FINAL REPORT FACULTY RESEARCH GRANT

1. Project Title: Effects of Trace Mineral Supplementation and Source on Reproductive Performance, Mineral Status and Performance of Grazing Cattle.

2. Name of Principal Investigator/Project Director: Willy Hoefler

3. College (abbrev): EAS

4. Department: Agriculture

5. Campus Mail Address: Room 123 B Dean Hall

6. PI/PD Campus Phone: 964-3258

7. Amount Funded: $2,000.00

8. Total Cost of Project: $34,524.00 for first year

10. Duration of Project: 2 years

SIGNATURES

Willy Hoefler 8-26-16

Principle Investigator Date

Malcolm R Laing 8-26-16

Chairperson Date

26 Aug 16

Dean Date

Problem Researched

Major factors that can affect reproduction of cows are calving difficulty, body condition score and nutrition (DeRoune et.al, 1994, Spitzer, et. al.1995). Under-feeding protein, energy, and minerals can result in weight loss and impaired reproductive performance.

Trace mineral deficiencies can occur as a primary deficiency when trace mineral intake is inadequate or as a secondary deficiency when other factors in the diet interfere with absorption and (or) metabolism. Studies in bioavailability of organic and inorganic minerals have reported contrasting results. Ward et.al. (2010) and Wittenberg et.al. (2011) found no differences between bioavailability of organic and inorganic minerals. However, Kincaid et.al. (2006) reported that calves fed Cu proteinate had higher Cu liver and serum levels than calves fed Cu sulfate. Kropp (2000), found that feeding chelated minerals to first calf heifers 30 days before breeding, caused more heifers to exhibit estrus and conceive after the first service than did feeding inorganic minerals. DiCostanzo (2007) supplemented Mn, Cu, and Zn in different combinations and levels, and found no effect on reproduction.

As mentioned above, there has been tremendous variability in results of trace mineral supplementation used in different studies, making interpretation of data and ability to reach a concise conclusion challenging. Data collected from this study will hopefully help to clarify if feeding high quality (chelated) minerals has an effect on animal reproduction and performance.

Procedure Utilized

During the first nine months of this study, one hundred and forty crossbred cows were assigned to either a spring or fall calving group based on their predictive calving dates. Cows in each calving group were then randomly assigned to one of two treatment groups. Animals were allowed free access to either a standard set of inorganic minerals or a premium set of organic minerals. Animal weights, body condition score, as well as mineral intake have been monitored monthly throughout the trial. To examine mineral status, liver biopsies were obtained from a subset of cows (8 per treatment group) at the beginning of year 1 with an additional sample to be taken at the end of year one as well as the end of year two. Effects of mineral supplementation on reproductive performance were also examined. Cows were artificially inseminated (AI) following a modified Select-Sync version of estrous synchronization. To allow for accurate differentiation between pregnancy to AI vs pregnancy to natural service, cows were not exposed to bulls until 14 days after insemination. To determine pregnancy rates to AI vs natural service, pregnancy was determined via rectal ultrasonography 40 days after insemination. Final pregnancy was determined via rectal palpation with the aid of ultrasonography 40 days after bull removal for the fall calving group. This same procedure will be followed for the spring calving group of cows. All calves were tagged, weighed at birth and at monthly intervals. Weaning weights for the fall group of calves were adjusted to a 205 day weight. The spring group of calves will not be weaned until late October. All animals were vaccinated and wormed twice during the first year of the trial.

Summary of Findings

Although we are still in the early stages of the study, the following is a summary of the data collected during the first 231 days of the study. There is a trend to see an increase in body condition scores for the fall calving group of cows (Table 1). However, there are no significant differences (P>.05) in BCS between the two treatment groups so far. Similar results have been seen in the spring calving group of cows (Table 1). But again, no significant differences (P>.05) in BCS between treatments have been noted.

Cow weights between the two treatments in the fall calving group increased during the first 231 days of the study (Table 2). However, there were no significant differences (P>.05) in cow weights between the two treatments. Cow weights have remained the same for those animals in the spring calving group during the first 231 days of the study (Table 2). Furthermore, no significant differences (P>.05) in cow weights between treatments have been noted.

Liver biopsy results indicate there were no significant differences (P>.05) in mineral concentrations between treatments for both fall and spring calving groups (Table 3). A second liver sample will be taken one year into the study to examine if any changes in mineral concentrations occurs.

