Feedback on the Nitrates Directive to the European Commission

Romke Postma, Gerard Ros, Laura van Schöll, Brent Riechelman & Wim Bussink

Romke.postma@nmi-agro.nl

Introduction

The Nitrates Directive protects groundwaters, rivers, lakes and seas from pollution caused by nitrates. It sets limits on the use of fertilisers and promotes the adoption of good farming and environmental practices. High nitrate concentrations in water are harmful to people and nature and affect water quality and many economic activities, including agriculture and fisheries. Concrete examples are eutrophication and toxic algae blooms. Excess of nitrates increases costs of drinking water production and contributes to the demise of unique nature.

The Nitrates Directive is a key instrument under the Water Framework Directive (WFD) (200/60/EC). This directive requires all European surface waters and groundwater to reach good quality by 2027 at the latest. Pollution by nutrients from fertilisers is one of the main stumbling blocks in this respect. For instance, about half of the nitrogen in fertilisers used is lost and emitted into the environment.

Within the scope of an open public consultation on the evaluation of the Nitrates Directive, the feedback of the Nutrient Management Institute is described in this short note.

Developments in the Netherlands: Action Programmes, measures, and water quality

In the subsequent Action Programmes (from the first Action Programme shortly after 1991 to the 7th Action Programme in 2021), a vast number of measures have been implemented aiming to reduce nutrient losses to groundwater and surface waters. The Netherlands has implemented all measures mentioned in the Annex 2 and 3 of the Nitrates Directive, following the Scientific and technical recommendations for establishing action programmes (DLO-Alterra, 2012). Through these measures, the national average nitrate concentration in water leaching from the root zone of sandy soils in the Netherlands, has decreased from values of 150-200 mg NO_3/l in 1991 to 50-75 mg NO_3/l in 2021. On clay and peat soils, the average nitrate concentrations in the upper groundwater were below the critical threshold of 50 mg NO_3/l due to high denitrification losses and limited leaching to groundwater (Figure 1; RIVM, 2022). Nevertheless, the nitrate concentrations are increasing in all soil types, a trend that contrasts the objectives of the Nitrate Directive. Note that high nitrogen and phosphorus emissions to surface water, in particular on the peat and clay soils, leads to eutrophication of surface waters hampering the ecological quality of aquatic ecosystems.

However, if we look at the time course of nitrate concentrations in leaching water from the root zone, a quick decrease in the first years after implementation of the Nitrate Directive was followed by a much slower decrease, a stabilization and even a slight increase of nitrate concentrations in leaching water in recent years (figure 1; RIVM, 2022). So, the decrease in concentrations during the first years, could not be continued during the full monitoring period from 1991 – 2021 despite of measures that have been taken within the scope of the Action Programmes. Warm and dry weather in recent years played an

important role in the slight increase of concentrations (van Boekel et al., 2021), because of extra N mineralisation and reduced crop growth, reducing the nitrogen use efficiency.

