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Advances in Animal Science 4: 440.

Growth, efficiency and carcass attributes of feedlot cattle supplemented with calcium nitrate or urea

Summary:

Introduction Dietary nitrate (NO3) can serve as a source of non-protein nitrogen for the rumen microbiota, as well as reducing emission of enteric methane from ruminants (Zijderveld et al., 2010). NO3-supplemented animals have a higher acetate proportion in the rumen volatile fatty acids and an increased microbial protein outflow compared with similar animals offered a diet with iso-nitrogenous urea (Li et al., 2012). There is also recent evidence that NO3-supplemented cattle exhibit higher feed conversion efficiency (FCE, kg gain/kg feed) than do urea-supplemented cattle. The following study was undertaken to quantify the growth, intake, FCE and carcass attributes of feedlot cattle supplemented with NO3 or urea.

Material and methods A 2 x 2 factorial study of the effects of level (N-Level) and source (N-Source) of nitrogen supplement in feedlot finished cattle was conducted. Composite breed steers (Brahman-based, n=384; initial LW = 414 kg) were introduced to the feedlot and adapted to one of 4 diets; i.e. low urea (LU: 0.50% urea in DM); low nitrate (LN: 0.95% NO3 as calcium nitrate in DM); high urea (1.00% urea in DM); or high nitrate (1.90% NO3 in DM). LU and LN were iso-nitrogenous (11.9%CP in DM) as were HU and HN (13.6% CP in DM) measured in the mixed rations. The diet was based on cracked barley (70.3%) and maize silage (8.5%) with an NIR derived ME content of 13.1MJ/kg DM. Urea and nitrate supplements were included as liquid supplements mixed into the dry ration prior to feeding. All cattle were introduced to their diets over 20d, with 96 head allocated using stratified randomisation to each of the 4 dietary treatments, using 18 bunk pens and 14 auto-feeder pens (Bindon 2001) with12 head/pen. Animals which did not adapt to the auto-feeder were transferred to a bunk-fed pen of that treatment. Cattle were offered a finisher diet for 102d, and then transported to a commercial abattoir for slaughter. A statistical model allowing for pen, feeder-type, age (assessed by dentition at slaughter) and genotype (visual assessment of composites) was used to test for effects of N-level, N-Source and their interaction.

Results Compared with the low N inclusion, high supplementary N was associated with significantly reduced feed intake, reduced ADG, reduced LW from day 38 onwards, and reduced carcass weight (Table 1). FCE was not affected by N-level or N-Source. NO3-supplemented cattle ate less and grew slower for a lighter final LW and carcass weight than did urea supplemented cattle. Main effects of N-level and N-source were consistent across the experiment, with no N-Source x N-Level interactions.

Table 1 Least square means for average daily gain (ADG), final liveweight (LW), average dry matter intake (DMI), feed conversion efficiency (FCE) and carcass weight of feedlot finisher cattle given supplementary nitrogen as urea or calcium nitrate (N-Source) at a low or high level (N-Level).

	N Source			N Level			N Source × N Level
Item	Urea	Nitrate	P value	Low	High	P value	P value
ADG (kg/d)	1.71	1.59	0.003	1.71	1.59	0.002	0.64
Final LW (kg)	596.8	585.4	0.005	596.4	585.8	0.013	0.68
DMI (kg/d)	11.02	10.32	<0.001	10.95	10.38	<0.001	0.09
FCE (kg LWG/kg DMI	0 .154	0.154	0.95	0.154	0.153	0.74	0.17
Carcass wt (kg)	334.8	326.1	<0.001	334.9	326.0	<0.001	0.28

Conclusions Both the higher level of supplementary N and provision of N as nitrate in place of urea led to significant reductions in feed intake, growth and carcass weight of feedlot steers. Since neither source nor level of supplementary N affected FCE, growth responses to both variables can largely be ascribed to the lower ME or nutrient intake. From the absence of a N-Level x N-Source interaction for intake or growth traits, it can be concluded that the negative effects of high N and inclusion of NO3 in place of urea in the diet are additive.

Acknowledgements This project is funded by Cargill Animal Nutrition and the Australian Government Department of Agriculture, Fisheries and Forestry Carbon Farming Futures - Action on the Ground programme.

References

Bindon, B.M. 2001. Australian Journal of Experimental Agriculture 41, 843-853.
Zijderveld, S.M.van, Gerrits, W.J.J., Apajalahti, J.A., Newbold, J.R., Dijkstra, J., Leng, R.A. and Perdok, H.B. 2010. Journal of Dairy Science 93, 5856-5866.
Li. L., Davis, J., Nolan, J.V. and Hegarty, R.S. 2012. Animal Production Science 52, 653-658.