

Subprimal Purchasing and Merchandising Decisions for Pork: Relationship to Retail Yield and Fabrication Time¹

C. L. Lorenzen, D. B. Griffin, T. R. Dockerty², J. P. Walter,
H. K. Johnson², and J. W. Savell

Department of Animal Science, Texas Agricultural Experiment Station,
Texas A&M University, College Station 77843-2471

ABSTRACT: Boxed pork was obtained to represent four different purchase specifications (different anatomical separation locations and/or external fat trim levels) common in the pork industry to conduct a study of retail yields and labor requirements. Bone-in loins (n = 180), boneless loins (n = 94), and Boston butts (n = 148) were assigned randomly to fabrication styles within subprimals. When comparing cutting styles within subprimals, it was evident that cutting style affected percentage of retail yield and cutting time. When more bone-in cuts were prepared from bone-in loin subprimals, retail yields ranged from $92.80 \pm .61$ to $95.28 \pm .45\%$, and processing times

ranged from 222.57 ± 10.13 to 318.99 ± 7.85 s, from the four suppliers. When more boneless cuts were prepared from bone-in loin subprimals, retail yields ranged from 71.12 ± 1.10 to $77.92 \pm .77\%$ and processing times ranged from 453.49 ± 8.95 to 631.09 ± 15.04 s from the different loins. Comparing boneless to bone-in cuts from bone-in loins resulted in lower yields and required greater processing times. Significant variations in yields and times were found within cutting styles. These differences seemed to have been the result of variation in supplier fat trim level and anatomical separation (primarily scribe length).

Key Words: Pork, Retail Marketing, Time Allocation

J. Anim. Sci. 1996. 74:5-12

Introduction

Pork is marketed in a variety of forms. At the wholesale level, carcasses are fabricated into primal and subprimal cuts that will vary in composition based on differences in anatomical separation and remaining external fat. This variation in separation and fat level differs among packers and within packers depending on seasonal market fluctuations and affects retail cut yield (Johnson et al., 1982). At the retail level, variation exists across the country in the amount of bone-in vs boneless retail cuts (Buege et al., 1989), which may be due to historic marketing methods that may not reflect the most effective product mix for maximum consumer satisfaction. A common problem, however, is the lack of consistent and standardized information regarding yield and

labor requirements to prepare pork in a variety of retail styles from different wholesale products.

The objectives of this study were to investigate labor requirements and yield of several retail cutting techniques for bone-in and boneless pork subprimals conducted in a simulated retail meat market setting.

Materials and Methods

Product Selection

Boxed pork was obtained to represent four different purchasing specifications common in the pork industry. Purchase specifications modified from the four suppliers are detailed in Table 1. Bone-in loins (n = 180), boneless loins (n = 94), and Boston butts (n = 148) were shipped to the E. M. Rosenthal Meat Science and Technology Center at Texas A&M University. Boxes within each subprimal were assigned randomly to various fabrication styles. Cutting procedures for each fabrication style were developed with input from the Retail Advisory Committee and staff from the National Live Stock and Meat Board, along with representatives of the National Pork Producers Council, Texas State Technical College, and Texas

¹Technical article from the Texas Agric. Exp. Sta. This study was supported, in part, by the Pork Industry Group of the National Live Stock and Meat Board on behalf of the Pork Board.

²National Live Stock and Meat Board, 444 N. Michigan Ave., Chicago, IL 60611.

Received February 21, 1995.

Accepted October 17, 1995.

A&M University. Universal Product Code (**U.P.C.**) descriptions (NLSMB, 1973, 1995) were used to identify the retail cuts obtained from each cutting style.

Retail Fabrication

A simulated retail cutting room was constructed in the E. M. Rosenthal Meat Science and Technology Center as detailed in Garrett et al. (1991). The design of the room closely simulated an "average" retail store meat department.

Bone-in loins, similar to Institutional Meat Purchase Specifications (**IMPS**) #410 (NAMP, 1992; USDA, 1993), were cut to five different fabrication styles. Style #1 yielded country-style ribs (U.P.C. 3275), rib chops (U.P.C. 3298), loin chops (U.P.C. 3313), and sirloin roast (U.P.C. 3328). The following retail cuts were cut using Style #2: country-style ribs (U.P.C. 3275), center rib roast (U.P.C. 3268), tenderloin roast (U.P.C. 3358), top loin bone-in roast (U.P.C. 3367), and sirloin roast (U.P.C. 3328). Style #3 produced blade chops (U.P.C. 3250), rib chops (U.P.C. 3298), loin chops (U.P.C. 3313), and sirloin chops (U.P.C. 3338). Chops were cut to two thicknesses, 1.59 and .95 cm, with loins evenly allotted to each thickness. Style #4 loins were cut into assorted chops (U.P.C. 3236); chops were cut to two thick-

nesses, 1.59 or .95 cm, with loins evenly allotted to each thickness. The following retail cuts were produced with Style #5: tenderloin roast (U.P.C. 3358), boneless sirloin roast (U.P.C. 3329), pork cubes (U.P.C. 3492), boneless blade roast (U.P.C. 3248), boneless top loin chops (U.P.C. 3374), and back ribs (U.P.C. 3243).

