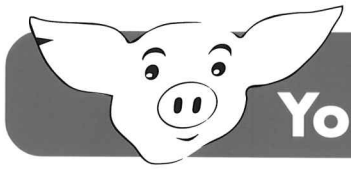


Chapter 3
Your Very First Step—Selection

Your Market Hog

Selection of a project animal should be done carefully, with consideration given to breed, size and quality. Size and quality are especially important, and while management and nutrition have great influence on both, it is a big help to begin with a good animal.

At the same time, however, while you want to select the best pigs you can possibly afford, be sure that the price you pay is consistent with your objectives. For the beginner, who is learning about feeding, management, etc., good quality pigs bought at a modest price may be the wisest investment. Purchasing livestock at high prices actually does not guarantee success or mean easier management.

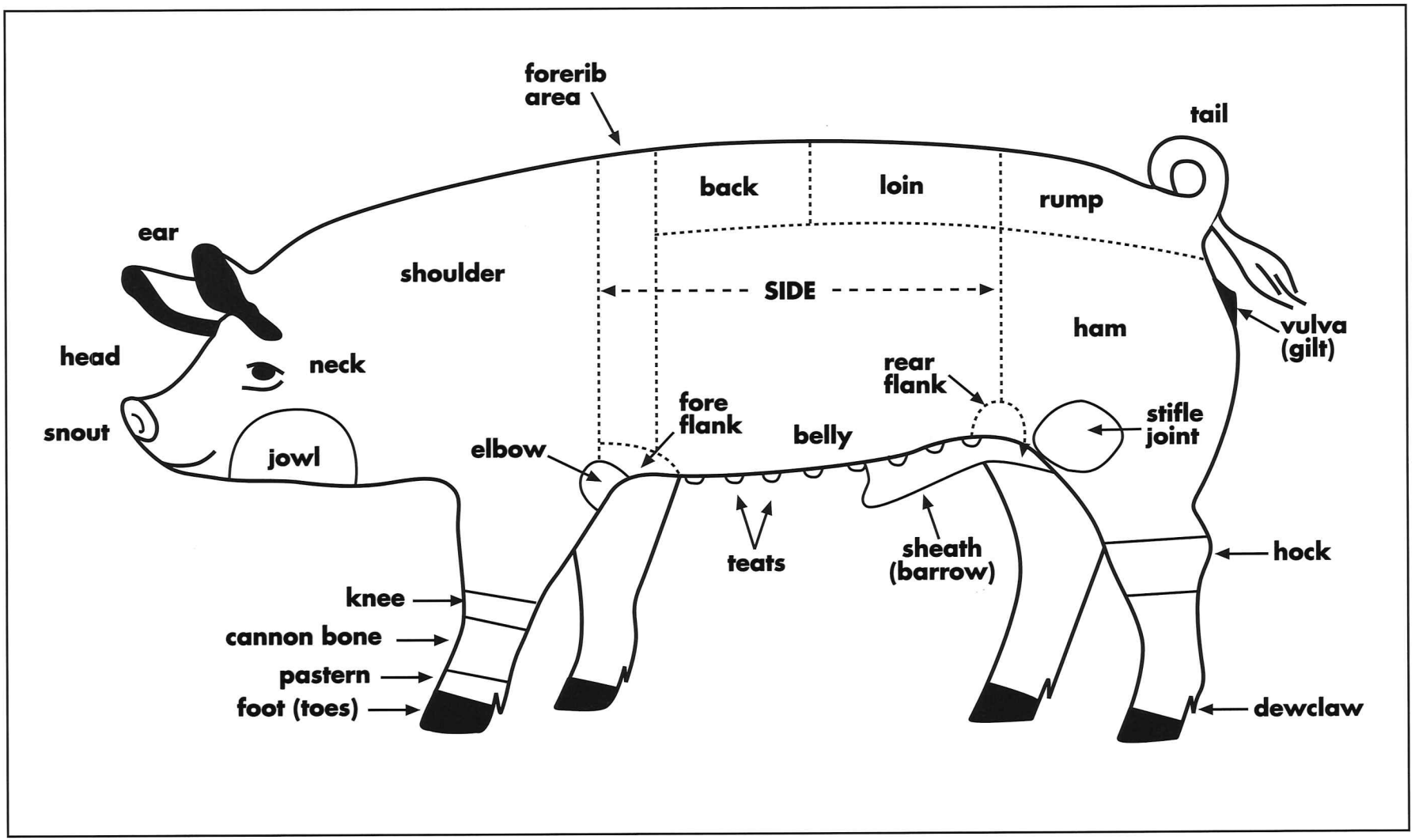
A successful project outcome requires the pig to have a desirable genetic background and an excellent environment while in your care.

Your aim, then, should be to find good quality pigs (because they have higher potential than others) at a price that fits within your budget.

This project will give you the information you need to select good quality pigs. Before discussing the characteristics of size and structure that indicate good quality, it will be helpful (1) to review the parts of a pig and (2) identify some of the breeds commonly available.

Parts of the Pig

If you are going to raise pigs, you need to know what parts are what. You should, in fact, know the parts of a pig even before you make your first purchase selections (see Figure 3.1). This knowledge should be permanent, at least for as long as you are in the business of raising pigs. When talking to fellow 4-H members, a breeder, or a judge, you will want to sound knowledgeable about your 4-H project. So take some time now to study the following diagram and become thoroughly familiar with all the indicated parts of a pig.



SWINE LEARNING LABORATORY KIT

This material is based upon work supported by Extension Service, United States Department of Agriculture, under special project number 93-EFSQ-4096

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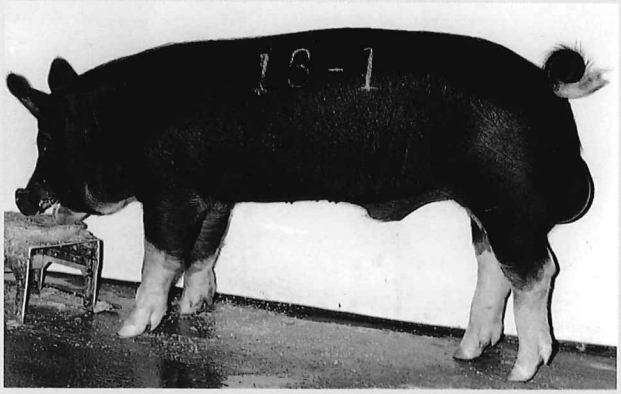
Figure 3.1
Parts of the pig

Breeds of Swine

There are many breeds of swine from which you can choose your project animal. Following are brief descriptions of some of the more popular ones.

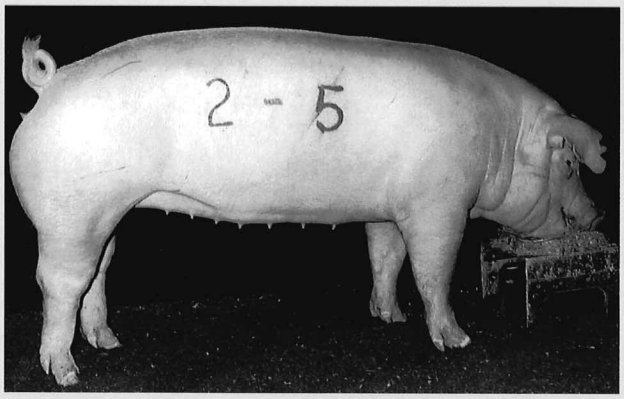


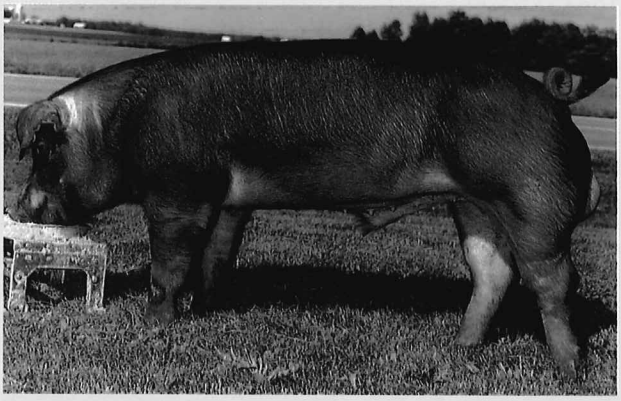
Berkshire

This breed comes from the county of Berkshire in England. The ears are short and erect. It is black with white feet, tail and usually has a splash of white on the face.

Chester White

This is an American breed, developed in Chester County, Pennsylvania. Swine breeders crossed imported White English hogs with smaller local hogs and called the results "Chester County Whites." The members of this breed are large and pure white, known for being good mothers and have medium sized ears that droop down over the eyes.





Duroc

This is another American breed. It came from a cross between red hogs bred in New York and red hogs bred in New Jersey. The result was called Duroc-Jersey. The Duroc part of the name came from a famous stallion kept on the farm of one of the red hog breeders in New York at that time. Since then, the name Jersey has been dropped and the breed is simply called "Duroc." Durocs are solid red, but they may range from dark to light shades. They have droopy ears and grow quickly and efficiently.

Hampshire

England is the place of origin of this breed, which comes from the County of Hampshire. It is easily recognized by its white belt encircling a black body. The standard of this breed states that the width of the belt must not exceed two thirds of the body length. This white belt covers both forelegs. Hind feet and legs may be white, as long as the white does not extend above the hocks. Hampshires have erect ears and are noted for being heavy muscled.

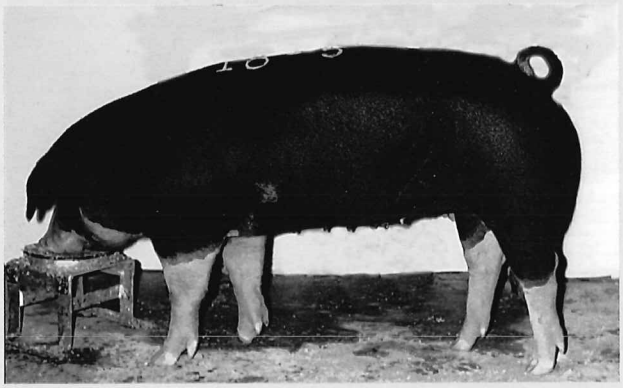
Hampshire color marking requirements for pedigreed barrow shows differ slightly from breeding shows. If you plan on exhibiting in a pedigreed exhibition, be sure to refer to the color marking requirements as outlined by The National Swine Registry.

Hereford

To be registered, Hereford hogs must have a white face, the body must be at least $^{2}/_{3}$ (light or dark) red and have at least 2 white feet. White also must be showing not less than one-inch above the hoof.

