Proceedings of the N.Z. Society of Animal Production, 41: 167-173 (1981)

ENERGY REQUIREMENTS OF RED DEER

P. F. FENNESSY, G. H. MOORE and I. D. CORSON
Invermay Agricultural Research Centre, Mosgiel

SUMMARY

Relationships between liveweight gain and metabolisable energy intake for stags indoors (in pens) and outdoors during winter have been derived. The winter maintenance requirement of 0.85 MJ ME/kg $^{0.75}$/d for stags outdoors was 50% higher than that for stags indoors.

After making allowances for velvet antler growth in stags and lactation in hinds and using assumptions derived from indoor feeding, estimates of the energy requirements of farmed red deer have been derived on a seasonal basis and compared with those of a ewe rearing 1.1 lambs (1 stock unit). Although on an annual basis, adult deer are equivalent to about 2 stock units, stags have a relatively high energy demand during winter, while hinds have relatively low demands during spring and high demands in summer (lactation). The implications for the seasonal management of grazing deer are discussed.

INTRODUCTION

Knowledge of the energy requirements of farmed animals is necessary when making comparisons between different species and classes of stock and when making management decisions concerning levels of feeding. This paper presents estimates of the energy requirements of farmed red deer.

EXPERIMENTAL

The energy requirements are based on relationships between liveweight gain and metabolisable energy intake (MEI) for stags indoors and for groups of mixed-age stags fed outdoors in winter (Table 1). The regression relationship between ME intake (MJ ME/kg$^{0.75}$/d) and liveweight gain (g LWG/kg$^{0.75}$/d) for the stags outdoors (group mean weights from 113 to 140 kg) was:

$$LWG = 15.2\ MEI - 12.9$$

$$r^2 = 0.882,\ RSD \pm 0.87,\ (n = 11)$$

The relationships for the stags indoors were derived from 2 groups of stags each fed high quality barley-lucerne-linseed pelleted diets (approximately 11 MJ ME/kg DM and 26 g nitrogen (N)/kg DM) *ad libitum* in individual pens. Intake and liveweight gain were computed for a 70-day period for each stag. The regression relationships were:

TABLE 1: ESTIMATED METABOLISABLE ENERGY INTAKE (MEI) AND LIVEWEIGHT GAIN FOR GROUPS OF STAGS FED OUTDOORS DURING WINTER

Year	No. of Stags	MEI ($MJ/kg^{0.75}/d$)	LWG ($g/kg^{0.75}/d$)	Feeding period Days	Months	Diet[4]
Invermay						
1978[1]	5	0.80	−1.33	100	May-Aug	LH, barley
1979[2]	16	0.98	2.16	42	Jul-Aug	LH,
	16	1.13	5.09	”	”	LH, nuts
	16	1.17	5.48	”	”	” ”
1980[2]	16	1.08	3.64	”	”	” ”
	16	1.08	3.75	”	”	” ”
	16	1.03	3.43	”	”	” ”
	16	1.08	2.19	”	”	” ”
Coringa[3]						
1979	18	0.69	−1.88	86	Jun-Sep	LH, pasture
	16	0.87	0.95	82	”	LH, nuts, pasture
	18	1.01	0.89	81	”	LH, nuts, pasture

[1] Stags in a small paddock.
[2] Stags in a plantation.
[3] Data from P. D. Muir (pers. comm.). Stags in small paddocks; pasture provided 12-15% of total MEI.
[4] LH, lucerne hay: nuts, a high quality pelleted feed (46% barley, 35% lucerne, 15% linseed meal, 4% minerals and vitamins).

Group A: LWG = 29.6 MEI − 16.9

$r^2 = 0.743$, RSD ± 3.09, (n = 45)

(5 or 10 stags per period, aged 6-18 months with mean initial and final liveweights of 50 and 110 kg: 1978-9)

Group B: LWG = 25.5 MEI − 14.5

$r^2 = 0.814$, RSD ± 1.42, (n = 40)

(8 or 16 stags per period, aged 13-20 months with mean initial and final liveweights of 80 and 105 kg: 1980)

The regression relationships for the two sets of data were not significantly different and the relationship for the means of the values calculated from the two regression equations is plotted in Fig. 1 together with the relationship for the groups of stags fed outdoors.

The estimates of maintenance requirement (MR) calculated from the regression relationships were 0.57 and 0.85 MJ ME/kg $^{0.75}$/d for stags fed indoors and outdoors respectively. The estimate of 0.57 MJ ME/kg$^{0.75}$/d was very similar to that derived for red deer in calorimetric studies by Simpson *et al.*, (1978a, b) i.e. 0.45 to 0.55 MJ ME/kg $^{0.75}$/d. These estimates were about 50% higher than the A.R.C. estimates for sheep but very similar to those for cattle (A.R.C. 1965).