Boneless pork loins, similar to IMPS #413 (NAMP, 1992), were fabricated using two cutting styles. Style #1 resulted in boneless blade chops (U.P.C. 3253), top loin chops (U.P.C. 3374), and blade roasts (U.P.C. 3248). Retail cuts from Style #2 were "Chef's Prime Filets™" boneless blade chops (NPPC, 1990; U.P.C. 3256), "America's Cut™" boneless loin chops (NPPC, 1990; U.P.C. 3379), and "Chef's Prime™" boneless blade roast (NPPC, 1990; U.P.C. 3249).

Two styles of Boston butts, similar to IMPS #406 (NAMP, 1992), were fabricated. Style #1 cuts included blade roasts (U.P.C. 3184) and blade steaks (U.P.C. 3186). Style #2 yielded boneless blade steaks (U.P.C. 3192) and pork cubes (U.P.C. 3211).

Fat trimmings, lean trimmings, bone, skin, and shanks were produced for each subprimal when appropriate.

Retail Yield Data

Each subprimal was weighed before initiation of cutting operations and after it was pre-trimmed. After

Table 1. Purchase specifications for pork subprimals modified from suppliers' descriptions^a

Subprimal		
Bone-in loin	Boneless loin	Boston butt
Supplier A		
.25 cm average fat, 10.2 cm scribe ^b , separated from the shoulder between 1st and 2nd ribs	.25 cm average fat, separated from the shoulder between 1st and 2nd ribs, intercostal and gluteus medius muscles removed	.64 cm average fat, neck off, square cut, separated between the 1st and 2nd ribs
Supplier B		
.64 cm (.32 to .96 cm) fat, 9.53 (8.89 to 10.17 cm) scribe ^b , second rib separation from the shoulder, 5.7 cm ham drop; inside trimmed of hanging tender, diaphragm, and excess fat	.32 cm (0 to .64 cm) fat, shoulder end showing a minimum of 6.5 cm total diameter of muscle area, ham end full and square cut, Longissimus costarum and portions of the Serratus dorsalis firmly attached	.64 cm (.32 to .96 cm) fat, second rib separation from the loin, neck end trimmed
Supplier C		
.64 cm fat, 10.8 cm scribe ^b , spinal cord removed, separated between the 1st and 2nd ribs	.32 cm fat, shoulder end 3.8 cm loin eye muscle diameter, butterflied in center, Longissimus costarum and portions of the Serratus dorsalis removed	.64 to .95 cm fat, separated between the 1st and 2nd ribs
Supplier D		
.64 cm (.32 to .96 cm) fat, 10.2 cm scribe ^b , second rib separation from the shoulder, hanging tender, diaphragm, and fat removed	No description provided by supplier	.64 cm (.32 to .96 cm) fat, second rib separation from the loin, picnic separation parallel to back line

^aCommercial supplier descriptions were obtained from each supplier for each subprimal. Where possible, scientific and(or) common industry terms were substituted to standardize.

^bscribe = the distance from the ventral end of the split vertebra to the parallel point on the anterior rib where the loin is separated from the belly.

the retail cuts were prepared, each class of retail cut, fat trimmings, lean trimmings, and bone were weighed. All weights were totaled and reconciled to within 99% of the starting weight of each subprimal before conducting the next cutting test. Weight data were collected before the wrapping function. Cutting loss was calculated by subtracting the total weight (kilograms) of all components from the subprimal from its initial weight (kilograms). Retail yield was calculated by the following formula: (salable weight, kg/initial weight, kg) \times 100, where salable weight was defined as the retail cuts and lean trimmings for each cutting style.

Timing Data

During the retail cutting operation, timing data were collected using hand-held stop watches. Times were recorded to the nearest 1/100 s. The meat cutting operation was divided into several steps with individual timing data collected for each step. Meat cutting was divided into four phases: box to table (opening vacuum bags or unwrapping subprimals), pre-trim (trimming fat to produce an even layer no more than .64 cm thick), cutting (producing the retail products described previously), and trim (final trimming on retail cuts, .32 cm of fat trim, and upgrading trimmings to a leaner product) and tray (placing retail cuts on plastic foam trays).

Statistical Analysis

All analyses were performed using the SAS (1991) program. Analysis of variance was used to determine

the effects of purchasing specifications and cutting style on percentage of retail yield and cutting time of pork subprimals. Additionally, Tukey's mean separation technique (Ott, 1988) was used to determine the effect of purchasing specification on mean retail cut weight, cutting time and retail yield.

Results and Discussion

Cutting style #1 for bone-in loins (Table 2) was the only cutting style of bone-in loins not to differ ($P > .05$) in total retail yield across purchase specifications, although some individual cuts did differ ($P < .05$). An inverse relationship existed between the yield of country-style ribs (U.P.C. 3275) and rib chops (U.P.C. 3298) due to the point of anatomical separation of the loin from the Boston butt, and cutting procedure dictated country-style ribs be produced until the end of the scapula was reached. Purchase specification C had one of the two longest ($P < .05$) pre-trim times, which was associated with a slightly ($P = .09$) higher fat trim percentage. In addition, purchase specification C also had the longest ($P < .05$) cutting time and was one of the two purchase specifications requiring the greatest ($P < .05$) total time.

