NUTRITION OF THE YOUNG GROWING LAMB: STUDIES AT LINCOLN COLLEGE

K. T. JAGUSCH, R. M. MITCHELL, G. R. MCCONNELL, P. F. FENNESSY, M. R. WOODLOCK, N. P. W. JAY

Department of Animal Science, Lincoln College, Canterbury

SUMMARY

Recent lamb nutrition experiments conducted at Lincoln College are described. Details of balance studies with lambs fed ewe's milk and fresh lucerne are given and trials involving pure species pastures briefly reviewed. Growth data for lambs early weaned at 3 to 4 weeks of age on to lucerne and in some cases grass pastures showed that satisfactory liveweight increases occurred.

TWO MAIN REASONS exist for studying the nutrition of the young growing lamb:

(1) To provide information concerning food utilization by young ruminants under New Zealand conditions.

(2) The need for practical knowledge of developments in intensive lamb production, with the necessity to rear the multiple-born lambs from ewe flocks of increasing prolificacy (Spedding, 1965).

In addition, the nutritional economy of the ewe and suckling lamb at pasture needs investigation because it is known that the lactating ewe eats considerably more than she requires for maintenance.

PURE SPECIES PASTURES

The great potential of pure legume pastures to produce rapid liveweight gain in lambs so that high carcass weight (20 kg) can be easily obtained, if they were acceptable to the market, has been shown by McLean *et al.* (1962, 1965). Alterations in the physical structure of the gut of the lamb and the different patterns of digestion between pasture species were highlighted in these experiments. Research into more fundamental aspects of the digestive physiology of the lamb, as adopted by Applied Biochemistry Division, DSIR (Ulyatt, 1969; Ulyatt and MacRae, 1971) with adult sheep has not so far been conducted at Lincoln.

Nicol and McLean (1970) found oestrogen treatment increased liveweight gain and reduced fat content of the

carcass of lambs fed on either lucerne or ryegrass but carcass weight was not affected. Jagusch and Nicol (1970) concluded that the chemical composition of a given breed of lamb, growing at markedly different rates on different pasture species, was independent of the nutritional environment. In another experiment it was found that only trained taste panels could distinguish between meats from lambs given lucerne or ryegrass (Nicol and Jagusch, 1971). This was in direct contrast to consumer preference tests.

BALANCE STUDIES WITH LAMBS

The Animal Science Department at Lincoln commenced screening foods important to the young lamb in 1968. Ewe's milk was examined first to study its utilization and also because data were required with which to compare milk replacer diets (assuming artificial rearing is not too remote a possibility with high fertility flocks). The results are given in Table 1.

TABLE 1: BALANCE DATA FOR LAMBS FED EWES' MILK FROM BIRTH TO 3 WEEKS OF AGE

Group (n = 3)	*Milk Intake (litre/ 21 day)*	*Empty Body Wt Gain (kg/ 21 day)*	*Digestible Energy (%)*	*Metabolizable Energy (%)*	*Energy Balance (Mcal/ 21 day)*	*N Balance (g/ 21 day)*
1	6.3	— 0.6	98.1	91.9	— 1.7	— 1.5
2	14.3	1.6	98.6	95.5	1.5	66.4
3	22.7	4.1	98.5	95.8	8.4	128.1
4	29.6	5.2	98.4	95.5	9.4	148.5

It was found that a rapidly growing lamb (250 g/day) consumed about 29.61 (6.5 gal) of ewe's milk and deposited about 0.5 kg fat and 1 kg protein in the first 21 days of its life. The digestibility and metabolizability of ewe's milk was high and unaffected by the plane of nutrition, with the exception of those lambs fed sub-maintenance levels when the energy loss in the urine became relatively high. Lambs used the metabolizable energy of ewe's milk with an efficiency of 77% and when restricted in nutrition utilized their body fat while retaining body protein (Jagusch and Mitchell, 1971). Obviously the easiest way to produce a high quality diet for lambs during the first three weeks of life, even under intensive rearing conditions with

triplet-bearing ewes, is to feed the post-parturient ewe for maximum milk production.

