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Limited creep-feeding supplementation effects on performance of beef cows and calves grazing limpograss pastures

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ABSTRACT

Limpograss (*Hemarthria altissima*) is a warm-season grass used by cow–calf producers in South Florida; however, limpograss protein concentration may limit animal performance. The objective of this study was to test the effects of creep-fed protein supplement on performance of cow–calf pairs grazing limpograss pastures. The experiments were conducted in Ona, FL from June to September 2011 (Experiment 1) and from June to August 2012 (Experiment 2). Twenty-four cows and calves [Angus-sired calves on crossbred cows (approximately 63% *Bos taurus* and 37% *Bos indicus*)] were randomly distributed in eight limpograss pastures (1.0 ha/pasture). In Experiment 1, calves received 200 g/d of soybean meal (SBM, 48% CP) daily by creep-feeding or no supplement (control). Treatments were distributed in a randomized complete block design with four replicates. In Experiment 2, calves received 200 or 400 g/d of SBM daily by creep-feeding or no supplement (control) distributed in a randomized incomplete block design with three replicates for 200 g/d and control and two replicates for 400 g/d. In Experiment 1, there was no difference in HM ($P=0.54$; mean$=4500\pm800$ kg/ha), in vitro digestible organic matter (IVDOM; $P=0.92$; mean$=62\pm1.4$%) and crude protein concentration (CP; $P=0.14$; mean$=14.3\pm0.9$%) between treatments. In addition, there was no difference in cow and calf ADG ($P=0.51$; mean$=0.25\pm0.1$ kg/d and $P=0.24$; 0.55 ± 0.1 kg/d for cows and calves ADG, respectively). In Experiment 2, there was no effect of creep-feeding on HM ($P=0.28$; mean$=6800\pm700$ kg/ha), IVDOM ($P=0.31$; mean$=52\pm3.5$%), and CP ($P=0.63$; mean$=11.1\pm0.5$%) concentrations; however, there was a linear ($P=0.03$) increase in ADG from 0.33 to 0.62 kg/d for calves receiving from 0 to 400 g/d SBM. Cow ADG was similar among treatments ($P=0.44$; mean$=0.23\pm0.12$ kg/d). Calves receiving 400 g/d SBM had 0.75 kg BW/kg feed added gain efficiency {[BW gain of creep-fed calves (kg) – BW gain of control calves (kg)]/[amount of feed consumed during the experimental period (kg)]}, and a tendency for 70% linear increase in economic return ($P=0.06$), when compared with the control calves. Limited creep-feeding of SBM supplement may be an effective management practice to improve weaning weights of beef calves on limpograss pastures.

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1. Introduction

Limpograss (*Hemarthria altissima*) is a perennial warm-season grass adapted to poorly drained soil, commonly found in South Florida. Limpograss generally contains greater total digestible nutrients (TDN) concentration than other tropical grasses at late maturity (Sollenberger et al., 1988); however, total herbage can have reduced crude protein (CP) concentrations and the plant parts vary widely in CP (Pitman et al., 1994). Thus, supplementation of animals grazing limpograss may be a feasible management practice to optimize animal production (Sollenberger et al., 1988; Newman et al., 2002).

Creep-feeding is a management practice used to provide extra nutrients to suckling calves in a discrete part of the pasture, which prevents the mother from gaining access to the feed (Bray, 1934; Stricker et al., 1979). Creep-feeding can be used to increase weaning weights, overcome decreased herbage allowance (HA), improve calf uniformity, and reduce nursing cow nutrient requirements (Bray, 1934; Powell, 1936; Stricker et al., 1979; Martin et al., 1981). According to Patterson et al. (1992), calves receiving diets with greater CP concentration may increase average daily gain (ADG), reach puberty earlier, and increase the likelihood of pregnancy. Creep-feeding calves may have a positive impact on cow performance (Prichard et al., 1989); however, this effect is not consistently reported in the literature (Lusby and Wettemann, 1986; Tarr et al., 1994; Vendramini et al., 2012).

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The most common creep-feeding management practice is to allow the calves to have ad libitum access to concentrate; however, the added gain:feed efficiency is decreased and may range from 0.2 to 0.06 kg BW/kg feed (Stricker et al., 1979; Cremin et al., 1989; Faulkner et al., 1994). The decreased efficiency may limit the economic viability of creep-feeding beef calves. However, creep-feeding the most limiting nutrients for calf growth in smaller quantities may be an efficient management to improve calf performance and decrease feed cost.

Creep-feeding of a limited amount of CP supplement is generally used to provide N to rumen microbes to improve fiber digestibility and forage intake (Cremin et al., 1991). Lusby et al. (1985) proposed a limited creep-fed protein supplementation of 0.37 kg/d of cottonseed (*Gossypium* spp.) meal (CSM) to cow–calf pairs grazing for 63 d and reported an increase of 0.13 kg/d in ADG of supplemented compared with control calves, with added gain: feed efficiency of 0.4.

Soybean (*Glycine max*) meal (SBM) is the most used CP supplement to ruminants due to its greater CP concentration, rumen degradability, and concentrations of high quality amino acids (NRC, 1996); however, the effects of creep feeding limited amounts of SBM to cow–calf pairs grazing limpograss pastures are not known. The objectives of this study were to test the effects of limited creep-feeding protein supplements on (1) calf and cow performance, (2) forage responses, and (3) economic analysis. The hypothesis of the study is that supplying limited-creep feeding supplementation to calves grazing limpograss pasture will increase calf performance with positive economic return without affecting cow performance and forage characteristics.

