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**Project Title:** Developing Winter Wheat Varieties with Enhanced Resistance to FHB and low DON

## PROJECT 1 ABSTRACT
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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 FHB resistant varieties like Lyman, Overland, and Redfield, however, these varieties provide limited protection and are becoming susceptible to other diseases. The proposed research project directly fits with the objectives of the HWW-CP.

*Objective 1:*
*1.) Increase the efficiency of coordinated project breeding programs to develop and release FHB resistant varieties. 2.) Test and evaluate regional germplasm to include breeding lines from the public and private breeding programs in mist-irrigated field nurseries.*

*Objective 2:*
*Enhance selection efficiency through technologies such as genomic selection, marker-assisted selection, doubled haploid production leading to pyramiding of major and minor genes for FHB resistance.*

Our plan is to combine the native resistance (Lyman, Overland, AC Emerson, and Redfield) with major genes (*Fhb1* and *Fhb6*) through markers assisted backcrossing into South Dakota elite breeding material. This objective 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 and choose parental lines; 3) genotype parents and segregating progenies ($F_1$ and $BC_1F_1$) to perform markers assisted selection; 4) selected breeding lines will be screened in the greenhouse /in 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 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 nursery through participation in several multi-location regional nurseries such as HWW FHB nursery, Private industry FHB nursery and through our Crop Performance Testing (CPT) nursery.

The data on FHB resistant varieties/germplasm will be shared with other participating breeding programs, extension specialists, producers, and end-use stakeholders through meetings, field days, social media platforms, publications, and Scab database.