Using "New Technologies" to Address "Old" Beef Production Questions

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2019 Beef Improvement Federation Meetings

Brookings, South Dakota

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New Technologies

- GROWSAFE Inc.
  - *Standard in technology for evaluating individual animal intake & intake behavior*
  - *Standard equipment at many USDA / Land Grant Universities*
    - *MSU Campus (18 beef, 8 sheep) and MSU NARC (32)*
  - *Industry examples:*
    - *Midland Bull Test (Montana)*
    - *Simplot Grandview Feedlot*

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New Technologies (cont'):

- C-Lock Inc. (Smartfeed Systems; Rapid City, SD)
  - *Relatively new entry to measuring feed intake and feed intake behavior*
  - *Developing equipment for unique challenges / opportunities*
    - *My Montana State University experience*
      - *Measure self-fed supplement intake in remote locations*
      - *No power, no internet, severe environment*
    - *Interested in precision nutrition and application to commercial beef cattle production*

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Beef Cattle Feed Intake

- Well established in backgrounding / feeder scenarios:
- Not well established for Cow / calf production:
  - *Limited information for cows and even less for grazing cows on pasture or rangelands*
  - *Previously, research was difficult and contained numerous sources of error*

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Strategic Supplementation Optimizes the Use of Low-Quality Forages

- Past Research

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Cow Efficiency

- In western production systems:
  - Reproduction is the #1 culling criteria
  - Other factors:
    - Production
      - % of body weight weaned

".. Cows should wean 50% of their body weight .. "

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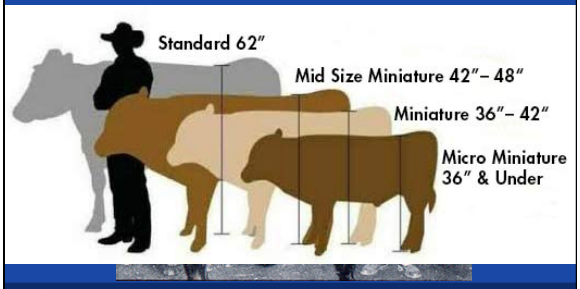
Ideal Cow Size?



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Ideal Cow Size?

Recent Popular Press Publications:

✓ University of Wyoming
✓ North Dakota State University
✓ Past publications

* Imply that smaller cows are more efficient than larger cows

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Energy requirements versus Body Size:

- **Smaller animals have higher metabolic rates than larger animals.**
  - Likely due to factors such as:
    - Thermo-regulation and body size
    - Maintenance functions required for all animals, but proportionally greater for small animals
- **Energy Metabolism and Body Size:**
  - Energy requirements are proportional to body weight raised to the .75 power
  - This is the basis to expressing intake as a function of $BW^{*.75}$
- **Van Soest (Nutritional Ecology of Ruminants)**

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Land & Forage Resources in the Western US

Problem & Justification

- Use of fall & winter forages will increase:
  - Economical alternative to harvested forages
  - Allows for increased use of rangelands outside of the growing season
  - Extended grazing seasons (decreased confinement feeding) may have physiological benefits
  - BUT, optimal use of high-fiber, low-quality, forages
- Cattle will be selected for environmental "fit"
- New technologies will assist in refining existing knowledge of strategic supplementation

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Current/Future Research

- Strategic Supplementation
  - Optimal nutrient delivery systems
  - Optimal use of Low-Quality Forages
  - Optimal use of Rangelands

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Winter Grazing Research at Havre

- Winter of 2016/2017 and 2017/2018

- Influence of Supplement Intake and Cow Age on Grazing Behavior and Rangeland Use Patterns
  - Sam Wyffels, Jan Bowman, Lance McNew, Darrin Boss, Cory Parsons, Julia Dafoe, Alyson Hicks-Lynch, and Tim DelCurto
    - Vegetation: production and cover by species, forage quality, robel structure estimates
    - Soil organic matter, temperature maps (GIS Layers)

