2531 THE USE OF TREATED WASTEWATER FOR CHEMLALI OLIVE TREE IRRIGATION: EFFECTS ON SOIL PROPERTIES, GROWTH AND OIL QUALITY

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Olive tree (*Olea europaea* L.) cultivation, the major tree crops in Mediterranean countries is being extended to irrigated lands. However, the limited water availability, the severe climatic conditions and the increased need for good water quality for urban and industrial sector uses are leading to the urgent use of less water qualities (brackish water and recycled wastewater) for olive tree irrigation. The aim of this work was to assess the effects of long term irrigation with treated waste water (TWW) on the soil chemical properties, on olive tree growth and on oil quality characteristics. The trial was carried out, during two crop seasons, on the Chemlali olive tree, characterizing the landscape of the south of Tunisia (34° 43N, 10° 41E). Eighteen year- old- olive tree, spaced 24 x 24 m, were used in a randomized complete block design with two different treatments: irrigation with well water and with wastewater. Each treatment consisted of 20 trees, with four replications of 5 trees each. All the plants were irrigated with the same amount of water (4000 m^3 ha^{-1} $year^{-1}$) and subjected to the same fertilization and common olive cultivation practices applied in Sfax area. Soil samples were characterized before and after irrigation. Olive tree growth, yield and oil quality were measured every year. Irrigation with TWW caused a slight decrease in plant growth and yield. This reduction was associated with higher accumulation of toxic salts in soil. On the other hand, it improved the available nutrients such as K and P. The same results showed that irrigation with TWW did not affect oil quality indexes (free acidity, specific ultraviolet absorbance K232 and K270). The mean values of these parameters are lower than the upper limits established for the best commercial olive oil quality designated as "extra virgin". However, a significant increase of palmitic, palmitoleic, linoleic, linolenic and stearic acid contents was found. In contrast, a decrease of oleic acid and polyphenol content was observed at the end of the experimental period.

2556 SOIL AMENDEMENT WITH OLIVE MILL WASTEWATER: IMPACT OF STORAGE BEFORE SPREADING

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The olive oil production performed by the traditional three-phase process generates considerable amounts of olive mill wastewater (OMW) that is a liquid effluent, red to darkcoloured depending on its level of oxidation. OMW is well known for the ecological problems it causes owing to the highly toxic polyphenolic compounds it contains.
A two-phase process has been adopted by some countries particularly Spain to avoid its production, but the three-phase system remains the dominant technology in the other countries especially in the southern part of the Mediterranean basin and there is no sign that this should change in the short term. Beyond other factors, this is probably due to the fact that the waste generated by the two-phase process and which is called "alpeorujo" (mixture of olive cake and OMW) also requires an adequate disposal and as a consequence does not really solve the problem.
Generally, freshly produced OMW (FOMW) is stored outdoor, in evaporation ponds, in an attempt to reduce its volume, after what it is widely released in soil. During storage, FOMW is subjected to auto-oxidation, after which occur a condensation of simple phenolic compounds in polymers of high molecular weight, responsible for the black colour of oxidized OMW (OOMW). Resulting black-stored OMW is theoretically less toxic than FOMW but also less biodegradable.
In this study, variable proportions of FOMW and OOMW (prepared in the lab from the same FOMW) were added to a sample of soil distributed in several plastic containers. The soil was selected to be representative of an important olive oil production area of Tunisia. Biological and chemical analyses were realised, so that biodegradability of fresh and stored OMW in soil, and effects of each kind of effluent, on soil microflora, could be settled. It appeared that OOMW greatly reduced the total number of aerobic bacteria and fungi that could be recovered from the soil by plate count. On the contrary, these numbers remained stable or even increased when the soil was amended with FOMW. In the same way, while soil respiration was doped for each dose of FOMW added, it was completely inhibited by the same dose of OOMW. The polyphenolic compounds of the soil were extracted immediately after OMW amendment and after 3 months of incubation and their molecular mass distribution was determined by filtration on Sephadex G-50 gel. It appeared that for the soils amended with FOMW, the permeation profile had shifted towards molecules of lower molecular weight whereas this was much less evident in the case of OOMW suggesting that the polymeric compounds present in OOMW were less biodegradable by the soil microorganisms than those of FOMW. These results suggest that in order to avoid any negative impact on soil microbial activity and on the contrary to favour the degradation of polyphenols, it should be recommended to perform OMW spreading at the same time it is produced or if this is not possible to avoid contact with air during storage. This could be obtained by storing OMW in closed vessels under vacuum or under an atmosphere of inert gas.

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