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Novel feeds may provide multiple benefits

Prof. Marketta Rinne, Natural Resources Institute Finland
Forage or concentrate feeds!?

- Organic and low-input dairy farms rely typically on forages produced on-farm – this is the key to success!
- However, in many systems, substantial amounts of concentrate feeds are also used
- By-product feeds may be beneficial to smooth out temporal feed shortages
  - Use as feed may be economically and environmentally a good choice for "waste disposal"
  - Ruminants have an advantage of being able to utilize efficiently also fibrous by-products
- As organic food and beverage production develops, also organically labelled by-products emerge
  - More organic feeds available
  - Higher value of by-products supports the main product
- There are a lot of expectations for biorefineries, bioenergy production etc. which is likely to result in opportunities for new feed products
  - In some cases the biorefineries may also compete with animals for the biomasses
• Rumen allows cows to use efficiently fibrous by-products and feeds, which are otherwise of low value

• But on the other hand it is difficult to improve the performance from the bulk feed category to higher levels of the cascade
European wide screening of novel & underutilized feeds in the SOLID project

- Research can support wider utilization of novel feeds
- We first conducted a literature review:
- In the next step, feed samples were collected from farms, companies, and other projects in Finland, Spain, Romania and UK.
- Samples were analysed with relevant chemical and in vitro methods to evaluate their suitability as feeds in organic and low-input dairy diets
Protein feeds

- Europe needs to improve its self sufficiency in protein feeding of farm animals

<table>
<thead>
<tr>
<th>Protein feeds</th>
<th>Crude protein, g/kg DM</th>
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<tbody>
<tr>
<td>Pumpkin seed meal</td>
<td>400</td>
</tr>
<tr>
<td>Camelina meal</td>
<td>375</td>
</tr>
<tr>
<td>Poppy seeds meal</td>
<td>350</td>
</tr>
<tr>
<td>Linseeds meal</td>
<td>325</td>
</tr>
<tr>
<td>Blue lupin seeds</td>
<td>300</td>
</tr>
<tr>
<td>Wheat germs meal</td>
<td>275</td>
</tr>
<tr>
<td>Rapeseed expeller</td>
<td>250</td>
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<tr>
<td>Faba beans</td>
<td>225</td>
</tr>
<tr>
<td>Corn DDG</td>
<td>200</td>
</tr>
<tr>
<td>Corn gluten feed</td>
<td>175</td>
</tr>
<tr>
<td>Peas</td>
<td>150</td>
</tr>
<tr>
<td>Orange leaves</td>
<td>125</td>
</tr>
<tr>
<td>Cucumber waste</td>
<td>100</td>
</tr>
<tr>
<td>Cauliflower waste</td>
<td>75</td>
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<tr>
<td>Tomato silage</td>
<td>50</td>
</tr>
<tr>
<td>Olive pulp</td>
<td>25</td>
</tr>
<tr>
<td>Olive pulp / silage waste</td>
<td>10</td>
</tr>
<tr>
<td>Olive leaves</td>
<td>0</td>
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</tbody>
</table>

"Protein feeds"
Fruit and vegetable by-products

• Roughly half of the fruits and vegetables in EU go to waste
  – Losses occur at all steps: Agricultural production, processing, distribution, consumers
• The materials are typically moist and easily spoiled, but with proper management (e.g. ensiling), can successfully be used as animal feed

Tomato waste co-ensiled with cereal straw in Spain
On-farm trials in Spain: by-products in dairy goats

Farm 1 (September-November 2013)
- Olive and tomato silages
- 3 experimental groups
  - Control: olive silage : tomato silage
- 2 months monitoring
- Feed intake, milk yield and composition and environmental assessment

Farms 2 and 3 (September-December 2013)
- Orange (farm2) and cauliflower (farm3) by-products
- 260 (1) and 600 (2) lactating goats
- 4 months monitoring
- Feed intake, milk yield and composition, farm inputs and outputs
<table>
<thead>
<tr>
<th>Control</th>
<th>Olive silage</th>
<th>Tomato silage</th>
</tr>
</thead>
</table>

**Daily intakes (g/d DM)**
- P = 0.772

**Milk yield (g/d)**
- P = 0.733

**Milk fat (g/kg)**
- P = 0.024

**Somatic cells counts (10^3 cell/ml)**
- P = 0.434
VALORISATION OF CAMELINA CAKES in Romania

**EXP 1:** 0%, 50% and 100% replacement of sunflower meal (in the context of diet based on silage & hay)

**EXP 2:** 100% replacement of sunflower meal (in the context of diet based on green biomass)

- insignificant decrease of milk yield
- significant decrease of mil fat content
- improvement of the milk fatty acids profile
Whole-crop cereal forages

- Grain legumes provide an option to maize with higher protein content, less dependence from N fertilization and suitable for environments where maize does not grow

Results from Finland

![Graph showing CP, Starch, NDF, and OMD for Maize, Faba bean, and Pea.](Photo: ©MTT Kaisa Kuoppala)
Agroforestry

- Multifunctionality of agroforestry systems has benefits, but browse from trees has low nutritional value compared to needs of dairy diets.

Ensiled willow leaves

Sampling of short rotation willow for both wood chips and feed in UK
Wood-derived novel products

- There is great interest in utilizing the forest biomasses in novel ways
- Ruminants are able to utilize variable fibrous products as energy sources – but value added is not very high
  - The conventional feeds are efficiently produced, logistics etc. well designed, and costs (relatively) low
- Industrial processing (hot water and pressure) of wood released hemicellulases into a highly digestible form
  - But commercially not (yet) feasible
  - What about consume reactions?
A palatability trial of birch and spruce extracts was conducted at Luke, Maaninka.

Novel feeds from grass

- Grass is an abundant feed source
- Ensiling makes it a stable raw material for biorefining
- Liquid part of it may be used even for pigs
- A national project going on in Finland (Innofeed)
Local niches vs. legislation

- Some by-products or plants may be produced in limited amounts
  - May have local significance
- EU feed material list is not closed
  - But the producer of the feed is responsible for the safety of its use
- The information regarding feed regulations at EU level can be found at the European Commission website:
  - [http://ec.europa.eu/food/food/animalnutrition/index_en.htm](http://ec.europa.eu/food/food/animalnutrition/index_en.htm)
Detailed report of “novel feeds” work conducted in the SOLID project is available in “Organic Agriculture”:

There is a feed for every need 😊

- The variability of the raw materials further modified by differing processing methods results in wide range of feed materials available
- Research can support the acceptance and optimal use of novel and under-utilized feeds
  - Demonstrations and publicity for the new options
  - Correct advice based on composition / characteristics
  - Some feeds have special characteristics (probiotic effects, modifications in product quality)
- Innovative use of novel and underutilized feed resources has the potential to improve the efficiency of the “green economy”
Things are changing!

Earlier:
Waiter, there is a fly in my meat soup!

Now:
Waiter, there is meat in my fly soup!
Thank you to colleagues for input

• In particular:
  – David Yáñez-Ruiz
  – Catalin Dragomir
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