

# Accelerated breeding for disease and insect pest resistance in winter wheat

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**Report type:** Annual progress report

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## Research Summary:

Wheat is one of the most important cereal crops in the state of South Dakota. Maintaining and increasing winter wheat yields and profitability are the primary goals of the SDSU winter wheat breeding program. The general objective of this research project is to enhance the disease and insect pest resistance in South Dakota winter wheat germplasm for development of winter wheat varieties with better resistance to Fusarium head blight (FHB or scab), stripe rust, leaf rust, Wheat streak mosaic virus (WSMV), bacterial leaf streak (BLS), and wheat sawfly. In 2018, the HWW Uniform Regional Scab Nursery was grown at four locations and 75 hard winter wheat experimental lines from five states were evaluated for FHB. In Kansas nursery, four of the 15 entries from SDSU winter wheat breeding program showed above-average resistance to FHB (Table 1). At Brookings, we identified several advanced breeding lines with good resistance to FHB including SD13062-2, SD14113-3, and SD12DHA00031. In addition, we also screened 299 released varieties or breeding lines of winter wheat for resistance against three diseases, Bacterial Leaf Streak (Fig.1 and Table 2), Spot blotch (see publication), and Septoria nodorum blotch. We identified genotypes resistant to one or more diseases. These cultivars and breeding lines will be employed as parents in improving resistance in SD winter wheat.

## Introduction:

Specific objectives of the program are to 1) continuously develop and evaluate hard red and hard white winter wheat germplasm and populations for resistance to FHB, stripe rust, leaf rust, WSMV, BLS, and leaf spot diseases thus lead to increased frequency of resistant materials in the breeding program.

## Description of Accomplishments:

All advanced experimental lines were evaluated for resistance to FHB, stripe rust, leaf rust, stem rust, and WSMV either in a greenhouse or in field nurseries. During the 2018 reporting period, more than 2,200 plot were evaluated only for FHB, that were derived from the SDSU breeding program and cooperating breeding programs. FHB nursery included released cultivars included in CPT, experimental in NRPN, SRPN, RGON, PYT, AYT and a few entries from private industry. The evaluation data helped in the selection of parents in the breeding program and are also used for the release of new cultivars. More than 200 segregating populations were also planted in Castroville, TX and 50- 60 heads were selected from leaf rust resistant populations. Several hundred crosses were made for mobilizing resistance to FHB, leaf rust, stripe rust, stem rust, WSMV, BLS, and wheat sawfly into South Dakota germplasm.

**Publications:**

Ayana GT, Ali S, Sidhu JS, Gonzalez Hernandez JL, Turnipseed B and Sehgal SK (2018)  
 Genome-wide association study for spot blotch resistance in hard winter wheat. *Front. Plant Sci.* 9:926. doi: 10.3389/fpls.2018.00926

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Table 1. 2018 HWW Uniform Regional FHB Nursery

Entry number	LINE ID	FHB Avg.	FDK (%)	Entry number	LINE ID	FHB Avg.	FDK (%)
29	17NDSU14	2.8	10.0	46	Overley (Early S)	78.0	46.3
21	17NDSU6	1.8	13.0	37	MT1893	9.1	48.8
48	Emerson (MR)	6.7	15.8	32	MT1793	16.1	48.8
30	17NDSU15	10.1	16.3	5	SD14338-1	19.5	48.8
17	17NDSU2	10.4	21.5	43	LCS-link	55.4	48.8
13	SD15083-2	17.1	25.0	44	Long Branch	59.9	48.8
26	17NDSU11	6.1	27.5	31	Decade	17.4	51.3
16	17NDSU1	16.0	28.8	24	17NDSU9	35.7	52.5
18	17NDSU3	3.7	30.0	27	17NDSU12	20.2	53.8
28	17NDSU13	7.0	30.0	38	MT1492	5.3	55.0
35	MT1797	10.1	31.3	7	SD12DHA01038	54.3	55.0
19	17NDSU4	13.3	33.8	15	SD16006-3	35.7	56.3
6	SD12DHA00031	28.5	33.8	22	17NDSU7	8.4	58.8
9	SD12DHA01353	45.0	35.0	1	SD12DHA03282	41.5	60.0
34	MT1796	15.3	38.8	33	MT1794	17.4	61.3
36	MT17103	11.4	40.0	4	SD13137-1	44.1	62.5
25	17NDSU10	18.1	40.0	11	SD13DHA02641	41.0	65.0
20	17NDSU5	23.1	41.3	2	SD12DHA01373	41.4	65.0
8	SD12DHA01043	29.2	41.3	3	SD13099-8	21.8	66.3
14	SD15205-1	29.6	41.3	40	MT1563	32.6	67.5
42	MT51588	41.9	42.5	45	Langin	52.3	70.0
41	MT1564	59.2	43.8	10	SD13153-3	43.9	73.8
12	SD15009-1	30.3	44.5	47	Flourish (Late S)	57.8	78.8
39	MTF1435	5.5	46.3		Average	26.8	45.0
23	17NDSU8	36.4	46.3		LSD (P=0.05)	9.6	23.9

