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PROJECT 1 ABSTRACT
(1 Page Limit)

Fusarium graminearum is a necrotrophic fungal pathogen that causes scab disease, resulting in considerable grain loss in cereal crops around the world. To date, insufficient resistance has been identified within existing wheat germplasm collections. Due to the lack of resistant germplasm, classical breeding and biotechnological techniques have been combined to enhance resistance to scab. The primary goal of the project is to evaluate advanced transgenic lines expressing antifungal and anti-apoptotic (anti-programmed cell death, PCD) genes in wheat for durable field resistance towards *F. graminearum*. Recent data supports the effectiveness of this approach for controlling scab infection in wheat. This effort addresses the following biotechnology priorities: transformation of wheat to demonstrate the effectiveness of "anti-apoptotic" transgenes to inhibit necrotrophic pathogen infection, primarily by *F. graminearum*; growth and rate of infection under greenhouse conditions and, ultimately, field conditions; identify and analyze additional genes with effective anti-apoptotic properties against *F. graminearum*, and evaluate novel synthetic promoters that are specifically pathogen responsive. Advanced homozygous lines expressing anti-fungal genes (lytic peptides, and ribosomal inactivating proteins) and anti-apoptotic genes (ced9, Bcl_xL, Op-IAP and recently Sf-IAP), are being derived and field tested both regionally and nationally. Moreover, our preliminary evidence indicates that scab infection takes place in an apoptotic-like process. We are also in the process of determining whether deoxynivalenol alone induces apoptotic like responses in wheat cells. Collaborations will continue with Dr. Yue Jin to screen advanced homozygous lines under greenhouse conditions as a critical part of independently confirming our results. With respect for intellectual property rights, Dr. Dickman has an exclusive agreement with a mammalian pharmaceutical company along with access to many non-publicly available genes found to modulate PCD, thus providing excellent candidates for generating additional transgenic lines with enhanced anti-apoptotic properties. Promising lines with FHB tolerance are being crossed into advanced winter wheat breeding lines as part of the breeding efforts. We propose crossing our elite anti-fungal gene containing lines to our elite anti-apoptotic gene containing lines to study additive resistance acquired through joint expression levels against FHB. We will also intercross elite lines expressing anti-fungal genes to anti-apoptotic transgenic plants to test enhanced FHB tolerance by molecular gene pyramiding.