

# Report of the 2019 Uniform Regional Scab Nursery for Spring Wheat Parents

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The Uniform Regional Scab Nursery for Spring Wheat Parents (URSN) was grown for the 24<sup>th</sup> year in 2019. Six locations (Brookings, SD, St. Paul, MN, Crookston, MN, Prosper, ND, Langdon, ND, and Morden, Canada) reported results.

A total of 20 entries was included in the 2019 URSN, in addition to the resistant checks 2710, BacUp, and Rollag, the susceptible checks Wheaton, Oslo, and Norm, and N10, a Norm near-isoline containing *Fhb1*. The entries were contributed by four university wheat breeding programs.

The core set of traits evaluated at the nursery locations varied, but included Fusarium head blight (FHB) incidence, FHB severity, and disease index. In addition, visual scabby kernel ratings (VSK/tombstone/FDK) were provided for most locations. Additional agronomic trait data are presented in individual location summary tables for locations where they were measured. Molecular marker genotypes for a set of FHB resistance QTLs and other traits are provided for entries. Adult plant leaf and stem rust reactions, as well as seedling stem rust reactions, are also presented. Due to the impact of the COVID-19 pandemic on university analytical laboratory operations, grain DON accumulation data is available for just one location. When additional DON data are obtained in the future for other locations, an addendum will be released.

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## **Cooperators for the 2019 Uniform Regional Scab Nursery for Spring Wheat Parents**

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### **North Dakota State University (Prosper, Langdon):**

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**Table 1. Entries for the 2019 Uniform Regional Scab Nursery for Spring Wheat Parents.**

<b>Entry</b>	<b>Line</b>	<b>Pedigree</b>	<b>1st Year in URSN</b>	<b>Submitter</b>	<b>Organization</b>
1	Bacup	Check			
2	2710	Check			
3	Rollag	Check			
4	Oslo	Check			
5	Wheaton	Check			
6	Norm	Check			
7	N10	Check (Norm <i>Fhb1</i> NIL)			
8	MN15155-2	MN06075-4/MN10099-1	2019	J. Anderson	UMN
9	MN16028	MN10204-6/MN-Washburn sel//RB07-Sr42	2019	J. Anderson	UMN
10	MN16040	Lang-MN/Forefront	2019	J. Anderson	UMN
11	MN16262-3	Rollag/MN10041-7//MN-Washburn sel	2019	J. Anderson	UMN
12	MN16317-5	Rollag/MN10041-7//MN-Washburn sel	2019	J. Anderson	UMN
13	NDHRS13-0170-0004	ND812/NORDEN	2019	A. Green	NDSU
14	NDHRS16-16-665	GLENN/SABIN	2019	A. Green	NDSU
15	NDHRS14-0136-C06	9950146ES/PARSHALL//06S0157- 1	2019	A. Green	NDSU
16	NDHRS16-14-126	ND804/FREYR	2019	A. Green	NDSU
17	NDHRS16-14-36	BARLOW/GRANITE	2019	A. Green	NDSU
18	SD4740	SD4181/SD4243	2019	K. Glover	SDSU
19	SD4834	SD4460/SD4366	2019	K. Glover	SDSU
20	SD4859	BRICK/SD4011	2019	K. Glover	SDSU
21	SD4865	MN08165-8/BARLOW	2019	K. Glover	SDSU
22	SD4868	MN09186/SD4434	2019	K. Glover	SDSU
23	MT 1621	MT1148/MT1133	2019	L. Talbert	MSU
24	MT 1716	MT1274/RB07	2019	L. Talbert	MSU
25	MT 1767	12SR225/12F5 827	2019	L. Talbert	MSU
26	Lanning	Glenn/MT0747	-	L. Talbert	MSU
27	Vida	Scholar/Reeder	-	L. Talbert	MSU

