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"Filling gaps and removing traps
for sustainable resource management"

Nitrogen Dynamics from Seasonal and Perennial Legume Residues in Mushinga South-Kivu Eastern, DR Congo

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Abstract

The use of leguminous organic residues in resource-prone smallholder farming systems is widely acknowledged. A central knowledge gap remains, however, to what extent a change of biochemical quality (e.g. similar C/N ratio, different lignin and ([polyphenol+lignin]/N (PP+L/N) ratio) of organic inputs as a result of different legume types shapes nitrogen dynamics in agricultural soils. The aim was thus to assess effect of legume type i.e. differences in biochemical quality of organic inputs, on soil N dynamics during a defined decomposition period. Organic inputs of the perennial legume *Calliandra calothyrsus* (CC) (C/N ratio: 13.80, lignin: 14.86 and PP+L/N: 8.00) *Leucaena leucocephala* (LL) (14.96, 10.63, 6.44) versus seasonal *Phaseolus vulgarus* (PV) (11.80, 8.82, 10.55) (10 ton ha^{-1} dry weight) were incorporated into Ferralsol (soil pH 4.79; TC 3.8; TN 0.35; P 5.5; K 0.12; Ca 5.9; Mg 0.7; Clay 34; %Sand 48; %Silt 18). A control treatment without residues was included. Soil samples were obtained at 15, 45, 75, 105, 165, 255 and 347 days after residue application. Samples were analysed for different N sources, including ammonia (NH_4^+), nitrate (NO_3) and dissolved organic nitrogen (DON). Generally, under residues treatment, increasing NH_4^+ ($p < 0.001$) and NO_3 ($p < 0.01$) contents were observed respectively at the beginning and at the end sampling points. Input type and decomposition time showed a significant interaction for NH_4^+ ($p < 0.001$), which leveled out with decomposition time while NO_3 increased ($p < 0.001$). NO_3 was negatively correlated with soil pH (r=0.5, $p < 0.0001$) and positively correlated with soil moisture (r=0.2, $p < 0.05$). No correlation was found between NH_4^+ with soil pH and soil moisture, similar for DON. The study demonstrated that the N dynamics were influenced by biochemical quality of residues obtained from differently legume types, which was mainly attributed to the increase in NO_3 concentration under seasonal residue (PV), a phenomenon that may have been explained by the low C/N ratio and lignin contents of used residue types. Results showed that changes in biochemical quality of organic inputs is a determinant of soil nitrification and has to be considered when using contrasting organic residues for adapted soil fertility management in resource-prone smallholder agricultural systems.

Keywords: Legume residues, nitrogen dynamic, residue quality

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