Determining manure nutrient content in Finland

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Current system for manure quality

- Two options as defined by “Government Decree on the restriction of discharge of certain emissions from agriculture” (1250/2014), under Nitrates directive (91/676/EC)
  - Farm-specific manure analyses min. every five years
  - Table values
    - Based on manure analysis data from two commercial laboratories; Lab 1 - 13 500 samples; Lab 2 – 4 600 samples
- Applies to all farms
  - All Finland nitrate vulnerable zone
- These two options are also included into the voluntary agri-environmental support scheme of the Rural Development Programme 2014-2020.
- Simple and understandable, but significant room for error
Current system for manure quantity

- Manure quantities/volumes per animal (m³/animal/yr) are calculational.
- Were updated in 2014 by Luke & SYKE
  1. Starting point: animal feeding and productivity data => excretion of urine and faeces
  2. Addition of cleaning water and bedding materials (depending on the housing system)
  3. Transformation from masses to volumes
     • volume weights of different manures were obtained from manure analysis data of the two commercial laboratories
  4. For solid manures, a rough estimation of 20% decrease in volume due to spontaneous composting during storing is included.
- Other mass changes are not included in the animal-specific figures
  - Precipitation and evaporation during storing are considered when manure storage capacity is calculated. Depends on the type of storage covering.
  - Emissions (e.g. ammonia) are not taken into account at this point.
Quality: Challenges with farm-specific manure analysis

- Subject to error in many steps
  - Sampling
  - Sample preservation
  - Sample pre-treatment
  - Analysis
  - Differences between laboratories and/or analysis methods

- Example of cattle slurry data from two commercial laboratories (next slide)
Example of cattle slurry data from two commercial laboratories (~2005-2011)
- Total nitrogen (kg N/ton)
Slurry samples from:
- 10 dairy farms
- 5 beef cattle farms
- 4 farms with fattening pigs
- 2 farms with sows
- 4 farms with fattening pigs and sows

Same samples analysed in two laboratories.

![Bar chart of phosphorus (kg P/ton) and total nitrogen (kg N/ton)]
Challenges with table values

- Limited to only few animals and manure types
  - no consideration of breed, age, feeding, housing type etc.
- Practices within farms may vary significantly
  - e.g. water usage and bedding choice and amount.

<table>
<thead>
<tr>
<th>Animal</th>
<th>Manure type</th>
<th>Total P (kg/m³)</th>
<th>Soluble N (kg/m³)</th>
<th>Total N (kg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cattle</td>
<td>Solid</td>
<td>1.0</td>
<td>1.1</td>
<td>4.0</td>
</tr>
<tr>
<td></td>
<td>Slurry</td>
<td>0.5</td>
<td>1.7</td>
<td>2.9</td>
</tr>
<tr>
<td></td>
<td>Urine</td>
<td>1.0</td>
<td>1.5</td>
<td>2.5</td>
</tr>
<tr>
<td>Pig</td>
<td>Solid</td>
<td>2.8</td>
<td>1.2</td>
<td>4.6</td>
</tr>
<tr>
<td></td>
<td>Slurry</td>
<td>0.8</td>
<td>2.2</td>
<td>3.4</td>
</tr>
<tr>
<td></td>
<td>Urine</td>
<td>0.2</td>
<td>1.3</td>
<td>2.0</td>
</tr>
<tr>
<td>Sheep / goat</td>
<td>Solid</td>
<td>1.3</td>
<td>1.0</td>
<td>4.9</td>
</tr>
<tr>
<td>Horse</td>
<td>Solid</td>
<td>0.5</td>
<td>0.4</td>
<td>2.6</td>
</tr>
<tr>
<td>Laying hen</td>
<td>Solid</td>
<td>5.6</td>
<td>4.2</td>
<td>9.4</td>
</tr>
<tr>
<td>Broiler</td>
<td>Solid</td>
<td>3.6</td>
<td>2.7</td>
<td>8.7</td>
</tr>
<tr>
<td>Turkey</td>
<td>Solid</td>
<td>4.4</td>
<td>3.2</td>
<td>8.0</td>
</tr>
<tr>
<td>Fox</td>
<td>Solid</td>
<td>12.7</td>
<td>1.4</td>
<td>6.5</td>
</tr>
<tr>
<td>Mink</td>
<td>Solid</td>
<td>12.1</td>
<td>0.9</td>
<td>5.2</td>
</tr>
</tbody>
</table>
One possible improvement:

- Continue with the farm-specific manure analysis
  - More frequently than every five years?
  - Improved guidelines for manure sampling
  - Improved manure sample identification
    - When samples are sent to laboratory
    - Not "poultry manure" but "broiler manure" etc

  => more precise data for "single farm manure properties" but also for table values

- NOT using either farm-specific analysis results OR table values as a basis for fertilisation, BUT calculating mean values using farm-specific results AND table values, and using mean values when planning fertilisation with manure.

  => compensates possible errors during sampling; considers farm-specific features.
A normative manure system under development

- A system calculating manure **quantity** and **quality**
  - ex animal: faeces and urine depending on feeding
  - ex housing: different manure types, incl. bedding, waters etc.
  - ex storage: stored manure to be spread on field
  - Emissions/losses included (linked to the national emission inventories)

- Possibility to calculate separately for different animals
  - e.g. not only cattle, but dairy cows, heifers, calves of different ages, bulls, suckler cows separately

- Possibility to consider farm-specificity
  - Different feeding choices
  - Different bedding materials, water use, storage

- An equal and documented database for all users / uses
Challenges of a normative manure system

- Complex model for multiple management options in variable conditions
  - Excretion calculation integral: many choices for feeding
  - Large number of animal categories and manure types
  - Data on national manure management required
- May seem too complex
  - Need for cooperation and dialogue between stakeholders to become acceptable
  - Must be well-documented and transparent
- Need for regular update
  - Clear routines: responsible organisations, schedule, data collection
Thank you!