USING THE DENITRIFICATION PROCESS AS A WATER QUALITY MANAGEMENT TOOL TO REDUCE NITRATE LOSSES FROM ARTIFICIALLY DRAINED SOILS

Alaa El-Sadek

Water Resources Research Institute, WRC Building, Delta Barrage, El-Kanater, P.O.Box 13621/5, Cairo, Egypt

ABSTRACT

Denitrification is the process by which nitrate-nitrogen is converted to nitrogen gas by soil microorganisms when soil oxygen is low or absent. The process of denitrification is important in preventing high agriculture-source nitrate loads from entering and polluting rivers. The aim of the research was to examine if the NO_3-N concentration in drain water of agricultural fields can be kept below the EU limit of 11.3 mg l^{-1} by controlling the denitrification process through management of the water table level. As such the research focused on the determination of the exact denitrification amount to achieve both, limitation of the NO_3-N leaching and optimisation of the nitrogen-nitrate uptake by the crop. The method used in this study is based on the nitrogen version of DRAINMOD model. This model was used to simulate the performance of the drainage system using two drainage strategies (conventional and controlled) at the Hooibeekhoeve experiment, situated in the sandy region of the Kempen (Belgium), and this for a 14-year (1985-1998) period. In the analysis a continuous cropping with maize was assumed. Daily NO_3-N losses were predicted for a range of drain spacings. The study illustrated that the denitrification process has a very strong impact on the amount of nitrate that can be leached to ground and surface waters. The results have also shown that if the water table elevation is properly controlled, one should be able to strike the delicate balance between our need for maximum yield production and a minimum hazard to our environment.

Keywords: conventional and controlled drainage, denitrification, plant uptake, nitrate leaching