FIELD OBSERVATIONS ON THE DAILY MILK INTAKE OF MERINO LAMBS IN SEMI-ARID TROPICAL QUEENSLAND

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SUMMARY

The milk intakes of lambs were measured over 15 hours each day when the ewes grazed indigenous pasture, or were fed various rations, at Longreach in central-western Queensland. The results indicated that the milk production of Merino ewes can be influenced by nutrition before and after lambing, and that large variations occur in the lamb's milk intake, both daily and at different times of the day.

I. INTRODUCTION

The short growing period characteristic of pasture in semi-arid areas produces marked fluctuations in the amount and quality of the forage available to sheep and it was considered that this may influence milk production. The work described in this paper was commenced in 1950 with an attempt to measure milk production of ewes grazing indigenous pasture in the Longreach district in central-western Queensland. However, because low stocking rates characteristic of pastoral conditions made it difficult to determine milk production, the ewes in subsequent observations conducted in 1951 and 1952 were confined and fed a standard ration. In addition, an experiment was conducted in 1952 when the ewes were fed rations chosen to make their liveweight changes simulate those often recorded under field conditions in a semi-arid environment.

II. MATERIALS AND METHODS

Peppin strain Merino ewes between 3 and 5 years old were used in these observations, which were made between September and November in 1950, 1951 and 1952.

The ewes lambed under surveillance and were then brought to the sheep yards. When the lambs were about 24 hours old they were separated from their mothers from 6.0 a.m. to 9.0 p.m. each day. Because of the high temperatures and aridity of the air, the lambs were allowed to suck every 3 hours, i.e.

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at 9.0 a.m., 12 noon, 3.0 p.m., 6.0 p.m. and 9.0 p.m., and they were weighed before and after sucking. For the purpose of this paper the term "daily milk intake" is used to describe that measured between 6.0 a.m. and 9.0. p.m.

The lambs were weighed on a clockface scale graduated in ounces. The ewes were weighed on a clockface scale graduated in $\frac{1}{2}$ lb.

Ewes that bore single lambs were used in the experiments and the ewes and lambs were identified by numbered ear-tags. In 1950 the ewes were allowed free grazing between sucking periods and at night, and were not offered any supplementary food. During observations in 1951 and 1952, the ewes were confined in yards after lambing and except when the rations were deliberately changed were fed each day on lucerne hay and compressed "nuts" in quantities calculated to provide 3·75 lb digestible crude protein (D.C.P.) and 10 lb starch equivalent (S.E.) per head per week.

In the experiment where the rations were varied, which was also conducted in 1952, 24 ewes were stratified according to their age and liveweight after lambing, and were then allotted at random to one of four groups. The liveweight of each ewe was recorded once a week for the duration of the experiment and the ewes were fed on lucerne hay and concentrates, estimated to provide the following nutritional regimens:

High-High 3.0 lb D.C.P. and 12·0 lb S.E. per week for 6 weeks.

High-Low 3·0 lb D.C.P. and 12·0 lb S.E. per week for first 3 weeks and 1·2 lb D.C.P. and 5·0 lb S.E. for next 3 weeks.

Low-High 1·2 lb D.C.P. and 5·0 lb S.E. per week for first 3 weeks and 3·0 lb D.C.P. and 12·0 lb S.E. for next 3 weeks.

Low-Low 1·2 lb D.C.P. and 5·0 lb S.E. per week for 6 weeks.

The bodily condition of the ewes varied owing to the different seasonal conditions that prevailed in each year. In 1950, "effective rain", based on a rainfall/evaporation ratio of 0·3 (Farmer, Everist, and Moule 1947), fell during the two months preceding mating and during the 3rd, 4th and 5th months of gestation. In consequence, there was an abundance of green feed at and following lambing and the ewes were in good bodily condition.

In 1951, "effective rain" fell during the month preceding mating, but there was no rain during either the gestation or the lambing. As a result, the only forage available was dry and the ewes were in poor condition.

In 1952, "effective rain" fell during the month preceding mating and during the second month of gestation, and although the feed was dry the ewes, which were lean at lambing time, were quite strong.

