# Effect of Supplement Timing on Blood Measurements and Reproductive Performance in Beef Heifers Grazing Annual Ryegrass in the Spring

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## Story in Brief

Forty Gelbvieh x Angus heifers (443 lb initial BW) were allocated randomly by weight to one of eight bermudagrass pastures overseeded with annual ryegrass to determine the impact of providing degradable carbohydrates at different intervals prior to breeding on conception rates, growth rates, and serum urea N concentrations. Two replicates received no supplement (C); 3 replicates each received 3.0 lb/head of supplement (32.5% ground corn, 32.5% cracked corn, 30% wheat middlings, and 5% liquid molasses) at approximately 0930 h daily beginning either 60 (60S) or 30 (30S) d prior to timed insemination (May 7). Heifers were weighed without prior removal from pasture and water at the initiation of the study and at approximately 28-day intervals. Blood samples were collected 7 d following the start of supplement and the day prior to timed insemination at 1230 and 1530 h. Available forage was measured and forage samples were clipped from each pasture on or immediately following weigh days. Total gains (avg 192 lb) did not differ ($P > 0.10$) among treatments. Serum urea nitrogen was lower ($P < 0.05$) from 60S than 30S on March 15, but not on April 13 or May 6. Serum glucose was not affected by treatment ($P > 0.94$), but was different among months ($P < 0.05$). Glucose increased between March and April ($P < 0.01$) and between April and May ($P < 0.05$). First-service conception rates were 33, 50, and 46% ($P > 0.10$) from C, 30S, and 60S, respectively. Overall conception rate from timed artificial insemination and natural service combined was 88.9, 79.6, and 61.5% for C, 30S, and 60S treatments, respectively, but was not different among treatments ($P > 0.14$). Preliminary results after yr 1 of the study suggests that timing supplementation strategically may alter blood measurements that have been previously shown to affect reproductive performance.

## Introduction

Arkansas producers frequently take advantage of the ability of cattle to obtain a high percentage of their protein and energy needs from both grazed and harvested forages. Recent studies of forages in Arkansas found that 59% of harvested forage samples tested contained adequate protein for a lactating beef cow, while only 29% contained adequate TDN (Davis et al., 1999). This suggests that a high proportion of forages have a high ratio of protein to energy. In addition, in Arkansas and the southeastern United States, beef cows and beef heifers frequently graze high quality cool season forages and small grains that have very high protein content, particularly relative to available energy in the rumen, thereby creating a situation in which rumen ammonia concentration and thus serum ammonia and serum urea nitrogen concentration may become elevated. Previous work has shown that the ratio of protein to fermentable carbohydrates in forages consumed by ruminants has important effects on blood and milk urea nitrogen. Low concentrations of readily fermentable carbohydrates contribute to the release of ammonia in the rumen and increased serum urea nitrogen. Forage from well-managed cool-season pastures often contains more than 25% CP and 20% rapidly degradable protein. Numerous studies have shown that high concentrations of serum urea nitrogen affect reproductive function and cause decreased pregnancy rates (Chapa et al., 2001). We hypothesize that supplementation of heifers grazing high protein cool season forages with energy sources prior to breeding may alter the serum urea nitrogen concentrations and enhance the reproductive performance.

## Experimental Procedures

This study was conducted at the University of Arkansas Division of Agriculture Southeast Research and Extension Center at Monticello.

*Animals.* Forty Gelbvieh x Angus heifers (442 lb initial BW) were allocated randomly by weight to one of eight groups and assigned randomly to one of eight pastures of bermudagrass (*Cynodon dactylon*) overseeded with annual ryegrass (*Lolium multiflorum*). Grazing began when adequate forage (1,700 to 2,000 lb/acre) was available. Available forage was measured on or immediately following weigh days. Forage samples were clipped from each pasture and composited into one large (400 g dry matter) sample for analysis of rumen degradable nitrogen in situ.

