RURAL INDUSTRIES RESEARCH
& DEVELOPMENT CORPORATION

Growing Weaner Deer

Overcoming Nutritional Constraints in Southern Australia

A report for the Rural Industries Research and Development Corporation

By Dr Dean Revell and Dr Philip Tow
Adelaide University, Roseworthy Campus

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Researcher Contact Details

Dr Dean Revell
Department of Animal Science
Adelaide University
Roseworthy Campus
Roseworthy SA 5371

Phone: (08) 8303 7911
Fax: (08) 8303 7972
Email: dean.revell@adelaide.edu.au

Dr Philip Tow
Department of Agronomy and Farming Systems
Adelaide University
Roseworthy Campus
Roseworthy SA 5371

Phone: (08) 8303 7857
Fax: (08) 8303 7979
Email: philip.tow@adelaide.edu.au

RIRDC Contact Details

Rural Industries Research and Development Corporation
Level 1, AMA House
42 Macquarie Street
BARTON ACT 2600
PO Box 4776
KINGSTON ACT 2604

Phone:	02 6272 4539
Fax:	02 6272 5877
Email:	rirdc@rirdc.gov.au.
Website:	http://www.rirdc.gov.au

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Foreword

The production of deer for the venison market in southern Australia is strongly dependent on the seasonality of pasture supply and pasture quality. Under most fallow deer operations, fawning occurs in early summer, and lactation continues until weaning in autumn or winter. Poor quality pasture residues in summer, and the low supply of poor-quality autumn pastures limit the growth of young deer, and consequently the use of supplementary feeds is usually necessary.

Body weight gains of weaned deer that are below potential during this early stage of growth are important because:

(i) Profitability of venison production is significantly improved if deer can reach a suitable market weight within 12 months of age and therefore do not need to be carried through a second summer and autumn period.

(ii) Early growth performance can have long-lasting effects on performance later in life.

This publication reports on studies conducted over two seasons that compared a range of feed supplements provided to fallow deer for the first 10-12 weeks post-weaning, and monitored the performance of the deer when they were turned onto high-quality annual medic and perennial lucerne during late winter and spring. Management strategies to increase the proportion of weaners that reach marketable weights by early summer are discussed.

This project was funded from industry revenue which is matched by funds provided by the Federal Government.

This report, a new addition to RIRDC's diverse range of over 700 research publications, forms part of our Deer R&D program, which aims to foster an Australian deer industry as a profitable and efficient mainstream agricultural enterprise.

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Peter Core
Managing Director
Rural Industries Research and Development Corporation

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Abbreviations

DM	dry matter
ha	hectare
ME	metabolisable energy
NDF	neutral detergent fibre
SE	standard error

Contents

Executive Summary

Weaning fallow deer in southern Australia usually coincides with low pasture availability and quality. The use of feed supplements or alternatives such as dryland lucerne are required. This project investigated the use of a range of feed supplements in autumn and the use of lucerne either in a cut-and-carry or grazing system on growth performance of weaner deer. The use of annual medic pasture in winter and early spring, combined with lucerne in late spring/early summer was also investigated.

The aim of venison production systems is to cost-effectively raise weaners to reach target market weights by about 12 months of age, to avoid carrying animals over a second summer. Our main findings in this regards were:

- To maximise post-weaning growth rates, the best supplements to natural pasture in autumn were barley/lupin grain (70:30 mix) or barley grain alone. Fallow deer fed these supplements have outperformed those that received hay, silage, or cut-and-carry lucerne as supplements. All supplements in the research trials have been fed for 10-12 weeks immediately after weaning. The grain supplementation cost about $8/head ($0.10/head/day), but returns from heavier carcases in early summer exceeded this by at least twice as much.

- The use of standing lucerne as an autumn feed source has shown great promise. Weaner deer performed as well, or better, on standing (ie, fresh) lucerne than on grain supplements.

- The provision of grain supplements or access to fresh lucerne did not completely overcome slow rates of growth that characteristically occur during the first 2-4 weeks immediately post-weaning. Importantly, though, their provision did prevent weight loss during this critical period.

- The improvement in early growth performance from supplementation continued after supplementation ended, resulting in improved live weight at the end of spring, and/or a reduction in the number of days required to reach a target weight.

- Moderate growth rates were achieved on high quality annual pasture - in our case, Parragio medic - from mid-winter to mid-spring. On average, male fallow deer attained growth rates in excess of about 150 g/day, with females growing at less than 100 g/day. However, some individual animals grew at more than 200 g/day, indicating that there is scope to select for higher production in breeding programmes.

- Under environmental conditions typical of that in southern Australia, weaner fallow deer did not compensate during spring for restricted growth during autumn, even when provided with an abundant supply of high-quality medic pasture. Therefore, it appears critical to ensure that early post-weaning growth is maximised through careful management of nutrition and weaning.

- Perennial lucerne and annual pastures such as medic complement each other very well for venison production. Lucerne provides a source of green feed earlier (ie, autumn to early winter, depending on the rainfall pattern) and later in the season (ie, late spring - early summer) than annual pasture species. This effectively extends the period that a valuable source of green feed is available for grazing.

- The trials have clearly shown that with cost-effective feed management, weaners can be turned-off at the end of spring or early summer. A high proportion of weaner fallow deer (all males and most females) can reach acceptable target weights by early December, thus minimising the number of animals that need to be carried over a second summer and thereby reducing feed costs. However, the temporary halt to growth immediately after weaning could jeopardise the attainment of such targets in this time frame. This problem needs further investigation, along with means of optimising profit per hectare.

