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Methods of ranking two-tooth rams for fat-free carcass growth rate

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ABSTRACT

Twenty eight Border Leicester 2-tooth rams (mean live weight 70 kg) were scored for fatness on a 10-point scale by 6 drafters and back fat thickness was measured by ultrasonic probe (UFD). Chemical fat percentage (mean 33.9%) was determined on a half-carcass of each ram. Mean carcass weight, measurement C and GR were 38.0 kg, 12 mm and 28 mm respectively. Mean drafters' fat score was more highly correlated with % carcass fat (+0.83) than UFD (+0.67). The prediction of fat-free carcass weight (FFCW) from live weight plus UFD ($R^2=0.72$, RSD 1.24 kg) or drafters' fat score ($R^2=0.76$, RSD 1.14 kg) was superior to prediction from live weight alone ($R^2=0.59$, RSD 1.49 kg). The inclusion of UFD or drafters' fat score increased the efficiency with which rams were ranked for fat-free carcass weight. Selection of the top 10% of rams ranked on the prediction of FFCW from live weight achieved 75% of the potential selection differential. Inclusion of either UFD or drafters' score improved the potential to 95%.

INTRODUCTION

Genetic improvement in lean tissue growth in sheep is dependent on the accurate ranking of rams for rate of lean tissue growth, the heritability of lean tissue growth and the selection differential achieved.

In New Zealand, live animal ultrasonic fat depth measurements (UFD) have been shown to be positively correlated (+0.76 to +0.83) with % carcass fat in lambs at 5 to +6 months of age (Gooden *et al.*, 1980; Purchas and Beach, 1981) but there are no data to support this relationship in 2-tooth rams should selection be deferred to this age. Subjective assessment of fatness by livestock drafters has been shown to be a viable alternative to ultrasonic measurement for estimating the weight of carcass fat in ewes (Bass *et al.*, 1982). Confirmation of the ability of livestock drafters with other classes of sheep would confirm the potential role of livestock assessors in selection programmes.

The Border Leicester breed has been identified as a potential sire of larger export lambs because of its relatively rapid growth (Carter *et al.*, 1974). Few details on the variation in carcass composition in New Zealand Border Leicester sheep have been presented.

This paper presents data on the carcass composition of 2-tooth Border Leicester rams and compares the effectiveness of ultrasonic methods of fat measurement with livestock drafters in predicting fat-free carcass weight.

MATERIALS AND METHODS

Twenty-eight Border Leicester 2-tooth rams which had been culled from a group of 61 for wool kemps were used.

Ultrasonic back fat thickness, of each ram was measured on both sides over the 12th rib, 5 to 6 cm from the dorsal vertebral process using an AIDD machine. Six commercial lamb drafters scored the rams for fatness by first identifying the fattest (fat score 10) and leanest (fat score 1) rams and then scoring the remaining rams. The exercise was repeated 30 minutes later. Live weight of each ram was recorded prior to slaughter after an overnight fast.

Rams were slaughtered in an export meat processing works under normal procedures (kidney and kidney fat removed). Carcass measurements C and GR were recorded on both sides of each carcass between the 12th and 13th rib by 2 operators after 24 h chilling. The right side of each carcass was subsequently minced 3 times, subsampled, air dried and the chemical fat content determined in duplicate by Soxhlet extraction. Fat-free carcass weight (FFCW) was calculated from the chilled carcass weight and % fat on a wet matter basis. Relationships between variables were established by simple and multiple linear regression.

RESULTS AND DISCUSSION

Live Animal and Carcass Measurements

Although the mean carcass weight was greater by 8 kg than that of Southdown and Romney rams (Table 1) dissected by Fourie *et al.* (1970), the fat percentage (Table 1) was intermediate between the Southdown and Romney. In a large sample of PM grade lambs, the mean carcass fat % was 30% (Kirton *et al.*, 1983). For the present sample of rams 30% carcass fat is equivalent to a GR measurement of not greater than 24 mm and a measurement C of not greater than 10 mm. Seventy nine percent of these rams had greater than 30% carcass fat.

