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# THE INTAKE AND UTILIZATION OF MILK AND GRASS BY LAMBS

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## SUMMARY

Two indoor feeding trials, involving 70 lactating ewes and 76 lambs, are described in which the milk production levels of the ewes and the grass and ewe milk intakes of the lambs were recorded from birth until weaning.

Most lambs commenced eating herbage by the third or fourth week of life, but this was influenced by the level of milk feeding. Results of the experiment indicate that while the unweaned lamb appeared to be capable of utilizing pasture at 6 weeks of age, milk still represented the major source of digestible protein and energy. The rate of liveweight gain of lambs was highly correlated with digestible energy (DE) intake. 7.5-9.6 Mcal DE intake were required per kg liveweight gain.

These results are discussed in relation to early weaning practices.

WITH the use of higher stocking rates to obtain increased lamb meat production per acre, the situation often arises in early summer where the ewe and her unweaned lamb are competing for available pasture. Under these conditions, early weaning and restricting the feed available to the ewe may permit increased rates of body growth of lambs. However, it is essential that consideration be given to the relative importance of milk and pasture in the ration of the unweaned lamb before these techniques can be employed. Unless a considerable proportion of the ration is being provided by pasture, and unless this herbage can be digested by the lamb, then cessation of the ewe milk supply to the lamb could result in greatly decreased rates of body growth.

Two factors determining responses of unweaned lambs to pasture feeding are the ability of the rumen to utilize pasture and the digestive capacity or rumen size of lambs on a high fluid diet.

The two experiments, described in this paper, investigated the effects of age, level of ewe milk feeding, birth rank and breed on the intake and utilization of fresh or frozen herbage by lambs from birth to weaning. The two trials covered the periods September to December 1966 (Trial A) and September to December 1968 (Trial B).

## EXPERIMENTAL

## TRIAL A

Forty Romney  $\times$  Border Leicester and Romney  $\times$  Romney mixed-age ewes were machine milked three times daily to provide a bulked source of ewe milk for hand-feeding lambs. Each day the total milk yield was measured and divided into 40 rations, half of which were twice the volume of the remainder.

Twenty Romney  $\times$  Southdown and twenty Romney  $\times$  Suffolk lambs were removed at 24 hours of age from their 5-year-old Romney dams in September 1966 and placed in pens for individual hand-feeding. Each lamb was bottle-fed three times daily until slaughter at 12 weeks of age. Ten lambs from each breed group were fed at twice the level of ewe milk (high milk group, HM) compared with the remaining ten (low milk group, LM).

Fresh herbage (white clover-perennial ryegrass), 2 in. to 4 in. in height was cut daily and offered *ad libitum* to individual lambs from 7 days of age.

A continuous series of twelve 7-day digestibility trials was carried out on 3 lambs from each of the four groups. To supplement data from the digestibility trials by providing information on levels of activity of rumen microflora, a series of additional lambs were killed at weekly intervals from the first to the sixth week of age. Immediately on slaughtering, the rumen was opened and the rumen fluid removed from the digesta by filtration through muslin gauze. This was subsequently compared with rumen fluid obtained at the same time from two adult rumen-fistulated wethers fed solely on hay, when used as the inocula for *in vitro* digestions of standard ground hay and dried grass samples.

## TRIAL B

Thirty Romney 5-year-old ewes, mated to either Hampshire or Southdown rams, were fed indoors on a 60% grassmeal-40% barleymeal ration, just prior to and after lambing in September 1968 until weaning 10 weeks later. Twenty-four ewes suckled single lambs (12 Hampshire cross and 12 Southdown cross) and six suckled twin lambs (3 sets of each breed cross).

A plunket system of feeding was used, with the lambs having access to the ewes five times daily. Initially the lambs were weighed before and after all feeds on every day, but after two weeks lamb weighings were carried out

only on 3 days of each 7-day period. Milk samples were withdrawn from the ewes once a week, using a ewe milking machine, for laboratory analysis.

All lambs were offered herbage (perennial ryegrass-white clover), which had been previously thawed from its frozen state, on an *ad libitum* basis. The herbage had been cut prior to the commencement of trial and stored in a frozen state at  $-20^{\circ}\text{C}$ . This overcame any problems of changes in pasture digestibility that were a feature of Trial A where freshly cut pasture was used.

