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Influence of biochar and terra preta substrates on wettability and erodibility of soils

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Biochar (BC) and terra preta substrates (TPS) have recently been promoted as soil amendments suitable for soil stabilization, soil amelioration and long-term carbon sequestration. BC is a carbon-enriched substance produced by thermal decomposition of organic material. TPS is composed of liquid and solid organic matter, including BC, altered by acid-lactic fermentation. Their effect on wettability, soil erodibility and nutrient discharge through overland flow was studied by laboratory experiments. At water contents between 0 and 100% BC is water repellent, while TPS changes from a wettable into a repellent state. The 5 and 10 vol % mixtures of BC and 10 and 20 vol% mixtures of TPS with sand remain mainly wettable during drying but repellency maxima are shifted to higher water contents with respect to pure sand and are mainly of subcritical nature. The runoff response was dominated by infiltration properties of the substrates rather than their wettability.Only one mixtures (20% TPS) produced more runoff than sandy-loamy soil on a 15% slope at an intensity of 25 mm•h-1. The 10% BC decreased runoff by up to 40%. At higher rainfall intensities (45 and 55 mm•h-1) the 10% TPS7 was up to 35% less erodible than 10% BC. Despite the TPS containing more nutrients, nutrient discharge varied between types of nutrients, slopes, rainfall intensities and mixtures. The application of a 1 cm layer onto the soil surface instead of 10% mixtures is not recommended due to high nutrient concentrations in the runoff and the wettability of pure substrates. The usage of 10% BC in lowland areas with low frequency and low-intensity precipitation and 10% TPS7 in areas with higher rainfall intensities appears to be appropriate and commendable according to current results. However, together with reversibility of repellency, it needs to undergo further examination in the field under different environmental and land use conditions

Key words: biochar, terra preta substrate, wettability, erodibility, nutrient discharge