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Progeny testing for lean meat production in the Poll Dorset breed

R.A. BARTON, R.M. PRATT* AND A.L. RAE

Department of Animal Science, Massey University, Palmerston North.

ABSTRACT

Five Poll Dorset breeders have co-operated since 1982 in a progeny-testing programme to improve lean meat production in their respective flocks. Ram lambs were selected from each flock on their BV's for weaning weight (in 4 of the 5 flocks) and were then assessed for fatness (visually and tactually initially, and finally by ultrasonic probe), structural soundness, and muscling. The ram lambs selected for the progeny test were mated at random to Coopworth mixed-aged ewes on a commercial prime lamb property. The progeny were identified to sire and dam and their birthrank indicated by eartag. Only progeny born during a 6- to 7-day period were identified in this way. At slaughter in November, information on export grade, carcass weight, and GR measurement was obtained.

Heritabilities of carcass weight (CWT) and GR measurement adjusted for carcass weight (AGR) were respectively 0.20 and 0.29 and the genetic correlation between them was -0.09 (based on 29 sires and 490 progeny).

To rank the sires, data were analysed on 3 criteria: AGR; carcass lean index (CLI); and a selection index (SI) which included estimates of the relative economic values of carcass weight and GR measurement. Use of CLI was expected to produce the greatest gain in CWT, but least reduction in GR while AGR gave the largest reduction in GR but little gain in CWT. Use of SI would result in intermediate gains in both traits and would achieve the highest increase in financial return/carcass.

Keywords Poll Dorset; progeny testing; carcass weight; GR measurement; selection indexes.

INTRODUCTION

To better satisfy the present needs of lamb consumers, much effort is now being expended by ram breeders to reduce fatness and increase the weight of lamb carcasses. To achieve this, a growing number of ram breeders are currently placing greater selection pressure on increasing the leanness of the sires and dams in their stud flocks and they are seeking professional advice to guide them in their breeding programmes to a greater extent than previously. An example of this effort is given here, together with a number of parameters of carcass merit derived from the analyses of data obtained in this programme.

In 1982 and 1983 five breeders and since 1984 four breeders of Poll Dorset pedigree sheep have collaborated to undertake an annual progeny test of selected ram lambs from their respective flocks. Following the analyses of data derived from the progeny test, the rams ranked highest are used as 2-tooths and at subsequent ages in the stud flocks of the collaborators. This procedure has been implemented to assist these breeders to make greater genetic progress in lowering fat levels and increasing growth rate and carcass weight. Other stud and commercial prime-lamb flocks that use the rams bred for these traits are also likely to benefit from the progeny-testing programme.

MATERIALS AND METHODS

Selection of Ram Lambs for Progeny Testing

The contributing group breeders involved in the progeny test programme were located in the Matamata, Apiti, Rangiwahia, Waipawa, and Gladstone districts. The flock in the latter district was dispersed in 1983. Ram lambs from each of their Poll Dorset flocks were selected by their respective breeders on the basis of Sheeplan records (where these were available), leanness, thickness of muscling, and freedom from structural defects of the reproductive organs, teeth, jaws, feet, and joints.

The breeders' selections were assembled at one centre and the final selection of up to 10 ram lambs was made collectively by the breeders, who also took into account the ultrasonic fat depth measurements that were available to them in relation to the live weight of each animal. This latter information was used in 1982, 1983 and 1984.

Management of the Ram Lambs, the Ewe Flock and Offspring

The ram lambs chosen for the progeny test were transported to a 830 ha. property in the Tirau district where each ram was exposed to 100 four-tooth and older Coopworth ewes. The ewes in each mating group were ear-tagged with a coloured tag; one colour for each group. The ram lambs were returned to their respective owners following mating. The ewes exposed to the ram lambs were brought together for 2 weeks in the presence of rams harnessed with mating crayons. Ewes marked by the harnessed rams had their coloured

*R.D.2, Kimbolton

eartags removed so that there would be no confusion over parentage at lambing time as far as the offspring of the test rams were concerned.

The ewes were rotationally grazed on pasture throughout the winter. They were crutched and vaccinated 2 weeks before the start of lambing at which time they were set-stocked at the rate of 14.4 ewes/ha. The ewes were drenched against internal parasites prior to the mating season, before lambing, and at the docking of their lambs.

