Management Considerations for Wintering the Cow Herd and Preparing for the Next Grazing Season

Ron Lemenager, Beef Extension Specialist
Keith Johnson, Forage Extension Specialist

Wouldn’t it be nice if....?

Top 11 Areas For Consideration:
1) Body condition score cows.
2) Inventory hay and other feed resources.
3) Analyze feeds for nutrient profile.
4) Pregnancy checking, culling and marketing.
5) Divide cow herd into management groups.
6) Utilization of crop residues.
7) Alternative supplementation strategies.
8) Limit feeding of hay.
9) Minimize hay waste.
10) Adjust rations for “cold stress”.
11) Plan for next growing season.

Thin cows do not compete well, and they need higher quality diets.

See www.thebeefcenter.com for a how-to video.
**BCS Are a Wake-up Call**

- Good indicator of nutrition/reproduction
- 1-9 system, 5-6 is ideal at calving
- “Look” at cows monthly
- If gaining or losing BCS
  - Evaluate
  - Adjust rations
  - Seek help if needed

**Body Condition Scores**

1 - Emaciated
2 - Very thin
3 - Thin
4 - Moderately thin
5 - Moderate (ideal)
6 - Moderately fleshy
7 - Fleshy
8 - Very fleshy
9 - Obese

**Use BCS as a Tool**

- They are an indicator of “balance”
- Keep the System Simple
- Be Consistent
- Look Through the Hair
- Evaluate fat,
  - NOT hair, muscle, fill or pregnancy
- Record Scores and Compare

**“Under practical management conditions, much of the variation in reproductive performance of beef cows may be accounted for by differences in total energy intake and body condition.”**

Conclusion from literature

**Weight-Cycling During the Year**

- Normal fluctuation
  - Excess nutrients = weight and BCS gain
  - Limited nutrients = weight and BCS loss
- Timing of fluctuation is critical
- Economical recovery is critical
  - Moderate BCS at calving / breeding

**Reproductive Efficiency**

- If a cow is to calve every 365 days, she must be bred within ~83 days after calving
- From calving until the uterus is ready for pregnancy is about ~40 d
  - This leaves only ~43 days to rebreed.
Thin Cow Impact

- Potential for 3 yr. economic affect
  - Year 1 ↑ Feed cost
  - Year 2 ↓ Calf vigor
  ↓ Colostrum quality
  ↓ Milk prod./calf weaning wts.
  ↑ PPI, days
  ↓ Conception rate
  - Year 3 ↓ Calf crop weaned

Energy Reserves and Reproduction

- Formulate diets to reach target BCS by calving
  - Cows ≥
    - 1st calf heifers = 5.5 - 6.0

- Weight change
  - Cows = 80 lb to gain or lose 1 BCS
  - 1st Calf Heifers = 150 lb to gain 1 BCS

Reproduction on the Farm

Body Condition at Calving and Percent Showing Estrus After Calving

<table>
<thead>
<tr>
<th>Body Condition at Calving</th>
<th>No. Cows</th>
<th>PPI, days Post-calving</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thin (1-4)</td>
<td>272</td>
<td>60</td>
</tr>
<tr>
<td>Moderate (5-6)</td>
<td>364</td>
<td>61</td>
</tr>
<tr>
<td>Good (7-9)</td>
<td>50</td>
<td>91</td>
</tr>
</tbody>
</table>

Whitman, Colorado State University, 1975.

Effect of Body Condition Score (BCS) at Calving on Postpartum Interval (PPI)

<table>
<thead>
<tr>
<th>BCS at Calving</th>
<th>PPI, days</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>88</td>
</tr>
<tr>
<td>4</td>
<td>70</td>
</tr>
<tr>
<td>5</td>
<td>60</td>
</tr>
<tr>
<td>6</td>
<td>52</td>
</tr>
<tr>
<td>7</td>
<td>31</td>
</tr>
</tbody>
</table>

Adapted from Houghton et al., Purdue University, 1990.

Predicted PPI (d) in Young Beef Cows

<table>
<thead>
<tr>
<th>BCS at Calving</th>
<th>Body Condition Score Change 90 d Post-calving</th>
</tr>
</thead>
<tbody>
<tr>
<td>BCS at Calving</td>
<td>≤ 1</td>
</tr>
<tr>
<td>3</td>
<td>189</td>
</tr>
<tr>
<td>4</td>
<td>161</td>
</tr>
<tr>
<td>5</td>
<td>133</td>
</tr>
<tr>
<td>5.5</td>
<td>118</td>
</tr>
</tbody>
</table>

Relationship of body condition score (BCS) to beef cow performance and income

<table>
<thead>
<tr>
<th>BCS</th>
<th>Preg Rate %</th>
<th>Calving Interval</th>
<th>Wean Age</th>
<th>Calf ADG</th>
<th>Calf WW</th>
<th>Calf value, $/100 lb</th>
<th>Gross Income</th>
<th>Cow Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>43</td>
<td>414</td>
<td>180</td>
<td>1.60</td>
<td>374</td>
<td>123</td>
<td>460</td>
<td>182</td>
</tr>
<tr>
<td>4</td>
<td>61</td>
<td>381</td>
<td>223</td>
<td>1.75</td>
<td>460</td>
<td>116</td>
<td>534</td>
<td>300</td>
</tr>
<tr>
<td>5</td>
<td>86</td>
<td>364</td>
<td>240</td>
<td>1.85</td>
<td>514</td>
<td>109</td>
<td>560</td>
<td>443</td>
</tr>
<tr>
<td>6</td>
<td>93</td>
<td>364</td>
<td>240</td>
<td>1.85</td>
<td>514</td>
<td>109</td>
<td>560</td>
<td>443</td>
</tr>
</tbody>
</table>