**Table 2. 2019 Uniform Regional Scab Nursery for Spring Wheat Parents, St. Paul, MN.**

Entry	Line	Incidence %	Severity %	Disease Index	VSK %	Heading d from 6-1	30 SSW <sup>1</sup> g	micro TWT <sup>2</sup> g
1	Bacup	76.7	22.9	17.8	11.0	34.0	15.9	11.1
2	2710	73.3	16.8	12.7	15.0	35.0	23.3	11.1
3	Rollag	90.0	35.9	32.3	22.5	35.0	9.7	-
4	Oslo	98.3	78.9	77.9	32.5	36.3	12.6	8.9
5	Wheaton	100.0	83.7	83.7	80.0	39.0	5.3	-
6	Norm	95.0	67.8	65.9	70.0	39.0	11.4	9.1
7	N10	100.0	65.8	65.8	82.5	39.0	7.1	9.1
8	MN15155-2	95.0	27.5	26.4	11.5	41.0	15.7	11.4
9	MN16028	98.3	41.2	40.7	11.5	36.3	8.0	-
10	MN16040	66.7	15.9	11.1	9.0	39.0	14.2	10.5
11	MN16262-3	90.0	29.3	26.4	18.5	39.0	16.1	11.6
12	MN16317-5	91.7	21.5	20.1	11.0	39.0	20.5	11.7
13	NDHRS13-0170-0004	83.3	18.5	15.4	13.5	35.0	17.8	11.2
14	NDHRS16-16-665	80.0	23.9	19.5	11.0	39.0	14.2	11.0
15	NDHRS14-0136-C06	95.0	24.8	23.7	20.0	36.3	19.8	10.5
16	NDHRS16-14-126	91.7	28.8	27.0	16.0	35.0	5.4	-
17	NDHRS16-14-36	86.7	17.5	15.2	12.5	35.0	10.0	10.3
18	SD4740	98.3	30.1	29.5	13.5	35.0	19.3	11.4
19	SD4834	81.7	14.6	12.3	14.5	35.0	16.4	10.7
20	SD4859	98.3	32.5	32.0	17.5	35.0	11.4	10.2
21	SD4865	93.3	32.8	30.7	37.5	35.0	11.7	9.5
22	SD4868	98.3	32.7	32.4	13.5	39.0	8.0	10.9
23	MT 1621	96.7	49.3	48.0	37.5	35.0	8.0	10.0
24	MT 1716	95.0	30.8	29.4	20.0	35.0	5.6	-
25	MT 1767	95.0	68.3	65.1	57.5	35.0	8.2	-
26	Lanning	98.3	34.7	34.3	32.5	39.0	11.5	10.1
27	Vida	100.0	72.0	72.0	35.0	37.7	2.3	-
	Alsen*	91.7	19.2	17.6	16.0	35.0	12.6	11.5
	Roblin*	100.0	68.3	68.3	80.0	32.0	6.0	-
	MN00269*	100.0	82.0	82.0	37.5	42.0	6.7	-
Mean		91.9	39.6	37.8	28.7	36.7	11.8	10.6
LSD		12.1	17.4	18.6	15.7	1.5	7.8	0.9
CV		8.0	27.0	30.1	26.8	2.5	32.4	4.2

<sup>1</sup> 30 SSW = 30 spike seed weight. This is the sample used to determine VSK.

<sup>2</sup> Weight of the VSK sample that fits in a 15.7 mL copper vessel measuring 20 mm in diameter and 50 mm in height

