## Project Abstract

| | | |
|---|---|---|
| **Project Title:** | Developing winter wheat varieties with enhanced resistance to FHB for South Dakota | |
| **Principal Investigator:** | Sunish Sehgal | South Dakota State University |
| **Co-Investigator:** | Shaukat Ali | South Dakota State University |

South Dakota is the primary state in the US Great Plains hard winter wheat region that is threatened by Fusarium head blight (FHB), a destructive disease with losses to the tune of $20 million in some years. Through years of breeding efforts, we have exploited native resistance to develop moderately resistant FHB varieties like Lyman, Overland, and Redfield; however, these varieties provide limited protection and are becoming susceptible to other diseases. The overall goal of the project is to combine the native resistance (Lyman, Overland, AC Emerson) with major genes (*Fhb1* through marker-assisted backcrossing and genome-wide selection into SD elite breeding material and expedite the development of new and improved varieties.

The specific objectives of the project are 1) to develop FHB resistant and low DON winter wheat varieties for South Dakota and surrounding regions; (2) pyramiding major and minor genes for FHB resistance by developing phenotypic and genomic selection models for the SDSU winter wheat program. These objectives will be addressed through 1) screening of elite breeding lines and adapted cultivars in a mist-irrigated and inoculated FHB field nursery to identify materials with FHB resistance and use them as parents in our crossing block; 2) use of DON testing results to select advanced lines with low DON and choose parental lines; 3) genotype parents and segregating progenies (F1 and BC1F1) to perform marker-assisted selection; 4) selected breeding lines will be screened in the greenhouse/ a mist-irrigated and inoculated FHB field nursery to advance the lines with enhanced FHB resistance; 5) continue to pyramid major and minor genes for resistance to FHB. In addition to phenotyping, we will continue our efforts to develop and implement a genomic selection strategy and perform genome-wide association analysis. Further, we will continue to evaluate breeding lines and cultivars from public and private breeding programs in the region under mist-irrigated nurseries through participation in several multi-location regional nurseries such as HWW FHB nursery, Private industry FHB nursery, and our Crop Performance Testing (CPT) nursery. The expected outcome of the project would be the release of new winter wheat cultivars with enhanced FHB tolerance and lower DON which are adapted to the South Dakota environment. The development of FHB resistant/tolerant varieties would benefit the growers by minimizing loss due to FHB. A lower DON content in the HWW supply will benefit the milling and baking and export industry, and consumers will benefit from safe wheat products.