PI: Amir Ibrahim **PI's E-mail: amir_ibrahim@sdstate.edu**

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Project Title: Winter Wheat Breeding for Scab Resistance in South Dakota.

PROJECT 1 ABSTRACT
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Resistant varieties will be the main economical and sustainable component of an integrated strategy to control scab. Although immunity to this disease is unknown, genetic variability for resistance is well documented. Steady progress has been documented by breeding programs that have implemented proper screening techniques. Breeding programs must continue to simultaneously select for resistance and desirable agronomic characteristics.

Our objective is to develop adapted hard winter wheat varieties and advanced generation lines with enhanced scab resistance in addition to superior agronomic and end-use quality characteristics, and biotic and abiotic stress resistance.

We have established a proactive effort to develop scab resistant hard winter wheat varieties. Reasons for this decision include: 1) Recent changes in winter wheat production practices could lead to an increase in scab (increase in reduced tillage and changes in cropping systems); 2) South Dakota is on the northern edge of the high plains winter wheat production area and is thus in a unique geographical position; 3)Increased production of winter wheat in northeast South Dakota, a traditional spring wheat area; and 4) South Dakota State University (SDSU) already has the facilities and expertise necessary to conduct scab screening nurseries, and inoculation methods and screening procedures were already established at SDSU.

A mist-irrigated scab evaluation nursery for winter wheat has been established near the campus of SDSU. This nursery has been used since 1999 to evaluate elite breeding lines, introduced germplasm, regional nurseries, commercial varieties, and segregating populations. We have constantly been acquiring elite scab-resistant germplasm and including it in three way crosses with adapted varieties and advanced lines. We evaluate F_3 plants by millet inoculation and plant $F_{3:4}$ 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 progeny rows in the scab nursery. The best lines are entered in the $F_{4:6}$ early yield trials in the scab nursery and are evaluated in the greenhouse for Type II resistance. Superior lines are again evaluated in the preliminary and advanced yield trials in various locations in the state in addition to the scab nursery and the greenhouse. Marker assisted selection is used, as a complementary tool to traditional breeding methods, to screen advanced generations.

An M.S. graduate student joined our program in the fall of 2002 and he is part of the proposed research. This student is assisting with the breeding program and conducting independent research regarding the genetics of scab resistance in hard winter wheat germplasm.