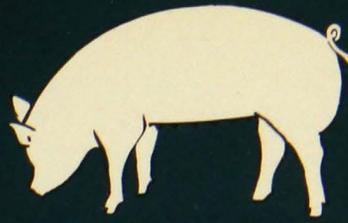


Pork Improvement

through Carcass Evaluation



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The efficient production of a meaty pig that yields a high percentage of high quality lean pork should be the objective of a sound swine selection program. The purpose of pork carcass evaluation is to assist swine producers in:

- producing quality pork carcasses
- producing a high lean to fat ratio efficiently
- identifying superior lines of breeding stock
- promoting a market-demanding product.

To fulfill these goals, certain carcass standards and procedures have been established. The purpose of this bulletin is to outline them in some detail.

Current pork carcass certification programs evaluate such quantitative measurements as length, loin-eye area, average backfat thickness, and carcass weight. The meat certification program is offered by all major breed associations and by the state swine evaluation program. These programs aim to identify outstanding sires and lines of breeding within each breed. To be eligible, litters must first qualify for litter number and weight for age as outlined in the breed production registry requirements. Two representative pigs from these litters must meet certification standards at slaughter weights between 200-240 pounds. Pigs should be slaughtered within this weight range, although hogs weighing 190-250 pounds will be accepted. When each of these two individuals

Figure 1. All animals are positively identified with tattoo numbers prior to slaughter. These indelible tattoos remain on the carcass and can be easily read in the coolers.



meets the standards shown below, the litter is designated as a certified litter.

Certification requirements for 220 pound hogs

Maximum adjusted age at 220 pounds (days)	180
Minimum carcass length (inches)	29.5
Maximum backfat thickness (inches)	1.50
Minimum loin-eye area (square inches)	4.50

All certifications are adjusted to a standard 220 pound weight. Conversion factors for adjusting to a 220 pound basis are:

- Days to 220 pounds=2 pounds per day.
- Length=0.025 inch per pound.
- Backfat=0.004 inch per pound.
- Loin-eye area=0.015 square inch per pound.

Figure 2. The rib section is marked between the 10th and 11th ribs on the right side of each carcass. The tattoo numbers are transferred to the ham and loin regions with a food grade pencil. Length is measured from the first rib to the anterior edge of the aitch bone.



EVALUATION PROCEDURES

Identification

Before slaughter, all animals should be tattooed on each shoulder and along the upper half of each side. These tattoos are used for identifying each carcass (figure 1). After slaughter, a food grading pencil is used to identify each ham on the inside shank portion and each loin on the rib section. The rib section is marked between the 10th and 11th ribs on the right side of each carcass (figure 2). This mark indicates the location where the loin will be cut for loin-eye size and quality evaluation.

Weight

Animals should be accurately weighed before shipping or slaughter. This weight is used in calculating dressing percentage and percentage of weight in high priced cuts. Chilled carcass weight is essential for complete carcass evaluation, and is usually obtained in most processing plants 24 hours after slaughter. In most carcass contests and evaluation programs, carcasses are chilled for 24 hours at a 34° F. If the chilled carcass weight is not available, a 2 percent shrinkage of the hot carcass weight can be subtracted from each carcass to yield an estimated chilled weight. Carcass weight is used in determining the yield of preferred cuts, such as the percentages of lean cuts, primal cuts, or ham and loin.

Backfat Thickness

Too much backfat is undesirable from the consumer's viewpoint, inefficient to produce, and essentially a waste to the processor. Average backfat thickness accounts for 45-55 percent of the variation in percentage of lean cuts. Since backfat can be measured easily on the carcass, it is one of the most important pork carcass measurements.

Backfat measurements should be made opposite the first rib, last rib, and last lumbar vertebra, as shown in figure 3, and then averaged. The measurements include the skin and the first two backfat layers and are made perpendicular to the skin surface. If splitting errors result, backfat should be measured on the side with the greater amount of backbone.

Length

Carcass length accounts for less than 20 percent of the variation in lean yield, so it contributes very little to estimating lean yield or value. Since meat certification requires a minimum carcass length, it should be measured, but it should not be overemphasized to the detriment of other carcass traits.

Length is measured from the anterior edge of the aitch bone to the anterior edge of the first rib adjacent to the vertebra (figure 2). On carcasses unevenly split, the side with the greater amount of bone should be measured.

