Project AQUA

Achieving good water QUality status in intensive Animal production areas

surface waters | nitrogen | eutrophication | ground water | water pollution

PROJECT DESCRIPTION

Pollution of water resources is often due to an excessive concentration of **nitrogen and phosphorus** used in agriculture. A typical form of pollution is that caused by nitrates, a particularly soluble mineral form of nitrogen. The European Union, through the **Nitrates Directive 676/91/CE**, has been governing the use of nitrogen in agriculture since 1991. Protection of water against pollution in areas with high concentration of intensive farming activities is one of the main problems zootechnics in Italy, likewise in other countries, has to face. The main objective of the **AQUA** project was to optimize the management of nutrients of agricultural origin in livestock farms with the aim of **reducing water pollution** both in groundwater and surface water. To this purpose the project envisaged interventions at different levels in 11 demonstrative livestock farms, 4 of which dairy cattle stalls, and 7 meat stalls (3 for beef cattle, 4 for pigs), located in 5 regions participating to the project: **Piedmont, Emilia-Romagna, Lombardy, Veneto and Friuli Venezia-Giulia.**

OBJECTIVES

The main technical objectives of the project were to:

- introduce feeding techniques aimed at reducing excreted nitrogen in livestock farms in dairy and meat cattle stalls, as well as in pig farms;
- introduce crop rotation characterized by long growing season and high nitrogen removal, as well as innovative techniques for applying slurry able to maximize the fertilizing efficiency;
- introduce agro-environmental techniques (buffer strips, phytodepuration) aimed at reducing the flow of nutrients towards the receptor waterbodies in order to protect water resources;
- relocation of the effluents' solid fractions through their exploitation as fertilizers in areas with organic matter deficient soils and at risk of loss of fertility, in order to reduce the environmental pressure in high density areas within zones vulnerable to nitrates (ZVN);
- emphasize stalling (feeding with reduced nitrogen content) and field practices (delocalization of effluents' solid fractions) through the use of tools implemented and made available on the project website.

The actions put in place have combined innovative techniques and management practices that can be used with profit in the livestock farms of Northern Italy and in those of other European countries characterized by areas with high density of farms.

PROJECT PHASES

The main activities of the project were:

- reduction of the nitrogen excretion by farm livestock through the application of **highly efficient diets**, aiming to demonstrate the possibility to reduce both the quantity of excreted nitrogen deriving from livestock farming, and the impact

of these farms on the quality of water, without compromising production levels;
- adoption of management and agronomic practices able to reduce **nitrogen emissions** in waterbodies, giving at the same time business and environmental benefits, consisting in the use of livestock effluents from animals fed with high nitrogen efficiency rations on crops with high removal capacity and long growing seasons, obtained with the application of innovative techniques (for example fertirrigation with clarified slurry, burying in an inter-row on existing crops, *trailing shoes* or *band spreading* on meadow);
- demonstration of the efficiency of the water quality protection systems, like buffer strips and phytodepuration systems, in reducing **nutrients losses to water**, resulting in this manner environmentally and economically more sustainable;
- transport of the livestock effluents' solid parts, by a consortium created ad hoc for the collection and distribution, to agricultural areas with low density of farms;
- development and validation of an **IT support** to track and certificate nitrogen management;
- evaluation of the environmental and economical sustainability of the proposed management strategies;
- ***networking* and transferability:** exchange of experiences, information and results related to the project themes through the creation of a **European Orientation Group**.

PROJECT RESULTS

AQUA has allowed common companies to investigate the possibility to reduce, through preventive actions, the loss of nutrients generated in livestock farming activities. The results achieved by the project were put in practice directly during the project implementation, as the companies participating to the project applied the proposed innovations (use of low-nitrogen diets and high-efficiency nitrogen farming practices) as indicated by the beneficiary. These companies, under the guidance of experts and nutritionists, have been continuing to apply the proposed techniques even after the end of the project because of the environmental benefits achieved without additional costs and without compromising the productivity.

