

Acid Soils Nitrogen Leaching and Buffering Capacity Mitigation Using Charcoal and Sago Bark Ash

ABSTRACT

Soil acidity compromises agricultural output in tropical acid soils. Highly weathered tropical acidic soils are characterized by low pH, organic matter, nutrient availability, but high aluminium and iron concentration. Hence, N availability becomes a limiting factor in such soils. To this end, these leaching and pH buffering capacity studies were conducted to determine the effects of co-application of charcoal and sago bark ash on the N leaching or retention and pH buffering capacity of acid soils. The soil leaching experiment was conducted for 30 days by spraying distilled water to each container with soil such that the leachates were collected for analysis. The rate of urea used was fixed at 100% of the recommended rate. The rates of charcoal and sago bark ash were varied by 25%, 50%, 75%, and 100%, respectively, of the recommended rates. The pH buffering capacity was calculated as the negative reciprocal of the slope of the linear regression. The leaching study revealed that the combined use of charcoal, sago bark ash, and urea does not only reduce leaching of NH_4^+ and NO_3^- but the approach also improves soil pH, total C, and soil exchangeable NH_4^+ . This effect is related to the fact that the sago bark ash deprotonates the functional groups of charcoal because of its neutralizing components such as Ca, Mg, Na, and K ions. As a result, the combined use of charcoal and sago bark ash was able to retain NH_4^+ in the soil. The carbonates in the sago bark ash and functional groups of charcoal improve pH buffering capacity. Thus, the combined use of charcoal and sago bark ash improved soil exchangeable NH_4^+ , soil pH, and soil total C, but reduced exchangeable acidity and amount of NH_4^+ leached out from soil. This study will be further evaluated in a pot trial to confirm the results of the present findings.