Recent nutritional strategies to enhance reproductive performance of heifers – A summary of Range Cattle REC studies

Monday, November 28th, 2016.

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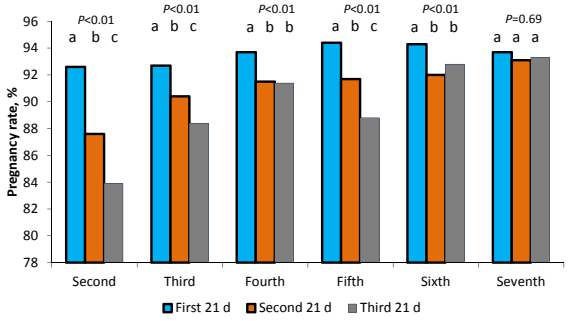
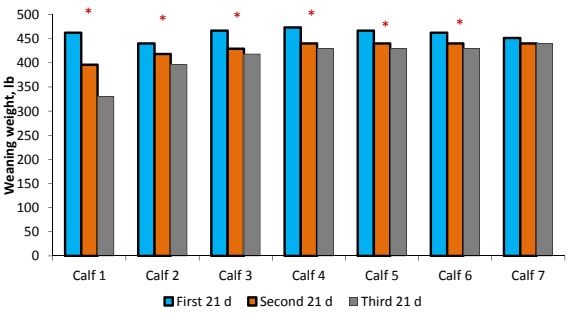
Why anticipate puberty?



Cushman et al. (2013) J. Anim. Sci. 91:4486

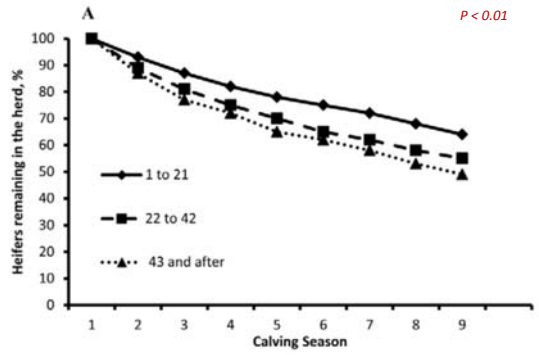
Why anticipate puberty?



First 21 d vs. Second and Third 21 d
* P < 0.05:

Cushman et al. (2013) J. Anim. Sci. 91:4486

Why anticipate puberty?



Cushman et al. (2013) J. Anim. Sci. 91:4486

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Study 1

Frequency of energy supplementation to beef heifers

Moriel et al. (2012) J. Anim. Sci. 90:2371–2380

Introduction

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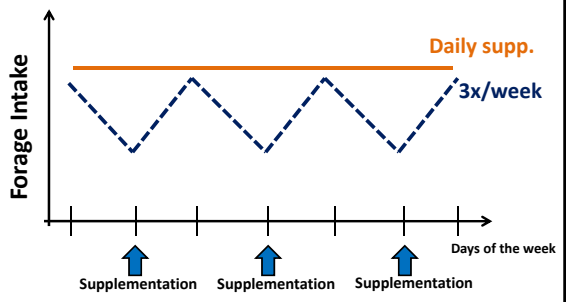
- Increased intake of low-quality forages by protein supplementation (Köster el al., 1996; Kunkle et al., 2000)
  - Not adequate energy intake by the animal (Bowman and Sanson, 1996)
- Replacement Beef Heifers
  - 55% TDN and 8.5% CP (NRC, 1996)
  - ADG ≥ 1 lb/day
- Supplemental energy is required (Caton and Dhuyvetter, 1997)

Introduction

- Supplementation Frequency
  - Typical strategy to decrease costs of production (labor, fuel, and equipment)
- Protein supplementation frequencies for cattle grazing low-quality forages
  - Did not alter cattle performance (Kunkle et al., 2000)

