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Pork carcass evaluation guidelines

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Quick Facts

- Carcass information, combined with production records, provides valuable direction for efficient production of lean, high-quality pork.
- The ideal carcass should have as much muscle and as little fat, skin and bone as possible without a reduction in muscle quality and production factors.
- The following carcass measurements normally are taken: hot carcass weight, carcass length, average backfat thickness, loin eye area and fat depth.
- Processing suitability, attractiveness and cooked palatability determine pork quality.
- Pork carcasses must meet several requirements to be eligible for competition in carcass contests.

Carcass evaluation is an integral component of swine performance testing programs. Information concerning economically important carcass characteristics allows swine producers to measure the effects of breeding and management systems on the end product: pork. Carcass information, combined with production records, provides valuable direction for efficient production of lean, high-quality pork.

This publication provides procedures for obtaining economically important carcass information. The following guidelines are based on recommendations provided by the National Pork Producers Council (NPPC).

Quantitative Characteristics

Quantitative carcass characteristics reflect differences in the amount of edible lean or muscle that a carcass contains. Degree of fatness and muscularity are the two most important factors associated with lean meat yield. The ideal carcass should have as much muscle and as little fat, skin and bone as biologically possible without a reduction in muscle quality and production factors. In quantitative evaluation of pork carcasses the following carcass measurements normally are taken.

Hot carcass weight is almost always obtained on pork carcasses prior to chilling. If chilled carcass weight is obtained, convert to a hot weight basis by dividing by .985 (most carcasses shrink about 1.5 percent during drying and chilling). For skinned carcasses, adjust to a skin-on basis by dividing the hot weight by 0.94 (the skin accounts for about 6 percent of hot carcass weight). Any trim losses should be accounted for and added to the final hot carcass weight.

A minimum carcass weight constraint of 140 pounds (64 kilograms) normally is recommended. However, if there is a concern about thin bellies at this weight, then the minimum carcass weight requirement should be increased. Most carcasses weighing 150 pounds (68 kg) or more will be free of the thin belly problem. Once bellies meet desired dimensions for subsequent processing, the major concern is desirable composition and quality.

Carcass length is measured with a metal tape from the anterior tip of the aitch bone (pubic bone) to the anterior edge of the first rib.

Average backfat thickness is the average of three measures of backfat taken at points opposite the first rib, last rib and last lumbar vertebra. This measure is made to the nearest tenth of an inch, perpendicular to the skin, and includes both the first (outer) and second (middle) layers of fat exposed on the split surface of the backfat. Measurements from one side of the carcass usually are satisfactory for accuracy, but both sides should be measured if the carcass is split off-center. Subjective adjustments should be made only when there are mechanical disfigurations and/or very unusual fat distributions. If the skin has been removed, add 0.1 inch (2.5 millimeters) to adjust to a skin-on basis.

Ribbing of the carcass is required to expose a cross-section of the loin eye muscle for area measurement, a fat depth measurement and evaluation of qualitative characteristics. The

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vertebra of the untrimmed carcass is first cut with a saw perpendicular to the long axis of the loin between the 10th and 11th ribs. Start adjacent to the 11th rib to permit a square cut across the loin muscle without cutting into the 10th rib. After the vertebra is sawed, use a knife to extend the cut no more than 1 inch (2.5 centimeters) beyond the outer end of the loin eye surface. Extending the cut farther will damage the belly. Ribbing should be done only on properly chilled carcasses (12 hours or more after slaughter), and it should be completed a minimum of 30 minutes prior to visual evaluations of muscle quality to allow for full expression of the qualitative characteristics.

Loin eye area is a measurement taken in square inches by using a clear plastic grid (grids are available from Iowa State University, identified as grid AS-235) or by tracing the outer perimeter of the loin muscle on acetate paper and using a compensating polar planimeter to measure the area of the tracing paper.

Fat depth is a measure of subcutaneous fat, including skin, opposite the loin eye. Divide the longest axis of the loin eye into quarters. Measure the fat depth opposite a point that is ¾ the distance along the loin eye (closest to belly side) in tenths of inches from the edge of the loin eye muscle to the outer edge of and perpendicular to the skin. For skinned carcasses, add 0.1 to the measurement.

The 10th rib fat depth is a more accurate measurement of subcutaneous fat than average backfat thickness because it is not influenced by variation in carcass splitting and trimming. No minimum fat thickness is recommended. As long as decreased fatness does not cause muscle quality deficiencies, inadequacies in belly thickness or live production efficiency, producers continually must attempt to reduce fatness.