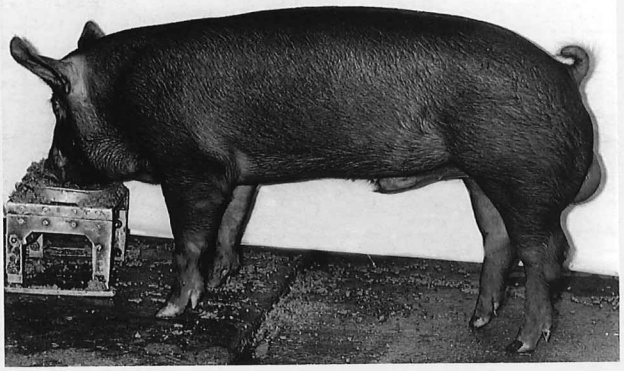
Poland China

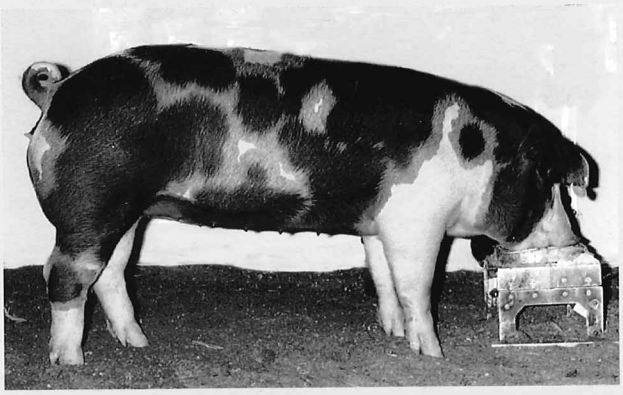
This breed did not come from Poland or China, but from Butler and Warren counties in Ohio. The color is generally black, with six white points. The six points are the four legs, tail and nose. Many have white spots on certain areas of the body. They have droopy ears and are known for being lean and heavy muscled.



Tamworth

England is also the origin of this breed. Tamworths are all red (shades golden to dark). Their ear carriage is erect with a long narrow face and snout.



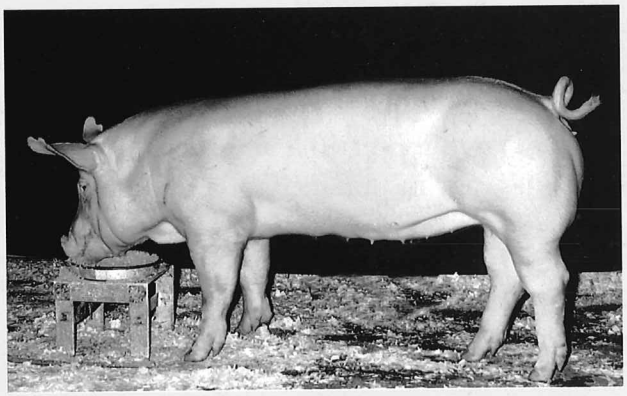


Spot

This breed was called Spotted Poland China for many years. It looks somewhat like the Poland China, but has much more white on its body. The Spot breed was established in 1961. It has droopy ears, gains weight well , and is known for being an aggressive breeder.

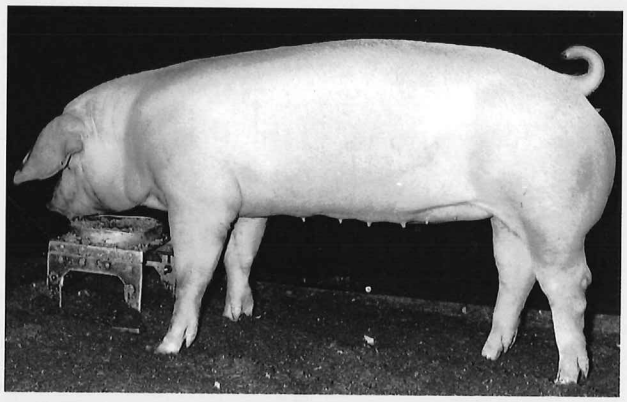
Yorkshire

These hogs came from England where two distinct types were produced—the "Large" and the "Middle Whites." Yorkshires used in the United States generally came from the "Large Whites." Members of this breed are long bodied, white hogs. The ears are erect. The hair or bristles are white; usually the body is white, but sometimes there may be some black pigmentation on the skin. This pigmentation is discouraged, but not condemned. Yorkshires produce large litters and are known as the mother breed.



Landrace

This is one of the newer breeds in the United States. American Landrace are descendants of Danish Landrace hogs. The American Landrace is all white and very long in body. In color it resembles the Chester White and the Yorkshire, but it is longer bodied than the Chester and has a much longer snout than the Yorkshire. The Yorkshire has erect ears, while both Chester White and Landrace ears want to point forward and down. The Landrace has especially large, floppy ears and is known for being a good mother.



Pietrain

This breed originated in Belgium. Breed characteristics generally include a black hair coat with varying amounts of white spots. Originally bred for their extreme muscle volume and leanness.

Swine Breed Associations

Now that you are aware of some of the breeds, you need to know that there are breed associations that maintain registration and performance records for the breeds. They also furnish information on judging, fitting and showing. Judging pictures and breed magazines may be obtained for a small fee.

Before you actually select your project hog, you may want to write to the executive secretaries of the breed associations in which you are interested and request their up-to-date information.

Breed Associations

Breed	Name of Association	Address
Duroc Hampshire Landrace Yorkshire	National Swine Registry/United Duroc Association /Hampshire Swine Registry/ American Landrace Association/ American Yorkshire Club	P.O. Box 2417 W. Lafayette, IN 47996-2417 765/463-3594 (phone) 765/497-2959 (fax)
Berkshire	American Berkshire Association	P.O. Box 2436 W. Lafayette, IN 47996-2436
Chester White	Chester White Association	P.O. Box 9758 Peoria, IL 61612-6320
Poland China	Poland China Record Association	P.O. Box 9758 Peoria, IL 61612-6320
Spotted Swine	Spotted Swine Breeders	P.O. Box 9758 Peoria, IL 61612-6320
Tamworth	National Tamworth Swine Association	200 Centenary Road, Winchester, OH 45697
Hereford	National Hereford Hog Record Assoc.	Route 1, Box 37 Flandreau, SD 57028-0037

Size Consideration/ Structure

Regardless of breed chosen, it is very important when selecting your project pigs to select ones at the right weight and size. If a pig is to weigh 240 pounds by fair time, a 60 pound pig needs 100–110 days to attain that size. Forty pound pigs need 125 days. Select a weight that is appropriate to the amount of time you have from project start until fair time. Expect the average growth rate for a feeder pig to be 1.5–1.75 pounds daily gain.

When selecting size, don't forget to consider frame size as well. Frame size plays an important part in the weight of your pig. If you have a large framed barrow or gilt, it can carry 240–280 pounds much easier and better than a smaller framed animal. The smaller framed pig will appear to be fatter.

Selecting the Right Type of Pig

Selecting pigs of the right type can be a difficult task because 40–60 pound pigs will not show the differences in body shape that larger pigs do. However, by developing a checklist of characteristics you need to consider for project selection, you can more accurately assess the potential of the project animal.

This list includes:

1. Breed of parents
2. Breed type/appearance
3. Performance history of parents
4. Visual observation and measurement of performance of relatives at 230–260 pounds (Figure 3.2)
5. Carcass evaluation of relatives

Figure 3.2
Monitor Swine Performance

Get a picture of a past champion market hog from a county or state fair. Memorize how that ideal market hog is designed. Keep in mind this "ideal" type of pig so you can look for its characteristics as much as possible (Figure 3.3).

Characteristics You Should Look For

Conformation

This refers to the general body shape of the pig as determined by its framework or skeleton and muscle structure. A large-framed, longer-sided pig will grow and reach a heavier market weight faster, yielding a carcass with more total muscle than that of a small-framed, shorter-sided pig. Poor management, improper feeding or poor health will prevent either type of pig from developing to its genetic potential.

Muscle

The ideal muscle pattern in today's meat hog is long, thick, and smooth. This muscle structure can best be observed by viewing the ham (Figure 3.4). Also, because this muscle structure is somewhat loose, the pig is able to move more freely off his front and rear legs.

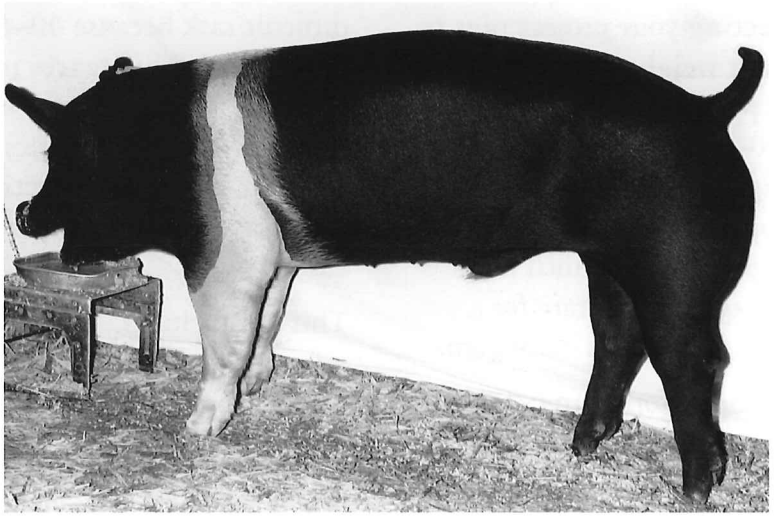


Figure 3.3
Ideal Market Hog Design

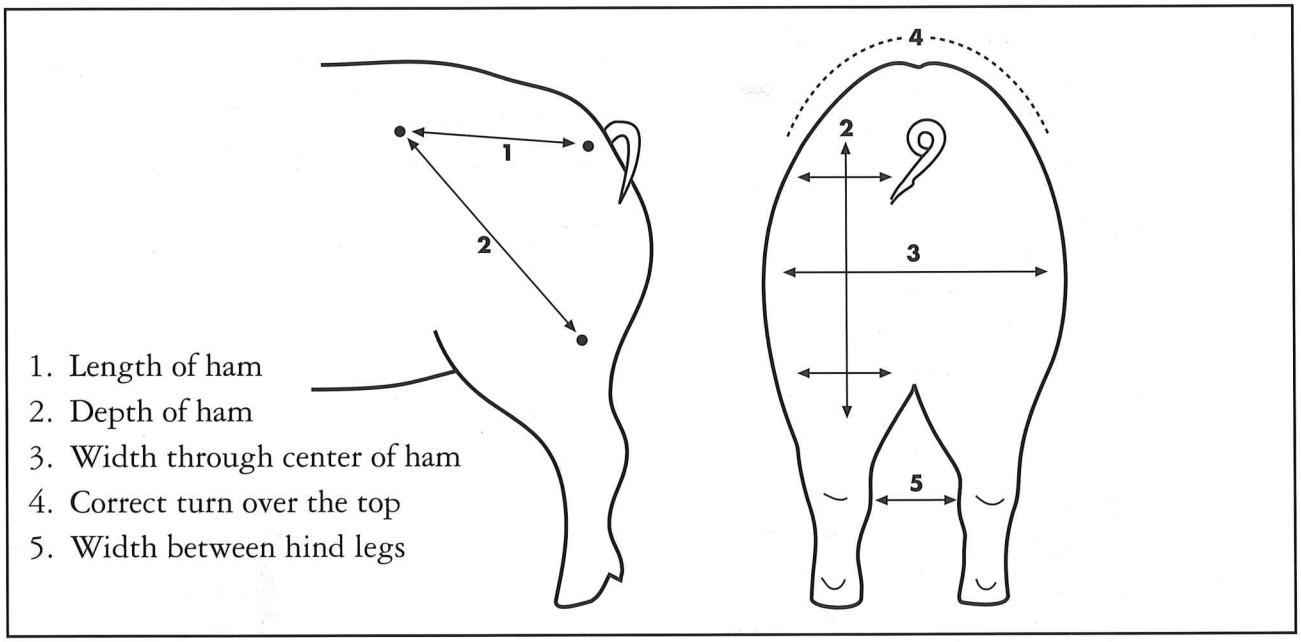


Figure 3.4
Points to consider in appraising muscling.

