LAMBPLAN AND WEIGHT AND FAT RESPONSES IN SECOND CROSS LAMBS

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SUMMARY

Live weight and fat measurements of 4332 second cross lambs sired by 30 rams from two studs with LAMBPLAN estimated breeding values from six experiments are reported. The responses for weight were as or higher than expected and fat responses were up to three times higher than anticipated. The discrepancies may be explained by non unity correlations between purebred and crossbred progeny, sites of measurement and age, or that the EBVs were under-estimated.

INTRODUCTION

Genetic improvement in growth and leanness of the Australian lamb industry is being assisted by LAMBPLAN (Banks 1990). Terminal sire rams are measured for growth and leanness and estimated breeding values (EBVs) are calculated for these traits using an animal model and all associated information (Gilmour and Banks 1992). Ram buyers can use the LAMBPLAN information to assist in making selection decisions based on predicted growth and leanness of the progeny. This paper summarises the results of six experiments where the weight and fat measurements of lambs sired by Dorset rams purchased from two separate studs were recorded. The rams were selected from within each stud to represent a range in weight and fat EBVs.

MATERIALS AND METHODS

The data come from six experiments which were based on six joinings from 1990 to 1993, four in late summer/autumn and two in spring. Ewes and cryptorchids from the 1991 summer joining were grazed separately to provide two experiments and data for the lambs from the summer 1992 and 1993 joinings were combined as the design was similar. All male lambs were made cryptorchids except for the summer 1990 joining when males were made into cryptorchids and wethers. In total there were 4332 lambs involved.

The experiments were based on a group of 1696 Border Leicester x Merino ewes which were randomised at each joining between Cowra and/or Temora Research Stations. In 1990 half the ewes were maidens (born 1989), 527 were 2• year old and parous (born 1988) and the balance were 4 -5 years old. The lambs and their dams during pregnancy were involved in a number of nutrition and management experiments with the sire of the lambs always being considered in randomisation across treatments.

The rams came from two studs which had been selecting for weight and fat for 9 years and the EBVs were derived using the BVEST program (Gilmour and Banks 1992) of the enhanced LAMBPLAN. For the two 1990 joinings, five high (G^+F) and five low (GF^+) lean growth index rams were selected from the one stud from a management group of 198. These rams were joined in two groups for the summer (experiment 1) and spring (experiment 2) matings (Table 1). For the 1991, 1992 and 1993 joinings 20 rams from a second stud where the management group was 170 were used. Four rams were selected to represent each combination of high growth & lean (G^+F^-), high growth & fat (G^+F^+), low growth & lean (G^-F^-), low growth & fat (G^-F^+) and average (G^0F^0) (Table 1). In summer 1991 the ewes were joined in five syndicate ram groups (ewe lambs: expt 3, cryptorchids: expt 4) and in spring 1992 (expt 5) and summer 1992 and 1993 (expt 6) single sire matings were used.

Two of the G^+F^- rams from stud 2 were entered in a Central Progeny Test in 1991 (Banks et al. 1994). Their performance ranked them at 97.9 and 102.0 on the Terminal Sire Index, + 1.37 and 1.30 kg carcase weight EBV and + 1.34 and 0.70 mm GR at constant weight EBV. Thus these rams compared to other rams tested were close to the overall average Terminal Sire Index, but had higher EBVs for weight and fatness. Additionally, two of the G^+F^- rams from stud 1 were used in the summer 1992 joinings to provide a genetic linkage across all sires and years. This showed the best two rams from stud 1 had progeny at slaughter that were 0.4 kg heavier and with GRs 0.6 mm larger (at constant weight) than the average of the G^+F^- progeny group of stud 2.

Table 1. Average growth and fat EBVs and lean growth index for each ram group

	Group	Growth EBV (kg)	Fat EBV (mm)	Lean Growth Index (50:50)
Stud 1	G^+F^-	1.50	-0.22	107.9
	G^-F^+	-0.52	+0.42	92.9
Stud	G^+F^-	+2.50	-0.35	113.2
	G^+F^+	+1.25	+0.60	96.4
	G^-F^-	-1.70	-0.20	97.0
	G^-F^+	-2.60	+0.35	86.6
	G^0F^0	-0.40	-0.05	99.6

[1] Overall group averages changed slightly between each joining because 2 of the rams used in 1991 died and were replaced by 2 similar rams from the same stud and a further 2 rams died before the final joining.

Live weight and fat (GR tissue depth or C fat depth at the final occasion when fat measurements were obtained on all lambs) were analysed independently for each experiment by AOV or a mixed model using REG (Gilmour 1988). The effect of birth type, date and location, dam source, ewe pregnancy feeding treatment and lamb treatment after weaning were fitted before sire group.

RESULTS AND DISCUSSION

The deviations from the mean in live weight of the lambs due to sire group are presented in Table 2. For the first two experiments there were 2.1 and 1.9 kg differences in live weight amongst progeny from the two sire groups. This represents 1.04 and 0.94 kg/ EBV kg for the two lamb groups as the average difference in EB's of the sires was 2.0 kg. The expected increase in lamb progeny live weight at 40 kg is about 0.3 kg/ sire EBV kg, if the correlations between purebred and crossbred performance and between different live weights are assumed to be unity and that each sire produced a similar number of lambs. Individual rams in the syndicate groups siring a disproportionate number of progeny would effect the expected differences. However, if the ram with the highest weight EBV in the high group (3.1 kg) and the ram with the lowest EBV in the low group (-1.8 kg) sired <u>all</u> lambs in their group, the expected progeny weight difference would be about 1.6 kg (2/3 by 1/2 of 4.9 kg), still slightly below our realised difference of about 2.0 kg. If this unlikely joining pattern did occur, the fat difference could be expected to be 0.33 mm (EBVs of highest and lowest were 0.6 mm and -0.4 mm and thus 2/3 by 1/2 by 1.0 mm is 0.33 mm) which was close to what actually did occur (Table 3).