III. RESULTS

(a) Milk Intake at Different Times of the Day

In each year the general patterns of milk intake for the 21-day period beginning the day after birth were similar. The midday intake, which was the lowest in each year, was significantly less than the maximum intake at 9.0 p.m. Mean intakes at different times of the day for 1952 are shown in Table 1.

TABLE 1

MEAN MILK INTAKES OF 4 SINGLE LAMBS AT VARIOUS TIMES OF THE DAY—1952

Time	Milk Intake (oz)	Remarks
9.0 a.m.	5·0	9.0 p.m. higher than noon ($P < 0.001$)
12 noon	4·3	9.0 p.m. higher than 6.0 p.m. ($P < 0.01$)
3.0 p.m.	4·9	9.0 a.m. and 3.0 p.m. higher than noon ($P < 0.05$)
6.0 p.m.	4·4	
9.0 p.m.	5·5	

(b) Milk Intake During the First Few Weeks

In all observations milk intakes followed similar trends during the first two weeks, rising rapidly to reach an early peak, and then declining, as shown in Figure 1. In each year large daily fluctuations occurred in measured intake; there were also substantial differences between the total intakes measured in each year.

(c) Liveweight Changes During the Day

The mean changes in liveweight of the lambs during the day for the first 20 days of life in the observations in 1951 and 1952 are shown in Table 2. These are based on the weights of the lambs before each sucking period.

TABLE 2

MEAN CHANGES IN LIVEWEIGHT OF LAMBS AT DIFFERENT PERIODS OF THE DAY DURING THE FIRST 20 DAYS OF LIFE—1951 AND 1952

Time	Net Increase in Liveweight (oz)	
	1951 5 lambs	1952 4 lambs
6.0—9.0 a.m.	−1·5	−2·3
9.0—12 noon	+0·5	+2·0
Noon—3.0 p.m.	−0·7	−0·5
3.0—6.0 p.m.	+0·1	+0·2
6.0—9.0 p.m.	+0·7	−0·4
Overnight	+9.0	+9·0
Total daily gain	+8·0	+8·0

