Nährstoffeffizienz im System Boden-Pflanze-Tier

Osnabrück

Chiefadviser Leif Knudsen,
SEGES, DENMARK

REGULATION OF NITROGEN INPUT IN DANISH AGRICULTURE

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Time	Plan	Significant elements in legislation:
1985	NPO-plan	Max. livestock units per ha. Storages capcity
1987	Water Environm. Plan I	-**50 percent reduction in N-leaching.** 65 percent wintecrops/catch crops
1992	Sustainable agriculture	Min. utilisation of nitrogen in animal manure N-quota per farm, Fertilizer plans and -accounts. No slurry in autumn except for grass and oilseed rape
1998	Water Environm. Plan II	10 pct decrease of the N-quota. 6 pct catch crops in autumn. 15 pct higher utilization of N in animal manure
2003	Water Environm. Plan III	Target for decrease of P surplus, **13 percent reduction in N leaching,** 10/14 pct catch crops
2011-2013	Water Frame Directive	**"Good ecological quality" in water bodies** More catch crops, riparian zones, Establish-ment of wetlands
2016-17	Water Frame Directive Water Area Plans II	More area specific regulation after the need to obtain "Good Ecological Quality"

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NITROGEN QUOTA

- The quotaes for each crop is based on optimal rates
- The optimal quotaes are reduced with a percentage to give the ”Maximum national quota”
- The reduction from optimal rates is 18,2 percent i 2015

- The farm quota is used by N in animal manure, organic manure or in mineral fertilizer

FERTILISER PLAN AND -ACCOUNTS

- All farms must do a fertiliser plan
- All farms must do and report a fertiliser account
- The fertilizer account is based on:
  - The N-qouta on the farms calculated from crop distributions, soil types and nitrogen quoata for each crop
  - Mineral fertilizer reported to the ministry by the sales companies
  - The amount of nitrogen in animal manure calculated from standards for each type of animal

- If the qouta is exceeded the farmer will have a ticket.

A SIMPLE EXAMPLE

Crop	Ha	Quota per ha	N-Quota total
Winter wheat after oilseed rape	20	129	2580
Winter wheat	20	138	2760
Winter barley	20	136	2720
Winter oilseed rape	20	175	3500
Spring barley	20	110	2200
Total	100		**13760**
Effect of mandatory catch crops:	14	25	**350**
Net quuta			**13410**

Animal manure	Kg N per 10 pigs	Kg N total
Total N from 5.000 produced pigs (31-107 kg)	25,1	12550
Minimum utilization (75 percent)		**9413**
Rest qoata for mineral fertilzer		**3998**
Rest qouta for mineral fertizer per ha		40

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Example from farm with dairy cows, 0,95 Dairy cow per ha, irrigated coarse sand

Crops	Hectars	N-from previous crop	Long term effect of animal manure	Total Quota, kg N/ha	Net Quota, kg N /ha
Clovergrass	15	0	26	242	217
Clovergrass	15	84	26	242	133
Wholecrop Maize	15	0	26	157	132
Wholecrop Maize	15	0	26	157	132
Spring Barley	15	0	26	129	104
Spring Barley, unders	15	0	26	161	136
Perennial Grassland	10		26	127	102
	100	13	26	176	138
Demand for utilization of animal manure					
1. year effekt:	170	kg x	55	percent	94
Long term effect[1]:	170	kg x	15	percent	26
Effect of catch crops	10,4	ha	25	kg/ha	3
Mineral fertilizer qouta					42

[1] Subtracted in the net quota

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OUTLINES OF LEGISLATION FOR ANIMAL MANURE

- Min. Utilization of N: Pig slurry 75 pct, Cattle slurry 70 pct. Deep Litter 45 pct.
- Allowed times for application for slurry: Only spring - except until 1th of October for oilseed rape and grass
- Application technique:
  - On bare soils (before crop establishment): Injection or acidification
  - On grassland: Injection or acidification
  - On winter cereals: Trailing hoses (no demand for injection or acidification)
- Max. Livestocks Units (100 kg N) per ha :
  - Cattle 1,7
  - Other animals 1,4