Introduction

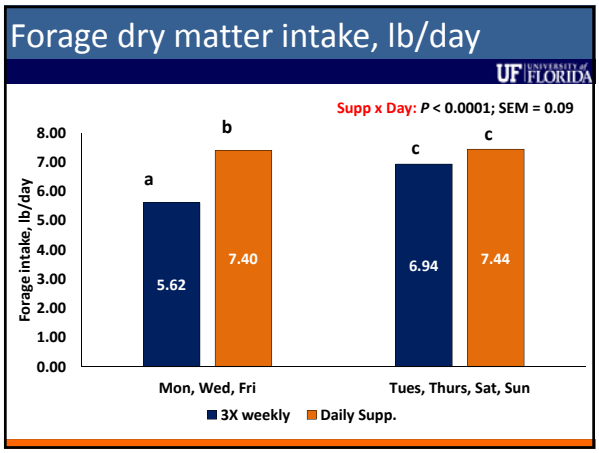


Materials and Methods

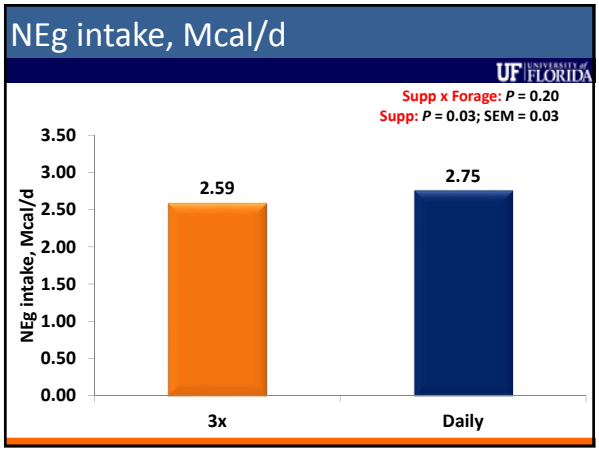
- 48 Brahman x Angus heifers
  - Initial BW = 531 ± 22 lb
  - Age = 294 ± 16 days
- Stratified by BW and age
  - Randomly assigned
  - 1 of 16 pens (3 heads/pen)

- Treatments randomly assigned to pens (3X or Daily)
- **Week 1 to 8** = Developing phase
- **Week 9 to 18** = Breeding season

