The Professional Animal Scientist 18 (2002):254–257

Supplementation with Whole Sunflower Seeds Before Artificial Insemination in Beef Heifers[1]

R. N. FUNSTON*, [2], T. W. GEARY†, R. P. ANSOTEGUI*, R. J. LIPSEY‡, and J. A. PATERSON*
*Montana State University, Bozeman, MT 59717; †USDA-ARS, Fort Keogh Livestock and Range Research Laboratory, Miles City, MT 59301; and ‡American Simmental Association, Bozeman, MT 59717

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 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 sunflower seed 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 sunflower seed treatments. Within location, diets were formulated to be isocaloric and isonitrogenous. All heifers received melengesterol acetate (0.5 mg/d per head) for 14 d followed 19 d later by an injection of prostaglandin $F_{2\alpha}$ ***(PGF)** *(25 mg). Heifers were bred by AI according to the AM/PM rule except on d 3 when all heifers that had not exhibited estrus were artificially inseminated in mass. Neither 72-h estrous response nor pregnancy rate was affected (P>0.10) by 30- or 60-d sunflower feeding. 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 when compared with controls.*

(Key Words: Estrous Synchronization, Heifers, Fat Supplementation.)

Introduction

Proper nutrition is important for adequate growth and development of replacement heifers to ensure that heifers are at puberty and can conceive early 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 (6). Replacement heifer development can be a major cost to a beef cattle operation, and, therefore, it is desirable to minimize inputs and achieve acceptable pregnancy rates. Heifer development systems are generally forage based; however, nonstructural carbohydrates, such as found in cereal grains, are generally required at some point in the feeding period to achieve BW gains needed for puberty before the breeding season. Supplemental lipids have been used to increase energy density of a ration and avoid the potential negative effects on forage digestion (3) that are associated with starch supplementation (2). Supplemental lipids may also have direct positive effects on reproduction in beef cattle, independent of their energy contribution. Supplemental dietary fat has previously been shown to increase serum and follicular fluid cholesterol, serum progesterone, lifespan of induced CL, and number of beef cattle ovulating (8). Lammoglia et al. (5) found that heifers fed safflower seeds (4.4% dietary fat) for 162 d tended (*P*=0.08) to reach puberty at the beginning of the breeding season in greater percentages than heifers fed no added dietary fat, but there was no difference in overall pregnancy rate. The diet × sire breed interaction suggested that the response to fat supplementation might be breed dependent; however, heifers fed supplemental fat also had greater cholesterol and progesterone concen-

[1]This research was conducted under cooperative agreement between USDA-ARS and the Montana Agricultural Experiment Station. The USDA-ARS is an equal opportunity/affirmative action employer, and all agency services are available without discrimination. Mention of a proprietary product does not constitute a guarantee or warranty of the product by USDA, Montana Agricultural Experiment Station, or the authors and does not imply its approval to the exclusion of other products that may also be suitable.

[2]To whom correspondence should be addressed: r-funston2@unl.edu

TABLE 1. Composition of experimental diets.

Item	Sunflower	Control
	(%, DM basis)	
Location 1		
Constituent		
Alfalfa hay	42	31
Corn silage	33	35
Barley straw	10	10
Sunflower seeds	10	0
Wheat middlings	0	19
Supplement	5	5
Analysis		
DM, %	59.8	58.1
CP, %	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		
DM, %	71.1	70.2
CP, %	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		
DM, %	70.0	69.8
CP, %	11.6	11.7
TDN, %	70.5	68.8
Fat, %	7.1	3.4

trations than heifers not fed supplemental fat. It was hypothesized that a shorter feeding period might have been more effective in improving reproductive performance in replacement heifers. Therefore, 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 on a 9-point scale, where 1 = emaciated to 9 = obese], 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/d per head) were included in a total mixed diet for 60, 30, or 0 d before prostaglandin $F_{2\alpha}$ (PGF) injection. 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 (Table 1). All heifers received melengesterol acetate (0.5 mg/d per head) for 14 d followed 19 d later by an injection of 25 mg PGF (dinoprost tromethamine; Lutalyse®; Pharmacia Upjohn Company, Kalamazoo, MI). Heifers were bred by AI approximately 12 h after estrus except on d 3 when all heifers that had not exhibited estrus were inseminated. Pregnancy status was determined by transrectal ultrasonography approximately 40 d after AI. Heifers were weighed approximately 60 d before and at the time of PGF administration, except at Location 3, where BW were taken 30 d before PGF administration to determine whether diet affected ADG.

