# Growth and venison production from red deer grazing either pure red clover or perennial ryegrass/white clover pasture

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## ABSTRACT

A study of growth and venison production from weaner red deer grazing pure "Pawera" tetraploid red clover (RC) or conventional perennial ryegrass/white clover (PRG) pasture was conducted, with the objective of attaining a minimum slaughter liveweight (92 kg; 50 kg carcass) by 12 months of age in the stags. Ten weaner red deer stags and 10 weaner red deer hinds were rotationally grazed on either RC or PRG pasture. In autumn and spring, forage allowances were respectively, 7 kgDM/h/d and 8 kgDM/h/d. In winter, the animals from both groups were grazed together on PRG pasture, at a residual dry matter of 1100 kgDM/ha; 0.5 kgDM/h/d of meadow hay was also provided.

Liveweight gains of RC and PRG stags were respectively 263 vs 192 g/d, 101 vs 106 g/d and 362 vs 341 g/d during autumn, winter and spring. With hinds, the liveweight gains of RC and PRG groups were respectively 198 vs 173 g/d, 52 vs 53 g/d and 242 vs 218 g/d during autumn, winter and spring. Animals grazing RC pasture had significantly higher liveweight gain during autumn ($p<0.01$), but not in winter and spring. At one year of age, stags grazing RC were 7 kg heavier and hinds 3 kg heavier than animals grazing PRG pasture. Animals grazing RC pasture had higher voluntary feed intake (VFI) in both autumn ($p<0.10$) and spring ($p<0.001$), than animals grazing PRG pasture.

All stags grazing RC pasture reached the minimum slaughter liveweight by one year of age, compared to 75% grazing PRG pasture. Stags that had grazed RC produced heavier carcass weights (59.9 vs 54.5 kg, $p<0.01$), and had higher carcass dressing percentage (55.3 vs 53.2%, $p<0.01$). RC has potential as a special purpose forage for the growth of weaner red deer.

**Keywords** Red clover, perennial ryegrass, white clover, red deer, stags, hinds, weaner, feed intake, growth, carcass.

## INTRODUCTION

Young deer show seasonality in their growth and voluntary feed intake (VFI), with high values in spring and summer, and low values in winter (Barry *et al.*, 1991). This acts as a constraint in the development of venison production systems to suit the requirements of overseas markets.

The New Zealand venison price is normally highest between August and November (Ataja *et al.*, 1989), and pays highest premium for carcasses over 50 kg (92 kg liveweight), reflecting northern hemisphere consumer demand. For most profitability, these targets should be attained by one year of age. However, under current pasture management, weaner red deer stags usually reach this slaughter liveweight when 15 months old (Drew, 1989), when venison schedules prices have declined.

Attempts to attain a minimum slaughter liveweight of 92 kg in red deer stags by one year of age, grazing annual ryegrass pastures, have been conducted by Ataja *et al.*, (1989), who showed that by giving high allowances (6.3 kgDM/h/d) during both winter and spring, the target could be attained by 75% of weaner stags.

Red clover (*Trifolium pratense*) is known as a summer forage, with high nutritive value, and is highly preferred by red deer (Hunt and Hay, 1990). Red deer fawns, reared on hinds grazing pure red clover swards during lactation, had significantly higher growth rates and weaning weights compared to control animals grazing conventional perennial ryegrass/white clover pasture (Niezen *et al.*, 1991).

Objectives of the present study were to determine the growth, voluntary feed intake and venison production by one year of age, of weaner red deer grazed on either pure red clover or perennial ryegrass/white clover pasture.

## MATERIALS AND METHODS

### Animals

Twenty weaner red deer stags and 20 weaner red deer hinds, aged approximately 3.5 months (mean calving date 24 November 1989), from the Niezen *et al.*, (1991) study, were randomly allocated to one of two pastures; pure "Pawera" red clover (*Trifolium pratense*) (RC) or perennial ryegrass (*Lolium perenne*)/ white clover (*Trifolium repens*) pasture (PRG), at the Massey University Deer Unit.

