SUPPLEMENTATION OF WHOLE SUNFLOWER SEEDS BEFORE AI IN BEEF HEIFERS[1,2]

R. N. Funston[3], T. W. Geary[4], R. P. Ansotegui[3], J. J. Lipsey[5], M. D. MacNeil[4], and J. A. Paterson[3]
[3]Montana State University, Bozeman, [4]USDA-ARS, Miles City, MT, and [5]American Simmental Association, Bozeman, MT

ABSTRACT: The objective of this study was to evaluate synchronization and pregnancy rates of beef heifers supplemented with 0.91 kg of whole sunflower seeds for either 0, 30, or 60 d before AI. Beef heifers from four locations (n = 1,014) were assigned by BW to treatment (within location) and randomly to AI sire. Heifers at Location 1 (n = 176; mean BW = 332 kg) received either 0 or 60 d treatments. Heifers at Location 2 (n = 397; mean BW = 334 kg) were fed sunflower seeds for 0, 30, or 60 d. Heifers at Locations 3 (n = 211; mean BW = 345 kg) and 4 (n = 230; mean BW = 343 kg) received 0 or 30 d treatments. Within location, diets were formulated to be isocaloric and isonitrogenous. All heifers received melengesterol acetate (0.5 $mg·hd^{-1}·d^{-1}$) for 14 d followed 19 d later by an injection of PGF (25 mg). Heifers were bred by AI approximately 12 h after the onset of estrus except on d 3 during which all heifers which had not exhibited estrus were time inseminated. Data were combined for Locations 1 and 2 to test the effect of 0 and 60 d sunflower feeding. Data from Locations 2, 3, and 4 were combined to test the effect of 0 and 30 d sunflower feeding. Heifers fed the control diet had a higher ($P < 0.01$) ADG than heifers fed sunflower seeds for 60 d. There was a location × treatment interaction ($P < 0.01$) for ADG in the comparison of 30 and 0 d sunflower treatments. Neither 72 h estrous response nor pregnancy rate were affected ($P > 0.10$) by 30 or 60 d sunflower feeding. There was no interaction of location by treatment ($P > 0.10$) in either analysis; therefore, data were pooled across locations to test differences among all three treatments. Neither estrous response nor pregnancy rate were affected ($P > 0.10$) by treatment. Pregnancy rate for heifers detected in estrus was 68% and 33% for mass bred heifers, estrous response by 72 h was 71%. In summary, feeding 0.91 kg of whole sunflower seeds for either 30 or 60 d before AI did not improve estrous response or pregnancy rate.

Key Words: Estrous Synchronization, Heifers, Fat Supplementation

Introduction

Proper nutritional inputs are important for adequate growth and development of replacement heifers to ensure attainment of puberty and early conception in the breeding season. Yearling heifers that conceive early in the breeding season have a greater lifetime productivity than heifers that conceive later in the breeding season (Lesmeister et al., 1973). Replacement heifer development can be a major cost to a beef cattle operation, and therefore it is desirable to minimize inputs and also achieve acceptable pregnancy rates. Heifer development systems are generally forage based; however, nonstructural carbohydrates, such as cereal grains, are generally required at some point in the feeding period to achieve weight gains needed for attainment of puberty before the breeding season. Supplemental lipids have been used to increase energy density of a ration and avoid potential negative effects on forage digestion (Coppock and Wilks, 1991) associated with starch supplementation (Bowman and Sanson, 1996). Supplemental lipids may also have direct positive effects on reproduction in beef cattle independent of its energy contribution. Feeding supplemental dietary fat increased serum and follicular fluid cholesterol, serum progesterone, lifespan of induced corpus luteum, and number of beef cows ovulating (Williams and Stanko, 1999). Lammoglia et al. (2000) reported that heifers fed safflower seeds (4.4% dietary fat) for 162 d tended to have a higher percentage reaching puberty at the beginning of the breeding season than did heifers fed no added dietary fat, but no difference in overall pregnancy rate. Diet × sire breed interaction suggested that the response to fat supplementation may have been breed dependent (Lammoglia et al., 2000). Heifers fed supplemental fat also had higher cholesterol and progesterone concentrations than nonfat supplemented heifers. It was hypothesized that a shorter feeding period may have been more effective in improving reproduction in replacement heifers. The objectives of this study were to evaluate the effects of supplemental dietary fat on estrous synchronization and pregnancy rates in beef heifers.

Materials and Methods

Beef heifers, primarily of British breed composition, (body condition score, **BCS** = 5 to 6) from four locations (n = 1,014) were assigned by BW to treatment (within location) and randomly to AI sire. Whole sunflower seeds (0.91 $kg·hd^{-1}·d^{-1}$) were included in a total mixed diet for 60, 30, or 0 d before PGF injection. Heifers at Location 1 (n = 176; mean BW = 332 kg) received sunflower seed diets for 0 or 60 d. Heifers at Location 2 (n = 397; mean BW = 334 kg) were fed sunflower seeds for 0, 30, or 60 d. Heifers at Locations 3 (n = 211; mean BW = 345 kg) and 4 (n = 230; mean BW = 343 kg) received sunflower seeds for 0 or 30 d. Within location, diets were formulated to be isocaloric and isonitrogenous (Table 1).

