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Animal Science Research Centre - Beef Unit Trial Results – 2018 (b)

Effect of feeding meadow hay or winter barley straw on the performance of artificially reared dairy-bred beef calves to 12 weeks

Introduction:

Studies at Pennsylvania State University have demonstrated that feeding concentrates to young milk fed calves stimulates papillae development compared to calves fed just milk and hay. Feeding concentrates results in the highest rumen concentrations of butyric acid, the metabolism of which in the rumen wall produces beta hydroxy butyrate which has a high correlation with animal performance at this stage. Calves are also typically offered some long fibre, for rumen muscle tone and to encourage cudging. They also require some dietary fibre to minimise problems with bloat and reduce issue with acidosis, especially with diets formulated with elevated levels of starch.

In a survey of commercial farms in Northern Ireland (Morrison *et al.*, 2009) it was found that straw and hay were offered by 59% and 33% of farms respectively. There are however some anecdotal comments that feeding hay results in 'pot-bellied' calves.

The objective of this experiment was to investigate the effect of feeding either good quality meadow hay or winter barley straw to artificially reared beef calves on their performance and health to 12 weeks.

Materials & Method:

The study involved 44 January 2018 born British Blue x Holstein bull calves bought from local high herd health status dairy farms at a mean age of 22.6 days. This would therefore be similar to purchasing calves from markets. The calves were randomized according to age and weight to the following treatments and housed in individual pens and bedded on shavings:

Hay Calves offered good quality meadow hay (10.3 ME MJ/kg DM, 10.3% CP in DM) from racks. Calves fed MILKY WAY, a 100% milk protein calf milk (skim, whey, buttermilk) replacer [24% Oil, 20% CP] Bonanza Calf Nutrition) mixed at 40-45°C and fed at 39°C at 125g per 875ml of water and fed at 2.0 litres twice per day (4.0 litres per day) to provide 500g CMR. Milk feed rates were gradually reduced to weaning at day 42 as shown below.

Days	Litres of milk per day	CMR	g CMR/l milk	No feeds/day	CMR consumed /day	CMR consumed (kg)
1-35	4.0	MILKY WAY	125	2	0.5	17.5
36-39	2.4	MILKY WAY	125	1	0.3	1.20
40-42	1.2	MILKY WAY	125	1	0.15	0.45
Total						19.15

'Normal' ME values for hay would range from 9.3-10.6 MJ/kg DM.

Straw Calves fed CMR 'as per' the hay fed calves and offered good winter quality barley straw (6.4 ME MJ/kg DM, 49.5% crude fibre, 4.4% CP) from racks.

The calves were fed at 7.30am and 3.30pm. The milk was fed via a teat from a Wydale feeder offered at head height. The calves were offered *ad lib* 18%CP early weaning concentrates (Primecalf Sprinter, Carrs Billington Agriculture) and fresh water. The calves were moved into group pens at weaning until 12 weeks and fed their respective forages.

Results:

Table 1 shows that offering hay had a significant ($p>0.05$) effect on daily liveweight gain (DLWG) from start to 1 week and start to weaning. There were no significant differences in DLWG from weaning to 12 weeks.

Table 1: Effect of hay versus straw on DLWG (kg)

Treatment	Hay	Straw	s.e.d	P value	Sig
Start - 1 week	0.59	0.39	0.055	0.017	*
Start - 3 weeks	0.65	0.55	0.056	0.060	Trend
Start - weaning	0.70	0.60	0.044	0.014	*
Wean - 12 weeks	1.36	1.33	0.095	0.649	NS
Start -12 weeks	1.03	0.97	0.050	0.112	NS

NS = Not Significant, * = $P<0.05$, ** = $P<0.01$, *** = $P<0.001$

Calf live weights are detailed in table 2 which show that the hay fed calves gained an extra 5kg to 12 weeks.

