

GROWTH AND WOOL PRODUCTION OF SINGLE AND TWIN-BORN MERINO LAMBS REARED ON A HIGH PLANE OF NUTRITION

J. R. GALLAGHER* and M. K. HILL*

Summary

Single and twin-born Merino lambs of both sexes were provided with "high plane" grazing conditions from birth until 11 months of age in an attempt to minimise any adverse effects of twinning on liveweight gain and wool fibre uniformity and growth.

Mean liveweight approximated 30 kg at 6 months and 40 kg at 11 months of age.

No significantly adverse effects of twinning were observed in either liveweight gain or wool growth rate. Singles and twins were similar in weight and secondary follicle/primary follicle (Sf/Pf) ratio at birth; subsequent Sf/Pf development was not affected by birth-type, and liveweights did not differ at any time. Wool production, measured by mid-side-patch clipping, was not affected by type of birth.

There was also no significant birth-type effect on mean fibre diameter at any period. Twin-born animals were, however, significantly ($P < 0.05$) more variable in fibre diameter than single born animals at birth and at one month of age, though there were no significant differences thereafter.

I. INTRODUCTION

Post-natal growth retardation in lambs may reduce the rate of secondary follicle maturation and, although the ultimate secondary follicle/primary follicle (Sf/Pf) ratio is apparently not affected, the capacity of follicles to produce fibre may be permanently restricted (Schinckel and Short 1961). An earlier report (Schinckel 1955) indicated that adverse post-natal conditions could have an even harsher effect on fleece development, namely, atrophy of a proportion of follicle anlagen present at birth, leading to sub-normal Sf/Pf ratios at maturity.

Even if the maturation and/or productive efficiency of secondary follicles were not affected by post-natal stress, effects of early growth retardation may still be measurable through the effect of animal size on productivity. Thus, although growth depression during the first year of life may be subsequently corrected by compensatory growth, the cumulative production from sheep exposed to an adverse environment may never reach that of better managed individuals (Coop and Clark 1955).

* Department of Livestock Husbandry, University of New England, Armidale, New South Wales.

These reports, combined with frequent demonstrations of pre- and post-natal growth retardation suffered by twin-born relative to single-born sheep (Dun and Grewal 1963), together with demonstrations of reduced production from twins (Turner 1961; Dun and Grewal 1963; Drinan 1968), have important implications for policies aimed at increasing flock fecundity.

Furthermore, if twin-born animals are exposed to an early adverse environment, qualitative as well as quantitative aspects of wool production may suffer. Fibre diameter, the most important determinant of commercial value and processing performance of wool (McMahon and Whiteley 1965), has been reported higher in twin than in single-born sheep (Brown *et al.* 1966). Similarly, variability of fibre diameter, which affects evenness of yarn (Martindale 1945), may also increase under conditions of undernutrition (Short, Fraser and Carter 1958) apparently as the result of differential effects on primary and secondary follicles.

The productivity margin between singles and twins is probably inversely related to environmental conditions, hence improved feeding might be necessary in order to minimise any adverse effects of birth type. In the present study, birth-type effects on liveweight growth, fleece development, wool production, fibre diameter and fibre diameter variability were measured in a group of grazing Merino sheep reared under high-plane conditions of feeding.

II. MATERIALS AND METHODS

(a) Animals

Twenty-eight new born lambs, sired by Merryville (superfine) Merino rams from medium Peppin Merino ewes, were employed. The animals were selected from a large group on the basis of birth type, sex and time of lambing. All lambs were born within a period of a few days in mid-September 1966, and the group was balanced for sex and type of birth. The seven sets of twins involved were of the mixed-sex type. All lambs were docked at 2 weeks of age, but male lambs were not castrated. The lambs were weaned at 16 weeks of age.

From the time of birth until 11 months of age, feed availability was carefully manipulated so as to sustain a high rate of liveweight growth. Summer and winter forage crops (Japanese millet and Algerian oats respectively) were extensively used.

Animals were weighed at birth and at 1, 2, 4, 6, 9 and 11 months of age.

(b) Skin Samples

A 1 cm trephine was used to remove skin samples from the left mid-side position of each lamb at birth and at 1, 2, 6 and 11 months of age. The Sf/Pf ratios were estimated according to the method of Carter and Clarke (1957), the mean of five separate estimates being used in the analyses.

(c) Wool Production

A square, approximately 4 cm² in area, was delineated by tattoo on the left mid-side of each lamb at two weeks of age. At 1, 2, 4, 6, 9 and 11 months of age, wool was harvested from within this area by means of fine-combed "Oster" clippers. Clean dry wool production was measured after scouring as described by Chapman (1960), and overnight drying at 100°C.