In the fall calving group, there were no differences (P>.05) in the number of animals that were artificially inseminated 60 days after calving (Table 4). However, of those animals artificially inseminated, conception rates were higher (P<.05) in those animals receiving a standard set of minerals compared to those receiving the premium set of minerals (65.3% vs 42.8%, respectively). When conception rates from natural service were examined, those animals receiving the premium set of minerals were higher (P<.05) compared to those receiving the standard set of minerals. Likewise, overall all conception rates were higher (P<.05) in those animals receiving the premium set of minerals compared to those receiving the standard set of minerals (88.5% vs 83.3%, respectively). In the spring calving group of cows, there were no significant differences (P>.05) between treatments in the number of animals that returned to estrus and artificially inseminated 60 days following calving (Table 5). Conception rates in this group of cows will be determined in September, 2016.

The trend for calf weights in the fall calving group of cows was to increase throughout the study (Table 6). However, there were no significant differences (P>.05) in calf weights at weaning (day 111) between the two treatment groups. Likewise, when calf weights for the spring calving group were examined, no significant differences (P>.05) between treatments during the first four weigh periods (Table 7).

Conclusions and Summary

In summary, at this point of the study there appears to be no differences in BCS, cow weights and calf weights regardless of calving group or treatment. However, the premium set of minerals

may help to improve overall conception rates. As mentioned earlier, this is a two year study and the data reported represents the early stages of this study. Conclusions and recommendations will be made at the end of the second year of the study.

Table 1. Average Cow Body Condition Scores

Calving Group	TRT	N	Day 0	Day 42	Day 76	Day 111	Day 137	Day 170	Day 199	Day 231
Fall	1	35	3.08[A]	3.41[A]	3.11 [A]	3.21[A]	3.49[A]	3.77[A]	3.80[A]	3.92[A]
Fall	2	36	3.04[A]	3.32[A]	3.18 [A]	3.11[A]	3.31[A]	3.32[A]	3.68[A]	3.87[A]
Spring	1	33	3.47[A]	3.44[A]	3.26[A]	3.27 [A]	3.14[A]	3.34[A]	3.44[A]	3.50[A]
Spring	2	34	3.48[A]	3.46[A]	3.23[A]	3.10[A]	3.25[A]	3.44[A]	3.42[A]	3.60[A]

[A] Column means with same superscripts within a calving group do not differ P> .05

Table 2. Average Cow Weights (lbs).

Calving Group	TRT	N	Day 0	Day 42	Day 76	Day 111	Day 137	Day 170	Day 199	Day 231
Fall	1	35	1108.4[A]	1095.5[A]	1069.0[A]	1123.8[A]	1198.4[A]	1259.2[A]	1285.1[A]	1295.8[A]
Fall	2	36	1117.2[A]	1051.1[A]	1093.7[A]	1081.5[A]	1148.2[A]	1115.9[A]	1249.6[A]	1306.7[A]
Spring	1	33	1144.4[A]	1157.5[A]	1103.9[A]	1119.2[A]	1133.3[A]	1116.4[A]	1119.8[A]	1141.7[A]
Spring	2	34	1148.5[A]	1175.9[A]	1160.5[A]	1090.4[A]	1119.2[A]	1148.0[A]	1130.6[A]	1151.7[A]

[A] Column means with same superscripts within a calving group do not differ P> .05

Table 3. Average Mineral Concentration (ppm) in Fall and Spring Calving Cows.

Group	TRT	N	Cr	Cu	Fe	Mg	Se	Z
Fall	1	8	0.32[A]	54.66[A]	197.05[A]	178.16[A]	0.27[A]	37.33[A]
Fall	2	7	0.48[A]	64.00[A]	146.37[A]	171.80[A]	0.19[A]	36.19[A]
Spring	1	8	0.56[A]	51.67[A]	127.28[A]	178.26[A]	0.29[A]	32.53[A]
Spring	2	8	0.60[A]	52.92[A]	120.96[A]	177.02[A]	0.26[A]	33.18[A]

[A] Column means with same superscripts within a calving group do not differ P> .05

Table 4. Reproductive Data for the Fall Calving Group.

TRT	N	% AI	% Conception from AI	% Conception from Natural Service	% Conception Overall
1	35	60.0[A]	42.8[A]	84.6[A]	88.5[A]
2	36	72.2[A]	65.3[B]	65.3[B]	83.3[B]

[A] Column means with same superscripts do not differ P> .05

[B] Column means with different superscripts differ P< .05

Table 5. Reproductive Data for the Spring Calving Group.

