PI: Mergoum, Mohamed **PI's E-mail: Mohamed.Mergoum@ndsu.edu**

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PROJECT 1 ABSTRACT

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Growing genetically resistant and adapted cultivars is the best strategy for an efficient, economical, and safe control of Fusarium head blight (FHB) disease in the hard red spring wheat (HRSW) region while protecting our environment. Recently developed HRSW cultivars by NDSU breeding program (Alsen, Steele-ND, and Glenn) with moderate FHB resistance are being grown extensively in ND. Aslen was grown on about 30% of North Dakota 7 million acres since 2003. 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 2006, Steele-ND was grown on more than 9% of ND wheat acreages. In 2005, "Glenn" was released combing both Alsen and Steele-ND resistance. Glenn covered about 2% of ND wheat area. The later two released cultivars are expected to take significant acreages in the coming years. In 2006. 'Howard' a new HRSW cultivar with FHB resistance similar to Steele-ND was released. Therefore, using classical breeding techniques combined with modern MAS techniques, this project aims to continue:

1 improving FHB resistance of the adapted HRSW cultivars that also combines resistance to grain shattering and major diseases; and superior bread-making quality.
2 identifying and introgressing novel FHB resistance that reduces disease infection and DON levels into adapted HRSW germplasm base.

In order 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. 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 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) 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 effect of FHB on the production, export, processing, and consumption of HRSW.