(d) Fibre Diameter Measurement

The clean dry wool samples described above, together with a mid-side sample collected at birth, were hand carded, cut into 0.4 mm sections and sub-sampled.

Each sub-sample was mounted in liquid **paraffin** and 100 diameter measurements were taken with the use of a Reichert Lanameter at magnification x 500.

(e) Statistical Analyses

At each sampling time, the effects of birth type and of sex on liveweight, Sf/Pf ratio, fibre diameter and wool growth rate were examined by analysis of variance and, where appropriate, by Duncan's multiple range test.

The effects of birth type and of sex on fibre diameter variability were examined by analysis of variance on transformed chi-square variates.

III. RESULTS

The rate of liveweight growth was regarded as satisfactory during all periods of the study, and the original aim of a mean of 30 kg liveweight at 6 months of age and 40 kg at 11 months of age was largely fulfilled. The liveweight growth curve illustrated in Figure 1a demonstrates a reduction in growth rate during winter but despite this, mean liveweight was significantly increased at each successive weighing time.

Neither birth-type nor sex significantly affected birth weight, but both had a significant effect on post-natal growth rate. Twin-born animals grew significantly faster than singles (127 g/day v. 117 g/day) and rams grew at a faster rate than ewes (134 g/day v. 109 g/day). No interaction between birth-type and sex could be measured in liveweight growth.

Clean wool production (Figure 1b) followed the same pattern as liveweight growth, except for the more pronounced effect of winter. Wool growth rate was not significantly affected by either birth-type or sex, and no interaction was evident. The patches from which the wool samples were clipped steadily increased in size and, in the final period, the original 2 x 2 cm patches were approximately 10 x 10 cm in area.

Mean fibre diameter, though higher (non-significantly) in twins than in singles at birth, was never significantly affected by either birth-type or sex. When all results were pooled, mean fibre diameters were ranked, highest to lowest, as follows:

(Age in months)	0	1	6	4	11	9	2
			—————				
				—————			
					—————		

(Ages not bracketed differ significantly ($P<0.05$) in mean fibre diameter).

Variability in fibre diameter in twin-born animals was significantly higher than that in singles at birth and at one month of age but, thereafter, there were no significant differences. There was no significant effect of sex on variability of fibre diameter at any time. When all results were pooled, variation in fibre diameter declined significantly from birth to one month of age ($P<0.05$), and from one to two months of age ($P<0.05$), but no significant change occurred thereafter.

The Sf/Pf ratio was at no time significantly affected by either birth-type or sex, nor was there evidence of an association between birth weight and the Sf/Pf ratio at birth. The Sf/Pf ratio curve illustrated in Figure 1c demonstrates a rapid rise during the first month of life, followed by a more gradual increase to an asymptote at approximately six months of age.

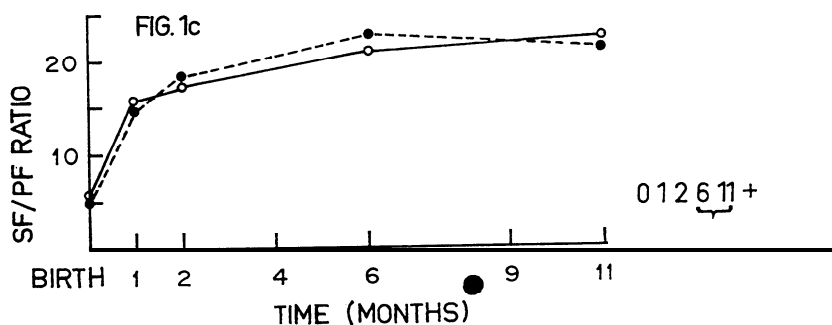
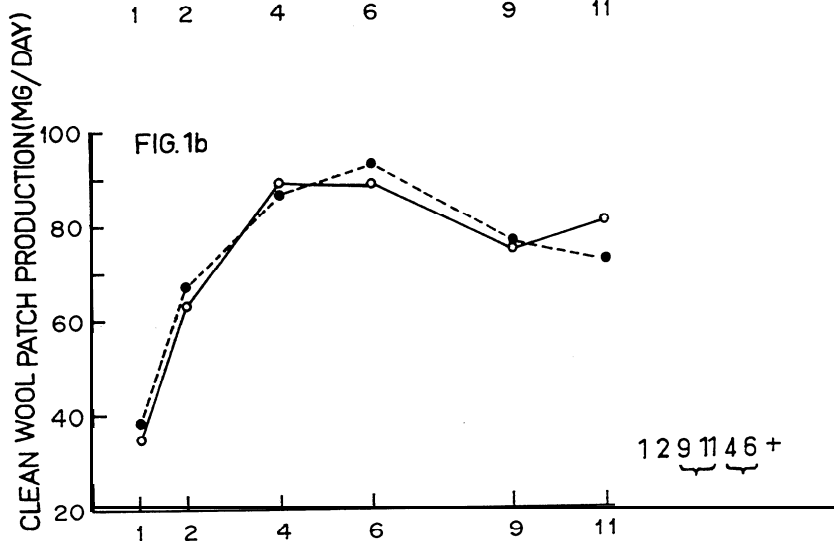
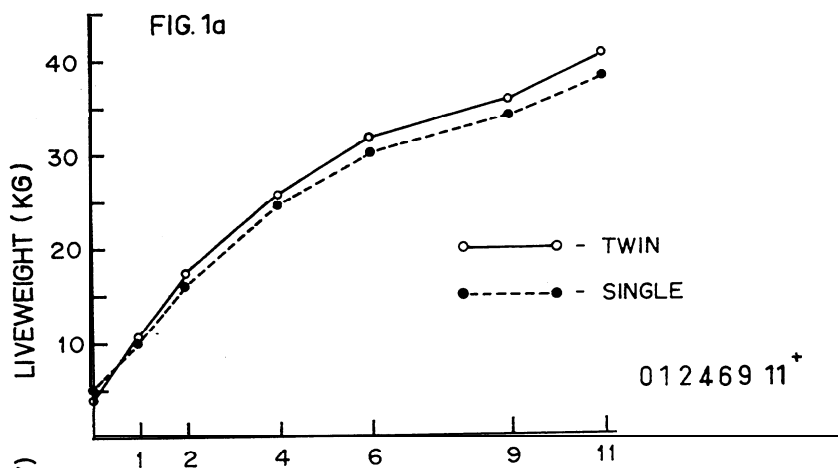


