Growth and feeding management of fallow deer in New Zealand

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Summary

Fallow deer, being of northern temperate origin, exhibit highly seasonal, photoperiodically induced patterns of growth and feed intake. In New Zealand average on-farm pre-weaning fawn growth rates to 3.5 months of age range from 140-190 g/day but can be severely compromised by poor doe nutrition during summer. For young bucks on pasture at Ruakura, subsequent autumn (3-5.5 months of age), winter (6-9 months), spring (9-12 months) and summer (12-15 months) growth rates averaged 77, 34, 125 and 46 g/day respectively. Recommended feeding levels (kg of pasture dry matter per day), calculated from red deer data, are presented for various classes/ages of stock. Winter supplementation of grazing deer usually involves the feeding of high energy rations to offset heat loss. Total concentrate (semi-feedlot) feeding is not practised in New Zealand.

Introduction

Deer have adapted to seasonal changes in feed supply in a wide range of climatic conditions from the cold polar region to the tropics. But this very adaption for survival can limit their potential as farmed animals. This is particularly the case for species of temperate origin such as fallow deer, red deer and elk. The more obvious adaptation characteristic shared by these three species is synchronisation of births within summer months. Less obvious in the natural range, but important, are seasonal variations in appetite and growth that are related to natural cycles of feed availability and annual reproductive cycles.

For the successful farming of fallow deer it is helpful to understand what controls their growth. It might be thought that seasonal growth patterns in deer reflect the availability and quality of feed. However, the voluntary feed intake of penned deer fed concentrates ad libitum varies with season in the same manner as for deer kept outside under more natural conditions. Seasonal variations in voluntary feed intake, associated with photoperiodic changes, have been found with several species of deer (fallow, mule, white-tail, roe and red deer) and also some sheep breeds. Characteristically feed intake is lowest over winter (short days) and highest in spring and summer (long days) (Kay 1979; Suttie & Simpson 1985).

Growth rates of pastured fallow deer in NZ

Although liveweight gains of fallow deer are affected by season, the actual pattern of change varies with animal age and sex. Typically, fallow commence fawning in summer. The suckling period can extend for 8 months but on farms generally ends after 100 days with weaning in late March. Over this suckling period fawns of both sexes grow faster than at any subsequent time. In addition, buck fawns grow faster than doe fawns (Table 1).

Table 1: Mean (±sd) growth rates of fallow deer fawns between birth and 100 days of age recorded on commercial farms in northern New Zealand.

Farm	Buck	Does
R1	160 ± 18 g/day	142 ± 13 g/day
R1	170 ± 16 g/day	146 ± 11 g/day
F4	189 ± 16 g/day	160 ± 10 g/day

After weaning, autumn growth rates of fawns at pasture are generally no more than 50% (i.e. ~80 g/day) of those before weaning (Figure 1). A further reduction in growth rate occurs over the winter, when fawns are between 6-9 months of age. In early spring, fawn growth rates increase in line with increases in pasture growth and quality. The extent to which the surge in liveweight gain over spring is kept up over summer will depend on pasture management over spring. In particular, the prevention of seed head formation on grasses during spring will help in maintaining pasture quality through the summer. For ryegrass/white clover pastures both summer temperatures and rainfall are important determinants of pasture production (Baars 1976)

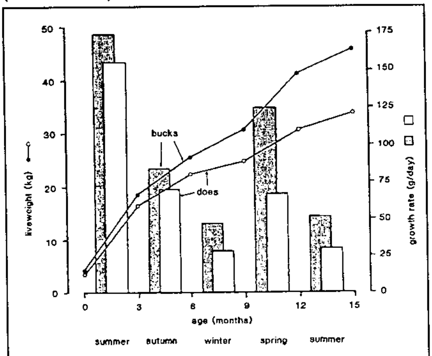


Figure 1: Growth rates of bucks and does from birth to 15 months of age for fallow deer on commercial farms in northern New Zealand (Asher, 1984).

By the end of their second summer, at about 14-16 months of age, both bucks and does are approaching puberty. At this age, bucks may, at best, maintain their autumn liveweights through the ensuing 6 month autumn/winter period to he following spring. Unlike the situation of a year earlier, rising 2 year bucks do not gain weight over their second autumn and winter.

