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PROJECT 1 ABSTRACT

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Scab or Fusarium head blight (FHB) has been major wheat disease in the spring wheat region. Combating this disease while protecting our environment by growing genetically resistant and adapted cultivars is the most efficient, economical, and safe strategy. Recently developed HRSW cultivars by NDSU breeding program (Prosper, Barlow, Faller, Howard, Glenn, Steele-ND, Alsen) with moderate FHB resistance are being grown extensively in ND and MN. In the past 6 years, these cultivars were grown on more than 50% of North Dakota wheat acreages which oscillate around 6 million acres annually. Additional acreages grown to these cultivars are also found in MN and SD. However, new adapted cultivars with different and/or higher resistance levels, combining different sources of resistance to FHB and other diseases are needed. In, 2004 and 2006, 'Steele-ND' and 'Howard' with scab resistance source different from Alsen were released. In 2005, "Glenn" was released combing good FHB resistance. From 2007 to 2011, Glenn was the leading cultivar in ND wheat replacing Alsen as the major HRSW cultivar grown in the region. Following the release of Glenn, Barlow, Faller, and Prosper cultivars with FHB resistance similar or better than Alsen, were released. Since 2012, Barlow became the leading cultivar in ND followed by Glenn. Similarly, Faller was also the leading cultivar in MN from 2009 to 2012 with about 30% of MN wheat acreages. In 2013, Prosper took over Faller in MN. Therefore, The ultimate goal of the NDSU HRSW breeding program –with the collaboration of other breeding programs in the region- is to develop and release superior adapted cultivars to replace the susceptible cultivars grown in ND and the HRSW growing region, to maximize the economic returns to the producers, and to provide high quality wheat for the USA wheat industry and the international export market. The specific objectives of this project are to (1) continue developing adapted HRSW cultivars that have resistance to FHB and other diseases such as rusts combined with good agronomic and quality attributes; (2) identify and introgress novel FHB resistance that reduces disease infection and DON levels into adapted HRSW germplasm base; and (3) use novel tools such molecular markers to facilitate screening of FHB resistant genotypes. To achieve these objectives, adapted superior 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. Advanced and elite lines will be tested in multiple field trials in ND to identify FHB and other major diseases resistant genotypes that meet the desired adaptation, agronomic and quality criteria for cultivar release. 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. This project has been taking a leading role in developing superior HRSW cultivars with resistance to FHB as a control measure to minimize the negative effects of FHB on the production, export, processing, and consumption of HRSW.