\* Extra entries

**Table 3. 2019 Uniform Regional Scab Nursery for Spring Wheat Parents, Crookston, MN.**

Entry	Line	Incidence %	Severity %	Disease Index	VSK %	Heading d from 6-1	30 SSW <sup>1</sup> g	micro TWT <sup>2</sup> g
1	Bacup	70.0	26.7	24.9	10.0	41.0	18.8	12.0
2	2710	80.0	12.5	11.0	10.0	45.7	25.6	12.9
3	Rollag	100.0	53.3	53.3	23.5	43.7	15.5	11.7
4	Oslo	100.0	67.9	67.9	70.0	44.0	5.9	-
5	Wheaton	100.0	80.7	80.7	85.0	47.0	6.9	-
6	Norm	100.0	62.9	62.9	75.0	46.7	11.8	9.7
7	N10	100.0	35.2	35.2	62.5	46.7	8.5	-
8	MN15155-2	87.5	21.6	19.4	11.5	48.0	19.9	12.5
9	MN16028	100.0	35.2	35.2	11.0	43.7	11.8	12.0
10	MN16040	100.0	18.2	18.2	11.0	47.0	21.5	12.0
11	MN16262-3	82.5	19.5	15.8	12.5	45.7	13.6	11.8
12	MN16317-5	47.5	7.6	3.6	7.0	47.7	24.0	12.8
13	NDHRS13-0170-0004	100.0	29.4	29.4	12.0	43.0	12.3	11.7
14	NDHRS16-16-665	60.0	12.2	7.1	8.0	45.7	20.7	12.6
15	NDHRS14-0136-C06	92.5	41.8	40.4	21.0	45.0	17.2	11.4
16	NDHRS16-14-126	100.0	24.6	24.6	16.0	42.0	14.7	11.7
17	NDHRS16-14-36	97.5	31.6	31.1	14.5	42.0	15.7	11.9
18	SD4740	97.5	33.5	33.1	12.5	42.7	22.5	12.2
19	SD4834	100.0	21.2	21.2	17.5	42.3	17.4	11.7
20	SD4859	70.0	22.4	20.2	19.5	42.0	16.5	11.2
21	SD4865	100.0	23.2	23.2	20.0	43.3	19.0	11.8
22	SD4868	100.0	32.2	32.2	18.5	45.0	11.1	12.0
23	MT 1621	100.0	54.7	54.7	42.5	43.3	10.8	12.2
24	MT 1716	95.0	47.4	44.9	32.5	44.7	10.4	-
25	MT 1767	97.5	77.1	74.9	82.5	43.0	7.2	-
26	Lanning	100.0	33.8	33.8	32.5	46.7	14.6	9.8
27	Vida	97.5	48.9	48.3	38.5	45.0	9.0	10.5
	Alsen*	97.5	25.9	25.2	13.5	44.7	12.7	12.1
	Roblin*	100.0	72.8	72.8	57.5	41.3	11.8	11.4
	MN00269*	100.0	58.9	58.9	42.5	50.7	8.6	-
Mean		92.4	37.7	36.8	29.7	44.6	14.5	11.7
LSD		29.0	32.4	33.5	20.5	1.8	3.8	0.7
CV		15.4	42.1	44.7	33.9	2.5	13.0	3.0

<sup>1</sup>30 SSW = 30 spike seed weight. This is the sample used to determine VSK.

<sup>2</sup>Weight of the VSK sample that fits in a 15.7 mL copper vessel measuring 20 mm in diameter and 50 mm in height

\* Extra entries

**Table 4. 2019 Uniform Regional Scab Nursery for Spring Wheat Parents, Brookings, SD.**

<b>Entry</b>	<b>Line</b>	<b>Incidence %</b>	<b>Severity %</b>	<b>Disease Index</b>	<b>Tombstone %</b>
1	Bacup	100.0	29.8	29.8	37.5
2	2710	100.0	17.5	17.5	23.3
3	Rollag	100.0	20.3	20.3	27.5
4	Oslo	100.0	35.4	35.4	45
5	Wheaton	100.0	39.4	39.4	48.3
6	Norm	100.0	27.5	27.5	41.7
7	N10	100.0	27.9	27.9	44.2
8	MN15155-2	100.0	19.4	19.4	19.2
9	MN16028	100.0	22.4	22.4	14.2
10	MN16040	100.0	21.3	21.3	25
11	MN16262-3	100.0	18.8	18.8	17.5
12	MN16317-5	100.0	17.5	17.5	13.3
13	NDHRS13-0170-0004	100.0	23.4	23.4	24.2
14	NDHRS16-16-665	100.0	19.3	19.3	12.5
15	NDHRS14-0136-C06	100.0	23.8	23.8	30.8
16	NDHRS16-14-126	100.0	21.2	21.2	31.7
17	NDHRS16-14-36	100.0	24.8	24.8	27.5
18	SD4740	100.0	24.1	24.1	28.3
19	SD4834	100.0	22.1	22.1	28.3
20	SD4859	100.0	22.7	22.7	31.7
21	SD4865	100.0	20.8	20.8	29.2
22	SD4868	100.0	19.8	19.8	25.8
23	MT 1621	100.0	33.7	33.7	36.7
24	MT 1716	100.0	24.8	24.8	25.8
25	MT 1767	100.0	20.6	20.6	41.7
26	Lanning	100.0	23.9	23.9	23.3
27	Vida	100.0	26.4	26.4	24.2
MEAN		100	24.02	24.02	28.83
LSD (0.05)			3.86	3.86	5.56
CV %			22.52	22.52	33.67

