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Project Title: Engineering Improved Anti-Fusarium Protein Accumulation in Transgenic Wheat.

PROJECT 1 ABSTRACT
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The goal of the proposed work is to use genetic transformation to create new sources of hexaploid and durum wheat germplasm with host plant resistance to scab. Transgene loci, by their very nature, carry molecular markers and thus can be readily introgressed into varieties adapted for growth in areas most severely affected by scab. Thus far, we have generated 23 lines of hexaploid wheat in which one or two of six different candidate anti-*Fusarium* (AF) gene constructs exhibit detectable expression. Two of these showed increased Type II (spread in head) resistance in greenhouse tests, but none tested thus far have exhibited field resistance. Type II resistance tests of other high expressers for each construct are in progress. The apparent ineffectualness of the AF transgenes could be because the proteins encoded by these genes do not affect fungal growth or mycotoxin production, but it equally likely to be due to inadequate levels of expression in the parts of the plants that encounter the fungus. The research proposed for 2003 aims to distinguish among these possibilities by localizing transgene expression more directly and precisely, by measuring AF enzyme levels in tissues, and by making pairwise combinations of transgenes with complementary modes of action. We will also make and test transgenic plants containing new versions of a *Fusarium*-derived glucanase-encoding gene with sequence changes expected to improve its RNA accumulation in wheat. New potential AF genes will be constructed and evaluated including ones that encode L3 ribosomal proteins that are resistant to DON's toxicity, and ones that will increase the oxidative defense response in parts of the floret. Tissue specificity of a new isolated barley promoter, *Lem1*, will be evaluated. The results of these experiments will guide the design of future AF genes for efficient expression in wheat.