Don't confuse type of muscling with the amount of muscle. There is a need for an adequate amount of muscling in the ham and loin region, but it must be long and smooth rather than tight and round. Some extremely thick-muscled pigs may carry an inherited defect known as the Porcine Stress Syndrome (PSS), which contributes to stress susceptibility. When a stress-susceptible (PSS) pig is excited by movement or fighting, he will begin to tremble and go into shock and may even die. If PSS pigs do not die, they will have carcasses that will yield pale, soft, watery pork. Also, because PSS pigs are often short and steep in their rump structure, females may have more difficulty giving birth. (See Figure 3.5, 3.6, 3.7.)

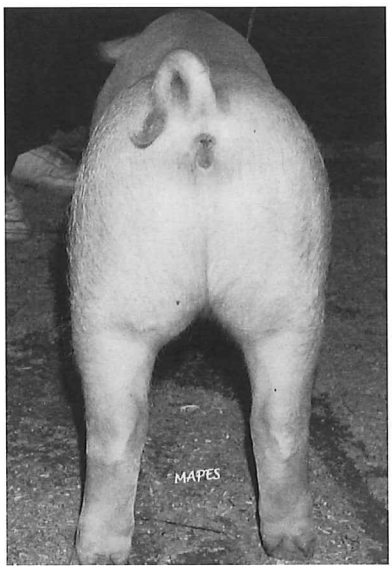


Figure 3.5
Light Muscled

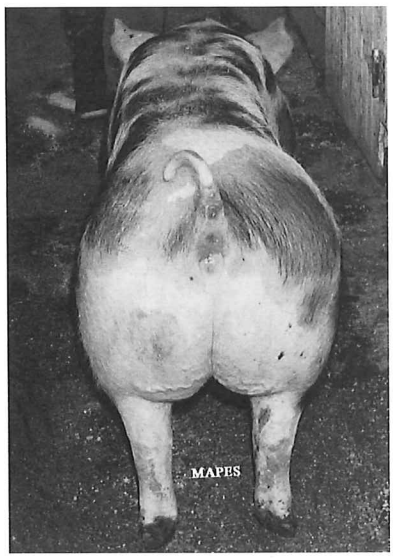


Figure 3.6
Round Muscled

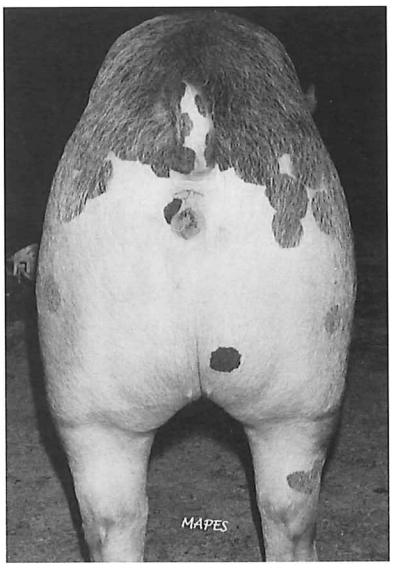


Figure 3.7
Ideal Muscled

Fat

Fat has been identified as the pork industries' number one enemy. Fat is a primary concern in our health conscious society. Also, fat is costly to the pork producer because it takes 2 1/2 times the amount of feed to produce a pound of fat versus a pound of lean. (Compare Back Views of Figures 3.8 and 3.9)

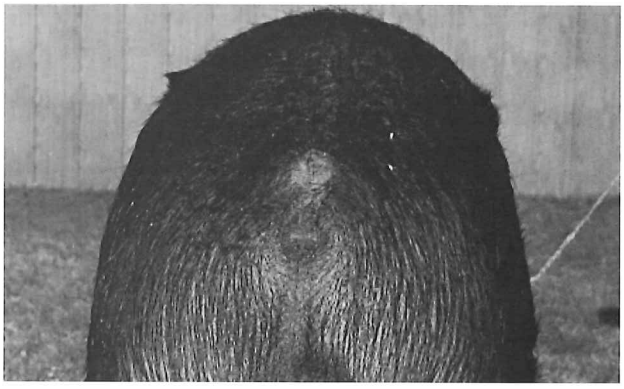


Figure 3.8
Fat Market Hog (Back View)

Figure 3.9
Lean Market Hog (Back view)

A small amount of fat is desirable in market hogs, but a large amount is not. Backfat is the best indicator of total fatness of hogs. Other areas that are good indicators of excess fat that can be observed easily include: lower ham region; area over the loin edge; jowl; middle; elbow pocket; behind the shoulder.

Structure

In today's confinement rearing of hogs, structural soundness is a necessity. Because of the demand for sound, fast growing, durable and efficient breeding stock, the seedstock producers must produce livestock that adapts to a confinement system in the breeding pens, farrowing crates and finishing floors. Hogs with good structural soundness can adapt to these conditions and produce quality carcasses.

Following are brief descriptions of general and particular characteristics of sound structure in hogs.

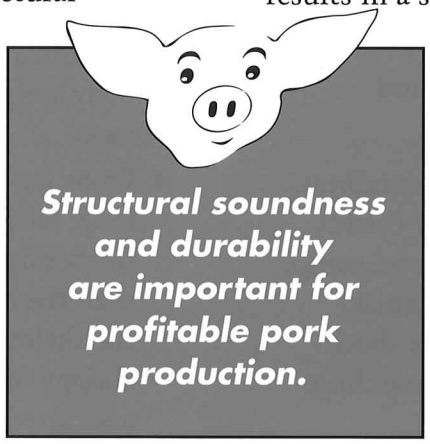
It takes several features to ensure soundness. Basic body design on a structurally correct hog includes a relatively flat top, level rump, high tail setting, and a sloping, angular shoulder position, which provides a shock-absorbing effect when walking or standing.

Some particular points important to structural soundness include the following:

- When the shoulder is too straight, pressure is applied at the shoulder joint and at the knee joint. Because the knee joint offers the least resistance to pressure, the front legs buckle over. Thus, the front legs should angle out of the shoulder into a long, sloping pastern.
- Normal rear leg placement is best described as hocks slightly flexed, bending into a flexible pastern. This allows the various joints to absorb shock equally.
- The toes should all be evenly sized to allow for more stability on the floor surface. Even toe surface wear occurs because of even weight distribution.
- Larger size of bone is desirable and important for ruggedness and durability, but, not at the expense of structural correctness.
- Desirable movement can best be described as freedom of movement with body weight distributed equally on eight toes.
- Front legs should reach forward with a long, loose stride. A pig will be able to freely raise his head and snout higher than the arch in the center of his back if the skeletal structure is correct. Short, choppy front leg movement appears to be associated with straight shoulders, steep pasterns and strongly arched tops.
- Desirable rear leg action is viewed from the side as long, loose strides with good cushion in both the hock and pastern areas.
- A sound structured market pig should be able to place its rear foot in approximately the same location that the front foot had been, as viewed from the side while walking.

Structural Soundness

Structural soundness and durability are important for profitable pork production in modern, intensive systems. Study the *undesirable* boar in Figure 3.10. He is steep rumped. The hip (E), stifle (F) and hock (G) lock in a straight line position with each step. This results in more shock to each joint during movement. Also, this boar can be expected to move with a stiff, shuffling gait off his rear legs. Two other structural problems are the top being arched too high and the shoulder blade (A) set in a straight line over the front leg bones. Thus, walking puts stress on the point of the shoulder (B), the knee (C) and the front pastern (D). Sometimes, the pressure will make the knee buckle or remain in a bent position.



Compare the *desirable* structure of the boar in Figure 3.11 to the undesirable boar in Figure 3.10. Observe the more level top line; the longer, more level rump; and the more sloping, angular shoulder blade position (A). The front legs appear to curve slightly backward at the knee (C), and the pasterns (D) slope at about a 60 degree angle. This angularity of the front skeletal structure results in a shock-absorbing or cushioning effect as the boar strides on a hard surface. The rear leg joints also are set with more angle than on the undesirable boar. Notice, too, that the desirable boar appears to stand wider based, with more room between the forelegs. This boar can be expected to move with more action and flexing of knees and hocks.