**Table 5. 2019 Uniform Regional Scab Nursery for Spring Wheat Parents, Prosper, ND.**

<b>Entry</b>	<b>Line</b>	<b>Incidence %</b>	<b>Severity %</b>	<b>Disease Index*</b>	<b>FDK %</b>	<b>FHB (1-9)</b>	<b>DON ppm</b>
1	Bacup	100.0	27.0	27.0	51.7	5.7	14.7
2	2710	95.0	16.3	15.5	56.7	4.7	10.8
3	Rollag	100.0	41.1	41.1	56.7	5.3	12.7
4	Oslo	100.0	52.7	52.7	50.0	5.7	14.2
5	Wheaton	100.0	68.4	68.4	55.0	6.0	15.4
6	Norm	100.0	80.5	80.5	85.0	6.7	33.1
7	N10	100.0	74.3	74.3	80.0	6.7	27.0
8	MN15155-2	100.0	38.1	38.1	41.7	4.3	18.0
9	MN16028	100.0	52.7	52.7	41.7	6.0	15.5
10	MN16040	100.0	33.9	33.9	46.7	4.3	15.6
11	MN16262-3	100.0	44.8	44.8	51.7	5.0	18.4
12	MN16317-5	100.0	36.7	36.7	46.7	4.0	24.7
13	NDHRS13-0170-0004	100.0	51.7	51.7	45.0	5.7	9.7
14	NDHRS16-16-665	100.0	36.0	36.0	38.3	4.0	11.5
15	NDHRS14-0136-C06	100.0	53.0	53.0	56.7	6.0	24.0
16	NDHRS16-14-126	100.0	46.1	46.1	45.0	6.3	12.0
17	NDHRS16-14-36	100.0	50.9	50.9	46.7	6.0	11.8
18	SD4740	100.0	46.6	46.6	53.3	6.3	12.0
19	SD4834	100.0	35.8	35.8	53.3	5.3	12.8
20	SD4859	100.0	44.5	44.5	61.7	6.7	13.1
21	SD4865	100.0	45.5	45.5	50.0	6.0	13.5
22	SD4868	100.0	46.1	46.1	48.3	5.0	10.8
23	MT 1621	100.0	61.4	61.4	60.0	6.7	20.9
24	MT 1716	100.0	53.2	53.2	55.0	4.7	21.0
25	MT 1767	100.0	71.3	71.3	81.7	8.0	32.0
26	Lanning	100.0	63.6	63.6	60.0	5.7	32.7
27	Vida	100.0	53.8	53.8	70.0	6.0	23.0
Mean		99.8	49.1		55.1	5.7	17.8
CV		0.84	16.81		11.17	9.94	21.23
LSD 0.05		1.37	13.53		10.09	0.92	6.20

\* calculated by report authors using incidence and severity values provided for this location.

**Table 6. 2019 Uniform Regional Scab Nursery for Spring Wheat Parents, Lan**

<b>Entry</b>	<b>Line</b>	<b>FDK %</b>	<b>FHB (1-9)</b>
1	Bacup	43.3	5.3
2	2710	33.3	4.0
3	Rollag	45.0	5.3
4	Oslo	45.0	4.3
5	Wheaton	61.7	4.7
6	Norm	73.3	5.0
7	N10	55.0	5.3
8	MN15155-2	35.0	3.7
9	MN16028	35.0	4.3
10	MN16040	40.0	4.3
11	MN16262-3	43.3	4.0
12	MN16317-5	35.0	3.3
13	NDHRS13-0170-0004	28.3	4.7
14	NDHRS16-16-665	21.7	3.3
15	NDHRS14-0136-C06	38.3	4.7
16	NDHRS16-14-126	38.3	5.0
17	NDHRS16-14-36	35.0	4.3
18	SD4740	38.3	5.0
19	SD4834	33.3	4.0
20	SD4859	36.7	5.0
21	SD4865	45.0	5.0
22	SD4868	41.7	4.7
23	MT 1621	65.0	5.7
24	MT 1716	43.3	4.3
25	MT 1767	66.7	7.0
26	Lanning	65.0	4.3
27	Vida	58.3	4.7
Mean		44.4	4.6
CV		17.40	12.67
LSD 0.05		12.67	0.96

