Contrasting tree effects on soil P sorption and availability on a Xanthic Ferralsol

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The Ferralsols of the central Amazon are highly weathered and often have low available nutrient contents. Even in fertilized soils available P contents can be low due to high P fixation by oxides. Perennial plants in managed or natural ecosystems may keep P in available form through a rapid P recycling between plant biomass and soil.

The central objective of these work is the investigation of the availability of soil P as affected by two tree species with widely different P return. Two composite soil samples were taken at 0.5 m distance from four individual trees of *Theobroma grandiflorum* and *Bixa orellana* and combined. Soils from trees at three levels of fertilization were collected. The field experiment was replicated three times using a randomized complete block design with a split plot arrangement for species and main plot for level of fertilizer. For a bioassay, soil under the canopy of the same tree species was collected and *Pueraria phaseoloides* was planted in pots in four replicates. Soil P availability was analyzed using Mehlich extraction, adsorption isotherms and sequential extraction according to Hedley.

Phosphorus adsorption did not increase with an exposure longer than 8 hours. Therefore, adsorption isotherms can be done within 8 hours in the studied soils. In general, about 50% of the added P were adsorbed by the soil matrix. The adsorption decreased for soils which received higher amounts of P fertilizer, indicating that adsorption sites were already blocked by previous fertilization. Soils under *Theobroma* adsorbed more of the added P than soils under *Bixa*. This can be explained by the high amounts of organic P which is present in soils under *Bixa* as an effect of high P recycling through litterfall.

The use of the described methodologies for assessing the various forms of P in soil and the P fixing ability was better able to characterize P availability than commonly used soil P analyses. Furthermore, the effects of fertilizer application can be better evaluated. *Bixa* was identified as a tree species which is better able to keep added P fertilizer in available form than *Theobroma*.