Effect of Parity and Milk Production Potential on Forage Intake of Beef Cows during Late Gestation

C.R. Johnson, D.L. Lalman, L.A. Appeddu, M.A. Brown, R.P. Wettemann, and D.S. Buchanan

Story in Brief

Limited research has been conducted comparing the effects of genetic merit for milk production within breed and parity on forage intake of beef cattle. Twelve multiparous cows and 12 first-calf heifers were used to evaluate the effect of milk production potential and parity on forage intake in Brangus females during late gestation. During the study cows averaged 61 d and heifers averaged 33 d prepartum. All females were individually fed long-stemmed hay harvested from mixed bermudagrass-native prairie pastures. Cottonseed meal was supplemented at .2% and .3% of body weight for cows and heifers respectively, to ensure adequate protein supply. Cows consumed 24% more forage dry matter daily, compared with first-calf heifers. However, when forage intake was expressed relative to body weight or metabolic body weight, cows and heifers consumed similar amounts of forage dry matter (1.7% of body weight). Genetic merit for milk production had no effect on forage intake during late gestation.

Key Words: Forage Intake, Cows, Heifers, Gestation, Milk Production

Introduction

It is imperative for cows to calve yearly for cow-calf producers to optimize efficiency of their production systems. The first-calf beef heifer presents challenges to achieving this goal, as they may have increased postpartum intervals and lower pregnancy rates upon rebreeding compared with multiparous cows. Reduced reproductive performance in cows and heifers can result from inadequate nutrient intake pre- or post-partum. However, data comparing forage intake of first-calf heifers and older cows is limited.

During late gestation, fetal growth increases dramatically resulting in increased nutrient demand for the cow. Furthermore, as beef cows make the transition from gestation to lactation, forage intake increases to accommodate increased nutritional requirements. During lactation, females that have higher milk production potential will consume more forage, but they also have higher nutrient requirements to sustain increased milk production. However the effects of genetic merit for milk production on forage intake during late gestation has not been established. Our objective was to determine if parity and genetic potential for milk production influences forage intake in beef females during late gestation.

Materials and Methods

In December 2000, 12 multiparous Brangus cows and 12 first-calf Brangus heifers were selected for high and low milk production potential prior to the initiation of the trial. Selection was based upon each animal's sire EPD for milk production. Animals from the upper and lower 25% of represented sires for each parity group were selected. All females were weighed at the beginning and end of the feeding period and average weight for the feeding period was used to express intake relative to body weight (BW). Body condition scores (scale 1, thin to 9, obese) were determined by two independent evaluators at the beginning of each feeding period.

Hay (Table 1) was harvested at the USDA-ARS Grazinglands Research Laboratory during the summer of 1998, from a bermudagrass-native prairie pasture and was stored outside as round bales until feeding. Round bales were re-baled into small square bales to facilitate feeding animals individually. To ensure adequate protein supply, cottonseed meal (CSM; Table 1) was supplemented so that all classes of females had a calculated degradable intake protein (DIP) balance of 150 g/d. Cows were supplemented at the rate of .2% of BW per day and heifers were supplemented at the rate of .3% of BW per day.

Table 1. Chemical composition of hay and cottonseed meal (CSM)

Chemical Component	Hay	CSM
Organic matter, % dry matter	87.9	85.1
Crude protein, % dry matter	5.3	44.6
Degradable intake protein, % crude protein	45	57[a]
Neutral detergent fiber, ash-free	75.9	33.3
Acid detergent fiber, ash-free	47.9	24.9
Total digestible nutrients	52	75[a]

[a]Tabular values for CSM from Nutrient Requirements for Beef Cattle (NRC, 1996)

Females were individually fed hay and supplement by using the Calan gate system (American Calan Inc., Northwood, NH) and were trained to the gates and adapted to the diet simultaneously. The training and adaptation period was 24 d followed by a 9-d intake collection period. All animals had ad libitum access to water and a trace mineralized salt block (contained not less than 93% NaCl, 3500 ppm Zn, 2800 ppm Mn, 1750 ppm Fe, 350 ppm Cu, 70 ppm I, and 70 ppm Co). Forage was offered at 130% of the previous 2-d average intake. During the collection period hay, CSM, and refusal were sub-sampled at each feeding and hay and CSM samples were composited for the period, and refusal samples were composited by animal.

Forage, refusal, and fecal samples were dried at 55°C in a forced-air oven and were ground to pass a 2-mm screen. Dry matter and ash determinations were conducted in accordance with approved methods of the AOAC (1996). Nitrogen content of forage, supplements, and feces was determined by combustion. Samples were analyzed for neutral detergent fiber (NDF) and acid detergent fiber (ADF) using ANKOM technology. Degradable intake protein (DIP) of the forage was estimated by measuring nitrogen disappearance during a 48-h incubation in a borate-phosphate buffer containing protease type XIV from *Streptomyces griseus* (Mathis et al., 2001). Total digestible nutrient (TDN) concentration of the forage was determined by the summative equation of Weiss et al. (1992). Tabular values for DIP and TDN for CSM were used (NRC, 1996).

