



**Effect of reducing nitrate concentrations under Dutch dairy farms on economic performance**

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Minerals Policy Monitoring Programme

Thanks to: Dico Fraters, Leo Boumans, Ton van Leeuwen, Gerben Doornwaard, Wim de Hoop and many others

**Outline of presentation**

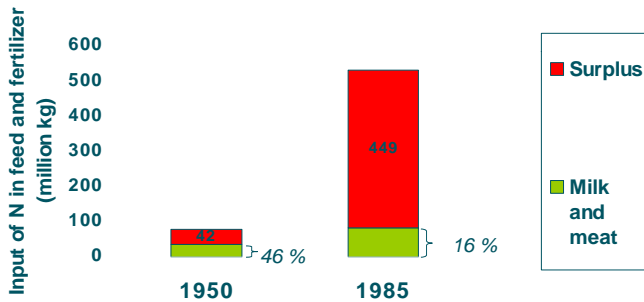
Background on

- Manure policy and monitoring programme in the Netherlands
- Achievements of Dutch dairy farms on sandy soils so far

Results of research:

- How are farm management, economic performance and environmental performance related?

**Nitrogen (N) in Dutch dairy farming sector 1950-1985**



Ketelaars & Van der Ven, 1992

**Major developments manure policy in the Netherlands**

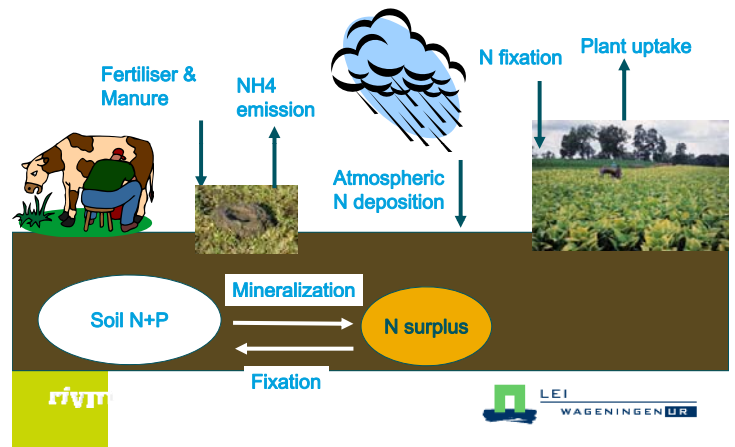
- 1984 – 1990: introduction of manure application limits
- 1991: EU nitrate Directive (50 mg NO<sub>3</sub>/l)
- 1991 – 1997: decrease of manure production, ban on manure application in winter, emission reducing techniques
- 1998 – 2005: MINAS → mineral accounting system
- 2006 onwards: manure application standards
  - 250 (grassland farms) or 170 (other farms) kg N from animal manure
  - Total N and P application standards per crop

**Minerals Policy Monitoring Programme**

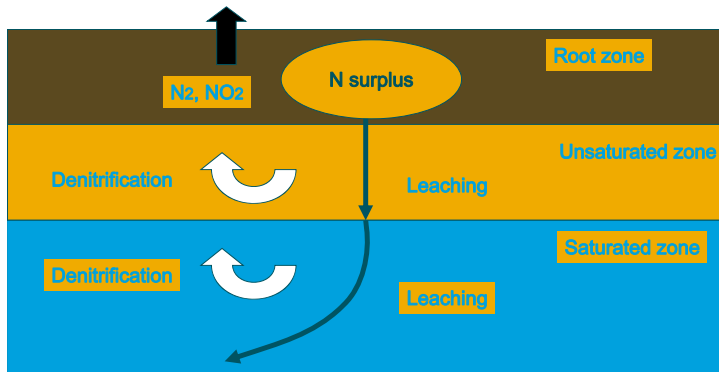
**Goal:** Measure effectiveness of Dutch action programmes to comply with EU Nitrate Directive

