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The application of a lean growth index in ram breeding flocks

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ABSTRACT

A Sheeplan supplementary lean lamb option has been developed to assist in the selection of sheep for meat production. Output information includes a breeding value for fat-depth measurement "C" over the 'eye muscle' and a lean growth index (LGI), combining leanness with growth performance.

Performance records, including live animal ultrasonic fat depth measurements and subjective assessments of fatness by lamb drafters were analysed on 1970 ram hoggets from 25 ram breeding flocks. The average mob live weight at assessment was 47.9 kg (range 34.2 to 60.3) associated with an average fat depth C of 3.3 mm (range 1.7 to 5.6).

The subjective assessment of live-animal fat depth has the advantages of speed and simplicity but further work is required to develop the most appropriate calibration techniques.

The extent of within-flock variability in the animal records was examined and comparisons made between 2 methods of adjusting fat depth for live weight within each flock. The calculation of within-flock fat-weight relationships for this adjustment was adopted for use in larger flocks, but a constant exponent method is preferred when flock size is small.

The wide variation in the LGI within flocks suggests considerable opportunity exists to make worthwhile genetic progress in lean growth rates.

Keywords Sheep selection; fat depth measurement; lean growth index.

INTRODUCTION

A number of techniques have been used for live animal carcass evaluation. Among them are ultrasonic measurement, and subjective visual assessment and handling or condition scoring (Kempster *et al.*, 1982; Kempster, 1983; Alliston, 1983). Research studies in New Zealand have demonstrated favourable responses to selection for reduced back-fat thickness using ultrasound (Fennessy *et al.*, 1982; Bennett *et al.*, 1983).

A lean growth index (LGI) is now available to rank animals for lean carcass production (Purchas *et al.*, 1985). A component of the index is a breeding value for fat depth "C" (BV(C)), a spot measurement over the eye muscle (*M. longissimus dorsi*) between the 12th and 13th rib. Fat depth "C" can be measured on the live animal by an ultrasonic probe. Subjective fatness assessment, by an experienced stock judge or lamb drafter, can also be conducted to a comparable degree of accuracy (Bass *et al.*, 1982; Nicol and Parratt, 1984). Theoretical expected outcomes of alternative selection schemes using a weight-adjusted fat depth or a LGI were outlined by Bennett and Clarke (1984).

The application of the LGI to ram breeders' flocks is described in this paper. Ultrasonic measurements, using the DSIR probe (Purchas and Beach, 1981), or subjective assessments of fatness were recorded. The 2 methods of adjusting fat depth for live weight used by Purchas *et al.* (1985) were also compared.

MATERIALS AND METHODS

From February to September 1983 and 1984, live weight was recorded and fat depth was assessed ultrasonically (13 flocks, 899 animals from 2847 weaned as lambs) or subjectively (12 flocks, 1071 animals from 2569 weaned) on ram hoggets for use in breeders' within-flock selection programmes.

Subjective assessment was generally carried out

TABLE 1 Example of a ram hogget selection list produced by the Sheeplan lean lamb option.

Iden.	Live weight (kg)	Ultrasonic depth (mm)	BV(C) (mm)	BV(WWT) (kg)	Lean growth index
1003	46.0	3.00	0.08	0.31	8
1005	51.0	3.00	0.03	0.45	7
1007	45.0	3.50	0.24	0.43	5
1012	49.0	2.25	-0.15	1.00	48
1014	41.0	3.00	0.15	-0.15	-14
1015	45.0	2.75	0.03	0.68	20
1016	38.0	2.50	0.04	-0.91	-39
1026	42.0	2.50	-0.01	-0.24	-9

by experienced lamb drafters, each assessed on his ability to estimate carcass measurements on the live animal. Subjective assessments were either an estimate of fat depth C or an estimate of carcass GR on the live animal. Live weights were recorded on or close to the date of fat assessment. There were 9 Romney flocks, 6 Coopworth, 4 Perendale, 3 Suffolk and one of each of the Southdown, South Suffolk and Hampshire breeds.

Data were processed by a microcomputer program developed to supplement recording on Sheeplan (Dodd *et al.*, 1984) and introduced for use until fat depth measurements are processed through the central Sheeplan system.

BV(C) was calculated by the double log adjustment procedures of Purchas *et al* (1985). The first method, the within-flock method, adjusted for live weight by calculating fat depth deviations from the fat/weight relationship existing within each flock. The second method, the constant exponent method, applied a constant slope in all flocks and was evaluated for its accuracy for use in smaller flocks where sampling errors are likely to be greatest.

The equation used in the within-flock method was:

$$\ln(\text{fat depth}) = \ln(a) + b.\ln(\text{live weight}).$$

For the constant exponent method, a fixed value of b of 1.6 was assumed.

Each ram breeder using the recording option was supplied with a selection list for rising 1-year-old rams (Table 1) giving BV(C), a growth performance breeding value (BV(LWT))—usually taken from other Sheeplan outputs—and the calculated LGI. A graph displaying individual animal fat depths and live weights was also provided. Sire and dam identification numbers and breeder's remarks were also processed if required.

RESULTS AND DISCUSSION

In the subjectively assessed flocks, hogget live weights and fat depths (49.1 ± 4.6 kg; 3.71 ± 0.96 mm (mean, SD)) tended to be greater than in the ultrasonically assessed flocks (46.7 ± 7.1 kg; 2.90 ± 0.77 mm).

