Livestock Nutrition & Grazing Management
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UMaine Cooperative Extension
1-5-16

New England Forage & Weed ID and Management Training Project

Known facts...
• Converting annual cropland to perennial forage decreases GHG emissions by sequestering more carbon
• Perennial forages sequester carbon than annual forages and grasses sequester more carbon than legumes
• Grazing livestock have lower methane emissions than grazing animals

Comparisons of grazing systems to confinement systems in greenhouse gas production are difficult due to variability in pastures and management.
(see JDS 94:1941-1951 2011 O’Neil et al)

Remsberg photo USDA

Lime and fertilizer application rates based on soil test and grass requirements reduce N2O emissions and increase carbon sequestration.

Managed pastures (Managed intensive grazing or MIG) results in lower total net GHG emissions than unmanaged pastures.

Remsberg photo USDA

• Estimating Carbon sequestration potential of grazing management is difficult due to diversity of plant communities, soils, landscapes and management

Remsberg photo USDA

• While cows feeding on high forage diets produce more methane than grain based diets, feeding a higher quality forage reduces methane production

Remsberg photo USDA

So what are the challenges to a new grazing dairy farm...
• Land resources that are accessible
• Feeding decisions...
• Do hayfields make good pastures?
• “My animals stand at the fence and bellow to come back to the barn”
• “My milk production dropped and I can’t cover my outstanding operating loans”
• Milk production varies from day to day...

Challenges
• Pasture forage quality, yield, and seasonal distribution
• Maximizing dry matter intake (DMI) of dairy cows on pasture
• Meeting energy requirements of lactating dairy cows
• Other nutritional issues on pasture

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Other questions and concerns..

- “how to I supplement the cows to maintain production, body condition and reproduction efficiency?”
- “Can I group my cows like I do in the barn?”
- “What happens when the pastures dry up in the summer?”
- “Will dry matter intake go down?”
- “What about water?”

Dry Matter Intake......why dry matter?

- Using dry matter removes water out of nutrient calculations, since many feeds fed to cows contain various amounts of water...
- 4500 pounds of 85% moisture pasture is how much dry matter?
  - 4500 x 0.15 = 675 lbs dry matter
- While we care about water, we need to know the amount of nutrients going into the cow...amounts are always more important than percentages...

Challenges......Pasture Quality Characteristics

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Pasture</th>
<th>TMR</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crude protein</td>
<td>18 – 34%</td>
<td>16 – 19%</td>
<td>High soluble protein</td>
</tr>
<tr>
<td>Net energy, Mcal</td>
<td>0.66 – 0.80</td>
<td>0.76 – 0.79</td>
<td>Potential Energy deficit</td>
</tr>
<tr>
<td>NDF</td>
<td>30 – 55%</td>
<td>&lt; 45%</td>
<td>low NDF</td>
</tr>
<tr>
<td>NFC</td>
<td>12 – 24%</td>
<td>32 – 36%</td>
<td></td>
</tr>
</tbody>
</table>
Sheep

<table>
<thead>
<tr>
<th></th>
<th>Percent Protein (CP)</th>
<th>Percent Energy (TDN)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintenance (154 lb. mature ewe)</td>
<td>9.6</td>
<td>57.6</td>
</tr>
<tr>
<td>Late Gestation 180-225% lamb crop expected</td>
<td>11.2</td>
<td>66.7</td>
</tr>
<tr>
<td>Lactation Nursing Twins</td>
<td>14.8</td>
<td>64.5</td>
</tr>
<tr>
<td>Early Weaned Lambs (80 lbs) Moderate growth</td>
<td>14.5</td>
<td>75.8</td>
</tr>
<tr>
<td>High Growth</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lamb Finishing 88 lbs, 4-7 mos of age</td>
<td>11.7</td>
<td>77.1</td>
</tr>
<tr>
<td>Yearlings (110 lbs.)</td>
<td>9.1</td>
<td>57.6</td>
</tr>
</tbody>
</table>

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200 lb ewe at Maintenance only needs a CP % of 10%....

Why is DMI so important?

- 1 pound improved DMI will result in about 2 pounds extra milk for cow in early lactation and peak milk
- Every pound of milk at peak equals about 200 pounds of milk for the entire lactation.
- Maximum DMI at Peak for Holsteins on pasture alone is about 40 pounds...Can be about 53 or more if concentrates are added to the diet

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Factors that affecting Dry Matter Intake

• Animal factors
  -- Size (wt) of animal...expressed as % of BW
  -- Stage of Lactation
  -- Milk yield and composition
  -- Body Condition (gain or loss)
  -- Stage of pregnancy

Traditionally we think of two factors that limit or control intake...

• 1) Physical or “bulk fill”

2) Chemical/chemostatic regulation

But in pastures...we find intake is limited by eating ability...how effective the cow harvests the pasture in the field!

Major factor is the amount of feed/forage taken per bite!

Bite size is determined by grass height, the density of the sward and proportion of green leaf in the sward

Pasture and Feed Factors that influence DMI

• Pasture quality (higher quality...higher NDFD...higher passage rate and intake of nutrients)
• Pasture availability
• Sward Density
• Time allowed for grazing
• Supplement type and amount (increased total dry matter intake when pastures are supplemented with concentrates)
• Forage digestibility NDFD

Don’t forget environmental factors

• Temperature
• Humidity
• Rainfall
• Availability of shade
• Access to water
PeNDF  Physically effective NDF

- NDF that contributes to the forage mat for rumen integrity
- 5 lbs forage >1 inch
- 50 chews per cud
- 450 minutes of rumination/day

F-NDF (oh yeah...another NDF term!!)

