THE POWER OF INNOVATION AT PNNL

Pacific Northwest NATIONAL LABORATORY

CONSORTIUM FOR ADVANCED SORGHUM PHENOMICS *(CASP)*

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Partners: Blue River Technology, Inc.; Lawrence Berkeley National Laboratory; Chromatin, Inc.; Kearney Agricultural Research & Extension Center

CRITICAL NEED:

SUSTAINABLE PRODUCTION OF AGRICULTURE FEEDSTOCKS REQUIRES CROPS WITH IMPROVED TOLERANCE TO ABIOTIC STRESS

Drought and salinity put stress on agriculture-based feedstocks, making it difficult for them to flourish. PNNL researchers are addressing this problem through the Consortium for Advanced Sorghum Phenomics, or CASP. The consortium is a collaborative effort with Blue River Technology, Inc.; Lawrence Berkeley National Laboratory; Chromatin, Inc.; and Kearney Agricultural Research & Extension Center.

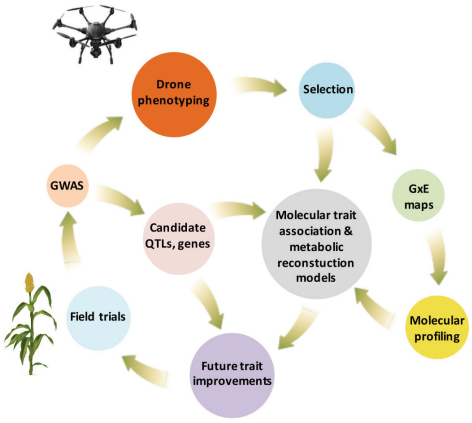
OUR SOLUTION:

ACCELERATE THE BREEDING PROCESS

The mission of CASP is to accelerate the breeding of biomass sorghum to maximize compositional yield under drought field conditions. The project will focus on simulating drought and salinity stresses to develop plant varieties that are more resilient to these environmental challenges. Using novel phenotyping platforms, predictive modeling techniques and image processing tools, PNNL will generate maps of plant composition and predict plant growth. Research will include the use of aerial drones and customized algorithms to provide high-throughput, field-based measurements.

PNNL will perform molecular phenotyping to identify breeding markers for these biotic stresses. Blue River Technology will develop autonomous phenotyping systems that can capture plant traits at the plot level from emergence to harvest. Chromatin, Inc., will advance improved commercial seed cultivars.

A major technical goal of the CASP project is to develop predictive genotype + environment phenotype (G x E) models for sorghum, allowing pairwise correlations of morphological, behavioral and molecular phenotypes, and of genotype with phenotypic data. Data collected from genotyping by sequencing will be used for genome-wide association studies. RNA sequencing and high-resolution metabolite and protein profiling of selected lines will be used to identify critical genes and to obtain mechanistic understanding for observed field traits.



OUR APPROACH:

INTEGRATING DRONE-BASED PHENOMOICS, GENOMICS AND MOLECULAR PROFILING

The CASP project will:

- *Combine field phenotyping of morphological and behavioral traits with molecular phenotyping of transcript, protein, and metabolite profiles that provides a mechanistic understanding of observed traits*
- *Assimilate much richer, higher volume, and deeper data sets with holistic predictive power and less tool-bias, including metabolite markers as phenotype predictors for growth and stress tolerance*
- *Use a drone-based sensor suite of LiDAR, NIR and thermal cameras to measure plant traits required for selection of drought and saline tolerant lines and yield prediction*
- *Leverage large collections of diverse and pre-selected sorghum germplasm*

THE RESULT:

INCREASED PRODUCTION OF RENEWABLE TRANSPORTATION FUELS

The CASP project will result in the creation of a sorghum pangenome to enhance the resolution and accuracy of G x E models and genomic selection. In addition, research from the CASP project will increase production of renewable transportation fuels and expansion of bioenergy production into affected areas—both of which will enhance the economic and energy security of the United States. G x E tools and processes being developed for this project can have broad applicability to other bioenergy and food crops, as well, where they also can accelerate the rate of genetic gain.

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FEBRUARY 2018 | PNNL-SA-115790