Deutscher Tropentag, October 9-11, 2002, Witzenhausen

"Challenges to Organic Farming and Sustainable Land Use in the Tropics and Subtropics"

Relationships of Soil Microbial Indices in Secondary Tropical Forest Soils

Eric Salamanca, Markus Raubuch, Rainer Georg Jörgensen

University of Kassel, Department of Soil Biology and Plant Nutrition, Germany

Abstract

In Bacnotan, Philippines, soils from six secondary tropical forest sites developed from the same parent material, but differing in the present vegetation, in stand age, and in land use history were investigated. The aim was to assess the effects of these differences on the activity, biomass and community structure of soil microorganisms in the A-horizon. The six sites investigated revealed strong differences in soil organic matter and soil microbiological properties. Although these were all within the range described in the literature, our six tropical forest sites revealed several marked differences to forest soils from a temperate climate. The average ratio of microbial biomass C-to-soil organic C was 2.8 %, exceeding that of microbial biomass N-to-total N of 2.0 %. This means that the average microbial biomass C-to-N ratio of 14.1 exceeded the average soil organic C-to-total N of 10.1. The mean ratios of ergosterol-to-microbial biomass C and ATP-to-microbial biomass C were 0.19 and 4.3 μmol g^{-1}, respectively, both very low. AEC (adenylate energy charge: (ATP + 0.5×ADP) / (ATP + ADP + AMP)) and metabolic quotient qCO_2 reached average levels of 0.71 and 36 (mg CO_2–C d^{-1} g^{-1} biomass), respectively. The different ratios of soil biological and soil chemical properties could be assigned to three different factors by principal component analysis. The ratios soil organic C-to-total N, ergosterol-to-microbial biomass C, and microbial biomass N-to-total N formed the first factor, reflecting a decomposition pathway characterised by fungi. The ratios ATP-to-microbial biomass C, AEC and qCO_2 were combined as second factor, characterising the specific metabolic activity of soil microorganisms. The third factor was loaded by the ratios microbial biomass C-to-soil organic C and microbial biomass C-to-N, characterising soil organic matter availability in relation to nutrient availability.

Keywords: Adenylates, AEC, ATP, basal respiration, biomass N, ergosterol, microbial biomass C

Contact Address: Rainer Georg Jörgensen, University of Kassel, Department of Soil Biology and Plant Nutrition, Nordbahnhofstraße 1a, 37213 Witzenhausen, Germany, e-mail: joerge@wiz.uni-kassel.de