EUROPEAN
STRATEGY FOR
THE DANUBE
REGION

EFFECTIVE REDUCTION OF DIFFUSE WATER POLLUTION BY NUTRIENTS FROM AGRICULTURAL LAND

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Priority Area 4:
To restore and maintain the quality of waters

DANUBE REGION strategy

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DIFFUSE WATER POLLUTION FROM AGRICULTURE – PERSISTENT TRANSNATIONAL PROBLEM

Diffuse water pollution from agriculture is considered as an important factor affecting the achievement of good water status under the EU framework directive on water. As follows from the Danube River Basin District Management Plan (DRBDMP) - Update 2015[1], agriculture is responsible for 42% and 28% of the basin-wide total nitrogen and phosphorus emissions of the surface waters, respectively. 20% of the surface water bodies are at risk to fail good ecological status by 2021 due to nutrient pollution. Moreover, the Black Sea which finally receives the waters from the Danube and its tributaries has been long term affected by nutrients which might cause eutrophication. This situation is necessary to remedy.

The selection and implementation of environmentally efficient and cost effective measures, which address the real problems of water pollution, is the basic precondition for improving the water quality at national and transnational levels. Cooperation on setting these measures is vital premise of success.

Trans-boundary river basin management on the basin-wide level, including the measures to protect water against diffuse pollution from agriculture, belongs to the core activities of the ICPDR and International Sava River Basin Commission (ISRBC). These organizations elaborate the river basin management plans at the basin scale for the Danube and Sava River in compliance with the requirements of the EU Water Framework Directive.

1. ICPDR 2015. The Danube River Basin District Management Plan - Update 2015. Vienna: International Commission for the Protection of the Danube River.

The maintenance or improvement of water quality in Danube River Basin is genuine part of targets and actions within the Priority Area 4 under European Strategy for the Danube Region. Many of PA4 Actions with basin-wide agreement, such as Strengthening cooperation at sub-basin level, Establishing buffer strips along the rivers, and Improvement of the dialogue and cooperation between agriculture and environment sectors aimed at reduction of agricultural pollution, can promote above mentioned process.

REDUCING NUTRIENT LOSSES AND IMPROVED NUTRIENT USE EFFICIENCY – THE GLOBAL REQUIREMENT

Ensuring of sufficient food production is linked to the use of fertilizers and manure in agriculture. Inefficient use of nitrogen and phosphorus has broad environmental consequences.

Efficient use of resources is considered a flagship initiative under the Europe 2020 strategy. Agriculture in the EU responds to the related social challenges by adopting a strategy of green growth and subsequent changes in the Common Agricultural Policy for the period 2014-2020.

The Common Agricultural Policy for the period 2014-2020 has the ambition to become a policy, which is of strategic importance for food security and food safety, the environment, climate change and balanced territorial development. Efficient use of resources, including reduction or prevention of water pollution from fertilizers and animal manure, is an integrative part of achieving this goal.

With regard to water protection, in agriculture it is necessary to improve nutrient use efficiency and to increase the fertilizer equivalence value of animal manure.

INPUTS REGULATION AND TIMING – THE STANDARD SOURCE ORIENTED AGRICULTURAL PRACTICE

Reducing unproductive losses of nutrients lies in matching the supply of nutrients to crop needs. Effectiveness of fertilization mainly includes:

- Nutrient input regulation (determining the total effective rate of given nutrient), and
- Nutrient loses regulation (optimum way and time of fertilizer or animal/organic manure application and crop management).

In order to achieve a balanced fertilisation, it is necessary to consider all nutrient sources (e.g. utilisable nutrients from applied animal/organic manure, level of available nutrient in the soil).

Calculation of the total rate of nitrogen, phosphorus and potassium is primarily based on the following information:

- Mean achievable crop yield under given site conditions,
- Need of nutrients per unit yield (tonne of main product and corresponding amount of by-product), and consequently to the yield of the intended crop,
- Available soil nutrient supply (in the case of P, K),
- Application of animal/organic manure to crop and pre-crop (for the deduction of utilizable nutrients).

Reduction of diffuse water pollution from agriculture, especially by nitrates, consists mainly in reducing the surplus of applied N with regard to its off-take by crops that is possible to reach through balanced fertilisation and timing.

It corresponds with key principle – improving the efficiency of nitrogen use by tightening the N cycle.

Just the timing of N fertilizers and animal manures (especially the liquid ones) can significantly contribute to the minimisation of N loses through leaching without negative impact on crop productivity (that should be in relation to soil productivity potential of given site).

However, this requires investments in storage capacity (considering the duration of the prohibition period and the uncertainty of weather conditions).

Application of liquid animal manure during vegetation period increases the efficiency of applied N

Key problem at the application of animal manure is the insufficient synchronicity between mine-ralisation of organic N and its uptake by crop and therefore nitrogen from organic manures, animal ones inclusive, is less manageable than fertilizer N that is immediately available for root system of crops.

Also covering of soil by winter crops, perennial crops as well as winter catch crops is of high rele-vance. It is necessary to pay attention also to N losses from insufficient storage capacities for animal manures which should exceed the period when their use is prohibited.