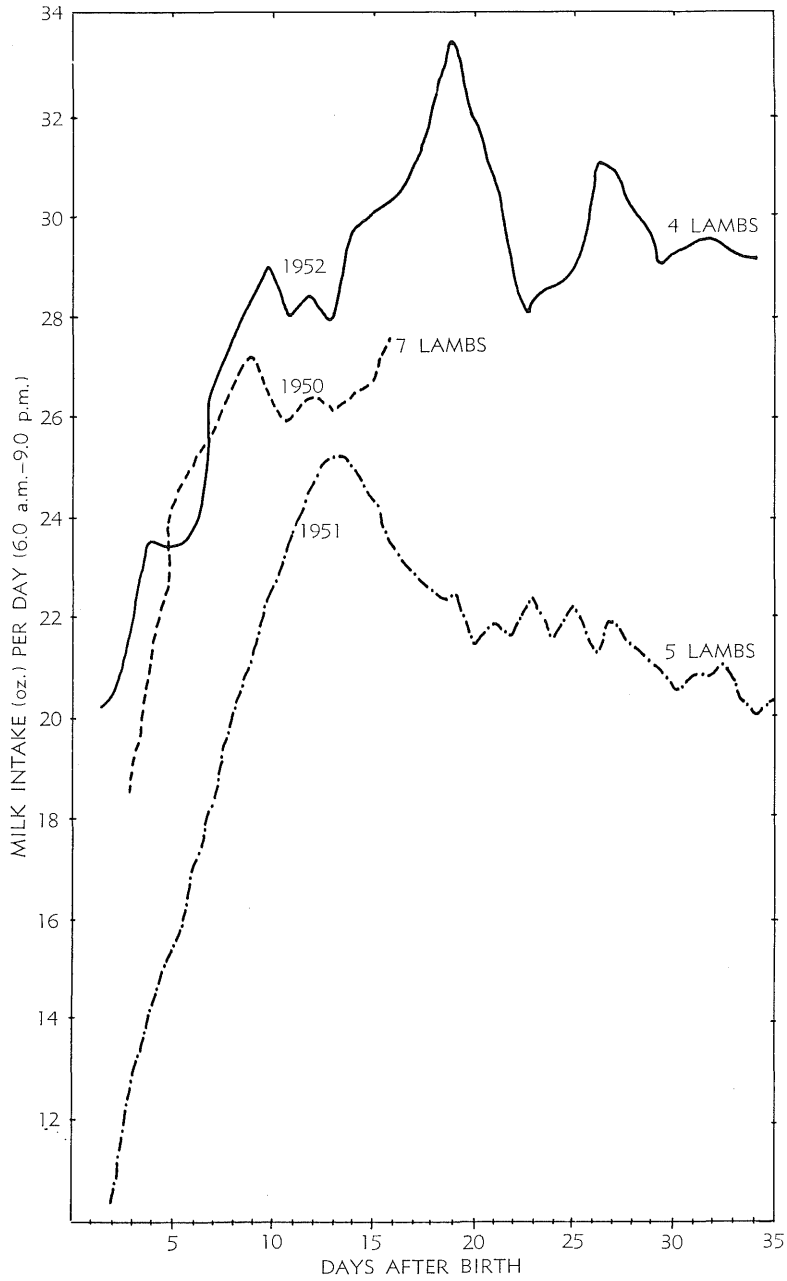

Fig. 1.—Mean daily milk intake of lambs during the first few weeks in 1950, 1951 and 1952. The results have been smoothed by the use of 3-day moving averages, i.e. the means of each consecutive 3 days.

(d) Effects of Different Nutritional Regimens After Lambing

Changes in the mean body-weight of the ewes in each group subjected to different nutritional regimens in the experiment conducted in 1952 are shown in Figure 2. The difference between the two groups that enjoyed a high plane of nutrition at the end of the experiment and those on a low plane is highly significant ($P<0\cdot001$).

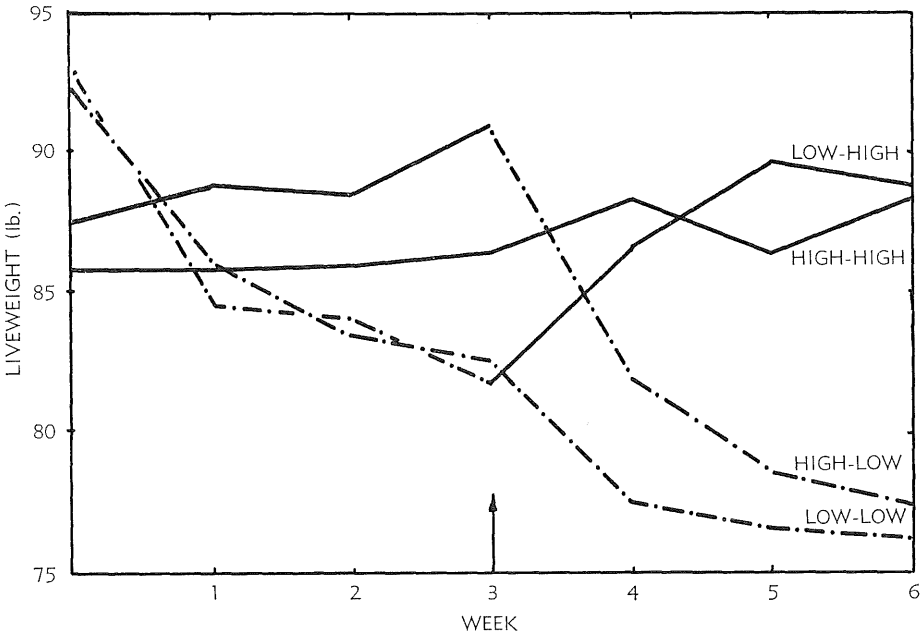

Fig. 2.—Mean weekly liveweights of ewes subjected to different nutritional treatments.

Mean measured daily milk intakes of each group of lambs for each period of the experiment are shown in Table 3, and the daily intakes are shown in Figure 3.

