

EARLY ENVIRONMENT AS A PERMANENT INFLUENCE ON THE PRODUCTIVE PERFORMANCE OF SHEEP

R. B. DUN*, R. ALEXANDER† and M. D. SMITH†

I. INTRODUCTION

Many experiments have been conducted in Australia comparing the production of sheep breeds and strains. Mathews (19 11) recognised the necessity for comparing sheep born and reared together, to free breed comparisons from the confounding effect of different environments early in life, but in other experiments (Thompson 195 1; Miller and McHugh 1955; Anderson 1958; Pattie and Donnelly 1962) the confounding is present.

Dunlop (1962, 1963) compared five Merino strains in three environments, using "base" (originally purchased) ewes reared in their home studs, and progeny born and reared on his three experimental stations. For wool production, differences between the strains were essentially the same whether base ewes or progeny were compared, but for body size, conformation and fertility this was not so. Dunlop's work thus demonstrates that early environment may affect the comparative performance of different types of sheep. This paper records a further example, from three groups of Merinos run at Trangie, two being subsequently compared again at Condobolin.

II. MATERIALS AND METHODS

(a) Location

Trangie Agricultural Research Station and Condobolin Experiment Farm are on the central western plains of New South Wales. At both stations sheep are run on natural pasture with access to cereal cropping areas and dry land lucerne. Safe stocking rates approximate 0·75 and 0·5 dry sheep per acre at Trangie and Condobolin respectively.

(b) Sheep

Ewes born in three groups of sheep were compared.

(i) Random Peppin

Originating in 1950 from Trangie Stud ewes, of Peppin stock, this flock is bred at random using a large percentage of rams, and acts as control for a number of selection flocks.

(ii) Experimental Pep pin

A breeding flock of 250 had been formed from one year old ewes culled each year from other flocks on the Station. Their origin and production records indicated that their average genetic potential for wool growth was equal to that of Random Peppin. In 1961 these ewes were mated to rams from the Selection Demonstration Flock, which is selected according to a plan stressing high clean

*N.S.W. Department of Agriculture Wool Research Laboratory, Trangie. †N.S.W. Department of Agriculture Experiment Farm, Condobolin.

fleece weight. From the selection differentials of the rams, the lambs (Experimental Peppin Flock) were expected to show relative to Random Peppin the average production levels listed in Table 1.

TABLE 1

The expected percentage advantage in the average production levels of 16 month old ewes from the Experimental Peppin flock, in comparison with Random Peppin.

Greasy Fleece Weight	Yield	Clean Fleece Weight	Staple Length	Crimps per cm	Fold Score	Body Weight Weaning	Body Weight 16 Months
+5	+2	+7	+2	—1	—5	+2	+2

(iii) South Australian

The origin of this flock of strong wool Merinos was described by Dun and Hayward (1962). The strain has a wool producing ability markedly superior to that of the medium wool Peppin (Dunlop 1962; Dun and Hayward 1962).

(c) Management

The Random Peppin and South Australian ewes grazed as part of the Station's breeding flock of 1,200 ewes, which received a supplement of oat-grain during June-July, 1961, because of semi-drought conditions. Lambs were born in August and weaned and shorn at approximately four months of age. The flock of 550 ewe weaners was run at stocking rates varying between one and five sheep per acre, necessitating frequent movement between paddocks.

The 250 cull ewes were run as a separate flock throughout pregnancy and were lambled separately. After weaning, the 150 ewe weaners (Experimental Peppins) grazed at lower stocking rates than the main flock.

After shearing in December, 1962, 100 Experimental Peppin and 54 South Australian one year old ewes were transferred to Condobolin Experiment Farm. Half of each group, chosen at random, were mated to Border Leicester rams in March, 1963.

(d) Production records

Body weights were recorded at 4, 16, 20 and 24 months of age. Skin-fold development was scored after the lambs were shorn in early December, 1961, using photographic standards (Carter 1943). Greasy fleece weight was recorded in December, 1962, and mid-side samples were processed to obtain standard fleece measurements. Greasy fleece weight was recorded for the June shearing at Condobolin, with the ewes carrying seven months' wool.

