Smooth Transitions: Feeding Heifers for a Smooth Transition into Lactation

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Today’s Discussion

• Fresh cow health challenges.
• Feeding strategies to minimize health challenges.
  – Controlled energy diets
• Focus on optimizing forages for dry cows.
  – Forage type
  – Forage management

When are cows leaving herds?

25% of culls leave before 60 DIM
8.6% of all cows calving leave before 60 DIM

When are cows leaving herds?

Transition Period

The problems with primiparous heifers are.....

• They are likely not a producers first priority.
• Producers may not harvest or purchase forages with dry cows or primiparous heifers in mind.
  – Often "too good"
• Dry cows and primiparous heifers do a poor job of moderating energy intake

Effects of Problems At Parturition on Performance

N= 1144 heifers (Florida)
1959-1979
Simerl et al., 1992
Item Incidence in first calf heifers
RP, % 3.3
LDA, % 2.9
Day @ DA 20.1
Lameness, % 15.1
Mastitis, % 19.4
Day @ Mastitis 97.9
Mortality, % 3.9
Culling After Calving, % 17.6
Proportion leaving the herd before 310 DIM 21.7

Ettema and Santos et al., 2004
N= 1905 heifers

What happened?

Transforming the Springing Heifer
- Unique nutrient requirements
  - Growth @ 1.5+/day
- Mammary gland development
- Lower DMI
- BCS has less impact on heifers
- Different protein requirements
- Social challenges

Energy (NE_\text{r}) requirements 2 days before versus 2 days after calving

<table>
<thead>
<tr>
<th></th>
<th>1500 lb cow</th>
<th>1250 lb heifer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Function</td>
<td>Pre</td>
<td>Post</td>
</tr>
<tr>
<td>Maintenance</td>
<td>11.2</td>
<td>10.1</td>
</tr>
<tr>
<td>Pregnancy</td>
<td>3.3</td>
<td>...</td>
</tr>
<tr>
<td>Growth</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>Milk Production</td>
<td>...</td>
<td>18.7</td>
</tr>
<tr>
<td>Total (Mcal)</td>
<td>15.5</td>
<td>28.8</td>
</tr>
<tr>
<td>Typical Intake</td>
<td>14.17</td>
<td>19.21</td>
</tr>
</tbody>
</table>
Dry cows will easily consume more energy than they require

<table>
<thead>
<tr>
<th>NE (Mcal/lb)</th>
<th>DMI (lb) for 15 Mcal NE</th>
<th>NE (Mcal) at 27 lb DMI</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.60 (high straw)</td>
<td>25.0</td>
<td>16.2</td>
</tr>
<tr>
<td>0.64</td>
<td>23.4</td>
<td>17.3</td>
</tr>
<tr>
<td>0.68</td>
<td>22.0</td>
<td>18.4</td>
</tr>
<tr>
<td>0.72 (typical close-up)</td>
<td>20.8</td>
<td>19.4</td>
</tr>
</tbody>
</table>

High-energy diets predispose cows to health problems

- May not be a problem in well-managed herds
- If intake is interrupted (stressors, disease, poor management, etc.)
- Overfed cows are more likely to develop subclinical ketosis, fatty liver, and other problems.

The Smorgasbord Affect

- Cows fed a moderate-energy diet (0.69-0.73 Mcal NE\_L/lb DM) will consume 40-80% more NE\_L than required during the dry period.
  (Drackley and Janovick-Guretzky, 2007)

Hepatic Lipidosis (Fatty liver)

Occurs when the rate of triglyceride synthesis exceeds the rate of oxidation and export.

Problems with Excessive Energy Intake

- Increased reliance on the diet and less on their own resolve.
- Metabolically lazy:
  - Fat burning capacity ↓
  - Glucose production ↓
  - Insulin resistance
  - Similar to Type II diabetes in humans

First Calf Heifers and DMI

- % of Body weight
  - 3% around weaning
  - 1.8% near calving

Observed vs predicted DM intake of growing dairy heifers (NRC 2001)
Effect of prepartum energy intake on lactation in primiparous cows

