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.

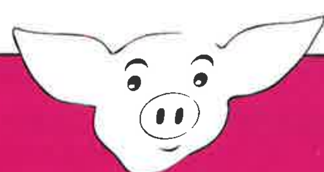
Porcine Stress Syndrome (PSS)

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.



Producers should avoid using stress positive and stress carrier hogs due to the poor muscle quality produced.

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.

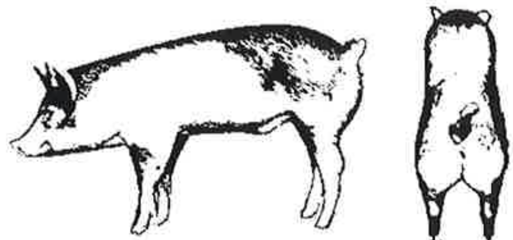
U.S. No. 2 feeder pigs are moderately long and have moderately thick muscling through the hams and shoulders. The back usually appears slightly full and well-rounded. Pigs in this grade would qualify for the U.S. No. 1 grade, except for having less than moderately thick muscling and more fat development.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

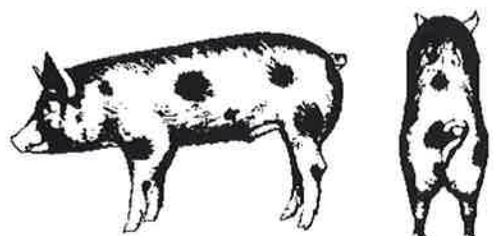
U.S. No. 4 feeder pigs are short and have thin muscling throughout, particularly in the lower parts of the ham toward the shanks. The back usually is wider than the underline. Feeder pigs in this grade are expected to produce U.S. No. 4 grade carcasses.

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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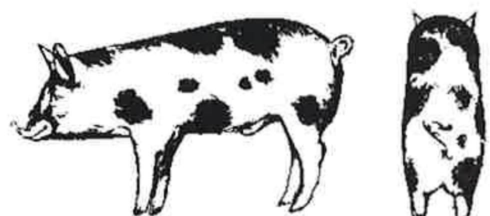
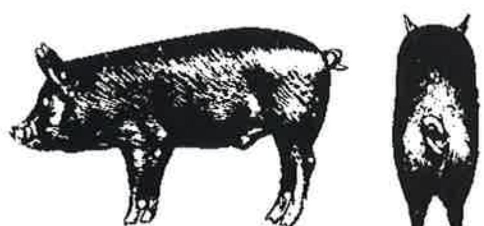
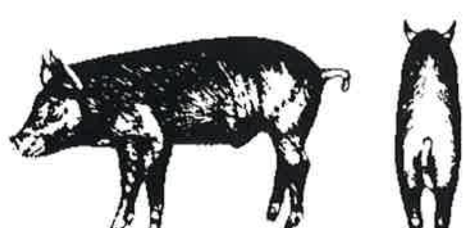


U.S. No. 3



U.S. No. 4



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

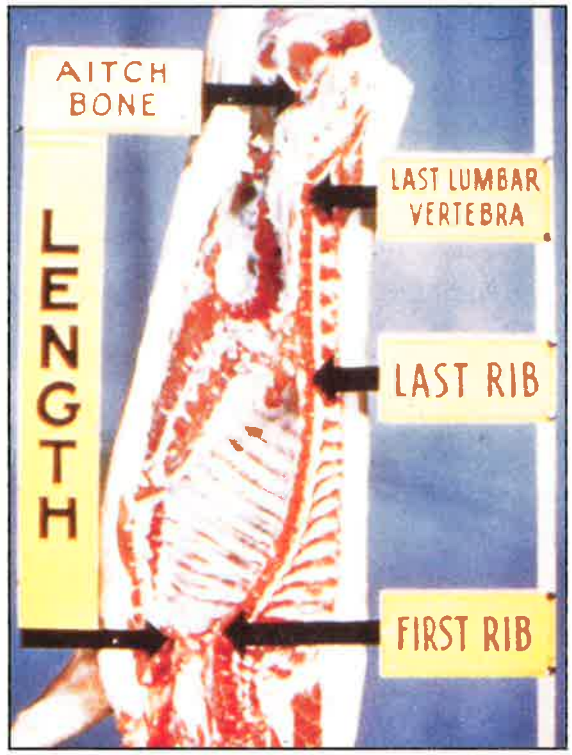


Figure 4.2
Carcass measurements
(length and midline fat depth locations)

