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This paper provides a brief review of research concerned with the nutrition of red deer carried out at the Invermay Research Centre.

Growth

Red deer, particularly stags, exhibit a very marked cyclical pattern of liveweight change even when fed ad libitum. During spring and summer, voluntary feed intake is high and the stag gains weight and condition thus attaining peak condition for the rut in April-May. During the rut the stag reduces feed intake and loses a considerable amount of weight even when not used for breeding. After the rut, the stag's intake increases so that with ad libitum feeding, generally it is possible to maintain liveweight of stags over the winter.

An indication of the annual pattern of voluntary feed intake which generates such liveweight changes can be gained from studies with deer indoors. A graph showing the weekly mean intakes over a 12 month period for a group of six stags from the age of two to three years is shown in Figure 1.

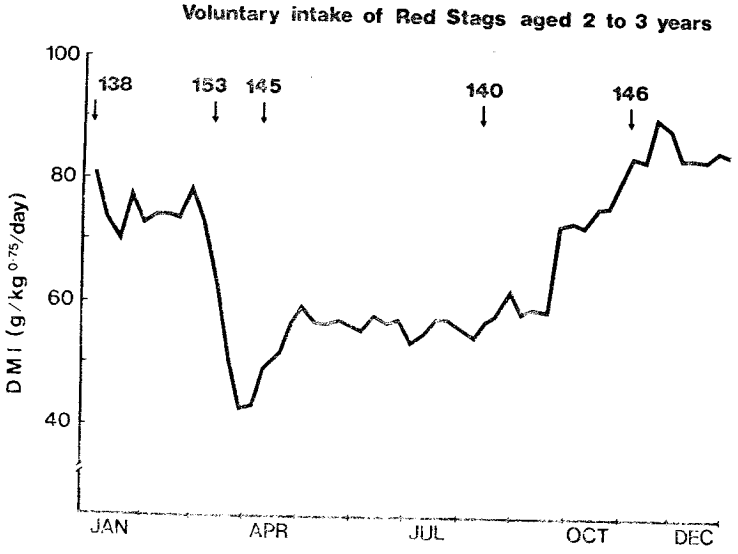

Figure 1: Weekly mean DM intakes ($g/kg^{0.75}/day$) of red stags from two to three years of age (the intakes and liveweight are the means for six stags. Liveweights are above the arrows (kg)).

It is clear from work reported later in this paper that the absolute intakes of stags outdoors during winter are higher than those recorded indoors. Therefore it is likely that intake is regulated through some mechanism related to energy expenditure such that even when fed ad libitum, the voluntary intake of stags is limited so that they can achieve only liveweight maintenance during winter. The stags were housed in individual pens and fed a high quality barley-lucerne-linseed pelleted diet ad libitum. The patterns of liveweight changes recorded were very similar to those for stags outdoors at pasture.

The general pattern of liveweight of farmed red stags from birth to six years of age is shown in Figure 2.

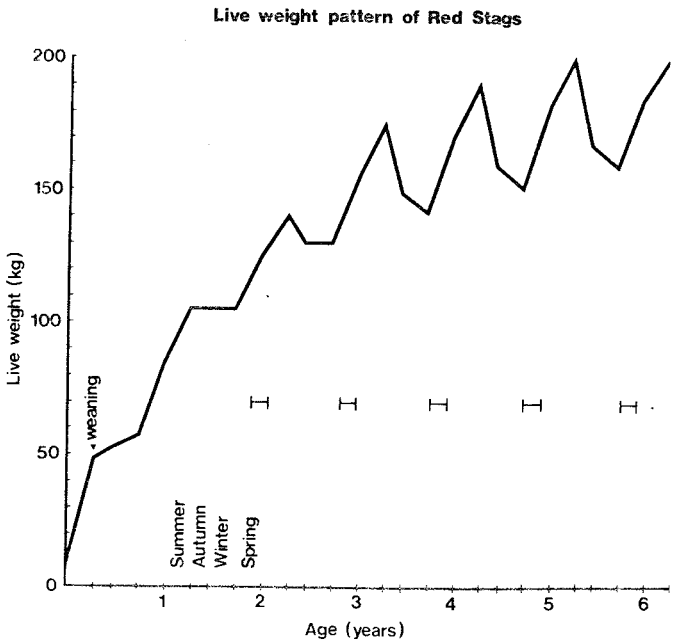

Figure 2: General pattern of liveweight for red stags.

The pattern is based on Invermay data but as a greater understanding of the appropriate management and nutrition for deer develops it is likely that weights will increase. In this respect weaning weights have increased over the years with the improvement in the nutrition of the hind during lactation.

Based on very limited data so far, it appears that stags attain their mature body weight at about 5-7 years of age. However, a distinction must be made between:

a. The animal's capacity to grow or growth potential, and
b. The actual growth rate.