TRT	N	% AI
1	32	100.0[A]
2	34	97.1[A]

[A] Column means with same superscripts do not differ P> .05

Table 6. Average Calf Weights (lbs) for the Fall Calving Group

Calving Group	TRT	N	Day 0	Day 42	Day 76	Day 111
Fall	1	24	198.0[A]	248.8[A]	335.3[A]	427.6[A]
Fall	2	27	195.8[A]	240.9[A]	320.3[A]	380.2[A]

[A] Column means with same superscripts do not differ P> .05

Table 7. Average Calf Weights (lbs) for the Spring Calving Group

Calving Group	TRT	N	5-16-16	6-17-16	7-15-16	8-15-16
Spring	1	31	223.8[A]	278.8[A]	345.6[A]	396.2[A]
Spring	2	33	202.7[A]	282.8[A]	335.7[A]	395.6[A]

[A] Column means with same superscripts do not differ P> .05

Breakdown of Expenditures and Shared Cost.

Faculty Research		
Semen	3,500.00	(1,500 Agriculture/**2,000 Faculty Research)**
Total	**2,000.00**	
ADM		
Minerals	20,000.00	
Liver Analysis	2,240.00	
Total	22,240.00	
Department of Agriculture		
Liver Biopsy Probe	75.00	
Ova Cyst	320.00	
Prostra Mate	800.00	(400 Agriculture/400 Undergraduate Research)
Semen	3,500.00	(1,500 Agriculture/ 2,000 Faculty Research)
Cover Sleeves for AI Gun	14.00	
Shoulder Length Polysleeve	84.00	
Estrotech Estrus Alert	162.40	
Ultra 7 Vaccine	1,044.00	
Bovi Shield Gold Vaccine	366.00	
Lepto Shield 5 Vaccine	60.00	
Ivomec Wormer	840.00	
Student Labor (3 students)	3,600.00	(1,600 Agriculture/2,000 Undergraduate Research)
Travel	200.00	
Total	6,665.40	
Undergraduate Research		
Poly Propylene Tube	12.80	
Alcohol	54.00	
Iodine	26.00	
Lidocaine	32.00	
Number 20 Scalpel Blades	21.50	
Number 4 Scalpel Handle	4.80	
Prostra Mate	800.00	(400 Agriculture/400 Undergraduate Research)
Latex Exam Gloves	19.00	
Disposable Needles (18 x 1 ½)	135.00	
Disposable Syringes (12 cc)	240.00	
Student Labor (3 students)	3,600.00	(1,600 Agriculture/2,000 Undergraduate Research)
Total	2,945.10	

Copy of abstract presented at the 2016 Undergraduate Research Symposium as well as the March meeting of Pope County Cattleman's Association.

EFFECTS OF MINERAL SUPPLEMENTATION ON COW-CALF PERFORMANCE IN FALL AND SPRING CALVING CATTLE

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Department of Agriculture

The objective of this two year study is to examine the effects of a premium versus standard set of trace mineral supplementation on animal performance in fall and spring calving beef cows. With livestock efficiency being a major concern in production agriculture, suggestions have been made that higher quality trace minerals improve cattle performance. Cows from spring and fall calving herds were randomly assigned into two treatment groups. For the first replication, treatment group 1 receives a premium formulated trace mineral supplement (organic), while treatment group 2 receives a standard formulated trace mineral supplement (inorganic). Both treatment groups were acclimated to their respective treatments prior to the start of the study. To evaluate the effects of the two trace mineral formulations, each animal was individually weighed and assigned a body condition score. Animal weights, body condition scores and mineral intake are monitored monthly throughout the trial. Additionally liver biopsies were performed on a subset of eight animals from each treatment group to establish a micronutrient base line for comparison of treatment groups. Two weeks following start-up, estrus was synchronized in the fall herd using a single injection of lutalyse and females were artificially inseminated (AI) on observed estrus. One week following AI, clean up bulls were turned out for 30 days. Approximately 40 days following breeding, cows will be diagnosed for pregnancy by rectal palpation to determine conception rates. The second replication begins year two with treatment groups being reversed to ensure data validity. There were no differences in cow and calf weights, or body condition score at the beginning of the study. However, those cows in both treatment groups of the fall calving group lost weight during the first two months of the study compared to the spring calving treatment groups which maintained body weight.

Bibliography

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