

# Report of the 2011 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 17th year in 2011. Five locations at Brookings, SD, St. Paul and Crookston, MN, Langdon, ND, and Glenlea, Manitoba, Canada were planted.

A total of 24 entries were included in the 2011 URSN, including the resistant checks 2375, BacUp, and ND2710, and the susceptible checks Wheaton and Oslo. The other entries were contributed by 5 university and government breeding programs.

A core set of traits evaluated provided from most locations included FHB incidence, FHB severity, disease index (incidence x severity), and visual scabby kernel ratings (VSK  $\cong$  tombstone  $\cong$  FDK). Additional trait data such as grain deoxynivalenol content, plot yield, and heading date, are presented in individual location summary tables. Overall means for traits over locations are presented, as are relative rankings for incidence, severity, disease index, VSK and DON. Correlation coefficients are provided between incidence, severity, disease index, and VSK. Molecular marker genotypes for a set of FHB resistance QTLs and other traits are provided for entries. Adult plant leaf and stem rust reactions are also presented.

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<b>Table 1. Entries for the Uniform Regional Scab Nursery for Spring Wheat Parents, 2011.</b>				
<b>Entry No.</b>	<b>Name</b>	<b>Pedigree</b>	<b>Year First Entered</b>	<b>Source</b>
1	2375	CHECK		
2	Wheaton	CHECK		
3	Bacup	CHECK		
4	Oslo	CHECK		
5	ND2710	CHECK		
6	MN07057-6-4	MN99322-5(Fuijan 5114-1/MN2538(BacUp'S')) /84-5-5-1-2(Parshall/MN97589)	2011	UMN
7	MN07167W-2-1	MN01280W/8019-R1-1//MN01281	2011	UMN
8	MN09023	MN01261-8-1(Ada/Parshall)/2*Sabin	2011	UMN
9	MN09092	Sabin//Tom/Faller	2011	UMN
10	X00009-16	Wheaton/Excelcier	2011	UMN
11	SD4313	STEELE-ND/SD3974	2011	SDSU
12	SD4331	GLENN/SD3997	2011	SDSU
13	SD4337	SD3948/SD3997	2011	SDSU
14	SD4338	SD3618/ND739	2011	SDSU
15	SD4343	SD3623/SD3744	2011	SDSU
16	10EXP13-16	ND735/Steele-ND	2011	NDSU
17	10EXP13-24	Keene/3/Grandin*2//Coteau/LNW(Tt-2)/4/ND708/5/ND711/6/ND756	2011	NDSU
18	10EXP13-44	Walworth/ND721	2011	NDSU
19	10EXP13-87	Frontana/W9207//Alsen/3/ND740'S'	2011	NDSU
20	10 EXPSW13-9	NDSW0849	2011	NDSU
21	10 EXPSW13-19	NDSW0925	2011	NDSU
22	10 EXPSW13-28	NDSW0948	2011	NDSU
23	BW 928	BW799/ND721//Alsen	2010	SPARC, AAFC
24	BW429	McKenzie/Alsen	2011	CRC, AAFC

