A Study of Circadian Genetics and Abiotic Stress towards Sustainable Agriculture

Geradi, Maya

Food security and agriculturally unfavorable climates are prevalent sustainability concerns. Irrigation, a vital agricultural process, results in salinization of arable land. Saline soil diminishes crop growth and yield. Circadian genes regulate plant response to abiotic stress and can be utilized to improve understanding. Furthermore, plant growth promoting rhizobacteria can be used in increasing yield under stress. This project aims to study circadian genetics and the effect of beneficial Bacillus strains to develop methods to alleviate saline and osmotic stress. Towards this goal, wildtype Arabidopsis thaliana and 3 circadian plant lines, gi-2, FKF1 and CCA1 OX, were studied. Plant development and germination were studied in 8 v.s. 16 hour chambers under ranging salt and mannitol concentrations (0-200mM). Stress mitigation and growth promotion by 2 Bacillus species were studied by spotting suspended cells onto agar plates with plants. Partition plates were used to study effect of microbial volatile compounds. Plant growth was evaluated by examining biomass, rosette surface area and hypocotyl length. B. subtilis GB03 and B. subtilis Bsn5 significantly improved plant yield and induced different responses in the 3 circadian genetic backgrounds and wildtype. Both strains increased biomass by 250% – 500% in plants grown under saline and osmotic stress. The FKF1 mutant has increased germination efficiency under salt and osmotic stress, compared to wildtype. Larger trichomes and higher trichome density was observed in the FKF1 and gi-2 mutants, during early development. These results show promise for engineering salt tolerant crops and identifying viable biofertilizers for improving agricultural productivity in the future.

Awards Won:
Fourth Award of $500