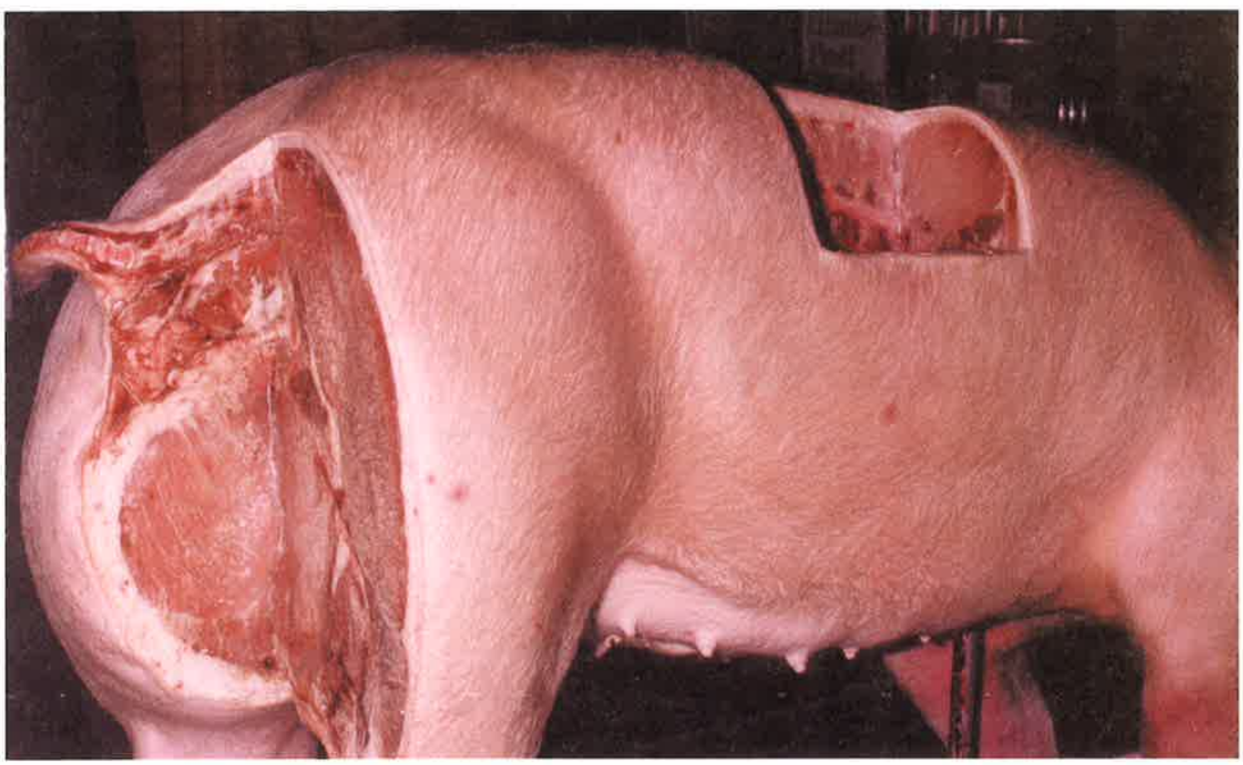


Figure 4.3
Ham muscle and loin muscle at the 10th rib

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: $A = (B \div C) \times 100$

$A = (96 \div 185) \times 100$
$A = (0.5189) \times 100$
$A = 51.89\%$

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: $A = [(B \div C) \div .74] \times 100$

$A = [(96 \div 250) \div .74] \times 100$
$A = [(0.384) \div .74] \times 100$
$A = (0.5189) \times 100$
$A = 51.89\%$

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

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

$$\frac{\overbrace{\left[8.5876 + 0.4650 \times \text{Carcass Weight, lbs} - 21.8957 \times \text{Tenth Rib Backfat, in} + 3.0047 \times \text{Tenth Rib Loin Muscle Area, sq in} \right]}^{\textit{Pounds of Lean in the Carcass}} - \overbrace{[(0.418 \times \text{Live Starting Wt, lb}) - 3.650]}^{\textit{Pound of Lean at Initial Wt.}}}{\text{Days on Test}}$$

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.** 10^{th} 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 10^{th} Rib Backfat, in. **(C)**
   + 5.4247 x 10^{th} 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.** 10^{th} 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.** 10^{th} 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 10^{th} 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.

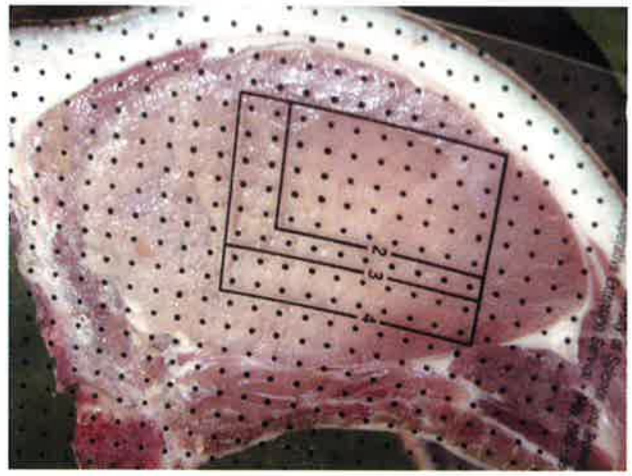


Figure 4.5
The loin muscle measurement is 9.00 square inches

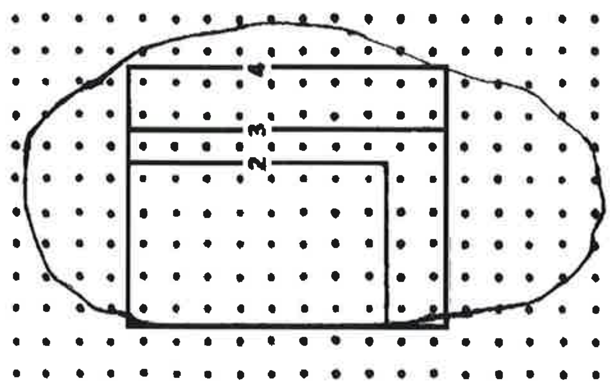


Figure 4.6
The measurement is 6.6 square inches.