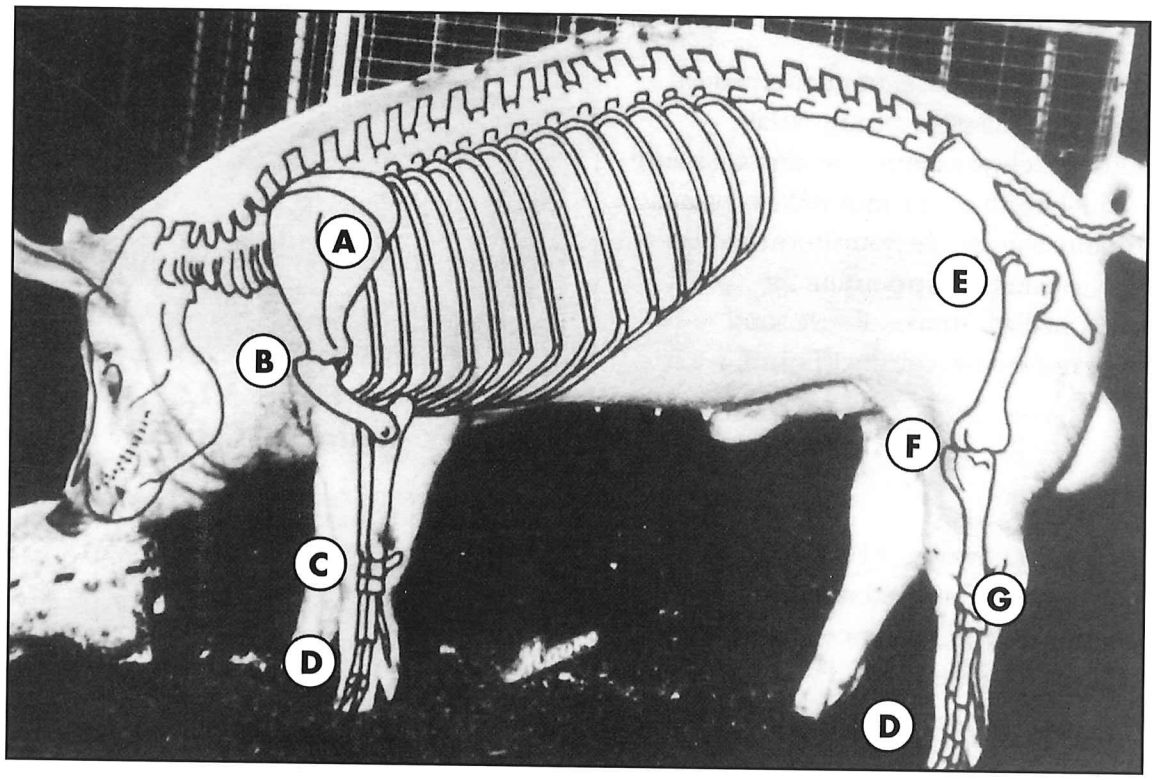


Figure 3.10
Undesirable Structure

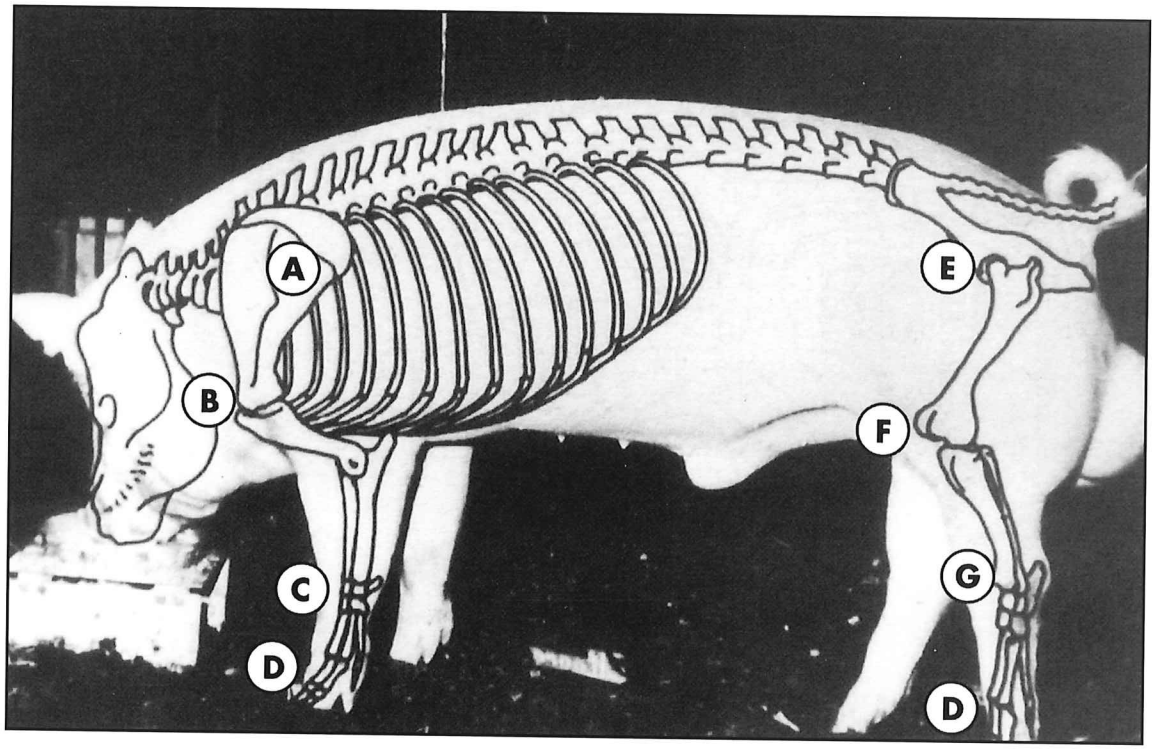


Figure 3.11
Desirable Structure

Capacity

The body cavity should be moderately deep and square, with the ribs sprung wide throughout the chest cavity. The depth should continue the length of the animal's body in a uniform manner from the forerib to the rear flank. Body capacity is important for maintaining health, intake of feed, and adequate reproductive volume (Figure 3.12, 3.13).

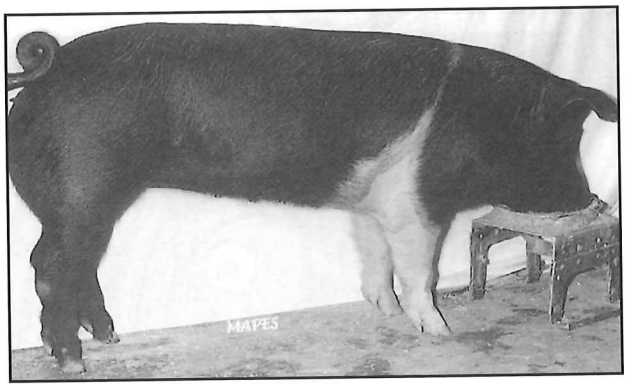


Figure 3.12
Restricted Capacity

Balance

Balance is the proportion of body parts. The pig should be strong topped and level rumped, which allows it to move out freely off its rear legs. (Figure 3.13)

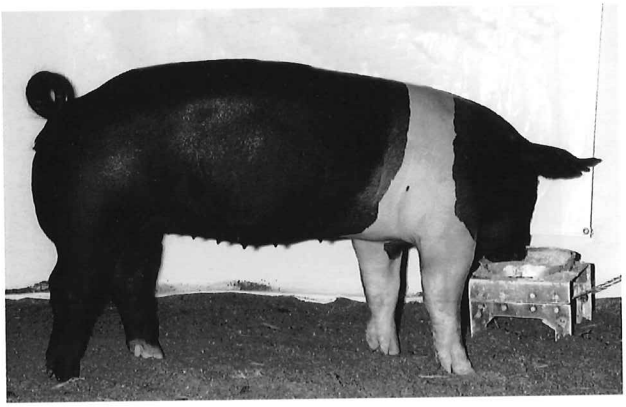
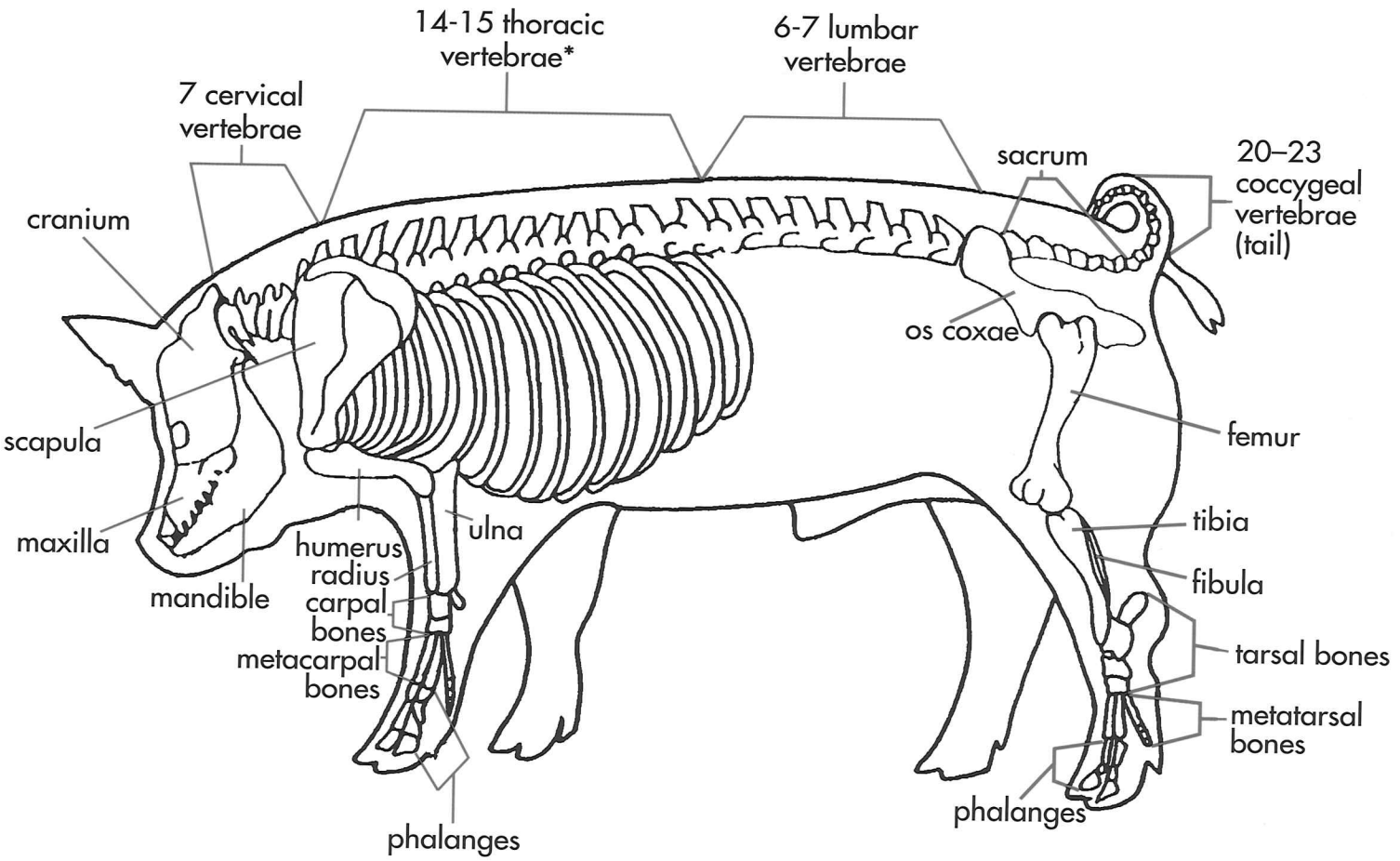
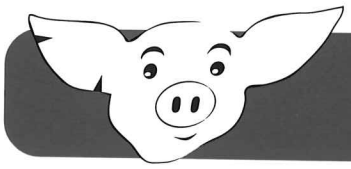


Figure 3.13
Large Capacity, Well-balanced

Skeleton of a Hog



*Some pigs may have up to 17 thoracic vertebrae.



Chapter 4
Quality

Quality Control and the Livestock Industry

Quality control in the livestock industry begins with providing the right genetics and continues with the proper husbandry of the live animal and good packing house and retailing practices. Every action you take as a livestock producer will reflect on the quality of the livestock industry as a whole (See Caring for Animals chapter).

Market Quality

The point of raising market hogs, of course, is to produce the highest quality end product possible. Achieving high quality is, to a large extent, dependent upon management techniques and a carefully planned nutrition program.

