

Report on the 2022-2023 Northern Uniform Winter Wheat Scab Nurseries (NUWWSN and PNUWWSN)

C. Sneller^{1*}, P. Paul², and N Arguello Blanco¹

Dept. of Horticulture and Crop Science¹, Dept. Plant Pathology², The Ohio State University, Wooster, Ohio 44691,.

*Corresponding author: PH:(330)749-8942, E-mail: sneller.5@osu.edu

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INTRODUCTION: The objective of the Northern Uniform Winter Wheat Scab Nursery (NUWWSN) and the Preliminary Northern Uniform Winter Wheat Scab Nursery (PNUWWSN) is to screen winter wheat genotypes adapted to the northern portion of the eastern US for scab resistance. Breeders submit entries each also conducts the trial in inoculated and misted FHB nurseries within their programs. Data is then sent to the coordinator for summation and distribution. Public and private breeders submit lines using their own criteria for inclusion though all must be adapted. Entries vary in the degree of pretesting and selection and their purpose (germplasm, cultivars).

MATERIAL AND METHODS:

The locations that reported data and the traits assessed are listed in Tables 1, 2 and 3. The NUWWSN had 50 entries (46 lines & four checks, Table 4) from 9 programs, and we obtained phenotypic data on seven FHB-related traits from nine locations. The PNUWWSN had 36 entries (32 lines & four checks, Table 5) from 6 programs, and we obtained phenotypic data from seven locations. Cooperators collect replicated data and submit either plot level data or means to the coordinator. The means from individual locations are used in an analysis over locations. The genotype x environment interaction (GEI) term is the error and is used to calculate an LSD (0.05). The LSD value is used to determine if a particular entry mean is statistically equal to the lowest entry mean (such values are designated with an “l”) or the highest entry mean (such values are designated with an “h”) for each trait. Variance components were estimated using PROC MIXED from SAS considering entries and locations to be random. Several cooperators scored FHB Index using a 0-9 scale (0=no disease, 9=severe disease). This creates issues with combining IND data over locations. The reported F09 values were multiplied by 10 to provide an IND value.

HIGHLIGHTs

- Several cooperators reported very low levels of visual symptoms of FHB. This lead several to not collected spike symptoms (INC, SEV, or IND)
- ILURB and OHWOO did not collected IND due to low visual symptoms, but still harvested grain samples for FDK and DON. Both reported high average FDK while ILURB samples had low DON and OHWOO had high DON. Seems we need to always get FDK and DON regardless of IND.
- The frequency of the R allele at FHB1 was 0.59 among the 32 breeding lines in the PNUWWSN and 0.32 in the 46 NUWWSN breeding lines.
- A high percentage of lines in both tests had better DON and FDK that the “resistant” check “Truman”, or the moderate resistant check “Freedom”, while very few were worse than the susceptible PIO2545.

	FDK		DON	
	NUWWSN	PNUWWSN	NUWWSN	PNUWWSN
% Lines < Truman	33	47	28	50
% Lines < Freedom	48	75	59	88
% Lines > PIO2545	0	3	7	0

Table 4. Entries in the 2022-2023 NUWWSN.

ENTRY	NAME	PEDIGREE
1	TRUMAN	
2	FREEDOM	
3	ERNIE	
4	PIONEER2545	
5	X11-0039-1-17-5	Pembroke//VA04W-90/KY97C-0508-01-01A-1
6	X11-0120-12-4-3	SYNGENTA W1104/VA0GW-558/SSMPV-57
7	X14-1147-158-14-5	KY03C-1002-02//KY04C-1195-10-8-5/SHIRLEY
8	X15-1118-27-1-3	KY03C-1237-05//KY03C-1195-10-8-5/KY03C-1237-05
9	X14-1206-52-2-1	KY05C-1105-43-6-1//KY03C-1237-39/KY03C-1237-12
10	KWS369	LCS19229 / VA12FHB-8
11	KWS407	KWS074 / GL1032-38-2
12	KWS450	KWS114 / KY06C-2020-11-12-1
13	KWS453	KWS114 / KY06C-2020-11-12-1
14	KWS456	KWS095 / VA11W-106
15	KWS460	KWS126 / MD04W249-11-7
16	IL19-6637	10-21934/13-1910
17	IL19-13414	13-20171/10-21934
18	IL19-18153	02-19463-7/12-21660//12-8545
19	IL19-20348	11-6626/10-21934//07-4415
20	IL19-27565	13-1910/02-19463-7
21	MI21R0250	Shirley/OH12-195-22
22	MI21R0089	MI14R0009/KY06C-2067-16-7-1
23	MI21R0195	OH12-195-22//Hilliard/MI14W0190
24	MI21R0202	OH12-195-22/F1026R
25	21PU-0033	0762A1-2-8/03549A1-18-25-4
26	21PU-0163	0762A1-2-8/06497A1-7-3
27	21PU-0185	0762A1-2-8/06497A1-7-3
28	21PU-0673	0566A1-3-1-9/05247A1-7-3-114
29	21PU-0532	04620/08334A1-31
30	FHB_MS_HS-47-2-1-5-1-1F17	Dominant MS Recurrent Selection
31	NY99056-161-O	NY85020-395 (Frankenmuth/6432-10//6120-15 (Geneva sib)/65305-2) /3/Pio25W33
32	NY12302-2-14-08-1442	NY09067-2-4 x NY09067-2-48R = OH02-12686/Cal-Res-L/NY03179-10
33	FHB_MS_HS-24-1-2-3-3-3-5F18	Dominant MS Recurrent Selection
34	NY12007-2-4-13-1381	Pio25R39 x NY03180-10
35	OH18-46-89	OH07-263-3 /IL07-19334
36	OH18-65-54	OH10-194-16/P0762A1-2-8
37	OH18*105-13	P0762A1-2-8/OH09-207-68
38	OH18-78-33	OH09-207-68/P0762A1-2-8
39	OH18-65-13	OH10-194-16/P0762A1-2-8
40	VA20W-142	GA041293-11E37 [Pion26R61/2*SS8641] / '102015123' (VA10W-123) // Hilliard (VA11W-108)
41	17VTK4-29	SY Viper / MDC07026-F2-19-13-1 (SS8641// McCormick*2 / Ning7840)
42	VA20FHB-20	'111301W' (Pioneer W000273A1) / 12V51 (VA05W-251) // Hilliard (VA11W-108)
43	VA21W-59	UX1327-4 [McCormick/3/McCormick/ Sr26recB// McCormick] / Hilliard (VA11W-108) // MDC07026-F2-19-13-4 [SS8641// McCormick*2/NING7840]
44	VA19FHB-36	SS 8340 (Pioneer 111301W) / 12V51 (VA05W-251) // Hilliard (VA11W-108)
45	NI1740	TX06A001281/NI04420
46	NW15443	OR 2060108/NW03681//NW03666
47	NE18455	TX07A001505/NE06430
48	NE20620	LCH13NEDH-14-31/NE10589
49	NE21420	LCS MINT/NE13483V//NE13483V
50	NE21420	LCS MINT/NE13483V//NE13483V

Table 5. Entries in the 2022-2023 PNUWWSN.

ENTRY	NAME	PEDIGREE
1	TRUMAN	
2	FREEDOM	
3	ERNIE	
4	PIONEER2545	
5	X14-1031-103-4-1	KY03C-1237-32//KY04C-1195-10-8-5/SYNGENTA W1104
6	X16-3013-1-12-5	VA11W-106/MDC07026-F2-19-13-1
7	X15-1091-49-2-3	KY03C-1002-02//KY03C-1237-05/Shirley
8	X14-1205-147-16-1	KY05C-1105-43-6-1//KY03C-1237-39/KY03C-1237-32
9	X14-1107-95-18-5	KY03C-1237-12//SHIRLEY/KY03C-1237-32
10	IL19-6946	10-21934/13-28833
11	IL19-10123	12-8512/13-23870
12	IL19-18826	10-19464/11-36131//P0762A1-2-8
13	IL19-18837	10-19464/11-36131//P0762A1-2-8
14	IL19-21848	11-36131/07-4415//12-14179
15	MI21R0028	Hilliard/MI14W0190
16	MI21R0054	KWS095//OH12-195-22/F1026R
17	MI21R0051	KWS095//MI14R0489/P25R47
18	MI21R0058	KWS095/MI14W0190
19	MI21R0133	MI14W0190//Venus/E2041
20	MI21R0179	OH11-118-18//OH12-195-22/F1026R
21	21PU-0294	0566A1-3-1-52/1042A1-1-23
22	21PU-0297	0566A1-3-1-52/1042A1-1-23
23	21PU-0298	0566A1-3-1-52/1042A1-1-23
24	21PU-0674	0566A1-3-1-9/05247A1-7-3-114
25	21PU-0561	0570A1-8-5-1/053A1-2-5-3-5-3
26	OH18*104-99	P0762A1-2-8/OH09-207-68
27	OH19*138-14	MO080104 /OH09-207-68
28	OH19-167-5	P0762A1-2-8 /OH07-175-11
29	OH19-71-5	119-11 /146-6
30	OH19-161-70	VA05W-151 /KY02C-1121-75
31	18VTK10-110	KWS122 / 13VTK429-3
32	18VTK12-60	KWS122 / USG 3118
33	18VTK15-27	KWS103 / VA16W-148
34	VA21FHB-8	IL07-19334 / VA12FHB-4
35	19VT1FHB_DH-241	13VTK59-148 / VA16W-105
36	16VT07-5-4-3	NC8248-14 / Featherstone 73 // MDC07026-F2-19-13-1

Table 6. Correlation among FHB traits and heading date in the 2022-2023 P+NUWWSN.

NUWWSN							
	INC	SEV	IND	FDK	ISK	DON	HD
INC		0.370	0.578	0.490	0.600	0.517	0.354
SEV	0.370		0.528	0.511	0.707	0.512	0.016
IND	0.578	0.528		0.591	0.781	0.424	-0.286
FDK	0.490	0.511	0.591		0.906	0.647	0.051
ISK	0.600	0.707	0.781	0.906		0.668	-0.035
DON	0.517	0.512	0.424	0.647	0.668		0.332
HD	0.354	0.016	-0.286	0.051	-0.035	0.332	

PNUWWSN							
	INC	SEV	IND	FDK	ISK	DON	HD
INC		0.418	0.544	-0.050	0.353	-0.206	-0.321
SEV	0.418		0.264	-0.093	0.353	-0.155	-0.239
IND	0.544	0.264		0.242	0.750	-0.089	-0.497
FDK	-0.050	-0.093	0.242		0.705	0.757	0.259
ISK	0.353	0.353	0.750	0.705		0.314	-0.254
DON	-0.206	-0.155	-0.089	0.757	0.314		0.617
HD	-0.321	-0.239	-0.497	0.259	-0.254	0.617	

Table 7. ANOVA over locations for all FHB traits in the 2022-2023 P+NUWWSN. Entry mean heritability (H) was calculated assuming 2 replications per location.

