Effects of a High-linoleic Sunflower Seed Supplement on Performance and Reproduction of Primiparous Beef Cows and their Calves

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Story in Brief

An experiment was conducted to evaluate the performance and reproductive responses by gestating beef cows to replacing a portion of a conventional winter supplement with a moderate protein, high fat supplement (whole sunflower seed). During late-gestation, 56 primiparous spring calving beef cows were fed one of two treatments for 65 d. Treatments included: 1) 1.5 lb/d of high-linoleic sunflower seed and 2.5 lb/d of range cubes (Linoleic, AF basis); and 2) 4.0 lb/d of range cubes (Control, AF basis). During the treatment period, cows fed Linoleic lost 22 lb more weight than cows fed Control. However, from the end of supplementation to the start of breeding cows previously fed Control lost 31 lb more than Linoleic cows. From the start of breeding until weaning Linoleic cows tended to gain 19 lb more than Control cows. However, cow body weight at weaning and body condition score throughout the experiment were similar between the two treatments. Furthermore, late-gestation supplement had no effect on calf birth weight, calf weaning weight or cow reproductive performance. Similarly feedlot performance and carcass characteristics of steer calves were not influenced by late-gestation cow supplement. In conclusion, it appears that whole sunflower seed can replace a portion of a traditional winter supplement without any effects (positive or negative) on cow reproductive performance or calf performance.

Key words: Beef, Cows, Fat Supplementation

Introduction

Two-yr-old primiparous cows represent the greatest reproductive risk in the beef herd; consequently, special attention to management of this age class of cow is necessary to insure low reproductive failure. Fat supplementation is one management strategy that has been evaluated as a means to improve reproductive efficiency through increased functional capability of the ovary and/or reduced $PGF_{2\alpha}$ synthesis by the uterus (Williams and Stanko, 2000). Limited research suggests that fat supplementation during late-gestation may improve reproductive efficiency of beef cows (Bellows et al., 2000; Graham et al., 2001).

Whole sunflower seeds have several desirable supplement characteristics, including a high fat concentration, a moderate concentration of protein, and excellent storage and handling characteristics. However, excessive fat supplementation may reduce forage intake and fiber digestion (Jenkins et al., 1993). The objective of this study was to determine the effects of replacing a portion of a conventional winter supplement with high-fat whole sunflower seed during late-gestation on performance and reproduction of primiparous beef cows and performance of their calves.

Materials and Methods

During the winter of 2002-2003, 56 two-yr-old primiparous spring calving Angus x Hereford beef cows were ranked by body condition score (BCS) and sequentially assigned to dietary treatments in a completely randomized design to determine responses to two late-gestation supplements on cow and calf performance. The 65-d treatment period began on November 27, 2002, and ended on January 31, 2003. During this time, cows were grazed together in a native grass pasture and had free choice access to a mineral supplement (Salt 24.6%, Ca 16.8%, P 8.7%, Cu 1,038 ppm, Zn 3,099 ppm, and Se 12 ppm; DM basis) and water. Forage availability was abundant throughout late-gestation, therefore no hay was provided.

Treatments included: 1) 1.5 lb/d of high-linoleic sunflower seed and 2.5 lb/d of range cubes (Linoleic, AF basis); and 2) 4.0 lb/d of range cubes (Control, AF basis). Range cubes contained 20% CP, AF basis. Each supplement was formulated to provide similar amounts of CP and degradable intake protein (Table 1). Due to the high fat content of the sunflower seeds, the Linoleic treatment provided more TDN than the Control treatment (Table 1). Cows were individually fed the appropriate supplement on Monday, Tuesday, Thursday, and Saturday mornings. The amount of supplement fed on each of these 4 d was determined by calculating the amount of supplement needed on a weekly basis (daily supplement amount x 7 d) and dividing that amount by four. Following the treatment period, all cows were fed 6 lb of 20% CP range cubes per day until April 10, 2003, when all supplementation was terminated due to vegetative growth of forage. Cows grazed in a common pasture until weaning.

Table 1. Supplement composition and amount of nutrients supplied daily

	Treatment	
	Control	Linoleic
Linoleic sunflower seed, lb of DM	-	1.35
Range cubes 20% CP, lb of DM	3.60	2.25
CP supplied, lb/d	.81	.80
TDN supplied, lb/d	2.5	3.4
Fat, lb/d	.16	.69

Individual weight and BCS (1 = emaciated, 9 = obese) of each cow was determined at the beginning and end of the supplementation period, at the onset of breeding and at weaning.

The 64-d calving season lasted from February 2 to April 7, 2003, (avg calving date: February 20, 2003). Percent of cows cycling at the start of the breeding season was determined by measuring progesterone concentration in plasma samples obtained 10 d before and on the first d of the breeding season. The 66-d breeding season began on May 12 and lasted until July 17, 2002. Cows were bred using artificial insemination from May 12 through May 29, followed by natural mating from May 29 through July 17. First service conception rate was determined using transrectal ultrasonography approximately 30 d after insemination. Pregnancy rate was determined by rectal palpation at weaning. Birth weight of each calf was determined within 24 h of birth and gross weaning weight was determined on October 2, 2003.

At weaning, all steer calves were transported to the Willard Sparks Beef Research Center to determine the effects of late-gestation cow nutrition on subsequent calf feedlot performance and carcass characteristics. Steers were randomly assigned to pens based on treatment and fed a high-concentrate finishing ration for 190 d until harvest. Feedlot arrival and out weight were determined on each steer and a 4% pencil shrink was applied to these weights to calculate shrunk in weight, shrunk out weight, and ADG. Steers were harvested at Excel Corporation (Dodge City, KS) and chilled for 72 h before collection of carcass data.