(e) Statistical analysis

Analyses of variance and multiple range tests were used to assess the significance of differences between group means.

III. RESULTS

Table 2 shows the means and standard errors for production measurements on the three flocks during their growth at Trangie. As expected, there were large differences between the South Australian and Random Peppin flocks in all measurements except weaning weight, where the difference was small and not statistically significant. The Experimental Peppin flock, however, instead of being close to the Random Peppins, was significantly above them and close in performance to the South Australian Flock. The divergence from expectation was especially

TABLE 2

Measurements on South Australian and Peppin Merino ewes grown at Trangie.

Flock	Number of Ewes	Greasy Fleece Weight (kg)	Yield (%)	Clean Fleece Weight (kg)	Staple Length (cm)	Crimps per cm	Fold Score	Body Weight (kg)	
		Mean	7.0	62.0	4.4	11.9	2.4	8.9	4 mth 18.8 16 mth 38.7
South Australian	27	S.E.	±0.1	±0.9	±0.1	±0.3	±0.1	±0.7	±0.6 ±0.6
		Mean	6.4	60.7	3.9	10.1	3.8	12.7	23.2 40.8
Experimental Peppin	50	S.E.	±0.1	±0.6	±0.1	±0.2	±0.1	±0.6	±0.5 ±0.4
		Mean	5.4	55.8	3.0	9.2	3.9	12.7	17.8 35.3
Random Peppin	30	S.E.	±0.1	±0.9	±0.1	±0.1	±0.1	±1.0	±0.6 9.0±

notable for weaning weight and 16 month body weight, where the Experimental Peppins were significantly heavier than the South Australians ($P < 0.01$).

Table 3 gives the greasy fleece weights and body weights measured at Condobolin. The South Australians gave slightly more wool than the Experimental Peppins but the difference was not significant. The advantage in body weight for Experimental Peppins was significant ($P < 0.01$) at both 20 and 24 months of age and remained at a similar level to the difference observed at 16 months (6 %).

IV. DISCUSSION

Nutritional treatments affecting growth between weaning (at four to six months of age) and 12 to 16 months have no permanent influence on body size or wool production (e.g. Coop and Clark 1955; Donald and Allden 1959). Although differential grazing management after weaning could have been responsible for the surprisingly good performance of the Experimental Peppins at 16 months (Table 2) this is unlikely to be the primary factor involved in their continued performance at this level (Table 3).

The work of Schinckel and Short (1961) has shown that a low level of pre-natal feeding can permanently reduce the mature body weight of sheep. They produced a permanent depression of wool production which was primarily associated with a lowered number of wool follicles per sheep. Restriction of feed intake between birth and 16 weeks was also associated with a permanent stunting effect. In this case there was little further permanent restriction on the maturation of the follicle population, but there was an effect on wool production due to smaller fibre weight. Observational work on the productivity of sheep born in

TABLE 3

Measurements on South Australian and Peppin ewes pastured at Condobolin between 16 months and 24 months of age.

Flock	Number of Ewes	Greasy Fleece Weight (7mth. wool) (kg)	Body Weight (kg)	
		Mean	20 mth	24 mth
South Australian	27	S.E.	43.8	52.0
		Mean	±0.1	±0.7 ±0.8
Experimental Peppin	50	S.E.	47.6	55.0
		Mean	±0.1	±0.5 ±0.6

multiple births (review by Dun and Grewal 1963) has shown that a permanent depression of size and wool production can be produced in the field.

Differences in pre-lambing and post-lambing nutrition are the likely explanation of the present observations, especially considering the management history of the flocks and the striking difference in growth to weaning. In this case, the sheep which were stunted to weaning were not given equal nutritional opportunity until after they were 16 months old. If permanent stunting is produced by differential feeding to four months of age, then it is logical to think that carrying the treatment through for another 12 months would enhance the effect.

These results emphasize the doubtful validity of conclusions drawn from breed comparisons where the groups have been influenced in their early growth by different environments and/or different management systems.

V. ACKNOWLEDGMENTS

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