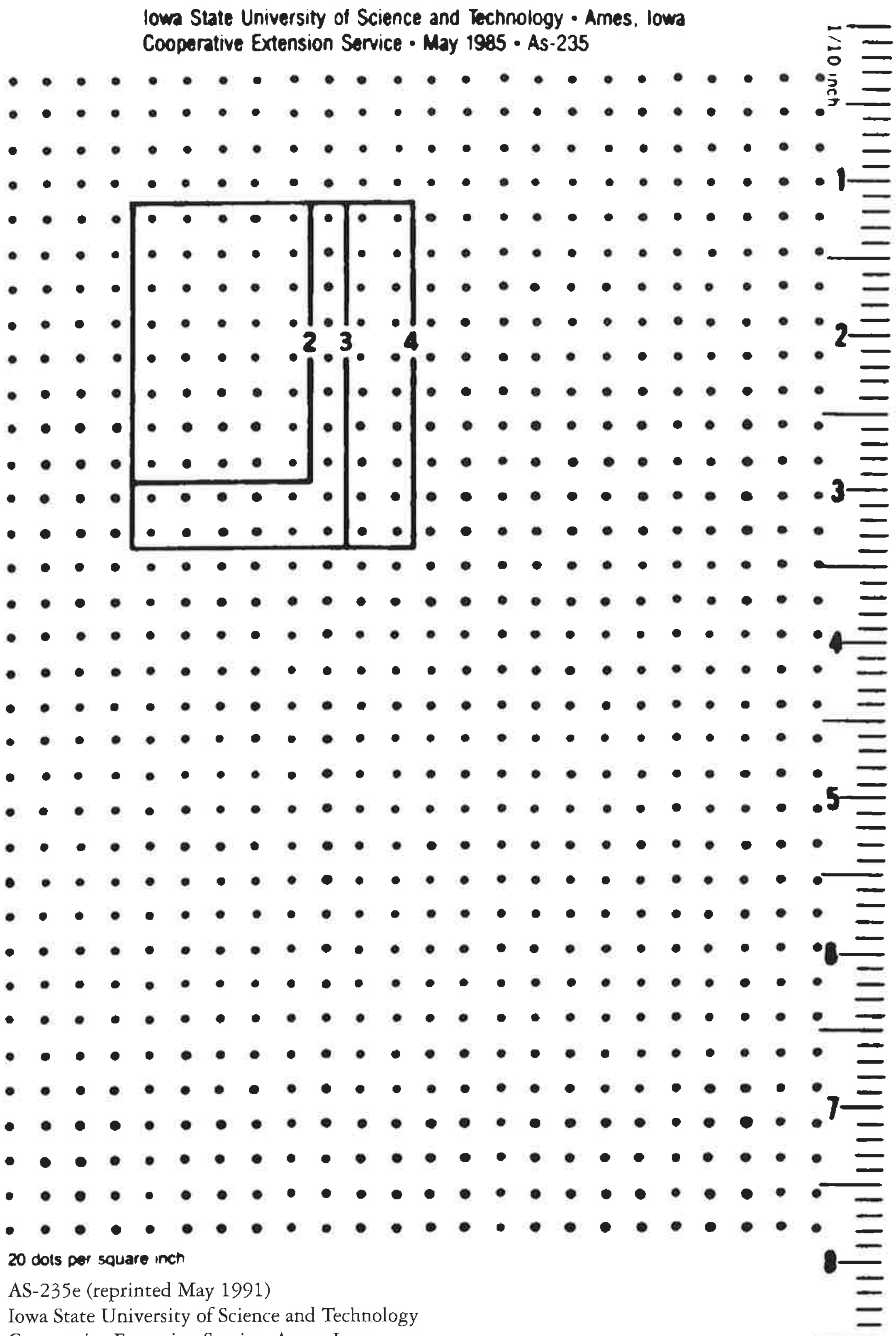


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Figure 4.7
Plastic grid for measuring loin eye

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.