Presented in Table 3 are retail yields and processing times for bone-in loins fabricated using style #2 procedures. Loins from purchase specification C had lower ($P < .05$) total retail yields than loins from the other purchase specifications. This reduced yield was due, primarily, to a greater percentage of fat ($P < .05$)

Table 2. Mean (\pm SE) retail yield (%) and processing times (s) for fabrication of bone-in loin style #1 stratified by purchase specification

Item	Purchase specification ^a			
	A (n = 9)	B (n = 9)	C (n = 9)	D (n = 9)
Retail yield	%			
Country-style ribs (U.P.C. ^b 3275)	22.39 ^c \pm 1.28	15.56 ^d \pm .32	14.04 ^d \pm .40	15.10 ^d \pm .41
Rib chops (U.P.C. 3298)	29.51 ^d \pm .63	32.57 ^{cd} \pm 1.25	35.20 ^c \pm 1.57	36.58 ^c \pm .91
Loin chops (U.P.C. 3313)	25.55 \pm .62	25.18 \pm 1.16	21.78 \pm 1.48	22.13 \pm 1.10
Sirloin roast (U.P.C. 3328)	16.84 ^d \pm .47	20.13 ^c \pm .54	21.77 ^c \pm .54	21.47 ^c \pm .65
Lean trimmings	.14 ^d \pm .14	1.52 ^c \pm .52	.02 ^d \pm .02	0 ^d \pm 0
Fat trimmings	2.81 \pm 1.06	3.14 \pm .58	4.71 \pm .52	2.25 \pm .40
Bone	1.59 ^c \pm .14	.85 ^d \pm .06	1.10 ^d \pm .06	1.15 ^d \pm .10
Cutting loss	1.17 ^{cd} \pm .06	1.05 ^d \pm .08	1.38 ^c \pm .08	1.31 ^{cd} \pm .07
Total retail yield	94.43 \pm 1.14	94.96 \pm .58	92.80 \pm .61	95.28 \pm .45
Processing time	s			
Box to table	2.66 ^d \pm .36	8.42 ^c \pm .65	3.43 ^d \pm .42	6.96 ^c \pm .70
Pre-trim	27.57 ^{de} \pm 4.83	20.42 ^e \pm 3.41	69.83 ^c \pm 9.25	50.44 ^{cd} \pm 6.06
Cutting	98.70 ^d \pm 4.75	57.89 ^e \pm 3.21	117.75 ^c \pm 3.02	102.21 ^d \pm 3.17
Trim and tray	93.63 ^d \pm 3.96	147.70 ^c \pm 12.33	127.98 ^c \pm 4.32	123.33 ^c \pm 5.68
Total time	222.57 ^d \pm 10.13	234.43 ^d \pm 14.47	318.99 ^c \pm 7.85	282.94 ^c \pm 7.45

^aRefer to Table 1 for description of specifications.

^bU.P.C. = Universal Product Code.

^{c,d,e}Means within a row lacking common superscript letter differ ($P < .05$).

Table 3. Mean (\pm SE) retail yield (%) and processing times (s) for fabrication of bone-in loin style #2 stratified by purchase specification

Item	Purchase specification ^a			
	A (n = 9)	B (n = 9)	C (n = 9)	D (n = 9)
Retail yield				
	%			
Country-style ribs (U.P.C. ^b 3275)	22.82 ^d \pm 1.04	14.64 ^f \pm .90	18.60 ^e \pm .40	20.76 ^{de} \pm .60
Center rib roast (U.P.C. 3268)	28.19 ^e \pm .71	35.51 ^d \pm .87	19.50 ^f \pm 1.13	25.23 ^e \pm .70
Tenderloin roast (U.P.C. 3358)	5.10 ^d \pm .22	4.70 ^{de} \pm .19	3.99 ^e \pm .15	4.26 ^e \pm .19
Top loin (BI) roast ^c (U.P.C. 3367)	21.20 ^f \pm .39	21.37 ^f \pm .65	28.02 ^d \pm 1.07	24.50 ^e \pm .71
Sirloin roast (U.P.C. 3328)	13.78 ^{de} \pm .56	12.31 ^e \pm .38	13.82 ^{de} \pm .52	14.60 ^d \pm .40
Lean trimmings	1.23 ^e \pm .12	2.24 ^e \pm .34	3.71 ^d \pm .60	2.04 ^e \pm .21
Fat trimmings	1.42 ^e \pm .25	1.85 ^e \pm .32	4.92 ^d \pm .46	2.35 ^e \pm .23
Bone	5.48 \pm .50	6.80 \pm .35	6.82 \pm .45	5.66 \pm .36
Cutting loss	.79 \pm .13	.58 \pm .06	.61 \pm .06	.60 \pm .08
Total retail yield	92.30 ^d \pm .74	90.77 ^d \pm .48	87.65 ^e \pm .67	91.39 ^d \pm .42
Processing time				
	s			
Box to table	2.37 ^e \pm .17	7.92 ^d \pm .49	3.81 ^e \pm .41	6.93 ^d \pm 1.31
Pre-trim	37.91 ^d \pm 6.13	28.62 ^{de} \pm 3.03	40.04 ^d \pm 3.43	17.52 ^e \pm 1.19
Cutting	200.72 ^d \pm 8.87	146.71 ^e \pm 5.29	130.13 ^e \pm 4.88	129.26 ^e \pm 6.74
Trim and tray	46.02 ^{de} \pm 2.48	52.50 ^d \pm 4.19	38.82 ^e \pm 3.29	39.54 ^e \pm 1.93
Total time	287.01 ^d \pm 10.97	235.76 ^e \pm 4.68	212.82 ^{ef} \pm 7.31	193.24 ^f \pm 8.25