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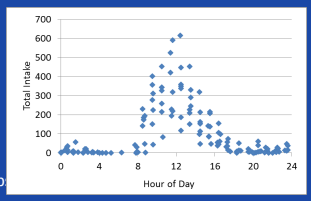
Feeding Bout Data

- **45 d (yr 1) & 60 d (yr 2):**
  - 42,472 visits yr 1 & 65,873 yr 2
    - Cow EID read
    - Time of day
    - Entry and exit are recorded
    - Coupled with weather station and GPS collar data
  - Avg Supple Intake = 2.75 lb (1.25 kg)
  - 264/272 (yr 1) and 302/306 (yr 2) cows were recorded



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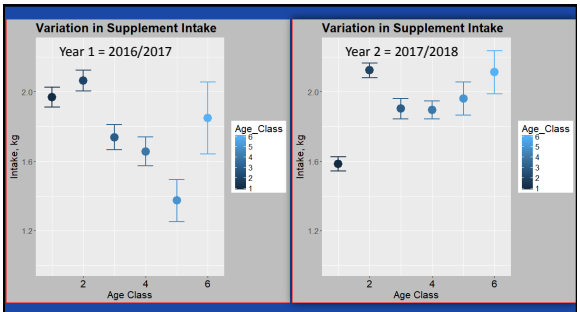

Figure 1. The influence of cow age on supplement intake and variation in intake. Age class 1 = yearling heifers, age class 2 = 2 & 3 yr cows, age class 3 = 4 & 5 yr cows, age class 4 = 6 & 7 yr cows, age class 5 = 8 & 9 yr cows, and age class 6 = 10 & older (Wyffels et al., 2018).

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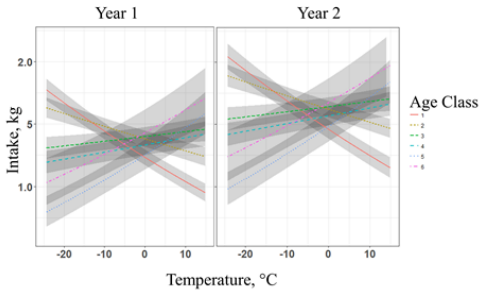

Figure 2. The influence of environment and cow age on supplement intake behavior. Best-Fit model involved mean daily temperature and cow age (Wyffels et al., 2018).

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Goals & Objectives

II. Matching Beef Cattle Production to Western Rangeland Environments

1. Influence of Mature Cow Weaning Weight Ratios and Cow Size on Intake and Grazing Behavior
   - Alyson Williams MS Program
2. Ability of Yearling Heifer Residual Feed Intake (RFI) Estimates to Predict Cow Productivity, Feed Intake and Grazing Behavior
   - Cory Parsons PhD Program

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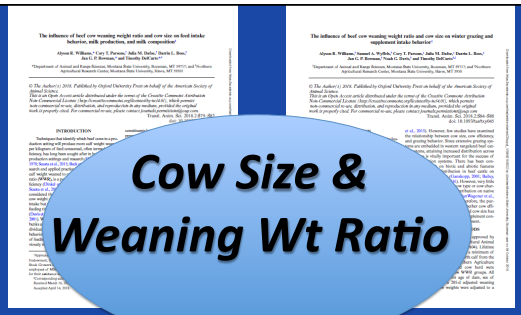
Cow Size & Weaning Wt Ratio



Transl. Anim. Sci. 2018.2:S79–S83 doi: 10.1093/tas/txy044
Transl. Anim. Sci. 2018.2:S84–S88 doi: 10.1093/tas/txy045

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Current/Future Research

- Strategic Supplementation
  - Optimal nutrient delivery systems
  - Optimal use of Low-Quality Forages
  - Optimal use of Rangelands