NUWWSN							
	Venv	Vgen	Vrep(loc)	Vgxl	Verror	# Envs	H (assume 2 reps)
INC	641.0	11.0	6.7	89.5	120.8	4	0.23
SEV	8.2	6.3	0.0	31.0	97.5	4	0.24
IND	177.7	8.1	0.5	42.1	19.5	6	0.48
FDK	251.3	64.1	0.0	32.8	98.7	4	0.76
ISK	41.9	35.3	0.1	11.6	44.8	3	0.76
DON	174.2	10.3	3.4	24.9	13.0	5	0.62
HD	173.4	3.1	0.1	1.3	4.9	6	0.83

PNUWWSN							
	Venv	Vgen	Vrep(loc)	Vgxl	Verror	# Envs	H (assume 2 reps)
INC	49.4	9.1	0.0	16.4	3.9	2	0.50
SEV	0.0	18.9	0.8	0.0	219.5	2	0.26
IND	475.8	9.0	2.2	21.6	39.4	4	0.47
FDK	54.3	123.1	21.9	65.2	134.6	3	0.74
ISK	79.9	42.4	0.0	14.4	56.5	2	0.67
DON	37.9	4.3	0.4	12.7	2.5	4	0.55
HD	148.2	1.9	0.8	2.0	4.4	5	0.69

Table 8. Location mean of all traits in the 2022-2023 P+NUWWSN.

NUWWSN							
LOC	INC	SEV	IND	FDK	ISK	DON	HD
ILURB	1.0	10.0	0.0	44.3	21.0	1.2	141.4
KYLEX	.	.	30.0	.	.	5.2	127.5
MIMAS	13.0	16.0	3.0	.	.	.	152.8
NELIN	40.0	9.0	20.0	.	.	.	.
NYITH	57.0	13.0	8.0	32.4	33.2	30.7	147.9
OHWOO	.	.	.	37.1	.	18.3	137.0
VAWAR	.	.	30.0	12.8	23.1	7.8	122.0
PNUWWSN							
LOC	INC	SEV	IND	FDK	ISK	DON	HD
ILURB	1.5	11.3	0.2	42.6	20.9	2.3	140.4
KYLEX	.	.	39.9	.	.	6.2	125.9
MIMAS	11.5	13.2	2.0	.	.	.	152.9
OHWOO	.	.	.	30.9	.	16.5	135.7
VAWAR	.	.	38.1	26.9	33.7	5.0	122.1

Table 9. Summary of all FHB traits from the 2022-2023 NUWWSN: “h” and “l” indicate means that are not significantly different from the highest (h) or lowest (l) mean in that column. “# R alleles for FHB1” indicates the number of resistance alleles at QTL *Fhb1*. PC1 scores are from principal component analysis using data from all traits.

ENTRY	NAME	INC	SEV	IND	FDK	ISK	DON	PC1	# "R" alleles at
		AVG	AVG	AVG	AVG	AVG	AVG	57%	
1	TRUMAN	29.3 h	14.9 l	11.2 l	27.2 l	20.5 l	9.7 l	-1.2	0
2	FREEDOM	30.2 h	15.6 hl	14.9 l	32.2	26.4 l	14.0	0.5	0
3	ERNIE	20.3 l	11.4 l	19.1 h	22.5 l	24.9 l	9.1 l	-0.3	0
4	PIONEER2545	31.7 h	15.9 hl	17.2 h	61.7 h	37.5 h	18.0	3.2	0
5	X11-0039-1-17-5	38.5 h	15.2 l	17.5 h	33.7	28.5	15.4	1.5	0
6	X11-0120-12-4-3	30.0 h	11.4 l	12.5 l	38.2	26.6 l	15.3	0.2	0
7	X14-1147-158-14-5	30.3 h	10.4 l	21.7 h	39.7	33.7 h	11.4 l	1.7	2
8	X15-1118-27-1-3	37.4 h	9.4 l	15.4 l	26.2 l	23.1 l	9.7 l	-0.7	2
9	X14-1206-52-2-1	29.0 hl	9.7 l	14.2 l	29.7 l	27.1 l	9.1 l	-0.4	0
10	KWS369	42.4 h	18.0 hl	17.7 h	32.2	30.5 h	12.0 l	1.9	0
11	KWS407	22.5 hl	18.5 hl	11.6 l	32.7	24.7 l	13.6	-0.3	0
12	KWS450	20.8 l	8.1 l	10.9 l	19.6 l	17.4 l	9.6 l	-2.5	0
13	KWS453	27.8 hl	5.8 l	12.1 l	17.9 l	19.3 l	10.2 l	-2.0	0
14	KWS456	33.2 h	9.0 l	16.8 h	28.2 l	22.8 l	12.7	-0.1	2
15	KWS460	40.2 h	13.3 l	19.8 h	27.2 l	28.7	13.2	1.6	0
16	IL19-6637	13.0 l	4.8 l	12.0 l	12.2 l	13.6 l	7.7 l	-3.7	0
17	IL19-13414	29.5 hl	8.9 l	15.1 l	20.2 l	20.1 l	9.3 l	-1.1	0
18	IL19-18153	12.9 l	5.6 l	11.1 l	13.0 l	14.2 l	6.4 l	-3.7	1
19	IL19-20348	20.0 l	8.0 l	13.0 l	21.8 l	21.0 l	7.6 l	-1.8	2
20	IL19-27565	22.9 hl	9.4 l	14.2 l	16.0 l	21.2 l	11.7 l	-1.4	0
21	MI21R0250	41.7 h	18.4 hl	22.5 h	48.2 h	39.5 h	18.5	4.2	2
22	MI21R0089	27.5 hl	12.0 l	16.2 hl	32.7	27.8	11.7 l	0.2	0
23	MI21R0195	28.5 hl	12.6 l	17.4 h	56.7 h	37.6 h	15.6	2.7	0
24	MI21R0202	27.0 hl	15.2 l	16.0 hl	41.2	32.1 h	16.8	1.5	0
25	21PU-0033	24.7 hl	15.7 hl	12.8 l	29.2 l	25.4 l	13.9	-0.4	2
26	21PU-0163	29.0 hl	7.4 l	12.7 l	35.2	25.5 l	8.6 l	-0.8	2
27	21PU-0185	39.2 h	10.0 l	18.2 h	35.2	31.1 h	14.4	1.5	0
28	21PU-0673	27.7 hl	13.8 l	18.6 h	42.2	33.1 h	16.0	1.7	0
29	21PU-0532	43.1 h	19.9 hl	20.2 h	31.2	33.0 h	12.4	2.7	0
30	FHB_MS_HS-47-2-1-5-1-1F17	18.1 l	5.7 l	8.2 l	11.2 l	13.4 l	4.5 l	-3.9	2
31	NY99056-161-O	34.3 h	8.5 l	11.9 l	33.2	22.7 l	26.8 h	0.7	0
32	NY12302-2-14-08-1442	28.9 hl	7.3 l	11.1 l	54.2 h	27.9	16.0	0.3	2
33	FHB_MS_HS-24-1-2-3-3-3-5F	26.6 hl	10.6 l	11.5 l	22.7 l	17.1 l	14.9	-1.4	0
34	NY12007-2-4-13-1381	34.6 h	10.6 l	14.7 l	31.7	24.6 l	13.0	0.1	2
35	OH18-46-89	32.5 h	13.6 l	15.1 l	26.2 l	24.0 l	8.0 l	-0.4	0
36	OH18-65-54	10.3 l	5.9 l	13.3 l	14.5 l	15.8 l	4.8 l	-3.5	2
37	OH18*105-13	8.9 l	3.9 l	12.3 l	18.7 l	17.7 l	5.1 l	-3.6	2
38	OH18-78-33	25.8 hl	9.0 l	16.2 hl	32.7	26.2 l	13.7	-0.1	2
39	OH18-65-13	26.6 hl	8.8 l	15.0 l	39.2	27.4 l	16.2	0.2	0
40	VA20W-142	23.2 hl	13.4 l	15.0 l	36.7	23.1 l	13.0	-0.3	0
41	17VTK4-29	34.9 h	14.4 l	20.7 h	25.2 l	29.4	9.5 l	1.1	2
42	VA20FHB-20	34.0 h	9.7 l	16.4 h	30.2 l	25.4 l	13.5	0.1	0
43	VA21W-59	37.9 h	22.8 h	23.8 h	56.2 h	44.5 h	22.1 h	5.5	0
44	VA19FHB-36	26.1 hl	10.5 l	14.8 l	33.2	23.2 l	15.8	-0.3	0
45	NI1740	19.3 l	12.3 l	15.8 hl	19.2 l	22.6 l	9.2 l	-1.4	0
46	NW15443	30.3 h	12.8 l	13.4 l	34.7	26.4 l	15.6	0.1	0
47	NE18455	19.8 l	32.1 h	16.7 h	37.2	37.7 h	15.2	2.8	0
48	NE20670	21.6 l	9.1 l	11.8 l	40.7	23.1 l	11.9 l	-1.2	0
49	NE21470	21.4 l	17.3 hl	15.6 l	39.2	25.1 l	15.6	0.1	0
50	NE21470E	24.4 hl	14.4 l	16.5 h	42.7 h	24.1 l	17.4	0.5	0
1001	MEAN	27.8	12.0	15.3	31.7	25.8	12.7		
1002	MINIMUM	8.9	3.9	8.2	11.2	13.4	4.5		
1003	MAXIMUM	43.1	32.1	23.8	61.7	44.5	26.8		
1006	LSD	20.9	16.6	8.1	19.2	14.1	7.6		

Table 10. Summary of all FHB traits from the 2022-2023 PNUWWSN: “h” and “l” indicate means that are not significantly different from the highest (h) or lowest (l) mean in that column. “# R alleles for FHB1” indicates the number of resistance alleles at QTL *Fhb1*. PC1 scores are from principal component analysis using data from all traits.