All lambs were weaned at 10 weeks of age and then slaughtered and minced for laboratory analysis and comparisons made with a group of similar lambs slaughtered at birth.

## RESULTS

### PASTURE AND MILK INTAKE

The chemical composition of the milk and pasture fed in both trials is presented in Table 1. The average milk intakes (g milk/day) by lambs in Trial A were 705 (HM groups) and 366 (LM groups) and in Trial B, 806 (singles) and 448 (twins).

Data on intake of pasture are shown in Fig. 1. Lambs in the LM groups ate considerably more herbage than those in the HM groups (9.31 kg *cf.* 7.17 kg DM/12 wk period  $P < 0.001$ ). Whereas only two HM group lambs commenced eating herbage during the second week of life, most LM group lambs had started during this period, but in all cases dry matter intakes were extremely low. By the third week all lambs had started eating pasture and the rate of consumption increased throughout the 12 wk period.

TABLE 1: CHEMICAL COMPOSITION OF EWES MILK AND PASTURE

	Milk		Pasture*	
	Trial A	Trial B	Trial A	Trial B
Total solids (%)	24.97	18.38	—	—
Protein (%)	5.83	5.08	24.4 (16.3-28.8)	25.1 (22.8-26.8)
Fat (%)	7.10	6.97	—	—
SNF	11.13	11.01	—	—
kcal/g*	6.309	6.354	4.542	4.498

\*on DM basis.

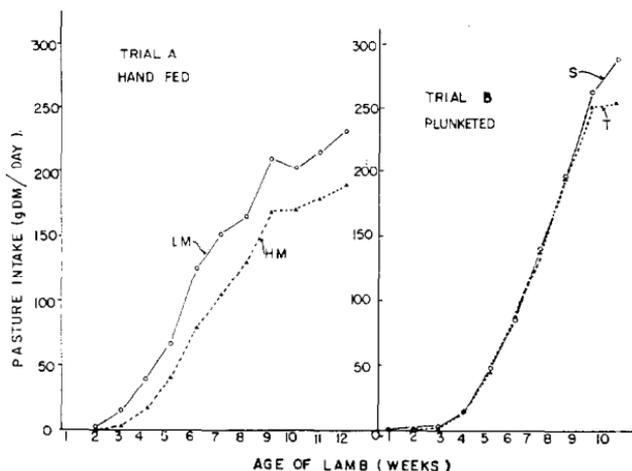


FIG. 1: *The effect of age and rearing on herbage intake.*  
 Trial A — LM, low milk group. HM, high milk group.  
 Trial B — S, single lambs. T, twin lambs.

In Trial B, although milk intakes were almost 17% higher, pasture intakes were similar to those in Trial A. Lambs commenced eating during the 3rd and 4th week of life but intakes, especially over the period 8 to 10 weeks of age, tended to be higher than those in the earlier trial. No difference could be shown in pasture intake between singles and twins despite large differences in milk intake.

#### MILK AND PASTURE DIGESTIBILITY

Milk digestibility coefficients were calculated from the feed intakes and faecal outputs of those lambs not eating grass during the first two weeks of life. The mean digestibilities of milk organic matter (OM) and milk protein were 97.9 and 97.7%, respectively. On the basis of this, a milk OM indigestibility percentage of 2.1 was used when calculating the digestibility of grass in each of the following 10 weekly periods. The apparent digestibilities of grass OM and crude protein in Trial A are given in Fig. 2. Results for Week 3 have been excluded owing to the extreme variability in individual digestibility coefficients during this week where pasture represented such a small fraction of the diet.

OM digestibility of herbage eaten in Trial A ranged from 86% to 70% and in general a falling off in digestibility was observed over the trial period. This was associated

