FACTORS INFLUENCING SLAUGHTER COW VALUE[1]

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INTRODUCTION

Approximately 50 % of beef consumed today is in the ground form and this does not include beef utilized for processed products. There are approximately 200,000 cull cows in Florida and over 6 million cows marketed for slaughter yearly in the U.S., and these contribute significantly to the processed beef supply. When cows are marketed for slaughter their value can vary greatly, and yet market quotes are often vague or insufficient to adequately communicate the real value differences to producers. Many times the lack of marketing information is due to a general lack of knowledge of the value determining characteristics of live cows or cow carcasses, and to a lack of efficient ways to communicate these differences from packers to producers.

The real value of a cow carcass is in the amount and composition of boneless meat derived from the carcass. Recently, a tremendous spread in prices has occurred between trimmings differing in fat content. Trimmings that are 90% lean and 10% fat are selling for $1.30 per lb., whereas, trimmings that are 50% lean and 50% fat are $.52 per lb. Thus, it is important to be able to predict the percentage of boneless meat that will be derived from a specific carcass, and the fat content of that meat in order to predict the carcass value.

In the current market, subprimal cuts are removed from the cow carcasses and sold at a price higher than that received for the trimmings. However, the removal of these cuts increases the fat content of the remaining meat and decreases it value. Thus, it is essential that the industry have a technique, which considers all the value-determining components simultaneously, to determine worth of a carcass.

It is evident that there needs to be a better understanding of the factors that influence the value of various carcass components of cull cows so that the best utilization (highest value) of each cut or carcass portion can be identified. This will allow packers and processors to receive the highest value for products produced from cull cows and therefore be able to pay producers for the true value of their animals.

METHODS

Sixty cow sides were selected based on conformation score (muscling) and preliminary yield grade (fat) at a local packing plant. Sides were selected to fill cells as evenly as possible so as to represent the full range of muscling and fat cover. Conformation scores (CONF) identified in USDA standards (1965) were used to form three muscling groups: commercial, utility, and cutter. Preliminary yield grades (PYG), as established in USDA yield grading standards (1989), were used to form five fat levels: less than 2.0, 2.0 to 2.5, 2.5 to 3.0, 3.0 to 3.5, and greater than 3.5. Carcass grade data were collected from each side by university personnel.

Plant personnel then proceeded to bone out the sides in the manner customary at that plant. All cuts were made boneless with the exception of the 174 short loin. University personnel then further trimmed and weighed each of the following Institutional Meat Purchase Specifications (IMPS) cuts: 112 ribeye, 174 short loin, 191 butt tender, 184 top butt sirloin, 167A peeled knuckle, 193 flank steak, 171C eye of round roast, 171B bottom round roast, and 168 top round roast. The 174 short loin was then boned out and the 180 strip loin and 192 tenderloin were weighed as well as any trim derived from the boning operation. The remainder of the muscle not already weighed in the previous cuts was collected and weighed as trim, and included all of the cross cut chuck, the plate muscles, muscles of the primal flank with the exception of the flank steak, bottom sirloin muscles, and any other muscles removed to form the previous cuts. All remaining bones were then weighed. All cuts were trimmed of fat in excess of half an inch, reweighed and the fat trim from each compiled. All cuts and trim were then individually ground through a 1/2 inch grinder plate twice and a 2 to 4 pound subsample collected. The subsample was then brought back to the University of Florida Meats Laboratory for further grinding and mixing through a 1/8th inch plate. Further subsamples were collected and frozen until such time that they could be further homogenized by use of a food processor, and then moisture and fat determinations were conducted.

All data were entered into a computerized statistical program (SAS) for statistical analysis. Best fit regression lines were chosen to predict percent fat in the total lean, percent fat in the trim, percent total lean yield with 10 % fat, and percent yield of major cuts. Dependant variables used to regress were PYG, CONF, hot carcass weight with kidney fat removed (AHCW), marbling scores (MARB), and ribeye area (REA). When curvilinearity was shown to be significant, the variable PYG2 was utilized. In each case a full model was fit first and the least significant variable removed until all variables left were significant to the .05 alpha level. The final models were as follows:

Percent fat in the total lean = -32.4676 + (23.1955 × PYG) - (2.5772 × PYG2) - (.0055873 × CONF) + (.0064941 × AHCW) + (.0181 × MARB)

