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PROJECT 1 ABSTRACT
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Our long-term goal is to develop wheat plants expressing enhanced and broad-spectrum resistance to scab. In recent years, scab has re-emerged as a devastating disease of wheat and barley, severely limiting productivity. 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. Past studies involving over expression of individual defense genes have met with limited success. These studies have suggested that to develop wheat with broad-spectrum resistance to scab, multiple defense genes will need to be simultaneously expressed. This offers many challenges. However, regulatory genes that control expression of multiple defense genes could overcome these difficulties. 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. Preliminary evidence gathered by us show that over expression of Arabidopsis NPR1 enhances resistance to scab in transgenic wheat. In addition, expression of the wheat NPR1-like gene, *WhNPR1*, which has been cloned by us, is activated in flag leaves and spikes of *Fusarium graminearum*-infected wheat plants, suggesting its possible involvement in defense against scab.

Our specific objectives of this proposal are to: **(i)** determine the efficacy of over expression of the Arabidopsis NPR1 protein on scab resistance in wheat. We have generated transgenic wheat plants that constitutively express the Arabidopsis *NPR1* (*AtNPR1*) gene form the ubiquitously expressed maize ubiquitin promoter. We will evaluate the stability of *AtNPR1* expression and scab resistance in the progeny of some of these *ubi1:AtNPR1* transgenic lines and determine if resistance correlates with the level of expression of the transgene. **(ii)** Generate transgenic plants constitutively expressing the wheat NPR1 (*WhNPR1*) cDNA under control of the maize ubiquitin promoter and evaluate resistance to scab in these *ubi1:WhNPR1* transgenic wheat plants. 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, promising lines exhibiting durable resistance in subsequent generations will eventually be propagated for introduction into the existing breeding programs at KSU. If successful in wheat, similar strategies could be applied to develop scab resistant barley germplasm.