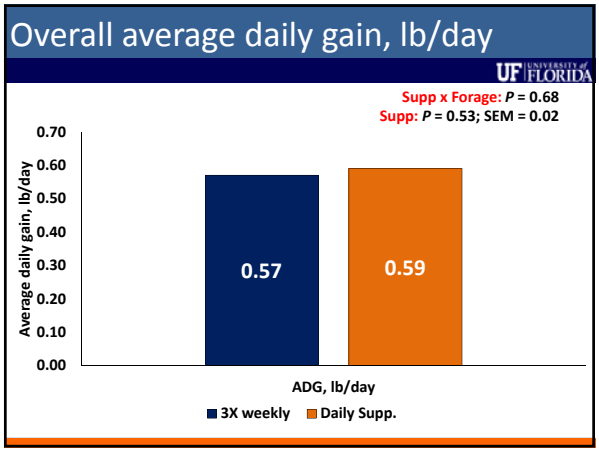
Forage dry matter intake, lb/day



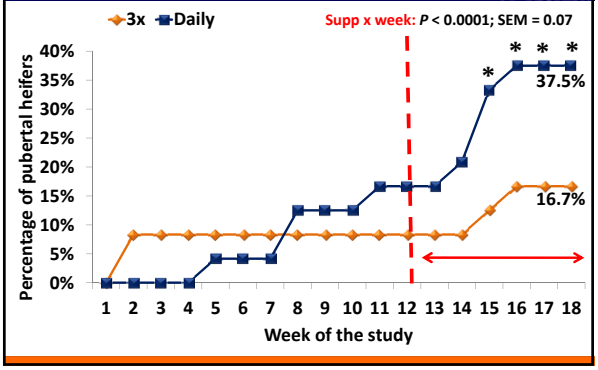
NEg intake, Mcal/d



Overall average daily gain, lb/day



Puberty achievement



Cooke et al. (2008) - J. Anim. Sci. 86:2296–2307

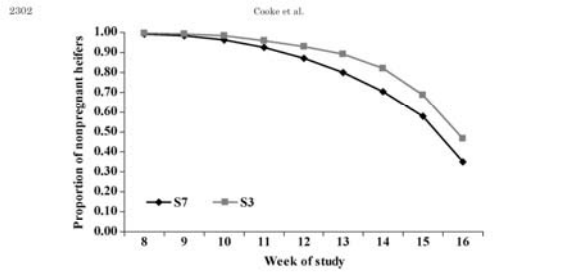
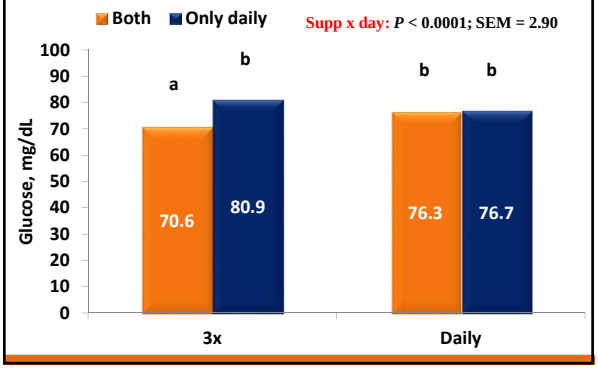
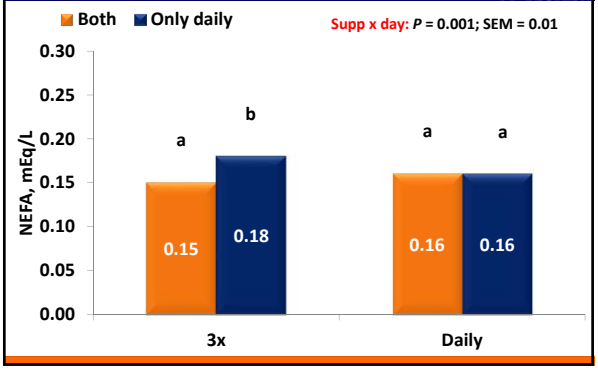


Figure 2. Proportion of nonpregnant heifers by week during the 60-d breeding season of Exp. 1. Survival curves represent heifers offered an energy supplement based on fibrous byproducts daily (S7) or 3 times weekly (S3), at a weekly rate of 18.2 kg of DM per heifer. Date of conception was estimated retrospectively by subtracting gestation length (286 d; Reynolds et al., 1980) from the calving date. A treatment effect was detected ($P = 0.02$).

Glucose, mg/dL



NEFA, mEq/L



Conclusion

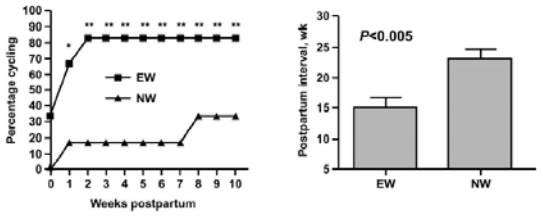
- Regardless forage quality, an increased frequency of energy supplementation led to:
  - Less variation on blood metabolites
  - Greater puberty achievement in development replacement beef heifers.

Study 2

Calf management systems for early-weaned heifers

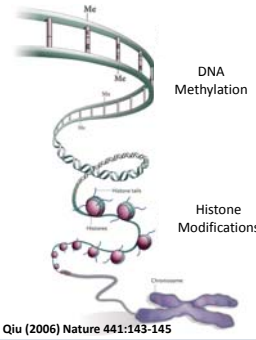
Moriel et al. (2014) J. Anim. Sci. 92:3096-3107.