Among the main achievements of the project the following are to be mentioned:

- **improvement of the corporate balances of nitrogen management** by means of interventions on the cows' and pigs' diet, leading to a reduction of the excreted minerals and a greater fertilizing efficiency of the livestock effluents. For each pilot company a specific nutrition plan was designed aiming to limit nitrogen excretion thanks to the reduction of the protein level in the diets and/ or a better balance between energy and protein content of the ration. The feasibility of the protein nitrogen reduction in the production cycle of heavy pigs, not experimented before on a large scale, was also verified. The results confirmed the good performance of the interventions in all types of livestock farms, even if with some variability in the companies' responses. In average the **nitrogen reduction was of about 15%**, both that of the excreted nitrogen and that of the nitrogen present in the effluents during distribution (nitrogen in the field). On the assumption of extending these practices to 10% of the pig farms and to 50 % of the beef cattle farms at national level, it was estimated a reduction of excreted nitrogen of approx. 9.000 t/year and a reduction of nitrogen managed in agricultural uses of approx. 7.000 t/ year;
- experimentation of agro-environmental practices aimed at reducing nutrients losses from fertilization to surface water. In particular two companies proceeded to adopt (20 m wide) **buffer strips** and then measured the **reduction of nitrogen and phosphorus losses to water**. The reduction was equal to **70% for nitrate nitrogen** and **60% for total nitrogen** within the first 5 m of the buffer strips. Taking into account the soil characteristics and considering a total quantity of 170-250 kg/ha of nitrogen distributed, the losses in the areas subject to control were, however, contained (approx. 1-3% of the applied nitrogen). One of the participating companies verified also the efficiency of a **drainage technique** of the **soil** treated with 250 kg per hectare of nitrogen applied through different types of fertilizers, consisting in the collection of wastewater from the soil surface layer through a drainage system and wastewater treatment with a surface flow phytodepuration system. The verification of the results confirmed the effectiveness of the implemented measures in reducing nitrogen leakage from cultivated soils;
- creation of a **consortium** between intensive beef cattle farms and farms without livestock to counteract soil depauperation through the use of organic material. Cattle slurry was treated to separate solid and liquid parts, then the solid parts were transported to farms without livestock. For the separation a **mobile device** was used in shifts by the different companies of the consortium, which allowed to have a better concentration of the organic material, nitrogen and phosphorus. The consortium transported more than 1.300t of solid fractions, so demonstrating the feasibility of this solution both from the technical and management point of view.
- establishment of the **European Orientation Group** with different country-members (France, Nederland, Spain, Greece, Malta) having the function of validating the techniques applied in the starting phase of the project and checking the effectiveness and transferability of the results; developing cooperation reports; and disseminating information on the results to the national and European authorities;
- development of a tool to calculate the nitrogen balance in beef cattle and pig farms, including: a simple and intuitive web application, **Calcola N**, a **Manual for Calcola N**; and a **Tool for monitoring transport of solid fractions of livestock**

effluents; an application addressed principally to consortia or groups of companies, useful to give evidence of the solid fractions' transport from areas with nitrogen excess into areas needing organic substances. For the correct use also a Manual has been developed;
- performance of an analysis in the demonstrative companies including a financial assessment, revealing that the applied practices did not lead to any loss in the production, rather allowed a more rational use of the resources without increasing the costs.

The **interregional dimension** of the project provides an important indicator about the transferability of the achievements to a wide range of companies. Concerning this aspect it is worth mentioning the broad participation of operators, experts and public administrators, belonging to different local authorities, even from regions not directly involved in the project activities. **Results of the practices for the management of effluents subject of the project activities** (separation of solid/ liquid effluents and exploitation of solid fractions, creation and management of buffer strips, adoption of high efficiency effluent spreader systems, introduction of crop rotations with high nitrogen demand and prolonged growing period) were utilized, during AQUA's implementation, for the definition of the **Rural Development Programme**'s measures, in particular in the regions of the target companies.

In 2014 AQUA was awarded the **Best LIFE Environment Project** prize.

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Acronym
AQUA

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Reference Programme
LIFE

Beneficiary Coordinator
C.R.P.A S.p.A.

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1.310.901,00

Call Year
2009

Start Year
2010

End Year
2014

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Region
Emilia-Romagna

Description

Emilia-Romagna, Piemonte, Veneto, Friuli Venezia Giulia, Lombardia