VARIATIONS IN THE PRICE OF EXPORT BEEF CARCASSES ASSOCIATED WITH GENOTYPE AND SEX

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SUMMARY

The influence of genotype and sex on commercial beef yield, and on the pricing of 190 beef carcasses was examined at a commercial abattoir. Genotype of the live cattle and sex, rump "P8" fat thickness, carcass weight and saleable beef yield (cuts plus manufacturing meats expressed as a percentage of chilled carcass weight) of the carcasses were recorded.

As carcass weight increased, the "classification" price (abattoir price paid to the cattle producer, based on carcass weight and fat thickness category) decreased relative to "LS" (Loaded on Ship, Brisbane) price. Compared to the "LS" prices, females tended to be underpriced in the "classification" prices, particularly the Brahman females, and particularly in the 300 kg and 360 kg carcass weight groups.

Covariance analysis of percentage saleable beef yield on rump "P8" fat thickness showed that of the 46.9% variance accounted for, 83.8% could be attributed to the fat thickness measurement, 15.8% to genotype and virtually non (0.1%) to sex.

Whilst genotype accounts for a significant amount of the variance in the determination of percentage saleable beef yield from rump "P8" fat thickness, its inclusion in commercial beef classification systems is probably not warranted.

INTRODUCTION

The Australian Meat and Live-stock Corporation has recently introduced an objective carcass appraisal system to beef marketing. With this system, termed AUS-MEAT (Anonymous 1987), a subcutaneous fat thickness measurement and carcass weight are used to estimate, or imply, the saleable beef yield of individual carcasses. Whilst the system has the potential to ensure a more equitable return to individual beef producers, certain variables inherent in the Australian beef industry, if accounted for, could improve objective evaluation even further.

"Maturity type", generally described as the liveweight at which the onset of fattening occurs, varies widely in Australian cattle. It is possible, therefore, that the accuracy of saleable beef yield estimated from a fat thickness measurement taken at the one site on a carcass may vary widely among different types of cattle. Mukhoty and Berg (1971) described sex differences in carcass composition in Hereford cattle while Charles and Johnson (1976) found breed differences in carcass fat percentage and fat distribution, at constant subcutaneous fat thickness.

In the following study the influence of genotype and sex on saleable beef yield and the commercial value of carcasses prepared for export markets was examined.

MATERIALS AND METHODS

One hundred and ninety cattle (75 Hereford bullocks, 38 Hereford females, 35 Brahman x [Hereford or Shorthorn] bullocks and 42 Brahman x [Hereford or Shorthorn] females) were slaughtered and dressed at a Queensland export abattoir. The weight of each "standard carcass" (defined by AUS-MEAT; Anonymous 1987) was recorded on the slaughter floor ("hot" carcass weight). After 24 hours chilling at 3°C carcass weight was again recorded, together with rump "P8" fat thickness (Moon 1980). "Hot" carcass weights ranged from 170 kg to 438 kg.

The chilled carcasses were prepared according to the specifications of the Japanese Livestock Industry Promotion Corporation. This produced 12 primal cuts and a variety of manufacturing meats each of which was

Table 1. Variation between classification price and price paid for export beef carcasses

Chilled carcass weight (kg)	Genotype-sex[A]	Rump "P8"[B] fat thickness (mm)	Fat thickness category[C]	Classification price[D] ($)	LS[E] price ($)	Classification price / LS price (%) [F]
250	BF	22.9	23-32	496.24	701.76	70.7
	BB	13.8	7-22	547.13	713.66	76.7
	HF	21.0	7-22	547.13	689.86	79.3
	HB	11.9	7-22	547.13	701.66	78.0
						(76.2)
300	BF	29.9	23-32	595.47	828.90	71.8
	BB	15.0	7-22	656.55	854.08	76.9
	HF	25.2	23-32	595.47	821.06	72.5
	HB	17.8	7-22	656.55	817.06	80.3
						(75.4)
360	BF	38.3	33+	677.93	975.02	69.5
	BB	16.6	7-22	787.87	1021.30	77.1
	HF	30.4	23-32	714.58	975.38	73.3
	HB	24.7	23-32	714.58	947.26	75.4
						(73.8)