ENTRY	NAME	INC AVG	SEV AVG	IND AVG	FDK AVG	ISK AVG	DON AVG	PC1 38.8%	# "R" alleles at
1	TRUMAN	3.6 l	6.0 hl	11.7 l	29.8 l	17.8 l	7.4 l	-3.06	0
2	FREEDOM	4.5 l	8.2 hl	16.1 l	41.0	23.5 l	10.1 h	-1.77	0
3	ERNIE	6.3 l	13.3 hl	20.7 hl	26.1 l	25.9 hl	6.8 l	0.00	0
4	PIONEER2545	6.7 l	20.7 hl	21.6 hl	54.8 h	38.6 hl	12.5 h	1.30	0
5	X14-1031-103-4-1	7.7 l	21.6 hl	27.2 h	50.4 h	43.7 h	7.9 hl	2.75	2
6	X16-3013-1-12-5	4.0 l	3.5 hl	13.1 l	36.7 l	16.2 l	7.8 hl	-2.73	2
7	X15-1091-49-2-3	7.6 l	18.6 hl	17.8 l	31.7 l	26.6 hl	8.9 h	-0.34	2
8	X14-1205-147-16-1	7.0 l	13.5 hl	18.3 l	21.4 l	23.4 l	4.8 l	-0.36	2
9	X14-1107-95-18-5	6.6 l	6.1 hl	18.4 l	42.9 h	28.6 hl	9.5 h	-0.69	2
10	IL19-6946	4.4 l	3.5 hl	21.8 hl	29.2 l	25.0 hl	4.5 l	-0.04	2
11	IL19-10123	6.3 l	30.6 hl	22.9 hl	16.2 l	29.2 hl	3.8 l	1.67	2
12	IL19-18826	8.3 l	13.9 hl	19.2 l	25.4 l	23.6 l	5.8 l	0.35	1
13	IL19-18837	9.2 l	18.1 hl	22.6 hl	10.3 l	23.2 l	4.9 l	0.93	0
14	IL19-21848	5.7 l	23.0 hl	15.6 l	20.6 l	22.9 l	4.0 l	0.02	0
15	MI21R0028	5.6 l	7.4 hl	21.1 hl	32.3 l	28.8 hl	7.9 hl	0.08	1
16	MI21R0054	10.9 hl	12.9 hl	19.2 l	39.2	28.6 hl	8.9 h	0.36	2
17	MI21R0051	5.3 l	5.2 hl	18.2 l	27.9 l	23.9 l	5.8 l	-1.09	2
18	MI21R0058	9.4 l	18.9 hl	17.7 l	46.7 h	30.5 hl	9.1 h	0.65	2
19	MI21R0133	5.9 l	10.0 hl	27.6 h	69.8 h	47.9 h	10.2 h	2.66	2
20	MI21R0179	6.3 l	5.6 hl	24.8 h	46.1 h	41.0 h	7.0 l	1.54	2
21	21PU-0294	3.7 l	1.7 hl	16.8 l	40.4	24.5 hl	8.9 h	-1.09	1
22	21PU-0297	4.5 l	13.5 hl	19.6 l	45.4 h	32.3 hl	10.8 h	-0.21	0
23	21PU-0298	3.7 l	1.7 hl	22.4 hl	54.2 h	32.9 hl	10.2 h	0.01	0
24	21PU-0674	5.5 l	7.7 hl	24.0 h	37.9	30.6 hl	6.3 l	0.81	0
25	21PU-0561	4.8 l	3.5 hl	18.3 l	28.6 l	23.4 l	9.7 h	-1.55	2
26	OH18*104-99	4.7 l	5.2 hl	21.8 hl	26.1 l	24.2 hl	6.3 l	0.01	2
27	OH19*138-14	4.7 l	34.1 hl	16.2 l	31.1 l	28.3 hl	6.8 l	0.01	1
28	OH19-167-5	4.7 l	3.5 hl	16.8 l	20.8 l	16.2 l	5.4 l	-1.74	2
29	OH19-71-5	6.6 l	26.6 hl	21.0 hl	34.8 l	31.7 hl	9.0 h	1.02	0
30	OH19-161-70	6.7 l	13.7 hl	18.0 l	44.2 h	23.7 l	10.3 h	-0.92	0
31	18VTK10-110	4.0 l	5.1 hl	18.9 l	20.1 l	15.1 l	7.9 hl	-2.30	0
32	18VTK12-60	9.7 l	10.3 hl	18.9 l	27.1 l	24.8 hl	5.3 l	0.47	0
33	18VTK15-27	20.3 h	20.6 hl	31.3 h	30.8 l	37.4 hl	5.5 l	4.91	0
34	VA21FHB-8	4.7 l	6.5 hl	21.0 hl	23.6 l	21.8 l	8.0 hl	-1.00	0
35	19VT1FHB_DH-241	9.6 l	22.8 hl	27.2 h	22.3 l	29.2 hl	5.0 l	1.91	2
36	16VT07-5-4-3	4.5 l	3.5 hl	13.3 l	20.2 l	15.7 l	6.4 l	-2.58	2
1001	MEAN	6.5	12.2	20.0	33.5	27.2	7.5		
1002	MAXI	3.6	1.7	11.7	10.3	15.1	3.8		
1003	MINI	20.3	34.1	31.3	69.8	47.9	12.5		
1006	LSD	10.4	43.3	11.6	27.2	23.7	5.0		

Table 11. Summary of incidence (INC, %) from 2022-2023 NUWWSN.

ENTRY	NAME	AVG	ILURB	MIMAS	NELIN	NYITH
1	TRUMAN	29.3 h	0.7	5.0	26.7	66.3
2	FREEDOM	30.2 h	0.7	10.0	44.2	62.5
3	ERNIE	20.3 l	0.3	15.0	36.7	41.3
4	PIONEER2545	31.7 h	2.3	11.0	56.7	61.3
5	X11-0039-1-17-5	38.5 h	1.0	13.3	30.0	83.8
6	X11-0120-12-4-3	30.0 h	0.3	5.0	43.3	63.8
7	X14-1147-158-14-5	30.3 h	3.0	20.0	73.3	51.3
8	X15-1118-27-1-3	37.4 h	1.3	7.5	30.0	82.5
9	X14-1206-52-2-1	29.0 hl	0.3	15.0	30.0	62.5
10	KWS369	42.4 h	0.3	10.0	60.0	86.3
11	KWS407	22.5 hl	2.0	5.7	70.0	38.8
12	KWS450	20.8 l	1.3	6.3	66.7	36.3
13	KWS453	27.8 hl	0.3	5.7	43.3	58.8
14	KWS456	33.2 h	0.0	15.0	43.3	68.8
15	KWS460	40.2 h	1.0	21.7	46.7	81.3
16	IL19-6637	13.0 l	0.0	5.0	46.7	25.0
17	IL19-13414	29.5 hl	0.0	8.3	66.7	56.3
18	IL19-18153	12.9 l	0.3	6.7	23.3	30.0
19	IL19-20348	20.0 l	0.3	6.7	46.7	40.0
20	IL19-27565	22.9 hl	3.0	18.3	43.3	42.5
21	MI21R0250	41.7 h	1.0	26.7	70.0	77.5
22	MI21R0089	27.5 hl	2.3	6.7	53.3	53.8
23	MI21R0195	28.5 hl	3.7	13.3	26.7	60.0
24	MI21R0202	27.0 hl	1.0	29.3	30.0	53.8
25	21PU-0033	24.7 hl	1.3	8.3	24.4	55.0
26	21PU-0163	29.0 hl	0.3	5.0	49.4	60.0
27	21PU-0185	39.2 h	0.3	6.7	34.4	86.3
28	21PU-0673	27.7 hl	1.0	16.7	34.4	57.5
29	21PU-0532	43.1 h	3.3	38.3	74.4	75.0
30	FHB_MS_HS-47-2-1-5-1	18.1 l	0.0	3.5	9.4	46.3
31	NY99056-161-O	34.3 h	0.0	4.0	19.4	80.0
32	NY12302-2-14-08-1442	28.9 hl	0.0	10.0	24.4	65.0
33	FHB_MS_HS-24-1-2-3-3	26.6 hl	0.0	5.0	24.4	61.3
34	NY12007-2-4-13-1381	34.6 h	0.7	10.0	34.4	75.0
35	OH18-46-89	32.5 h	1.0	20.0	44.4	65.0
36	OH18-65-54	10.3 l	1.0	5.0	14.4	26.3
37	OH18*105-13	8.9 l	0.0	5.0	39.4	17.5
38	OH18-78-33	25.8 hl	0.3	21.7	14.4	57.5
39	OH18-65-13	26.6 hl	0.7	12.3	29.4	57.5
40	VA20W-142	23.2 hl	0.7	26.7	60.0	38.8
41	17VTK4-29	34.9 h	3.3	30.0	43.3	66.3
42	VA20FHB-20	34.0 h	0.3	25.0	20.0	73.8
43	VA21W-59	37.9 h	2.0	33.3	51.2	71.3
44	VA19FHB-36	26.1 hl	0.3	20.0	23.3	56.3
45	NI1740	19.3 l	1.0	20.0	40.0	36.3
46	NW15443	30.3 h	0.3	5.0	26.7	68.8
47	NE18455	19.8 l	1.7	15.8	26.7	41.3
48	NE20670	21.6 l	0.3	15.0	23.3	47.5
49	NE21470	21.4 l	1.3	5.0	43.3	43.8
50	NE21470E	24.4 hl	1.3		50.0	47.5
100	MEAN	27.8	1.0	13.4	39.7	57.2
101	MIN	8.9	0.0	3.5	9.4	10.0
102	MAX	43.1	10.0	38.3	74.4	100.0
999	LSD(0.05)	20.9	.	.	.	.

Table 12. Summary of severity (SEV, %) data from the 2022-2023 NUWWSN.

ENTRY	NAME	AVG	ILURB	MIMAS	NELIN	NYITH
1	TRUMAN	14.9 l	16.7	18.3	7.0	14.0
2	FREEDOM	15.6 hl	13.3	25.0	9.7	15.8
3	ERNIE	11.4 l	2.3	41.7	17.3	8.5
4	PIONEER2545	15.9 hl	14.0	25.0	10.0	16.0
5	X11-0039-1-17-5	15.2 l	9.3	26.7	7.0	18.3
6	X11-0120-12-4-3	11.4 l	11.0	13.3	7.7	11.5
7	X14-1147-158-14-5	10.4 l	7.0	13.3	16.7	10.0
8	X15-1118-27-1-3	9.4 l	4.7	5.0	3.0	15.0
9	X14-1206-52-2-1	9.7 l	2.3	23.3	4.3	12.5
10	KWS369	18.0 hl	16.7	8.3	13.0	22.0
11	KWS407	18.5 hl	35.3	8.3	15.3	8.5
12	KWS450	8.1 l	7.0	5.0	12.0	8.0
13	KWS453	5.8 l	2.3	5.0	6.3	7.8
14	KWS456	9.0 l	0.0	6.7	8.0	16.0
15	KWS460	13.3 l	4.7	25.0	9.0	17.3
16	IL19-6637	4.8 l	0.0	5.0	5.7	7.5
17	IL19-13414	8.9 l	0.0	11.7	17.7	12.0
18	IL19-18153	5.6 l	2.3	5.0	4.3	8.0
19	IL19-20348	8.0 l	2.3	6.7	19.7	9.0
20	IL19-27565	9.4 l	7.0	18.3	10.0	8.3
21	MI21R0250	18.4 hl	18.0	25.0	13.3	17.8
22	MI21R0089	12.0 l	15.7	10.0	10.7	9.5
23	MI21R0195	12.6 l	9.3	21.7	4.7	14.3
24	MI21R0202	15.2 l	23.7	21.7	3.7	9.5
25	21PU-0033	15.7 hl	26.7	10.0	3.0	11.5
26	21PU-0163	7.4 l	2.3	5.0	9.0	10.8
27	21PU-0185	10.0 l	0.0	8.3	4.5	18.8
28	21PU-0673	13.8 l	15.7	20.0	5.0	12.5
29	21PU-0532	19.9 hl	14.0	43.3	15.5	19.0
30	FHB_MS_HS-47-2-1-5-1	5.7 l	0.0	5.0	1.0	10.8
31	NY99056-161-O	8.5 l	0.0	5.0	3.0	16.5
32	NY12302-2-14-08-1442	7.3 l	0.0	8.3	2.5	13.0
33	FHB_MS_HS-24-1-2-3-3	10.6 l	0.0	10.0	5.5	19.3
34	NY12007-2-4-13-1381	10.6 l	2.3	16.7	11.0	14.5
35	OH18-46-89	13.6 l	13.3	13.3	15.0	13.0
36	OH18-65-54	5.9 l	2.3	5.0	6.0	8.3
37	OH18*105-13	3.9 l	0.0	5.0	4.0	6.0
38	OH18-78-33	9.0 l	0.0	31.7	2.5	11.0
39	OH18-65-13	8.8 l	4.7	10.0	4.0	12.3
40	VA20W-142	13.4 l	9.3	33.3	13.3	10.8
41	17VTK4-29	14.4 l	11.7	30.0	14.3	12.0
42	VA20FHB-20	9.7 l	2.3	16.7	3.0	14.5
43	VA21W-59	22.8 h	31.3	38.3	2.7	17.0
44	VA19FHB-36	10.5 l	2.3	33.3	5.0	11.8
45	NI1740	12.3 l	14.0	28.3	7.0	7.8
46	NW15443	12.8 l	16.7	6.7	2.7	13.3
47	NE18455	32.1 h	70.3	22.5	2.7	12.5
48	NE20670	9.1 l	2.3	21.7	6.0	11.3
49	NE21470	17.3 hl	26.0	5.0	17.3	13.3
50	NE21470E	14.4 l	7.0		50.0	9.3
100	MEAN	12.0	10.0	16.5	9.0	12.5
101	MIN	3.9	0.0	5.0	1.0	6.0
102	MAX	32.1	100.0	43.3	50.0	35.0
999	LSD(0.05)	16.6	.	.	.	.

