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Adapting cattle from pasture to brassica diets

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ABSTRACT

Strategies for adapting cattle from pasture to brassica diets were compared. Groups of 20 Friesian weaner bulls were offered three diets at a fixed daily allowance of 12% of liveweight as drymatter on offer, for a six week period during February and March 1994. Animals continuously grazing pasture and a Wairoa brassica crop were compared to a group receiving half their allowance as pasture and half as Wairoa brassica, in separate night and day breaks. Unfasted animal liveweights were measured each week for the duration of the trial. Utilisation and botanical compositions were estimated from quadrat harvests to ground level before and after grazing.

Liveweight differences among treatments at the start (overall mean 178.9 kg) and at the finish of the trial (overall mean 207.4 kg) were not statistically significant ($P>0.90$), although growth paths differed between treatments. Both groups receiving brassica initially lost weight, the effect being most pronounced after the first week when growth rates were -0.28 kgLW/day in brassica, 0.36 kgLW/day in pasture, and - 0.77 kgLW/day in the mixed diet ($P<0.05$). During the final week of the trial growth rates were 1.12 kgLW/day, 1.86 kgLW/day and 1.44 kgLW/day for brassica, pasture and mixed diets respectively ($P<0.05$). Overall average growth rates did not differ significantly ($P>0.10$).

Large areas of crop will be required to fully realise the benefits of short term rapid growth rates.

Keywords: brassica; liveweight gain.

INTRODUCTION

Low feed supply and quality are factors in poor performance of beef cattle during summer and autumn in summer dry environments. Brassica forage crops are capable of providing a bulk of quality feed for intensive beef production at this time. They serve a dual purpose in supplying summer feed and being part of pasture renewal programmes. A considerable range of forage brassica types are commercially available (Percival *et al.*, 1986). Seasonal yields and ability to regrow after grazing vary among cultivars (Newton *et al.*, 1987; Piggot *et al.*, 1980; Percival *et al.*, 1986; Banfield and Rea, 1986), regrowth being greatest under lax grazing regimes. Animals are known to take a considerable time to attain maximum voluntary intake when changed from all pasture diets to all brassica diets, and this may be compounded by slow rumen adaptation, and other subclinical health effects (Nicol and Barry, 1980; Barry, 1978). Animal intakes have been inversely related to crop dry matter content (Barry *et al.*, 1971). Loss of liveweight and reduced rates of liveweight gain occur for 2-3 weeks after initial access to brassica crop while animals adapt. Strategies for minimising these losses are needed. In dairying situations cows are allowed access to brassica crop for 2-3 hours before being returned to pasture. Similar systems may be useful in beef systems both to adapt animals from pasture to crop, and to extend the period crop is available for use. This paper reports a comparison of the growth performance of cattle grazing pasture, brassica, and mixed pasture and brassica diets.

MATERIALS AND METHODS

Groups of 20 Friesian weaner bulls were offered three different diets at a fixed daily allowance of 12% of liveweight as drymatter on offer, for a six week period during February and March 1994. Weaner bulls of mixed genetic origin were purchased locally. Animals continuously grazed either Wairoa brassica crop (*Brassica napus* var *biennis*) or pasture or received half their allowance as pasture and half as Wairoa brassica, in separate back fenced night and day breaks (mixed diet treatment). Animals were matched for liveweight and assigned to treatment groups of the same initial mean and variance. Unfasted animal liveweight was measured each week. Animals were injected with 2mls coprin (Barry *et al.*, 1981) one week before the trial commenced, and drenched for parasites with 17mls Ivomec pour on every four weeks, beginning one week before placement on treatments. Rectal temperatures were taken from animals in each treatment at the end of the trial period. Statistical analysis of animal data were performed using a single factor analysis of variance procedure. Standard errors of the mean were determined from individual treatment variances.