**Table 7. 2019 Uniform Regional Scab Nursery for Spring Wheat Parents, Morden, Can**

<b>Entry</b>	<b>Line</b>	<b>Incidence %</b>	<b>Severity %</b>	<b>Disease Index</b>
1	Bacup	66.7	23.3	15.4
2	2710	28.3	16.7	4.9
3	Rollag	88.3	28.3	25.1
4	Oslo	95.0	65.0	61.8
5	Wheaton	91.7	76.7	70.4
6	Norm	90.3	81.7	74.1
7	N10	93.3	51.7	47.9
8	MN15155-2	73.3	28.3	21.1
9	MN16028	76.7	45.0	34.4
10	MN16040	66.7	16.7	11.3
11	MN16262-3	73.3	20.0	14.7
12	MN16317-5	51.7	15.0	7.5
13	NDHRS13-0170-0004	75.0	18.3	13.4
14	NDHRS16-16-665	41.7	13.3	5.5
15	NDHRS14-0136-C06	75.0	31.7	23.6
16	NDHRS16-14-126	88.3	21.7	19.1
17	NDHRS16-14-36	83.3	28.3	23.7
18	SD4740*	-	-	-
19	SD4834*	-	-	-
20	SD4859*	-	-	-
21	SD4865*	-	-	-
22	SD4868*	-	-	-
23	MT 1621	90.7	46.7	42.7
24	MT 1716*	-	-	-
25	MT 1767	85.0	60.0	51.3
26	Lanning*	-	-	-
27	Vida*	-	-	-

\* not planted

**Table 8. 2019 Uniform Regional Scab Nursery for Spring Wheat Parents - Summary of Means.**

Line	Incidence		Severity		Disease	
	%	Rank	%	Rank	Index	Rank
No. of Locations>	5		5		5	
Bacup	82.7	4	25.9	6	23.0	6
2710	75.3	1	16.0	1	12.3	1
Rollag	95.7	15	35.8	17	34.4	17
Oslo	98.7	22	60.0	25	59.1	25
Wheaton	98.3	21	69.8	27	68.5	27
Norm	97.1	17	64.1	26	62.2	26
N10	98.7	22	51.0	23	50.2	23
MN15155-2	91.2	7	27.0	8	24.9	8
MN16028	95.0	12	39.3	20	37.1	18
MN16040	86.7	5	21.2	4	19.2	4
MN16262-3	89.2	6	26.5	7	24.1	7
MN16317-5	78.2	3	19.7	2	17.1	2
NDHRS13-0170-0004	91.7	8	28.3	9	26.7	9
NDHRS16-16-665	76.3	2	20.9	3	17.5	3
NDHRS14-0136-C06	92.5	10	35.0	16	32.9	15
NDHRS16-14-126	96.0	16	28.5	10	27.6	10
NDHRS16-14-36	93.5	11	30.6	13	29.1	11
SD4740*	99.0	24	33.6	15	33.3	16
SD4834*	95.4	13	23.4	5	22.8	5
SD4859*	92.1	9	30.5	11	29.8	12
SD4865*	98.3	20	30.6	12	30.1	13
SD4868*	99.6	26	32.7	14	32.6	14
MT 1621	97.5	18	49.1	21	48.1	21
MT 1716*	97.5	19	39.0	19	38.1	19
MT 1767	95.5	14	59.4	24	56.6	24
Lanning*	99.6	26	39.0	18	38.9	20
Vida*	99.4	25	50.3	22	50.1	22

\* Mean values calculated without Morden results.

**Table 9. Correlation Coefficients Between Traits, by Location.**

<b>Correlation Between</b>	<b>St. Paul</b>	<b>Crookston</b>	<b>Brookings</b>	<b>Prosper</b>	<b>Morden</b>
Incidence & Severity	0.63	0.54	*	0.45	0.67
Incidence & Disease Index	0.67	0.58	*	0.46	0.74
Incidence & Tombstone/VSK/FDK	0.47	0.40	*	-0.03	
Incidence & DON				0.20	
Severity & Disease Index	1.00	1.00	1.00	1.00	0.99
Severity & Tombstone/VSK/FDK	0.83	0.88	0.74	0.65	
Severity & DON				0.66	
Disease Index & Tombstone/VSK/FDK	0.82	0.87	0.74	0.65	
Disease Index & DON				0.66	
Tombstone/VSK/FDK & DON				0.72	

\* No value since incidence was 100% for all entries.

