

Characterizing Physiochemical Properties and Nutrient Leaching Behavior of Different Coir-Based Substrate Mixtures

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High production costs, limited resource availability, and the underutilization of byproducts such as short fiber have highlighted the need for more cost-effective coir substrate formulations in Sri Lanka. This study evaluated the physicochemical properties and nutrient leaching behavior of four factory-made coir-based substrate mixtures: A (100% coco peat), B (70% coco peat + 30% coco chips), C (80% coco peat + 20% short fiber), and D (60% coco peat + 30% coco chips + 10% short fiber). All mixtures exhibited bulk densities between 0.057 and 0.064 gcm⁻³, with substrate C showing the highest total porosity (40.79%) and highest water retention at 50 cm suction (0.66 cm³cm⁻³). Substrate B, with its coarse texture, had the lowest water retention (0.28 cm³cm⁻³) and the highest air-filled porosity (40.42%). Substrate C had the highest cation exchange capacity (CEC = 46.24 cmol⁺/kg) and an electrical conductivity (EC) of 1.63 dS/m, within acceptable limits (0.5–2.5 dS m⁻¹). A fertilizer-pulse leaching column experiment assessed nutrient breakthrough via nitrate and phosphate concentrations in successive leachate. Relative concentration (RC = C/C₀) vs. pore volumes (PVs) revealed retention patterns. The substrate B showed early breakthrough (0.10 PVs) and high RCs (0.90 for both NO₃⁻, PO₄³⁻), indicating poor nutrient retention. Whereas substrate C had delayed breakthrough (0.40 PVs NO₃⁻, 0.30 PVs PO₄³⁻) and lower RCs (0.70, 0.60 respectively), reflecting better nutrient retention from finer particles and higher CEC. Meanwhile, Substrate D outperformed B but was inferior to A and C. Incorporating 20% short fiber is promising, but further protected trials are needed to confirm agronomic and economic benefits.

Keywords: Coir-based substrate mixture, Breakthrough curves, Water retention, Short fiber

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