AQUA

Achieving good water quality status in intensive animal production areas

LIFE09 ENV/IT/000208

VENETO AGRICOLTURA

Azienda Regionale per i settori Agricolo, Forestale e Agro-Alimentare

Convegno finale - Il controllo dell'azoto nelle aziende agro-zootecniche

14 marzo 2014 - Tecnopolo di Reggio Emilia

ENVIRONMENTAL MEASURES TO INTERCEPT NUTRIENT POLLUTANTS FROM FERTILISED FIELDS: BUFFER ZONES EFFICIENCY

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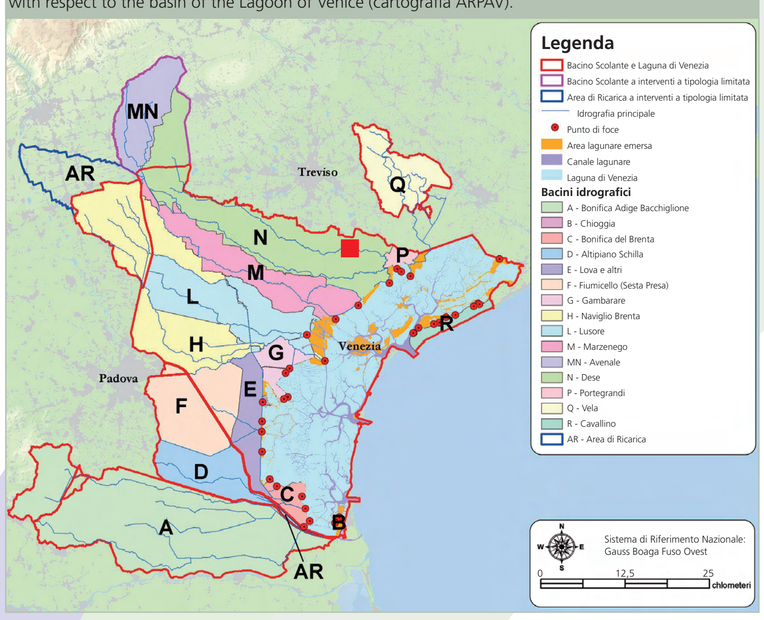
GOALS AND EXPERIMENTAL DESIGN

Main objectives

- **Monitor the effectiveness of two buffer strips (two-wire)**, relating to 2 "indicator" plots. The first plot is managed according to the usual farm practices (no exemption), while in the second we adopt cultivation techniques for improvement/innovation (exemption) carried out by Action 2 (AQUA LIFE+ project);
- **Understand and describe the main** processes and the **hydrological dynamics** in order to provide any **guidance for the enhancement** of these systems.

The experimental site, managed by Veneto Agricoltura, is located within the experimental farm "Diana" in Mogliano Veneto (TV).
The landscape is completely flat, with an average of 5 meters above sea level, mainly with natural drainage. The agricultural fields are delimited longitudinally from drainage ditches. The soils are medium-textured with tendency to clay.
The "Diana" farm is mainly used for experiments aimed regarding the transfer of innovation sustainable agricultural techniques at low impact on the natural environment (Veneto Agriculture 2011).

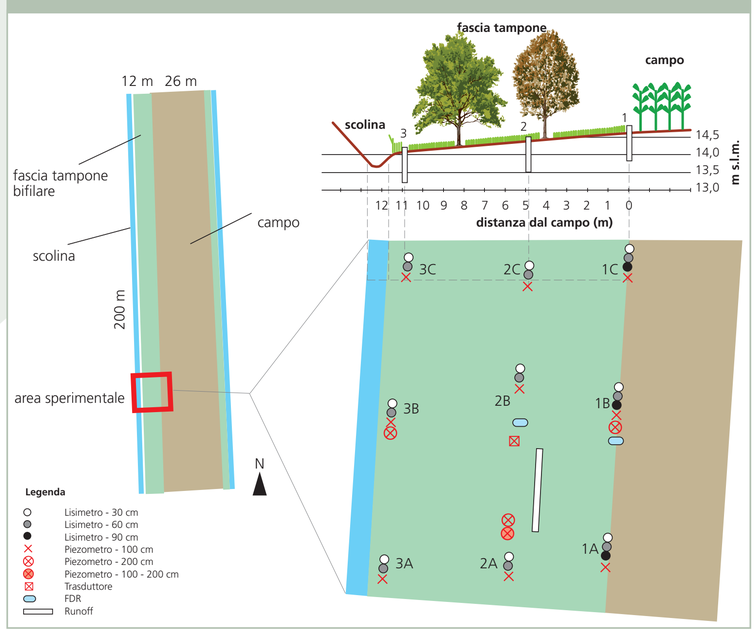
Location of the experimental area (red square) within the catchment area of the River Dese and its position with respect to the basin of the Lagoon of Venice (cartografia ARPAV).