1. Introduction

Weaning strategies for fallow deer in Australia

Two distinctive weaning strategies are adopted in fallow deer production in Australia; pre-rut (mid- to late-March) or post-rut (mid-June) weaning. There are many proponents of each system, with largely only anecdotal evidence to support one strategy over the other (Mulley *et al*, 1994). The reasons for choosing a particular time of weaning are many, including its effect on:

(i) weaner growth performance,
(ii) subsequent doe fertility or other measures of doe reproductive performance,
(iii) opportunities for selling weaned does for breeder recruitment,
(iv) general herd management and
(v) mating strategy (ie, single-sire mating versus group mating)

Stress of weaning

Canadian researchers (Haigh *et al*, 1997; Church and Hudson, 1999) have recently compared weaning techniques of wapiti (*Cervus elaphus*) calves. Their data show that when weaning is performed abruptly, as is most common in Australia, stress responses such as pacing along a fence-line, vocalisations, heart rate or the ratio of neutrophils to lymphocytes, are higher than when weaning is performed more gradually. Interestingly, these indicators of increased stress were not associated with any penalty in growth performance of the weaned calves. Alternatives to abrupt weaning, which may be preferred on welfare grounds, include ‘interval-weaning’ where a few hinds are removed from the group each day, or ‘contact weaning’ where weaned calves (or fawns) are allowed fence-line contact with their dams. These strategies are not always practical under commercial farming conditions. ‘Interval weaning’ requires repeated handling of the animals to draught off a certain number of does each day during the weaning period, which could conceivably add to the stress of both the young deer and the does. ‘Contact weaning’ is more feasible, as it only requires adjacent paddocks to be available at weaning time. Nevertheless, given the lack of response in growth rate of the young weaned deer, it is unlikely that this practice will be widely adopted in Australia.

Postponing ‘abrupt weaning’ from pre-rut to post-rut may offer advantages to young deer. Being older at weaning, fawns (or calves) may have begun to wean themselves naturally from their dam and, as a consequence, fawns may be less stressed when finally separated from their mothers. Furthermore, a more developed digestive system at the time of weaning may assist in the transition from a milk-based diet (during lactation) to the exclusively solid diet of pasture and/or supplements.

An ideal weaning strategy is therefore one that (i) minimises the psychological stress of weaning, (ii) improves growth rate of the young animals and (iii) is best timed to prepare the does for their next reproductive cycle. Given that the method of weaning has little or no benefit to post-weaning growth rates, alternative management strategies need to be considered to achieve this goal. Providing nutritional supplements that are readily accepted and easily digested by the young animals is one such option, which will be discussed in the following section.

Post-weaning growth

Mulley *et al* (1994) investigated the effect of pre- or post-rut weaning on fallow deer fawns in New South Wales. All fawns were about 21 kg in mid-March and either weaned at this time, or left with their mothers until post-rut weaning in late June. From March to June, weaned deer grew only 15 g/day less than unweaned deer. At the end of June, there was therefore little difference in the bodyweight of fawns; unweaned doe fawns were 1.5 kg heavier, and unweaned buck fawns were 0.3 kg heavier, than their weaned counterparts (not significant).

In a later study by the same group (Flesch *et al*, 1999), the effects of weaning age and the provision of a nutritional supplement to early-weaned fallow deer were investigated. Overall, this study showed little difference in growth rate between 12 and 25 weeks of age between weaned (pre-rut) and unweaned fawns. The provision of a high-energy diet to weaned bucks provided a small, although non-significant, benefit in terms of growth rate between 12 and 25 weeks; 89 g/day versus 73 g/day for bucks weaned onto pasture only. Feeding the supplement provided no advantage to female weaners (weight gain 77 g/day in both groups).

Weaning deer directly onto pasture, regardless of the animals' age (ie, pre- or post-rut weaning) was associated with a 1-2 week loss of weight in the study of Flesch *et al* (1999) due to the stress of weaning and, presumably, to the adaptation to a new diet. Although precise values were not presented by Flesch *et al* (1999), the growth 'check' may have been about 1 week longer in fawns weaned at 12 weeks of age (pre-rut) than those weaned at 20 weeks of age. However, such a small difference, if indeed it occurred, was not sufficient to elicit differences in body weight at 25 weeks of age. The growth rates (72-89 g/day) of fawns between 12 and 25 weeks in this study by Flesch *et al*, 1999) were quite reasonable compared with other studies, and hence it is possible that significant treatment differences were not seen because pasture conditions were favourable. In more southern regions of Australia, where pasture quality and quantity in autumn and winter are more likely to limit animal production than in the cooler and more temperate climate of eastern New South Wales, effects of weaning strategy may be more pronounced.

Post-weaning nutritional stress

The peak period of nutritional requirements for lactating does and weaner deer occurs from December to May for most enterprises. In southern Australia, this period typically coincides with low pasture quantity and/or quality, thereby resulting in post-weaning nutritional stress and unsatisfactory weight gains by weaners. Consequently, without nutritional supplementation, weaners do not reach a suitable market weight by summer, and hence need to be kept on for a second summer/autumn. Even with the provision of supplements, a significant proportion of fallow weaners are kept for a second summer, which increases feed costs, and reduces the margin between costs and income when the animals are marketed. This has been considered as an impediment to enticing new growers to enter the deer industry. Consistency of supply to processors throughout the year requires more growers in the industry.

Therefore, identifying cost-effective feeding strategies to improve the performance of weaner fallow deer, and thereby increase the proportion of animals that can be marketed at about 12 months of age is important to improve profitability of venison production and encourage new entrants into the industry.

