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Fat colour and meat colour in different breeds of steers in five consecutive years raised on pasture and slaughtered at 30 months of age

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ABSTRACT

Subcutaneous fat colour at slaughter, after chilling for 24 hours was subjectively assessed on a scale of 1 (very white) to 5 (very yellow). Beef breeds (Angus, Beef Shorthorn, Galloway, Hereford and Red Poll), and dairy breeds (Friesian, Milking Shorthorn, Ayrshire and Jersey) of steer were slaughtered at 30 months of age over 5 consecutive years. The Friesian and Angus breeds were present every year and other breeds except for the Hereford and Red Poll were present for at least 2 years.

The beef breeds had significantly ($P < 0.01$) more carcasses with white fat than the dairy breeds. The Beef Shorthorn had significantly ($P < 0.05$) more carcasses with white fat than the Angus. The Ayrshire had more carcasses with white fat ($P < 0.01$) than the other dairy breeds. The Jersey had more carcasses ($P < 0.05$) with yellow fat than all the other breeds.

For the dairy breeds only there were significant correlations (0.4 - 0.7) between fat colour after chilling and the weight of kidney and channel fat. The more kidney and channel fat present the yellower the carcass.

There was a correlation of 0.32 between meat colour and fat colour after slaughter. Friesian steers had more carcasses ($P < 0.01$) with dark red meat than did the other breeds.

Keywords: cattle breeds, fat colour, meat colour.

INTRODUCTION

The opportunity for New Zealand to export beef to high-priced Asian markets has directed the attention of farmers to the carcass and meat quality traits these markets require. An important aesthetic trait is that carcasses have white fat and light coloured red meat. The subject has been reviewed by Morgan and Everitt, (1969).

Producing carcasses with these traits presents a challenge for New Zealand farmers and meat processors because animals raised on pasture exhibit yellow fat associated with a high intake of carotene. The meat from such carcasses could receive price discounts on Asian markets.

Placing cattle on a feedlot on a grain diet for a period of time can alleviate the problem of yellow coloured fat (Muir *et al.*, 1992). However, this option is expensive, so the shorter the period of time animals need to spend in a feedlot to achieve acceptable fat colour the better. If there are breed differences in fat colour from animals raised on pasture then breeds with whiter fat may be more economical to place in a feedlot.

This paper reports subjective observations made on fat colour and meat colour on a number of cattle breeds common in New Zealand observed over five consecutive years.

MATERIALS AND METHODS

A detailed description of the origin and management of the steers in five consecutive years of trials is given in a series of publications (Barton, 1971, 1972, 1973, 1975, and Barton

and Armstrong, 1974). These papers reported results from Trials V, VI, VII, VIII and IX in the notation used for this work. This notation will be followed in this paper to maintain continuity with the earlier publications. Each trial represented a separate year. Consecutive trial numbers correspond to consecutive years.

Steers from the Angus and Friesian breeds were represented in each trial. The Beef Shorthorn and Milking Shorthorn breeds were assessed in trials V and VI. The Galloway was assessed in trials VI and VII. The Ayrshire was assessed in trials VII and VIII. The Jersey was assessed in trials VIII and IX. The Hereford was represented in trial VI and the Red Poll was represented in trial IX. There were 15 animals of each breed in each trial in which the breed was represented.

At slaughter the subcutaneous fat colour of each breed was assessed visually by assigning a score of 1 (very white) to 5 (very yellow). A second assessment was done after the carcass had spent 24 hours in the chiller.

Meat colour was subjectively assessed visually in trials V and VI. It was scored from 1 (light red) to 3 (dark red) by observing the cut surface of the 12th rib.

Differences between years and breeds for subcutaneous fat colour and meat colour were analysed using contingency tables (Sokal and Rohlf, 1989). Correlations between the colour variables were calculated by the Spearman rank correlation (Sokal and Rohlf, 1989).

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RESULTS

TABLE 1: Least squares means and standard errors for carcass weight (kg) for each breed within each trial.

Breed	Trial Number				
	V	VI	VII	VIII	IX
Angus	243 ± 4.7	301 ± 5.5	280 ± 6.3	258 ± 5.3	272 ± 5.7
Friesian	241 ± 4.7	278 ± 5.5	294 ± 6.0	296 ± 5.1	291 ± 5.5
Milking					
Shorthorn	255 ± 5.1	280 ± 5.8			
Beef					
Shorthorn	270 ± 4.7	282 ± 5.9			
Galloway		268 ± 5.5	236 ± 6.0		
Hereford		288 ± 5.8			
Ayrshire			250 ± 5.8	266 ± 5.1	
Jersey				212 ± 5.3	209 ± 5.3
Red Poll					281 ± 5.7

TABLE 2: Percentage of carcasses for each breed in all trials in each fat colour class after chilling.

Breed	Fat Colour Score		
	1	2	3
Beef Shorthorn	73	17	3+
Galloway	66	24	10
Angus	60	25	15
Ayrshire	47	37	16
Friesian	17	40	43
Milking Shorthorn	7	38	55
Jersey	7	14	79

The means for the carcass weights of each breed in each trial are presented in Table 1, which also shows which breeds were measured in the different trials.