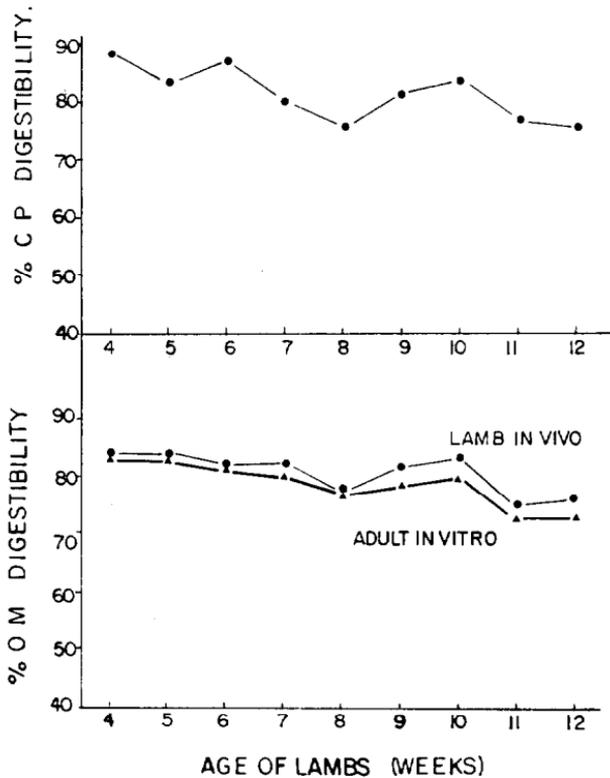


FIG. 2: The apparent digestibility of herbage organic matter (OM) and crude protein (CP) for Trial A.

with a gradual decrease in crude protein and soluble carbohydrate levels and an increase in crude fibre. The changes in apparent digestibility of crude protein were very similar to those of organic matter. Also shown in Fig. 2 are the *in vitro* digestibility coefficients determined on the same pasture using adult rumen-fistulated wethers as a source of rumen inocula.

In Trial B where a stored source of frozen pasture was used as a feedstuff to overcome variations in pasture digestibility, the digestibility of gross energy increased from 45% to 76% by the 6th week of life of the lamb and thereafter ranged from 76 to 80% until termination of the trial at 10 weeks. The digestibility of pasture protein followed a pattern very similar to that of gross energy.

## DIGESTIBLE ENERGY AND NITROGEN INTAKE

The total digestible energy (DE) intakes for Trials A and B, combining both milk and grass intakes, are given in Fig. 3. While there were slight differences between breeds in Trial A in DE intake, the greatest difference was between the HM and LM groups (0.09 *cf.* 0.66 Mcal DE/day/lamb), with the former having a 36% greater intake of DE. It was apparent that the increased pasture intake by the LM groups did not compensate for the lowered milk intake.

The graph for Trial B (Fig. 3), showing the digestible energy intakes of singles and twins with increasing age, was similar in shape to the DOM intake graph for Trial A. The average DE intakes for singles and twins were 0.91 and 0.63 Mcal DE/day, respectively.

The relative importance of grass and milk in the diet is shown in Fig. 4. In Trial A, pasture represented the major part of the diet of the LM group from the 6th week of life, but for the HM group milk was always more important than pasture. The plateau effect from the 9th to 12th weeks was presumably a result of decreased pasture digestibility over this period. In the second trial, pasture represented a greater part of the diet for twins as compared with single lambs owing not to greater intakes of

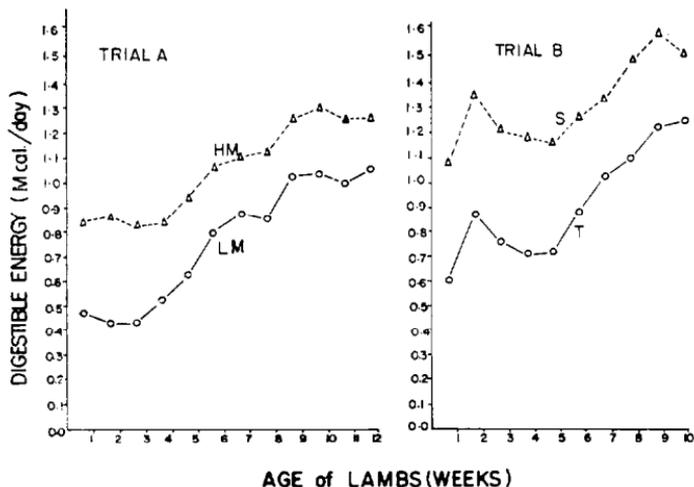


FIG. 3: The apparent digestible energy intakes of high (HM) and low milk (LM) fed lambs in Trial A and single (S) and twin (T) lambs in Trial B.

