Potential of Cowpea, Pigeonpea and Greengram to Supply Mineral N to Maize in Rotation on Ferralsols in Muheza Tanga- Tanzania

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Abstract

A rotational field experiment of cowpea, pigeonpea and greengram with maize as married out for two rotational cycles to determine the potential of the legumes to supply N to the subsequent maize. The experiment was carried out on sandy clay Rhodic Ferralsol with bimodal rainfall pattern. The legumes were planted during the short rain season followed by maize during long rains. Soil was sampled from 0 – 20 cm layer before maize planting from plots where the legumes were grown and from continuous maize plots. The composite soil samples were sieved through 6 mm screen while fresh. Sub samples equivalent to 250 g each were incubated in 500 ml wide mouth volumetric flasks at 60% field capacity and room temperature for 42 days. Destructive samplings were done at 14 days intervals and analysed for mineral N (NH_4^+ and NO_3^-). The quantities of mineral N increased with incubation time. Most of the mineral N was mineralised between 0 and 14 days of incubation. Out of the total N mineralized during the entire incubation period, the proportions of the mineral N determined at the 14th day sampling were 64% for the cowpea, 50% for the pigeonpea, 73% for the greengram and 88% for the continuous maize plots. Such high proportions indicate that the subsequent maize would obtain maximum N during these early stages of growth. It was concluded that there is lack of synchrony between the release of mineral N and the maize crops' N demand which lead to the maize N deficiency symptoms and low yields observed in the legume – maize cropping system.

Keywords: Aerobic mineralization, incubation, legumes, rotation

Introduction

Nitrogen is one of the major elements required by plants for growth and production. However it is depleted in most soils in Sub- Sahara Africa (SSA), to a level that adversely affects soil productivity (Bationo, 2003). This is evident from nutrient balance studies from 38 SSA countries (Stoorvogel and Smaling, 1990; Stoorvogel *et al.*, 1993), which show that the average N balance is –22 kg ha^{-1} $year^{-1}$, of which Tanzania accounts for –27 kg ha^{-1} $year^{-1}$ (Stoorvogel *et al.*, 1993).

Continuous cropping without appropriate land management practices and addition of nutrients to the soils to replenish those taken up and harvested with crops is the primary cause of the negative nutrient balance (Smaling *et al.*, 1997; CP-URT, 2000). Possible strategies to alleviate this trend of declining N in agricultural

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