- From 1992 onwards
- Representative sample of Dutch farms:
  - Dairy farms, Arable farms, other animal husbandry farms
  - 4 regions: Sandy, clay, peat, loess
- Monitoring of (a.o.)
  - Nitrate leaching from root zone (RIVM)
  - Nitrogen surplus (LEI)

**Nitrogen surplus: soil balance**



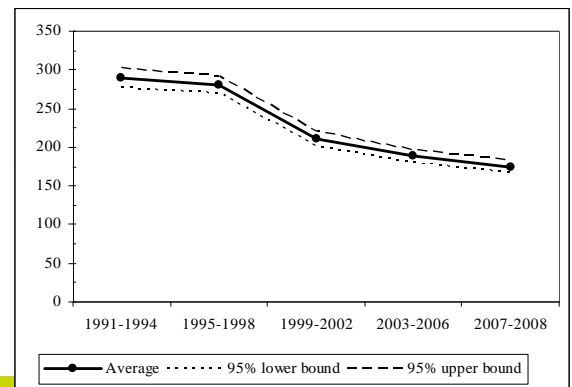
## Destiny of nitrogen surplus



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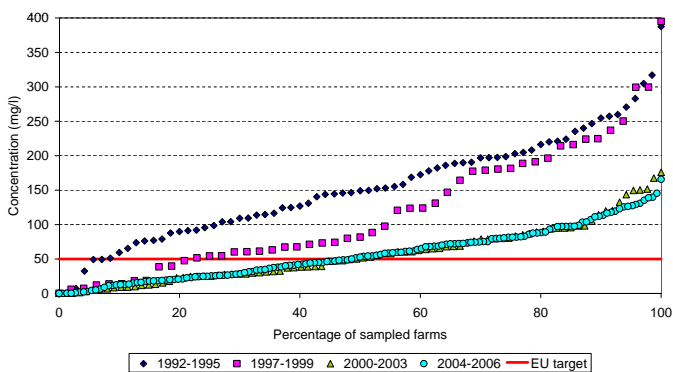
## Trend in N surplus for dairy farms on sandy soils



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## Nitrate in upper groundwater of dairy farms in sand regions



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Zwart et al., 2008

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## Variation in farm results in 2006 (154 dairy farms on sandy soils)

Farm characteristic	Percentile		
	5%	50%	95%
Milk production per farm (kg FPCM)	215,551	576,986	1,190,010
Milk production (kg FPCM/ha)			131
Milk production (kg FPCM/cow)			881
Fodder yield (kg DM/ha)			070
Gross Margin (€)			2.97
Net result (€)			0.05
Soil N surplus (kg/ha)	82	171	263
Nitrate concentrations (mg/l)	10	51	129

*Enormous variation in economic and environmental performance*

*(How) are they related?*

*What can we learn from it?*

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## Relations on farm level

- Are economic and environmental performance related to farm structure and/or farm management?
- Synergy between economic and environmental performance?

=> Regression analysis: 485 dairy farms on sandy soils 1991-2006

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## Effect of farm structure on farm performance

Farm characteristic	Effect on:			
	Soil N surplus	Nitrate concentration	Gross margin	Net result
Farm size (ESU)		+	---	+++
Percentage of animals in pigs and poultry	-			--
Percentage of total area in non-fodder crops		+		-
Percentage of total area in grassland	--	++	--	

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## Effect of farm management on farm performance

Management characteristic	Effect on:			
	Soil N surplus	Nitrate concentration	Gross margin	Net Result
Capacity manure storage (months)		+		--
Kg N art. fertilizer / ha grassland	---	--	-	
Kg N organic fertilizer / ha	---	-	-	+
Kg milk per cow	-	++	-	+++
Concentrate use (DFU / kg milk)	-	--		-
Mowing percentage		++		
Fodder yield (DFU / ha)	+++		+++	++

