Final Client Report

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Project: Improving spring growth of weaner deer using supplemental roughage

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Summary

The opportunity to increase the growth rates of yearling deer using supplemental roughage during spring was investigated at the Invermay Research Centre, Mosgiel, New Zealand. Roughage offered as barley straw or meadow hay during November had no significant effect on intake or weaner liveweight gain. Yearling females grew at between 300 and 500 g/d during November. Yearling males grew at between 400 and 600 g/d. Elk x Red yearlings grew faster than Eastern Red yearlings which grew faster than NZ Red yearlings. The use of high quality pasture ensured that high growth rates were achieved even at high stocking rates of 30 yearlings per hectare. Pastures during November had acid detergent fibre (ADF) concentrations above 250 g/kg DM and were adequate in fibre for maximal growth. These growth rates were achieved on pure grass pastures.

General Comments

This experiment was one of a set of two that were programmed to be done under contract for DEEResearch Ltd. The first, reported here, was to examine the role of monocotyledonous (grass) fibre sources during spring and the second was to investigate the use of dicotylendous (legume) fibre sources.

The results from the first experiment indicated no response from the use of grass fibre sources. An analysis of the research portfolio of DEEResearch Ltd concluded that it would be prudent to discontinue this research, regardless of the potential outcomes of the second experiment. The final decision was made to discontinue this research contract due to the lack of response to fibre supplementation. The outcomes from the comparison of genotypes and sexes indicated that the science involved was robust.

Introduction

The growth potential of rising yearling deer in spring is high. Research has shown little difference between pasture species when they are green, growing and leafy during spring (summarized by Barry et al.1998) with average gains of between 250 and 350 g/d. However, recent experimentation at Invermay has shown live weight gains approaching 400g/d on pastures that had high levels of seed head and stem (Stevens et al. 2003).

The difference between these results may be due to the amount of fibre in the diet. Effective dietary fibre is required for rumen health and function. Dietary fibre is supplied by the cell wall of the plant. Research has shown that maximum animal production occurs when ADF (acid detergent fibre) is approximately 23 to 28% of the diet. This provides the optimal cell wall to cell contents ratio and controls the rate of breakdown of the feed in the rumen. Spring pasture has a high ratio of cell contents to cell wall and this can result in a lack of effective fibre in the diet. Data collected during September shows that pastures in the South Island can have ADF levels of 15 to 20%, which is below the optimum for animal production. Pastures with low ADF levels are highly digestible, but the low effective fibre content can induce both sub-clinical and acute acidosis. Research has shown that cows grazing young pasture in spring can be in acidosis for large periods of the day, reducing the potential intake of those animals.

Effective fibre can be supplied to grazing animals by offering a source of roughage such as hay or straw. Animals will eat this feed as required to manage their own rumen health. The supply of an effective fibre source may improve both the intake and utilisation of spring feed.

This project investigated the potential of temperate monocotyledonous sources of fibre in the form of barley straw and meadow hay to improve the growth of yearling deer in spring

Method

The purpose in the spring of 2002 was to compare two monocotyledonous sources of fibre to zero supplementation. Grasses are monocotyledons and as such have a specific pattern of fibre deposition. This pattern gives rise to long fibres, particularly in the stem material, that are very resistant to breakdown by either chewing or bacterial and chemical digestion. The model used here compared grass hay with moderate amounts of stem to barley straw with high amounts of stem. Paddock feeding of the treatments groups was finally chosen to simulate on-farm conditions as closely as possible.

The experimental design used three diets which included:

- Control: High quality green leafy pasture only
- Meadow Hay: Pasture plus *ad libitum* meadow hay
- Barley Straw: Pasture plus *ad libitum* barley straw

The experiment ran from 29th October to 9th December 2002. There were 15 animals of mixed sex allocated to each treatment. These included genotypes of NZ Red, Elk x Red, and European Red deer.

Individual feed intakes were measured on 5 NZ Red and 3 European animals per treatment only by alkane dilution (Dove & Mayes 1991). Roughage intake was measured weekly on a group basis. Live weight gain of individuals was recorded weekly. Pasture and roughage quality were also recorded weekly. Pasture mass both pre- and post-grazing, and botanical composition were also measured weekly.

The pastures offered had been spelled from grazing for no more than 4 weeks before the beginning of the experimental period. Pasture growth was boosted with 50 kg N/ha as urea in late September. The yearling deer of each genotype were randomly allocated to each treatment group. The yearlings were treated with a 4g bolus of copper oxide needles and pour-on anthelmintic (Cydectin®) before being put onto appropriate pastures and offered *ad libitum* roughage for the experimental period. Pasture offered each week was spelled from grazing for 1 week. All treatments were exposed to each of the 6 paddocks available during the 6 week period. Pasture mass before and after grazing was measured by taking 120 readings per paddock with a rising plate meter calibrated for the pre and post grazing conditions during the experimental period.

Eight animals (male only) per treatment were used for intake assessment. Slow release alkane capsules (Captec™ Alkane CRC for sheep 25-80kg, batch 601116) were administered on the 1st November and faecal collections were taken three times on the 11th, 13th and 15th for intake assessment and the 18th, 20th and 22nd to determine the capsule endpoint. Pasture intake was calculated by alkane dilution as described by Dove & Mayes (1991). Roughage intake was calculated from measured disappearance of the offered feed. The digestibility of the pasture was also calculated by alkane dilution (Dove & Mayes 1991) using the relative concentrations of the naturally occurring C_{33} and C_{35}.

Data was analysed using the GENSTAT ANOVA procedure using feeding as a main plot and breed and sex as sub-plots within a split-plot design.

