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Milk Production of the Ewe

C. R. BARNICOAT, Massey Agricultural College, Palmerston North.

Most papers on ewes' milk deal with the product obtained in Mediterranean countries from special breeds of milking sheep for use in the manufacture of certain types of cheese. Such cheeses are, incidentally, of considerable commercial importance. In New Zealand, however, we are interested in ewes' milk as a basic food for more than 20 million lambs reared annually, some for flock replacements, others for meat, particularly the "fat lambs" of our export trade.

Of the numerous reports dealing with ewes' milk, there will be time to summarise only those from three institutions. These papers have been selected because they discuss certain quantitative and qualitative aspects of ewes' milk and attempt to relate these to lamb growth, i.e., they consider ewes' milk as a factor in animal production.

F. N. Bonsma (1939) of the University of Pretoria was the first to use the "Plunket" method of estimating ewes' milk yield. In this method the total ingestion of the lamb over a 24-hour period is used as an index of the output of its dam. From weekly observations, Bonsma recorded lactation curves and yields for individual ewes, and by using fairly large numbers of animals and applying statistical treatments to his results he was able to place this work on a proper scientific footing.

Bonsma was primarily interested in finding the most suitable breeds of sheep for South African fat lamb farming and therefore worked with Merinos and their crosses. Owing to climatic conditions his grazing ewes were allowed extra rations and the experimental conditions were artificial.

Typical results obtained by Bonsma are shown in Figure I. There were characteristic hereditary differences in lactation curves and milk yields. Border Leicester-Merino crosses were the best, Romney-Merino crosses mediocre, and Merinos were very poor yielders indeed. The higher-yielding crosses also showed characteristic peaks at an early stage of lactation.

He recorded positive correlations between milk production and (i) Live weights of ewes, (ii) Birth weights of lambs, and (iii) rate of gain of lambs.

The pronounced variations in milk productions of individual ewes suggested that individuality was even more important than choice of breed as a factor in milk production.

The next work to appear was that of L. R. Wallace (1948) of the University of Cambridge, who studied milk secretion of Suffolk and of Border Leicester-Cheviot cross ewes as one aspect of a comprehensive study of sheep nutrition. The investigation comprised a series of balance trials with stall-fed animals kept on different nutritional planes, consequently smaller numbers of ewes were observed, but a very detailed series of records were collected. Typical lactation curves of these breeds are shown in Fig. II.

Wallace estimated that during the first month, when his experimental lambs were maintained entirely on milk, 4oz. of milk fed gave 1oz. increase in live weight. During this early period of life, over 80% of the variations in growth rates of lambs were related to differences in milk intakes. This relationship declined as the lambs became increasingly dependent on supplementary foodstuffs.

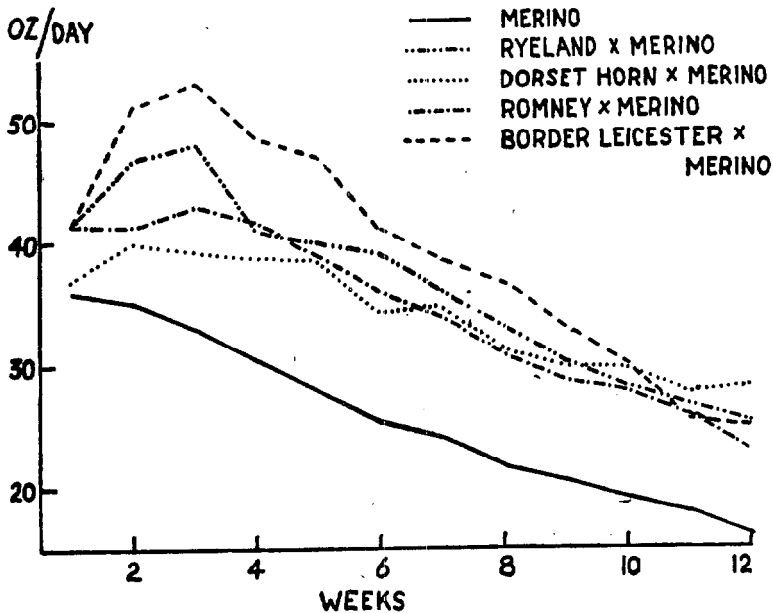


FIGURE 1.

