Correspondence:
Mercado, A.R. Jr, Meine van Noordwijk, Hilger T, and Cadisch, G.

Nitrogen Facilitation and Competition in Timber tree - Maize Agroforestry System

Introduction

Soil erosion is a major problem limiting availability of nitrogen and other nutrients for crops on sloping lands in Southeast Asia. Integrating timber trees on croplands as contour hedgerows to control soil erosion, increase income to farmers, and improve environmental services such as biodiversity, water quality and carbon sequestration. Timber based contour hedgerow is now thought to be a viable option for smallholders.

Objective

To assess above- and below-ground nitrogen facilitation and competition in timber tree-maize hedgerow intercropping system.

Materials and Methods

- A half-drum experiment was conducted in Claveria, Misamis Oriental, Philippines (B°38' N 124°55' E) consisting of Acacia mangium or Gmelina arborea in association with maize, and supplied with 0 and 80 N kg ha⁻¹ during 3 cropping cycles: 1 simultaneous (tree + crop) and 2 sequential (crop) cycles.
- Tree plant parts were labeled using ¹⁵N stem injection technique in order to quantify N transfer during simultaneous phase, and to partition tree above and belowground N contributions to subsequent maize crops. N fertilizer was also labeled with ¹⁵N during the sequential phase. N fixation of Acacia in drum and field experiments was determined using the ¹⁵N natural abundance method.

Results

Effect of trees and N application on maize total dry matter yield

Conclusion

Acacia mangium is better suited for mixed agroforestry systems than the non-fixing Gmelina arborea due to its high N₂-fixating potential, lower N competition and higher belowground N facilitation to the associated and sequential maize crops.

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Agustin R. Mercado, JR.,
World Agroforestry Centre
Claveria Research Site, MOSCAT Campus
Claveria, Misamis Oriental, 9004 Philippines

Acacia mangium N₂ fixation

- Drum experiment with and without N
  - N  =  N (80 kg ha⁻¹)
    54 %  +  31 % = 7
- As hedgerows with 80 kg N ha⁻¹ application
  - 38 % + 11
- As woodlots
  - 54 % + 22
  (+= 15 more)