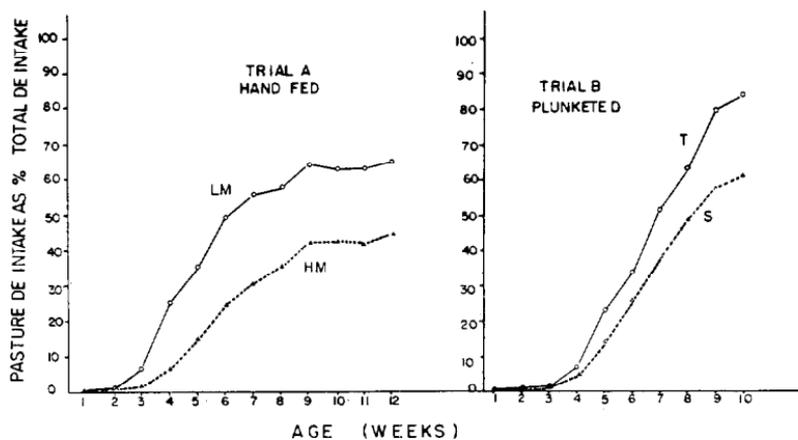


FIG. 4: The relative proportion of the total digestible energy intake that originated from pasture as compared with milk.

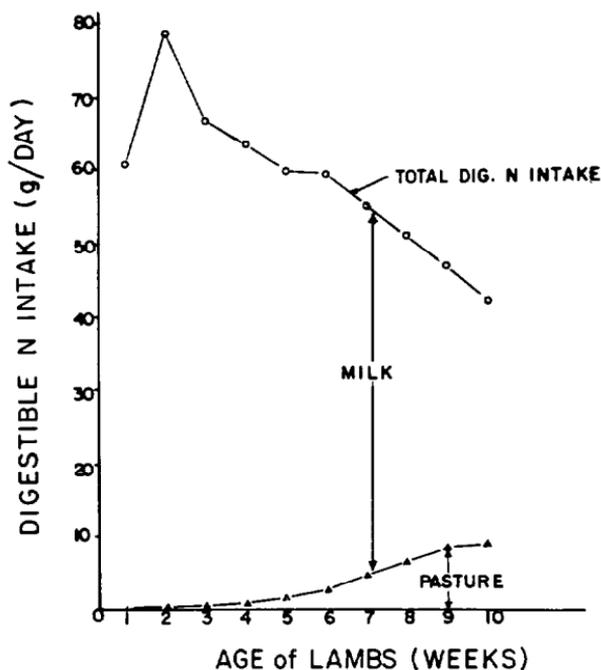


FIG. 5: Total digestible nitrogen intake, averaged for all lambs in Trial B, and the relative amounts originating from pasture and milk.

pasture but to lowered milk intakes. By the 7th week for twin lambs and the 9th week for single lambs, pasture contributed the greater proportion of digestible energy in the diet.

The digestible N intake, calculated only for all lambs in Trial B, rose initially over the first week as milk intakes increased (Fig. 5) but thereafter declined steadily as milk intakes fell. Owing to the low N content of pasture compared with milk, the ever-increasing intakes of pasture were insufficient to balance the decline in milk N consumption.

#### COMPARISON OF RUMEN FLUID FROM LAMB AND ADULT SOURCES FOR IN VITRO DIGESTIONS (DATA, TRIAL A)

The average digestibilities of the standard grass and hay samples, when digested using adult wether rumen fluid as inocula, were 71.0 and 58.6%, respectively, with little variability over the trial period. The *in vitro* digestibility

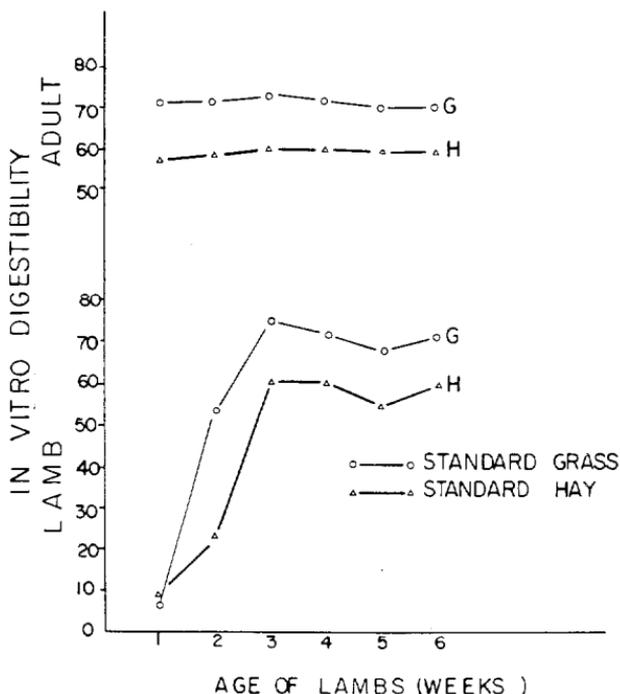


FIG. 6: The *in vitro* digestibility of standard grass (G) and hay (H) samples when rumen inoculae were obtained from either slaughtered lambs of varying ages or fistulated adult wethers.

