

**Title:** Using RFID Technology to Assess Factors Impacting Variation in Free-Choice Mineral Intake among Grazing Cattle

**Investigator:** John Arthington, Professor and Center Director  
Juliana Ranches, PhD Student  
UF/IFAS, Range Cattle Research and Education Center, Ona

**Funding:** FDACS / FCA  
2016 FY Funding  
Contract No. 022968

**Executive Summary:**

Funding was received in FY2016 to engineer and construct 6 electronically-equipped, portable mineral feeders. In addition, funds were provided to perform initial testing with the central aim of evaluating breed differences on behavioral measures of voluntary free-choice intake of salt-based mineral supplement. Interesting new information has been revealed implying that Brahman cattle make more frequent visits to the mineral feeder with a larger percentage of visits during the hottest hours of the day compared to Braford or Angus cattle. Using this new research tool, we will seek additional funding in FY2017 to begin to address how these behavior differences relate to the mineral status of Brahman vs. Angus cattle and how recommended management systems may differ when addressing the mineral nutrition of these two breed types.

**Overview:**

Around the World, almost all grazing cattle are deficient in sodium, thus supplemental salt has been recognized as vital to the health and performance of grazing livestock. In tropical and subtropical climates, where a large percentage of the World's beef is produced, cattle are typically enrolled in year-long grazing schedules. Often, free-choice, salt-based mineral supplements are offered with the anticipation of adequate intake to offset nutrient deficiencies. Variation in free-choice intake, however, is a common problem impacting the efficacy of this management system. The need to understand the factors impacting variation in free-choice, salt-based supplement intake is evident. Through FY2016 funding support by FCA/FDACS, our team engineered and developed field-ready RFID (radio-frequency identification) technology to accurately assess the frequency of individual animal visits to a mineral feeder. Six portable units were constructed (Photo). Each mineral feeder was equipped with a tag reader, which allowed every animal's visit to the feeder to be recorded.

With this technology, we can now estimate the impact of individual cow or calf free-choice mineral intake variation and how this variation impacts individual trace mineral status. Initial evaluation of the equipment has shown that the technology accurately accounts for individual visits to the mineral feeder. This equipment can be utilized in multiple studies, such as those aimed at assessing variation in mineral intake and subsequent mineral status when impacted by; (1) breed of animal (i.e. *Bos indicus* vs. *Bos taurus*), (2) season of the year, (3) method of mineral delivery (i.e. salt-based, liquid, low moisture block), and (4) mineral formulation. These new mineral feeders were initially evaluated during the summer of 2016 using pregnant yearling heifers representing 3 differing breed types.

### **Material and Methods:**

An observational study was conducted at the Range Cattle Research and Education Center (Ona, FL) to evaluate behavior differences due to breed on the consumption of salt-based, free-choice mineral supplements.

Sixteen heifers representing 3 breeds were utilized (4/breed; Brahman, Braford, and Ona White Angus). Heifers were allocated to a single "Jiggs" Bermudagrass [*Cynodon dactylon* (L.) Pers.] pasture with access to a single RFID-equipped mineral feeder containing a salt-based mineral supplement in amounts to ensure free-choice consumption (9.1, 4.0, and 62.5% Ca, P, and NaCl, and 1,750, 60.0, and 5,000 mg/kg Cu, Se, and Zn, respectively). Distribution of daily visits were reported in 8 h intervals; morning = 05:00 to 12:59, afternoon = 13:00 to 20:59, and night = 21:00 to 04:59. Supplement intake was evaluated throughout the study by calculation of disappearance rate. Individual heifer visits to the mineral feeder were recorded from May to July of 2016. A total of 47 d of data resulted in 1400 readings were achieved.

Readings were evaluated in cycles of 24 h. Recorded data were sometimes impacted by the capacity of the battery and infrequent software errors. If the reader stopped recording data, the next reading to be added to the file was the first reading of the same period in the following day and in-between readings deleted. Data were analyzed using the MIXED procedure of SAS. (SAS Inst. Inc., Cary, NC; version 9.4). The dependent variable was the number of individual visits and the model statement included the effects of week, period, breed and their interactions. Results are reported as least squares means; Significance was set at  $P \leq 0.05$ , and tendencies were determined if  $P > 0.05$  and  $P \leq 0.11$ .

### **Results:**

Individual visits to the mineral feeder were reported as a total and percentage of total for each breed group throughout the individual daily segments (Table 1).

During the evaluation period, visits were consistently distributed throughout the day. The afternoon period (13:00 to 20:59) had a numerically greater number of visits (562 visits; 40.1% of total) when compared to the other two periods. The number of morning visits (05:00 to 12:59; 554 visits; 39.6% of total) followed the afternoon visits with the night period (21:00 to 4:59) having the least frequent visits (284 visits; 20.3% of total). There were no differences ( $P = 0.85$ ) for the number of visits when comparing morning and afternoon periods; however, both periods had a greater ( $P \leq .001$ ) number of visits when compared to the night period.

When assessing mineral feeder visits by breed, there was a tendency for Brahman heifers to visit the mineral feeder more often than the Ona White Angus ( $P = 0.08$ ) and Braford heifers ( $P = 0.11$ ). There were no differences in the frequency of mineral feeder visits between Braford and Ona White Angus heifers ( $P = 0.90$ ). As a total of visits, the Brahman heifers visited the feeder 516 times, while the Braford and Ona White Angus heifers made 445 and 439 visits, respectively (36.9, 31.8, and 31.4% of the total of visits for Brahman, Braford and Ona White Angus heifers, respectively).