Table 13. Summary of index (IND, %) data from the 2022-2023 NUWWSN.

ENTRY	NAME	AVG		ILURB	KYLEX	MIMAS	NELIN	NYITH	VAWAR
1	TRUMAN	11.2	l	0.3	20.0	0.9	17.3	9.4	10.0
2	FREEDOM	14.9	l	0.1	25.0	2.5	21.2	10.4	25.0
3	ERNIE	19.1	h	0.0	25.0	6.3	66.0	3.6	40.0
4	PIONEER2545	17.2	h	0.5	25.0	2.8	16.7	10.9	40.0
5	X11-0039-1-17-5	17.5	h	0.1	40.0	3.6	18.0	15.2	25.0
6	X11-0120-12-4-3	12.5	l	0.1	25.0	0.7	17.0	7.4	20.0
7	X14-1147-158-14-5	21.7	h	0.2	65.0	2.7	24.7	5.1	55.0
8	X15-1118-27-1-3	15.4	l	0.1	25.0	0.4	10.0	12.9	30.0
9	X14-1206-52-2-1	14.2	l	0.0	25.0	3.5	14.0	7.7	30.0
10	KWS369	17.7	h	0.2	25.0	0.8	22.3	19.1	25.0
11	KWS407	11.6	l	0.5	25.0	0.5	20.7	3.4	20.0
12	KWS450	10.9	l	0.1	25.0	0.3	16.7	2.9	20.0
13	KWS453	12.1	l	0.0	35.0	0.3	13.0	4.7	20.0
14	KWS456	16.8	h	0.0	35.0	1.0	15.7	13.1	30.0
15	KWS460	19.8	h	0.1	55.0	5.4	21.7	14.3	30.0
16	IL19-6637	12.0	l	0.0	25.0	0.3	13.7	1.9	30.0
17	IL19-13414	15.1	l	0.0	35.0	1.0	28.7	7.3	25.0
18	IL19-18153	11.1	l	0.0	30.0	0.3	16.0	2.4	20.0
19	IL19-20348	13.0	l	0.0	20.0	0.4	32.7	3.7	25.0
20	IL19-27565	14.2	l	0.6	25.0	3.4	28.0	3.6	30.0
21	MI21R0250	22.5	h	0.3	50.0	6.7	18.7	14.1	50.0
22	MI21R0089	16.2	hl	0.3	35.0	0.7	19.3	5.3	40.0
23	MI21R0195	17.4	h	0.3	35.0	2.9	17.7	8.8	40.0
24	MI21R0202	16.0	hl	0.3	35.0	6.4	11.3	5.3	40.0
25	21PU-0033	12.8	l	0.3	25.0	0.8	11.9	6.8	25.0
26	21PU-0163	12.7	l	0.0	20.0	0.3	18.4	6.6	25.0
27	21PU-0185	18.2	h	0.0	20.0	0.6	13.9	16.5	40.0
28	21PU-0673	18.6	h	0.2	35.0	3.3	15.4	7.9	50.0
29	21PU-0532	20.2	h	0.7	40.0	16.6	20.4	14.1	35.0
30	FHB_MS_HS-47-2-1-5-1	8.2	l	0.0	15.0	0.2	5.4	5.0	10.0
31	NY99056-161-O	11.9	l	0.0	15.0	0.2	16.9	13.2	10.0
32	NY12302-2-14-08-1442	11.1	l	0.0	30.0	0.8	10.4	8.6	10.0
33	FHB_MS_HS-24-1-2-3-3	11.5	l	0.0	10.0	0.5	21.9	12.0	10.0
34	NY12007-2-4-13-1381	14.7	l	0.0	25.0	1.7	26.9	11.3	20.0
35	OH18-46-89	15.1	l	0.2	30.0	2.7	25.4	8.8	25.0
36	OH18-65-54	13.3	l	0.0	30.0	0.3	32.9	2.3	25.0
37	OH18*105-13	12.3	l	0.0	25.0	0.3	10.4	1.1	35.0
38	OH18-78-33	16.2	hl	0.0	30.0	6.9	15.4	6.2	40.0
39	OH18-65-13	15.0	l	0.0	30.0	1.2	12.4	7.3	35.0
40	VA20W-142	15.0	l	0.1	35.0	8.9	21.3	4.1	30.0
41	17VTK4-29	20.7	h	0.5	40.0	9.0	38.0	8.1	45.0
42	VA20FHB-20	16.4	h	0.0	25.0	4.2	17.7	10.7	35.0
43	VA21W-59	23.8	h	0.5	55.0	12.8	11.0	11.8	60.0
44	VA19FHB-36	14.8	l	0.0	35.0	6.7	12.0	6.5	30.0
45	NI1740	15.8	hl	0.2	25.0	5.7	29.3	2.9	40.0
46	NW15443	13.4	l	0.2	25.0	0.3	10.0	9.3	25.0
47	NE18455	16.7	h	1.1	45.0	3.6	11.0	5.0	40.0
48	NE20670	11.8	l	0.0	25.0	3.3	13.7	5.5	20.0
49	NE21470	15.6	l	0.3	30.0	0.3	34.7	5.9	30.0
50	NE21470E	16.5	h	0.1	25.0		62.0	4.8	25.0
100	MEAN	15.3		0.2	30.2	2.9	20.4	7.9	29.9
101	MIN	8.2		0.0	10.0	0.2	5.4	0.6	10.0
102	MAX	23.8		1.9	65.0	16.6	66.0	29.8	70.0
999	LSD(0.05)	8.1		.	.	.	.	.	.

Table 14. Summary of Fusarium Damaged Kernel (FDK, %) data from the 2022-2023 NUWWSN.

ENTRY	NAME	AVG		ILURB	NYITH	OHWO	VAWAR
1	TRUMAN	27.2	l	28.3	30.0	41.7	10.0
2	FREEDOM	32.2		45.0	27.5	40.0	15.0
3	ERNIE	22.5	l	33.3	42.5	9.3	15.0
4	PIONEER2545	61.7	h	70.0	60.0	78.3	35.0
5	X11-0039-1-17-5	33.7		48.3	35.0	40.0	10.0
6	X11-0120-12-4-3	38.2		45.0	47.5	46.7	15.0
7	X14-1147-158-14-5	39.7		66.7	30.0	41.7	15.0
8	X15-1118-27-1-3	26.2	l	31.7	20.0	41.7	10.0
9	X14-1206-52-2-1	29.7	l	55.0	30.0	25.0	7.5
10	KWS369	32.2		50.0	35.0	30.0	15.0
11	KWS407	32.7		40.0	32.5	48.3	7.5
12	KWS450	19.6	l	38.3	22.5	16.7	2.0
13	KWS453	17.9	l	30.0	30.0	13.3	3.5
14	KWS456	28.2	l	41.7	27.5	33.3	10.0
15	KWS460	27.2	l	50.0	32.5	20.0	7.5
16	IL19-6637	12.2	l	18.3	15.0	13.3	7.5
17	IL19-13414	20.2	l	38.3	32.5	10.0	5.0
18	IL19-18153	13.0	l	21.7	22.5	9.3	5.0
19	IL19-20348	21.8	l	50.0	27.5	7.0	5.0
20	IL19-27565	16.0	l	31.7	22.5	10.0	4.0
21	MI21R0250	48.2	h	65.0	42.5	56.7	25.0
22	MI21R0089	32.7		41.7	45.0	36.7	10.0
23	MI21R0195	56.7	h	71.7	65.0	58.3	32.5
24	MI21R0202	41.2		56.7	50.0	46.7	10.0
25	21PU-0033	29.2	l	41.7	22.5	41.7	7.5
26	21PU-0163	35.2		65.0	22.5	40.0	5.0
27	21PU-0185	35.2		58.3	27.5	38.3	12.5
28	21PU-0673	42.2		58.3	32.5	53.3	20.0
29	21PU-0532	31.2		53.3	47.5	18.3	10.0
30	FHB_MS_HS-47-2-1-5-1	11.2	l	30.0	15.0	1.7	2.5
31	NY99056-161-O	33.2		38.3	30.0	46.7	17.5
32	NY12302-2-14-08-1442	54.2	h	76.7	32.5	78.3	15.0
33	FHB_MS_HS-24-1-2-3-3	22.7	l	18.3	25.0	33.3	20.0
34	NY12007-2-4-13-1381	31.7		40.0	32.5	38.3	17.5
35	OH18-46-89	26.2	l	41.7	22.5	30.0	10.0
36	OH18-65-54	14.5	l	26.7	20.0	11.0	5.0
37	OH18*105-13	18.7	l	36.7	17.5	18.3	2.5
38	OH18-78-33	32.7		41.7	35.0	43.3	10.0
39	OH18-65-13	39.2		45.0	47.5	56.7	5.0
40	VA20W-142	36.7		43.3	35.0	56.7	7.5
41	17VTK4-29	25.2	l	46.7	32.5	16.7	7.5
42	VA20FHB-20	30.2	l	40.0	27.5	43.3	7.5
43	VA21W-59	56.2	h	60.0	57.5	70.0	37.5
44	VA19FHB-36	33.2		46.7	27.5	43.3	12.5
45	NI1740	19.2	l	33.3	17.5	20.0	7.5
46	NW15443	34.7		28.3	25.0	50.0	40.0
47	NE18455	37.2		50.0	50.0	35.0	17.5
48	NE20670	40.7		51.7	20.0	63.3	20.0
49	NE21470	39.2		33.3	40.0	66.7	15.0
50	NE21470E	42.7	h	43.3	32.5	65.0	27.5
100	MEAN	31.7		44.3	32.4	37.1	12.8
101	MIN	11.2		5.0	10.0	1.0	2.0
102	MAX	61.7		90.0	80.0	90.0	45.0
999	LSD(0.05)	19.2		.	.	.	.

Table 15. Summary of INC/SEV/FDK (ISK, %) data from the 2022-2023 NUWWSN.

