Forage Quantity

Cow BCS

Forage Quality

Fertility

Calving Interval

Milk Production, Forage Intake, and Body Weight Gain
Short Term Dietary Restriction
12 to 13 days (effects started showing up at 7 days)

- Operated at ovary level with reduced growth rate of dominant follicle and reduced maximum size of dominant follicle.

Long Term Dietary Restriction
30 days = additional 21 days before re-feeding
- At first, operated at ovary level. A 10% weight loss caused a 9% decrease in both the maximum size of dominant follicle and ovulatory follicle. The CL size was reduced by 11%.
- The life of the dominant follicle was reduced by 0.4 days for each wt. loss of 22 lbs.
- LH release was not reduced until cows quit cycling (anestrus) at 93 days (BCS = 3.3).
- 54 days re-feeding at full feed were required to bring heifers back in estrus (BCS = 3.9). First estrus cycles following re-feeding were 10 days shorter than later normal cycles.
- The shorter the time period required to achieve anestrus, the longer the anestrus period, suggesting that animal variation is important and that the trajectory of the weight loss is important.

Increased weight loss and stress causes the release of cortisol.

Increased cortisol causes a decrease in LH release.

LH is necessary for ovulation.
Pregnancy % by Body Condition Score

<table>
<thead>
<tr>
<th>Body Condition at Calving</th>
<th>Day 40 of Breeding Season</th>
<th>Day 60 of Breeding Season</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>43 ± 5</td>
<td>56 ± 6</td>
</tr>
<tr>
<td>5</td>
<td>55 ± 4</td>
<td>60 ± 6</td>
</tr>
<tr>
<td>6</td>
<td>90 ± 5</td>
<td>60 ± 8</td>
</tr>
</tbody>
</table>

Crude Protein in Arizona During Drought

<table>
<thead>
<tr>
<th>Month</th>
<th>Crude Protein, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feb</td>
<td>4</td>
</tr>
<tr>
<td>Mar</td>
<td>6</td>
</tr>
<tr>
<td>Apr</td>
<td>6</td>
</tr>
<tr>
<td>May</td>
<td>6</td>
</tr>
<tr>
<td>June</td>
<td>12</td>
</tr>
<tr>
<td>July</td>
<td>14</td>
</tr>
<tr>
<td>Aug</td>
<td>15</td>
</tr>
<tr>
<td>Sep</td>
<td>16</td>
</tr>
</tbody>
</table>
Energy Content in Arizona During Drought

<table>
<thead>
<tr>
<th>Month</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>June</th>
<th>July</th>
<th>Aug</th>
<th>Sep</th>
<th>Sand-dropped (50% net, percent)</th>
<th>Sand-dropped (50% norm, percent)</th>
<th>Sandy-clay loam</th>
<th>Sandy upland</th>
</tr>
</thead>
</table>

Non-supplemented Steers

S. Central NM Blue Grama Rangeland (6233 to 7564')

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Growing Season</th>
<th>Dormant Season</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plant</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crude Protein</td>
<td>15.4%</td>
<td>9.9%</td>
</tr>
<tr>
<td>Available Protein</td>
<td>12.8%</td>
<td>6.5%</td>
</tr>
<tr>
<td>Forage Digestibility</td>
<td>66.8%</td>
<td>42.6%</td>
</tr>
<tr>
<td>Animal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Forage intake, % of BW</td>
<td>2.17%</td>
<td>1.49%</td>
</tr>
<tr>
<td>% Grasses in Diet</td>
<td>74.6%</td>
<td>45.8%</td>
</tr>
<tr>
<td>% Forbs in Diet</td>
<td>25.4%</td>
<td>53.2%</td>
</tr>
<tr>
<td>Rumen Retention Time</td>
<td>45.3 h</td>
<td>36.2 h</td>
</tr>
</tbody>
</table>

Kelso et al., 1987 AASU Bulletin 727

Sedentary attraction ± chert flake. Photo by Lucile Joubert, USGS photographer.
Effect of Crude Protein on Forage Intake
Nonlactating Cow on Native Range

Forage Intake, % of BW

Crude Protein

Adapted from Cochran, 1982, KSU Range Field Day

Forage Intake of a Nonlactating Range Cow

Forage Intake, % of BW/day

Amount Needed for Maintenance
Amount Can Eat

Forage Intake of a Lactating Range Cow

1000 lb. cow milking 10 lbs. / day

Forage Intake, % of Body Weight

Amount Needed for Maintenance
Amount Can Eat

Winter grazing under the Continental Divide, Snow Flats, Custer, Montana

Winter grazing is very much like grazing during drought except the cow is not usually dry.
Production of Cows with and without Supplement

- Older cows lost 0.88 lb/d, estimated intake = 1.97% of BWT
- Young cows lost 1.76 lb/d, estimated intake = 1.84% of BWT

Production rate, %

- 0-20
- 20-40
- 40-60
- 60-80
- 80-100

Cow Age

- Without Supplement
- 1 Lb./sky Cattleman's Mix

Feeder, Wilkerson Feed Producer, 2nd March, 1996
How much forage?

