Dietary Grouping Strategies to Improve Profitability on Dairy Farms

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Considering nutritional grouping

Take home messages

**Opportunity to improve economic efficiency**
Considering additional nutritional groups

**Diets closer to requirements**
Saves feed costs and increases income over feed costs

**Improved profitability**
IOFC gains far exceed additional expenses or losses

**Additional benefits**
- ↓ environmental concerns
- ↑ health conditions
Feeding all lactating cows equally
A larger number of cows are overfed

Same ration (TMR) to all cows (groups)
All lactating cows receive same nutrient density diet

Preferred “high” rations
Low producing animals receive more nutrients than required

One diet for all
Would never optimize production and efficiency

VandeHaar, 2011
Improve feed efficiency
+ feeding groups

**Improved nutrient use efficiency**
Diet closer to cow requirements

**Less nutrient excretion**
Decreased environmental concerns

**Less overfed animals**
Decreased over conditioned cows

**Lower feeding costs**
Higher milk income over feed cost

Wang et al., 2000
Why farmers do not group more?
Trying to find most important constraints

2-page mailed survey

Results (responses)
- 196 WI farms
- 211 MI farms

Constraints to feeding more ration groups
1. Milk drops when cows are moved
2. Desire to keep management simple
3. Conflicts with grouping for reproduction
4. Farm facilities do not allow it
5. Not enough labor or personnel to handle it

Contreras-Govea et al., 2013
A simulation study...
Strategies for grouping cows
Depend on farm and herd characteristics

**Individual cow nutrient requirements**
- Energy
- Protein (RUP, RDP, MP)

**Farm characteristics**
Capacity to handle lactating feeding groups

**Number of lactating cows on the herd**
States

Adapted from McGilliard et al., 1983; St-Pierre and Thraen, 1999
Milk (and components)
Cow-specific lactation curves

Milk based on
• Herd ME305
• Cow PPA or ME305
• Stochasticity

Components
• Herd
• Stochasticity

Base function
• Woods
• Adjusted Woods

De Vries, 2001
Available from farm records, or

Stochastic distribution

1. Available from farm records, or
2. Stochastic distribution

Daily BW and BCS change according to:
- Lactation
- DIM
- Stochasticity
Criteria for nutritional grouping
Several criteria exist

Days after calving (DIM)
Based on stage of lactation

Fat (protein) corrected milk
Based on level of production measured as F(P)CM

Dairy merit
Function of both F(P)CM and BW

Cluster
Seems to be MOST efficient criterion

McGilliard et al., 1983
St-Pierre and Thraen, 1999
Obligated groups
- Fresh (< 22 DIM)
- Dry (~> 220 DCC)
- Daily assigned

Optional groups
- Actual additional groups
- Daily assigned
- Monthly re-grouped
Cow and herd simulation
Monte Carlo approach

Next event scheduling
• Pregnancy
• Abortion
• Dry-off
• Parturition
• Involuntary culling
• Death

Two-step
• 1. Binary outcome of event:
  • Happens or not
  • E.g., uniform distribution

• 2. DIM of the occurrence
  • When it happens
  • E.g., Weibull distribution

Immediate replacement
• After a cow leaves the herd

Replicates
• 1,000 replicates for each cow within specific herd
Cow simulation
Follows actual COW card

<table>
<thead>
<tr>
<th>Variable</th>
<th>Unit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cow ID</td>
<td>#</td>
<td>Cow identification</td>
</tr>
<tr>
<td>Parity</td>
<td>#</td>
<td>Lactation</td>
</tr>
<tr>
<td>DIM</td>
<td>d</td>
<td>Days in milk, days after calving</td>
</tr>
<tr>
<td>DCC</td>
<td>d</td>
<td>Days in pregnancy (DIP)</td>
</tr>
<tr>
<td>Fat</td>
<td>%</td>
<td>Fat component on milk</td>
</tr>
<tr>
<td>Protein</td>
<td>%</td>
<td>Protein component on milk (%)</td>
</tr>
<tr>
<td>PPA*</td>
<td>%</td>
<td>Predicted producing ability</td>
</tr>
<tr>
<td>ME 305*</td>
<td>kg/305 d</td>
<td>Mature equivalent milk production</td>
</tr>
<tr>
<td>BW</td>
<td>kg</td>
<td>Live body weight</td>
</tr>
</tbody>
</table>