Grummer et al., 1995

Effect of prepartum dietary protein amount

Santos et al., 2001

Limit Feeding Approach

Hoffman et al., 2007

Avoid Overfeeding Energy During the Far-off Dry Period

Changes in Blood Calcium

Grummer et al., 1995

Effect of prepartum energy intake on lactation in primiparous cows

Treatment | Item | Moderate energy (59.7 TDN) | High energy (69.3 TDN) | SEM | P (prepartum effect)
--- | --- | --- | --- | --- | ---
NEFA, μM | 572 | 720 | 2.0 | 0.01
BHBA, mg/dL | 12.6 | 21.2 | 0.3 | 0.01
Liver TG, % of DM | 4.4 | 5.6 | 0.7 | 0.10

Cow Description | Blood Calcium Levels
--- | ---
Normal lactating cow | 8.4-10.2 mg/dL
Normal at calving | 6.8-8.6 mg/dL
Milk fever (slight) | 4.9-7.5 mg/dL
Milk fever (moderate) | 4.2-6.8 mg/dL
Milk fever (severe) | 3.5-5.7 mg/dL
Milk Fever Prevention

- Feeding diets with anionic salts during the close-up dry period PREVENTS milk-fever and hypocalcemia.
- Minimizing dietary
  - Potassium
  - Sodium

How do I know what my DCAD is?

Step 1. All feed must be tested for sodium, potassium, sulfur, and chlorine.

Step 2. DCAD equivalents are calculated using this formula:

\[ DCAD = (Na + K) - (Cl + S) \]

Effects of Anionic Salts on Blood Calcium (Moor et al., 2000)

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Item</th>
<th>Cows</th>
<th>DCAD</th>
<th>SEM</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>iCa prepartum, mg/dL</td>
<td>4.4</td>
<td>4.7</td>
<td>4.9</td>
</tr>
<tr>
<td></td>
<td>iCa calving, mg/dL</td>
<td>3.7</td>
<td>3.8</td>
<td>4.3</td>
</tr>
<tr>
<td>Heifers</td>
<td>iCa prepartum, mg/dL</td>
<td>4.7</td>
<td>4.8</td>
<td>4.9</td>
</tr>
<tr>
<td></td>
<td>iCa calving, mg/dL</td>
<td>4.4</td>
<td>4.6</td>
<td>4.6</td>
</tr>
</tbody>
</table>

Effects of Anionic Salts on Intake and Energy Balance (Moor et al., 2000)

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Item</th>
<th>Cows</th>
<th>DCAD</th>
<th>SEM</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Prepartum DMI, kg/d</td>
<td>15.5</td>
<td>14.4</td>
<td>13.0</td>
</tr>
<tr>
<td></td>
<td>Energy balance, Mcal/d</td>
<td>8.42</td>
<td>8.24</td>
<td>6.01</td>
</tr>
<tr>
<td>Heifers</td>
<td>Prepartum DMI, kg/d</td>
<td>10.5</td>
<td>9.6</td>
<td>8.0</td>
</tr>
<tr>
<td></td>
<td>Energy balance, Mcal/d</td>
<td>3.75</td>
<td>2.62</td>
<td>0.09</td>
</tr>
</tbody>
</table>

Effects of DCAD on Liver Triglyceride (Moore et al., 2000)

- Forages are an Important Source of Macro Minerals for Dry Cows
  - Amount:
    - Potassium (K) in forages:
      - Legumes 2.0 - 3.0%
      - Grasses 1.5 - 3.0%
      - Corn Silage 1.5 - 3.0%
  - Availability 85-90%
  - Interactions
    - High level of K will ↓ Mg absorption
Udder Edema

- Minimize:
  - Salt intake
  - High K and Ca
  - Avoid overfeeding grain
  - Prepartum milking
  - 3 X milking

Diet is an important component, but not the whole story...

- Cows need low stress, comfortable non-crowded environments.
- Stressors decrease DMI, increase NEFA, divert nutrients from milk to stress response and immune system.

Behavioral Differences Between Cows and Heifers

- Heifers take smaller bites and spend more time feeding.
- Use of less desirable stalls
- More time grooming and fighting
- Struggle with overcrowding.
  - Animals lowest on social hierarchy affect to a greater extent.

