Økonomisk Analyse

28. March 2012

Axelborg, Axeltorv 3
DK 1609 København V

T +45 3339 4000
F +45 3339 4171

E info@lf.dk
W www.lf.dk

Further reductions in agricultural environmental impact

Highlights:

- Recent figures show a continuation of the decoupling of Danish agricultural production from nitrogen and phosphorus surpluses. While agricultural production, measured in volumes, has increased by 30 pct. from 1985 to 2010, the agricultural phosphorus surplus fell by 105 pct. and the nitrogen surplus by 54 pct. Nitrogen and phosphorus surplus is defined as the difference between agricultural nutrient input and nutrient removed by harvesting. The lower the nutrient surplus, the lower the environmental impact, other things being equal.

- The deficit in agricultural phosphorus balance in 2010 was 2,500 tonnes. A deficit means that less phosphorus has been applied by manure than has been removed by harvest, thereby reducing the total amount of phosphorous in the soil. The recent figures have been revised backward in time, and a deficit is now also recorded for 2009.

- The agricultural nitrogen balance shows a surplus of 193,700 tons, which is a slight increase of 8 pct. compared to 2009.

- The most direct way to assess the development in the loss of nitrogen from agriculture is by measuring the concentration in water discharged into the aquatic environment. This concentration has been reduced by half since the early 1990's. Thus, new figures show that agriculture's share has decreased by approximately 40 pct.

- An intensive effort within agricultural research and development has been a main driving factor behind the reduction of the environmental impact. Improved breeding, feed optimisation, better varieties, improved cultivation techniques and improved manure handling has significantly contributed to the lower environmental impact per unit produced as well as to the reduced overall environmental impact.

- Further reductions in the future may be obtained by measures within the farm area such as earlier sowing of winter varieties, the use of manure for biogas, mini-wetlands and phosphorus drainage filters, as well as measures outside the farm area, such as establishing of reefs, cultivation of mussels, etc.

Phosphorus surplus turned into a deficit

The figures for agricultural nitrogen surplus for 2010 show that although agricultural production has increased, the nitrogen surplus is more or less

on the same level as the previous year, and the phosphorus surplus has decreased. The 2010 nitrogen surplus was 193,700 tons, an increase of 8 pct. compared to the previous year. The phosphorus surplus was minus 2,500 tons, i.e. a deficit, and thus the total amount of phosphorous in the soil has been reduced.

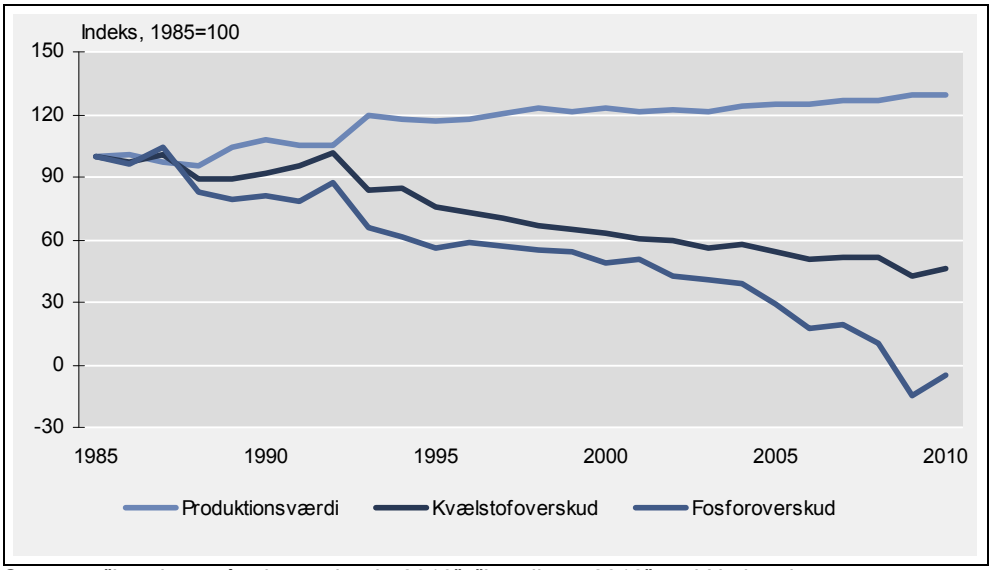
The nitrogen and phosphorus surplus is measured as the difference between nitrogen and phosphorus applied by manure, and nitrogen and phosphorus removed by harvest. The lower the nutrient surplus, the lower the environmental impact will be.