*Treatments.* Two replicates were provided no supplement feed (C). Three replicates were provided 3.0 lb/hd of a corn-based supplement feed (32.5% ground corn, 32.5% cracked corn, 30% wheat middlings, and 5% liquid molasses) 60 (60S) days prior to timed insemination (approximately May 5 to 10). Three replicates were provided 3.0 lb/hd with the same corn-based supplement 30 (30S) days prior to timed insemination. Supplement for the 60S treatment was discontinued at the time 30S was initiated. Each treatment group received supplement for a total of 30 days. Supplement was fed 7 d per week at approximately 1000 h daily to avoid disruption of the morning grazing period.

*Weighing and Sampling Procedures.* Heifers were weighed full at the initiation of the study and at approximately 28-day intervals. Blood samples for serum urea nitrogen (SUN) and glucose determination were obtained via jugular venipuncture 7 days following

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the start of supplement feeding and the day prior to timed insemination at 1230 h and 1530 h. Heifers were returned to their respective pasture following each blood sample collection.

*Blood Assays*. Serum urea nitrogen and serum glucose were determined on a Ciba-Corning 550 Express clinical analyzer (Global Medical Instrumentation, Ramsey, Minn.).

This paper will only focus on serum urea nitrogen and glucose concentrations in the months of March, April, May and June. It will examine the preliminary results of supplement effects and time effects on both variables, and will present preliminary results in regard to conception rates, to timed insemination (TAI), and overall pregnancy rates. The project will be conducted for a minimum of 2 years with the possibility of a third year if necessary. This paper discusses results of the first year.

*Breeeding*. A 6-day CIDR (controlled internal drug releasing device) protocol followed by timed artificial insemination similar to that described by Martinez et al. (2000) was used. Briefly, on April 28 CIDRs (Eazibreed, Pfizer, New York, N.Y.) were inserted and GnRH (gonadtrophin releasing hormone; 100 ug, IM.; Cystorelin; Merial; Duluth, Ga.) were given to all heifers. On May 4, CIDRs were removed and prostaglandin shots (25 mg IM; Lutalyse, Pfizer, New York, N.Y.) were given. On May 6, heifers were bled at 1230 h and 1530 h; then supplement was given to the 30S group following first bleeding. A second GnRH shot (100 ug) was given at approximately 4 pm on May 6, and all heifers were bred by timed artificial insemination (TAI) beginning at 900 h on May 7. At 10 d after TIA, heifers were moved to the Livestock and Forestry Branch Experiment Station at Batesville, and were exposed to a bull of proven fertility for an additional 50 d. Conception rate to TAI was determined by ultrasound at approximately 30 d post TAI, and overall pregnancy rate was determined at calving.

*Statistical analysis*. The MIXED procedure of SAS (SAS Institute, Inc., Cary, N.C.) was used to evaluate all continuous response variables. Data for repeated blood samplings 7 days following introduction of supplement feeding were analyzed as repeated measurements. Differences in conception rate to TAI and overall pregnancy rates were analyzed by Chi Square test.

## Results and Discussion

Total gains averaged 192 lb and did not differ ($P > 0.10$) among treatments. Average serum glucose and SUN by month and treatment are presented in Table 1. There was a treatment by month interaction ($P < 0.05$) for SUN. Serum urea nitrogen was lower ($P < 0.05$) from 60S than 30S on March 15, but not on April 13 or May 6. Serum glucose concentration did not differ among treatments ($P > 0.94$, Table 1), but was different among months ($P < 0.05$, Table 2). Glucose concentration was lowest in March and increased in April and May. Conception rate to TAI and overall pregnancy rates are depicted in Figure 1. First-service conception rates to TAI were 33, 50, and 46% ($P > 0.10$) from C, 30S, and 60S, respectively. Overall pregnancy rates (TAI and natural service combined) were 88.9, 79.6 and 61.5% for C, 30S, and 60S respectively, but were not different among treatments ($P > 0.14$). After one year of the study, it appears that timing supplementation strategically may alter blood measurements that have been shown to affect reproductive performance.

