Root adaptive responses for improvement of abiotic stress tolerance in Pennycress

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https://www.pennycressresilience.org/

Project Goals: This project will employ evolutionary and computational genomic approaches to identify key genetic variants that have enabled *Thlaspi arvense* L. (Field Pennycress; pennycress) to locally adapt and colonize all temperate regions of the world. This, in combination with knowledge of metabolic and cellular networks derived from first principles, will guide precise laboratory efforts to create and select high-resilience lines, both from arrays of random mutagenesis and by employing cutting-edge CRISPR genome editing techniques. This project will deliver speed-breeding methods and high-resilience mutants inspired by natural adaptations and newly formulated biological principles, to be introduced into a wide range of commercial pennycress varieties to precisely adapt them to the desired local environments.

Abstract: Roots are the interface between the plant and the soil and play a central role in multiple ecosystem processes. With intensification of agricultural practices, rhizosphere processes are being disrupted and are causing degradation of the physical, chemical, and biotic properties of soil. Improvement of ecosystem service performance is rarely considered as a breeding trait due to the complexities and challenges of belowground evaluation. Advancements in root phenotyping and genetic tools are critical in accelerating ecosystem service improvement in cover crops. Here I will present root phenotyping approaches for assessing ecosystem service in a prospective cash cover crop; pennycress (*Thlaspi arvense* L.). In development is a large format mesocosm system that will allow 3D root system architecture analysis of multiple plants. Using this system, we will be assessing how variation in pennycress root system architecture can affect ecosystem service and abiotic stress tolerance with the plant to scale from single plant to canopy level traits.

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