Percent fat in the trim = -41.228365 + (29.463335 × PYG) - (3.508226 × PYG2) - (.004292 × CONF) + (.007953 × AHCW) + (.020255 × MARB)

Percent yield of 90/10 lean = 84.3847 - (3.3827 × PYG) + (.0059301 × CONF) - (.0187 × AHCW) - (.0163 × MARB) + (1.2341 × REA)

Percent major cuts = 24.1431 - (.5529 × PYG) + (.0042619 × CONF) - (.0136 × AHCW) + (.8158 × REA)

Utilizing a graphics program, these regression lines were graphed to display the effects of exterior fat and conformation scores on fat content of lean and trim and percent yield of lean and major cuts. Any variables used but not visually graphed were held to a constant equivalent to the value of the overall mean for each of those variables.

RESULTS

Table 1 characterizes the 60 cow carcasses utilized in this study. As can be seen this sample of carcasses varied greatly in weight, fatness and muscling, and spanned of the range of carcass traits that would be encountered for cows coming to slaughter. Data presented in table 1 show that cow carcasses can and do vary greatly in fat content of the lean derived from the carcass (4.7 to 39.5% fat). This illustrates the possible differences in value that can occur in cow carcasses and the necessity of being able to identify these differences. On the average, 22% of the cow carcass is merchandized as whole muscle cuts with the remaining utilized for trim for ground or processing beef. This can vary from 15 to almost 30 percent in cows depending on the muscle and fat content of the carcass. The next few figures illustrate how muscle and fat interact to influence fat content of the lean and yield of whole muscle cuts that are available for sale.

Figure 1 shows the relationship between fat and muscling on the percentage total fat in the lean of slaughter cow carcasses. This graph shows that cow carcass with no outside fat still have between 12 and 13% fat content in the lean and this value goes up in an almost linear fashion to over 25% fat in cows with .6 in fat opposite the ribeye. This figure suggests that if a packer wants to produce lean trim with 15% or less total fat, cows must have very little fat on the outside of the carcass (less than .1 in) or fat must be trimmed off during fabrication. Also, it can be noted from Figure 1 that external fat has a greater influence on percentage total fat than does muscling. As cow carcasses increased in fat from 0 to .6 in, the fat content of the carcass increased by over 15%. In contrast, if you compare a light muscled cow carcass to a heavy muscled cow carcass there is only about a 2% difference in total percentage fat.

Almost all slaughter cows have some whole muscle cuts removed from the carcass and merchandized as such, because these cuts demand a higher price than can be received when sold as lean trim. Figure 2 illustrates the relationship of external fat and muscling on percent fat of the trim that is remaining after whole muscle cuts are removed. When Figure 2 is compared to Figure 1, the same basic relationship of fat and muscle to percentage fat in the trim was noted for total fat content, except that when cuts are removed the fat content of the trim left over is increased by about 3% on the average. Cows with no fat on the outside of the carcass produce lean trim with about 15% fat, and this goes up to about 30% for cows with .6 external fat. Since most processors want trim with 15% fat, packers must do one of three things to achieve this fat content; 1) purchase very lean cows and pull very few cuts, 2) trim off fat during processing or 3) add very lean bull meat. All of these can add costs to the product. Muscling still only influences fat content about 2% when all other factors such as weight and external fat, are held constant.

Figure 3 shows the relationship of muscling to total fat content and fat content of lean trim when all other carcass traits are held constant. Total fat content decreases about 2 percent as you go from a very light muscled carcass to a heavy muscled carcass. A similar situation was noted for the effect of muscling on percentage fat in only the lean trim.

The influence of muscling on yield of whole muscle carcass cuts and total lean yield (adjusted to 10% chemical fat), when other carcass traits are held constant, is presented in figures 4 and 5, respectively. Both figures show a positive linear relationship between muscling and cut yield and total lean yield. Although, it was somewhat surprising that in both situations muscling only influenced cut or lean yield by less than 2% if other carcass traits are held constant.

The relationship of external fat to percentage yield of whole muscle cuts and total carcass lean is presented in Figures 6 and 7 respectively. In both instances, as external fat increased, yield of cuts and total lean (adjusted to 10% fat) decreased in a linear fashion. As fat increased from 0 to .6 in, cuts yield decreased only about 1% and total lean yield decreased about 5.5 percent. These values are not as high as was expected, probably because all other factors are held constant. This is probably not realistic because weight would vary as fat and muscle change, which indicates that carcass weight is also valuable in predicting carcass composition. Hot carcass weight was included in the prediction equations given in the methods section of this paper. When all carcass traits are considered, as was presented in the full equations in the methods section of this paper, prediction of cow composition is very acceptable. Equations for predicting percent fat identified over 90% of the variation with accuracy of about 2%. The equation for predicting lean yield adjusted to 10% chemical fat identified over 80% of the variation, with accuracy of 2.5%. However, the ability to predict whole muscle cut yield was not quite as high with only about 55% of the variation accounted for and an accuracy of 1.6%.