When assessing mineral feeder visits by breed and period, Brahman and Braford heifers had a greater ( $P \leq 0.05$ ) number of visits to the feeder in the mornings when compared to Ona

White Angus heifers. There were 223, 197, and 134 visits, respectively, for Brahman, Braford, and Ona White Angus heifers, representing 43.2, 44.3, and 30.5% of the morning visits, respectively.

For the afternoon period, Brahman heifers had the greatest ( $P \leq 0.01$ ) number of visits when compared to the other two breeds. There were no differences ( $P = 0.55$ ) for the number of afternoon visits between Braford and Ona White Angus heifers. There were 233, 172, and 152 visits, respectively, for the Brahman, White Angus and Braford heifers, representing 45.2, 39.2, and 35.3% of the afternoon visits, respectively.

For the night period, Ona White Angus heifers had a greater ( $P \leq 0.01$ ) number of visits compared to Brahman heifers, and tended ( $P = 0.10$ ) to have a greater number of visits compared to Braford heifers. There were no differences ( $P = 0.22$ ) among Brahman and Braford heifers for the number of night visits to the mineral feeder. There were 133, 91, and 60 visits, respectively, for White Angus, Braford and Brahman, representing 30.3, 20.4, and 11.6% of the night visits, respectively.

Within breed comparisons for each period were also evaluated. Braford heifers tended ( $P = 0.11$ ) to have a greater number of visits during the morning vs. afternoon and night periods (197, 157 and 91 visits for morning, afternoon and night, respectively). Brahman heifers had fewer ( $P < 0.01$ ) visits to the mineral feeder in the evening vs. morning and afternoon periods. Unlike Braford and Brahman heifers, there were no differences ( $P = 0.13$ ) among periods for the number of visits that Ona White Angus heifers made to the mineral feeder (134, 172 and 133 visits in the morning, afternoon and night, respectively).

Mineral supplement intake was recorded and calculated by the disappearance rate. During the evaluation period, mineral supplement intake ranged from 38 to 130 g/head daily, which resulted in an average of 79 g/head daily. These data illustrate the expected variation in free-choice mineral intake. Heifers experienced periods when daily consumption was below and above the targeted rate of 50 g/head daily. This variation is impacted by many factors, including soil fertility, forage type, season of the year, sodium content of drinking water, and precipitation.

In summary, these data imply that there are breed and time of day differences in the frequency of visits to a mineral feeder. Future approaches, considering season of the year, source of supplements, and location of feeder should be considered. These research efforts will help better explain this variation and allow for the implementation of management systems that seek to optimize the mineral nutrition of grazing beef cattle.

## Tables

**Table 1.** Effect of yearling heifer breed on the frequency of visits to a RFID-equipped feeder containing salt-based, free-choice mineral supplement<sup>1</sup>

Breed <sup>2</sup>	Total of Visits by Breed	Morning <sup>3</sup>	Afternoon <sup>3</sup>	Night <sup>3</sup>
Braford	445 (31.8) <sup>a</sup>	197 (44.3) <sup>a,d</sup>	157 (35.3) <sup>a,d</sup>	91 (20.4) <sup>a,e</sup>
Brahman	516 (36.9) <sup>a†</sup>	223 (43.2) <sup>a,d</sup>	233 (45.2) <sup>b,d</sup>	60 (11.6) <sup>a,e</sup>
White Angus	439 (31.4) <sup>a</sup>	134 (30.5) <sup>b</sup>	172 (39.2) <sup>a</sup>	133 (30.3) <sup>b</sup>
Total <sup>4</sup>	1400	554 <sup>d</sup>	562 <sup>d</sup>	284 <sup>f</sup>

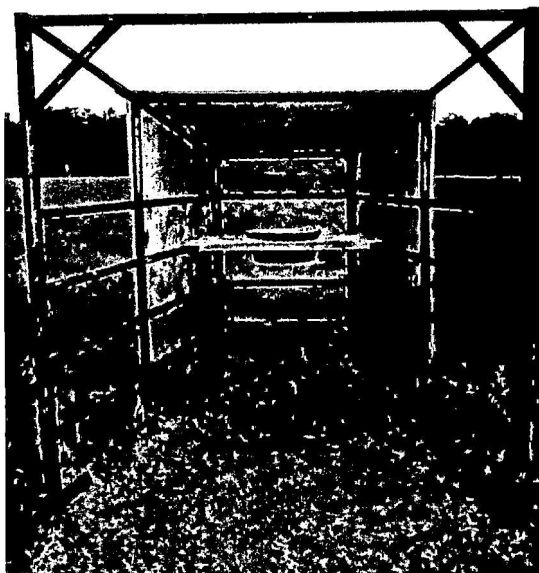
<sup>1</sup>Data collected over 47 days in May/July, 2016. Heifers were grazing fertilized 'Jiggs' Bermudagrass pasture. Supplement was a salt-based mineral supplement in amounts to ensure free-choice consumption (9.1, 4.0, and 62.5% Ca, P, and NaCl, and 1,750, 60.0, and 5,000 mg/kg Cu, Se, and Zn, respectively).

<sup>2</sup>Breeds consisted of Braford (n = 4) and Brahman (n = 4), and Ona White Angus (n = 4). The pooled Breed x Period SEM = 3.6.

<sup>3</sup>Distribution of daily visits reported in 8 h intervals; Morning = 05:00 to 12:59, Afternoon = 13:00 to 20:59, and Night = 21:00 to 04:59.

<sup>a,b</sup> Number of visits in a column with different superscript differ ( $P < 0.05$ ).

<sup>d,f</sup> Number of visits in a row with different superscript differs ( $P < 0.05$ ).



**Photo Caption:** RFID Mineral Feeder Validation Experiment (April, 2016)  
Motion sensor camera used to validate system by pairing computer  
RFID data with visual presence.  
UF/IFAS, Range Cattle Research and Education Center, Ona