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## Impact of *Canavalia brasiliensis* on Nitrogen Budgets in Smallholder Crop-Livestock Farms of the Nicaraguan Hillsides

FRANÇOIS-LIONEL HUMBERT<sup>1</sup>, SABINE DOUXCHAMPS<sup>1</sup>, REIN VAN DER HOEK<sup>2</sup>, ALEXANDER BENAVIDEZ<sup>3</sup>, MARTIN MENA<sup>3</sup>, AXEL SCHMIDT<sup>4</sup>, IDUPULAPATI RAO<sup>5</sup>, STEFANO BERNASCONI<sup>6</sup>,  
EMMANUEL FROSSARD<sup>1</sup>, ASTRID OBERSON<sup>1</sup>

<sup>1</sup>Swiss Federal Institute of Technology (ETH), Institute of Plant Science, Switzerland

<sup>2</sup>CIAT Central-America / CIM, Nicaragua

<sup>3</sup>Instituto Nicaraguense de Tecnología Agropecuaria (INTA), Nicaragua

<sup>4</sup>CIAT, Regional Coordination for Central America and the Caribbean, Nicaragua

<sup>5</sup>International Centre for Tropical Agriculture (CIAT), Colombia

<sup>6</sup>Swiss Federal Institute of Technology (ETH), Geological Institute, Switzerland

### Abstract

In smallholders farming systems of the Nicaraguan hillsides, intensification of land use resulted in soil nutrient depletion and a decrease in agricultural productivity. Nitrogen (N) is considered as most limiting nutrient in the traditional maize-bean-livestock system. Furthermore, farmers lack forage for their livestock. We are testing the hypothesis that an underutilised and drought tolerant cover legume, *Canavalia* (*Canavalia brasiliensis*), can be introduced into the traditional system to overcome soil fertility decline. On farm trials were conducted between June 2007 and January 2008 at four locations in the Nicaraguan hillsides. We set up the soil surface N budget of traditional maize-bean (M/B) rotation and compared it with the budget of maize-*Canavalia* (M/C) rotation, with different cutting intensities of *Canavalia* above ground biomass to simulate grazing. Nitrogen input variables were mineral fertiliser N, N input with seeds and symbiotic N<sub>2</sub>-fixation, estimated using the natural abundance method. The estimation of N output was based on N removed with harvested parts of maize, bean and *Canavalia*. *Canavalia* fixed between 15 to 38 kg N ha<sup>-1</sup> while bean fixed 10 kg N ha<sup>-1</sup> on average. Fixation by bean was lower due to its low biomass production. Farmers applied between 38 and 60 kg N ha<sup>-1</sup> in form of mineral fertilisers, while N contained in seed represented only between 1 and 4 kg N ha<sup>-1</sup>. Highest N outflow occurred with harvest of maize, with an average of 43 kg N ha<sup>-1</sup>. Nitrogen output by bean remained under 10 kg ha<sup>-1</sup> due to small yields. The different *canavalia* removal proportion had an important impact on the N balance: on average, when 0% of *Canavalia* was removed from the field, N surplus was 31 kg N ha<sup>-1</sup>. In contrast, complete removal of *Canavalia* biomass led to a N deficit of 10 kg ha<sup>-1</sup>. Under M/B rotation, the N balance remained more or less equilibrated with on average a N surplus of 10 kg N ha<sup>-1</sup>. *Canavalia* shows potential to fix a significant N amount. However, when completely removed as forage, it bears risk of soil N depletion unless N would be recycled to the plot by animal manure.

**Keywords:** <sup>15</sup>N natural abundance method, *Canavalia brasiliensis*, N budget, Nicaraguan hillsides, on-farm trial