Chilling the carcass for 24 hours after slaughter at -15.5 degrees centigrade whitened the subcutaneous fat ($P < 0.01$). The correlation between fat colour score immediately after slaughter and after 24 hours chilling ranged between 0.40 and 0.55 in the five trials. The subcutaneous fat from the dairy-type breeds (Friesian, Milking Shorthorn, Ayrshire and Jersey) appeared to whiten more than fat from the beef-type breeds (Angus, Beef Shorthorn, Galloway, Hereford and Red Poll). However, this effect was not significant. The breed effects for chilled fat colour are ranked in Table 2. There was a significant ($P < 0.01$) difference in subcutaneous fat colour between the beef-type breeds and the dairy-type breeds. The beef-type breeds had more than 60% of carcasses classified into the whitest fat class. Dairy-type breeds generally had less than 10% of animals in the whitest fat class (Table 1). Among those breeds which were represented in a least two years, the Angus breed tended to have more yellow fat than the Galloway or the Beef Shorthorn. The Beef Shorthorn exhibited significantly ($P < 0.05$) whiter fat than the Angus.

Within dairy-type breeds the Ayrshire showed significantly ($P < 0.01$) whiter fat than the Friesian, Milking Shorthorn or Jersey breeds. Though the fat colour of the Ayrshire breed was more yellow than that of the Angus breed in each

of the two years the difference was measured, this difference was not significant in either year. The Jersey breed had fat which was significantly ($P < 0.05$) more yellow than that of any other dairy-type breeds. Jerseys were the only breed to have most carcasses graded into fat score 3 or above (73% in trial VIII, and 86% in trial IX). But the Jersey also showed the greatest variability in fat colour. A number of Jersey steers being graded into the whitest fat class (13% in trial IX).

Analysis of data from the Angus and Friesian breeds which were represented in each of the five trials showed that trial V had significantly yellower subcutaneous fat than the fat measured in the other four trials. There was no significant breed by year interaction.

When the meat colour was measured in trials V and VI the Friesian had meat of a darker red colour than the meat from the other breeds ($P < 0.01$). Over 80% of the Friesian in these trials had meat colour scores of 2 and above, compared with 30% of the other breeds.

There was no correlation between meat colour and chilled subcutaneous fat colour in trial V, but a correlation of 0.32 ($P < 0.01$) between subcutaneous fat colour and meat colour in trial VI. That is whiter fat was associated with lighter red meat. This relationship did not appear to be linear, with most of the change in meat colour occurring at fat colour scores higher than 2. There was negligible difference in meat colour between carcasses with subcutaneous fat scores 1 and 2.

There were significant correlations (ranging from 0.4 to 0.7 in the five trials) between subcutaneous fat colour score and the amount of kidney and channel fat in the dairy-type carcasses. There was no correlation between these variables in the beef-type breeds.

There was no relationship between fat colour score and the dressing-out percentage, fat depth at the 12th rib, eye muscle area, or the weight of fat, bone or lean of the carcass in any breed.

DISCUSSION

Because evaluation of the fat and meat colour in each of the trials was carried out subjectively these results must be interpreted with caution. Furthermore it is difficult to relate these results to the requirements of high-priced Asian markets demanding light-coloured meat with white fat. However the results do rank breeds with favourable fat and meat colour characteristics, and they suggest fruitful avenues for exploration.

The whiter fat of the beef breeds observed in these trials is well established (Morgan and Everitt, 1969). However, it appears that differences in subcutaneous fat colour occur within both beef and dairy breeds. Our results suggest that the Angus tends to have fat which is more yellow, and the Beef Shorthorn has fat which is whiter than the subcutaneous fat of the other beef breeds. The Ayrshire appears to have much whiter fat than that of the other dairy breeds, the fat colour from this breed approaching the whiteness of the fat of the Angus breed.

The high numbers of carcasses with very white fat in the Beef Shorthorn breed was consistent over the two trials this

breed was measured. This suggests that this breed should be further examined for this trait.

The Ayrshire which matched the fast growth rate of the Friesian (Barton, 1973; Barton and Armstrong, 1974), could be a useful breed if white fat colour needed to be combined with fast growth rates.

The tendency of the Friesian to have undesirable dark red meat colour compared to the other breeds should be noted. This was not a trait exhibited by other dairy breeds. As discussed above the Friesian may be less desirable as a dairy-beef animal than the Ayrshire when aesthetic meat qualities for the table beef trade are important.

The relationship between the amount of kidney and channel fat and subcutaneous fat colour in the dairy breeds is evidence of a relationship between fat colour and growth path, or degree of maturity of the animal. Dairy breeds have more kidney and channel fat than beef breeds (Preston and Willis, 1970), so that differences in energy intake or in maturity will affect this variable in dairy cattle. Differences in fat colour between spring and early summer, probably reflecting energy or diet differences, have been observed by Muir *et al.*, (1992). Morgan and Everitt (1969) reviewed evidence which suggested that changing growth paths resulted in a yellowing of fat in cattle, though this was not observed in the trials which they conducted.

Barton *et al.*, (1993) in a trial involving Jersey, Friesian-Jersey cross, and Friesian steers, found that there were breed differences in fat colour with the Jersey carcasses more yellow in colour while the Friesian carcasses had whiter subcutaneous fat. They also showed that the intensity of fat colour changed following an overnight period in a chiller at -15.5 degrees centigrade.

Purchas *et al.*, (1992) showed that the progeny of various sires (Simmental, Limousin, Murray Grey, and Hereford) mated to Jersey cows did not differ in the intensity of fat colour.

The significantly more yellow fat ($P < 0.01$) observed in trial V may have been observer bias, and no conclusions can be drawn from this result. There was no standardisation of

observers between years. However, the insignificant differences between the chilled fat scores between the years represented by trials VI to IX suggest some stability in this trait. In particular the lack of any breed by year interaction for the Friesian and Angus breeds imply that the physiology of fat colour is the same for both breeds.

It is clear that variability in subcutaneous fat colour exists in all breeds. Even the Jersey breed which had very yellow fat on average included carcasses having very white fat. As noted the variability of the fat colour in this breed is higher than the variability of fat colour in any other breed.

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