**PROJECT 1 ABSTRACT**

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*Fusarium* head blight (FHB), also known as scab, has reemerged as a devastating disease of wheat and barley. *Fusarium graminearum* is the primary cause of scab. Gene-for-gene resistance has not been identified for scab. The best source of resistance against scab is a complex, quantitative trait derived from the spring wheat cultivar Sumai 3. Similar resistance is not available for durum. Biotechnology provides an alternative approach for developing scab resistant wheat. Our approach has been to utilize regulatory genes involved in plant defense mechanisms to engineer enhanced scab resistance. Regulatory genes offer the advantage that they can simultaneously modulate expression of multiple defense genes. Our USWBSI supported studies have identified salicylic acid (SA) as an important signaling molecule in plant defense to *F. graminearum*. Furthermore, these studies have documented the utility of the *Arabidopsis thaliana* NPR1 gene (AtNPR1), a key regulator of SA signaling, in augmenting scab resistance in transgenic wheat. Our work with Arabidopsis-*F. graminearum* interaction has identified Arabidopsis *PAD4* (AtPAD4), which modulates SA signaling and the accumulation of antimicrobial metabolites, as another candidate gene for engineering scab resistance. In addition, AtPAD4 is also involved in defense against aphids, which are vectors of plant viruses.

The specific objectives of this proposal are to: (1) **Continue field trial evaluation of the Ubi1:AtNPR1 transgenic cv Bobwhite plants.** We propose to build on the encouraging results from our past field trials with the transgenic Ubi1:AtNPR1 cv Bobwhite plants in Kansas, by replicating these trials in Minnesota. We will measure FHB disease index and DON levels in these trials. (2) **Continue our efforts to transform and characterize AtNPR1 expressing durum and elite cultivars of hexaploid wheat.** We will continue our efforts to transform the Ubi1:AtNPR1 construct into durum and elite cultivars of hexaploid wheat. In addition, we will evaluate transgene expression and scab resistance in the transgenic durum wheat plants that have already been generated and others that we hope to obtain during the remainder of fiscal year 2006. (3) **Engineer AtPAD4 expression in wheat.** The AtPAD4 cDNA will be cloned under the control of a maize Ubi1 promoter, and the resulting Ubi1:AtPAD4 construct will be transformed into hexaploid wheat. We will evaluate transgene expression and the level of the chimeric AtPAD4 protein in the transgenic plants. In ensuing years, we will test scab resistance in promising lines.

*Our ongoing and proposed projects are relevant to the BIOTECHNOLOGY initiatives of USWBSI, by promoting the transgenic testing of genes/signaling pathways for creating scab resistant germplasms.*