Corn Germ as a Source of Supplemental Fat for Cows in Late Gestation[1]

Dick Pruitt[2], Jeff A. Clapper[3], William B. Epperson[2], and George A. Perry[4]
Department of Animal and Range Sciences

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Summary

To evaluate corn germ as a source of supplemental fat, 217 two to twelve-year-old cows receiving grass hay free choice were supplemented with either 2.75 lb of corn germ (dry basis) or an equal amount of crude protein from soybean meal (0.80 lb dry matter) starting approximately 50 days prior to the first expected calving. Cows were removed from treatment the day they calved and where managed as a group through the breeding season. Supplement treatment did not affect cow weight change or body condition score. Corn germ did not improve any measure of reproduction, including the percentage of cows cycling or conceiving in the first 21 days of the breeding season or the days from calving to the onset of cyclicity or conception. Calf performance, calf health or indicators of colostrum absorption (total serum protein or IgG) were not influenced by supplement treatment. The results were similar whether all age groups were included in the analysis or when only data for the two and three year old cows were included in the data set. Under the conditions of this study there was no advantage to feeding a source of supplemental fat from corn germ during late gestation.

Introduction

Several studies have shown dietary fat to influence ovarian activity and hormones associated with reproduction. Studies at other locations have demonstrated that providing supplemental fat during late gestation may improve pregnancy rate, increase cow body weight and improve calf vigor, health and weaning weight. The response has not been consistent in all studies and may be dependant on the source of fat. The objective of this study was to evaluate corn germ as a source of supplemental fat for cows in late gestation.

Materials and Methods

This study was conducted during two years at location 1 and one year at location 2. Within location and year, pregnant cows from two to twelve years of age were allotted by age group (2, 3, 4 and greater than 4 years old), breed and projected calving date to two treatments starting approximately 50 days prior to the first expected calving. At location 1, two-year-olds had been bred to start calving 21 days prior to the rest of the cowherd so they started on trial prior to the rest of the cowherd. At location 2 all age groups were bred to start calving on the same day and started on trial the same day. During the treatment period, all cows received grass hay free choice (Table 1 and 2). Cows on the corn germ treatment received 2.75 lb of corn germ dry matter per head and cows in the control group received 0.80 lb of soybean meal dry matter to provide an equal daily amount of crude protein as the corn germ treatment.

At the beginning of each trial and prior to the first scheduled calving, cows were weighed on two consecutive days following an overnight shrink away from feed and water. Fat thickness between the 12th and 13th rib was measured by ultrasonography and cows were assigned a body condition score (1 – 9 with 1 being extremely thin and 9 being obese; Pruitt and Momont, 1988) by 2 people. Within 24 hours of calving, cows were assigned condition scores by the same two people, weighed, removed from the treatments and managed as one group (within location) through the breeding season until weaning in the fall. Cows grazed a common pasture, within location, starting approximately 14 days prior to the breeding season until weaning time.

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[2] Professor
[3] Associate Professor
[4] Assistant Professor

Starting four weeks prior to the beginning of the breeding season blood samples were collected by jugular veni-puncture weekly and analyzed for serum progesterone by radioimmunoassay. Onset of cyclicity was defined as: 1) the date of the first of two consecutive weekly samples with great than 1 ng progesterone/mL of serum; 2) the date of a sample >1 ng progesterone/mL of serum followed by an observed estrus within 14 days; or 3) the date of the first observed estrus without a preceding sample >1 ng progesterone/mL of serum. At the beginning of the breeding season cows were observed for estrus at least twice daily for 7 days and artificially inseminated (AI) approximately 12 hours after standing estrus. Cows not inseminated were then administered an injection of prostaglandin $F_{2\alpha}$ to synchronize estrus. At location 1, heat detection and AI continued for 30 days and then cows were exposed to a bull for 30 days. At location 2, heat detection and AI continued for 7 days and then cows were exposed to a bull for 45 days. Pregnancy was determined by transrectal ultrasonography. Conception date was determined using a combination of breeding records, calving date and ultrasonography (when calving date was not available).

Calves were weighed within 24 hours of birth, at weaning and at about a year of age. Calves were observed daily for symptoms of disease and treatments were recorded.

Blood samples were collected from the calves by jugular veni-puncture between 24 and 48 hours after birth. Serum was separated the following day after centrifuging at 1500x g for 25 minutes and frozen. Total serum protein was measured by refractometry, which has been shown to be an accurate measure of total protein, which is closely correlated with the amount of immunoglobulin in serum and plasma. IgG was determined by radioimmunoassay.

Statistical analysis. Since cows were fed as a group within each location, treatment and year, feeding group were defined as: 1) year 1, location 1; 2) year 2, location 1; and 3) year 2, location 2. Cows producing twins were deleted from the data set and only cows that weaned a calf were included in the analysis.

