AGR1507: Evaluation of Cytokinin Producing *Methylobacterium* as an inoculant for seedling performance, yield improvement, and drought stress tolerance in four legume species

Beneficial bacteria that live in symbiosis with crop plants are gaining a lot of attention as a new, environmentally friendly alternative to traditional, chemical fertilizers and pesticides. In nature, bacteria inhabit surfaces and live inside plant tissues. However, not all of these microbes possess growth promoting characters, such as: production of plant hormones; increasing nutrient supply to plants; or enhancing host resistance to pathogens. Successful application of bioinoculants in agricultural production is highly dependent on the selection of the right type of microbes. Bacteria used as components of natural biofertilizers have to improve plant growth and development, but they also need to be well adapted to environmental conditions of field sites. In this project we investigated beneficial effect of plant inoculation with symbiotic *Methylobacterium* on four legume species: chickpeas, peas, lentils, and faba beans, exposed to limited water supply during early growth stages and at flowering. All control and inoculated plants were cultivated in specially designed growth rooms with a fully controlled light, temperature, and irrigation regime. The *Methylobacterium* strain was selected based on its ability to produce high levels of active plant growth hormones called cytokinin, and simultaneous high tolerance to drought, that we tested in a series of in vitro laboratory screenings prior to plant treatments. The experiments conducted in this project revealed a positive effect of bacteria on plant performance, both in control and drought stress conditions. Plant inoculation stimulated germination, early growth, and general plant vigour, with no particular differences observed between the four legume species. Inoculated plants were characterized by more efficient water management during drought periods, increased levels of cytokinins, and higher rates of photosynthesis. By increasing the overall plant performance, the presence of *Methylobacterium* ultimately offset the negative effect of limited water availability. Therefore, the applied biofertilizer helped to improve yield parameters, especially the harvest index. In an era of climate change where reduced rainfall and expansion of arid areas significantly limits farmland productivity, our results suggest that introduction of *Methylobacterium* inoculants to farming practices may help in plant adaptation to adverse growth conditions and allow for successful production even in regions not very suitable for crop cultivation.