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Potential of Short-Term Legume Fallows for Conserving Soil Macrofauna Diversity and Enhancing Maize Productivity in Semi-Deciduous Forest Landscapes, Ivory Coast

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Abstract

It is increasingly admitted that one option to reduce land degradation in humid tropical countries is to adopt sustainable farming practices that conserve belowground biodiversity and enhance crop yields. However, very few field investigations have documented this assertion. A study based on the beneficial effects of 1-year-old improved fallows (*Cajanus cajan*, *Pueraria phaseoloides*) on a subsequent maize crop in degraded agro-ecosystems landscapes in Western Ivory Coast, was designed to assess the relationship between increased crop yield and soil macrofauna abundance and diversity. The methodological approach consisted in (i) a comparative impact of natural and improved fallows on soil chemical properties, soil macro-invertebrates diversity, and maize productivity, and (ii) the modelling of the relationship between maize productivity and soil macro-invertebrates. Results revealed positive impacts of improved fallows on earthworm diversity and species richness, while only soil pH and total phosphorus were significantly increased beneath legume fallows. However no consistent rises were found in maize production apart from slight and marked changes in total biomass and cob production, respectively when improved fallows were pooled as one treatment. Mixed-effect models suggested that improved fallows have beneficial impacts on macrofauna communities, which presence significantly increased maize grain yield and total production. On the other hand, some taxonomic units of soil macrofauna, namely termites, diplopoda, earthworms, diptera larvae, chilopoda, hemiptera were found to be indicator species of legume fallows, with hemiptera being specialist and restricted to *P. phaseoloides*. Overall, results provide more insights into the role of improved fallows in sustaining agricultural production in agro-ecosystems through soil macro-invertebrates. Additionally, the contribution of these organisms in the resilience of agricultural systems is discussed.

Keywords: Biodiversity, improved fallow, indicator species, soil macro-invertebrates, sustainable agriculture