OUTLINE OF LEGISLATION FOR CATCH CROPS

- Farms with animals (more than 80 kg N in animal manure per hectare): **17,4 per cent of farm area** (25 kg N per hectare reduction in fertilizer next year)
- Farms with no animals (less than 80 kg N in animal manure per hectare): **13,4 per cent of farm area** (17 kg N per hectare reduction in fertilizer next year)
- Catch crops: Undersown grass, crusifers established before the 20th of August
- Catch crops must be followed by a spring sown crop

SETTING THE N-QUOTAS

- Based on traditionel plot trials with increasing amounts of Nitrogen
- Optimal rates are calculated at average of 5 years prices for crops and nitrogen
- Values for protein is incorporated in the calculation

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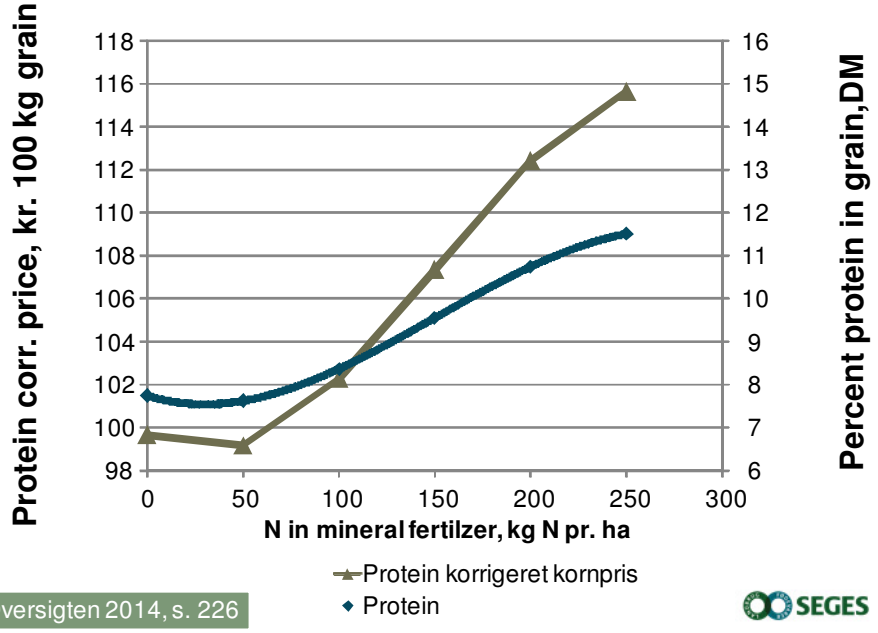
N for winter wheat, 19 trials 2014