^aRefer to Table 1 for description of specifications.

^bU.P.C. = Universal Product Code.

^cBI = bone-in.

^{d,e,f}Means within a row lacking common superscript letter differ ($P < .05$).

in loins from purchase specification C. Yields of individual chops and roasts varied significantly among the four purchase specifications. Most of these differences were due to different anatomical separation procedures followed by the packers who produced

these products. Total processing time differed ($P < .05$) among the four suppliers. Most of this difference could be attributed to differences in cutting time. Again, anatomical separation may have played a role in these results.

Table 4. Mean (\pm SE) retail yield (%) and processing time (s) for fabrication of bone-in loin style #3 stratified by purchase specification

Item	Purchase specification ^a			
	A (n = 9)	B (n = 9)	C (n = 9)	D (n = 9)
Retail yield				
	%			
Blade chops (U.P.C. ^b 3250)	25.63 \pm 1.46	22.06 \pm 1.38	21.61 \pm 1.26	23.01 \pm 1.34
Rib chops (U.P.C. 3298)	25.84 \pm .81	27.27 \pm 1.10	26.08 \pm 1.44	26.63 \pm 1.28
Loin chops (U.P.C. 3313)	26.80 \pm .70	28.74 \pm .93	27.66 \pm 1.09	28.20 \pm 1.09
Sirloin chops (U.P.C. 3338)	14.55 \pm .58	14.63 \pm .50	13.34 \pm 1.15	12.61 \pm .78
Lean trimmings	1.54 ^{cd} \pm .53	1.24 ^d \pm .42	2.93 ^c \pm .33	2.09 ^{cd} \pm .17
Fat trimmings	2.37 ^d \pm .52	3.20 ^{cd} \pm .57	4.69 ^c \pm .51	3.49 ^{cd} \pm .34
Bone	1.69 ^c \pm .10	.89 ^d \pm .11	2.03 ^c \pm .11	2.28 ^c \pm .29
Cutting loss	1.57 \pm .10	1.97 \pm .45	1.67 \pm .25	1.68 \pm .13
Total retail yield	94.36 ^c \pm .55	93.94 ^{cd} \pm .91	91.62 ^d \pm .47	92.55 ^{cd} \pm .35
Processing time				
	s			
Box to table	3.64 ^d \pm .31	7.96 ^c \pm .48	3.89 ^d \pm .25	8.12 ^c \pm .78
Pre-trim	31.83 ^d \pm 2.88	28.69 ^d \pm 4.85	81.05 ^c \pm 5.47	68.34 ^c \pm 7.77
Cutting	115.24 ^c \pm 6.05	64.14 ^d \pm 3.96	115.73 ^c \pm 8.86	102.51 ^c \pm 5.22
Trim and tray	138.32 \pm 7.38	168.36 \pm 7.21	165.88 \pm 12.36	144.90 \pm 10.63
Total time	289.02 ^d \pm 12.23	269.14 ^d \pm 11.17	366.56 ^c \pm 20.68	323.86 ^{cd} \pm 14.76

^aRefer to Table 1 for description of specifications.

^bU.P.C. = Universal Product Code.

^{c,d}Means within a row lacking common superscript letter differ ($P < .05$).

Table 5. Mean (\pm SE) retail yield (%) and processing times (s) for fabrication of bone-in loin style #4 stratified by purchase specification

