DIGESTIVE AND METABOLIC CHANGES IN FALL-CALVING BEEF COWS DUE TO STAGE OF PRODUCTION AND EARLY POSTPARTUM PROTEIN SUPPLEMENTATION

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Story in Brief

Fourteen fall-calving Hereford x Angus cows were maintained on low-quality native grass hay (4.7% crude protein) during late gestation and early lactation to characterize digestive changes due to stage of production and early postpartum protein supplementation. Supplemented cows received 2.5 lb cottonseed meal/day starting at calving. During the first 5 weeks of lactation, control cows lost 106.3 lb while supplemented cows gained 48.6 lb. In addition, supplemented cows produced more milk (6.7 lb/day) and calf weight gain (21.3 lb) than control cows. Hay organic matter intake increased 33% for control cows and 110% for supplemented cows during the first five weeks after calving. Compared to control cows, supplementation increased total organic matter digestibility and intake to the extent that digestible organic matter intake approximately doubled. This study illustrates that small quantities of supplemental protein (2.5 lb cottonseed meal/day) efficiently improve utilization of low-quality forage and performance of lactating beef cows. Thus, supplementation programs for fall-calving beef cows should be initiated immediately after calving.

(Key Words: Beef Cattle, Lactation, Native Range, Cottonseed Meal, Intake, Digestibility)

Introduction

Fall-calving beef cows maintained on native range experience marked physiological changes during late gestation and early lactation. In addition, the nutritional quality of native range declines during the fall months. Increased nutrient demands coupled with decreased forage quality create large nutrient deficiencies that must be satisfied for cows to lactate and rebreed normally.

Small quantities of supplemental cottonseed meal (2.14 lb/day) effectively reduce body weight and condition losses in lactating beef cows maintained on native range in the fall (Gonzalez et al., 1987). Although protein supplementation should improve forage utilization, the impact of small quantities of supplemental protein on changes in digestive function of lactating beef cows grazing low-quality native range is unknown. This experiment was designed to characterize changes in digestive function of lactating beef cows due to physiological status and early postpartum protein supplementation.

Materials and Methods

Fourteen mature, late-gestation Hereford x Angus cows (1208 lb initial weight) were housed individually and fed coarsely chopped (2-

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inch screen) native grass hay free choice. Cows were treated similarly prepartum but paired based on calving date and randomly assigned to either a control or a supplemented group (2.5 lb cottonseed meal/day). Calves were weighed within 24 h of birth and bull calves elastrated.

The trial consisted of nine periods (7 days/period). On day 3 of each period, all cows and calves were weighed. Cow body condition scores (1=emaciated, 9=obese) were assigned by three independent evaluators. Milk production was measured during week 5 using the weigh-suckle-weigh technique.

Fresh hay was placed in the feeders every day, and hay refusals were weighed and subsampled on days 3, 5 and 7. Fecal grab samples were collected twice daily (0800 and 2000 h) on days 4 to 7, refrigerated, composited and dried. Hay, hay refusal, supplement and fecal composite samples were ground and analyzed for dry matter, ash and acid insoluble ash content. Organic matter (OM) digestibility was calculated by the marker ratio technique using acid insoluble ash as the reference marker.

Changes in the physiological status of the control group were evaluated using polynomial equations. To evaluate response to postpartum cottonseed meal supplementation, data were analyzed as a split-plot design with treatment as the main unit, cows as replications and periods as the subunits. Treatment responses within each period were evaluated by t-test.

Results and Discussion

The native grass hay used in this study contained 4.7% crude protein and 5.2% lignin (Table 1). Fall-calving beef cows grazing native tallgrass pastures in Oklahoma experience a forage base providing as little as 3.79% CP and 35.8% crude fiber in October (Waller et al., 1972).

Precalving weight and body condition changes were similar for both groups (Figure 1). All cows lost an average of 142.3 lb (12.7% of precalving weight) at calving. After calving, control cows (no supplement) rapidly lost body weight (-3.0 lb/day) and condition (-.14 units/week). In contrast, supplemented cows gained weight (+1.4 lb/day) and body condition (+.005 units/week) after calving. Increased nutrient requirements due to milk synthesis coupled with low hay quality created a large nutritional void in the control cows. Consequently, unsupplemented cows mobilized body stores to meet the nutrient demands of the mammary gland.

