Nutrient balances as implementation of the EU Nitrates Directive; experiences from the Netherlands

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In 1998, The Netherlands introduced a nutrient balance approach, to comply with the EU Nitrates Directive. This mineral accounting system (MINAS) quantifies farm gate nutrient inputs and outputs. Differences (i.e. the surpluses) have to be lower than loss standards, based on the required quality of water. However, in 2003 the EU Court of Justice decided that the Nitrates Directive requires fertilizer application standards, not nutrient loss standards. Therefore, application standards will be introduced in 2006. It can be considered to reintroduce MINAS when the Nitrate Directive is replaced by the Water Framework Directive. This paper describes main Dutch experiences with MINAS in dairy farming practice.

Why do Dutch farmers prefer mineral accounting, instead of fertilizer application standards? About 70% of the Dutch agricultural area is used by 24,000 dairy farmers. Average intensity is 12,250 kg milk per ha, but most of the farms on sandy soils produce over 15,000 kg. There is a high need for land to recreate, to live or to give space to nature. Agricultural land prices are in the order of 35,000 euro per ha, much higher than in most other European regions. Without environmental restrictions, there is a clear negative relationship between animal density (= manure production) and environmental quality, as a result of increasing nutrient inputs as feed that is not fully compensated by rising outputs. Restricting application rates of animal manure is effective to improve environmental quality, but also expensive, because farmers have to buy land, need to reduce milk quota or should dispose of part of the manure. In the mid 1990s, research on the experimental farm De Marke showed that improved nutrient management can lead to the desired environmental quality, at much lower costs. Purchases of N as fertilisers and feeds were 62% below commercial farms. Purchases can be reduced by minimising the requirements of both livestock (for instance by increasing milk production per cow) and crops (for instance by partly replacing grassland by maize), and by meeting the remaining requirements as much as possible by forage and manure produced on the farm. Purchases should only be used to complete and to optimise crop fertilisation and the composition of the cattle diet. When less feed and fertilisers are purchased, also smaller amounts of nutrients enter the farm. Thus, when the output of milk and sold animals remain at the same level, the surpluses will decline. Ecologically acceptable surpluses per ha can be defined, dependent on soil type and hydrology.

Under Dutch conditions, environmental benefits of the mineral accounting system is though to be at least equal to a system of fertilizers application standards, but the mineral accounting system is preferable from an economic point of view. It provides farmers the opportunity to find a low cost, farm specific way to reduce nutrient losses to an acceptable level.

How does the Mineral Accounting System (MINAS) act?
MINAS is based on a farm gate nutrient balance, not on a full balance. Inputs by atmospheric deposition and biological fixation are excluded (difficult to determine). Calculated ammonia losses from stable and manure storage are included as output, because they do not affect soil surplus and related
leaching of nitrate. On average, the MINAS surplus is 70 kg N per ha lower than the full balance surplus.

MINAS obliges each farm to monitor nutrient flows entering the farm in animals, feeds, mineral fertilisers and manures and leaving the farm in animals or their products, crops and manures. If the MINAS surplus exceeds levy-free surplus, the farmer has to pay for the excess. The levy-free N surplus depends on soil type and has been tightened, from 1998 onwards, with 20 – 25 kg per year. In 2005, for leaching sensitive soils it amounts to 140 kg N per ha grassland and 80 kg N per ha arable land. For other soil types, the levy-free N surpluses are 40 kg N higher. The levy-free P surplus is set to 9 kg per ha. The levies per unit in excess are EURO 21.00 per kg for P and EURO 2.30 for N. The effectiveness of MINAS in achieving the objectives of the EU Nitrates Directive is evaluated every two years by the Dutch government. Evaluation includes discussions about the level of levy-free surpluses and about changes in the way surpluses are calculated.

What are the main results of MINAS?
MINAS showed to be an effective way to control nutrient losses in agriculture. Average farm gate N-surplus of dairy farms decreased from 250 kg N per ha in 1997, to 150 kg in 2002. Inputs of mineral N-fertilizers were reduced by 25%, as a result of improved utilisation of slurry (time and method of application), less grazing (more slurry) and lower fertilisation rates. Yields of crops did not decrease, due to more careful management. Inputs of N as concentrates were reduced as well, because farmers preferred low protein products. Excretion of cattle was restricted by less protein consumption, as a result of lower fertilisation rates on grassland (to reduce purchases of mineral fertilizers) and lower protein levels in concentrates (to reduce purchases of protein). MINAS allows competent farmers to produce near 18,000 kg milk per hectare, without the need to dispose of manure. About 80% of the dairy farmers could comply with the decreasing maximum norms. Reduction of the P surplus was, in general, most difficult. Especially in the sandy regions, quality of groundwater improved strongly, but not always enough. Therefore, surpluses of some soil types should be further reduced.

Reduced purchases of feeds and fertilisers reduced costs of milk production up to 0.005 EURO per kg (annually 2,500 EURO for a farm that produces 500,000 kg milk). However, farmers had to spend more time to plan fertilisation and feeding and to record farm data. It is obvious that MINAS stimulates quality of management, because it forces farmers to be aware of the efficiency of key processes in dairy farming - fertilisation and feeding - and about the possibilities to improve efficiency. For that reason, many farmers will continue mineral accounting voluntarily, when MINAS stops as a governmental instrument.

What is Dutch future?
In October 2003, the European Court of Justice decided that the Nitrate Directive requires application standards, not loss standards. As a consequence of the Court judgement, the Netherlands have to change its approach from loss standards to application standards for organic and inorganic fertilizers. The EU agreed that the MINAS-system can stay in force until 2006. The new system will oblige farmers to dispose of part of the manure if milk production exceeds 13,000 kg milk per ha, assuming that Dutch derogation request is honoured (an application standard of 250 kg manure-N per ha instead of 170 kg). If not, this threshold level will be 9,000 kg per ha. Each 1,000 kg milk above this level will increase cost by 50 euro per ha, because of the need to dispose of manure. Costs will even be higher, because purchases of mineral fertilizers will increase, to replace nutrients in exported manure.

An encouraging aspect is that the costs for the government presumably will be lower. Costs of verifying the MINAS registration of a farm were about 400 EURO. Besides, it can be considered to reintroduce MINAS, improved by experiences during the period 1998 - 2005, when the Nitrate Directive is replaced by the Water Framework Directive.

Literature