Wairoa brassica was sown into a cultivated seed bed on a Waipu silt loam at the Kaikohe Research Station during late October 1993. Coated seed was broadcast with fertiliser at 5 kg/ha, chain harrowed and rolled. 500 kg/ha 30% potassic superphosphate was applied to both the brassica and pasture areas at sowing time. During mid December 1993 urea was applied at 100 kg/ha to both pasture and brassica areas when brassica plants were approximately 10 cm high. Weeds and pests (springtail, aphid and white butterfly) were present but control was not warranted. Sufficient pasture for the trial was accumulated during late December and January from an adjacent area of existing temperate perennial pasture. Daily allowances and utilisations were calculated from pre and post grazing crop and pasture drymatter assessments made three times per week. Pre and post grazing harvests to ground level from five quadrats, cut using hand shears, were oven dried and used to assess drymatter present. Fresh residue from quadrat harvests was then bulked and subsamples taken for botanical dissection. Two grazing cycles were used over the Wairoa brassica crop, but animal treatment groups did not consistently regraze the same areas during the second cycle. One grazing cycle was used over the pasture. After the trial all animals were grazed *ad libitum* on pasture as one herd. Liveweights continued to be monitored for a further two weeks.

RESULTS

Initial accumulated yields of up to 8,000 kgDM/ha of Wairoa brassica crop and 7,000 kgDM/ha of pasture were achieved (Table 1 and 2) from cuts to ground level. During the first grazing cycle brassica was leafy. However in the second grazing cycle more stem and dead material were present. The application of nitrogen during December encouraged pasture growth but quality declined rapidly as summer progressed. The crop was capable of continuing growth and retained better quality when pasture growth had ceased. Green ryegrass content in pasture was low as leaf material died. Up to 37% of pasture on offer consisted of dead material. This is typical of summer and early autumn pastures in Northland. Utilisation rates for pasture tended to be greater than for Wairoa brassica.

Liveweight differences among treatments at the start (overall mean 178.9 ± 3.3 kg), and at the finish of the trial (overall mean 207.4±3.5 kg) were not statistically significant (P>0.90). Growth paths differed between treatments (Figure 1). Both groups receiving brassica initially lost weight, the effect being most pronounced after the first week (P<0.01). By the end of the second week animals had recovered the initial loss. With the exception of the final week of the trial, animals receiving pasture alone had a relatively constant rate of liveweight gain. In all treatments the rate of liveweight gain peaked during the final week of the trial, pasture being significantly better than the Wairoa brassica treatment (1.12 ±0.24, 1.86±0.16, 1.44±0.13 kgLW/day, P<0.05 for Wairoa brassica, pasture and mixed diets, respectively). The overall mean rate of liveweight gain over the period of the trial did not differ significantly among treatments (0.64 ± 0.02, 0.72 ± 0.03, 0.68 ± 0.03 kgLW/day, P>0.10, for Wairoa brassica, pasture and mixed diets respectively). Feed conversion ratios calculated from overall mean data were 3.3, 11.4 and 8.2 kgDM/kgLW for Wairoa brassica, pasture and mixed diets respectively. Rectal temperatures taken at the end of the trial were normal for all animals sampled and did not differ significantly among treatments. Mean rectal temperatures were 39.0±0.1, 39.1±0.2, 39.2±0.1 °C (P>0.80) for animals on Wairoa brassica, pasture and mixed diets respectively.

TABLE 1: Mean pre and post grazing herbage mass (kgDM/ha) and botanical composition (%) of Wairoa brassica in each diet treatment, across all daily breaks in each grazing cycle.

