Effect of allowance and the rate of adaptation of weaned calves to two brassica types

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ABSTRACT

Groups of 10 Friesian bull calves averaging 142 kg were offered Winfred forage brassica (62% leaf) at allowances of 3, 6, 9, 12 or 15% of bodyweight (BW) for 6 weeks. Similarly, groups of 8 Friesian bull calves averaging 150 kg were offered Wairoa forage brassica (67% leaf) at allowances of 3, 5, 7, 9, and 12% of bodyweight. Calves were weighed weekly and offered fresh allowances each week. The two experiments were conducted between January and March of the same year but were not run concurrently.

There was a significant effect ($P < 0.01$) of allowance on liveweight gain for calves offered Winfred, with calves on the lowest allowance (3% of BW) growing at 0.90 kg/day, compared to 1.20 kg/day for calves grazing the other four allowances. Calves grazing the low allowance (3% of BW) utilized 77% of the total crop, but only 43% of the stem. On the other hand, calves grazing the low allowance of Wairoa utilised 90% of the total crop and 72% of the stem without suffering a liveweight penalty. There was no effect of allowance of Wairoa on calf growth rate and overall, calves on Wairoa grew at an average of 1.03 kg/day. Choice of a leafy type of brassica maybe important if the objective is a high degree of utilisation coupled with good animal performance. Alternatively, on "stemmy" brassicas, calves should not be forced into a "clean up" role on brassicas if the objective is to maximise liveweight gains.

The period of adjustment to brassicas appeared to take four weeks. Over the first four weeks, calves grazing Winfred grew at 1.06 kg per day and calves grazing Wairoa grew at 0.54 kg per day. Over the final two weeks, the pattern reversed and calves grew at 1.50 and 1.94 kg per day on Winfred and Wairoa, respectively. Rate of adaptation to brassica may be an important consideration if short term grazing/finishing periods are desired.

Keywords: allowance; calves; brassica; Winfred; Wairau.

INTRODUCTION

Brassicas have high digestibility and metabolisable energy concentrations (Milne and Burnett, 1984) yet in lambs, intakes are relatively low in relation to these digestibility values and this has been attributed to the effect of non protein bound, sulphur-containing amino acids in brassicas (Barry and Drew, 1978; Hodgson *et al.*, 1985). A large number of studies in New Zealand and overseas have indicated that the performance of lambs can vary between brassica types (Nicol and Barry, 1980; Fitzgerald, 1983) and with degree of utilisation of the crop and method of grazing (Armstrong *et al.*, 1984).

New Zealand is relatively unique in its use of calves of dairy origin which are artificially reared for subsequent bull beef production. In drier areas of the country there are difficulties in maintaining summer growth rates of weaned calves and summer brassicas provide a useful high quality feed when pasture quality is limiting. There are, however, no data on the growth rate of young, weaned calves on brassicas.

This experiment examined the effect of forage allowance on calf growth rate of two brassicas cultivars commonly grown as summer feed; Winfred and Wairoa. Data are provided on the rate of adjustment of calves to brassicas, apparent differences between cultivars and the effect of allowance on calf growth rate.

MATERIALS AND METHODS

Two experiments were conducted. In Experiment 1, Winfred forage brassica (sown 20 Oct 1993) was used. Fifty Friesian bull calves were allocated to 5 treatment groups and grazed at 5 allowances (3, 6, 9, 12, 15% of bodyweight) over a 6 week period from 17 January to 1 March 1993. Wairoa forage brassica (sown 2 Dec 1993) was used in Experiment 2, with forty Friesian bull calves averaging 150 kg being allocated to 5 allowances (3, 5, 7, 9, 12% of bodyweight) for a 6 week period from 7 February to 23 March. Calves had been weaned for at least 4 weeks prior to commencing the experiment and no calves had any previous experience of brassicas. Allowances were based on the data of Armstrong *et al.*, (1984) and Fitzgerald (1983) which showed that allowances in excess of 7% are required to maximise lamb growth rates. However liveweight gains measured during Experiment 1 indicated that allowances could be lower for calves and the allowances used in Experiment 2 were adjusted downwards prior to commencement of the experiment.