**Forage: Green or Dry**

- **Adequate Forage**
  - What's Missing?
    - Nutritional Stress: TM, or E, or CP
      - Protein Supplementation: Forage > 7% CP
    - For TM: Available at all times. For energy, usually helped by CP.

- **Inadequate Forage**
  - Protein/Energy or Energy Supplement

What's BCS?

- **Growing**
  - Traditional Knowledge: Supplement 60-90 d before calving to preserve BCS. Calve at BCS = 5. Cattle at BCS = 4 or = at breeding. 1 to 2 used fed 1/2 wk or 2 wk or daily.

- **Nonlactating Mature Cows**
  - MILCS: OPEN WINTER - Each cow gets self fed minute mineral with protein added for 30 d before calving (.15 lb/d of 50% TM & 50% protein sources (65-70% rumen undegradable))
  - MILCS: BEFORE WINTER - Min: 0.55 lb/d of 36% CP fed 1 x wk (3.5 lbs/feeding). From 35 to 40 % bypass protein. To try to build BCS before winter when needed.
  - MILCS: MORE SEVERE WINTER - 1 lb/d of 36% CP fed 2 x wk (3.5 lbs/feeding) to daily. Use oil seed feeds and is < 40 % bypass protein. Will add 0.25 to 0.50 BCS.

- **Lactating Mature Cows**
  - MILCS: SEVERE WINTER & SEVERE WT LOSS - 2 lb/d of 36% CP fed 2 x wk (7 lbs/feeding) to daily. Has 50% bypass protein. Reduces wt loss, milk fat, & days to estrus.

For replacement heifers, may require drylot feeding for two most severe months to achieve weight needed for puberty.
Forage Intake on Dormant Tallgrass Prairie Hay
1.9% Crude Protein; 38% TDN

Forage Intake, % of Body Wt.

<table>
<thead>
<tr>
<th>Lbs. of 33% Protein Supplement</th>
<th>0.9</th>
<th>1.8</th>
<th>2.7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forage Intake</td>
<td>1.2</td>
<td>1.5</td>
<td>1.9</td>
</tr>
</tbody>
</table>

Slafford et al., March 1995 Journal of Animal Science

Forage Digestibility on Dormant Tallgrass Prairie Hay
1.9% Crude Protein; 38% TDN

Forage Digestibility, TDN%

<table>
<thead>
<tr>
<th>Lbs. of 33% Protein Supplement</th>
<th>0.9</th>
<th>1.8</th>
<th>2.7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forage Digestibility</td>
<td>38</td>
<td>41</td>
<td>45</td>
</tr>
</tbody>
</table>

Slafford et al., March 1995 Journal of Animal Science

How much forage?

What's Cow Behavior?

What's BCS?
Supplement Composition

- **Protein 30% crude protein**
  - Cornsteep Meal: 12%
  - Feather Meal: 17%
  - Fish Meal: 5%
  - Miconia: 11%
  - Ground Milo: 20%

- **Cellulose 30% crude energy**
  - Cornsteep Meal: 47%
  - Soybean Meal: 12%
  - Molasses: 11%
  - Ground Milo: 9%

-$275 per ton

$235 per ton

Supplements formulated as cubes or 33lb blocks fed two or three times weekly to provide 2 lbs/head/day

Delayed February Start Supplementation

<table>
<thead>
<tr>
<th>February start</th>
<th>Bypass (n=65)</th>
<th>Control (n=65)</th>
<th>± SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>October</td>
<td>503</td>
<td>516</td>
<td>7.8</td>
</tr>
<tr>
<td>January</td>
<td>511</td>
<td>501</td>
<td>11.6</td>
</tr>
<tr>
<td>March</td>
<td>542</td>
<td>536</td>
<td>14.7</td>
</tr>
<tr>
<td>May</td>
<td>538</td>
<td>560</td>
<td>16.7</td>
</tr>
</tbody>
</table>

Heifer body weights (lb) and pregnancy rate (04-05; 06-07)
Bypass Protein with Brahman Cows and 1st Calf Heifers in TX

<table>
<thead>
<tr>
<th></th>
<th>Low Bypass Protein (37%)</th>
<th>Medium Bypass Protein (56%)</th>
<th>High Bypass Protein (76%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Service Conceal</td>
<td>29%</td>
<td>58%</td>
<td>55%</td>
</tr>
<tr>
<td>60 Day Progability</td>
<td>43%</td>
<td>62%</td>
<td>56%</td>
</tr>
</tbody>
</table>


Potential Nutritional Mediators of Reproduction

- Hypothalamus
- GnRH
- Excitatory Amino Acids
- Anterior Pituitary
- LH, FSH
- Ovaries

Supplementation

- If forage supply is adequate (less than 50% utilization) and low in protein:
  - Feed Protein
- If forage supply is limiting (greater than 50% utilization):
  - Feed Energy (and satisfy protein req.)
Effect of Stocking Rate Upon Cottonseed Meal Supplementation

- Stocking Rate vs. Average Daily Gain (lbs.)

