature is the bare earth. From the standpoint of the hog, there probably is no better floor than a dirt floor when it is kept in proper condition. It must, however, be kept smooth and dry, but not dusty. Since the natural earth as a floor is difficult to keep in proper condition, artificial floors are usually made. Wood floors laid firmly upon the soil are very good from the standpoint of conditoin for the pig, but they are not durable. They rot out very soon and must be replaced which, on account of the present high price of lumber, makes them undesirable. A floor that is raised from the ground is unsatisfactory because with the space underneath it is likely to be cold, and if not perfectly water-tight the liquid manure will seep through, making such a place unsanitary.

In the hog house described part of the floor is made of brick and part of concrete. Where brick was used in this particular case it was a little cheaper, and is a little better because it is not quite so slippery; it is also probably a little warmer than concrete. Where brick was used it is laid on edge in the alley and on side in the pens, on a foundation of either gravel or cinders bedded over with sand, and then the cracks between the bricks are flushed with cement. This makes a solid floor which will not allow the liquid manure to pass through, can easily be cleaned, and will never rot out. The cement floor is laid in the usual way. Floors like these are sanitary and will furnish a cool place for the hogs to lie during the summer, but during the winter season they are too cold.

The concrete or brick being laid on the ground will contain some moisture and is a good conductor of heat,

therefore the animals lying on it will become unduly cold. Pigs kept on such floors are likely to be troubled with rheumatism and may have other diseases brought on from becoming chilled. To remedy this difficulty, wood floors called overlays are made for the corner of the pen occupied by the fender where the sow makes her nest. These are made by simply nailing together boards one inch thick with three or four narrow strips across the bottom. These overlays are put in the corner where the fender is and where the nest is to be with the strips underneath, which keeps the pigs off the brick or concrete, making the nest very warm and dry during the cold weather of winter. In the house described these overlays more than paid for themselves during the first year in the amount of bedding saved, the pigs requiring a great deal more bedding when kept on the concrete or brick floors without the overlays. The amount of good to be derived from these overlays is very great in the improvement of the health of the breeding stock as well as in the number of pigs that may be saved. During the summer season, when these overlays are not needed, they should be taken up and put away to prevent them from rotting and also to make the house neater in appearance and cleaner and more sanitary.

Cost of Hog House.—A house of this kind, or any other kind, may be built economically or expensively, in accordance with the wishes of the builder. It is true that wire partitions are a little more expensive than wooden ones, but the advantages to be gained by them are considered more valuable than the extra cost. Beside this, with the increase in the cost of lumber, it may be possible that the wire partitions will become relatively cheaper. In the building in question the iron material, includ-

ing the fender, posts, gates and fences, cost \$13.60 per pen. This price of course will vary with conditions. Outside of this, a hog house of this character can be built at a total cost that is similar to the cost of other buildings of the same size and construction. In order to save expense in a building of this kind it may be made a little narrower, a little lower, and the pens may be a little smaller. The floors may be left out, and the part of the building containing the office, feed bins, scale, etc., may also be left off, all of which would help to reduce the cost to a minimum.

Location as to Pasture.—In order to be useful to the greatest degree a hog house should be so situated that it will furnish the hogs with an abundance of exercise. This may be done during the summer season by having the house placed to give the pigs access to pasture. The pasture will not only supply exercise, but will also furnish a great deal of the feed, together with considerable mineral matter. During the winter season when pastures are not available, a hog house of this kind can still be located to supply the pigs with exercise. It might be placed at a suitable distance from the regular barn yard where the horses and cattle are kept. During the day the pigs may be turned into the barn yard to pick over the manure and thus get the required amount of exercise. The arrangement of the house and pastures as in use at the Illinois Experiment Station is shown in Cut 31.

HOG HOUSE AND PASTURES.

In the cut (31) B is the hog house, A' pens on the outside, L a small pasture and E and F are the lanes leading to the pastures. In this particular instance there is very little land available for pasture, while a great

many pigs are being bred and grown for experimental purposes, but the arrangement is still such as to provide an abundance of exercise. The larger lots, H and J, afford pasture to the breeding herd in general for the two sides of the house respectively, while the narrow lots, X, shown at the left, are used for the experimental feeding of

CUT 31.—HOG HOUSE WITH A PLAN FOR PASTURES.

pigs. In these the sleeping cots for the pigs are placed at the farther end and the pigs are fed at the front end near the hog house. Thus by traveling back and forth from the cot to the feed trough, considerable exercise is taken and the pig may be compelled to take the desired amount of exercise by simply regulating the number of feeds per

day. These are built in the form of a right angle to have them compact and not take too much room and still have sufficient length. They are of the same length to have the conditions the same in all for experimental purposes. W represents smaller lots used for mature herd boars. This arrangement is not absolute but may be modified to suit circumstances and convenience.

Use of the Hog House.—The use to which such a house may be put is general. Its primary use is for farrowing purposes. The pens are so arranged that this part of the swine industry may be carried on to the best advantage. Between the farrowing seasons, this house may be used for feeding purposes provided it is not used at all times for farrowing purposes. A house of this character then will answer the purpose for producing pure bred hogs for breeding purposes, as well as for producing market hogs. If the breeding herd is large, or if the hog house is small, the herd may be divided so that the pigs are not all farrowed at the same time. As previously outlined, it is desirable to have all the pigs of a given season farrowed as nearly as possible at the same time. The reason for this is that the pigs may be fed to the best advantage because as they get older and heavier they require varying quantities of nutrients. Also if the pigs are farrowed at the same time, they will be more nearly the same size and will sell to better advantage. Thus if the building is not large enough to accommodate all the sows at one time, the breeding herd may be divided. The spring crop may be allowed to farrow, as for instance, in February and April, and the fall crop in August and October. With such an arrangement the house will be in use the greater part of the year for farrowing purposes, and in such a case the feeding will necessarily have to be done at some other place.

The advantages of a large hog house, then, as outlined, are that it is serviceable, sanitary, convenient, and affords safety both to the pigs that are farrowed as well as to the attendant. It also supplies the conditions for handling the pigs with the greatest ease, and for doing the greatest amount of work with the smallest amount of labor. With a large hog house also large pastures can be used; hence after the farm is fenced with hog fence into different fields, these may be used in rotation for hog pastures, which will at the same time save the scattered and lodged grain and supply the pig with a sufficient amount of exercise to allow him to develop normally. Moreover, the acquaintance maintained among the individuals of the herd is of considerable advantage, as well as the fact that the hogs are, when in the house, at all times visible to the attendant.

INDIVIDUAL HOG HOUSES.

These buildings are frequently called cots and received their name from the fact that they usually afford shelter for a single sow with her litter similar to a single pen of a large house. Such houses or cots are usually placed in a small lot where the sow is put by herself to farrow. The pigs after weaning time are still kept in the same lot until grown to maturity. Such a practice has the advantage that individual sows are entirely isolated and away from all disturbance. The pigs have a lot which may be either large or small, but which will furnish exercise and provide them a place to graze. Furthermore, they may be compelled to take exercise by placing the cot at the farther end of the lot and the feed trough in front. Thus by going back and forth from the cot to the trough they will be compelled to take exercise. If disease should

ever break out in the herd, it would not be as likely to destroy as many individuals when they are isolated in this manner as it would if they were kept in close proximity in the large house. However, if the large house is properly constructed and used, and the pigs are properly fed, there is no danger of disease ever breaking out in the herd. If disease is introduced into the herd from external sources, of course the small hog house, on account of its isolation, has an advantage over the large one.

A small house may be moved from place to place, thus providing clean quarters if the original location becomes foul and the manure is not taken away. With this arrangement of individual houses, or cots, the hog lot will be more or less permanent because it is expensive to build new lots. In order to furnish sufficient exercise these lots should be of considerable size, usually from one-half to one acre. A larger area would be still better. This is one of the disadvantages of the small house, or cot, because it involves considerable expense and inconvenience, as a separate lot is necessary for each sow.

A-SHAPED COTS; FRONT AND REAR.

The form in which these small houses or cots are built is decidedly varied, as nearly every breeder or every locality or community of breeders has a special type. Cuts 32 and 33 illustrate both the front and rear respectively of the cots in use at the Illinois Experiment Station farm. As can readily be seen this consists of a base or sill made of 4x4's, to which boards 8 feet long are nailed, meeting above in the form of the letter A. The gables are also enclosed with a door in front and a smaller opening near the top of the rear end. A cot of this form is very good. It affords room for a bunch of eight or ten pigs and when built on skids can be easily

drawn from place to place by a horse. In the cuts given the cots are raised from the ground for summer use. This prevents the sills from rotting and is cooler for the

CUT 32.—FRONT VIEW OF A-SHAPED COT FOR SWINE

pigs. In winter they are set on the ground to make them warmer.

