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Influence of water deficit on symbiotic performance during soybean (*Glycine max*) nodule development

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Drought is considered to be a major threat to soybean (*Glycine max*) production worldwide. The symbiotic interaction between soybean and rhizobia facilitates atmospheric nitrogen fixation, a process that provides essential nitrogen to support plant growth and development. In soybean this interaction is short-lived leading to the elimination of the rhizobial partner and a reduction in symbiotic nitrogen fixation (SNF) and yield. Water deficit affects the survival, multiplication and symbiotic efficacy of soil rhizobia. Symbiotic efficacy and abiotic stress tolerance of soybean microsymbionts remains limited. Species that devise tolerance mechanisms often lose the nitrogen fixation ability. This study therefore aims at selecting symbiotically efficient abiotic stress tolerant rhizobia for soybean inoculation. Osmotic tolerance of bacterial strains was assessed in yeast extract mannitol (YEM) supplemented with different concentrations of sodium chloride ranging from 0.5%-3%. All strains were tested for drought tolerance simulated by PEG6000 in YEM. Soybean plants were grown under greenhouse conditions subjected to two water deficit regimes and inoculated with strains of differing osmotolerance. The effect that water deficit and the contribution of the rhizobial partner has on nodulation and development of the plants was assessed. Rhizobial isolates exhibited varying tolerance to salinity and drought stress with strain SMH12 showing highest osmotolerance. SMH12 significantly increased nodulation under water deficit conditions. The selection of efficient strains among tolerant strains may contribute to the formulation of inoculants for arid regions. The findings from this study could be used to boost soybean production in Africa, through selection of tolerant rhizobial isolates with better symbiotic performance under water limiting conditions.