The relationships of % carcass fat and weight of

TABLE 1 Mean, standard deviation and range of physical characteristics of 28 2-tooth Border Leicester rams.

	Mean	SD	Range
Live weight (kg)	70	5.5	61–81
Ultrasonic fat depth (mm)	7.8	1.8	4.5–14.5
Carcass weight (kg)	38	3.8	32.4–44.6
Measurement C (mm)	12	4.1	5–21
GR Measurement (mm)	28	7.6	17–42
% Fat in carcass	33.9	3.77	26.5–39.4
Fat-free carcass weight (kg)	24.7	2.32	19.9–30.9

carcass fat to live animal and carcass measurements are shown in Table 2. All correlations were different from zero ($P<0.05$). The first assessment of fat score had a higher ($+0.72$ *v* $+0.62$) correlation with carcass fatness than the second assessment for 5 out of 6 drafters. Only the first assessment is shown in Table 2. A single observation of UFD on the left side (used in Table 2) showed a slightly higher correlation with % fat than either the right side or mean of the left plus right side measurement. At present no comment can be offered on the apparent superiority of the left UFD measurement over the right. Further work might establish the existence and reason for the difference.

The correlation between % carcass fat and UFD ($+0.667$) is slightly below the range ($+0.77$ to $+0.83$) of a number of operators (Purchas and Beach, 1981). The operator in our study was fully trained and was included in the operators of Purchas and Beach (1981). The regression coefficient of UFD on carcass measurement ($+0.38$) is much lower than 1.0. This trend is illustrated for most UFD operators by Purchas and Beach (1981) but would appear to be greater at higher fat depths. It has been suggested (A. M. Nicol and P. F. Fenessey, pers. comm.) that 'layering' of fat can lead to erroneous low readings of UFD at large fat depths.

Although layering may have contributed to the relatively low correlation of UFD with measurement C, the RSD of 2.91% fat in this work is within the range of 2.54 to 3.09% observed by Purchas and Beach (1981) using lighter and leaner sheep.

Drafters varied in their ability to score the rams for fatness. The mean score of all drafters and the fat scores of better drafters were more highly correlated ($P<0.05$) with % carcass fat or weight of fat than UFD. Bass *et al.* (1982) found that experienced livestock judges were equal to ultrasonic probes in assessing fatness of 2-tooth ewes. Variability between drafters (Bass *et al.*, 1982 and this study) would appear to be greater than between UFD operators (Purchas and Beach, 1981).

GR measurement showed a slightly higher correlation with % carcass fat and weight of fat than measurement C, an observation in accord with Kirton and Johnson (1979). The fat scores of good drafters were slightly more highly correlated with % carcass fat than C or GR measurements.

Prediction of FFCW

FFCW was predicted from live weight alone and in conjunction with ultrasonic backfat measurement or drafters fat score (Table 3).

Live weight accounted for only 59% of the variation in FFCW. The inclusion of either UFD or the mean or 'best' drafters fat scores significantly improved the prediction and reduced the RSD by 17 and 23% respectively. Fat scores of the poorest drafter did not improve the prediction.

There was little difference between the error of predicting FFCW from LW + UFD or LW + 'best' drafter, yet drafters were significantly better than UFD in predicting % carcass fat (Table 2). This observation suggests to us that drafters made some correction for live weight in their fatness scoring.

Ranking for FFCW

Better prediction of FFCW is only of value if it improves the efficiency with which animals can be selected for breeding programmes. Correlations between actual and predicted values of FFCW using

TABLE 2 Simple regression between % carcass fat and weight of carcass fat (kg) with UFD, drafters' fat scores and carcass measurements of 28 Border Leicester rams†.

