Financial Advantages of Grouping & Feeding Dairy Cows by Nutritional Need

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Grouping and Feeding by Nutritional Need
Benefits of Nutritional Grouping

Nutritional grouping can be beneficial by:

- Feed costs
- Feed efficiency
- Productivity
- Herd health
- Emissions

Cabrera and Kalantari, 2016

One TMR for all lactating cows
- Over-conditioned cows
- Nutrient excretion issues

Allen, 2009

One TMR is standard
58% WI & MI farms use 1 TMR

Contreras-Govea et al., 2015

1 TMR
2 TMR
3 TMR
4 TMR
Needed: continued assessment of nutritional grouping’s economic efficiency

**Economic impact of nutritional grouping in dairy herds**

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J. Dairy Sci. 99:1672-1692

http://dx.doi.org/10.3168/jds.2015-9810
# Grouping and Feeding by Nutritional Need
Simulated Research per Cow

## Application
(Reads an input .CSV herd file)

### Initializer (Instantiate the herd)
- Simulation Period (d)
- Milk Price ($/kg)
- NE Cost ($/Meal)
- RUP cost ($/kg)
- RDP cost ($/kg)

### Cow
- Cow ID
- Parity
- Days in milk (d)
- Days in pregnancy (d)
- Days open (d)
- Days dry (d)
- Milk Potential (%)
- Milk Production (kg/d)
- Milk fat (%)
- Milk Protein (%)
- Dry matter intake (kg)
- Body weight (kg)
- Body condition score (1-5)
- Body energy (Meal)

### Group (List of cows in the herd)
- Group ID
- Group type (obligated, optional)

### Herd
- Herd ID
- Herd Size
- Number of groups
- Group Size
- Abortion (%)
- Milk depression (kg/d)
- Duration of milk depression
- Involuntary culling (%)
- Cut-off DIM (d)
- Cut-off Milk threshold
- Conception rate (%)
- Estrous detection rate (%)
Grouping and Feeding by Nutritional Need
Different Nutritional Grouping Strategy

Obligated Groups

Fresh Group (0-21 DIM)

| cow 1 | cow 2 | ... | cow n |

Dry Group

| cow 1 | cow 2 | ... | cow n |

Optional Groups

Group 1

| cow 1 | cow 2 | ... | cow n |

Group 2

| cow 1 | cow 2 | ... | cow n |

Group 3

| cow 1 | cow 2 | ... | cow n |

TMR

TMR 1

TMR2

TMR3

TMR4

TMR5
Cow-level requirements

- NE
- MP

Cow-level projections according to diet

- Milk
- Fat
- Protein
- BW
- BCS
Grouping and Feeding by Nutritional Need

Nutritional grouping
- Post-fresh (>21 d) lactating cows
- Same size groups:
  Available cows ÷ no. of groups

Group diet formulation
- Average NEL
- Average MP+1SD
  Kalantari et al., 2016

Monthly regrouping
- NEL and MP requirements
  McGilliard et al., 1983

Economic parameters
- 2005-2014 Wisconsin prices
- $0.39/kg milk
- $0.1/Mcal
- $0.18/kg RDP
- $1.04/kg RUP
  Kalantari et al., 2016
### Grouping and Feeding by Nutritional Need

#### Testing Consistency of Nutritional Grouping

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Herd Size (Lactating + Dry)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Characteristics</td>
<td>331</td>
</tr>
<tr>
<td>Average Herd ME305 (kg/cow per year)</td>
<td>13,348</td>
</tr>
<tr>
<td>1&lt;sup&gt;st&lt;/sup&gt; Lactation (%)</td>
<td>38</td>
</tr>
<tr>
<td>Average days in milk (d)</td>
<td>193</td>
</tr>
<tr>
<td>Average days in pregnancy (d)</td>
<td>134</td>
</tr>
<tr>
<td>Average lactation number (#)</td>
<td>2.03</td>
</tr>
<tr>
<td>21-d Pregnancy Rate (%)</td>
<td>17</td>
</tr>
<tr>
<td>Conception Rate (%)</td>
<td>35</td>
</tr>
<tr>
<td>Estrus Detection (%)</td>
<td>49</td>
</tr>
<tr>
<td>Culling (%/yr)</td>
<td>35</td>
</tr>
<tr>
<td>Abortion (%/gestation)</td>
<td>16</td>
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</tbody>
</table>
Grouping and Feeding by Nutritional Need
IOFC Difference from 1 TMR
Grouping and Feeding by Nutritional Need
Density Diets According to Animal Needs
Grouping and Feeding by Nutritional Need

Resulting Herd BW

Change in BW
- Similar distributions
- Nutritional grouping did not change BW in the cows or herd

Stable BW with groups
- Previously reported
  Smith et al., 1978; Clark et al., 1980; Kroll et al., 1987
Grouping and Feeding by Nutritional Need
Resulting Herd BCS

1 TMR
- Thick tailed
- Mode = 2.75

3 TMR
- Normal
- Mode = 3.25
Grouping and Feeding by Nutritional Need
Nutrient Efficiency Increase due to TMR Increase

Herds
331  570  727  787  1460
# Grouping and Feeding by Nutritional Need

## Sensitivity Analysis

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Milk $/kg</th>
<th>NEₘ $/Mcal</th>
<th>RDP $/kg</th>
<th>RUP $/kg</th>
<th>Difference from 1 TMR ($/cow per yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>2 TMR</td>
<td>3 TMR</td>
<td>4 TMR</td>
<td></td>
</tr>
<tr>
<td>Base</td>
<td>0.39</td>
<td>0.1</td>
<td>0.18</td>
<td>1.04</td>
<td>38.7</td>
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<tr>
<td>Worst</td>
<td>0.29</td>
<td>0.14</td>
<td>0.26</td>
<td>1.52</td>
<td>35.5</td>
</tr>
<tr>
<td>Best</td>
<td>0.52</td>
<td>0.05</td>
<td>0.09</td>
<td>0.52</td>
<td>44.3</td>
</tr>
<tr>
<td>Milk Loss</td>
<td>5 d, 1.8 kg milk loss group change</td>
<td>20.5</td>
<td>25.9</td>
<td>23.5</td>
<td></td>
</tr>
<tr>
<td>1st Lactation</td>
<td>1st Lactation are a separate group</td>
<td>32.6</td>
<td>38.8</td>
<td>38.5</td>
<td></td>
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<tr>
<td>4 TMR</td>
<td>Only for 1,460 cow herd</td>
<td></td>
<td></td>
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</tbody>
</table>
Nutritional grouping has an economic value and should be promoted.

The difference of milk income minus costs of NE_L, RUP and RDP ($/cow per yr) from 1 TMR were:
- $39 for 2 TMR
- $46 for 3 TMR
- $47 for 4 TMR

Gains are explained by more milk production and less RUP costs, so greater milk income minus feed costs.

Potential losses due to regrouping cows would have an deleterious economic impact, but not high enough to overcome the gains.
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