Nordic Feed Evaluation System: NorFor-Plan & NorFor-Evaluation

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EAAP 2005
Present system

NorFor-system!

NorFor Plan

- Ration planning and optimisation
- Based on the AAT-model

NorFor Evaluation

- Deeper evaluation of rations
- Based on the Karoline-model
General facts about NorFor Plan

- Developed in Norway from the AAT/PBV system
- Interactions between animal and feeds, also nutrient based and non-linear relations
- Digestibility depends on feed intake and dietary composition (rapidly degraded CHO/NDF)
- Four compartments:
  - Rumen
  - Small intestine
  - Large intestine
  - Intermediary metabolism
The model calculates

- Feed digestibility at actual feeding level
- AATp
- PBVp
- Net energy
- Starch to the small intestine
- Nitrogen in faces, urine and milk
- Predicted milk and protein production
- Predicted feed intake
Input - Animal data

- Body weight
- Milk yield
- Milk composition (Fat, Protein and Lactose)
- Week of lactation
Feed data

- DM %
- Crude protein, g/kg DM
- NDF, g/kg DM
- Starch, g/kg DM
- Crude fat, g/kg DM
- Ash, g/kg DM

NOT CHANGED
Feed fractions in the AAT-model

- Ash
- Crude Fat
- "Rest fraction"
- Fermentation products
- Starch
- Crude Protein
- NDF
  - Soluble
  - Potential degradable
  - Undegradable
  - Indigestible

Digestibility, %
Energy still important

- Feed intake and energy supply most important factors for prediction of milk yield
- Many important parameters (AAT, NDF…)
- NorFor Plan uses net energy, (digestibility influenced by DMI)
Milk protein synthesis

- Milk protein yield is calculated as:
  \[(\text{AAT available for milk production}) \times (\text{efficiency of utilization of AAT})\]

- Efficiency of utilization of AAT depends on AAT/MJ

- Accretion and mobilization of protein is considered when calculating AAT available for milk production
Comparison of a present system and NorFor Plan
## Differences between systems...

<table>
<thead>
<tr>
<th>Present system:</th>
<th>Additive feed values</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>NorFor Plan:</th>
<th>Non-additive feed values. Consider interaction between feed and animal:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- Total feed intake</td>
</tr>
<tr>
<td></td>
<td>- Rapidly degraded CHO in the diet</td>
</tr>
</tbody>
</table>
Differences between systems...

<table>
<thead>
<tr>
<th>Present system:</th>
<th>Constant factor for microbial protein yield / kg dig. Carbohydrate</th>
</tr>
</thead>
<tbody>
<tr>
<td>NorFor Plan:</td>
<td>Digestible organic matter instead of only digestible carbohydrates. Microbial protein production efficiency: non linear equation that depends on feed intake, body weight and rapidly degraded CHO</td>
</tr>
</tbody>
</table>
### Differences between systems…

<table>
<thead>
<tr>
<th>Present system:</th>
<th>Ammonia nitrogen and extent of fermentation of silage not considered when calculating AAT</th>
</tr>
</thead>
<tbody>
<tr>
<td>NorFor Plan:</td>
<td>Both ammonia nitrogen and fermentation products are considered when calculating AAT</td>
</tr>
</tbody>
</table>
## Differences between systems…

<table>
<thead>
<tr>
<th>Present system:</th>
<th>Constant passage rate och rate of degradation for all feedstuffs</th>
</tr>
</thead>
<tbody>
<tr>
<td>NorFor Plan:</td>
<td>Different passage rates for liquid and particles. Variable degradation rates for different feeds and fraction.</td>
</tr>
</tbody>
</table>
Effect of feed intake on AATp of the ration
Ration with 50 % concentrate

AAT, g/kg DM

Feed intake, kg DM/day

NorFor Plan
Present system
Effect of feed intake on energy value of the ration

Ration with 50 % concentrate

Feed intake, kg DM/day

FEm per kg DM

FEm, AAT-model

FEm-system
## Diet to a cow yielding 40 kg ECM

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Kg DM</th>
<th>Components</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silage, mixed ley</td>
<td>10</td>
<td>CP</td>
<td>18 % of DM</td>
</tr>
<tr>
<td>Barley</td>
<td>7</td>
<td>NDF</td>
<td>32 %</td>
</tr>
<tr>
<td>Protein Conc.</td>
<td>5.4</td>
<td>Starch</td>
<td>19 %</td>
</tr>
<tr>
<td>Total ration</td>
<td>22.4</td>
<td>Crude fat</td>
<td>4.2 %</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MJ/kg DM*</td>
<td>12.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AAT/MJ*</td>
<td>7.9</td>
</tr>
</tbody>
</table>

* Swedish ME MJ and AAT
### Results, NorFor Plan

<table>
<thead>
<tr>
<th></th>
<th>NorFor Plan</th>
<th>Swedish</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Energy balans, %</strong></td>
<td>97</td>
<td>101</td>
</tr>
<tr>
<td><strong>AAT balans, %</strong></td>
<td>98</td>
<td>105</td>
</tr>
<tr>
<td><strong>AAT totalt, g/day</strong></td>
<td>2679</td>
<td>2214</td>
</tr>
<tr>
<td><strong>PBV, g/day</strong></td>
<td>362</td>
<td>455</td>
</tr>
<tr>
<td><strong>AAT, g/kg DM</strong></td>
<td>120</td>
<td>99</td>
</tr>
<tr>
<td><strong>PBV, g/kg DM</strong></td>
<td>16</td>
<td>20</td>
</tr>
<tr>
<td><strong>NElact</strong>*, MJ/day**</td>
<td>153</td>
<td></td>
</tr>
<tr>
<td><strong>ME, MJ/day</strong></td>
<td></td>
<td>280</td>
</tr>
<tr>
<td><strong>Eff. Microbial, g/kg dig org matter</strong></td>
<td>195</td>
<td></td>
</tr>
<tr>
<td><strong>Microbial protein</strong></td>
<td>2498</td>
<td></td>
</tr>
</tbody>
</table>
Several new parameters influence the evaluation of the diet. They result in many differences between NorFor Plan and present systems.

Differences depend on:
- Rapidly degraded CHO (NDF dig., microbial-AAT)
- Degradation rate of NDF (energy, AAT)
- Fermentation products (AAT, DMI)
- DMI (energy, microbial-AAT)
A new tool for ration analysis: *NorFor-Evaluation*

- Based on the whole animal model Karoline
- Dynamic model with complex equations
- Developed in a Nordic research project 2000-2004
- Feed input data similar to NorFor Plan
NorFor-Evaluation, cont.

- Can **not** be used for ration formulation or optimisation
- **Special tool** for:
  - evaluations, for example trouble-shooting rations
  - education, simulating metabolism and physiology
  - research, simulate metabolism
What’s up in NorFor?

- Further development of NorFor-Plan:
  - Digestion model
  - Feed intake model
  - Physical structure/fiber
- Official group for feed table and analyses
- Official group for requirements and recommendations
- Report from our evaluation work
- A project group working on IT tools
Conclusions

- One and the same system in all NorFor countries!
- NorFor-Plan will replace our present systems
- NorFor-Evaluation, a new tool for check-up rations
- Interactions between feeds and the animal will be considered in the new system
- NorFor system is based on today’s knowledge from Nordic and international research
- Rational tools will help consultants improve both efficiency and economy in the dairy production