Following the onset of puberty at about 14 months of age, entire males can become difficult to handle, particularly during yarding. However, many producers take this as an opportunity to send for slaughter those bucks not required for breeding. At this time carcass weights of bucks have proved acceptable to venison processors. In addition, carcasses typically averaging about 24 kg were shown to contain as little as 7% chemical fat (Gregson & Purchas 1985).

After puberty, fallow bucks exhibit an annual liveweight cycle which is most marked when they are used as sires (Figure 2). Over the rutting season sire bucks may lose up to 25% of their pre-rut liveweight. Mixed age does also show an annual cycle of liveweights, but fluctuations are less marked

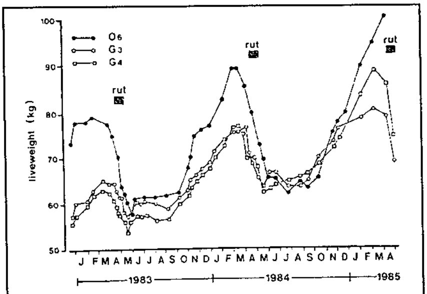


Figure 2: Liveweight changes of sexually mature fallow bucks used as sires on the Ruakura Agricultural Centre (Asher, 1985).

than for bucks, with the increase in pre-fawning liveweight reflecting the weight of the unborn fawn and the products of conception.

Effects of castration on growth

After puberty entire males not only become more difficult to handle but are also more agonistic toward each other during the breeding season. As a consequence of this, groups of entire bucks are not usually yarded at this time. Where markets require an all year round supply of chilled venison this can be restrictive.

One possible way to extend the killing season is by castrating bucks (Mulley 1993). In one of the earliest trials at the Ruakura Agricultural Centre, bucks were allocated to two unequal sized groups which were balanced for birth date, birth weight and weaning weight. Bucks in the smaller group (n = 11) were castrated at 5 months of age with elastrator rubber rings and the larger group (n = 21) were left intact. The two groups of animals were grazed as one mob to about 27 months of age.

Liveweight profiles of entire and castrated bucks from birth to 4 years of age are shown in Figure 3. Pre-weaning growth rates to 3.5 months for both groups averaged 187 g/day and between weaning and castration 77 g/day. From this latter time until 9 months of age, both entire and castrated bucks grew slowly at the same rate of 34 g/day. However, from the start of spring the mean growth rate of entire bucks was 125 g/day compared with 96 g/day for the castrated group. Over the summer period from 12 to 15 months of age the entire bucks averaged 46 g/day with castrates averaging 27 g/day. By 15 months of age castrated bucks were 9.8% lighter than entire bucks. By 27 months this difference increased to 14%.

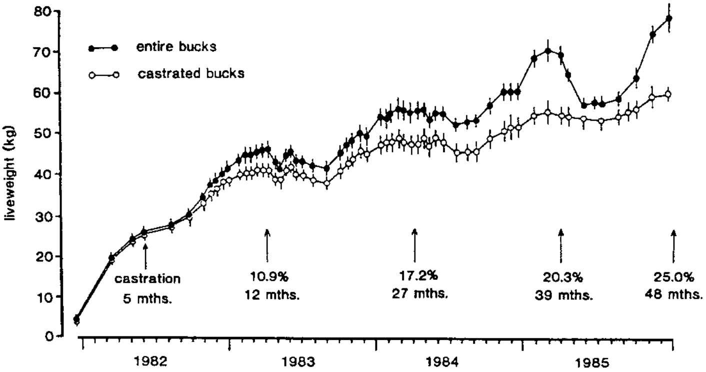


Figure 3: Growth (mean ±95% CI) of entire and castrated fallow bucks on the Ruakura Agricultural Centre. The percentage difference in liveweight is indicated for various ages up to 48 months (Asher, 1986).

Feeding levels

In New Zealand, ryegrass/white clover pastures, whether grazed directly or offered as conserved products (hay or silage), can provide the nutrients required by fallow deer. For efficient utilisation of pastures, information is required on seasonal pasture production, target performance levels of fallow deer and the feed required to achieve the targets.