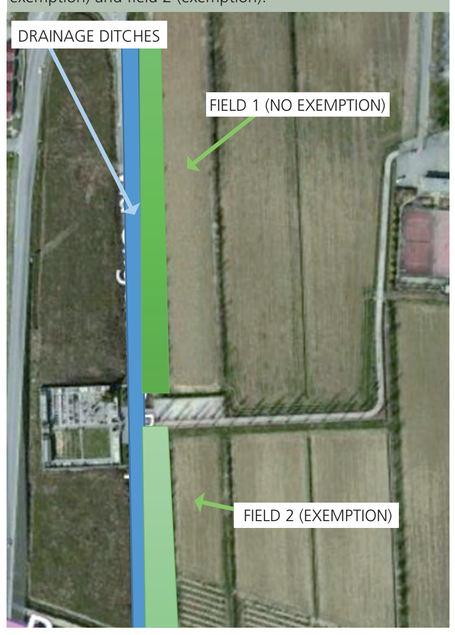
Experimental design

As monitoring sites were chosen two adjacent buffer strips placed between a cultivated field and drainage channel according to the scheme shown out below.
Monitored parameters: volumetric soil moisture, groundwater depth, runoff, weather data, nitrate-nitrogen and total nitrogen.
Were also calculated both the hydrologic balance the nitrogen mass balance.

Experimental design of the monitoring sites, cross-section and top view.



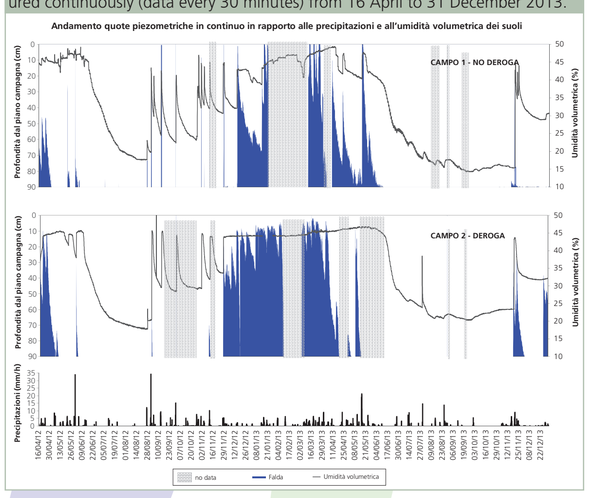
Orthographic view of the two monitoring sites: field 1 (no exemption) and field 2 (exemption).



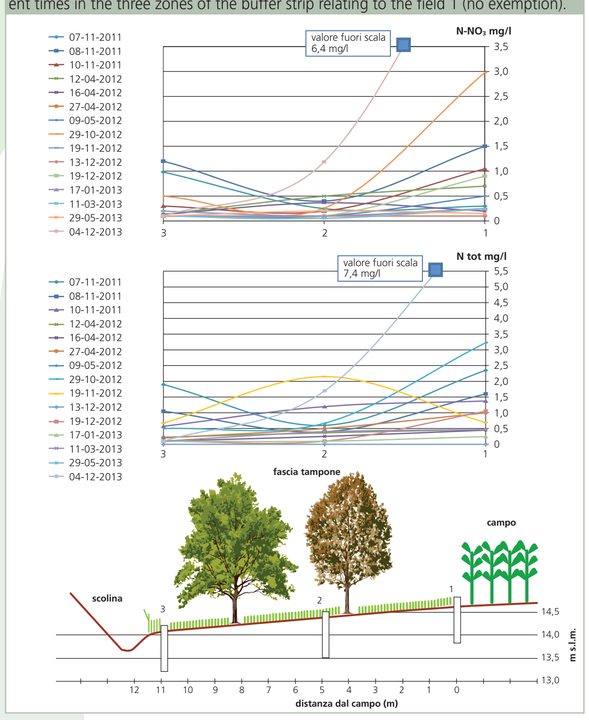
RESULTS

In monitored soils, on average, a shallow aquifer (first 90-100 cm soil layer) persists from late autumn to early spring. During spring the aquifer becomes more intermittent and eventually disappear altogether in summer and for most of the fall. These types of soils need a lot of water (rain) before fully saturated and have free water flow.