<table>
<thead>
<tr>
<th>Stocking Rate</th>
<th>Treatment (5 lb. CSM/day)</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.5 A/cow</td>
<td>1.9</td>
<td>1.5</td>
</tr>
<tr>
<td>5.6 A/cow</td>
<td>1.5</td>
<td>1.4</td>
</tr>
</tbody>
</table>


Concepts & Rules for Energy Supplementation

- Energy supplements must be fed every day as opposed to protein supplements which can be fed once a week (at 7 times the daily rate of 1 lb/d; 7 lbs. total).
- Energy supplements usually decrease forage intake when fed with poor-quality forage. Cattle usually substitute the supplement for forage. This can be an advantage in drought.
- The above substitution effect is less severe when energy supplements are fed at rates of less than 30% of body weight (3 lbs. for a 1000 lb. cow).
- If you do not desire to overly impact grazing time, it is best to feed energy supplements in the early afternoon when cows are resting.
- Energy supplements are more efficient for putting on weight.

Urea toxicity

- Must feed urea every day.
- Cattle must adapt to urea and can lose ability to use urea very quickly (days).
- To feed urea you must meet energy need first, without sufficient energy urea is not useful.
- NPN < 1/3 total diet nitrogen.
- Urea toxicity is often seen in AZ during drought.

Effects of Frequency of Supplementation

- Grazing Time and Date

<table>
<thead>
<tr>
<th>Grazing Time</th>
<th>N Great Basin Exp Range</th>
<th>Miles City, MT</th>
<th>Dubois, ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>10.7 (Pre)</td>
<td>10.4 (Pre)</td>
<td>10.6 (Pre)</td>
</tr>
<tr>
<td>7 days</td>
<td>7.9</td>
<td>7.2</td>
<td>7.9</td>
</tr>
<tr>
<td>14 days</td>
<td>7.9</td>
<td>7.2</td>
<td>7.9</td>
</tr>
<tr>
<td>21 days</td>
<td>7.9</td>
<td>7.2</td>
<td>7.9</td>
</tr>
<tr>
<td>28 days</td>
<td>7.9</td>
<td>7.2</td>
<td>7.9</td>
</tr>
</tbody>
</table>
Supplements can be very palatable.

Cattle are willing to travel long distances (even 3.0 km) and climb steep slopes to consume the supplement.

[Image: Cattle on a hillside, supplement visible]

[Diagram: Comparison of Harvesting Rate for Supplemented vs Control. Bars indicate mean bite rates with different letters (a, b, c) denoting statistical significance (P<.05).]
Other Tools for Operations with Easier Access to Cows

Suppression of Estrus by Suckling

- 1st estrous bleed after calving occurs in 11% beef cows
- For dairy cows, 75%
- Interval to 1st estrous: Short et al. 1972
- 55 days suckled cows
- 25 days non-suckled cows
- 12 days non-suckled, older removed
- Suckling by calf reduces LH release by cow
- 1st Estrus in beef cows is usually short
- Some suggest the 1st heat calve removal is weak, cows need to be at least 36 days after calving and BCS of 4.5
- If now is blank, can combine 48 hour calve removal with hormone manipulation (CIDR & Prostaglandin) to improve conception

Effect of Ovsynch/Cosynch Estrus Synchronization and 48 Calf Removal

Angus & Hereford Cows, 1 Timed AI = Bulls in WY & CO

University of Arizona Tools for Assessing Drought
Based on historical data from 1895 to present, chance of staying very dry into October is 55%.

https://uaclimateextension.shinyapps.io/SPITool/

Can also access through
https://cals.arizona.edu/droughtandgrazing/tools
Gulde to Co-Developing Drought Preparation Plans for Livestock Grazing on Southwest National forests

https://droughtview.arizona.edu/

University of Arizona Drought Resources

https://cals.arizona.edu/droughtandgrazing/dashboard
https://cals.arizona.edu/droughtandgrazing/tools

https://droughtview.arizona.edu/
Rules for Range Nutrition

1. Feed both the cow & the rumen. Supplemental protein required when forage is < 6 to 7% CP. Protein that feeds the rumen is degradable intake protein; protein for the cow is undegradable intake protein or bypass protein and some microbial protein.

2. Quantity: A range cow needs to have the opportunity to eat all she can every day. If she doesn’t lay down mid-morning, potential problem with forage supply.

3. Quality: Supplementing CP will often increase both forage intake and digestibility on warm season grasses due to increased rumen microbes and faster passage rate.

4. BCS = 5 is a good target for calving.

5. Minimize wt. loss after calving with lower milk production, moderate cow size, calving to match forage supply, and using best pastures.

6. For thinner cows after calving, some tools to improve pregnancy are bypass protein, 48 hr calf removal, hormonal manipulation, and small amounts of added glucose in protein supplements.