



Tropentag, September 16-18, 2015, Berlin, Germany

“Management of land use systems for enhanced food security:
conflicts, controversies and resolutions”

Soil Properties under Manured *Tamarindus indica* in the Littoral Plain of South-Western Madagascar

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Abstract

This study is part of a research project in the Mahafaly Plateau in south-western Madagascar where measures are investigated to increase cropping system productivity under multiple constraints in order to improve people's livelihoods. In the present study we assessed soil chemical and microbial parameters of soils as indicators for soil fertility from beneath tamarind (*Tamarindus indica* L.) canopies with and without deposited manure to evaluate if agroforestry systems including tamarinds may help to ameliorate soil fertility. More specifically, the effects of tamarind and manure on (1) soil chemical properties, (2) C and N mineralisation, (3) microbial biomass indices (C, N, and fungal ergosterol), (4) microbial residues, i.e. amino sugars, and (5) the germination of sorghum seeds were tested.

In September 2011, soil samples were taken from below (T+) and beside (T0) the canopy of six tamarinds growing in the coastal plain of the Mahafaly Plateau region. Three of the six tamarinds were growing in pasture zones, hence manure has been deposited beside and under these trees (M+). The remaining tamarinds were growing in agricultural fields without manure accumulation (M0).

Soil pH was lower in T+ than in T0, whereas SOC, total N, K, and CEC were about three times and plant available P was about two times higher in T+. Basal respiration was increased nearly threefold, whereas net N mineralisation remained unaffected in T+. However, net N mineralisation was increased by 74% in M+. Contents of microbial biomass C and N, and especially fungal ergosterol, were also higher in T+. The amino sugars muramic acid, galactosamine, and glucosamine were increased threefold in T+. M+ increased the contribution of microbial residue C to SOC from 28% to 41% and of microbial biomass N to total N from 3.5% to 5.6%. The germination of sorghum seeds was not inhibited in T+.

The soils beneath the tamarind canopies show a potential for crop cultivation but further research is necessary to address the possible effects of allelochemicals on crops cultivated under field conditions, the identification of suitable and high-value crop species, and management systems that can be adopted by farmers.

Keywords: Basal respiration, ergosterol, microbial biomass, microbial residues, N mineralisation, SOC