At $143 difference – there is opportunity to buy some “extra feed

At $143 difference – there is opportunity to buy some “extra feed

Adjusted BCS

- NE Requirements, Mcal/d (1200 lb cow)
  - Mid-gestation: 8.68
  - Late-gestation: 10.83
  - Early Lactation (10 lb milk): 12.09 (80% increase)
- CP Requirements, lb/d (1200 lb cow)
  - Mid-gestation: 1.4
  - Late-gestation: 1.7
  - Early Lactation (10 lb milk): 2.1 (95% increase)
  - Early Lactation (20 lb milk): 2.7

Colostrum Quality

- Cows fed 57% vs. 100% NRC (E & CP)
  - Calves fed colostrum (2 x 2 design)
  - Colostrum from restricted cows
    - No differences in IgG between colostrums
    - 21% ↓ absorption - calves from deficient cows

Hough et al., 1990; supported by Burton et al., 1984 and Lake et al., 2005
Effect of Weaning Date on Change in Cow Body Condition Score

Early weaning

- Feed conservation
  - ↓ cow DMI by 25-30% (Purdue, unpublished data)
  - ↓ calf forage intake
  - ↓ trampling loss by calf
- Improved BCS – reduced supplemental feed
- Grazing situations
  - Extend forage supplies > 30%
  - Early gestation cow can “rough it”

Summary

- The level of nutrition (energy) fed pre-calving will affect cow herd productivity
- Under-fed or thin cows:
  - Have lower quality colostrum/milk quantity
    - Calf’s immunity to fight disease
    - Calf’s ability to deal with stress
  - Are slow to return to estrus
  - Have lower overall conception rates

Heifer Development

One of the most important management groups in the herd

Heifer Development and Puberty**

- Factors affecting age at puberty
  - Pre-weaning growth and weaning wt.
  - Low post-weaning growth
    - Delay development of repro. tract (Gropp, 1980)
    - Delay in puberty = ↓ pregnancy rate,
    - ↑ pregnancy loss (Short and Bellows, 1971)
    - ↓ size at 1st calving, ↑ dystocia (Bellows, 1978)

Feeding to a “Target Weight”

<table>
<thead>
<tr>
<th>Item</th>
<th>% of Mature Wt @ breeding</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>55%</td>
</tr>
<tr>
<td>Pre-breeding wt</td>
<td>600</td>
</tr>
<tr>
<td>Conception (21d)</td>
<td>30</td>
</tr>
<tr>
<td>Calving wt.</td>
<td>834</td>
</tr>
<tr>
<td>Calf birth wt.</td>
<td>71</td>
</tr>
<tr>
<td>Calving difficulty,%</td>
<td>52</td>
</tr>
<tr>
<td>Calf death loss,%</td>
<td>6</td>
</tr>
<tr>
<td>Fall Preg Rate, %</td>
<td>85</td>
</tr>
</tbody>
</table>
Effect of Time of Gain From Weaning to Breeding on Heifer Performance

Impact of sudden, severe reduction in feed intake on cycling activity of yearling heifers

<table>
<thead>
<tr>
<th>Item</th>
<th>1.2X Maintenance</th>
<th>0.4X Maintenance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day of trt,</td>
<td>0</td>
<td>14</td>
</tr>
<tr>
<td>Heifers, no.</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>Weight, lb.</td>
<td>704</td>
<td>711</td>
</tr>
<tr>
<td>Cycling, no.</td>
<td>9/9</td>
<td>9/9</td>
</tr>
</tbody>
</table>

All heifers cycling on day 0.
Oklahoma State University data

Step 1 – Determine Avg. Bale Wt. by “Lot”

• “Lot” = cutting, field, quality
• Sample hay by “lot”
• Determine dry matter (DM) content of bales
  – One could assume that bales:
    • Inside storage - about 88% DM (ex. 1300 lb bale x .88 = 1144 lb of DM/bale)
    • Outside storage - about 80% DM (ex. 1300 x .80 = 1040 lb of DM/bale)

Top 11 Areas For Consideration:

2) Inventory hay and other feed resources.

See www.thebeefcenter.com for how-to publication (Vol II)
Step 2 – Calculate Daily Forage Needs/Cow

- For inventory purposes, let’s assume
  - DMI = 2.5% of cow body weight/day
  - Plus “waste factor”
    - Large round bales
      - Stored inside = 7%
      - Stored outside = 20%
      - Fed chopped in bunk = 5%

Intake (%BW) by Forage Quality

<table>
<thead>
<tr>
<th></th>
<th>Gestation</th>
<th>Protein Sup</th>
<th>Corn Sup</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>1.5</td>
<td>1.8</td>
<td>1.5</td>
</tr>
<tr>
<td>Moderate</td>
<td>2.0</td>
<td>2.2</td>
<td>2.0</td>
</tr>
<tr>
<td>High</td>
<td>2.5</td>
<td>2.5</td>
<td>2.5</td>
</tr>
</tbody>
</table>

Lactation

<table>
<thead>
<tr>
<th></th>
<th>Protein Sup</th>
<th>Corn Sup</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>2.0</td>
<td>2.2</td>
</tr>
<tr>
<td>Moderate</td>
<td>2.3</td>
<td>2.5</td>
</tr>
<tr>
<td>High</td>
<td>2.7</td>
<td>2.7</td>
</tr>
</tbody>
</table>

More accurate estimate of intake
120 ÷ %NDF = DMI expressed as % of body wt.
Ex. 120 ÷ 60% = DMI of 2% of body wt.
1300 lb cow x .002 = DMI of 26 lb

Step 2 - Example

- Example:
  - 1200# cow
  - 2.5% of her body weight (good quality forage)
  - Bales stored outside (assume 20% waste)
  - 2.5% x 1.2 = 3% of her body weight/d in DM
  - Daily DM disappearance is 1200# x .03 = 36# of hay DM/cow.