Presently there are no published estimates of feed or energy required by fallow deer at pasture. However, as a guide, feeding levels for fallow have been calculated from liveweight gain/energy intake relationships found with red deer (Fennessy *et al.* 1981). Although feed requirements were calculated in terms of metabolisable energy (Table 2), for some practical purposes it is more convenient to express feed requirements in terms of pasture dry matter (Table 3). As the energy contents of pasture dry matter and several other feeds are known, conversion from metabolisable energy to dry matter is straight forward (Table 3).

It should be stressed however, that the feed requirements given in Tables 2 and 3 are estimates and intended as a guide. Contained in these estimates are allowances for growth, season and, in the case of does aged 2 years and over, an allowance for milk production intended to support fawn growth rates of around 180 g/day over summer. From what has already been discussed, it will be appreciated that rutting bucks are unlikely to consume their estimated feed requirement. As a consequence such animals lose considerable liveweight over the rut (up to 430 g/day loss for a 30 day period).

Table 2: Calculated energy requirements (megajoules of metabolisable energy per day) of fallow deer at pasture.

	March liveweight (kg)	Season: Autumn 100 days	Winter 65 days	Spring 100 days	Summer 100 days
Young bucks					
0.25 to 1.25 yr	20	11.0	11.8	14.2	13.0
1.25 to 2.25 yr	47	13.3	15.4	16.0	15.0
Sire bucks					
2 yr	65	17.0	16.1	18.1	18.1
3 yr	85	20.7	19.6	20.3	20.3
4+ yr	105	24.3	23.0	24.1	24.1
Young does					
0.25 to 1.25 yr	18	9.7	10.4	11.3	11.3
1.25 to 2.25 yr	38	11.3	13.1	15.2	20.7
Breeding does	45	12.9	13.9	15.8	21.6
	55	15.0	16.1	17.5	23.4

Table 3: Calculated feed requirements (kilograms of dry matter per day) of fallow deer at pasture.

	March liveweight (kg)	Season			
		Autumn 100 days	Winter 65 days	Spring 100 days	Summer 100 days
Young bucks					
0.25 to 1.25 yr	20	1.0	1.0	1.2	1.3
1.25 to 2.25 yr	47	1.2	1.4	1.3	1.5
Sire bucks					
2 yr	65	1.6	1.4	1.5	1.8
3 yr	85	1.9	1.8	1.7	2.0
4+ yr	105	2.3	2.2	2.1	2.4
Does					
0.25 to 1.25 yr	18	0.9	0.9	0.9	1.1
1.25 to 2.25 yr	38	1.1	1.2	1.3	2.0
Breeding does	45	1.2	1.2	1.3	2.1
	55	1.4	1.4	1.5	2.3

Growth and venison production

It was mentioned earlier that pasture can provide the nutrients required by deer. Indeed, in much of New Zealand, deer production is based on the harvesting of pasture by grazing. Supplementing pasture intakes of fallow deer with hay, silage or grain is primarily aimed at making up seasonal shortfalls in available pasture.

In April of 1983 and 1984, studies were undertaken on the Ruakura Agricultural Centre to determine the effect of stocking rate on growth and venison production from young fallow bucks grazing ryegrass/white clover pastures. Newly weaned 4-month-old bucks were allocated to 2 stocking rate treatments of 32 and 48 bucks/ha (13 and 20 per acre). In each year, initial liveweights and the source of stock was the same for each treatment. Each group of bucks was rationally grazed on its own 0.5 ha (1.1 acre) farmlet, which was divided into 8 paddocks. Grazing periods varied between 2 and 7 days depending on season and year, with paddock changes being made on the same day, within years, for each stocking rate. While the grazing cycle varied with season it did not differ between stocking rates except during the spring of 1984. Over spring, the grazing cycle varied as different proportions of each farmlet's area were conserved for silage. In 1983 two paddocks per farmlet were conserved for silage at both stocking rates, whereas 3 paddocks were conserved at the lower stocking rate only in 1984.

The intake of pasture dry matter was calculated as the sum of the differences between pre-grazing pasture dry matter and residual pasture dry matter for each grazing period. Bucks were weighed at 28 day intervals and slaughtered at 14 months of age.

