

## ABSTRACT

### MICROBIAL INTERACTIONS BETWEEN RHIZOBIA AND VAM FUNGI FOR NODULATION AND GROWTH OF COWPEA (*VIGNA UNGUICULATA*)

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Vesicular-arbuscular mycorrhizal (VAM) fungi from various parts of Jamaica have been isolated and identified based on their spore morphology. They were grouped into 9 species belonging to 3 genera. These genera include *Glomus* (five species) *Sclerocystis* (two species) and *Scutellispora* (two species). Out of nine species three were purified and multiplied on corn (*Zea mays*) roots. Similarly ten native *Bradyrhizobium* strains were isolated and tested for their effectiveness on cowpea (*Vigna unguiculata* (L) Walp.) in sterilized and non-sterilized soil under greenhouse conditions. Two rhizobial strains were selected from sterilized soil (JRC19 and TAL169) and two other strains were selected from non-sterilized soil (JRC14 and JRC29).

These four *Bradyrhizobium* strains were then paired individually with either *G.pallidum*, *G.aggregatum* or *S.microcarpa* in separate sterilized and non-sterilized soil experiments under greenhouse conditions. The purpose of the experiments was to determine the effect of

sterilization of soil on the selection of effective cowpea rhizobia and to see whether these rhizobia differed in their effect on cowpea growth when paired with various VAM fungi. The results showed that the rhizobia selected in sterilized soil produced few growth responses in cowpea compared to the other introduced rhizobia irrespective of pairing with VAM fungi in sterilized or non-sterilized soil. In contrast, the two rhizobia selected in non-sterilized soil significantly improved cowpea growth in non-sterilized soil, especially when paired with *G.pallidum* and *S.microcarpa*. These two VAM fungi and two rhizobial strains were co-selected.

The response of cowpea to inoculation with co-selected pairing of VAM fungus and *Bradyrhizobium* strains was field tested in two different locations in two soil types (Red bauxitic silt loam and black clay loam). Inoculation of cowpea with each of the four pairings increased pod yield, mycorrhizal infection, nodule formation and shoot P and N content over uninoculated control or single inoculation of either of the microsymbionts. Dual inoculations increased pod dry weight 25% and 16% over single inoculations of VAM fungi and rhizobia respectively in both soil types. On an average JRC14 and JRC29 when paired with either of the VAM fungi increased the pod dry weight 46% and 39% respectively over the uninoculated control in the three experiments.

The influence of VAM fungus *G.pallidum* on the competitive ability of introduced and native *Bradyrhizobium* strains for nodulation of cowpea was examined under non-sterilized soil conditions. The results revealed that in the presence of VAM fungus, introduced *Bradyrhizobium* strains become more competitive than native rhizobia. For example, strain JRC29 occupied 59.2% of the total nodules when inoculated alone, but this figure increased to 71.2% when JRC29 was used in dual inoculations with VAM fungus. Moreover VAM fungus selectively influenced the nodulation ability of competitive strains.

The effect of *G.pallidum* on the phosphatase and cellulase activities and cytokinin content in cowpea roots was also examined. Both acid and alkaline phosphatase activities were significantly ( $p=0.05$ ) increased in mycorrhizal compared with non-mycorrhizal roots. Similarly cytokinin content was significantly increased in mycorrhizal roots than non-mycorrhizal roots. An increased level of cellulase activity was also noted in mycorrhizal cowpea roots and the maximum activity was found around the 21st day after inoculation.