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Effects of Different Plant and Residue-Derived Ashes on Ameliorating Soil Acidity in Paddy Soils of the Low Country Wet Zone, Sri Lanka

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Soil acidity is a major constraint limiting paddy productivity in the Low Country Wet Zone (LCWZ) of Sri Lanka, while the high cost and limited availability of conventional liming materials such as dolomite restrict their use among farmers. Although wood ash has long been recognized as a liming agent, comparative information on the effectiveness of locally available plant and residue-derived ashes compared with dolomite remains limited. Therefore, this study aimed to evaluate the comparative liming effect of different ash sources. An eight-week laboratory incubation experiment was conducted using acidic paddy soil collected from the Regional Rice Research and Development Centre, Bombuwela, Sri Lanka. Treatments were arranged in a Completely Randomized Design with four replicates. Ashes (2 t ha^{-1}) derived from rubber (Hevea brasiliensis), cinnamon (Cinnamomum verum), alstonia (Alstonia macrophylla), and rice husk (Oryza sativa residue) were applied, along with dolomite and an unamended control, with recommended rates of N, P, and K fertilizers (urea – 40 kg/ac, MOP – 44 kg/ac, TSP – 20 kg/ac, respectively) as per Department of Agriculture guidelines. The ashes were produced under open combustion conditions, with recorded pH ranging from 9.5 to 12.9. Soil moisture was maintained at 50% of field capacity, and weekly measurements of pH, EC, available P, exchangeable K, and organic matter (OM) were conducted. All ash treatments significantly ($p < 0.05$) increased soil pH compared to the control, while cinnamon ash exhibited the highest liming efficiency in week 2, raising soil pH from 4.65 to 6.0. However, dolomite-treated soil showed significantly ($p<0.05$) higher pH (5.67) in week 8. Cinnamon ash-amended treatment increased available P (from 4.4 to 17.56 ppm) and exchangeable K (from 17.93 to 258.48 ppm) by week 8. EC values increased in all treatments, with significantly ($p<0.05$) highest EC (278.25 μ S/cm) observed in cinnamon ash-treated soil. Organic matter content improved significantly ($p<0.05$) in rubber (8.8%) and alstonia (8.2%) amended treatments compared to the control. The findings suggest that using locally available cinnamon wood ash could provide an affordable and sustainable alternative to dolomite for ameliorating acidic soils in the LCWZ. Field-scale validation is recommended prior to widespread agricultural adoption.

Keywords: Acidic paddy soils, Ash amendment, Liming effect, Nutrient dynamics