Milk Production of Merino and Merino Crosses under South African Conditions (After Bonsma).

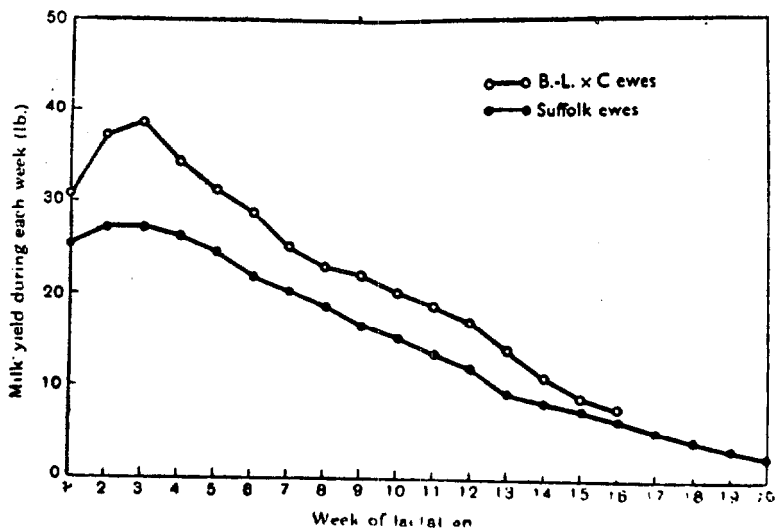


FIGURE 2.

Milk Production of Stall-fed ewes (After Wallace).

Wallace noted that both birth-weights of lambs and milk yields were markedly affected by plane of nutrition of the ewes, particularly during late stages of pregnancy. He considered that this interesting finding was of great significance in affecting milk yield, and consequently growth rate of lambs under practical farming conditions.

The third set of investigations came from Massey College (C. R. Barnicoat, A. G. Logan and A. I. Grant, 1949), and are the preliminary reports on a series of experiments with grazing Romney ewes commenced in 1941. After some seasons of exploratory work, fairly large groups of ewes have been studied each year and over 400 lactation records have now been collected.

Typical lactation curves of New Zealand Romney ewes are shown in Fig. III.

Most of our lactation curves and correlations relate to the 0-12 weeks period (i.e., about the weaning stage with quick-growing lambs). Correlations are highest during the 3rd-9th weeks, i.e., when lactation is at its peak. From eight typical years' results (with over 200 mixed Romney ewes) correlations between milk yields and lamb gains at 12 weeks were found to range from 0.61—0.81 (all H.S.), average 0.72. In other words, variations in milk consumption during the first 12 weeks were associated with one-third to two-thirds (average one-half) of the variations in growth rate. In another experiment where ewes were stall-fed and their lambs' grazing was restricted, the correlation was 0.90, i.e., about 80 per cent. of the variations in gain were controlled by differences in milk intakes.

Under fat-lamb conditions milk intake is clearly a most important—usually the most important—factor governing lamb growth rate. Under "hard" conditions comparable with certain hill country districts it is of very great importance indeed.

The influence of milk yield on the comparative growth rate of lambs can be illustrated by means of the simplified scheme shown in Table I.

TABLE I.
Effect of Milk Ingestion on Relative Weight Gains of Lambs.

Ewes' Milk.		Weight Gains of Lambs.			
Av. Yield oz./day*	During lactation* oz./day	Weight at end of 12 weeks** (lb.)	Required gain to 70lb. (lb.)	Weeks required to reach 70lb. ***	Age at 70lb. (slaughter) Weeks.
Below 28	2.4	23	47	19	31
29-42	4.3	32	38	15	27
43-57	5.6	40	30	12	24
58-71	6.7	46	24	10	22
Above 71	7.8	51	19	8	20

* 12 weeks' lactation.

** Assuming 10lb. weight at birth.

*** Assuming 2.5lb. l.w. gain/week.

Approximately one-third of full-mouthed ewes with singles, and a larger proportion of those with twins give only 40oz. or less of milk, per lamb, per day. These lambs are at an obvious disadvantage in comparison with those getting a better start.

