Impact of reuse of the purified wastewater on some properties of soil. Case study of Ain Defla station (Northwestern Algeria)

Touil S.[1,2], Richa A.[1,2]

[1]Djilali Bounaama University, Khemis Miliana, Algeria
[2]Laboratory of Agricultural Production and Sustainable Valorization of Natural Resources (PRAVDURN), Djilali Bounaama University, Khemis Miliana, Algeria

*corresponding author: e-mail: touil_sy@hotmail.fr

Abstract
Purified wastewater (PWW) is a major source of water and nutrients for many farmers in arid and semi-arid climates. The aim objective of this study is to follow the change of soil characteristics *i.e* permeability porosity, total calcium, electrical conductivity (extract diluted) and pH before and after an irrigation event. Two plots were selected near wastewater treatment plant of Ain Defla, the first one irrigated by fresh well water and the second one by PWW. Geostatistical analysis and soil mapping of the two plots showed that the risk of soil salinity is present with a rate of increase may be up to 0.5 ds / m after each watering. The spatiotemporal variability of soil Stalinization and total calcium levels can lead to a possible accumulation of persistent contaminants in the soil after prolonged irrigation (over 10 years) in this region.
Keywords: Purified wastewater, soil, salinization, irrigation, Algeria.

1. Experimental Site, Material and Methods

This study was carried out on soil survey to determine two study sites, one irrigated by a fresh water well and another one irrigated by PWW to study some soil properties. The second site was selected for its location near of an effluent which is mainly fed by wastewater treatment discharges of Ain Defla plant.
The soil survey consists of a set of successive operations performed on field and in the laboratory. On field, the work took place in several steps and consisted of an analysis of two sites (site 1: soil irrigated by PWW , site 2 soil irrigated by fresh water) located in the Ain Defla town. The samples were dried and subjected to major physical and chemical analyzes (AFNOR, 1996).

Spatial mapping of the salinity (electric conductivity) and pH of the two sites was undertaken using geostatistics.

Table 1. Wastewater analysis results after purification

Parameter	Unit	S_1 04-May 2014	S_2 05- May 2014	S_3 11- May 2014	S_4 12- May 2014	Average
Temperature	°C	21.9	20.4	23.2	22.3	21.9
pH	6	7.9	7.97	8.05	7.99	7.97
EC	ms/cm	2	2.03	2.02	2	2
DBO_5	mg O_2/l	2.4	5	12.3	10.1	7.45
DCO	MgO_2/l	39	39.6	36	37.4	38
MES à 105°c	mg/l	4.3	4	8.5	1.6	4.6
N-NO_3	mg/l	-	-	-	-	-
N total	mg/l	-	-	-	-	-

2. Results and Discussion

In site 1, before irrigation, soil is mainly alkaline at 0.20 m depth, whereas in the west side, soil becomes strongly alkaline. For 0, 40m depth, soil is slightly alkaline in the central and east side but southwest and North small part of the plot is highly alkaline soil and the rest is alkaline soil. At the same site (1) to 0.20 m depth and after an irrigation event is recorded a high change soil class (Fig 2-a) in the centre and north side and south-west and small part southeast soil has become highly alkaline, and a small part in the northeaster side remains slightly alkaline and north western side and south the soil is alkaline. At 0.40m depth after an irrigation episode, same trend of rapid change is observed for pH.
In Site 2 before irrigation to 0.20 m in the North East to the south-east side, soils are unsalted, while in the North-west side to the south -West, a slight concentration of soluble salts is observed. In the north-west of the plot the soil is salty. At 0.40m depth, the variability of electrical conductivity in the different depth is nearly stationary; indicating the same distributions of the concentrations of salts in listed fourths of the plot.After an irrigation event, there is a CE class change for the 0.20m depth (Fig 2-b), North- West side to the north-east side and a small part of the South side soil became salty, the southwest side in the

Southeast and Northeast soil became slightly salty. In a small part in the centre is the soil is unsalted.