Effects of Stocking Density

- Multiparous-primiparous Milk yield, lb/d

<table>
<thead>
<tr>
<th>Stocking Density</th>
<th>Multiparous-primiparous Milk yield, lb/d</th>
</tr>
</thead>
<tbody>
<tr>
<td>100%</td>
<td>5</td>
</tr>
<tr>
<td>115%</td>
<td>15</td>
</tr>
<tr>
<td>130%</td>
<td>25</td>
</tr>
<tr>
<td>145%</td>
<td>30</td>
</tr>
</tbody>
</table>

R. Grant, Miner Institute

Stress: Overcrowding and Pen Movement

- Use of less desirable stalls
- More time grooming and fighting
- Struggle with overcrowding.
  - Animals lowest on social hierarchy affect to a greater extent.

Feeding behavior of primiparous cows housed alone or with multiparous cows

<table>
<thead>
<tr>
<th>Item</th>
<th>Treatment</th>
<th>SEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item</td>
<td>PP</td>
<td>PP + MP</td>
</tr>
<tr>
<td>Total eating time, min/d</td>
<td>163.5</td>
<td>192.9</td>
</tr>
<tr>
<td>Meal size, kg of DM/meal</td>
<td>3.45</td>
<td>4.20</td>
</tr>
<tr>
<td>Number of meals/day</td>
<td>4.9</td>
<td>4.0</td>
</tr>
<tr>
<td>Total DMI, kg/d</td>
<td>18.1</td>
<td>18.7</td>
</tr>
</tbody>
</table>

Bach et al., 2006
Control of DMI

- Social Dominance and Competition
  - Cattle Management
- Feeding Strategy
  - Environment
- Feeding System
  - Health

DMI
- Feeding Behavior
  - # Meals
  - Meal Length
  - Eating rate

Evaluation Tools

- First lactation animals:
  - Target an 8% increase in milk per day for the first 18 days of lactation.
  - A problem exists if:
    - There is no increase in milk yield.
    - Milk yield is less than 65 lb/d at 30 DIM.

What should a dry cow diet offer?

- Avoid excessive energy intake.
  - Offered at an ad libitum rate.
- Address minerals
  - Milk fever prevention.
- Consistent and high quality.
- Optimize milk production.
- Minimize metabolic disorders postpartum.

Dry Cow feeding Strategies

1. Roughing it
2. Steam-up feeding
3. Limit feeding
4. High bulk, moderate energy diets

“Roughing it” strategy

- Concept:
  - Feed dry cows only poor-quality roughages and other ingredients to minimize the potential for excessive intake.
- Problem:
  - Excessive variation of ingredient quality.
  - Inconsistent intake of nutrients.
  - Imbalanced nutrient profile.

“Steam-up” Feeding

- Concept:
  - Feed a high energy diet to maximize energy intake.
  - Stimulate rumen
  - Adjust to lactation ingredients
- Problem:
  - Metabolic “laziness”
“Limit Feeding” Strategy

- **Concept:**
  - Feed to an empty bunk.

- **Problem:**
  - Need adequate bunk space.
  - Negative social issues
  - Bunk management is key.
  - Variable feed intake.
  - Lack of diet bulk/rumen fill.

High bulk/low energy

- **Concept:**
  - Low energy diet formulated for ad libitum consumption.
  - Feed a diet of sufficient fiber (bulk) so cows cannot over-consume energy.

The “Goldilocks diet” to the Rescue?

- Not excessive energy...
- Not restricted energy...
- But, just right!

Controlled energy means **less or more** energy

- May need to dilute energy density
  - If feeding high corn silage and alfalfa
- May need to increase energy density
  - If feeding poor quality roughages.

Controlled energy Dry cow diets should allow ad libitum access to feed without allowing cows to over-consume energy

<table>
<thead>
<tr>
<th>Item</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry matter intake</td>
<td>30 lb/cow/day (60 lb as-fed)</td>
</tr>
<tr>
<td>Ration dry matter</td>
<td>50%</td>
</tr>
<tr>
<td>Energy density</td>
<td>0.60 Mcal NE/lb of dry matter</td>
</tr>
<tr>
<td>Crude protein</td>
<td>12-14% of Dry Matter</td>
</tr>
<tr>
<td>Metabolizable protein</td>
<td>1,000 g/cow/d</td>
</tr>
<tr>
<td>Starch</td>
<td>12-16% of dry matter</td>
</tr>
<tr>
<td>Forage NDF</td>
<td>40-50% of DM (0.7-0.8% of body weight)</td>
</tr>
<tr>
<td>Vitamins and Minerals</td>
<td>Follow NRC, 2001 recommendations</td>
</tr>
</tbody>
</table>

Forage Options for Dry Cows

- Corn silage
- Straw
  - Wheat straw
  - Oat straw
  - Barley straw
- Grass hay
- Corn stocks
- Sorghum silage
- Tropical corn silage
What should dry cow forages provide?

