The influence of age and environmental conditions on supplement intake and behavior of winter grazing beef cattle on mixed-grass rangelands

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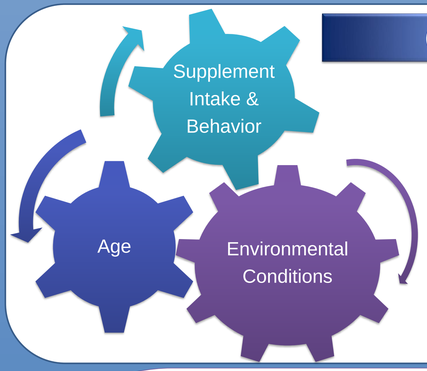
Beef cattle production on Montana ranches accounted for $1.78 billion of gross income and 42% of total agricultural sales in 2012 (USDA-NASS, 2016). Economic efficiency of cattle production is threatened by high feed and input costs (Meyer and Gunn, 2015). To improve profitability and reduced reliance on transported harvested feeds, many cow-calf producers have adopted management strategies involving dormant season grazing extending into the winter months (Adams et al., 1996). In order to meet the nutritional needs and maintain a desired level of productivity on nutrient deficient rangelands during winter months, supplemental protein is often provided to increase intake and performance (Bowman et al., 1995; Bodine et al., 2001). Effectiveness of supplementation programs on grazing cattle performance have been inconsistent (DelCurto et al., 1990). This inconsistency may be due to variation in supplement intake by individual cows, often influenced by social dominance associated with age class within the herd (Wagnon, 1965; Friend and Polan, 1974). In addition, potential changes in energetic requirements to maintain homeothermy during winter months could alter supplement intake.



Objectives

To evaluate how cow age and environmental conditions influence:

1. Individual animal supplement intake.
2. Supplementation behavior of mixed-aged cattle grazing winter rangelands in Montana.

Methods

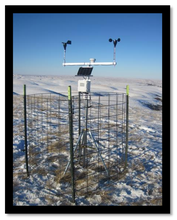
- Winter grazing study on mixed-aged cow herd
  - November-January 2016-2018
- Grazing native mixed grass prairie
  - Thackeray Ranch, Havre, Montana
  - 329 ha pasture (~1.2 ha AUM^{-1})
- 300 cows (Angus, Angus x Simmental)
  - Cattle were assigned to one of six age classifications: 1-yr-old, 2 & 3-yr-olds, 4 & 5-yr-olds, 6 & 7-yr-olds, and 8 & 9-yr-olds, and ≥ 10-yr-olds

Supplement Intake and Behavior

- All cattle had free-choice access to a 30% CP self-fed canola meal-based pelleted supplement with 25% salt to limit intake
  - Target intake: 0.91 kg/cow/d
- Daily individual supplement intake and number of visits were measured using a SmartFeed Pro self-feeder system (C-Lock Inc., Rapid City, SD)
  - 8 feeding stations
- Data were analyzed using ANOVA with a mixed model

Environmental Conditions

- A HOBO Weather Station was placed near the supplement feeders to collect air temperature, relative humidity, and wind speed and direction data for the entirety of the grazing period
- All data was analyzed using generalized linear mixed models
- Akaike's Information Criterion adjusted for small sample sizes (AIC_c) was then used to evaluate support for competing models (Burnham and Anderson, 2002)



Funding

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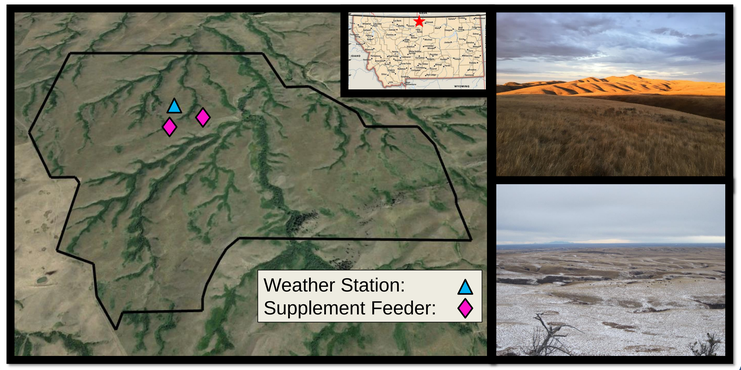
Study Area