Oversigten 2014, s. 226

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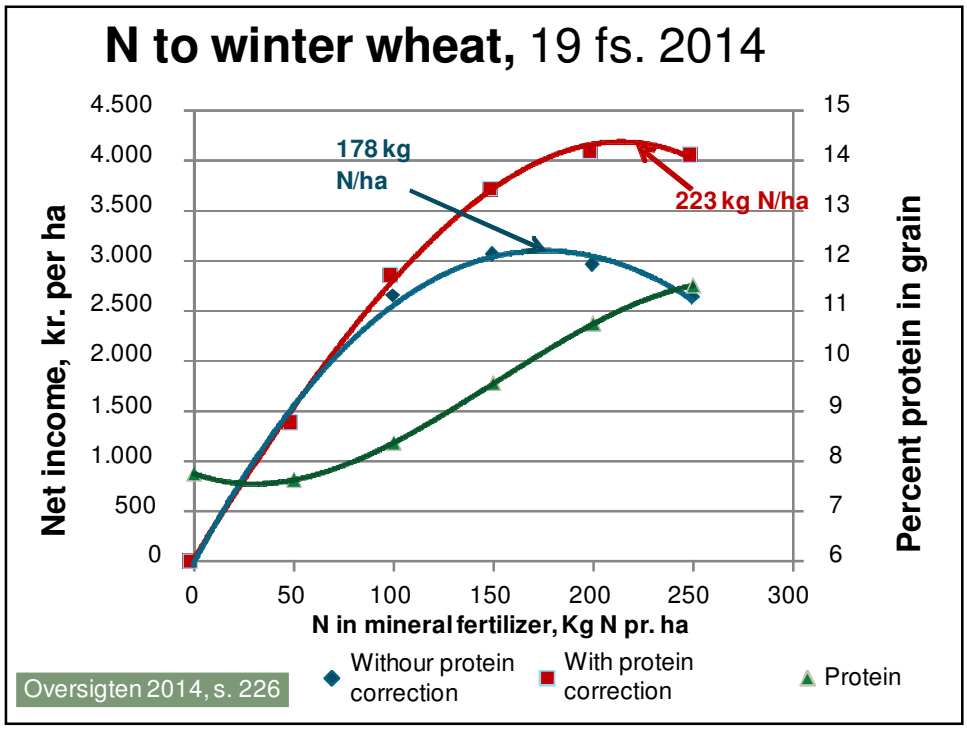
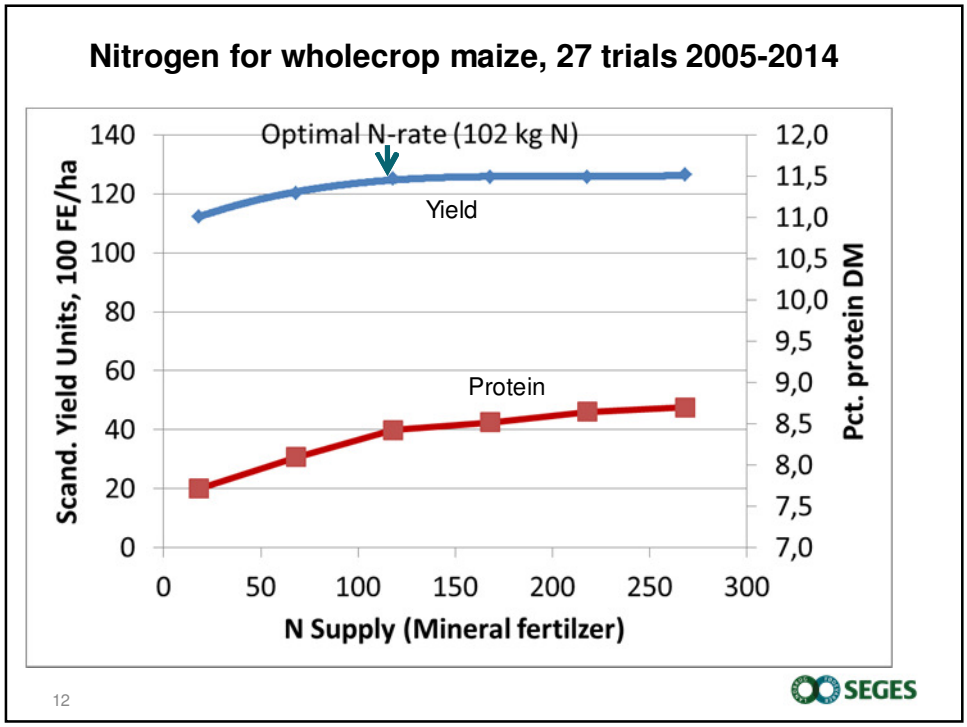

N to winter wheat, 19 fs. 2014
Net income, kr. per ha
Percent protein in grain
178 kg N/ha
223 kg N/ha
N in mineral fertilizer, Kg N pr. ha
Withour protein correction
With protein correction
Protein
Oversigten 2014, s. 226