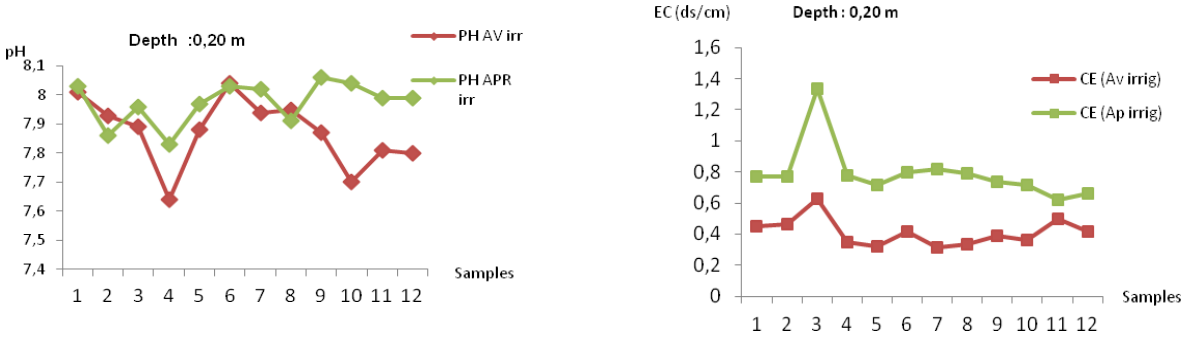
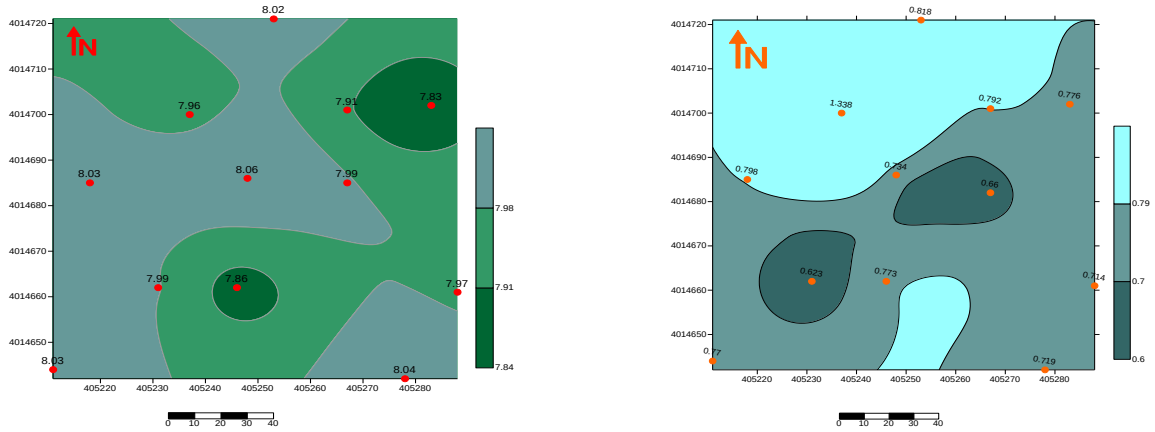


Figure 1. Graphic representation, of pH and EC on 0,2 m depth.



(a) **(b)**

Figure 2. pH (a) and EC (b) maps of site N° 2 after irrigation (soil irrigated by purified wasterwater)

3. Conclusion

Geostatistical analysis and soil mapping of the two plots, it was found that the risk of soil salinity is present with a rate of increase may be up to 0.5 ds / m after each watering. In a normal agropedological context, the spatial and temporal variability of soil Stalinization and recorded total calcium levels should be taken seriously. More generally, it is important to note that careful monitoring of discharges from wastewater treatment plants of Ain Defla should be applied immediately. Attention should be to the impacts (health and environmental) of a possible accumulation of persistent contaminants in the soil after prolonged irrigation.

Furthermore, this study includes a minimum follow-up of the impact of reuse of PWW for unsupervised irrigation on some physicochemical parameters of the soil, while it is absolutely inevitable to follow the contamination by heavy metals that are very dangerous. This assessment should be renewed every 3 years to verify the absence of drift or possible toxic accumulation in soils. This frequency may be increased depending on the size of the device reuse of purified wastewater or sensitivity of crops.

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