Dairy Cattle Ration Formulation: Lactating Cattle

Importance of Feed Intake
- Milk yield and DMI positively correlated
- Every pound of DMI = 2.0 – 2.5 lbs. milk

Quick and Simple Equation
- DMI (kg/day) = (0.0968 x BW^{0.75}) + (0.372 x kg FCM)
- FCM = (0.4 x kg milk) + (15 x kg fat)
- 635 kg cow, 36 kg milk, 3.5% fat
- FCM = (0.4 x 36) + (15 x 1.26) = 32.8
- DMI = (0.0968 x 635^{0.75}) + (0.372 x 32.8)
  24.7 kg/day or 49.7 lb/day

Dry Matter Intake

DMI and Milk Production
Stages of Lactation

<table>
<thead>
<tr>
<th>Phase</th>
<th>Feeding</th>
<th>Peak Intake</th>
<th>Peak Milk</th>
<th>Fresh</th>
<th>Close-Up</th>
<th>Far-Off</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>1st 35 days dry</td>
<td>Far-Off</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Last 21 days dry</td>
<td>Close-Up</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>0 to 14</td>
<td>Fresh</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>14 to 80</td>
<td>Peak Milk</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>80 to 200</td>
<td>Peak Intake</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>200 to 330</td>
<td>Tail End</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Dry Cow Nutrient Concentrations

<table>
<thead>
<tr>
<th>Phase</th>
<th>Far-off</th>
<th>Close-up</th>
</tr>
</thead>
<tbody>
<tr>
<td>NEL, Mcal/lb</td>
<td>0.60 - 0.64</td>
<td>0.68 - 0.74</td>
</tr>
<tr>
<td>CP, %</td>
<td>12 - 13</td>
<td>13 - 14</td>
</tr>
<tr>
<td>ADF</td>
<td>32 - 40</td>
<td>19 - 25</td>
</tr>
<tr>
<td>NDF</td>
<td>45 - 60</td>
<td>27 - 35</td>
</tr>
</tbody>
</table>

Fresh Cows
- Step Nutrient Intake
- Stabilize Rumen
- Optimize Dry Matter Intake
- Observe the Cow
- Majority of metabolic disorders

Early Lactation - First 100 days
- Goal
  - High peak dry matter intake, peak milk yield, healthy
  - Each lb. of peak yield = 250 - 300 lb. of lactation yield
  - Negative nutrient balance - first ? days of lactation
  - Most difficult time to manage cows
Mid- Late Lactation

- Take advantage of forages
  - lower cost
  - nutrient requirements not as high
- Gain weight (body condition) lost during early lactation

Milk Components

Milk Fat & Protein Relationship

<table>
<thead>
<tr>
<th></th>
<th>Fat %</th>
<th>Protein %</th>
<th>Protein vs Fat</th>
<th>Fat vs Protein</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aryshire</td>
<td>3.91</td>
<td>3.40</td>
<td>87%</td>
<td>1.15</td>
</tr>
<tr>
<td>Brown Swiss</td>
<td>4.03</td>
<td>3.57</td>
<td>89%</td>
<td>1.13</td>
</tr>
<tr>
<td>Guernsey</td>
<td>4.55</td>
<td>3.57</td>
<td>78%</td>
<td>1.27</td>
</tr>
<tr>
<td>Holstein</td>
<td>3.66</td>
<td>3.19</td>
<td>87%</td>
<td>1.15</td>
</tr>
<tr>
<td>Jersey</td>
<td>4.76</td>
<td>3.81</td>
<td>80%</td>
<td>1.25</td>
</tr>
</tbody>
</table>

