Dutch dairy farms in a post quota era

*economic and environmental consequences*

Cindy Klootwijk¹, **Corina van Middelaar**¹, Paul Berentsen², Imke de Boer¹

¹ Animal Production Systems group

² Business and Economics group

Aim

From milk quota... to phosphate quota!

Evaluate consequences of quota abolition and Dairy act:

- Farm structure and management
- Labour income
- Nitrogen and phosphate surplus
- Greenhouse gas emissions
Dairy farm model

Model objective: maximize labour income
Method

Typical farm before quota abolition

Exclude milk quota, include Dairy act

Optimize farm plan: maximize labour income

Difference economic & environmental performance
## Typical Dutch dairy farm

### 2014 vs 2016

#### Milk quota
- **2014:** 679 ton yr\(^{-1}\)
- **2016:** no milk quota

**Dairy Act**
- 4841 kg \(P_2O_5\) yr\(^{-1}\)

### Base

<table>
<thead>
<tr>
<th>Parameter</th>
<th>2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stable capacity</td>
<td>83 cows</td>
</tr>
<tr>
<td>Milk production</td>
<td>8,160 kg cow(^{-1}) yr(^{-1})</td>
</tr>
<tr>
<td>Farm land</td>
<td>50 hectares</td>
</tr>
<tr>
<td>Milk price</td>
<td>355 € ton(^{-1})</td>
</tr>
</tbody>
</table>

**FADN, 2015; KWIN-V, 2014**

### Options

<table>
<thead>
<tr>
<th>Option</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase stable capacity</td>
<td>€ 558 cow(^{-1}) yr(^{-1})</td>
</tr>
<tr>
<td>Purchase phosphate quota</td>
<td>€ 2.10 kg (P_2O_5) yr(^{-1})</td>
</tr>
<tr>
<td>Process manure surpluses</td>
<td>€ 13 kg (P_2O_5) yr(^{-1})</td>
</tr>
<tr>
<td>Purchase additional land</td>
<td>€ 1187 ha(^{-1}) yr(^{-1})</td>
</tr>
</tbody>
</table>

**KWIN-V, 2014**
# Results

<table>
<thead>
<tr>
<th></th>
<th>2014</th>
<th>2016</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Farmland</strong></td>
<td>ha</td>
<td>50</td>
</tr>
<tr>
<td><strong>Dairy cows</strong></td>
<td>#</td>
<td>83</td>
</tr>
<tr>
<td><strong>Milk production</strong></td>
<td>ton yr(^{-1})</td>
<td>679</td>
</tr>
<tr>
<td><strong>Farm intensity</strong></td>
<td>kg milk ha(^{-1}) yr(^{-1})</td>
<td>13,578</td>
</tr>
<tr>
<td><strong>Manure production</strong></td>
<td>kg P(_2)O(_5) yr(^{-1})</td>
<td>3990</td>
</tr>
<tr>
<td><strong>Labour income</strong></td>
<td>€ yr(^{-1})</td>
<td>10,343</td>
</tr>
</tbody>
</table>

* Equals phosphate application room
Sensitivity analysis

# Dairy cows

- **2016**: 87
- **Stable capacity**: 120, 83 → 120
- **Milk price**: 180, 355 → 420 € ton\(^{-1}\)
- **Manure proc. cost**: 100, 13 → 8 € ton\(^{-1}\)
- **Land cost**: 100, 1187 → 573 € ha\(^{-1}\)
Sensitivity analysis

kg P$_2$O$_5$ yr$^{-1}$

- Stable capacity: 83 → 120
- Milk price: 355 → 420 € ton$^{-1}$
- Manure proc. cost: 13 → 8 € ton$^{-1}$
- Land cost: 1187 → 573 € ha$^{-1}$
Environmental impact

2014       2016     Stable       Milk      Manure    Land
capacity    price       proc.        cost

kg N ha\(^{-1}\) kg P\(_{2}O_5\) ha\(^{-1}\)

140       160       180       200       220

2014       2016       Stable capacity ↑ Milk price ↑ Manure proc. cost ↓ Land cost ↓
Environmental impact

- kg CO₂-eq ton FPCM⁻¹

- 2014
- 2016
- Stable capacity ↑
- Milk price ↑
- Manure proc. cost ↓
- Land cost ↓
Conclusions

- Increasing number of cows profitable until manure processing or land purchases is required (current prices!)
- Phosphate quota limiting factor only when cost manure processing or land decrease
- Within phosphate quota, growth of about 15% possible by increasing phosphate use efficiency
- Slight increase in N and P surplus per hectare; similar GHG emissions per unit milk; increase total GHG emissions

New Dutch manure policy will likely limit farm intensity up to an increase of 4-15%
PhD course

Environmental impact assessment of livestock systems

13-17 February 2017

Animal Production Systems, Wageningen University, the Netherlands

Imke de Boer, Wageningen University
Pierre Gerber, FAO
Martin Persson, Chalmers University
Oene Oenema, Wageningen University

and others

INFO: www.aps.wur.nl Or contact: Corina.vanMiddelaar@wur.nl

Awarded the WIAS education prize for best PhD course in 2015
## Sensitivity analysis

<table>
<thead>
<tr>
<th></th>
<th>Higher stable capacity</th>
<th>Higher milk price</th>
<th>Higher farm productivity</th>
<th>Lower costs manure processing</th>
<th>Lower land costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farmland</td>
<td>56</td>
<td>84</td>
<td>50</td>
<td>50</td>
<td>58</td>
</tr>
<tr>
<td>Dairy cows</td>
<td>120</td>
<td>180</td>
<td>107</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Intensity</td>
<td>17,440</td>
<td>17,440</td>
<td>19,191</td>
<td>16,331</td>
<td>14,130</td>
</tr>
<tr>
<td>Manure production</td>
<td>5884</td>
<td>8826</td>
<td>5376</td>
<td>4841</td>
<td>4841</td>
</tr>
<tr>
<td>Manure processing</td>
<td>608</td>
<td>1191</td>
<td>608</td>
<td>424</td>
<td>0</td>
</tr>
<tr>
<td>Labour income</td>
<td>2369</td>
<td>81,914</td>
<td>32,227</td>
<td>11,354</td>
<td>14,569</td>
</tr>
</tbody>
</table>
Sensitivity analysis

labour income in € yr\(^{-1}\)

- 2016
- higher stable capacity
- higher milk price
- lower costs manure processing
- lower land costs