Item	Purchase specification ^a			
	A (n = 9)	B (n = 9)	C (n = 9)	D (n = 9)
Retail yield				
Assorted chops (U.P.C. ^b 3236)	95.07 ^c \pm .72	94.95 ^c \pm .24	87.09 ^e \pm .95	91.69 ^d \pm .72
Lean trimmings	0 ^d \pm 0	.30 ^d \pm .10	2.79 ^c \pm .30	1.94 ^c \pm .43
Fat trimmings	2.25 ^d \pm .69	2.50 ^d \pm .25	6.57 ^c \pm 1.03	3.38 ^d \pm .56
Bone	1.31 ^d \pm .15	.73 ^e \pm .10	2.03 ^c \pm .16	1.57 ^{cd} \pm .13
Cutting loss	1.37 \pm .14	1.53 \pm .10	1.53 \pm .18	1.42 \pm .12
Total retail yield	95.07 ^c \pm .72	95.25 ^c \pm .29	89.88 ^d \pm 1.00	93.63 ^c \pm .61
Processing time				
Box to table	3.60 ^d \pm .32	6.97 ^c \pm .45	4.49 ^d \pm .45	8.04 ^c \pm .43
Pre-trim	27.13 ^e \pm 4.30	24.76 ^e \pm 1.39	106.44 ^c \pm 9.61	57.44 ^d \pm 7.63
Cutting	94.72 ^{de} \pm 6.08	79.31 ^e \pm 7.13	126.47 ^c \pm 6.92	112.98 ^{cd} \pm 8.33
Trim and tray	106.97 ^d \pm 5.47	98.64 ^d \pm 3.97	154.55 ^c \pm 17.40	123.80 ^{cd} \pm 4.11
Total time	232.41 ^e \pm 11.41	209.69 ^e \pm 9.19	391.95 ^c \pm 27.30	302.26 ^d \pm 14.75

¹Refer to Table 1 for description of specification.

^bU.P.C. = Universal Product Code.

^{c,d,e}Means within a row lacking common superscript letter differ ($P < .05$).

Retail cut yields differed ($P < .05$) for bone-in loin cutting style #3 (Table 4). Total retail yield differed ($P < .05$), mainly as a result of variation in fat trim and bone among suppliers. Total time differed ($P < .05$) by supplier; C had the longest processing time. Pre-trim and cutting times had the greatest impact on total time.

Bone-in loin style #4 data are presented in Table 5. Differences ($P < .05$) in retail yield were due primarily to differences ($P < .05$) in the yield of assorted chops (U.P.C. 3236). For example, purchase specification C produced the greatest percentage ($P < .05$) of lean trimmings, fat trimmings, and bone resulting in the smallest ($P < .05$) retail yield. In

Table 6. Mean (\pm SE) retail yield (%) and processing times (s) for fabrication of bone-in loin style #5 stratified by purchase specification

Item	Purchase specification ^a			
	A (n = 9)	B (n = 9)	C (n = 9)	D (n = 9)
Retail yield				
Tenderloin roast (U.P.C. ^b 3358)	4.78 ^d \pm .17	4.36 ^{de} \pm .19	3.69 ^e \pm .17	4.37 ^{de} \pm .32
Sirloin roast, bnls ^c (U.P.C. 3329)	9.37 ^d \pm .19	6.20 ^e \pm .21	6.60 ^e \pm .37	7.07 ^e \pm .24
Pork cubes (U.P.C. 3492)	3.23 \pm .41	2.91 \pm .23	3.80 \pm .30	3.35 \pm .30
Blade roast, bnls ^c (U.P.C. 3248)	14.88 ^d \pm .51	8.57 ^{ef} \pm .65	7.63 ^f \pm .30	9.98 ^e \pm .46
Top loin chops, bnls ^c (U.P.C. 3374)	31.68 ^e \pm .66	35.98 ^d \pm .80	29.11 ^e \pm 1.04	23.96 ^f \pm 1.05
Back ribs (U.P.C. 3243)	9.29 ^e \pm .61	6.70 ^f \pm .25	6.64 ^f \pm .27	11.24 ^d \pm .36
Lean trimmings	4.69 ^g \pm .54	10.53 ^f \pm .63	13.65 ^e \pm .62	17.36 ^d \pm .90
Fat trimmings	.97 ^e \pm .29	2.67 ^e \pm .55	6.25 ^d \pm .77	2.67 ^e \pm .34
Bone	20.92 \pm .72	21.48 \pm .83	22.46 \pm .77	19.70 \pm .42
Cutting loss	.19 ^e \pm .07	.61 ^d \pm .11	.16 ^e \pm .07	.31 ^{de} \pm .07
Total retail yield	77.92 ^d \pm .77	75.23 ^d \pm .76	71.12 ^e \pm 1.10	77.32 ^d \pm .66
Processing time				
Box to table	2.80 ^f \pm .28	10.38 ^d \pm .92	3.44 ^f \pm .24	6.12 ^e \pm .41
Pre-trim	29.52 ^e \pm 3.20	22.98 ^{ef} \pm 1.75	49.90 ^d \pm 3.41	17.52 ^f \pm 2.10
Cutting	527.71 ^d \pm 11.77	374.72 ^e \pm 18.22	310.38 ^f \pm 16.29	383.06 ^e \pm 7.63
Trim and tray	71.05 ^e \pm 3.21	85.81 ^{de} \pm 7.64	120.08 ^d \pm 20.74	46.80 ^e \pm 2.95
Total time	631.09 ^d \pm 15.04	491.33 ^e \pm 20.86	483.81 ^e \pm 12.78	453.49 ^e \pm 8.95

^aRefer to Table 1 for description of specifications.

^bU.P.C. = Universal Product Code.

^cbnls = boneless.

^{d,e,f,g}Means within a row lacking common superscript letter differ ($P < .05$).