Statistical Analysis

Cow and Calf Performance. Cow was considered to be the experimental unit because supplements were fed individually. Data were analyzed using MIXED MODEL procedures of SAS (SAS Inst. Inc., Cary, NC). The initial model included treatment as a fixed effect and cow sire as a random effect. The calf performance data was analyzed using calf sex as a fixed effect and calf sire as a random effect. Calf age was also used as a covariate in the calf weaning weight model. Least squares means were separated using the least significant difference procedure of SAS.

Cow Reproductive Performance. A 2 x 3 contingency table was developed for proportion differences among treatments for pregnancy rate, percent cycling, and first service conception rate and tested using a chi-square test. Data were analyzed using FREQ procedures of SAS.

Feedlot Performance and Carcass Characteristics. Steer was considered to be the experimental unit because supplements were individually fed to their dams during late-gestation. Data were analyzed using MIXED MODEL procedures of SAS. The model included treatment as a fixed effect and cow sire and calf sire as random effects. In addition, calf age was included as a covariate. Least squares means were separated using the least significant difference procedure of SAS. A 2 x 3 contingency table was developed for proportion differences among treatments for percent choice or greater and tested using a chi-square test. Data were analyzed using FREQ procedures of SAS.

Results and Discussion

Cow Weight Change and BCS. Cows fed Linoleic lost 22 lb more ($P<.01$) weight during the late-gestation treatment period compared with cows fed Control (Table 2). However, from the end of supplementation to the start of the breeding season, cows previously fed Linoleic lost ($P<.01$) 31 lb less than control cows (Table 2). Additionally, Linoleic supplemented cows tended to gain more weight between the beginning of the breeding season and weaning compared with Control supplemented cows. Cow body weight at weaning and BCS throughout the experiment were not significantly different between treatments (Table 2).

Table 2. Effect of late-gestation supplement on cow weight change (WC) and body condition score (BCS)				
	Treatment			
Item	Control	Linoleic	SEM[b]	P-value
Number of cows	26	30		
Initial weight, lb (11/27/02)	1044	1041	35	.87
Supplementation WC, lb (11/27 to 1/31/03)	-29	-51	7	<.01
WC to breeding, lb (1/31 to 5/12/03)	-101	-70	8	<.01
WC to weaning, lb (5/12 to 10/2/03)	66	85	12	.05
Overall WC, lb (11/27/02 to 10/2/03)	-67	-40	15	.06
Final weight at weaning, lb (10/2/03)	975	998	30	.24
Initial BCS, (11/27/02)[a]	5.9	5.8	.3	.34
Supplementation BCS, (1/31/03)	5.4	5.3	.1	.19
Start of breeding BCS, (5/12/03)	5.0	4.9	.1	.33
Final BCS at weaning, (10/2/03)	4.8	4.8	.1	.87

[a]BCS: 1= emaciated, 9 = obese.
[b]Most conservative standard error of the mean (n=26).

Calf Performance. Late-gestation supplement did not influence calf birth weight (72 lb) or calf weaning weight (475 lb; Table 3).

Table 3. Effect of late-gestation supplement on calf birth weight and weaning weight				
	Treatment			
Item	Control	Linoleic	SEM[b]	P-value
Number of calves	26	30		
Calf birth weight, lb	73	70	2	.13
Calf weaning weight, lb[a]	485	480	17	.67

[a]Gross weaning weights are reported (avg calf age = 223 d).
[b]Most conservative standard error of the mean (n=26).

Cow Reproductive Performance. Late-gestation supplement did not influence percent of cows cycling at the start of the breeding season (29%), first service conception rate (70%), or pregnancy rate at weaning (80%; Table 4). The low percentage of cows cycling at the start of the breeding season and the low pregnancy rates are most likely due to the fact that the cows were in a negative energy balance during the supplementation period as evidenced by their weight loss, during this period. By providing additional energy, during the winter, either as high quality hay or an increase in the amount of range cubes fed would be expected to increase pregnancy rates.

Table 4. Effect of late-gestation supplement on cow reproductive performance

	Treatment		
Item	Control	Linoleic	P-value
Number of cows	26	30	
Days from calving to the start of the breeding season	83	77	.21
Cows cycling at the start of the breeding season, %	23	33	.40
Pregnancy rate at weaning, %	73	87	.20
Number of cows	9	11	
First service conception rate, %	67	73	.77

Feedlot Performance and Carcass Characteristics. Supplements fed to cows during late-gestation did not influence feedlot performance or carcass characteristics of their steer calves (P>.15; Table 5).

Table 5. Effect of late-gestation supplement on steer feedlot performance and carcass characteristics

	Treatment			
Item	Control	Linoleic	SEM	P-value
Number of steers	9	13		
Feedlot in weight, lb	442	453	18	.48
Feedlot out weight, lb	1122	1151	28	.34
ADG, lb	3.58	3.66	.11	.58
Hot carcass weight, lb	719	717	21	.93

Backfat thickness, in	.55	.51	.12	.63
Ribeye area, in^2	12.6	12.5	.4	.88
Kidney, pelvic, heart fat, %	2.7	2.4	.3	.15
Calculated yield grade	3.17	3.14	.25	.90
Marbling score, Small 00 = 40	44	45	1.9	.59
% Choice or greater	89	84	-	.77

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