Table 1. Chemical composition of native grass hay and cottonseed meal supplement.

Item	Hay	Cottonseed meal
	----% (DM basis)----	
Crude protein	4.70	44.03
Acid detergent fiber	34.80	19.51
Lignin	5.20	2.79

In addition to improved cow performance, cottonseed meal supplementation also increased milk production (6.7 lb/day). Consequently, calves suckling supplemented cows gained more weight (21.3 lb, P<.09) than calves suckling control cows by week 5 postpartum (Figure 1).

Hay OM intake of control cows decreased 21% for both groups during the last three weeks of gestation (Figure 2). Decreased hay intake in late gestation may be due to the physical size of the conceptus which

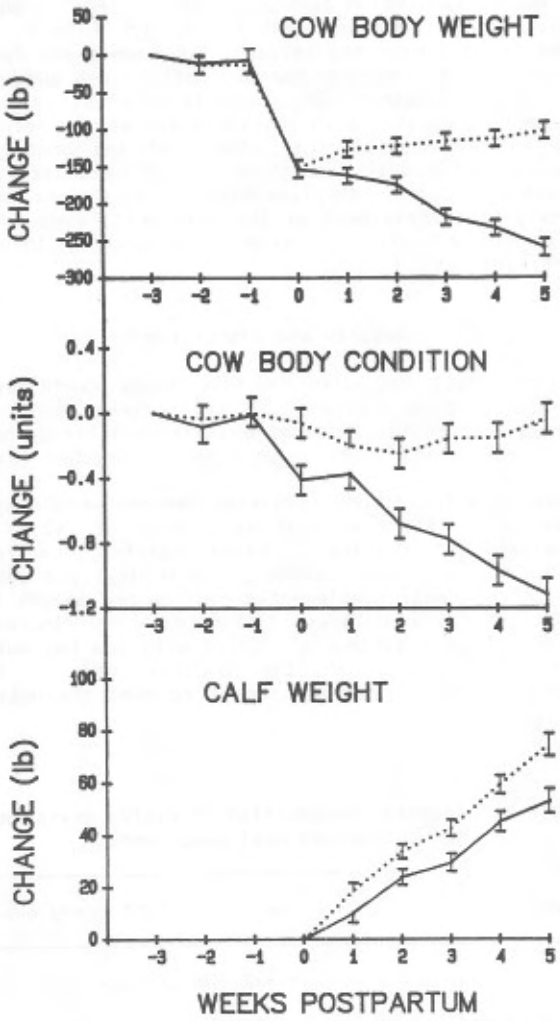

Figure 1. Changes in cow body weight and condition and calf weight due to stage of production and postpartum protein supplementation (———— control, ····· 2.5 lb CSM/day).

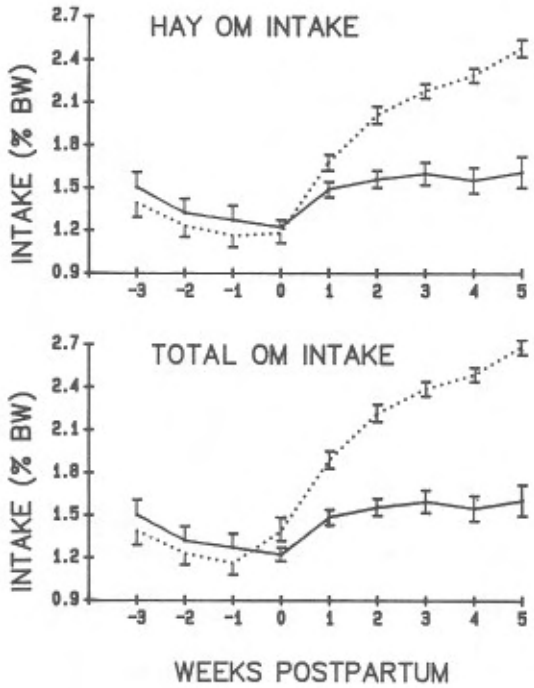

Figure 2. Effect of stage of production and postpartum protein supplementation on organic matter intake (———— control, ····· 2.5 lb CSM/day).

could decrease digestive capacity. After calving, hay OM intake increased rapidly (33% in five weeks) and stabilized at about 1.6% of body weight. Increased hay intake after calving may be attributed to increased physiological demands from lactation in addition to increased abdominal space.