However, quality is also determined by the genetic background of the animal. Thus, if you select a project animal whose parents do not show high structural quality, you will have to work harder and longer to bring your animal up to a higher standard; and it's possible you may never achieve the level you wish. So it pays to select your project hog carefully, giving close attention to the characteristics of the parents. Hogs with the stress gene have much more muscle and less fat but also have tougher, poor quality meat. Therefore, this gene is undesirable because light colored, watery meat is not wanted by the consumer.

To help you recognize the characteristics in a hog that represent a high quality market animal, a brief discussion is provided of the various government feeder pig grades, starting with the most desirable U.S. No. 1. This is followed by a discussion of evaluating pork carcass characteristics (composition and muscle quality) to give you some practical under-standing of what quality and grade mean in terms of the actual pork production setting.

Major Genes

Scientific advances in genetic technology have allowed the swine industry to identify major genes that affect muscle quality attributes of pork (i.e. color, firmness/wetness, marbling). The impact of these genes on muscle quality has generally been negative, leading to pork that is not desirable to our consumers, packers and processors. Knowledge of these genes is essential for making improvements in the quality of pork produced.

Porcine Stress Syndrome (PSS)

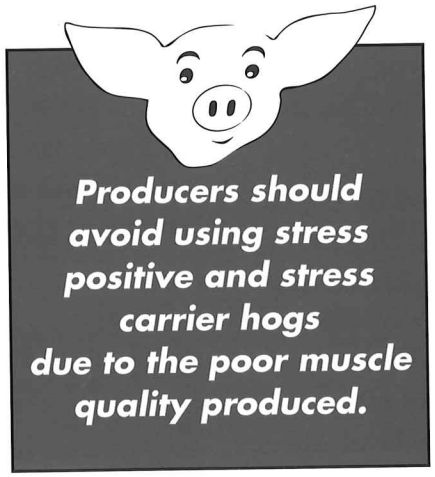
The PSS gene or "stress gene" is an inherited recessive condition in pigs, and has been identified in and associated predominately with the Pietrain breed. Pigs carrying two copies of the stress gene are classified as "Stress Positive" and denoted as "nn" genotype. Stress positive (nn) pigs are

susceptible to external stress associated with animal movement, mixing, and changes in environment and can lead to excessive death loss within a herd when stress occurs. Stress positive (nn) pigs produce Pale, Soft, and Exudative (PSE) carcasses more than 90% of the time, but produce carcasses that are 2 to 3% higher in lean content than normal (NN) pigs. Pigs carrying one copy of the stress gene are classified as "Stress Carriers" (Nn). Stress carriers are not susceptible to death due to stress, but do produce PSE pork between 30 and 60% of the time while producing a carcass with 1 to 1.5% more lean than normal (NN) pigs. Normal (NN) pigs provide higher quality pork with low percentages of the PSE condition.

A DNA gene test is available to classify animals for the PSS condition. Producers should avoid using stress positive and stress carrier hogs due to the poor muscle quality produced. Guidelines for removal of the PSS gene from the U.S. pig population were instituted by National Pork Producers Council members in 1996.

Rendement Napole Gene

Research on the "Napole Gene" has shown this genetic condition is inherited in a dominant fashion with the positive (RN^-, RN^-) and carrier (RN^-, rn^+) pigs having undesirable muscle quality attributes. The presence of the dominant Napole gene (RN^-) is associated with poor water holding capacity (i.e. poor firmness/wetness scores), excessive moisture loss in cooking and poor processing characteristics of pork. The Napole gene has been identified in and associated with the Hampshire breed of swine and extensive research is underway to further study this genes' affect on muscle quality. A DNA test is available for the Napole Gene. This test will allow producers to directly select for or against the RN^- allele.



USDA Feeder Pig Grades

U.S. No. 1 feeder pigs have long hams and shoulders and thick muscling. Their hams and shoulders are thicker than their well-rounded back. Feeder pigs in this grade are expected to produce U.S. No. 1 grade carcasses when slaughtered.

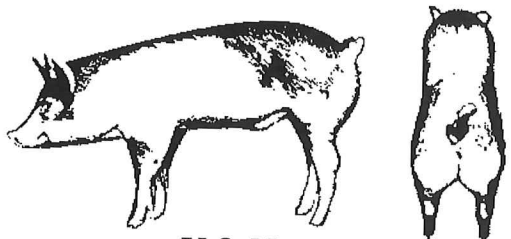
U.S. No. 2 feeder pigs are moderately long and have moderately thick muscling through the hams and shoulders. The back usually appears slightly full and well-rounded. Pigs in this grade would qualify for the U.S. No. 1 grade, except for having less than moderately thick muscling and more fat development. In this class feeder pigs are expected to produce U.S. No. 2 grade carcasses when slaughtered.

U.S. No. 3 feeder pigs are slightly short and have slightly thin-muscled hams and shoulders. Feeder pigs in this group are expected to produce U.S. No. 3 grade carcasses.

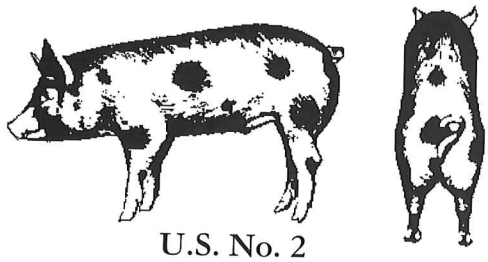
U.S. No. 4 feeder pigs are short and have thin muscling throughout, particularly in the lower parts of the ham toward the shanks. The back usually is wider than the underline. Feeder pigs in this grade are expected to produce U.S. No. 4 grade carcasses.

U.S. Utility feeder pigs are small for their age and appear unthrifty. They often have a rough, unkempt appearance, indicating the effects of disease or poor care. The hams and shoulders are usually thin and flat and taper toward the shanks. The Utility grade feeder pigs may produce U.S. No. 1, U.S. No. 2, U.S. No. 3 or U.S. No. 4 grade carcasses when slaughtered. However, if the unthrifty condition is not corrected, U.S. Utility grade feeder pigs will produce U.S. Utility grade carcasses.

U.S. Cull feeder pigs typically are very deficient in thriftiness because of poor care or disease. They can be expected to reach a normal market weight only after an extremely long and costly feeding period.



U.S. No. 1



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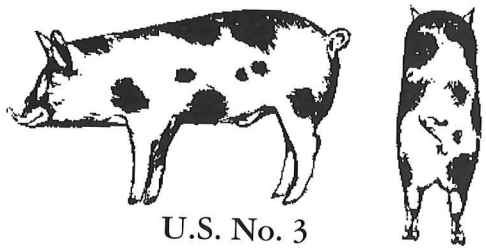

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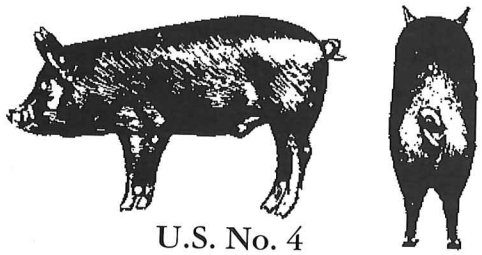

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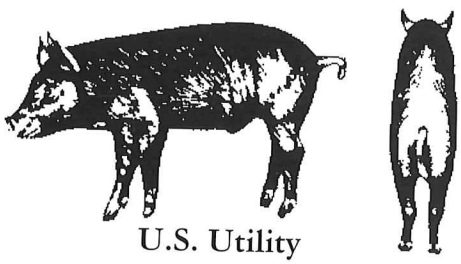


U.S. Utility

Pork Carcass Evaluation

Carcass evaluation is an important part of determining the success of pork production. Following reproduction, feeding and marketing of the hog, the final step is transformation into food for humans. Through these processes, pork producers can effectively evaluate their progress in selection and management. In addition to measuring efficiency in terms of producing large, healthy litters that gain rapidly on minimum feed, producers also should be concerned about how much lean, edible pork is produced and how desirable that lean is for processing and consumption (see Pork Quality Standards, page 4-18).

Every market hog should have its carcass evaluated for weight, wholesomeness, composition and quality. Identification of these traits serves as an incentive for packers to differentiate economic value (Figure 4.1 and 4.2).

Carcass composition plays an important role in the success of pork production systems. Market hogs with a high lean content and acceptable quality of lean are more efficient and more valuable to producers. Pork producers are encouraged to continually collect data and evaluate the animals they produce, and utilize the information to make improvements in their pork production system. The procedures described in the following paragraphs outline the important factors to look for when evaluating the composition of a market hog carcass and describe how to fairly compare hogs.

The value of a market hog at slaughter is determined primarily by the amount of lean meat produced. Premiums and discounts are placed on animals based upon the measured lean content of the animal. To determine the lean content of a pig, three important factors (described below) are measured and placed in a mathematical equation to estimate the pounds of lean in the pig.

Weight

Weight is an important measure used in estimating the pounds of lean in a pig. For producers measuring lean content on the live animal using ultrasound, an accurate estimate of live weight is needed. For producers selling pigs to the packing plant, where the price is based upon the carcass weight, the producer must understand how to convert live weight into carcass weight using expected dressing percent (yield) of the pig (see Price Conversion Table page 4-13). Dressing percent is an expression of the proportion of live weight found in the hanging carcass and is measured using the following formula:

Dressing Percent (%) =
(carcass weight ÷ live weight) x 100

Animals with a higher dressing percentage have a higher proportion of their live weight in the carcass. The dressing percentage will tend to go up as pigs get heavier and certain genetic types may have higher dressing percentages than other types. As the weight of a pig or carcass goes up, more pounds of lean are found in the animal. Weight (carcass or live) is used to help predict the pounds of lean in the pig.

