



Crop water use efficiency following biochar application on maize cropping systems on sandy soils of tropical semiarid eastern Indonesia

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Abstract

A field study was conducted to evaluate the effect of biochar on crop water use efficiency under three consecutive maize cropping system on sandy loam of Lombok, eastern Indonesia from December 2010 to October 2011. The treatments tested were: coconut shell- biochar (CSB), cattle dung-biochar (CDB), cattle manure applied at only early first crop (CM1) and cattle manure applied at every planting time (CM2) and no organic amendment as the control. Evaluation after the end of third maize, the application of organic amendments (biochar and cattle manure) slightly altered the pore size distribution resulting changes in water retention and the available water capacity. The available water capacity was relatively comparable between biochar treated soils ($0.206 \text{ cm}^3 \text{ cm}^{-3}$) and soil treated with cattle manure applied at every planting time ($0.220 \text{ cm}^3 \text{ cm}^{-3}$). Water use efficiency (WUE) of maize under biochars were 9.44 kg/mm (CSB) and 9.24 kg/mm (CDB) while WUE for CM1 and CM2 were 8.54 and 9.97 kg/mm respectively, and control was 8.08 kg/mm . Thus, biochars as well as cattle manure applied at every planting time improved water use efficiency by 16.83% and 23.39% respectively compared to control. Overall, this study confirms that biochar and cattle manure are both valuable amendments for improving water use efficiency and to sustain maize production in the sandy loam soils of semiarid North Lombok, eastern Indonesia. However, unlike biochar, in order to maintain its positive effect, cattle manure should be applied at every planting time, and this makes cattle manure application more costly.

Keywords: Biochar, organic management, cattle manure, water retention, maize yield