Early growth, leaf yield, protein content and pod yield of four *Moringa* accessions in Hawai`i.


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The leaves of *Moringa oleifera* and *M. stenopetala* are well regarded for their high concentration of nutrients, particularly protein. The pods of *M. oleifera* are also consumed and the seeds yield a high value oil that has potential culinary, cosmetic and biofuel applications. Three accessions of *M. oleifera* (PKM-2’ ‘Hawaii-1’ ‘Hawaii-2’) and a single accession of *M. stenopetala* were grown at two locations with three replications on the island of O`ahu. Seedlings were transplanted two months after seeding and height measured periodically for more than six months. At 180 days after transplanting, 5 trees were coppiced in each replication (30 trees per accession) and final plant height, leaf yield, immature pod yield and leaflet crude protein content determined. Pods were allowed to mature on the remaining uncoppiced trees and collected to determine final pod size, seed yield and oil content. Growth rates were fastest in the *M. oleifera* accessions. Final height of *M. oleifera* trees (4.7-5.1 m) were almost twice that of *M. stenopetala*, while leaf yield was greatest in *M. stenopetala*. Among the *M. oleifera* accessions, leaf yield of ‘Hawaii-1’ and ‘Hawaii-2’ were similar to each other and 54% higher than ‘PKM-2’. Average crude protein concentrations were similar among *M. oleifera* accessions (~33%) and lowest in *M. stenopetala* (26%). Pod and seed yield followed the order ‘PKM-2’ > ‘Hawaii-2’ > ‘Hawaii-1’. *M. stenopetala* did not flower during the period evaluated. The data strongly suggested that variability within *Moringa* germplasm needs to be more thoroughly evaluated in order to optimize production of different *Moringa* commodities (i.e. leaf, immature pod and oil) in the U.S.
Arbuscular mycorrhizal dependency of three *Moringa* genotypes.

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**ABSTRACT**

The genus *Moringa* includes several multi-purpose species that are receiving increased attention worldwide because of their potential to enhance health, nutrition and income generation in the tropics. Although adapted to low-input environments, fertilization of *Moringa* is generally required for optimum production. Inoculation with arbuscular-mycorrhizal fungi is a strategy frequently employed in the tropics to enhance plant growth and P nutrition while reducing inputs. However, there is almost no information available regarding the response of *Moringa* sp. to mycorrhizal inoculation. To address this knowledge gap, two genotypes of *Moringa oleifera* (‘PKM-2’ and ‘Hawaii’) and one accession of *Moringa stenopetala* (Steno) were evaluated for their response to inoculation with *Glomus aggregatum* under varied soil solution P levels in two greenhouse experiments. The response of the three genotypes varied significantly and was dependent on soil solution P. Dry matter accumulation and tissue P levels of all genotypes were generally enhanced with inoculation at relatively low soil-solution P levels (0.009-0.02 mg L⁻¹). Under limited P conditions, mycorrhizal dependencies were determined to be 40-50% for ‘Hawaii’, 20-50% for ‘PKM-2’ and <20% for ‘Steno’. We therefore classify *M. oleifera* as moderately dependent and *M. stenopetala* as marginally dependent on mycorrhizal associations. At higher soil solution P concentrations (0.02-0.20 mg L⁻¹), ‘PKM-2’ exhibited a sharp decrease in dry matter accumulation with inoculation resulting in severely negative dependency values (-20 to -40%). The parasitic effect of *G. aggregatum* under high soil solution P was not observed in the other genotypes. This work represents the most comprehensive investigation of *Moringa* sp. response to arbuscular-mycorrhizal fungi and is the first report of mycorrhizal dependency in the Genus.