Enhanced reproductive performance of EW primiparous cows



Arthington and Minton (2004) Prof. Anim. Sci. 20:34-38

Metabolic Imprinting



DNA Methylation

Histone Modifications

"…early adaptations to a nutritional stress/stimulus permanently change the physiology and metabolism of the organism and continue to be expressed even in the absence of the stimulus/stress that initiated them…"

"Metabolic Programming"
or
"Metabolic Imprinting"

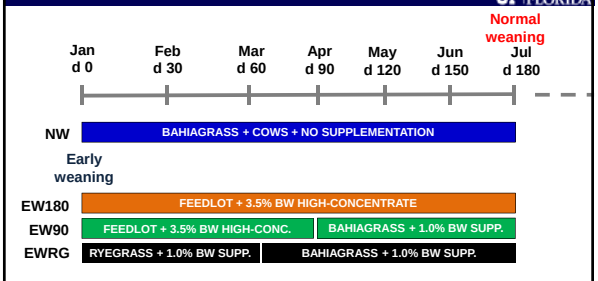
Lucas (1991)
CIBA Found. Symp. 156:38-50

Qiu (2006) Nature 441:143-145

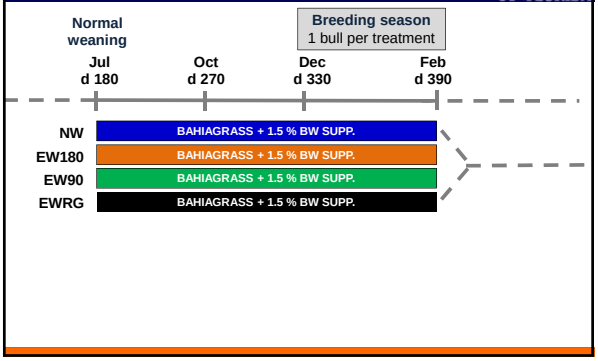
Metabolic imprinting study - Animals

- Brahman x British crossbred heifers
  (n = 40 and 38 in year 1 and 2)
  - Age = 72 ± 13 days
  - BW = 196 ± 35 lb
- Stratified by weight and age
- 4 treatments
  - 2 pens/trt annually

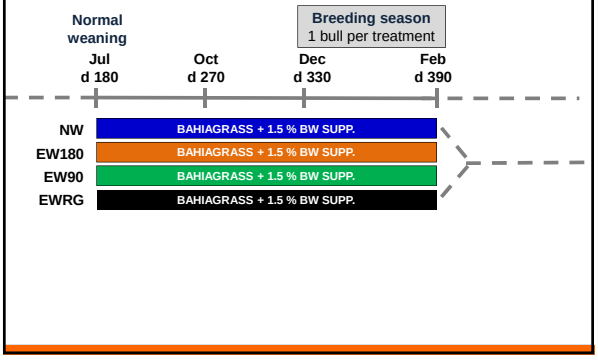
Treatments – Jan (d 0) to Jul (d 180)



