

The Effect of Genotype on Fat Deposition and Carcass Quality

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Carcass-value marketing systems continue to demand the efficient production of lean pork. Unfortunately, some swine genotypes which provide a high percentage of carcass lean also tend to produce carcasses which are poor in overall quality. An increased incidence of soft carcass fat, which is seen in some lean genotypes, has been associated with mechanized processing difficulties and decreased consumer acceptability. In this study, three genotypes were evaluated for both leanness and overall carcass quality. While similar in total backfat, lean genotypes can be dramatically different in backfat quality, belly quality and overall carcass quality.

Materials and Methods

In the fall of 1996, gilts of three genotypes were reared using segregated early weaning procedures. Line 1 [Large White sires x (Large White-Landrace) dams, n=6] and Line 2 [Dekalb Pietrain sires x Dekalb (Large White-Landrace) dams, n=8] are lean pigs of comparable backfat thickness, but were obtained from different genetic sources. Line 3 [synthetic terminal sires x (Yorkshire-Landrace) dams, n=6] is a commercial terminal cross which represents average U.S. pigs for leanness. The pigs were fed a conventional corn-soybean meal diet which contained .85% lysine with no added fat, and was offered on an ad-libitum basis. Pigs were slaughtered at 264 lbs. liveweight.

In addition to standard carcass measurements, depths of the individual backfat layers (outer, middle and inner) were taken at the 10th rib. Firmness/softness of the middle layer and the degree of adhesiveness/separation between the middle and inner layers were evaluated. Thicknesses of individual fat and lean layers within the belly were taken at two locations of bellies sliced at the 10th rib: the dorsal tip of the inner lean streak and the ventral tip of the outer lean streak. Firmness/softness of chilled skin-on bellies and separation between fat and lean belly layers were evaluated.

Results and Discussion

Backfat Quality and Thicknesses. Line 3 had the most backfat at every midline and fat depth measurement (Table 1). Although Lines 1 and 2 were comparable in total 10th rib fat depth, their backfat was distributed between the individual layers disproportionately. Line 1 had more outer layer backfat and less inner layer backfat when compared to Line 2 (Table 1). The lesser amount of inner layer backfat seen in Line 1 is associated with softer middle layer backfat and a greater incidence of separation between the middle and inner backfat layers (Table 1). In attempting to attain leanness, Line 1 may have been selected for slower maturing backfat layers which has resulted in softer carcass fat.

Carcass Quality and Thicknesses. No differences in color or firmness of the *longissimus dorsi* were found between the lines (Table 2). Line 1 produced the largest loin eye areas and the least inner layer backfat (Table 2). Line 2 had slightly higher marbling scores than did Line 1 (Table 2), which is associated with having more inner layer backfat. Thus, the presence of a further developed

inner backfat layer may be indicative of a growth and maturity state in which a pig deposits intramuscular fat, or marbling.

Belly Quality and Thicknesses. Line 1 had less total belly thickness, less middle layer belly fat and less outer lean streak than the other two lines (Table 3). The thinner, leaner bellies of Line 1 were also less firm (Table 3). Thin, soft bellies can result in processing and slicing difficulties, which could make this lean line less desirable to belly purchasers.

Summary

While we have not yet reached the quantitative limits for producing lean pork, this study indicates that some lines may be approaching their qualitative limits. Producers continue to genetically produce leaner pigs, but they are accomplishing this by indirectly selecting for a number of different biological factors, some of which also affect quality. For example, while Lines 1 and 2 are comparable in total backfat, the total amount of fat is disproportionately distributed between the individual backfat layers and the quality of their bellies is drastically different. Future research will seek to identify the biological factors which affect these qualities, as well as the effects of individual backfat layer thicknesses, in an effort to identify and produce lean pigs with good overall quality.

Table 1. Least squares means of backfat quality and thicknesses.

	<u>Line 1</u>	<u>Line 2</u>	<u>Line 3</u>
<u>Backfat Thicknesses</u>			
First Rib Midline Backfat (in.)	1.28	1.41	1.59
Last Rib Midline Backfat (in.)	1.03	0.86	1.10
Last Lumbar Midline Backfat (in.)	0.75	0.68	1.03
Total 10 th Rib Fat Depth (in.)	0.59	0.64	1.00
10 th Rib Outer Layer Fat Depth (in.)	0.30	0.26	0.41
10 th Rib Middle Layer Fat Depth (in.)	0.23	0.26	0.40
10 th Rib Inner Layer Fat Depth (in.)	0.05	0.14	0.18
Middle Backfat Layer Firmness (1-3)*	2.33	3.00	3.00
Middle/Inner Layer Separation (0,1)**	0.50	0.25	0.33

* 1 = unacceptably soft, 2 = moderately soft, 3 = firm.

** 0 = no separation, 1 = separation.

Table 2. Least squares means of carcass quality and composition.

	<u>Line 1</u>	<u>Line 2</u>	<u>Line 3</u>
<u>Carcass Quality^a</u>			
Color	2.83	2.88	2.75
Firmness	2.42	2.94	2.75
Marbling	1.25	1.44	1.92
<u>Carcass Composition</u>			
Loin Eye Area (sq.in.)	8.67	7.53	7.46
Slaughter Weight	263.75	265.79	263.88
Dressing Percentage	72.72	76.46	72.54
Carcass Length (in.)	33.88	33.22	32.92
Kidney Fat (lbs.)	2.70	2.85	3.63

^a 1-5 NPPC scoring system, evaluated at the 10th rib.

Table 3. Least squares means of belly quality and composition.

	<u>Line 1</u>	<u>Line 2</u>	<u>Line 3</u>
<u>Belly Quality</u>			
Belly Firmness (1-3)*	1.83	2.88	2.83
Belly Separation (0,1)**	0.33	0.00	0.00
<u>Dorsal Belly</u>			
Outer Fat Layer (in.)	0.33	0.36	0.38
Outer Lean Streak (in.)	0.29	0.43	0.40
Middle Fat Layer (in.)	0.19	0.28	0.31
Muscle (in.)	0.34	0.29	0.25
Total Thickness (in.)	1.14	1.36	1.34
<u>Ventral Belly</u>			
Outer Fat Layer (in.)	0.40	0.44	0.48
Middle Fat Layer (in.)	0.21	0.34	0.33
Inner Lean Streak (in.)	0.23	0.17	0.23
Total Thickness (in.)	0.83	0.96	1.04

* 1 = unacceptably soft, 2 = moderately soft, 3 = firm.

** 0 = no separation, 1 = separation.