Cow weight, average daily gain, condition score, rib fat, calving date and days from calving to onset of cycling and conception were analyzed using Proc GLM of SAS. Independent variables in the statistical model included treatment (corn germ and soybean meal), feeding group and treatment x feeding group. Treatment x feeding group served as the error term. Means were separated by the PDIFF option of SAS.

Calf weights, average daily gain, total serum protein and IgG were analyzed using Proc GLM of SAS. Independent variables included: treatment (corn germ and soybean meal), feeding group, treatment x feeding group, percentage Angus of the dam and calf sex. The error term to test treatment effects was treatment x feeding group. Means were separated using the PDIFF option of SAS.

Percentage cycling in the first 21 days of the breeding season, percentage conceiving in the first 21 days of the breeding season and overall pregnancy rate were analyzed with Proc GENMOD of SAS. Independent variables were treatment, cow age group and treatment x cow age group.

The first set of analyses included all cows. Since young, thin cows are more likely to show a reproductive response to nutritional treatments, a second analysis was performed with only 2 and 3 year old cows in the data set.

Results and Discussion

Cow weight and average daily gain were not affected by supplement treatment (Table 3). The higher fat content of corn germ makes it a higher energy feed than soybean meal. But the fat content also has the potential to decrease the digestibility of the grass hay and reduce hay intake. The similar weight gains between the treatment groups indicate that the total energy available to each of the treatment groups was similar.

The cows receiving soybean meal before calving had a higher percentage conceiving in the first 21 days of the breeding season than those receiving corn germ (Table 4). No other measure of reproductive performance was affected by treatment. Researchers in Miles City, Montana reported inconsistent responses to supplemental fat fed in late gestation to first calf heifers (Bellows et al., 2001). They concluded that when pasture forage quality and quantity prior to and during the breeding season was limited, supplemental fat in late gestation resulted in a beneficial response to reproduction. When weather conditions resulted in abundant high quality forage, they found not reproductive response to supplemental fat in late gestation. In our study pasture forage prior to and during the breeding season was not limiting.

Supplemental treatment did not affect calf birth weight (Table 5). Similar mean values for total serum protein and IgG of calves from blood samples taken 24 to 48 hours after birth indicate that corn germ did not increase passive immunity of the calf from colostrum. Analysis of health records indicated a very low incidence of calf disease symptoms and there was no effect of supplement treatment on the percentage of calves requiring treatment prior to weaning or from weaning to yearling time.

Typically two and three year old cows are thinner at the beginning of the breeding season, require more days from calving to the first postpartum estrus and have lower pregnancy rate. Management that has potential to improve reproductive performance is more likely to affect young cows than mature cows, so the results from two and three year old cows and their calves are presented in Tables 6 through 8. The results are not different than when the analysis included all age groups.

Implications

Under the conditions of this study supplemental fat in the form of corn germ during late gestation did not have a beneficial effect on cow reproductive performance or calf performance. Under these conditions, additional expense to provide supplemental fat during late gestation would not be justified. It is possible that under conditions where calf disease is a problem, supplemental fat could be beneficial.

Tables

Table 1. Feed Analysis

	Corn germ	Soybean meal	Grass hay
Location 1, Year 1			
% dry matter	93.7	89.2	84.9
% crude protein[a]	12.4	49.4	9.4
% crude fat[a]	38.6	2.0	2.2
% NDF[a]			63.4
% ADF[a]			42.1
Location 1, Year 2			
% dry matter	92.9	89.1	89.4
% crude protein[a]	12.4	49.3	9.4
% crude fat[a]	47.6	1.4	
% NDF[a]			62.8
% ADF[a]			41.4
Location 2, Year 2			
% dry matter	92.9	89.1	83.6
% crude protein[a]	12.4	49.3	10.4
% crude fat[a]	47.6	1.4	
% NDF[a]			62.0
% ADF[a]			40.2

[a]dry matter basis

Table 2. Feed intake.

Treatment	No. cows	Dry matter disappearance, lb per cow daily: Grass hay	Corn germ	Soybean meal	Total	Supplemental fat: Lb per cow daily	% of daily dry matter
Location 1, Year 1							
Corn germ	52	19.3	2.75		22.1	1.06	4.82
Soybean meal	50	20.2		0.80	21.0	0.02	0.08
Location 1 Year 2							
Corn germ	49	20.5	2.74		23.3	1.31	5.61
Soybean meal	50	24.2		0.80	25.0	0.01	0.04
Location 2, Year 2							
Corn germ	37	20.9	2.73		23.6	1.30	5.50
Soybean meal	37	25.1		0.82	25.9	0.01	0.04

Table 3. Performance of all cow age groups.

