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## Evaluation of Soil Fertility in Monoculture and Successional Agroforestry Land Use Systems for *Citrus Sinensis*, in Alto Beni, Bolivia

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### Abstract

Agroforestry systems as a type of sustainable agriculture are important due to their productive potential and ecosystem services. To maintain soil fertility, preservation of soil organic matter, physical properties and nutrient levels are necessary. The study site is situated in a tropical submountainous rainforest at 600 m.a.s.l in the Alto Beni, Bolivia. For the past 50 years the region was converted into monoculture and agroforestry land use systems based on cocoa, citrus and banana which produce the main income for smallholder farmers.

The field experiment was done as a sampling study during the transition period from dry to rainy season 08/2008 — 01/2009. Seven citrus based systems cultivated for at least 20 years (three agroforestry, two monoculture, one abandoned monoculture, one monoculture in conversion to agroforestry) were selected as treatments and two representative plots of 20 m × 20 m were chosen within each treatment as replicates. For each treatment a soil characterisation was done by soil profile method. To evaluate the nutrient status (C, N, P, K) of the citrus plants four young leaves from three trees per plot were sampled at first flush and three months later. To evaluate the nutrient status of the soil each plot was overlaid by a grid of 5 m × 5 m to determine sampling points for augering from 0–10 cm, 10–30 cm, 30–60 cm depth (nine per plot, then bulked by depth for further analysis). The samples were analysed for bulk density (core), water content (gravimetric), pH, C, N, P-Bray1, K, CEC, electrical conductivity, soil texture. Four littertraps (1 m<sup>2</sup>) per plot were installed to monitor the nutrient recycling by litter. Litter was collected fortnightly from 09/2008–12/2008. Physical and chemical analysis of samples will be completed July 2009.

For both dates the nutrient status of the citrus plants showed no significant differences for C and N. The soils under agroforestry had deeper Ah-horizons and higher humus content but soil texture was not different. The additional contribution of litter from shade trees in the agroforestry systems provided more biomass than in the monoculture for soil organic matter maintenance.

**Keywords:** Leaf nutrient status, litter input, multi-storey cropping, shade trees, sweet orange