TABLE 3

MEAN MEASURED DAILY INTAKE OF THE 6 SINGLE LAMBS BORN TO EACH GROUP OF EWES SUBJECTED TO DIFFERENT PLANES OF NUTRITION—1952

Group : Nutritional Regimen	Daily Milk Intake (oz) (period 6.0 a.m.—9.0 p.m.)		
	Day 3 to 22	Day 23 to 42	Whole Period
High–High	24·8	22·3	23·5
High–Low	22·8	14·7	18·7
Low–High	19·1	21·4	20·2
Low–Low	19·4	14·6	17·0

Whole period : High-High greater than High-Low ($P< 0\cdot05$)
High-High greater than Low-Low ($P< 0\cdot01$)
First 20 days : Highs greater than Lows ($P< 0\cdot01$)
Second 20 days : Highs greater than Lows ($P< 0\cdot001$)

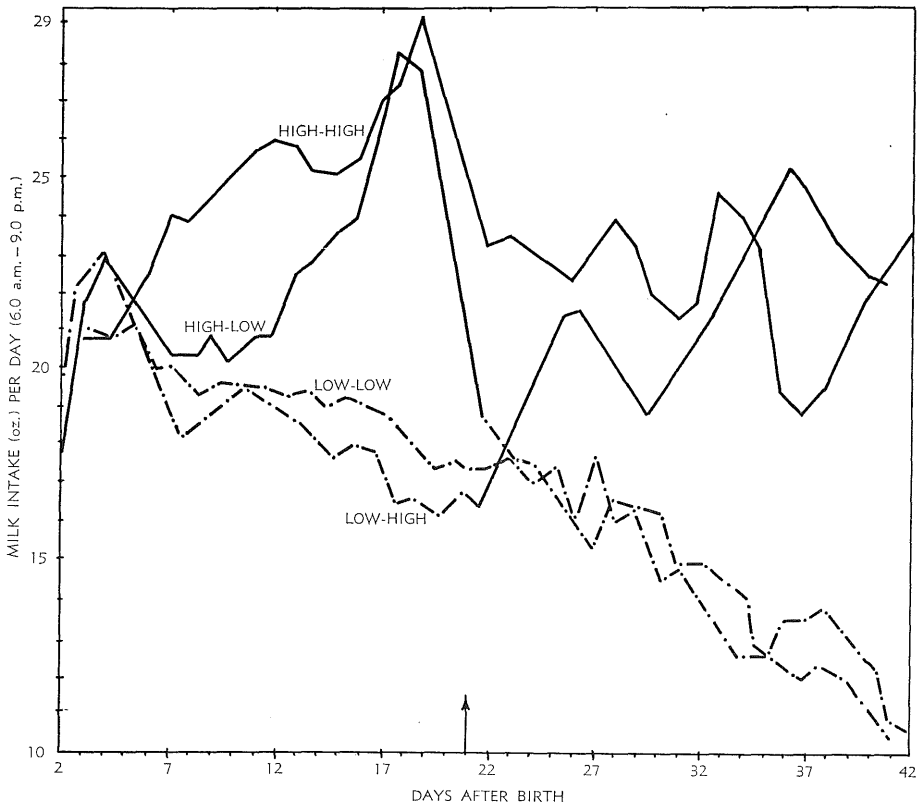

Fig. 3.—Mean daily milk intake of lambs whose mothers were subjected to different nutritional treatments. The results have been smoothed by the use of 3-day moving averages, i.e. the means of each consecutive 3 days.

In both 20-day periods the two groups of ewes receiving at that time the higher level of feeding yielded significantly more milk than those on the lower level of feeding. In neither period was there any significant difference between the two groups receiving the same treatment. Over the 40-day period the milk

TABLE 4

MEAN DAILY WEIGHT GAIN OF 6 LAMBS IN EACH GROUP WHOSE MOTHERS WERE SUBJECTED TO DIFFERENT PLANES OF NUTRITION—1952

Group	Daily Gain (oz)		
	1st 20 days	2nd 20 days	Whole Period
High–High	7·9	5·7	6·8
High–Low	7·7	2·9	5·3
Low–High	6·4	6·9	5·7
Low–Low	6·5	3·3	4·9

Whole period : High-High and Low-High greater than High-Low and Low-Low—($P < 0.001$)
High-Low greater than Low-Low ($P < 0.01$)

intake of the lambs of the High-High group exceeded that of the High-Low group ($P<0\cdot05$) and of the Low-Low group ($P<0\cdot01$).

