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Research Article

Evaluation of the effect of the magnetic apparatus on the water, the plant and the state of the soil

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Abstract

Magnetic devices are nowadays used in different fields. Primarily, these devices have an effect on the environment: water, plant and soil. The experimental tests carried out showed a significance of the treatment of water by the magnetization technique. The effect of the magnetic device is illustrated by the increase of cucumber and melon yield respectively 25% and 27%; Thus, an improvement in the state of the soil is recorded by reducing its compaction.

Keywords: *Magnetic, state of soil, yield, Resistance of penetration, water.*

1. Introduction

The impact of climate change, increased prevalence of drought and population growth are the main factors limiting agricultural production. To prevent food security in arid and semi-arid zones from being subjected to the vagaries of the climate, optimal water and soil management are essential. To address this problem, research therefore focuses on innovation that can improve efficiency, promote equity and protect the environment.

A new technology, based on a physical treatment of water by a magnetic field, can constitute a solution of recourse allowing the valorization of the soil and water resources and to improve the production of the crop since a good supply of water and fertilizers are provided.

The aim of this study is to evaluate and fully understand the effects of the newly introduced magnetism technology in Tunisia on the physical parameters of the soil on the one hand and on plant parameters on the other hand (Ben Amor *et al*., 2016).

Thus, researchers have shown that the magnetic apparatus changes the quality of water and increases crop yield (Ben Amor *et al*., 2018; Cheikh *et al*., 2018; Elaoud *ets al*., 2016).

Water magnetic, as called by some, is a water that has passed through a magnetic field. Magnetic devices for magnetic water treatment or water softener are respectful to the environment, cost competitive and no energy needs (Hozyan and Qados 2010). In the literature (Alimi *et al*., 2006), wall treatment is the most developed. However, little research are oriented towards the improvement of the characteristics of the magnetic machine and the optimization of the parameters for a treatment against the salinity of irrigation water.

Thus, the magnetized water used for irrigation can improve the productivity of water (Maheshwari and Grewal, 2009), thus retaining the water supply for the future in the light of the world expected water shortage.

In this context, our topic arises in order to study the characteristics related to the magnetic machine and the variation of water characteristics, plant yield and soil state.

2. Materials and methods

2.1 Site of experiences and process

The study plot is located in Nabeul-Tunisia with a clay sand soil (21% clay, 6.9 loam and 72.1% sand).

The plot is split into two parts, one considered as irrigated control with irrigation water and the other irrigated with magnetized irrigation water where the magnetizer is placed directly on the main pipe.

The salinity of irrigation water used in this experiment was about 2.5 g/l. The experiment was carried out in complete random block device with three repetitions. In each block, 100 plants were distributed randomly with 2.2 per m^2 planting density. In this work, a part is treated (magnetized water) and a part control light (raw water).

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Culture

The yields of cucumber and melon were studied.

2.2 Apparatus and experimental device

Magnetic device

The device used is brand Delta Water with a magnetic field strength of 3400Gauss (fig. 1).

Fig.1 Magnetic device

2.3 Soil characterization parameters

Resistance to penetration

Resistance to penetration is a physical parameter that allows knowing the state of a soil. It is measured in situ using a penetrometer (Fig. 2) whose handling is the depression into the ground of the device that records every centimeter runs a force value.

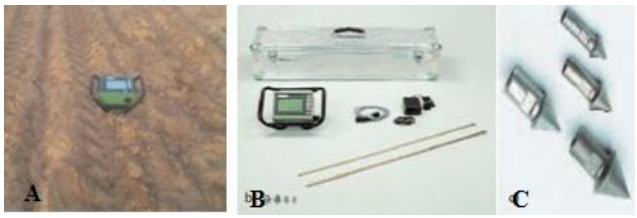

Fig.2 Penetrometer

A: Measuring device, B: Accessories, C: Tapered tips

3. Results and discussion

3.1 Evaluation of yield and plant height.

These tests demonstrated the favorable effect on soil physical parameters such as a decrease in resistance to soil penetration at the irrigated plot with magnetized water and growth and the yield in terms of quantity. The results indicated an acceleration of the growth rate during the early stages. They also showed a relevant development of leaf potential. This method is designed to increase the yield cucumber and melon respectively 25% and 27%.