Supplement Intake & Visits

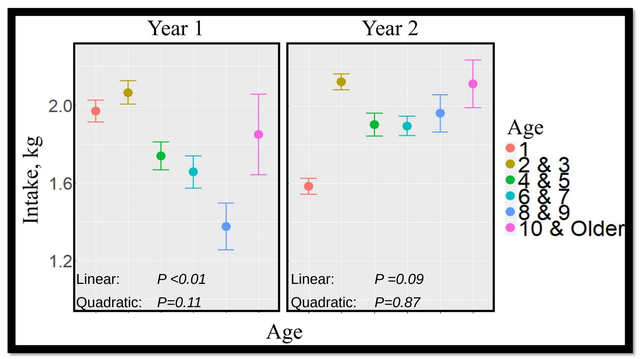


Figure 1. Average daily supplement intake and confidence intervals (95%) by age class for cattle winter grazing rangeland in 2016 & 2017 at the Thackeray ranch, Havre, Montana.

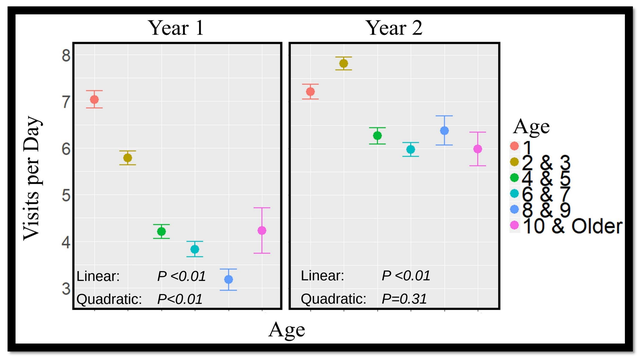


Figure 2. Average daily visits and confidence intervals (95%) by age class for cattle winter grazing rangeland in 2016 & 2017 at the Thackeray ranch, Havre Montana.

Supplement Intake & Environment

Table 1. Model selection for evaluating the effects of environmental conditions and age class on supplement intake for cattle winter grazing rangeland in 2016 & 2017 at the Thackeray ranch, Havre, Montana.

Model[1]	ΔAIC_c[2]	W_i[3]
Year + temp x age class	0.00	1.00
Year + temp x age class + wind speed	13.12	0.00
Year + temp x age class + wind speed x age class	47.59	0.00
Constant (null)	241.31	0.00

[1]Cow is used as a random variable in all models. Only models with a Akaike weight (W_i) > than the null model are presented.
[2]Difference in Akaike's information criterion adjusted for small sample size compared to the best model.
[3]Akaike weight.

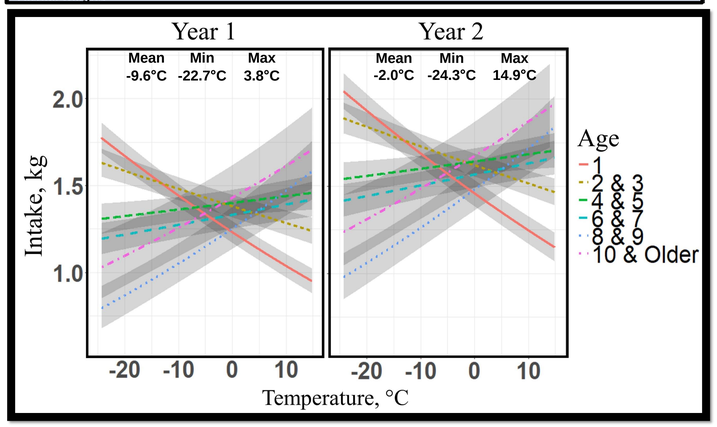


Figure 3. Model output and confidence intervals (85%) evaluating the interaction of temperature x age class on supplement intake of cattle during the winter grazing period for 2016 & 2017 at the Thackeray ranch, Havre, Montana.

Results & Conclusions

- The effects of age class on intake and visits displayed an age class x year interaction (P<0.05)
- Daily supplement intake decreased linearly as age class increased in the 1st yr (P<0.05)
- Visits per day had a quadratic response to age class in the 1st yr (P<0.01)
- There was no effect of age class on daily intake in the 2nd yr (P>0.09)
- Visits per day decreased linearly as age class increased in the 2nd yr (P<0.01)
- Our top model reveals that temperature interacts with age class
  - Young animals increase supplement intake as temperature decreases
  - Older animals decrease supplement intake as temperature decreases
- Average daily temperatures in yr 1 were 7.6°C colder than yr 2
- Development of precise strategic supplementation practices need to consider the interaction of cow age and environmental conditions with salt limited protein supplements