We have given considerable attention to qualitative (compositional) factors of ewes' milk and consider that many of the published analyses of milks of ewes of non-milking breeds are not quite correct because the udders have not been completely milked out. With our method the

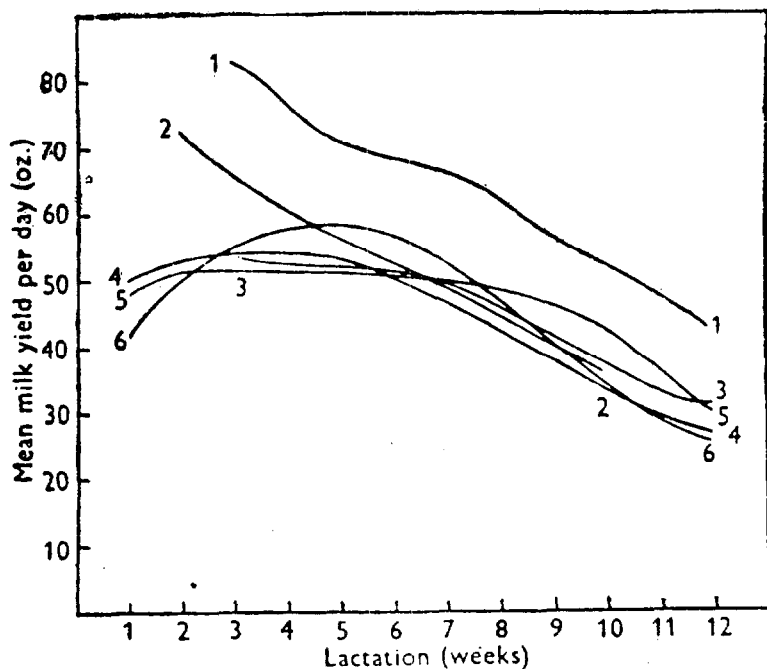


FIGURE 3.

Milk Production of New Zealand Romney Ewes: 1, 1941 twins; 2, 1943 singles; 3, 1941 singles; 4, 1944 singles (2-year-old ewes); 5, 1942 singles; 6, 1944 singles (6-year-old ewes). (After Barnicoat, Logan and Grant).

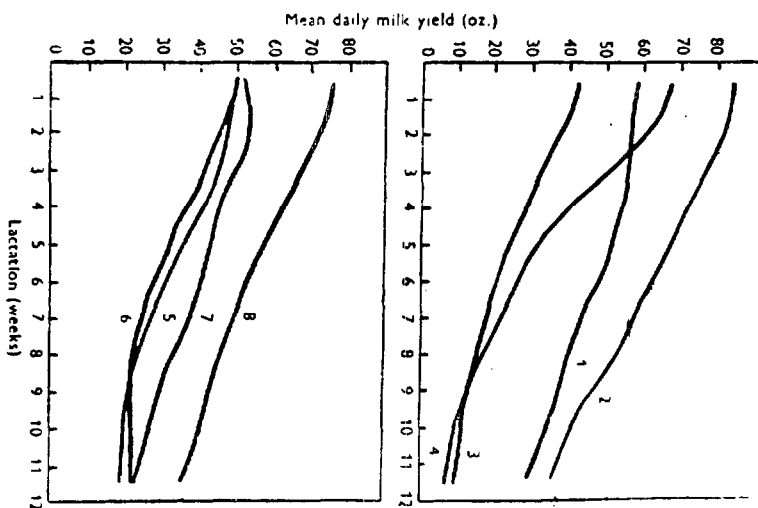


FIGURE 4.

Average lactation curves of Romney Ewes on high and low planes of Nutrition: 1, HH singles; 2, HH twins; 3, LL singles; 4, LL twins; 5, HL singles; 6, HL twins; 7, LH singles; 8, LH twins. (After Barnicoat, Logan and Grant).

ewe is milked out on one side while the lamb suckles the other, and by this means a complete sample is obtained.

Fat percentages vary somewhat from day to day, the variation being, in general, inversely related to yield. As these fluctuations affect all ewes we believe, but cannot yet prove, that they are brought about by changes in weather conditions.

The averaged results of Romney ewes' colostrum and milks are shown in Table II.

TABLE II.
Average Composition of Romney Ewes' Colostrum and Milk.

