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RESTORING SOIL ECOSYSTEMS AND BIOMASS PRODUCTION OF ARUNDO DONAX L. UNDER MICROBIAL COMMUNITIES-DEPLETED SOIL

T. Alshaal & É. Domokos-Szabolcsy & L. Márton & M. Czakó & J. Kátai & P. Balogh & N. Elhawat & **H. El-Ramady** & A. Gerőcs & M. Fári

Department of Soil Science, Faculty of Agriculture, University of Kafr el-Sheikh, Kafr el-Sheikh, Egypt

ABSTRACT

In recent years, giant reed (Arundo donax L) has received considerable attention as a promising plant for energy production. Giant reed is able to grow in a range of environments, including wetlands and marginal soils, and has shown promise in phytoremediation efforts. A pot experiment was carried out to investigate the ability of giant reed to restore ecosystems of different soils, including bauxite-derived red mud-amended soil and pure red mud (red mud—a waste generated by the Bayer process in the aluminum industry—is strongly alkaline and has a high salt content and electrical conductivity (EC) dominated by sodium). Samples were exposed to high temperatures, which simulate the effects of bushfires. Selected soil properties that were measured included soil dehydrogenase, alkaline phosphatase, urease and catalase activities, soil organic carbon, soil pH, EC, available soil macronutrients NPK, and above- and below-ground plant biomass yield. The results showed that giant reed reduced EC in all autoclaved soils and red mud-contaminated soils by 24–82 %. Significantly, available N was increased, and a slight increase was recorded for available K. The presence of giant reed enhanced the soils' enzyme activities to recover in all tested autoclaved soils and red mud-contaminated soils; specifically, dehydrogenase activity increased by 262 and 705 % in nonautoclaved and autoclaved soils, respectively, and urease and catalase activities increased by 591 and 385 % in autoclaved soils, respectively. Total bacterial and fungal counts were higher in autoclaved soils than non-autoclaved soils after cultivating giant reed for 12 weeks. Autoclaved soils enabled higher biomass production for giant reed than non-autoclaved soils. These results demonstrate that giant reed is not only able to survive on soil that has lost its microbial community as a result of heat, but can also yield significant amounts of biomass while assisting recovering soil ecosystems after bushfires.