THE CORRECTION FOR AGE AND TYPE OF BIRTH EFFECTS ON WEANING WEIGHT IN SHEEP

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Summary

The effects of age at weaning and type of birth on weaning weights were assessed amongst 1398 lambs of three breeds at Cowra and Glen Innes over two years. There was large variation in regression coefficients for weight on age at weaning between breed, sex, type of birth, location and year subclasses, although all were positive. Similar regressions for data pooled within years and locations were all large, positive and highly significant (P < 0.001). Correction of the weaning weights for age considerably reduced all regression coefficients.

Single lambs were heavier than twin lambs at weaning, though the variation in the magnitude of the difference was considerable, and ranged from 0.5 kg to 5.6 kg or 2.4 per cent to 25.6 per cent of the weight of the twins. A significant breed x type of birth interaction was present as the effect of type of birth in the crossbred lambs was twice that in the Merino lambs.

Corrections to weaning weights of lambs for the effects of age and type of birth are required if selection for weaning is to be efficient. The results of the present trial indicate that the magnitude of these effects varies considerably between breeds, years and locations. It is concluded that standard correction factors for these effects would be inadequate for all flocks involved in performance recording in New South Wales.

I. INTRODUCTION

Selection of at least some animals for breeding at the time of weaning has the advantage of allowing the disposal of cull animals at an early age, and the early mating of selected animals with an associated reduction in the generation interval. Environmental factors, such as age, type of birth and age of dam, have been shown to have considerable effects on weaning weight in sheep (see Bowman 1966), and corrections for these factors are required if selection is to be efficient (Shelton and Campbell 1962; Pattie 1965a). In addition, selection based on uncorrected weaning weight may tend to discriminate against twins. This was shown by Pattie (1965b) with 20 per cent more twin ewes and 100 per cent more twin rams being selected in low (Weight minus) than high (Weight plus) weight selection flocks when uncorrected weaning weight was used. Since positive responses to selection for twinning can be expected (Turner et al. 1962), selection for uncorrected weight at weaning will reduce the genetic potential for twinning and overall reproductive performance in the flock.

To enable breeders in the prime lamb industry to use measured performance in their selection programmes, the New South Wales Department of Agriculture has implemented a performance recording scheme in which weaning weights are

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corrected for effects due to age, type of birth and age of dam. In this paper the effects of age at weaning and type of birth on weaning weights of lambs of three breed types bred in each of two years in two locations are examined. The dams were all five and six years old, consequently the age of dam effect was not considered.

II. MATERIALS AND METHODS

(a) Animals and locations
The weaning weights examined were of 1398 lambs born and reared at Cowra and Glen Innes Agricultural Research Stations in 1964 and 1965. The lambs were from a-flock of 450 five and six-year-old Peppin Merino ewes at each location. The ewes at each location were divided into three groups of 150; each group was joined to either Peppin Merino, Border Leicester or Dorset Horn rams to lamb over a period of five to six weeks in August-September.

Improved pastures were available for grazing at each location. Drought conditions prevailed in 1965, and supplementary feeding was necessary from mid-February to September at Cowra and June to November at Glen Innes.

(b) Records
The lambs were ear-tagged within 24 hours of birth, and breed type, date of birth, weight, sex and type of birth were recorded. All the lambs at each location in each year were weaned and weighed on the same day, except at Glen Innes in 1964 when the lambs were weaned approximately one month after weighing. The average age at weighing ranged from 2% to 4 months.

(c) Statistical analysis
The regression coefficients for weaning weight on age at weaning were calculated for breed type, sex and type of birth subclasses in each location, each year. Similar regression coefficients were calculated after the data were pooled for breed type, sex and type of birth within locations and years. Regressions for age corrected weaning weight on age were also calculated as for actual weight. The weaning weights of the lambs were corrected to the average age at weaning within location and year by the average gain per day from birth to weaning method of Warwick and Cartwright (1958).

Age corrected weaning weights were examined within each location and sex by least squares analysis with constants estimated for breed type, type of birth, year and the first order interactions. Differences between the subclass means were tested for significance using standard errors calculated from the appropriate variance-covariance matrix.

III. RESULTS

Within subclasses the regression coefficients for weaning weight on age at weaning varied considerably, and ranged from 0.02 to 0.34 with 69 per cent of the coefficients being significant. The regression coefficients for the pooled data were all large, positive and highly significant \((P < 0.001)\) as shown in Table 1.

The age corrections applied to the weaning weights considerably reduced the value of the regression coefficient within each subclass. The range in the regression
coefficients however, remained large, from -0.17 to 0.13, although only 12 per cent were significantly different from zero. The regressions for age corrected weaning weight on age for the pooled data (Table 1) were small and not significant except at Glen Innes in 1964.

Single lambs were heavier at weaning than twin lambs within all the breed, sex, year and location subclasses, with the differences being significant (P < 0.05) in 84 per cent of the subclasses. Mean differences between singles and twins, together with the ranges and percentages are shown in Table 2. The type of birth effect for the Merino lambs was only half that for each of the crossbred types, which resulted in the breed x type of birth interaction being significant (P < 0.05) in all analyses.