ENTRY	NAME	AVG	ILURB	NYITH	VAWAR
1	TRUMAN	20.5 l	16.5	34.5	10.0
2	FREEDOM	26.4 l	22.2	35.9	21.0
3	ERNIE	24.9 l	14.1	33.5	30.0
4	PIONEER2545	37.5 h	32.9	41.6	38.0
5	X11-0039-1-17-5	28.5	22.4	44.6	19.0
6	X11-0120-12-4-3	26.6 l	21.4	40.6	18.0
7	X14-1147-158-14-5	33.7 h	29.7	32.3	39.0
8	X15-1118-27-1-3	23.1 l	14.5	34.7	22.0
9	X14-1206-52-2-1	27.1 l	22.8	37.2	21.0
10	KWS369	30.5 h	25.1	45.7	21.0
11	KWS407	24.7 l	27.2	28.2	15.0
12	KWS450	17.4 l	17.8	19.1	12.8
13	KWS453	19.3 l	12.8	32.6	13.4
14	KWS456	22.8 l	16.7	30.4	22.0
15	KWS460	28.7	21.7	44.5	21.0
16	IL19-6637	13.6 l	7.3	13.4	21.0
17	IL19-13414	20.1 l	15.3	28.2	17.0
18	IL19-18153	14.2 l	9.5	19.2	14.0
19	IL19-20348	21.0 l	20.8	23.0	17.0
20	IL19-27565	21.2 l	15.7	28.8	19.6
21	MI21R0250	39.5 h	31.7	48.2	40.0
22	MI21R0089	27.8	22.1	33.8	28.0
23	MI21R0195	37.6 h	32.6	43.6	37.0
24	MI21R0202	32.1 h	30.1	37.0	28.0
25	21PU-0033	25.4 l	25.1	30.9	18.0
26	21PU-0163	25.5 l	26.8	29.6	17.0
27	21PU-0185	31.1 h	23.4	42.3	29.0
28	21PU-0673	33.1 h	28.3	33.1	38.0
29	21PU-0532	33.0 h	26.5	48.3	25.0
30	FHB_MS_HS-47-2-1-5-1	13.4 l	12.0	19.7	7.0
31	NY99056-161-O	22.7 l	15.3	41.1	13.0
32	NY12302-2-14-08-1442	27.9	30.7	37.5	12.0
33	FHB_MS_HS-24-1-2-3-3	17.1 l	7.3	32.5	14.0
34	NY12007-2-4-13-1381	24.6 l	16.9	39.6	19.0
35	OH18-46-89	24.0 l	21.0	31.2	19.0
36	OH18-65-54	15.8 l	11.7	18.5	17.0
37	OH18*105-13	17.7 l	14.7	15.6	22.0
38	OH18-78-33	26.2 l	16.8	36.4	28.0
39	OH18-65-13	27.4 l	19.6	41.2	23.0
40	VA20W-142	23.1 l	20.3	26.9	21.0
41	17VTK4-29	29.4	23.2	35.8	30.0
42	VA20FHB-20	25.4 l	16.8	37.4	24.0
43	VA21W-59	44.5 h	34.0	51.5	51.0
44	VA19FHB-36	23.2 l	19.5	26.6	23.0
45	NI1740	22.6 l	17.8	23.1	27.0
46	NW15443	26.4 l	16.4	34.3	31.0
47	NE18455	37.7 h	41.6	36.2	31.0
48	NE20670	23.1 l	21.5	26.3	20.0
49	NE21470	25.1 l	21.5	29.4	24.0
50	NE21470E	24.1 l	19.8	26.2	26.0
100	MEAN	25.8	21.0	33.2	23.1
101	MIN	13.4	2.0	12.3	6.8
102	MAX	44.5	51.6	54.5	58.0
999	LSD(0.05)	14.1	.	.	.

Table 16. Summary of deoxynivalenol (DON, ppm) data from the 2022-2023 NUWWSN.

ENTRY	NAME	AVG	ILURB	KYLEX	NYITH	OHWOO	VAWAR
1	TRUMAN	9.7 l	0.9	6.3	21.6	15.8	4.6
2	FREEDOM	14.0	0.9	5.4	34.4	17.0	11.0
3	ERNIE	9.1 l	0.3	1.8	23.6	6.8	7.6
4	PIONEER2545	18.0	2.4	7.4	36.4	22.2	21.2
5	X11-0039-1-17-5	15.4	1.9	8.9	37.1	19.9	10.0
6	X11-0120-12-4-3	15.3	0.9	4.4	39.6	27.3	7.2
7	X14-1147-158-14-5	11.4 l	2.7	4.7	29.2	12.3	4.8
8	X15-1118-27-1-3	9.7 l	0.6	5.0	19.5	20.8	5.3
9	X14-1206-52-2-1	9.1 l	0.4	1.3	26.4	10.6	3.2
10	KWS369	12.0 l	1.7	5.0	31.4	16.9	4.1
11	KWS407	13.6	1.0	6.0	36.5	18.4	6.0
12	KWS450	9.6 l	1.3	5.8	21.8	17.8	2.6
13	KWS453	10.2 l	0.5	7.5	23.9	15.9	4.8
14	KWS456	12.7	0.7	9.5	33.3	17.0	4.7
15	KWS460	13.2	1.0	6.5	38.1	12.2	5.3
16	IL19-6637	7.7 l	0.8	2.9	15.2	13.0	5.4
17	IL19-13414	9.3 l	0.5	3.5	25.5	10.2	3.8
18	IL19-18153	6.4 l	0.3	0.8	17.0	7.3	2.4
19	IL19-20348	7.6 l	0.3	0.4	24.3	5.4	1.6
20	IL19-27565	11.7 l	0.4	1.3	35.9	13.0	4.0
21	MI21R0250	18.5	3.0	7.6	49.4	20.4	10.5
22	MI21R0089	11.7 l	1.9	3.0	30.3	14.4	5.7
23	MI21R0195	15.6	2.5	5.6	43.4	15.3	7.6
24	MI21R0202	16.8	2.6	5.2	45.3	26.6	5.5
25	21PU-0033	13.9	0.9	3.4	38.4	24.2	4.1
26	21PU-0163	8.6 l	0.6	6.0	17.4	18.0	3.7
27	21PU-0185	14.4	1.0	6.4	40.8	18.9	4.9
28	21PU-0673	16.0	2.2	6.0	42.1	20.4	8.5
29	21PU-0532	12.4	2.1	4.6	32.8	13.1	5.9
30	FHB_MS_HS-47-2-1-5-1	4.5 l	0.3	2.2	9.7	4.3	1.7
31	NY99056-161-O	26.8 h	1.9	23.1	56.5	40.4	24.4
32	NY12302-2-14-08-1442	16.0	1.2	4.0	42.5	32.8	4.3
33	FHB_MS_HS-24-1-2-3-3	14.9	0.7	9.7	31.2	20.1	15.1
34	NY12007-2-4-13-1381	13.0	1.2	2.1	30.3	20.0	10.3
35	OH18-46-89	8.0 l	0.9	6.7	17.6	8.2	4.7
36	OH18-65-54	4.8 l	0.4	3.1	9.8	7.4	1.2
37	OH18*105-13	5.1 l	0.5	6.0	9.5	5.3	2.1
38	OH18-78-33	13.7	0.6	5.3	31.5	18.9	12.3
39	OH18-65-13	16.2	1.6	6.0	42.2	25.3	7.7
40	VA20W-142	13.0	1.3	2.1	32.2	19.5	8.7
41	17VTK4-29	9.5 l	1.0	5.3	22.4	10.9	5.8
42	VA20FHB-20	13.5	0.6	2.5	37.3	18.6	6.9
43	VA21W-59	22.1 h	2.6	5.1	54.2	25.3	21.0
44	VA19FHB-36	15.8	1.5		38.8	29.4	6.1
45	NI1740	9.2 l	0.7		21.8	12.7	6.3
46	NW15443	15.6	1.6		24.0	32.8	18.1
47	NE18455	15.2	1.0		28.3	12.6	23.2
48	NE20670	11.9 l	0.7		22.6	29.3	7.9
49	NE21470	15.6	1.0		30.6	32.8	12.5
50	NE21470E	17.4	1.4		34.6	36.9	13.2
100	MEAN	12.7	1.2	5.2	30.7	18.3	7.8
101	MIN	4.46	0.1	0.40	6.00	4.30	1.10
102	MAX	26.8	6.1	23.1	70.0	40.4	27.8
999	LSD(0.05)	7.6	.	.	.	.	.

Table 17. Summary of heading date (HD, Julian days) data from the 2022-2023 NUWWSN.

ENTRY	NAME	AVG	ILCHA	ILURB	KYLEX	MIMAS	NYITH	VABLA	
1	TRUMAN	139.4	135.5	144.7	130.5	153	149	123.5	
2	FREEDOM	138.9	136	143.3	129.5	154.7	150	120	
3	ERNIE	136.8	134	140.3	126	151.3	146	123	
4	PIONEER2545	138	134.5	141.7	127	152.3	147.8	125	
5	X11-0039-1-17-5	137.2	134	141.3	126.5	152	148	121.5	
6	X11-0120-12-4-3	138.8	135.5	143.3	127.5	154	149	123.5	
7	X14-1147-158-14-5	137.1	134	141.7	125.5	152	147	122.5	
8	X15-1118-27-1-3	139.4	135	142	131.5	152	149	127	
9	X14-1206-52-2-1	135.7	134	139.7	121	152	147	120.5	
10	KWS369	139.6	136.5	145.3	127	154.3	149	125.5	
11	KWS407	138.6	135.5	141.3	131	153.3	148	122.5	
12	KWS450	137	135.5	141.3	127.5	151.7	146	120	
13	KWS453	138.2	135.5	141	128	153.7	148	123	
14	KWS456	137.7	134.5	141	128	152.7	148	122	
15	KWS460	137.6	135	142	124.5	152.3	148	123.5	
16	IL19-6637	136.5	133.5	139	124	152.3	148	122	
17	IL19-13414	136	132	137.3	123.5	151	147	125	
18	IL19-18153	136.2	133	137.3	125.5	150.3	145	126	
19	IL19-20348	134.8	133	135.3	125	150	145	120.5	
20	IL19-27565	135.6	132	138.3	125	151.3	146	121	
21	MI21R0250	136.9	134.5	140.7	122.5	151.3	147	125.5	
22	MI21R0089	135.6	133	138.7	124	150.7	145	122	
23	MI21R0195	136.8	133.5	139	125.5	154.7	147	121	
24	MI21R0202	136.3	134	139	127	152	146	120	
25	21PU-0033	138	135	143	127	153.7	148	121.5	
26	21PU-0163	138.8	136	143	128.5	155.7	151	118.5	
27	21PU-0185	137.6	134.5	140	125.5	154	149	122.5	
28	21PU-0673	136.2	134.5	139.3	125.5	153	148	117	
29	21PU-0532	137	134.5	141	127	152	146	121.5	
30	FHB_MS_HS-47-2-1-5-1-1F17	142.7	h	143.5	148	136.5	156	152	120
31	NY99056-161-O	144.1	h	143.5	149	138.5	158	152	123.5
32	NY12302-2-14-08-1442	143.1	h	143	148	136.5	156.3	152	122.5
33	FHB_MS_HS-24-1-2-3-3-3-5F	143.3	h	144.5	148	136.5	156.3	152	122.5
34	NY12007-2-4-13-1381	139.5		137.5	143.7	131	153.7	150	121
35	OH18-46-89	137.9		134.5	140	130.5	152	149	121.5
36	OH18-65-54	135.4	l	134	139	123	151.7	147	118
37	OH18*105-13	133.9	l	130.5	135.7	122	150.3	144	121
38	OH18-78-33	136.7		134	139.3	129	152	148	118
39	OH18-65-13	137.5		134.5	141.7	125.5	153	147	123.5
40	VA20W-142	138.7		135.5	142	126.5	152.7	147	128.5
41	17VTK4-29	136.8		133	139.3	128	153	147	120.5
42	VA20FHB-20	136.3		133	141	125	152.3	148	118.5
43	VA21W-59	138.2		135	142.7	127.5	152	148	124
44	VA19FHB-36	137.3		134	142	125.5	152	147	123
45	NI1740	134.9	l	133.5	138.7	121	152	147	117.5
46	NW15443	140.1		138	145.7	134	152.3	150	120.5
47	NE18455	136.8		133.5	138	124	152.2	147	126
48	NE20670	138.9		136	144.3	133	152	147	121
49	NE21470	137.4		134.5	139.3	128	154.3	148	120.5
50	NE21470E		l	134	141.3	126		148	
1001	MEAN	137.8		135.2	141.4	127.5	152.7	147.9	122
1002	MIN	144.1		144.5	149	138.5	158	152	128.5
1003	MAX	133.9		130.5	135.3	121	148	144	117
1006	LSD(0.05)	1.9			2.8			0.1	

Table 18. Summary of other traits collected on the 2022-2023 NUWWSN. PM=Powdery Mildew, LR=Leaf Rust.