Provision of feed supplements to weaner deer

Based on experience with other animal species, it will be critical that weaners actually consume sufficient feed during the period immediately post-weaning. It is not uncommon for newly-weaned animals that are experiencing stress as outlined above to have poor feed intake for some weeks after weaning, and this directly impacts not only on animal welfare, but also the required number of days for the animals to reach their target market weight. Therefore, the selection of appropriate supplements for weaner deer needs to address this issue. There has previously been no direct comparison of feedstuffs for weaner fallow deer that is relevant to the southern Australian environment.

A number of options are potentially available to provide newly-weaned deer with nutritional supplements. This project specifically focussed on feedstuffs that would be available locally for growers in southern Australia. These included lucerne, annual medic, silage, hay, cereal grain and lupins.

Lucerne
One strategy to overcome the shortfall in nutrient supply from dry pasture residues in late summer/autumn is to provide grazing with lucerne (Challacombe and Tow, 1997). While low summer rainfall limits the warm season production of lucerne, its high nutritive value and drought resistance make it a valuable forage for growing animals. Its production in autumn increases as monthly rainfall increases. For example, at Roseworthy its estimated average monthly production approximately doubles each month from about 170 kg DM/ha during March to 600 kg DM/ha in May. This rate of production, and the nutritive value of lucerne during autumn is higher than for newly emerging annual legumes and grasses on average rainfall.

Annual medic
The temparature and rainfall pattern experienced in southern Australia are suited to annual pasture species. Their role as a feed source for newly-weaned deer is limited by complete absence or very low abundance in early autumn when the deer are weaned. However, later in the season, the quality and quantity of a well-managed annual legume pasture should support satisfactory growth rates. Finishing weaners for market in late spring/early summer on annual pastures may be difficult as nutritive value declines rapidly with pasture senescence in mid-October (Revell *et al*, 1994). Combining the use of annual pasture species with lucerne may overcome this limitation as lucerne can respond to late spring and early summer rainfall, and effectively increase the growing season and provision of green feed.

Hay and silage
Hay and silage are common conserved feedstuffs in southern Australia and may provide DM bulk to replace pasture residues. Whilst good quality hay and silage may supply sufficient ME and protein, their relatively low nutritive value compared with fresh forage or grains, may limit weaner growth. Furthermore, their higher fibre (eg, NDF) content and palatability may not be ideal for young deer.

Grains
Cereal and pulse grains provide a readily available supplementary feed in the grain-growing zones in southern Australia. Most deer producers currently utilise grains in their feeding program for weaners, but no direct comparisons of cereal grain alone, and with pulse grains such as lupins have been made. Furthermore, since the price of grains varies from year to year, it is important to compare the performance of weaners given grain supplements with that attained from possibly cheaper feed sources. When making comparisons between alternatives, it is important to make comparisons on an appropriate basis. Considering only the price per tonne is not sufficient; it would be more meaningful to compare on the basis of price per unit of ME or crude protein or, preferably, price per unit body weight gain in the animals of interest.

Compensatory growth

Compensatory growth can occur when animals that have undergone a period of restricted growth are then provided with improved nutrition. Daily rates of gain in compensating animals (ie, during a realimentation phase) are higher than in counterparts that are not restricted in earlier life. In some cases, the composition of bodyweight gain and feed conversion ratios during compensation may be altered. If the feed conversion ratio does not increase, then there are no economic benefits of compensatory growth, unless the periods of reduced and enhanced feed intake coincide with seasonally available pasture patterns. This situation may, in theory, apply to deer weaned under the environment of southern Australia. If the growth of newly weaned animals is restricted during the period of poor pasture production in autumn and early winter, they may have the opportunity to compensate during the subsequent period of lush feed. However there are limited data available to indicate whether this occurs. Evidence from other species (including lambs and pigs) suggest that any depression in growth rate in early life carries longer term penalties, including an increase in the days required to reach market weights.

The following study compared, over two years, the use of a range of supplements for weaner fallow deer. We monitored animal performance from weaning until the deer approached market weights to evaluate whether fallow deer exhibit compensatory growth when they have access to abundant and high-quality herbage from late winter through to late spring.

2. Objectives

1. Provision of cost-effective strategies for nutrition of weaner deer in dryland farming regions in southern Australia that will reduce nutritional stress in the dry autumn post-weaning period and maintain high growth rates.

2. Through dissemination of research results, improve deer production and foster expansion of the deer industry into dryland farming regions of southern Australia.

3. Methodology

This study was conducted over two growing seasons, 1999 and 2000. In each year, a range of feed supplements was provided to weaner fallow deer for 10-12 weeks post-weaning before the animals were turned onto high quality medic pasture.

Experiment 1 - 1999 study

Experimental design and animals

The experiment was a randomised block design of five feeding treatments, with two replicates and 4-6 animals in each group (ie, a total of 8-12 weaners in each treatment group). All available weaner fallow deer from the Roseworthy deer enterprise were used in the trial. Male and female fawns were weighed 56 days before the experiment commenced; average live weight was 19.3 kg, SE 0.1 kg. The fawns were stratified by live weight, and then randomly allocated to treatment groups with males and females evenly represented in each group.

At the time of weaning, all weaners were vaccinated with 2 ml of 6-in-1 vaccine (Coopers Animal Health, Australia) to prevent clostridial disease, and all weaners were colour-coded by ear tag to allow rapid identification of treatment groups.