LARGE COT.

The cut (34) shows a small house of another type. This, however, is a little larger and is intended for supplying shelter to a considerable number of breeding animals in a pasture.

Besides these, there are many other designs and sizes of small houses or cots. Some have the roof sloping only one way, others have a gable roof which is short on one

side and long on the other side. In the latter the short part of the roof is usually arranged so that it can be removed to let the sun shine in on warm days. Many times these cots are built square, like an ordinary house, with windows and doors at the sides. The size of these cots

CUT 33.—REAR VIEW OF A-SHAPED COT FOR SWINE.

should be such that they will shelter the desired number of pigs, and in the manner of construction the fundamental principles for a hog house should be observed, namely, they should allow the sun to shine on the floor of the interior; they should afford warmth and shelter from cold winds in the winter; they should have sufficient fresh air, and at all times they should be dry.

The individual hog house system as compared to the large house is further handicapped by requiring more labor to feed and care for the herd, and the cots are not as well adapted for purposes of farrowing because a fender cannot be so well arranged, it is not so sanitary, and in the case of vicious sows not so safe for the attendant. A cot, however, costs less than a pen in the large hog house, but this is at least partly overbalanced by the fact that each cot has with it, when used for farrowing purposes, a small pasture.

Perhaps the best and most economical arrangement is a combination of the two, using the large house for farrowing purposes and the cots or small houses as shelters for the shotes and fattening hogs, as well as for the members of the breeding herd that are not in the large house caring for a litter. The large house, when built as here outlined, and when not in use for farrowing purposes, can be used to better advantage for feeding than the cot because it is more sanitary, more convenient, and also cooler in summer.

A PORTABLE PANEL FENCE.

A piece of fence that can easily be moved is a great convenience on a hog farm. With it pens can quickly be made or readjusted to suit circumstances. Many times such a fence is not in use because its advantages are not known, or because it is thought to be difficult to construct. To simplify the construction of such a fence the cut (35) and following directions for construction are herewith given. This was originally prepared for an Illinois Experiment Station circular, but only a limited number of this circular were published. There are other fences of this nature in use, but this has proved satisfactory at the Illinois Experiment Station farm.

CUT 34.—TYPE OF LARGE COT OR HOUSE FOR SWINE.

Method of Construction.—Construct a table four feet wide and seventeen feet long. (With a little more care and inconvenience the barn floor may be substituted for the table.) At one end of the table and at right angles with the same nail a piece of straight board, C, Figure A in the illustration. At the front side of the table, or the side of the workman, nail two blocks, d, made of two-inch lumber, so that they are at right angles to c, to form supports for the lower board of the panel and the lower ends

CUT 35.—PORTABLE PANEL FENCE FOR SWINE.

of the two end cross bars. Then take two-inch blocks, f, e, g, that are about two inches wide, and nail them to the table so that their outside ends are 11 inches from the proposed ends of the panel, and arrange them so that it is nine inches from the upper side of d to the upper side of f, eleven inches from the upper side of f to the upper side of e, and fourteen inches from the upper side of e to the upper side of g. Next place six-inch boards sixteen feet long (the length of the panel) so that they lie firmly

against the upper side of the blocks d, f, e, g, and butt against c. This may easily be accomplished by raising the farther side of the table a little so that the boards will keep their position against the blocks. The table should also be inclined a little toward c. The crossbars which have been sawed 40 inches long are now nailed one across each end and one at the middle as shown in the illustration. These are to be six inches wide and only on one side of the panel and nailed with 8d wire nails which should be clinched. The two end crossbars can rest against the ends of the blocks f, e and g, with their sides and against d with their ends. Saw out one inch deep from the upper edge of each end of the lower board outside of the cross-bar. This will make a fence that is forty inches high when the lower board rests on the ground. By following the method here outlined the panels will all be of the same dimension and will thus fit the triangles without difficulty.

To construct the triangle represented in B and B' and used to support the panel, saw three pieces of board six inches wide and four feet long. Nail a one-inch board at the front side of the table for a straight edge and use this as the base line. Take a point l on the base line and 21 inches each side of this point, the points m and m'. Take a point o so that it is $27\frac{1}{2}$ inches above l, and at right angles to the base line at l. Now take two of the boards four feet long and lay the lower and inside corners at m and m', and allow the inside of the two boards to cross at the point o. Nail the boards lightly in this position, and lay out r and s which are notches sawed out for the ends of the boards of the panel to fit into. These notches are $2\frac{1}{2}$ inches wide and the upper end of r is $28\frac{1}{2}$ inches from the base line. The lower end of notch s is $7\frac{1}{2}$

inches above r. Now draw out the nails, saw out r and s, and use the two pieces i and j for patterns. For h take a six-inch board four feet long and at the middle of each side saw out a notch one inch deep and $2\frac{1}{2}$ inches wide.

After having sawed out a sufficient number of pieces according to Figure B, then proceed to put them together as in Figure B'. Saw out a piece, x, $17\frac{1}{2}$ inches long, 2 inches thick and $2\frac{1}{2}$ inches wide. Nail this on the table so that its median line is perpendicular to the base line at l, and so that the upper end is $28\frac{1}{2}$ inches from the base line. Now prepare two blocks, y and z, of one-inch lumber and nail them to the table so that the outside lower points, as in Figure B', are each 21 inches from the point l. Place i, j and h in the position as in Figure B' so that the inside notches of i and j will rest firmly against the upper end of x, and that the notch on the upper side of h will rest firmly against the lower end of x and that h is parallel to the base line. Nail firmly and saw the corners of h so that it is flush with i and j. The upper ends of y and z have nothing to do with determining the lower line of h. Use 8d wire nails and clinch.

Both the triangles and panels should be made of common rough fencing and the number of triangles should equal the number of panels plus one. In placing the panels and triangles to make a fence, reverse every alternate panel so that the crossbars are on opposite sides and set a triangle at every juncture of the panels and at the ends of the fence.

CHAPTER XIX.

TUBERCULOSIS.

Tuberculosis is a germ disease and affects swine in a similar manner in which the human family is affected by consumption, which then is simply another term for the same disease. The first external symptom of tuberculosis in swine is that the hog will appear less thrifty and not make as rapid gains. As the disease develops the hog becomes sick in appearance, ceases to make gains, and then rapidly loses flesh, and finally dies. Frequently tuberculosis is accompanied by a cough, but very often this is not true.

This disease is caused by a germ called *Bacillus tuberculosis*. The germ is so small that it can float in the air the same as particles of dust, and consequently may be inhaled at any time in places that are affected with this disease. Furthermore, the germs are so small that when once they are taken into the system, they can pass out of the digestive system and out of the circulatory system very freely. As a comparison the tubercle bacillus compares in size with the blood cell as a piece of a lead pencil compares in size with an apple. Thus it is seen that the blood vessels which contain the blood cells would not necessarily retain the tubercle bacilli. These are so small that they could readily pass through the meshes of the various tissues of the body.

The name tuberculosis originated from the fact that when one of these disease germs becomes lodged at any

point in the body, it develops into what is called a tubercle. That is, the germ multiplies very rapidly, which causes an irritation at the point and produces a swelling. As this swelling continues to grow and the germs continue to multiply, it becomes hard, and still later the interior of it will become mortified, decompose and form an abscess. The contents of this abscess may be either in the form of pus or may be dry and gritty.

The tubercle bacilli gain entrance to the bodies of different species of animals in different ways. In the case of man and also cattle the germ may be either inhaled or taken in with the food.

With swine the disease germs usually gain entrance by being taken in with the feed, hence by ingestion. It is only seldom that the disease starts in a hog by the germs being inhaled. This being true, the disease is very easily controlled with swine. The parts affected first in the hog are usually the glands of the lymphatic system which are located in the neck immediately back of the jaw bone. Thus if the head of a hog is cut off at this point, it can very easily be determined whether the hog has tuberculosis or not by first examining these glands in a healthy hog, and then those of the hog killed. When these glands are affected with the disease they take on the nature of a tubercle; that is, at first they may be simply enlarged and congested, and later they may have small pus particles scattered throughout which in the final stages may become one large abscess. As these parts swell when the tubercle develops they cause irritation in the throat and may be responsible for the coughing that results from this disease. When the lungs of a hog are affected, he will of course always cough. As the disease develops the lymphatic glands throughout the body are usually affected

next, and then the disease spreads to the intestines, the liver, the spleen, the lungs, the chest cavity, and may in the final stages be found in most of the inner parts of the body.

