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Project Title: Enhanced Resistance to Fusarium in Two-Rowed Barley.

PROJECT 1 ABSTRACT

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The primary object of this project is development of two-rowed malting barley (*Hordeum vulgare*) cultivars for the Upper Midwest with better resistance to Fusarium head blight (FHB) or scab, *Fusarium graminearum.* Secondary goals include 1) identifying two-rowed breeding lines with better FHB resistance, 2) accumulating genes for FHB resistance in elite two-rowed breeding, and 3) examining genetic factors that restrict development of Midwest barley cultivars with FHB resistance. A modified pedigree scheme is being used to generate breeding lines with more FHB resistant and better adaptation North Dakota (ND). Semi-dwarf, early-heading cultivars from Eastern China are used as the primary source of FHB resistance (*Rfg*) genes. FHB resistance, low deoxynivalenol (DON) accumulation, and key agronomic trait have complex inheritance patterns; thus, more emphasis is being placed on isolation of FHB resistant lines from single crosses. The FHB reactions and the DON levels of lines and populations grown in FHB screening nurseries in China and ND will be evaluated. Several morphological traits mapped near the six-rowed spike (*vrs1*) locus in chromosome 2H have limited progress in combining essential agronomic traits with *Rfg* genes. The agronomic effects of early maturity (*Eam6*) and plant height (*hcm1*) genes in 2H have been investigated; however, suitable recombinants with *Rfg* genes have not been found. To aid in identifying recombinants, agronomic and molecular marker data will be collected on single-seed descent lines from a Shenmai 3/ND19119 cross.

In a progeny from an early-maturing cultivar from East China crossed to a ND line, QTLs for FHB resistance or DON levels were not found in the centromeric region of 2HL. This suggests that characteristics that promote FHB escape may be as important as genes for FHB resistance. The key may traits include lodging resistance (short stature), early maturity (*Eam5* and *eam9*), and short grain-fill-period. The *Eam5* and *eam9* genes for short-day response seem necessary to develop early, semidwarf lines (*sdw1* and *sdw4*) for long-day conditions. Bowman backcross derived lines with various spike density and maturity factors will be screened to identify possible FHB escape factors. Agronomically acceptable lines will be developed to further investigate escape mechanisms in two-rowed barley. Screening for low FHB readings and DON levels will be continued in elite lines because the utilization of two-rowed barley is based primarily on malt quality factors such as high kernel plumpness, low grain protein, high malt extract, and low beta-glucan values. Progeny from three-way and other complex crosses tested to identify ones in which these characteristics are combined with high yield and low DON levels. The most promising line so far is 2ND21863.