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PROJECT 1 ABSTRACT

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Fusarium head blight (FHB; scab), a fungal disease of wheat and barley caused by *Fusarium graminearum*, threatens to reduce these small grains to economically unviable crops in the United States. Substantial losses are occurring due to reduced grain yield and quality. To complement the major wheat and barley breeding efforts, several laboratories have established genetic engineering approaches to enhance resistance to FHB. However, a limitation of the genetic engineering efforts is the lack of useful resistance genes. This proposal aims to continue our gene discovery effort for FHB resistance genes. We will use the latest genomics tools to study the wheat-*F. graminearum* and barley-*F. graminearum* interactions and to identify the mechanisms, pathways and genes that are involved in FHB resistance. RNA profiling experiments using barley and wheat Affymetrix GeneChips will be conducted on resistant and susceptible barley and wheat genotypes infected with *F. graminearum*. In particular, we will examine barley and wheat near-isogenic line pairs carrying contrasting resistant and susceptible alleles at known QTL. These experiments will identify differences in gene expression in these different genotypes. Bioinformatics analysis of the profiling experiments will be employed to identify genes that are up and down regulated as well as clusters of genes that are coordinately regulated over the course of infection. Additional bioinformatics will include comparing the gene expression profiles in barley and wheat. Due to the different FHB disease phenotypes in wheat and barley, comparing gene expression in wheat and barley will identify differences in gene expression that underlie the different disease phenotypes. Comparisons to other species including maize, rice and Arabidopsis will help determine functions of genes and direct future experimentation. Finally, genes that we identified from our previous EST analysis and genes identified in our RNA profiling experiments will be validated. Potentially useful resistance genes will be examined further and provided to the genetic engineering groups for transformation and to the breeding programs for use as molecular markers. The proposed research meets the objectives of the U.S. Wheat and Barley Scab Initiative and fits within the biotechnology area of research because we will identify molecular mechanisms, pathways and genes that are involved in these small grains-pathogen interactions and are potentially involved in FHB resistance.