The phosphorus deficit thus means that less phosphorus has been applied by manure than removed by harvest. Hence, the plants have used some of the prevalent phosphorus resources, whereby the risk of future leaching into the aquatic environment has been reduced.

Simultaneous increase in production and reduction in environmental impact

Since 1985, the agricultural output, measured in fixed prices (volumes), has increased by 30 pct., while the nitrogen surplus has decreased by 54 pct. and the phosphorus surplus by 105 pct. For both 2009 and 2010 there were phosphorus deficits.

Production value (fixed prices) and nitrogen and phosphorus surplus. Index 1985 = 100. Volumes.



Sources: "Landovervågningsoplande 2010", "Landbrug 2010" and National accounts.

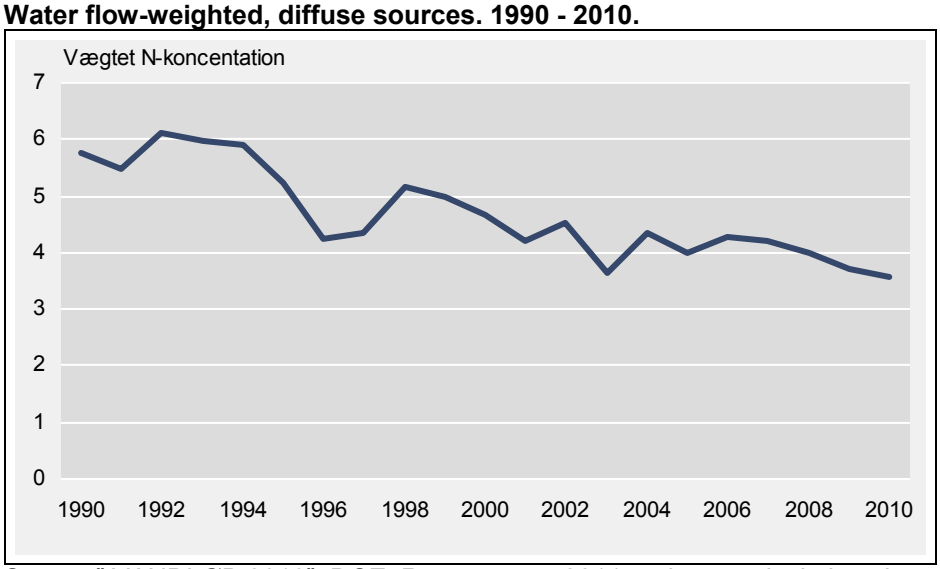
Crop farms not using livestock manure have lower surplus

Nitrogen and phosphorus surpluses are somewhat higher for livestock farming and for crop farms using livestock manure, than for crop farms that do not use livestock manure. The surplus increases with livestock density.

Discharges to fiords and inland waters has also decreased

The total discharge of nitrogen to fiords and other coastal waters have decreased by approximately 50 pct. Reductions in agricultural discharges are the main cause hereof. Thus, new figures show that agriculture's share has decreased by approximately 40 pct. since 1990.

Nitrogen concentration in the runoff water to the sea coast of Denmark. Water flow-weighted, diffuse sources. 1990 - 2010.



Source:" VANDLØB 2010". DCE, Report no. 4, 2011 and own calculations based on figures from the Department of Bioscience, DCE.
Note: Calculated diffuse nitrogen inputs from cultivated and uncultivated land i.e. total discharge minus industrial and household waste water.

Breeding and feed optimisation

An intensive effort within agricultural research and development has been a driving factor behind the reduction of the environmental impact. Improved breeding, feed optimisation, better varieties, improved cultivation techniques and improved handling of manure has significantly contributed the lower environmental impact per unit produced from livestock manure and the reduced overall environmental impact.

The use of amino acids in feed for pigs has reduced the nitrogen surplus from pig production, and breeding has led to a better feed efficiency and leaner pigs with higher meat percentage. For nitrogen and phosphorus, the environmental impact per produced kg slaughter pig has decreased to about half of the 1985 impact.

Another example is that breeding has led to types of cows with higher milk production, which has enabled a reduction of cow herds. This, in turn, has reduced the environmental impact.

Better handling of manure.

An improved handling of livestock manure and investments in manure treatment has also reduced the environmental impact and increased the utilization of nitrogen. Storage capacity for manure has thus been increased. This improves the possibilities for delivering manure at the most optimal time, when plants can absorb the nutrition, and the environmental impact therefore is the least. An increased proportion of the manure is now being applied in spring and summer, when the crops can absorb the fertilizer. Another example is that broad spreading of manure has been replaced by application of manure by trailing hoses and direct injection.