*Either PPA or ME305 used to assess cow’s milk class. PPA preferred if available.
## Studied herds

All data collected at the **cow-level**

<table>
<thead>
<tr>
<th>Herd (size)</th>
<th>570</th>
<th>787</th>
<th>727</th>
<th>331</th>
<th>1460</th>
</tr>
</thead>
<tbody>
<tr>
<td>Herd ME 305, kg</td>
<td>16,140</td>
<td>12,884</td>
<td>13,897</td>
<td>13,348</td>
<td>14,188</td>
</tr>
<tr>
<td>1st lactation, %</td>
<td>43</td>
<td>39</td>
<td>39</td>
<td>38</td>
<td>45</td>
</tr>
<tr>
<td>Average DIM</td>
<td>187</td>
<td>178</td>
<td>201</td>
<td>208</td>
<td>189</td>
</tr>
<tr>
<td>21-d PR, %</td>
<td>18</td>
<td>19</td>
<td>19</td>
<td>17</td>
<td>18</td>
</tr>
<tr>
<td>Culling risk, %</td>
<td>32</td>
<td>37</td>
<td>36</td>
<td>35</td>
<td>40</td>
</tr>
<tr>
<td>Abortion, %</td>
<td>7</td>
<td>11</td>
<td>11</td>
<td>16</td>
<td>7</td>
</tr>
<tr>
<td>BW available</td>
<td>✗</td>
<td>✗</td>
<td>✓</td>
<td>✓</td>
<td>✗</td>
</tr>
</tbody>
</table>
...And we are finding
Herd 787, nutritional diets

Energy in diet (Mcal/Kg DM)

Months after starting simulation
Cow 6338(727) = 78% milk, 1 yr

3rd Lactation

- Milk
- DMI

- $23 milk, -$200 feed, +$177 IOFC

Group-pen availability
State of cow

-846 Mcal

-137 kg CP
Cow 10020(727) = 92% milk, 1 yr

1st Lactation

- $18 milk, -$43 feed, +$25 IOFC

-165 Mcal

-32 kg CP
Economic efficiency

Income over feed cost ($/cow per yr)

Nutritional groups

|$2,375
|$2,425
|$2,475
|$2,525
|$2,575

+$19
+$20
+$22
+$43
+$53
+$61
+$66
+$70
+$73

331
570
727
787
1460
Energy efficiency

![Graph showing energy efficiency across different nutritional groups.](image)

- Nutritional groups: 1, 2, 3, 4, 5, 6
- Energy efficiency increases for each group:
  - Group 1: +0.26%
  - Group 2: +0.38%
  - Group 3: +0.58%
  - Group 4: +0.69%
  - Group 5: +0.75%
  - Group 6: +0.63%
Impact of milk depression

\[
\frac{9.1 \text{ kg}}{\Delta \text{group}}
\]

Income over feed cost ($/cow per yr, bars)

Milk depression
No milk depression

Nutritional groups

-0.05%  -0.06%  -0.07%  -0.10%  -0.13%

- $16  - $19  - $21  - $23  - $23

Milk N produced/Feed N consumed (%/lines)

Herd 787
Decision support tool…

http://DairyMGT.info
A simplified online tool
Herd-specific assessments (DairyMGT.info)
Additional costs and benefits

Impacts grouping feeding strategies

Management cost
• Additional labor
• Extra management

Avoid costs
• Additives and supplements savings

Milk depression
• Cow social interactions
Grouping Strategies

Farm/herd possibilities and decision-making

Current Groups

- How many can?

  - Current diet
  - Group sizes
  - Added Cost & Benefits

  NO

- How many does?

  - How many can?

