

# Nitrogen Credits from Cowpea, Soybean, Groundnut and *Mucuna* to Maize in Rotation

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## Abstract

Legumes constitute a major component of sustainable cropping systems due to their biological nitrogen fixing capacity. A field study was conducted in 1999 and 2000 at Ejura in the forest savanna transition zone of Ghana to quantify nitrogen credits to maize from early (65–105 days) and medium/late-maturing (80–120 days) grain legumes (cowpea, soybean, and groundnut), and from *Mucuna* cover crop. The design was a split plot in randomized complete block with three nitrogen levels (0, 45, 90 kg N ha<sup>-1</sup>) applied to maize following legumes as the main plots. There was in addition a basal application of 26 kg P ha<sup>-1</sup> and 42 kg K ha<sup>-1</sup>. Subplot treatments were 10 cropping systems: 6 grain legumes (an early and later-maturing variety each of soybean, cowpea, and groundnuts), *Mucuna pruriens* as a planted fallow, a natural fallow, and two maize varieties as reference crops, early (95 days) and medium (105 days). *Mucuna* had the highest nodule mass (20 kg ha<sup>-1</sup>), cowpea (7.8 and 10.2 kg ha<sup>-1</sup>) and soybean (10.1 and 17 kg ha<sup>-1</sup>) were intermediate, with the least nodule mass on groundnut (5.2 and 5.4 kg ha<sup>-1</sup>). Nitrogen credit to maize from *Mucuna* and medium-maturing cowpea variety "Soronko" was more than 90 kg N ha<sup>-1</sup>, 22 N ha<sup>-1</sup> from early-maturing cowpea "Asontem" and 16 kg N ha<sup>-1</sup> from natural fallow. No appreciable N credits were measured from soybean and groundnut varieties. Early soybean variety TGX 1478-2E had negative N credit to maize. The species and maturity group of legumes are important determinants of their N contribution to crops in rotation.

## Introduction

Soil fertility decline is a major constraint to crop production in Ghana and other developing African countries where slash and burn constitute major features of land preparation, with minimal application of fertilizers or none at all due to high cost (GGDP, 1992a, 1994; Bationo *et al.*, 1997). In a recent survey on maize production in the Ejura-Sekodumase district (a predominantly maize growing area), 70% of farmers had never used inorganic fertilizers, due to their high cost (GGDP, 1994).

The inclusion of legumes as an essential component of cropping systems is an inex-

pensive, feasible, and sustainable intervention to supplement inorganic fertilizers. Legumes may be used in crop rotations as cover crops (Asibuo and Osei Bonsu, 2000; Ennin and Clegg, 2001), in intercropping (Ennin *et al.*, 2001), as green manures (Sekhon and Bajwa, 1993), and in alley cropping (Tossah *et al.*, 1999). This will ensure increased crop production at high yields per unit area, while maintaining or improving on the soil fertility status. The benefit of legumes in cropping systems is through biological nitrogen fixation (BNF), which can be as much as 450 kg