RootBot: High-Throughput Root Stress Phenotyping in Maize

Mia Ruppel[1,1,1], Grace Sidberry[2,2,2], Shawn Thomas[3,3,3], and Jacob Washburn[4,4,4]

[1]Department of Biomedical, Biological and Chemical Engineering, University of Missouri
[2]Division of Plant Science and Technology, University of Missouri
[3]Division of Biological Sciences, University of Missouri
[4]Plant Genetics Research Unit, USDA-ARS, Columbia, Mo

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Abstract

Higher temperatures across the globe are causing an increase in the frequency and severity of droughts. In agricultural crops, this results in reduced yields, financial losses for farmers, and increased food costs at the supermarket. Root architecture plays a major role in a plant's ability to survive and perform under drought conditions but phenotyping root growth to determine the genetic and environmental factors involved is extremely difficult due to roots being under the soil. RootBot is an automated high-throughput phenotyper that eliminates many of the difficulties and time constraints for performing multiple drought-stress studies. RootBot can simulate plant growth conditions during the first 72 hours of growth using transparent plates filled with soil (as opposed to synthetic media such as agar). RootBot has the capacity for up to 50 plates at a time, however, designing a system to organize these plates, image them at the appropriate times, and save and analyze the data for many plates simultaneously is challenging. To improve upon the pipeline, we incorporate strategies from existing phenotyping pipelines into the imaging and measurement processes. We will also investigate the genotypes using GWAS to identify sequence variants associated with drought tolerance or lack thereof. This pipeline will improve RootBot's abilities in high-throughput phenotyping and the information gathered will be helpful towards future genetic engineering and breeding.

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