The mean daily gains of the lambs in each group whose mothers were subjected to different planes of nutrition for each period and the whole of the experiment are shown in Table 4, which shows that the lambs from the High-High group made significantly greater gains than those in the remaining groups.

IV. DISCUSSION

The curves in Figures 1 and 3 reveal the large variation that occurred in daily milk intake. This raises doubts about the validity of the results that might be obtained under field conditions in the semi-arid tropics from the methods used by workers (Bonsma 1939; Barnicoat, Logan, and Grant 1949*a,* 1949*b*; Davies 1958; Owen 1957; Pierce 1934, 1936; Thomson and Thomson 1953; and Wallace 1948), who computed total milk production from measured milk intakes on selected days during lactation. On the other hand, high correlations were noted at the Trangie Agricultural Experiment Farm in New South Wales (Philpotts 1954) between 1-day tests and the weekly averages during the first and second weeks. The correlation between measured intakes separated by 24 hr was $+0\cdot86$, and between yields for 12 and 16 hr with 24 hr were $+0\cdot93$ and $+0\cdot95$ respectively.

The differences between milk intakes in 1950, 1951 and 1952 shown in Figure 1 are in keeping with the finding (Wallace 1948) that the plane of nutrition enjoyed by the ewes prior to lambing influenced milk production. However, a rapid increase in measured milk intake by Merino lambs during the first two or three weeks of life has not been noted by other workers (Bonsma 1939; Davies 1958), nor has the effect of incomplete emptying of the udder during the first few days been assessed in relation to milk production during the remainder of lactation.

The significantly lower intakes during the hottest parts of the day, when ambient air temperatures rose above 100°F, suggest that milk secretion may be decreased in an effort to conserve body fluids. Similarly, the negligible gains in liveweight achieved by the lambs during the day despite substantial milk intakes may reflect rapid evaporation of fluid necessary to maintain stable body temperatures; evaporation may be as high as 1 oz/hr when ambient air temperatures rise to 104°F (Alexander and Brook 1960). The loss of weight between 6.0 a.m. and 9.0 a.m. may be explained by the passing of urine and faeces following night feeding.

The differences between the milk production of the groups maintained on "High-High" and "Low-Low" nutritional planes in 1952 may reflect those that could well occur under the different grazing conditions that prevail from year to year in pastoral areas. In addition, the rapidity of the changes in milk production

that followed changes in the ration may not exaggerate the type of situation that can also occur in the Queensland environment. Extremely hot weather, or light falls of rain followed by cold weather, can damage much of the forage carried over from the summer growing periods, which constitutes the main source of food available to the sheep. As a result, the plane of nutrition can fall rapidly. Similarly, the plane of nutrition can rise suddenly if effective rains fall during lambing. The results presented in Figure 3 indicate that when this occurs Merino ewes may increase their milk production quickly and this was reflected in increased weight gains of the lambs (Table 4). The results also indicate that given adequate nutrition Merino ewes may still be producing considerable volumes of milk six weeks after parturition, but the milk production of ewes that are inadequately fed during the whole or the later part of lactation is rapidly reduced, and it also seems likely that the duration of lactation may be shortened.

Significant correlations have been noted by a number of workers between daily liveweight gain of lambs and the milk production of their mothers. In view of the results reported here and the daily weight gain of between 0·29 lb/day and 0·51 lb/day previously noted in Queensland (Moule 1954) it is suggested that given adequate good forage Merino ewes can milk well. However, under pastoral conditions high air temperatures and inadequate nutrition may contribute to lowered milk production of Merino ewes.

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