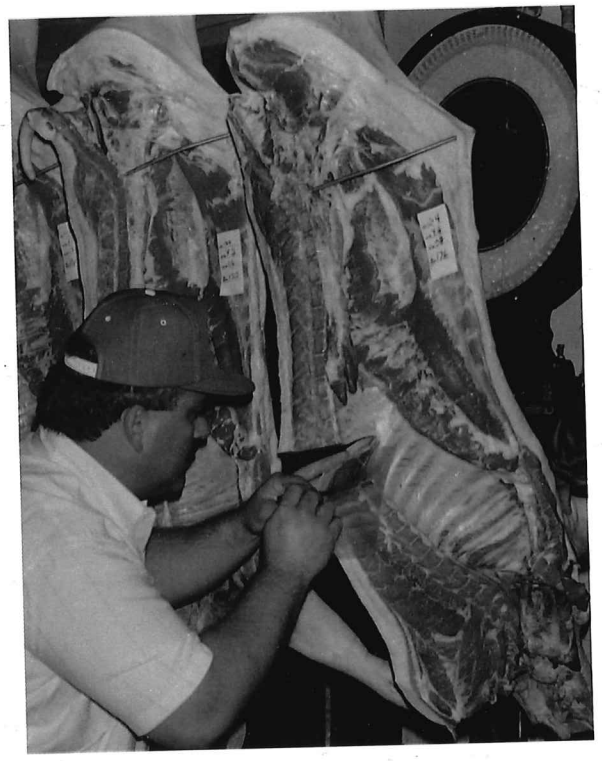


Figure 4.1
Carcass evaluation at 10th rib

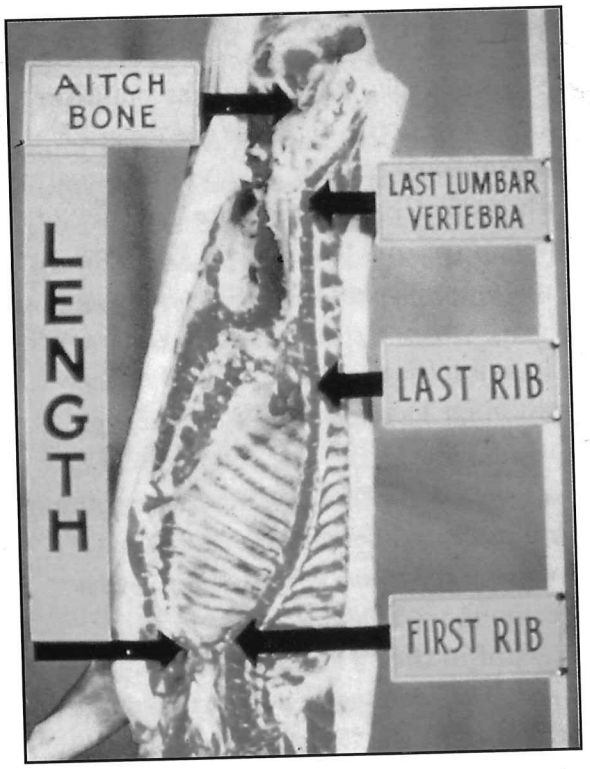


Figure 4.2
Carcass measurements
(length and midline fat depth locations)

Figure 4.3
Ham muscle and loin muscle at the 10th rib

Fat Depth

The primary factor affecting the pounds of lean in a pig is the depth of the exterior (subcutaneous) fat that covers the animal. Fat depth is often measured along the back of the animal at specific locations. A common site for ultrasound evaluation of live hogs and on carcasses where the loin is split is the tenth rib location (figure 4.1, 4.3, 4.4). Other common fat locations include midline measurements at the last rib (figure 4.2). Fatter pigs will produce a lower percentage of lean muscle and be less efficient when converting feed into lean tissue. Genetic selection for reduced backfat has been successful in the swine industry and producers are encouraged to utilize replacement animals that will meet the backfat level desired by their packer.

Figure 4.4
Real-time ultrasound image taken at the 10–11th rib location in swine. Image describes a cross-sectional view of the loin muscle and overlaying fat.

Muscle Mass

Muscle is most commonly measured on the loin of the pig and is helpful in predicting the pounds of lean in the carcass. As the size of the loin muscle increases, more pounds of lean are found in the pig. Commonly a measurement of Loin Muscle Area (LMA) is made (figure 4.1, 4.4, 4.7) when measuring the split carcass or when using live animal ultrasound. Other technologies used in the packing industry measure only the depth of the loin muscle and use this to help predict pounds of lean. Packing companies generally do not split the loin to assess loin muscle area because this significantly reduces the value of the loin, and instead use devices to measure muscle depth. In carcass competitions that include quality assessment, the most common method of carcass assessment is to split the loin at the 10th rib location (Figure 4.1 and 4.3).

The average loin muscle area in swine is between 5.75 and 6.50 square inches. This size is very appropriate for our consumers. Very large loin muscles in pigs have been found to be associated with poor muscle quality attributes such as very pale, soft and watery meat. Caution should be taken when selecting pigs with extreme loin muscle areas (LMA) and emphasis should be placed on muscle quality when selecting for larger LMA.

Predicting Pounds of Lean

Using a mathematical equation, the weight of the carcass, fat depth measurement and loin muscle measurements are combined to predict the pounds of lean in the pig. Prediction equations are available for different types of measurement techniques including:
1) real-time ultrasound of fat and loin muscle area on live animals, 2) measurements of fat and loin muscle at the 10th rib (Figure 4.1),

3) measurements taken at the midline, last rib location (Figure 4.3), and 4) measurements taken using packing plant technologies such as the optical probe (Fat-o-Meater™).

Calculating Percentage of Lean

Packer carcass data sheets often summarize carcass evaluations based upon the percent lean found in the carcass. Percentage of lean is simply an expression of the proportion of the carcass that is lean meat and is calculated using the following mathematical equation.

Percent Carcass Lean = (Estimated Pounds of Lean ÷ Carcass Weight) x 100

Example Calculation "Percent Carcass Lean"

Typical Market Hog
250 Pounds Live Weight
185 Pounds Carcass Weight
96 Pounds of Estimated Lean

Where:
Percentage Carcass Lean = (A)
Estimated Pounds of Lean = (B)
Carcass Weight = (C)

And: A = (B ÷ C) x 100

A = (96 ÷ 185) x 100
A = (0.5189) x 100
A = 51.89%

For producers using ultrasound measurements on live pigs, percent lean is estimated using the following equation, where a standard dressing percent of 74% is used to convert live weight to carcass weight.

Ultrasonic Percent Lean = [(Estimated Pounds of Lean ÷ Live Weight) ÷ .74] x 100

Example Calculation "Ultrasonic Percent Carcass Lean"

Typical Market Hog
250 Pounds Live Weight
96 Pounds of Estimated Lean
74% (.74) Standard dressing Percentage

Where:
Percentage Ultrasonic Carcass Lean = (A)
Estimated Pounds of Lean = (B)
Carcass Weight = (C)

And: A = [(B ÷ C) ÷ .74] x 100

A = [(96 ÷ 250) ÷ .74] x 100
A = [(0.384) ÷ .74] x 100
A = (0.5189) x 100
A = 51.89%

The following page describes the prediction equations and example calculations that can be used to estimate the lean content of a pig.

Rate of Lean Growth

The very important measure of production efficiency in the finishing phase of production is the rate of lean growth. Lean growth combines the economically important traits of growth rate and pounds of lean produced by a pig per day on test (days in the finisher). Pigs with a high rate of lean growth convert feed into lean muscle tissue more efficiently, resulting in improved feed conversion efficiency and greater economic return. To accurately estimate fat-free lean growth rate, pigs should be weighed at the start of the finishing phase (40 to 70 pounds), and at time of slaughter (live weight or carcass weight), and the number of days between the starting weight and ending weight should be calculated. The following formula describes how to compute fat-free lean growth rate for a pig when carcass data is available. When measuring with other devices, substitute the appropriate prediction equation for pounds of lean in the hog at market weight using equations described on the following pages.

Pounds of Lean Growth Rate Per Day on Test Using Carcass Data

$$= \frac{\text{(Pounds of Lean in the Carcass)} - \text{(Pounds of Lean at Start (initial wt.) of Test)}}{\text{(Days on Test)}}$$

Pounds of Lean in the Carcass

$$8.5876 + 0.4650 \times \text{Carcass Weight, lbs} - 21.8957 \times \text{Tenth Rib Backfat, in} + 3.0047 \times \text{Tenth Rib Loin Muscle Area, sq in}$$

Pound of Lean at Initial Wt.

$$- [(0.418 \times \text{Live Starting Wt, lb}) - 3.650]$$

Days on Test

Carcass Lean Estimation Equations

The most appropriate equations are those listed for ribbed carcasses, because both composition and muscle quality can be assessed. Where carcass ribbing is not possible, equations that utilize fat thickness, weight and muscle are available for both carcass and live animal (ultrasound) measurements. In addition, equations are available for grading instruments (optical probe, Fat-o-Meater™) used in packing facilities.

The following examples will be used to demonstrate the lean evaluation calculations.

Carcass Lean Estimation Equations and Example Calculations

Scenario: 250 lb. live weight, **185 lb.** carcass weight, **0.80 in.** 10th rib backfat, **0.95 in.** midline last rib backfat, **2.60 in.** loin depth, **6.50 sq. in.** loin muscle area, **Sex** = gilt.

A. For carcasses ribbed at the 10th –11th rib.

1. Estimating Pounds of Fat-free Lean (A)

   A = 8.5876
   + 0.4650 x Carcass Weight, lb. (B)
   - 21.8957 x 10th Rib Backfat, in. (C)
   + 3.0047 x 10th Rib Loin Muscle Area, sq. in. (D)

2. Estimating Standardized Percent Fat-free Lean (E)

   (Pounds of Fat-Free Lean ÷ Carcass Weight) x 100

   E = (A ÷ B) x 100

Example: Using the Scenario Described:

1. Estimating Pounds of Fat-free Lean (A) where: **B = 185 lb.; C = 0.80 in.; D = 6.50 sq. in.**

8.5876	8.5876	=	8.5876
+ 0.4650 x (B)	+ 0.4650 x (185)	=	+ 86.0250
- 21.8957 x (C)	- 21.8957 x (0.80)	=	- 17.5166
+ 3.0047 x (D)	+ 3.0047 x (6.50)	=	+ 19.5306
	A	=	**96.6266 lb Lean**

2. Estimating Standardized Percent Fat-Free Lean (E)

   E = (A ÷ B) x 100

   E = (96.6266 ÷ 185) x 100

   E = (0.5223) x 100

   E = 52.23 %

Note: Composition Assessment Equations derived from the "Pork Composition and Quality Assessment Procedures," 2000 National Pork Board as implemented by the National Pork Producers Council, Des Moines, Iowa.

Carcass Lean Estimation Equations and Example Calculations

Scenario: 250 lb. live weight, **185 lb.** carcass weight, **0.80 in.** 10th rib backfat, **0.95 in.** midline last rib backfat, **2.60 in.** loin depth, **6.50 sq. in.** loin muscle area, **Sex** = gilt.

B. For Live Hogs using Real-time Ultrasound

1. Estimating Pounds of Fat-free Lean (**A**)

   A = - 0.5343
   + 0.2907 x Live Weight, lb. (**B**)
   + 0.8326 x Sex (value for sex: 1 = Barrow, 2 = gilt)
   - 16.4977 x 10th Rib Backfat, in. (**C**)
   + 5.4247 x 10th Rib Loin Muscle Area, sq. in. (**D**)

2. Estimating Standardized Percent Fat-free Lean (**E**)

   [(Pounds of Fat-Free Lean ÷ Live Weight) ÷ .74] x 100

   E = [(A ÷ B) ÷ .74] x 100

Example: Using the Scenario Described:

1. Estimating Pounds of Fat-free Lean (**A**) where: **B = 250 lb.; C = 0.80 in.; D = 6.50 sq. in.; Sex = 2 (gilt)**

– 0.5343	– 0.5343		=	– 0.5343
	+ 0.4650 x (B)	+ 0.2907 x (250)	=	+ 72.6750
	+ 0.8326 x (Sex)	+ 0.8326 x (2)	=	+ 1.6652
	– 16.4977 x (C)	– 16.4977 x (0.80)	=	– 13.1982
	+ 5.4247 x (D)	+ 5.4247 x (6.50)	=	+ 35.2610
		A	=	**95.8687 lb Lean**

2. Estimating Standardized Percent Fat-Free Lean (**E**)

   E = [(A ÷ B) ÷ .74] x100
   E = [(95.8687 ÷ 250) ÷ .74] x 100
   E = [(0.3835) ÷ .74] x 100
   E = (0.5182 x 100)
   E = 51.82 %

Note: Composition Assessment Equations derived from the "Pork Composition and Quality Assessment Procedures," 2000 National Pork Board as implemented by the National Pork Producers Council, Des Moines, Iowa.

