

## Acid-adapted Arbuscular Mycorrhizal Fungi Promote Growth of Legumes in Phosphorus-Deficient Acid Soil

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### ABSTRACT

*Soil acidity is a major limiting factor for upland crops. Arbuscular mycorrhizal fungi (AMF) help improve soil fertility through a fallow enriching tree, *Macaranga denticulata*, and directly enhance growth of many crops, but its benefit to legumes in acid soil are not known. Three experiments evaluated the benefits from AMF on legumes growing on acidic, low phosphorus soil (pH 5, 11 mg P kg<sup>-1</sup> by Bray II). In Experiment 1, root zone soil and root fragments of *M. denticulata* significantly increased cowpea (*Vigna unguiculata*) growth and P uptake. In experiment 2, CMU22 – a strain of *Acaulospora morrowiae* propagated from a single spore in the rhizosphere of mimosa (*Mimosa invisa*) – growing in soil with pH 5 and 11 mg P kg<sup>-1</sup> was as effective as soil from the root zone of *M. denticulata* on cowpea and mimosa growth. In experiment 3, cowpea growing in soil with pH 5 and 11 mg P kg<sup>-1</sup> was inoculated with varying rates of mimosa root zone soil containing CMU22 and CMU22 spores. Both types of inoculum promoted cowpea growth, but at a low rate of 100 spores plant<sup>-1</sup>. Root zone soil that contained infected root fragments and hyphae, as well as spores, was more effective. Arbuscular mycorrhizal fungi adapted to acidic, low P soils have been shown to be effective in alleviating acid soil stress in legumes, with CMU22, an *Acaulospora morrowiae*, especially well adapted to acid soil.*

**Keywords:** Acid soil, Arbuscular mycorrhizal fungi, Legumes, Phosphorus

### INTRODUCTION

Soil acidity is a major limiting factor of legume growth (Munns and Fox, 1977). In acid soil, factors such as toxicity of aluminium (Al) or manganese (Mn) or deficiencies of phosphorus (P), molybdenum (Mo), calcium (Ca) and magnesium (Mg) can limit growth and nitrogen fixation by legumes (Marschner, 1995), with P deficiency the most common (Maddox and Soileau, 1991). Lime and chemical fertilizer, especially phosphatic fertilizer, can ameliorate acid soil