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BRIEF COMMUNICATION: Rearing calves on crushed barley

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Abstract

Bull calf rearing systems typically have tight financial margins, with calf starter meal being a significant cost under a restricted milk-feeding regime. Two experiments were carried out to examine the effect of substituting calf starter meal with crushed barley. In the first experiment, there was no difference in growth rate during the first five weeks of milk feeding but during the seven days of transitioning from milk to grass, the growth rate of the barley-fed calves was lower (0.24 kg/d vs 0.88 kg/d; P<0.001). This period of lower growth was a major contributor to the 7 kg live weight difference at 12.5 weeks. In Experiment 2, the calves on crushed barley consistently grew slower than those on calf starter (0.67 kg/d vs 0.83 kg/d; P<0.001) resulting in a 16 kg live weight difference at 12 weeks of age. While feeding crushed barley was cheaper, the poorer and more variable calf performance indicates there is a lower likelihood of meeting individual live weights targets resulting in having to sell calves on a declining summer market.

Keywords: barley; calf pellets; rearing calves

Introduction

Rearing surplus male calves from the dairy industry is typically a specialist operation undertaken by small-block holders who rear calves from four days-of-age in early spring (August) for sale in late spring/early summer (December). Target live weights in early December are typically 100kg. Calves which take longer to reach 100 kg are frequently discounted by purchasers who want calves before the onset of summer dry conditions. Calf rearing is a business of small margins with ongoing pressure to reduce rearing costs. Calf rearers feed an average of 64 kg of compound pelleted feeds (calf starter) per calf (Thomson et al. 2018), with some rearers seeking lower cost alternatives. Current whole barley prices are $500-$560/Tonne to the grower whilst cost of bagged 16% protein calf pellets is $1600/Tonne (PGG Wrightson website September 2025) so there is considerable incentive for rearers to use a lower cost feed such as crushed barley. Whilst a number of rearers have used home-made crushed barley rations, there is little or no data comparing the growth rate of these calves to those reared on pellets.

In New Zealand, crushed barley is often used as a soluble carbohydrate and energy source in calf starter meals but it is typically low in crude protein. However, since both milk and spring pasture have high protein contents, it is possible that crushed barley on its own could provide an adequate source of the butyric and propionic acids that are the primary stimulators of ruminal tissue growth (Davis and Drackley 1998; Govil et al. 2017).This manuscript will present two experiments that were undertaken to test the suitability of crushed barley as a replacement for calf starter when fed as part of a low-milk system.

Materials and methods

Permission for these trials was granted by the AgResearch Grasslands Ethics Committee (No 10534). Two experiments were conducted on a commercial calf-rearing unit in 2003 and 2004 with spring (August) born Holstein-Friesian bull calves purchased at four days-of-age in the Waikato region and transported to Hawkes Bay. In both experiments, calves were weighed and fed electrolytes on arrival, then allocated to pens of 10 which were balanced for live weight. Calves that did not feed properly or had other issues such as navel infection were not allocated to a treatment group. Calves were kept in partially covered pens with sawdust bedding and remained in these treatment pens until weaning. Post weaning, calves within each treatment group were mobbed together and let outside onto pasture.

Calves were fed calf milk replacer (CMR) supplied by Ngahiwi Farms (Auckland, New Zealand) at a rate of 1.5 litres of milk (170 g CMR/litre) twice daily for seven days. The CMR concentration was slowly increased and by day 10 calves were being fed two litres once daily (250 g CMR/litre). Calf starter and crushed barley were offered *ad libitum* and residuals determined weekly.

Individual records were kept for all animal health treatments. Calves were de-budded at 10 weeks of age. A B12 injection (Prolaject, Bayer Animal Health, Auckland, New Zealand) was administered at three weeks and 12 weeks of age. Calves were drenched with Genesis (Ancare, NZ) and injected with 1ml of copper (Troy Coppernate; Airr, Shepparton, Australia) at 10 weeks of age. Calves were treated for clostridial diseases with 2 ml of 5-in-1 vaccine (Ultravac 5-in-1, Zoetis, Auckland, New Zealand) at 8 and 12 weeks of age.