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2. *Salt Limited Supplement Intake: Impacts of Salt Level, Frequency, and Form of Supplement on Intake, Nutrient Digestion, and Variability of Supplement Intake in Beef Cattle* Hayley White MS program

Intake Variation Study:

- Approximately 60 crossbred heifers
- Comparing intake and intake variation between two forms of salt-limited supplement, pelleted or loose, using SmartFeed Pro Trailer.
- 3 Treatment Groups:
  1. Control (no supplement)
  2. Pelleted form
  3. Loose form
- Heifers will be weighed and body condition scored on days 0, 42, and 84. Individual dry matter supplement intake, frequency of feed events, and total number of feed events will be measured for each heifer.

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Red Bluff Project

- Use new prototype feeder
- Lotek new prototype GPS Collars
- OBJECTIVES:
  - Winter environment effects on vegetation change
  - Resource use patterns

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Red Bluff Research (cont')

- **Long-Term Effects of Protein Status on Winter Grazing Beef Cows**
  - Treatments
    1. non-supplemented control cows
    2. 1.5 kg of Alfalfa Pellets
    3. 3.0 kg of Alfalfa Pellets
  - DESIGN:
    - 150 hd of dry pregnant mature cows
    - Feed Supplements late November to mid-February
    - Three year study

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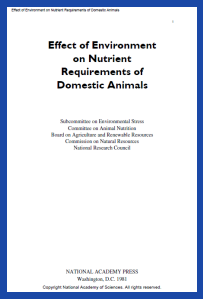
Environment and Nutrient Requirements

- Most of the models for environment are based on 1981 NRC Publication
- Most are focused on energy requirements
  - Protein, minerals & vitamins?
- Relate to temperature and hair coat
  - Limited in respect to precipitation and/or wind conditions
    - Wind Chill equivalent?



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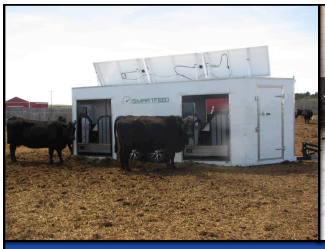

Validation Study Needs:

1. How does "stocking rate" influence supplement intake behavior?
2. How does supplement delivery method influence supplement intake behavior?
   - SmartFeed Pro and SuperSmartFeed systems are different
3. Effectiveness of feeders to limit and/or more precisely deliver supplements in extensive environments.

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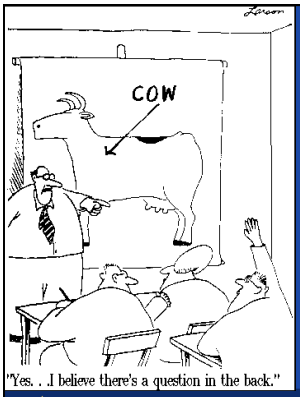

Thank You!

Questions?

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Research Support

Nancy Cameron Endowment

Bair Ranch Foundation

Montana State University College of Agriculture & Montana Agricultural Experiment Station

Montana Stockgrowers Association

CoBank — Cooperative. Connected. Committed.

Northwest Farm Credit Services — Advancing Rural America's Success

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Beef Cattle Nutritional Requirements:

Cow Size	Milking Level	lb of milk/ cow/day	lb TDN Needed	lb CP Needed
1000	Below Avg	10	12.4	1.9
1000	Average	20	14.8	2.6
1000	Above Avg	30	17.2	3.5
1200	Below Avg	10	13.8	2.1
1200	Average	20	16.2	2.8
1200	Above Avg	30	18.7	3.5
1400	Below Avg	10	15.2	2.3
1400	Average	20	17.6	3.0
1400	Above Avg	30	20.1	3.7

Source: Nutrient Requirements of Beef Cattle; 1984, 1996 & 2016.

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Final Thoughts:

- Beef Cattle Efficiency is primarily defined by reproduction
  - Optimal size depends on environment
  - Metrics for Environmental "Fit" are limited

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