		VABLA	
		PM (0-9)	LR (0-9)
1	TRUMAN	6.0	6.0
2	FREEDOM	5.0	7.5
3	ERNIE	5.5	7.0
4	PIONEER2545	3.0	7.0
5	X11-0039-1-17-5	4.0	7.5
6	X11-0120-12-4-3	3.5	5.0
7	X14-1147-158-14-5	4.0	8.0
8	X15-1118-27-1-3	4.5	4.5
9	X14-1206-52-2-1	2.0	1.5
10	KWS369	4.0	1.0
11	KWS407	3.0	0.5
12	KWS450	1.5	3.0
13	KWS453	3.0	3.5
14	KWS456	2.5	2.0
15	KWS460	3.5	6.5
16	IL19-6637	4.0	1.0
17	IL19-13414	4.5	5.0
18	IL19-18153	5.5	4.0
19	IL19-20348	5.5	3.0
20	IL19-27565	3.5	4.5
21	MI21R0250	3.0	0.5
22	MI21R0089	3.0	1.0
23	MI21R0195	2.5	2.0
24	MI21R0202	2.5	3.5
25	21PU-0033	2.5	1.0
26	21PU-0163	4.0	6.0
27	21PU-0185	3.0	4.5
28	21PU-0673	3.0	0.0
29	21PU-0532	3.5	5.0
30	FHB_MS_HS-47-2-1-5-1	2.0	4.5
31	NY99056-161-O	2.5	7.5
32	NY12302-2-14-08-1442	2.0	6.5
33	FHB_MS_HS-24-1-2-3-3	4.0	3.5
34	NY12007-2-4-13-1381	3.0	8.0
35	OH18-46-89	3.0	3.0
36	OH18-65-54	4.5	3.5
37	OH18*105-13	5.0	7.5
38	OH18-78-33	2.0	8.5
39	OH18-65-13	2.5	2.0
40	VA20W-142	3.0	1.0
41	17VTK4-29	1.0	1.0
42	VA20FHB-20	2.0	5.0
43	VA21W-59	3.5	0.5
44	VA19FHB-36	3.5	1.0
45	NI1740	6.0	2.5
46	NW15443	2.0	6.5
47	NE18455	5.5	1.0
48	NE20670	4.5	2.5
49	NE21470	4.8	1.0

Table 19. Summary of incidence (INC, %) from 2022-2023 PNUWWSN.

ENTRY	NAME	AVG	ILURB	MIMAS
1	TRUMAN	3.6 l	0.3	3.5
2	FREEDOM	4.5 l	1.0	5.0
3	ERNIE	6.3 l	0.7	13.3
4	PIONEER2545	6.7 l	2.3	10.0
5	X14-1031-103-4-1	7.7 l	3.0	11.7
6	X16-3013-1-12-5	4.0 l	0.3	5.0
7	X15-1091-49-2-3	7.6 l	2.7	12.3
8	X14-1205-147-16-1	7.0 l	3.0	9.0
9	X14-1107-95-18-5	6.6 l	2.7	8.3
10	IL19-6946	4.4 l	0.3	6.7
11	IL19-10123	6.3 l	0.7	13.3
12	IL19-18826	8.3 l	1.7	18.3
13	IL19-18837	9.2 l	3.3	16.7
14	IL19-21848	5.7 l	0.3	11.7
15	MI21R0028	5.6 l	1.3	8.3
16	MI21R0054	10.9 hl	2.3	26.7
17	MI21R0051	5.3 l	1.0	8.3
18	MI21R0058	9.4 l	2.0	21.7
19	MI21R0133	5.9 l	0.7	11.7
20	MI21R0179	6.3 l	0.7	13.3
21	21PU-0294	3.7 l	0.0	5.0
22	21PU-0297	4.5 l	1.0	5.0
23	21PU-0298	3.7 l	0.0	5.0
24	21PU-0674	5.5 l	0.7	10.0
25	21PU-0561	4.8 l	0.3	8.3
26	OH18*104-99	4.7 l	0.7	6.7
27	OH19*138-14	4.7 l	0.7	6.7
28	OH19-167-5	4.7 l	1.7	4.0
29	OH19-71-5	6.6 l	1.0	13.3
30	OH19-161-70	6.7 l	1.7	11.7
31	18VTK10-110	4.0 l	0.3	5.0
32	18VTK12-60	9.7 l	1.3	25.0
33	18VTK15-27	20.3 h	11.0	38.3
34	VA21FHB-8	4.7 l	0.7	6.7
35	19VT1FHB_DH-241	9.6 l	1.7	23.3
36	16VT07-5-4-3	4.5 l	1.0	5.0
100	MEAN	6.5	1.5	11.5
101	MIN	3.6	0.0	3.5
102	MAX	20.3	20.0	38.3
999	LSD(0.05)	10.4	.	.

Table 20. Summary of severity (SEV, %) data from the 2022-2023 PNUWWSN.

ENTRY	NAME	AVG		ILURB	MIMAS
1	TRUMAN	6.0	hl	2.3	15.0
2	FREEDOM	8.2	hl	7.0	10.0
3	ERNIE	13.3	hl	9.3	23.3
4	PIONEER2545	20.7	hl	16.3	31.7
5	X14-1031-103-4-1	21.6	hl	26.0	6.7
6	X16-3013-1-12-5	3.5	hl	2.3	5.0
7	X15-1091-49-2-3	18.6	hl	20.3	11.7
8	X14-1205-147-16-1	13.5	hl	15.7	5.0
9	X14-1107-95-18-5	6.1	hl	4.7	8.3
10	IL19-6946	3.5	hl	2.3	5.0
11	IL19-10123	30.6	hl	32.3	23.3
12	IL19-18826	13.9	hl	15.7	6.7
13	IL19-18837	18.1	hl	16.3	21.7
14	IL19-21848	23.0	hl	26.7	10.0
15	MI21R0028	7.4	hl	7.0	6.7
16	MI21R0054	12.9	hl	9.3	21.7
17	MI21R0051	5.2	hl	4.7	5.0
18	MI21R0058	18.9	hl	15.7	26.7
19	MI21R0133	10.0	hl	9.3	10.0
20	MI21R0179	5.6	hl	4.7	6.7
21	21PU-0294	1.7	hl	0.0	5.0
22	21PU-0297	13.5	hl	15.7	5.0
23	21PU-0298	1.7	hl	0.0	5.0
24	21PU-0674	7.7	hl	4.7	15.0
25	21PU-0561	3.5	hl	2.3	5.0
26	OH18*104-99	5.2	hl	4.7	5.0
27	OH19*138-14	34.1	hl	40.3	13.3
28	OH19-167-5	3.5	hl	2.3	5.0
29	OH19-71-5	26.6	hl	26.0	26.7
30	OH19-161-70	13.7	hl	9.3	25.0
31	18VTK10-110	5.1	hl	2.3	11.7
32	18VTK12-60	10.3	hl	7.0	18.3
33	18VTK15-27	20.6	hl	16.3	31.7
34	VA21FHB-8	6.5	hl	4.7	10.0
35	19VT1FHB_DH-241	22.8	hl	20.3	28.3
36	16VT07-5-4-3	3.5	hl	2.3	5.0
100	MEAN	12.2		11.3	13.2
101	MIN	1.7		0.0	5.0
102	MAX	34.1		100.0	31.7
999	LSD(0.05)	43.3		.	.

Table 21. Summary of index (IND, %) data from the 2022-2023 PNUWWSN.

ENTRY	NAME	AVG		ILURB	KYLEX	MIMAS	VAWAR
1	TRUMAN	11.7	l	0.0	20.0	0.5	20.0
2	FREEDOM	16.1	l	0.1	30.8	0.5	30.0
3	ERNIE	20.7	hl	0.1	40.0	3.1	40.0
4	PIONEER2545	21.6	hl	0.4	35.0	3.2	45.0
5	X14-1031-103-4-1	27.2	h	0.9	55.8	0.8	55.0
6	X16-3013-1-12-5	13.1	l	0.0	30.0	0.3	20.0
7	X15-1091-49-2-3	17.8	l	0.6	40.0	1.4	30.0
8	X14-1205-147-16-1	18.3	l	0.5	45.0	0.5	30.0
9	X14-1107-95-18-5	18.4	l	0.2	45.8	0.7	30.0
10	IL19-6946	21.8	hl	0.0	40.8	0.3	45.0
11	IL19-10123	22.9	hl	0.3	35.0	3.1	50.0
12	IL19-18826	19.2	l	0.2	40.8	1.2	35.0
13	IL19-18837	22.6	hl	0.7	30.8	3.6	50.0
14	IL19-21848	15.6	l	0.3	35.8	1.2	25.0
15	MI21R0028	21.1	hl	0.1	35.0	0.6	45.0
16	MI21R0054	19.2	l	0.4	45.8	5.8	30.0
17	MI21R0051	18.2	l	0.1	35.0	0.4	35.0
18	MI21R0058	17.7	l	0.3	35.8	5.8	30.0
19	MI21R0133	27.6	h	0.1	50.0	1.2	60.0
20	MI21R0179	24.8	h	0.0	30.8	0.9	60.0
21	21PU-0294	16.8	l	0.0	25.8	0.3	35.0
22	21PU-0297	19.6	l	0.2	35.0	0.3	40.0
23	21PU-0298	22.4	hl	0.0	45.0	0.3	45.0
24	21PU-0674	24.0	h	0.0	45.0	1.5	50.0
25	21PU-0561	18.3	l	0.0	35.8	0.4	35.0
26	OH18*104-99	21.8	hl	0.0	40.8	0.3	45.0
27	OH19*138-14	16.2	l	0.4	30.0	0.9	30.0
28	OH19-167-5	16.8	l	0.1	45.8	0.2	25.0
29	OH19-71-5	21.0	hl	0.3	40.8	3.6	40.0
30	OH19-161-70	18.0	l	0.2	50.8	2.9	25.0
31	18VTK10-110	18.9	l	0.0	40.0	0.6	35.0
32	18VTK12-60	18.9	l	0.1	45.8	4.6	30.0
33	18VTK15-27	31.3	h	1.9	70.0	12.1	55.0
34	VA21FHB-8	21.0	hl	0.0	45.0	0.7	40.0
35	19VT1FHB_DH-241	27.2	h	0.4	50.8	6.6	55.0
36	16VT07-5-4-3	13.3	l	0.1	30.8	0.3	20.0
100	MEAN	20.0		0.2	39.9	2.0	38.1
101	MIN	11.7		0.0	20.0	0.2	0.0
102	MAX	31.3		4.2	70.0	12.1	70.0
999	LSD(0.05)	11.6		.	.	.	.