Each treatment group was allocated post-weaning to a small paddock measuring 38 x 72 m. These plots were defined by electric fencing that, initially, did not successfully constrain the weaners to their allocated paddock. A number of modifications were made, including the addition of extra 'live' wires and, by day 27, animals were successfully held in their allocated paddocks.

Although rainfall between February and mid-April was well below average, there was a 'false break' in mid-April resulting in some new pasture growth. To better simulate a typical dry autumn, all of the small paddocks were spayed with herbicide (1 litre/ha of Roundup^{TM}) two weeks prior to the experimental period. Based on visual assessments, herbage on offer did not exceed 150 kg DM/ha during the period when supplementary feeding was carried out.

Supplementary feeding ceased on 13 August 1999, and animals were then grouped together in a 5 ha paddock of Paraggio barrel medic at a stocking rate of about 11 deer/ha. When the medic reached maturity in mid-October, the deer were removed to prevent consumption of seed pods. They then grazed lucerne for a month, being removed on 15 November in order to spell it and safeguard its persistence.

The experimental period was divided into four phases, as follows:

Phase I; Days 0-28, immediately post-weaning when supplements were offered but problems associated with the use of electric fencing were encountered.

Phase II; Days 29-90, when supplements were offered and animals were successfully held in their allocated paddocks

Phase III; Days 91-165, when all animals grazed a pure stand of medic pasture during spring

Phase IV; Days 166-198, when animals grazed lucerne containing some grass and broadleaf weeds.

The transition from phase I to II was based upon a retrospective decision and not on the basis of a pre-determined live weight or time.

Animals were weighed weekly when the supplements were provided and at approximately fortnightly intervals after the supplements were withdrawn. The animals were housed overnight in the deer yards each time they were weighed to obtain fasted live weights to avoid possible confounding of body weight with differences between treatments in gut fill.

Supplements

Five dietary treatments were used as outlined in Table 1. The 'control' group was fed oaten hay in an attempt to maintain live weight. Each of the remaining four groups were offered the same amount of hay as for the 'control' group, but also received an additional supplement (lucerne, silage or grain). The supplements were fed on an *ad libitum* basis, except for the grain treatments that were fed at 0.1 and 0.25 kg/head/day during the first and seconds weeks, respectively. This was done to avoid acidosis (no buffer was included with the grain). The barley/lupins treatment provided these grains in the ratio of 70:30 in order to increase the supply of crude protein (from 10 to 17%). Lupins were selected over other pulses due to their ready availability and favourable cost.

Autumn rainfall was at first inadequate to provide grazed lucerne. Therefore, fresh lucerne from a small irrigated area was cut daily and fed in the mornings, whilst grain and silage availability was monitored every two days. All feed supplements were fed for 90 days immediately post-weaning.

Table 1. Supplementary feeds used in the 1999 study, and their nutritional composition.

	DM (%)	Crude protein (%)	DMD (%)	Estimated ME (MJ ME/kg DM)
Oaten hay (control)	85	4.5	41-49	7.6
Lucerne	15-30	29-31	75-82	10-11
Oat-vetch silage	30-40	19-21	65-70	10.2
Barley	90	10.0	88	13.0
Barley/lupins	90	17.3	86	12.8

Statistical analysis

The data were analysed using SAS Proc GLM (SAS, 1989). A model to partition variation in animal weight was developed from the maximal model fitted that contained treatment group, phase and sex as fixed effects, and weight on day zero and 'day' number nested within phase. All first order interactions were initially included in the model, and non-significant interactions and effects were removed where possible in a stepwise manner. A second model was developed from the maximum model to explain variation within each growth phase, independent of the other growth phases.

Experiment 2 - 2000 study

Experimental design, animals and supplements

The trial undertaken in 2000 was of similar design to that in 1999 except for some differences in the supplements used. The supplement used in the control group was medic hay, replacing the use of oaten hay and oat-vetch silage that were used in Experiment 1. Incorporating medic hay into the trial provided the opportunity to evaluate another roughage source that is widely available to farmers in southern Australia. The two grain treatments used in Experiment 1, namely barley grain and barley:lupin grain mix (70:30), were also used in Experiment 2 to allow for a comparison across different years. The final treatment in Experiment 2 was standing lucerne to replace cut-and-carry lucerne that was used in Experiment 1, as there was adequate rainfall for paddock grazing.

There were two replications of each treatment, with 9-10 weaner fallow deer per replication (4-5 males and 4- females). Conventional deer fencing was used for the two lucerne paddocks, but an 8-line plain-wire electric fence was used for the small paddocks used for the other treatment groups. The electric fence did not adequately contain all groups of deer, and only one of the replicates provided reliable data. The deer in the other replicate (all adjacent paddocks) frequently broke out from their allocated paddocks and we were not able to confine them to one type of supplement only. Only data from the 'reliable' replicate will be discussed in this report (both replicates for the lucerne treatment group are valid).

The supplements of hay or grain, or access to standing lucerne were provided from 10 April to 29 June 2000. After this time, all deer were moved as one group to the 5 ha paddock of Paraggio barrel medic (with no form of supplementation) until late-October (as for Experiment 1). The stocking rate was about 16 deer/ha. The animals were then transferred on to lucerne until the completion of the trial on 3 November 2000.

Regular measurements (random quadrat sampling) of feed on offer in the medic paddock were made between July and October, and sub-samples were taken for nutritive value analysis (FeedTest, Agriculture Victoria, Pastoral and Veterinary Institute, Hamilton, Victoria).

