

# Effect of Phosphate Rock Fertilization and Arbuscular Mycorrhizae (AM) Inoculation on Growth and Nodulation of Agroforestry Tree Seedlings

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## Abstract

Phosphate rocks (PR) have been identified as cheap complements of easily soluble phosphate fertilizers for low pH soil. A-mycorrhizae improve plant uptake of P and other nutrients in acidic, low-P soils. Using two acid soils, Acrisols and Andosols, two greenhouse studies were carried out to evaluate effect of Minjingu Phosphate Rock (Minjingu PR) on growth of four agroforestry multipurpose trees: *Leucaena leucocephala*, *Senna siamea*, *Grevillea robusta*, and *Eucalyptus grandis*. In the first experiment, one-month-old seedlings received Minjingu PR at 0 (PR<sub>0</sub>), 52 (PR<sub>1</sub>) and 77 (PR<sub>2</sub>) kg P ha<sup>-1</sup> in 2 kg soil. In a second experiment, the Minjingu PR rates of the first experiment were maintained while *G. robusta* and *L. leucocephala* were used as the test trees on the Acrisol only. A-mycorrhizae inoculum in the form of *A. tortilis* roots mixed soil was included in this study. There was a slower response to Minjingu PR fertilizer application in Andosols than in Acrisols. At 19 weeks after transplanting, PR<sub>2</sub> had caused a significant ( $P \leq 0.05$ ) height increase over PR<sub>0</sub> in *L. leucocephala*. Addition of PR<sub>2</sub> had a negative effect on the height of *C. siamea* whereas *E. grandis* did not respond to PR additions. Application of PR in Andosol, significantly reduced ( $P \leq 0.05$ ) height and root collar diameter of *G. robusta* and *S. siamea* as compared to the control. In the second study, there were significant increases of up to 121% in height ( $P \leq 0.001$ ) and root collar diameter ( $P \leq 0.05$ ) and 4.5 times biomass over the controls when *L. leucocephala* seedlings received PR alone and PR + mycorrhizae at 12 months after planting. Nodulation of *L. leucocephala* was significantly affected by P application and/or A-mycorrhizae inoculation but was variable within any similar treatments except for the controls, where no nodulation was observed. Species  $\times$  treatments interactions were significant,  $P \leq 0.05$  for shoot dry weight and  $P \leq 0.001$  for root dry weight. It is probably not necessary to add Minjingu PR fertilizer to *G. robusta* in either soil and to *S. siamea* in the Andosols soils. PR and mycorrhizae inoculation have the potential to improve legume performance in these acidic soils.

## Introduction

Increasing over-exploitation of woody vegetation for timber and/or fuelwood, and declining soil fertility of cultivated land now characterize over 40 of the 50 tropical African countries (Sanginga 1989). The

establishment of low-input sustainable land-use systems especially for resource-poor-small scale farmers has therefore become a priority to meet these demands in the developing countries. The high cost of soluble phosphate