Table 22. Summary of Fusarium Damaged Kernel (FDK, %) data from the 2022-2023 PNUWWSN.

ENTRY	NAME	AVG	ILURB	OHWOO	VAWAR
1	TRUMAN	29.8 l	28.3	35.0	27.5
2	FREEDOM	41.0	40.0	53.3	20.0
3	ERNIE	26.1 l	33.3	16.7	32.5
4	PIONEER2545	54.8 h	61.7	51.7	52.5
5	X14-1031-103-4-1	50.4 h	58.3	36.7	62.5
6	X16-3013-1-12-5	36.7 l	31.7	60.0	12.5
7	X15-1091-49-2-3	31.7 l	43.3	28.3	22.5
8	X14-1205-147-16-1	21.4 l	41.7	11.0	10.0
9	X14-1107-95-18-5	42.9 h	50.0	38.3	42.5
10	IL19-6946	29.2 l	38.3	28.3	20.0
11	IL19-10123	16.2 l	30.0	3.7	17.5
12	IL19-18826	25.4 l	28.3	25.0	25.0
13	IL19-18837	10.3 l	21.7	3.0	7.5
14	IL19-21848	20.6 l	36.7	12.0	12.5
15	MI21R0028	32.3 l	45.0	25.0	27.5
16	MI21R0054	39.2	50.0	31.7	37.5
17	MI21R0051	27.9 l	40.0	21.7	22.5
18	MI21R0058	46.7 h	46.7	48.3	47.5
19	MI21R0133	69.8 h	73.3	61.7	80.0
20	MI21R0179	46.1 h	66.7	23.3	52.5
21	21PU-0294	40.4	46.7	48.3	22.5
22	21PU-0297	45.4 h	53.3	46.7	35.0
23	21PU-0298	54.2 h	56.7	60.0	45.0
24	21PU-0674	37.9	51.7	35.0	25.0
25	21PU-0561	28.6 l	36.7	23.3	27.5
26	OH18*104-99	26.1 l	40.0	25.0	10.0
27	OH19*138-14	31.1 l	40.0	33.3	17.5
28	OH19-167-5	20.8 l	31.7	23.3	4.0
29	OH19-71-5	34.8 l	43.3	28.3	35.0
30	OH19-161-70	44.2 h	46.7	60.0	20.0
31	18VTK10-110	20.1 l	18.3	35.0	3.5
32	18VTK12-60	27.1 l	48.3	12.7	20.0
33	18VTK15-27	30.8 l	61.7	9.3	20.0
34	VA21FHB-8	23.6 l	21.7	23.3	30.0
35	19VT1FHB_DH-241	22.3 l	36.7	16.7	12.5
36	16VT07-5-4-3	20.2 l	35.0	18.3	4.0
100	MEAN	33.5	42.6	30.9	26.9
101	MIN	10.3	15.0	1.0	2.0
102	MAX	69.8	90.0	75.0	90.0
999	LSD(0.05)	27.2	.	.	.

Table 23. Summary of INC/SEV/FDK (ISK, %) data from the 2022-2023 PNUWWSN.

ENTRY	NAME	AVG		ILURB	VAWAR
1	TRUMAN	17.8	l	12.1	23.0
2	FREEDOM	23.5	l	18.4	26.0
3	ERNIE	25.9	hl	16.3	37.0
4	PIONEER2545	38.6	hl	30.3	48.0
5	X14-1031-103-4-1	43.7	h	32.0	58.0
6	X16-3013-1-12-5	16.2	l	13.5	17.0
7	X15-1091-49-2-3	26.6	hl	24.2	27.0
8	X14-1205-147-16-1	23.4	l	22.3	22.0
9	X14-1107-95-18-5	28.6	hl	22.2	35.0
10	IL19-6946	25.0	hl	16.1	35.0
11	IL19-10123	29.2	hl	21.9	37.0
12	IL19-18826	23.6	l	16.5	31.0
13	IL19-18837	23.2	l	14.6	33.0
14	IL19-21848	22.9	l	22.8	20.0
15	MI21R0028	28.8	hl	20.5	38.0
16	MI21R0054	28.6	hl	23.5	33.0
17	MI21R0051	23.9	l	17.7	30.0
18	MI21R0058	30.5	hl	24.0	37.0
19	MI21R0133	47.9	h	32.3	68.0
20	MI21R0179	41.0	h	28.3	57.0
21	21PU-0294	24.5	hl	18.7	30.0
22	21PU-0297	32.3	hl	26.3	38.0
23	21PU-0298	32.9	hl	22.7	45.0
24	21PU-0674	30.6	hl	22.3	40.0
25	21PU-0561	23.4	l	15.5	32.0
26	OH18*104-99	24.2	hl	17.6	31.0
27	OH19*138-14	28.3	hl	28.3	25.0
28	OH19-167-5	16.2	l	13.9	16.6
29	OH19-71-5	31.7	hl	25.4	38.0
30	OH19-161-70	23.7	l	22.0	23.0
31	18VTK10-110	15.1	l	8.1	22.4
32	18VTK12-60	24.8	hl	21.8	26.0
33	18VTK15-27	37.4	hl	32.9	41.0
34	VA21FHB-8	21.8	l	10.3	36.0
35	19VT1FHB_DH-241	29.2	hl	21.3	38.0
36	16VT07-5-4-3	15.7	l	15.0	13.6
100	MEAN	27.2		20.9	33.7
101	MIN	15.1		6.0	1.2
102	MAX	47.9		44.3	78.0
999	LSD(0.05)	23.7		.	.

Table 24. Summary of deoxynivalenol (DON, ppm) data from the 2022-2023 PNUWWSN.

ENTRY	NAME	AVG	ILURB	KYLEX	OHWOO	VAWAR
1	TRUMAN	7.4 l	1.3	8.2	17.2	4.7
2	FREEDOM	10.1 h	2.0	13.4	24.2	6.4
3	ERNIE	6.8 l	1.0	4.3	9.8	8.9
4	PIONEER2545	12.5 h	6.2	7.9	16.1	16.1
5	X14-1031-103-4-1	7.9 hl	4.0	3.6	16.5	5.2
6	X16-3013-1-12-5	7.8 hl	2.0	5.7	21.7	4.3
7	X15-1091-49-2-3	8.9 h	4.4	2.7	21.4	6.1
8	X14-1205-147-16-1	4.8 l	2.2	1.0	8.2	2.6
9	X14-1107-95-18-5	9.5 h	4.2	2.1	22.9	8.1
10	IL19-6946	4.5 l	1.0	4.1	7.7	1.8
11	IL19-10123	3.8 l	0.8	2.2	6.8	1.3
12	IL19-18826	5.8 l	2.5	2.1	10.6	3.8
13	IL19-18837	4.9 l	1.2	1.7	9.2	3.3
14	IL19-21848	4.0 l	0.5	2.8	6.0	2.6
15	MI21R0028	7.9 hl	2.2	8.2	18.6	4.6
16	MI21R0054	8.9 h	2.8	5.1	22.1	6.8
17	MI21R0051	5.8 l	1.8	6.7	8.9	3.5
18	MI21R0058	9.1 h	3.2	5.2	24.7	5.7
19	MI21R0133	10.2 h	5.7	3.9	21.6	8.0
20	MI21R0179	7.0 l	2.6	6.8	12.7	4.3
21	21PU-0294	8.9 h	1.8	7.4	26.8	4.9
22	21PU-0297	10.8 h	2.3	11.4	33.3	5.4
23	21PU-0298	10.2 h	1.2	7.8	31.8	7.8
24	21PU-0674	6.3 l	1.7	8.9	11.9	2.5
25	21PU-0561	9.7 h	3.3	15.3	16.4	6.8
26	OH18*104-99	6.3 l	0.5	5.7	14.9	4.4
27	OH19*138-14	6.8 l	0.8	7.6	15.9	4.6
28	OH19-167-5	5.4 l	1.8	3.4	13.7	1.3
29	OH19-71-5	9.0 h	2.1	10.5	21.8	5.9
30	OH19-161-70	10.3 h	3.1	7.4	30.2	6.2
31	18VTK10-110	7.9 hl	2.1	6.1	23.7	3.0
32	18VTK12-60	5.3 l	2.4	7.1	7.0	1.3
33	18VTK15-27	5.5 l	2.8	7.0	6.2	2.1
34	VA21FHB-8	8.0 hl	1.3	7.0	15.6	8.2
35	19VT1FHB_DH-241	5.0 l	1.2	3.3	7.5	3.8
36	16VT07-5-4-3	6.4 l	2.3	8.6	10.0	3.1
100	MEAN	7.5	2.3	6.2	16.5	5.0
101	MIN	3.8	0.2	1.0	6.0	0.9
102	MAX	12.5	8.5	15.3	33.3	20.6
999	LSD(0.05)	5.0	.	.	.	.

Table 25. Summary of heading date (HD, Julian days) data from the 2022-2023 PNUWWN.