In a second study fresh lucerne as a feed was examined over a period of 21 days with lambs weaned at 5.5 weeks of age. The results of the balance trial are given in Table 2. The gain in weight was closely related to the intake of lucerne and represented by the following equation ($n=7$):

$$G = 0.190\,ME - 22.594$$
$$RSD = \pm 2.862;\ r = 0.96$$

Where G = empty body weight gain ($g/kg^{0.75}$ 24 hr),
ME = metabolizable energy ($Mcal/kg^{0.75}$ 24 hr),
RSD = residual standard deviation, and r = correlation coefficient.

Table 2 also shows that lamb No. 230, fed *ad libitum*, ate about 90 kg fresh lucerne in 21 days and that increasing the plane of nutrition depressed the digestibility and metabolizability of lucerne.

Although three of the seven lambs gained in empty body weight, all were still in negative energy balance after the 21-day feeding period. In contrast only one lamb was in negative nitrogen balance and in one lamb (No. 230) there was a 27% efficiency of conversion of food protein to crude body protein. (If all N was deposited in muscle protein then lamb No. 230 consumed 4.4 kg protein and produced 6.0 kg muscle tissue in 21 days.) Such an apparent high efficiency of utilization demonstrates the intensity of N metabolism in the young growing lamb.

Figure 1 shows the relationship between the weight of fat and protein and empty body weight for lambs given lucerne and a control group of lambs suckling their mothers, who in turn grazed ryegrass-white clover pasture. It was found that the lambs fed lucerne had significantly more protein ($P < 0.01$) and less fat ($P < 0.01$) than lambs suckling the ewe. Even when lambs were fed sufficient lucerne to promote growth, they still utilized body fat at some stage during the 21-day feeding period; presumably as an endogenous source of energy supply. The change in body composition explained the unusual balance data in Table 2.

This experiment has raised the question as to whether the change in body composition was owing to the type of ration given the lamb or weaning as early as 5.5 weeks of age. It also seemed important to know whether fat mobilization was phasic in nature or whether the relation-

TABLE 2: BALANCE DATA FOR LAMBS GIVEN LUCERNE FROM 5.5 TO 8.5 WEEKS OF AGE

Lamb No.	*Dry Matter Intake (kg/21 day)*	*Empty Body Weight Gain (kg/21 day)*	*Digestible Energy (%)*	*Metabolizable Energy (%)*	*Energy Balance (Mcal/21 day)*	*N Balance (g/21 day)*
146	4.4	— 2.5	72.2	54.4	— 15.3	— 11.2
224	5.3	— 1.2	71.5	55.9	— 8.4	28.7
320	8.2	— 0.6	69.7	55.7	— 7.7	65.9
400	10.7	— 0.1	69.8	53.6	— 13.4	42.2
229	12.0	1.4	66.3	50.4	— 8.4	92.4
49	12.2	1.5	66.8	51.3	— 2.9	88.6
230	17.4	3.3	69.7	56.1	— 0.4	192.3