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Table 1. Composition of experimental diets

Diet	Sunflower	Control
Location 1		
Constituent		
Alfalfa hay	42[a]	31[a]
Corn silage	33	35
Barley straw	10	10
Sunflower seeds	10	0
Wheat middlings	0	19
Supplement	5	5
Analysis		
Dry matter, %	59.8	58.1
Crude protein, %	12.7	12.7
TDN, %	66.8	65.4
Fat, %	6.7	3.2
Location 2		
Constituent		
Alfalfa hay	22	12
Clover hay	22	11
Barley straw	22	25
Grain hay	21	24
Sunflower seeds	11	0
Barley grain	0	26
Supplement	2	2
Analysis		
Dry matter, %	71.1	70.2
Crude protein, %	15.8	14.4
TDN, %	56.2	56.8
Fat, %	6.4	2.3
Locations 3 and 4		
Constituent		
Corn grain	25	38
Corn silage	20	20
Alfalfa hay	26	17
Sunflower seeds	12	0
Corn gluten feed	0	12
Barley straw	14	9
Supplement	3	3
Analysis		
Dry matter, %	70.0	69.8
Crude protein, %	11.6	11.7
TDN, %	70.5	68.8
Fat, %	7.1	3.4

[a]Percentage of diet; DM basis.

All heifers received melengesterol acetate (0.5 mg·hd^{-1}·d^{-1}) for 14 d followed 19 d later by an injection of PGF (25 mg; d 0). Heifers were bred by AI approximately 12 h after the onset of estrus except on Day 3 during which all heifers which had not exhibited estrus were time inseminated. Pregnancy status was determined by ultrasound approximately 40 d after AI. Heifers were weighed approximately 60 d before and at the time of PGF, except at location 3 where weights were taken 30 d before PGF to determine if diet affected ADG.

Two blood samples were collected 1 wk apart from heifers assigned to the 60 d and control diets before the beginning of sunflower feeding at Location 2. Blood samples were analyzed for progesterone using coat-a-count tubes (Kit TKPGX; DPC, Los Angeles, CA) as described by Bellows et al. (1991) to determine percentage cycling before treatments were imposed.

Data were combined for Locations 1 and 2 to test the effect of 0 and 60 d sunflower feeding. Data from Locations 2, 3, and 4 were combined to test the effect of 0 and 30 d sunflower feeding. Data were analyzed using PROC MIXED of SAS (SAS Inst. Inc., Cary, NC). Location, treatment, and method of AI (bred on estrus or timed) were fixed effects and sire was considered a random source of variation. The model was reduced by backward elimination of nonsignificant interactions until only the main effects remained.

Results and Discussion

Heifers fed the control diet had a greater (0.77 kg/d; $P < 0.01$) ADG than heifers fed sunflower seeds (0.64 kg/d) for 60 d. There was a location × treatment interaction ($P < 0.01$) for ADG in the comparison of 30 and 0 d sunflower treatments (Table 2). It was previously reported that feeding greater than 5% of total dry matter intake as fat can markedly reduce fiber digestibility and reduce dry matter intake in ruminants (Williams and Stanko, 1999). However, certain types of fat-containing feedstuffs have been fed at levels greater than 5% without negative effects. It is hypothesized that oilseeds can be fed at greater levels because ruminal metabolism of the oil is slowed by the fibrous seed coat, and a portion actually bypasses through the rumen intact (Coppock and Wilks, 1991). It is possible that the sunflower feeding inhibited fiber digestion in the 60 d treatments and at Location 3 in the 30 d treatment. It is not clear why the differences in ADG were not consistent across location and treatment, because the same levels of sunflowers were fed but for different lengths of time. Regardless of the effect on performance, neither 72 h estrous response nor pregnancy rate were affected ($P > 0.10$) by 30 or 60 d sunflower feeding. There was no interaction of location × treatment ($P > 0.10$) in either analysis; therefore, data were pooled across locations to test differences among all three treatments. Neither estrous response nor pregnancy rate were affected ($P > 0.10$) by treatment. Means for pregnancy rate by location and treatment are presented in Table 3. Pregnancy rate for heifers detected in estrus was 68% vs 33% for time bred heifers. Estrous response by 72 h was 71% in the present study. Lammoglia et al. (2000) reported a response to fat supplementation on puberty in beef heifers; however, this was dependent on genotype with leaner animals having a positive response. Regardless, no differences in final pregnancy rate were detected. Heifers in the present study were all in adequate body condition (BCS 5 to 6) and a high percentage were cycling before treatments began at Location 2 (92 and 93%, for heifers assigned to 60 d and control diets, respectively). Cattle experiencing a greater nutritional challenge appear to be more responsive to supplemental nutrients (DelCurto et al., 1999). There may have been a positive response to fat supplementation had the heifers been nutritionally stressed or not cycling before treatment. In summary, feeding 0.91 kg of whole sunflower seeds for either 60 or 30 d before AI did not improve estrous response or pregnancy rate in beef heifers in good body condition.

Implications

Supplementing beef heifers with dietary fat in the form of whole sunflower seeds did not improve estrous response to synchronization or pregnancy rate to AI. Heifers with a lower body fat composition and(or) different genetic makeup may have a dietary fat requirement different from the heifers in the present study and respond favorably to lipid supplementation before estrous synchronization and AI.

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Table 2. Dry matter intake (kg/d) and average daily gain (kg/d) by treatment

Location	Dry matter intake	Treatment: Control	30 d sunflower	60 d sunflower
1	7.5	.59		.48
2	8.6	.93	.89	.81
3	6.8	.28	.16	
4	6.8	-.21	.16	

Table 3. Actual means for pregnancy rate (%) by location ($P > 0.10$)

Location	N	Treatment: Control	30 d sunflower	60 d sunflower
1	176	55		45
2	397	61	66	61
3	211	56	62	
4	230	54	52	