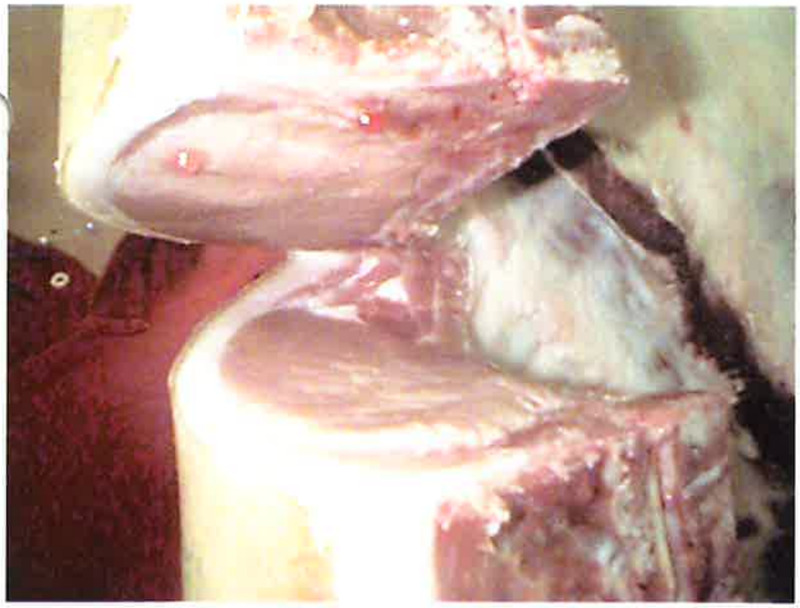


Figure 4.8
Loin muscle visual quality assessment. Unacceptable visual color score (1), wetness score (1), and firmness score (1). Extreme Pale, Soft, Exudative (PSE) muscle. Note the extreme pale color and fluid dripping from the cut loin surface.

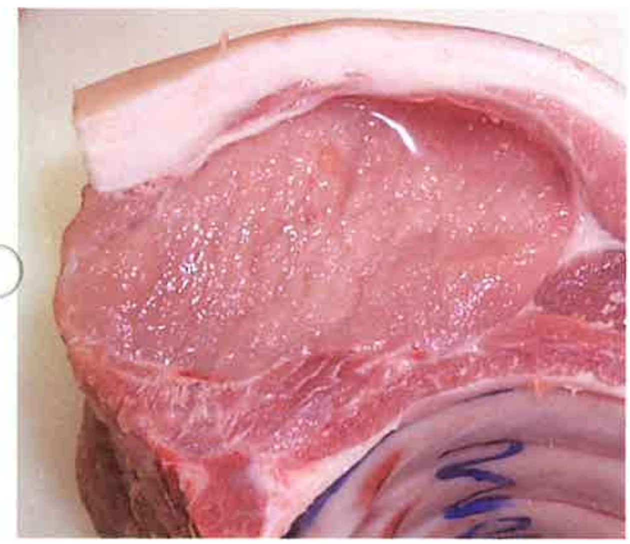


Figure 4.9
Loin muscle visual quality assessment. Unacceptable visual color score (1), wetness score (1), and firmness score (1). Pale, Soft, Exudative (PSE) loin. Note the inability of the loin to maintain its shape, the pulling away of the fat from the muscle and the pool of fluid on the cut loin surface.