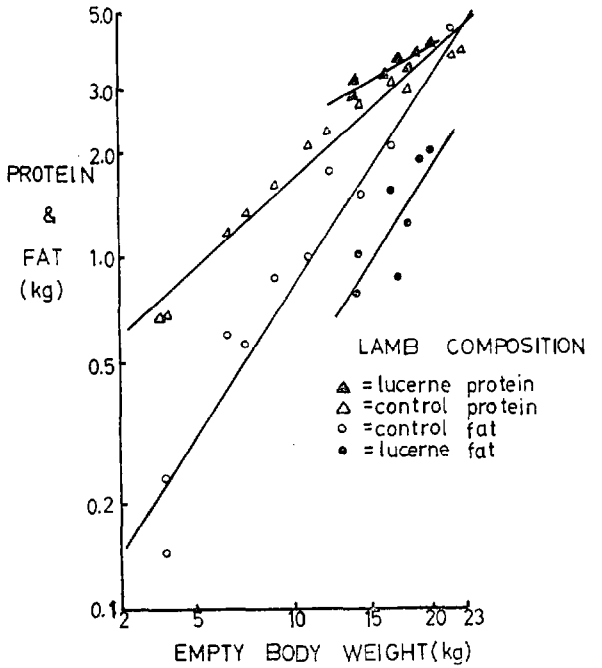

Fig. 1: Composition of lambs fed lucerne or suckled by ewes grazing ryegrass-white clover pasture. Lucerne-fed lambs — protein ▲, fat 0; suckled lambs — protein △, fat 0.

ship remained the same until slaughter weight. Accordingly, balance experiments were conducted with groups of 16 lambs weaned at 3.5, 5.5, 7.5, and 9.5 weeks of age, and half of each group were fed on lucerne or ryegrass-clover pasture.

Although analyses of results are not complete and only two types of pasture have been tested, it appears that the change in body composition is an effect of early weaning rather than of the type of pasture consumed. Examination of bloods from weaned and suckled lambs shows that early weaning at 3.5 and 5.5 weeks of age caused a marked elevation in plasma non-esterified fatty acids but not in those animals weaned at 7.5 and 9.5 weeks of age. In contrast, blood glucose levels were reduced no matter what age lambs were weaned compared with lambs suckling the ewe.

FIELD EXPERIMENTS

Field experiments with early weaned lambs were first conducted in spring, 1969. In that season groups of lambs were weaned at 3, 4, and 5 weeks of age, respectively, on to fresh lucerne and their growth rates compared with suckled lambs whose mothers grazed ryegrass-white clover pasture (Jagusch *et al.*, 1970). The liveweights recorded up to slaughter are given in Table 3.

TABLE 3: MEAN LIVEWEIGHTS (kg) OF LAMBS EARLY WEANED ON TO LUCERNE AND SUCKLED LAMBS

Group	*No. of Lambs*	*Age (weeks)* 0	3	5	7	11
Weaned — 3 wk	24	5	11	12	15	23
Weaned — 4 wk	20	5	10	14	17	25
Weaned — 5 wk	16	5	12	16	19	24
Suckled	130	5	11	—	17	25

Weaned lambs ate the plant apex and side leaves of the lucerne plant and left the stalk, thus selecting a diet high in protein and low in fibre. No scouring occurred. The growth rates of the lambs, with the exception of those weaned at 3 weeks and which suffered a post-weaning check for 10 days, were comparable to lambs suckling the ewe; however, carcass weights were 1 kg lighter.

During spring 1970, the effect of various systems of early weaning on lamb growth have been studied. These trials have included weaning of lambs with or without hay, with or without water, weaned gradually or abruptly, and fed spring grass or lucerne. The results will be published elsewhere but some data for lambs early-weaned at 26 days of age are given in Tables 4, 5 and 6.

Table 4 shows that the higher mean weaning weight of lambs from the Coopworth dams was associated with a

TABLE 4: MEAN LIVEWEIGHTS (kg) OF SINGLE FEMALE LAMBS EARLY WEANED ON TO LUCERNE

Breed	*No. of Lambs*	*Age (days)* 26*	60	100
Dorset Down × Coopworth	37	13.7	21.9	35.0
Dorset Down × Romney	35	11.4	19.7	30.8
Dorset Down × Romney (without water)	28	11.5	20.7	32.1

*Lambs weaned

100-day-liveweight greater than that for Dorset × Romney lambs. All final weights were excellent, with carcasses 44% of liveweight. It is also interesting that lambs given early spring lucerne, under the mild weather conditions experienced during the trial, did not appear to require water.

