Manure processing in The Netherlands

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The Netherlands,

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Overview manure processing in NL

Three ‘waves’:

1. **Late 1960s - early 1970s**: driven by sewage water treatment technology:
   - only veal slurry processing has remained

2. **Late 1980s – early 1990s**: driven by policy & technology
   - Poultry manure drying and export (remained)
   - Pig slurry processing, drying and pelleting

3. **Mid 2000s - ....**: driven by sector & technology & policy
   - Anaerobic digestion, pasteurization
   - Separation, drying & incineration,
   - Ultrafiltration & reverse osmosis
The Netherlands (NL)

- Area: 3.5 Mha
- Ag area 2.0 Mha
- 16 million people
- 4.0 million cattle
- 16 million pigs
- 100 million chicken
- World 2nd exporter of agric. produce
Manure problems are regionally differentiated

South and east:
Dairy farming & intensive animal production
- Sandy soils
- Nitrate in groundwater
- Ammonia emissions

North and west:
Dairy farming and arable farming
- Clay and peat soils
- Eutrophication of surface waters
Changes in N balances in NL (1950-2000)

Amount of N, Gg/yr

Animal production
imported feed
N fertilizer
N surplus

Controls of Nitrogen- en Phosphorus in agriculture

Input
- Feeds
- Fertilizers

Output
- Animal Products
- Manure export
- Crop Products

 Processes:
- Dairy
- Pigs
- Poultry
- Manure
- Roughage
- Concentrates
- Grassland
- Maize land
- Arable land / Horticulture

Emitted gases:
- CH₄
- N₂O
- NH₃
- PO₄
- NO₃
Manure production and disposal, Gg P$_2$O$_5$/yr

Manure production may not exceed 172 Gg P$_2$O$_5$ per year
Manure disposal cost, euro per ton

![Bar chart showing manure disposal cost for cattle, pigs, and poultry from 2005 to 2010.](chart.png)
Set-up of obligatory manure processing

Feeding

Animals

Manure production

Application own farm

Manure surplus

Application other farms

Obligatory processing

Export

Hence, obligatory manure processing is export of manure phosphorus

Total application in NL = < total room for application
## Assessment of manure processing need and capacity, Gg P$_2$O$_5$ per year

<table>
<thead>
<tr>
<th></th>
<th>2011</th>
<th>‘Optimistic’</th>
<th>‘Pessimistic’</th>
<th>Koersvast (Farmers)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manure production 2015</td>
<td>170</td>
<td>164</td>
<td>164</td>
<td>164</td>
</tr>
<tr>
<td>Room for application</td>
<td>134</td>
<td>120</td>
<td>110</td>
<td>135</td>
</tr>
<tr>
<td>Poultry processing</td>
<td>26</td>
<td>26</td>
<td>26</td>
<td>26</td>
</tr>
<tr>
<td>Surplus</td>
<td>36</td>
<td>44</td>
<td>54</td>
<td>29</td>
</tr>
<tr>
<td>Processing needed</td>
<td>-</td>
<td>18</td>
<td>28</td>
<td>3</td>
</tr>
<tr>
<td>Current capacity</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>New capacity -&gt; 2015</td>
<td>4</td>
<td>4</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>Total capacity</td>
<td>14</td>
<td>14</td>
<td>26</td>
<td></td>
</tr>
<tr>
<td>Missing capacity</td>
<td>4</td>
<td>14</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

PBL-WUR, 2013
Regional differentiation of the fraction of the manure surplus that has to be processed

<table>
<thead>
<tr>
<th>Region</th>
<th>2014</th>
<th>2015</th>
<th>2014 mln kg</th>
<th>2015 mln kg</th>
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</thead>
<tbody>
<tr>
<td>South</td>
<td>30%</td>
<td>50%</td>
<td>12 mln kg</td>
<td>21 mln kg</td>
</tr>
<tr>
<td>East</td>
<td>15%</td>
<td>30%</td>
<td>3 mln kg</td>
<td>7 mln kg</td>
</tr>
<tr>
<td>Other</td>
<td>5%</td>
<td>10%</td>
<td>1 mln kg</td>
<td>2 mln kg</td>
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<tr>
<td>Totaal</td>
<td></td>
<td></td>
<td>17 mln kg</td>
<td>29 mln kg</td>
</tr>
</tbody>
</table>

Fraction will be determined ‘each’ year
## Application limits for phosphorus (P$_2$O$_5$/ha)

### Arable land

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</thead>
<tbody>
<tr>
<td>Low</td>
<td>85</td>
<td>85</td>
<td>85</td>
<td>85</td>
<td>80</td>
<td>75</td>
</tr>
<tr>
<td>Neutral</td>
<td>80</td>
<td>75</td>
<td>70</td>
<td>65</td>
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<tr>
<td>High</td>
<td>75</td>
<td>70</td>
<td>65</td>
<td>55</td>
<td>55</td>
<td>50</td>
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</tbody>
</table>

### Grassland

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<td>95</td>
<td>95</td>
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<tr>
<td>High</td>
<td>90</td>
<td>90</td>
<td>85</td>
<td>85</td>
<td>85</td>
<td>80</td>
</tr>
</tbody>
</table>
Relative distribution of soil P-status, %

### Arable land

- **Zuid**: Predominantly high status (close to 100%).
- **Oost**: Mixed status, with a significant portion in the high category.
- **Ov NL**: A mix of low and neutral, with a small portion in the high category.

### Grassland

- **Zuid**: High status predominant.
- **Oost**: A mix of high, neutral, and low.
- **Ov NL**: Predominantly neutral, with a small percentage in the high category.

**Legend:**
- Low
- Neutral
- High
- Not measured
Conclusion

- Manure processing has long history
- Manure processing is costly (>20 euro per ton)
- Free riders dilemma obstructs implementation of processing
- Obligatory manure processing in NL from 2014
- Manure processing = export of manure P
- Main processing techniques:
  - Drying and incineration of poultry manure
  - Digestion & pasteurization of pig slurry
  - Separation of slurries and export of solid fraction