

Maternal efficiency in beef cattle is not compromised by selection for leanness or feed efficiency.

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Introduction

Beef cattle producers are concerned that selecting for carcass traits such as leanness, or for increased feed efficiency, might be deleterious to maternal efficiency and limit the use of genetic improvement technologies such as Estimated Breeding Values (EBVs). We define maternal efficiency by production parameters such as days to calving, birth weight, growth rate, weaning weight, as well as efficiency measures such as total intake and kg weaned per megajoule of metabolisable energy consumed per cow calf unit – *kg weaned/MJ ME intake*. Selecting for leanness in cattle is of economic benefit due to the relationship to higher yielding carcasses (Nkrumah *et al.*, 2004). Net Feed Intake (NFI) is a trait used to measure feed efficiency in beef cattle, and is calculated as the actual amount of feed eaten by an individual animal less the expected amount of feed consumed based on the animal's growth rate and body weight (Koch *et al.*, 1963). Low NFI (high efficiency) is economically desirable due to the potential to reduce feed costs and increase stocking rates. Both traits affect the body condition of dams and this is closely linked to maternal traits in cattle (Morrison *et al.*, 1999; Roche *et al.*, 2000; Meikle *et al.*, 2004). This experiment aims to quantify the impact on the breeder herd of selection for leanness or feed efficiency over three breeding cycles. The impact of level of nutrition was also assessed.

Materials and Methods

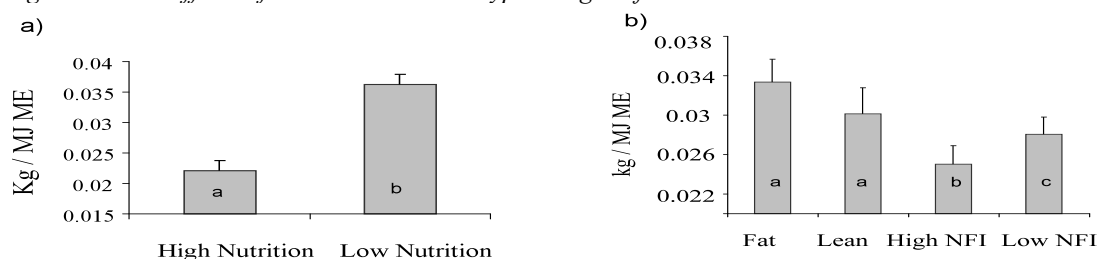
Two hundred BREEDPLAN registered, stud Angus heifers, selected for a divergence in either fatness (Fat or Lean) or feed efficiency (High NFI/ Low NFI), were subjected to either a high or low plane of nutrition, on an extensive grazing system at Vasse Research Centre, Busselton, Western Australia. The experiment followed three breeding cycles. The hypothesis tested was that animals selected for leanness, or superior feed efficiency, would maintain maternal efficiency in good, but not in poor nutritional environments, and the economic benefits of selecting for these animals would be lost when energy intake was restricted. Nutritional treatments were controlled by set stocking and providing the low nutrition treatments with restricted food on offer. Low nutrition animals were fed to 90% maintenance requirements and high nutrition animals were fed to 120% maintenance requirements. Body weight and condition score was monitored fortnightly and a minimum 20% difference between nutritional treatments was maintained throughout the experiment. Estimated pasture intake was calculated by visually assessing food on offer (FOO) before and after animals grazed an area. Weekly calibration cuts were done to verify the visual assessments. Pasture cuts were done fortnightly for assessment of pasture quality. Linear mixed REML models were fitted to the data using Genstat 11 (2008, VSN International, Hertfordshire, UK) to look for the main effects of nutrition and genotype and any interactions between the two. Appropriate covariates and random effects were fitted to each analysis.

Results

The experiment is now in its third year (second calving). In '07 and '08 neither level of nutrition, nor the genotype of the animal, had an effect on days to calving (time from mating start date to calf birth date) or the birth weight of calves. In both years the calves of dams on low nutrition grew significantly more slowly than the calves of dams on high nutrition ($P < 0.05$). The genotype of the cow had no effect on the growth rate of the calf. In '07 and '08 the calves of dams on low nutrition weighed less at weaning than those calves from dams on high nutrition ($p < 0.05$). The genotype of the cow had no effect on calf weaning weight. Measures of group intake showed that Fat and Low

NFI (superior efficiency) animals ate less pasture than Lean or High NFI (feed inefficient) in 2007 ($P < 0.001$). In 2007 across all genotypes, animals on low nutrition weaned significantly heavier calves per MJ ME intake than animals on high nutrition ($P = 0.03$). Low NFI animals weaned heavier calves per MJ ME intake than High NFI animals ($P = 0.03$). Main effect means are illustrated in Figure 1a and b. These results are not yet available for the 2008 season.

Figure 1. Main effects of Nutrition and Genotype on kg beef weaned/ MJ ME intake 2007



1a) Main effect of Nutrition (n=60) on kg weaned / MJ ME intake; 1b) Main effect of Genotype (n=30) on kg weaned / MJ ME intake. Means with different letters differ significantly ($P < 0.05$).

Discussion and Conclusions

Animals selected for leanness, despite their greater total intake, weaned as much calf per MJ ME consumed as Fat animals. Low NFI animals not only had a lower total feed intake, but weaned heavier calves per MJ ME intake, than High NFI animals. Where level of nutrition has an effect, such as on growth rate and weaning of calves, and in kg weaned / MJ ME intake, the effect is across all genotypes. Animals selected for a divergence in leanness weaned heavier calves per MJ ME intake than animals divergently selected for NFI ($P < 0.05$). This is a consequence of five generations of focussed selection for a divergence in feed efficiency in the NFI lines without any focus on improving growth rates or body composition. These early results suggest that the economic benefits of selection for leanness or feed efficiency persist in a restricted energy environment, without compromising maternal efficiency, thus far disproving our hypothesis. Note must be made that this result is from the first parity in an experiment that will include three parities.

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References

- Koch, R. M., Swiger, L. A., Chambers, D., and Gregory, K. E. 1963. Efficiency of Feed Use in Beef Cattle. *Journal of Animal Science* 22: 486-494.
- Meikle, A., Kulcsar, M., Chilliard, Y., Febel, H., Delavaud, C., Cavestany, D., and Chilibroste, P. 2004. Effects of parity and body condition at parturition on endocrine and reproductive parameters of the cow. *Reproduction* 127: 727-737.
- Morrison, D. G., Spitzer, J. C., and Perkins, J. L. 1999. Influence of prepartum body condition score change on reproduction in multiparous beef cows calving in moderate body condition. *J. Anim Sci.* 77: 1048-1054.
- Nkrumah, J. D., Basarab, J. A., Price, M. A., Okine, E. K., Ammoura, A., Guercio, S., Hansen, C., Li, C., Benkel, B., Murdoch, B., and Moore, S. S. 2004. Different measures of energetic efficiency and their phenotypic relationships with growth, feed intake, and ultrasound and carcass merit in hybrid cattle. *J. Anim Sci.* 82: 2451-2459.
- Roche, J. F., Mackey, D., and Diskin, M. D. 2000. Reproductive management of postpartum cows. *Animal Reproduction Science* 60-61: 703-712.