



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

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

## Changes in Soil Fertility in 25 Years of Sugar Cane Monoculture in Comparison to Natural Ecosystems

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### Abstract

There are growing concerns about the soil fertility when changing natural land into agricultural land. With the objective to determine the long term effects of sugar cane cultivation on the soil fertility, a 25 years investigation was carried out on Vertic Haplustepts soils (0–20; 20–40; 40–60 cm depth) comparing one sugar cane field (conventional agriculture), with natural forest, natural grassland and a field with annual crops. Every year soil samples of the respective plots were analysed regarding organic matter, available P and K content (extraction with H<sub>2</sub>SO<sub>4</sub> 0.1 N), pH (H<sub>2</sub>O), exchangeable cations (extraction with ammonium acetate 1.0 N), bulk density, total porosity, and macro fauna. The sugar cane cultivation resulted in a decrease of the organic matter content (from 2.7 to 2.2%, 0–20 cm) after the 25 years, while the forest showed high and stable values of about 4% during the experimental time. The organic matter content of the grassland was relatively low at the beginning of the study, but increased with time from 2.3 to 2.9%. The pH value increased in the sugar cane plots until undesirable high values of about 8.0, which is related to erosion and the following reduction of the upper soil layer. This brought the CaCO<sub>3</sub> rich layer near to the soil surface. This effect was even more pronounced for annual crop cultivation. The nutrient status of the soil was higher for the field with sugar cane and annual crops because these fields received chemical fertilisers. The sugar cane field showed a lower total porosity (46% in 40–60 cm depth) than the forest (61%) and the grassland (58%). The diversity of the macro fauna (number of taxons and individuals) in the sugar cane field was smaller than in the forest and the grassland but higher than in the field with annual crops which is probably related to the amount of organic residues remaining after the harvest at the fields. This study confirms that land use changes from natural vegetation to sugar cane cultivation can have negative effects on soil fertility.

**Keywords:** Biodiversity, grassland, land use, monoculture, soil fertility, tropical forest