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Impact of land use on soil physicochemical properties in the semiarid climate zone in Benin (West Africa)

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Abstract

In Benin, a West African country, land and soil degradation affect the livelihood of the local population mainly in the semiarid climate zone where intensive cash crop production is the dominant land use. Natural vegetation with non-degraded soils may provide a benchmark to evaluate the status of soil degradation in different cropping systems. In the present study we therefore compared topsoil at 0–10 cm depth from different food crops (cereals and legumes) and cash crops (cotton) with natural vegetation (woodland) for differences in physicochemical soil properties such as particle size distribution, bulk density, pH, electrical conductivity (EC), water stable aggregates (WSA), water holding capacity (WHC), total soil nitrogen (N), soil organic carbon (SOC) and total soil sulfur. The findings revealed no significant differences between land use in the physicochemical properties except for bulk density (BD) which was significantly higher in cropped fields (1.44 ± 0.01 – 1.58 ± 0.02) except for cotton (1.34 ± 0.01) and peanut (1.35 ± 0.02), compared to woodland (1.40 ± 0.02). The C/N ratio was significantly lower in cropped fields (7.06 ± 4.05 – 11.14 ± 1.47) than in woodland (14.54 ± 2.91). The pH (H₂O) of the cropped fields was mildly acidic (6.22 ± 0.10 – 6.55 ± 0.22) as compared to woodland (7.14 ± 0.78) except for sorghum-millet fields (7.20 ± 0.41). The EC and WSA were low in crops fields particularly the cotton fields (18.63 ± 0.52 μ S/cm for EC and 68.70 ± 0.61 % for WSA) compared to woodland (56.30 ± 46.53 μ s/cm for EC and 89.95 ± 7.60 % for WSA). WHC was higher in crop fields (28.77 ± 2.97 – 32.20 ± 0.84 %) except cotton (27.47 ± 0.83 %) compared to woodland (28.71 ± 2.93 %). Total N and SOC were low in crop fields particularly in peanut fields.

Keywords: Cotton, ferruginous soils, land use, soil degradation, West Africa