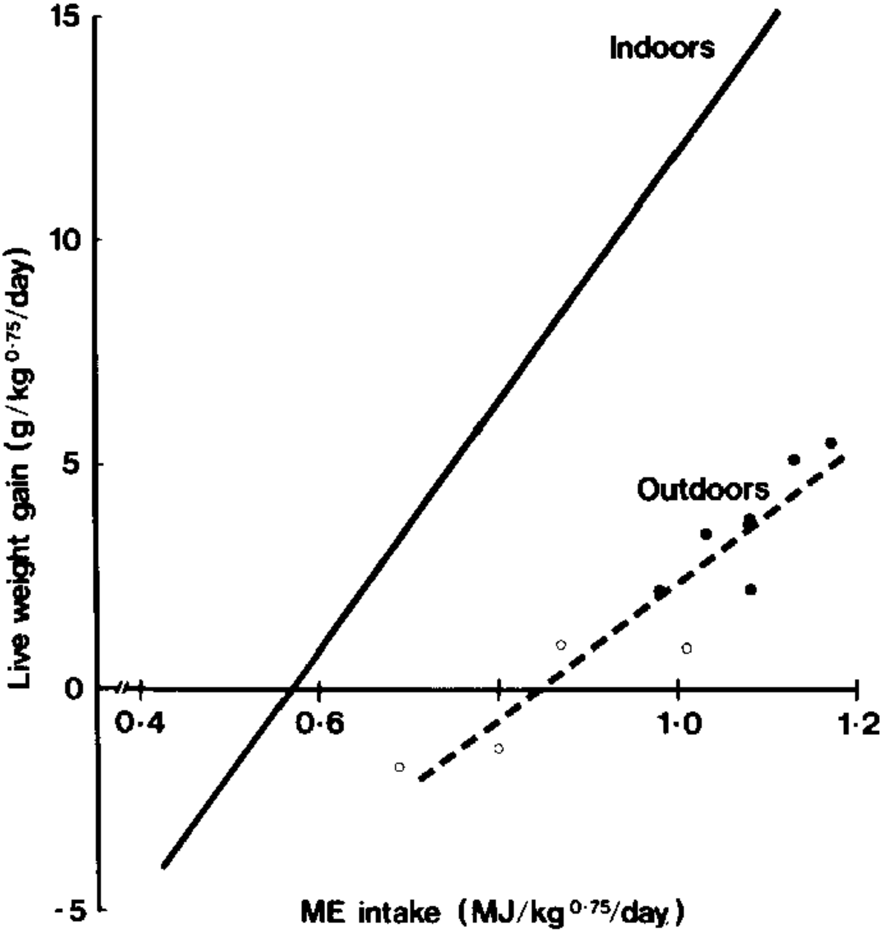

FIG 1: *Regression relationships between metabolisable energy intake and liveweight gain for stags fed indoors and outdoors (○ stags in paddocks, • stags in plantations which are more sheltered).*

ESTIMATING ENERGY REQUIREMENTS

The assumptions used for the calculation of the energy requirements are as follows.

The year was divided into four periods with the MR being taken as 30, 50, 20 and 10% above that for pen-fed stags, for Autumn, Winter, Spring and Summer periods respectively:

Autumn,	65 days (20 Mar - 23 May) MR =	0.74 MJ ME/$kg^{0.75}$/d
Winter,	100 days (24 May - 31 Aug)	0.85
Spring,	100 days (1 Sep - 9 Dec)	0.68
Summer,	100 days (10 Dec - 19 Mar)	0.63

The ME requirement for liveweight gain was derived from the equations for the stags fed indoors and is 37 MJ ME/kg LWG.

The ME requirement for the suckling calf was derived from the data of Fennessy *et al.*, (1981) for deer calves fed milk replacers indoors using the following equation (GEI = gross energy intake from milk only in MJ/d),

$$\text{LWG (kg/d)} = 0.0294\ \text{GEI} - 0.0224$$

Milk provided 90% of the calf's total MEI from 5 to 9 weeks indoors. The calculated requirement was increased by 10% to allow for an increased energy expenditure outdoors. Further assumptions were, that the ME content of milk was 0.95 of the GE content (Jagusch and Mitchell, 1971), that the efficiency of utilisation of ME for milk synthesis by the hind was 0.64 (Moe *et al.*, 1971) and that the daily ME requirement for the hind and calf during the middle third of lactation was equal to the average requirement for the whole lactation, which covered the Summer period.