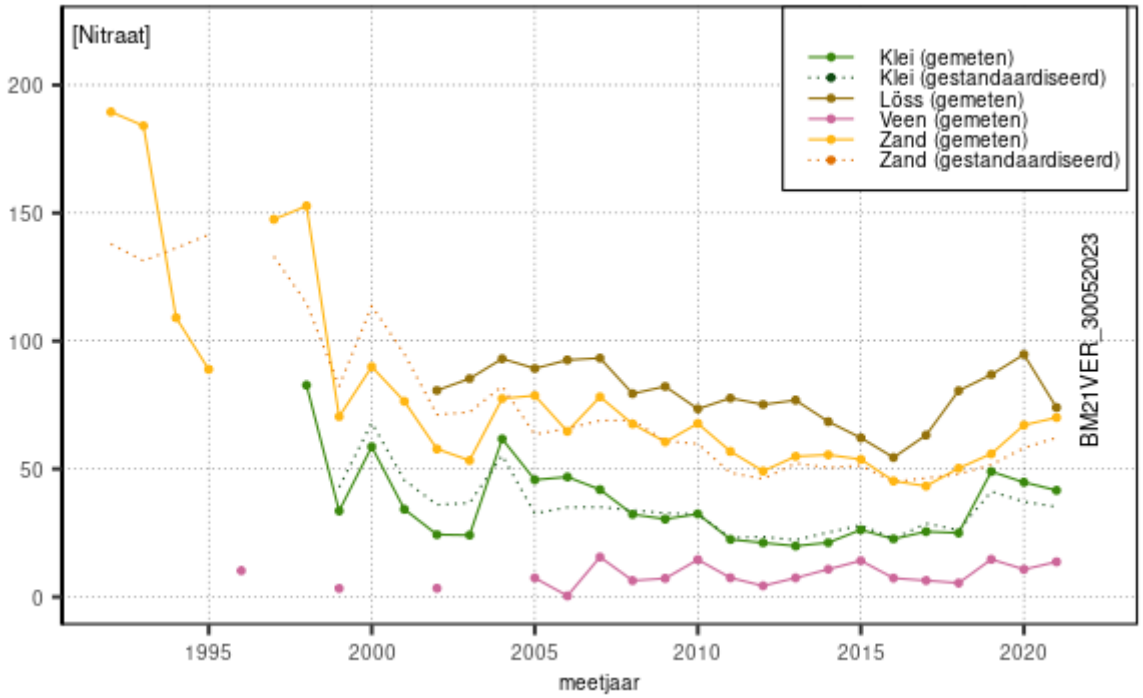

Figure 1. Development of the average nitrate concentration in leaching water from the root zone per soil type in the Netherlands in the period 1991-2021 (Source: RIVM, 2022).

Conclusions about the effectiveness and the efficiency of the Nitrates Directive

This leads to our first conclusion that the *effectiveness* of measures which were implemented within the scope of the Nitrate Directive was quite good during the first 15-20 years, but that it has been decreased during the last 5-10 years. Knowing that the delay time for nitrogen is lower than 4 years (implying that impacts of N inputs are detectable in the water ecosystem within those years), the effectiveness of additional measures that were implemented from 2012 onwards could be characterized as quite low, because it did not lead to a further improvement of the quality of groundwater. Possible explanations are related to the diminishing returns of reducing N inputs on the N surplus (since both crop yield as the losses decline when the N inputs decline), the stabilisation in N inputs since 2008 (de Vries et al., 2022), shifts in land use (less permanent grassland and an increasing area of nutrient inefficient maize, bulbs and cash crops), the maximisation of manure application, inappropriate nutrient (re)distribution among fields within farms and even the occurrence of overfertilization in specific regions across the Netherlands.

In addition, the *efficiency* of the measures that were prescribed from 2012 onwards was low as well, because the efforts and costs associated with the measures prescribed by the Action Programmes from 2012 onwards increased, while they did not result in better water quality. This is especially the case, if the socio-economic effects of the prescribed measures to farmers are taken into account: farmers are frustrated by the proliferation of ineffective measures which are costly to them. This frustration reduces the willingness of farmers to execute them. The implementation of the measures require investments and additional costs without additional financial benefits, not only for farmers but also for the authorities that have to set up extensive registration and control programmes. Costs for the export of 'excess' manure from the farms and for the manure treatment facilities come with high costs that may result in a transformation of the agricultural sector.

Especially during recent years, the implementation of certain measures hampers good agricultural practice in some regions. Here we describe three examples of costly measures with questionable effectiveness which are detrimental to farmers' trust and willingness to cooperate.

First, most application limits for a number of crops that are cultivated in large areas, in particular those on soils vulnerable for leaching, are far below the crop nutrient requirements described by the national fertilizer recommendations. This results in suboptimal yields.

Second, some of the latest prescribed measures are scientifically known to be ineffective (e.g. buffer strips on drained soils, fixed mandatory harvest periods, etc.), thereby limiting the correct adoption of these measures.

The final example is the phasing out of the derogation for dairy farms. As part of the Dutch derogation, these farms must have at least 80% of their area as grassland. On such farms, nitrate leaching is relatively low (nitrate concentrations are below the desired threshold), but still the maximum amount of N from livestock manure that may be applied will be lowered to 170 kg N per ha in the coming years. This measure may even lead to opposite effects due to a series of unforeseen side-effects like the conversion of grasslands into arable land (Ros et al., 2023). However, the societal costs will be enormous, because livestock manure has to be exported from those farms, which will result in high costs for the dairy farmers.

