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## Bio-organic Microbial Consortia with Soil Conditioner Promotes Drought Tolerance to Improve Tuber Yield of Potato

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### Abstract

Application of silicatic soil conditioner to improve soil water relationships under drought stress may be strategy to support rhizosphere establishment of beneficial microbial inoculants with drought-protective potential. In this study, we investigated drought-protective effects of plant-beneficial microbial consortia based on selected strains of *Pseudomonas* (Cons1), *Burkholderia* (Cons2) and *Burkholderia* + *Trichoderma* (Cons3) in combination with arbuscular mycorrhizal fungi (*Rhizophagus irregularis*) applied in protective organic fertiliser formulations (Minigran®1–3) with or without application of a silicatic organic soil conditioner (Sanoplant®) on plant performance and tuber formation of potato ( hybrid) under controlled conditions in greenhouse experiments . Our results showed that at the end of a two-weeks recovery period from 6 weeks severe drought stress treatments at a soil moisture level of only 25 % soil water-holding capacity, all tested Minigran-Consortia formulations reduced the proportion of irreversibly drought-damaged leaves by 35–88 %, irrespective of the soil conditioner treatments, with the strongest expression of protective effects by the Consortium<sup>3</sup>. Interestingly, already the Minigran blank formulations had a certain beneficial effect on enzymatic (ascorbate peroxidase) and particularly non-enzymatic (total antioxidants) detoxification of reactive oxygen species (ROS), indicated by a significantly reduced ROS (H<sub>2</sub>O<sub>2</sub>) accumulation in the leaf tissue, which was further improved by introduction of the microbial Consortia. Both, the Minigran blank formulations and the Minigran-Consortia formulations, affected the hormonal status in the leaf tissue towards increased ABA/Gibberellic acid (GA) ratios and increased IAA levels, known to support tuber initiation and tuber growth and increased the jasmonic acid (JA) concentrations involved in abiotic stress signalling.

The Minigran blank formulations also increased the root colonisation with native arbuscular mycorrhizal fungi, which was further increased by inoculation with the Minigran-Consortia combinations and the soil conditioner. In contrast to the effects on vegetative growth, beneficial effects of the consortia on tuber biomass were mainly recorded in combination with the soil conditioner and even reached the values of well-watered controls with NPK fertilisation in case of the Consortium1. Our findings suggest that application of microbial consortia formulations in combination with silicatic soil conditioner has potential to improve the drought tolerance and tuber yield of potato.

**Keywords:** Drought, Microbial Consortia, organic fertilisers, Sanoplant, *Solanum tuberosum*, Stress metabolites

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