The ME requirement for velvet antler growth has been calculated assuming an efficiency of utilsation of ME of 0.33. Although velvet antler growth takes place over a 55-70 day period, the requirement has been spread over the Spring period. Compared with the total ME requirement that for velvet antler growth is very small, amounting to only 0.5 MJ ME/d over 100 days for a stag producing 2.4 kg of velvet antlers.

The general patterns of liveweight change for red deer (P. Fennessy, unpublished data) as used in the calculations are shown in Figs. 2 and 3. For young calves the patterns show a low rate of gain over the Autumn-Winter periods following weaning, with a high rate of gain during the Spring-Summer periods when the deer are 9-15 months of age. For older stags the annual cycle includes a considerable and unavoidable weight loss during the rut in the Autumn period followed by a slight weight loss in the Winter period.

The calculated seasonal ME requirements for red deer and the requirement for the one stock unit (SU, i.e. a 55 kg ewe rearing 1.1 lambs to weaning; Coop, 1965) are presented in Table 2.

From Table 2 and Fig. 2 it is apparent that for the older stag an increased ME intake of about 20% in the Spring period compared with the Winter period is the difference between an 8 kg weight loss in Winter and a 25-30 kg weight gain in Spring. This is a very small change in ME intake for such a change in weight gain and is in marked contrast to the situation with stags penned indoors even though the seasonal patterns of liveweight change in the two

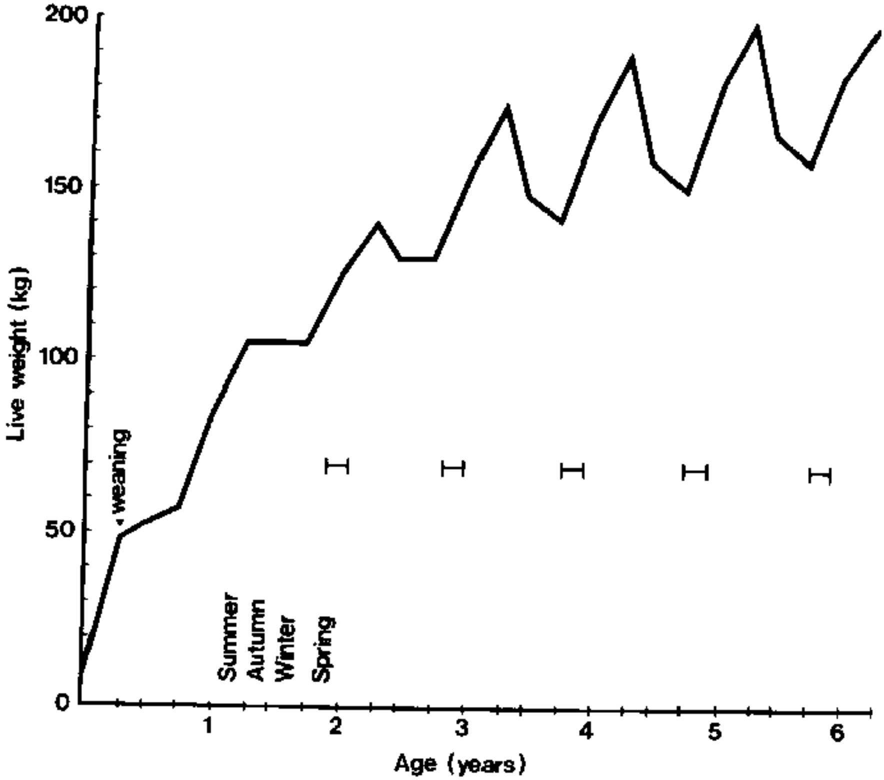

FIG 2: *General pattern of liveweight for red deer stags.*

environments are similar. The stag indoors has a very marked seasonal pattern of voluntary feed intake with a low intake during winter. This is not the case outdoors where the very high maintenance requirements necessitate a higher feed intake during winter. Consequently the stag outdoors requires about 27% of his annual ME intake during the 100 day Winter period.

Both the hind and the ewe require about 20% of their annual ME intake during the Winter period. The essential difference between the two occurs in the timing of lactation — spring for ewes and summer for hinds, the ewe requiring approximately 49% of her total MEI during lactation and the hind, 43%.