Statistical analysis

Due to problems with one of the replicates (blocks) for each of the groups receiving supplements, this data was not included in the analysis. Data from the reliable block was analysed by ANOVA (GenStat for Windows, Release 4.2, 5th edition) that tested for effects of sex and feeding treatment, and the interaction between these factors.

Rainfall pattern

Experiment 1 (1999) was conducted in a drier than average year, whilst experiment 2 (2000) was conducted in a slightly wetter than average year (Table 2).

Table 2. Monthly rainfall (mm) during the two seasons in which experiments were conducted.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	*Total*
1999	3	0	50	9	58	32	33	24	45	49	57	28	*388*
2000	1	73	22	32	37	59	53	63	49	57	22	11	*479*

4. Results

Animal performance

Experiment 1 (1999)

The growth performance during phase I was highly variable, both between and within treatment groups, with most animals losing weight. Those fed either of the grain supplements and those fed oaten hay lost about 100 g/day, those fed lucerne approximately maintained weight, whilst those fed silage tended to gain about 25 g/day. During phase II, the animals fed oaten hay maintained weight, as planned, whilst all others gained weight (Figure 1). Those receiving silage or lucerne gained about 30 g/day, whilst those fed either of the grain supplements gained about three times that rate (92 and 121 g/day for the deer fed barley and barley/lupins, respectively; $P<0.05$). As a consequence, the grain-fed deer finished their supplementary feeding period 4-5 kg heavier than their counterparts receiving the roughage type diets (*c.* 28 vs. 23 kg; $P<0.05$).

During phase III, when the deer grazed high-quality medic pasture, all groups grew at approximately the same daily rate (Figure 1). However, male deer grew about 50% faster ($P<0.05$) than females; *c.* 125 g/day for males vs *c.* 80 g/day for females. A similar pattern of liveweight gain occurred when deer grazed lucerne.

By the end of the experiment (17 November, 1999), the proportion of male deer that had reached 45 kg was 75% for those fed that had been fed the barley/lupin supplement, and 60% for those that had been fed barley. Only 17-40% of males reached 45 kg if they had been fed the roughage-type diets.

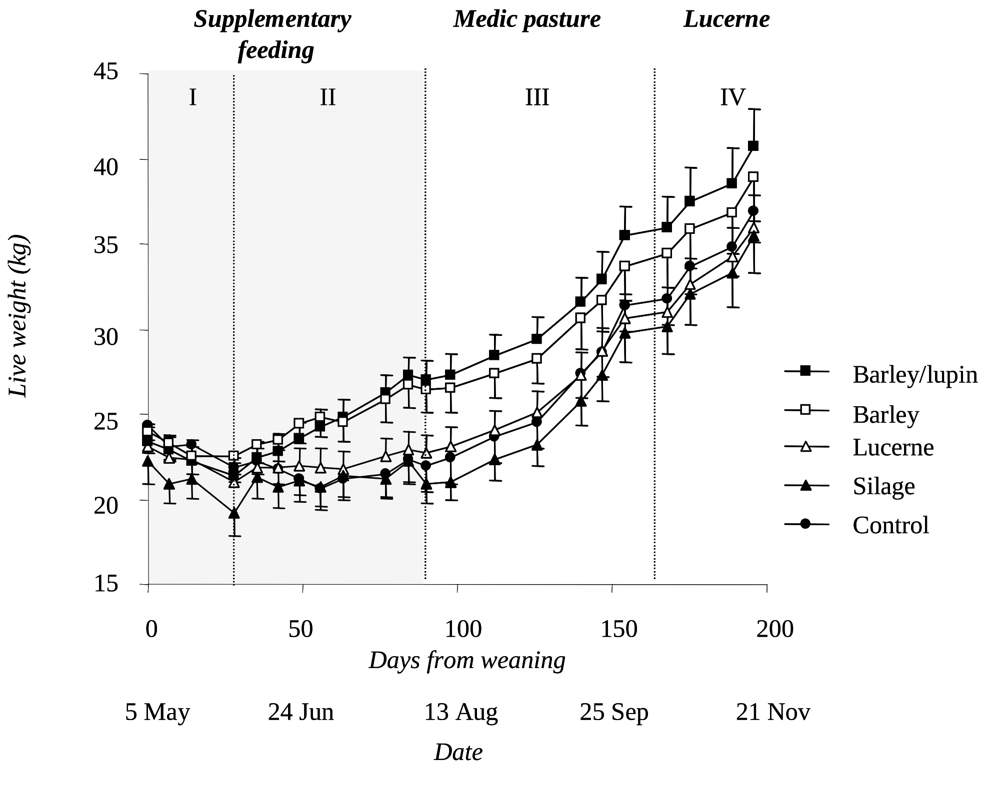

Figure 1. *Fasted live weight during each phase of experiment 1 for fallow deer that received one of five supplements during the first 90 days immediately after weaning. Error bars show SE.*

Experiment 2 (2000)

For the first 31 days after weaning there were no significant differences in body weight between groups (ie, medic hay, barley, barley/lupins or grazed lucerne; Figures 2 and 3). By the end of the supplementary feeding period, weaners that were offered medic hay were significantly lighter than all other groups (by 2.5-4.0 kg pooled across sexes; P<0.01), and those that had grazed lucerne were significantly heavier (by 1.4-4.0 kg pooled across sexes; P<0.01) than all other groups. The body weight of grain-fed weaners (barley or barley/lupins) did not differ from each other and were intermediate between the weights of the hay- and lucerne-fed animals.

