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“Development on the margin”

Does Phosphorus Deficiency Aggravate Pasture Degradation in the Forest Margins?

DJANGO HEGGLIN¹, IDUPULAPATI RAO², BERTHA RAMIREZ³, JAIME VELASQUEZ³, EMMANUEL FROSSARD¹, ASTRID OBERSON¹

¹*ETH Zurich, Institute of Agricultural Sciences, Switzerland*

²*International Centre for Tropical Agriculture (CIAT), Colombia*

³*Universidad de la Amazonia, Colombia*

Abstract

Pastures are the main land use throughout the deforested areas in South America including the forest margins of the department of Caquetá, Colombia. Pasture degradation induced severe loss of plant biomass production (PBP) with drastic ecological and economic implications. Highly weathered tropical soils usually have low phosphorus (P) contents, but the importance of P deficiency in pasture degradation has not been well defined. Our objectives were to determine i) whether P availability is lower in degraded pastures compared to productive pastures, and ii) whether the introduction of legumes in the pasture increases P availability through enhanced biological P cycling through plants, plant litter and the soil microbial biomass. An on-farm study was conducted in 2010 on nine farms in the department of Caquetá, Colombia. On every farm three different pasture types were studied: degraded grass alone pastures (GD), productive grass alone pastures (GA) and productive grass legume pastures (GL). Basic soil characteristics and indicators on soil P status, microbial P cycling, PBP, plant litter deposition (PLD) and nutrient concentrations in plant tissue were determined. Degraded grass alone pastures were characterised by significantly higher soil bulk density in the 0–5 cm soil layer and significantly lower soil gravimetric water content, PBP, PLD, soil organic P and basal soil respiration rate than GA. Moreover, per unit soil mass clear trends towards lower total carbon, nitrogen, total P and microbial P and higher Al saturation could be observed in soils of GD compared to GA while available soil P content and P concentration in plant biomass did not differ. No significant differences were found in any of the measured parameters between the two productive pasture types, GA and GL. Biological P cycling was clearly reduced in GD compared to GA while it was not substantially affected by the presence of legumes in GL. In the presentation we will show the importance of biological P cycling in sustainable pastoral systems and explain why it is important to include several soil and plant indicators to define the role of P in pasture degradation. The potential and limitations of on farm studies will be discussed.

Keywords: Biological cycling, degradation, pastures, phosphorus