As mentioned, reducing non-productive losses of nutrients (especially of nitrogen) corresponds with matching the supply of nutrients to the crops.
In most cases splitting the total nitrogen rate is an essential prerequisite for its effective use.

Resource-oriented measures for reduction of N leaching losses

Early incorporation of fertilizers/manure into the soil or subsurface application generally reduces gaseous losses of nitrogen and on sloping land also the nitrogen and phosphorus loses to surface waters via runoff and soil erosion.
So, anti-erosion measures are required on sloping grounds to reduce the nutrient transport to surface water.

Long-term negative phosphorus balance in many East European countries and taking into account the available soil P content at P rates projection can make an impression that P losses into surface waters are negligible.

Soil erosion as important transportation factorof nutrients to water courses

Multifunctional vegetation strips on the edges of fields reduce the transport of nutrients from agricultural land

The most important type of measures to decrease phosphorus loses into (surface) waters include:

- Matching the P supply to the crop needs which embraces consideration of all nutrient sources (e.g. utilisable P from applied animal/organic manure, level of available P in the soil),
- Early incorporation of fertilizers/manure into the soil or subsurface application (when relevant).

Beside management of above mentioned source factors, on sloping land the anti-erosion measures together with appropriate timing and early incorporation of manure/fertilizer are also significant measures reducing phosphorus loses to waters.

Past land use or land management activities can lead to a long-term legacy of phosphorus within watershed what can overlap the current level of farming. This should be kept in mind at the assessment of environmental effect of adopted measures.

SUFFICIENCY OF ADOPTED MEASURES TO ACHIEVE GOOD STATUS OF WATERS IN TERMS OF NUTRIENTS

In the EU countries, water pollution by nutrients from agriculture is mainly regulated by the Nitrate Directive, which was born already in 1991.

In designated Nitrate Vulnerable Zones (VZ) the amount of nitrogen applied on agricultural land is limited and its application in fertilizers and animal manure is regulated through action programmes which are core of basic measures (which are mandatory) defined in Article 11.3 of the Water Framework Directive.

Measures for the regulation of phosphorus losses into water should be also integral part of implemented measures under the Nitrate Directive as phosphorus also contributes to the eutrophication of surface waters.

Diffuse water pollution from agriculture can be controlled also via supplementary measures which are covered by public sources (mostly from the Rural Development Programmes in EU countries).

Voluntary application of the Code of Good Agricultural Practice outside the Nitrate Directive vulnerable zones has preventive character and its environmental effect depends on the number of farmers who respect it. Both basic and supplementary measures are part of national River Basin Management Plans for the period 2016-2021 as well as the DRBDMP- Update 2015.

In the case of non-EU countries, water pollution from agriculture is regulated by national legislation, which should include the necessary measures for its gradual decline.

Gradually improving state of waters, as can be seen from the results of water monitoring, can create an impression that it is necessary to adopt additional measures in order to achieve at least good water quality and ecological status.

Little or no change in water quality does not have to definitely mean that the adopted measures are ineffective. Although meeting the WFD goals is primary requirement for setting effective measures in agriculture to reduce diffuse pollution, the time for responding water bodies to the implemented measures (reaching up to several decades) does not provide adequate feedback to farmers and policy makers. So this time lag is necessary to be estimated via modelling.

In line with the strategy of green growth, the sustainable intensification including the improvement of nutrient use efficiency, are the base for the crops growing in the next period.

Nutrient balance surplus represents appropriate indicator which can be used at regulation of total nutrient inputs via fertilizers and animal manure.

More precise identification of current sources of pollution and taking into account the nature of pollution is an indispensable precondition for setting up remedy or prevention through target-oriented and economy efficient measures.

Moreover, the monitoring of effectiveness of already adopted measures, with regard to the time for responding water bodies to the implemented measures is another issue which needs increased attention.

The lush riparian macrophyte vegetation indicates an excess of nutrients in water

INTEGRATION OF NUTRIENT SOURCE AND TRANSPORT TO MAKE MEASURES MORE EFFECTIVE

Risk assessment of diffuse water pollution (by nitrogen and phosphorus) is the principal basis for the allocation of effective measures.
The critical area concept, which basically falls into the Best Agricultural Practice, combines the nutrient source and transport conditions in agricultural land. This concept, which is essentially based on risk assessment, practically represents the intersection of two spatial information, namely level of agricultural land loading by nutrients and nutrient transport conditions.

Usually, these areas for nitrogen and phosphorus are different. Targeting management activities to "critical areas", where the highest nutrient emissions to water come from or where the highest nutrient transport from land to water occurs, contributes to increase the environmental and cost effectiveness of measures which can be more acceptable and viable for farmers.

Since diffuse water pollution by nutrients from agriculture exceeds the boundaries of the field and farm, its efficient protection assumes proper allocation of effective measures at river basin level.

FINAL REMARKS

Diffuse water pollution by nutrients from agricultural land use is a problem, which needs to be solved gradually in cooperation with transnational organizations (ICPDR, ISRBC, EUSDR PA4) as well as with relevant national organizations of state and public administration and representatives of agriculture. Such cooperation provides the needful space for exchange of information and experience.

This brochure can be used as basis for dialogue between agriculture and environment sectors, which is necessary to make progress at reduction of diffuse water pollution by nutrients.

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