Ensiled roughages (Chaffhage and Stockhage) as feeds for young calves

D.E. COLLINS AND I.M. BROOKES[1]

Department of Animal Science, Massey University, Palmerston North, New Zealand.

ABSTRACT

Twenty four, three-week old Friesian calves were fed restricted levels of milk replacer and ad libitum levels of either ensiled roughages (R) or cereal-based pellets (P). The roughage diet consisted of ensiled lucerne-molasses (Chaffhage), followed by a mixture of Chaffhage and ensiled maize-molasses (Stockhage). The calves were weaned off milk over a two week period once they reached 70 kg.

Diet R calves grew significantly faster ($P < 0.001$) and finished the trial significantly sooner ($P < 0.05$), based on unfasted weekly liveweight data. However, no differences were observed in fasted body weight gain. Diet R was consumed in significantly ($P < 0.001$) larger quantities and resulted in a significantly ($P < 0.001$) greater fasting weight loss at the end of the trial. No carryover effects were observed in terms of subsequent growth rate in heifer calves at pasture following weaning.

Energy digestibilities of Chaffhage and diet P (measured using 8 bull calves following weaning) were not significantly different. No carryover effects in the ability of calves reared on R or P to digest pasture were observed.

It is concluded that ensiled roughage can be consumed in sufficient quantities by young calves to produce acceptable levels of liveweight gain.

Keywords: Calves, liveweight gain, digestibility, roughages, silage, pelleted diet.

INTRODUCTION

Liquid milk or milk replacers are the most expensive feed components in calf rearing systems. Replacement of milk with solid feed not only reduces costs but encourages rumen development, so that growth checks are minimised when calves are weaned on to pasture. During the transitional phase between the pre-ruminant and ruminant, intake of energy and protein must be sufficient to meet the demands of the growing calf. Solid feeds used at this time must therefore have high voluntary intakes and high nutritive value (Roy, 1980; Davey, 1977).

High quality ensiled roughage products are commercially available in the form of Chaffhage[1] (ensiled wilted lucerne and molasses) and Stockhage[1] (ensiled whole-crop maize and molasses). Calves fed restricted milk and Chaffhage have been reported to gain 0.73 kg/day prior to weaning at 70 kg (K. Giles, unpublished).

This trial was designed to compare the performance of calves fed Chaffhage and Stockhage prior to weaning with those fed the more conventional cereal-based pellets and to ascertain whether the consumption of these roughages had a beneficial carry-over effect on calves grazing pasture after weaning.

EXPERIMENTAL METHODS

Growth Trial

24 Friesian calves (12 male and 12 female) with an average fasted live weight of 54.1 ± 4.4 kg (SD) and approximately 3 weeks old, were divided into two similar groups in March 1992. Prior to the experiment, each calf received approximately 5 litres of whole milk daily. The calves were individually penned and fed 4.5 litres of milk replacer (1 kg Tui Nutricalf:8 litres warm water) daily in two feeds. Ad libitum access was provided to one of two solid feed mixtures. Diet R consisted of Chaffhage for the first 26 days of the trial. Over the next 4 days, Stockhage was mixed with Chaffhage in increasing amounts, so that from day 30, a 70:30 Chaffhage:Stockhage mixture was offered. Diet P consisted of a cereal-based pellet formulated to contain 10% crude fibre and 16% crude protein and manufactured by the Massey University Feed Processing Unit. The ingredient composition of diet P is given in Table 1 and the chemical composition of the dietary components in Table 2. Access to fresh water was provided throughout the trial. One calf on diet R was removed from the trial on day 13 due to a respiratory infection.

TABLE 1: Ingredient Composition of Massey University calf pellets (Diet P)

	g/kg
Maize	300
Barley	50
Malt Culms	150
Lucerne	360
Barley Dust	35
Lupin	100
Sodium chloride	2.5
Mineral-Vitamin Premix[a]	2.5

[a] Danmix, Nutritech, Mount Wellington, Auckland 6

1 The Great Hage Company, RD 2, Reporoa, New Zealand.

Calves were fasted for 12 hours prior to the commencement of the trial and then weighed. Thereafter, weekly unfasted calf weights were recorded. Once a calf achieved an unfasted live weight of 70 kg, milk replacer was offered at a rate of 2.0 litres daily in two feeds for a further 7 days. In the final 7 days of the trial, solid feed only was offered. Calves were then weighed, fasted for 24 hours, re-weighed and turned out to pasture. The post-weaning growth rates of 10 heifer calves (3 on diet R and 7 on diet P) were monitored at grazing over a 28 day period following termination of the growth trial.

TABLE 2: *Chemical composition of components of diets R and P*

	Chaffhage	Diet R Stockhage	Diet P
DM (g/kg feed)	535	475	870
g/kg DM			
Crude Protein	210	72	167
Hemicellulose	112	249	258
Cellulose	175	208	152
Lignin	43	18	25
pH	4.6	4.3	–

Daily weights of feed offered to and refused by individual calves were recorded and samples taken for dry matter determination.

Treatment differences between the two diets were tested by analysis of variance using the initial fasted live weight as an independent covariate.

Digestibility Trial

Four bulls reared on diet R and four on diet P were transferred to metabolism crates at the termination of the growth trial. Bulls previously fed diet R were offered Chaffhage (C) and the other 4 bulls continued to be offered diet P for a 7 day adjustment period. Daily feed intakes were standardised at 3.0 kg C and 1.6 kg P and total faecal collections made over a 6 day period. At the conclusion of the digestibility trial one calf on diet P died from acidosis. Feed and faecal samples were retained for analysis of DM and gross energy (GE) concentrations.