Supplementation (2.5 lb cottonseed meal/day) rapidly increased hay OM intake after calving (Figure 2). In fact, hay OM intake of supplemented cows continued to increase through week 5 after calving. By the end of the study, supplemented cows consumed 54% more hay OM (2.5% body weight) than control cows (1.6% body weight). In addition to increased hay OM intake, supplemented cows received 2.3 lb of supplemental OM from cottonseed meal. Thus, supplemented cows consumed 67% more total OM than control cows by week 5 postcalving.

Organic matter digestibility was increased ($P<.01$) for supplemented cows after calving (Figure 3). This response coupled with increased total OM intake resulted in a marked increase in digestible OM intake for supplemented cows. In fact, digestible OM intake of supplemented cows approximately doubled that of control cows by the end of the study.

Small quantities of cottonseed meal supplement have a tremendous impact on the performance of lactating beef cows maintained on low-

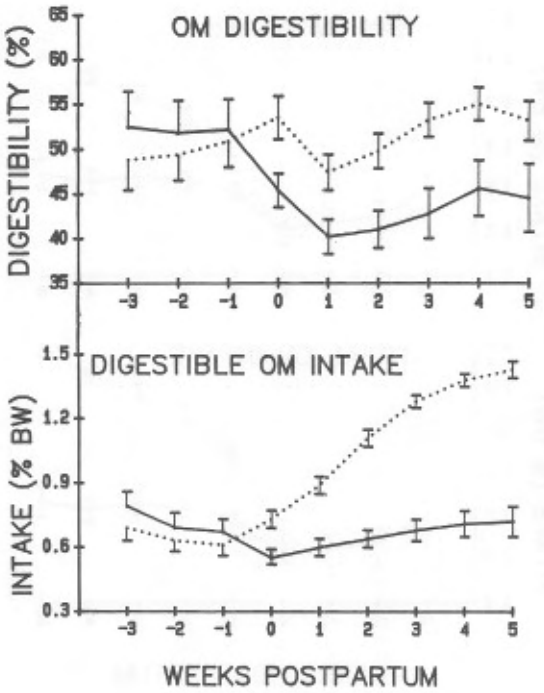

Figure 3. Effect of stage of production and postpartum protein supplementation on organic matter digestibility and digestible organic matter intake (———— control, ····· 2.5 lb CSM/day).

quality grass hay. Much of this response is due to the fact that control cows consumed only .76 lb protein/day which is only 38% of their NRC requirement. Supplemented cows received 1.1 lb of cottonseed meal protein/day plus an additional 1.3 lb protein from the hay which totals 120% of their NRC requirement. Supplemental protein improves forage utilization as well as bacterial growth. Consequently, protein supplementation should improve both the energy and protein status of lactating beef cows. Thus, the protein requirements of beef cows in early lactation should not be ignored if producers desire optimum performance.

Lactating beef cows maintained on low-quality grass hay without supplement rapidly lost large quantities of body weight (3.0 lb/day) and condition (.14 units/week). These losses occurred because nutrient requirements increased while energy intake was limited by the poor nutritional quality of the forage. In contrast, cows fed 2.5 lb cottonseed meal/day gained weight and body condition. Supplemental protein probably stimulated ruminal bacterial activity resulting in increased hay digestion and intake. Thus, supplemented cows were able to consume approximately twice as much digestible OM as control cows.

This difference explains the large response to cottonseed meal supplementation in this study. Consequently, supplementation programs for fall-calving beef cows grazing low-quality native range should be initiated immediately after calving in order to realize the maximum response to small quantities of protein supplement.

Literature Cited

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