

MULTIPLE BIRTHS LIMIT THE ADVANTAGE OF USING HIGH GROWTH SIRES

K.R. Kelman^{1,2}, C.L. Alston³, D.W. Pethick^{1,2} and G.E. Gardner^{1,2}

¹ Australian Cooperative Research Centre for Sheep Industry Innovation, Armidale, New South Wales, Australia

² School of Veterinary and Life Sciences, Murdoch University, Murdoch, Western Australia, Australia

³ School of Mathematical Sciences, Queensland University of Technology, Brisbane, Queensland, Australia

Abstract – The Australian lamb industry uses Australian Sheep Breeding Values for increased post weaning weight (PWWT) to select for progeny with increased live weight. This effect is moderated by lamb nutrition. As lamb birth-type and rear-type impact the nutritional status of lambs it was hypothesized that the weight difference at 150 days between the progeny from high and low PWWT sires would be smaller in multiple birth progeny than single born lambs. Weight data totaling 164,797 observations was collected from 17,525 lambs across eight sites and five years of the Sheep Cooperative Research Centre Information Nucleus Flock. A Bayesian random regression model was fitted to the live weight data to predict live weight at 150 days for each lamb. These weights were then analysed in a linear mixed model to determine the production and genotypic factors, including sire PWWT, which influence lamb weight at 150 days. In line with the hypothesis, the weight of born and raised singles, twins and triplets at 150 days increased on average by 9.66, 6.90 and 3.68kg across the 23kg sire PWWT range ($P < 0.05$) confirming that multiple births limit the full expression of weight potential.

Key Words – Breeding values, Growth, Lamb

• INTRODUCTION

Lamb growth rates are of significant economic importance in the sheep industry as they enable calculation of accurate age estimates for lambs to reach target slaughter weights and therefore underpin management and feeding strategies. The Australian lamb industry uses Australian Sheep Breeding Values for increased post-weaning weight (PWWT) to select for progeny with increased growth and live weight. However, these effects are moderated by nutrition with one study showing that the live-weight-gain advantage in progeny from high PWWT sires was more than 5-fold greater in lambs on a high plane of nutrition compared to those on a low plane of nutrition [1]. As lamb birth-type and rear-type also impacts the nutritional status of lambs, both in utero and pre weaning, it may reduce the full expression of growth potential. Therefore we hypothesise that the difference in weight at 150 days between the progeny from high and low PWWT sires will be smaller in multiple born and raised lambs than single born lambs.

• MATERIALS AND METHODS

Weight data was collected from 17,525 lambs across eight sites and five years of the Sheep Cooperative Research Centre Information Nucleus Flock. Lambs were weighed at intervals throughout their grow-out period, resulting in 164,797 observations. A Bayesian method was used to fit a random regression linear mixed model to the live weight data with fixed effects (interacted with a cubic polynomial for age) for site, year, gender, birth type-rear type, age of dam, sire type, dam breed within sire type. Random terms included sire, dam by year and animal identification, each interacted with a cubic polynomial for age. Within this model sire PWWT, and post weaning c-site fat depth and eye muscle depth breeding values (interacted with a cubic polynomial for age) were included as covariates. This model was used to calculate the weight at 150 days (post weaning) which was then analysed in a linear mixed model of similar structure, excluding age. Birth type-rear type combinations were represented

numerically with single born and raised lambs represented as 11 through to triplet born and raised lambs represented as 33.

• RESULTS AND DISCUSSION

The difference in weight at 150 days between the progeny from high and low PWWT sires varied between different birth type-rear type combinations. The differences were 9.66, 8.51, 6.90, 5.52, 5.98 and 3.68kg for the birth type-rear type combinations 11, 21, 22, 31, 32 and 33 respectively. On average across all of these groups the progeny of sires with the highest PWWT breeding value were 6.56kg heavier than the progeny of sires with the lowest PWWT breeding value ($P < 0.05$).

This effect was moderated by lamb birth-type and rear-type with lambs born and raised as singles having the largest weight response to selection for an increased PWWT while triplet born and raised lambs had the smallest (Table 1). When the magnitude of these responses was compared to the average weight of the respective birth type-rear type combinations single born and raised lambs had the largest weight response with a weight difference of 26% between low and high PWWT sires. Conversely triplet born and raised lambs had the smallest weight response with a weight difference of 16% between low and high PWWT sires.

Table 1 Birth type-rear type least squared means for predicted weights at 150 days and regression coefficients for the relationship between birth type-rear type and sire PWWT breeding value

Birth type – rear type	Least Squared Mean	PWWT Coefficient
11	37.69 ± 0.66	0.42 ± 0.04
21	35.41 ± 0.66	0.37 ± 0.05
22	32.79 ± 0.66	0.30 ± 0.04
31	34.44 ± 0.71	0.24 ± 0.08
32	31.33 ± 0.68	0.26 ± 0.05
33	29.26 ± 0.69	0.16 ± 0.05

This aligns well with our hypothesis that the difference in weight at 150 days between the progeny from high and low PWWT sires would be smaller in multiple born and raised lambs than single born lambs. Nutritional restriction in utero has previously been shown to impact birth weight with twin lambs 23% lighter than single lambs at birth [2]. As multiple birth lambs are nutritionally restricted in utero and after birth until weaning this may explain the greater expression of PWWT potential by single born and raised lambs.

Single born lambs had the greatest weight response, increasing in weight by almost half a kg for every unit of sire PWWT breeding value. In contrast, in utero restriction has a depressive effect on the full expression of the sire PWWT effect. This is evidenced by an 80% greater weight response in single born and raised lambs compared to triplet born then single raised lambs, which only experience nutritional restriction in utero.

Nutritional restriction pre weaning also depresses the full expression of the sire PWWT effect. Within multiple birth types, there was a trend toward an increased weight response when lambs were raised as singles, with the weight response of triplet born then single raised lambs being 50% greater than triplet born and raised lambs. Lambs are known to experience a period of compensatory growth when nutritional restriction is lifted [3], in this case the triplet lambs are restricted in utero but not between birth and weaning when they are raised as singles, where they experience an increased weight response to selection for increased PWWT, although not as great as lambs both born and raised as singles.

- CONCLUSION

The expected weight and growth performance of progeny from high PWWT sires should be tempered by knowledge of lambing percentages. Additionally, while multiple birth lambs from high PWWT sires will attain a greater adult weight than lambs from low PWWT sires it will take them longer to reach target weights than single born lambs, resulting in an increased cost of finishing these lambs.

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