  YES

- How many does?
  - Current diet
  - Group sizes
  - Added Cost & Benefits
Tool demonstration
Online simulator

Grouping Strategies for Feeding Lactating Dairy Cattle

Evaluates grouping strategies for feeding lactating dairy cattle

- HTML Online Tool
- Instructions and Documentation
- Presentation 1
- Presentation 2
- Paper
- Demo (Click to View/Hide the Video)

Dairy Management UW-Extension
University of Wisconsin-Madison

Grouping Strategies for Feeding Lactating Dairy Cattle

Overview | Upload Farm Details | Group Cows | Reap Benefits | Sample Farm: Total Cows = 470

Prices

<table>
<thead>
<tr>
<th></th>
<th>CP%</th>
<th>NE, MCal/lb</th>
<th>$/(Unit)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn</td>
<td>10</td>
<td>0.9</td>
<td>6.72 ($/bu)</td>
</tr>
<tr>
<td>Soybean Meal</td>
<td>50</td>
<td>0.88</td>
<td>350 ($/ton)</td>
</tr>
</tbody>
</table>

Please note that the values highlighted with this color will be used by the tool.

Calculated Values

<table>
<thead>
<tr>
<th></th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$/lb CP</td>
<td>0.14337</td>
</tr>
<tr>
<td>$/Mcal NEL</td>
<td>0.1174</td>
</tr>
</tbody>
</table>

Milk Price: 15.89 ($/cwt)

Download Parameter Excel File (xls or xlsx version)

- Download Parameters File (xls) OR Download Parameters File (xlsx)

Upload Parameters as Excel File

Upload the Excel File: Choose File no file selected  Upload

Current File/Data Status

Using Data from Default Parameters File on Server
Anatomy of Grouping Strategies for Feeding Lactating Dairy Cattle
Grouping Illustration

Economic impact of nutritional grouping

Lactating Cows: 470
Current Groups: None
NEL Mcal/lb: 0.80
CP, %: 17

Possible Situation:
Groups: 3
Group Sizes: 100, 100, 270
Milk loss: 2.27 kg/d x 4 d
Added Costs: $1,000/month
Saved costs: None
Decision Support System Illustration

Cluster grouping criteria

### Possible Situation

<table>
<thead>
<tr>
<th>Group</th>
<th>Cows</th>
<th>NEL</th>
<th>CP</th>
<th>IOFC</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>100</td>
<td>0.62</td>
<td>13.07</td>
<td>4.7</td>
</tr>
<tr>
<td>2</td>
<td>100</td>
<td>0.65</td>
<td>14.18</td>
<td>7.2</td>
</tr>
<tr>
<td>3</td>
<td>270</td>
<td>0.71</td>
<td>16.05</td>
<td>9.3</td>
</tr>
<tr>
<td>All</td>
<td>470</td>
<td>0.68</td>
<td>15.02</td>
<td>7.9</td>
</tr>
</tbody>
</table>

Annual value of grouping $135,000/ herd
Wisconsin herds analysis
Analysis from dairy farm records
30 Wisconsin dairy farms

No grouping vs. 3 groups
• Same size groups

Grouping criterion
• Cluster

Same prices for all
• $0.35/kg milk
• $0.315/kg CP
• $0.1174/Mcal NEI

Projected body weight
• 500 kg primiparous
• 600 kg multiparous
Analysis from dairy farm records
30 Wisconsin dairy farms

<table>
<thead>
<tr>
<th>Lactating cows (n=30)</th>
<th>No grouping</th>
<th>3 Groups</th>
<th>Gain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum</td>
<td>&lt;200</td>
<td>697</td>
<td>1,059</td>
</tr>
<tr>
<td>Mean</td>
<td>788</td>
<td>2,311</td>
<td>2,707</td>
</tr>
<tr>
<td>Maximum</td>
<td>&gt;1,000</td>
<td>2,967</td>
<td>3,285</td>
</tr>
</tbody>
</table>

Income Over Feed Cost ($/cow.yr)

Increase of IOFC ($/cow per year)

- Between 7 and 52%
- Mean = $396
- Range = $161 to $580
Acknowledgements

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Thanks