Independent Variable	% carcass fat b	c	r	RSD	Weight of carcass fat b	c	r	RSD
Ultrasonic fat depth (mm)	1.29	23.5	0.67	2.91	0.60	7.91	0.55	1.80
Drafter fat score								
–mean of 6	1.43	24.84	0.83	2.14	0.80	7.69	0.83	1.18
–best	1.42	24.55	0.89	1.79	0.73	7.97	0.81	1.25
–worst	0.66	30.44	0.48	3.37	0.41	10.57	0.55	1.80
Carcass measurement (mm)								
C	0.72	24.7	0.76	2.49	0.31	8.75	0.60	1.72
GR	0.56	17.6	0.79	2.39	0.30	3.94	0.77	1.36

† where b = regression coefficient, c = intercept, r = correlation coefficient.

equations in Table 3 were calculated and the 'efficiency' of ranking for FFCW estimated from the number of rams correctly included in the first 10% (Table 4). The correlation of predicted FFCW with actual FFCW was higher when UFD or 'best' drafter were included with live weight. This increased the number of rams correctly included in the top 10% from 33% when FFCW was predicted from live weight alone to 66% when either UFD or 'best' drafter was included. The selection differential for FFCW of the heaviest 10% FFCW was calculated. Prediction of FFCW from live weight only would have only achieved 75% of the potential selection differential. Inclusion of either UFD or 'best' drafter increased the proportion to 95% of potential. Because of 1 exceptional ram (45 kg carcass weight, 26.5% carcass fat) which had a FFCW 1.5 kg heavier than any other ram, selection of the top 5% of rams would have been almost equally efficient by all ranking methods. A 15% selection gave 78, 94 and 94% of the selection differential for ranking on live weight, live weight plus UFD and live weight plus drafter respectively.

CONCLUSIONS

Carcass fatness measurements of this particular group of rams suggest that up to 79% of their carcasses contained excess fat. UFD underestimated carcass measurement C by 35%. In this and other studies, GR measurement had a higher correlation with carcass fatness than measurement C. As GR is used as a fatness assessment in the export lamb grading system perhaps more consideration should be given to techniques for measuring GR in live animals.

Most livestock drafters in this and the work of Bass *et al.* (1982) were as good as UFD in assessing fatness of the live animal. Where access to UFD probes is restricted and/or time for live animal fat assessment is limited, ram breeders should use drafters for fatness assessment of rams for sale. Good drafters must be identified and/or the skills of poorer drafters be improved. The New Zealand Meat Producer Board has recently introduced short courses aimed at improving drafting skills and some processing companies organise their own courses. Competitions for drafters such as that introduced by at least 1 Agricultural and Pastoral Association will publically identify good drafters.

The improvement in ranking of the rams in this study for FFCW achieved by the inclusion of either UFD or 'best' drafters fat score with live weight compared with live weight alone was sufficient to increase the rate of genetic gain for FFCW.

TABLE 3 Multiple regression equations predicting FFCW from live weight alone or in conjunction with UFD or drafters' fat score.

Independent Variables	Regression coefficients b_1	b_2	Intercept c	R^2	RSD (kg)
Fasted live weight alone	0.33	–	1.51	0.593	1.49
Live weight + UFD					
Ultrasonic right	−0.36	−0.38	2.93	0.671	1.34
Ultrasonic left	−0.36	−0.48	3.54	0.719**	1.24
Ultrasonic mean (left and right)	−0.35	−0.41	3.36	0.694	1.29
Live weight + drafters'					
worst	−0.37	0.18	0.06	0.620	1.44
best	−0.38	−0.42	0.82	0.760**	1.14
Mean 6	−0.41	−0.49	0.98	0.752**	1.16

** Significant improvement over live weight alone.

TABLE 4 Correlation of predicted FFCW with actual FFCW and efficiency of ranking.

Independent Variables	Correlation	Efficiency of ranking[1]	Proportion of potential selection differential
Live weight alone	0.780	0.33	0.75
Live weight + UFD (left)	0.860	0.66	0.95
Live weight + best drafter	0.882	0.66	0.95

[1] Proportion of rams correctly included in top 10% on FFCW.

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