At the end of the period in which the deer grazed Parragio medic pasture, those that had been fed hay immediately post-weaning remained lighter than all other groups (by 1.8-3.7 kg pooled across sexes; P<0.01; Figure 2 and 3). The deer that had grazed lucerne post-weaning were 1.9-3.7 kg heavier (pooled across sexes; P<0.01) than those that had received barley/lupins or hay. At completion of the experiment, the heaviest groups (P<0.05) were those that had grazed lucerne or fed barley grain post-weaning (39.7 and 39.0 kg, respectively, pooled across sexes), whilst those fed barley/lupins were of intermediate body weight (37.7 kg), and those that had been offered hay post-weaning remained the lightest (36.4 kg; P<0.05).

Male deer were heavier (P>0.01) than female deer throughout the experimental period (Figures 2 and 3). On the day of weaning, males were on average 2 kg heavier, and by the end of the supplementary feeding period the difference had increased to over 3 kg. At the end of the experiment, the difference between the sexes was over 9 kg.

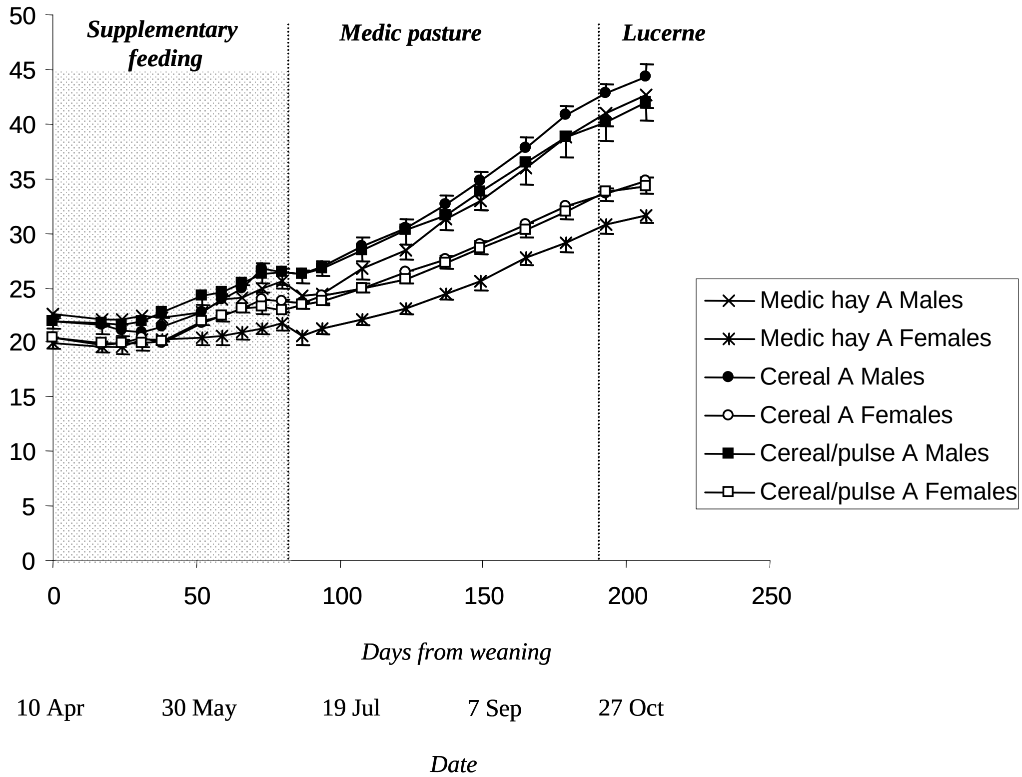

Figure 2. *Fasted live weight during each phase of the experiment for male and female fallow deer that received hay or grain supplements during the first 80 days after weaning (single replication only). Error bars show SE within groups.*

The growth performance of weaner deer that had access to standing lucerne for 80 days immediately after weaning is shown in Figure 3. The growth curves were the same as that found for deer fed barley grain post-weaning.

Growth rates attained on medic pasture was, on average, 91 g/day for female weaners, and 143 g/day for males.