Two blood samples were collected at a 1-wk interval from heifers assigned to the 60-d treatment diet and the control diet before the beginning of sunflower feeding at Location 2. Blood samples were analyzed for progesterone using coated tubes (Kit TKPGX; DPC, Los Angeles, CA) as described by Bellows et al. (1) to determine percent 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 (7). 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.

TABLE 2. Dry matter intake (kg) and ADG (kg/d) by treatment.

		ADG		
Location	DMI	Control treatment	30-d sunflower treatment	60-d sunflower treatment
1	7.5	0.59		0.48
2	8.6	0.93	0.89	0.81
3	6.8	0.28	0.16	
4	6.8	–0.21	0.16	

Results and Discussion

Heifers fed the control diet (0 d) 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 when comparing 30- and 0-d sunflower treatments (Table 2). It was previously reported that feeding >5% of total DMI in fat can markedly reduce fiber digestibility and reduce DMI in ruminants (8). However, certain types of fat-containing feedstuffs have been fed at levels >5% without negative effects. It has been 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 the rumen intact (3). 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 locations and treatments, because the same concentrations of sunflowers were fed but for different lengths of time. Regardless of the effect on performance, neither 72-h estrous response nor pregnancy rate was affected (*P*>0.10) by 30- or 60-d sunflower treatments. 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 was affected (*P*>0.10) by treatment. Means for pregnancy rate by location and treatment are presented in Table 3. Lammoglia et al. (5) found a response to fat supplementation on puberty in beef heifers; however, this was dependent on genotype, as leaner animals had a positive response. Regardless, no differences in final pregnancy rate were detected.

Pregnancy rate for heifers detected in estrus was 68% *vs* 33% for time-bred heifers in the present study. By 72 h, estrous response was 71% in the present study. Heifers all had adequate BCS (5 to 6), and a high percentage of heifers were cycling before treatments began at Location 2 (92 and 93%, for heifers assigned to the 60-d and control treatments, respectively). Cattle experiencing a greater nutritional challenge appeared to be more responsive to supplemental nutrients (4). Heifers that were nutritionally stressed or not cycling before treatment might have had a positive response to fat supplementation.

TABLE 3. Actual means for pregnancy rate (%) by location (*P*>0.10).

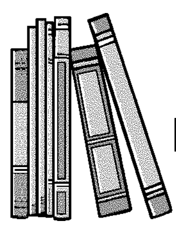
		Treatment		
Location	n	Control	30-d sunflower	60-d sunflower
1	176	55		45
2	397	61	66	61
3	211	56	62	
4	230	54	52	

Implications

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

Acknowledgments

The authors acknowledge Pharmacia and Upjohn, Inc. for the donation of Lutalyse® to support this research.



Literature Cited

1. Bellows, R. A., R. B. Staigmiller, J. M. Wilson, D. A. Phelps, and A. Darling. 1991. Use of bovine FSH for superovulation and embryo production in beef heifers. Theriogenology 35:1069.

2. Bowman, J. G. P., and D. W. Sanson. 1996. Starch- or fiber-based energy supplements for grazing ruminants. Proc. 3rd Grazing Livest. Nutr. Conf. Proc. West. Sec. Am. Soc. Anim. Sci. 47(Suppl. 1):118.

3. Coppock, C. E., and D. L. Wilks. 1991. Supplemental fat in high-energy rations for lactating cows: Effects on intake, digestion, milk yield, and composition. J. Anim. Sci. 69:3826.

4. DelCurto, T., B. W. Hess, J. E. Huston, and K. C. Olson. 1999. Optimum supplementation strategies for beef cattle consuming low-quality roughages in the western United

States. Proc. Am. Soc. Anim. Sci. Available at: http://www.asas.org/jas/symposia/proceedings/0922.pdf.

5. Lammoglia, M. A., R. A. Bellows, E. E. Grings, J. W. Bergman, R. E. Short, D. M. Hallford, and R. D. Randel. 2000. Effects of dietary fat and sire breed on puberty, weight, and reproductive traits of F1 beef heifers. J. Anim. Sci. 78:2244.

6. Lesmeister, J. L., P. J. Burfening, and R. L. Blackwell. 1973. Date of first calving in beef cows and subsequent calf production. J. Anim. Sci. 33:1.

7. SAS. 1990. SAS/STAT® User's Guide. (Version 6, 4th Ed.). SAS Inst. Inc., Cary, NC.

8. Williams, G. L., and R. L. Stanko. 1999. Dietary fats as reproductive nutraceuticals in beef cattle. Proc. Am. Soc. Anim. Sci. Available at: http://www.asas.org/jas/symposia/proceedings/ 0915.pdf.