Soil Functional Ability for groundwater recharge related with Land Use and Tillage system in a dry Mediterranean climate, southern Portugal

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Groundwater has capacities like storing, filtering and transforming, which allows regulates atmospheric, hydrological and nutrient cycles. For agronomists, groundwater recharge is defined as the quantity of freshwater derived from precipitation that infiltrates vertically downward from the land surface to below the root zone. At this point the water may move laterally to discharge in streams or downward to enter an aquifer. Fresh water sustains biomass growth in terrestrial ecosystems, and provides key ecological services that supports biodiversity, sequesters carbon and combats desertification. On the other hand, soils provide us services like give clean water and abundant crops. To do this, soils plays there function of "regulator" distributing water for the recharge of groundwater and for the use by plants and animals, regulating the drainage, flow and storing water. Soil functions are difficult to measure directly, so they are usually assessed by measuring soil quality indicators. The soil functional ability to provide groundwater recharge is dependent on the water flowing within soils, under natural conditions or ones affected by its exploitation. Thus Soil Functional Ability to recharge groundwater (SFAgr) and Land use are essential to study the environmental sustainability and agricultural production capability once groundwater is a key component of a healthy watershed. But it is necessary pay attention to the Tillage System and not only to Land Use because the same Land Use can be related with more or less soil mobilizations and that have a great influence on soil structure and its hydrological skills. The purpose of this study was to investigate the relationship between Soil Functional Ability for groundwater recharge (SFAgr), different Land Uses and different Tillage Systems in a Dry Mediterranean climate in Alentejo, Portugal. This will be achieved by building a SFAgr, generated with combination of four properties related to water infiltration and percolation into the soil: depth; bulk density; saturated hydraulic conductivity; and drainable porosity. The saturated hydraulic conductivity was calculated by an indirect method based on texture and drainable porosity was also calculated by an indirect method though the difference between total porosity and field capacity. Each unit Soil/ Land Use/ Tillage System was analyzed in several identical units within the same catchment. When comparing SFAgr for different Land

Uses and different soils, the results show a higher dependency of the groundwater recharge ability on Soil properties than on Land Use. The highest influences on SFAgr were bulk density and saturated hydraulic conductivity and the smallers were depth and drainage porosity. Better situations are where soils have bulk density rounding 1,2 covered by Cork/Holm Oak (50%) + Pasture and the worst situation are soils with bulk density greater than 1,5 even with Cork/Holm Oak (30%) + Pasture. When comparing SFAgr only for Annual Crops at same soils but having different Tillage Systems, the results showed that in both soils studied, the SFAgr was highest when Tillage System was a conservation one than when was a traditional system. The conclusions of this study for a Dry Mediterranean Climate are: 1 – Land Use influences the Soil Functional Ability to recharge groundwater, but more important than Land Use itself is the Tillage System used; 2- Tillage Systems associated with Conservation Agriculture more specifically No Tillage Systems provide better ability to recharge groundwater in clayey soils; 3 - The more years a system of No Tillage is practiced the higher Soil Functional Ability to Groundwater Recharge is expected in clayey soils.

Keywords: groundwater recharge; tillage system; land use; soil functional ability

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