Wairoa brassica as sole diet			Botanical composition			
First grazing cycle	mass	SEM	leaf	stem	gra†	dead
Pre grazing	7888	383	51.1	32.2	3.0	13.6
Post grazing	6917	634	24.2	63.7	4.7	7.4
Utilisation	12%					
Second grazing cycle						
Pre grazing	4134	367	26.2	44.0	3.8	26.0
Post grazing	3925	556	6.4	76.5	7.0	10.1
Utilisation	5%					
Wairoa brassica as mixed diet			Botanical composition			
First grazing cycle	mass	SEM	leaf	stem	gra†	dead
Pre grazing	8260	193	47.0	33.0	1.3	18.7
Post grazing	6585	518	11.2	83.9	2.8	2.1
Utilisation	20%					
Second grazing cycle						
Pre grazing	4405	487	27.7	47.3	0.4	24.9
Post grazing	3363	506	1.4	97.4	0.3	0.9
Utilisation	24%					

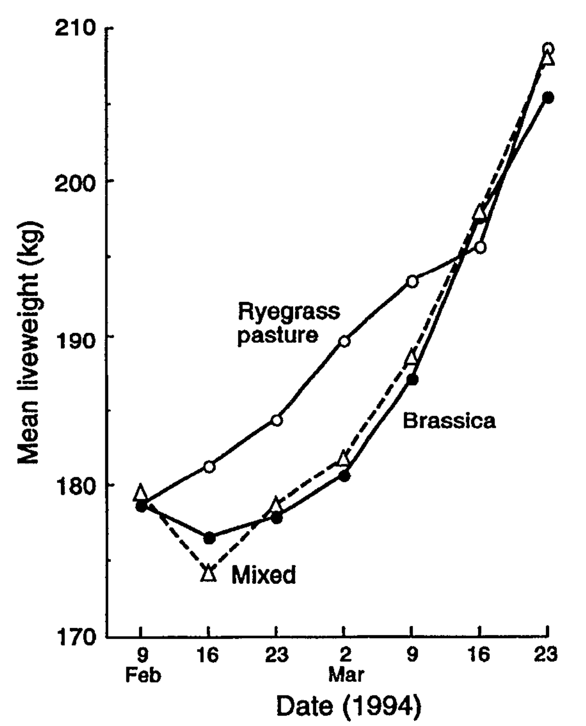
†Abbreviation: gra = grasses.

TABLE 2: Mean pre and post grazing herbage mass (kgDM/ha) and botanical composition (%) of pasture for each diet treatment, across all daily breaks throughout the trial.

Pasture as sole diet			Botanical composition					
	mass	SEM	ryeg†	wclv†	oleg†	ogra†	weed	dead
Pre grazing	7716	238	8.3	20.8	8.2	26.9	0.7	35.1
Post grazing	4936	232	7.7	18.5	6.1	25.1	1.0	41.6
Utilisation	36%							
Pasture as mixed diet			Botanical composition					
	mass	SEM	ryeg†	wclv†	oleg†	ogra†	weed	dead
Pre grazing	6862	184	12.9	24.3	1.8	23.7	0.8	36.5
Post grazing	4855	251	8.9	11.7	9.2	32.3	0.2	37.8
Utilisation	29%							

†Abbreviations: ryeg = ryegrass, wclv = white clover, oleg = other legumes, ogra = other grasses.

FIGURE 1: Bull liveweights throughout the trial for Wairoa brassica, pasture and mixed diets.



At the end of the trial all animals were grazed as one herd on pasture. After two weeks back on pasture, rates of liveweight gain were lower for all treatment groups but were not significantly different (0.41 ± 0.19, 0.61 ± 0.14, 0.64 ± 0.14 kgLW/day respectively for Wairoa brassica, pasture and mixed diets, P>0.50). Liveweights from all treatments were virtually the same (210 ± 6, 209 ± 6, 209 ± 6 kg, P>0.99).

DISCUSSION

Annual crops may provide short term benefits of animal access to quality feed during periods of feed stress or when pasture quality is poor, and in pasture renewal programmes. Many species and cultivars are available and farmers need to ensure that the crop is matched to an identified animal feed or management requirement. Variability in soil type and inconsistencies in crop establishment and production, necessitate careful consideration of options by farmers.