The trial started on 19 March 1990 and ended on 29 November 1990. During the study, two stags from the PRG group died, due to bone infection and winter stress, and one stag from RC group showed very low performance, and was deleted from the data.

### Pasture allocation

In autumn and spring, the animals were rotationally grazed on either RC or PRG pasture. Pasture allowance was 7 kgDM/h/d in autumn and 8 kgDM/h/d in spring. As RC is dormant during winter, all animals were joined on PRG pasture over this time, with the pasture being maintained at a residual dry matter of 1100 kgDM/ha. Meadow hay (0.5 kgDM/h/d) was also provided over winter.

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Pre- and post-grazing herbage masses were determined by cutting the herbage to soil level (8 quadrats/paddock). Diet selection was estimated by daily sampling hand-plucked plants as the deer were grazing. The samples were then pooled for each paddock.

### Animal health

At four and half months of age, all animals were vaccinated against clostridial infections using Tasvax Convax 5 vaccine (Coopers Animal Health Ltd,N.Z). Drenching with Ivermectin (IVOMEC, Merck, Sharpe & Dohm Ltd.,N.Z) to protect from internal parasites and lungworm, was conducted every three weeks until the end of October 1990.

### Feed intake

During autumn and spring, 9 deer of each sex grazing each forage (8 deer in PRG stags) were dosed with sheep size chromium releasing capsules (CRD, $Cr_2O_3$ matrix, Captec Ltd., Auckland, N.Z), to estimate faeces output. Rectal faecal samples (10 pellets) from individual animals were collected from day 8 to 20 after the CRD was administered, on six occasions at 2 day intervals.

### Body weight

Body weight changes were recorded every three weeks. At the end of the trial, all stags attaining a minimum liveweight of 92 kg (50 kg hot carcass weight) were slaughtered. Hot carcass weight and subcutaneous fat depth, measured as maximum fat thickness over the 12$^{th}$ rib (GR; Kirton *et al.*, 1989), were recorded. Carcass dressing percentage (CDP) was then calculated as the proportion of hot carcass weight over liveweight.

### Laboratory analyses

Chromium analysis was according to Parker *et al.*, (1989), and a chromium release rate value was 121 mg/d was assumed (Ataja, pers.comm.). This was taken from the sheep size CRD release rate, measured in rumen fistulated red deer stags. In vitro digestibility followed the method described by Roughan and Holland (1977), and total nitrogen was determined by the Kjeldhal procedure in a Kjeltec Auto 1030 Analyzer (Tecator A.B, Sweden).

### Calculation of data & statistical analyses

Voluntary feed intake (gOM/kg$W^{0.75}$/d) was calculated as faecal OM output divided by (1-OMD), where the OMD (organic matter digestibility) value was obtained from hand-plucked samples to represent diet selected. Feed intake, growth rate, carcass weight, carcass dressing percentage, and GR measurement for each season (autumn, winter and spring) were analyzed using Generalised Linear Model (GLM; SAS, 1987), as a 2 x 2 factorial design, with two levels of sex and two pasture types. Except for feed intake analysis, initial body weight was fitted as a covariate. GR measurement was also analyzed using hot carcass weight as a covariate. Least square means (LSM) were used to test the differences between treatments.

## RESULTS

Means of pre- and post-grazing herbage masses for the RC and PRG pastures in each season are shown in Table 1. RC and PRG pastures on offer had similar total nitrogen content during autumn (3.4 vs 3.1 %DM), but during spring the RC pasture had a higher total nitrogen concentration (3.8 vs 3.1%DM, $p<0.001$) than PRG pasture. RC pasture had a higher OMD than PRG pasture, during both autumn (80.5 vs 76.5%, $p<0.01$) and during spring (82.1 vs 80.3%, $p<0.05$). In winter, when both animal groups were grazing together on PRG pasture, the total nitrogen content of herbage on offer was 4.0%DM and OMD was 82.7%.