Step 3 – Calculate Hay Needs/Cow

- Assume feeding period Dec 16 - Apr 20 (140d).
- 36# of DM/d x 140 d = 5040# of DM/cow.
- Bales stored outside will be about 80% DM
  - 1300# bale x .80 = 1040# of DM/bale
  - 5040#/1040# = 4.8 bales needed/cow for period
- Easy to justify extending the grazing season

Step 4 – Calculate Days of Hay on Inventory

- Example:
  - 30 cows in the herd that average 1200 lb
  - 100 large round bales, good quality hay stored outside that each contain 1040# of DM
  - Total hay available is calculated as:
    - 100 bales x 1040# bale = 104,000 lb total DM
    - DM disappearance/d = 30 cows x 36#/d = 1080#/d
    - Days of hay supply = 104,000# / 1080#/d = 96.3 d
  - 140 feeding period – 96 day feed supply = 44 days short

Top 11 Areas For Consideration:

3) Analyze feeds for nutrient profile.

See www.foragetesting.org for a listing of available labs
Test Your Forages

Forage Sampling

See www.thebeefcenter.com for a how-to video

Know What Is Needed

- Analysis:
  - Moisture (DM)
  - Energy (TDN or Net energy)
  - Protein (Adjusted CP)
  - Neutral Detergent Fiber (NDF)
- Possibly:
  - Calcium
  - Phosphorus
  - Magnesium

Will need to provide a good mineral containing salt, Vitamin A, copper, zinc, selenium

Effect of Nutrition on Reproduction

- Deficiencies in:
  - Energy
  - Protein
  - P, Ca, Mg, Cu, Co, Zn, Se
  - Vitamins A and E
- Possible excesses:
  - Nitrogen (CP)
  - P, S
  - Fat

Principle factor influencing reproduction is general under nutrition due to feed shortage or poor feed quality.

Gilbert, 1992

Sub-maintenance Energy Levels

- Delayed onset of puberty
- Prolonged postpartum anestrus
- Enhanced effects of suckling on anestrus
- Increased onset & duration of seasonal anestrus
- Lower conception rates/later calving
Most cases of protein, mineral, and vitamin deficiencies are confounded with ENERGY.

**Variation in Nutrient Content**

<table>
<thead>
<tr>
<th>Feed</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn stalks, %TDN</td>
<td>50 - 56</td>
</tr>
<tr>
<td>Soybean straw, %TDN</td>
<td>32 - 50</td>
</tr>
<tr>
<td>Hay, %TDN</td>
<td>45 - 65</td>
</tr>
<tr>
<td>Hay, Adjusted %CP</td>
<td>6 - 22</td>
</tr>
</tbody>
</table>

*Values reported on a dry matter basis.

**Protein and Reproduction**

- When gestation CP < 8%
  - Related to BCS
  - Forage digestibility
  - Rate of digestion
  - Forage intake and nutrients
  - Colostrum quality
  - Ability of calf to get up and nurse
- When lactation CP < 12%
  - Milk production
  - PPI
  - Conception

**Caution:** Overfeeding protein will increase calf birth weights and dystocia.

**Other Considerations**

- **8 – 10 – 12 protein rule**
  - (mid-gestation, late gestation, early lactation)
- Treat for internal and external parasites
- Vitamin A deficiency
  - Stored forages
  - Requirements:
    - Gestation: 40,000 IU/d
    - Lactation: 70,000 IU/d

**Other Considerations**

- 8 – 10 – 12 protein rule
  - (mid-gestation, late gestation, early lactation)
- Treat for internal and external parasites
- Vitamin A deficiency
  - Stored forages
  - Requirements:
    - Gestation: 40,000 IU/d
    - Lactation: 70,000 IU/d

**Other Considerations**

- 8 – 10 – 12 protein rule
  - (mid-gestation, late gestation, early lactation)
- Treat for internal and external parasites
- Vitamin A deficiency
  - Stored forages
  - Requirements:
    - Gestation: 40,000 IU/d
    - Lactation: 70,000 IU/d

**Other Considerations**

- 8 – 10 – 12 protein rule
  - (mid-gestation, late gestation, early lactation)
- Treat for internal and external parasites
- Vitamin A deficiency
  - Stored forages
  - Requirements:
    - Gestation: 40,000 IU/d
    - Lactation: 70,000 IU/d

**Decide When Forages Should Be Fed**

- Long-standing recommendation has been:
  - Lowest quality feeds → Low nutrient requirements (mid-gestation, after weaning)
  - Highest quality feeds → High nutrient requirements (late gestation/early lactation)

**Additional Consideration**

- Forage management based on nutrient requirements:
  - Breeding: Low nutrient requirements
  - Weaning: Medium nutrient requirements
  - Calving: High nutrient requirements

*Source: Nutrient Requirements of Beef Cattle, 2000.*
Interpreting a Feed Analysis

- Sample Type: SMALL GR HAY
- Identification: RYE BALES
- Test Pack: FORAGE BASIC

### Analytical Data

- **Assay**
  - **DM Basis**
  - **As is**
  - **DM Typical Range**
- **Moisture (%)**
  - 9.76 - 14.00
- **Dry Matter (%)**
  - 90.24
- **Protein (%)**
  - 8.86 - 8.00 - 10.33 - 3.09
- **Avail. Pro (%)**
  - 7.60 - 6.86
- **Adj. Cr. Pro (%)**
  - 8.66 - 7.81
- **Adproteins (%)**
  - 1.26 - 1.14
- **Fat (%)**
  - 1.60 - 1.44 - 2.62 - 0.72
- **Fiber-ADF (%)**
  - 44.25 - 39.93 - 36.07 - 5.70
- **Fiber-NDF (%)**
  - 70.94 - 64.02 - 56.60 - 8.17
- **NFC (%)**
  - 12.66
- **Ash (%)**
  - 5.94 - 5.36 - 8.53 - 2.34

### Calculations

- 120/70.94 = DMI of 1.69% BW
- 1200 lb cow x .0169 = 20.3 lb of hay DM
- 20.3 lb x .0866 = 1.76 lb of CP/d
- 20.3 lb x .44 NE = 8.93 Mcal NE/d

### Top 11 Areas For Consideration:

1. Open cows
2. “Bad attitudes”
3. Old or “Broken mouth” cows
4. Unsound cows (feet & legs, udders, eyes)
5. “Tail-end” performing cows
6. Late calving cows
7. Thin/“hard doing” cows

### Mineral Effects on Microbial Populations

- Effects of Nutrients on the Microbial Population
  - Hay only: 35%
  - Hay, Minerals, Vitamins: 69%
  - Hay and CP/NPN: 63%
  - Hay, Minerals, Vitamins, and CP/NPN: 100%

### Culling Cows

- Open cows
- “Bad attitudes”
- Old or “Broken mouth” cows
- Unsound cows (feet & legs, udders, eyes)
- “Tail-end” performing cows
- Late calving cows
- Thin/“hard doing” cows

See www.thebeefcenter.com for how-to publication (Vol II)
Top 11 Areas For Consideration:

5) Divide cow herd into management and nutritional groups.

