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and

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Water and nutrient fluxes as indicators for the stability of different land use systems on the Terra firme near Manaus

Annual Report 1999

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Abstract

This is the annual report of the SHIFT project "Water and nutrient fluxes as indicators for the stability of different land use systems on the Terra firme near Manaus". The experiments started during the first year of the second phase of this project were continued, such as studies about the effect of trees on soil phosphorus and sulfur availability, dissolved organic nutrients in rainfall, throughfall, stemflow and soil solution. Additionally, we focussed on the effects of cover crops on tree nutrition, soil nutrient and water dynamics. Soil nitrogen and phosphorus uptake was investigated using different N-15 and P-32 tracer experiments. The fate of fertilizer nitrogen was studied with N-15 labelled ammoniumsulfate in plant, soil, soil extracts and soil solution. In laboratory incubations, the effect of leaf quality on decomposition and incorporation of nutrients into soil organic matter was studied as affected by soil microbes and soil fauna.

12) Microbial biomass as affect by litter quality and fertilization on a Xanthic Ferrasol

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The soils of the Brazilian Amazon region are generally poor and acid. Xanthic Ferralsols are the predominant soils on "terra firme" ecosystems in this region. The topsoil organic matter is the main reserve of nutrients in these soils. After conversion of forests to agriculture by use of slash-and-burn soil preparing systems, the organic matter is almost completely destroyed. The restoration of biogeochemical cycles and nutrient fluxes is an important step to improve soil capacity for a sustainable agriculture system. Microbial biomass represents an important compartment of the nutrient fluxes. Therefore, we conducted a laboratory incubation to investigate the effects of litter from different species (*Theobroma grandiflorum*, *Bactris gasipaes*, *Bertholletia excelsa, Bixa orellana* and *Pueraria phaseoloides*) and fertilization with N and P on C, N and P in microbial biomass of the topsoil (0-5 cm) with high organic C contents and of an underlying horizon (10-15 cm) with low organic C contents of a Xanthic Ferralsol.

The soils used in this study were collected from a natural forest area. 150 g of soil were incubated with 246 mg of air-dried leaves or with N or P fertilizer (according to local recommendations) or both using four replicates per treatment. The incubation was conducted in controlled conditions during 78 days. Samples were collected after 15, 36, 50 and 78 days of incubation. The N, P and C in microbial biomass were determined by the fumigation-extraction method. Statistical analyses were done with ANOVA using a completely randomized design.

Results

These preliminary data show that the microbial biomass was influenced by the type of soil (with large or little amounts of C), litter quality and fertilization (Figure 1). In general, the soil from the superficial soil layer had a higher level of C in the microbial biomass. This is expected because this soil had also higher level of soil organic matter. The effects of different litter applications and fertilization depended on soil C, as well. In the topsoil, the microbial biomass was not influenced by litter applications and fertilization. In the soil with little amounts of C, however, the litter application had a significant effect on C in microbial biomass. Soil microbial biomass was highest after application of *Pueraria phaseoloides* plus fertilization with N and P, which even reached values which were not significantly lower than those of the topsoil. The N and P analyses are presently carried out and will present during the workshop.

These preliminary results indicated the large potential of *Pueraria phaseoloides* to increase the microbial biomass and probably to accelerate nutrient fluxes through microbial biomass under very poor soil conditions.

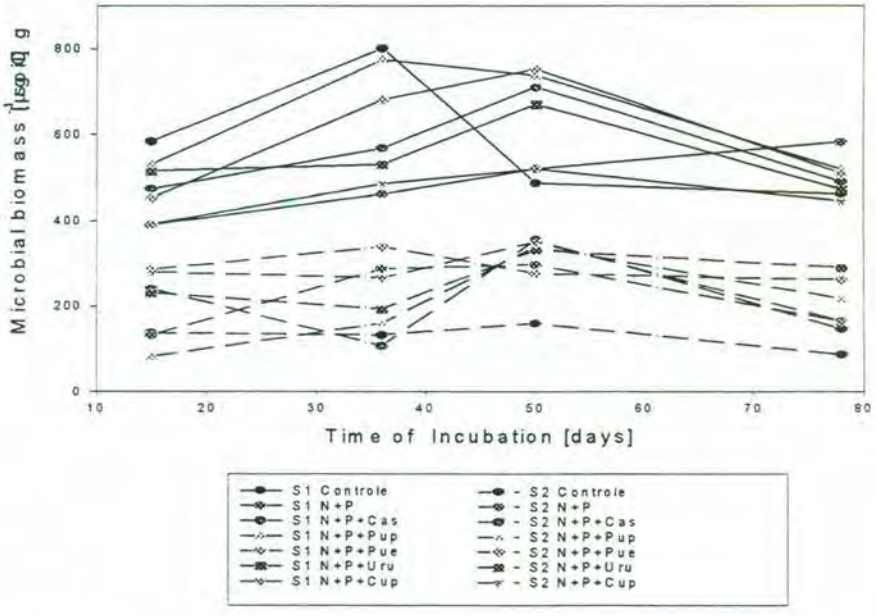

Figure 1 Microbial C in soils with high and low amounts of organic matter affected by litter and N and P applications (n=4).