**Table 10. Correlation coefficients among traits, using means across locations.**

	<b>Incidence</b>	<b>Severity</b>	<b>Disease Index</b>
<b>Severity</b>	0.38		
<b>Disease Index</b>	0.48	0.99	
<b>Tombstone/VSK/FDK</b>	0.43	0.79	0.80

**Table 11. 2019 Uniform Regional Scab Nursery for Spring Wheat Parents, St. Paul, MN.  
Adult plant leaf and stem rust reactions (J. Kolmer and Y. Jin, USDA-ARS).**

<b>Line</b>	<b>Leaf Rust</b>	<b>Stem Rust</b>
Bacup	50S	5RMR
2710	40MRMS	5RMR
Rollag	50MRMS	5RMR
Oslo	70S	15MR
Wheaton	70MRMS	5RMR
Norm	60MR	5RMR
N10	50MRMS	10RMR
MN15155-2	TR	15MRR
MN16028	TR	5RMR
MN16040	TR	5RMR
MN16262-3	TR	10MRR
MN16317-5	TR	10RMR
NDHRS13-0170-0004	10MR	10RMR
NDHRS16-16-665	TR	5RMR
NDHRS14-0136-C06	60MRMS	20MR
NDHRS16-14-126	60S	10RMR
NDHRS16-14-36	60S	5RMR
SD4740	20MR	25MR
SD4834	40MRMS	20MR
SD4859	TR	35MRMS
SD4865	TR	10RMR
SD4868	30MRMS	10RMR
MT 1621	30MRMS	15MRR
MT 1716	50S	25MRMS
MT 1767	30MRMS	10RMR
Lanning	50S	10MRR
Vida	60S	15MRR

**Table 12. 2019 Uniform Regional Scab Nursery for Sprign Wheat Parents, St. Paul, MN.  
Seedling stem rust reactions (Y. Jin, USDA-ARS).**

Line	Race									Notes	Adult plant stem rust <sup>1</sup>
	QFSC	QTHJC	MCCFC	RCRSC	RKRQC	TPMKC	TTTTF	GFMNC	QCCSM		
Bacup	0;	2-	0;	1-1;	2-	;1	3	;1-	;	BIN	10R MR
2710	0	2-	0;	0;	;1	2-;	;1-	0;	;		10R
Rollag	0	2-	;1-	;1-	2-	1	1;	;	1;		5R MR
Oslo	;	12	;1-	;2-	;	12	3	;1	;	BIN	10R MR
Wheaton	0;	2-	0;	0;	1	12-	1;	0;	;		0
Norm	0;	-	0;	-	;	-	;1	0;	0;		0
N10	0;	-	0;	-	;	12-	1;	0	0;		0
MN15155-2	0	1	;2-	;1-	1	12-	1;	;	2-		0
MN16028	0	12-	0;	0;	1	;	1;	0;	0;		0
MN16040	0	;1-	0;	0;	12-	0;	1;	0;	0;		0
MN16262-3	0	12- LIF	;1-	1-;	2	2-	1;	;	;2-		0
MN16317-5	0	12-	1-	1-	2-	2-	1;	;1	12-		0
NDHRS13-0170-0004	0	1-	;1-	0;	1-	2-	1;	0;	0;/2-		0
NDHRS16-16-665	0	1	;1-	;1-	12-	2-	1;	;	;1-		0
NDHRS14-0136-C06	12-	1+	12-	11+	1+	2-	11+3-;	2-	2-	BIN	30R MR
NDHRS16-14-126	0	2-	;	0;	;1-	2-	1+1;	0;/	0;		0
NDHRS16-14-36	0	2-	0;	0;	;	2-	1;	0;/	;0;		0
SD4740	;	2-	;1-	;1-	2	2-	1;	;1-	2-;/1-		20MR
SD4834	0;	2-	;	0/1-LIF	12-	;	1;	;	;1-		10R MR
SD4859	;1-	2-	2-	1-;	2-	2-	1;	0;1-	2-		30MR
SD4865	0	-	;	;	;1-	2-	1;/1+;	;	;0;/2-		0
SD4868	;1-	12-	;	0;	12-	0;	1;	0;/	;		0
MT 1621	0;/	2-	;2-	2-	2-2	2-	4	2-	2-		20R MR
MT 1716	0;	11+	;	0;1-	2	;	1+3-;	;	;1-		20R MR
MT 1767	0;	1	;	0;	1-1;	;	11+;	0;	;		0
Lanning	;	12-	1-;	1-1	12-	2	11+;	;1-	2-		0
Vida	0;/1	2-	1	2-;	2-	2	1;	1	12-		20R MR
Line E	4	4	4	4	4	4	4	4	4		90S
LMPG-6*	33+	3	3	33+	3+	-	3+	3+	4		90S
NA101/MqSr7a	1+;	33+	33+	1;	11+;	4/;	1+13-;/4	33+	11+		60MS S