See www.forageshortage.com for how-to publication (Vol II)

Sort Herd Into Mgmt. Groups

- Ideally at least three groups:
  1. Replacement heifers
  2. Young and subordinate (thin) cows
  3. Mature, moderate BCS cows

- Differences in:
  - Capacity (volume) to consume feed
  - Requirements and feed quality
  - Dry vs. lactating cows

Top 11 Areas For Consideration:

6) Utilization of crop residues.

See www.thebeefcenter.com for how-to publication (Vol II)

Alternative Feed Usage

<table>
<thead>
<tr>
<th>Item</th>
<th>% TDN</th>
<th>% CP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gestation Req.</td>
<td>53</td>
<td>8</td>
</tr>
<tr>
<td>Lactation Req.</td>
<td>63</td>
<td>12</td>
</tr>
<tr>
<td>Corn</td>
<td>91</td>
<td>8 - 9</td>
</tr>
<tr>
<td>Corn silage</td>
<td>70</td>
<td>7 - 8</td>
</tr>
<tr>
<td>Hay</td>
<td>45 - 65</td>
<td>8 - 20</td>
</tr>
<tr>
<td>Corn stover</td>
<td>45 - 55</td>
<td>&lt; 5</td>
</tr>
<tr>
<td>Wheat straw</td>
<td>44 - 48</td>
<td>&lt; 5</td>
</tr>
<tr>
<td>Soybean straw</td>
<td>32 - 45</td>
<td>&lt; 5</td>
</tr>
</tbody>
</table>

When to Feed Different Forages

- Lowest quality feeds → Low nutrient requirements (mid-gestation, after weaning)
  - Can be fed to high requirement cows, but supplement will be needed

- Highest quality feeds → High nutrient requirements (late gestation/early lactation)
  - May or may not need supplementation

Top 11 Areas For Consideration:

7) Alternative supplementation strategies

- Corn and soybean meal
- By-product, commodity feeds
- Commercially prepared feeds

See www.thebeefcenter.com for by-product pictures and descriptions
Keeping the Rumen Efficient

- Starch-based feeds can cause rumen “upset”
- Microbial pH requirement
  - Fiber digesting microbes prefer high pH
  - Starch digesting microbes prefer low pH

Thumb rule: No more than 0.3% of body weight in starch-based feeds (corn) on forage diet
- 1200 pound cow x 0.003 = 3.6 pounds / day

Co-products’ Role in Beef Diets

- Vary in dry matter, protein, and energy levels, but all low starch, high fiber feeds
- Three primary co-products used
  - Soybean hulls (SBH)
  - Corn gluten feed (CGF)
  - Distillers grain’s w/ solubles (DGS)

Dry matter composition

<table>
<thead>
<tr>
<th>Feed</th>
<th>CP%</th>
<th>RUP %CP</th>
<th>TDN%</th>
<th>Ca%</th>
<th>P%</th>
</tr>
</thead>
<tbody>
<tr>
<td>SBH</td>
<td>12</td>
<td>42</td>
<td>85</td>
<td>0.6</td>
<td>0.2</td>
</tr>
<tr>
<td>CGF</td>
<td>21</td>
<td>25</td>
<td>83</td>
<td>0.1</td>
<td>1.0</td>
</tr>
<tr>
<td>DGS</td>
<td>28</td>
<td>55</td>
<td>88</td>
<td>0.15</td>
<td>0.9</td>
</tr>
</tbody>
</table>

Energy value of co-products dependent on feeding program

Other “Local” Feeds (DM basis)

- High fiber feeds
  - Brewer’s grains (70% TDN, 26% CP)
- Starch containing feeds
  - Hominy (95% TDN, 11% CP)
  - Wheat midds (83% TDN, 18% CP)
  - Grain screenings (75% TDN, 15% CP)
  - Corn skins (75% TDN, 8% CP)

High Moisture Feeds and Transportation Cost

- Determine dry matter delivery cost
- Truck is only as full as %DM
High Moisture Feeds Are Subject to Spoilage and Waste

Handling, Storage & Transportation

- Best system – freq. delivery of WDG
  - Flat storage
  - Cost of transporting water
  - 3 - 28 day shelf-life
- DDGS
  - Commodity bay
  - Bridging in bins and trucks – esp. when warm
  - Long shelf-life

Using Corn Byproducts Safely

- CGF or DGS
  - Keep fat under 6%
  - Keep sulfur under 0.4%
  - Maintain Ca:P ratio of 2:1
- As forage quality improves move from
  - DGS ➔ CGF ➔ SBH

Take Home

- Co-products offer flexibility in forage-based feeding programs due to diverse nutrient composition
- Thumb rules: Upper limit for cows on free choice, forage-based diets:
  - 0.6% CGF (brewer’s grains)
  - 1.0% SBH