Experiment 1 Two hundred calves arrived in two batches, two days apart and were weighed on arrival and allocated to pens with 10 calves per pen on a live weight basis. They were fed electrolytes and the following morning any calf that had not fed well was removed and pens re-balanced for live weight-180 calves were used for the experiment with an average weight of 44.4 kg. Calves were weighed at 4, 5, 6, 8, 10 and 12 weeks after start of treatments. On arrival, calves were allocated to 18 pens of 10 calves so that each pen had similar average live weights. Nine pens were randomly allocated to each of two treatments. Treatment 1

(90 calves) was fed crushed barley with 50 ml/kg molasses added to improve palatability in a similar manner to Davis and Drackley (1998) and from day 26, 0.26% sodium bicarbonate in powdered form was added as a buffering agent against rumen acidosis. Post-weaning, 3g/100 kg of Rumensin 90 was added as a coccidiostat. A coccidiostat was not considered necessary pre-weaning as the calf milk replacer contained an ionophore coccidiostat. Treatment 2 (90 calves) were fed 20% protein calf starter pellets (Topcalf, Inghams, New Plymouth, New Zealand) before weaning and 16% protein calf starter pellets (Topcalf, Inghams) after weaning. Five and six weeks after arrival (5.5 - 6.5 weeks old), calves whose arrival weight had increased by at least 20 kg were weaned off milk. Calves were kept indoors for seven days after weaning and fed their respective concentrate diets *ad libitum* before having access to pasture. All calves that had not reached this weaning weight (i.e. had not put on 20 kg weight gain from arrival) were fed milk for an additional five days. They then spent two days inside being fed their treatment ration *ad libitum* before joining the calves weaned earlier. At this point replication ceased although the two treatment groups had access to different parts of the same paddock containing perennial ryegrass/white clover pasture with covers of approximately 2000 kg DM/ha. Calves were fed their diets ad lib in the paddock for a further week. From the end of week seven the calf starter pellets and the crushed barley diets were fed at 1kg/head/day for a further two weeks (i.e. until calves were 9.5 weeks of age). At nine and a half weeks of age, both treatment diets were reduced to 0.5 kg/head/day. At 11.5 weeks of age, starter treatments ceased and all calves were run together.

Experiment 2. In August 2004, one hundred spring born calves arrived in two batches, three days apart and were weighed on arrival. Calves were weighed at 4, 5.5, 7.5, 9.5, 11.and 13 weeks after start of treatment. On arrival, calves were allocated to 10 pens of 10 calves so that each pen had similar average live weights. Treatment 1 comprised fifty calves (five pens) which were fed crushed barley with molasses added at 50 ml/kg feed for the first three weeks, reduced to 25 ml/kg thereafter. On day 27, 0.26% sodium bicarbonate was added to the crushed barley diet. Treatment 2 comprised fifty calves (five pens) fed calf starter pellets (20% protein before weaning and 16% protein after weaning) (Topcalf, Inghams). Five and a half weeks after arrival, calves whose arrival weight had increased by at least 20 kg were weaned off milk. Calves were kept indoors for seven days after weaning and fed their respective diets *ad libitum* before having access to pasture. Calves not at weaning weight were fed milk for an additional five days. They then spent two days inside being fed *ad libitum* on their respective diets before joining the calves weaned earlier. Both groups of calves had access to fresh ryegrass/white clover pasture of approximately 2000 kg DM/ha and at this stage, calf starter and crushed barley diets were fed at 1.5 kg/head/day for a further two weeks (i.e., until calves were eight and a half weeks of age). At eight and a half weeks of age, both treatment diets were reduced to 1 kg/head/day. At 13.5 weeks of age the experiment ceased and all calves were run together

The live weight analysis was carried out using a generalised linear model (GLM) analysis with pen as the experimental unit and initial live weight as a covariate for the liveweight analysis in Minitab for Windows (Version 14.1).

Results and discussion

In Experiment 1, calves averaged 44.5 ± 0.3 kg on arrival. There was no difference in the growth rate between the two groups of calves over the first five weeks of feeding and similar numbers of calves were weaned at the same time (71/90 for the crushed barley group and 74/90 for the calf starter group). Average calf live weights at 5 weeks were 61.6 and 61.7 kg for the barley and starter group, respectively. During the transition period (after milk feeding but while the calves remained inside) the growth rate of the barley feed calves was depressed (Table 1) although once these calves had access to spring pasture, growth rates improved. This difference in weight gain over the transition period resulted in the barley-fed calves being 7 kg lighter (108 ± 0.7 kg) than the calf starter calves (115 ± 0.7 kg) at 12.5 weeks of age ($P<0.001$). With the exception of week 5, calves tended to consume more crushed barley than pellets (Fig 1). Overall, calves on crushed barley consumed 68 kg/head and those on calf starter consumed 66 kg/head.

In Experiment 2, calves averaged 46.5 ± 0.84 kg on arrival. Calves fed crushed barley grew consistently slower (0.67 kg/d) than did those fed the calf starter ration (0.83 kg/d; $P<0.001$). Calf live weights at 13.5 weeks were 140.6 and 126.5 kg for the calves fed the calf starter ration and crushed barley, respectively. Feed consumption tended to be lower in the crushed barley group (76.9 vs 82.8 for crushed barley and starter pellets respectively). Overall, feed consumption for the crushed barley and calf-starter groups was 78 kg and 82 kg per head, respectively.