- Moderate energy density
- Palatable
- Free of negative nutritional factors
- Address mineral imbalances
- Provide rumen fill

Corn Silage

**Advantages:**
- Adds moisture
  - 65%
- Low protein
  - 8%
- Highly palatable
- Low Calcium
  - 0.25%
- Low Potassium
  - 1.1%

**Disadvantages:**
- High moisture
- High NEL
  - 0.7 Mcal/lb
- High starch
  - 30%
- Low fill factor (eNDF)
- High sorting
- Avoid poor quality

Should not provide greater than 50% of forage dry matter (Overconditioning)

Wheat Straw

**Advantages:**
- Low energy
  - 0.3 Mcal/lb
- Excellent bulk
  - 74% NDF
- Palatable
- Consistent
- Low calcium
  - 0.34%
- Moderate potassium
  - 1.4%

**Disadvantages:**
- Low moisture
  - 8%
- Processing challenges
- Sorting issues

Reasons for Use of Wheat Straw in Dry Cow Diets

- Dilute the energy density of the diet.
- Dry out "wet" diets
  - High byproduct diets
- Alter the dietary cation:anion ratio
  - Milk fever prevention

Dry Cow Diets Affected Cows During the First 10 Days in Milk

<table>
<thead>
<tr>
<th>Variable</th>
<th>Straw</th>
<th>Overfed</th>
<th>Underfed</th>
</tr>
</thead>
<tbody>
<tr>
<td>DMI, % of BW</td>
<td>2.5</td>
<td>2.2</td>
<td>2.5</td>
</tr>
<tr>
<td>Energy balance, % of requirements</td>
<td>88</td>
<td>80</td>
<td>93</td>
</tr>
<tr>
<td>NEFA, micro M</td>
<td>787</td>
<td>792</td>
<td>627</td>
</tr>
<tr>
<td>Milk, lb</td>
<td>65.3</td>
<td>57.2</td>
<td>58.1</td>
</tr>
</tbody>
</table>

Dann et al., 2006

Example Diet

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>% of Diet Dry Matter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn Silage</td>
<td>35.3</td>
</tr>
<tr>
<td>Chopped wheat straw</td>
<td>31.8</td>
</tr>
<tr>
<td>Chopped alfalfa hay</td>
<td>17.1</td>
</tr>
<tr>
<td>Corn grain, ground, dry</td>
<td>3.6</td>
</tr>
<tr>
<td>Soybean meal, solvent, 48%</td>
<td>5.1</td>
</tr>
<tr>
<td>Expelled Soy</td>
<td>4.0</td>
</tr>
<tr>
<td>Urea</td>
<td>0.9</td>
</tr>
<tr>
<td>Minerals and vitamins</td>
<td>2.2</td>
</tr>
</tbody>
</table>
### Example Diet Composition

<table>
<thead>
<tr>
<th>Chemical composition</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forage NDF</td>
<td>50.4</td>
</tr>
<tr>
<td>NFC</td>
<td>25.4</td>
</tr>
<tr>
<td>Crude protein</td>
<td>14.4</td>
</tr>
<tr>
<td>Metabolizable protein (grams)</td>
<td>1,085</td>
</tr>
<tr>
<td>NE(_{L}), Mcal/lb DM</td>
<td>0.62</td>
</tr>
</tbody>
</table>