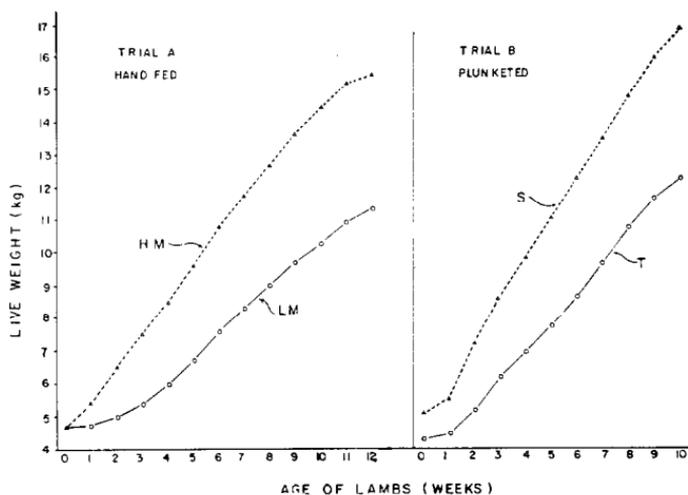


FIG. 7: Liveweights of high (HM) and low milk (LM) fed lambs in Trial A and single (S) and twin (T) lambs in Trial B.

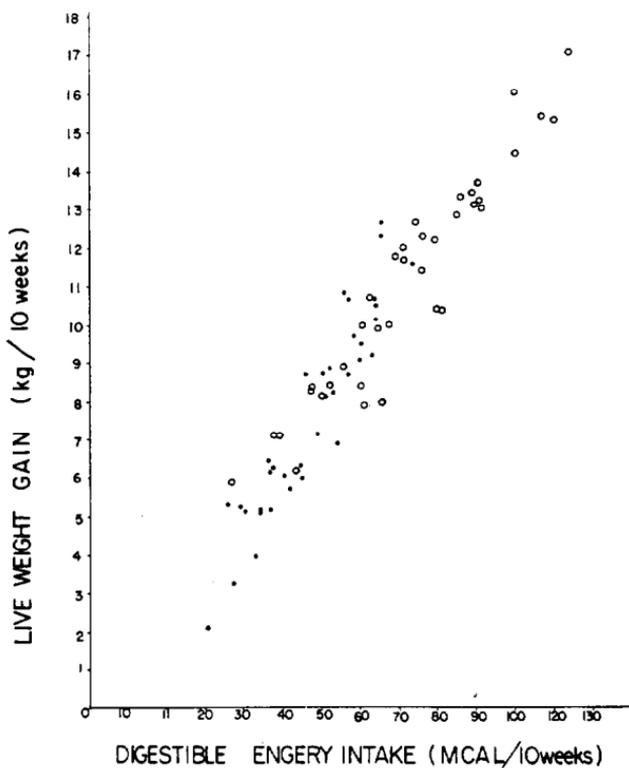


FIG. 8: The relationship between digestible energy intake and liveweight gain. O Trial A. ● Trial B.

coefficients obtained with lamb rumen inocula gave low apparent digestibilities until the lambs had reached 3 weeks of age (Fig. 6). Rumen fluid from lambs feeding exclusively on a milk diet during the first week of life gave *in vitro* digestibilities of less than 10% for both standard grass and hay samples. These *in vitro* digestibilities increased markedly in the second week, the extent of the digestion being greater for the grass than for hay. It is assumed from these data that, after the third week, the rumen is fully functional.