Nitrogen for wholecrop maize, 27 trials 2005-2014
Optimal N-rate (102 kg N)
Yield
Protein
Scand. Yield Units, 100 FE/ha
Pct. protein DM
N Supply (Mineral fertilzer)
12
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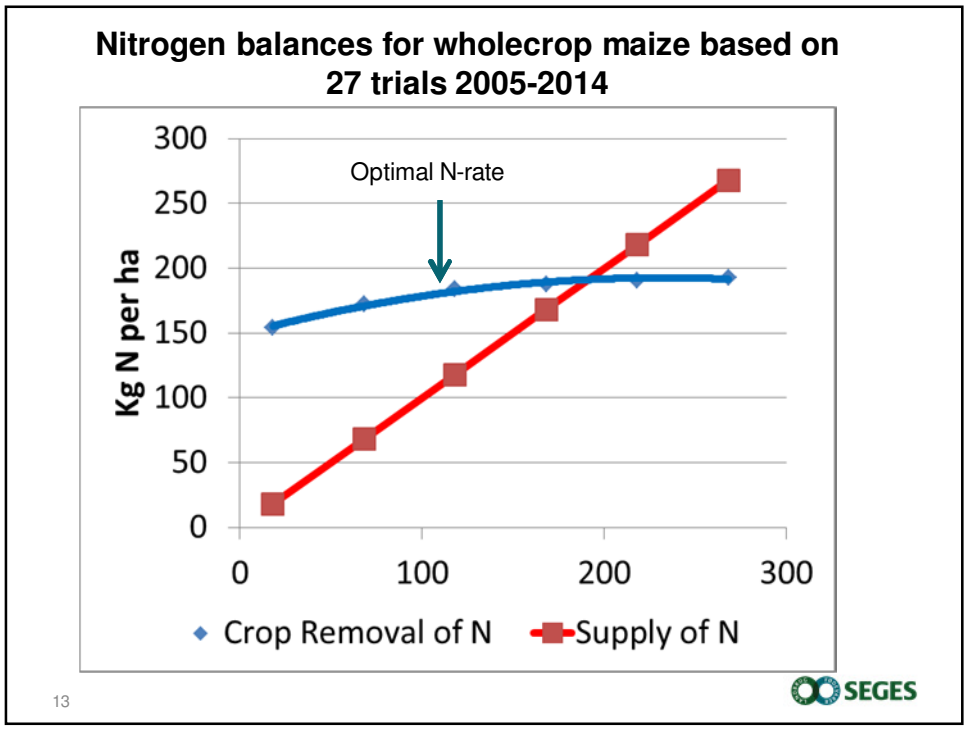
Nitrogen balances for wholecrop maize based on 27 trials 2005-2014
Optimal N-rate
Kg N per ha
300
250
200
150
100
50
0
0
100
200
300
Crop Removal of N
Supply of N
13
