

## Characterization, Validation and Deployment of QTL for Grain Yield Components in Wheat

<https://www.triticeacap.org/>

More than 700 million tons of wheat are produced globally each year, providing more than one fifth of the calories and protein consumed by the human population. Current rates of improvement for wheat grain yield are not sufficient to meet the future demand of a rapidly growing population. Further increases in global wheat production will benefit from the deployment of new genes identified, characterized and validated to increase wheat yield. A Coordinated Agricultural Project (CAP)

**“Validation, Characterization and Deployment of QTL for Grain Yield Components in Wheat”**, a 5-year project aligned with IWYP that ended in December 2021 exploited new genomics tools and knowledge to identify genes controlling grain size, grain number, reproductive tiller number and overall grain yield. The effects of the identified genes were validated using available sequenced mutant populations, transgenic approaches and genome editing. After initial validation the alleles were incorporated into elite wheat lines to test their effect on grain yield when grown under different environments. The overall goal of the project was to discover the means of accelerating the rate of wheat improvement for grain yield without jeopardizing its quality and nutritional value. Another major objective of the project was to train the next generation of plant breeders during the course of the research.

### Main Objectives

- Characterize 15 QTL for grain yield and identify the underlying candidate genes
- Use wheat mutant lines and transgenic approaches for gene validation
- Deploy beneficial alleles of validated genes in commercial varieties and advanced breeding lines for testing of effects in the field
- Develop genomics tools to characterize the regulatory regions of the wheat genome
- Train a new cohort of 15 plant breeders and make the training resources widely available

### Key Outputs Available to Wheat Improvement Programs

- 16 cloned genes affecting grain size, number of grains, grain yield and resistance to diseases
- 98 new wheat varieties released into all market classes grown in the US
- 24 improved wheat lines and 23 discovery mapping populations developed and freely available
- Knowledge shared with the wheat breeding community via 237 peer reviewed scientific publications
- Improvements made to existing wheat transformation methods that increase regeneration and gene editing efficiencies in wheat
- More than 1 billion genotyping datapoints produced that facilitate genomic selection, marker-assisted selection and map based cloning projects in public wheat breeding programs
- Improvements in the [T3 repository](#) to provide easier access to existing wheat datasets, improved applied breeding functionality and better connection with Breedbase ([T3/Breedbase](#)), thus benefitting from exposure to a larger developer community and its applied breeding features (both current and planned)

**WHEAT CAP**  
Coordinated Agricultural Project



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  - Meet our students (WheatCAP 2017-2021)
- 2020 Webinar series
- 2019 WheatCAP Plant Science

#### Welcome to the WheatCAP

Our efforts in advancing wheat breeding

The U.S. Department of Agriculture (USDA) breeders and researchers from 22 institutions better adapted to the challenges imposed by drone imagery and phenotyping, high-throughput tools. The project will also contribute to training the next generation of plant breeders.

Come back to this site often as we post updates

#### Education extension and outreach

- Educational Activities
- Plant Breeding Training Network
- Wheat and Barley Related Education

#### Unmanned Aerial Systems (UAS)

- UAS User Manual for the WheatCAP

<https://www.triticeacap.org/meet-our-students/>