Cost of Energy, $/t TDN

<table>
<thead>
<tr>
<th>$/ton of feed</th>
<th>Corn</th>
<th>85% TDN suppl</th>
<th>75% TDN suppl</th>
<th>60% TDN hay</th>
<th>50% TDN hay</th>
</tr>
</thead>
<tbody>
<tr>
<td>60</td>
<td>74</td>
<td>80</td>
<td>90</td>
<td>114</td>
<td>136</td>
</tr>
<tr>
<td>80</td>
<td>100</td>
<td>106</td>
<td>122</td>
<td>152</td>
<td>182</td>
</tr>
<tr>
<td>100</td>
<td>124</td>
<td>134</td>
<td>152</td>
<td>180</td>
<td>228</td>
</tr>
<tr>
<td>120</td>
<td>150</td>
<td>160</td>
<td>182</td>
<td>228</td>
<td>272</td>
</tr>
<tr>
<td>140</td>
<td>174</td>
<td>188</td>
<td>212</td>
<td>266</td>
<td>318</td>
</tr>
<tr>
<td>160</td>
<td>200</td>
<td>214</td>
<td>242</td>
<td>304</td>
<td>364</td>
</tr>
<tr>
<td>180</td>
<td>224</td>
<td>240</td>
<td>272</td>
<td>340</td>
<td>410</td>
</tr>
<tr>
<td>200</td>
<td>250</td>
<td>268</td>
<td>304</td>
<td>378</td>
<td>454</td>
</tr>
<tr>
<td>220 ($6.16)</td>
<td>274</td>
<td>294</td>
<td>334</td>
<td>416</td>
<td>500</td>
</tr>
</tbody>
</table>

Breakeven Cost of Energy, $/ton

<table>
<thead>
<tr>
<th>Corn, $/bu</th>
<th>SBH, $/t</th>
<th>DDGS, $/t</th>
<th>MWDGS, $/t</th>
<th>DCGF, $/t</th>
<th>WCGF, $/t</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.50</td>
<td>89.39</td>
<td>91.42</td>
<td>67.53</td>
<td>86.23</td>
<td>47.90</td>
</tr>
<tr>
<td>3.00</td>
<td>107.27</td>
<td>109.71</td>
<td>81.03</td>
<td>103.47</td>
<td>57.48</td>
</tr>
<tr>
<td>3.50</td>
<td>125.15</td>
<td>127.99</td>
<td>94.54</td>
<td>120.72</td>
<td>67.07</td>
</tr>
<tr>
<td>4.00</td>
<td>143.02</td>
<td>146.27</td>
<td>108.04</td>
<td>137.96</td>
<td>76.65</td>
</tr>
<tr>
<td>4.50</td>
<td>160.90</td>
<td>164.56</td>
<td>121.55</td>
<td>155.21</td>
<td>86.23</td>
</tr>
<tr>
<td>5.00</td>
<td>178.78</td>
<td>182.84</td>
<td>135.05</td>
<td>172.45</td>
<td>95.81</td>
</tr>
<tr>
<td>5.50</td>
<td>196.66</td>
<td>201.13</td>
<td>148.56</td>
<td>189.70</td>
<td>105.39</td>
</tr>
</tbody>
</table>

| Mix 30% at 175, 50% at 180, only affordable at 180. |
Mix 30 is available at $175/t; SBM at $350/t, can only afford to pay $140/t.

Mix 30 (16% all natural CP, 10% fat) at $160/t; $170/t; $180/t; $190/t.

Breakeven Cost of Protein, $/ton

<table>
<thead>
<tr>
<th>Supplement</th>
<th>Cost per unit</th>
<th>Lb protein/ unit</th>
<th>Cost, $/lb protein</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soybean meal, 48% (all natural)</td>
<td>$350/t</td>
<td>960</td>
<td>.365</td>
</tr>
<tr>
<td>$360/t</td>
<td>960</td>
<td>.375</td>
<td></td>
</tr>
<tr>
<td>$370/t</td>
<td>960</td>
<td>.385</td>
<td></td>
</tr>
</tbody>
</table>

Cost per Unit of Protein

<table>
<thead>
<tr>
<th>Supplement</th>
<th>Cost per unit</th>
<th>Lb protein/ unit</th>
<th>Cost, $/lb protein</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soybean meal, 48% (all natural)</td>
<td>$350/t</td>
<td>960</td>
<td>.365</td>
</tr>
<tr>
<td>$360/t</td>
<td>960</td>
<td>.375</td>
<td></td>
</tr>
<tr>
<td>$370/t</td>
<td>960</td>
<td>.385</td>
<td></td>
</tr>
</tbody>
</table>

Mix 30 (16% all natural CP, 10% fat) at $160/t; $170/t; $180/t; $190/t.

Breakeven Cost of Protein, $/ton

<table>
<thead>
<tr>
<th>Supplement</th>
<th>Cost per unit</th>
<th>Lb protein/ unit</th>
<th>Cost, $/lb protein</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soybean meal, 48% (all natural)</td>
<td>$350/t</td>
<td>960</td>
<td>.365</td>
</tr>
<tr>
<td>$360/t</td>
<td>960</td>
<td>.375</td>
<td></td>
</tr>
<tr>
<td>$370/t</td>
<td>960</td>
<td>.385</td>
<td></td>
</tr>
</tbody>
</table>

Mix 30 (16% all natural CP, 10% fat) at $160/t; $170/t; $180/t; $190/t.

Breakeven Cost of Protein, $/ton

<table>
<thead>
<tr>
<th>Supplement</th>
<th>Cost per unit</th>
<th>Lb protein/ unit</th>
<th>Cost, $/lb protein</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soybean meal, 48% (all natural)</td>
<td>$350/t</td>
<td>960</td>
<td>.365</td>
</tr>
<tr>
<td>$360/t</td>
<td>960</td>
<td>.375</td>
<td></td>
</tr>
<tr>
<td>$370/t</td>
<td>960</td>
<td>.385</td>
<td></td>
</tr>
</tbody>
</table>

Mix 30 (16% all natural CP, 10% fat) at $160/t; $170/t; $180/t; $190/t.

Breakeven Cost of Protein, $/ton

<table>
<thead>
<tr>
<th>Supplement</th>
<th>Cost per unit</th>
<th>Lb protein/ unit</th>
<th>Cost, $/lb protein</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soybean meal, 48% (all natural)</td>
<td>$350/t</td>
<td>960</td>
<td>.365</td>
</tr>
<tr>
<td>$360/t</td>
<td>960</td>
<td>.375</td>
<td></td>
</tr>
<tr>
<td>$370/t</td>
<td>960</td>
<td>.385</td>
<td></td>
</tr>
</tbody>
</table>

Mix 30 (16% all natural CP, 10% fat) at $160/t; $170/t; $180/t; $190/t.