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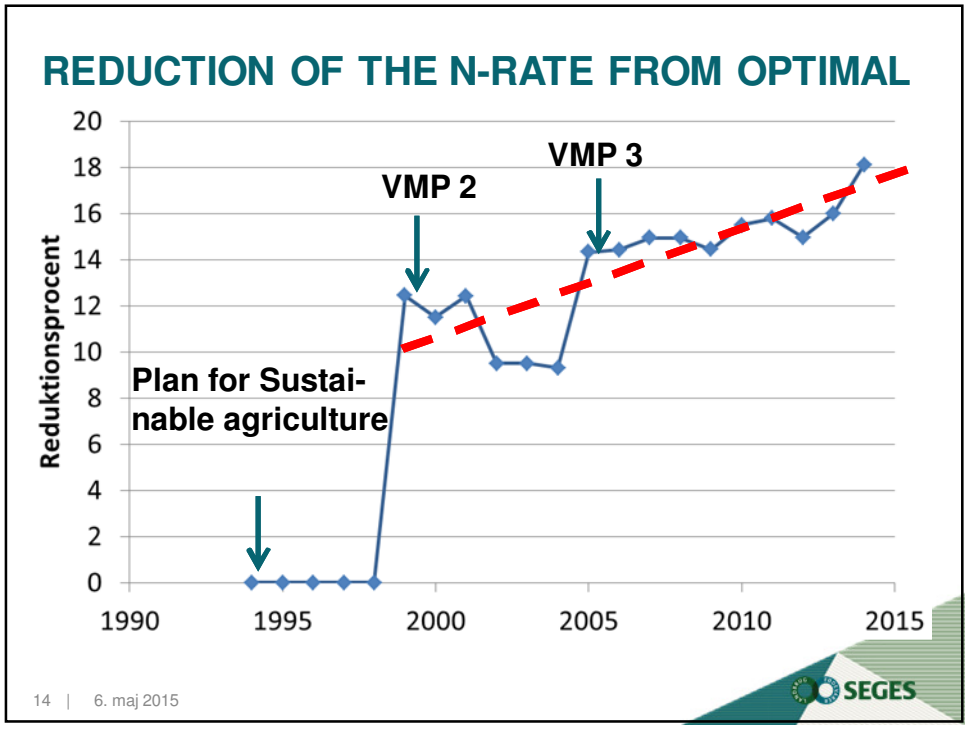
REDUCTION OF THE N-RATE FROM OPTIMAL
Reduktionsprocent
20
18
16
14
12
10
8
6
4
2
0
1990
1995
2000
2005
2010
2015
VMP 2
VMP 3
Plan for Sustai-
nable agriculture
14 | 6. maj 2015
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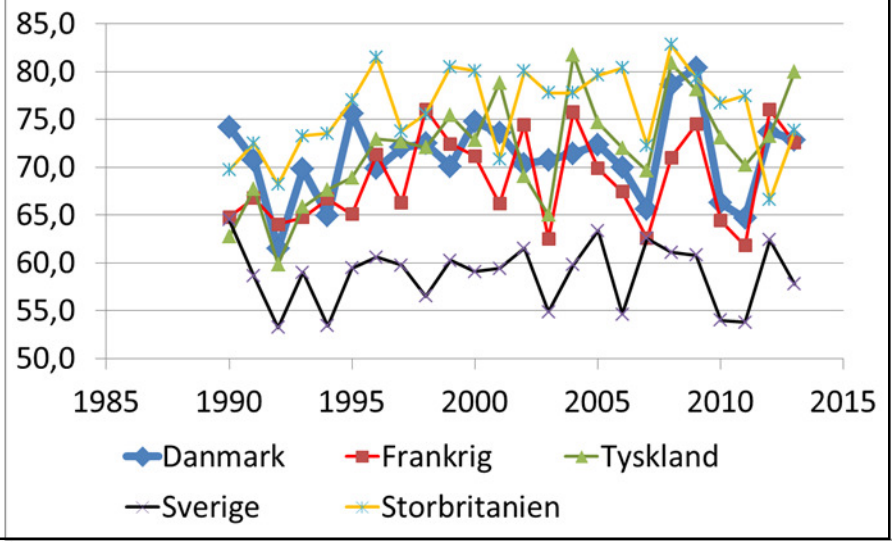
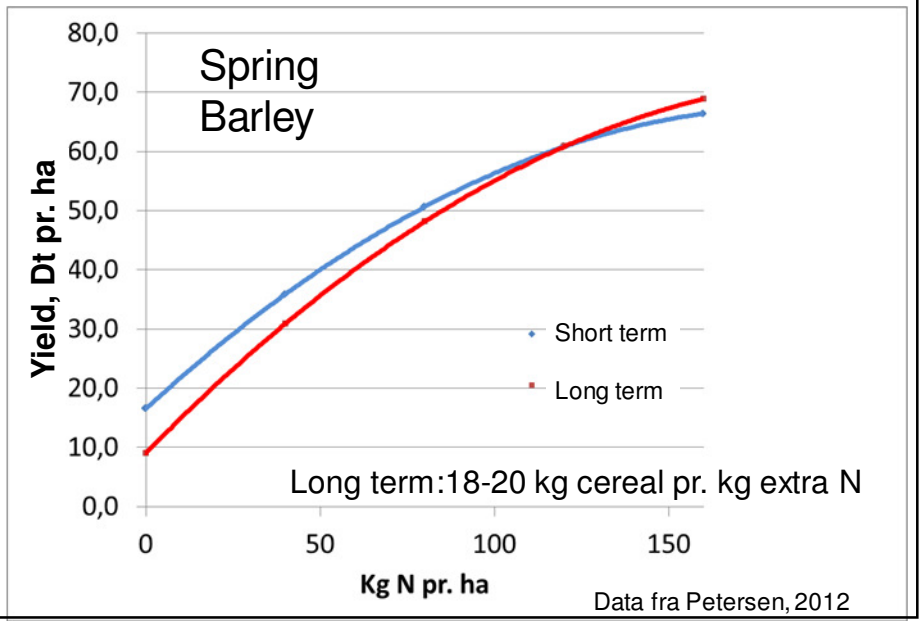
VIDENCENTRET FOR LANDBRUG

