Nutrient Cycling and Safety-net Mechanism in the Tropical Homegardens

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Abstract: Nutrient cycling and safety-net mechanism of tropical homegardens are reviewed here in relation to the same processes reported mainly in alley cropping and other multistrata systems, where comparable. This is because literatures on the nutrient cycling of the homegardens are scarce. Those processes are discussed in view of biodiversity and management practices of the homegardens. Some suggestions are also put forward to better design and management of the homegardens for a higher productivity and sustenance. There are some methodological limitations of using conventional tracer techniques in scrutinizing nutrient flow in the homegardens, which warrants the search of more advanced techniques. It is frequently reported that the biodiversity or species diversity of plants is an important factor for the sustenance of soil fertility in any agroecosystem. Nevertheless, it was noticed in the present review that it is not just the biodiversity, but plant structural diversity that determines efficient nutrient cycling in the homegardens. In general, there is a less diverse faunal community in the homegardens than their original ecosystems, because of the invasion of predatory fauna and changes in the microclimate and food resources. However, the biomass is often higher owing to the colonization by mainly different earthworm species with the favourable soil moisture and increased organic matter turnover. There is a limited adaptability of the alley cropping system in the water-limited tropical agroecosystems, because of the limited scope for spatial differentiation in rooting between trees and crops (i.e., spatial complementarity). In multistrata agroforestry systems like homegardens, it is apparent that there is a signaling system of the root systems for balancing the nutrient uptake through the spatial complementarity and the safety-net mechanism, which seems to depend up on the management practices and possibly climatic factors that modify the resources availability and root activity. This allows extensive applicability of the homegardens in tropics. Tree pruning adversely affects the safety-net role of the hedgerow trees of the alley cropping. However in the homegardens, the pruning of selected trees may not influence the safety-net role due to presence of multistrata root systems of unpruned trees, which constitute multiple safety-nets. In the forested area of the homegardens with a relatively high tree density, below-ground root activities, high litterfall and relatively low nutrient export contribute to a nutrient conservation. In contrast, farming area of the homegardens with a high organic matter turnover and a relatively low tree density does not seem to support to an efficient nutrient cycling. Therefore, plant density should be increased in the farming area with suitable trees having deep and distant root activities for a better safety-net role. In addition, cover crops should be grown in appropriate areas of the homegardens for reducing topsoil nutrient leaching. These additional plantings will provide

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