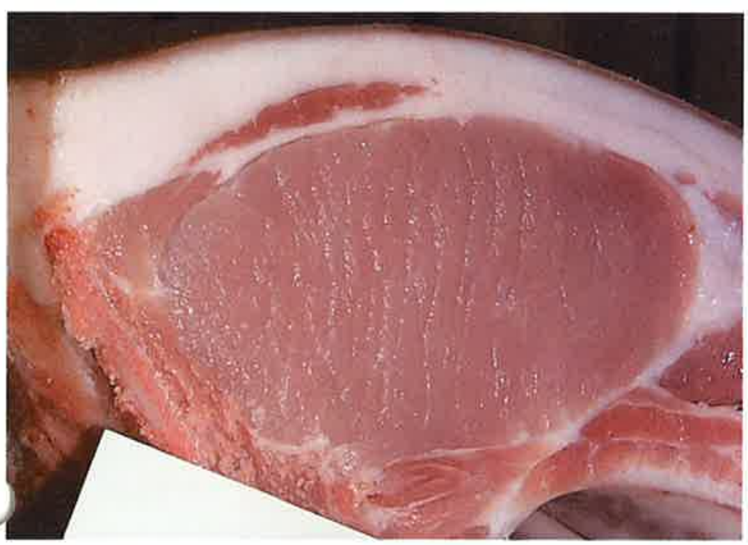
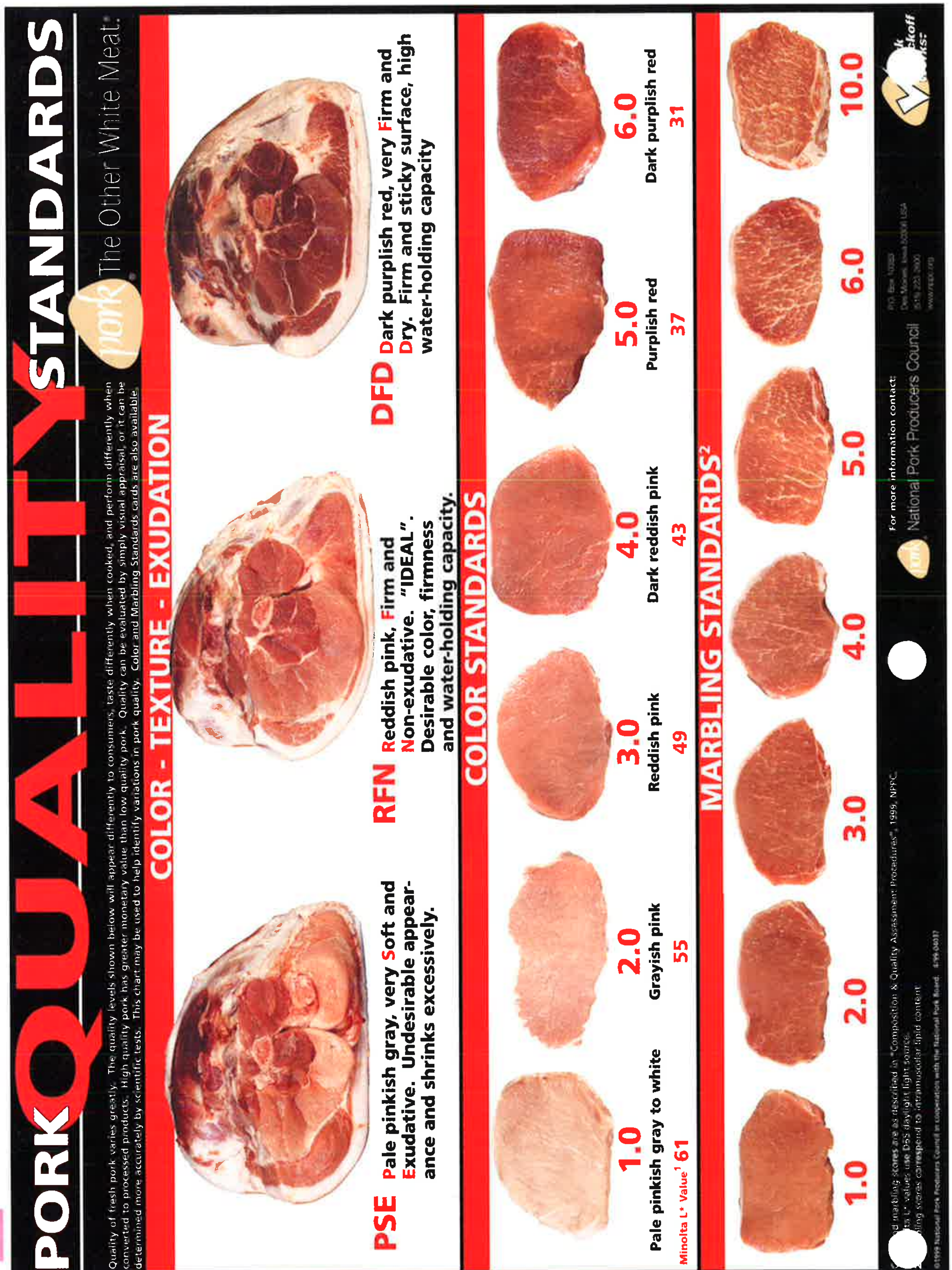


Figure 4.10
Loin muscle visual quality assessment. Acceptable visual color score (3), wetness score (3) and firmness score (3). Note the bright, reddish-pink surface, the ability of the muscle to maintain its shape and the smooth, moisture-free cut loin surface.



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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

Chapter 5
Pork Products

Wholesale, Retail and Food Service Cuts

Now that you have raised a show and/or market hog, you will probably find it interesting and perhaps useful to see how this animal contributes to the Consumer Market.

The illustration (Figure 5.1) shows the location and names of the main or "wholesale" cuts of pork that come from a market pig.

Pork chops come from the loin. Bacon comes from the belly. The butt makes a tasty pork roast. The picnic is often called "callie". The callie looks like a small ham.

Remember, you are looking at one side of this pig. There are two of each of these main cuts in a pig. Each of these cuts from an average market pig will weigh as follows: **Ham (leg):** 15–20 pounds; **Loin:** 10–14 pounds; **Belly (side):** 15–20 pounds; **Butt (boston butt/ shoulder butt):** 5–7 pounds; **Picnic (picnic shoulder/ arm shoulder)** : 6–8 pounds.

A 250 pound hog would yield two 15–20 pound hams, 60 to 70 pork chops, 15 to 20 pounds of pork steaks, two 6 to 7 pound roasts, 15 to 20 pounds of bacon, spare ribs, and pork hocks, and 15 to 20 pounds of sausage.

Retail cuts of pork—see Figure 5.2.
Food service cuts of pork—see Figure 5.3.