PREVALENCE OF THE DISEASE.

This disease is most prevalent among swine in those sections of the country where cattle are most affected, which usually is in the dairy sections and sections where beef cattle are being fed for market. More hogs are being condemned at the large packing centers for tuberculosis than for all other diseases combined, including hog cholera. Furthermore, while comparatively a few years ago few animals were condemned, at the present time it is thought that about 3 per cent are affected, and the disease is gaining headway very rapidly. That is, a larger percentage of hogs is being condemned every year.

All hogs affected with tuberculosis are not necessarily condemned. If the disease is present only in the first stages, so that just a few organs of the body are affected, these parts only are condemned; while if the disease has become general so that it is found in various parts of the carcass, the entire hog is condemned. These condemned carcasses are almost a complete loss. They are used for the manufacture of cheap grease and fertilizer. The lard is rendered from such a carcass in an enclosed receptacle like a steam boiler called a tank, by means of live steam under pressure. This boils out the lard which is then pressed from the solid matter. The heat in such a process is sufficiently great to destroy all disease germs. Thus even if the lard, or the rest of the contents of the tank, were used for other purposes than those mentioned it would not be particularly dangerous.

SOURCE OF INFECTION.

As already stated the disease is caused by the tubercle bacilli. The question then naturally comes up, Whence comes the germ that causes this disease in swine? It is usually caused by the pig eating feed that is affected with tuberculosis. Various causes may be cited as follows:

Skim Milk.—Milk from tuberculous cows may contain the tubercle bacilli; while all tuberculous cows do not give tuberculous milk, it is said that as high as twenty per cent of them may have the disease germ in the milk. If this is fed to pigs it will naturally cause the disease, as a pig is very susceptible to germs of this nature. In order to prevent this cause of infection the dairy herd should be thoroughly freed from tuberculous individuals, or else the milk should be sterilized. This may be done by boiling the milk before it is fed. Pasteurizing also destroys most of the germs. The latter consists in keeping the milk at 60° C. or 140° F. for twenty minutes.

Country Slaughter Houses.—These slaughter houses are very often responsible for tuberculosis in swine. Such places usually have a drove of pigs present to consume the offal which otherwise would be wasted. Eating the entrails from the bodies of tuberculous cattle that are slaughtered and thrown out to the hogs, they will be pretty sure to become affected with tuberculosis. This means of infection is usually very great because often cattle that are not thrifty are sold and frequently are sold to country butchers, because they are sold at unusual times. Furthermore, these places do not have government inspectors, hence all the animals slaughtered at such places pass into consumptive channels which is dangerous to the hog eating the offal in a raw state.

Other Means of Infection.—Very often cattle that die on the farm die of tuberculosis and are taken into the hog lot where the carcass is consumed. In such a case tuberculosis is also started in a herd of swine. If tuberculous cattle are being followed by swine in a pasture or feed lot, the disease will also be transmitted. The droppings from such cattle may be filled with the bacilli and the hogs eating them will naturally eat the germs and contract the disease. Human tuberculosis even may be transmitted to hogs in a case where the sputum is not properly taken care of, but thrown into the slop bucket the contents of which are finally taken to the hogs.

If the disease is once present in a herd of swine it may be transferred from one individual to others in the herd. In order to be thus transmitted the disease must be sufficiently far advanced that the hog will cough up the tubercular material from his lungs in the form of sputum, which would be responsible for starting the disease in other individuals, especially if they eat the sputum. The disease is very readily transmitted from the sow to her litter. If the sow has tuberculosis in a generalized form, and especially if she should have tuberculosis of the udder, the disease will almost certainly be transmitted to the pigs sucking her. If the disease is present in a herd, it is usually found in quite a number of individuals—not because the disease is easily transmitted from one individual to another, but because different individuals of the herd contract the disease from the same source.

DURATION OF THE DISEASE.

Tuberculosis works much more rapidly with swine than it does with cattle. A pig, if affected when young, may succumb to the disease within a few weeks. At other

times the disease may last much longer. A hog may even be affected with the disease and not show the effects of it until after he is slaughtered. The duration of the disease also is determined to a greater or less extent by the condition of the animal and the amount of tubercular material eaten.

Kind of Pigs Affected.—Young pigs are more subject to the disease than older hogs, and brood sows are more likely to be affected than barrows because during the periods of gestation and lactation they are more reduced in vitality, hence more subject to disease. A strong, healthy, vigorous animal can withstand the attacks of this disease as well as of others better than one that is not in such a condition. Therefore it is not necessarily true that all animals eating tuberculous feed become affected with the disease. Those that are weakest in constitution and have the lowest degree of vitality, or those that eat the largest quantity of the diseased material, are the ones that are affected first and also are the ones that will succumb first.

HANDLING A TUBERCULAR HERD.

If the disease is present in a herd, it can very readily be diagnosed before it has advanced sufficiently far to be transmitted from one individual to another. The diagnosis consists in knowing whether the animals are thrifty in appearance, whether they cough, whether they are making rapid gains, or whether they are gradually losing in flesh and finally die. If the glands of the neck are affected to the extent that they become swollen, this may also be used as a means of diagnosing. If the disease seems to be present in a herd, the individuals that are apparently the most affected should be immediately killed

and examined. If found to be present by an examination of the glands of the neck, as well as of the internal organs in general, noting whether these contain tubercles—then all the individuals that show the effects of the disease externally should be immediately destroyed and the carcasses should either be burned or buried sufficiently deep that they will never come to the surface. Thus the individuals that are likely to prove dangerous are put away and the remainder of the market herd should be put on the market and passed upon by a government inspector as soon as they can possibly be put into proper condition. Any of these that are sufficiently diseased to render the carcass unfit for food will be condemned and put into the tank for cheap grease and fertilizer.

With the present arrangements of packing house methods, all animals that do not show disease to a sufficient degree, either tuberculosis or any other disease, so that it can be recognized by the inspector at the scale as the hogs pass by him, are taken and paid for by the packers. Thus the loss to individuals who desire to clean up their herds of tubercular animals is not very great, if taken in time. However, if the disease is not promptly taken in hand, it may advance to such a stage that the greatest part of the herd will become a complete loss to the owner. This is especially true of swine because the disease works much more rapidly with them than it does with cattle.

If the system of tagging that is being advocated becomes adopted, it will mean that the loss of tubercular animals will fall directly upon the individual owner. By this system all the animals that are slaughtered will be tagged and if found diseased will be traced to their owner who has to stand the loss. With present arrangements

it is true that the individual owner is not the loser alone, but the loss as a whole falls upon the producer, for the packer, knowing what per cent of his hogs are condemned daily, will pay sufficiently less so that this part of the loss is well covered.

Valuable breeding animals need not necessarily be disposed of, but they should be carefully watched and taken in hand when the disease first manifests itself and care should be exercised that the litter is not allowed to suck a tuberculous udder.

After removing the tuberculous individuals from a herd, all places occupied by the hogs should be thoroughly disinfected. Buildings and all wooden surfaces should be thoroughly washed with a five per cent carbolic acid solution or 1 to 1,000 corrosive sublimate solution (mercuric chloride), and then whitewashed with a fresh lime mixture. Pastures and feed lots exposed to the sun are not such a serious source of danger as the buildings, but it is well to keep the hogs out of infected pastures and feed lots for a time after removal of the infected herd. If possible it is well to use other land for the new lot of hogs and to plow up the old pastures and lots.

The last but not the least important consideration to free a herd from tuberculosis is to remove the cause. All tuberculous feed should at once be withheld.

CHAPTER XX.

HOG CHOLERA.

Hog choléra exists principally in the corn belt of the United States. Its prevalence is not uniform from year to year and when the disease does appear it does not have the same degree of virulence; that is, sometimes comparatively few of the hogs that have it will die, while at other times nearly every individual in an entire herd will be taken. When it once appears it spreads very rapidly, not only among the individuals of a herd, but across the country from farm to farm. Thus it is one of the principal drawbacks to the pork-producing industry of the United States. Many times when a breeder gets nicely started and gets a bunch of hogs almost ready for market, the disease may suddenly attack and destroy his entire herd. This will give him a severe set-back from which it is very hard to recover, and it is the cause for the fact that not as many hogs are raised as would be if this disease were not so prevalent.

CAUSE OF THE DISEASE.

