A Platform to Quantify Phenotypic Responses to Root-Root Interactions Among Kin and Non-kin Common Beans

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Abstract

Quantifying phenotypes of root-root interactions would allow a greater understanding of how plants react to belowground competition through plasticity of architectural traits. Past research has shown that plants will over proliferate roots in the presence of competition, leaving less resources to allocate above ground, negatively impacting shoot growth and yields [1]. Further evidence highlights a response to neighboring plants in the root architecture of Arabidposis thaliana, as individuals concentrate root mass towards their competitors [2]. To visualize and quantify root architecture plasticity involved in these root-root interactions in real soil, we developed a modified mesocosm system. Within the mesocosm box common bean (Phaseolus vulgaris) seeds were germinated 10 inches apart from each other. Mesh screens were placed on either side of each bean, in order to capture root growth towards each other and/or away from each other. Plants were harvested at the 7-week mark, when the root archetype of each individual was developed and prominent. To harvest our boxes three sides of the mesocosm box was removed and the soil was washed away. Images of each box was taken to produce 3D models. Improvements to the mesocosm system will be made to reliably extract root traits in real soil. These experiments will shine light on an understudied section of crop science and will allow farmers and researchers a better understanding of an otherwise unseen phenomena.

A Platform to Quantify Phenotypic Responses to Root-Root Interactions Among Common Beans

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Abstract

Quantifying phenotypes of root-root interactions would allow a greater understanding of how plants react to belowground competition through plasticity of architectural traits. Past research has shown that plants will over proliferate roots in the presence of competition, leaving less resources to allocate above ground, negatively impacting shoot growth and yields [1]. Further evidence highlights a response to neighboring plants in the root architecture of *Arabidposis thaliana,* as individuals concentrate root mass towards their competitors [2]. To visualize and quantify root architecture plasticity involved in these root-root interactions in real soil, we developed a modified mesocosm system. Within the mesocosm box common bean (*Phaseolus vulgaris*) seeds were germinated 10 inches apart from each other. Mesh screens were placed on either side of each bean, in order to capture root growth towards each other and/or away from each other. Plants were harvested at the 7-week mark, when the root archetype of each individual was developed and prominent. To harvest our boxes three sides of the mesocosm box was removed and the soil was washed away. Images of each box was taken to produce 3D models. Improvements to the mesocosm system will be made to reliably extract root traits in real soil. These experiments will shine light on an understudied section of crop science and will allow farmers and researchers a better understanding of an otherwise unseen phenomena.

Keywords: Architectural root traits, phenotypes, root-root interactions, root plasticity

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