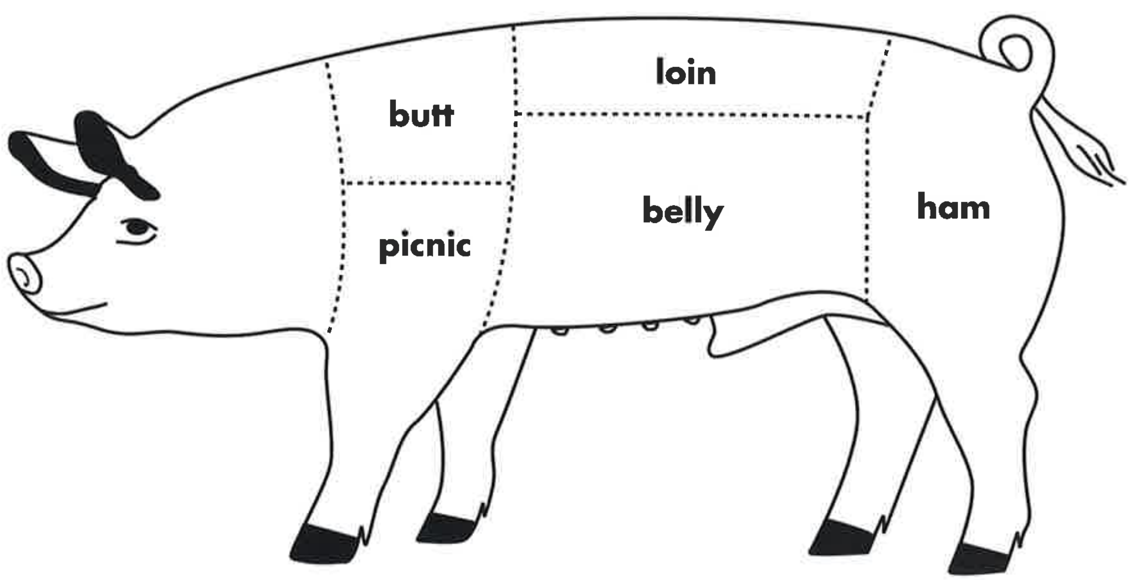


Figure 5.1
Wholesale cuts

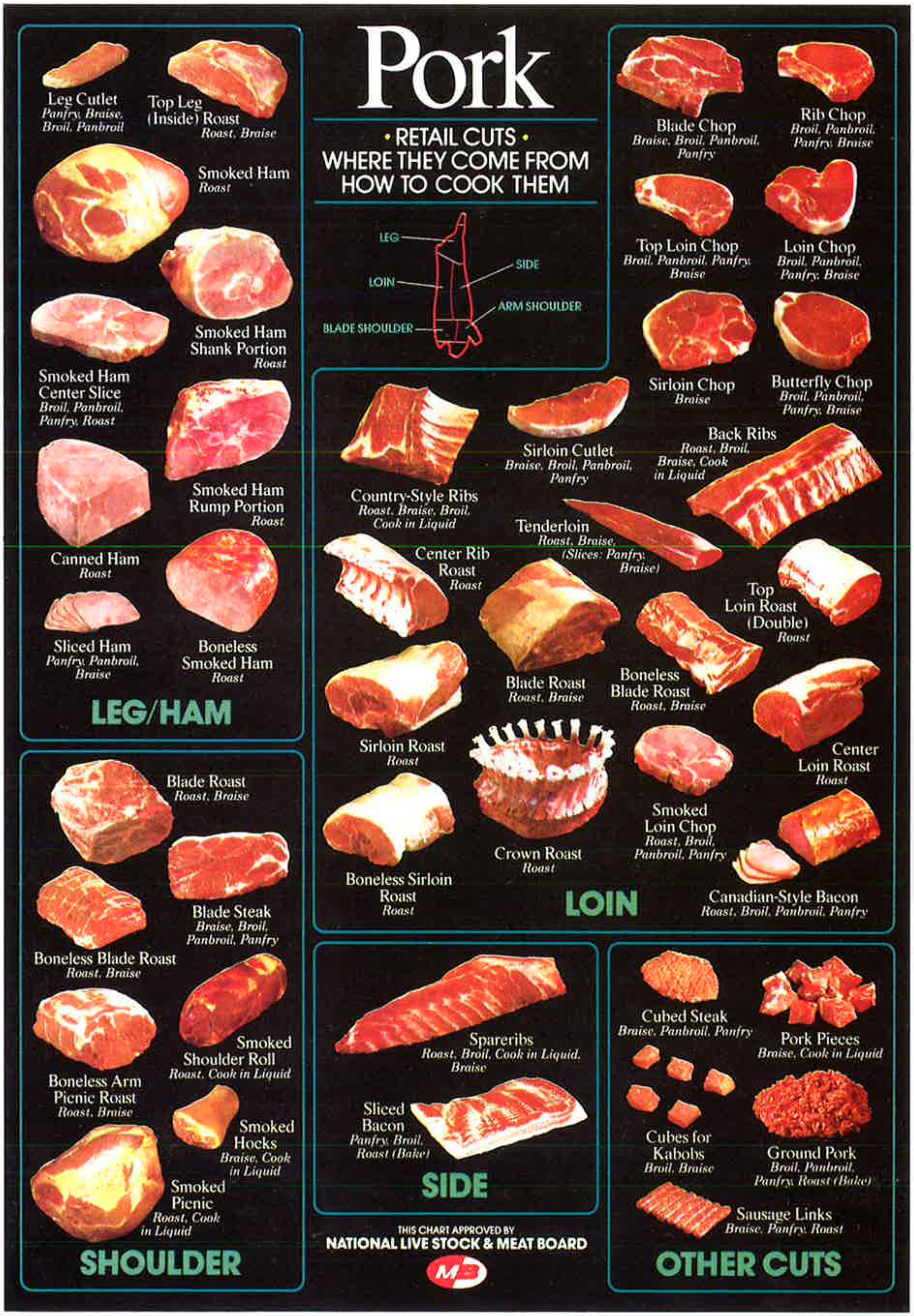
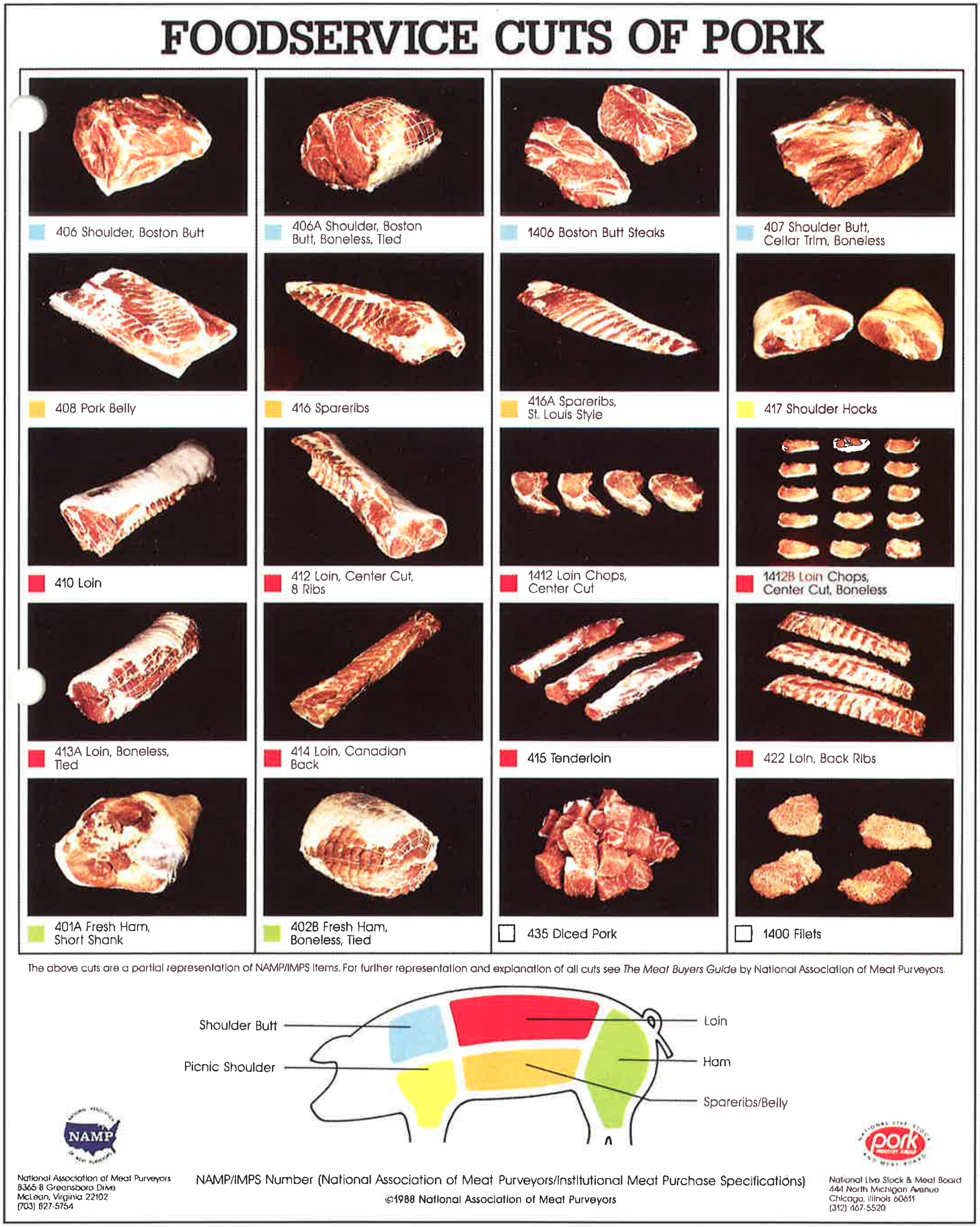


Figure 5.2
Retail cuts of pork



Meat charts and photographs provided by the North American Meat Processors Association, 1920 Association Drive, Suite 400, Reston, VA, 20191-1547 (703) 758-1900.

Figure 5.3
Food service cuts of pork

By-Products from Hogs

Serving Essential Human Needs

No other animal provides society with a wider range of products than the hog.

Hogs are, of course, the source of high quality animal protein in the form of the widest and most varied range of food products available from any animal.

By-products from hogs play a vital, though less visible, role in maintaining and improving the quality of human life. New and different by-products from hogs are constantly being developed.

Insulin from hogs is used in the treatment of diabetes; hog heart valves are used to replace damaged or diseased human heart valves; skin from hogs is used to treat severe burn victims.

The amazing utility of the hog has motivated the saying, "We use everything but the oink."

Viable animal agriculture not only provides an abundant supply of vital nutrients found in meat, but is also a ready source of essential and useful by-products that humanity depends on so extensively.

Listed here are some of the important medical and industrial products we get from hogs.

