

# Comparative Nitrogen Fixation, Native Arbuscular Mycorrhiza Formation and biomass Production Potentials of Some Grain Legume Species Grown in the Field in the Guinea Savanna Zone of Ghana

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## Abstract

An on-station trial was conducted in the experimental field of Savanna Agricultural Research Institute at Nyankpala in the Northern Region of Ghana to assess the nitrogen fixation, native arbuscular mycorrhizal formation and biomass production potentials of cowpea (*Vigna unguiculata*), devil-bean (*Crotalaria retusa*), *Mucuna pruriens* var. *utilis* (black and white types) and *Canavalia ensiformis* with maize (Dorke SR) as the reference crop using the total nitrogen difference (TND) method. Plants were fertilized with 40 kg P/ha and 30 kg K/ha at 2 weeks after planting and grown for 55 days after which they were harvested. The harvested biomass (separated into roots, stems and leaves) of each crop was oven-dried at 70 °C for 48 h to a constant weight. Cowpea and devil-bean produced approximately 5 and 6 t/ha biomass whereas *Mucuna* and *Canavalia* yielded about 2 t/ha biomass each. Although cowpea had the least number of arbuscular mycorrhiza fungal (AMF) spores in its rhizosphere, its roots were the most heavily colonized (34%) and *M. pruriens* recording below 5% colonization. Apart from *C. ensiformis*, the test legumes derived over 50% of their total accumulated N from the atmosphere with cowpea being the most efficient (90% Ndfa). Both N and P accumulations were significantly higher in cowpea than the other legumes due to increased N concentration and dry matter accumulation, respectively. In all the legumes, there was a direct positive correlation between the extent of mycorrhiza formation, biological N fixation and total N uptake. It could, therefore, be concluded that the extensive mycorrhiza formation in cowpea and its high N<sub>2</sub>-fixing potential resulted in a high shoot N and P uptake leading to a comparatively better growth enhancement. Cowpea could, therefore, be the grain legume for consideration in the selection of a suitable legume pre-crop to cereals for the amelioration of the low fertility of the degraded soils of the Guinea savanna zone of Ghana, and also as a source of food to fill the hunger gap that precedes the growing season in the Northern Region of Ghana.