Table 7. Mean (\pm SE) retail yield (%) and processing times (s) for fabrication of boneless loin style #1 stratified by purchase specification

Item	Purchase specification ^a			
	A (n = 10)	B (n = 12)	C (n = 10)	D (n = 12)
Retail yield				
%				
Blade chop, bnls ^b (U.P.C. ^c 3253)	6.94 ^f \pm 2.38	16.63 ^{de} \pm 1.32	20.27 ^d \pm 2.16	8.44 ^{ef} \pm 3.41
Top loin chop, bnls ^c (U.P.C. 3374)	73.59 ^d \pm 2.41	62.14 ^e \pm 1.53	61.46 ^e \pm 2.09	64.43 ^{de} \pm 3.30
Blade roast, bnls ^c (U.P.C. 3248)	16.84 ^d \pm .36	17.45 ^d \pm .39	12.24 ^e \pm 2.11	19.58 ^d \pm .79
Lean trimmings	0 ^d \pm 0	.08 ^d \pm .08	1.83 ^e \pm .36	2.48 ^e \pm .48
Fat trimmings	2.34 ^e \pm .43	3.50 ^{de} \pm .25	4.05 ^{de} \pm .49	5.26 ^d \pm .85
Cutting loss	.29 ^d \pm .08	.20 ^{de} \pm .07	.16 ^{de} \pm .10	0 ^e \pm 0
Total retail yield	97.37 \pm .43	96.30 \pm .29	95.79 \pm .52	94.92 \pm .90
Processing time				
s				
Box to table	2.12 ^f \pm .18	6.86 ^e \pm .44	20.78 ^d \pm 1.08	6.98 ^e \pm 1.50
Pre-trim	21.17 ^e \pm 3.00	17.65 ^e \pm 1.50	46.81 ^d \pm 3.41	40.40 ^d \pm 3.76
Cutting	41.93 ^f \pm 2.00	31.80 ^f \pm 1.22	81.91 ^d \pm 5.10	68.67 ^e \pm 2.79
Trim and tray	37.00 ^f \pm 2.70	49.78 ^e \pm 2.19	62.27 ^d \pm 3.70	45.69 ^{ef} \pm 2.42
Total time	102.23 ^f \pm 4.20	106.09 ^f \pm 2.48	211.77 ^d \pm 9.94	161.74 ^e \pm 7.55

^aRefer to Table 1 for description of specifications.

^bbnls = boneless.

^cU.P.C. = Universal Product Code.

^{d,e,f}Means within a row lacking common superscript letter differ ($P < .05$).

addition, purchase specification C had the longest ($P < .05$) cumulative pre-trim and trim and tray times, indicating that increased fatness increased total processing time. Total time differences ($P < .05$) were a combination of pre-trim and cutting time differences ($P < .05$). Although styles #3 and #4 were cut identically, they were packaged differently to represent various retail methods (quarter loins vs

blade, rib, loin, and sirloin chops). This caused a numerical increase in total time of 24.50 s to tray retail cuts in a more innovative manner when purchase specifications were pooled (data not presented in tabular form).

Bone-in loin style #5 was cut to a boneless retail end point that accounted for the higher percentage of bone and lower total retail yield than other bone-in

Table 8. Mean (\pm SE) retail yield (%) and processing times (s) for fabrication of boneless loin style #2 stratified by purchase specification

Item	Purchase specification ^a			
	A (n = 10)	B (n = 12)	C (n = 10)	D (n = 12)
Retail yield				
%				
Chef's Prime Filet TM (U.P.C. ^b 3256)	26.21 ^d \pm .52	18.23 ^e \pm .89	20.00 ^e \pm 2.39	26.89 ^d \pm 1.09
America's Cut TM (U.P.C. 3379)	68.79 ^d \pm 1.01	61.85 ^e \pm 1.03	66.47 ^d \pm 1.52	68.97 ^d \pm 1.01
Chef's Prime TM , rst ^c (U.P.C. 3249)	0 ^f \pm 0	16.62 ^d \pm .38	10.17 ^e \pm 1.75	0 ^f \pm 0
Lean trimmings	3.60 ^d \pm .60	.23 ^e \pm .09	.12 ^e \pm .12	.08 ^e \pm .08
Fat trimmings	1.50 ^e \pm .27	2.92 ^{de} \pm .26	2.96 ^{de} \pm .61	3.92 ^d \pm .65
Cutting loss	0 ^e \pm 0	.16 ^{de} \pm .06	.28 ^d \pm .05	.13 ^{de} \pm .07
Total retail yield	98.57 ^d \pm .29	96.92 ^{de} \pm .23	96.76 ^{de} \pm .64	95.95 ^e \pm .67
Processing time				
s				
Box to table	1.42 ^f \pm .09	10.61 ^e \pm .71	15.90 ^d \pm .93	2.24 ^f \pm .33
Pre-trim	18.51 ^{de} \pm 2.71	19.78 ^{de} \pm 1.48	22.33 ^d \pm 3.34	14.07 ^e \pm 1.31
Cutting	50.18 ^d \pm 2.80	34.10 ^e \pm 2.41	22.59 ^f \pm 1.32	36.53 ^e \pm 3.06
Trim and tray	37.25 \pm 2.92	27.22 \pm 1.35	29.33 \pm 1.84	30.88 \pm 2.86
Total time	107.36 ^d \pm 5.13	91.71 ^{de} \pm 3.75	90.14 ^{de} \pm 5.33	83.72 ^e \pm 6.04

^aRefer to Table 1 for description of specifications.

