



Tropentag, September 11-13, 2024, hybrid conference

“Exploring opportunities ...
for managing natural resources and a better life for all”

Nutrient release from litter under five cacao cultivation systems in Sara Ana (Alto Beni Bolivia)

ISABEL MORALES-BELPAIRE¹, KAREN LOSANTOS-RAMOS², PATRICIA AMURRIO-ORDOÑEZ²,
STÉPHANE SAJ³

¹*Universidad Mayor de San Andrés, Institute of Molecular Biology and Biotechnology, Bolivia*

²*Universidad Mayor de San Andrés, Inst. of Ecology, Bolivia*

³*Research Inst. of Organic Agriculture (FiBL), International Cooperation, Switzerland*

Abstract

Cocoa serves as a primary source of income for smallholder farmers in the Alto Beni region (Bolivia). Given its ability to thrive in low-light conditions, it is well adapted for cultivation within agroforestry systems (AFS). Cacao's phenotypic plasticity also allows for successful growth under full-sun conditions, often resulting in higher yields compared to AFS, particularly in the first years. However, the longevity of full-sun monocultures tends to be shorter compared to AFS. Cultivating cacao within AFS can offer various benefits and ecosystem services, including nutrient cycling, which may reduce the need for external fertilisers. Nutrient cycling encompasses litter decomposition processes and is influenced by many factors such as the species and diversity of shade trees, management practices, microclimatic conditions, and soil type. Within the framework of the long-term SysCom cacao trial in Alto Beni, our study aimed to determine the effects of five different cacao cultivation systems on leaf-litter decomposition and nutrient release. We placed litterbags containing cacao leaves or mixtures of cacao and shade tree leaves across the different cultivation systems. Two mesh sizes were used for the litterbags: 2 mm mesh that allowed the entry of mesofauna and 0.2 mm mesh that excluded them. After 4, 8, and 12 months of decomposition, we collected the litterbags for chemical analysis. On average, after 4 months of decomposition, there was approximately a 40 % loss of carbon, 30 % loss of nitrogen, 65 % loss of phosphorus, and 70 % loss of potassium. By 12 months, samples lost on average 82 % of carbon, 60 % of nitrogen, 95 % of phosphorus, and 98 % of potassium. The percentage of cellulose in the samples remained relatively constant, while lignin content tended to increase. There was no significant effect of the cultivation system on decomposition. Surprisingly, no significant difference in the decomposition of samples that only contained cacao leaves compared to those with leaf mixtures was observed. At four months, carbon and nutrient contents in larger mesh litterbags were significantly lower than in smaller mesh litterbags, possibly due to presence of mesofauna, but also to other processes such as easier leaching from large mesh bags.

Keywords: Agroforestry, litter decomposition, nutrient cycling