

Valorization of treated wastewater in high saline and waterlogging soil by agroforestry species

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The increasing scarcity of water and the rapid population growth in urban areas require the use of non-conventional water and appropriate management practices. Treated wastewater (TWW) is considered as an additional water resource especially in arid and semi-arid countries. In Tunisia, the use of TWW is part of a national strategy to mobilize and use the water resources. It contributes to the protection of the environment, the sustainability of agricultural production, it saves water and facilitates the expansion of irrigated areas. It also contributes to the reduction of saline water intrusion in coastal areas through groundwater recharge. In addition, the reuse of TWW for irrigation provides nutrients, reduces the total needs of chemical fertilizers and thus increases the income of the farmers. In Tunisia, 110 treatment plants (WWTP) produced 243 Mm³ of wastewater. However, only a small fraction (about 24%) is reused for the agricultural irrigation, the rest is released into natural environment (sea, sebkhas and rivers). It is therefore important to find other possibilities for the reuse of TWW in irrigation. One alternative is the irrigation of forest species. Thus, the main objective of this study is to test the suitability of TWW for agroforestry. The reuse of TWW started in 2012. We irrigated six forest trees species growing on a saline soil affected by a shallow saline water table and covered with halophytes. The parcel is located close to the WWTP of the village of Kalaât Landelous (30 km North of Tunis City, semi-arid region, 450 mm of rain/year, close to the Mediterranean Sea). Because the parcel is located on the area affected by a shallow and

saline water table, the soil was lifted about 1 m above the surface. The forest trees species tested are *Eucalyptus gomphocephala*, *Atriplex nummularia*, *Acacia cyanophyllia*, *Casuarina glauca*, *Pinus halepensis* and *Cupressus sempervirens*. The TWW used for irrigation is basic (pH =8.3) with a moderate salinity (EC = 4.1dS/m). The content of metallic traces elements (MTE) allows the reuse of TWW in agriculture according to the the Tunisian standard (NT 106.03). After 4 years of irrigation with TWW, we observed a decrease of soil salinity from 22.1dS/m to 16.2 dS/m in the surface layer (0-30 cm). The MTE of the soil was very low. The water table was characterized by a basic pH (7.5) and a high salinity exceeding 90 dS/m. The water contains essentially sodium and chloride, and its MTE concentration did not exceed the Tunisian Standard for TWW (TN106.02). Besides the soil reclamation caused by under rain and irrigation with TWW, another positive effect is observed on plants which depends on the species *Atriplex nummularia* was as the most tolerant and *Pinus halepensis* the most sensitive species to hydro-pedological conditions. The parameters analysed were: morphological criteria (high and diameter) of the plants, mineral composition of the leafs and root distribution, concentrations of salt and heavy metals in leaves and roots, mortality and morphological and anatomical changes. The preliminary results show significant differences between forest species.