

1. What major problem or issue is being resolved relevant to Fusarium head blight (scab) and how are you resolving it?

Our primary and long-term goal is to reduce the losses caused by FHB, including quality discounts due to DON contamination. This can be best achieved by developing barley cultivars with the highest level of resistance possible. We have identified promising sources of resistance through multiple years and locations of field screening. Several diverse sources of resistance have been crossed with advanced breeding lines to map and characterize loci conferring FHB resistance. The specific objective for this proposal is to determine the number, effect, and chromosomal position of FHB resistance loci in two barley accessions (Kutahya, a two-rowed cultivar from the Netherlands and W-365, a wild barley accession from Iraq) using the advanced backcross quantitative trait locus (QTL) method. This research will lead to the development of advanced breeding lines with loci conferring resistance to FHB and the accumulation of DON. This information and germplasm will allow breeders to more rapidly develop FHB resistant barley cultivars for growers.

2. List the most important accomplishment and its impact (i.e. how is it being used) to minimize the threat of Fusarium head blight or to reduce mycotoxins. Complete both sections (repeat sections for each major accomplishment):

Accomplishment: We have produced ~70 BC2F1's from the Kutahya/Quest population and ~86 BC2F1's from the W-365/Quest population. The BC2F1 crossed seed will be advanced three additional generations (BC2F1, BC2F2, and BC2F3) by long day (22 hour) incubation in the growth chamber in order to have sufficient seed for disease phenotyping in the field in 2012 at St. Paul and Crookston. Plants from the BC2F4 generation will be genotyped with SNP markers in Fall 2012.

Impact: We have discovered new and diverse sources of FHB resistance in barley that are different from those already reported. This is based on genotyping assays conducted with Diversity Arrays Technology (DArT) and other molecular markers such as SNPs. The identification of resistant germplasm is the first step in developing barley cultivars with enhanced resistance to FHB and the accumulation of toxins. Our project previously developed an advanced backcross QTL population involving the Israeli wild barley accession PI466423 with the Minnesota cultivar 'Rasmusson' as the recurrent parent. Progeny with enhanced resistance and acceptable agronomic characteristics were identified and are being used in the breeding program.

Include below a list of all germplasm or cultivars released with full or partial support of the USWBSI. List the release notice or publication. Briefly describe the level of FHB resistance.

I was a team member in the development of Conlon barley, the first two-rowed malting barley accepted by industry in the Upper Midwest. Our testing, through USWBSI funding, revealed that Conlon exhibited lower FHB severities and lower DON levels (about 25% lower) than other six-rowed cultivars at the time. The cultivation of Conlon contributed to more barley grain with non-detectable DON levels being available for malting. Conlon was bred by Jerome Franckowiak at North Dakota State University and was released in 1996. It was accepted for malting by AMBA in 2000.

I also was a team member in the development of Quest barley, the first six-rowed malting type cultivar with partial FHB resistance to be released after the 1993 epidemic. Quest was released in January 2010 and was available for commercial production in 2011. It accumulates about half the level of DON compared to the dominant varieties Tradition and Lacey, and this information has been posted on the ScabSmart website. Moreover, Quest was added to the list of recommended varieties for malting by the American Malting Barley Association (AMBA).

Include below a list of the publications, presentations, peer-reviewed articles, and non-peer reviewed articles written about your work that resulted from all of the projects included in the grant. Please reference each item using an accepted journal format. If you need more space, continue the list on the next page.

During the period of May 2010 to May 2011, I was on sabbatical leave in Scotland. No publications or presentations were delivered during this period.