Breakeven Cost of Protein, $/ton

<table>
<thead>
<tr>
<th>Supplement</th>
<th>Cost per unit</th>
<th>Lb protein/ unit</th>
<th>Cost, $/lb protein</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soybean meal, 48% (all natural)</td>
<td>$350/t</td>
<td>960</td>
<td>.365</td>
</tr>
<tr>
<td>$360/t</td>
<td>960</td>
<td>.375</td>
<td></td>
</tr>
<tr>
<td>$370/t</td>
<td>960</td>
<td>.385</td>
<td></td>
</tr>
</tbody>
</table>

Mix 30 (16% all natural CP, 10% fat) at $160/t; $170/t; $180/t; $190/t.

Breakeven Cost of Protein, $/ton

<table>
<thead>
<tr>
<th>Supplement</th>
<th>Cost per unit</th>
<th>Lb protein/ unit</th>
<th>Cost, $/lb protein</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soybean meal, 48% (all natural)</td>
<td>$350/t</td>
<td>960</td>
<td>.365</td>
</tr>
<tr>
<td>$360/t</td>
<td>960</td>
<td>.375</td>
<td></td>
</tr>
<tr>
<td>$370/t</td>
<td>960</td>
<td>.385</td>
<td></td>
</tr>
</tbody>
</table>

Mix 30 (16% all natural CP, 10% fat) at $160/t; $170/t; $180/t; $190/t.

Breakeven Cost of Protein, $/ton

<table>
<thead>
<tr>
<th>Supplement</th>
<th>Cost per unit</th>
<th>Lb protein/ unit</th>
<th>Cost, $/lb protein</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soybean meal, 48% (all natural)</td>
<td>$350/t</td>
<td>960</td>
<td>.365</td>
</tr>
<tr>
<td>$360/t</td>
<td>960</td>
<td>.375</td>
<td></td>
</tr>
<tr>
<td>$370/t</td>
<td>960</td>
<td>.385</td>
<td></td>
</tr>
</tbody>
</table>

Mix 30 (16% all natural CP, 10% fat) at $160/t; $170/t; $180/t; $190/t.

Breakeven Cost of Protein, $/ton

<table>
<thead>
<tr>
<th>Supplement</th>
<th>Cost per unit</th>
<th>Lb protein/ unit</th>
<th>Cost, $/lb protein</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soybean meal, 48% (all natural)</td>
<td>$350/t</td>
<td>960</td>
<td>.365</td>
</tr>
<tr>
<td>$360/t</td>
<td>960</td>
<td>.375</td>
<td></td>
</tr>
<tr>
<td>$370/t</td>
<td>960</td>
<td>.385</td>
<td></td>
</tr>
</tbody>
</table>

Mix 30 (16% all natural CP, 10% fat) at $160/t; $170/t; $180/t; $190/t.

Breakeven Cost of Protein, $/ton

<table>
<thead>
<tr>
<th>Supplement</th>
<th>Cost per unit</th>
<th>Lb protein/ unit</th>
<th>Cost, $/lb protein</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soybean meal, 48% (all natural)</td>
<td>$350/t</td>
<td>960</td>
<td>.365</td>
</tr>
<tr>
<td>$360/t</td>
<td>960</td>
<td>.375</td>
<td></td>
</tr>
<tr>
<td>$370/t</td>
<td>960</td>
<td>.385</td>
<td></td>
</tr>
</tbody>
</table>

Mix 30 (16% all natural CP, 10% fat) at $160/t; $170/t; $180/t; $190/t.

Breakeven Cost of Protein, $/ton

<table>
<thead>
<tr>
<th>Supplement</th>
<th>Cost per unit</th>
<th>Lb protein/ unit</th>
<th>Cost, $/lb protein</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soybean meal, 48% (all natural)</td>
<td>$350/t</td>
<td>960</td>
<td>.365</td>
</tr>
<tr>
<td>$360/t</td>
<td>960</td>
<td>.375</td>
<td></td>
</tr>
<tr>
<td>$370/t</td>
<td>960</td>
<td>.385</td>
<td></td>
</tr>
</tbody>
</table>

Mix 30 (16% all natural CP, 10% fat) at $160/t; $170/t; $180/t; $190/t.
1200 lb cow – Low Hay

- Late Gestation
  - 1.7 lb CP, 11.8 lb TDN
- Low quality hay
  - 6% CP, 45% TDN, 66% NDF
- Intake
  - 1.8% of body weight, DM basis (21.6 lb)
  - 1.3 lb CP, 9.72 lb TDN
  - Short .4 lb/d CP, 2.08 lb/d TDN

1200 lb cow – Corn Stalks

- Late Gestation
  - 1.7 lb CP, 11.8 lb TDN
- Low quality hay
  - 4% CP, 45% TDN
- Intake
  - 1.8% of body weight, DM basis (21.6 lb)
  - .86 lb CP, 9.72 lb TDN
  - Short .84 lb/d CP, 2.08 lb/d TDN

1200 lb cow – Avg. Hay

- Early lactation (20 lb milk/d)
  - 2.7 lb CP, 15.2 lb TDN
- Average quality hay
  - 10% CP, 53% TDN, 60% NDF
- Intake
  - 2.0% of body weight, DM basis (24 lb)
  - 2.75 lb CP, 14.6 lb TDN
  - Short .3 lb CP, short 1.88 lb TDN
- Requirements can be met by
  - 2.5 lb SBH, DDGS or DCGF/day

Top 11 Areas For Consideration:

8) Limit feeding of hay

See [www.thebeefcenter.com](http://www.thebeefcenter.com) for how-to publication (Vol II)

Historical Example of Limit-Feeding Winter Rations
Occasionally, limiting intake may be a good thing!!

