Field Phenotyping Using Machine Learning Tools Integrated with Genetic Mapping to Address Heat and Drought Induced Flower Abortion in Soybean

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Overview of Project Objectives

A 30 to 80% flower drop in soybeans across the U.S. is an unresolved bottleneck that has limited full genetic yield potential ability. The multi-regional team will develop an image-based field phenotyping system, integrated with deep-learning tools to capture and correlate genetic variation in flower abortion and pod retention for different soybean genotypes grown under different soils and climatic conditions. This knowledge will help discover novel traits and molecular switches to enhance flower and pod retention and preserve and increase yield potential.

Key Results

Trial plots containing 30 different soybean genotypes were grown at Texas Tech University, Kansas State University, University of Missouri and the University of Tennessee. Flower and pod count numbers were recorded as well as flower abortion during the growing season. Other measurements taken include soybean yield, pods per node, number of seeds per plant and seed weight. Temperature and precipitation events were recorded during the growing season as well. Researchers at Texas Tech are in the process of developing a customized multi-object tracking algorithm designed to count soybean flowers in the field, through an image-based phenotyping system. This groundbreaking research offers solutions to use algorithms for large-scale flower counting beyond still images. Regarding floral organ abscission, researchers have focused on six genes in the Arabidopsis plant, which correspond to 27 soybean genes involved in this process. The team is investigating other genes reported to play a role in the process as well.

Benefit to Farmers

Retaining even a portion of the 30% to 80% of soybean flowers aborted under stressful conditions will allow for a 10 to 20% yield increase for U.S. soybean producers. This advantage can be extended to different soils, water availability conditions, temperatures, and is the major rationale for testing this hypothesis across different soybean growing states. This will allow soybean producers to gain additional economic return at the same level of investment including seed costs, fertilizer levels and management.

Links

Field Phenotyping Using Machine Learning Tools Integrated with Genetic Mapping to Address Heat and Drought Induced Flower Abortion in Soybean
USB National Soybean Checkoff Research Database

Multi-Regional Research Collaboration Focuses on Soybean Flower and Pod Retention for Improved Yield
SRIN article