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PROJECT 2 ABSTRACT
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CRISPR/Cas9 genome editing system developed recently is a powerful tool for genetic engineering. This system has been widely used in many crop species including rice, maize and wheat. However, only a few wheat varieties can be used for transformation due to low rate of callus induction and regeneration in tissue culture process of most wheat varieties using available transgenic method. Currently, most transgenic plants have been generated from a spring variety 'Bobwhite' that has many undesired agronomic and grain quality traits and is not suitable for commercial production. Therefore, it is necessary to develop a new efficient gene delivery method to accelerate the utilization of genome editing technology for routine wheat breeding. *Barley stripe mosaic virus* (BSMV) is an efficient virus-induced gene silencing vector (VIGS) and has been widely used in wheat and other cereal crops for RNAi. Many studies showed that BSMV can spread to progeny through infected germline cells (pollens and ovules) at about 10% seed transmission rate, and the infected plants may produce some seeds with targeted modifications. Therefore, we propose to develop a novel gene delivery strategy for genome editing that can be used in any elite wheat varieties. Our objectives are to 1) develop BSMV-mediated CRISPR/Cas9 genome editing system that bypasses the requirement for transformation and regeneration of tissue culture procedure in wheat; 2) generate FHB resistant varieties by genome modification of a susceptible gene *TaHRC* for *Fhb1* that was recently cloned from our lab using this new system; 3) release the newly developed elite lines with *Fhb1* resistance as resistant parent for wheat breeding programs. In the second year of the planed project (5/1/2019-4/31/2020) we will construct and deliver specific gRNA targeting *TaHRC* into the homozygous lines with Cas9 through the BSMV-mediated gRNA delivery system, screen for the presence of *TaHRC* mutation using next-generation sequencing of target amplicons from all wheat samples, select wheat elite lines with improved resistance to FHB and release to wheat breeding programs for further breeding activities. Successful completion of this project will provide a new genome editing technology for wheat breeders and facilitate the development of new wheat varieties with FHB resistance and eventually will benefit wheat farmers.