Hog cholera is primarily a germ disease. It was formerly supposed to be caused by a germ called *Bacillus cholera suis*. Recent investigations, however, have shown that this is not the case, but that the disease is caused by some living organism which is so small that it can pass through the finest kind of a porcelain filter and is so small that it has never been detected with the most powerful microscope. Furthermore, the bacillus of the virus has

never yet been successfully cultivated by any artificial method. So far as known this virus will not produce the disease in any other animal except the hog, at least not to a fatal degree.

Since this disease is prevalent to a greater or less extent only in the corn belt, it might be called a corn belt disease and its prevalence depends apparently on the condition of the animal. Nature has endowed all animals with a means of protection against disease germs. The white blood corpuscles of the body perform this duty by destroying disease germs as they come into the system. If by any system of feeding the general tone or vitality of the animal has been reduced to such an extent that it is unable to destroy the disease germs as they are brought into the system, or if these germs are brought in in such large numbers that the natural means of the animal with which it is endowed cannot destroy them, then the disease will develop. Since the prevalence of the disease is only in the cornbelt it would seem that this reduced state of vitality of the animal body is entirely responsible for its origin. After the disease once becomes established, then the germs will be produced in such large numbers that even the most resistant of animals, except those that are naturally immune or have been rendered immune artificially, will contract the disease. Herds that have been properly fed, however, will not suffer so severely as those that have been improperly fed.

MANNER OF SPREADING THE DISEASE.

The disease may be spread by association, which probably means the inhalation by a healthy individual of the expelled air of a diseased animal; also by ingestion of diseased particles of food, or of virus direct. Any means

therefore that will cause the spread of this virus or of the germs, will be responsible for the spread of the disease. Very often when the disease breaks out in a neighborhood, the adjoining farmers will come to investigate and offer advice, and by so doing they may carry away a sufficient number of germs on their boots to spread or produce the disease in their own herds. Dogs running across the country, and even crows flying from a yard containing the disease to a healthy herd, are supposed to carry sufficient germs to start the disease. The wind blowing particles of dust from one place to another will also carry with it sufficient of these germs to start the disease.

PREVENTION OF THE DISEASE.

Thus far there has not been discovered any means by which this disease can be cured; the only safeguard, therefore, is prevention. Since hog cholera, as herein outlined, seems to be a corn belt disease, it would indicate that improper feeding is the direct cause of an outbreak and the prevention, then, would be proper feeding. If a herd is properly fed so that it has strong resistant powers, there is apparently no danger of the disease breaking out. From what has been stated, if the disease is in the neighborhood, there is danger of it being carried to other herds, and it is well to have every means of prevention at hand.

The quarantine method is adopted either to prevent the disease from gaining entrance to a herd, or to prevent its spreading after it is once started in a herd. In order to prevent a herd from contracting the disease, provided it has developed in the community, the herd should be thoroughly quarantined. That is, it should be completely isolated from all external communication so that there will be no possibility of the germs being carried to it. A

creek or any other form of running water flowing across the country will carry these germs. If the diseased hogs are allowed access to such a stream, sufficient germs may be carried down the stream so that any hogs having access to it farther down will be likely to contract the disease.

In order to prevent its spreading after the disease once gains entrance to a herd, the hogs should be divided up into as small lots as possible which should be kept completely isolated from each other. If any of them are already affected and show signs of sickness, these should be entirely separated from the healthy ones, and the healthy ones should be divided up into as small bunches as possible and kept in separate pens. Then by exercising great care in going from the diseased hogs to the healthy ones,—not using the same clothes or the same apparatus for feeding,—there will be the least danger of communicating the disease to other hogs in the herd.

Great care should also be exercised when new animals are brought into a herd. It is usually well to quarantine these for a period of about three weeks so as to be sure that they do not have the cholera, before they are put into the general herd. Unaffected hogs may be bought from entirely healthy herds, but this is not always true, as the herds from which the hogs are purchased may have been recently infected and the disease not yet developed so as to be noticed. The period of incubation, or the period from the time the disease germs are taken into the system to the time that the disease appears, is from one to two weeks. Consequently, diseased animals may be bought when a herd is apparently entirely healthy. Furthermore, healthy individuals shipped across the country may come in contact with the disease in various forms;

they may be shipped in infected cars, they may pass through infected localities, and they may come in contact with diseased animals en route. This is especially true if they pass through stock yards and thus get the disease which will manifest itself after the pig reaches its destination, and if not quarantined may inoculate the entire herd.

GOVERNMENT HOG CHOLERA SERUM.

The Bureau of Animal Industry of the United States Department of Agriculture has developed a serum which, by means of vaccination, will render hogs immune (not subject) to hog cholera.

Preparation of the Serum.—In order to prepare this serum an immune hog must first be obtained, either one that is naturally immune to the disease or one that has been rendered immune artificially. This hog is hyper-immunized. This consists of inoculating him in the muscles of the thigh with about 1000 c. c.* of virulent hog cholera blood, from which the clot has been removed, per hundred pounds live weight of hog. The hypodermic inoculation consists simply in placing the inoculating fluid beneath the skin or in the muscle of the hog, which is done by means of a syringe that has a hollow pointed needle. The syringe is filled, the needle forced through the skin, and the contents expelled. But in the case of inoculations of this kind this fluid is usually forced into the muscles of the thigh, in which form it is more satisfactory. There are two ways in which this hyper-immunization is brought about. First, the inoculating fluid, or the 1000 c. c. of virulent hog cholera serum which is injected into a hundred-pound pig, may be injected at one and the same time. This is called the quick method. The slow method consists in using a part of this amount of

*Cubic centimeters

serum at one time, taking a small quantity to begin with, after a week a larger quantity, and still later a larger quantity still, until the entire amount is used in three or four inoculations. When an immune hog is thus inoculated, it is said to have been hyper-immunized.

If a naturally immune hog is not at hand, or cannot be obtained, and the serum is to be prepared, a hog must first be made immune as will be described later in the regular process of protecting hogs from hog cholera, and following this he is hyper-immunized as already stated; that is, by being inoculated with 1000 c. c. of defibrinated hog cholera serum from a hog that is sick with hog cholera. This may be done by the quick method, injecting the serum all at once, or by the slow method by which it is injected at three or four different times, starting with a relatively small proportion of this quantity and then gradually using larger quantities in successive weeks thereafter.

About a week after the injection of the serum in the process of hyper-immunization, the hog is ready to have his blood drawn for the regular process of protecting hogs from hog cholera. The blood may be drawn by two processes: The hog may be killed and his entire quantity of blood taken at once, or he may be bled at the tail. The latter method is usually resorted to. The tail is thoroughly cleaned and disinfected with an antiseptic solution and then the end is cut off so as to allow the blood to flow out, which is caught in a sterilized bottle under antiseptic conditions, or under conditions such that it does not become infected with foreign germs of any kind. By this method, from 300 to 600 c. c. of blood may be obtained at one time. This is repeated two or three times at intervals of a week. It cannot be carried on longer

than this because the blood gradually loses the properties that it has acquired by the hyper-immunizing process and will no longer protect hogs from hog cholera.

After the blood has been collected by either one of the methods here described, it is allowed to clot, and then is filtered through sterilized gauze so as to get the serum or the liquid part of the blood separated from the clot. The serum or the liquid portion is the part that is used. This is mixed with a five per cent solution of carbolic acid, making a .5 per cent solution, in which form it is more easily preserved.

Use of the Serum.—In order to protect hogs from hog cholera, they are inoculated hypodermically, as previously stated, with the hog cholera serum. In order to protect hogs from this disease, they must be inoculated with the serum before they have contracted the disease, or at least within four days after being exposed. Twenty to thirty c. c. of this serum is used for a hog weighing 30 to 75 pounds. If a hog is thus inoculated with this serum, he will be rendered temporarily immune, and his immunity is supposed to last several weeks. Such immunity, however, is not as great as by means of the serum simultaneous method.

According to this method, the hog is inoculated with this serum, which is usually injected into the muscle of the thigh on one side of his body, and at the same time, two or three c. c. of virulent hog cholera serum, obtained from a diseased hog and prepared in a way so that the clot has been removed from the serum, is injected into the muscle on the inside of the thigh of the other side of the body. Two to three c. c. of virulent hog cholera serum is considered a fatal dose when injected into a hog without the serum from a hyper-immune hog, and will

produce a fatal case of hog cholera. Thus by injecting the virulent hog cholera serum on one side of the hog, and the protective serum from a hyper-immunized hog on the other side, the hog is rendered immune. This immunity is much greater than in the case where the serum alone is used, and lasts for a much longer time. Where by simple inoculation with the serum the hog is rendered immune for several weeks, if he is inoculated by the serum simultaneous method he will be rendered immune for several months, and possibly a great deal longer. Such immunity is thought to be permanent in some instances.