## Implications

The preliminary results from this study indicate that serum urea nitrogen concentrations in all heifer groups grazing ryegrass in the early spring were higher than concentrations that have been shown to cause a decrease in pregnancy rates. The 60S group had moderately lower SUN concentrations than the other two treatment groups in the early sampling period, suggesting that supplementation of this group at 60 d prior to TAI was beneficial in reducing SUN concentrations. Numerical differences were observed in both conception rate to TAI and overall pregnancy rate, but these differences were not statistically significant. Replication of this study will be required to validate these findings.

## Literature Cited


Chapa, A.M., et al. 2001. J. Dairy Sci. 84:908-916.

Davis, G.S., et al. 1999. Arkansas Research Series 478:104 -111.

Martinez, M.F., et al. 2000. Theriogenology 54:757.


**Table 1. Serum urea nitrogen, and serum glucose by treatment and month of sampling.**

| Item | Month | Treatment[1] C | 30S | 60S | SE |
|---|---|---|---|---|---|
| SUN[2] | March | 26.2[ab] | 29.1[a] | 25.2[b] | 1.44 |
| | April | 13.0 | 11.7 | 13.8 | 0.98 |
| | May | 7.0 | 7.8 | 8.6 | 0.85 |
| | Average[3] | 15.4 | 16.2 | 15.9 | 1.09 |
| GLU[2] | March | 79.9 | 87.5 | 92.7 | 7.01 |
| | April | 102.3 | 95.8 | 95.7 | 5.27 |
| | May | 101.4 | 105.7 | 100.1 | 5.34 |
| | Average[3] | 94.5 | 96.3 | 96.2 | 5.03 |

[1]C = Control with no supplement, 30S = Supplemented for 30 d starting 30 d before timed AI, 60S = Supplement for 30 d starting 60 d before timed AI.
[2]SUN: Serum urea nitrogen (mg/dl); GLU: serum glucose (mg/dl).
[3]Averages are average serum urea nitrogen and serum glucose within each treatment (column).
[a,b,c] Means in a row with different superscripts differ ($P < 0.05$).

**Table 2. Serum glucose concentration by month across treatments.**

| Month | GLU[1] | SE |
|---|---|---|
| March | 86.7[a] | 4.1 |
| April | 97.9[b] | 3.1 |
| May | 102.4[b] | 3.1 |

[1]GLU: Serum glucose (mg/dl)
[a,b,c]Means with different superscripts are different ($P < 0.05$).

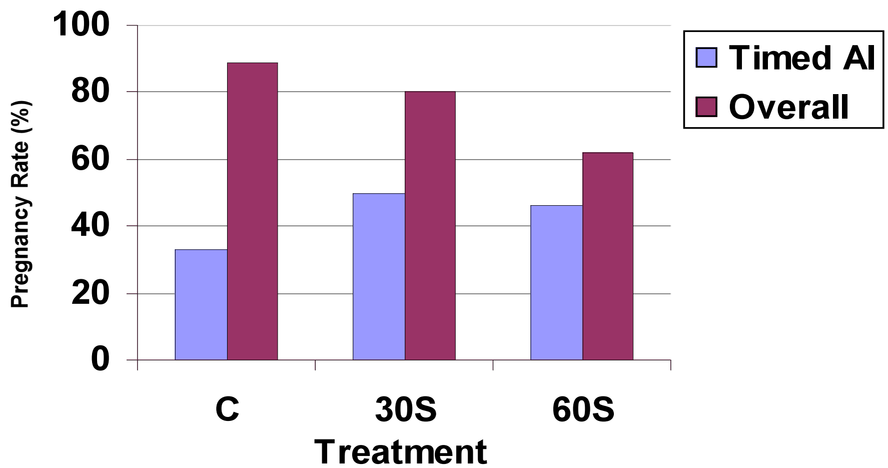


**Fig. 1. Pregnancy rate to timed artificial insemination (TAI) and overall pregnancy rate by treatment (C = Control with no supplement, 30S = Supplemented for 30 d starting 30 d before TAI, 60S = Supplemented for 30 d starting 60 d before timed AI; conception rate to TAI was determined by ultrasound at approximately 30 d post AI and overall pregnancy rate was determined at calving).**