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Project Title: Development of Spring White and Specialty Wheat Cultivars Resistant Scab Disease.

PROJECT 1 ABSTRACT

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Fusarium head blight (FHB) or scab is the major fungal disease affecting all spring wheat in the U.S. Northern Great Plains. It is therefore, imperative that white and specialty spring wheat (WSW) varieties express FHB field-level resistance. The use of genetically resistant and adapted cultivars is the best strategy for an efficient, economical, and safe control of FHB disease in the spring wheat growing region while protecting our environment. Recently developed HRSW cultivars by NDSU breeding program (Alsen, Steele-ND, Howard, Glenn, and Faller) with moderate FHB resistance which are being grown on more than 50% of ND 7 million wheat acres is an example to follow to develop adapted white and specialty wheat germplasm and cultivar for the spring wheat region. The ultimate objectives of this project are to develop adapted WSW germplasm and cultivars to ND and the spring wheat region with enhanced FHB resistance. Proven breeding methodologies including classical and novel techniques such as molecular markers to facilitate screening of resistance lines will be utilized. The overall objectives of this projects are: 1) developing WSW germplasm and cultivars which combine higher levels of resistance to FHB (with low disease severity and DON levels), superior grain yield and endues product quality; and 2) identifying and introgressing multiple FHB resistance that reduces disease infection and DON levels into adapted WSW germplasm base.

To achieve these objectives, adapted superior WSW genotypes will be used to develop segregating populations for selection and advancement of elite lines that combine FHB and other diseases resistances with desired agronomic and quality traits. Pre-harvest sprouting, insect resistance such as solid stem for saw fly resistance and grain shattering resistance will be also selected for. Advanced and elite lines will be tested in multiple field trials in ND to identify FHB and other major insect/diseases resistant genotypes that meet the desired adaptation, agronomic and quality criteria for cultivar release. The complex nature of genetic resistance to FHB in wheat is significantly affected by the environmental conditions. Continuous search of new sources of resistance, particularly type I resistance coupled with appropriate breeding strategies and selection methodologies are needed to deal with a diverse germplasm and large breeding populations. Appropriate field and greenhouse evaluation for FHB resistance and the newly identified molecular markers –mainly QTL's located on 3 BS and 3 A chromosomes- are useful tools to select efficiently and to combine several types of resistance to FHB with other economical-value traits. In addition, we will use the off-season nursery in New Zealand (NZ), Puerto Rico, and Arizona to accelerate the generation advance and seed increase for ND trials. Past experience showed that selection for maturity, height, lodging resistance, and grain shattering can be done in NZ. The introgression of diverse germplasm sources of FHB and shattering resistance will provide the germplasm base for selection of enhanced and combined types of FHB resistance in WSW germplasm. This project will allow NDSU to take the lead in developing WSW germplasm with FHB resistance as we did for the HRSW. Developing superior WSW cultivars with resistance to FHB is the most economic and sustainable control measure to minimize the negative effects of FHB on the production, export, processing, and consumption of wheat produced in the USA.