	Colostrum*	Milk**
Fat	17.7	5.3 %
S.N.F.	22.5	11.0 %
Protein (N x 6.38)	19.3	5.5 %
Lactose	2.2	4.6 %
Ash	0.97	0.90%
Total Solids	40.2	16.3 %
CaO	0.26	0.27%
P ₂ O ₅	0.47	0.36%
Vitamin A (micrograms)	147	44%

* 13 samples.

** 40 composites representing over 800 milks.

Both fat and plasma solids have slight upward trends during lactation.

Despite the fact that we consider that our samples include all the fat, the fat percentage is comparatively low. Fat is responsible for over half the calorific value of ewes' milk and there are considerable variations in fat production between individuals. So far we have not been able to demonstrate—at least under fat lamb conditions—that there is any significant relationship between milk fat ingestion and rate of lamb gain.

In 1945 we carried out a nutritional study with 55 stall-fed ewes maintained on concentrates at high and low levels of feeding. The ewes were changed over at lambing and the effect on their milk yield is shown in Fig. IV. and in Table III.

TABLE III.
Effect of Plane of Nutrition, before and after Lambing on Milk Yields of Ewes. (12 weeks' lactation.)

Plane of Nutrition of Ewes.		Average yield oz./day)	
Before Lambing	After Lambing	Twins	Singles
High	High	60	45
Low	Low	31	22
High	Low	32	32
Low	High	54	39

The milks from the low-plane ewes were richer in fat and poorer in protein contents.

These results agree with the findings of Wallace and other workers that feeding during the latter part of pregnancy is of paramount importance.

During the last five years at Massey College we have extended this work. Last season Mr. Murray studied the effect of over-grazing (i.e., a low plane of nutrition) on ewes, also the effect of early weaning on another group of animals. Our work in the past was restricted to Romneys, but last season Mr. Roberts compared their milking performances with half and three-quarter Cheviot-Romney crosses.

We have also paid particular attention to the performances of twin and single-bearing ewes.

From our records of milking performances of about 30 ewes followed through four consecutive lactations we hope to find whether or not individual ewes give consistent milk yields. If it can be shown that milk yields of individual ewes are consistent, this knowledge would be of value to breeders wishing to select high milk yielding ewes at an early age.

The present methods are quite unsuitable for applying under farming conditions, and the possibility of using simplified techniques for estimating milk yield of ewes is not being overlooked.

References:

- (1) Barnicoat, C. R., Logan, A. G., and Grant A. I. (1949). *Journal Agr. Science* 39, 44; and 237.
- (2) Bonsma, F. N. (1939). University of Pretoria Publication, Series I. Agriculture No. 48.
- (3) Wallace, L. R. (1948). *J. Agr. Science* 38, 93.

Discussion

Dr. WALLACE: Could you give us details of the preliminary results of the early weaning trial?

Dr. BARNICOAT: The results are not finalised, but I am under the impression that the differences between the early and normally weaned groups are not marked.

Mr. HART: Is there any correlation between solids-not-fat and the fat percentage?

Dr. BARNICOAT: Both tend to fall slightly at the start and then rise throughout lactation.

Professor CAMPBELL: Is there any explanation for the fact that the yield of milk is the same irrespective of the plane of nutrition before lambing? In cows a low plane of nutrition before calving will reduce the amount of milk produced. Do ewes lose weight early in lactation?

Dr. BARNICOAT: The plane of nutrition before lambing has an effect, but it is not as marked as the effect of feeding levels after lambing. The ewe normally loses weight early in lactation.

Mr. SWAN: Was there any milk fever in the low-high group?

Dr. BARNICOAT: No milk fever was seen in any of these animals.

Mrs. PERRIN: The fat figures for colostrum appear to be rather high. Were the samples taken after the milk flow was established?

Dr. BARNICOAT: They were taken immediately after lambing and before the lamb had suckled.

Mr. HART: Is there a single distinct let-down or are there two let-downs?

Mr. LOGAN: There is a single let-down similar to that seen in cows.

Dr. McMEEKAN: In the cow all the milk is removed, but in the ewe the amount produced is conditioned by the amount removed.

Dr. BARNICOAT: In order to study the importance of this we have during the last four or five years obtained as many records as possible from twin-bearing ewes in order to compare the performances of individual animals in different seasons with singles and with twins. The results are not yet worked up. Experimental work with twin-bearing ewes complicates things greatly.