EFFECTS OF PREPARTUM HIGH LINOLEIC SAFFLOWER SEED SUPPLEMENTATION FOR GESTATING EWES ON COLD TOLERANCE AND SURVIVABILITY OF LAMBS

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Mortality of lambs due to cold stress is a problem during winters and cold, wet springs in the Northern Great Plains. Lambs produce heat through shivering and non-shivering thermogenesis. Brown adipose tissue is the origin of the non-shivering portion. Research has shown that feedstuffs high in linoleic acid increases brown fat and increases cold tolerance of calves. High linoleic safflower seeds may be an economical source of linoleic acid.

Safflower is an oilseed crop that is becoming increasingly popular in this area. According to Farm Service Agency estimates, approximately 49,000 acres of safflower were raised in North Dakota in 1998. Seeds from the high linoleic varieties can contain up to 75% linoleic acid. In addition, the seed is a high energy feed and a good source of rumen degradable protein, making it an ideal winter feed.

The objectives of this study is to determine the effects of supplementing high linoleic safflower to gestating ewes 45 days prior to lambing on lamb performance and cold tolerance.

Experiment 1 was conducted at the Hettinger Research Extension Center. One hundred twenty-two gestating ewes (166.8 16.7 lb initial weight) were allotted randomly to one of two dietary treatments (4 pens per treatment). Ewes received diets equal in calories and crude protein, containing either 4.6 (high fat; HF) or 1.9% (low fat; LF) dietary fat. Diets consisted of alfalfa and a supplement and were fed beginning approximately 45 days before lambing. Rolled safflower seeds (32% fat; 75% linoleic acid) served as the supplemental fat source in HF. Solvent extruded safflower meal was used as protein source in LF supplement and energy was balanced with corn. All pens were offered same amounts of feed throughout trial. Initial and final ewe body condition and weights were measured. In addition lamb birth weights, morbidity, and mortality were also measured.

In experiment 2, 20 gestating ewes (183.7 ± 0.9 lb initial weight) were housed individually at the NDSU Animal Research Center and assigned randomly to either the LF or HF treatment. All ewes received ad libitum access to the same basal diet (37.5 % grass hay, 37.5% alfalfa hay, 25% corn silage; DM basis) in addition to a supplement. Rolled safflower seeds were supplemented in HF while LF supplement contained 64.5% corn, 30.5% safflower meal, and

5.0% molasses. Diets were equal in protein and energy. Prepartum ewe performance was monitored by body weight. Lamb birth weights were recorded. One lamb from each ewe was selected randomly to be slaughtered. Perirenal and pericardial brown fat was excised and weighed, and carcass was frozen for compositional analysis.

RESULTS AND DISCUSSION

In experiment 1, initial ($P = 0.43$) and final ($P = 0.91$) body condition of ewes were similar; however, ewes fed LF supplement gained more weight ($P = 0.05$) during the 45 day supplementation period (Table 1). Birth weights of lambs (Table 2) were not different ($P = 0.47$). Numerically, lambs from HF dams had higher survivabilities. More LF lambs died due to starvation ($P = 0.06$) and pneumonia ($P = 0.14$).

In experiment 2, ewe body weight increased throughout the trial ($P < 0.001$) but was similar between treatments and basal diet dry matter intake decreased ($P < 0.001$) over the trial in both treatments (Table 3). Lamb birth weight was not different ($P = 0.51$). Brown fat weights were similar for the perirenal ($P = 0.88$) deposit and when the deposits were combined ($P = 0.37$). LF lambs tended to have more pericardial fat ($P = 0.12$). Lamb carcasses were similar in fat ($P = 0.92$) and crude protein ($P = 0.65$). HF carcasses tended to be higher in ash ($P = 0.18$)

CONCLUSIONS

High linoleic safflower seeds may be beneficial in improving lamb survivability and tolerance to cold. Supplementation does not seem to affect lamb birth weight, perirenal or pericardial fat mass, or carcass constituents. However, additional research in this area is needed before making strong conclusions and both trials are being repeated in the current year.

Table 1. Effect of safflower supplementation on ewe performance in Exp. 1

	Treatment		
Item	HF	LF	SEM
Weight, lb			
Initial	166.1	167.5	1.5
Final BW	202.8[a]	209.2[b]	2.2
Change	36.7[c]	41.7[d]	1.4
Body condition score*			
Initial BCS	3.3	3.4	0.1

Final BCS	3.9	3.9	0.1
BCS change	0.6	0.5	0.1

*1=emaciated, 5=obese

[a,b]Row means with different superscripts are different (*P* = 0.10)

[c,d]Row means with different superscripts are different (*P* = 0.05)

Table 2. Effect of safflower supplementation of birth weight and morbidity in Exp. 1

	Treatment		
Item	HF	LF	SEM
Birth weight, lb	13.3	12.5	0.8
	-------------------% of ewes----------------		
Lambs	165.48	149.40	0.16
Live	89.77	82.95	0.06
Dead	7.11	15.41	0.73
Born dead	5.39	2.63	0.84
Starvation	1.14[a]	8.28[b]	0.31
Pneumonia	0.00	1.27	0.46

[a,b]Row means with different superscripts are different (*P* = 0.06)

Table 3. Effect of safflower supplementation on ewe performance in Exp. 2

	Treatment		
Item	HF	LF	SEM
Weight, lb			
Initial	183.7	183.8	1.5
Final	200.6	206.6	1.5

Dry matter intake			
Initial 7 days, lb	7.81	7.92	0.17
Final 7 days, lb	4.84	6.58	0.17
Initial 7 days, % BW	1.94	1.97	0.08
Final 7 days, % BW	1.11	1.43	0.08

Table 4. Effect of safflower supplementation on variables in lambs in Exp. 2

	Treatment		
Item	HF	LF	SEM
Birth weight, lb	11.6	11.9	0.3
Brown fat, g	0.194	0.209	0.011
Pericardial, g	0.032	0.036	0.003
Perirenal, g	0.162	0.164	0.005
Carcass composition, %			
Fat	15.17	15.11	0.45
Crude protein	69.24	69.71	0.72
Ash	21.33	17.43	1.95