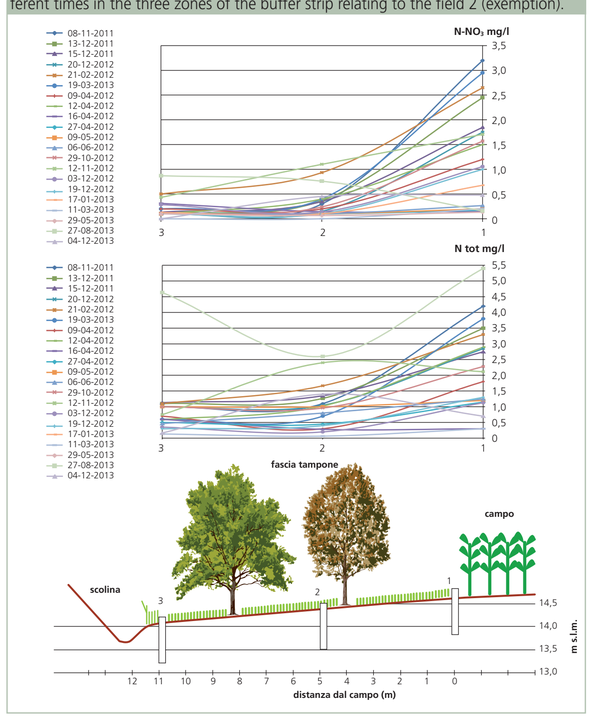
Groundwater level and soil moisture at 90 cm depth. The parameters were measured continuously (data every 30 minutes) from 16 April to 31 December 2013.



Average concentrations of nitrogen-nitrate (above) and total nitrogen (bottom) at different times in the three zones of the buffer strip relating to the field 1 (no exemption).



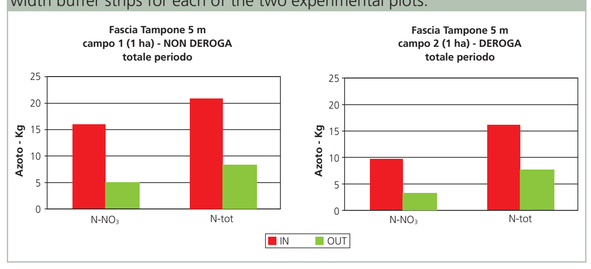
Average concentrations of nitrogen-nitrate (above) and total nitrogen (bottom) at different times in the three zones of the buffer strip relating to the field 2 (exemption).



The total amount of nitrogen conveyed out of the field 1 and 2 via subsurface outflows are in the order of 4-10 kg / ha / year. The release of nitrogen from the two fields are extremely low but in line with those reported in literature for this type of soil, with losses of 1-3% compared to distributed. Most likely this is due both by the high protective capacity of the soil and by good agricultural practice carried out.
There are not significant differences between the two theses: Field 1 (no exemption) and Field 2 (exemption). Any differences that may arise between the two fields are due to occasional episodes and pinpoint.

The first 5-meter buffer zone are sufficient to reach values of nitrogen reduction, on the order of 70% for nitrate and 60% for total nitrogen.

Comparison of the nitrogen amount in the input and output from the 5 meters width buffer strips for each of the two experimental plots.



CONCLUSIONS

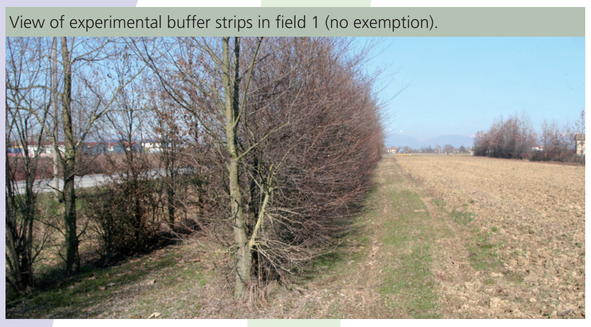
In case of protective soil as those investigated, it was observed that both experimental sites (exemption and no exemption) generate a nitrogen load on surface water network very low.

Given the small size of the agricultural basin flowing into the buffer zone, in order to achieve significant reduction of nitrogen amount a composed (herbaceous plus tree species) buffer strip is more than adequate.

The percentages of nitrogen removal in subsurface outflows are in accordance with previous investigations at the site Nicolas (65% of total nitrogen and 85% nitrate) (Gumiero *et al*. 2011 *Journal of Applied Ecology*) wherein the buffer system received nitrogen loads significantly higher.

Wanting to extend at large-scale the results achieved with this experiment, raises a number of issues related to the site-specificity of the systems and on the other hand can't be put into practice by the farmer the same accuracy and attention to the spreading of sewage. Consequently, the nitrogen losses from the field recorded in this project may be underestimated if used in an extrapolation to larger scale.

View of experimental buffer strips in field 1 (no exemption).



View of experimental buffer strips in field 2 (exemption).

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