Our proposal: a target-oriented tailor made approach

Based on the experiences with the implementation of the Nitrate Directive in the Netherlands, we conclude that the *effectiveness* and the *efficiency* of the additional measures prescribed within the scope of the Action Programmes from 2012 onwards, were low. We are convinced that the accumulation of measures has led to a disturbed relationship between the European and national government on the one hand and the farmers on the other hand. Meanwhile, there is no progress anymore with respect to the water quality: the water quality has not further improved significantly since 2012. Recent evaluations of the manure policies in the Netherlands state that generic input-focused regulations (though already specified per soil and crop type) have limited additional value when one aims to reach the desired objectives of clean and healthy water systems.

The same conclusion has been reached by the Commission in the most recent Evaluation report (COM/2021/1000 final): *"The data on nitrates concentration at EU level show that groundwater quality has improved since the adoption of the Directive, however the further improvement goes very slow since 2012. This can be interpreted as the low hanging fruits having been already collected and now more far reaching measures being needed to improve the positive trend."*

However, as we have shown above, implementing more far reaching measures is not expected to improve the positive trend in ground water quality. Also, it is questionable whether the societal and socio-economic consequences of the accumulating measures with decreasing returns for water quality improvements can be seen as proportionate.

Therefore, we advocate for a different approach, in which farmers are challenged to attain water quality targets which are specific for the environmental conditions of fields and farms, without confronting the farmers with an accumulation list of measures. Instead of that, farmers should receive the responsibility for realising the desired water quality and make their own choices from a toolbox of measures to minimize leaching (Ros et al., 2021). A first draft of such an approach has been designed and evaluated (CDM, 2022) and is based on a combination of the indicators 'N surplus at field and/or farm level' and 'residual N after harvest'. It is called the 'tailor-made approach'.

In contrast to a generic threshold for animal manure (e.g. 170 kg N ha^{-1}) we propose to set fixed thresholds for the nitrogen surplus, thereby accounting for all the N inputs (coming from manure, fertilisers, fixation and deposition) and the crop N uptake and ammonia losses on the one hand, and

leaching fractions that account for soil type, crop category and groundwater depth on the other hand. This automatically implies regional specific thresholds that allow tailor-made but effective regulations across Europe. Using prescribed (and scientifically underpinned) calculation methods like NEMA, or comparable systems, we foresee high potential for goal-oriented policies that effectively impact the real cause of the nitrate leaching, being the high N surplus not taken up by crops, independent from its source. In addition, the use of residual N measurements after harvest might facilitate the transition to a more N efficient agriculture, and even be used as measure to detect inappropriate management by farmers. An extensive review based on literature and experiences in Germany and Belgium has shown a good relationship of the mentioned indicators with nitrate concentrations in groundwater (Noij et al., 2019), and target values have been set for these indicators to be able to realise the target value of 50 mg NO_3/l in groundwater for various circumstances. Monitoring and control are important issues to guarantee that farmers have done what they planned to do, and this could be organised via a certification system.

The tailor-made approach

In the tailor-made approach farmers decide themselves about measures that lead to at least equivalent water quality improvement as the measures in the 7th Action Programme in the Netherlands. The idea of the tailor-made approach is that 'the most effective measures are taken in the most sensible place' and a plea to steer towards a sustainably managed agricultural soil with minimal losses to the water system by good craftmanship. This approach focuses on improving the quality of groundwater and surface water through farm-based management by steering towards a maximum N surplus and residual mineral N after harvest at field and/or farm level as well as the intended impact of additional measures on surface water quality.

Alongside this more goal-oriented approach we recommend to implement a very strict input regulated farming system (using the current soil and crop dependent regulations for N and P use, but then even more strict and at lower acceptable nutrient inputs) being in principle sufficient for an extensive farming system. Farms that do not comply with the tailor-made targets for the N and P surplus on farm level purposely are automatically transferred to this strictly input regulated system. This guarantees the compliance with the objectives of the Nitrate Directive that the nutrient losses to groundwater and surface water stay within ecological safe boundaries. During the transition period from the current measure and input based regulations, farmers have to be coached and advised how to increase the nutrient use efficiency on their farms to reach the desired targets for the soil nutrient surpluses. The existing national monitoring networks can be used to monitor and evaluate the impact of the policies, and whether the acceptable surpluses need to be adjusted to account for future changes in climatic conditions.

