

Irrigated agriculture improvements to reduce aquifer pollution: a case study from a Portuguese vulnerable area

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The Portuguese agriculture intensification on last decades has allowed several situations of surface and groundwater pollution with severe impact on water quality to domestic supply systems. These problems resulted mainly in irrigated areas due to the conjugation of misuse water management and excessive nitrogen fertilization rates particularly with intensive horticultural crops. Moreover the incorrect cattle manure application may lead to nitrogen pollution. This communication will present nitrogen levels in water resources and fertilizers consume, according to official Portuguese reports, to give an insight into this problem.

The Agriculture Ministry and the Water Institute are implementing and coordinating the Nitrogen Directive in Portugal. Three vulnerable zones were identified and established: the aquifers between Esposende and Vila do Conde (North), the quaternary aquifer of Aveiro (Center) and the miocene and jurassic aquifer of Campina de Faro (South). This communication refers to the vulnerable zone of Aveiro case that was established by Portuguese government in July 2003.

The agriculture is severely conditioned, with the purpose to conserve the quality of groundwater, which is a crucial resource to supply municipal systems in the area. The constraints refer to seasonal crop distribution, the fertilization doses and the special cases in which are forbidden the fertilization and manure application on soils, the requirement to plan and monitoring the nitrogen fertilization balance, the irrigation practices allowed and recommended. Also, the framework of official nitrates control is coordinated by the Portuguese Water Institute.

A guide on environmental agricultural practices was developed by the Agriculture Ministry and is nowadays applied to support farmers in the operations that influence the nitrogen dynamics on agrarian ecosystems. It includes fertilization and irrigation recommending better practices, considering the lixiviation risks, which depend on the crop systems, soil type and climatic pattern. The record of fertilizers applied on field is now an obligation allowing the monitoring and the risk control.

A research and farmers demonstration project, funded by the Agriculture Ministry, was carried out on this vulnerable zone that will be described in this communication. The traditional practices of high nitrogen consume was evaluated. A soil survey was done to characterize the hydrodynamic behaviour, the porosity and the hydraulic conductivity. The lixiviation potential was evaluated by RZWQM98 model, with several mineral nitrogen doses. The results showed that the macropores are determinant on water and solute fluxes and the lixiviation of 7 and 17% of total nitrogen applied with a system of horticultural and forage crops. The communication will explain the results and the contribution to define the best manage practices in vulnerable areas.