Total Mixed Ration (TMR): Alternative to Conventional Feeds for Dairy Animals


Animal and Dairy Sciences Cluster
College of Agriculture, University of the Philippines Los Baños, College, Laguna 4031

1Paper presented during the 19th Dairy Congress held on April 13-15, 2016 at Negros Oriental Convention Center, Dumaguete City

Correct nutrient intake

- Locally adopted breed
- Good production practices
- Milk yield
- Milk quality (safe & nutritious)

Profitable dairy operation
The ruminant digestive system

Number of days of digestive adjustment to changes in the diet

<table>
<thead>
<tr>
<th></th>
<th>Feed intake</th>
<th>Stomach and small intestine</th>
<th>Rumen and reticulum</th>
<th>Total, days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cattle</td>
<td>3</td>
<td>4</td>
<td>7</td>
<td>14</td>
</tr>
<tr>
<td>Pig</td>
<td>3</td>
<td>4</td>
<td></td>
<td>7</td>
</tr>
</tbody>
</table>
Variability in supply and quality of ruminant feed

- Small land holding
- Urbanization
- Overgrazing/mismanaged grazing areas

http://www.skyscrapercity.com/

Feed Fractions

**Feed**
- Dry matter
- Moisture

**Organic Matter**

**Crude Ash**

- Crude Protein
- Crude Fat
- Crude Fiber
- Nitrogen Free-Extract

- Vitamins
- Minerals
Law of the minimum (Leipig’s Barrel)

- Nutrients
  - Carbohydrate, Protein, Vitamins, Minerals, Water, Additives

```
25 L Milk/day
15 L
10 L
5 L
0 L
```

Nutrients as staves in oak barrel
Nutrients as staves in oak barrel

[Diagram showing two oak barrels with sections labeled as Additives, Vitamins, Protein, Energy, Water, Minerals, indicating volumes in liters, with 25L, 15L, 10L, 5L, and 0L markings.]
Nutrients as staves in oak barrel

Which means that..

- Energy content determines the level of intake
- Excesses of other nutrients will not complement the lacking nutrients
- The gastro-intestinal track has a limited capacity
- **So:** Ration should contain the right density and correct proportions of the rest of required nutrients
TMR = Total Mixed Ration

• A form of complete feed containing a mixture of forages, by-products, cereals, protein sources, fats, minerals and vitamins

(Encyclopedia of Farm Animal Nutrition, 2004, p116)

Conventional lactating feeding

• Grazing (*ad libitum*) or Confined (*ad libitum*, indicated by 5% refusal)

• Concentrate supplementation - 1 kg concentrate (NLT 16% CP, NLT 65 % TDN) per 2 kg milk

• Mineral lick
3-month TMR feeding trial at ADSC Dairy Farm, UPLB

• 12 HF X S milking cows divided into 2 groups
• Treatment 1- fed with soilage (*ad libitum*) + concentrate (NLT 16% CP) at 1 kg / 2L of milk
• Treatment 2 – fed with TMR (NMT 16% CP, *ad libitum*)
• Feeding period – 4 weeks
• Feed and milk samples were analyzed using standard methods
Preliminary results (4 weeks)

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Conventional</th>
<th>TMR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ave. intake of soilage(^1), kg</td>
<td>29.01</td>
<td></td>
</tr>
<tr>
<td>Ave. intake of conc(^2), kg</td>
<td>3.19</td>
<td></td>
</tr>
<tr>
<td>Ave. intake of TMR(^3), kg</td>
<td></td>
<td>24.92</td>
</tr>
<tr>
<td>Average DM Intake, Kg</td>
<td>10.25 (2.64%)</td>
<td>11.17(2.91%)</td>
</tr>
<tr>
<td>Ave Milk production, Kg</td>
<td>6.78</td>
<td>9.55</td>
</tr>
<tr>
<td>DM: Milk</td>
<td>1.51</td>
<td>1.17</td>
</tr>
</tbody>
</table>

1-24.29% DM, 2–94.17% DM, 3-44.85% DM

Preliminary results – milk production persistency

\[ y = -0.0963x + 9.2683 \]
\[ R^2 = 0.6704 \]

\[ y = -0.0579x + 11.066 \]
\[ R^2 = 0.326 \]
Milk Quality of Cows Fed with grass and TMR

<table>
<thead>
<tr>
<th>Day 30</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Fat</td>
<td>3.07</td>
<td>3.17</td>
</tr>
<tr>
<td>Protein</td>
<td>3.36</td>
<td>3.39</td>
</tr>
<tr>
<td>Solids Non-Fat</td>
<td>8.94</td>
<td>9.02</td>
</tr>
<tr>
<td>Total Solids</td>
<td>12.01</td>
<td>12.19</td>
</tr>
</tbody>
</table>

A TMR farm in Batangas

![Milk Production Chart](image)
Conclusion

- The name of the game is **nutrient intake consistency**
- Rations should be designed to effectively deliver nutrients
- TMR may reduce your logistical nightmare and consistently provide the required nutrients
  - maintain the level of milk production (has a tendency to increase)
  - maintain milk quality
  - maintained body condition (and subsequent performance)
- TMR can be a potential substitute to conventional feeding systems.
Thank you!

Amado A. Angeles, Ph.D.
Animal and Dairy Sciences Cluster, College of Agriculture,
University of the Philippines Los Baños, College, Laguna 4031

*aaangeles8@up.edu.ph; 049 536 3426 / 0917 806 6066