Fig. 1.—Relative performances of single and twin-born Merino sheep. Measurements at each time not bracketed are significantly different ($P < 0.05$)⁺.

IV. DISCUSSION

Disadvantages which may be suffered by twin-born sheep include not only a reduction in birth weight, the Sf/Pf ratio, ability to survive, liveweight gain, wool growth rate and total lifetime productivity but also an increase in mean fibre diameter and variability of fibre diameter.

Dun and Grewal (1963) concluded that twin-born sheep produce from 2 to 8 per cent less clean wool as adults than single-born animals, a margin which, though small, is of some economic significance, even if differences in ability to survive and total lifetime productivity are ignored.

In the present study, the experimental group was provided with adequate nutrition at all times and mean liveweight approached 40 kg at 11 months of age. Under these conditions, no adverse accompaniments of twinning were measured. Singles and twins were born at similar weight with similar Sf/Pf ratios; subsequent Sf/Pf development was not affected by birth type and liveweights did not differ at any time. Wool production, measured by mid-side patch clipping, was similar in singles and twins. Mean fibre diameter was not significantly affected by birth-type and variability of fibre diameter in samples from the two types did not differ after one month of age.

V. ACKNOWLEDGMENTS

The technical assistance of Mrs. B. Richards and Miss Marlene Payne is gratefully acknowledged. Gratitude is also due to the Australian Wool Board for financial support of this study.

VI. REFERENCES

- BROWN, G. H., TURNER, H. N., YOUNG, S. S. Y., and DOLLING, C. H. S. (1966). *Aust. J. agric. Res.* **17**: 557.
- CARTER, H. B., and CLARKE, W. H. (1957). *Aust. J. agric. Res.* **8**: 91.
- CHAPMAN, R. E. (1960). *Animal Res. Lab. Tech. Pap. No. 3. C.S.I.R.O. Aust. App.* **III**.
- COOP, I E., and CLARK, V. R. (1955). *N.Z. Jl. Sci. Tech.* **37A**: 214.
- DRINAN, J. P. (1968). *Proc. Aust. Soc. Anim. Prod.* **VII**: 208.
- DUN, R. B., and GREWAL, R. S. (1963). *Aust. J. exp. Agric. Anim. Husb.* **3**: 235.
- MARTINDALE, J. G., (1945). *J. Text Inst.* **36**: T35.
- McMAHON, P. R., and WHITELEY, K. J. (1965). *III Congres International de la Recherche Textile Laniere, Paris.*
- SCHINCKEL, P. G., (1955). *Aust. J. agric. Res.* **6**: 308.
- SCHINCKEL, P. G., and SHORT, B. F. (1961) . *Aust. J. agric. Res.* **12**: 202.
- SHORT, B. F., FRASER, A. S., and CARTER, H. B. (1958). *Aust. J. agric. Res.* **9**: 229.
- TURNER, H. N. (1961). *Aust. J. agric. Res.* **12**: 974.