Yield increases in different countries



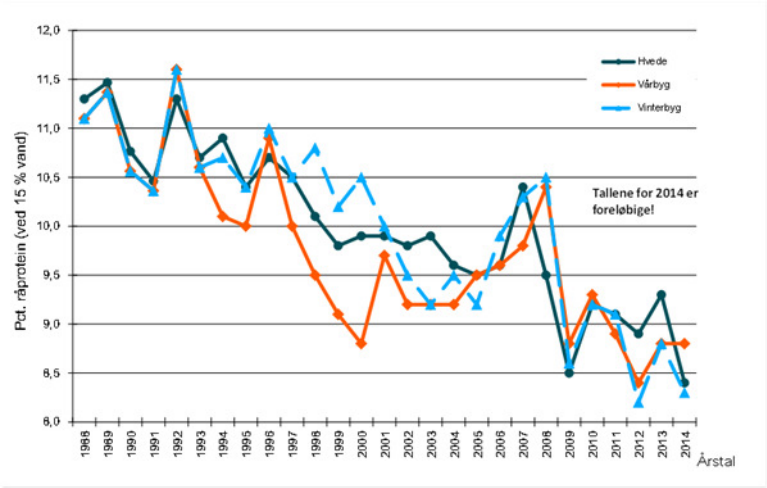
15 |

Responsecurve for one year and long term trials



Data fra Petersen, 2012

PROTEIN CONTENT IN CEREALS 1986-2014



Kilde Niels Morten Sloth, VSP

