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Influence of Mango Trees on Soil Fertility in
Intercropping Systems in North-West Vietnam

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Abstract

The limited expansion possibilities of farmland, increasing population, and demand for agricultural products can result in overexploitation of natural resources. Especially in North-West Vietnam, in the mountainous region of Yen Chau, the expansion of agriculture has placed unsuitable land, for example mountains and hillsides, into cultivation. The consequences are soil erosion and degradation of soil fertility parameters such as soil organic carbon (SOC) and nutrients, which then lead to a decline in crop yields. Agriculture on steep slopes is a common practice in Yen Chau district and some local farmers plant mango trees (*Mangifera indica* L.) and maize in intercropping systems at steep slopes. The mango trees bring in extra income from the sale of fruit. Preliminary results have shown that these mango trees are beneficial for soil fertility.

The aim of this study is to describe the effect of mango trees on soil fertility and to quantify the proportion of mango- and maize-derived SOC. With the mango tree as C₃ plant, and maize as C₄ plant, the percentage of C₃ derived SOC close to the trunk, would be higher due to higher production of mango biomass. The relative contributions of C₃- and C₄- derived C was elucidated with isotope measurements of $\delta^{13}\text{C}$. Both, the exchangeable cations and plant available phosphorus in soil were also expected to decrease with increasing distance from the central tree.

Six sites were chosen with 3 trees each for sampling. The chosen sites were similar in soil type and inclination but differed in the age of intercropping system. Samples were taken in distances of 0.5, 2, and 9 m from the trunk in 10 cm increments from 0 to 30 cm depth.

At all mango-maize intercropping fields under the mango trees the SOC stocks were significantly higher by 12.6% and potassium stocks by 77%. The isotopic signals did not change significant with distance from the tree. Under the mango as well as under maize cultivation in 0-10 cm depth higher proportion of C₄ derived C appeared than in 10-20 cm (. P stocks were 51% higher under maize cultivation than under the canopy due to the effect of fertilizer.

Mango-maize intercropping is a better option compared to maize monocropping in terms of nutrient supply and nutrient recycling and C-supplying capacity.