The former is essentially a function of the animal's capacity to eat and its efficiency of growth which are determined genetically whereas the latter is a function of the animal's inheritance and the actual quantity and quality of the feed consumed. A good indication of growth potential can be obtained from pen-feeding studies where deer are fed ad libitum from an early age. Figure 3 gives the liveweight pattern for three such groups of stags from six to 24 months of age at Invermay.

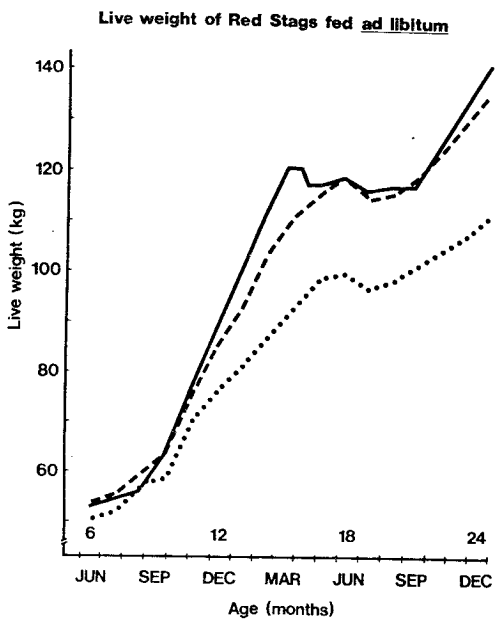

Figure 3: Mean liveweights for groups of stags individually fed a high quality diet ad libitum indoors from six to 24 months of age (—— mean of six stags, progeny of two sires, A and B, in 1978-79; - - -mean of 10 stags, progeny of sire C in 1979-80; ····· mean of six stags, progeny of sire D in 1979-80).

The interesting features are the difference between the two years data in the time at which the peak weight is attained and the very large difference between the mean weights of the progeny of the two sires in 1979-80. The latter may provide an indication of the potential for selection for growth rate within the N.Z. red deer.

The origin of the deer may be important in discussions of body size, and also antler growth. The Invermay deer are derived mainly from stock of Otago-Southland origin along with some from the Taupo region. The Otago deer are descended mainly from liberations of Scottish deer, Cervus elaphus scoticus and although most of the N.Z. liberations were of deer from the United Kingdom, not all were of the "pure" C. e. scoticus strain. For example, the Rakaia releases were from the Stoke Park herd in which the local deer had been crossed with red deer of European origin (Banwell, 1972). The European strains of red deer (e.g. C. e. hippelaphus) are of larger body size than the Scottish strain while the conformation of the antler very often is different (Whitehead, 1972).

Weight and Performance

The possible relationships between liveweight and performance are of considerable importance to deer farmers attempting to improve their herds.

In this respect Kelly & Moore (1978) examined the relationship between fertility of two year old hinds and their weight at mating at 16 months of age. The data are shown in Table 1. Clearly it is important that hinds attain a weight of 65 kg by first mating.

Table 1: Relationship between mating weight at 16 months and calving performance of young red hinds[1].

Weight (kg)	Calving %
55	0
55-60	0
61-65	50
66-70	90
70	91

[1]From Kelly & Moore (1978)

A guide to the expected calving percentage for herds of two year old hinds as a function of their mean mating weight is given in Table 2. Thus for every kilogram increase in the mean between 65 and 70 kg one could expect 4% more hinds to calve. These data relate to hinds at Invermay and the weight of 65 kg (essentially a puberty weight) may be different for the different strains of red deer. However, the principle still holds that yearling hinds must be well grown if they are to produce a calf as a two year old. With reasonable nutrition good average weights are not difficult to achieve.

For older hinds, Kelly & Moore (1978) found no difference in the weight at mating for those that subsequently calved or failed to calve. The mean weight was 88 kg.

Table 2: Expected calving performance for herds of young red hinds as related to mating weight.

Mean Weight (kg)	% Over 65 kg	Expected Calving %
65	47	56
70	74	75
75	91	86
80	98	90

The general liveweight pattern of red hinds based on Invermay data is shown in Figure 4. Mature hinds are allowed to lose weight over winter and then to gain weight in late pregnancy. Lactating hinds must be fed well if good calf growth rates are to be achieved. Good feeding during the period also allows the hinds to gain weight and condition.

