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Effects of molasses-based creep-feeding supplementation on growth performance of pre- and post-weaned beef calves

P. Moriel, J.D. Arthington *

IFAS, Range Cattle and Education Center, University of Florida, Ona, FL 33865, USA

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ABSTRACT

Two 2-year experiments were conducted to evaluate the effects of molasses-based creep-feeding supplements fortified with DL-methionine hydroxyl analog (MHA; Exp 1), or different supplemental nitrogen sources (Exp. 2), on growth performance of pre- and post-weaned beef calves. In both experiments, cows and calves were stratified by calving date and randomly assigned to pastures (n=8 and 12 pastures for Exp. 1 and 2, respectively). Treatments were randomly assigned to pastures. In Exp. 1, treatments consisted of no creep-feeding supplementation (**NoCreep**), creep-feeding supplementation of sugarcane molasses plus 4% of a 50:50 urea+hot water blend (as-fed; **Mol+U**) or Mol+U plus 0.22% of MHA (as-fed; **Mol+MHA**). In Exp. 2, treatments consisted of NoCreep, creep-feeding supplementation of sugarcane molasses added with 4% of 50:50 urea+hot water blend (50:50, as-fed; **Mol+U**) or 20% cottonseed meal (as-fed; **Mol+CSM**). Calves were supplemented in cow exclusion areas for 122, 117, 104 and 102 days prior to weaning in years 1 and 2 of Exp. 1 and 2, respectively. In year 2 (Exp. 2), 18 heifers (2 heifers/pen; 3 pens/treatment) were randomly selected for a 17-day post-weaning evaluation and were provided free-choice access to a grain-based concentrate. In Exp. 1, Mol+U calves had similar (P=1.00) voluntary creep-feed supplement intake in year 1, but greater ($P<0.01$) voluntary creep-feed supplement intake in year 2, compared with Mol+MHA calves. In Exp. 2, voluntary creep-feed supplement intake was not affected (P=0.39) by treatment. In Exp. 1, but not in Exp. 2, creep-feeding supplementation increased ($P \leq 0.01$) calf BW at weaning and pre-weaning ADG compared with NoCreep calves. Calves supplemented with MHA had lesser (P=0.03) pre-weaning ADG than Mol+U calves. In Exp. 2, nitrogen source added to creep-feed supplement did not affect (P=0.15) calf pre-weaning ADG. Additionally, pre-weaning creep-feeding supplementation of heifers did not affect ($P \geq 0.25$) post-weaning growth performance or plasma concentrations of haptoglobin and fibrinogen during the receiving period. At weaning, heifers fed Mol+U had greater (P=0.03) plasma concentrations of ceruloplasmin (Cp) than Mol+CSM heifers (23.8 versus 18.7 ± 1.62 mg/dL, respectively), with NoCreep heifers being intermediate. On day 9, relative to weaning, Mol+U heifers had greater (P=0.03) plasma Cp concentrations than NoCreep heifers (31.6 versus 26.6 ± 1.62 mg/dL, respectively), with Mol+CSM heifers being intermediate. In conclusion, molasses-based creep-feed supplements increased pre-weaning growth performance of calves in Exp. 1, but not in Exp. 2, and did not affect post-weaning growth performance of heifers.

* Corresponding author. Tel.: +1 863 735 1314x202; fax: +1 863 735 1930.
E-mail address: jarth@ufl.edu (J.D. Arthington).

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1. Introduction

Meeting nutrient requirements is a challenge of forage-fed cattle production systems (Hersom et al., 2009). Creep-feeding is a management tool used to provide supplemental nutrients to pre-weaned calves that may not be fully obtained from milk and forage. However, unlimited creep-feeding is often associated with poor efficiency of BW gain (Faulkner et al., 1994; Stricker et al., 1979), which may be avoided if creep-feed supplements are limit-fed (Cremin et al., 1991). Grain-based creep-feed supplements limit-fed at 0.16 kg/calf daily increased calf pre-weaning ADG and BW at weaning compared with calves receiving no pre-weaning supplementation (Moriel and Arthington, in press).

Methionine is a sulfur-containing amino acid and is thought to be the first-limiting amino acid for growing beef cattle (Storm and Ørskov, 1984). In one study, ADG gain of beef calves was increased when 6 g of rumen undegradable, DL-methionine hydroxyl analog (MHA) was added to a sugarcane molasses-based supplement (Hersom et al., 2009). Sugarcane molasses supplements are widely used as an energy source for grazing beef cattle and can be combined successfully with multiple ingredients to alter its nutritional profile and palatability characteristics (Pate, 1983; Pate and Kunkle, 1989). Therefore, these supplements may offer unique advantages over dry concentrate supplements as creep feeds for pre-weaned calves. Thus, we hypothesized that sugarcane molasses-based creep feeds would serve as an effective self-limiting supplement for pre-weaned beef calves. Further, the fortification of these supplements with MHA or true protein (i.e. cottonseed meal) would improve growth performance of pre-weaned beef calves compared to supplements fortified with urea. Our objectives, therefore, were to evaluate the growth performance of pre-weaned beef calves provided molasses-based creep-feed supplements with or without MHA (Exp. 1), or differing sources of supplemental nitrogen (Exp. 2).

