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Composts with and without wood ash admixture for the management of tropical acid soils: chemical, physical and microbiological effects

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Acid soils generally found in the tropics have a low pH, are poor in organic matter, deficient in Ca2+, Mg+, P, or Mo ; limited in mineralization, nitrification, nodulation, and mycorrhizal infection , suffer from Al or Mn toxicity. Within the framework aiming at using organic wastes and wood ash to overcome soil infertility in tropical acidic soils, a green house experiment was conducted with two acid soils collected from Cameroon (Ferralsol and Acrisol) and amended with three types of compost 3:1(W/W) containing 0 (K0), 8(K8) and 16% (K16) wood ash admixture respectively for two consecutive cycles of 100 days, during which soybean (Glycine max) was grown on the first, the second cycle was left as fallow. Generally the same trends of variation of the physico-chemical parameters were observed in both soils. Addition of organic wastes increased the pH electrical conductivity, soil organic matter, water holding capacity, total Carbone and total nitrogen as compared to the controls. The rate of nitrification highly increased posing the problem of possible leaching of nitrates in the ground water. The cations and micronutrients content followed the same trends. These changes leaded to an increase of the P availability and a decrease of Al toxicity. At the end of the second cycle, generally most of the different parameters slightly decreased except for the electrical conductivity. All composts passed a toxicity test, and the amended soils had significant better fresh and dried plant biomass, the Total nitrogen also significantly increased. Amended soils with K0 generally performed better than those amended with K8 and K16, thinking that their pH (closer to the neutrality) was responsible of these performances, all the parameters were significantly correlated to the pH. K8 and K16 performances could be performed by reducing the added quantities. The study of PCR-DGGE have shown a shift in the fungal and bacterial communities, Ammonia oxidizing bacteria community were more diversify, explaining the high level of mineralization in the amended soils compared to the control. Composts with ash admixture induced similar shifts in these communities. All the used composts enhanced utilisation of all carbon sources (polymers, carboxylic and amino acids, alcohol, and carbohydrates) in a MicroResp® assay.
Use of organic wastes and wood ash is an ecological and efficient alternative to overcome soil acidity for resources poor farmers, unable to afford the high price of lime and chemical fertilisers which are sometimes held responsible of the soil fertility decline.

Key words: Compost, wood ash, acidic soils, Al toxicity, P availability