As just outlined it will be seen that this is a process of vaccination. By inoculating according to the simple method where the serum from an immune hog is used alone, it will have the germs or whatever else the virus may be, that cause the disease, but in such an attenuated form that it will render the hog but slightly immune. By the serum simultaneous process where the virulent hog cholera serum is injected into one side, and the protective serum from the hyper-immunized hog on the other side, the properties of the latter will counteract the virulence of the disease germs of the former, thus producing the disease in a mild form, but not sufficiently virulent to be fatal, and at the same time developing in the hog protective means by which it can resist future attacks of this virus.

Curative Properties of the Serum.—So far as is known at the present time, the serum has no curative properties whatever. That is, after a hog shows symptoms of the disease known as hog cholera, he cannot be saved, unless he would live through the disease anyway, by being inoculated with this hog cholera serum. However, the protective properties of the serum may be used to advantage

even up to four days after exposure. Thus it is seen that a considerable number of hogs of a herd may be saved even after the disease breaks out. The entire number would probably not be exposed at the beginning, and furthermore, the disease is not transmitted from one individual to the next in the herd until after it breaks out, and there is a period of incubation between the time the hog is exposed and the time the disease breaks out or manifests itself. Thus after the disease appears in visible form in a herd, if the healthy individuals are immediately inoculated, a greater portion of them may be saved. In such a case, the simple method of inoculation by using the protective serum alone, and not the virulent hog cholera serum, will furnish practically the same results in the individuals that were already exposed as would otherwise be obtained where the entire healthy herd is treated by means of the serum simultaneous method; because after being exposed to the disease, the hog has already in his system the virus or the germs that produce the disease, the same as would be introduced by injecting into the hog the two or three c. c. of virulent hog cholera serum. The protective serum that is injected at such a time will counteract the disease germs that are already in the system and thus render the hogs more or less permanently immune, at least for a period of several months.

Objections to the Serum Method of Treatment.—The two principal objections to this method of treating hogs to protect them from hog cholera are that it is expensive, and that it is somewhat dangerous. It is expensive because a hog will furnish a comparatively small amount of blood, from 1000 to 2000 c. c., from which the serum can be obtained. Considering that the clot must be taken from this, and that it requires from 20 to 30 c. c. for a

comparatively small hog,—that is 30 to 75 pounds,—it can readily be seen that the expense of this method is an item of considerable importance. Furthermore, the hogs from which this serum is to be obtained must first be rendered immune and then hyper-immune, which involves labor and expense and the danger of losing some individuals; besides this the process of manufacturing must be continued indefinitely so as to have the serum on hand for any possible outbreaks of the disease. Although the serum may be kept for a considerable length of time, it is not considered that it will keep indefinitely. When prepared with the carbolic acid solution, and kept in ordinary cellar temperature, it may be preserved for several months.

The hyper-immunizing process is dangerous because it requires the use of the virulent hog cholera serum, or serum containing the living hog cholera organisms. When this is used without the protective serum an outbreak of hog cholera is immediately started. Thus if this method of treatment is put into the hands of people who are not thoroughly familiar with this sort of work, there is danger of spreading hog cholera broadcast.

Since the development of this hog cholera serum by the Bureau of Animal Industry of the United States Department of Agriculture, various state experiment stations have taken up the work and have tried to improve upon it. At different places the method has been somewhat modified. In some cases, the hog in being rendered hyper-immune, is fed the viscera of hog cholera hogs in connection with being inoculated with the virulent hog cholera serum.

The horse and also the donkey have been used as a means of producing serum that shall have the same prop-

erties as the serum of the hyper-immunized hog. While this work has been more or less successful, it has not as yet been carried far enough to have any very definite results. It can easily be seen that if the blood serum of a horse could be used, it could be made much more cheaply because the horse will produce a very much greater quantity of blood serum. In the case of hogs, individuals from which the blood is drawn, after being hyper-immunized, are not necessarily a loss because the carcasses of such hogs can be used for pork.

SYMPTOMS OF THE DISEASE.

The symptoms of hog cholera given briefly are as follows: Pigs having the disease will present the general appearance of sickness and may have a short hacking cough. They lose spirit and activity, the ears and tail droop, the coat becomes rough and the pigs lose their appetite, become weak and are disinclined to move about. They may at first be constipated and then develop diarrhea, passing dark and very offensive feces. In very acute cases the pigs may even die before sickness is noticed. The skin at the more tender parts may be red and inflamed. Other ailments may also produce these same symptoms except the feces.

On post-mortem examination yellow and black ulcers may be found in the wall of the intestine. In acute cases these may not be found and the internal organs and body fluid may be red, or the intestines and other internal organs may be dotted with small red spots, and sometimes only a few red pin-points are found on the kidneys and it may even be necessary to remove the outer membrane to see these.

CHAPTER XXI.

LICE.

The hog in his natural state is not known to be affected with these parasites. Hence it is clearly a malady that has either been brought on, or allowed to develop under the conditions of domestication. The hog louse is a flat, oval insect of a dark color, and comparable in size when full grown to a flax seed or a grain of wheat. It lives upon the skin of the hog and saps his blood, thus reducing the vitality, and when badly infested the hog may become decidedly unthrifty.

MEANS OF COMBATING.

Since wild hogs do not have lice, there must be a natural means of destroying the lice or else the conditions under which the wild hog lives are such that this insect cannot develop.

The Mud Wallow.—The mud wallow is the natural means of destroying lice. It is a well known fact that many herds of swine are never affected with lice; also that hogs having free access to good mud wallows are not troubled in this way. Hog lice cannot live under a coating of mud; consequently when a hog has access to a mud wallow and covers himself entirely over with mud, the lice will be destroyed, or at least driven off. One means of destroying lice then, is supplying the pigs with a good mud wallow. While this may have some objections, nevertheless it also has advantages besides the destruction of lice.

A mud wallow will afford white hogs a means of protection from the heat of the sun. A coating of black mud on a white hog will serve the same purpose as the black cuticle of the black hog, namely, it will arrest the rays of the sun and not allow the entire quantity to go into the interior of the body. A hog that has free access to a mud wallow can keep cool during the heated weather by lying in the mud and this also puts the skin of a hog in good condition. After being taken out of the mud wallow and thoroughly cleaned and dressed up, a hog is in very good show condition so far as his skin is concerned. When the mud wallow is used, it should be kept sanitary. A good way to do this is to have a small stream of water running through it at all times.

The Water Wallow.—Lice are also destroyed by having water wallows and using either crude oil or some of the coal tar dips in the water. The most natural water wallow, namely, a creek or other stream, cannot be prepared in this way, but where the water stands either in pools on the ground naturally, or where a cement trough is provided for this purpose, the water may be properly prepared to destroy lice as the pigs wallow in it. This also should be kept sanitary.

The Rubbing Post.—The rubbing post is sometimes used as a means for destroying lice. Lice usually first inhabit the arm pit, or place between the forearm and brisket, and the place back of the ears on the neck. The lice as well as the nits will usually be found in these places first and later they will spread over the entire body. The nits or eggs are small elongated white objects that may readily be seen with the naked eye and are fastened to the hairs. The rubbing post is intended to destroy the lice and nits at the side of the hog, and espe-

cially at the side of the neck, and may also help to keep other parts of the hog free. Such a post is made of hard wood set in the ground. A hole is bored down in the center of this post from the top; holes are also bored in the side of the post meeting the center hole and these are plugged with soft wood. The hole in the post is then filled with kerosene oil, which will seep through the soft wood plugs to the outside of the post. Kerosene or any other form of oil is deadly to insects of any kind because they breathe by means of small openings in the side of their body. If a little oil is put on an insect these breathing pores will be stopped up and the insect will die as quickly as an animal would if put beneath the water. Thus when the hog rubs against this post, he gets the oil onto his skin, and this will destroy the lice and also the nits which the oil touches.

Rubbing and Spraying with Oil.—Another means of destroying lice is by simply rubbing those parts of the hog infested with nits with a cloth soaked in kerosene or in any other form of grease. While this is a rather slow process it is very effective.

A more rapid means is with a spray pump. Either a kerosene emulsion, which is a solution of kerosene and water, or crude oil may be used. Ordinarily a force spray pump, such as can be set into a bucket of the solution, held in place with one foot and worked with one hand, is used. The short piece of hose containing the nozzle is held in the other hand, and after the hogs are driven into their sleeping place or cot, they are thoroughly sprayed. In such an operation care must be taken to entirely cover the hog at all points with the solution. This is sometimes difficult to do as the under side of a hog, especially in the arm pits, is not very easily reached. The advan-

tage of this system is that if hogs are thus sprayed in their sleeping cots these places are also freed from lice.

