Managing Phosphorus surpluses

The phosphorus problems in the Dutch dairy sector

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Overview

- Dairy in an urbanized and livestock dense country
- Phosphate balance the Netherlands
- Phosphate policy
- Mitigating P surpluses at farm level
 - Fertilisation
 - Manure processing and export
 - Animal nutrition
- P amongst other environmental issues



People, animals and land

| (millions) | Northern Ireland | Nether- lands | Ratio |
|------------|---------------------|------------------|-------|
| Cattle | 1.6 | 4.2 | 2.5 |
| Sheep | 2.0 | 0.9 | 0.5 |
| Pigs | 0.5 | 12.4 | 25 |
| Poultry | 20.4 | 105.0 | 5 |
| Grassland | .8 | 1.0 | 1.25 |
| Maize | | .23 | |
| Arable | .01 | .5 | |
| Population | 1.9 | 17 | 9 |
| Total area | 1.4 | 4.2 | 3 |







94 kTon Stays in NL 38%

| Destination of phosphate surplus | kTon P2O5 |
|-----------------------------------------------------|--------------|
| Accumulation agricultural soils | 27 |
| Losses to water | 15 |
| Loss to inert materials (concrete, underlayment) | 52 |

Loss to inert materials: the human P cycle

Source: Smit et al., (2010)



Phosphate surpluses on agricultural land

P2O5 surplus /ha/year in the 20th and 21st century:

| Decade | P2O5 surplus/ha/yr |
|------------|-----------------------|
| 1910, 1920 | 25 |
| 1950 | 40 |
| 1980 | 78 |
| 2008 | 40 |
| 2015 | 0 - 20 |

Total about 4500 kg P2O5 per ha in the last 100 years

Source: Reijs et al., (2016)



Policy





1984

Production rights

• Limited animal numbers of pigs and poultry



1984

- Milk quota • Limits to milk production



1987

Fertiliser act (manure production rights)



1987

Closed period for manure application



1990

Soil Protection Act

• Decree on Use of Fertiliser



1991

EU Nitrates Directive (Ground water monitoring network)

• Maximum application rate 170 kg N/ha/year



1993-2006

Mineral Accounting System at farm level

• Penalty for plant nutrient losses

2000

EU Water Framework Directive

• Surface water quality

2006

Application standards system for minerals

2007

Low emission housing of animals in newly-built structures



2014 Mandatory manure processing

2015



2015

National conditions for dairy sector growth within the EU water framework directive



Phosphate policy essential in Nitrogen action plans: condition for derogation

- Maximum excretion level: 172.9 mln kg P2O5 per year Excretion level livestock sector in 2002
- Dairy sector: 84.9 mln kg per year
- Monitoring via Excretion standards, based on:
 - •animal numbers (national statistics),
 - P contents all feed types (service labs, feed industry)
 - Standardised rations (FADN)
- No exchange between sectors



N and P excretion defaults 2017

| Milk production | N excretion (Milk Urea =22) | P excretion per cow |
|--------------------|--------------------------------|---------------------------|
| 6000 | 98 | 34.8 |
| 7000 | 106 | 37.7 |
| 8000 | 115 | 40.6 |
| 9000 | 124 | 43.5 |
| 10000 | 132 | 46.4 |





Dairy herd (mln kg)
Phosphate excretion max level
Phosphate utilization

 Other animals (mln kg)
Phosphate excretion max level Total (mln kg)

Phosphate quota exceeded in dairy

2010: exceeding about by 1 mln kg

 Compound feed agreement, (private sector): maximum P content defined, escape via P/CP ratio

2015: quota abolishment, exceeding by 8 mln kg

- Increase in animal numbers
- Fluctuations in P contents feed
- P-feed agreement (private sector, no public policy) appeared not to be enough
- Sector not able to manage growth



Additional phosphate policy

- Governmental phosphate quota plan in 2016 regarded as support to private sector
- Alternative plan: government & private sector

| Activity | P2O5 reduction (mln kg) |
|---------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|
| Stricter feed agreement (private; if fails, public) | 1.7 |
| Buy out (M€ 50, NL+EU 50%, sector 50%) | 2.5 |
| Reduction animal numbers P excretion > P application standard: 2/7/2015 – 4% P excretion < P application standard: 2/7/2015 Bonus/malus system | 4.0 |

Impact on farm level

- If N,P > application standards: manure export from farm
- The largest exceedance defines manure export
- N, P excretion based on defaults/standards
- Annual Nutrient Cycling Assessment (ANCA) as a tool to calculate farm specific excretion of N and P
 - Centralized data collection
 - Enforcement by all sector organisations
 - Accepted by the Ministry of Economic Affairs
 - Extension to GHG



Application standards phosphate 2017, aiming at P-surplus = 0

| P status | Grass land | Arable land |
|--------------------------------|---------------|----------------|
| Low (PAI-<27, Pw<36) | 100 | 75 |
| Medium (Pal 27-50;Pw 36-55) | 90 | 60 |
| High (Pal>50; Pw>55) | 80 | 50 |



P surplus and yields 1998 - 2014



No P application at all (mining): strong decrease in DM yields

Source VanMiddelkoop et al., 2016



P content grass silages 1996 - 2016



Source: Veeteelt, November 2016



P utilization in dairy production (including young stock)



N and P excretion defaults

| Milk production | N excretion (Milk Urea =22) | P excretion per cow | Milk /kg P Herd level |
|--------------------|--------------------------------|---------------------------|--------------------------------|
| 6000 | 98 | 34.8 | 123 |
| 7000 | 106 | 37.7 | 132 |
| 8000 | 115 | 40.6 | 141 |
| 9000 | 124 | 43.5 | 148 |
| 10000 | 132 | 46.4 | 154 |



Pilot group of farmers on sandy soils

| Farmers | kg milk/kg P2O5 |
|------------|-----------------|
| Α | 164 |
| В | 178 |
| С | 198 |
| D | 185 |
| E | 187 |
| F | 232 |
| G | 170 |
| Н | 200 |
| Ι | 204 |
| J | 175 |
| Average | 190 |
| Range FADN | 105 - 200 |



Steering P in feeding

- Grass silage: hard to manage, although decreasing P contents
- Maize silage: P content is low
- Compound feeds:
 - Pmax = 4.3 g/kg or
 - P/CPmax = 2.2 (P can be max 2.2 % of CP content) Exception for protein rich compound feeds



Room for dairy production in NL ?

- Conditions:
 - Phosphate (84.9 Mkg)
 - Nitrogen (Nitrates Directive + derogation, 170/250)
 - NEC ammonia (2020: 122 Mkg)
 - GHG (Effort sharing, -36 %, little flexibility)
 - Grazing cattle
 - Animal welfare/longevity
 - Biodiversity: special position of meadow birds



Ammonia, NEC



- Dierlijke mest, melk- en fokvee
- Kunstmest totaal
- ■Niet landbouw

Dierlijke mest, overige diersoorten
Overig landbouw



Room for dairy in NL?

- Close to every constraint (P, N, NH3, GHG)
- Derogation desperately needed
- Future GHG reduction is a challenge
- Conflicting interests, the dairy sector is losing it's good name:
 - Decrease in grazing
 - Biodiversity at risk
 - Landscape destruction
- Climate change adaptation: challenges and opportunities
- A debate is needed about the long term future of dairy, volume is part of the debate



Thank you for your attention