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## Difference between farms with high and low N surplus

N surplus	Low	Average	High
<i>Number of farms</i>	51	52	51
<b>Soil N surplus (kg N per ha)</b>	<b>107</b>	<b>171</b>	<b>228</b>
Milk production per ha (kg FPCM)	14296	14398	14451
Milk production farm	681908	664687	583473
Percentage of animals in pigs and poultry (LSU)	0.0 <sup>a</sup>	5.0 <sup>b</sup>	7.9 <sup>b</sup>
Kg N art. fertilizer / ha grassland	112 <sup>ab</sup>	160 <sup>a</sup>	174 <sup>b</sup>
Kg N organic fertilizer / ha	225 <sup>a</sup>	250 <sup>b</sup>	258 <sup>b</sup>
Milk production per cow (kg / year)	7665 <sup>a</sup>	8268 <sup>b</sup>	8258 <sup>b</sup>
Gross Margin (€/100 kg melk)	28.7 <sup>a</sup>	27.0 <sup>b</sup>	26.9 <sup>b</sup>
Net result (€/100 kg melk)	-11.6 <sup>a</sup>	-11.7 <sup>a</sup>	-17.5 <sup>b</sup>
Nitrate concentration (mg/l)	53	58	65
Deviation expected nitrate concentration (mg/l)	-14 <sup>a</sup>	-7 <sup>ab</sup>	3 <sup>b</sup>

<sup>abc</sup> significant differences (P<0,05)

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## Difference between farms with positive and negative performance on nitrate

Deviation from expected nitrate concentration	Positive	Neutral	Negative
<i>Number of farms</i>	51	52	51
<b>Deviation expected nitrate concentration (mg/l)</b>	<b>-37</b>	<b>-10</b>	<b>30</b>
Milk production per ha (kg FPCM)	13048 <sup>a</sup>	14626 <sup>b</sup>	15467 <sup>b</sup>
Percentage of animals in pigs and poultry (LSU)	1.9 <sup>a</sup>	2.5 <sup>a</sup>	8.6 <sup>b</sup>
Kg N art. fertilizer / ha grassland	148 <sup>ab</sup>	136 <sup>b</sup>	162 <sup>b</sup>
Kg N organic fertilizer / ha	233 <sup>a</sup>	244 <sup>ab</sup>	257 <sup>b</sup>
Soil N surplus (kg N / ha)	165 <sup>ab</sup>	159 <sup>a</sup>	183 <sup>b</sup>
Grazing in autumn (% of time)	29 <sup>a</sup>	42 <sup>b</sup>	32 <sup>ab</sup>
Gross Margin (€/100 kg melk)	27.2 <sup>ab</sup>	28.0 <sup>a</sup>	26.5 <sup>b</sup>
Nitrate concentration (mg/l)	29 <sup>a</sup>	52 <sup>b</sup>	95 <sup>c</sup>

<sup>abc</sup> significant differences (P<0,05)

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## Conclusions I

Manure policies during last decades have resulted in a strong decrease of nitrogen surpluses and nitrate concentrations

- Last years both surpluses and concentrations are stabilizing
- On average 50 mg/l is within reach but still a large number of farms exceeds the EU standard

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## Conclusions II

Reducing nitrate concentrations does not necessarily hamper the economic performance!

- Increasing the yield of fodder crops without an increased use of artificial fertilizer is both economically and environmentally attractive
- Farms with a good performance on nitrate tend to have a better economic performance
- Farms with low surpluses have a better economic performance

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## Key issues of this presentation

- In the Netherlands we have come a long way in reducing nitrogen use and nitrate concentrations on dairy farms.
- The question is whether further improvement can be made to obtain the EU directive of 50 mg/l on all farms.
- Variation in farm management is large. That offers opportunities to improve environmental performance.
- Economic and environmental performance often go hand in hand. This is an important key in further reduction of nutrient loads.

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Thank you for your attention