**Table 2.** 2011 Uniform Regional Scab Nursery for Spring Wheat Parents, Brookings, SD.

<b>Line</b>	<b>Incidence %</b>	<b>Severity %</b>	<b>Disease Index</b>	<b>Tombstone %</b>	<b>DON ppm</b>
2375	100.0	53.7	53.7	15.0	4.9
Wheaton	100.0	61.8	61.8	21.7	7.6
Bacup	98.3	38.3	38.0	5.0	2.6
Oslo	100.0	64.2	64.2	10.0	2.8
ND2710	100.0	39.5	39.5	5.0	1.8
MN07057-6-4	98.3	46.0	45.2	5.0	4.6
MN07167W-2-1	100.0	50.5	50.5	5.0	6.1
MN09023	96.7	51.3	50.1	5.0	4.1
MN09092	100.0	49.0	49.0	5.0	3.7
X00009-16	100.0	43.0	43.0	6.7	2.6
SD4313	96.7	27.7	26.8	5.0	1.8
SD4331	98.3	37.7	37.2	8.3	5.1
SD4337	100.0	52.5	52.5	6.7	5.1
SD4338	100.0	53.5	53.5	5.0	2.5
SD4343	100.0	39.2	39.2	5.0	1.5
10EXP13-16	100.0	52.3	52.3	11.7	5.4
10EXP13-24	100.0	49.3	49.3	5.0	2.3
10EXP13-44	98.3	33.8	33.2	5.0	1.6
10EXP13-87	100.0	57.7	57.7	5.0	2.2
10 EXPSW13-9	100.0	54.8	54.8	8.3	6.7
10 EXPSW13-19	100.0	56.2	56.2	6.7	6.2
10 EXPSW13-28	96.7	30.3	29.3	3.3	2.2
BW 928	100.0	48.3	48.3	5.0	3.3
Brick	93.3	25.8	24.8	5.0	1.6
Mean	99.0	46.5	46.2	7.0	3.7
LSD	NS	18.8	19.2	5.0	2.8
CV	1.7	22.5	23.3	58.2	50.0

**Table 3.** 2011 Uniform Regional Scab Nursery for Spring Wheat Parents, Crookston, MN.

<b>Line</b>	<b>VSK %</b>	<b>DON ppm</b>	<b>Heading d from 6-1</b>	<b>micro TWT<sup>1</sup> g</b>
2375	17	9.8	37	9.8
Wheaton	60	12.5	41	–
Bacup	24	11.2	33	9.9
Oslo	25	8.2	35	–
ND2710	14	14.9	38	10.2
MN07057-6-4	8	4.4	41	9.6
MN07167W-2-1	9	14.1	37	10.0
MN09023	5	6.6	41	10.9
MN09092	8	6.8	39	9.8
X00009–16	17	12.2	38	9.9
SD4313	19	6.6	33	9.5
SD4331	30	10.2	34	9.7
SD4337	14	6.1	35	9.9
SD4338	12	7.8	33	10.7
SD4343	8	5.0	36	11.1
10EXP13-16	14	9.1	37	10.6
10EXP13-24	9	8.5	35	10.4
10EXP13-44	16	7.3	34	10.1
10EXP13-87	10	10.4	37	10.7
10 EXPSW13-9	16	18.3	36	9.4
10 EXPSW13-19	13	7.4	41	–
10 EXPSW13-28	30	4.6	33	9.0
BW 928	8	10.0	38	10.7
BW429	–	–	–	–
Alsen (MR check)	6	5.9	37	11.2
Roblin (S check)	62	9.3	33	8.3
MN00269 (S check)	28	7.1	42	9.9
Mean	17.6	9.0	36.7	10.1
LSD	8.6		1.4	0.7
CV	29.8		2.4	4.4

<sup>1</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  
No data collected on incidence or severity at this location