Kerosene emulsion usually contains from 5 to 10 per cent of kerosene. Since oil and water do not mix very readily, care must be taken as to how this is prepared. One way to make kerosene emulsion is to take one-half pound of hard soap and dissolve it in one gallon of hot water and then add two gallons of a cheap grade of kerosene. With a high grade of oil a smaller quantity will suffice. This should then be thoroughly emulsified, or mixed, which is probably done the best by means of the spray pump just mentioned. The pump set into the bucket containing the hard soap, water and kerosene, may be worked and by turning the nozzle back into the bucket thoroughly mix the solution. After being thoroughly mixed in this way, the hard soap tends to keep the oil in suspension, then seven gallons of water should be added and the whole again well mixed; it is then ready for use.

The Dipping Tank.—One of the best methods of destroying lice is by means of the dipping tank. The cut (36) shows this piece of apparatus as in use at the Illinois Experiment Station farm. Various solutions may be used in this as well as by the other means of destroying lice. Coal tar dips are frequently used and are quite effective, but not always so. They have a tendency to destroy the greater part of the lice, or at least drive them away, but they do not destroy the nits. It is necessary therefore to dip a second time about ten days after the first dip to destroy the lice hatched from the nits, and in practice it is found that if hogs are to be kept free from lice with coal tar dips they must be used frequently. It has also been found on different occasions that hog lice may be given a bath in a solution of the coal tar dips and not be seriously

CUT 38.—DIPPING TANK FOR SWINE.

affected. Consequently this treatment is not always fatal to lice. Coal tar dips, however, have the advantage of having antiseptic properties, hence the skin of the hog when dipped in such a solution will be kept in good condition. Kerosene emulsion may be used in the dipping tank, but this is somewhat expensive and difficult to prepare.

One of the best solutions and one of the cheapest preparations for destroying lice is crude oil. This may be used by filling the tank nearly full of water and then pouring a few gallons of oil into this. The oil will float on the surface of the water. When hogs are driven through and made to dive into this solution at one end of the tank and swim to the other end and walk out they are thoroughly covered with oil at all points. Oil in this form also is not sufficiently strong to do any harm to the hog. Furthermore, it will destroy all lice as well as the nits.

A convenient arrangement of a dipping tank is shown in the foregoing cut. The tank is set into the ground. The available commercial tanks are usually made of galvanized iron. Cement can also be used and is more durable. The tank should be wide enough so that a hog will not become wedged in and deep enough to allow the hog to go completely under. The lower corner should be cut off at both ends, thus making an incline where the hog goes in and also where he comes out. A platform is built at the end at which the hogs are to be driven in somewhat higher than the level of the tank and an incline is made from this platform into the tank. The lower end of this incline should be at the surface of the liquid in the tank. In order to get the hogs onto the platform a chute must be built from the rear leading up to it. This as well as the platform and the incline must be enclosed with a fence

sufficiently high that the hogs cannot jump over. The sides of the tank also should be provided with boards that the liquid cannot slop over so easily.

After pigs have been driven through such a tank once, they become wise and are more difficult to take through a second time. In order to facilitate matters a trap door is arranged on the top of the platform. This is hinged at the point where the platform meets the incline. At the front of this incline where it meets the solution is a wide board or door hinged at the top to prevent the hog from seeing what is ahead. Thus after the hog is driven onto the platform, and he walks far enough forward, the trap, which should be made of hard wood laid lengthwise so as to make it slippery, will go down in front and allow the hog to slide into the tank. The board in front will prevent him from jumping across and will also allow him to slide into the solution head first and without injury to himself. If he should jump against this and throw it forward, the attendant may stand at the side and hold it, thus allowing the hog to slide into the solution quietly and without injury. The hog should go in head first, take a dive, and then swim through to the other end, where there is an inclined board with cleats which will allow him to walk up and out easily. This is also arranged with a drain board to catch the liquid that runs off the hog and allow it to run back into the tank. The lower part of the tank is connected with a tile drain to draw off the water in case it rains, thus preventing the oil from running off at the top; also when the tank becomes dirty, the liquid may be easily drawn off and the dirt shoveled out.

Another means of helping to keep hogs free from lice is by keeping their habitations clean because the pens also usually afford lodging places for lice and nits. All rub-

bish should be kept cleaned out of the pens and they may also be sprayed and then whitewashed. Lice may also be destroyed in the cracks in buildings by spraying with a solution of hot salt brine.

CHAPTER XXII.

OTHER AILMENTS OF SWINE.

WORMS.

It is said that one ounce of prevention is worth nine of cure, and this is true in every sense of the word in regard to worms in swine. These internal parasites consist of worms of various kinds. They inhabit the stomach, the intestines, and sometimes the lungs. There are several remedies that will free hogs from worms, all of which should be administered to the hog when his stomach is empty; that is, when treatment is to be given, the hog should be allowed to go for about one day with little or no feed and then given a small amount of some palatable feed with the worm remedy in solution.

Cure.—Fluid extract of spigelia and senna given in one-half ounce doses every four hours until purging starts in is an effective though rather expensive remedy. After purging begins the doses should be discontinued.

Another good remedy for worms is santonin. This is a white powder which can be bought at most drug stores. It should be thoroughly dissolved in warm or hot water and then mixed in the slop and fed to the pigs. An ounce of santonin is said to be sufficient for fifty to sixty hogs weighing a hundred pounds each. This should be followed with a physic to drive off the worms after being destroyed, and treatment should be repeated after a few days.

A one per cent solution of coal tar creosote given in one ounce doses on an empty stomach and repeated in ten days is also said to be an effective remedy for worms.

Prevention.—The best method, however, of handling this evil in the swine growing industry is by prevention. Well fed hogs, in general, are not subject to worms,—that is, a hog in good condition is better able to resist this parasite than one that is not in good condition. If a hog is fed a proper and well balanced ration, including mineral substances as well as the other nutrients, he is not likely to be troubled sufficiently with worms that they need cause any worry. Furthermore, he will be better able to resist the attacks of other forms of disease. By giving free access to various mineral substances, such as wood ashes, charcoal, air-slaked lime, and coal cinders, the hog apparently will take care of the worm evil himself. It seems that the alkali of wood ashes together with gritty cinders have a tendency to destroy worms. At any rate these mineral substances help to balance the ration so that the hog has greater powers of resistance. If pumpkins are fed in the fall of the year the seeds which have vermifuge properties also help to keep hogs free from worms.

In order to keep hogs free from worms they should have sanitary places in which to live and also their water troughs, if such are used, should be kept thoroughly clean. If foul water is allowed to stand in these from day to day it affords an excellent place for worms to develop.

SCOURS.

Scours in pigs usually results from two causes,—either from improper feeding or by contagion. Improper feeding that results in scours usually consists of two forms, excess of feed, and particularly of protein, and sudden changes in the ration, especially from sweet to sour and from sour to sweet feeds. This trouble is usually preva-

lent to a maximum degree in young pigs soon after farrowing, and with pigs at weaning time.

Over Feeding.—If a sow is not properly fed immediately before or immediately after farrowing, so that she has more milk than the pigs can take, it will result in scours either from having the milk of the dam in a feverish condition, or from having a greater supply than the pigs should take, in which latter case the pigs will eat more than they can properly take care of after it is eaten.

At weaning time pigs are very often overfed, especially on protein. This is true frequently where skim milk is fed. Many people having skim milk do not consider it much more valuable as a food for pigs than water; hence they give the pigs all the milk that they can possibly take and sometimes they drink so much that they look like stuffed toads. It must be remembered that skim milk is whole milk with the fat taken out. The fat is the carbonaceous part of the solid matter in milk; hence when this is taken out, the skim milk has relatively more protein than whole milk. If pigs drink an unusually large amount of this, they will get an excess of protein which may be more than the pig can properly take care of and will naturally start a case of scours. Even if the pig can digest all he eats, it may result in an excess of protein, setting up a high factor of waste, which, as already outlined, consumes a large part of the ration, thereafter making such a pig a much more unprofitable feeder.

Sudden Changes.—Sudden changes in feed result in scours not because feeds of one kind are not as good as feeds of another kind, but because it takes the pig a considerable length of time to become accustomed to different kinds of feeds or to feeds in different conditions. Thus if the ration of a pig is changed from sour to sweet slop,

or vice versa, or from sweet milk to sour milk, it is almost sure to cause trouble. Experimental data show that sour skim milk is just as good as sweet skim milk, and that butter milk is just as good as sour or sweet skim milk, but if these various feeds are to be used they must be used continuously and not alternately.