Bucks exhibited seasonal patterns of growth between 4 and 14 months of age at both stocking rates (Figure 4). In each of the 2 years daily liveweight gains were highest in spring and lowest over winter. All bucks reached a final slaughter liveweight of around 44 to 45 kg regardless of stocking rate. Daily intakes of pasture dry matter by bucks ranged from 0.7 kg at 4-6 months up to 1.3 kg at 14 months. These intakes were slightly lower than the estimated requirements (Table 3). One possible reason for this difference was that the technique for measuring pasture intake did not take into account the contribution of pasture growth and, therefore, slightly under estimated actual intake

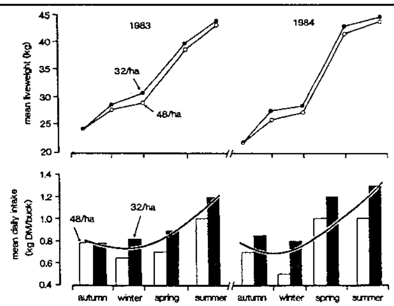


Figure 4: Seasonal changes in mean liveweight and dry matter intakes of fallow bucks on low (solid bar graph) and high (open bar graph) stocking rate farmlets.

Average pre-grazing pasture dry matter varied between seasons. While it was generally higher for those bucks at the lower stocking rate, pasture utilisation was always lower (Figure 4). Maximum pasture utilisation for both stocking rates occurred in winter (~59%). The very high pre-grazing pasture dry matter offered to the lower stocked bucks in summer 1983, which was accompanied by a low pasture utilisation (~13%), was due to inadequate pasture conservation measures in the previous spring.

Table 4: Carcass yield characteristics of fallow bucks at 14 months of age stocked at 32 and 48 per ha (13 and 20 per acre).

Year	Stocking rate	Mean hot carcass	Carcass yield	Net carcass gain
1983	32/ha	24.7 kg	789 kg/ha	402 kg/ha
	48/ha	24.1 kg	1156 kg/ha	580 kg/ha
1984	32/ha	25.5 kg	816 kg/ha	430 kg/ha
	48/ha	24.7 kg	1184 kg/ha	622 kg/ha

The mean hot carcass weight at 14 months of age was only slightly heavier for bucks at the lower stocking rate in each of the 2 years of the trial (Table 4). However, the total carcass yield/ha was ~45% higher for the higher stocked bucks. Similarly, net carcass gain/ha, estimated as the difference between total carcass yield and 58% of initial total liveweight, was ~45% higher for the high stocked groups. The fact that average carcass weights were not more markedly depressed as stocking rate increased from 32 to 48 bucks/ha suggests even higher stocking rates were possibly justifiable. The total and net carcass yields from these fallow bucks were achieved on farmlets producing between 10,000 and 12,000 kg dry matter/ha/year.

Constraints to on-farm production

A number of differences in the patterns of feed demand exist between fallow deer and more traditional livestock. These arise due to the late onset of fawning and the seasonal pattern of liveweight growth. Whereas pasture growth exceeds the demands of deer over spring, the reverse occurs over summer and autumn. Consequently, summer pasture growth appears an important limitation to increased on-farm production. Further limitations can arise in summer and late autumn due to ryegrass staggers and facial eczema. Essentially, the primary constraint to increased production is the poor alignment between the feed demands of deer and pasture production. One consequence of this can be a markedly seasonal venison kill of 14 to 16 month old bucks over the late summer/early autumn period before their growth stops for up to 6 months. However, this does not suit the nature of venison markets, which are largely based on year-round supply of fresh venison. Recent innovations within the fallow deer industry in New Zealand may serve to reduce such constraints to production, and include introduction of earlier fawning, the use of larger terminal sires (i.e. Mesopotamian fallow) and the targeting of different pasture cultivars for dry-season production.