- Forage NDF is related to DMI...
- Average F-NDF of cows on pasture is about 1.1% to 1.3% of Body wt. of animal
- 1300 pound cow...that means she will eat about 14-17 pounds of F-NDF per day and produce about 45-55 pounds of milk (if forage quality is excellent)

How do you sample pastures?

<table>
<thead>
<tr>
<th>Total plant height was 9 inches</th>
<th>Crude Protein (%)</th>
<th>NDF (%)</th>
<th>NEL (Mcal/lb)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top one-third</td>
<td>27.4</td>
<td>38.5</td>
<td>0.79</td>
</tr>
<tr>
<td>Middle one-third</td>
<td>22.9</td>
<td>44.6</td>
<td>0.76</td>
</tr>
<tr>
<td>Bottom one-third</td>
<td>14.0</td>
<td>60.0</td>
<td>0.67</td>
</tr>
</tbody>
</table>

Balancing Rations

- Pasture DMI is not known
- Nutrient intake is not known (diet selection)
- DM/nutrient intake may change from day to day
- Pasture is usually energy deficient..protein surplus
- No-grain farms???
- Too much protein, particularly degradable protein
Average nutrient composition for cool season grass pasture and legumes

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Cool Season Grass (%)</th>
<th>Cool Season Legumes (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total protein (TP), NDM</td>
<td>18-22</td>
<td>23-28</td>
</tr>
<tr>
<td>RUP, % of TP</td>
<td>25-30</td>
<td>23-30</td>
</tr>
<tr>
<td>NDF, NDM</td>
<td>35-45</td>
<td>30-45</td>
</tr>
<tr>
<td>NSC, NDM</td>
<td>25-30</td>
<td>25-30</td>
</tr>
<tr>
<td>NDF, %DM</td>
<td>40-55</td>
<td>30-45</td>
</tr>
<tr>
<td>NSC, %DM</td>
<td>25-30</td>
<td>25-30</td>
</tr>
</tbody>
</table>

Excess protein costs in...

- Use of energy for excretion of surplus N from soluble and NPN sources
- Potentially detrimental to reproductive performance
- Utilize MUN (Milk Urea Nitrogen) or BUN (Blood Urea Nitrogen) as a monitor

*Summarized from Fales et al., 1995; Hoffman et al., 1993; Holden et al., 1994; Hongerholt et al., 1998; Kolver et al., 1998; Rayburn, 1991

Rumen undegradable protein
Soluble protein

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Spartan Ration Balancer

For 65 lbs of milk (3.5 FCM) - 1400 lb cow

Requirement: 44 lbs of pasture dry matter provides

- CP 7.2 lbs
- Ne 33 Mcals
- NSC 16.8 lbs
- 10.12 lbs CP
- 33.44 Mcals Ne
- 7.92 lbs NSC

Carbohydrate (Grain)
Supplementation of Pasture

- Provides fermentable carbohydrate in the rumen to utilize N and increase rumen microbial yield
- Increase milk yield
  - Increase N output in milk
- Decrease urinary N excretion
- Decrease milk urea nitrogen
- Income over feed costs

Accounting for Pasture

- Ration needs to be adjusted
  - Both amounts of other feeds and nutrients supplied
  - Why pasture samples are helpful
- Nutritionists struggle
  - “Don’t know what or how much they’re eating”
  - “Can’t balance a ration”

Mike Hutjens pasture guidelines

- If you want 90% of expected milk production... feed 50% of DMI from quality pasture
- If you want 75% of expected production.... feed 75% of DMI from quality pasture
- If you want 50% of expected production...... feed 90% of DMI from pasture

Systems

- Total mixed ration (“TMR”)
  - All forages and grain mixed together so every bite is “complete”
  - Different TMRs for different production groups
- Component feeding
  - Each forage and grain fed individually
  - Amounts can be tailored to each cow’s needs
  - Many trips around the barn

Accounting for Supplement

- Substitution effect of supplement
  - Decreases amount of pasture consumed
  - Forages 1:1 substitution
  - Grain 1:0.5 substitution
Minerals - where and how do they fit in?

- Usually look at Ca, P, Mg, S, Cu, Zn, Se and salt
- Mg is essential to reduce risk of grass tetany (dolomitic limestone)
- Most producers supplement with commercial 2:1 mix (Ca to Phos)
- Free choice?

No ‘cookie cutter’
- Every farm is different
- Must optimize resources available on farm
  - Land
  - Animals
  - Feeds/forages
  - Management

Body Condition Scoring

Questions??

Rumen Physiology

- Two types of bacteria
  - Fiber digester – cellulytic – higher when fed high forage diets. Most active pH >6
  - Starch digester – amylytic – higher when fed high grain/starch diets. Most active pH 5-6
- Anything affecting rumen pH affects rumen function and how feeds are digested
Rumen Physiology

- Balance between acid production and removal as well as the buffers available to neutralize acids
- Rapid carbohydrate digestion → rapid VFA production that exceeds removal and decrease in pH reducing forage digestion and reduces intake because of fill. Look at CHO availability
- Saliva is a major source of buffer (Bicarbonate and phosphate ions)