Results

The pastures were similar in all aspects of quality, botanical composition and yield throughout the spring measurement period (Table 1). The acid detergent fibre (ADF) concentration is the most reliable indicator of the need to supplement roughage. Roughage supplementation is required for sheep and cattle when the ADF concentration declines below 200 g/kg DM. With an average ADF concentration of over 250 g/kg DM a response to roughage is not expected. Overall the quality of the pasture was high, with little dead material and only approximately 20% stem. This was borne out by the high energy concentration of 11.4 MJ ME/kg, and crude protein concentrations over 18%.

Table 1: The chemical and botanical composition and pasture mass of the pasture offered to yearling weaners during November 2002.

	Treatments			
	Control	Meadow Hay	Barley Straw	LSD (P<0.05)
Pasture Quality (g/kg DM)				
ADF	256	259	258	26
NDF	437	439	430	40
SSS	99	97	93	15
Crude Protein	187	191	197	46
OMD	815	818	821	28
ME (MJ/kg)	11.4	11.4	11.4	0.4
Roughage Quality (g/kg DM)				
ADF	NA[1]	401 a[2]	522 b	24
NDF	NA	660 a	797 b	45
SSS	NA	19 a	0 b	6
Crude Protein	NA	124 a	42 b	32
OMD	NA	630 a	< 500 b	55
ME (MJ/kg)	NA	8.9 a	< 7 b	0.7
Pasture Botanical Composition (g/kg DM)				
Leaf	563	523	530	17
Leaf Sheath	212	212	222	70
Stem	180	223	192	168
Dead	45	43	56	22
Pasture Yield (kg DM/ha)				
Pre-grazing	3100	3080	2820	633
Post-grazing	2880	3050	2690	585

[1] NA = not applicable

[2] Means with different letters differ significantly (P<0.05)

Roughage quality analysis (Table 1) showed that the straw was of consistently lower quality than the meadow hay.

The feed intake of the rising yearlings (Table 2) was not affected by the provision of a roughage supplement. The field measurement of roughage disappearance reflected some small losses of roughage due to weather conditions rather than any consumption by the yearlings. Field observations confirmed that no roughage was eaten by the yearlings.

There was a small difference in the intake of the yearlings during the measurement week. This proved significant when expressed as MJME per kg metabolic bodyweight ($BW^{0.75}$). This was not a result of the treatments but rather a reflection of slightly different pasture conditions during that week, as reflected by the variation in pasture digestibility.

Table 2: The intake of pasture and roughage, and the diet digestibility of male yearling deer as predicted by alkane concentration methodology.

	Treatments			
	Control (n=8)	Meadow Hay (n=7)	Barley Straw (n=6)	LSD (P<0.05)
Pasture Intake (11-15 November (C31:C32)**)**				
kg DM/d	2.46	3.03	2.83	0.77
g/kgBW	24.7	30.1	28.8	5.8
MJME/kg $BW^{0.75}$	0.87 b[1]	1.12 a	1.02 ab	0.24
Pasture digestibility (g/kg DM) (Av C33 and C35)	733 b	775 a	738 b	21
Roughage Intake from field records				
kg DM/d	0	0.01	0.016	0.02

[1] Means within a row with different letters differ significantly.

The liveweight gain during the experiment (Table 3) was not significantly different between the three feeding treatments, though reflected the same pattern as intake, reflecting the pasture conditions during the week of measurement.

Table 3: The liveweight and live weight gain of male yearlings during the period of alkane administration.

	Treatments			
	Control	Meadow Hay	Barley Straw	LSD (P<0.05)
Live weights of alkane treated deer				
During intake period (kg)	100.1	100.2	98.2	9.6
Live weight gain (g/d)	419	482	401	89

The overall liveweight gain during the experimental period varied most significantly between the males and females, and between the genotypes (Table 4). The males grew on average approximately 100 g/d faster than the females. The NZ Red males grew at 400 g/d while the Eastern Red males grew at 505 g/d and the Elk x Red yearling males grew at 615 g/d. The feed intake of the Eastern Red males was numerically higher, though not significantly different from the NZ Red males. A small sample size may have been responsible for this lack of significance in absolute feed intake. When expressed in metabolic bodyweight terms, there was no difference in feed intake. The average stocking rate in all treatments was approximately 30 yearlings per hectare.

Table 4: The live weight, live weight gain and feed intake of NZ red, eastern European red and elk x red yearlings on pasture during November 2002, including males and females.

	Genotypes			
	NZ Red	Eastern Red	Elk x Red	LSD (P<0.05)
Starting Liveweight (kg)				
Males	87.7	95.4	124.5	12.8
Females	66.5	nd[1]	101.2	
Liveweight gain (g/d)				
Males	400 c	505 b	615 a	58
Females	304 b	nd	509 a	100
Intake Males only	(n=13)	(n=8)		
kg DM/d	2.54	3.05	nd	0.56
g/kg BW	27	29	nd	5
MJ/kg $BW^{0.75}$	1.04	1.14	nd	0.22

[1] nd = no data

Conclusions

Supplementary roughage was not required in late spring to achieve high growth rates in rising yearling red deer. The fibre content of the pasture as represented by the ADF was above 250 g/kg DM. This figure is similar to that required to maximise growth rate in sheep and cattle. The overall growth rate of between 400 and 600 g/d in yearling male red deer was due to the offering of ample high quality pasture. No significant amount of roughage was consumed during the experimental period. Important new information about the variation in spring liveweight gain between predominant genotypes used in New Zealand was recorded.

References

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