Treatment.—The best way to handle scours of this kind is not to allow the cause for them a chance to prevail. Feed both the sow and the pigs as they should be fed. If through accident a mistake is made and scours of this kind are started, remove the cause as nearly as possible, and supply sanitary conditions as well as good feed. If the scours result from over-feeding, the feed should be reduced and at the same time the dam, in case the pigs are sucking, or the pigs themselves after they are weaned, should be given a physic and thoroughly cleaned out. This should be followed by a small quantity of good, wholesome easily digested feed, and the pens should be thoroughly cleaned and disinfected. Better still if the pigs are put into entirely new pens.

Contagious Form.—The contagious form of scours is usually called white scours. Sometimes the discharge may also be black. The best cure for this trouble is the same as given, namely, physic the animals thoroughly, disinfect and clean up the troughs and pens and other places occupied by the pigs so as to clean out all the germs which are the cause of this trouble. As a physic epsom salts, castor oil or linseed oil may be used.

PARTIAL PARALYSIS.

This disease seems to be caused by improper nutrition. It usually consists of paralysis of the hind quarters of the hog so that it cannot stand on its hind feet, but drags it-

self around by means of its front legs. A hog affected in such a way has soft, spongy bones, especially at the joints in the legs, and its muscles are filled with soft slimy ooze. The bones are weak and the stomach is out of order. This disease is thought to be caused by insufficient mineral matter in the feed, hence is usually prevalent in localities where the soil is insufficiently supplied with mineral matter, or where the pig is kept under artificial conditions and not given enough mineral matter in his feed.

The prevention of the disease consists simply in feeding the hog properly, especially giving him sufficient of various kinds of mineral matter, of which lime and phosphorus are perhaps the most important. He may be fed mineral substances direct, or feeds that are rich in mineral matter. The cure for this evil is not very well established and is a slow process. It may take a year to effect a cure by feeding mineral substances.

Another malady that is said to be caused by a deficiency of bone-making material in the pig is what is called sniffles. This may also be remedied by proper feeding.

COUGHING.

A cough in hogs may be the result of various causes. As already noted, hogs that have tuberculosis may cough, and besides this hogs may cough for various reasons, as for instance, when they have worms, especially in the lungs; sore throat, colds, pneumonia, etc. A hog is subject to various diseases similar to those affecting man. If he coughs because he has tuberculosis, there is no cure except to destroy the individual; if he has worms, these may be taken care of; if he has sore throat, he should be treated like a man with such an ailment; if he has pneumonia, he should be handled likewise,—namely, be kept

in warm well ventilated and comfortable quarters, given a dose of physic, and then small quantities of laxative and easily digested feeds.

Another cause of coughing is dust. During a dusty season when a bunch of hogs go to pasture, the first ones kick up considerable dust, part of which will be inhaled by those in the rear. This is a more important factor with pigs than with other animals because a pig lives on or quite close to the surface of the earth. Moreover, many hog houses instead of having clean places for the hogs to lie and sleep, have only a dust floor, which might answer very well to destroy lice on chickens, but is no place for a hog to live, because a hog standing on short legs and having his nostrils or snout close to the ground, will inhale a great deal of the dust. These particles lodging in the bronchial tubes or the lungs will cause irritation and induce the hog to cough, also furnish a lodging place for disease germs of various kinds and may be the cause of other troubles such as tuberculosis, hog cholera, pneumonia, etc.

ROOTING.

Rooting cannot be said to be a form of disease, still it may be considered at this time. A hog in his natural state gets a good share of his feed, especially the mineral nutrients, from the soil by rooting for them. His snout equips him well for this form of work. It is frequently said that if a domesticated hog is properly fed he will not root. This, however, is not necessarily true. While rooting may be prevented to a considerable extent by proper feeding, this will not always prevent it entirely. The appetite of a pig, especially for protein, is more or less abnormal, and irregularity in feeding will set up the factor of waste which will demand a large quantity of protein,

the tendency of which is to increase rather than to decrease. The pig then, when he is at liberty in a pasture, will help himself to protein substances such as insects and grubs of various forms, which are found in the soil, even though he will have to root for them. These materials are the natural food for hogs and are much more palatable than substances that are given him. Consequently a hog will still be inclined to root more or less even though he may be fed the proper quantity of protein and sufficient mineral matter to supply the demands of his system for substances of this nature.

While rooting does not do any harm to the hog, it may injure pastures to a considerable extent. If pastures are not thus to be injured, artificial means must be adopted to prevent the hog from rooting. Various means are at hand to do this. Sometimes the cartilage at the end of the hog's snout is cut with a knife, and at other times an instrument is used which will cut a slit in the center of the snout and then cut the cartilage crosswise from this for a considerable distance. This is quite an effective means of preventing the hog from rooting, but is rather inhuman treatment and will disfigure the snout of the hog considerably. A better means to prevent rooting is by using an ordinary ring. A single ring is considered better than a double ring. These rings may be bought at any hardware store together with the pliers with which they are inserted. They usually come in two sizes, for small pigs and for large hogs. These rings are simply put into the snout of the hog by means of the pliers and if one will not answer the purpose, two or three may be used. A single ring is considered better than a double ring because it is less likely to get caught on various obstructions and be pulled out, and less likely to have particles of feed

or manure adhere to it in the winter and freeze into a ball. When this occurs it is objectionable to have rings in the snouts of hogs, especially the larger or more cumbersome varieties of rings.

In order to hold a hog for the purpose of ringing a strong light rope may be used with a ring securely fastened in one end. The other end of the rope is drawn through this ring, making a slip noose, which is put on the upper jaw of the hog. A large loop may be made in the form of a lasso, and after having a bunch of hogs in the pen, this may be thrown over the head of the hog, catching him by the upper jaw and drawing the rope back into his mouth and then drawing fast. The end of the rope is then wound once around a post and the hog is thus held. He will naturally pull backwards, which will hold his snout perfectly firm and rigid so that the ring can be clasped into place very easily. Any other means of holding a hog that will keep its snout perfectly quiet and that may be safe, would be equally good, but the hog should be held so that he cannot jerk backwards or jerk his snout sideways or up and down.

THUMPS.

Thumps is a very common ailment among pigs under certain conditions. It occurs most frequently in young pigs that do not have enough exercise. The symptoms are labored, jerky breathing, similar to heaves in a horse. The most practical cure is removal of the cause, but this is insignificant in value as compared with prevention. To prevent this trouble pigs should have an abundance of exercise, but if this cannot be supplied the ration should be materially reduced.

CHAPTER XXIII.

MARKETING SWINE.

Hogs may be sold to the local butcher, to local packers, or they may be sold on the large central markets. In the latter case they usually go through the hands of country shippers who make a business of buying hogs in the country and shipping them to the market centers where they are sold. They may also be shipped direct by the producer.

DEMAND AND SUPPLY OF HOGS.

As previously noted, the market demands more heavy hogs in winter and more light hogs in summer. The supply of hogs on the market is not always in accordance with the demand, and therefore they do not sell for as much money as they should. This is true because hogs that are selling not because they are in demand, but simply because they are offered for sale, will sell at a discount as compared with hogs that are put on the market in a condition when such hogs are in greatest demand. Under present conditions, the bulk of the hogs going to market are produced from pigs farrowed in the spring of the year. Thus by being farrowed early and being well fed during the summer, they may go to market during the close of the light hog season and may be in harmony as to weight with what the market demands. They also may sell as heavy hogs during the winter. However, if they are farrowed a little later and not fed quite so well, and go to market during the winter season, they will go

in as light hogs while the market at this time demands heavy hogs. If they are carried through the winter, as many hogs are, and sold during the next summer, they will have had time to develop into heavy hogs which again puts a product on the market that is not in greatest demand because at this time light hogs are what is wanted principally. Thus if a man is to market his hogs to the best advantage, he must supply what the market demands.

It is very often said that the market always demands what is not available. That is, when light hogs are furnished the packers want heavy hogs, and when heavy hogs are furnished, they want light hogs; but if this question is properly considered it is seen that the demands for the various types of hogs are more or less constant in order to supply the demand for pork as it comes during the different seasons of the year. Thus in order to produce market hogs to the best advantage they should be farrowed at such a time, and fed in a way, that they will reach the market with the weight and condition that are in greatest demand at that particular time.

