

Nutrient stocks and nutrient cycling of fallows in the humid lowlands of Papua New Guinea

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Shifting agriculture is widely practised in the humid lowlands of Papua New Guinea where each year approximately 200,000 ha of forest, secondary fallow or grassland are cleared for village-based food and cash crop production. The shifting agricultural system in parts of the lowlands consists of a short fallow period (< 3 to 5 y) alternated with a cropping period of about one year. Fallow vegetation is dominated by *Piper aduncum* which invaded from S America, and by *Imperata cylindrica* in areas where bushfires are common. At the end of the fallow period, the vegetation debris is left to dry for some weeks whereafter the woody parts are removed and are mostly used for firewood. Taro (*Colocasia esculenta*) or maize (*Zea mays*) are commonly firstly planted after a fallow period and these are gradually interplanted with sweet potato (*Ipomoea batatas*), which is the major staple in the lowlands, bananas (*Musa* sp.) and sugar cane (*Saccharum* sp.). No information is available on the amount of nutrients cycled in these short fallow shifting cultivation systems.

A series of experiments were conducted on Typic Eutropepts investigating nutrient stocks and cycling under natural (*Piper aduncum*, *Imperata cylindrica*) and improved or managed fallows (*Gliricidia sepium*). Plots were planted with piper, imperata and gliricidia, which were slashed after one year and planted with sweet potato. Litter bags were installed with the planting of sweet potato to quantify (i) the chemical contents and decomposition rates of the fallow vegetation leaves, (ii) nutrient release pattern during decomposition, and (iii) the effects of decomposition on some selected soil chemical and physical soil properties. Large differences were found in the rates of decomposition and nutrient release pattern. Piper leaf litter is a significant and easily decomposable source of K. Gliricidia leaf litter contained much N whereas imperata leaf litter releases relatively little nutrients and keeps the soil more moist. Gliricidia fallows are more attractive than an imperata fallow for it improves the soil fertility and produces additional saleable products.

In addition, plots with piper and imperata were planted and sampled every three months for 23 months to assess above ground biomass and nutrient content. It was found that for the accumulation of biomass and nutrients imperata fallows should not exceed one year. Piper accumulated large amounts of biomass and nutrients, particular K, which is an important nutrient for root crops that dominate the cropping phase in the humid lowlands of Papua New Guinea.

Keywords: nutrient cycling, nutrient accumulation, improved fallows, Papua New Guinea