Carcass Lean Estimation Equations and Example Calculations

Scenario: 250 lb. live weight, **185 lb.** carcass weight, **0.80 in.** 10th rib backfat, **0.95 in.** midline last rib backfat, **2.60 in.** loin depth, **6.50 sq.** in. loin muscle area, **Sex** = gilt.

C. For unribbed Carcasses

1. Estimating Pounds of Fat-free Lean (A)
   A = 23.5682
   + 0.5030 x Carcass Weight, lb. (B)
   – 21.3477 x Midline Last Rib Backfat, in. (C)

2. Estimating Standardized Percent Fat-free Lean (E)
   (Pounds of Fat-Free Lean ÷ Carcass Weight) x 100
   D = (A ÷ B) x 100

Example: Using the Scenario Described:

1. Estimating Pounds of Fat-free Lean (A) where: B = 185 lb.; C = 0.95 in.

23.5682	23.5682	=	23.5682
+ 0.5030 x (B)	+ 0.5030 x (185)	=	+ 93.0550
– 21.3477 x (C)	– 21.3477 x (0.95)	=	– 20.2803
	A	=	96.3429 lb Lean

2. Estimating Standardized Percent Fat-Free Lean (E)
   E = (A ÷ B) x100
   E = (96.3429 ÷ 185) x 100
   E = (0.5208) x 100
   E = 52.08 %

Note: Composition Assessment Equations derived from the "Pork Composition and Quality Assessment Procedures," 2000 National Pork Board as implemented by the National Pork Producers Council, Des Moines, Iowa.

Carcass Lean Estimation Equations and Example Calculations

Scenario: 250 lb. live weight, **185 lb.** carcass weight, **0.80 in.** 10th rib backfat, **0.95 in.** midline last rib backfat, **2.60 in.** loin depth, **6.50 sq. in.** loin muscle area, **Sex** = gilt.

D. For Optical Probe Meaurements (Fat-O-Meater™)

1. Estimating Pounds of Fat-free Lean (A)

   A = 15.3098
   + 0.5096 x Carcass Weight, lb. (B)
   – 31.2796 x 10th Rib Backfat, in. (C)
   + 3.8132 x Loin Muscle Depth, in. (D)

2. Estimating Standardized Percent Fat-free Lean (E)

   (Pounds of Fat-Free Lean ÷ Carcass Weight) x 100

   E = (A ÷ B) x 100

Example: Using the Scenario Described:

1. Estimating Pounds of Fat-free Lean (A) where: **B = 185 lb.; C = 0.80 in.; D = 2.60 in.**

15.3908	15.3908		=	15.3908
+ 0.5096 x (B)	+	0.5096 x (185)	=	+ 94.2760
– 31.2796 x (C)	–	31.2796 x (0.80)	=	– 25.0237
+ 3.8132 x (D)	+	3.8132 x (2.60)	=	+ 9.9143
		A	=	**94.5574 lb Lean**

2. Estimating Standardized Percent Fat-Free Lean (E)

   E = (A ÷ B) x 100
   E = (94.5574 ÷ 185) x 100
   E = (0.5111) x 100
   E = 51.11 %

Note: Composition Assessment Equations derived from the "Pork Composition and Quality Assessment Procedures," 2000 National Pork Board as implemented by the National Pork Producers Council, Des Moines, Iowa.

Price Conversion Table

Today hogs are purchased by both live weight and carcass weight. The following table will help you understand how these are derived based upon the dressing percent of the hogs being marketed.

Conversion of Carcass Weight Prices to Live Weight Prices at Various Carcass Dressing Percents

Carcass Weight Price ($/cwt)	Live Weight Price ($/cwt)			
	Dressing Percent=73%	Dressing Percent=74%	Dressing Percent=75%	Dressing Percent=76%
80	$58.40	$59.20	$60.00	$60.80
75	$54.75	$55.50	$56.25	$57.00
70	$51.10	$51.80	$52.50	$53.20
65	$47.45	$48.10	$48.75	$49.90
60	$43.80	$44.40	$45.00	$45.60
55	$40.15	$40.70	$41.25	$41.80
50	$36.50	$37.00	$37.50	$38.00
45	$32.85	$33.30	$33.75	$34.20
40	$29.20	$29.60	$30.00	$30.40
35	$25.55	$25.90	$26.25	$26.60
30	$21.90	$22.20	$22.50	$22.80
25	$18.25	$18.50	$18.75	$19.00
20	$14.60	$14.80	$15.00	$15.20
15	$10.95	$11.10	$11.25	$11.40
10	$ 7.30	$ 7.40	$ 7.50	$ 7.60
5	$ 3.65	$ 3.70	$ 3.75	$ 3.80

Dressing Percent = proportion of carcass weight to live weight

Example: (carcass weight ÷ live weight) x 100 = Dressing %

(185 lbs carcass ÷ 250 lb live weight) x 100 = 74%

*Normal Dressing Percentages range from 73%–77%.

Steps for Measuring Loin Muscle Area in the Carcass Using a Plastic Grid

1. Place the grid over the actual loin muscle or over a tracing of the loin muscle.
2. Lay the grid so that one or more of the areas blocked out by the heavy black lines falls within the loin muscle outline.
3. Count the dots within the loin muscle outside the blocked out areas. Count only those dots that lie within the loin muscle.
4. Add the number of dots to the 40, 60, or 80 dots enclosed by the heavy black lines. Divide the total number of dots by 20 to get the area in square inches.

You will notice the numbers-2, 3, 4-and the heavy black lines. These help speed up the counting process. The area within the heavy black line, designated by 2, contains 40 dots or 2 square inches; area 3 (area 2 plus 20 dots) contains 60 dots or 3 square inches; area 4 contains 80 dots or 4 square inches.

In the example on the right, the dots within the outlined area would be counted; the others would not. The 80 inside the block added to the 52 outside give 132 dots or 6.6 square inches.

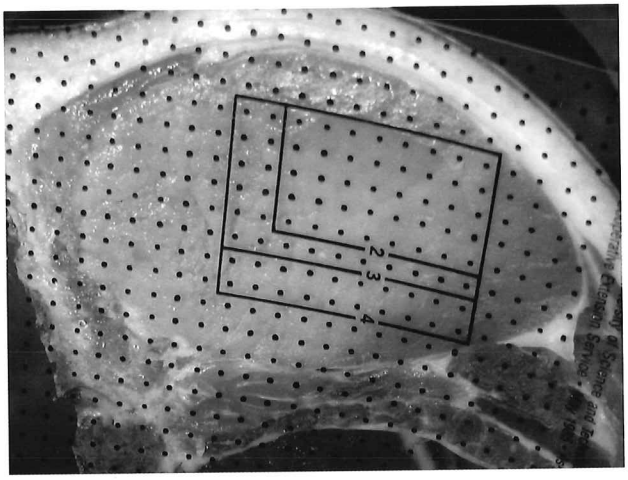


Figure 4.5
The loin muscle measurement is 9.00 square inches

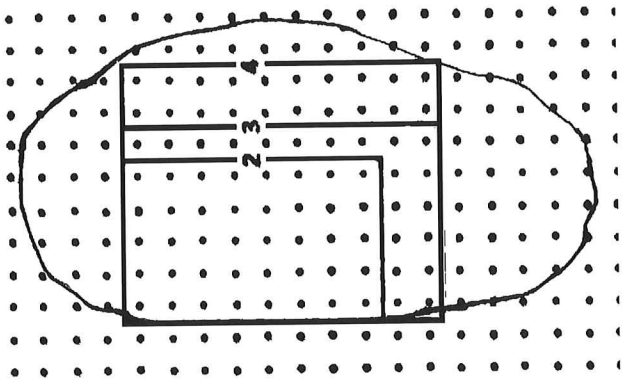
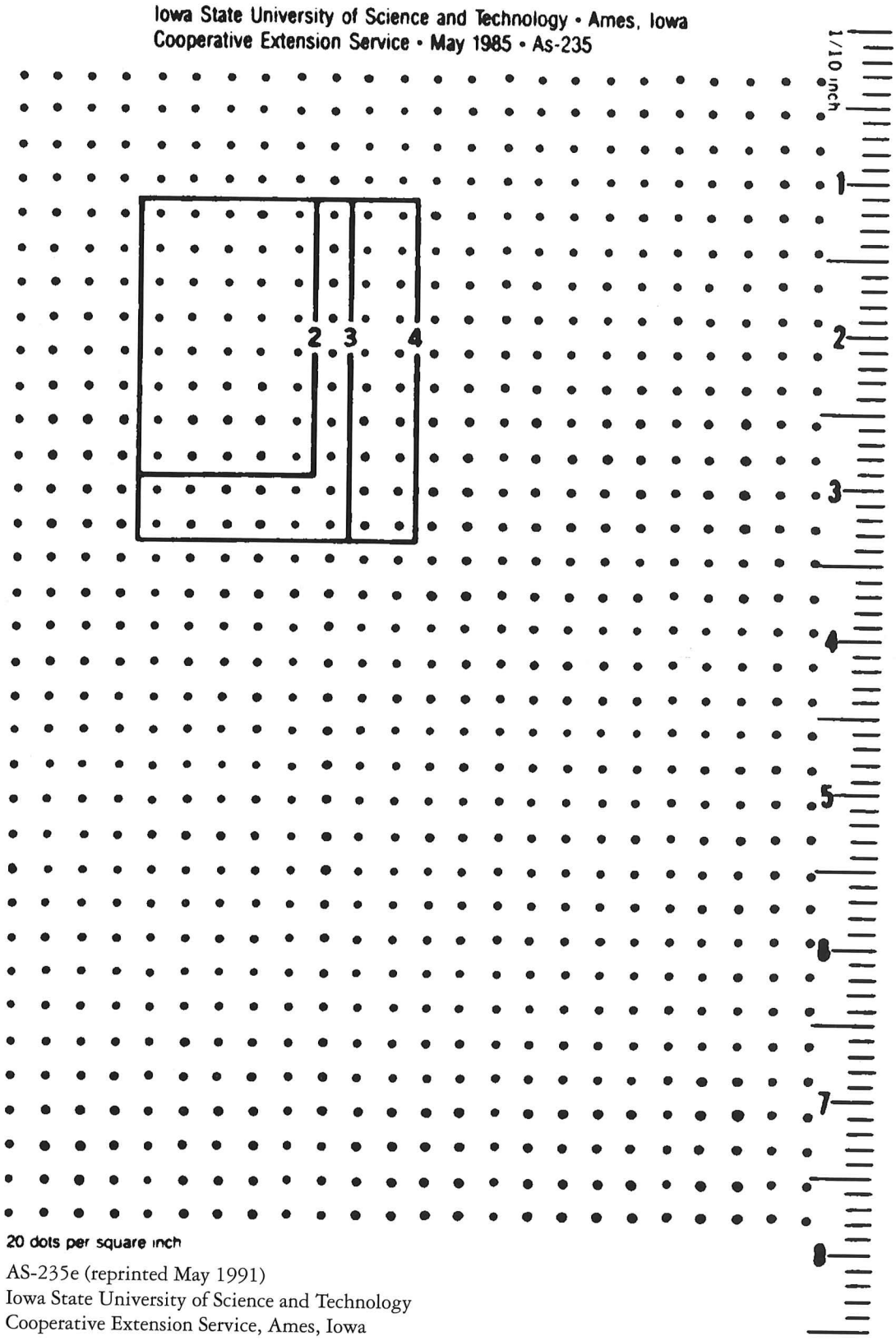


Figure 4.6
The measurement is 6.6 square inches.