Furthermore, EU regulation governs the production. For instance, the number of livestock units per ha restrict the quantity of livestock manure being spread at a given point of time, and fertilization requirements are specified in nitrogen norms, providing maximum quotas for application of nitrogen for alternative combinations of soil conditions, crops, etc. There at also requirements for reduced tillage.

Catch crops can be problematic

Catch crops can sometimes absorb excess nitrogen from the fields, whereby the leaching of nitrogen is reduced. Accordingly, some agricultural regulation demands farmers to establish catch crops. Quite often, however, the costs of catch crops are not commensurate with the effect, which can sometimes be negligible.

Targeted measures are more cost effective

It is essential that efforts to protect and improve the water environment are aimed as directly as possible at the actual environmental impact of individual water catchments. With general approaches there is a risk that resources are used inefficiently. The nature is more robust in some geographic areas than in others. This can not be captured by the general approach.

Therefore, increased focus should be on targeted interventions tailored to the individual water catchment area, and measures should be aimed at or near the recipient, as well as include other cost-effective measures, which ensures both the environment and a competitive agricultural production.

Mini wetlands, mussel production, reefs, etc.

Technological development and new knowledge is expected to reduce agricultural environmental impact further in the future. New ideas of integrating production, waste and ecological balance can support such a development. Nutrients and materials must be recycled wherever possible in ways that benefit both the economy and the environment.

For example, mini wetlands and reefs are relatively inexpensive and flexible methods for capturing excess nutrients from the field, either before they enter the aquatic environment or in the aquatic environment. At the same time they provide valuable habitats for flora and fauna. Pilot projects have shown good results in terms of ecology, flora and fauna and hydraulic capacity.

Other examples are phosphorus drain filters, using manure for biogas and mussel production, which can clean the water for algae.

Sources

DCE (2011):*"Landovervågningsoplande 2010. NOVANA". Scientific report from DCE, no. 3, 2011.* Aarhus University, DCE - National Centre for Environment and Energy.

DCE (2011a):*"VANDLØB 2010".* Scientific report from DCE, no. 4, 2011 Aarhus University, DCE – National Centre for Environment and Energy

Jørgen Windolf (2012): Institute for Bioscience, DCE - National Centre for Environment and Energy. Figures.

Danmarks Statistik (2011): *Landbrug 2010. Statistik om landbrug, gartneri og skovbrug". November 2011.*

Some concepts

Nitrogen and phosphorus surplus
Nitrogen and phosphorus surplus is calculated as the difference between the applied nutrient and nutrient removal at harvest (nutrient balance). The lower the nutrient surplus, the lower the environmental impact.

NOVANA
NOVANA is a national program for monitoring nature and the aquatic environment, initiated in 1988. The program follows up on the leaching of nitrogen and phosphorus to the aquatic environment, and monitors the status and trends of the aquatic environment and the nature in Denmark.

Instruments
The Danish water plans distinguishes between two types of measures. One group (the general) are used in all lake and coastal catchments, regardless of the local reduction requirements, and consists of:

- Buffer zones – up to 10 meters along lakes and streams
- Catch crops instead of winter green fields
- Ban on ploughing during certain periods
- Prohibition of certain types of soil tillage in the autumn
- Changing of the standard system

The second group of instruments are used specifically in relation to each lake and costal catchments and consists of:

- Changed maintenance of streams
- Creation of wetlands for nitrogen removal
- Further use of catch crops in the rotation
- Establishment of land used for periodic flooding in stream valleys and upstream lakes for phosphorus removal in lakes.

Figures for environmental impact

Nitrogen and phosphorus surplus 1985 - 2010

Year	N 1000 tons	P 1000 tons
1985	420	52,2
1986	408	50,2
1987	423	54,3
1988	376	43,3
1989	374	41,5
1990	386	42,2
1991	400	40,7
1992	426	45,6
1993	353	34,3
1994	357	32,1
1995	320	29,3
1996	307	30,4
1997	295	29,7
1998	281	28,8
1999	272	28,3
2000	267	25,6
2001	254	26,3
2002	251	22,3
2003	234	21,5
2004	241	20,2
2005	226	15,1
2006	214	8,9
2007	215	10,0
2008	215	5,5
2009	180	-7,9
2010	194	-2,5

Source: DCE (2011).

Landbrug & Fødevarer

Axelborg, Axeltorv 3
DK 1609 København V

T +45 3339 4000
F +45 3339 4141

E info@lf.dk
W www.lf.dk

Yderligere kontakt

Thomas Søby 33394252 ths@lf.dk
Anne Ohm 33394496 ano@lf.dk