Three bulls from each treatment were allowed a 2 day period at grazing before returning to the metabolism crates for a 5 day adjustment period, during which they were offered cut ryegrass-white clover pasture. Daily pasture intakes were standardised at 4.0 kg fresh weight (18% average DM) and total faecal collections made over a 6 day period. Samples of feed, refusals and faeces were retained for analysis of DM and GE concentrations.

Treatment differences in energy digestibilities were tested by analysis of variance.

RESULTS AND DISCUSSION

Two solid feed mixtures, R and P were fed to calves receiving restricted levels of milk replacer, from 3 weeks of age until two weeks after they reached an unfasted live weight of 70 kg. This period was significantly ($P < 0.05$) shorter for diet R (R 40; P 43 days, SEM ± 1.1).

The performance of the calves is shown in Table 3. Based on unfasted live weight data, R calves were significantly ($P < 0.01$) heavier and had grown significantly ($P < 0.001$) faster by the end of the period. However, when fasted live weight data were used, no such differences occurred.

TABLE 3: *Mean final live weights and liveweight gains, daily DM intakes, and fasting weight loss adjusted for initial fasted live weight.*

	Diet R	Diet P	SEM
Unfasted			
Final LWT (kg)	80.2	76.0	0.8**
LWG (g/d)	726	574	26.0***
Fasted			
Final LWT (kg)	74.4	73.5	0.8 NS
LWG (g/d)	512	452	26.0 NS
Daily DMI (g/d)	1006	684	54.2***
Fasting weight loss (% final fasted liveweight)	7.8	3.4	0.5 ***

** $P < 0.01$; *** $P < 0.001$

The weight loss observed during the 24 hr fast on the last day represents a proportion of the total gutfill, and was a significantly ($P < 0.001$) larger proportion of the fasted live weight for R calves. The decision to initiate the weaning procedure was taken when calves reached 70 kg unfasted live weight. At this stage, R calves can be calculated to have had a 4% lighter fasted body weight than P calves. In estimating the true live weight, it is necessary to take into account gutfill (Hughes, 1976), particularly when making important management decisions such as when to wean.

The increased fasting weight loss of the R calves may be related to the significantly ($P < 0.001$) higher daily DM intakes achieved on diet R over the period (Table 3). These were not associated with any significant increase in fasted liveweight gain, implying a less efficient feed conversion ratio for the roughage diet.

Data obtained from the small number of heifer calves retained at grazing for the month following the completion of the trial indicated no carryover effect of pre-weaning feeding on post-weaning growth rate (R 633; P 708 g/d, SEM ± 104).

The energy digestibilities of Chaffhage (C) and the pelleted diet (P) were determined with bull calves following weaning. No significant differences were observed between the two feeds (C 62.6, P 57.5%, SEM ± 2.1), though the values for P were unexpectedly low. One calf on this diet died at the conclusion of the collection period and post-mortem analysis attributed the cause of death to acidosis. The data for this calf were retained in the analysis, as they fell within the range of those obtained from the other calves. However,if rapid rumen fermentation of the cereal portion of diet P was responsible for low rumen pH levels, these might have had an inhibitory effect on cellulolytic activity (Mould *et al.*, 1983), thereby reducing the digestibility of the fibre provided by the lucerne component.

No significant differences were observed in the ability of the calves reared on either R or P to digest dietary energy from pasture (P 55.7, C 57.2%, SEM ± 1.7). Although these

figures are low for leafy autumn pasture (Bryant and Trigg, 1982), there is no evidence that prior rearing on a roughage-based diet has increased the ability of calves to digest pasture following weaning.

CONCLUSIONS

This study demonstrates that ensiled roughages can be used successfully in calf rearing systems based on restricted levels of milk. Calves fed diet R consumed 35% more DM over the period of the trial, but liveweight gains (corrected for gutfill) were comparable to those fed diet P. The use of roughages for calf rearing will therefore depend primarily on their cost being competitive with other available feeds. There was no evidence that introducing roughages early in the pre-weaning period has any carry-over effect on rumen development thereby enhancing post-weaning performance.

ACKNOWLEDGEMENTS

The staff of Massey No. 1 Dairy Farm for provision of the calves; Mr W.B. Parlane for technical assistance; Professor R.J. Townsley for statistical advice; The Great Hage Company for financial support.

REFERENCES

Bryant, A.M.; Trigg, T.E. 1982. The nutrition of the grazing dairy cow in early lactation. In: Dairy Production from Pasture (Eds. K.L. Macmillan and V.K. Taufa). *New Zealand Society of Animal Production,* Hamilton, New Zealand, pp 185-207.

Davey, A.W.F. 1974. Nutrition of the pre-ruminant calf. *Proceedings of the New Zealand Society of Animal Production* **34:** 133-144.

Hughes, J.G. 1976. Short-term variation in animal live weight and reduction of its effect on weighing. *Animal Breeding Abstracts* **44:** 111-118.

Mould, F.L.; Orskov, E.R.; Mann, S.D. 1983. Associative effects of mixed feeds. I. Effects of type and level of supplementation and the influence of the rumen fluid pH on cellulolysis in vivo and dry matter digestion of various roughages. *Animal Feed Science and Technology* **10:** 15-30.

Roy, J.H.B. 1980. The Calf. 4th Edition. Butterworths, London.