Minimize Hay Disappearance

<table>
<thead>
<tr>
<th>Item</th>
<th>Access Time, hr.</th>
<th>24</th>
<th>12</th>
<th>8</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wt. change, lb</td>
<td></td>
<td>+58</td>
<td>+58</td>
<td>+65</td>
<td>+49</td>
</tr>
<tr>
<td>Hay disappearance</td>
<td></td>
<td>100</td>
<td>95.6</td>
<td>82.4</td>
<td>62.8</td>
</tr>
<tr>
<td>(% change)</td>
<td></td>
<td>(0)</td>
<td>(-4.4)</td>
<td>(-17.6)</td>
<td>(-37.2)</td>
</tr>
<tr>
<td>Saving, $/cow&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
<td>0</td>
<td>$10.25</td>
<td>$41.00</td>
<td>$96.65</td>
</tr>
</tbody>
</table>

<sup>a</sup>Assumptions:
- 1200 lb cow with DMI of 2.5% of Body weight
- 10% waste for 24 hr/d access time
- $80/t hay
- 150 d feeding period

Limit Feeding LQ Hay Mid-gestation 1<sup>st</sup> and 2<sup>nd</sup> Calf Heifers

<table>
<thead>
<tr>
<th>Item</th>
<th>Access Time, hr.</th>
<th>1</th>
<th>2</th>
<th>4</th>
<th>24</th>
</tr>
</thead>
<tbody>
<tr>
<td>SBH, lb/d as-fed</td>
<td></td>
<td>15</td>
<td>11</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>Hay intake, lb as-fed</td>
<td></td>
<td>8.2</td>
<td>14.5</td>
<td>23.8</td>
<td>35</td>
</tr>
<tr>
<td>Cost, $/d&lt;sup&gt;a&lt;/sup&gt; ($80/t hay)</td>
<td></td>
<td>1.67</td>
<td>1.60</td>
<td>1.83</td>
<td>1.50</td>
</tr>
<tr>
<td>Cost, $/d&lt;sup&gt;a&lt;/sup&gt; ($100/t hay)</td>
<td></td>
<td>1.76</td>
<td>1.76</td>
<td>2.09</td>
<td>1.92</td>
</tr>
<tr>
<td>Cost, $/d&lt;sup&gt;a&lt;/sup&gt; ($120/t hay)</td>
<td></td>
<td>1.85</td>
<td>1.92</td>
<td>2.35</td>
<td>2.31</td>
</tr>
</tbody>
</table>

<sup>a</sup> Cost assumes 10% hay waste, SBH = $175/t

Total Consumption (lb, as-fed)

<table>
<thead>
<tr>
<th>Time</th>
<th>LQ hay</th>
<th>HQ hay</th>
<th>Mixed hay</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 hr</td>
<td>15.4</td>
<td>17.1</td>
<td>16.8</td>
</tr>
<tr>
<td>2 hr</td>
<td>14.5</td>
<td>17.1</td>
<td>16.8</td>
</tr>
<tr>
<td>4 hr</td>
<td>13.6</td>
<td>17.1</td>
<td>16.8</td>
</tr>
</tbody>
</table>

HQ hay (56.7% TDN, 17.1% CP)
LQ hay (47.3% TDN, 8.1% CP)

Sample Rations FC (late-gestation)<sup>a,b</sup>

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>LQ grass</th>
<th>HQ grass</th>
<th>Mixed hay</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expected Hay intake, lb</td>
<td>29</td>
<td>35</td>
<td>32</td>
</tr>
<tr>
<td>Soybean hulls, lb</td>
<td>4.6</td>
<td>0**</td>
<td>0**</td>
</tr>
<tr>
<td>Vitamin A</td>
<td>40,000 IU</td>
<td>40,000 IU</td>
<td>40,000 IU</td>
</tr>
</tbody>
</table>

<sup>a</sup> Assumes a 1250 lb non-lactating, crossbred cow, 8 mo. pregnant, gaining .25 lb/d.
<sup>b</sup> lb/d, as-fed basis

Sample Rations 2 hr (late-gestation)<sup>a,b</sup>

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>LQ grass</th>
<th>HQ grass</th>
<th>Mixed hay</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hay, lb</td>
<td>14.5</td>
<td>17.1</td>
<td>16.8</td>
</tr>
<tr>
<td>Soybean hulls, lb</td>
<td>10.5</td>
<td>6.9</td>
<td>7.5</td>
</tr>
<tr>
<td>Vitamin A</td>
<td>40,000 IU</td>
<td>40,000 IU</td>
<td>40,000 IU</td>
</tr>
</tbody>
</table>

<sup>a</sup> lb/d, as-fed basis

Estimated savings in hay intake = 50%
### Sample Rations 4 hr (late-gestation)\textsuperscript{a,b}

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>LQ grass</th>
<th>HQ grass</th>
<th>Mixed hay</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hay, lb</td>
<td>23.8</td>
<td>27.5</td>
<td>25.0</td>
</tr>
<tr>
<td>Soybean hulls, lb</td>
<td>6.7</td>
<td>1.0</td>
<td>3.1</td>
</tr>
<tr>
<td>Vitamin A</td>
<td>40,000 IU</td>
<td>40,000 IU</td>
<td>40,000 IU</td>
</tr>
</tbody>
</table>

\textsuperscript{a,b} as-fed basis

Estimated savings in hay intake $\approx 20\%$

### Guidelines for Limit-fed, High Concentrate Diets

<table>
<thead>
<tr>
<th>Stage of Production</th>
<th>Amount to be fed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Corn</td>
</tr>
<tr>
<td>Gestation</td>
<td>.75% BW</td>
</tr>
<tr>
<td>Lactation, avg. milk</td>
<td>1.0% BW</td>
</tr>
<tr>
<td>Lactation, high milk</td>
<td>1.1% BW</td>
</tr>
</tbody>
</table>

OSU Factsheet F-3028

This is about 3 hr access time/day

### Limit-fed, High Concentrate Diet Concerns

- **Protein deficiency**
  - Feedlot formulated protein supplement
- **Vitamin A deficiency**
- **Calcium deficiency**
  - High concentrate rations
  - Corn by-product diets
- **Sulfur excess**
  - Corn by-product diets

