EFFECT OF PRE-WEANING ENVIRONMENT ON THE WOOL PRODUCTION AND LIVESTOCK OF MERINO SHEEP

G.D. DENNEY*, K.J. THORNBERRY* and A.J. WILLIAMS*

SUMMARY

Groups of ewes in early pregnancy were dispatched from a flock with similar genetic and environmental background to 14 commercial flocks in central New South Wales to raise their lambs.

Average live weight of the progeny at birth and weaning varied among the flocks over a range of 0.7 kg and 6.9 kg respectively. At three months of age the progeny of all groups were weaned and returned to the Agricultural Research Station, Condobolin where they ran together under favourable conditions. At 12 months of age the overall average for live weight was 37.3 kg, for greasy fleece weight 5.00 kg, with variation over a range of 7.2 kg and 1.25 kg respectively.

The persistence of these apparently large early environmental effects on wool production is currently being assessed.

(KEYWORDS: Pre-weaning, grazing environment, Merino, wool production, live weight)

INTRODUCTION

Competitions to compare sheep genotypes (wether trials) have created much interest amongst producers by demonstrating the considerable variation in wool production evident when sheep of different bloodlines are compared in a common environment. The extent to which trials accurately reflect genetic differences depends on the absence of any carry-over effects of previous management and nutrition (Anon. 1980). Sheep normally enter competitions as two tooths, although the range can be from weaning to 24 months of age. However, this is of little consequence as differences in post-weaning environment have only a temporary effect on wool production (Allden 1968a). Competitions are normally run over several seasons to reduce the influences of pre-selection environment but there could be permanent effects arising before weaning that influence lifetime productivity.

Pen studies have shown that when adverse conditions are imposed on lambs from conception to weaning, lifetime wool production is permanently reduced by affecting development of the wool follicle population and by reducing follicle productivity (Schinckel and Short 1961). However, this has not been confirmed by long term grazing experiments for although the adult wool production of progeny has been affected by the severe undernourishment of their mothers in late pregnancy (Everitt 1967), the residual effects of undernutrition in early post-natal life were not significant (Langlands et al. 1984) or persisted for less than two years (Allden 1968a).

This paper reports the early results of an experiment to compare the effects of early environment in commercial flocks on the subsequent adult wool production of medium-Peppin Merino lambs.

MATERIALS AND METHODS

In late February 1983 700 mature medium-Peppin Merino ewes of similar genetic and environmental background were mated to 20 rams of similar breeding at the Agricultural Research Station, Condobolin. The sheep were run in one group to ensure random mating and rams were fitted with mating harnesses to determine time of mating and returns to service. Ewes were assumed pregnant if they failed to return to service within 21 days of their initial mating.

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Groups of 25 pregnant ewes were dispatched at approximately day 45 of pregnancy to run with commercial breeding flocks at 14 locations over the central tablelands and central western slopes and plains of New South Wales. This wide dispersion ensured large variation in both climatic and nutritional environment as the properties varied in many aspects: altitude, total annual rainfall and seasonal incidence, soil type and degree and type of pasture improvement.

Ewes were allocated to their treatment group by stratified randomisation based on live weight and mating date. The latter ensured experimental ewes commenced lambing at the same time as the producer's flock. Experimental ewes remained with commercial flocks until weaning except for a 10-14 day period when they were run separately to allow lambing information to be collected. Apart from this period they were treated as part of the producer's own flock and managed accordingly.

Information on liveweight change rate was collected only at times of biological and physiological importance to avoid disturbing the producer's breeding flock. These coincided with day 100 of pregnancy, birth, marking and weaning. Experimental lambs were weaned in November 1983 at approximately 90 days of age and returned to a common environment (Agricultural Research Station, Condobolin) where they were run together. At 12 months of age (August 1984) the experimental progeny were shorn and information was collected on total greasy fleece weight and starved liveweight.

Statistical analysis was by the method of least squares as the number of observations varied between groups and were disproportionate. Twin born sheep that were subsequently raised as singles were excluded from the analysis. The results presented are means adjusted for sex and birthtype.

RESULTS

The experiment started in the midst of drought with all co-operators except one (Group 12) finding it necessary to handfeed their sheep for survival. Fortunately widespread rains fell in late April 1983 which allowed establishment of pastures and forage crops, mild conditions and continuing rain gave enough forage by mid-May 1983 to allow all hand feeding to stop. Adequate forage was then available over late pregnancy and lactation. The exception was on the eastern tablelands (Group 2) where pasture availability remained very low until mid-spring when warmer temperatures allowed rapid growth at a time when pastures on many properties on the slopes and plains were drying off.

Weaners returned to good dry pasture conditions at Condobolin which improved over summer due to heavy rains. May and June 1984 were very dry and a shortage of feed during these months was not relieved until July.

Although the average live weights of all groups were similar at dispatch, the averages of groups of ewes bearing single lambs covered a range of 11.8 kg by day 100 of pregnancy. Differences between groups \( (P < .05) \) continued to be observed with the range in ewe liveweight post-lambing, at marking and at weaning being 13.9 kg, 10.3 kg and 12.6 kg respectively. Over late pregnancy average maternal live weight gain for ewes bearing single lambs varied from -7.4 kg to 8.2 kg between groups. Maternal liveweight gain over lactation for ewes raising single lambs varied from -9.4 kg to 3.0 kg.

