Programmed Feeding Effects on Growth, Puberty, and Pregnancy Rates in Yearling *Bos indicus* and *Bos taurus* Beef Heifers

Brad Austin[1]
Matt Hersom
Joel Yelich

Programmed supplementation of heifers can have a negative impact on the growth and reproductive performance of heifers if heifers are placed under extreme nutritional stress.

Summary

The objective of this study was to examine the effects of programmed supplementation on growth, age at puberty, estrous synchronization response, and pregnancy rates of yearling Brangus and Angus heifers consuming round bale silage (RBS). Sixty heifers (30 Angus, 30 Brangus) were stratified by initial body weight, breed, and age and randomly allocated to 12 pens. Pens were randomly assigned to one of two treatments: 1) RBS and dried distillers grains (DDG) supplemented 3 d/wk for duration of experiment (174 d, CON) or, 2) RBS ad libitum for the first 88 d and RBS and DDG supplemented 3 d/wk from d 89-174 (L-H). All heifers were offered ad libitum bermudagrass RBS during the trial. Round bale silage quality was lower than predicted causing poorer performance than expected. Heifers in the L-H treatment had decreased average daily gain (ADG), percentage of heifers pubertal at d 89 and at AI, 28-d pregnancy rates, and overall pregnancy rates compared to heifers supplemented for the entire trial. Synchronized pregnancy rates (46 vs 33%) and conception rates (50 vs 53%) were similar (P>0.05) between CON and L-H, respectively. In this study, decreased growth rates experienced by L-H heifers during the first phase of the trial were very significant. These heifers did not experience the predicted compensatory gain during the second period of the trial which had dramatic effects on heifer reproductive performance.

Introduction

The development of replacement heifers is one of the major economic considerations in a cow-calf operation. Heifers that calve by two yr of age have greater lifetime productivity than heifers that calve at an older age. Heifers must be maintained on a high plane of nutrition to reach puberty and conceive by 14 to 15 mo of age. Therefore, management decisions regarding replacement heifers should focus on factors that promote early onset of puberty and early calving.

Most cattle raised in the Southeastern United States have some degree of *Bos indicus* breeding and heifers with *Bos indicus* breeding tend to mature slower and reach puberty at older ages than *Bos taurus* heifers. The influence of *Bos indicus* breeding can negatively affect the rancher's success of having heifers pregnant to calve at two yr of age. The impact of supplemental nutrition is increasingly important in these situations.

There has been a great deal of research examining the effects of timing of gain on puberty in heifers. Research has shown that programmed feeding of heifers can have positive effects on attainment of puberty, establishment of pregnancy, and future production of the animal. Managing heifers to attain puberty with decreased feed inputs and then taking advantage of compensatory gains may have economic advantages.

Altering the feeding patterns of heifers to affect weight gain is a management tool that can help to decrease the feed cost involved with developing replacement heifers. Most of this research has been conducted with *Bos taurus* animals in drylot situations. No data is available on *Bos indicus* X *Bos taurus* heifer performance, or heifer performance in a forage based system.

The objective of this study was to examine the effects of programmed supplementation on growth, age at puberty, estrous synchronization response, and pregnancy rates of yearling *Brangus* and *Angus* heifers consuming RBS.

Procedure

This study was conducted at the Santa Fe Beef Unit, located near Gainesville in northern Alachua County. Sixty heifers (n=60) were divided by age, body weight, and sire into 12 pens (6 pens Angus and 6 pens Brangus). Beginning in October 2007, heifers were supplied ad libitum access to bermudagrass RBS (54% dry matter, 7.9% crude protein, 53.9 % total digestible nutrients) and free choice mineral. One half of the heifers (3 pens Angus and 3 pens Brangus, CON) were supplemented with distillers dried grains (DDG) to gain approximately 1.5 lb/d as determined by NRC computer model. The other half of the pens (L-H) were offered only RBS for the first 88 d (Phase 1). For the final 86 d distillers grains were supplemented at a rate to provide a gain of approximately 3.0 lb/d.

Prior to the start of the and at the conclusion of the experiment, heifers were withheld from water and feed for approximately 12 h to obtain a shrunk body weight (SBW) and hip height (HH). At the beginning, middle and end of the trial a body length (BL) and heart girth (HG) were taken on each heifer. Ultrasound measurements of ribeye area (REA) and rump fat were obtained on d 16, 89, and 174.

Blood samples were collected on d 79 and 89 to determine puberty status of the heifers. Heifers were weighed and bled weekly during phase 2 to determine average daily gain (ADG) and age at puberty.

Heifers were synchronized for artificial insemination on d 173 of the experiment. A CIDR was inserted concurrent with GnRH. Seven days later the CIDR was removed and prostaglandin was administered to synchronize estrus. Estrus was detected for 72 h, using the Heatwatch system, and heifers were inseminated approximately 8-12 h after the onset of estrus by a single AI technician. Heifers not exhibiting estrus by 72 h after prostaglandin received GnRH and were timed-AI. Estrous detection and AI were continued for 27 d while heifers remained in their respective pens and continued to receive supplement treatments. Pregnancy was diagnosed by ultrasonography 31 d after prostaglandin at which time heifers were removed from supplementation treatments and pens. Heifers were grouped by breed and placed with a clean-up bull for 25 d. Final pregnancy diagnosis was performed by ultrasonography 28 d after the clean-up bull was removed.