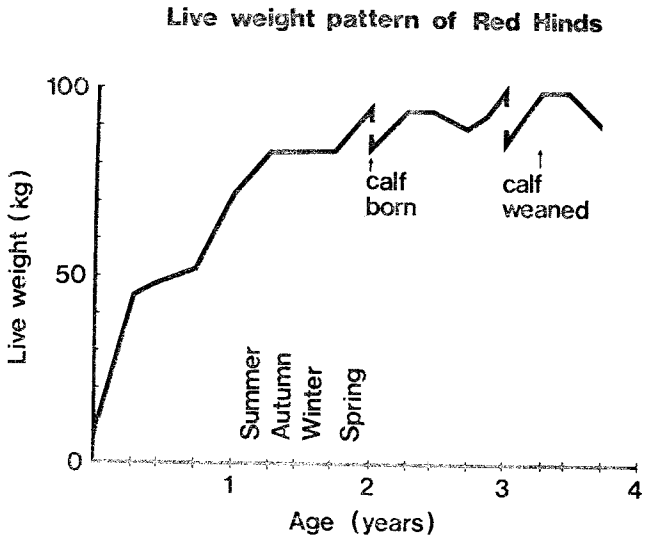

Figure 4: General pattern of liveweight for red hinds.

There is considerable interest in the possibility of selection of stags at an early age for subsequent body weight and velvet antler production. Although at this stage very limited data are available it seems that liveweight at 15 months may be a reasonable predictor of these parameters and therefore could be used as a selection tool (Brown, 1980). The information obtained so far with the par-fed stags would tend to support this conclusion.

Feed Requirements

Knowledge of the energy requirements is necessary when making comparisons between different species of farm animals. The information presented here is taken from the paper by Fennessy et al, (1981).

The energy requirements are based on regression relationships between liveweight gain and metabolisable energy intake (MEI) for stags indoors and for groups of mixed age stags fed outdoors in winter (Figure 5). The ME requirement for maintenance for stags outdoors was about 50% higher than that for stags indoors.

Figure 5: Regression relationships between metabolisable energy intake and liveweight gain for stags fed indoors and outdoors.

For the calculation of energy requirements the year has been divided into four seasonal periods:

Autumn: 65 days, March to May - rut
Winter: 100 days, May to August
Spring: 100 days, September to December - velvet antler growth, late pregnancy
Summer: 100 days, December to March - lactation

The maintenance required (MR) has been taken as 30, 50, 20 and 10% above the MR for the Autumn, Winter, Spring and Summer periods respectively. Allowances have been made in the calculation for liveweight gain, milk production by hinds and velvet antler growth in stags.

The general patterns of liveweight for stags and hinds on which the calculation of energy requirements are based are those shown in Figure 2 and 4.

The ME requirements by season for stags and hinds are given in Table 3. The requirements for the standard stock unit, a 55 kg ewe rearing one lamb to weaning are also given.

Table 3: Metabolisable energy (ME) requirements and stock unit equivalents of red deer.

	Autumn	Winter	Spring	Summer	Annual Stock Units
	(MJ ME/day)				
Stags					
3-15 months	16	19	27	26	1.4
15-27 months	24	28	31	30	1.8
Older stags	19	35	42	38	2.2
Hinds					
3-15 months	15	18	22	21	1.2
Older hinds	23	22	24	47	1.9
Ewe rearing lamb	13	10	28	11	1.0*

*One SU requires about 540 kg pasture DM per year

There are a number of points which need comment. For the older stag an increased ME intake of about 20% in Spring compared with Winter is the difference between an 8 kg weight loss in Winter and a 25-30 kg weight gain in the 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 (see Figure 1) even though the seasonal patterns of liveweight change in the two environments are similar. Outdoors, the very high maintenance requirement necessitates a higher feed intake during winter. Consequently the stag outdoors requires about 27% of his annual ME intake during the 100 day Winter period. The provision of effective shelter especially during this period could be expected to reduce heat loss and therefore feed requirements of stags.

Both the hind and the ewe require about 20% of their annual ME intake during the Winter. The essential difference between the two females occurs in the timing of lactation - spring for ewes and summer for hinds, the ewe requiring approximately 49% of her total ME intake during lactation and the hind, 43%. The Appendix Table gives ME values for a number of different feeds.

The stock unit equivalent for the various classes of deer on an annual basis also are equivalent to about two stock units. However, compared with a ewe rearing a single lamb 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 plus lamb the Spring energy requirements for deer are relatively low. Consequently such periods of relatively low energy demands in Spring and high energy demands in Winter and Summer have important implications for stock managers in N.Z. where generally there is a marked seasonal pattern of pasture production characterised by a high Spring pasture production.

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APPENDIX

Table 4: Dry matter (DM) and metabolisable energy (ME) contents of feeds.*

	DM %	ME (MJ/kg DM)
Ryegrass/white clover pasture		
Autumn	15	10.8
Winter	15	11.2
Spring - short	15	12.0
- mixed length	15	11.2
Summer - leafy	18	10.3
Meadow hay		
Young leafy	85	9.0
Mature	85	8.0
Weathered	85	7.0
Lucerne hay		
Pre bloom	85	10.5
Mid bloom	85	9.0
Weathered	85	8.0
Grains		
Barley	85	12.5
Wheat	85	12.5
Oats	85	11.5
Deer nuts	85	10.8

*More detailed tables are available in the paper by Ulyatt et al (1980).