**TABLE 1.** Pre- and post-grazing herbage mass (kgDM/ha;SE) of both red clover (RC) and perennial ryegrass/white clover (PRG) pastures during autumn, winter and spring.

| | PRG | | RC | |
|---|---|---|---|---|
| | Pre-grazing | Post-grazing | Pre-grazing | Post-grazing |
| Autumn | 2,780 (147.8) | 2,177 (122.5) | 3,320 (137.7) | 2,901 (122.9) |
| Winter[1] | 1,539 (66.8) | 1,128 (59.0) | | |
| Spring | 2,360 (171.1) | 1,848 (116.9) | 3,542 (197.3) | 2,779 (141.6) |

[1] Both PRG and RC animals were joined and grazed on PRG pasture during winter.

During autumn, liveweight gain was significantly higher in the RC group than the PRG group ($p<0.05$, Table 2). In winter, the liveweight gains of both RC and PRG groups averaged 77 vs 80 g/d, and during spring averaged 298 vs 279 g/d, respectively. The small difference during winter and spring did not attain significance. The interaction between group and sex was significant in autumn ($p<0.05$), indicating a greater response to RC in stags than hinds; the interaction was not significant in the other seasons.

**TABLE 2** Liveweight gains (g/d) and body weights (kg) of weaner red deer grazing either RC or PRG pasture, during autumn, winter and spring. LSMeans values were adjusted to equal initial liveweight.

| | Stags | | Hinds | | SEM |
|---|---|---|---|---|---|
| | PRG (n=8) | RC (n=9) | PRG (n=10) | RC (n=10) | |
| Liveweight gain | | | | | |
| Autumn | 192 | 263 | 173 | 198 | 11.8 |
| Winter | 106 | 101 | 53 | 52 | 6.7 |
| Spring | 341 | 354 | 218 | 242 | 16.8 |
| Body weight | | | | | |
| Initial (7.3.'90) | 48 | 47 | 48 | 50 | 2.3 |
| End of autumn (19.5.'90) | 62 | 67 | 61 | 62 | 0.9 |
| End of winter (11.8.'90) | 74 | 79 | 67 | 68 | 1.3 |
| End of spring (29.11.'90) | 101 | 108 | 84 | 87 | 1.9 |

Animals grazing RC pasture consistently had higher liveweights than those grazing PRG pasture (end autumn, $p<0.001$; end winter $p<0.01$ and end spring $p<0.01$). The interaction between group and sex was significant at the end of autumn ($p<0.05$), but not in the other seasons. At one year of age, stags grazing RC were 7 kg heavier and hinds were 3 kg heavier than animals grazing PRG. Voluntary feed intake (VFI) of animals grazing RC pasture were consistently higher during both autumn ($p<0.10$) and spring ($p<0.001$) than for animals grazing PRG pasture. The interaction between group and sex was significant in spring ($p<0.05$, Table 3), but not in autumn.

All stags that had been grazing RC pasture for two seasons (autumn and spring), attained their minimum slaughter liveweight (92 kg) at one year of age, compared to 75% of those grazing PRG pasture. RC stags that went to slaughter, had significantly

heavier slaughter liveweight ($p<0.1$, Table 4), carcass weight ($p<0.01$) and higher dressing percentage ($p<0.01$) than PRG stags. After being adjusted to equal carcass weight, there was no difference in carcass subcutaneous fat depth (GR, $p>0.05$).