During each experiment, fecal grab samples were collected daily for five d and composited. Fecal output of the cows was estimated using acid detergent insoluble ash as an internal marker. Acid detergent insoluble ash was determined as the residue following complete combustion of the ADF residue. Digestibility was calculated as ((organic matter consumed – organic matter in feces)/organic matter consumed)*100.

Data were analyzed as a split plot arrangement using least squares analysis of variance. Individual animal was considered the experimental unit. The main effects of parity (cows vs heifers) and milk production potential (high vs low) and the interaction were included in the model. Pen was considered a random effect.

Results and Discussion

When forage dry matter intake (DMI) was expressed on an absolute basis multiparous cows consumed 24% more forage than primiparous heifers (Table 2). Yet, when forage DMI was expressed relative to BW or metabolic BW ($BW^{.75}$), neither parity nor milk production potential affected forage DMI (Table 2).

Table 2. Least squares means for forage intake and digestibility of cows consuming low-quality forage during late gestation

	High Milk		Low Milk			
Variable	Cows	Heifers	Cows	Heifers	SEM	Effect[a]
Average sire milk EPD	+9.5	+10.8	-12.2	-11.0	--	--
Age, mo	46	23	61	22	--	--
Cottonseed meal, lb/d	3.1	3.1	3.1	3.1	--	--
Wt, lb	1272	1104	1318	1030	43.6	P
Body condition score	4.4	4.8	4.9	4.8	.15	--
Forage dry matter intake, lb/d	22.2	17.8	22.7	18.5	1.54	P
Forage dry matter intake, % BW	1.76	1.59	1.71	1.73	.13	--
Forage dry matter intake, % $BW^{.75}$	8.6	7.6	8.5	8.1	.6	--
Total diet organic matter digestibility, %	56.0	57.9	58.0	55.4	.93	X

[a]Effects in the model that are significant at the P<.05 level; P = parity, X = interaction of parity and milk production

Varel and Kreikemeier (1999) compared forage intake and utilization by mature cows and 10-mo old heifers fed alfalfa and brome hay. Forage intake did not differ between cows and heifers when expressed per kg of BW, yet when expressed per unit of $BW^{.75}$, mature cows consumed 21% more alfalfa and 33% more brome hay than the heifers. Additionally, these researchers observed that mature cows had faster rates of ruminal NDF digestion, which may have been attributed to a smaller ruminal fluid fill that turns over more rapidly. We did not observe a difference in intake when expressed per unit of $BW^{.75}$. One explanation may be that the first calf heifers used in this study were older and closer to their expected mature weight compared to the 10-mo old heifers used by Varel and Kreikemeier (1999).

Limited data has been published regarding the effect of milk production potential on forage intake during late gestation. Fiss and Wilton (1992) evaluated various breeding systems from 1980 to 1988, including straightbred Herefords and crossbred systems involving Angus, Gelbvieh, Pinzgauer, Tarentaise, Charolais, Simmental and Maine Anjou. Cows were fed a 50% corn silage and 50% haylage diet on a DM basis. The crossbred females produced 47% more milk during lactation than the straightbred Hereford cows, indicative of increased genetic potential for milk production. Prior to lactation, the crossbred cows consumed 18% more feed energy (Mcal of ME) during gestation (weaning to parturition). This increase in feed intake during gestation may have been a function of body weight rather than milk production potential, as the crossbred cows also were heavier at weaning, than the straightbred Herefords. In our study, selection for differing levels of milk production did not influence forage DMI during late gestation.

Implications

To properly manage forage resources, producers must be able to estimate forage intake by various classes of animals within their herd. When determining supplementation needs and forage use by beef cows, multiparous cows and first-calf heifers consume similar amounts of forage dry matter, when intake is expressed relative to body weight. In our study, during late gestation, beef females consumed approximately 1.7% of their body weight as forage dry matter regardless of genetic merit for milk production or parity.

Literature Cited

AOAC. 1996. Official Methods of Analysis (14th ed.). Arlington, VA.

Fiss, C.F. and J.W. Wilton. 1992. J. Anim. Sci. 70:3686.

Mathis et al. 2001. Anim. Feed. Sci. Technol. 93:31.

NRC. 1996. Nutrient Requirements of Beef Cattle (7th Ed.). National Academy Press, Washington DC.

Varel, V.H. and K.K. Kreikemeier. 1999. J. Anim. Sci. 77:2774.

Weiss, W.P. et al. 1992. Anim. Feed Sci. Technol. 39:95.

Acknowledgements

The authors would like to thank Scott Schmidt and the undergraduate students of Redlands Community College for their assistance in the daily management of the cattle.