The time at which hogs are to be marketed should be determined at the time the sow is bred and also when the pigs are weaned. A system of feeding should be adopted that will get the hogs into prime market condition at a certain definite time, and when this time arrives the hogs should be sold. The greatest and most economical gains can be obtained by feeding a hog with a certain definite end in view, that is, by finishing him at a certain time. If when this time arrives the hog is not sold, but carried over in order to wait for a better market, if he has been properly fed up to this time he will not make profitable gains thereafter, and if carried over will not make suf-

ficient gain to pay for his feed, which will probably more than overbalance anything that may be gained by waiting for a better market.

HANDLING AND SHIPPING HOGS.

If swine are raised on a large enough scale to produce hogs in car load lots, they can be shipped to market directly by the producer in such lots. If the farmer does not produce this number, a few neighbors may combine and ship their own hogs, or in either case the hogs may be sold to the country buyer or local shipper. At any rate, hogs to sell to the best advantage should be uniform in size, be well fed and in proper condition in accordance with the market demand, and should be of the same color, because a drove of hogs that is uniform as to size, condition and color will sell much better than a mixed bunch. A few white hogs in a bunch of black ones or vice versa may detract more from the value of the bunch than the white individuals are worth in themselves. Before being shipped hogs should not be fed abnormally, because any sudden changes in a ration at any time are more or less harmful. Immediately before shipping it is best not to feed hogs too heavily. They should be given a light feed which, to make it better still, should be somewhat of a dry nature.

The car in which hogs are to be shipped should be provided with bedding in accordance with the season. During the winter there is no better bedding, either for use in cars or otherwise, than rye straw or shredded corn fodder. Oat straw is not as good because it is more heating and will allow the hogs to become damp and appear steaming when they come out of the car, in which condition they will not present so attractive an appearance,

hence will not sell so well. During the summer season when the weather is hot, sand makes the best material for bedding. This should be thoroughly wet down to give the hogs a cool place to lie. During extremely hot weather, if hogs must be shipped and there is danger of their being overheated, it is well to put a few cakes of ice in the center of the car, which will help to keep them cool.

The greatest loss usually occurs in shipping hogs immediately after loading and during the time the car is being switched. It is well to have a man with the car at this time to see that they do not fight, which would occur if strange hogs were put together; and that they do not pile up by being frightened during switching of the car.

SELLING HOGS ON THE MARKET.

Hogs are usually sold on the large markets by commission firms who are there for the purpose. When hogs are shipped they are usually consigned to commission men whose business it is to sell them for the owner to the best advantage, deduct their charges as well as the freight and other charges, and remit the balance to the owner. Hogs might sometimes be sold by the owner himself, provided he accompanied the shipment to market, but he cannot do this as well as a commission firm because he does not know the buyers and is not familiar with general market conditions. Furthermore, the commission firms are there for that express purpose and consignments that are not thus billed may be boycotted and the owner who tries thus to avoid paying commission charges may find himself seriously handicapped.

Very often a consignment of hogs is billed direct to the packers, either by the producers in the country or by

country shippers, which avoids having them go through the yards and saves yardage, commission charges, etc. While this is an advantage in a way, hogs thus billed are usually paid for at the discretion of the packer and do not go through the yards and meet the competition as is ordinarily practiced. Furthermore, hogs billed direct do not have an opportunity to get the fill that is the practice when hogs are sold in the yards. This may often amount to several hundred pounds per car, because the hogs will eat a little corn and drink considerable water after they are unloaded and before they are sold in the yards.

Hogs should be loaded and started on the road at such a time, in accordance with the distance from market, that they will reach their destination in the morning. The market for hogs, as well as for other classes of live stock, is usually in the forenoon. This is the time of day when the buyers from the various packing houses visit the yards to buy their supplies for the day. Sometimes hogs are bought early in the morning, and at other times the buyers may not take hold until later in the forenoon. This depends altogether upon conditions and the way they feel about it. If they think hogs can be bought cheapest early in the day, they will buy early in the morning; at other times, if they think they can buy cheaper by waiting until later in the forenoon, they will wait. Hogs should go to market in time then so that they can be unloaded, fed and watered, and then sold at the time the market is the best. It is best if they can be sold immediately after they are fed and watered because at this time they will have the greatest fill and therefore will weigh the most.

After reaching the yards, the car of hogs is taken in charge by agents of the stock yards company. Em-

ployes of this firm take charge of the cars as they arrive, unload the hogs, count out the individuals, take charge of any dead ones that may be in the car, and deliver the remaining ones (or all of the shipment if there are none dead) to the commission firm to which the car is billed. The commission firm then feeds, waters and sells the bunch. If any dead hogs are in the car, they are noted and the shipper is given credit for the same at the rate of 75 cents per hundred pounds weight, provided the hog weighs more than one hundred pounds. The weight, however, is estimated and not obtained by weighing.

The expenses for selling hogs on the large markets, as for instance in Chicago, consist of eight cents per head for yardage, and one dollar per bushel for corn, which amount goes to the stock yards company for the use of its pens. There usually also is a switching charge which is for taking the car from the railroad company and hauling it over private track to the chutes where it is unloaded. This consists of from one to two dollars per car. The commission firm charges for its work of selling the hogs eight dollars per single deck car, but by smaller lots the charge is thirty cents per head. With these charges deducted the balance is remitted to the owner except that, as the hogs pass over the scales before they go to the buyer, ten cents per car is also charged to pay the expenses of the government inspector who inspects them at this point to note and take out any individuals that show external symptoms of disease. These are taken and slaughtered under inspection, and if found to be diseased to such an extent that the carcass is unfit for food, the loss falls upon the owner. If they are found not to be diseased they go into the regular channels of the trade and the price of the hog is remitted to the owner.

Hogs may be sold on the large markets to packers and local butchers, speculators and shippers. The latter are buyers on the market whose duty it is to buy hogs for outside packers, usually in the east. These eastern packers do not have a large enough home supply of hogs to keep their plants running throughout the year and therefore when the home supply is used up they buy hogs in western markets to keep their plants running. Since hog product, or the pork, can be shipped more economically than the live hogs it might be asked why live hogs should be shipped east at all. But considering that the east produces some hogs, which can be handled to the best advantage locally, it is necessary to have packing houses, but these cannot be kept running during the entire year with the local supply. Thus during times when the local supply is not sufficient, rather than to shut down their plants and not have competent labor, when needed, it is more economical for them to buy hogs in the great markets of the west to supplement the local supply in order to keep their plants running.

Speculators are individuals in the large markets who make a business of buying and selling hogs. They usually make their profit by buying hogs cheap and selling them at a higher price. This may be done in various ways. They may either buy from inexperienced salesmen and buy the hogs for less than they are worth, or they may buy on a rising market and then sell at a higher price later in the day or later in the week; or, they may buy mixed droves of hogs, which usually sell for less than they are worth, divide them up into droves of similar size, color, etc., and sell them in convenient-sized bunches when thus properly sorted. The hogs can in this way be sold to better advantage than in the original mixed

bunch. The speculator has an advantage in this business that the commission man does not have. The commission man, by getting simply one car of hogs from a shipper, must sell this car to the credit of this man. If such a car of hogs is made up in the main of black hogs, but has a few white ones mixed in, these cannot be sold separately to the best advantage because there would be so few that a regular buyer would not look at them. There may also be a few hogs of odd sizes, poor condition, or otherwise out of harmony with the bunch; these cannot be sold to the best advantage if taken out of the bunch because they are too few in number. Consequently the bunch as a whole can be sold to better advantage, but the whole mixed bunch usually cannot be sold for what they are really worth because they are mixed. The speculator can buy a number of cars of mixed hogs like these, divide them up into their respective classes, and sell them at a margin of profit. He however runs great risks because often he pays more for hogs than is paid for the same kind by the packers. Then again he runs the risk of losing considerable on a bunch of hogs by the market going down.

While occasionally a shrewd man makes considerable profit as a speculator, the majority of them are said to lose as much as they make; hence the speculator is not a disadvantage by taking away the profit that should belong to the farmer, but is a decided advantage because he creates competition and is responsible for the hogs selling to much better advantage than would be the case if he were not present. Hogs that are sold to speculators follow the same route as those that are sold otherwise except that after passing over the scales under the eye of the inspector, they go to the pens of the speculator while hogs

sold to the packers go to the large packing houses, or those sold to shippers go to the shipping pens. The shipping pens are at one side of the yards where the hogs are usually loaded in the evening to be shipped east because the centers of consumption are in the east rather than in the west. The hogs sold to the speculators are resold later to the packers or shippers.

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