**TABLE 3** Organic matter intake (gOM/kgW0.75/d) of weaner red deer grazing either RC or PRG pasture, during autumn and spring.

| | Stags | | Hinds | | SEM |
|---|---|---|---|---|---|
| | PRG (n=8) | RC (n=9) | PRG (n=9) | RC (n=9) | |
| Autumn | 80 | 82 | 78 | 90 | 4.1 |
| Spring | 65 | 99 | 70 | 82 | 3.9 |

**TABLE 4** Liveweight and carcass production from stags grazing either RC or PRG pasture and attaining slaughter liveweight (92 kg) by one year of age. LS Mean values were adjusted to equal initial liveweight.

| | PRG (n=6) | RC (n=9) | SEM |
|---|---|---|---|
| Stags attaining target slaughter liveweight (%) | 75 | 100 | |
| Liveweight (kg) | 102.5 | 108.3 | 2.45 |
| Carcass weight (kg) | 54.5 | 59.9 | 1.29 |
| Dressing percentage (%) | 53.2 | 55.3 | 0.45 |
| GR (mm) | 6.3 | 9.4 | 1.33 |
| GR[2] (mm) | 7.7 | 8.6 | 1.14 |

[2] Adjusted to equal carcass weight

## DISCUSSIONS

Table 2 showed a seasonal liveweight gain pattern of the weaner red deer, being moderate in autumn, slow in winter and high in spring, as reported elsewhere (Kay 1985). Slow liveweight gain during winter was typical for red deer, because of loss of appetite (Barry *et al.*, 1991; Kay, 1985) and acts as a constraint to venison production.

The present study showed that with high feed allowance during autumn, winter and spring, 75% of weaner red deer stags grazing PRG pasture can attain target slaughter criteria (> 50kg carcass, 92 kg liveweight) within one year of age. A similar result has been achieved by Ataja *et al.*, (1989) with red deer stags grazing annual ryegrass, during winter and spring. Advantages of RC over PRG pasture as a feed for weaner red deer during autumn and spring include a higher nitrogen content and OMD and also higher VFI. This resulted in higher liveweight being achieved at the end of each season, relative to deer grazing PRG pasture. Stags grazing RC pasture over two seasons (autumn and spring), attained minimum slaughter liveweight within one year of age, in higher proportion (100 %) than those grazing PRG pasture (75 %).

The greatest difference in liveweight gain between the RC and PRG groups occurred in autumn (+70 g/d in stags, +25 g/d in hinds), dropped during winter (-5 g/d in stags, -1 g/d in hinds), and regained in spring (+13 g/d in stags, +24 g/d in hinds). Niezen *et al.*, (1991) showed that red deer fawns reared on hinds grazing RC pasture during summer had liveweight gains 100 g/d greater than red deer fawns reared on hinds grazing PRG pasture, under similar pasture allowance. This suggests that areas of RC could best be used for nutrition of lactating hinds and their fawns over summer, and then be used for growth of the weaner stags during autumn.

There was a problem in estimating VFI with red deer using the present CRD technique in that responses to RC in terms of VFI did not always match responses in liveweight gain. This might be due to general variability in chromium release and in sampling technique, as also found by Niezen (pers. comm.) and by Ataja (1990). Further study is needed to evaluate the CRD technique in red deer.

Final liveweight of both RC and PRG stags were 16 and 9 kg higher than the minimum slaughter liveweight requirement (92 kg). Overall, stags grazing RC pasture produced 5 kg heavier carcass yield and 2% higher dressing percentage, with no additional fat deposition (when corrected for carcass weight). Thus, with their accelerated growth, early slaughter (October) could be considered with stags grazing RC.

## CONCLUSIONS

With high pasture allowances during autumn, winter and spring, 75 % of weaner red deer stags grazing PRG can attain the target slaughter criteria (>50 kg carcass, 92 kg liveweight) within one year of age. With weaner red deer stags grazing RC pasture over autumn and spring, this can be increased to 100 % within one year of age. In order to achieve this target, summer (Niezen *et al.*, 1991) and autumn (present study) grazing are the most important times, being the times when animals grazing RC pasture could attained the largest difference in liveweight gain relative to deer grazing PRG pasture.

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