Dry Matter Intake

Introduction

- Fundamentally Important
- Establishes the amount of nutrients available to the cow
- Dry matter intake (DMI) is important for the formulation of diets to prevent underfeeding or overfeeding nutrients
- Factors that affect voluntary DMI
  - Physical fill
  - Metabolic feedback

Introduction

- Milk yield and DMI positively correlated
- Increase DMI - Increase milk yield
- Every pound of DMI = 2.5 lbs. milk
  1 lb. 3.5% milk = 0.31 Mcal NEL
  1 lb. DM = 0.78 Mcal NEL
  2.5 lbs. milk = (0.78 Mcal/lb.)/0.31 Mcal

Intake Variation Associated With

- Animal - 40 to 60%
- Ration - 20 to 30%
- Environment - 10 to 15%
- Management - 10 to 15%

Ration

- Moisture Content
- Rumination Capacity
- Rumen pH
- Fat
- Effective Fiber
- Nutrient Density
- Bulk Density
Animal
- Body Weight
- Production
- Pregnancy
- Growth
- Maintenance
- Disease
- Hormonal/VFA

Management
- Bunk Management
- Crowding
- Access to feed
- Refusals
- Feeding Frequency
- Animal health/Stress
- Behavioral

Environmental
- Temperature
- Humidity
- Shelter
- Wind
- Night Cooling

Predicting Intake
- Actual Measurement
- Equations
  - body weight
  - fat-corrected milk
  - protein
- Equations are no substitute for knowledge of actual intake

Predicting Intake
- Animal - 40 to 60%
- Ration - 20 to 30%
- Environment - 10 to 15%
- Management - 10 to 15%

DMI Equation
- DMI (kg/day) =
  \((0.0968 \times BW^{0.75} + 0.372 \times \text{kg FCM}) \times (1 - e^{(-0.192 \times (\text{WOL} + 3.67))})\)
- FCM = \((0.4 \times \text{kg milk}) + (15 \times \text{kg fat})\)
- WOL = week of lactation
- Ex: 650 kg cow, 45 kg 3.5% milk, 6^{th} WOL
- FCM = \(((0.4 \times 45) + (15 \times 1.58)) = 41.7 \text{ kg}\)
DMI Equation

- DMI (kg/day) = 
  \[(0.0968 \times 650^{0.75}) + (0.372 \times 41.7) \times (1 - e^{-0.192 \times (6 + 3.67)})\]
- DMI (kg/day) = (12.5 + 15.5) \times 0.84 = 23.5 
  or 51.8 lbs
- What about 12th week?
  - DMI (kg/day) = (12.5 + 15.5) \times 0.95 = 26.6 or 58.6 lbs/day

DMI Curve

DMI and Milk Production

Management Factors

- Empty Bunks – 5% feed refusal
- Cows need 2 linear ft of bunk space
- Eating surface 4-6 inches above foot height
- Smooth, light colored bunk surfaces
- Comfortable cows
- Cows eat about 8 meals per day
- Push-up feed often – 4x/d

Nutritional Management of the Lactating Cow

Management Factors

- Access to feed 20 hrs per day
  - especially after milking
- Restricting water intake reduces DMI
- Poor quality, high fiber forage
- Short particle length (lack of eNDF) and excess fat
- First calf heifers grouped together
Transition Period

- Period from 3 wks before calving to 3 wks after calving
- Previously discussed prepartum management
- Best management for 3 weeks after parturition is management before parturition
- Calm before the storm

Transition Period

<table>
<thead>
<tr>
<th>BW</th>
<th>Milk (lb)</th>
<th>NEL (Mcal)</th>
<th>CP (lb)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1500</td>
<td>0</td>
<td>13.2</td>
<td>2.8</td>
</tr>
<tr>
<td>1400</td>
<td>40</td>
<td>21.2</td>
<td>4.3</td>
</tr>
<tr>
<td>60</td>
<td>28.2</td>
<td>4.9</td>
<td>5.9</td>
</tr>
<tr>
<td>100</td>
<td>40.6</td>
<td>9.3</td>
<td></td>
</tr>
</tbody>
</table>

- NE and CP increases 200-300%

Goals for transition

- Achieve high intake as quickly as possible
  - Cow driven
- Adapt rumen to new feeds
  - Bacterial
  - Rumen papillae
- Critical to determining success in ensuing lactation
  - Peak DMI, low incidence of metabolic disorders
  - Peak milk

Transition Management

- Cow grouping
  - Fresh cow group
  - Enter low group
  - Enter high group
- Fat
  - Don’t feed
  - Intake commonly declines to a level where NEL intake is the same
  - Maximize DMI

Observation!!