This is consistent with the results of (Taimourya *et al*, 2015; Elaoud *et al*., 2016; Ben Amor *et al*., 2018) which showed that irrigation with magnetized water resulted in an increase of the yield respectively of Cabbage, Melon and Potato.

The height of the plant reached 48 cm (Fig. 3) for the sample irrigated with magnetized water while it was recorded that 40 cm for the sample irrigated with untreated water. The height of the plant reached 49 cm (Fig. 3) for the sample irrigated with magnetized water in the disc, and only 42 cm was recorded for the sample irrigated with untreated water.

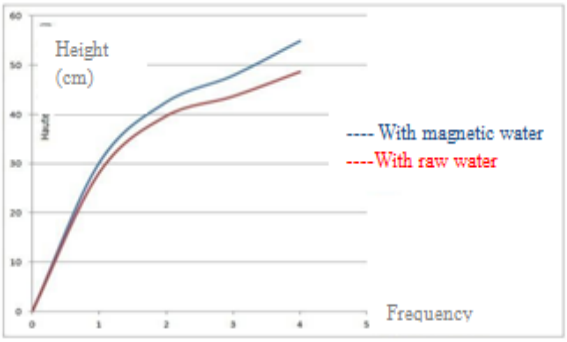

Fig.3 Measuring the height of the plant

3.2 Soil state

In this part, we study the state of irrigated soil with raw water and other irrigated with magnetized water. The measure of the resistance to the penetration of the soil is the indicator of its state.

At the 10 cm horizon, the penetration resistance at the level of the irrigated plot with untreated water is 1.5N/cm², whereas the resistance measured at the level of the irrigated plot with magnetized water 1N/cm² (Fig.4).

Irrigation with magnetized water improves the state of the soil by reducing its compaction.

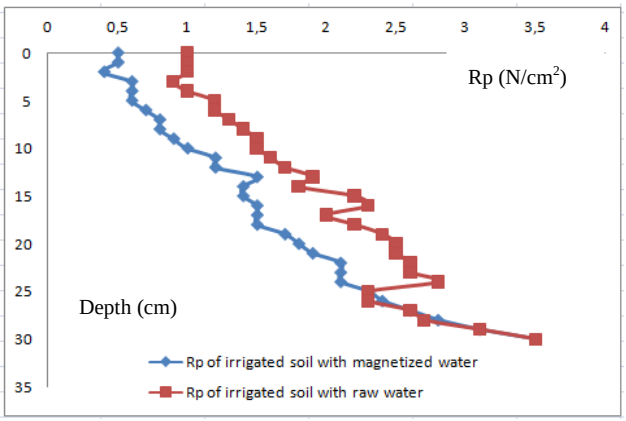

Fig.4 Measure of soil resistance to penetration function of number pas tractor and working conditions

3.2 Statistical analysis

If the calculated F value is greater than the F critical value, there is a real relation between dependent and independent variables. The significance test of regression analysis (F-test) is performed according to the standard procedure.

This test follows an F-distribution with degree of freedom (d.o.f) ν1=3 and ν2=56 for magnetized water. Also, the experience are significant were F calculated (F = 695.485276)>critical value F (2.8379E-4).

Conclusions

The physical treatment of water by a static magnetic field improves the structural condition of the soil and the plant growth with a significant gain in production and yield. This affordable technology paves the way for specific treatments using the magnetic properties of water, which requires further investigations. The direct effects of magnetic technology on both soil and plant variants should also be better understood using statistical analysis through which correlations between the different parameters could be observed.

Acknowledgment

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