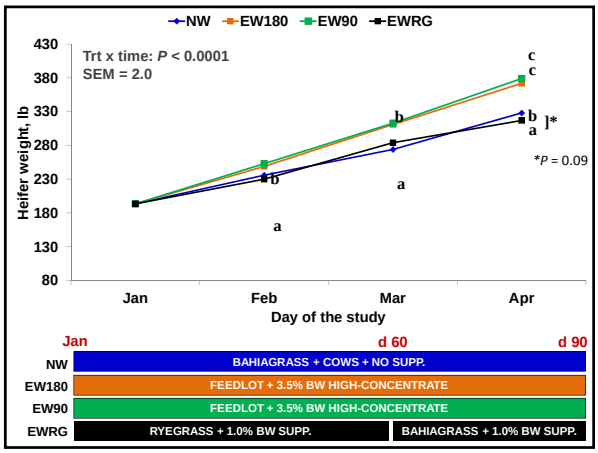
Treatments - Jul (d 180) to calving

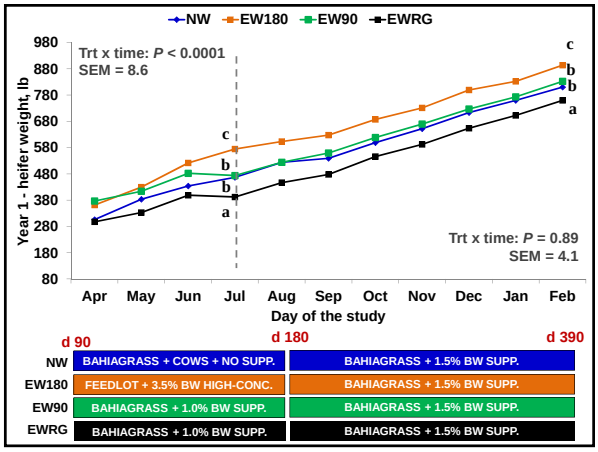


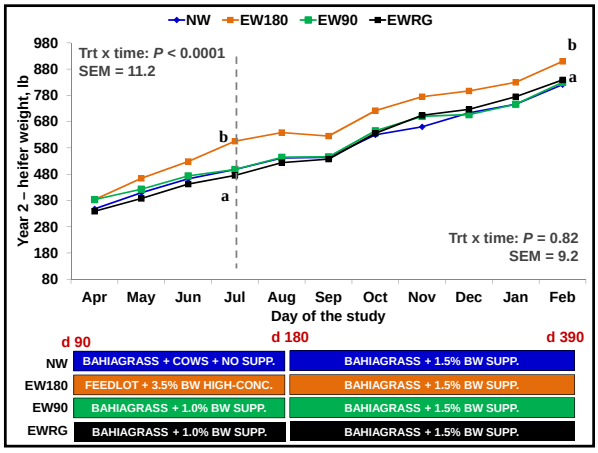
Treatments - Jul (d 180) to calving

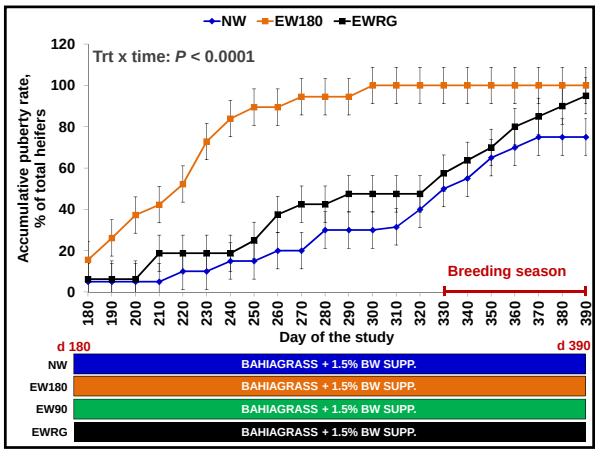


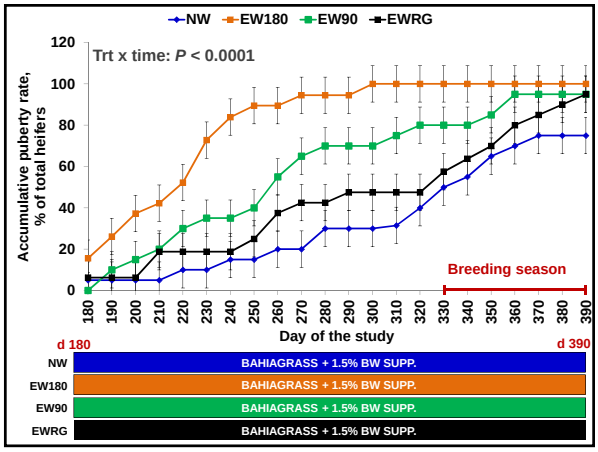
Results

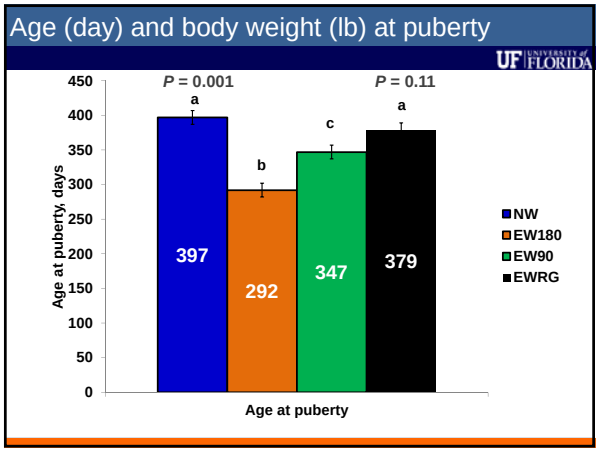

NW EW180 EW90 EWRG
Trt x time: P < 0.0001
SEM = 2.0
Heifer weight, lb
430
380
330
280
230
180
130
80
Jan
Feb
Mar
Apr
Day of the study
*P = 0.09
Jan
d 60
d 90
NW
BAHIAGRASS + COWS + NO SUPP.
EW180
FEEDLOT + 3.5% BW HIGH-CONCENTRATE
EW90
FEEDLOT + 3.5% BW HIGH-CONCENTRATE
EWRG
RYEGRASS + 1.0% BW SUPP.
BAHIAGRASS + 1.0% BW SUPP.


NW EW180 EW90 EWRG
Trt x time: P < 0.0001
SEM = 8.6
Year 1 - heifer weight, lb
980
880
780
680
580
480
380
280
180
80
Trt x time: P = 0.89
SEM = 4.1
