Tropentag, September 20-22, 2023, hybrid conference

"Competing pathways for equitable food systems transformation: Trade-offs and synergies"

Effects of microbial inoculants on growth and salinity tolerance of hydroponically-grown tomatoes

Graham Giesting, Jörn Germer, Folkard Asch

University of Hohenheim, Inst. of Agric. Sci. in the Tropics (Hans-Ruthenberg-Institute), Germany

Abstract

The relationships of plants with soil-living bacteria and fungi are known to potentiate plants' resistance to diseases, ameliorate plants' stresses and stress responses, and promote plants' growth. Hydroponic production has increased in prevalence all over the world, as a production approach which enables greater control for growers over their plants' environments and more optimal use of scarce resources. The microbial communities with which plants interact in hydroponic environments vary from those in soil in profusion and variety, but microbes are nonetheless present there and can interact with plants, and their effects in these production systems are largely uninvestigated and untapped.

To assess the effect of different microbiota in conferring salinity resistance to tomato (*Solanum lycopersicum*, var. Sweeterno), plants were inoculated with *Bacillus megaterium* Ni-5-SO-11, *Pseudomonas brassicacaerum* 3Re2–7, and *Trichoderma harzianum* DSM 32006 in a basic hydroponic system. Tomato seedlings were treated with each these three inoculants, with and without 60 mM of NaCl, grown for 2 weeks in 2.5 l buckets with 50 % INTEGAR nutrient solution oxygenated via a bubbling air hose, then harvested, measuring biomass, SPAD, leaf area, and tissue ion concentration. Significant differences were found between inoculant treatments and controls in biomass and biomass distribution, SPAD, leaf area, and tissue ion concentrations. Endophytic bacteria were found to induce more consistent and positive responses than fungi, whose mycorrhizae did not thrive in solution and who had widely variable – but generally detrimental – effects on biomass, SPAD, and root length and health. These findings suggest that (certain of) the studied inoculants may boost plant performance in a hydroponic setting.

Growth promotion of hydroponically grown plants by microbes could potentially provide significant benefits. This would occur in a physical and biological environment where the makeup of the microbial community can be directly controlled, e.g. via aqueous inoculation of plants with beneficial inoculation over the full submerged root surface. The plants in this study were harvested at 18 days. Although this makes yield-effect predictions more abstract, this approach could be used as a screening protocol for candidate PGP microbial strains.

Keywords: Hydroponics, microbial innoculant, salinity, *Solanum lycopersicum*

Contact Address: Graham Giesting, University of Hohenheim, Inst. of Agric. Sci. in the Tropics (Hans-Ruthenberg-Institute), Stuttgart, Germany, e-mail: ggiesting@gmail.com