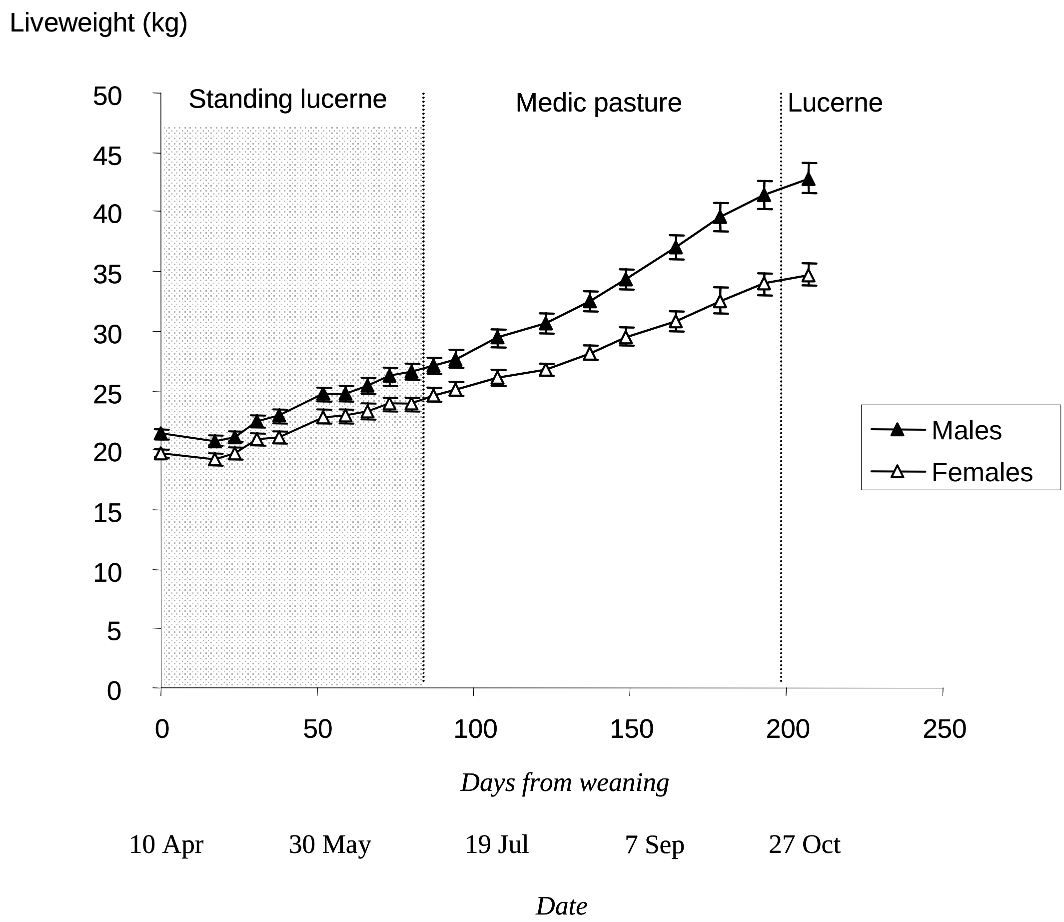

Figure 3. *Fasted live weight during each phase of the experiment for male and female fallow deer that grazed lucerne for 80 days immediately after weaning. Error bars show SE.*

Compensatory growth

There was no evidence of compensatory growth of weaners during the spring period when feed supply was abundant. Animals that were heavier at the end of the supplementary feeding period remained heavier at the end of the experiment (Figure 4). An extra kilogram at the end of the supplementary feeding period equated, on average, to an extra 1.4 kg at by late spring in experiment 1 and an extra 2.3 kg in experiment 2.

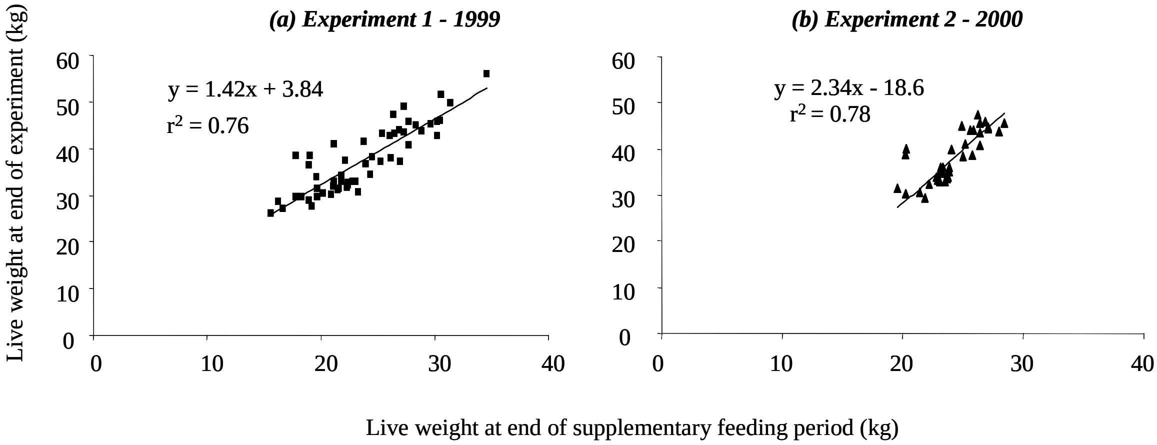

Figure 4. The relationship between live weight at the end the of the supplementary feeding period and the end of the experiment for (a) experiment 1 and (b) experiment 2.

Value of annual medic and lucerne in winter and late spring

Experiment 1 (1999)

Some features of medic and lucerne performance and management, and their relationship to seasonal rainfall are worth noting:

(i) The medic regenerated from self-sown seed, on 49 mm rain in late March, and survived dry conditions over seven weeks until rains in the second half of May.

(ii) Spraying the medic for lucerne flea, grass weeds and broadleaf weeds in July ensured the availability of a dense, healthy weed-free pasture for the deer from the beginning of August. Good medic growth occurred in July and earlier spraying of weeds would have ensured ample feed in July if this had been required for the experiment.

(iii) The Sceptre cultivar of lucerne was sown in August 1998. Though receiving only 125 mm rain in its initial spring-summer period, and 220 mm in the next 6 months, it has survived well. Following winter-early spring spraying for weeds and insect pests and a light hay cut at the end of September, it provided ample leafy grazing from mid-October until the deer were removed a month later. Rains later in November have indicated that further grazing may be available in December.

(iv) Paraggio medic and Sceptre lucerne appeared well adapted for growth, persistence and grazing by deer in the Roseworthy environment, which is reasonably typical of much of the cereal zone of southern Australia.

Experiment 2 (2000)

Parragio medic again demonstrated its capacity to regenerate and survive on early rains. A good germination occurred after rain in February and, in the absence of grass weeds, these plants survived with the aid of light rains until the break of season and were ready for grazing at the end of June.

Medic growth in excess of intake increased steadily through the season (Table 2). This increase was associated with an increasing proportion of stem from late winter, although a dense canopy of leaf remained on top into early spring (September). Pod development also began in September.