Pounds or percentage of muscle (containing 10 percent fat) are estimated by combining hot carcass weight, fat depth and loin eye area. The following equations can be used to estimate pounds or percentage of muscle in a pork carcass:

Pounds of muscle =

2.0 + (hot carcass weight, pound x .45)
+ (10th rib loin eye area, inch x 5.0)
- (10th rib fat depth, inch x 11.0)

Percentage of muscle =

$$\frac{\text{pound of muscle}}{\text{hot carcass weight}} \times 100$$

Qualitative Characteristics

Pork quality refers to the suitability for processing, attractiveness and cooked palatability of the meat. Suitability for processing relates to pork that sustains minimal shrinkage, and this is related to muscle acidity. Color and structural appearance largely determine the attractiveness of pork. Palatability characteristics include flavor (taste and aroma), tenderness and juiciness. The following quality factors are related to shrinkage, appearance and palatability and should be used in evaluating the acceptability of pork (determined at the 10th and 11th rib interface).

Muscle color of pork should be bright grayish pink to pinkish red. Muscles that are too pale or too dark are objectionable to retailers. Abnormally pale muscles quickly turn gray in the retail display case and often incur considerable shrinkage, resulting in economic losses during processing and in dry tasting products after cooking. A dark color indicates a shorter shelf-life because of a higher pH and is usually not considered acceptable by the consumer. The five color scores (1 = pale, 2 = slightly pink, 3 = grayish pink, 4 = slightly dark red, and 5 = dark red) shown in "Procedures to Evaluate Market Hogs" (NPPC) represent normal variation of pork color. It is recommended that carcasses having either of the two extreme color scores be disqualified from competition.

Muscle firmness and texture are important if the loin eye is soft and watery, displaying obvious fluid accumulations on its surface and exhibiting a loose, coarse texture. These conditions are related to a pale color. Cuts with these muscle characteristics often sustain excessive shrinkage when processed. Such pork carcasses should be disqualified or severely penalized.

Marbling is fat found within the loin eye muscle. Marbling scores for pork (1 = traces, 2 = slight, 3 = small, 4 = moderate, and 5 = abundant) are shown in "Procedures to Evaluate Market Hogs" (NPPC). Slight to moderate amounts of marbling are desired to provide a juicy, flavorful product. It is recommended that pork carcasses possessing traces or abundant quantities of marbling be disqualified. Pork possessing traces or less than a trace of marbling may be less juicy and flavorful than desired. At the other extreme, pork that has an abundant amount of marbling may be less desirable to calorie conscious consumers.

Pork fat should be firm and white. Soft, oily and slightly brownish-colored fat is unattractive and susceptible to the onset of rancidity during processing and storage.

Carcass Contests

Pork carcasses must meet certain requirements to be eligible for competition in carcass contests. These requirements should be established as contest rules prior to the competition. These are recommended carcass traits:

1. free of arthritis, abscesses and other obvious diseases and abnormalities as determined by USDA plant inspectors;
2. free of cryptorchidism;
3. minimum carcass length of 29.5 inches (74.9 centimeters);
4. maximum average backfat of 1.5 inches (3.8 cm);
5. minimum loin eye area of 4.5 in^2 (29.3 cm^2);
6. minimum hot carcass weight of 140 pounds or 63.5 kg (131 pounds — 59.4 kg — if skinned);

7. muscle color score in the range of 2 to 4;
8. muscle marbling score in the range of 2 to 4;
9. muscles free of soft, watery, coarse-textured properties; and
10. pork fat firm and white.

Carcasses meeting these requirements then can be ranked on percentage muscle calculated to the nearest tenth.

Carcass evaluation alone cannot accurately assess the total pork production system. When chronological age of individual animals is known, a more desirable method of ranking should be implemented. The following equation is used to calculate age units required to produce 85 pounds of muscle, which more realistically measures the overall progress in pork production:

$$\text{Age units required to produce 85 pounds of muscle} = \frac{(85 \times \text{age at slaughter, days})}{\text{Pounds of muscle}} - 5100 + 60$$

This formula is essential to accurately compare carcasses having wide ranges in weights. If market gilts are allowed to compete with barrows, the age units required to produce 85 pounds of muscle should be adjusted by subtracting two units for gilts. Pigs are ranked on the basis of adjusted number of age units required to produce 85 pounds of muscle with the pig requiring the fewest number of units ranking first.

Carcass evaluation in itself can be a desirable tool for selection and management, but selection for improved carcass traits should be balanced against production efficiency.