Laying the foundation for genomics assisted oat breeding at the University of Minnesota.

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Minnesota once lead the United States in oat production, peaking at over 5 million acres in the 1940's. However, acreage has steadily declined to about 300,000 acres today. The oat breeding program at the University of Minnesota developed improved oat varieties from 1890's until 2013. The focus of the program was on oats for animal feed. The largest oat processing companies and millers in North America are based the Upper-Midwest and use as much as 95% imported oats for milling for human food. University of Minnesota recently reinstated oat breeding program to meet producers demand for locally sourced milling oats. To quickly develop germplasm suitable for starting a milling oat breeding program, a diverse "founder" panel was gathered from other breeding program in the Upper-Midwest and Canada. These 252 lines were genotyped with over 200,000 genotyped by sequencing markers and targeted sequencing approach. The panel was phenotyped in 2016 and 2017, and 2018 for agronomic, milling-quality, and disease resistance traits. Predictive ability of traits of importance ranged from 0.4 (grain yield) to 0.7 (heading date). Genome-wide association studies (GWAS) of this panel have identified a number of important significant loci of many traits including crown rust, heading data, plant height, and grain color. This panel is a community resource that has the ability to be mined for different traits to inform breeding decisions, develop useful germplasm, and facilitate collaboration across the oat community.