Loin-Eye Area

The longissimus dorsi (loin-eye) muscle area accounts for less than 50 percent of the variation in lean yield. This muscle varies in size from the last rib to the first rib. The area is approximately 0.3 square inch larger



Figure 3. Backfat is measured opposite the first rib, last rib, and last lumbar vertebrae.

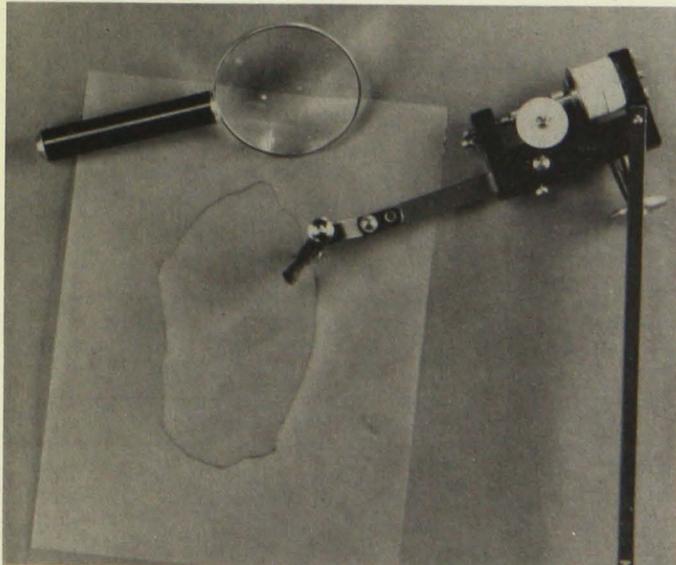
Figure 4. The right loin is cut perpendicular to the backbone between the 10th and 11th ribs. The loin-eye area is measured at this cross section.





Figure 5. The longissimus dorsi (loin-eye) muscle is traced on an acetate paper for a permanent record. The loin quality score is recorded on the acetate.

Figure 6. A planimeter is used to measure loin-eye area. Loin-eye area is measured between the 10th and 11th ribs after the carcass has been chilled correctly for 24 hours. The loin is cut at an exact right angle and the short end of the loin is set on a table with the newly exposed loin-eye at the top. A piece of acetate is then placed over the exposed loin-eye and the main muscle is traced. Only the loin-eye muscle, not the adjacent lean area, is included in this measurement.



at the last rib compared to the 10th rib. Even though loin-eye area is not as highly related to lean yields as some other measurements, emphasis should be placed on size because most consumers select chops for leanness.

The right loin is cut perpendicular to the backbone between the 10th and 11th ribs. Since breaking the loin necessitates cutting across the 10th rib, the loin should be placed fat surface down and cut by a saw, starting from the vertebral column (figure 4). This will insure a right angle cut across the loin-eye muscle.

A tracing of the longissimus dorsi muscle is made on acetate paper with a sharp pencil. The identification number with the quality score should be placed on the tracing (figure 5).

A planimeter measurement from an acetate tracing of the loin-eye cross section is then measured (figure 6).

Yields

The most accurate procedure for evaluating carcass composition is by either chemical or physical separation. However, these analyses are too expensive and time consuming for most carcass evaluations. So, yields of wholesale cuts are used to estimate composition or value. Since the ham and loin constitute over 50 percent of the total carcass value and contain a high ratio of muscle to fat and bone, they are most frequently used for carcass evaluation.

The ham is the most reliable wholesale cut measured, since there is less cutting and trimming error involved (figure 7). Both sides of the carcasses should be cut and weighed. When only one side can be cut, it should always be the right side.

Figure 7. Ham weight and the quality score are recorded. Each ham is identified by carcass number. Both hams should be weighed and scored to obtain the most reliable data.



Quality Score



Quality Score 1: The ham is two-toned and the gluteus medius (ham) muscle appears pale, soft, and watery. The longissimus dorsi (loin-eye) muscle has the same light color and soft appearance. These cuts are unacceptable.



Quality Score 2: The ham is a more uniform light grayish pink and reveals a moderate amount of firmness and wateriness. These cuts are marginally acceptable.



Marbling Number 1: Traces of marbling (fat specks within the lean muscle) can be seen in this loin. After cooking, this loin will lack juiciness.