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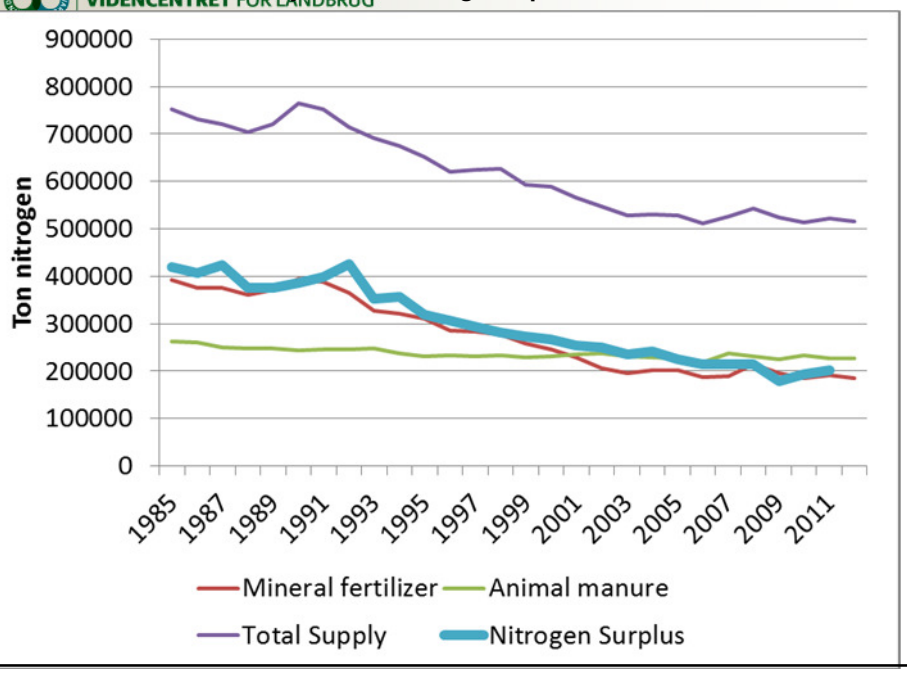
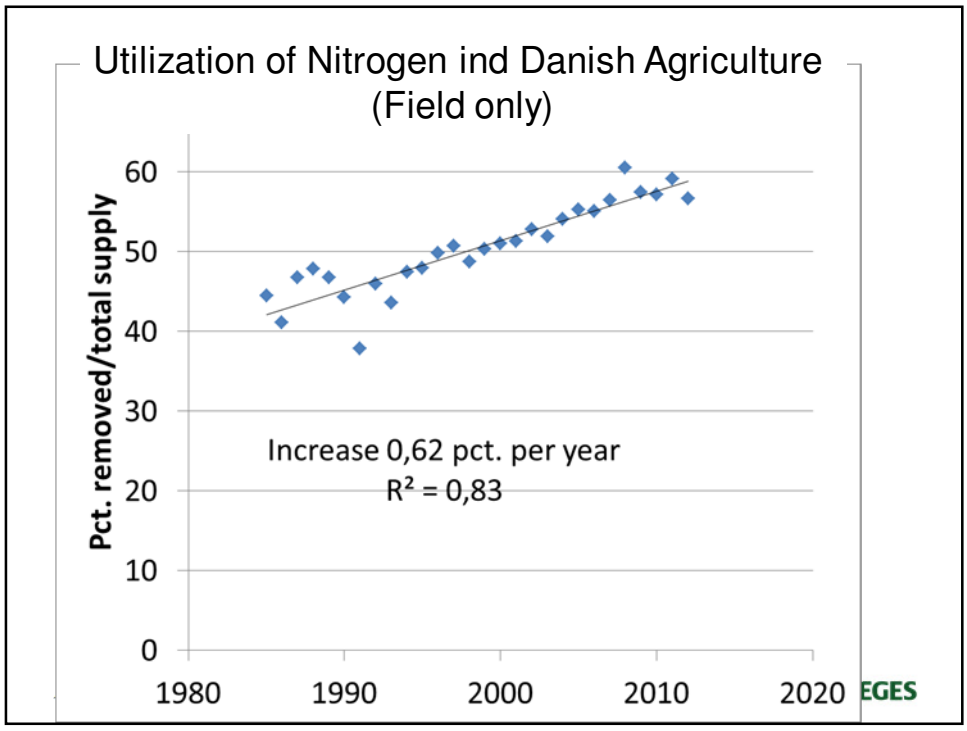
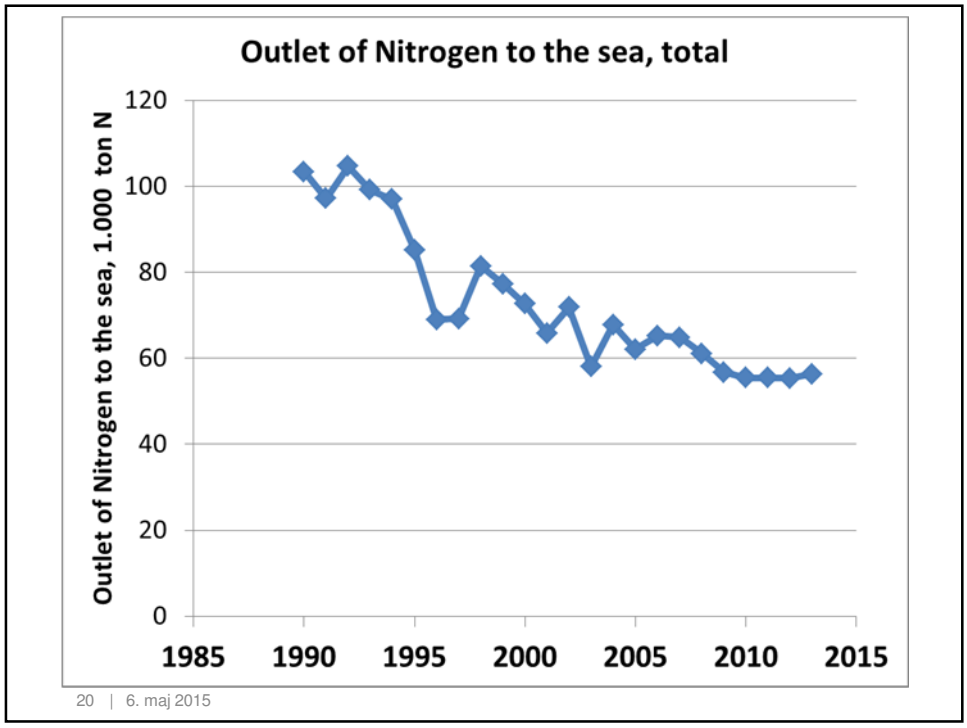
Key data for Nitrogen Input in DK