The supply of quality feed to young stock during summer and autumn has been identified as a constraint to animal production in Northland, hence crops which can supply quality feed at this time are needed. Forage brassicas are often used for this purpose, and a range of morphologically diverse species (turnips, swedes, rape, kale and chinese cabbage) and hydrids, are available. Turnips and swedes are often used in the dairy industry, but mature earlier than kale and rape (Piggot *et al.*, 1980; Percival *et al.*, 1986) and do not target the period of greatest constraint in sheep and beef production systems. Percival *et al.*, (1986) reported that most rape cultivars including Wairoa brassica reached maximum yield at 120-150 days from sowing (late February to early April), and that leaf yields showed little change from 90-150 days from sowing. Piggot *et al.*, (1980) suggested that Wairoa brassica would provide good regrowth after a February harvest, but was more prone to loss of yield by leaf fall if left unharvested late in the growing season. Percival *et al.*, (1986) commented that Wairoa brassica stems were particularly woody, and utilisation was lower than other rape cultivars. Total Wairoa brassica crop yields achieved in this trial were within the range (4,000-13,000 kgDM/ha) previously reported for spring sown crops in Northland (Piggot *et al.*, 1980). Other forages such as sorghum, and limpograss (Taylor *et al.*, 1974; Rumball, 1989) which are ready for multiple grazing at a similar time have achieved higher drymatter yields, but are of poorer quality than brassicas which usually range in drymatter digestibility from 81-89% (Barry, 1978).

Initial depression of liveweight gain in animals placed on brassica crops has been reported previously. Greenall (1959) reported that lambs gained weight at a faster rate, and that the level of intake increased, as the time during which animals had been grazing rape increased. Results from this trial concur with these findings and suggest there is little or no liveweight advantage in cattle given access to Wairoa brassica rather than pasture, for short periods. To fully realise the benefits of high rates of liveweight gain which can be achieved on Wairoa brassica crops, sufficient area to ensure continued animal feeding for a minimum of six weeks would be needed. Mixed diets of both pasture and brassica in separate day and night breaks were just as effective as a pure brassica diet during the short duration of the trial. Using swedes (*Brassica napus*), Kay (1974) found that the period of initial depression of liveweight gain could be eliminated if the brassica comprised 33% or less of the total drymatter intake. Similarly, Barry (1978) postulated that to avoid depressed animal performance, brassica should initially comprise a minor part of the animals diet which is gradually increased until an all brassica diet is achieved. Access to both pasture and Wairoa brassica as separate day and night breaks did not reduce initial depression of rates of liveweight gain during adaptation to crop. Subsequent rates of liveweight gain from both brassica and mixed diets were similar. Further study is required to determine if rates of liveweight gain from these treatments remain similar after prolonged access to crop, and whether there are significant liveweight advantages over pasture. Consideration of the effects of depressed animal growth rates both during initial adaptation to the crop, and readaptation to pasture when the crop is finished, is needed.

The use of crops during summer is one means of avoiding clinical or subclinical toxicity in animals grazing pasture during periods of fungal challenge, however there is a risk that crop itself may contain toxins. Persistent ryegrass pastures in Northland are known to be infected with endophytic fungi (*Acremonium loliae*), and to contain ergovaline levels sufficient to cause heat stress (indicated by elevated rectal temperatures) in animals (Cooper and Easton, *pers. comm.*). Lolitrem toxicity (ryegrass staggers) caused by the same endophyte is also common in the region, particularly in young stock during late summer and autumn. Sporodesmin (facial eczema) and zearalenone (infertility) toxicity resulting from the ingestion of fungal spores (*Pithomyces chartarum* and *Fusarium* spp. respectively) produced in pasture litter, also regularly occur during summer and autumn. Pastures used in this trial were not high in ryegrass, but contained much dead material, a substrate for growth of the later two fungi. Animals used in this trial may have avoided dead material and hence had minimal intakes of mycotoxins. In farming systems accumulated pasture may have been more effectively transfered to summer by mechanical conservation, however feed may still have contained mycotoxins, and animals would have had less ability to be selective.

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