^bU.P.C. = Universal Product Code.

^crst = roast.

^{d,e,f}Means within a row lacking common superscript letter differ ($P < .05$).

Table 9. Mean (\pm SE) retail yield (%) and processing times (s) for fabrication of Boston butt style #1 stratified by purchase specification

Item	Purchase specification ^a			
	A (n = 22)	B (n = 26)	C (n = 10)	D (n = 20)
Retail yield				
	%			
Blade roast (U.P.C. ^b 3184)	52.75 ^d \pm .93	52.46 ^d \pm .86	53.40 ^{cd} \pm 1.81	57.71 ^c \pm .81
Blade steak (U.P.C. 3186)	29.44 ^c \pm .56	26.09 ^d \pm .69	25.93 ^d \pm .95	25.81 ^d \pm .45
Lean trimmings	11.86 ^d \pm .92	20.05 ^c \pm .91	13.54 ^d \pm 1.71	11.13 ^d \pm .89
Fat trimmings	5.63 ^c \pm .44	.80 ^d \pm .26	6.73 ^c \pm .96	4.89 ^c \pm .61
Bone	0 \pm 0	.04 \pm .02	.02 \pm .02	0 \pm 0
Cutting loss	.31 \pm .10	.57 \pm .14	.37 \pm .12	.46 \pm .04
Total retail yield	94.05 ^d \pm .40	98.59 ^c \pm .31	92.88 ^d \pm .98	94.65 ^d \pm .61
Processing time				
	s			
Box to table	2.41 ^d \pm .15	6.03 ^c \pm .32	2.94 ^d \pm .23	6.39 ^c \pm .59
Pre-trim	24.96 ^e \pm 1.16	26.29 ^e \pm 2.04	74.47 ^c \pm 4.40	54.92 ^d \pm 3.80
Cutting	9.47 \pm 1.41	6.54 \pm .49	9.56 \pm .60	6.25 \pm .25
Trim and tray	15.96 ^d \pm .59	26.81 ^c \pm 1.56	24.09 ^c \pm 1.35	18.07 ^d \pm .67
Total time	52.79 ^f \pm 1.82	65.67 ^e \pm 3.11	111.06 ^c \pm 3.97	85.63 ^d \pm 3.69

^aRefer to Table 1 for description of specifications.

^bU.P.C. = Universal Product Code.

^{c,d,e,f}Means within a row lacking common superscript letter differ ($P < .05$).

cutting styles (Table 6). Percentage of lean trimmings differed ($P < .05$) between suppliers. Differences ($P < .05$) in percentage of fat trim were reflected in total retail yield differences. Retail cut yields were lowest and percentage of fat trim was the greatest ($P < .05$) for purchasing specification C, resulting in the lowest

($P < .05$) total retail yield. Purchase specification A required the longest ($P < .05$) cutting time and, as a result, the longest ($P < .05$) total time.

Boneless pork loins were cut into two styles; style #1 is presented in Table 7. All components of the cutting tests differed ($P < .05$) by supplier, but total

Table 10. Mean (\pm SE) retail yield (%) and processing times (s) for fabrication of Boston butt style #2 stratified by purchase specification

Item	Purchase specification ^a			
	A (n = 22)	B (n = 18)	C (n = 20)	D (n = 10)
Retail yield				
	%			
Blade steak, bnls ^b (U.P.C. ^c 3192)	37.05 ^e \pm 1.05	42.42 ^d \pm 1.15	35.89 ^e \pm .55	36.04 ^e \pm .55
Pork cubes (U.P.C. 3211)	21.08 ^d \pm 1.11	15.29 ^e \pm .61	17.82 ^e \pm .50	16.44 ^e \pm .50
Lean trimmings	30.83 ^f \pm 1.05	36.61 ^e \pm 1.14	41.83 ^d \pm .83	35.98 ^e \pm .83
Fat trimmings	6.03 ^d \pm 1.00	0 ^e \pm 0	0 ^e \pm 0	5.75 ^d \pm .80
Bone	5.03 ^{de} \pm .19	5.61 ^d \pm .17	4.43 ^e \pm .13	5.60 ^d \pm .30
Cutting loss	0 \pm 0	.07 \pm .03	.03 \pm .06	.20 \pm .18
Total retail yield	88.96 ^e \pm .97	94.32 ^d \pm .16	95.54 ^d \pm .16	88.45 ^e \pm .16
Processing time				
	s			
Box to Table	1.78 ^f \pm .15	6.83 ^d \pm .35	2.66 ^f \pm .17	4.92 ^e \pm .64
Pre-trim	25.18 ^d \pm 1.83	16.14 ^e \pm 1.43	13.09 ^e \pm .62	12.48 ^e \pm 1.58
Boning	50.88 ^e \pm 3.26	70.22 ^d \pm 3.27	52.15 ^e \pm 2.12	24.23 ^f \pm 1.34
Cutting roast	48.94 ^d \pm 2.27	21.00 ^f \pm 2.03	12.94 ^g \pm .53	35.44 ^e \pm 4.56
Trim and tray roast	12.36 ^e \pm .82	32.98 ^d \pm 2.58	13.22 ^e \pm .77	15.69 ^e \pm 1.01
Cutting cubes	33.01 ^e \pm 1.58	19.32 ^f \pm 2.27	25.10 ^{ef} \pm 1.76	74.28 ^d \pm 7.11
Trim and tray cubes	5.54 ^d \pm .39	1.52 ^e \pm .25	.89 ^e \pm .06	1.30 ^e \pm .17
Total time	177.69 ^d \pm 6.47	168.02 ^d \pm 6.06	120.05 ^e \pm 4.12	168.34 ^d \pm 12.97

