Department of Biological Sciences

Tiana Miller

Mentor: Hilary Callahan

Responses to Simulated Drought Stress in Arabidopsis:
Assessment of Above- and Below-ground Traits.

The well-studied species Arabidopsis thaliana is known to be plastic and affected by environmental conditions. For this experiment we choose to focus on the above ground system as well as the root system. We conducted our experiments with nine previously studied Arabidopsis ecotypes and grew them under mild osmotic stress conditions and in control conditions. Coupling the above ground system results with the root system results, we can make a whole plant assessment of whether each ecotype responds similarly to simulated drought conditions.

I assisted with two experiments. Experiment One was a 12-day study conducted on tipped, nutrient-filled Petri dishes. Experiment Two was a 13-day study conducted in sand-filled pots. The drought-simulating stressor for both experiments was mannitol added to a standard nutrient solution. Based on this study we were aiming to quantify the stress-induced phenotypic plasticity of several above-ground and below-ground traits: leaf mass, leaf area, specific leaf area, root mass, root length, and specific root length.

Based on a previously published study, we expected that osmotic stress should negatively affect plant growth, but that ecotypes might differ in the magnitude of response to stress. Below-ground traits of the ecotype Landsberg, for example, have previously been shown to resist simulated drought conditions, based on the observation of similar below-ground growth in both simulated drought and control conditions. We predicted that such resistant ecotypes would resist drought by showing similar responses in above ground traits.

Preliminary studies revealed some methodological challenges. In studies conducted on plates there was non-uniform growth within an ecotype in both the control and experimental groups. In studies with sand-filled pots, ecotypes receiving the mannitol-free nutrient solution showed sufficient above and below-ground growth, but ecotypes receiving mannitol had limited above and below-ground growth, making it difficult to measure traits.

Future research will compare the whole plant responses to simulated drought in Arabidopsis plants grown in sand until later in the life cycle, aiming eventually to gauge the life-long fitness effects of such stresses.