	Corn Germ	SE	Soybean Meal	SE	Probability
No. of females	127		128		
Avg. days on treatment	56.8		56.0		
Avg. calving date	3/20		3/20		
Weight, lb					
Initial	1374	31	1386	31	0.79
Prior to the start of calving	1403	22	1398	22	0.87
Post-calving	1324	12	1326	12	0.90
Cow ADG from initial weight, lb					
Prior to the start of calving	0.78	0.29	0.35	0.29	0.35
To post-calving	-1.12	0.42	-1.20	0.42	0.90
To weaning	-0.02	0.23	-0.05	0.24	0.93
Condition score					
Initial	6.2	0.1	6.2	0.1	0.99
Prior to the start of calving	6.2	0.1	6.2	0.1	0.87
Post-calving	6.1	0.1	6.1	0.1	0.94
Ribfat, in.	0.22	0.02	0.21	0.02	0.70

Table 4. Reproductive performance of all cow age groups.

	Corn Germ	SE	Soybean Meal	SE	Probability
No. of females	127		127		
Cycling before the start of the breeding season, %	36.2		38.1		0.76
Cycling by day 21 of the breeding season, %	92.9		94.5		0.61
Calving to cycling, days	66.9	8.9	68.4	9.1	0.91
Conception in first 21 days of breeding season, %	62.2		74.2		0.04
Calving to conception, days	88.4	2.3	88.1	2.3	0.97
% pregnant	92.6		94.3		0.58

Table 5. Calf performance and health for all cow age groups.

	Corn Germ	SE	Soybean Meal	SE	Probability
No. of calves	129		130		
Birth weight, lb	87.6	3.0	85.9	3.0	0.71
Age at weaning, lb	189	8	191	8	0.89
ADG birth to weaning, lb	2.51	0.12	2.49	0.12	0.90
Weaning weight, lb	564	38	562	38	0.97
Total serum protein 24-48 h after birth, g/dl	6.6	0.2	6.6	0.2	0.95
No. of calves[a]	88		86		
IgG, 24-48 h after birth, mg/dl	4951	323	5444	335	0.38
No. of calves	127		127		
Calves treated from birth to weaning, %	2.4		2.4		1.00
Calves treated from weaning to yearling, %	5.7		5.1		0.85
Calves treated from birth to yearling, %	7.6		6.8		0.82
No. of yearlings	117		122		
ADG from weaning to yearling, lb	2.56	0.02	2.59	0.03	0.53

[a]Calves at location 1 only.

Table 6. Performance of 2 and 3 year old cows.

	Corn Germ	SE	Soybean Meal	SE	Probability
No. of females	57		58		
Avg. days on treatment	55.9		56.5		
Avg. calving date	3/15		3/17		1.00
Weight, lb					
Initial	1249	20	1254	19	0.88
Prior to the start of calving	1278	16	1267	15	0.64
Post-calving	1205	15	1205	14.2	0.98
Cow ADG from initial weight, lb					
Prior to the start of calving	0.76	0.25	0.41	0.24	0.36
To post-calving	-1.02	0.40	-0.92	0.38	0.87
To weaning	0.08	0.23	0.10	0.23	0.95
Condition score					
Initial	6.1	0.2	6.1	0.2	0.99
Prior to the start of calving	6.0	0.2	6.0	0.2	0.99
Post-calving	6.0	0.2	6.0	0.2	0.83
Ribfat, in	0.20	0.02	0.19	0.02	0.65

Table 7. Reproductive performance of 2 and 3 year old cows.

	Corn Germ	SE	Soybean Meal	SE	Probability
No. of females	58		55		
Cycling before the start of the breeding season, %	24.1		30.9		0.89
Cycling by day 21 of the breeding season, %	87.9		89.3		0.89
Calving to cycling, days	71.8	9.1	74.9	9.0	0.82
Conception in first 21 days of breeding season, %	62.1		73.2		0.20
Calving to conception, days	87.3	4.7	92.6	4.5	0.46
% pregnant	92.9		96.4		0.41

Table 8. Performance of calves from 2 and 3 year old cows

	Corn Germ	SE	Soybean Meal	SE	Probability
No. of calves	58		56		
Birth weight, lb	82.8	3.0	82.4	2.7	0.93
ADG to summer wt., lb	2.42	0.10	2.40	0.09	0.84
Age at weaning, lb	188	9	192	9	0.77
ADG birth to weaning, lb	2.38	0.13	2.35	0.12	0.89
Weaning weight, lb	532	43	536	40	0.95
Total serum protein 24-48 hr after birth, g/dl	6.40	0.11	6.47	0.10	0.65
No. of calves (location 1 only)	42		38		
IgG, 24-48 h after birth, mg/dl	4337	86	4572	90	0.17
No. of yearlings	43		49		
ADG from weaning to yearling, lb	2.45	0.09	2.58	0.08	0.31