Dairy Nutrition Research Update

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U.S. Dairy Forage Research Center
USDA Agricultural Research Service
Research Projects

1. Increasing the utilization of forage and fiber in dairy cow diets

2. Feed efficiency of lactating dairy cows fed different diets

3. Use of canola meal in dairy cow diets
1. Increasing the utilization of forage and fiber in dairy cow diets
Importance of forages and fiber in dairy cow diets

- Forages are critical for providing necessary fiber for dairy cow diets
  - Provides energy
  - Regulates the intake of feed
  - Stimulates chewing, saliva production, and rumination
  - Increases buffering of the rumen
  - Regulates rumen function
  - Provides a source of precursors for milk fat
Reasons to increase forages in diets of lactating dairy cows

1. There is a need to increase animal productivity to meet the increasing demand for animal-sourced food.

2. Increase utilization of feeds that are not in direct competition with human food, monogastric feed, and biofuel feedstock.

3. Lower the cost of the diet.
• **Limitation:**
  
  • High fiber concentration or poor digestibility of fiber limits intake of high producing dairy cow resulting in less than desirable milk production.
Corn silage: Brown mid-rib (BMR) varieties

• BMR mutation reduces lignin concentration
• Characteristic brown mid-rib color on the leaf
• Improvement in digestibility outweighs negative agronomic characteristics (lower yield, potential for lodging, more stressed by drought, and more susceptible to northern corn leaf blight).

• Lower in lignin content, higher in fiber digestibility, results in greater DMI (Holt et al., 2013).
Value of low-lignin alfalfa varieties

• Wider harvest window?
• Later harvest
  • Greater tonnage per cutting
  • Make use of full growing season
  • Reduce number of cuttings
    • a 15 to 18% lignin reduction means we could harvest 8 to 10 days later
• Improved forage quality
Feeding low-lignin alfalfa silage with BMR corn silage

• Interest to combine both of these varieties to continue to increase silages in diets.
• No feeding study data to date.
2. Feed efficiency of lactating dairy cows fed different diets
Objective 1

Do the cows maintain their efficiency when switching from a typical high starch diet to a less human edible diet (high fiber-low starch)?

High starch diet (high human edible)  Low starch diet (low human edible)

Efficient

Inefficient
On-going project at USDA DFRC

Objective 1

Do the cows maintain their efficiency when switching from a typical high starch diet to a less human edible diet (high fiber-low starch)?
Objective 2

Why are **some cows** able to maintain efficiency and **not the others**?

- **High starch diet** (high human edible)
- **Low starch diet** (low human edible)

Efficient

Inefficient
Objective

Why are some cows able to maintain efficiency and not the others?

Digestibility

Metabolic activity / health
- Blood
- Liver
- Mammary gland

Feeding behavior
- Automatic continuous recording
- Sorting behavior

Methane/CO2 emissions

Rumen microbiota
- Buccal swabs
- Rumen liquid + solid samples
- Rumen wall microbiota
• Feed efficiency can be approached at different levels (from animal to system)
3. Use of canola meal in dairy cow diets
What is canola meal?

- Variety of rapeseed
- *Brassica* genus
- Co-product of canola oil processing (for human consumption)

**Nomenclature**
- Canola meal
- Double-low rapeseed meal

**Low in...**
- erucic acid (oil; <2%)  
- glucosinolates (meal; <30µmol/g)
Objective

• Determine the effect of protein source in early lactation on production and utilization of body reserves using canola and soybean meals as the primary sources.
Materials & Methods

- Multiparous Holstein cows (n = 79)
  - Average parity 2.76 ± 0.87

- Cows received 1 of 4 diets
  - Low protein (16% CP) – Soybean meal diet
  - Low protein (16% CP) – Canola meal diet
  - High protein (18% CP) – Soybean meal diet
  - High protein (18% CP) – Canola meal diet

- Cows received same diet for first 16 weeks of lactation
DMI tended to be greater for cows on CM diets

<table>
<thead>
<tr>
<th>Item</th>
<th>LO SBM</th>
<th>LO CM</th>
<th>HI SBM</th>
<th>HI CM</th>
<th>SEM</th>
<th>CP</th>
<th>S</th>
<th>CP X S</th>
</tr>
</thead>
<tbody>
<tr>
<td>DMI, kg/d</td>
<td>24.6</td>
<td>26.1</td>
<td>25.4</td>
<td>25.6</td>
<td>0.49</td>
<td>0.87</td>
<td>0.09</td>
<td>0.17</td>
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<tr>
<td>Milk yield, kg/d</td>
<td>50.1</td>
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<td>0.83</td>
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<td>FCM, kg/d</td>
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<tr>
<td>ECM, kg/d</td>
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**CM > SBM : 0.80 ± 0.34 kg/d**
DMI tended to be greater for cows on CM diets.
Cows fed CM diets had greater milk yield

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CM > SBM : \(4.45 \pm 0.97\) kg/d
Cows fed CM diets had greater milk yield.
Tendency for CM fed cows to be more efficient

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CM > SBM : 0.10 ± 0.04
QUESTIONS?

Leading the world in integrated dairy forage systems research.

U.S. Dairy Forage Research Center

www.ars.usda.gov/mwa/madison/dfrc
Methods to improve NDF digestibility to increase silage utilization in dairy cow diets

- **Physical treatments**
  - Chopping, shredding, grinding, pelleting, steaming

- **Biological treatments**
  - Enzymes, inoculants, yeast, fungi

- **Chemical treatments**
  - Acids, hydrolyzing alkalis

- **Genetic technologies**
  - Variety selections available to producers