Results

The ADG of the heifers was lower than predicted by computer modeling due to poor RBS quality. During phase 1 of the trial, CON heifers had greater ($P<0.05$) ADG than L-H heifers (1.25 vs. -0.22 lb/d). The performance of the L-H heifers was worse than expected and can be associated with poor forage quality. During phase 2 of the trial ADG tended ($P=0.07$) to be greater for L-H (1.63 lb/d) compared to CON (1.34 lb/d). The compensatory gain of the L-H heifers was not as great as anticipated. The ADG and shrunk ADG for the entire trial were greater ($P<0.05$) for the CON heifers compared to the L-H heifers (1.19 vs. 0.68 lb/d; 0.98 vs. 0.53 lb/d, respectively). Because of this the final body weights of the CON heifers were 100 lbs greater than the L-H ($P=0.002$; 771 vs. 684 lbs; Table 1) at the conclusion of the trial. The weight loss experienced by the L-H heifers during phase 1 was too great for them to overcome during phase 2. These results enforce the necessity of high quality forages when developing heifers.

Heifers in the CON treatment had greater ($P<0.05$) HG, BL, and HH at d 89 and 174 than L-H heifers (Table 1). The CON heifers had greater ($P<0.05$) REA compared to L-H on d 89

(7.24 vs 5.43 in^2) and on d 174 (8.11 vs 7.01 in^2), respectively. Rump fat was greater ($P<0.05$) for CON (0.17 in) compared to L-H (0.12 in) on d 89 but were similar ($P>0.10$) for CON (0.17 in) compared to L-H (0.15 in) on d 174.

The percentage of CON heifers pubertal after the first 87 days and at AI (13% and 33% respectively) was significantly greater ($P<0.05$) than L-H heifers (3% and 7%, Table 2). This difference is attributable to the lower BW and decreased ADG of the L-H heifers during the trial. Estrous response (73 vs 40%), 30 d AI pregnancy rates (83 vs 56%), and overall pregnancy rates (93 vs 66%) were greater ($P<0.05$) for CON compared to L-H, respectively. Synchronized pregnancy rates (46 vs 33%) and conception rates (50% for both) were similar ($P>0.05$) between CON and L-H, respectively. It is important to note that the synchronized pregnancy rates were higher than the number of heifers pubertal at AI. This reinforces the importance of using a synchronization treatment that utilizes a progestagen source to induce puberty in non-pubertal heifers. These results reinforce the importance of nutrition and weight gain prior to breeding to induce puberty and increase the heifer's chances of becoming pregnant during the breeding season.

In conclusion, data from this experiment indicates the importance of forage quality in heifer development. The data further emphasizes the importance of providing heifers the appropriate nutrition to maximize their growth potential and reach puberty prior to breeding. A nutritionally induced stress on growing heifers can have a great impact on growth and reproductive performance.

[1]Brad Austin, Gradute Student; Matt Hersom, Assistant Professor; Joel Yelich, Associate Professor, UF-IFAS Animal Sciences, Gainesville, FL

Table 1. Summary of growth performance of program supplemented heifers

	CON	L-H	*P* value
Body weight, lb			
d 0	565	566	0.93
d 89	658	545	0.0002
d 174	772	684	0.001
Hip height, in			
d 0	45.07	44.92	0.56
d 89	47.26	45.85	0.002
d 174	48.33	47.09	0.004
Heart girth, in			
d 0	59.11	58.39	0.15
d 89	62.47	57.98	<0.0001
d 174	65.44	62.53	0.001
Body length, in			
d 0	26.18	26.38	0.45
d 89	39.75	38.18	0.003
d 174	42.51	40.55	0.002

Table 2. Summary of reproductive performance of program supplemented heifers

	CON	L-H
Pubertal at d 87 (%)	4/30 (13)[e]	1/30 (3)[f]
Pubertal at d 174 (%)	10/30 (33)[e]	2/30 (7)[f]
Estrous response (%)[a]	22/30 (73)[e]	12/30 (40)[f]
Conception rate (%)[b]	11/22 (50)	6/12 (50)
Synchronized pregnancy rate (%)[c]	14/30 (46)	10/30 (33)
30 d AI pregnancy rate (%)[d]	25/30 (83)[e]	17/30 (56)[f]
Overall Pregnancy rate (%)	28/30 (93)[e]	17/30 (66)[f]

[a] Percentage of heifers displaying estrus during the 3 d after PGF_2 of the total treated.
[b] Percentage of heifers pregnant to AI of the total that exhibited estrus and were AI.
[c] Percentage of heifers pregnant during the synchronized breeding of the total treated
[d] Percentage of heifers pregnant to AI during the first 30 d of the breeding season of the total number of heifers.
[e, f] Means without a common superscript within a row differ (P<0.05)