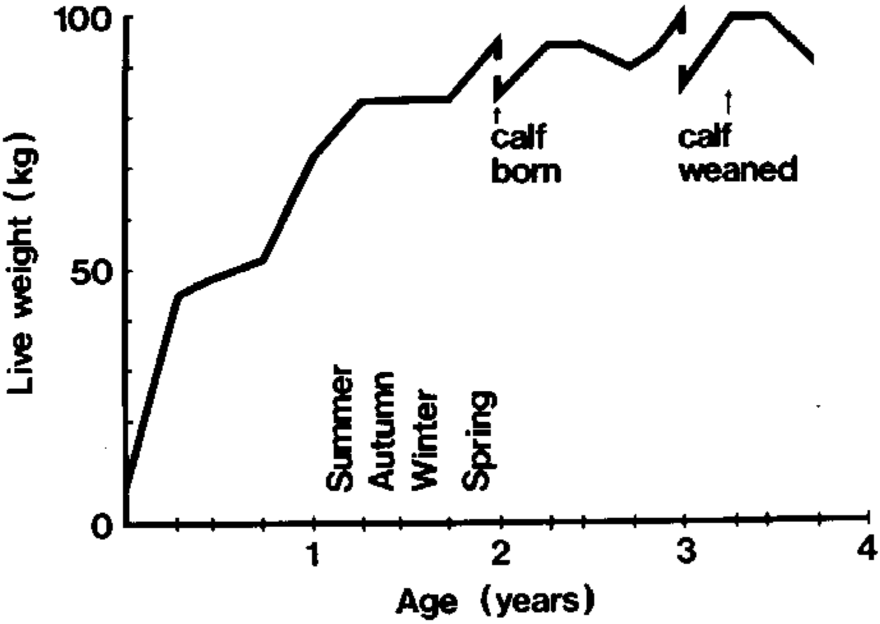

FIG 3: *General pattern of liveweight for red deer hinds.*

TABLE 2: METABOLISABLE ENERGY REQUIREMENTS OF RED DEER COMPARED WITH THAT FOR A EWE REARING 1.1 LAMBS

Period:	*Autumn*	*Winter*	*Spring*	*Summer*	*Annual*
No. Days:	*65*	*100*	*100*	*100*	*365*
			(MJ ME/head/d)		*(MJ ME/head × 10³)*
Males:					
(age-years)					
0.25-1.25	16.2	19.9	27.1	26.4	8.3
-2.25	24.3	28.0	31.6	30.0	10.5
-3.25	23.6	32.9	37.7	36.2	12.2
-4.25	19.4	32.9	38.4	38.2	12.2
-5.25	18.5	34.7	43.3	38.9	12.9
> 5.25	18.7	36.1	42.3	37.9	12.9
Females:					
0.25-1.25	15.1	17.5	22.0	20.7	7.0
-2.25	20.3	23.5	23.3	44.9	10.5
-3.25	22.3	23.9	24.3	47.4	11.0
> 3.25	23.4	22.3	24.3	47.4	10.9
SU[1]	13.0	10.3	28.5	11.1	5.8

[1] Calculated from Ulyatt *et al.*, (1980).

IMPLICATIONS

The SU equivalents for the various classes of deer on an annual basis are given in Table 3. Adult red deer are equivalent to about 2 SU. However, compared with a ewe rearing lambs the periods of relatively high energy demand for red deer are in the winter for stags and during the summer lactation for hinds. In comparison with a ewe and lambs the spring energy requirements for deer are relatively low. These varying energy demands have important implications for stock managers in New Zealand because of the marked seasonal pattern of pasture production.

TABLE 3: STOCK UNIT EQUIVALENTS FOR RED DEER

Age (years)	*Male*	*Female*
0.25-1.25	1.4	1.2
1.25-2.25	1.8	1.8
Adult	2.1	1.9

The feed requirement for 1 SU is equivalent to about 540 kg of pasture DM.

ACKNOWLEDGEMENTS

Thanks are due to P. D. Muir of Lincoln College for the Coringa data and to C. Brown and A. Searle for assistance with field trials.

REFERENCES

A.R.C. 1965. *The Nutrient Requirements of Farm Livestock, No. 2 Ruminants.* Agricultural Research Council, London.
Coop, I. E., 1965. *N.Z. Agricultural Science 1*: 13-18.
Fennessy, P. F.; Moore, G. H.; Muir, P. D., 1981. *N.Z. Jl exp. Agric., 9:* 17.
Jagusch, K. T.; Mitchell, R. M., 1971. *N.Z. Jl agric. Res., 14:* 434.
Moe, P. W.; Tyrrell, H. F.; Flatt, W. P., 1971. *J. Dairy Sci., 54:* 548.
Simpson, A. M.; Webster, A. J. F.; Smith, J. S.; Simpson, C. A., 1978a. *Comp. Biochem. Physiol., 59A:* 95.
Simpson, A. M.; Webster, A. J. F.; Smith, J. S.; Simpson, C. A., 1978b. *Comp. Biochem. Physiol., 60:* 251.
Ulyatt, M. J.; Fennessy, P. F.; Rattray, P. V.; Jagusch, K. T., 1980. In *Supplementary Feeding,* edited K. R. Drew and P. F. Fennessy. N.Z. Society of Animal Production Occ. Publ. 7. Mosgiel.