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PROJECT 1 ABSTRACT
(1 Page Limit)

An increase in planting of winter wheat into spring wheat stubble and in traditional corn – soybean rotations in eastern South Dakota have led to an increase in scab. Resistant varieties are the main economical and sustainable components of our integrated strategy to control this problem. Our long term objective is to use traditional breeding techniques, aided by molecular markers selection, to develop scab resistant hard winter wheat varieties and germplasm with superior agronomic performance and end-use quality characteristics, winterhardiness, and resistance to diseases prevalent in South Dakota and the northern Great Plains (a priority of the U.S. Wheat and Barley Scab Initiative). Our short term objectives are to: 1) characterize scab resistance among local and regional germplasm, in addition to new introduced sources, 2) identify sources with high levels of scab resistance, and develop populations segregating for scab resistance and desirable agronomic traits, and 3) enter promising resistant lines in regional nurseries to facilitate development of varieties with broad adaptation. We have been evaluating elite and introduced breeding lines, commercial varieties, and segregating populations in our mist-irrigated scab nursery since 1999. The development of scab resistant segregating populations in our program begins by inoculating F_3 plants from promising crosses followed by planting $F_{3:4}$ progeny rows under normal growing conditions to select for agronomic performance. We enter the best lines into the $F_{3:5}$ yield trials and grow corresponding $F_{4:5}$ progeny rows in the scab nursery. The best lines are entered in the $F_{4:6}$ early yield trials and are evaluated in the field and greenhouse for Type II resistance. Superior lines are again evaluated in the preliminary and advanced yield trials and are screened to confirm scab resistance. 'Expedition' which was released in 2002 possessed good FHB resistance superior to 'Harding' and 'Arapahoe'. Two experimental lines, SD97380-2 and SD98102, which have good FHB resistance, excellent leaf and stem rust resistance, in addition to superior and stable agronomic performance, were increased with intention to release. Our program relied on indigenous local resistance in the past. However, with the spread of scab threat, the use of highly resistant sources became paramount. In the 2004 – 2005 season, we planted 36 out of 400 F_3 and 57 out of 423 F_2 bulks that had either Sumai3, Ning7840, or their derivatives as un-adapted parents in three-way crosses with local varieties and germplasm. This will enable us to combine the major 3BS and 5AS QTLs with our local indigenous resistance in an adapted background. Seed from these populations will be available for interested programs in the region. Scab-resistant advanced lines from these populations will be entered in regional nurseries to facilitate development of varieties with broad adaptation to the northern Great Plains.