The average number (17.2 ± .8) and percentage of males (49.8 ± .04) and single born (78.9 ± .04) progeny varied between groups, however analysis was possible by the method of Least Squares. Significant differences \( (P < .01) \) were observed between groups of progeny in predicted live weight at birth, weaning and 12 months of age, and greasy fleece weight (Table 1). Although average group birth date

varied over 40 days, it was not significant when used as a covariate in the analysis of live weight and greasy fleece weight. Growth rate from birth to weaning averaged 149 g/day but varied from 87 to 204. Rank correlations of greasy fleece weight with weaning weight and 12 months fleece-free weight (Spearman's coefficient of rank correlation, $r_s$; Steel and Torrie, 1960) were .87 and .75 respectively ($P < .01$). However, in a covariance analysis 12 month fleece-free live weight removed only a small, although significant, proportion of between group variation. The range of group least square predicted means for greasy fleece weight was reduced from 1.25 to 1.01 kg but group ranking was very similar ($r_s = .93$, $P < .01$).

Table 1 Least square adjusted means for birth, weaning and 12 month liveweights, with 12 month greasy fleece weight of progeny reared at different locations

<table>
<thead>
<tr>
<th>Group</th>
<th>Location</th>
<th>Birth $^a$</th>
<th>Weaning $^b$</th>
<th>12 months $^b$</th>
<th>Greasy fleece weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Orange</td>
<td>4.77</td>
<td>21.49</td>
<td>37.73</td>
<td>5.42</td>
</tr>
<tr>
<td>2</td>
<td>Wallerawang</td>
<td>4.51</td>
<td>20.21</td>
<td>38.39</td>
<td>4.88</td>
</tr>
<tr>
<td>3</td>
<td>Canowindra</td>
<td>4.74</td>
<td>18.99</td>
<td>35.63</td>
<td>4.91</td>
</tr>
<tr>
<td>4</td>
<td>Forbes</td>
<td>4.76</td>
<td>18.65</td>
<td>38.94</td>
<td>4.95</td>
</tr>
<tr>
<td>5</td>
<td>Grenfell</td>
<td>4.52</td>
<td>22.29</td>
<td>40.79</td>
<td>5.55</td>
</tr>
<tr>
<td>6</td>
<td>Grenfell</td>
<td>4.42</td>
<td>18.94</td>
<td>38.01</td>
<td>5.14</td>
</tr>
<tr>
<td>7</td>
<td>Trundle</td>
<td>4.36</td>
<td>15.45</td>
<td>35.41</td>
<td>4.64</td>
</tr>
<tr>
<td>8</td>
<td>Wellington</td>
<td>4.21</td>
<td>22.35</td>
<td>38.78</td>
<td>5.70</td>
</tr>
<tr>
<td>9</td>
<td>Young</td>
<td>4.12</td>
<td>17.91</td>
<td>40.54</td>
<td>5.52</td>
</tr>
<tr>
<td>10</td>
<td>Young</td>
<td>4.20</td>
<td>17.32</td>
<td>34.84</td>
<td>4.51</td>
</tr>
<tr>
<td>11</td>
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<td>18.31</td>
<td>34.75</td>
<td>4.82</td>
</tr>
<tr>
<td>12</td>
<td>Gilgandra</td>
<td>4.33</td>
<td>16.00</td>
<td>36.27</td>
<td>4.78</td>
</tr>
<tr>
<td>13</td>
<td>W. Wyalong</td>
<td>4.46</td>
<td>20.56</td>
<td>37.80</td>
<td>5.15</td>
</tr>
<tr>
<td>14</td>
<td>W. Wyalong</td>
<td>4.12</td>
<td>17.12</td>
<td>33.55</td>
<td>4.45</td>
</tr>
</tbody>
</table>

**Average SE (diff.)** .18 .88 1.41 .22

*a* - lambs weighed within 24 hours of birth  
*b* - sheep weighed after being denied feed and water overnight

**DISCUSSION**

The effects of pre-weaning environment in this experiment are large; the maximum difference in predicted live weight and greasy fleece weight at 12 months of age was 17.8% and 21.9% respectively. The latter fell to 18.7% when 12 month liveweight was used in a co-variate analysis suggesting that factors other than weight per se are important in these differences in wool production.

Few experiments have studied wool production following pre-partum and/or pre-weaning nutrient deprivation under grazing, although there have been many post-weaning studies (Donald and Allden 1959; Giles 1968; Allden 1968b). Everitt (1967) imposed high and low planes of nutrition on grazing ewes over pregnancy. Nutritional stress over the first 90 days of foetal life caused no residual effects on the mature follicle population or wool production. Nutritional deprivation over late pregnancy reduced adult liveweight and diminished wool production at 33 months of age by 8.2%. Langlands et al. (1984) studied the overall productivity of grazing ewes over their reproductive life of eight years. Although they had been raised under two grazing treatments imposed from
conception to weaning and from weaning to 15 months of age, their adult body size and clean wool production were unaffected. However, a permanent change in the components of adult wool production was indicated as ewes raised under high pre-weaning stocking rates showed increases in fibre diameter and staple length, averaging 2.9% and 4.2% respectively, compared to sheep raised under low stocking rates.

In a review on nutrient deprivation and subsequent productivity Allden (1970) criticised early experiments for their short duration and suggested that long term grazing experiments were needed to confirm that undernutrition in early life permanently influenced the wool follicle population and wool production.

This experiment shows that differences in wool production from sheep raised under different commercial conditions is important over at least the first year of life, confirming reservations as to the usefulness of production trials for the comparison of genotypes. However, continued monitoring is necessary to determine the magnitude and permanency of the effects of early environment on wool production for if these effects persist for more than 12 months of age subsequent losses become a more important proportion of lifetime production and assume great importance to commercial wool growing. Producers may have to consider a permanent loss of wool production as a consequence of inadequate nutrition of their breeding flocks.

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REFERENCES