- Intake
- Metabolic disorders

Lactation Curve

- 25,000
- 24,750
- 23,890

Wk Lactation
Lactation Curves

Lactation Curves

Lactation/Component Curves

Peak MY & DMI, and BW

Monitoring Fresh Cows

- Feed Intake
  - Monitor
  - After Milking/Feeding, lock-ups
- Temperature
  - <102.5
  - High temps reduce DMI
- Ketosis Measurement
  - Pink – Milk ketone test (B-hydroxybutyrate)
  - Ketostix – urine ketone test (Acetoacetate)

Monitoring Fresh Cows

- Rumen Motility
  - >2 contractions/minute
  - Ca
  - Cannulated cow
- Uterine Health
  - Odors and discharge
  - 95% of cows suffer from bacterial infection
Early lactation - the 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
    - WHY?
    - DMI is inadequate

Maximizing Nutrient Intake

- Energy (CHO)
  - High energy forages
    - Alfalfa - <30% ADF
    - Corn silage - <25% ADF
  - High energy concentrates - >0.88 Mcal/lb.
    - ground or flaked corn or barley
    - whole cottonseed
  - Highly digestible fiber sources
    - Wheat midds
    - Soy hulls

Maximizing Nutrient Intake

- CHO Source
  - Digestible CHO - Starch - fast and slow
  - Amount and form of fiber
  - Cud chewing, saliva flow, buffer

- Protein
  - Amount and quality (amino acid content)
  - Correct amount of degradable and undegradable protein

Maximizing Nutrient Intake

- Protein
  - Meet the needs of rumen microbes first
    - Optimizes rumen microbial amino acid synthesis
  - Increase dietary AA reaching small intestine
  - Minimize loss of N in urine and feces
  - Nitrogenous substrates
    - soluble - NH3, urea (0.3 lb/cow/d)
    - support rumen microbial growth

Shift Dry Matter Intake Curve

- Higher and earlier
  - Adjust cow gradually to milking herd ration
  - Provide highest quality forage
    - palatable, digestible, high nutrient content
  - Recommended body condition
  - Optimize rumen function
    - Rumen is fermentation vat - What does it require to function optimally?
    - Steady state - CHO and N substrate, pH, Temperature, Liquid

Management to optimize intake

- Forage quality
  - Fiber - Amt. and form
    - 19 - 20% ADF
    - 28 - 32% NDF
    - 60 - 70% of NDF from forage
  - Particle length
Mid – Late Lactation

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

Feed Costs

- Typically 50% of expenses
- Feed costs – lactating cows
  - Green light - <6.00/cwt
  - Yellow light - 6.00 - 7.00/cwt
  - Red light - >7.00/cwt
- Feed costs - all cows
  - Green light - <6.50/cwt
  - Yellow light - 6.50 - 7.50/cwt
  - Red light - >7.50/cwt

Relationship between Feed Costs and Milk Production

Balancing Rations

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

NDF Intake

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

<table>
<thead>
<tr>
<th>Milk lb</th>
<th>DMI (lb/d)</th>
<th>NE(_i) (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>
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<tr>
<td>77</td>
<td>52</td>
<td>0.67</td>
<td>15.2</td>
<td>64</td>
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<tr>
<td>99</td>
<td>59</td>
<td>0.70</td>
<td>16.0</td>
<td>61</td>
<td>39</td>
</tr>
<tr>
<td>120</td>
<td>66</td>
<td>0.73</td>
<td>16.7</td>
<td>59</td>
<td>41</td>
</tr>
</tbody>
</table>

Suggested Ration Composition

<table>
<thead>
<tr>
<th>Milk lb</th>
<th>ADF (%DM)</th>
<th>NDF (%DM)</th>
<th>eNDF (%DM)</th>
<th>NFC (%DM)</th>
<th>Fat (%DM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>55</td>
<td>25</td>
<td>35</td>
<td>20</td>
<td>35-38</td>
<td>2.4</td>
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<tr>
<td>77</td>
<td>23</td>
<td>32</td>
<td>20</td>
<td>38-40</td>
<td>2.5</td>
</tr>
<tr>
<td>99</td>
<td>20</td>
<td>27</td>
<td>20</td>
<td>40-42</td>
<td>2.6</td>
</tr>
<tr>
<td>120</td>
<td>19</td>
<td>25</td>
<td>20</td>
<td>40-42</td>
<td>2.7</td>
</tr>
</tbody>
</table>

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)
  - 4 groups
    - early lactation, high, low, first lactation
  - Monitor DMI

Ration Formulation

- Start with forages
  - determine energy/protein supplement needs
- Monitor DMI, CP, NEL, and Fiber 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
Feeding Systems

- Component Systems
  - Forages and Grains separate
  - Accurate estimate of intake
  - Grain
    - Parlor
    - Magnetic feeder
    - Computer feeder
  - Fluctuations in rumen pH
  - Ration formulated and that consumed likely different

Feeding Systems

- Total Mixed Rations
  - Every bite contains the same nutrient density
  - Ration formulated and the one consumed should be similar
  - Rumen environment more stable
  - Cows can not choose ingredients

TMR Wagons

- Horizontal - Reel Mixers

TMR Wagons

- Horizontal – Auger Mixers

TMR Wagons

- Vertical mixer