Table 2: Live weight (kg)

Treatment	Hay	Straw	s.e.d	P value	Sig
Start	58.7	60.6	0.66	0.630	NS
1 week	62.8	63.3	0.74	0.689	NS
3 weeks	72.4	72.0	0.99	0.796	NS
Weaning	88.0	85.7	1.19	0.218	NS
12 weeks	144.9	141.8	2.37	0.363	NS
Increase in livewt	86.2	81.2			+5kg

Table 3: Frame scores at 12 weeks (cm)

Treatment	Hay	Straw	s.e.d	P value	Sig
Heart girth (cm)	118.7	117.7	1.03	0.503	NS
Wither height (cm)	95.3	96.1	0.84	0.487	NS
Hip height (cm)	102.8	103.4	0.97	0.667	NS
Hip width (cm)	20.4	21.1	0.30	0.101	NS
Mid rib girth @ wean (cm)	113.6	111.9	2.10	0.565	NS
Mid rib girth (cm)	133.3	132.9	1.08	0.812	NS
Last rib girth (cm)	144.1	141.1	1.16	0.079	Trend

Frame scores were not significantly different. There was however a trend for increased last rib girth measurement at 12 weeks for the hay fed calves.

Table 4: Feed intakes (kg) and Feed Conversion Ratio (FCR) to 12 weeks

Table 4 shows that offering hay had a significant ($p>0.05$) effect on daily and total forage intake to weaning. This did not result in a reduction in concentrate intake with the hay fed calves.

Treatment	Hay	Straw	s.e.d	P value	Sig
Milk replacer	19.2	19.2			
Concs/day - start to wean	0.96	0.91	0.059	0.569	NS
Concs - start to wean	40.4	38.4	2.49	0.569	NS
Concs - wean to 12 weeks	161.5	160.8			
Concs - total	201.9	199.2			
Forage/day - start to wean	0.24	0.17	0.017	0.020	*
Forage - start to wean	9.9	7.4	0.718	0.020	*
Forage - wean to 12 weeks	19.5	16.4			
Forage - total	29.4	23.8			
FCR - start to weaning	2.37	2.59	0.061	0.279	NS
FCR - start to 12 weeks	2.91	2.98			

Table 5: Financial performance – feed costs per calf and per kg gain to 12 weeks (£)

	Hay	Straw
CMR @ £1,780/t	34.09	34.09
Concs @ £291/t	58.75	57.96
Hay @ £90/t	2.66	
Straw @ £75/t		1.79
Feed costs/calf (£)	95.50	93.84
Feed cost per kg gain (£)	1.11	1.16

Feed costs per calf were slightly higher with hay however feed costs per kg gain were lower due to the improved performance of the hay fed calves.

Calf health:

A study into the effect of feeding hay and straw on the health of the calves to 12 weeks was also carried out. Calf dehydration, cough, nasal discharge, eye discharge, ear, and faecal scores measurements were taken over the 12 week period and analysed. Hay fed calves had significantly higher ($p>0.05$) cough scores, although, significantly lower ($p<0.05$) i.e. better, faecal scores than straw fed calves.

Discussion & Conclusions:

- Overall performance of the calves was very good meeting the recognised targets for rearing calves to 12 weeks. This excellent performance is likely to be partially due to the standard of stockmanship and feeding a high quality milk replacer. There was zero calf mortality in the study.
- There was a significant increase in DLWG with calves fed hay from start to week 1 and start to weaning.
- Forage intakes were significantly higher with hay and with slightly higher concentrate intakes this resulted in an additional 70MJ of energy intake from start to weaning resulting in the improvement in DLWG.
- There were no differences in DLWG from weaning to 12 weeks and the straw fed calves did not exhibit compensatory growth i.e. 'catch up'.
- There were no significant differences in frame scores and the hay fed calves did not develop 'pot bellies'. There was an increase in last rib girth measurement for the hay fed calves indicating an improvement in rumen development.
- The reason for the hay fed calves recording a higher cough score is difficult to explain and did not appear to have a detrimental effect on performance. The lower (better) scour score is indicative of good feed digestion and utilisation.

- The total feed costs per calf were slightly higher with hay however feed costs per kg gain were lower due to the improved performance of the hay fed calves.

Acknowledgement:

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Reference:

Morrison, S.J., Carson, A.F., Matthews, D. and Mulholland, M. 2009, March. An investigation of calf rearing practices on dairy farms in Northern Ireland. *Proceedings of the British Society of Animal Science Conference, Annual Meeting*, 30.

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