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## Addition of Biochar and Clay Increase the Nutrient Retention of a Tropical Arenosol

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### Abstract

Arenosol is one of the main soil types in the Itaparica region, located in the semi-arid northeast of Brazil. This sandy soil typically has low nutrient content and limited capacity to retain water and nutrients. Our overall goal is to contribute to food safety in the region by using locally available and inexpensive materials that serve as long-term amendments to improve the fertility of Arenosols. We tested locally produced pyrolyzed biochar, made of feedstock of the invasive tree *Prosopis juliflora*, and a clayey lake sediment on the laboratory and field scale for their ability to increase the retention of nutrients.

Both materials were mixed into the Arenosol. In batch experiments according to OECD 106 the sorption capacities of nitrate, ammonium, phosphorous and potassium were investigated for different Arenosol-biochar, respectively Arenosol-clay ratios. In a field trial planting holes with an untreated control, 5% biochar, respectively 10% clay share (each v/v) were established, each of them in an unfertilised variant and another variant fertilised with mineral NPK. The native tree species *Spondias tuberosa Arruda* was planted in all holes. The nutrient leaching out of the planting holes in 70 cm depth within an eight month period was quantified by self-integrating accumulators (SIA).

Our results show that biochar increases the sorption capacity of nitrate and, consequently, reduces the leaching of nitrate in the field, whereas clay has no influence on nitrate retention. Both materials lead to a slight increase of ammonium sorption. Biochar also slightly increases the sorption of phosphorous, whereas clay has a marginal higher potential to sorb phosphorous. Clay strongly increases potassium sorption, in contrast to biochar, which releases a high amount of water soluble potassium. According to these results we conclude that biochar and clay have the potential to increase the retention of the tested nutrients and therefore can meliorate the fertility of an Arenosol. We also assume that the application of a mixture of both materials would result in an even higher increase of the nutrient retention capacity. To prove this assumption further experiments are needed.

**Keywords:** Brazil, leaching, NPK, soil amendment, soil fertility, sorption