

# Fishing for New Crop-Benefiting Soil Bacteria through Plant-Microbe Interactions

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The world is facing a serious food crisis due to increasing population, intensive farming, and environmental stressors such as drought. More effective and environment-friendly farming technologies are urgently needed. Crop-beneficial soil microbes are a promising alternative to chemical fertilizers and pesticides that have adverse effects on the environment and human health. This project aims to discover new crop-benefiting microbes that increase plant growth and its tolerance to drought using wheat as a fishing tool. I hypothesized that plant-microbe interactions allow the plants to select microbes beneficial to them. Soils were selected from an agricultural plot (Agr-M), an organic farm (Org-M), and a non-agricultural forest (TWDEF) in northern Utah. Cultivable microbes from these soils were applied to wheat. The Org-M or Agr-M microbes showed better effects on CO<sub>2</sub> assimilation in wheat than the TWDEF microbes or sterile water (control). Nine root-colonizing bacteria, GZR1-R9, were isolated and identified using 16S rRNA sequences. For wheat grown with normal hydration, GZR4-R5 (Org-M isolates) and GZR7-R9 (Agr-M isolates) increased the CO<sub>2</sub> assimilation rate by 18%-65%. After a drought stress, the wheat colonized by GZR8 and GZR4 had higher CO<sub>2</sub> assimilation rates (107% and 252% than the control). The water transpiration rates with GZR4, GZR5, GZR7 or GZR9 were about 200% greater than the control. GZR4, a *Pseudomonas* species, was the most promising strain in enhancing both the CO<sub>2</sub> assimilation and drought tolerance in wheat, and thus has great potential for agricultural applications. This finding demonstrates the success of the fishing method to isolate new crop-beneficial strains.

## Awards Won:

University of Arizona: Renewal Tuition Scholarship