For the progeny of stud 2 the lamb live weight regressions were between 0.10 to 0.43 kg/kg EBV compared to the expected values of about 0.3 kg (Table 2). The largest regression was for ewe lambs from the summer 1991 joining (experiment 4) where syndicate joinings were used. For the single sire joinings from summer 1992 and 1993 (experiment 6) the regression was 0.19 kg/kg.

Table 2. Least square mean live weights, deviation in weight from mean for each sire group and actual and expected regression (•se) of final lamb live weight on sire weight EBV

Stud of sires	One		Two			
Experiment	1	2	3	4	5	6
n	515	274	375	560	327	2281
Live weight (kg)	37.2	41.0	45.3	35.8	36.5	40.2
G^+F^-	+1.05	+0.95	+0.77	+1.03	+1.73	+0.57
G^+F^+			-0.24	+1.30	+0.20	+0.23
G^-F^-			+0.72	-1.19	-0.77	-0.09
G^-F^+	-1.05	-0.95	-0.22	-0.54	+0.50	-0.43
G^0F^0			-1.05	-0.60	-1.63	-0.28
Regression (kg/kg EBV)	1.04[1]	0.94[1]	0.10• 0.18[2]	0.43•0.11[2]	0.26•0.15	0.19• 0.09
Expected regression	0.31	0.34	0.37		0.30	
				0.30		0.33

[1] Two groups. [2] Five groups.

Mean fat levels and deviations for the lamb progeny of the various sire groups for the six experiments are presented in Table 3. The differences in fat depth between the two progeny groups in experiments 1 & 2 were 0.26 mm and 0.40 mm which represent 0.41 and 0.61 mm/ EBV mm respectively whereas the expected values are 0.27 and 0.34. The regressions of lamb fat depth on sire EBV for experiments 3 to 6 range from 0.62 to 1.05 with the corresponding expected values, assuming unity correlations, ranging from 0.30 to 0.38.

Table 3. Least square mean GR[1] (mm) , (adjusted to live weight at occasion of fat measurement), deviation in GR from the mean for each sire group and actual and expected regression of GR on sire fat EBV

Stud of sires	One		Two			
Experiment	1	2	3	4	5	6
Weight (kg)	32.4	41.1	45.3	35.8	36.5	44.6
Fat: GR (mm)	5.9	9.2	10.6	7.8	9.7	10.8
G^+F^-	-0.13	-0.195	-0.56	-0.35	-0.18	-0.26
G^+F^+			+0.30	+0.57	+0.12	+0.57
G^-F^-			-0.39	-0.83	-0.30	-0.75
G^-F^+	+0.13	+0.195	+0.59	+0.49	+0.24	+0.37
G^0F^0			+0.06	+0.11	+0.12	+0.07
Regression (mm/mm EBV)	0.41[2]	0.61[2]	1.05• 0.38[3]	0.79•0.19[3]	0.62•0.37	1.05•0.43
Expected regression	0.27	0.34	0.38	0.30	0.30	0.37

[1] Fat measurements were tissue depth at the GR site on the carcase (experiments 3, 4 & 6) or fat depth at the C site by 3.0 (experiments 1, 2 and 5).
[2] Two groups. [3] Five groups.

The differences between the actual and expected progeny group differences may result from uneven numbers of progeny per sire in each group (experiments 1 to 4), non unity correlations between fat measurements at different ages and sites, and/or between purebred and crossbred performance. The selection of the rams may have changed the correlations between C fat depth, which is measured on the rams, and GR tissue depth measurements which are used for the EBVs. LAMBPLAN uses a constant C: GR ratio of 1: 3. The error associated with fat measurement is also high. Another possible explanation for the large differences is that the sire EBVs were underestimated by forcing them close to zero as a BVEST response to data with a possible high level of error. The rams from the first and second stud were measured respectively at an average of 300 and 244 days of age when they were 67.3 and 54.6 kg and had an average C fat depth of 4.58 and 2.87 mm. Thus the weights were below and above, and age was lower than the 60 kg and 12 months when LAMBPLAN EBVs are estimated, but they are still within the recommended limits. However, it has been shown that after 5 months of age that the variability in fat percentage does not increase as fat increases (Bennett et al. 1988).

This is one of very few experiments which have examined the pure-bred: cross-bred correlation, and from these results and traits it appears to be high. This supports using pure-bred data to make genetic change in that it will produce the anticipated results in cross-bred progeny. The variation in progeny performance that occurs between individual sires is also highlighted as is the question 'what do 12 month pure-bred EBVs really mean'.

CONCLUSION

These experiments confirm that selecting terminal sires on LAMBPLAN EBVs for high weight and low fat will result in heavier and leaner crossbred progeny and as such demonstrate to stud breeders and lamb producers the value of selecting rams on EBV which will assist the adoption of LAMBPLAN. Overall the results were greater than those predicted, especially for fat. The predicted values assume that correlations between ages, sites of measurement for fat, and purebred and crossbred performance are unity. However, selection for growth and/or fat may have changed these correlations over time. There may be a need for greater effort to improve accuracy of raw data used to generate fat EBVs and a level of accuracy needs to be associated with all EBVs.

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