Table 5 shows the liveweights of twin lambs reared as singles after 26 days either on the ewe, which grazed ryegrass-white clover pasture, or early-weaned on to lucerne or spring grass. At 100 days of age lambs fed lucerne were heavier than those suckling the ewe and these were heavier

TABLE 5: LIVEWEIGHTS (kg) OF SUCKLED* AND EARLY-WEANED TWIN DORSET DOWN × COOPWORTH LAMBS

Sex of Lamb and Type of Feeding	*No. of Lambs*	*Age (days)* 26	60	100
Wether:				
Lucerne	7	10.4	18.5	33.6
Ryegrass-White clover	7	11.5	18.8	26.4
Suckled	13	11.1	21.5	29.7
Female:				
Lucerne	6	11.4	19.3	32.2
Ryegrass-White clover	6	11.2	16.1	25.5
Suckled	16	10.5	19.8	27.7

*Lamb reared as single on ewe after 26 days.

TABLE 6: GROWTH RATES OF LAMBS FROM 26 TO 100 DAYS OF AGE

Description of Lamb	*Feeding Treatment**	*No. of Lambs*	*Liveweight Gain (g/day)*
Dorset Down × Coopworth:			
Single wether	suckled	10	254
Twin wether	suckled	13	251
Twin wether	lucerne	8	314
Twin wether	ryegrass-white clover	7	201
Twin female	suckled	16	232
Twin female	lucerne	6	281
Twin female	ryegrass-white clover	6	193
Single female	lucerne	38	288
Dorset Down × Romney:			
Single female	lucerne	63	270

*Lamb reared as single on ewe or fed lucerne or ryegrass-clover, after 26 days.

than lambs fed grass. It was during the period 40 to 100 days that lambs early-weaned on to lucerne grew faster than those suckling the ewe. A post-weaning check in growth was not as severe for these lambs, when weaned at 26 days of age compared with lambs weaned at 21 days in the previous year.

An idea of the overall daily rates of gain by various groups of lambs are shown in Table 6. In general, the liveweight gains, even for lambs from Romney ewes, were more than satisfactory.

FUTURE STUDIES

Arising from the above results and the need for information on intensified lamb production in New Zealand, several research topics are indicated. These include measurement of the relative intakes of the lactating ewe and lamb given high quality fodders such as lucerne; the efficacy of creep-grazing by lambs of high quality feeds and the use of clover pasture for early weaning. There is also interest in the feeding problems associated with increasing stocking rates on farms utilizing lucerne pasture and where special-purpose feeds (*e.g.*, grain, 'Grasslands Tama' ryegrass) are grown to supplement the pasture when in short supply.

REFERENCES

Jagusch, K. T.; Clarke, V. R.; Jay, N. P., 1970: *N.Z. Jl agric. Res., 13:* 808.

Jagusch, K. T.; Mitchell, R. M., 1971: *N.Z. Jl agric. Res., 14:* 434.

Jagusch, K. T.; Nicol, A. M., 1970: *Proc. N.Z. Soc. Anim. Prod., 30:* 116.

McLean, J. W.; Thomson, G. G.; Iversen, C. E.; Jagusch, K. T.; Lawson, B. M., 1962: *Proc. N.Z. Grassld Ass.:* 57.

McLean, J. W.; Thomson, G. G.; Jagusch, K. T.; Lawson, B. M., 1965: *Proc. Ruakura Fmrs' Conf.:* 34.

Nicol, A. M.; Jagusch, K. T., 1971: *J. Sci. Fd Agric.* (in press).

Nicol, A. M.; McLean, J. W., 1970: *N.Z. Jl agric. Res., 13:* 385.

Spedding, C. R. W., 1965: *Sheep Production and Grazing Management.* Bailliere, Tindall and Cox, London.

Ulyatt, M. J., 1969: *Proc. N.Z. Soc. Anim. Prod., 29:* 114.

Ulyatt, M. J.; MacRae, J. C., 1971: *Proc. N.Z. Soc. Anim. Prod., 31:* 74.