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Day of the study
d 90
d 180
d 390
NW
BAHIAGRASS + COWS + NO SUPP.
BAHIAGRASS + 1.5% BW SUPP.
EW180
FEEDLOT + 3.5% BW HIGH-CONC.
BAHIAGRASS + 1.5% BW SUPP.
EW90
BAHIAGRASS + 1.0% BW SUPP.
BAHIAGRASS + 1.5% BW SUPP.
EWRG
BAHIAGRASS + 1.0% BW SUPP.
BAHIAGRASS + 1.5% BW SUPP.

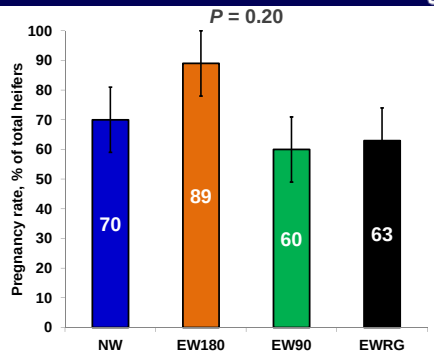

NW EW180 EW90 EWRG
Trt x time: P < 0.0001
SEM = 11.2
Year 2 – heifer weight, lb
980
880
780
680
580
480
380
280
180
80
Trt x time: P = 0.82
SEM = 9.2
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Day of the study
d 90
d 180
d 390
NW
BAHIAGRASS + COWS + NO SUPP.
BAHIAGRASS + 1.5% BW SUPP.
EW180
FEEDLOT + 3.5% BW HIGH-CONC.
BAHIAGRASS + 1.5% BW SUPP.
EW90
BAHIAGRASS + 1.0% BW SUPP.
BAHIAGRASS + 1.5% BW SUPP.
EWRG
BAHIAGRASS + 1.0% BW SUPP.
BAHIAGRASS + 1.5% BW SUPP.