Live animal fat depth was significantly affected by live-weight differences between and within flocks, fat measurement method and flocks within measurement method ($P<0.001$ for all tests). The slope of the within-flock regression of ln(fat depth) on ln(live weight), "b", was not affected by the average live weight, average fat depth or ram-hogget mob size (Fig. 1). Fatness increased more rapidly as weight increased in the subjectively assessed flocks (Table 2). It is not known if this discrepancy is due to real differences in the regression or due to inaccuracies in fat depth assessment. In addition, differences between flocks in "b" were greater in the subjectively assessed flocks than in those ultrasonically assessed (Table 2). These findings indicate that there is a need for further work to establish calibration methods for subjective assessments, particularly by applying both techniques of fat depth measurement to the same animals.

The accuracy of the constant exponent method is likely to be enhanced if breed differences are further resolved. There were however insufficient numbers of flocks of the various breeds to make meaningful between-breed comparisons of the relationships between fat depth and live weight.

TABLE 2 Slopes (b) and intercepts of relationships between fat depth C and live weight using 2 methods of adjusting fat depth for live weight on data obtained by ultrasonic and subjective measurement.

		Ultrasonic	Subjective
Within-flock method			
Intercept	Mean	-3.95	-9.87
	SD	1.95	4.28
b	Mean	1.29	2.84
	SD	0.50	1.03
Constant exponent method			
Intercept	Mean	-5.08	-4.92
	SD	0.20	0.23
b	Mean	Set at 1.6	

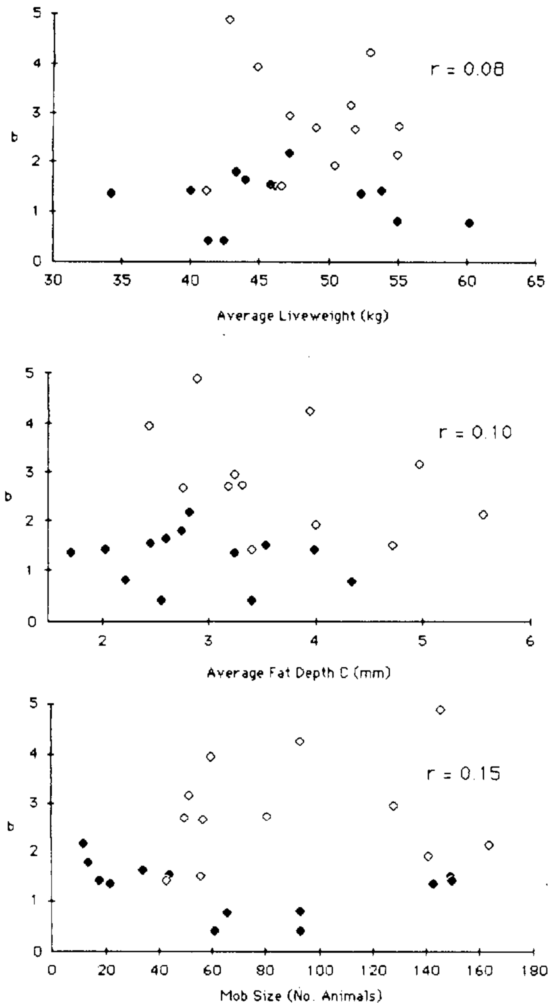

FIG. 1 The relationships of live weight, fat depth and mob size with the slope ('b') of the regression of ln(fat depth) on ln(live weight) for ultrasonic (•) and subjective (o) assessment of fat depth.

The greater within-flock variation in the LGI using subjective assessment (Table 3) was due to greater variation in the breeding values of both fat depth (BV(C)) and live weight (BV(LWT)). The more intense selection of ram hoggets measured/weaned for ultrasonic measurement is likely to be a contributing cause of this difference. Fewer animals, selected using a post-weaning index, were often tested using the ultrasonic method as it is more time consuming (e.g. 30 to 40 animals/hr).

The LGI was more closely associated with BV(LWT) than BV(C) (Table 4). This was a consistent trend for the 2 methods of fat-depth assessment using either method of adjusting fat depth. As there is strong emphasis on growth performance in the LGI, breeders wishing to apply intense selection on leanness alone would make substantially faster progress using BV(C).

TABLE 3 Average standard deviation of breeding values for live weight and fat depth and of lean growth index in ultrasonically and subjectively assessed flocks.

	Ultrasonic	Subjective
Within-flock regression:		
BV(C) (mm)	0.22	0.29
BV(LWT) (kg)[1]	0.37	0.53
Lean growth index	20	30
Constant exponent:		
BV(C) (mm)	0.22	0.26
BV(LWT) (kg)[1]	0.37	0.53
Lean growth index	20	24

[1]BV(LWT) (weaning weight or hogget live weight) present for 9 ultrasonically and 9 subjectively assessed flocks only.

TABLE 4 Average weighted[1] correlation coefficients between the lean growth index and its components for 25 flocks.

	Ultrasonic	Subjective
Within-flock method		
BV(C),LGI	-0.56	-0.63
BV(LWT),LGI	0,87	0.88
Constant exponent method		
BV(C),LGI	-0.61	-0.47
BV(LWT),LGI	0.88	0.87

[1]Weighted for flock size using Z transformation

CONCLUSIONS

The changing requirements of New Zealand's lamb markets have placed greater importance on the production of leaner and heavier carcasses. The LGI selection programme provides performance criteria that enable selection for carcass traits to be conducted using meaningful production information.

As greater sampling errors can be expected in fat/weight trends in smaller flocks there is a case for using the constant exponent method of fat depth adjustment in these flocks (e.g. when flock size is less than 40). There is however a need for analysis of data from flocks where both ultrasonic measurements and subjective assessments are made, to derive more accurate constant exponents to use.

The ultrasonic probe provides an objective means of routine measurement in ram breeding flocks or as a means of teaching subjective visual assessment and handling techniques. The subjective assessment of fat depth is usually much quicker than the ultrasonic probe but users of the technique should be tested through the comparison of their assessments with carcass measurements taken on slaughter animals.

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