2. Material and methods

2.1. Animals and experiment design

The research was conducted at the UF/IFAS Range Cattle Research and Education Center (RCREC), Ona, FL (27° 26′ N and 82° 55′ W) from June to September in 2011 (experiment 1) and from June to August in 2012 (experiment 2). Animals were cared for in accordance with acceptable practices and experimental protocols reviewed and approved by the University of Florida Institutional Animal Care and Use Committee.

Twenty four cows and calves [Angus-sired calves on crossbred cows (approximately 63% *Bos taurus* and 37% *Bos indicus*)] with initial BW of 434 ± 88 kg and 176 ± 30, respectively, in 2011 and 474 ± 67 kg and 215 ± 18 kg, respectively, in 2012 were randomly allocated to eight pastures (3 cow–calf pairs per pasture). The average body condition score of the cows at the beginning of the study was 5.3 ± 0.4 on a 1 to 9 scale, according to visual estimation described by Neumann and Lusby (1986). Pastures were stocked continuously using a fixed stocking rate. The stocking rate at the initiation of the study was 4.6 animal units (AU; 450 kg BW)/ha. Calves were approximately 6 month of age at the initiation of the study.

In experiment 1, treatments were: (1) calves receiving 200 g/d of SBM (48% CP) daily by creep feeding, or (2) calves not receiving creep-fed supplement (Control). Treatments were distributed in a randomized complete block design with four replicates. In experiment 2, treatments were: (1) calves receiving 200 g/d of SBM daily by creep-feeding, (2) calves receiving 400 g/d of SBM daily by creep-feeding, or (3) calves not receiving creep-feeding supplementation (Control). The treatments were distributed in a randomized incomplete block design with three replicates for the control and 200 g/d treatment, and two replicates for 400 g/d treatment. The initial HM was used as criteria to block the pastures.

2.2. Pasture description

The soil at the research site is classified as Pomona fine sand (siliceous, hyperthermic, Ultic Alaquod). Before the initiation of the study, mean soil pH (in water) was 5.1, and Mehlich-I (0.05 M HCl + 0.0125 M H_2SO_4) extractable P, K, Mg, and Ca concentrations in the Ap1 horizon (0-to 15-cm depth) were 35, 75, 155, and 1450 mg/kg, respectively. Pastures were fertilized with 90 kg N/ha in April 2011 and 2012. The source of N was ammonium nitrate.

Limpograss pastures (1.0 ha per pasture, experimental units) were established in 2010 and grazed in 2011 and 2012.

2.3. Forage measurements

In experiments 1 and 2, pastures were sampled just prior to initiation of grazing and every 14 d thereafter. Herbage mass and nutritive value [CP and in vitro digestible organic matter (IVDOM)] were measured. Herbage mass was determined by the double sampling technique. The indirect measure was the settling height of a 0.25-m^2 aluminum disk, whereas direct measure involved hand clipping all herbage at soil level to the top of the canopy using an electric clipper. One or two double samples were taken from each of the eight experimental units for a total of 20 in a 28 d interval. Sites were chosen to represent the range of herbage mass present on the pastures. At each site, the disk settling height was measured and the forage was clipped at ground level. Clipped forage was dried for 72 h at 60 °C and weighed. In order to ensure that all sections of the pasture were represented in the indirect measures taken every 14 d to determine herbage mass (not the site for double sampling), 20 sites per pasture were chosen by walking a fixed number of steps between each drop of the disk for the settling height measurement.

The average disk height of the 20 sites was entered into a regression equation HM (*y* axle) and disk height (*x* axle) to predict actual HM for a given 28-d period. A cage technique was used to measure herbage accumulation since pastures were stocked continuously. Three 1-m^2 cages were placed in each pasture at the initial sampling date. Placement sites were chosen where the disk settling height was the same (±1 cm) as that of the pasture average. Disk settling height was recorded at a specific site and the cage placed. After 28 d, the cage was removed and the new disk settling height recorded.

Herbage allowance (HA) was calculated for each pasture as the average HM (mean across two sampling dates within each 28-d period) divided by the average total cow–calf live weight during that period (Sollenberger et al., 2005). The hand-plucked sampling technique was used to estimate herbage CP and IVDOM concentration at the initiation of grazing and every 14 d thereafter. Herbage samples were composited across sites within a pasture, dried at 60 °C for 48 h in a forced-air oven to constant weight and ground in a Wiley mill (Model 4, Thomas-Wiley Laboratory Mill, Thomas Scientific, Swedesboro, NJ) to pass a 1-mm stainless steel screen. Analyses were performed at the University of Florida Forage Evaluation Support Laboratory using the micro-Kjeldahl technique for N (Gallaher et al., 1975) and the two-stage technique for IVDOM (Moore and Mott, 1974).

2.4. Animal responses

The cow–calf pairs were weighed at initiation of the experiment and every 28 d thereafter. Initial and final weights were taken at 0800 h with a shrink period of 16 h and the animals were unshrunk for the intermediate weight collections. The difference in initial and final BW of cows and calves were used to calculate ADG. Cow body condition score was evaluated at the same schedule. The gain per ha was determined based on the ADG of the