

How Danish farmers have doubled N efficiency already & how to reach ambitious future targets

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Abstract

With more than 30 years of experience in regulating agriculture, Denmark has shown, that nitrogen losses to atmosphere and aquatic environment can be considerably reduced, while farmers - despite the costs – managed to increase productivity. This can mainly be assigned to a significant increase in nitrogen efficiency in both livestock and arable farming. Long term monitoring data shows that water and air quality have increased as a result of optimizing agricultural practice and regulation. However, environmental pollution still remains a concern and requires more nutrient-loss-reductions. For improved cost-efficiency, further mitigation measures are targeted to specific water bodies or habitats.

Keywords: targeted regulation, fertilizer accounting system, nutrient use efficiency

1. Setting the scene

With more than 60% of the national territory being agricultural area, an intensive livestock production, shallow groundwaters and short distances to nutrient-sensitive coastal waters along > 7000 km long coastline, Denmark has for many years been facing challenges on how to facilitate competitive farming, while reducing nitrogen (N) losses to sensitive water bodies and habitats.

2. General regulation as a solid base for increasing nitrogen efficiency

Since the 1980'ies, a comprehensive set of N-loss-reducing measures have been developed and primarily imposed as general regulatory obligations nationally, such as limiting livestock density, prescriptions for the handling of manure, compulsory growing of catch crops on a percentage of agricultural land, a maximum N allowance at farm level accounting for all N-containing fertilizers, binding fertilization norms for crops etc. (Dalgaard et al., 2014).

3. Achievements so far

3.1 Advancement in agricultural key indicators

Dalgaard et al. (2014) have documented that the N field balance, i.e. N surplus on agricultural land has been reduced by approximately 40% over time, N leaching from the rootzone has halved and N efficiency in the agricultural sector has approximately doubled and despite this productivity was even increased.

3.2. Improvement of environmental parameters

Since the 1990'ies, ammonia losses have been reduced considerably, as well as N loads to sensitive surface waters. Hansen et al. (2017) could moreover show that groundwater nitrate concentrations decrease is related to the increase in N use efficiency, which becomes most apparent in trend analysis of nitrate levels in most recently formed groundwater.

4. Targeting regulation as a more cost-efficient mitigation measure

Despite major achievements, some water bodies and habitats are still challenged by too high nutrient loads. Since 2017, a targeted regulatory scheme has been introduced, where reduction targets - and hence mitigation obligations – are set for special areas, i.e. catchments. Initially, local farmers can apply for being compensated for e.g. establishing supplementary catch crops. Contingent remaining reduction needs will however be issued as obligations without compensation. By supplementing general regulation with a targeted scheme, achievement of environmental goals becomes more cost-efficient, while competitiveness of farmers across the country is kept at comparable level.

5. New challenges

A need for climate change mitigation and adaptation is expected to call for changes in agricultural practice and even more holistic regulatory schemes. Multibeneficial measures and practices will have to be favoured and require rethinking by all stakeholders – farmers, regulators, researchers and consumers.

References

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