ENTRY	NAME	AVG	ILURB	KYLEX	MIMAS	VABLA
1	TRUMAN	138.1 h	137	144.3	130	154.5
2	FREEDOM	137.3 h	137	143.7	130.4	155
3	ERNIE	135.3	135	140.7	125	152.3
4	PIONEER2545	135.7 h	135	142	127.5	152
5	X14-1031-103-4-1	134.9 l	133	142.7	125.4	153.3
6	X16-3013-1-12-5	136.6 h	135	143	127.5	155
7	X15-1091-49-2-3	136.5 h	135	143.7	127	152
8	X14-1205-147-16-1	134.9 l	134	139.3	124.5	152.3
9	X14-1107-95-18-5	135.7 h	136	145.3	125.9	153
10	IL19-6946	133.6 l	134	137.7	124.9	151.7
11	IL19-10123	133 l	132	136	124	150
12	IL19-18826	133.7 l	134	137.7	124.9	152
13	IL19-18837	133.9 l	135	136.7	128.4	152
14	IL19-21848	132.9 l	132	135.3	124.4	150.3
15	MI21R0028	134.4 l	133	140	124.5	152
16	MI21R0054	136.3 h	136	143.3	128.4	154
17	MI21R0051	136.2 h	136	142.7	128.5	153.3
18	MI21R0058	135.2	136	142.7	128.4	153.3
19	MI21R0133	134.7 l	133	138.7	123.5	152
20	MI21R0179	135.3	136	140	125.4	152.3
21	21PU-0294	134.3 l	135	139.3	126.4	154
22	21PU-0297	136.8 h	135	140.3	126	153.7
23	21PU-0298	135.6 h	134	139.3	125.5	154.3
24	21PU-0674	134.3 l	135	138	124	152.7
25	21PU-0561	137.3 h	136	141	127.9	153.3
26	OH18*104-99	132.7 l	132	136.3	122.9	151.7
27	OH19*138-14	135.5	135	140.7	125.5	153
28	OH19-167-5	134.6 l	134	142.3	123.9	153.7
29	OH19-71-5	135 l	135	139	124.9	152.3
30	OH19-161-70	136.7 h	136	143.3	126.9	154
31	18VTK10-110	136.7 h	136	143.7	128.5	154.3
32	18VTK12-60	133.3 l	133	138	122.9	152
33	18VTK15-27	132.8 l	132	136.3	121.5	151
34	VA21FHB-8	135.7 h	134	140.3	126.5	154
35	19VT1FHB_DH-241	135.1 l	135	140	124.9	152
36	16VT07-5-4-3	135.9 h	136	142.3	126.4	154.5
1001	MEAN	135.2	134.6	140.4	125.9	152.9
1002	MAXI	138.1	137	145.3	130.4	155
1003	MINI	132.7	132	135.3	121.5	150
1004	NOBS	5.9	1	2.9	1	1
1005	MSE	4.4	.	2.2	.	.
1006	LSD	2.5	.	2.5	.	.

Table 26. Summary of other traits collected on the 2022-2023 PNUWWSN. PM=Powdery Mildew, LR=Leaf Rust.

		VABLA	
		PM (0-9)	LR (0-9)
1	TRUMAN	4.5	6.0
2	FREEDOM	5.0	7.0
3	ERNIE	5.5	5.0
4	PIONEER2545	4.0	6.5
5	X14-1031-103-4-1	3.5	4.5
6	X16-3013-1-12-5	2.0	1.0
7	X15-1091-49-2-3	2.5	1.0
8	X14-1205-147-16-1	3.0	4.5
9	X14-1107-95-18-5	3.0	4.0
10	IL19-6946	5.5	2.5
11	IL19-10123	4.0	1.0
12	IL19-18826	6.0	6.0
13	IL19-18837	5.5	3.0
14	IL19-21848	4.5	1.0
15	MI21R0028	3.5	7.5
16	MI21R0054	4.0	7.0
17	MI21R0051	3.5	7.0
18	MI21R0058	4.5	6.5
19	MI21R0133	3.5	5.0
20	MI21R0179	2.0	0.5
21	21PU-0294	4.0	3.0
22	21PU-0297	5.0	4.5
23	21PU-0298	3.5	4.0
24	21PU-0674	4.0	1.0
25	21PU-0561	4.5	0.0
26	OH18*104-99	4.0	2.0
27	OH19*138-14	2.5	6.0
28	OH19-167-5	2.5	3.0
29	OH19-71-5	3.5	3.5
30	OH19-161-70	3.5	3.0
31	18VTK10-110	2.0	1.0
32	18VTK12-60	4.5	1.0
33	18VTK15-27	2.0	2.0
34	VA21FHB-8	2.5	1.0
35	19VT1FHB_DH-241	3.0	1.0
36	16VT07-5-4-3	1.0	0.5

Table 27. Number of marker alleles associated with resistance for the entries in the 2022-2023 NUWWSN.

Entry	SampleID	FHB1	5A ERNIE	5A NING 7840	2D Wuhan1 /W14	3B Massey	1B James- town	1A Neuse	4A Neuse	6A Neuse	2B Bess	3B Bess
1	TRUMAN	0	0	0	0	0	2	2	0	0	2	2
2	FREEDOM	0	0	0	0	2	0	2	1	1	0	0
3	ERNIE	0	1	0	0	1	0	2	0	1	0	0
4	PIONEER2545	0	0	0	0	0	0	0	1	0	0	0
5	X11-0039-1-17-5	0	0	0	0	0	1	0	1	0	0	0
6	X11-0120-12-4-3	0	2	0	ND	0	0	0	0	2	0	0
7	X14-1147-158-14-5	2	0	0	ND	0	0	0	0	0	2	0
8	X15-1118-27-1-3	2	0	0	0	0	2	0	0	0	0	0
9	X14-1206-52-2-1	0	0	0	0	0	2	0	0	0	0	0
10	KWS369	0	0	0	0	1	ND	0	0	0	0	0
11	KWS407	0	0	0	0	2	2	0	2	0	0	0
12	KWS450	0	0	0	0	0	0	2	2	0	0	0
13	KWS453	0	0	0	0	0	0	2	2	2	0	0
14	KWS456	2	0	0	ND	0	2	0	0	0	0	0
15	KWS460	0	0	0	0	0	0	0	0	0	0	0
16	IL19-6637	0	0	0	0	0	0	2	0	2	2	2
17	IL19-13414	0	0	0	0	0	2	2	0	2	2	2
18	IL19-18153	1	0	0	0	0	2	2	0	2	0	2
19	IL19-20348	2	0	0	0	0	2	2	2	0	0	2
20	IL19-27565	0	0	0	0	0	2	2	0	2	2	0
21	MI21R0250	2	0	0	0	0	0	0	0	1	1	0
22	MI21R0089	0	0	0	0	0	0	0	0	0	0	0
23	MI21R0195	0	0	0	0	0	0	2	2	0	0	0
24	MI21R0202	0	0	0	0	0	0	2	0	0	0	0
25	21PU-0033	2	0	0	0	0	0	2	0	2	0	0
26	21PU-0163	2	0	0	0	0	0	2	0	0	0	0
27	21PU-0185	0	0	0	0	0	0	1	1	0	0	2
28	21PU-0673	0	1	0	ND	0	0	1	2	2	1	0
29	21PU-0532	0	1	0	0	1	0	2	2	0	0	0
30	FHB_MS_HS-47-2-1-5-1-1F17	2	0	0	0	0	0	2	0	2	0	0
31	NY99056-161-O	0	2	0	0	0	0	1	2	0	0	0
32	NY12302-2-14-08-1442	2	0	0	0	0	0	0	0	0	0	0
33	FHB_MS_HS-24-1-2-3-3-3-5F18	0	0	0	0	0	0	0	1	0	0	0
34	NY12007-2-4-13-1381	2	0	0	0	0	0	2	0	0	0	0
35	OH18-46-89	0	0	0	0	0	2	1	0	0	0	0
36	OH18-65-54	2	1	0	0	2	0	2	2	0	0	0
37	OH18*105-13	2	0	0	ND	0	0	2	0	0	0	0
38	OH18-78-33	2	0	0	0	0	0	0	0	0	0	0
39	OH18-65-13	0	0	0	0	2	0	0	2	0	0	0
40	VA20W-142	0	0	0	0	0	2	0	0	0	0	0
41	17VTK4-29	2	0	0	0	0	0	0	2	0	0	0
42	VA20FHB-20	0	0	0	0	0	2	0	0	0	0	0
43	VA21W-59	0	0	0	0	0	0	0	0	1	0	0
44	VA19FHB-36	0	0	0	0	0	0	2	0	0	0	0
45	NI1740	0	2	0	0	0	0	2	2	2	1	0
46	NW15443	0	0	0	0	0	0	2	0	0	0	0
47	NE18455	0	0	0	2	0	0	2	2	0	1	0
48	NE20670	0	0	0	0	0	0	0	2	0	0	0
49	NE21470	0	0	0	0	0	0	2	0	0	0	0
50	NE21470E	0	0	0	0	0	0	2	0	0	0	0
	Freq of R Allele (no checks)	0.32	0.10	0.00	0.02	0.09	0.26	0.52	0.34	0.24	0.13	0.11

Table 28. Number of marker alleles associated with resistance for the entries in the 2022-2023 PNUWWSN.

Entry	SampleID	FHB1	5A ERNIE	5A NING 7840	2D Wuhan1 /W14	3B Massey	1B James-town	1A Neuse	4A Neuse	6A Neuse	2B Bess	3B Bess
1	TRUMAN	0	0	0	0	0	1	2	1	0	1	2
2	FREEDOM	0	0	0	0	2	0	2	0	0	0	0
3	ERNIE	0	1	0	0	2	0	2	0	2	0	0
4	PIONEER2545	0	0	0	0	0	0	1	1	0	0	0
5	X14-1031-103-4-1	2	0	0	0	0	1	0	2	0	2	0
6	X16-3013-1-12-5	2	0	0	0	0	0	0	0	0	0	0
7	X15-1091-49-2-3	2	0	0	0	0	2	0	0	0	2	0
8	X14-1205-147-16-1	2	0	0	0	0	1	0	0	0	0	0
9	X14-1107-95-18-5	2	0	0	0	0	2	0	0	0	0	0
10	IL19-6946	2	0	0	0	0	2	2	0	2	2	1
11	IL19-10123	2	0	0	0	0	2	2	2	2	0	2
12	IL19-18826	1	0	0	0	0	2	2	0	0	2	0
13	IL19-18837	0	0	0	0	0	0	2	0	0	0	0
14	IL19-21848	0	0	0	0	0	2	0	0	1	0	0
15	MI21R0028	1	0	0	ND	0	1	0	0	1	0	0
16	MI21R0054	2	0	0	ND	0	0	2	0	0	0	0
17	MI21R0051	2	0	0	0	0	0	0	0	0	0	0
18	MI21R0058	2	0	0	0	0	0	0	0	0	0	0
19	MI21R0133	2	0	0	0	0	0	2	2	0	0	0
20	MI21R0179	2	0	0	0	0	0	0	0	0	0	0
21	21PU-0294	1	0	0	0	0	0	2	1	0	0	0
23	21PU-0298	0	0	0	0	0	0	0	2	0	0	2
22	21PU-0297	0	ND	ND	0	0	0	0	2	0	0	2
24	21PU-0674	0	1	0	0	0	1	1	2	1	1	0
25	21PU-0561	2	2	0	0	0	0	0	2	2	0	0
26	OH18*104-99	2	0	0	0	0	0	2	0	ND	0	0
27	OH19*138-14	1	0	0	0	0	0	2	1	0	0	0
28	OH19-167-5	2	0	0	0	0	0	2	0	0	0	0
29	OH19-71-5	0	0	0	0	0	2	0	0	0	0	0
30	OH19-161-70	0	2	0	0	0	0	0	2	0	0	0
31	18VTK10-110	0	0	0	0	0	2	2	0	2	0	0
32	18VTK12-60	0	0	0	0	2	0	2	2	0	0	0
33	18VTK15-27	0	0	0	0	1	2	2	2	2	0	0
34	VA21FHB-8	0	0	0	0	0	2	2	0	0	0	0
35	19VT1FHB_DH-241	2	0	0	0	2	0	0	2	0	0	0
36	16VT07-5-4-3	2	0	0	0	0	0	0	1	2	0	0
Freq of R Allele (No checks)		0.59	0.08	0.00	0.00	0.08	0.38	0.45	0.39	0.24	0.14	0.11