We plea for the mandatory monitoring of all nutrient inputs and outputs on farm level, thereby accounting for the crops cultivated. Similarly to the successful adoption of the KringloopWijzer in the dairy sector we recommend to implement a similar budgeting approach for all agricultural sectors. This is a basic requirement to allow the implementation of an effective and efficient tailor-made approach.

According to the Water Framework Directive, additional measures beyond nutrients are needed to improve the quality of surface waters. This implies a strong connection between the ND and the WFD. In last years, scientists and farm advisors have developed a quantitative framework defining and analysing the main bottlenecks limiting the achievement of this goal and supporting the selection of tailormade solutions that improve the quality of surface waters (STOWA, 2023; Ros et al., 2020). For each field, farm and region, the deployment of effective measures to improve water quality is therefore known and is being implemented within regional approaches. The use of this framework increases the impact of measures/regulations regarding the nutrient emissions to surface water, where the impact of nutrients on the desired ecology is largely determined by ditch and river morphology, depth of the water,

the maintenance of ditch banks, and the regulation of water flows (in constructed artificial water systems like the Netherlands) among others.

Because it is important that in addition to water quality targets, other targets in the rural area will be met as well, the tailor-made approach -based on steering towards a maximum N surplus- should be combined with other sustainability goals. This could be realised by formulating targets (critical performance indicators for) ammonia emissions, phosphate leaching, greenhouse gas emissions and biodiversity loss at farm level and develop strategies for the realisation of those targets (Ros et al., 2023).

ReNure implementation

The Netherlands, like some other regions, have a high livestock density and a resulting manure surplus. The implementation of measures to limit the amount of manure that can be applied on the field in the NVZ has resulted in the development of innovative manure processing technologies. Derived products from this manure processing can be transported to other regions in the EU with a low usage of organic manure. The recycled-N from the manure treatments can be used to replace chemical fertilisers. The safe use of these recycled N products has been evaluated by the EC-JRC within the SAFEMANURE/ RENURE project. The EC-JRC has developed a set of ReNure criteria that safeguards the safe use of the ReNure products as replacement for chemical N-fertilisers above the 170 kg N per hectare limit for manures. The Commission is considering the ReNure as a flagship achievement under the Nitrate Directive (COM/2021/1000 final). However, the ReNure criteria are not implemented yet. Manure processing and ReNure are necessary to relieve the costs of the manure export from farms as a result of the 170 kg N limits. The continuous postponement of the ReNure criteria, with the lack of transparency on the motivation for the postponement or without any set timeframe is undermining farmers' confidence in the EU and national authorities.

Concluding remarks

The Nitrates Directive should be amended to allow a more flexible and transparent implementation of measures needed to reach the ultimate goal of a good water quality.

The tailor-made approach can be expected to reach good results for the further improvement of water quality. Involving the farmers as problem-solvers and using their expertise will create more support for the implementation of measures.

Currently, the measures that have to be implemented by the farmers are decided upon by the Commission and the Nitrate Committee. Communication on the decision process is seriously lacking. Farmers do not have effective feedback options. This lack of transparency is undermining farmers trust and commitment and we recommend to improve both communication and transparency.

What is NMI?

The Nutrient Management Institute (NMI), located in Wageningen, the Netherlands, is an independent agency for research and consultancy. NMI translates technical knowledge about soil and nutrient management into practical tools. Our mission is sustainable, climate-proof agriculture in balance with the natural environment. We combine research, practical knowledge, and a wealth of data to contribute to solving the complex issues facing our society.

Nutriënten Management Instituut BV
Nieuwe Kanaal 7c
6709 PA Wageningen
tel: (06) 29 03 71 03
e-mail: nmi@nmi-agro.nl
website: www.nmi-agro.nl