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PROJECT 1 ABSTRACT
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In the US, annual losses of wheat to scab have at times reached $ 1 billion, averaging between $ 200-400 million annually. Biotechnology offers an alternative approach for rapidly developing scab resistant wheat. Regulatory genes that control expression of multiple defense genes are good candidates for enhancing durable resistance. The *NPR1* gene, which coordinates expression of defense genes in *Arabidopsis thaliana* and its wheat ortholog, *WhNPR1*, are regulatory genes that offer promise in developing plants with resistance to fungal diseases. We have shown that expression of Arabidopsis *NPR1* (*AtNPR1*) from the maize *Ubi1* promoter enhances resistance to scab in transgenic wheat. In addition, expression of the wheat NPR1-like gene, *WhNPR1*, is activated in flag leaves and spikes of *F. graminearum*-infected wheat, suggesting its possible involvement in defense against scab.

The specific objectives of this proposal are to: (1) Continue evaluating the stability of *Ubi1:AtNPR1* expression and scab resistance in field trials and green house studies. We propose to carry out field trials on two *Ubi1:AtNPR1* expressing lines, 125 and 192. We will measure the disease index, grain yield and DON levels in these trials. In addition, in green house studies, we will continue evaluating stability of transgene expression and scab resistance in the T4 – T6 progeny derived from the two promising lines 125 and 192. (2) Characterize the molecular basis of scab resistance in *Ubi1:AtNPR1* plants. We will use the suppression subtractive hybridization (SSH) technology to identify cDNA's of genes that are expressed at elevated levels in the *Ubi1:AtNPR1* expressing lines in comparison to non-transgenic wheat. These cDNA's will improve our understanding of the defense mechanisms, signal transduction pathways and transcription factors associated with the scab-resistant phenotype of the *Ubi1:AtNPR1* expressing plants. (3) Characterization of transgene expression in wheat transformed with the *Ubi1*:*WhNPR1* construct. We will evaluate transgene expression in transgenic wheat plants expressing the wheat NPR1 under control of the *Ubi1* promoter. Considering that this is a wheat gene, which will interact better with other components in wheat cells, we expect it to be more effective in enhancing resistance than the Arabidopsis NPR1. In ensuing years, we will test scab resistance in promising lines.