**Developing Soft Winter Wheat Varieties for Michigan, 2022**

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**Principal Investigator**

*Dr. Eric Olson*, Michigan State University, Department of Plant Soil and Microbial Sciences, 1066 Bogue Street, Room 382, East Lansing, MI 48824, eolson@msu.edu

**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. 2022 Results**

**A. Commercial Yield Trials**

In 2022, 14 soft white winter and 13 soft red wheat lines were tested in the Michigan commercial yield trial <https://varietytrials.msu.edu/wheat/>. The commercial yield trial was comprised of 123 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.

Two soft white winter wheat lines, MI20W0035 and MI20W0121, were advanced to a second year of commercial testing in 2023.

**B. 2022 Advanced Yield Trials**

Advanced yield trials (AYT) was comprised of 37 soft red winter wheat entries and five commercial checks. The AYT was tested in 16 locations across IL, IN, KY, MI, MO and OH. A set of eight soft red winter wheat lines were advanced to commercial testing in 2022.

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.

**C. 2022 Preliminary Yield Trials**

Preliminary yield trials (PYT) of 328 soft red and white wheat experimental genotypes and commercial 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 34 soft red winter and four soft white winter wheat lines were advanced to a second year of testing at 30 locations across Michigan and the Eastern soft wheat region.

**D. 2022 early generation nursery**

The 2022 early generation nursery was comprised of 500 F4 derived lines advanced in 2021 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 2022. 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 560 F4 plots at Mason. A total of 3,040 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. 2022 Crossing Program**

A total of 458 crosses were made between the fall and spring crossing blocks in fall 2021 and spring 2022 including single crosses, topcrosses and several backcrosses to elite Michigan-adapted varieties. Topcrossing and backcrossing F1s 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. F4 populations were produced in the greenhouse and planted in 50’ by six row bulk plots of ~300 individuals for selection in spring, 2021. Populations are singulated at 6” to allow separation of individual plants