### Limit-fed, High Concentrate Diet Considerations

- **Bunk space (30-36 in. of bunk space)**
- **Potential for acidosis, bloat, founder**
- **Increased level of management needed**
  - Feed at the same time each day
  - Must have good fences
  - Monitor body condition

### Limit-fed, High Concentrate Diet Management Considerations

- **Work up to limit-fed diet slowly**
  - Start with 3-4 lb grain plus free choice hay
  - Increase grain by no more than 1 lb/EOD
  - When final grain level is reached, begin removing hay to desired level
- **Rumensin (100-200 mg/d) is beneficial**
- **Consistent, accurate feeding is essential**

---

12/20/10
What to Expect From Limit-fed, High Concentrate Diet Feeding

- Aggressive behavior at the bunk
- Consume ration in ~ 20 to 30 minutes
  - Lots of “free time” to pace, crib, etc.
  - Takes ~ 2 weeks to “adapt”
- Variation in weight gains/losses?

Limit-fed, High Concentrate Diet Management Considerations

- Watch cattle closely
  - May not work for all cows
  - Consider limit-feeding just 1-2 groups
  - Monitor condition of cows and adjust
- Corn (whole vs. ground)
- Feed extra hay when daily feeding is late/missed

Feeding Corn Silage

- Limit feeding
  - 1200# cow, late gestation
    - 45# of silage (16# DM), 2# SBM (48%)
  - 1200# cow, early lactation (23# milk)
    - 65# silage (23# DM), 3# SBM (48%)
- Make sure to adjust for moisture
- Provide good quality vit./min. mix FC

Top 11 Areas For Consideration:

9) Minimize hay waste

See www.thebeefcenter.com for how-to publication (Vol II)

Outdoor Storage

- Losses 5 – 35%
  - Amount of precipitation
  - Storage site location
  - Original condition of the bale
- Reduce losses by:
  - ~2/3 with inside storage
  - ~1/2 with good plastic covering

Hay Loss From Weathering

- 5’ Bale
  - Outer 3” = 25%
  - Outer 6” = 45%
  - Inside 2’ = 25% of bale wt
- 6’ Bale
  - Outer 3” = 15%
  - Outer 6” = 30%
  - Inside 3” = 25% of bale wt
### Dry Hay Feeding Wastage

<table>
<thead>
<tr>
<th>Waste, %</th>
<th>Cone</th>
<th>Ring</th>
<th>Trailer</th>
<th>Cradle</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2 - 6%</td>
<td>4 – 7%</td>
<td>10 – 14%</td>
<td>11 – 20%</td>
</tr>
</tbody>
</table>


### Hay Wasted by Cows

<table>
<thead>
<tr>
<th>Bale type</th>
<th>% Wasted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small Square in rack</td>
<td>7</td>
</tr>
<tr>
<td>LRB in rack</td>
<td>9</td>
</tr>
<tr>
<td>LRB w/o rack</td>
<td>45</td>
</tr>
</tbody>
</table>


### Feeding Losses

<table>
<thead>
<tr>
<th>Method</th>
<th>% Waste</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unrolled</td>
<td>12.3</td>
</tr>
<tr>
<td>Ring</td>
<td>4.9</td>
</tr>
<tr>
<td>1 day</td>
<td>7.0</td>
</tr>
<tr>
<td>7 day</td>
<td>43.0</td>
</tr>
</tbody>
</table>

### Impact of 5 – 40% Waste

- 200-day feeding period
- Good quality mixed hay (1000# LRB)
- 1200# cow
  - Consuming 2.5% of BW (30# of DM/d)
  - Hay needed: 6000# DM + .85 = 7060# as-fed
  - 7060# needed + 1000#/bale = 7.06 bales/cow

### Cost of Wasted Hay

<table>
<thead>
<tr>
<th>Base</th>
<th>+5%</th>
<th>+10%</th>
<th>+15%</th>
<th>+20%</th>
<th>+40%</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.06</td>
<td>7.41</td>
<td>7.76</td>
<td>8.11</td>
<td>8.47</td>
<td>9.88</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Bales/cow</th>
<th>$282</th>
<th>+$14</th>
<th>+$28</th>
<th>+$42</th>
<th>+$56</th>
<th>+$112</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bales/30 cows</td>
<td>$8472</td>
<td>+$425</td>
<td>+$850</td>
<td>+$1270</td>
<td>+$1700</td>
<td>+$3400</td>
</tr>
</tbody>
</table>

* Assumes 1000 lb bales, 85% DM

### Top 11 Areas For Consideration:

10) Adjust rations for “cold stress”

See [www.thebeefcenter.com](http://www.thebeefcenter.com) for how-to publication (Vol II)
Cold Stress

For each 10\(^\circ\) drop in wind chill below 30\(^\circ\) F, the energy requirements increase:

- 13\% for moderate BCS cows w/ winter hair coat (~1# corn)
- 30\% for wet or thin cows (~2.25# corn)

E Requirements: Wind Chill

<table>
<thead>
<tr>
<th>Wind Chill, (^\circ)F</th>
<th>Thin or Wet Cow</th>
<th>Moderate, Dry Cow</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>0 %</td>
<td>0 %</td>
</tr>
<tr>
<td>20</td>
<td>+30 % - 2% lb corn</td>
<td>+13 % - 1% lb corn</td>
</tr>
<tr>
<td>10</td>
<td>+60 % - 5 lb corn</td>
<td>+26 % - 2% lb corn</td>
</tr>
<tr>
<td>0</td>
<td>+90 % - 7% lb corn</td>
<td>+39 % - 4 lb corn</td>
</tr>
</tbody>
</table>

Top 11 Areas For Consideration:

11) Plan for next grazing season

www.thebeefcenter.com
Rejuvenating Pastures
https://mdc.itap.purdue.edu/item.asp?itemID=19670
Forage Field Guide