Overall, the calves fed crushed barley did not grow as well as those fed the calf starter post-weaning. We suspect the reduced growth rates on the crushed barley could be due to the lower protein content of the crushed barley. De Ruiter et al. (1998) found that across four locations and nine varieties, crude protein contents ranged from 8.6% to 12.1%. Calf pellet composition was not measured in this experiment but previous batches of the same product had average crude protein contents of 15.5% and 16.4% (Muir unpublished data). During the milk-feeding period, we would have expected that the lower protein content of the crushed barley would be compensated by milk protein and after weaning by the high level of protein in spring pasture. The size of this difference between the two trials varied and it may be that, even with the added molasses, some batches of barley may still be less palatable. Palatability is critical to get good calf feed intakes in very young calves (Davis & Drackley 1998; Moran 2002) and any reduction in palatability impacts growth rate and increases the level of uncertainty and risk for the calf rearer.

Table 1 Live weight (kg) and growth rate (kg/d) for Friesian bull calves fed crushed barley or calf starter from four days-of-age in Experiment 1

Age (wks)	Barley	Pellets	SEM	P
Live weight (kg)				
Start	44.5	44.4	0.30	0.2
4	52.6	52.1	0.30	0.2
5	61.6	61.7	0.33	0.8
6	68.1	73.5	0.37	0.001
8	78.3	83.9	0.50	0.001
10	88.8	96.9	0.61	0.001
11.5	99.4	107.3	0.67	0.001
12.5	107.6	114.5	0.73	0.001
Growth rate (kg/d)				
To wean (0-5 wks)	0.61	0.63	0.018	0.13
Transition (5-6 wks)	0.24	0.88	0.033	0.001
Outside (6-12.5 wks)	0.86	0.89	0.013	0.07
Overall (0-12.5 wks)	0.71	0.79	0.010	0.001

Initial liveweight fitted as covariate for liveweights

Table 2. Live weights (kg) and weight gains (kg/d) for Friesian bull calves fed crushed barley or calf starter pellets from milk to pasture in Experiment 2.

Age (weeks)	Barley	Pellets	SEM	P
0	46.7	46.3	0.84	0.9
4*	59.7	61.1	0.70	0.07
5.5*	68.4	71.7	0.77	0.001
7*	72.1	78.9	0.92	0.001
9*	83.1	94.5	1.27	0.001
10.5*	89.0	104.0	1.50	0.001
13.5*	110.6	126.5	1.94	0.001
Growth rate to weaning	0.59	0.68	0.015	0.001
Growth rate after weaning	0.72	0.93	0.020	0.001
Overall growth rate	0.67	0.83	0.015	0.001

* initial weight fitted as a covariate

On the farm where these experiments were run, a transition period is used when calves are held indoors off milk and kept on calf starter, to allow calves to increase meal intakes. This is done to ensure that calves with poor calf starter intakes get a chance to increase their intakes before being placed on pasture. However, this means that during the transition period the crushed barley was not balanced with a high-protein feed (pasture or milk) and there was a substantial reduction in growth rate of the calves fed crushed barley. This was a major contributor to the 7 kg difference in weight at 12.5 weeks in Experiment 1. It is possible that access to pasture during the transition period would have significantly reduced the weight difference between the treatment groups

However, in Experiment 2 the growth rate of the crushed barley fed calves was consistently lower than the calves on the starter diet. The barley used may have had a low crude protein content or a less desirable amino acid profile. Even with molasses supplementation, the barley used in Experiment 2 appeared to be less palatable. Palatability is critical to get good calf feed intakes in very young calves (Davis and Drackley 1998; Moran 2002) and any reduction in palatability impacts growth rate and increases the level of uncertainty and risk for the calf rearer.

Whilst calves can be reared on crushed barley, there is a significant risk of not meeting liveweight targets when bull calves are being reared on contract or for sale. Savings that might be made on calf starter are likely to be out-weighed by the declining sale price of calves in late spring. Alternatively, it would seem there is considerable potential for rearers to refine their feeding systems and reduce cost by feeding barley in conjunction with a high protein supplement such as peas or soymeal.

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References

Davis CL, Drackley JK 1998. The Development, Nutrition and Management of the young calf. Pub Iowa State University Press.

Govil K, Yadav DS, Patil AK, Nayak S, Baghel RPS, Yadav PK, Malapure CD, Thakur D 2017. Feeding Management for Early Rumen Development in Calves. Journal of Entomology and Zoology Studies 5; 1132-1139.

De Ruiter JM, James KAC, Johnstone JV, Rea MB (1998). The effects of nitrogen management and cultivar on the yield, total protein and amino acid composition of feed barley. Proceedings Agronomy Society 28: 235-45.

Moran J 2002. Calf rearing: A practical guide. 2nd edition. Landlinks Press, Australia.

Thomson BC, Muir PD, Ward KR 2018. Calf-rearing systems on dairy farms and specialist calf rearing units. New Zealand Journal of Animal Science and Production 78: 173-176