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The Role of Trees in Homegardens on Soil Nutrient Improvement in Maytemeko Watershed, Northwestern Highlands of Ethiopia

MESERET KASSIE DESTA¹, HERBERT HAGER¹, MONIKA SIEGHARDT¹, BELAYNEH AYELE ANTENEH², DEMEL TEKETAY³

¹University of Natural Resources and Life Sciences (BOKU), Institute of Forest Ecology, Austria

²Bahir Dar University, Dept. of Natural Resources Management, Ethiopia

³Botswana College of Agriculture, Dept. of Crop Science and Production, Botswana

Abstract

Soil nutrient depletion is a major threat of Ethiopian highland soils that causes a decline in productivity, resulting in food insecurity problem in the country. Homegardens are among the most important agroforestry practices since they contain more diverse tree species compared to the open farm plots in Maytemeko watershed. Despite this reality, the influence of different tree species under farmers' traditional farm management level has not been documented in the area. The objective of this study was, therefore, to assess the status of soil nutrients in homegardens under and outside the canopies of different tree species, namely *Croton macrostachyus* Del., *Cordia africana* Lam., *Acacia abyssinica* Hochst. Ex. Benth., *Sesbania sesban* (L.) Merr. and *Eucalyptus camaldulensis* Dehnh. To compare the status of soil total nitrogen (N), organic carbon (OC), cation exchange capacity (CEC) available phosphorus (P) and exchangeable potassium (K^+), a total of 160 composite soil samples were collected from two soil depth classes (0-15 cm and 15-30 cm) at a distance equivalent to two thirds of the canopy radius from the trunk and in areas, which were relatively outside the influence of the tree canopies and root lateral growth. Mean value of all parameters were significantly different ($P < 0.05$) from soil samples collected under and outside the canopies of different tree species. Soil samples collected under the canopy of trees of *C. africana* showed relatively higher OC (32.4 mg g^{-1}) and N contents (3.0 mg g^{-1}) compared with those collected under trees of other species and outside tree canopies. The magnitude of contents of OC and N under soils of trees had the following order: *A. abyssinica* > *C. macrostachyus* > *S. sesban* > *E. camaldulensis*. Soil samples collected outside the canopies of trees exhibited the lowest contents of OC (18.9 mg g^{-1}) and N (2.0 mg g^{-1}). Significant variation in the contents of N and OC was also observed in between soil samples collected from the two depth classes under and outside the canopies of different tree species. Soil samples under trees of *C. africana* also showed the highest P (0.054 mg g^{-1}) and CEC ($16.6 \text{ cmolc kg}^{-1}$). The lowest values of P (0.033 mg g^{-1}) and CEC ($11.7 \text{ cmolc kg}^{-1}$) were found from soil samples collected outside the canopies of trees while the highest value of K^+ was found from soil samples collected under *A. abyssinica*. Generally, soils under tree canopies of homegardens exhibited better nutrient status compared with those outside the canopies of trees.

Keywords: Agroforestry, cation exchange capacity, nitrogen, potassium, phosphorous, tree species