Concentrate feeding

The equable year-round climate in New Zealand is conducive to year-round grazing systems, whereby the feeding of concentrate rations or conserved pasture (hay or silage) is largely restricted to periods of relative pasture deficit in winter or late summer (depending on region). Such feeding is usually in the form of supplementary rations rather than an exclusive diet. Winter supplementation generally aims to provide deer with an adequate energy intake to offset heat loss by increasing heat production. Therefore, it is usual to provide deer with supplements high in energy rather than protein (available winter pasture will generally provide adequate protein to over-wintering deer). Summer supplementation during periods of drought is often directed at maintaining high lactational yields of does rearing fawns. As milk production involves considerable investment by the doe into energy and protein metabolism, consideration is often given to supplementation of both energy and protein intake.

In general terms, cereal grain feeds (oats, maize, barley) have high energy value but very low protein value. Feeds such as lucerne hay, lupin grain, soy beans and other legume-type crops generally had high protein contents. The choice of supplementary feed will be dependent on the desired nutrient and local availability/cost.

In the North American continent, climatic conditions are considerably more extreme than in New Zealand. It is not uncommon for farmers to provide a total concentrate diet to fallow deer for periods of 6 months during winter. This situation contrasts markedly with supplementary feeding and the choice of feeds needs to be considered carefully. In particular, a balanced diet should be provided under semi-feedlot conditions. Again, the choice of feedstuffs depends on cost and local availability.

References

Asher, G.W. (1984) Growth and reproduction of farmed fallow deer: a preliminary summary and current information. Technical Addresses. *9th Annual Conference of the NZ Deer Farmers Association* 91-98.

Asher, G.W. (1986) Studies on the reproduction of farmed fallow deer (*Dama dama*). PhD thesis, University of Canterbury, Lincoln College, New Zealand.

Baars, J.A. (1976) Seasonal distribution of pasture production in New Zealand. *NZ Journal of Experimental Agriculture* 4: 157-161.

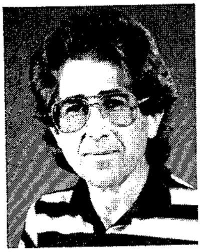
Fennessy, P.F. & Moore, G.H., Corson, I.D. (1981) Energy requirements of red deer. *Proceedings of NZ Society of Animal Production* 41: 167-173.

Gregson, J.E. & Purchas, R.W. (1985) The carcass composition of male fallow deer. In *Biology of Deer Production. Royal Society of New Zealand, Bulletin* 22, Wellington 291-293.

Kay, R.N.B. (1979) Seasonal changes of appetite in deer and sheep. *Agricultural Research Council Review* 5: 13-15.

Mulley, R.C. (1993) Venison production from farmed fallow deer (these proceedings).

Suttie, J.M. & Simpson, A.M. (1985) Photoperiodic control of appetite, growth, antlers, and endocrine status of red deer. In *Biology of Deer Production. Royal Society of New Zealand, Bulletin* 22, Wellington 429-432.



Dr Geoff W Asher, PhD

Geoff was educated at Victoria University of Wellington and Lincoln University (Christchurch), where he gained his MSc and PhD in animal physiology. He joined the staff of the internationally renowned Ruakura Animal Research Station (Ministry of Agriculture and Fisheries) in June 1980 as scientist, with a brief to investigate factors limiting productivity of farmed deer in the northern regions of New Zealand. He specialised in reproductive physiology of fallow deer and red deer, and quickly established an international reputation for his studies. Lately, Geoff has concentrated his efforts on artificial breeding of farmed deer with particular emphasis on artificial insemination and embryo transfer. These studies have lead to the establishment of a commercial Artificial Breeding Centre at Ruakura, which supplies semen from some of the world's top fallow deer bucks to deer farmers in NZ, Australia, USA and Canada. Geoff has established collaborative links with the Smithsonian Institute in Washington DC, USA in the investigation of artificial breeding as a tool for propagating endangered cervid species in captivity (eg. Brow-antlered Eld's deer).

In July 1992 the Ruakura Agricultural Centre became part of the newly established New Zealand Pastoral Agricultural Research Institute (AgResearch), leaving behind its MAF ancestry. In the re-organisation of NZ's science, Geoff was appointed National Science Programme Leader for AgResearch's research programme on Alternative Animal Species (goats, alpaca, buffalo) but still maintains a considerable input into deer research. Geoff has over 100 publications to his credit, including 30 in refereed science journals.