SUMMARY

This study revealed that the composition of cow carcass can vary greatly. Factors that appear to be related to the prediction of fat

content were: outside fat, conformation, hot carcass weight and marbling. Fatness had a much greater influence on carcass composition than did muscling. This study found a greater ability to predict fat composition than yield of whole muscle cuts. As we continue to study these data and disseminate the results to others, perhaps a better understanding of factors that influence cow composition will be available for all segments of the beef industry.

REFERENCES

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Table 1. Means, standard deviations, minimum and maximum value for traits of cow carcasses.

Trait	Mean	Standard deviation	Minimum	Maximum
Hot carcass weight, lbs	556	127	348	766
Fat over the ribeye, in	.2	.2	.0	1.1
Ribeye area, in^2	9.1	2.4	4.4	14.0
Yield grade	3.1	.9	1.1	5.1
Conformation	U[77]		Ct[10]	Se[70]
Total fat, %	20.3	10	4.7	39.5
Fat in trim, %	21.7	10.1	5.3	39.0
Major cuts, %	22.8	3.1	14.9	28.5

[a] U = Utility, Ct = Cutter, Se = Select.

FIGURE 1. EFFECT OF EXTERNAL FAT AND MUSCLING ON TOTAL FAT CONTENT OF COW CARCASSES

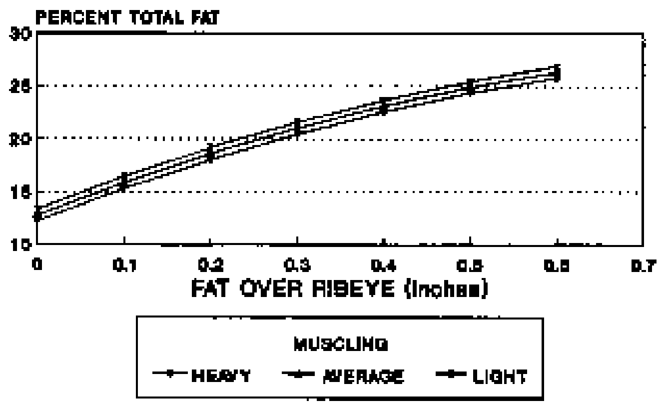


FIGURE 2. EFFECT OF EXTERNAL FAT AND MUSCLING ON FAT CONTENT OF COW CARCASS TRIM

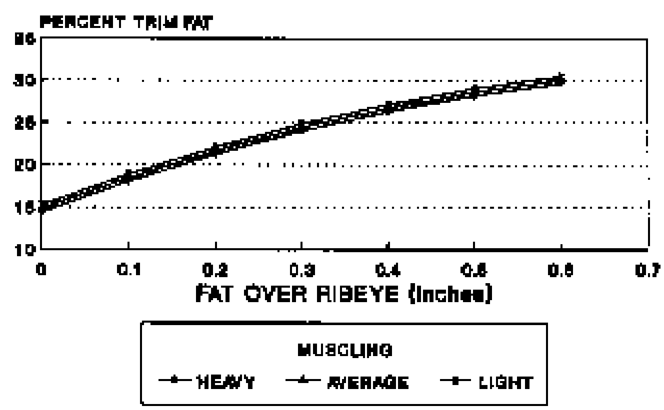


FIGURE 3. EFFECT OF MUSCLING ON FAT CONTENT OF COW CARCASSES

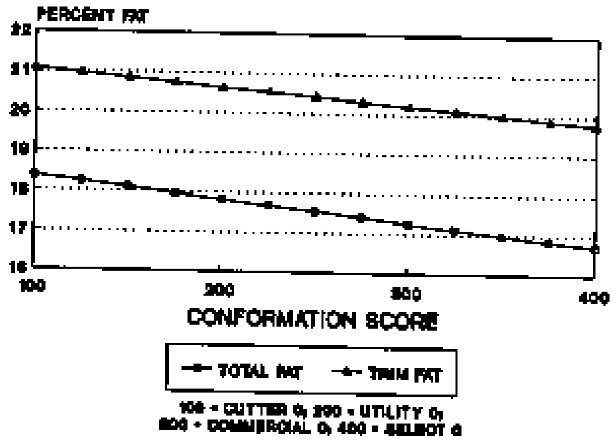


FIGURE 4. EFFECT OF MUSCLING ON YIELD OF COW CARCASS CUTS

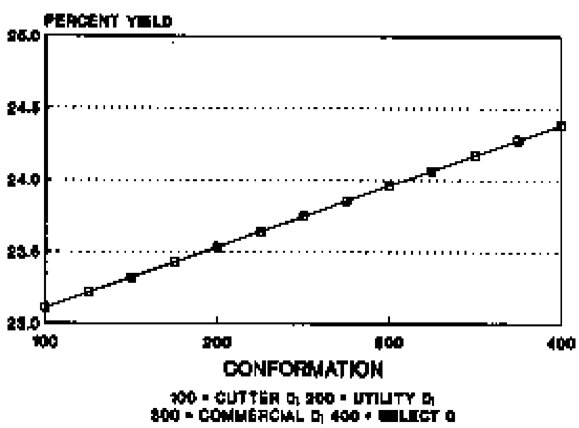


FIGURE 5. EFFECT OF MUSCLING ON TOTAL LEAN YIELD

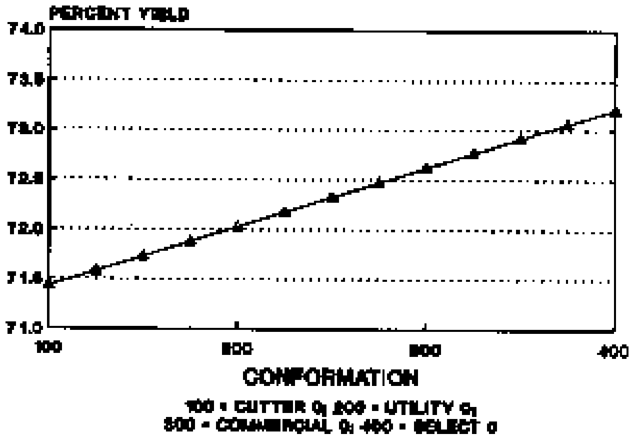


FIGURE 6. EFFECT OF EXTERNAL FAT ON PERCENT YIELD OF COW CARCASS CUTS

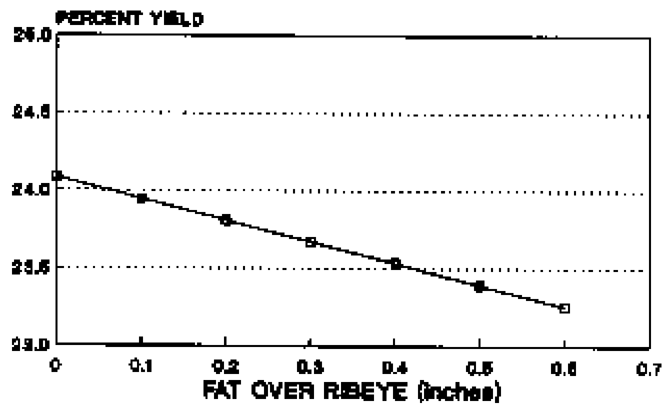
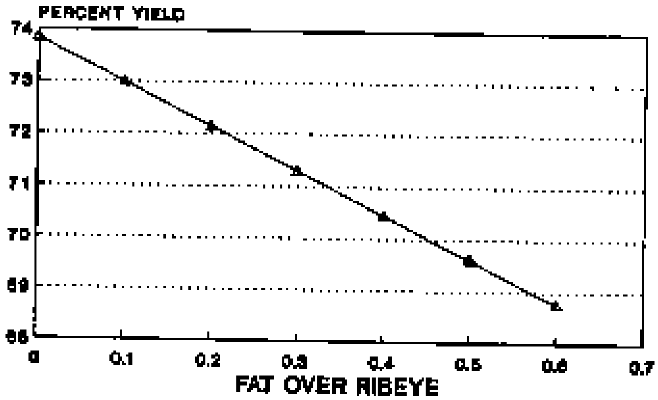


FIGURE 7. EFFECT OF EXTERNAL FAT ON PERCENT YIELD OF COW CARCASS TOTAL LEAN



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