In both experiments sufficient feed was only available for a 42 day feeding period and it was intended that the first 14 days would be an adjustment period followed by a 28 day experimental feeding period. Calves were weighed weekly in order to calculate weekly herbage allowances and were also weighed following overnight fasting both at the beginning and end of the pre-feeding period and at completion of the experiment.

Pre and post-grazing herbage mass for each allowance were determined by hand cutting five sites per allowance to ground level. The area taken for each cut was 6 rows, each 60 cm long within a quadrat 900 cm x 600 cm. The harvesting sites within each allowance were pre-determined using a semi

stratified technique. The site of each cut was representative of the crop within the particular harvest site. For each cut, plant numbers were recorded and divided to two components: leaf plus petiole and stem. Each component was weighed in the field and sub-samples taken to form a composite sample for standard dry-matter determination. The same technique for measuring pre-grazing yields was used for post-grazing assessments, although harvesting sites were two metres from pre-grazing sites to avoid localised stock camping and trampling.

Liveweight gain data were analysed by standard analysis of variance techniques with covariate adjustment for initial liveweight.

RESULTS

Brassica yields and utilisation

Pre-grazing dry matter yields averaged 4726 and 3265 kg DM/ha for the Winfred and Wairoa, respectively. The proportion of leaf was greater in the Wairoa than in the Winfred (67% versus 62%). The summer of 1993/94 was typically dry in Hawkes Bay and there was a clear trend for leaf senescence to occur, with percentage leaf deteriorating through the experiment, from 79% to 65% and from 66% to 53% for Wairoa and Winfred, respectively. There appeared to be a small difference in dry matter content between the stem and leaf of Winfred (17.9% versus 21.4%) but not in the case of Wairoa (21.7% versus 21.1%).

Leaf senesence and variation in the number of plants between quadrats and before and after grazing made accurate calculation of intake data difficult. The level of utilisation decreased as the allowance increased (Table 1). Overall levels of utilisation were lower on the Winfred than on the Wairoa; e.g. on the low allowance, levels of utilisation were 77% and 90%, respectively (Table 1). Of the calves grazing Winfred, only those grazing the low allowance consumed significant amounts of stem whereas all calves grazing Wairoa appeared to consume significant amounts of stalk (Table 1), irrespective of allowance.

TABLE 1: Total crop dry matter, percentage leaf and degree of utilisation of weaned calves fed 5 allowances of either a) Winfred or b) Wairoa forage brassica.

a) Winfred (Experiment 1)

Allowance (% BW)	DM on offer (kg DM/ha)	% Leaf	% Total utilisation	% Leaf utilisation	% Stem utilisation
3	4867	60	77	100	43
6	4538	63	64	92	0
9	4678	62	46	72	0
12	4663	63	43	66	0
15	4878	62	32	62	0

b) Wairoa (Experiment 2)

Allowance (% BW)	DM on offer (kg DM/ha)	% Leaf	% Total utilisation	% Leaf utilisation	% Stem utilisation
3	3106	67	90	100	72
5	3374	67	77	100	30
7	3346	67	68	87	22
9	3576	67	60	56	25
12	2923	69	49	58	10

