SOYGEN3: Building Capacity to Increase Soybean Genetic Gain for Yield and Composition Through Combining Genomics-Assisted Breeding with Characterization of Future Environments

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Overview of Project Objectives

The overall goal of this program is to advance the use of soybean genetic data to accelerate the development of soybean varieties with improved yield, composition, and stress resistance. The team calls this approach genomics-assisted breeding. The team will develop better breeding methods that include routine implementation of genomic prediction in public soybean breeding programs. Project objectives include developing and enhancing genomics-assisted breeding resources and tools; developing and testing methods for predicting cultivar performance in target environments through genomics-assisted breeding models, phenomics, and environment characterization; and testing structural variants (differences in genomic sequences and genetic structure across different varieties) for improved genomic predictions for yield and seed composition.

Key Results

The team continued to develop the Northern Uniform Soybean Tests (NUST) database by planting and evaluating 511 new advanced breeding lines. Tissue samples for DNA extraction were collected from each line and they have been shipped for genotyping, as well as the 560 NUST breeding lines collected last year. The team continues to upload NUST data to the soybase website and it now includes NUST trial data (yield, disease resistance, and quality trait performance) from 1993-2023.

The team is working to enable public breeders with standardized and validated tools and technologies for executing genomic prediction. They are conducting a coordinated performance trial of 1,200 diverse breeding lines to better predict interactions between the environment and genotype (GxE). Each breeding line is being phenotyped for several agronomic and phenological traits and each will also be genotyped with the goal to improve prediction of GxE interactions.

Benefit to Farmers

Soybean breeding has a large impact on agriculture efficiency and profitability through the development of new high-yielding varieties with critical defensive traits and enhanced seed composition. Ensuring that private and public breeding programs are using state-of-the-art technologies to drive genetic gain in the face of changing environments and narrowing genetic diversity contributes to continual development and release of ever better soybean varieties. These efforts also help educate future agricultural scientists and soybean breeders to enter the seed industry and develop impactful products for farmers.

Links

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National Soybean Checkoff Research Database

Breeders Continue to improve Tools for Soybean Genetic Gain
SRIN article