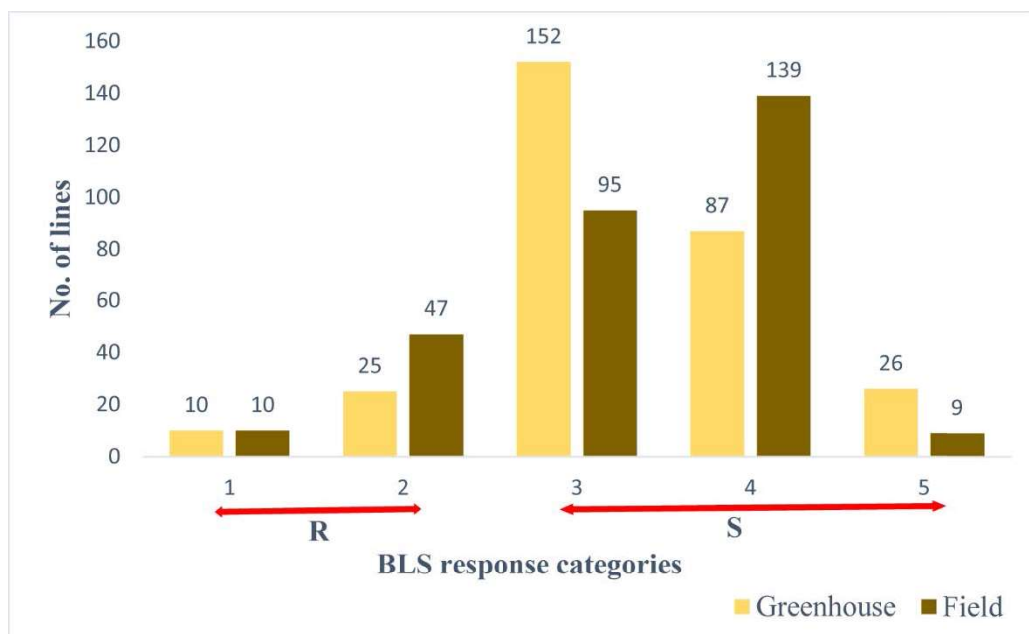


Fig 1. Distribution of the 300 genotypes of the HWWAMP into 5 categories based on response to BLS infiltration. The bars represent the mean response of the genotypes to BLS in both the greenhouse and the field (1-R, 2-MR, 3-MS, 4-S, and 5-HS).

Table 2. List of ten genotypes from the HWWAMP that showed resistance reaction against bacterial leaf streak (BLS).

Genotype	Pedigree	PI
EAGLE (KS: 1970)	Selection from Scout	Cltr15068
GOODSTREAK (NE: 2002)	Len//Butte/ND526/6/Agent/3/ND441//Waldron/Bluebird/4/Butte/5/ Len/7/KS88H164 /8/NE89646	PI632434
NE04490	NE95589/3/Abilene/Norkan//Rawhide/4/Abilene/Arapahoe	-
OK05723W	SWM866442/Betty	-
OK1068112	Farmec/Jagalene	-
ROBIDOUX (NE: 2010)	Odesskaya P/Cody//Pavon 76/3* Scout 66/3/Wahoo	PI659690
SCOUT66 (NE: 1976)	Nebred//Hope/Turkey/3/Cheyenne/Ponca	CI13996
TX07A001420	U1254-1-5-2-1/ TX81V6582//Desconocido	-
VISTA (NE: 1992)	Warrior//Atlas66/Comanche/3/Comanche/Ottawa/5/Ponca/2* Cheyenne/3/Illinois No. 1//2* Chinese Spring /T. timopheevii/4/Cheyenne/Tenmarq//Mediterranean/Hope/3/Sando60/6/Centurk/Brule	PI562653
WENDY (SD: 2004)	Gent/Siouxland//Abilene	PI638521