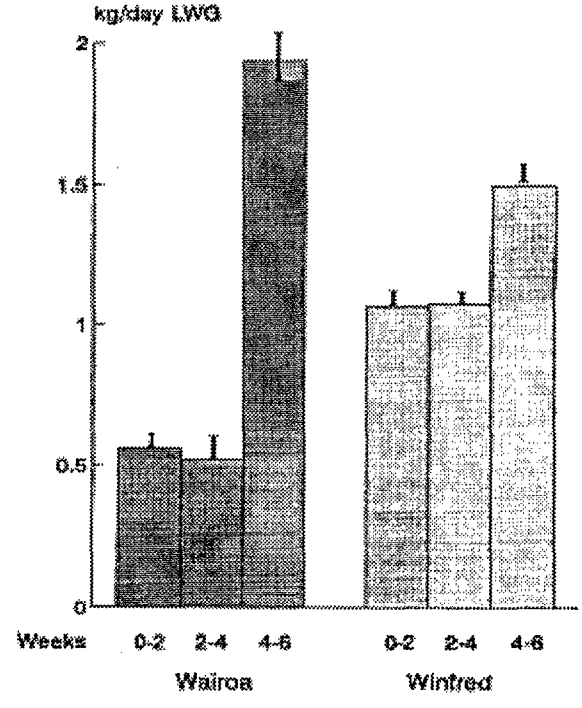
Liveweight gain

Level of allowance had a significant effect ($P < 0.01$) on liveweight gain in calves grazing Winfred, with calves on the low allowance (3% of bodyweight) growing at 0.93 kg/day, compared with an average growth rate of 1.22 kg/day for calves on the other four allowances (Table 2). There was no statistically significant effect of allowance on liveweight gain of calves grazing Wairoa and growth rates averaged 1.03 kg/day over all 5 allowances. When the fasted liveweight gains were examined, there was still a significant effect of allowance on liveweight gain for the calves grazing Winfred ($P < 0.05$). However there was relatively little difference in overall fasted liveweight gain between the two brassica types (0.75 and 0.68 kg/d for the Winfred and Wairoa, respectively).

Rate of adaptation to brassica

It appears that calves did not adjust fully from pasture to brassicas for at least four weeks (Fig 1), as there was a significant increase in liveweight gain ($P < 0.0001$) in calves on both brassica types between weeks 0 to 4 and weeks 4 to 6. Calves grazing Winfred rape grew at 1.06 kg/d and 0.56 kg/d on Wairoa over over the first 4 weeks (Fig 1). Over the final two weeks calves on Winfred grew at 1.50 kg/d and 1.94 kg/d on Wairoa.

FIGURE 1: Rate of adaptation of weaned calves to Winfred and Wairoa forage brassicas.



DISCUSSION

At an allowance of 3% of bodyweight, calves grazing Wairoa were able to graze 90% of the total crop and 72% of the stem without penalty. By contrast, the calves on the same allowance of Winfred grazed only 77% of the total crop and 43% of the stem, but were unable to maximise liveweight

TABLE 2: Liveweight gain of weaned calves fed 5 allowances of either a) Winfred or b) Wairoa forage brassica.

a) Winfred (Experiment 1)

Allowance (% of BW)	17/1 Prefeeding	2/2 Start Trial	15/2	2/3 End Trial	Total LWG (kg)	LWG (kg/d)	Fasted LWG (kg/d)
3	141.8	158.5	164.2	180.7	38.9	0.90	0.58
6	142.7	157.7	171.8	190.9	50.2	1.17	0.76
9	141.9	158.9	172.5	192.3	50.4	1.17	0.80
12	140.4	156.3	169.9	194.3	53.9	1.25	0.72
15	142.9	158.3	172.7	194.1	51.2	1.19	0.72
Significance						**	*
SED						0.10	0.12

b) Wairoa (Experiment 2)

Allowance (% of BW)	7/2 Prefeeding	22/2 Start Trial	9/3	23/3 End Trial	Total LWG (kg)	LWG (kg/d)	Fasted LWG (kg/d)
3	152.1	158.4	167.9	193.9	41.8	0.97	0.61
5	148.8	158.5	167.3	199.1	50.3	1.17	0.79
7	150.9	159.3	167.2	196.4	45.5	1.06	0.73
9	150.5	159.7	166.2	190.1	39.6	0.92	0.62
12	150.4	158.6	162.3	195.3	44.9	1.04	0.66
Significance						NS	NS
SED						0.10	0.08