\* Susceptible check

<sup>1</sup> Different field evaluation than results in the adult rust table

Note: Explanatory notes on next page

**Table 12 continued, Explanatory notes.**

**A. Races used in seedling evaluations:**

Race	Origin	Virulence on differential genes
MCCFC	USA	5 7b 9g 10 17 <b>Tmp</b> McN
QCCSM	USA	5 9a 9d 9g 10 17 21 <b>24</b> McN
QFCSC	USA	5 8a 9a 9d 9g 10 17 21 McN
QTHJC	USA	5 6 8a 9b 9d 9g 10 11 17 21 McN
RCRSC	USA	5 7b 9a 9b 9d 9g 10 17 21 <b>36</b> McN
RKRQC	USA	5 6 7b 8a 9a 9b 9d 9g 17 21 <b>36</b> McN
TPMKC	USA	5 7b 8a 9d 9e 9g 10 11 17 21 <b>36 Tmp</b> McN
TTTTF	USA	5 6 7b 8a 9a 9b 9d 9e 9g 10 11 17 21 30 36 <b>38 Tmp</b> McN

**B. Seedling rating scale:**

0 to 4 infection type scale of Stakmen et al., 3 or 4 are considered susceptible

"/" denotes heterogeneous, the predominant type given first.

"LIF" denotes low infection frequency, or fewer number of pustules.

"C" stands for excessive chlorosis

"N" stands for excessive necrosis

"Sr2M" referred to seedling chlorosis, similar to Sr2 expression in seedling under certain environments

**C. Field stem rust nursery evaluations:**

Entries were planted in 1-m row plots perpendicular to spreader rows of mixed susceptible wheat lines in X-13 field

Nurseries were inoculated by needle injection of spreader rows, and by spray inoculations

A composite of the following stem rust races was used as inoculum in the field inoculation: QFCSC, QTHJC, RCRSC, RKRQC, and TPMKC

**D. Field ratings:**

Stem rust infection responses (R, MR, MS, S or combination thereof) and disease severity were rated when entries were at the soft dough stage

BIN-Black internode, a likely indication of the presence of Sr2. This trait is considered to be more consistent than pseudo black chaff (PBC) in the St. Paul nursery.

Table 13. Markers Associated With Selected Traits/Genes (J. Fiedler, USDA-ARS).