### Wheat Straw Composition

<table>
<thead>
<tr>
<th>Component</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>DM, % of fed</td>
<td>93.3</td>
<td>0.82</td>
</tr>
<tr>
<td>CP, % of DM</td>
<td>3.8</td>
<td>0.83</td>
</tr>
<tr>
<td>NDF, % of DM</td>
<td>79.6</td>
<td>3.7</td>
</tr>
<tr>
<td>ADF, % of DM</td>
<td>53.3</td>
<td>2.9</td>
</tr>
<tr>
<td>NFC, % of DM</td>
<td>11.6</td>
<td>3.0</td>
</tr>
<tr>
<td>Ca, % of DM</td>
<td>0.27</td>
<td>0.11</td>
</tr>
<tr>
<td>K, % of DM</td>
<td>1.30</td>
<td>0.12</td>
</tr>
</tbody>
</table>

Values are from 21 monthly composite samples from two experiments (Dann et al., 2006; Janovick Guretzky et al., 2006) analyzed by wet chemistry (Dairy one, Ithaca, NY).

### Evaluating Nutrient Composition of Straw

- Obtain a representative sample.
- Limited data for NIR prediction of straw composition.
  - Check with your lab.
- Be safe: Use wet-chemistry.
  - Important for minerals (limited spectra absorbance).

### Straw Particle Size Guidelines

- Weigh-back should be less than 10% different in particle size and nutrient composition.
- Penn-State Particle Size Box:
  - Top screen: ~10-15%
  - Middle screen: ~40%
  - Bottom pan: ~40-50%

### Sorting Issues

### Sorting Example

<table>
<thead>
<tr>
<th>Normal TMR</th>
<th>Sorted TMR (ate ½ of the straw)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CP- 15.5%</td>
<td>CP- 17.6%</td>
</tr>
<tr>
<td>NDF- 40.1%</td>
<td>NDF- 33.9%</td>
</tr>
<tr>
<td>ADF- 25.8%</td>
<td>ADF- 21.6%</td>
</tr>
<tr>
<td>NFC- 36.5%</td>
<td>NFC- 41.0%</td>
</tr>
<tr>
<td>NE(_{L})- 0.68 Mcal/lb DM</td>
<td>NE(_{L})- 0.73 Mcal/lb DM</td>
</tr>
</tbody>
</table>
Feeding Behavior Advantages?

- Prepartum eating time
  - 5 hours daily?
- Rumen
  - Stretch
  - Muscular tone
  - Rumination time
  - Reduce change

Normal Rumen Fill

Gas layer
Fiber layer
Liquid layer

Off-Feed Rumen Fill

Gas layer
Fiber layer
Liquid layer

Increased Risk for Displaced Abomasum

Rumen Filled With Wheat Straw

Gas layer
Fiber layer
Liquid layer

Increased Rumen Fill
Should Reduce the risk for Abomasal Displacement

In Situ Dry Matter
Disappearance of Forages

Wheat Straw increased feeding time in growing heifers

Greeter et al., 2008
Advantages and Benefits of High Straw Diets

- Straw and corn silage generally are low in potassium.
  - Helps prevent milk fever
  - May reduce the amount of anionic salt mixture to decrease the DCAD.

Advantages and Benefits of High Straw Diets

- Simplified dry cow management and ration changes
  - Feed one TMR with two different mineral mixes.
    - Far-off group
    - Close-up group
      - Essentially the same diet, but with concentrate mix incorporating anionic salts, extra vitamins and minerals, additional protein, and selected feed additives.

Controlled Energy Diets are a Dry period Strategy, not a close-up or pre-fresh strategy only

- Allow 7-10 day adjustment
- May observe reduced intake

Small Grain Straw Comparison

<table>
<thead>
<tr>
<th>Component</th>
<th>Wheat Straw</th>
<th>Oat Straw</th>
<th>Barley Straw</th>
</tr>
</thead>
<tbody>
<tr>
<td>DM, % as fed</td>
<td>93.6</td>
<td>93.3</td>
<td>93.1</td>
</tr>
<tr>
<td>CP, % of DM</td>
<td>4.6</td>
<td>4.8</td>
<td>4.4</td>
</tr>
<tr>
<td>NDF, % of DM</td>
<td>78.8</td>
<td>77.0</td>
<td>77.3</td>
</tr>
<tr>
<td>NDFD, % of NDF</td>
<td>39.0</td>
<td>45.0</td>
<td>39.8</td>
</tr>
<tr>
<td>NFC, % of DM</td>
<td>9.7</td>
<td>9.7</td>
<td>11.5</td>
</tr>
<tr>
<td>Ca, % of DM</td>
<td>0.23</td>
<td>0.22</td>
<td>0.45</td>
</tr>
<tr>
<td>K, % of DM</td>
<td>1.24</td>
<td>2.12</td>
<td>1.44</td>
</tr>
<tr>
<td>Ash, % of DM</td>
<td>7.7</td>
<td>8.8</td>
<td>7.2</td>
</tr>
</tbody>
</table>

Values are from: Anderson and Hoffman: Focus on forages Vol 8: No 1.