#### LIVWEIGHT GAIN AND FEED CONVERSION

The growth rates of the four groups in the two experiments are shown in Fig. 7. The final mean liveweight of the HM group was almost 41% heavier than for the LM group. In Trial A, 7.8 to 9.6 Mcal DE intake (Table 2) were required per kg liveweight gain (LWG), with the HM group having a higher feed conversion efficiency. In Trial B, only 7.5 to 7.6 Mcal DE intake were required per kg LWG. Figure 8 shows the relationship between LWG and DE intake for both trials. The derived regressions were highly significant ( $P < 0.001$ ).

$$\text{LWG} = 0.134 \text{ DEI} \pm 0.90 \text{ Trial A}$$

$$\text{LWG} = 0.136 \text{ DEI} \pm 1.12 \text{ Trial B}$$

where LWG = liveweight gain (kg/week)

DEI = digestible energy intake (Mcal/week).

#### DISCUSSION

The growth rates of lambs in the first trial were slightly lower than those of similar lambs grazing under field conditions at Ruakura Research Centre. These differences were probably due to the low levels of milk fed in this trial.

Similar trials by Hodge (1966) and Bourke (1967), using Merino crossbred lambs, have used either artificial

TABLE 2: EFFICIENCY OF FEED CONVERSION

	<i>Hand-fed Lambs</i>		<i>Plunketed Lambs</i>	
	<i>High Milk</i>	<i>Low Milk</i>	<i>Single</i>	<i>Twin</i>
Initial LW (kg)	4.71	4.71	4.71	3.95
Final LW (kg)	15.94	11.27	16.78	12.23
DE intake (Mcal)	86.7	63.2	91.0	63.2
gLWG/Mcal DE intake	129	104	133	131

milk or dried grass as lamb feeds. It was preferred in these experiments to use fresh ewe milk and fresh or frozen pasture for feeding lambs to simulate a dietary regime approximating field conditions.

In Trial A restricting the level of milk intake caused a significant increase in the amount of pasture eaten. However, the increased intake of pasture DE by the LM group was insufficient to compensate for the lower milk intake. Similar results have been found by Spedding *et al.* (1963) who showed that, with lambs fed indoors on different levels of milk substitute, the intake of grass was negatively related to milk intake. The failure of the twin lambs in the second experiment to compensate for lower milk intakes by eating more pasture compared with the single lambs is difficult to explain. Intakes of pasture by both these groups were, however, considerably greater than for either group in the first experiment.

The results of the first experiment indicated that differences in feed conversion efficiency were related to the rate of liveweight gain. This result is in accordance with results of Gardener (1964) in which lambs were most efficient at high milk feeding levels. The failure of the single lambs in the second experiment to be more efficient in feed conversion than the twin lambs is in direct contrast to the results of the first experiment. This result, however, while agreeing with Bourke (1967), who was unable to demonstrate that efficiency of gain was effected by the level of milk intake, may be a reflection of the small number of twin sets used.

Consideration is often given to weaning lambs earlier than 12 weeks of age to prevent the ewe from competing with her lambs for available feed, especially under high stocking rate conditions. The results of these experiments indicate that while the young lamb appears to be capable of utilizing pasture at 6 weeks of age, the intakes of digestible protein and energy would be drastically reduced if the ewe milk supply was stopped. For example, weaning at six weeks of age would, on the basis of these results, reduce the digestible protein and energy intakes to only 10-15% and 30-50%, respectively, of their former combined diet. Similar figures for 9-week-old weaning would be 25% and 50-70%, respectively. Consequently, any system of early weaning would be expected to slow down the lamb's growth rate where the ewe milk supply was of any consequence. This has since been shown in early weaning trials at Ruakura. Whereas, at a stocking rate of 7 ewes per acre, weaning of lambs at 6 weeks of age reduced the 12-

week-old liveweight by 20% compared with their 12-week-old unweaned counterparts; at 10 ewes per acre, where pasture availability was greatly reduced, weaning at 6 weeks of age reduced the 12-week-old liveweight by only 7% and weaning at 9 weeks increased it by 2% compared with 12-week-old unweaned lambs at the same stocking rate. The use of early weaning at this higher stocking rate greatly eased management problems.

#### REFERENCES

- Bourke, M. E., 1967: *Aust. J. exper. Agric. & Animal Husbandry*, 1: 199-222.
- Gardener, R. W., 1964: Ph.D. Thesis, Cornell University [cited by Bourke, 1967].
- Hodge, R. W., 1966: *Aust. J. exper. Agric. & Animal Husbandry*, 6: 139-44.
- Spedding, C. R. W.; Brown, T. H.; Large, R. V., 1963: *Proc. Nutr. Soc.*, 22: 32-41.