

## **Variety Development 2021**

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### **Principal Investigator**

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### **I. Mission Statement**

Michigan State University Wheat Breeding and Genetics develops high yielding soft winter wheat varieties with improved quality and disease resistance that meet the demands of wheat growers and the Michigan flour milling industry. The MSU wheat breeding program sustains a pipeline of elite soft white and soft red winter wheat varieties by combining accelerated generation advancement and enrichment of genetic diversity. As a service to the wheat industry of Michigan, statewide testing of wheat varieties and experimental lines is conducted annually.

### **II. 2021 Results**

#### **A. Commercial Yield Trials**

In 2020, 9 soft white winter and five soft red wheat lines were tested in the Michigan commercial yield trial <https://varietytrials.msu.edu/wheat/>. The commercial yield trial was comprised of 115 soft red and white winter wheat varieties and experimental lines and tested at seven locations across Michigan. Combine harvest collected data on grain yield and test weight. Other important traits evaluated include plant height, flowering date and FHB resistance. Additionally, data on milling and baking quality is provided by the USDA-Soft Wheat Quality Lab in Wooster, OH.

#### **B. 2020 Advanced Yield Trials**

Advanced yield trials (AYT) were divided into soft red and soft white winter wheat market classes. Intensive management practices are applied to the AYT including an early fungicide application, additional nitrogen and a fungicide at flowering. Intensive management enables a more accurate assessment of yield potential and comparison with commercial check varieties. Data were collected on a suite of traits and disease resistance. Flowering date was measured at Mason. Plant height was measured at Mason and SVREC sites. Three replications of each line were evaluated in the misted and inoculated FHB nursery. All lines in the AYT were screened for resistance to leaf rust in the greenhouse.

The soft red AYT included 107 experimental entries and five checks, DF 112 R, P25R40, P25R74, P25R77 and SY 100 (Table 1). The six testing locations included SVREC and Mason in MI, Champaign and Centralia in IL and Rockford and Tiffin in OH. A set of 9 lines were advanced to commercial testing in 2022.

The soft white AYT included 54 experimental entries and six checks, Ambassador, Dyna-Gro 9242, Jupiter, KWS317, P25W38 and Whitetail (Table 1). Three testing locations in MI included Mason, SVREC and Huron county. Four lines were advanced to commercial yield testing in MI including MI18W0200, MI18W0286, MI18W0144 and MI18W1044. A set of 10 lines were advanced to commercial testing in 2022.

### **C. 2021 Preliminary Yield Trials**

Preliminary yield trials (PYT) of 253 lines and 12 soft red and white checks were conducted at four locations, the Mason breeding location, Huron count, Sanilac county and the Saginaw Valley Research and Extension Center (SVREC) in Richville, MI. All lines were evaluated for grain yield, test weight, plant height and flowering date in two replicates at each location. Additionally, lines were tested in three replicates in the FHB nursery and screened in the greenhouse for resistance to leaf rust. DON data from 2020 was also available as a selection criteria.

A set of 29 soft red winter wheat lines were advanced to testing at 16 locations across Michigan and the Eastern soft wheat region. A set of eight soft white winter wheat lines advanced directly to the Michigan commercial yield trial.

### **D. 2021 early generation nursery**

The 2021 early generation nursery was comprised of 700 F<sub>4</sub> derived lines advanced in 2020 genome-estimated breeding values for high grain yield, low DON mycotoxin and low preharvest sprouting. Flowering date canopy architecture and agronomic data were collected in spring and summer 2020. Fusarium head blight resistance was evaluated in the FHB nursery.

Lines not selected were mowed by hand prior to harvest. Selected lines were combine harvested and seed was cleaned for planting. FHB resistance, agronomic type and resistance to rusts was used to advance a set of 250 new lines to replicated yield testing in 2022.

### **E. Early Generation Selection**

Single plant selections were made in 562 F<sub>4</sub> plots at Mason. A total of 2,400 single plants were selected, harvested and threshed individually. Tissue was collected in all selected plants, DNA was isolated and SNP genotyping was carried out. Marker data and phenotypic data on the program training population were used to develop GEBVs for grain yield, FHB resistance and resistance to preharvest sprouting. A set of 500 plants were selected and planted in short four-row plots for observation and seed increase in 2022.

### **F. 2021 Crossing Program**

A total of 583 crosses were made between the fall and spring crossing blocks in fall 2020 and spring 2021 including single crosses, topcrosses and several backcrosses to elite Michigan-adapted varieties. Topcrossing and backcrossing F<sub>1</sub>s back to adapted material from other regions is necessary to recover adaptation to Michigan environments. Topcrossing also drives the recombination necessary to generate the new allelic combinations for superior agronomic performance. F<sub>4</sub> populations were produced in the greenhouse and planted in 487 35' by four row bulk plots of ~300 individuals for selection in spring, 2021. Populations are singulated at 6" to allow separation of individual plants

### **G. 2021 Variety Trials**

Trials comprised of both MSU advanced breeding lines and Michigan State Wheat Performance Trials were managed by Dennis Pennington and Amanda Noble. The State Performance Trials included 115 entries and 2,415 plots were harvested from six locations. Results from the State Performance Trials were published in Michigan Farm news and online at <http://www.miwheat.org/trial-variety-infomation/> and <http://www.varietytrials.msu.edu/>. Trials

were harvested five locations in Huron, Ingham, Sanilac, and Tuscola counties. Funding from The Michigan Wheat Program enabled the testing of lines in the State Performance Trials under intensive management practices at Tuscola county. Treatments included additional nitrogen as well as an early and late season fungicide application to control foliar diseases and Fhb, respectively. Comparisons of lines under different management practices were made and included in the variety trial report at <http://www.varietytrials.msu.edu/>.