Milk Fat Sources

- 50% - Acetate and Butyrate
- 50% - Blood Lipids
  - Dietary
  - Body Fat

Low Fat Test

<table>
<thead>
<tr>
<th>Energy Shortage</th>
<th>Milk Fat Depression</th>
</tr>
</thead>
<tbody>
<tr>
<td>- 90-150 days Postpartum</td>
<td>- Any stage of lactation</td>
</tr>
<tr>
<td>- Thin cows</td>
<td>- Good cow condition</td>
</tr>
<tr>
<td>- 2.5 to 3.0% Milk Fat</td>
<td>- 0.9 to 2.5% Milk Fat</td>
</tr>
<tr>
<td>- Milk protein also lower</td>
<td>- Milk protein higher</td>
</tr>
<tr>
<td>- Ration unbalanced</td>
<td>- Off-feed conditions</td>
</tr>
</tbody>
</table>

Balancing Rations
Rations Delivered to the Cow

- The ration on paper
- The ration in the bunk
- The ration consumed by the cow
- The ration absorbed in the blood stream

Requirements

- Body weight
  - Holsteins/Brown Swiss – 1350 to 1450 lbs
  - Aryshire/Guernsey – 1200 to 1300 lbs
  - Jersey – 900 to 1000 lbs
- Milk production
  - daily metered weights, monthly test weights, daily tank averages
- Weight gain/loss

Accurate Feed Analysis

- Test forages when harvested
- Test forages monthly
  - $15 – 30/sample
- Determine forage DM weekly
- Grains – use book values
- Test by-products by load

Ration Formulation

- Lead factors
  - One group – 30% (70 lb avg = 91 lb goal)
  - Two groups – 20% (80 lbs avg = 96 lb goal)
  - Three groups – 10% (90 lbs avg = 99 lb goal)

Ration Formulation

- Start with forages
  - determine energy/protein supplement needs
- Monitor DMI, CP, NEL, and ADF as you change ingredient amounts
- ADF-NDF spread about 10 pts
  - By-products 15-25 pt spread
- Minerals and vitamins – commercial grain mix or mineral pack

Production Potential

- Requirements
- Accurate Feed Analysis
- Predicted Dry Matter Intake
- Ration Formulation
- Actual Dry Matter Intake
- Energy/CP Allowable Production
- Optimal Productivity
NDF Intake

<table>
<thead>
<tr>
<th></th>
<th>NDF Intake (% of BW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry Cow</td>
<td>0.8 – 1.0%</td>
</tr>
<tr>
<td>Early Lactation</td>
<td>0.8 – 1.0%</td>
</tr>
<tr>
<td>First Lactation</td>
<td>1.0%</td>
</tr>
<tr>
<td>Second Lactation</td>
<td>1.2%</td>
</tr>
</tbody>
</table>

Suggested Ration Composition

<table>
<thead>
<tr>
<th></th>
<th>Milk (lb/d)</th>
<th>DMI (lb/d)</th>
<th>NE(\text{L}) (Mcal/lb)</th>
<th>CP (%DM)</th>
<th>RDP (%CP)</th>
<th>RUP (%CP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>55</td>
<td>45</td>
<td>0.62</td>
<td>14.1</td>
<td>67</td>
<td>33</td>
<td></td>
</tr>
<tr>
<td>77</td>
<td>52</td>
<td>0.67</td>
<td>15.2</td>
<td>64</td>
<td>36</td>
<td></td>
</tr>
<tr>
<td>99</td>
<td>59</td>
<td>0.70</td>
<td>16.0</td>
<td>61</td>
<td>39</td>
<td></td>
</tr>
<tr>
<td>120</td>
<td>66</td>
<td>0.73</td>
<td>16.7</td>
<td>59</td>
<td>41</td>
<td></td>
</tr>
</tbody>
</table>

Note on Nutrient Densities

- Nutrient Densities are useful
- However – Most Important
  - Meet the nutrient requirements at a given level of feed intake

Feed Costs

- Typically 50% of expenses
- Feed costs – lactating cows
  - $6.00 – 7.00/cwt
- Feed costs - all cows
  - $6.50 – 7.50/cwt

Relationship between Feed Costs and Milk Production