Only lambs born within a 6- or 7-day period were identified with eartags of the same colour as that of their dams. The tagging periods coincided with the peak of lambing for most mating groups. The single-born lambs in the last 3 years were colour eartagged in the left ear and the twin-born lambs in the right ear. The aim was to eartag up to 25 lambs/sire with lambs born over a few days so that it would not be necessary to correct the carcass data for birth date or age at slaughter.

In some sire groups this total of 25 progeny was achieved in 3 or 4 days.

The lambs in 1982 and 1983 were tailed with the searing iron and with the rubber ring in 1984 and 1985. The male lambs in the first 2 years were castrated using the rubber ring, but in 1984 and 1985 they were left entire.

The lambs were drenched for endoparasite control at docking and thereafter every 3 weeks. They thus had 3 drenches before their slaughter in November.

Slaughter Procedure and Carcass Data Recorded

The lambs of each sire group were slaughtered at an export slaughter plant in November each year when they were on average 81 to 87 days old. However, in 1983 there were 73 poor lambs and these were retained on the farm and slaughtered on 20 March 1984 when they were 210 days old. All except the very poor lambs were sent to slaughter and these numbered no more than 21 as a total of all sire groups.

The lambs were killed in sire groups. In 1983, and subsequently, the birth rank of each lamb was known and this made it possible to separately slaughter 2 sub-groups for each sire group. The carcasses were held on the cooling floor until their weight, export grade, GR measurement and sex were recorded individually.

Statistical Analyses

The analysis was limited to the data from 1983 (November slaughter), 1984 and 1985 and is based on 29 sires and 490 progeny. The 1982 data were excluded because birth rank of the lambs was not recorded and the spread of eartagging at lambing was 14 days. An indication of the importance of these 2 non-genetic factors was an increase in the residual variance of carcass weight by 55% in that year.

The heritability of carcass weight (CWT) and weight-adjusted GR (AGR), and the genetic and phenotypic correlations between them, were estimated using the paternal half-sib relationship. The model included the fixed effects of year and birth rank while sires within years were assumed to be random effects. The estimates of the genetic parameters were then used to obtain best linear unbiased predictors (BLUP) of the breeding values of CWT and AGR for each sire.

TABLE 1 Estimates of genetic and phenotypic parameters (heritabilities on the diagonal, genetic correlations above and phenotypic correlations below the diagonal) for carcass weight (CWT) and weight adjusted GR measurement (AGR). (Based on 29 sires and 490 progeny.)

	Trait	
Trait	CWT	AGR
CWT	0.20	-0.09
AGR	0.06	0.29

Selection Indexes

Three indexes combining the sire breeding values for CWT and AGR were considered.

(i) The standard selection index (SI)

This index requires information on relative economic values of the 2 traits. The problems of estimating these values have been discussed by Rae (1984). The present estimates were obtained from the export schedule prices for lamb carcasses of different weights and grades published on 14 December 1985 and are measured as the increase in gross financial return/carcass for 1 kg increase in CWT (130 cents) and for 1 mm increase in GR (-89 cents). The index is then:

130 BV(CWT) -89 BV(AGR)

which was scaled for presentation by dividing by 130 to be

SI = BV(CWT) -0.69 BV(AGR).

(ii) Carcass lean index (CLI)

This index predicts the weight of lean tissue in the carcass. The weighting factor for CWT is the change in lean tissue weight for 1 kg change in carcass weight. The value of 0.45 used by Purchas *et al.* (1985) was chosen. The weighting factor for AGR is the change in lean tissue proportion for 1 mm increase in AGR (-0.005; Kirton *et al.* 1985) multiplied by average carcass weight (14 kg). Thus

CLI = 0.45 BV(CWT) -0.07 BV(AGR)

which was scaled to

BV(CWT) -0.16 BV(AGR).

(iii) GR adjusted for carcass weight (AGR)

This is the deviation of the actual carcass GR from the average GR of carcasses of the same weight calculated from the linear regression of GR on CWT. The negative deviations are desired (i.e., smaller than average GR). Consequently, the

TABLE 2 An example of within-year estimates (1984) of sire breeding values for carcass weight (CWT) and weight adjusted GR (AGR), and indexes combining the 2 traits.

Sire	Breeding values		Carcass lean index (CLI)	Standard selection index (SI)	AGR
	CWT (kg)	AGR (mm)			
1	-0.13	1.07	-0.30	-0.87	-1.07
2	-0.16	0.81	-0.29	-0.72	-0.81
3	-0.59	-0.58	-0.50	-0.19	0.58
4	-0.35	0.83	-0.48	-0.92	-0.83
5	0.45	0.13	0.43	0.36	-0.13
6	0.49	1.11	0.32	-0.28	-1.11
7	-0.17	-0.23	-0.13	-0.01	0.23
8	-0.03	-0.84	0.10	0.55	0.84
9	0.38	-1.05	0.54	1.10	1.05
10	0.21	-1.61	0.46	1.32	1.61

BV(AGR) was multiplied by -1.