2. Materials and methods

Two experiments were conducted at the University of Florida, Institute of Food and Agricultural Sciences, Range Cattle Research and Education Center (RCREC) at Ona, FL. All procedures were approved by the University of Florida, Institute of Food and Agricultural Sciences, Animal Research Committee (003-10ONA). Each experiment was conducted in consecutive years and were initiated in April and concluded at the time of weaning (July). Treatments were administered during an initially estimated 100-days, pre-weaning creep supplementation period. The actual length of pre-weaning supplementation (range = 102–122 days) was dictated by the actual time of weaning, which was influenced by annual calf marketing decisions and weather.

2.1. Animals and diets

In Exp. 1, Braford multiparous cows and calves (n = 105 and 95 pairs; initial cow BW = 481 ± 53 and 495 ± 53 kg; calf initial BW = 162 ± 21 and 168 ± 24 kg for years 1 and 2, respectively) were stratified by calving date and randomly allocated into 1 of 8 bahiagrass (*Paspalum notatum*) pastures (8 ha; approximately 13 pairs/pasture). Treatments were randomly assigned to pastures and consisted of no creep-feeding supplementation (**NoCreep**; n = 2 pastures/year), creep-feeding supplementation of sugarcane molasses plus urea (**Mol+U**; n = 3 pastures/year) or Mol+U plus MHA (**Mol+MHA**; n = 3 pastures/year). Calves were supplemented for 122 and 117 days prior to weaning in years 1 and 2, respectively. A 50:50 urea+hot water blend was included into the sugarcane molasses at approximately 4% (as-fed basis), whereas the source of MHA (Alimet; Novus International Inc., St. Louis, MO) was blended into the molasses+urea formulation at 0.63% (as-fed basis) in order to provide 0.22% MHA (as-fed basis).

In Exp. 2, Brangus crossbred multiparous cows and calves (n = 48 and 36 pairs; initial cow BW = 412 ± 44 and 438 ± 49 kg; calf initial BW = 136 ± 16 and 129 ± 19 kg for years 1 and 2, respectively) were stratified by calving date and randomly allocated into 1 of 12 bahiagrass pastures (2 ha; n = 4 and 3 pairs/pasture in years 1 and 2, respectively). Treatments were randomly assigned to pastures (4 pastures/treatment annually) and consisted of no creep-feeding supplementation (**NoCreep**), creep-feeding supplementation of sugarcane molasses added with 4% of a 50:50 urea+hot water blend (as-fed; **Mol+U**) or cottonseed meal (**Mol+CSM**; 80% molasses and 20% cottonseed meal, as-fed basis). Calves were supplemented for 104 and 102 days prior to weaning in years 1 and 2, respectively.

In Exp. 1 and 2, calves were provided free-choice access to supplements in cow exclusion areas within open 340-L tubs. Voluntary supplement intake (as-fed basis) was determined by weighing each tub on 7 to 14-day intervals and disappearance calculated. To ensure consistent availability for free-choice intake, additional supplement was added at these weighing periods. Chemical composition of supplements and pastures of Exp. 1 and 2 are shown in Table 1. In Exp. 1 and 2, all cows and calves were provided free-choice access to a complete salt-based mineral supplement (Cattle Select Essentials Range, Lakeland Animal Nutrition, Lakeland, FL; 6.0, 0.10, 0.10, 0.30, 63 and 1.0% of Ca, K, Mg, S, NaCl and P, respectively, and 50, 15,000, 800, 210, 500, 40 and 3000 mg/kg of Co, Cu, Fe, I, Mn, Se and Zn, respectively).

2.2. Data collection

In Exp. 1 and 2, BW of cows and calves, and cow BCS were taken at the beginning of the study and at the time of weaning. Cows were weighed at 0800 h after a 12-h period of water and feed withdrawal. Calves remained with their dams during this period.

Hand plucked pasture samples (n = 3 samples/year), during the pre-weaning phase, were collected in June of each year and pre-weaning supplements samples in Exp. 1 and 2 were collected monthly and pooled for analysis of nutritional value. Samples were sent in triplicate to a commercial laboratory for chemical composition analysis (Dairy One Laboratory, Ithaca, NY). Samples were