Entry	Line	Trait																		
		Sr2	Sr8	Sr12	Sr25	Lr21	Lr34	Yr7	Tsn	Fhb1	TaHRC	barc180	barc186	GPC	GluD1	umh19	RhtB1	RhtD1	PpdB1	PpdD1
1	Bacup	S	S	R	S	S	U	S	S	U	Het	R	R	N	G	Het	wt	wt	I	I
2	2710	S	S	Het	S	S	R	R	S	R	U	R	Het	N	G	Het	wt	wt	S	S
3	Rollag	S	S	R	S	S	R	S	I	R	R	S	R	N	G	2	wt	D	S	S
4	Oslo	S	R	R	S	S	S	R	S	S	Het	S	S	N	P	Het	D	wt	S	I
5	Wheaton	S	S	R	U	S	R	R	I	S	S	S	S	N	G	2	wt	D	S	I
6	Norm	S	S	R	S	S	R	R	I	S	S	S	S	N	G	Het	wt	D	S	S
7	N10	S	S	R	S	S	R	R	I	R	R	Het	S	U	U	Het	wt	D	S	S
8	MN15155U2	--	S	R	S	S	R	R	S	R	R	S	S	U	U	2	D	wt	I	I
9	MN16028	--	S	R	S	Het	R	R	S	S	S	S	S	N	G	2	D	wt	S	S
10	MN16040	S	S	R	S	R	R	S	S	R	R	S	S	N	G	Het	wt	U	S	I
11	MN16262U3	--	S	R	S	S	R	R	S	R	R	S	S	N	G	Het	D	wt	I	I
12	MN16317U5	--	S	R	S	S	S	S	S	R	R	S	S	N	G	Het	D	wt	S	S
13	NDHRS13U0170U0004	--	S	R	S	U	Het	R	I	R	R	R	R	N	G	2	D	wt	S	S
14	NDHRS16U16U665	--	S	R	S	U	R	R	S	R	R	S	S	U	G	Het	wt	wt	S	I
15	NDHRS14U0136UC06	S	S	R	S	S	S	R	S	R	R	S	S	U	U	Het	D	wt	I	I
16	NDHRS16U14U126	S	S	R	S	U	S	S	S	R	R	S	S	U	U	2	D	wt	S	S
17	NDHRS16U14U36	--	S	R	R	R	S	S	I	S	S	S	S	N	G	2	D	wt	S	S
18	SD4740	--	S	S	S	S	R	R	I	R	R	S	S	N	G	Het	wt	wt	S	S
19	SD4834	--	S	S	R	S	R	R	I	S	S	S	S	N	G	2	wt	wt	S	S
20	SD4859	S	S	S	S	S	R	R	S	S	S	S	S	N	G	2	U	wt	S	S
21	SD4865	--	S	R	S	U	S	R	I	S	S	S	R	N	G	2	D	wt	S	S
22	SD4868	--	R	S	S	S	R	R	S	R	R	S	S	N	G	2	D	wt	S	S
23	MT 1621	--	S	R	S	S	S	R	I	S	S	S	S	U	U	2	D	wt	S	S
24	MT 1716	--	S	R	S	S	S	R	I	S	S	S	S	U	U	2	D	wt	S	S
25	MT 1767	S	S	S	S	R	S	R	S	S	S	S	S	N	G	2	D	wt	S	I
26	Lanning	--	S	R	S	R	S	S	I	S	S	S	S	N	G	Het	D	wt	S	S
27	Vida	--	S	R	S	S	S	R	I	S	S	S	S	N	G	2	D	wt	Het	S

Note: see next page for key to marker data.

Table 13 continued, Key to Marker/Trait Associations.

Allele Code	Marker/Gene
Resistant (Hope allele) = T	Sr2
Susceptible = C	
Resistant (Harvest allele) = T	Sr8
Susceptible = C	
Resistant (Thatcher allele) = G	Sr12
Susceptible = A	
Resistant (200 bp present)	Sr25
Susceptible (no 200 bp)	
Resistant = C	Lr21
Susceptible = T	
Resistant = T	Lr34
Susceptible = A	
Resistant (Thatcher allele) = G	Yr7
Susceptible = C	
Insensitive = null	Tsn
Susceptible = G	
Resistant = G	Fhb1
Susceptible = A	
Resistant = T	TaHRC
Susceptible = G	
Resistant = A	barc180
Susceptible = G	
Resistant = A	barc186
Susceptible = C	
Increased = T	GPC
Normal = A	
1=359bp = Ax1 or Ax-null	umr19
2 = 341bp = Ax2	
Good (5+10) = C	GluD1
Poor(2+12) = G	
Dwarfing = Rht-B1b = T	RhtB1
Wild Type = Rht-B1a = C	
Dwarfing = Rht-D1b= A	RhtD1
Wild Type = Rht-D1a = C	
Insensitive = A	PpdB1
Sensitive = G	
Insensitive = C	PpdD1
Sensitive = T	

U = No Call or Unknown = Indeterminant designation

Het = Heterozygous call

- = null allele