**Table 4.** 2011 Uniform Regional Scab Nursery for Spring Wheat Parents, St. Paul, MN.

Line	Incidence %	Severity %	Disease Index	VSK %	DON ppm	Heading d from 6-1	30 SSW <sup>1</sup> g	micro TWT <sup>2</sup> g
2375	100.0	28.8	28.8	11.0	3.5	30	17.9	10.1
Wheaton	100.0	78.5	78.5	86.7	5.8	30	4.2	8.7
Bacup	95.0	34.6	33.1	9.3	3.6	28	13.3	10.7
Oslo	100.0	77.9	77.9	20.0	4.7	30	7.4	8.9
ND2710	86.7	13.3	11.6	9.3	2.5	30	18.1	10.3
MN07057-6-4	95.0	36.8	35.3	15.0	6.0	35	10.3	10.4
MN07167W-2-1	100.0	27.9	27.9	9.3	8.7	30	11.3	10.0
MN09023	96.7	30.8	29.8	8.0	5.3	35	11.1	10.6
MN09092	100.0	12.0	12.0	9.7	4.5	30	12.3	9.6
X00009-16	98.3	23.3	22.9	8.0	3.1	30	17.4	10.5
SD4313	95.0	22.0	20.7	15.7	3.2	27	10.1	10.2
SD4331	91.7	27.2	25.3	17.7	5.5	27	14.2	10.0
SD4337	76.7	29.2	22.3	7.3	2.6	28	14.7	9.3
SD4338	93.3	19.8	18.7	8.0	3.1	27	16.0	10.6
SD4343	80.0	7.9	6.3	4.7	2.0	30	15.2	10.8
10EXP13-16	100.0	29.3	29.3	12.0	4.8	30	14.4	10.9
10EXP13-24	98.3	16.2	15.9	7.3	3.6	30	13.8	11.0
10EXP13-44	98.3	32.3	31.9	16.7	3.1	30	16.0	10.5
10EXP13-87	98.3	18.5	18.3	15.7	5.0	30	13.5	10.1
10 EXPSW13-9	100.0	40.4	40.4	10.0	8.3	30	12.6	9.5
10 EXPSW13-19	100.0	51.6	51.6	19.7	3.3	35	18.2	8.9
10 EXPSW13-28	96.7	33.5	32.5	13.0	4.1	30	7.2	10.4
BW 928	100.0	12.0	12.0	14.0	3.8	30	10.7	9.2
BW429	–	–	–	–	–	–	–	–
Alsen (MR check)	98.3	15.2	15.0	6.7	3.7	30	9.3	10.0
Roblin (S check)	100.0	79.6	79.6	68.3	4.8	27	9.7	9.0
MN00269 (S check)	100.0	86.7	86.7	48.3	7.6	35	3.1	10.7
Mean	94.0	35.7	34.9	20.3	4.5	30.0	12.1	10.1
LSD	9.7	11.4	12.1	10.4		1.6	5.1	1.0
CV	6.3	19.4	21.1	31.1		3.3	20.7	6.3

<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

**Table 5.** 2011 Uniform Regional Scab Nursery for Spring Wheat Parents, Langdon, ND.

<b>Line</b>	<b>Incidence %</b>	<b>Severity %</b>	<b>Disease Index</b>	<b>DON ppm</b>	<b>Heading d from 6-1</b>
2375	100	59.5	59.5	1.5	14
Wheaton	100	86.8	86.8	1.0	17
Bacup	100	72.7	72.7	0.9	14
Oslo	100	90.4	90.4	1.3	11
ND2710	100	32.5	32.5	0.7	15
MN07057-6-4	100	68.1	68.1	0.2	21
MN07167W-2-1	100	70.0	70.0	0.9	20
MN09023	100	49.3	49.3	0.3	19
MN09092	100	54.7	54.7	0.3	18
X00009-16	100	56.6	56.6	0.9	14
SD4313	100	49.6	49.6	0.5	15
SD4331	100	52.2	52.2	1.2	11
SD4337	100	43.1	43.1	1.2	12
SD4338	100	25.8	25.8	0.8	12
SD4343	100	20.8	20.8	0.4	17
10EXP13-16	100	41.5	41.5	0.6	16
10EXP13-24	100	43.7	43.7	0.5	13
10EXP13-44	100	38.5	38.5	0.3	12
10EXP13-87	100	44.1	44.1	0.4	18
10 EXPSW13-9	100	80.3	80.3	1.1	19
10 EXPSW13-19	100	63.7	63.7	0.8	19
10 EXPSW13-28	100	56.6	56.6	0.5	15
BW 928	100	53.4	53.4	1.3	16
BW429	100	69.0	69.0	0.7	18
Mean	100	55.1	55.1	0.8	15.6
LSD		19.5	19.5	0.8	4.1
CV		25.1	25.1	70.4	18.6