<table>
<thead>
<tr>
<th>Location</th>
<th>Cowra 1964</th>
<th>Cowra 1965</th>
<th>Glen Innes 1964</th>
<th>Glen Innes 1965</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of lambs</td>
<td>352</td>
<td>284</td>
<td>413</td>
<td>349</td>
</tr>
<tr>
<td>Regression for actual weaning weight (kg/day)</td>
<td>0.24†</td>
<td>0.15†</td>
<td>0.25†</td>
<td>0.18†</td>
</tr>
<tr>
<td>Regression for corrected weaning weight (kg/day)</td>
<td>0.04</td>
<td>-0.02</td>
<td>-0.05†</td>
<td>-0.04</td>
</tr>
</tbody>
</table>

* P < 0.05
† P < 0.001

IV. DISCUSSION

The large variation between subclass regression coefficients for weaning weight on age at weaning was to be expected, as there was considerable variation in subclass numbers with an age range of the lambs of approximately 40 days. These results are in accord with those of Shelton and Campbell (1962). The regression coefficients for the pooled data were all highly significant (P < 0.001) although they varied between locations and years depending on the growth rate of the lambs. The range in weaning weights due to age over a 6 weeks lambing period calculated from these regressions was 6 to 10.5 kg or 26 per cent to 41 per cent of the mean weaning weight. Consequently some form of correction to the weaning weights was required for the effect of age at weaning.

When age corrections were applied to the weaning weights the regression coefficient within each subclass was reduced, although considerable variation between the coefficients remained. The regression coefficients for the pooled corrected weaning weights were small, and except at Glen Innes in 1964 were not significant. Thus the age correction used eliminated a considerable portion of the variation in weaning weight due to age.

TABLE 2

Mean differences between singles and twins in age corrected weaning weights

<table>
<thead>
<tr>
<th>Breed</th>
<th>Merino</th>
<th>Border Leicester x Merino</th>
<th>Dorset Horn x Merino</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td>Ewe</td>
<td>Wether</td>
<td>Ewe</td>
</tr>
<tr>
<td>Single (S) —</td>
<td>1.7</td>
<td>1.7</td>
<td>3.5</td>
</tr>
<tr>
<td>twin (T) (kg) *</td>
<td>(1.1–2.2)</td>
<td>(0.5–2.5)</td>
<td>(3.0–4.1)</td>
</tr>
<tr>
<td>(S-T) x 100/T*</td>
<td>8.3</td>
<td>8.3</td>
<td>16.7</td>
</tr>
<tr>
<td>(4.6–10.7)</td>
<td>(2.4–12.1)</td>
<td>(11.6–19.5)</td>
<td>(15.0–25.6)</td>
</tr>
</tbody>
</table>

* Unweighted means over years and locations with range in parenthesis.
The young age of the lambs at Glen Innes in 1964 could explain the significant negative regression for corrected weaning weight on age in this group. The age of the lambs at weighing ranged from 42 to 85 days compared with average ages of 93 to 117 days in the other groups. The lambs younger than approximately 56 days would have been in the transitional ruminant phase of development (Wardrop and Coombe 1961), and consequently less dependent on pasture for their nutrition than the older lambs. As the pasture was deteriorating prior to weighing, the growth rate of the older lambs would have been reduced more than that of the younger lambs. The method of age correction used would have over corrected the older lambs resulting in the negative regression. The use of average daily gain for age correction may also be inadequate when a change in growth rate of the lambs occurs due to a change in seasonal conditions which markedly effects nutrition (McGuirk—unpublished data).

In the present study there was considerable variation between breeds, locations and years for the type of birth effect on weaning weight. However, this variation is within the range reported in the literature (e.g. Shelton and Campbell 1962; Dun and Grewal 1963; and Dawe 1968), and perhaps could be expected considering the different breeds and conditions of nutrition involved in the present study.

A significant breed x type of birth interaction for weaning weight resulted from the difference in weights of single and twin lambs being less in the Merino than in the crossbred lambs. For the Merino lambs, the growth rate to weaning of the singles was 4.1 per cent higher than the twins, and for the crossbred lambs the singles were 11.2 per cent higher. This indicated that the nutrient supply was more limiting to the growth of the crossbred than the Merino twin lambs because of their higher growth requirements. This type of interaction appeared to be negligible in the study reported by Dawe (1968); however the sheep involved were grazed on irrigated pastures.

The effect on weaning weight of age and type of birth of lambs are such that corrections are required if selection for weaning weight is to be efficient. The results from the present study show that the variation in these effects between breeds, years and locations is considerable. Consequently standard corrections for all flocks involved in performance recording throughout New South Wales would not be adequate. Corrections would need to be calculated within individual flocks each year.

V. ACKNOWLEDGMENTS

I would like to thank the Managers and staffs of Cowra and Glen Innes Agricultural Research Station for their assistance in maintenance of the sheep and records; also the Biometrical Branch staff for assistance in analysis of the results.

VI. REFERENCES’