gains. Although Armstrong *et al.*, (1984) and Fitzgerald (1983) suggested that allowances in excess of 7% of liveweight are necessary to maximise growth rate in lambs, the present study suggests that results are dependent on crop type and that an allowance of 3% may be sufficient to maximise growth rate with calves on some brassicas. Differences between cultivars in level of utilisation and effect of allowance may be due to differences in stem digestibility, as Armstrong (1984) found that digestibility values and intakes were lower in lambs consuming the lower stem than those consuming upper stem and petiole. Digestible organic matter was not measured but surprisingly, overall stem dry matters were lower in the Winfred than the Wairoa (17.9% versus 21.7%), although the Winfred appeared less succulent. There may, however, have been a greater range in dry matter and digestibility between the top and base of the longer stemmed Winfred. Choice of a leafy, more digestible type of brassica may well be important if the objective is a high degree of utilisation coupled with good animal performance. Alternatively, young calves should not be forced to clean-up "stemmy" brassicas if high growth rates are desired. In this instance it would seem appropriate to use an alternative class of stock.

The two brassica cultivars cannot be directly compared in terms of performance because of differences in timing of the trial and of the calves used. However the data suggests differences between cultivars in degree of utilisation and, from a farmers point of view, in liveweight gains. The liveweight gains of 1.22 kg/d and 1.03 kg/d for Winfred and Wairoa, respectively (for those treatments not affected by allowance) did not translate to similar differences in fasted liveweight gains (0.75 and 0.68 kg/d, respectively) and indicate substantial differences in gutfill. Overall the non-fasted calf liveweight gains were high and close to those achieved with calves either suckling Friesian nurse cows or fed a high energy/high protein pellet *ad libitum* (1.2 and 1.3 kg/d, respectively; Muir *unpublished data*). These results tend to suggests that the effects of non protein-bound, sulphur-containing amino acids thought to reduce intake and performance of lambs on brassicas (Barry and Drew, 1978; Hodgson *et al.*, 1985) may not have such a marked effect in calves. However it is also possible that the intake problems generally associated with brassicas have been reduced with the advent of new, improved cultivars,

The apparent differences between cultivars in rate of adaptation may be due to differences in initial grazing preference/palatability which has previously been observed in lambs (Armstrong *et al.*, 1984). The catch-up observed in the calves grazing Wairoa over weeks 4 to 6 suggests that calves had fully adjusted to the crop at this stage. Nevertheless it would seem that type of brassica is important, particularly if short term grazing periods are envisaged.

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REFERENCES

Armstrong R.H. (1984). The structure of the rape crop (*Brassica napus*) and its effect on intake by lambs. *In* Proceedings of 'Better Brassicas '84' Conference, St Andrews, 1984. (ed. W.H. McFarlane-Smith and T. Hodgkin). 72-76. Scottish Crop Research Institute, Dundee.

Armstrong R.H., Maxwell T.J. and Sibbald A.R. (1984). The rape crop (*Brassica napus*): utilisation and effects on animal performance. *In:* Proceedings of 'Better Brassicas '84' Conference, St Andrews, 1984 (ed. W.H. McFarlane-Smith and T. Hodgkin). 72-76. Scottish Crop Research Institute.

Barry T.N. and Drew K.R. (1978). Responses of young sheep grazing swedes, turnips and kale to intraperitoneal and oral supplementation with DL-Methionine. *New Zealand Journal of Agricultural Research.* **21**: 395-399.

Fitzgerald S. (1983). The use of forage crops for store lamb fattening. *In:* Sheep Production (ed. W. Haresign). 239-286. 35th Easter School in Agricultural Sciences, University of Nottingham, Butterworths, London.

Hodgson J., Milne J.A. and Armstrong R.H. (1985). Forage brassicas for finishing lambs. *In:* Hill Farming Research Organisation Biennial Report, 1984-85, 145-153.

Milne J.A. and Burnett F. (1984). Nitrogen digestion of forage brassica crops by lambs. *In:* Proceedings of 'Better Brassicas '84' Conference, St Andrews, 1984 (ed W.H. McFarlane-Smith and T. Hodgkin), pp 67-71. Scottish Crop Research Institute.

Nicol A.M. and Barry T.N. (1980). The feeding of forage crops, Chapter 3. *In:* Supplementary Feeding. Edited by K.R. Drew and P.F. Fennessy. New Zealand Society of Animal Production, Occasional Publication, No 7. 69-106.