A BF Brahman females; BB Brahman bullocks; HF Hereford females; HB Hereford bullocks
B Described by Moon (1980)
C Four fat thickness categories used at the export abattoir, 0-6mm, 7-22mm, 23-32mm and 33mm and over
D Calculated from hot carcass weight and rump "P8" fat thickness
E Loaded on Ship, Brisbane
F Values shown in parenthesis are means

Table 2. Sources of variation in percentage saleable beef yield determined from rump "P8" fat thickness

Genotype	Sex	Number of carcasses	RSD (%)	R^2 (variance accounted for)[A] (%)	Source of explained variance Fat thickness (%)	Genotype (%)	Sex (%)
Hereford	Steer	75	2.78	63.3	-	-	-
Hereford	Female	38	1.94				
Brahman	Steer	35	1.72	46.9	83.8**	15.8**	0.1[NS]
Brahman	Female	42	1.81				

[A] Hereford steer group deviated from constant variance and was not considered further in covariance analysis

** $p < 0.01$ [NS] Not significant

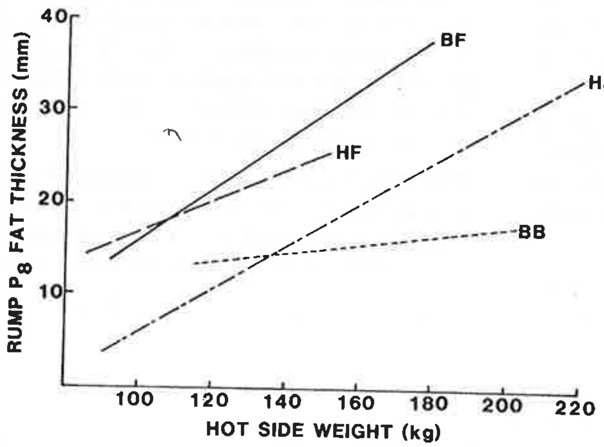

Fig.1 Change in rump P8 fat thickness with hot side weight.

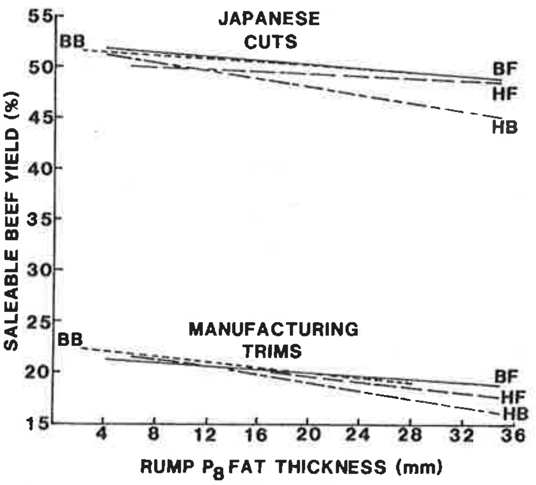

Fig. 2 Change in saleable beef yield percentage with rump P8 fat thickness.

weighed. The relationships between fat thickness at the rump "P8" site and hot side weight, cuts percentage (total weight of primal cuts expressed as a percentage of chilled side weight) and manufacturing trims percentage (total weight of manufacturing meats expressed as a percentage of chilled side weight) were studied using regression analysis within each of the four genotype-sex groups.

Two carcass values are compared in this study (see Table 1). The first, or "classification" price, was calculated from the abattoir's price payment schedule of 13th July, 1987, based on carcass weight and rump "P8" fat thickness category without reference to genotype or sex; the second, or "LS" (Loaded on Ship, Brisbane) price, was calculated from saleable beef yield and the prices paid for primal cuts and the various manufacturing trims on the 13th July, 1987, by importers from Japan and the U.S.A.