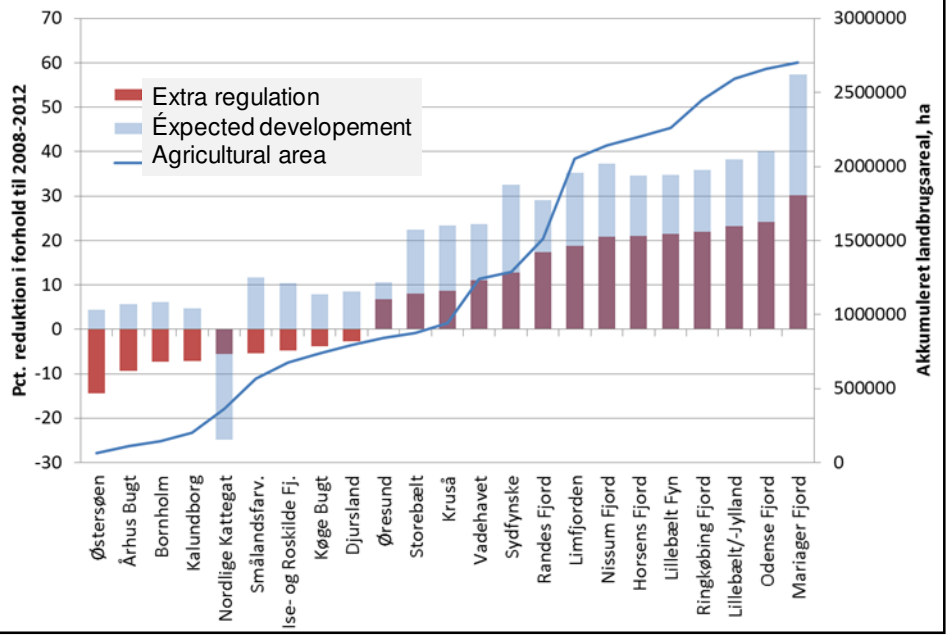
VIDENCENTRET FOR LANDBRUG




Utilization of Nitrogen ind Danish Agriculture
(Field only)
Pct. removed/total supply
60
50
40
30
20
10
0
1980
1990
2000
2010
2020
Increase 0,62 pct. per year
R² = 0,83
EGES


Outlet of Nitrogen to the sea, total
Outlet of Nitrogen to the sea, 1.000 ton N
120
100
80
60
40
20
0
1985
1990
1995
2000
2005
2010
2015
20 | 6. maj 2015

Reduction Target for N in WFD 2015-2021



OUTLINES

- Regulation in DK is based on Nitrogen Quotas 18 pct. below optimal rates
- High demands for utilization of N in animal manure
- Mandatory catch crops and restriction in soil tillage and ploughing of grass
- The Nitrogen surplus have been reduced by 50 percent
- The protein content in danish crops are very low
- The loss of yield by restricted N-quotas is 0,5-0,7 t/ha
- The loss of N to the coast have been reduced by more than 50 percent since 1985
- New targets in WFD are a threat against farming in some areas.

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