Modeling the spatial evolution of nitrogen pollution in groundwater and the amount of nitrogen leached under potato crops in the Khemis Miliana Plain

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Abstract

The maximum concentration of nitrate in drinking water admitted by the World Health Organization is 50 mg/l. Europe recommends a standard content of 25 mg NO_3^-/l according to the interdisciplinary research program on the environment. The present work quantifies spatially the evolution of this pollution and determines and estimates the influence of agricultural practices "calendars of irrigation and fertilization" on the quantity of nitrates leached under the potato crops towards the groundwater of the Khemis-Miliana plain usin Pilote N model. The spatial evolution of the average nitrate concentrations above the norms in the groundwater of the Khemis-Miliana plain represents 80% of the total area of the plain. The transfer of nitrates through the unsaturated zone was simulated by the PiloteN model giving an estimate of the amount of N leached under the potato crops, which represents, according to the model 40% of the total N supplied 300 KgN/ha on the ground. According to the model, the nitrogen leaching period is greater with the days of fertigation. In this context, a field study was conducted to get an idea of the agricultural practices brought to the soil of the Khemis-Miliana plain in order to know, on average, the quantities of nitrogen leached by calculating the nitrogen balance at the potato plot scale using an empirical method and the PiloteN.

Keywords: Nitrogen pollution, PiloteN, fertigation, Potato, Khemis-Miliana, Algeria.

1. Introduction

In the plain of Khemis-Miliana nitrate pollution has already been highlighted by earlier studies, with nitrate levels simulated over time far exceeding the norm with a minimum content of 70mg/l to the year of 2033 (ANRH,2012).

2. Methods and Results

The alluvial plain of Khemis plain belongs to the province of Ain Defla. Located 120 km south-west of Algiers (Figure.1) The region is characterized by a semi-arid climate with very hot summers and cold winters.

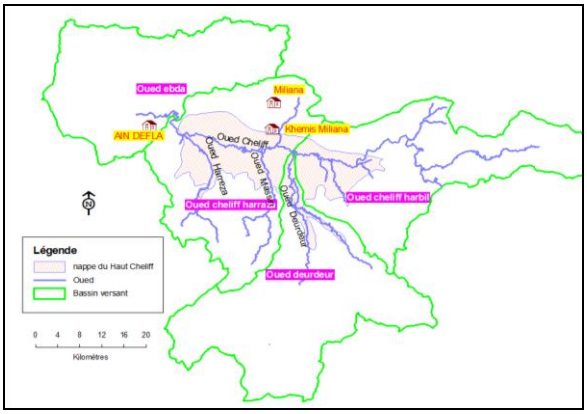

Figure 1. Situation map of the study area**.**

Spatial prediction technique, This determination will be done by a geostatistical approach called ordinary kriging, and finally by establishing a nitrate map for different grades of mg / l. the map representation will be done using the Arc Gis 9.1 software.

The nitrate map established by ordinary kriging shows the spatial distribution of nitrates in the groundwater of the alluvial groundwater of the Khemis Miliana Plain. Referring to the standards established by the World Health Organization O.M.S, mapping of nitrates shows that the groundwater that is affected by nitrate pollution covers most of the plain. Consequently, this increasing contamination in the waters of the alluvial aquifer of Khemis-Miliana plain is a serious threat to human health. This is why we consider that even the zones or the contents are m 35mg / l also constitute pollution ranges that extend over not insignificant areas in the plain

It appears that the most affected zone by this pollution are the eastern areas, The map also shows, a general background lower than 50mg / l characterizing the center of the plain. (Figure 2).

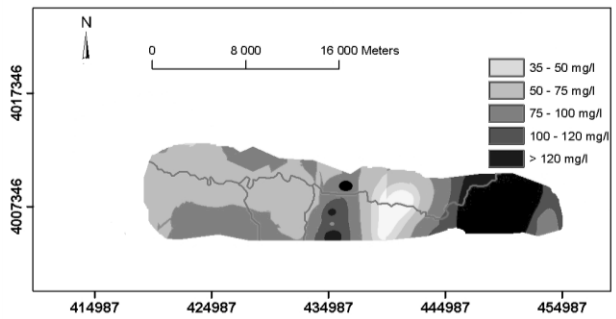

Figure 2.

Pilot N model: Simulation Results

The results of the model are represented in the graph (Figure3).

The nitrogen balance as well as the amount of nitrogen leached under the potato crops are shown in the graphs, and as met by other actors (Doltra et Munoz, 2010), the period of leaching of nitrogen occurs corresponds to the rainy days or irrigation, Nitrogen content in the plant was reasonably simulated.

3. Conclusion

According to the map of the nitrates the highest concentrations are in the western part of the plain those same zones where the vegetable crops spatially is located the potato in this part of the plain are located the permeable soils that favor the infiltration According to the pilot model, it has been possible to verify that the quantities of nitrogen leached from the potato crops constitute more than half of the annual total of nitrogen supplied to the soils of the plain and that the leaching coinciding in this year 2016 with dates of fertilization and irrigation which increased water drainage and leaching of nitrogen. it is necessary to adapt a strategy for the quantity of water and nitrogen supplied to the soil during the cropping cycle and to adapt it to the needs of crops, taking into account the climate but also the heterogeneity of the soil. The initial state of the physicochemical profile and the water and nitrogen stock must be taken into account.

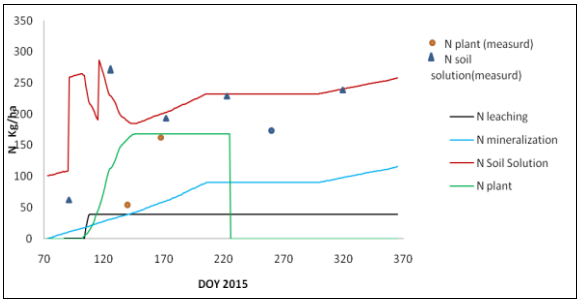

Figure3. Simulation of the nitrogen budget

On the Simulation Duration:

Rain Total: 336. mm, Evaporation soil: 341. mm, Drain: 134. Mm.

The period or leaching of nitrogen becomes important 80 JAS (days after semi), coincides with the days of fertilization and spreading, this leads directly to the same conclusion about the main origin of nitrate pollution in the groundwater was the excessive quantities of fertilizer nitrogen brought to the soil of the plain without forgetting the residue of nitrogen already present in the soil.

Losses during the drying period depend on the initial nitrate stock in the soil, usually the amount not absorbed by the potato from late fertilization or post-harvest mineralization.

Mineralization of nitrogen during periods of potato cultivation is well simulated, on the basis of simulated and measured Nsoil solution

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