Marbling Number 3: The amount of marbling is modest and acceptable. The meat will be juicy and palatable after cooking.



Quality Score 3: Color, firmness, and shape are ideal. All muscles are grayish pink, firm, and relatively dry.



Quality Score 4: The ham and loin sections are slightly dark and are firm. The muscle is dry and keeps its shape. Consumers prefer this intermediate color.



Quality Score 5: These cross sections appear dark, dry, and firm. The firmness is desirable, but consumers associate darkness with older animals or products that have been on display too long.

Marbling Number



Marbling Number 5: This cut has excessive marbling, which consumers associate with a fat product and so avoid. But such a cut still is more acceptable than a soft, watery loin devoid of marbling.

COMMON PROCEDURE FOR REMOVING WHOLESALE CUTS

Separation of Shoulder

The shoulder is cut perpendicular to the back between the second and third ribs. The foot is cut from the shoulder 0.5 inch above the knee joint. The neck bone is removed. The jowl is cut off parallel to the shoulder cut. The exterior shoulder fat is trimmed to a maximum 0.25 inch thickness.

Ham Removal

The ham is removed between the second and third sacral vertebrae. The foot is cut off at the hock joint and the tail bones are removed. The flank corners are cut off by following the natural flank seam. The external fat cover is trimmed to a maximum 0.25 inch thickness.

Loin Removal

The loin is separated from the belly along a line made by the tenderloin muscle starting at the posterior end of the loin. The backfat is removed from the loin, leaving no more than 0.25 inch of fat on the loin.

PORK QUALITY CONSIDERATIONS

Pork quality has been defined as the combination of traits that provides an edible product that is free of spoilage during processing and is attractive, appetizing, nutritious, and palatable. These traits are predicted by fresh meat characteristics such as color, firmness, and marbling.

In the early 1880's, German meat scientists reported processing problems due to pale, moist surfaces of pork muscle. Danish researchers have been concerned with pork color problems since the thirties, and refer to it as depigmented pork. In England, Holland, and more recently in the United States, the term pale, soft, exucative (PSE) pork has described undesirable pork quality.

Fresh cut pork from PSE meat is less desirable because of the liquids that appear in the packaged product in the display case. PSE hams will shrink more in processing. The PSE product will have higher cooking losses when cooked to the same internal temperature as normal pork and usually will be less tender.

Reports indicate that PSE pork conditions occur when there is a rapid buildup of lactic acid within the muscle fiber in the carcass immediately after slaughter. This condition may be due to an upset in the enzyme system controlling the breakdown of glycogen (animal starch) in the muscle fibers.

Stress conditions such as extremes in exercise, temperature conditions, humidity, atmospheric pressure, sound, shock, fear, or any emotional excitement prior to slaughter can cause the PSE condition in certain individuals. In extreme cases, it may cause death and is referred to as the porcine stress syndrome.

Although there is a tendency for some meatier pigs to exhibit some pork quality problems, superior muscled hogs with acceptable quality can and are being produced. However, producers must select lines that are most resistant to stress conditions, since PSE conditions are thought to be moderately heritable.

A scoring system has been developed to designate pork quality. The longissimus dorsi (loin-eye) and/or gluteus medius (ham) should be visually scored for color, firmness, structure, and marbling.

Color, Firmness, and Structure

The following scores are used in designating color, firmness, and structure (see the colored photos illustrating these differences).

Desirability	Description	Score
Unacceptable	Muscles extremely pale, soft, and watery	1
Marginal	Muscles pale, moderately soft, and moderately watery	2
Excellent	Muscles uniformly grayish-pink, moderately firm, and dry	3
Acceptable	Muscles moderately dark, firm, and dry	4
Marginal	Muscles dark, very firm, and dry	5

Marbling

Marbling is designated with one of three scores (see the colored photos).

Devoid	1
Modest	3
Abundant	5

Carcass Requirements

Quality of the carcass is one of the most important considerations in carcass evaluation. Preslaughter stress, stunning method, and rate of carcass chilling may affect pork quality. Therefore, all attempts should be made to minimize preslaughter stress and to maintain uniform slaughter and cooling conditions.

Muscles from carcasses that average less than 1.5 on both quality criteria are considered unacceptable and should not be eligible for competition in a carcass contest.

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