THE EFFECTIVENESS OF HEDGEROW CROPPING SYSTEM IN REDUCING MINERAL N-LEACHING IN ULTISOLS

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ABSTRACT

Arable land in the humid tropics is dominated by Ultisols. This arable land is characterized by acid soils with shallow crop root development, relatively coarse texture, low cation exchange capacities, low organic content, and having 2500 to 3000 mm of annual rainfall. Such conditions cause intensive leaching of soluble nutrients, especially NO_3^-, below the crop root zone. Therefore, hedgerow inter-cropping systems, with development of tree root systems under the main crop root zone, can hypothetically intercept the nutrients lost and recycle them by acting as a "safety net". To provide a better understanding of the effectiveness of hedgerow cropping in reducing mineral N leaching, we studied two contrasting tree species. In this paper we describe field measurements of the root distribution, mineral-N leaching and crop production from *Peltophorum dasyrrhachis* (a deep-rooted local tree and with low litter quality), *Gliricidia sepium* (extensive rooted and with high litter quality) and alternate *Peltophorum /Gliricidia* hedgerow cropping systems, and maize monoculture treatments. The hedgerow inter cropping systems have been established by the BMSF-Project since1986 (about 13 years ago) in N. Lampung. The result showed that all trees have a tap root into the subsoil. *Gliricidia* extended some thick roots horizontally into the top soil and *Peltophorum* had the lowest root length density on profile wall between 0-1 m. The deepest tap root growth was found in the alternate of *Peltophorum & Gliricidia* hedgerow inter-cropping systems. The hedgerow inter-cropping system with *Peltophorum dasyrrhachis* was the most effective in reducing mineral N-leaching. It showed that incorporation of *Peltophorum* and *Peltophorum & Gliricidia* in *Peltophorum* and alternate *Peltophorum /Gliricidia* hedgerow inter-cropping systems respectively into the soil produce maize grain yield equivalent to those resulting from application of 45 kg ha^{-1} or even 90 kg ha^{-1} inorganic N in maize monoculture systems within 4 years of cropping systems.

INTRODUCTION

Leaching of Nitrogen (N) is very intensive under arable rainfed-upland in the humid tropics (Van-Noordwijk, 1989; Seyfried and Rao 1991). Arable rainfed-upland in the humid tropics is dominated by acid soils of low inherent fertility known as Oxisols and Ultisols (Sanchez, 1976). In Indonesia, Ultisols which are classified as Red-yellow Podzolic Soils, are estimated to cover 47.5 million ha or 24.9 % of the total land area of Indonesia (Santoso, 1998). The major part of this arable rainfed-upland are characterized as acid soils with shallow crop root development, relatively coarse texture, low cation exchange capacities, low organic matter content, and having 2000 to 3000 mm of annual rainfall (Van Noordwijk, 1996). Such conditions cause intensive leaching of soluble nutrients, especially NO_3^-, below the crop root

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