**Table 6.** 2011 Uniform Regional Scab Nursery for Spring Wheat Parents, Glenlea, MB.

Line	Incidence %	Severity %	Disease Index		FDK %	DON %	DISK*	ISD**	
2375	2.8	2.0	5.3	MR	1.8	2.6	2.3	2.5	MR
Wheaton	3.6	5.3	17.6	MS	7.1	7.7	6.2	5.8	MS
Bacup	2.9	1.4	4.3	R	0.9	1.9	1.7	2.0	MR
Oslo	3.0	2.4	7.6	MR	4.4	6.7	4.4	4.3	I
MN07057-6-4	1.6	0.5	1.2	R	1.0	0.4	0.9	0.8	R
MN07167W-2-1	2.6	1.4	3.4	R	1.3	3.8	2.3	2.7	MR
MN09023	3.4	1.4	4.4	R	0.7	0.7	1.4	1.7	MR
MN09092	2.8	0.6	1.6	R	0.8	1.1	1.2	1.4	R
X00009-16	1.9	1.1	2.1	R	0.8	1.3	1.2	1.4	R
BW928	2.9	1.1	3.1	R	2.0	3.3	2.4	2.5	MR
Mean	2.7	1.7	5.1		2.1	3.0	2.4	2.5	
LSD	4.0	2.5	7.6		2.7	4.6	2.4	2.4	
CV	60.6	60.5	61.9		53.0	64.0	40.9	39.1	

\*DISK = (DON, % Incidence, % Severity, Kernel (FDK))

is calculated by:  $((0.2 \cdot \text{AVG}\%I) + (0.2 \cdot \text{AVG}\%S) + (0.3 \cdot \text{AVG-FDK}) + (0.3 \cdot \text{AVG-DON}))$  for a given entry

\*\*ISD (%Incidence, %Severity, DON) is calculated by:  $(0.3 \cdot \text{AVG}\%Inc) + (0.3 \cdot \text{AVG}\%Sev) + (0.4 \cdot \text{AVG-DON})$  for a given entry.

Entries from NDSU, SDSU and a few others were not planted

**Table 7.** Correlation coefficients among traits on a per-location basis.

<b>Correlation Between</b>	<b>Brookings</b>	<b>Crookston</b>	<b>St. Paul</b>	<b>Langdon</b>
Incidence & Severity	0.64		0.33	
Incidence & Disease Index	0.67		0.39	
Incidence & Tombstone/VSK	0.32		0.25	
Incidence & DON	0.88		0.48	
Severity & Disease Index	1.00		1.00	1.00
Severity & Tombstone/VSK	0.51		0.68	
Severity & DON	0.55		0.33	0.39
Disease Index & Tombstone/VSK	0.51		0.69	
Disease Index & DON	0.55		0.35	0.39
Tombstone/VSK & DON	0.62	0.19	0.21	

**Table 8.** 2011 Uniform Regional Scab Nursery for Spring Wheat Parents - Cross-Location Means and Ranks.

Line	Incidence %	Incidence Rank	Severity %	Severity Rank	Disease Index	Disease Index Rank	VSK %	VSK Rank	DON ppm	DON Rank
No. of Locations	3	3	3	3	3	3	3	3	4	4
2375	100	15	47.3	16	47.3	16	14.4	19	4.9	18
Wheaton	100	15	75.7	23	75.7	23	56.1	23	6.7	22
Bacup	97.8	5	48.6	17	47.9	17	12.8	16	4.6	15
Oslo	100	15	77.5	24	77.5	24	18.3	21	4.3	12
ND2710	95.6	3	28.4	2	27.9	2	9.4	10	5.0	19
MN07057-6-4	97.8	5	50.3	19	49.5	18	9.3	8	3.8	8
MN07167W-2-1	100	15	49.5	18	49.5	18	7.7	5	7.5	23
MN09023	97.8	5	43.8	15	43.1	15	6.1	2	4.1	11
MN09092	100	15	38.6	8	38.6	9	7.6	4	3.8	8
X00009-16	99.4	12	41.0	12	40.8	13	10.4	12	4.7	17
SD4313	97.2	5	33.1	4	32.4	3	13.2	18	3.0	4
SD4331	96.7	4	39.0	9	38.2	8	18.7	22	5.5	21
SD4337	92.2	1	41.6	14	39.3	10	9.3	8	3.8	8
SD4338	97.8	5	33.0	3	32.6	4	8.4	6	3.5	6
SD4343	93.3	2	22.6	1	22.1	1	5.9	1	2.2	2
10EXP13-16	100	15	41.0	12	41.0	14	12.7	15	5.0	19
10EXP13-24	99.4	12	36.4	6	36.3	6	7.2	3	3.7	7
10EXP13-44	98.9	11	34.9	5	34.5	5	12.4	14	3.1	5
10EXP13-87	99.4	12	40.1	10	40.0	12	10.2	11	4.5	14
10 EXPSW13-9	100	15	58.5	21	58.5	21	11.3	13	8.6	24
10 EXPSW13-19	100	15	57.2	20	57.2	20	12.9	17	4.4	13
10 EXPSW13-28	97.8	5	40.2	11	39.5	11	15.4	20	2.9	3
BW 928	100	15	37.9	7	37.9	7	9.0	7	4.6	15
BW429*	100	15	69.0	22	69.0	22			0.7	1
Mean	98.4		45.2		44.8		13.0		4.4	