NW
EW180
EWRG
Trt x time: P < 0.0001
Accumulative puberty rate, % of total heifers
Breeding season
Day of the study
d 180
d 390
NW
EW180
EW90
EWRG
BAHIAGRASS + 1.5% BW SUPP.


NW
EW180
EW90
EWRG
Trt x time: P < 0.0001
Accumulative puberty rate, % of total heifers
Breeding season
Day of the study
d 180
d 390
NW
EW180
EW90
EWRG
BAHIAGRASS + 1.5% BW SUPP.


Age (day) and body weight (lb) at puberty
UF UNIVERSITY of FLORIDA
P = 0.001
P = 0.11
a
b
c
a
397
292
347
379
Age at puberty, days
NW
EW180
EW90
EWRG
Age at puberty

Pregnancy rate, % of total heifers



Summary - Heifers

- **EW + Ryegrass grazing and EW + high-concentrate**
  - Similar or greater growth performance than NW
- **EW + high-concentrate diet**
  - Greater percentage of EW90 heifers cycling before the breeding season compared to NW heifers <u>despite similar BW gain</u>

Study 3

Should I mix cottonseed meal with Sugarcane molasses in a slurry form, or offer them separately to beef heifers?

Martins et al. (2016) The Professional Animal Scientist 32(2016):302–308

Sugarcane Molasses

- Commercially available molasses-based liquid supplements usually rely on NPN to increase CP concentrations (Pate et al., 1995).
- Adding cottonseed meal (**CSM**) to molasses–urea mixture improved growth performance of younger cows compared with an isonitrogenous, isocaloric molasses–urea supplement (Pate et al., 1990).
- **Currently, the mixing of dry feeds with molasses is performed manually or through relatively expensive equipment that are not widely spread among cow-calf operations.**

Objective

- Compare two sugarcane molasses feeding systems on measures of performance of replacement beef heifers
  - Slurry: cottonseed meal thoroughly mixed into molasses
  - Cottonseed meal provided in a concrete bunk, separate from molasses

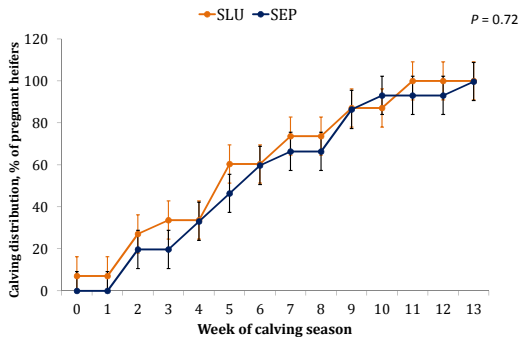
Materials and methods

- 48 Brangus crossbred heifers
  Weight = 520 ± 10 lb; Age = 335 ± 5 days
- 12 bahiagrass pastures (4 heifers/pasture)
  - 70 lb of blackstrap molasses and 14 lb of cottonseed meal for 70 days
  - Mondays and Thursdays

Results

Item	Treatment[1] SLU	Treatment[1] SEP	SEM	P-value Treatment	P-value Treatment × day
Body weight, lb					
day 0	515	513	12.6	0.74	0.98
day 35	524	522			
day 70	546	540			
ADG, lb/d					
day 0 to 35	0.09	0.18	0.095	0.41	-
day 35 to 70	0.66	0.53	0.096	0.27	-
day 0 to 70	0.37	0.35	0.066	0.82	-
Percentage of mature weight on day 70	45.4	45.0	1.23	0.76	-
Overall pubertal heifers, %	18.9	7.8	5.79	0.10	0.89
Overall pregnancy, %	51.2	47.9	11.4	0.81	-

Results



Summary

1. Cottonseed meal and molasses could be offered separately rather than in a slurry form without affecting growth and reproductive performance of grazing replacement beef heifers.

2. By providing cottonseed meal and molasses separately, cow-calf operations should be able to reduce labor and further lower feed costs leading to greater profitability compared to providing cottonseed meal and molasses in a slurry form.

Thank you

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