Alfalfa Silage

Limit to less than 30-50% of forage DMI

Advantages:
- Moderate moisture - 60%
- Moderate NE
  - 0.61
- Moderate fill factor
- Minimal sorting (palatable)

Limitations:
- High crude protein - 21%
- High potassium - 2.8%
- Udder edema and milk fever
- High Calcium - 1.4%

Grass Hay

Advantages:
- Low moisture - 10%
- Moderate crude protein - 11%
- Moderate NE
- High fill factor (NDF) - 60%
- Moderate Calcium - 0.5%

Disadvantages:
- High Potassium - 2.0%
- Higher energy than straw
- More digestible
- More rapid rate of passage
- Potential for sorting
**Dietary Cation Anion Difference of Five Cool-season Grasses**

<table>
<thead>
<tr>
<th>Grass</th>
<th>Spring growth</th>
<th>Summer regrowth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orchardgrass</td>
<td>656</td>
<td>633</td>
</tr>
<tr>
<td>Meadow bromegrass</td>
<td>540</td>
<td>569</td>
</tr>
<tr>
<td>Tall fescue</td>
<td>510</td>
<td>496</td>
</tr>
<tr>
<td>Smooth bromegrass</td>
<td>490</td>
<td>447</td>
</tr>
<tr>
<td>Timothy</td>
<td>384</td>
<td>332</td>
</tr>
</tbody>
</table>

Tremblay et al., 2006

**Moderating Forage Potassium**

- Select low K fields for production of dry cow forages.
  - Soil test
  - Monitor manure application
- Delayed harvesting
  - Forage K declines with increasing maturity.

**Management of Dietary Potassium**

- When low K forages are not available:
  - Far-off dry cows and springing heifers ("higher" K forages)
  - Close-up dry cows (lower K forages)

**Challenges With Processing Grass Hay**

- Time consuming
  - "Mixer A" 45 minutes
  - "Mixer B" 35 minutes
  - "Mixer C" 22 minutes
- Challenge to evaluate particle size
- Management of round bales

**Sorghum Silage**

**Advantages:**
- Adds moisture – 70%
- Moderate energy – 0.53 Mcal/lb
- Moderate starch – 10%
- Low protein – 9.5%
- Low calcium – 0.5%

**Disadvantages:**
- High Potassium – 1.9%
- Less digestible – %IVTD 24hr 67%

**Corn Stalks**

**Advantages:**
- Low energy – 0.36 Mcal/lb
- Low starch – 5%
- Moderate calcium – 0.5%
- Moderate potassium – 1.3%
- Excellent bulk – 71% NDF

**Disadvantages:**
- High ash – 8.6%
- Low moisture – 15%
- Sorting challenges
- Beware of molds
**Corn Stalks**
- Processing challenge (Particle size)
- Winter feed
- Spring moisture a challenge
- High ash content (7%+)

**Tropical Corn Silage**

**Advantages:**
- Low energy
- Low starch
- High fiber
- High yield tonnage
- Low protein
- Potassium?

**Disadvantages:**
- Late harvest
- Difficult to get seed
- Limited research

**Avoid Challenging Primiparous Cows**
- Overfeeding energy
- Keep an eye on DCAD
- Social Stress
  - Overcrowding

**Forage Selection for dry cows**
- There is no single perfect forage for dry cows.
- Diets based on corn silage and either wheat straw or grass can be successful.

**Take Home Messages**
- Moderate energy diets for dry cows show promise.
- Use low energy, high bulk forages, with favorable mineral profiles.
- Allow cows to consume at an ad libitum rate without over-consuming energy.

Any Questions?