\* - Based on data from one location.

**Table 9.** Correlation coefficients among traits using cross-location means.

	Incidence %	Severity %	Disease Index	VSK %	DON ppm
Incidence %					
Severity %	0.51				
Disease Index	0.54	1.00			
VSK %	0.22	0.63	0.62		
DON ppm	0.30	0.26	0.26	0.34	

Note: Correlation coefficients were calculated with means across locations.

**Table 10.** Allele Sizes of Molecular Markers Associated with Selected Traits/Genes. From S. Chao (USDA-ARS, Fargo, ND)

Trait / Gene	HMW Glutenins / Glu-1A	HMW Glutenins / Glu-1Dx	HMW Glutenins / Glu-1Dy	Leaf Rust / Lr34	Stem Rust / Sr25			Leaf Rust / Lr21	Scab / Fhb_5A	Scab / Fhb1	Grain Protein Content / GPC	Tan Spot / tsn1	Photoperiod / Ppd-D1a (insen)	Photoperiod / Ppd-D1b (sen)	Height / Rht-B1a (wild type)	Height / Rht-B1b (dwarf)	Height / Rht-D1a (wild type)	Height / Rht-D1b (dwarf)
Marker	umn19	umn25	umn26	csLV34	Sr25			Lr21	barc180	umn10	uhw89	fcp397	Ppd-D1a	Ppd-D1b	Rht-B1a	Rht-B1b	Rht-D1a	Rht-D1b
Chromosome	1A	1D	1D	7D	7D			1D	5A	3B	6B	5B	2D	2D	4B	4B	4D	4D
2375	<b>341</b>	<b>278</b>	<b>391</b>	<b>156</b>	183	204	210	304	194	239	125	251	284		+	+	+	-
Wheaton	<b>341</b>	<b>278</b>	<b>391</b>	<b>156</b>	183	204	210	304	190	239	125	<b>224</b>	284		+	+	-	+
Bacup	359	<b>278</b>	<b>391</b>	237	183	<b>200</b>	204	304	197	239	125	251	284		+	+	+	-
Oslo	359	295	408	237	183	204	210	304	190	239	125	226	284		-	+	+	-
ND2710	NS*																	
MN07057-6-4	359	<b>278</b>	<b>391</b>	<b>156</b>	183	<b>200</b>	204	304/307	200	<b>242</b>	125	251		414	+	-	+	-
MN07167W-2-1	<b>341</b>	<b>278</b>	<b>391</b>	237	183	210	232	304	190	239	125	251	284		+	+	+	-
MN09023	359	<b>278</b>	<b>391</b>	<b>156</b>	183	204	210	304	200	<b>242</b>	125	251		414	+	-	+	-
MN09092	359	<b>278</b>	<b>391</b>	<b>156</b>	183	204		304	200	<b>242</b>	125	251	284		+	-	+	-
X00009-16	359	<b>278</b>	<b>391</b>	237	183	204	210	304	190	239	125	<b>224</b>	284		+	+	+	-
SD4313	359	<b>278</b>	<b>391</b>	<b>156</b>	183	<b>200</b>	204	304	190	239	125	251	284		+	+	+	-
SD4331	359	<b>278</b>	<b>391</b>	237	183	204	210	304	190	239	125	251		414	+	-	+	-
SD4337	<b>341</b>	<b>278</b>	<b>391</b>	<b>156</b>	183	204	210	286	200	239	125	251		414	+	+	+	-
SD4338	<b>341</b>	<b>278</b>	<b>391</b>	237	183	204	210	304	190	<b>242</b>	125	251		414	+	+	+	-
SD4343	<b>341</b>	<b>278</b>	<b>391</b>	<b>156</b>	183	204	210	304	194	<b>242</b>	125	251		414	+	-	+	-
10EXP13-16	NS*																	
10EXP13-24	NS*																	
10EXP13-44	NS*																	
10EXP13-87	NS*																	
10 EXPSW13-9	NS*																	
10 EXPSW13-19	NS*																	
10 EXPSW13-28	NS*																	
BW928	<b>341</b>	<b>278</b>	<b>391</b>	<b>156</b>	183	204		304	197	<b>242</b>	125	251		414	-	+	+	-
BW429	<b>341</b>	<b>278</b>	<b>391</b>	237	183	204	210	<b>196</b>	<b>203</b>	<b>242</b>	125	251		414	-	+	+	-

