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PROJECT 2 ABSTRACT

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Developing genetically resistant and adapted cultivars is the best strategy for an efficient, economical, and safe control of Fusarium head blight (FHB) in hard red spring wheat (HRSW) produced in North Dakota while protecting our environment. Recently developed HRSW cultivars by NDSU breeding program such as "Alsen" (2000) was among the first commercially cultivar released with moderate FHB resistance that are being grown extensively in ND. It was grown on more 2.4, 1.8, and 1.6 million acres in 2003, 2004 and 2005 crop seasons representing respectively, 37, 29, and 23 % of ND wheat acres. However, new adapted cultivars with different and/or higher resistance levels, combining different sources of resistance to FHB and other diseases, and which have grain shattering resistance are needed. In, 2004, "Steele-ND" with scab resistance source different from Alsen was released. In 2005, Steele was grown on about 2% of ND wheat acreages. In 2005, "Glenn" was released combing both Alsen and Steele-ND resistance. The later two released cultivars are expected to take significant acreages in the coming years. Therefore, using classical breeding techniques and MAS, this project aims to continue:

1. developing improved and adapted HRSW cultivars with higher level of resistance to FHB and grain shattering, other diseases; and superior bread-making quality.
2. identifying and introgressing new FHB resistance from diverse germplasm sources into adapted germplasm base of the HRSW breeding program.

To achieve these objectives, adapted superior genotypes will be used to develop segregating populations for early generation selection and advancement of lines that combine FHB and other disease resistances with desired agronomic and quality traits. Advanced and elite lines will be tested in multiple site 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. The complex nature of genetic resistance to FHB in wheat is significantly affected by the environmental conditions which require a continuous search of new sources of resistance and the employment of appropriate breeding strategies and selection methodologies to deal with a diverse germplasm base and very large breeding populations. Tuned field and greenhouse evaluation for FHB resistance and the newly identified molecular markers –mainly QTL's located on 3 BS and 3 A chromosomes- will be used 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 and Arizona to accelerate the generation advance and seed increase for ND trials. Experience from previous winter cycles in NZ showed that selection for maturity, height, lodging resistance and 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 effect of FHB on the production, export, processing and consumption of HRSW.