

## Molecular Characterization

### Principal Investigators:

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### Objectives:

1. Study the effect of certain gliadins alleles in the end use quality of SD spring and winter wheat varieties.
2. Study the genetic basis of Fusarium Head Blight (FHB) resistance of SD3934, and identify PCR based markers for potential use in both breeding programs.

### Justification:

Protein quality is probably the most important single factor shaping grain quality in wheat. Protein quality is a complex trait determined by the total grain protein concentration and the type of proteins present in the grain. Both aspects of protein quality have important consequences for producers, grain handlers, millers, and bakers. Different combinations of glutenins are known to be associated with quality characteristics in the end product. The effect of gliadins on end use quality is not well understood, mainly due to the large number of allelic combinations. In this project we plan to make use of the information on glutenins and gliadin composition generated in the previous project to select a set of lines with the same glutenin composition but with diverse gliadins that will allow us to study their effect over several location-year combinations. The goal of this study is be able to answer questions about the contribution of gliadins to protein quality by studying some dough functionality traits.

Scab (FHB) is at this time and without a doubt, the most important disease, especially for its double impact in yield and in quality. Recently, the HRSW breeding program at SDSU has identified a SDSU line, SD3934, with improved level of resistance to FHB different from that of the NDSU varieties Alsen and Steele-ND. The pedigree for SD3934 is NORIN34//SD3247/1319 313-3-1-3/3/FORGE/4/SD3411. SD3934 does not have Sumai3 or other known source of resistance genes in their pedigree and the source/s of resistance in these lines are unknown. SD3934 is adapted to the Northern Plains growing region, with medium height, little lodging, and average maturity.

### Materials and Methods:

The selection of groups of lines of diverse genetic backgrounds sharing the same glutenin patterns, but different gliadins composition, will allow us to isolate the effect of those gliadins alleles. The selected lines will be grown in multiple environment-year combinations across South Dakota. The plots will be harvested at maturity and different quality parameters will be studied using a MIXOLAB -- a polyvalent dough mixer which is used to determine the rheological and gelatinization properties of flours. The MIXOLAB is part of the equipment purchased for the Grain Quality Lab.

We propose to use a novel approach in plant genetics to identify the major loci controlling resistance to FHB in SD3934. The proposed approach is based on the method used in human genetics to identify loci controlling genetic disorders in human families. This type of family-based genetic analysis is based on the co-transmission of the phenotypic trait and molecular markers in several families affected by the trait. We anticipate studying 80-90 families of ~5 individuals per family. We plan to run ~100 markers in each sample. The main advantages of this approach is the faster turn around compared to 'traditional' Quantitative Trait Loci (QTL) analysis where one has to wait 2+ years to begin the analysis. Unfortunately, SD3934 is not a high yielding variety, but by doing a large number of crosses, we will be simultaneously introgressing this potential new source of resistance into multiple adapted genetic backgrounds that can be used in further varietal development. We have proven the power of this approach using a well validated QTL in wheat. The results of this validation are being submitted for publication.

### **Progress Report**

We have finished all the glutenins and gliadins screening. The data for the glutenins has been provided to the breeding programs. The gliadin data is currently being summarized in conjunction with quality data available for a portion of the lines in the study. This will be submitted for publication in peer reviewed journals in the coming months.

We have developed the family based approach using a well validated QTL in wheat (Fhb1). Our results are being submitted for publication in "Theoretical and Applied Genetics." A second manuscript is also being prepared describing the different parameters influencing the statistical power of this approach in plants. We have been able to secure additional funding, for one year, from the US Wheat and Barley Scab Initiative to study the application of this genetic study of novel sources of resistance to FHB. This funding will allow us to study additional sources of resistance with larger population size, which will result in improved statistical power and mapping resolution.

In relation to the work with SD3934, we have completed the population development. In the fall we will evaluate the population for resistance to Fusarium. At the same time tissue samples will be taken for DNA extractions. The genotyping will begin at that time.