^aRefer to Table 1 for description of specifications.

^bbnls = boneless.

^cU.P.C. = Universal Product Code.

^{d,e,f,g}Means within a row lacking common superscript letter differ ($P < .05$).

retail yield did not ($P > .05$). Purchase specification C took longer ($P < .05$) to process in every aspect of the time test.

Data in Table 8 reveal that differences ($P < .05$) in total retail yield reflect additive differences ($P < .05$) in lean trimmings (U.P.C. 3356), fat trimmings, and cutting loss for boneless loins style #2. Supplier A had the greatest ($P < .05$) cutting time and highest ($P < .05$) yield of lean trimmings.

Boston butt cutting style #1 data are presented in Table 9. Supplier B had the highest ($P < .05$) retail yield, primarily due to differences ($P < .05$) in lean trimmings resulting from a lower ($P < .05$) percentage of fat trim. Purchasing specification C had the longest ($P < .05$) total processing time due to an extensive pre-trim segment. As has been the case in earlier tables, this is a reflection of the trend for this purchase specification to have higher levels of fat trimmings.

For Boston butt style #2, suppliers B and C had the greatest ($P < .05$) retail yield (Table 10). Purchase specifications B and C were influenced by boneless blade steaks (U.P.C. 3192) and lean trimmings, respectively. Product from supplier C took the least ($P < .05$) amount of total time to process, which is reflective of the smaller bone and fat trim percentages.

Total processing times were increased and retail yields were decreased when subprimals were fabricated to a boneless retail end point. The combination of retail yield and processing time will determine profitability at the retail level. No real trend existed between retail yield and processing time within subprimals, indicating that different purchase specifications lend themselves to being more profitable for different cutting styles. Anatomical separation and subprimal weight can change the retail cut mix at a retail outlet; thus, purchase specification must be a consideration in marketing decisions.

Implications

This research project provides a standardized base for the Pork Computer Assisted Retail Decision Support software (Pork CARDS) for Windows®. Differences in the composition of pork subprimals followed by variation in the retail cutting end point greatly influences retail yield and cutting times to prepare these products. The Pork CARDS program will allow easy access to the combinations of products and cutting procedures retailers need to make more informed purchase and merchandising decisions.

Literature Cited

- Buege, D. R., J. F. Held, C. A. Smith, L. K. Sather, and L. V. Klatt. 1989. A nationwide survey of the composition and marketing of pork products at retail. Final Report to the National Live Stock and Meat Board and the United States Department of Agriculture. Dept. of Meat and Anim. Sci., Univ. of Wisconsin-Madison.
- Garrett, R. P., R. W. Theis, J. P. Walter, D. B. Griffin, J. W. Savell, H. K. Johnson, T. Dockerty, J. W. Allen, and T. R. Pierson. 1991. Communicating Cutability to the Retailer. Final Report to the National Live Stock and Meat Board. Dept. of Anim. Sci., Texas A&M Univ., College Station.
- Johnson, D. D., J. W. Savell, G. C. Smith, and L. Weatherspoon. 1982. Predicting cutability of packer-trimmed pork loins. *Meat Sci.* 7:313.
- NAMP. 1992. The Meat Buyers Guide (3rd Ed.). National Association of Meat Purveyors, Reston, VA.
- NLSMB. 1973. Uniform Retail Meat Identity Standards. National Live Stock and Meat Board, Chicago, IL.
- NLSMB. 1995. U.P.C. identification numbers. National Live Stock and Meat Board, Chicago, IL.
- NPPC. 1990. The Retail Guide to the Most Profitable Meat in the Store. National Pork Producers Council, Des Moines, IA.
- Ott, L. 1988. An Introduction to Statistical Methods and Data Analysis (3rd Ed.). PWS-Kent, Boston, MA.
- SAS. 1991. SAS User's Guide: Statistics (4th Ed.). SAS Inst. Inc., Cary, NC.
- USDA. 1993. Institutional Meat Purchase Specifications for Fresh Pork Products. Agric. Marketing Serv., USDA, Washington, DC.