Numbers in bold are associated with gene/QTL. Please see next page for more details on marker allele/gene associations.

\* Seed not provided

**Table 10 continued.**

<b>Trait</b>	<b>Marker</b>	<b>Gene</b>	<b>Chromosome</b>	<b>Size (base)</b>
scab	umn10	Fhb1	3B	Resistance=242
scab	barc180	Fhb_5A	5A	Resistance=203
Tan Spot	fcp394	tsn1	5B	Resistance=224
grain protein content	uhw89	GPC	6B	H=121, L=125
HMW Glutenins	umn19	Glu	1A	Ax2*=341, Ax1=359
HMW Glutenins	umn25	Glu-1Dx	1D	Dx5=278, Dx2=295
HMW Glutenins	umn26	Glu-1Dy	1D	Dy10=391, Dy12=408
Leaf rust	Lr21	Lr21	1D	Resistance=196
Leaf rust	csLV34	Lr34	7D	Resistance=156
Stem rust	Sr25	Sr25	7D	Resistance = 200
photoperiod	Ppd-D1a	Ppd-D1a (insensitive)	2D	284
photoperiod	Ppd-D1b	Ppd-D1b (sensitive)	2D	414
plant height	Rht-B1a	Rht-B1a (wild type)	4B	360 = +
plant height	Rht-B1b	Rht-B1b (dwarf)	4B	366 = +
plant height	Rht-D1a	Rht-D1a (wild type)	4D	250 = +
plant height	Rht-D1b	Rht-D1b (Dwarf)	4D	252 = +

**Table 11.** Leaf and stem rust reactions in inoculated field nurseries of the 2011 Uniform Regional Scab Nursery for Spring Wheat Parents, St. Paul, MN (J. Kolmer and Y. Jin, USDA-ARS CDL)

Line	Leaf rust		Stem rust
	19-Jul	7/22 (0-TR not noted)	
2375	-		
Wheaton	10RMR		
Bacup	-		
Oslo	30MS		
ND2710	20MRMS		
MN07057-6-4	20MR		
MN07167W-2-1	10R		
MN09023	10MR		
MN09092	TR		
X00009-16	40MS		5MR
SD4313	5R		20MR-MS
SD4331	20MS		
SD4337	10R		10MR
SD4338	10MR		10MR
SD4343	5T		
10EXP13-16	5M		
10EXP13-24	TR		
10EXP13-44	TR		
10EXP13-87	TR		
10 EXPSW13-9	TR		
10 EXPSW13-19	5R		5MS
10 EXPSW13-28	10MRMS		
BW 928	10MR		
BW429	-		-