RESULTS

Figure 1 shows that increasing hot side weight was associated with an increase in rump "P8" fat thickness. The slopes of all the regression lines except that for Brahman-cross bullocks (BB) were significantly different from zero and differed among genotype-sex groups. That of the Brahman-cross females (BF) was significantly different from those of the Brahman-cross bullocks and the Hereford-cross bullocks (HB) (both, $p<0.001$); the slope of the Hereford-cross females (HF) differed from those of the Brahman-cross bullocks ($p<0.01$) and Hereford-cross bullocks ($p<0.001$), while the slopes of Brahman-cross bullocks and Hereford-cross bullocks were significantly different ($p<0.001$).

Using data from Figure 1, rump "P8" fat thicknesses were calculated at three arbitrarily-chosen carcass weights, 250, 300 and 360 kg. From regressions of percentage saleable beef yield (calculated individually for percentage cuts and percentage manufacturing trims) on rump "P8" fat thickness (Figure 2) the yield of saleable beef was calculated for the four groups at each of the three carcass weights (Table 1).

In order to show the relativity of prices, the "classification" price (price paid to the cattle producer for an animal) is expressed as a proportion of the "LS" price (price received by the exporter for the beef from the carcass of that animal). As carcass weights increased the proportion decreased. At 250 kg carcass weight it was 76.2%, at 300 kg, 75.4%, and at 360 kg, 73.8%.

In order to quantify the effects of genotype and sex on beef yield, the regression, percentage saleable beef yield on rump "P8" fat thickness, was examined by covariance analysis, using the genotype-sex groups as covariates (Table 2).

Approximately half the variance was accounted for by regression and the Hereford steer group which deviated from constant variance was not considered further in covariance analyses. Fat thickness (83.8%) and genotype (15.8%) accounted for most of the explained variance, with virtually no contribution from sex (0.1%) within Brahmans.

DISCUSSION

A basic premise of objective carcass evaluation systems in Australia is that, given carcass weight and a fat thickness measurement, saleable beef yield can be estimated. Because the genotype-sex groups in Figure 1 show differences in the onset of fattening relative to side weight, it is possible that anatomical carcass composition and, therefore, saleable beef yield could vary with genotype or sex, or both.

Both components of saleable beef yield, percentage cuts and percentage manufacturing trims decreased with increasing rump "P8" fat thickness in a generally similar manner amongst genotype-sex groups (Figure 2). This probably reflects a reasonably close adherence by the abattoir to the rigid trimming techniques for both cuts and manufacturing trims, by importing countries. However the Hereford females had a higher yield of percentage saleable beef than Hereford bullocks at the same rump "P8" fat thickness. This may have been attributable to a different fat distribution between the Hereford sexes or a lower degree of fat trim in the females. Because the study was conducted in a commercial abattoir, however, neither anatomical nor chemical composition of the cuts and manufacturing trims could be determined.

As carcasses increased in weight the classification prices tended to fall relative to the "LS" prices (Table 1). At 250 kg carcass weight the mean classification price was 76.2% of "LS" price; at 300 kg it was 75.4% and at 360 kg, 73.8%. With classification prices the carcasses of females tended to be relatively underprices, especially the Brahman females and particularly in the 300 kg and 360 kg carcass weight groups. Whether this means that the fatter carcasses at a given carcass weight (the females) receive a more lenient fat trim, produce more saleable beef and therefore receive a higher "LS" price, is uncertain in the absence of detailed composition data. In addition the use of fat "categories" may have confounded price comparisons.

In the regression equation percentage saleable beef yield on rump "P8" fat thickness, regression accounted for only about 50% of variance. Covariance analysis showed that, of this, the fat thickness measurement accounted for 83.8% and genotype, 15.8%. With fat thickness accounted for, sex (0.1%) was not important.

While the inclusion of genotype in objective carcass classification systems would improve the estimation of percentage saleable beef yield its use in commercial circumstances is probably not warranted. The recording of genotype, which explains only 15.8% of variance accounted for, is another duty and another cost for the abattoir; in addition it probably could not always be recorded accurately and the full effects (of various genotypes) on percentage saleable beef yield would need to be known. On the other hand the fat thickness measurement which explains 83.8% of the variance accounted for obviates the need to record sex for the purpose of determining yield.

Perhaps the industry should be more concerned with the fact that the fat thickness measurement explains only about half the variance in the regression, percentage saleable beef yield on rump "P8" fat thickness measurement.

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