

**Abstract:**

Trace minerals are essential for many biological and metabolic processes and often supplemented ad libitum to grazing beef cattle. However, research has shown large variations in individual intakes. The objective of this study was to examine the impact of mineral feeder design on visitations and intake. In a crossover experimental design, beef cattle operations (n=5) were randomly assigned to treatment sequence (lid status) and each evaluation period occurred for 5-7 days. Browning game trail cameras (Prometheus Group LLC, Birmingham, AL) were used to record time lapse pictures at 2-minute intervals from sunrise to sunset. Time was categorized as morning (≤10:00), mid-day (10:01 – 14:00), afternoon (14:01 – 18:00) and evening (>18:00). Activity was categorized as eating mineral, standing, lying or other within 0.5 m of feeder. Effects of farm, treatment, and time were analyzed using the GENMOD procedures of SAS 9.4 and mineral intake data were analyzed using PROC GLM. There were significant effects of farm (p<0.001), treatment (p<0.007), time (p<0.001), and the treatment by time interaction (p<0.001) for the numbers of cows and calves eating. Different herd sizes likely contributed to the significance of farm. Data were further analyzed using PROC FREQ. Of the animals eating, more cows and calves were observed eating with the lid removed (59.1% and 61.7%, respectively). However, average mineral disappearance did not differ (p = 0.57) by treatment (50.3 kg vs. 41.9 kg). Regardless of treatment, more cows were observed eating during the morning and afternoon (35% and 34.8%, respectively) than in the evening (10.3%). Similarly, more calves were categorized as eating in the morning and afternoon (29.3% and 41.3%, respectively) than in the evening (14.1%). These preliminary results indicate that feeder design may impact visitation of cows and calves but not average mineral disappearance.

**Introduction:**

- Trace minerals are essential for many biological and metabolic processes in ruminants
- Deficiencies of trace minerals in cattle can impact fertility [1], immunity [2], and growth rates [3]
- Trace minerals are most widely supplemented ad libitum to grazing beef cattle [4]
- But research has shown large variations in mean individual mineral intake [5]
- Plastic molded mineral feeders with a rubber lid are widely popular in the industry

**Objective:**

- To examine the impact of mineral feeder design on animal visitations and intake in grazing beef cow-calf operations

**Materials & Methods:**

- Cow-calf producers (n=6) across central Kentucky
- The experiment was conducted in a crossover design
- Farms were randomly assigned to treatment sequence
  - Lid status: on or removed (Figures 1 and 2)
- Each evaluation period occurred for 5-7 days
- Mineral disappearance was measured in each period

**Methods Continued:**

- Browning™ game trail cameras were placed 10m from the feeder and captured time lapse pictures at 2-minute intervals from sunrise to sunset
- Time was categorized into four time periods; morning (≤10:00), mid-day (10:01 – 14:00), afternoon (14:01 – 18:00) and evening (>18:00). Activity for both cows and calves were categorized as eating mineral, standing, lying, or other within 0.5m of feeder
- Data were analyzed using the GENMOD, GLM, and FREQ procedures of SAS 9.4

**Results:**

- Significant effects of farm (p<0.001), treatment (p<0.007), time (p<0.001), and the treatment by time interaction (p<0.001) for the numbers of cows and calves eating were found (Tables 1,2).
- Average mineral disappearance did not differ (p = 0.57) by treatment (50.3 kg vs. 41.9 kg; Table 3).

Table 1. Effect of treatment on the percentage of cows & calves categorized as eating in images		
	Treatment	
	Lid Off	Lid On
Cows, %	59.1 <sup>a</sup>	40.9 <sup>b</sup>
Calves, %	61.7 <sup>a</sup>	38.3 <sup>b</sup>
a,b rows with different superscripts differ p<0.007		

Table 2. Effect of time x treatment on the percentage of cows & calves categorized as eating in images					
	Treatment	Time			
		Morning (≤10:00)	Mid-day (10:01 – 14:00)	Afternoon (14:01 – 18:00)	Evening (>18:00)
Cows, %	Lid Off	18.7 <sup>cd</sup>	14.6 <sup>b</sup>	20.9 <sup>d</sup>	4.9 <sup>a</sup>
Cows, %	Lid On	16.3 <sup>bc</sup>	5.3 <sup>a</sup>	14 <sup>b</sup>	5.4 <sup>a</sup>
Calves, %	Lid Off	18 <sup>f</sup>	12.5 <sup>f</sup>	26.3 <sup>g</sup>	5 <sup>e</sup>
Calves, %	Lid On	11.3 <sup>ef</sup>	2.8 <sup>e</sup>	15 <sup>f</sup>	9.1 <sup>e</sup>
a-d rows and columns with different superscripts differ p<0.001					
e-g rows and columns with different superscripts differ p<0.001					

Table 3. Mineral disappearance by farm and treatment <sup>1</sup> , kg		
Farm #	Treatment	
	Lid Off	Lid On
1	17.7	22.7
2	45.4	90.7
3	51.2	41.1
4	45.6	22.4
5	90.5	33.1
6	51.5	41.5
Mean <sup>2</sup>	50.3 ± 9.5	41.9 ± 10.3

<sup>1</sup>Mineral disappearance was not affected by treatment (P=0.57) or farm (P=0.47)  
<sup>2</sup>Values displayed are the mean ± S.E.M.



Figure 1. Two calves eating at the mineral feeder with the lid on.



Figure 2. A cow and calf eating at the mineral feeder with the lid off.

**Conclusions:**

- Mineral feeder design may impact the visitations of cows and calves consuming mineral
- Average mineral disappearance was not affected by mineral feeder design

**Future Direction:**

- Migrate to short video clips rather than time lapse photography
- Determine if mineral feeder design impacts the length of time cows and calves spend eating mineral
- Replicate the study across additional farms

**Acknowledgements:**

A special thank you to the producers and Extension Agents for their willingness to participate in the pilot project and the undergraduate students for their help analyzing the time lapse images.

**References:**

[1] McClure TJ, Eamens GJ, Healy PJ. Improved fertility in dairy cows after treatment with selenium pellets. Aust Vet J 1986;63:144-6.  
 [2] Erskine RJ, Eberhart RJ, Grasso PJ, Scholz RW. Induction of Escherichia coli mastitis in cows fed selenium-deficient or selenium supplemented diets. Am J Vet Res 1989;50:2093-100.  
 [3] Gleed PT, Allen WM, Mallinson CB, Rowlands GJ, Sansom BF, Vagg MJ, et al. Effects of selenium and copper supplementation on the growth of beef steers. Vet Rec 1983;113:388-92.  
 [4] Greene, L.W. 2000. Designing mineral supplementation of forage programs for beef cattle. Proc. Am. Soc. Am. Sci. 1-9.  
 [5] Patterson, J.D., W.R. Burris, J.A. Boling, and J.C. Matthews. 2013. Individual intake of free-choice mineral mix by grazing beef cows may be less than typical formulation assumptions and form of selenium in mineral mix affects blood Se concentrations of cows and their suckling calves. Biol Trace Elem Res. 155:38-48.