Pharmaceutical By-Products

Pharmaceuticals rank second only to meat itself in the important contributions hogs make to society. Rapidly advancing science and technology are continually adding to the list of life-supporting and life-saving products derived from the incredible hog.

Hogs are powerful medicine. All told, hogs are a source of nearly 40 drugs and pharmaceuticals.

Adrenal Glands

Corticosteriods
Cortisone
Epinephrine
Norepinephine

Brain

Cholesterol

Blood

Blood Fibrin
Fetal Pig Plasma
Plasmin

Gall Bladder

Chenodeoxycholic Acid

Heart

Heart Valves

Hog heart valves, specially preserved and treated, are surgically implanted in humans to replace heart valves weakened by disease or injury. Since the first operation in 1971, tens of thousands of hog heart valves have been successfully implanted in human recipients of all ages.

Intestines

Enterogastrone
Heparin
Secretin

Liver

Desiccated liver

Ovaries

Estrogens
Progesterone
Relaxin

Pancreas Gland

Insulin
Lipase
Pancreatin
Trypsin
Chymotrypsin

Hog pancreas glands are an important source of insulin hormone used to treat diabetics. Hog insulin is especially important because its chemical structure most nearly resembles that of humans.

Pineal Gland

Melatonin

Pituitary Gland

ACTH—Adrenocorticotropic Hormone
ADH—Antidiuretic Hormone
Oxytocin
Prolactin
TSH—Thyroid Stimulating Hormone

Skin

Porcine Burn Dressings

Gelatin

Specially selected and treated hog skin, because of its similarity to human skin, is used in treating massive burn injuries in humans, that have removed large areas of skin, and in healing persistent skin ulcers.

Spleen

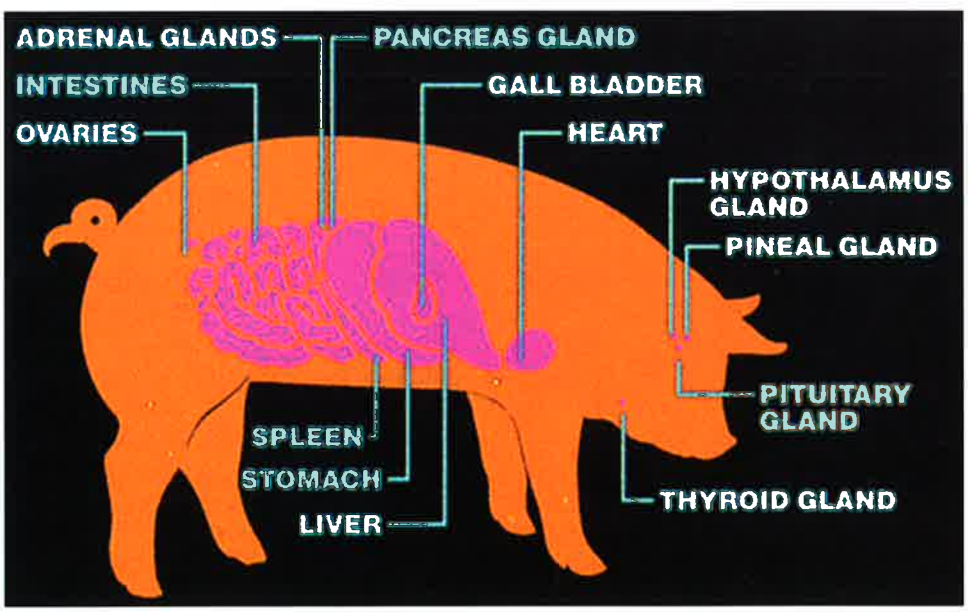
Splenic Fluid

Stomach

Pepsin
Mucin
Intrinsic Factor

Thyroid Gland

Thyroxin
Calcitonin
Thyroglobin



Industrial By-Products

Hogs also make a very significant contribution to the world of industrial and consumer products. Hog by-products are sources of chemicals used in the manufacture of a wide range of products. Pigskin is used extensively as high quality leather for clothing, shoes, handbags, sporting goods, upholstery...the list goes on and on.

Blood

Sticking Agent
Leather Treating Agents
Plywood Adhesive
Protein Source in Feeds
Fabric Printing & Dyeing

Bones & Skin

Glue
Pigskin Garments, Gloves & Shoes

Dried Bones

Buttons
Bone China

Bone Meal

Mineral Source in Feed
Fertilizer
Porcelain Enamel
Glass
Water Filters

Fatty Acids & Glycerine

Insecticides
Weed Killers
Lubricants
Oil Polishes
Rubber
Cosmetics
Antifreeze
Nitroglycerine
Plastics
Plasticizers
Printing Rollers
Cellophane
Soap
Floor Waxes
Water-Proofing Agents
Cement
Fiber Softeners
Crayons
Chalk
Phonograph Records
Matches
Putty
Paper Sizing
Insulation
Linoleum

Gall Stones

Ornaments

Hair

Artist Brushes
Insulation
Upholstery

Meat Scraps

Commercial Feeds
Feed for Pets

Courtesy of the National Pork Producers Council in cooperation with the National Pork Board

Figure 5.4
Swine by-products