Crude protein content, digestibility and metabolisable energy were very high in July, but declined thereafter, reflecting increased stemminess of the samples and, later, pod development, as also indicated by the increasing NDF content (Table 3).

Table 3. Feed on offer and nutritive value of Parragio medic during the 2000 growing season (experiment 2).

Date	Feed on offer (kg DM/ha)	Estimated ME[3] (MJ ME/kg DM)	*In vitro* DM digestibility[3] (%)	Crude protein[3] (% of DM)	NDF[3] (% of DM)
6 July[1]	1318 (59)[2]	11.4	77.6	29.6	33.5
27 July	2450 (117)	11.3	76.9	27.0	30.4
11 August	3374 (171)	10.9	74.8	45.9	34.1
25 August	2944 (159)	10.5	72.0	22.4	36.4
6 September	3578 (213)	10.2	70.2	20.8	40.2
25 September	4809 (185)	9.6	66.6	17.8	42.6
6 October	2528 (151)	9.4	65.4	18.8	43.4

1 6 July was Day 87 of the experiment.
2 Values in parentheses are SE
3 Nutritive values pooled across samples collected at each time

5. Discussion

Given the lack of compensatory growth of weaner deer during spring, despite the abundance of high quality annual medic on offer, it is important that producers avoid, or at least minimise, early setbacks in animal performance. This means that the management of weaning and the provision of feed supplements during the first 1-2 months after weaning are critical in determining the proportion of animals that can be marketed at about 12 months of age. Although the provision of high quality feed supplements (or provision of good quality standing lucerne in autumn) carries a cost to a deer enterprise, the real benefit is realised by the fact that every extra kilogram of live weight gained from supplementary feeding returns 1.4-2.3 kg of extra live weight by late. If this improved weight gain reduces the proportion of animals that are carried over a second summer, even greater benefits accrue.

The weaner growth rates recorded on the dense, leafy, weed-free pasture provide a useful benchmark estimate of 'feeding value' of Parragio medic for weaner fallow deer. 'Feeding value' is a function of nutritive value and feed intake when feed availability is non-limiting. The almost constant growth rates of the deer while grazing medic that was slowly declining in nutritive value indicate that the animals were selecting leaf material, which was abundant. Although the proportions of leaf and stem in the pasture were not quantified in this study, it was clear that stem was a high proportion of feed on offer from late winter. The stems fell over and gradually died and, from the point of view of feeding value, this material was wasted. Thus the pasture was under-utilised.

The estimated feeding value of the medic was not particularly high, as indicated by the moderate animal growth rates attained whilst the weaners grazed the medic paddock (91 and 143 g/day for female and male deer, respectively). However, as indicated above, the pasture was under-utilised, and hence there is the opportunity to increase stocking rates above the 11-16 deer/ha that were used in the present studies, and thereby increase the amount of bodyweight gain per hectare. Furthermore, medic pasture has other strengths in the environment typical of southern Australia, viz a high winter growth rate, high potential carrying capacity and low establishment and maintenance costs. The capacity for winter stocking rate and deer production per hectare needs to be tested by appropriate experiments.

It is interesting to note that although the average growth rates of deer during spring were only moderate, some individual animals grew at over 200 g/day. The mechanisms that accounted for the variation on growth rate whilst grazing spring pasture were not identified in the current project, but may include differences in herbage intake, the resistance to subclinical disease (eg, gastrointestinal parasites) or genetic capacities for tissue growth. Irrespective of the underlying mechanisms, superior animals should be identified and used in breeding programmes where possible.

Annual medic (eg, Parragio as used in these trials) and lucerne (eg, Sceptre) are complementary in that Paraggio grows most strongly in late winter and early spring and Sceptre from that time into early summer. Their combined use can achieve satisfactory weight gains from early winter right through to early summer. Therefore, based on the results of the experiments reported here, it would be reasonable to expect that a considerable portion of males in the herd should reach an acceptable market weight prior to summer if they receive grain supplements or graze lucerne immediately after weaning, and then have access high-quality forage from late winter through to late spring.

6. Implications

Cost-effectiveness of supplementation

The effectives of supplementary feeding weaner deer can also be shown by the following simple example:

Costs:

1. 80 days of feeding supplementary feed (eg, grain)
2. 0.5 kg/head.day
3. If supplement cost is $200/tonne, then costs $0.10/head/day, or total of **$8.00/head** over the supplementation period.

Returns:

Scenario 1 - supplementation with grain

1. Assume supplemented animals reach 47 kg in December (average of males and females)
2. Carcase value = **$100** if price is $4.00/kg hot carcase or = **$65** if price is $2.69/kg hot carcase

Scenario 2 – inappropriate supplements used (eg, hay or silage) of no supplements used

1. Assume these animals reach only 40 kg in December
2. Carcase value = **$85** if price is $4.00/kg hot carcase or = **$42** if price is $2.69/kg hot carcase

Difference = about **+ $15-20/head**

General comments

This project has demonstrated the feasibility of the combined use of grain supplements, annual medic pasture and lucerne pasture to achieve marketable weights of fallow deer by early summer. Success depends on high standards of both deer husbandry and pasture management. This project opens the way for entry of grain/livestock farmers in southern Australia into the deer industry, which would gratefully improve the reliability of venison production.

7. Recommendations

Deer producers can immediately adopt the findings of this project.

Important matters that remain unresolved include the low weight gain in the immediate post-weaning phase and the determination of optimum stocking densities for economic returns per hectare. The present project should be backed up with further research as well as trials conducted on farms.

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