Pooled within-year correlations between these indexes were calculated and the expected rates of change resulting from use of each index were assessed.

RESULTS

In Table 1, the estimates of heritability and phenotypic correlations between them are presented. They are very close to those given by Bennett and Clarke (1984). Hence it was decided to use them as the parameters required in the best linear unbiased prediction of the sire breeding values. An example of the breeding values and indexes is presented in Table 2 for 1984 only. In addition, the correlations among the 3 indexes and the gains expected from their use are presented in Tables 3 and 4.

DISCUSSION

The correlations between SI and both CLI and AGR are high. In contrast, the correlation between CLI and AGR is markedly lower both in expected value and in the sample analysed. This difference can be explained by examination of the expected performance of the indexes. CLI achieves the greatest increase in CWT, but the least change in carcass fat as assessed by AGR. At the other end of the scale, use of AGR results in only a small increase in CWT, but a marked decrease in fatness. The SI, as indicated by the relative economic values, gives similar emphasis to the 2 traits. The high correlation between CLI and SI comes largely from contrast, the relationship between SI and AGR is largely made up by the AGR component in the 2 indexes.

If the relative economic values used in SI are accepted, then the gain (measured in cents/carcass) from one unit of standardised selection differential using CLI and AGR are nearly equal, but only about 85% of that which would be achieved by use of SI. These results agree in general with those of Bennett and Clarke (1984).

TABLE 3 Actual and expected correlations between the indexes.

	SI-CLI	SI-AGR	CLI-AGR
Actual pooled within year	0.89	0.86	0.48
Expected	0.86	0.69	0.21

TABLE 4 Expected gain/generation from one unit of standardised selection differential using indexes CLI, SI and AGR.

	CLI	SI	AGR
CWT (kg)	0.45	0.26	0.04
AGR (mm)	-0.29	-0.69	-0.85
Expected gain (cents/carcass)	65	74	63

The analysis of results for presentation to the breeders has varied from year to year. Each year, least square means of the sire groups for CWT and GR have been obtained from a model which included birth rank effects (except 1982) and sex effects. These means were expressed as deviations from the overall mean and adjusted for the number of progeny involved in order to obtain sire breeding values for each trait. The procedure used to combine the information on CWT and GR varied. In 1982 and 1983, AGR was used while in 1984 and 1985, a selection index using relative economic values appropriate for those years was used. These different bases of selection reflected the state of knowledge at the time. However, even though regressed least squares rather than BLUP and different parameters were used, discrepancies in sire rankings compared with those in Table 2 were small.

Although it proved not possible to undertake detailed analyses of the effectiveness of the initial selection of ram lambs to enter the test or of the effectiveness of the utilisation of the progeny-tested rams within the collaborators' flocks, these are important considerations. The possible use of artificial insemination to extend the utilisation of the progeny-tested rams; repeat matings of rams in the test to allow year-to-year comparisons; the integration of records of the flocks in the group; and the estimation of maternal effects in the breeding value assessment of the ram lambs are all matters which need investigation.

The progeny testing procedures outlined here were simple to implement and have been considered to be reasonably effective in achieving gains in the direction desired. The procedures described do, however, have the advantage that they can be used within the constraints imposed by a commercial prime-lamb farm as the testing site and by meat processing companies for the slaughtering of the lambs.

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REFERENCES

Bennett G.L.; Clarke J.N. 1984. Expected selection responses in lamb carcass composition and weight. *Proceedings of the New Zealand Society of Animal Production* **44:** 243-247.

Kirton A.H.; Duganzich D.M.; Feist C.L.; Bennett G.L.; Woods E.G. 1985. Prediction of lamb carcass composition from GR and carcass weight. *Proceedings of the New Zealand Society of Animal Production* **45:** 63-66.

Purchas R.W.; Bennett G.L.; Dodd C.J. 1985. The calculation of a simple lean-growth index for young sheep. *Proceedings of the New Zealand Society of Animal Production* **45:** 73-76.

Rae A.L. 1984. Development of selection programs for increasing lean meat production in sheep. *Proceedings of the Fourth Conference Australian Association of Animal Breeding and Genetics* pp 3-7.