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Iowa State University of Science and Technology
Cooperative Extension Service, Ames, Iowa

Figure 4.7
Plastic grid for measuring loin eye

Pork Muscle Quality Characteristics

The modern meat hog has to furnish a high quality, nutritious, wholesome product for today's health conscious consumer. The following list provides the characteristics desired in high quality pork (Pork Quality Standards).

Muscle color: Fresh pork should be reddish pink. Individual muscles are usually uniform in color, but muscle groups often vary considerably in color (such as in the ham).

Consumers object to muscles that are too pale or too dark. Abnormally pale muscles quickly turn gray in the retail display case and often shrink considerably, resulting in economic losses during processing, and dry-tasting products after cooking. Dark muscles may have a shorter shelf life because they are less acidic and therefore may support bacterial growth. Some consumers assume that dark muscles come from older animals, but that is not always true.

Muscle firmness: Pork muscle should be firm to the touch and not display any obvious fluid accumulations on its surface.

PSE = Pale, Soft, Exudative.
This condition is often related to a pale pinkish gray color, but is also common to the grayish pink color. This condition will result in excess, unappealing moisture in fresh pork packages. The product will shrink excessively during processing, lack juiciness after cooking, and be tough when cooked.

RFN = Reddish Pink, Firm, Non-Exudative.
Pork that has desirable color, firmness and waterholding capacity. The "ideal" pork.

DFD = Dark Purplish Red, Firm, Dry.
Very good waterholding capacity and often tender pork. May be susceptible to short shelf life because of high pH.

Marbling: Marbling is the visible fat within the boundaries of the muscle area. Slight to small amounts are desirable to provide a juicy and flavorful cooked product. Pork without marbling may be less flavorful and less juicy.

At the other extreme, large quantities of marbling do not make pork proportionately more palatable but do supply excess calories from fat and are often not appealing to the consumer.

Fat: Pork fat should be firm and white. Feeding highly unsaturated fat in pig diets can result in soft, oily fat that is not desirable.

Pigs that possess the stress gene have been found to produce poor muscle quality (pale, soft and very watery) a high percentage of the time. This type of meat is not wanted by the consumer.

Figure 4.8
Loin muscle visual quality assessment. Unacceptable visual color score (1), wetness score (1), and firmness score (1). Extreme Pale, Soft, Exudative (PSE) muscle. Note the extreme pale color and fluid dripping from the cut loin surface.

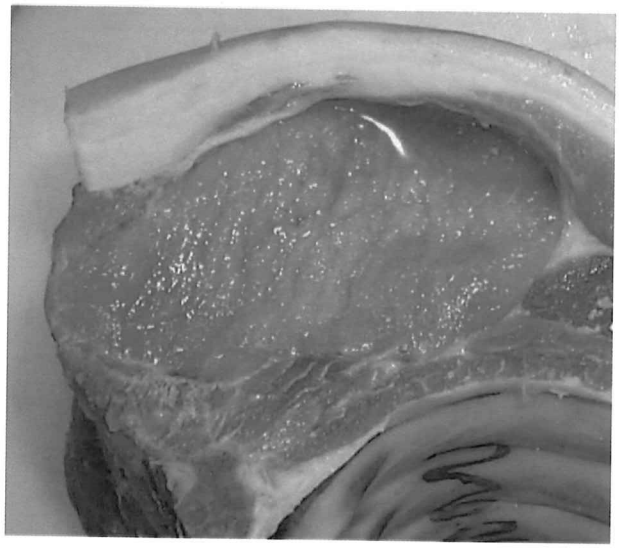


Figure 4.9
Loin muscle visual quality assessment. Unacceptable visual color score (1), wetness score (1), and firmness score (1). Pale, Soft, Exudative (PSE) loin. Note the inability of the loin to maintain its shape, the pulling away of the fat from the muscle and the pool of fluid on the cut loin surface.

Figure 4.10
Loin muscle visual quality assessment. Acceptable visual color score (3), wetness score (3) and firmness score (3). Note the bright, reddish-pink surface, the ability of the muscle to maintain its shape and the smooth, moisture-free cut loin surface.

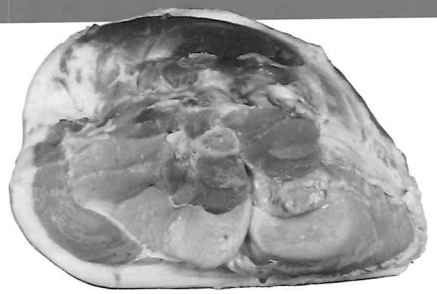
Pork Quality Standards

PORK QUALITY STANDARDS

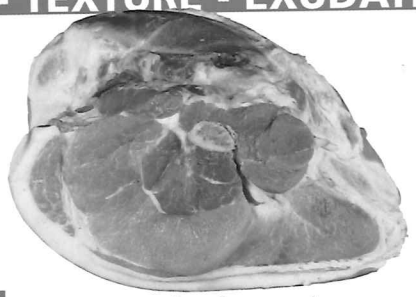
pork The Other White Meat.®

Quality of fresh pork varies greatly. The quality levels shown below will appear differently to consumers, taste differently when cooked, and perform differently when converted to processed products. High quality pork has greater monetary value than low quality pork. Quality can be evaluated by simply visual appraisal, or it can be determined more accurately by scientific tests. This chart may be used to help identify variations in pork quality. Color and Marbling Standards cards are also available.

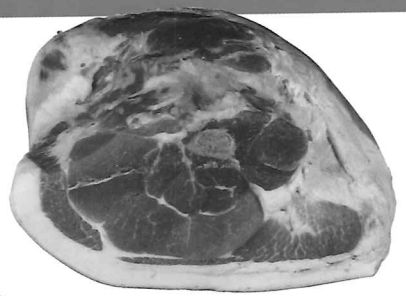
COLOR - TEXTURE - EXUDATION



PSE Pale pinkish gray, very Soft and Exudative. Undesirable appearance and shrinks excessively.

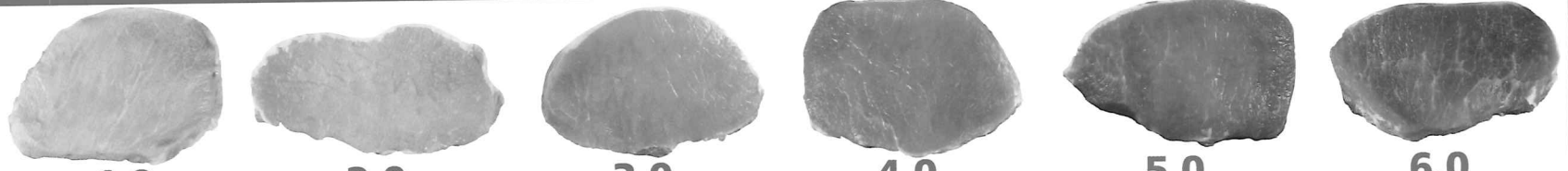


RFN Reddish pink, Firm and Non-exudative. "IDEAL". Desirable color, firmness and water-holding capacity.



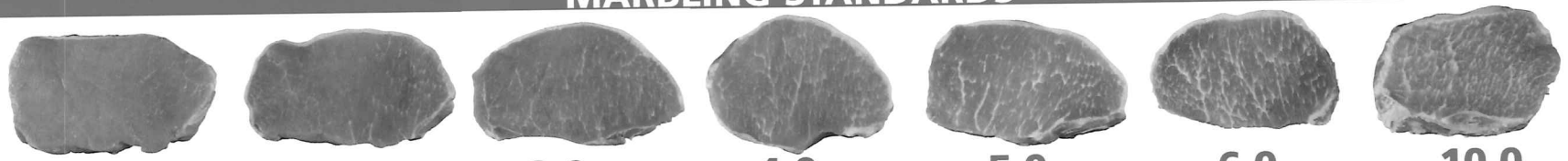
DFD Dark purplish red, very Firm and Dry. Firm and sticky surface, high water-holding capacity

COLOR STANDARDS



1.0	2.0	3.0	4.0	5.0	6.0
Pale pinkish gray to white	Grayish pink	Reddish pink	Dark reddish pink	Purplish red	Dark purplish red
Minolta L* Value[1] 61	55	49	43	37	31

MARBLING STANDARDS[2]



1.0 2.0 3.0 4.0 5.0 6.0 10.0

Color and marbling scores are as described in "Composition & Quality Assessment Procedures", 1999, NPPC.
1 Minolta L* values use D65 daylight light source.
2 Marbling scores correspond to intramuscular lipid content

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Pork Checkoff Works.

Muscle Quality Characteristics Score

Visual Color	Visual Firmness	Visual Wetness	Visual Marbling
*1 Pale, Pinkish Gray to White	*1 Exudative with excessive fluid on surface	*1 Soft: Surface distorts easily and is visibly soft	+1=1% intramuscular fat
2 Grayish Pink			2=2% intramuscular fat
3 Reddish Pink	2 Cut surface appears moist, with little or no free water on surface	2 Firm: Surface tends to hold its shape	3=3% intramuscular fat
4 Dark Reddish Pink			4=4% intramuscular fat
5 Purplish Red			5=5% intramuscular fat
*6 Dark Purplish Red	3 Cut surface exhibits no evidence of free water	3 Very firm: Surface tends to be very smooth with no distortion of shape	+6=6% intramuscular fat
			*10=10% intramuscular fat

*= Unacceptable quality attribute
+= Non-desirable quality attribute