Report on the 2020-2021 Northern Uniform Winter Wheat Scab Nurseries (NUWWSN and PNUWWSN)

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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). Most of the entries have only native resistance though some have undergone MAS for *Fhb1* and other QTL.

MATERIAL AND METHODS

The locations that reported data and the traits assessed are listed in Tables 1, 2 and 3. The NUWWSN had 54 entries (50 lines & four checks, Table 4) from 10 programs, and we obtained phenotypic data on seven FHB-related traits from nine locations. The PNUWWSN had 43 entries (39 lines & four checks, Table 5) from 7 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. Data for IND is report in two ways: 0-9 (referred to as "F09" trait) and as a %, referred to as IND. The reported F09 values were multiplied by 10 to provide an IND value.

Genomic estimated breeding values for all entries in the 2021 test were generated by Dr. Brian Ward of The Ohio State University using GBS markers generate by the USDA Eastern Regional Small Grains Genotyping Lab and by Michigan State University. Marker and phenotypic data from the 2014-2020 P+NUWWSN were used to build the genomic selection model (using rrBLUP) and that model was used to estimate the GEBVs for all 2021 entries where DNA was available. Quality data is from grain samples harvested by Virginia Tech University and processed by the USDA Soft Wheat Quality Lab located in Wooster Ohio.

The tables in this report are created from excel files that are available from Clay Sneller (sneller.5@osu.edu).

RESULTS

Disease Pressure (Table 4)

- Average IND > 20% in 4 of 9 NUWWSN tests and in 4 of 7 PNUWWSN tests
- Average DON > 3 ppm in 2 of 5 NUWWSN tests and in 2 of 3 PNUWWSN tests

Trait Correlations and heritability (Tables 7,8)

- The correlation among all FHB traits was lower than in the 2020 tests. In the NUWSN the correlation od DON with other traits was relatively low except for FDK (0.61). The correlation od DON with HD was 0.57. The correlations among the other FHB traits all exceeded 0.32. The correlation of DON with other FHB traits in the PNUWWSN was higher than in the NUWWSN with all values exceeding 0.30: the highest DON correlation was with FDK at 0.60. The correlations among other FHB traits all exceeded 0.35.
- "H" was lower in 2021 that 2020 though all values exceeded 0.51.

Level of Resistance (Tables 9, 13, Figures 1, 2, 3): In general, the entries in the 2021 trials displayed less FHB resistance than the entries in the 2020 trials. There also appears to be little gain in relative resistance from 2013 to 2021 (Figure 1)

- In the NUWWSN, the % of lines with greater resistance than Truman was 6% for IND, 24% DON, and 5% for PC1
- In the NUWWSN, the % of lines with greater resistance than Freedom was 26% for IND, 37% DON, and 37% for PC1
- In the PNUWWSN, the % of lines with greater resistance than Truman was 7% for IND, 47% DON, and 9% for PC1
- In the PNUWWSN, the % of lines with greater resistance than Freedom was 28% for IND, 35% DON, and 3% for PC1
- Based on DON levels, 8 entries in the NUWWSN and 8 in the PNUWWSN had greater DON levels than the susceptible check (Pioneer 2545)

FHB QTL (Tables 33, 34),

- The frequency of the resistant allele at *Fhb1* was 0.42 among the 50 breeding lines (checks excluded) in the NUWWSN and 0.21 among the 39 breeding lines in in the PNUWWSN.
- Across the 11 genotyped FHB-related QTL, 1 NUWWSN and 1 PNUWWSN had 10 "resistant" alleles though neither had resistance at Fhb1. 10 NUWWSN and 8 PNUWWSN entries had at least 8 "R" alleles.

Genomic Predictions (Tables 11, 12, 15, 16)

- Phenotypic and genotypic data from the 2014-2020 P+NUWWSN tests were able to predict the FHB trait values of lines in the 2021 P+NUWWSN tests. The correlation of GEBV with trait means over all environments ranged from 0.37 (SEV, PNUWWSN) to 0.65 (FDK, NUWWSN)
- The correlation among the GEBVs among the 6 FHB traits exceeded 0.71 in the NUWWSN and PNUWWSN. The lowest correlations were DON with IND in the NUWWSN (0.76) and DON with INC in the PNUWWSN (0.72); Interestingly, the correlation of the GEBVs was greatler the correlation among the traits themselves.

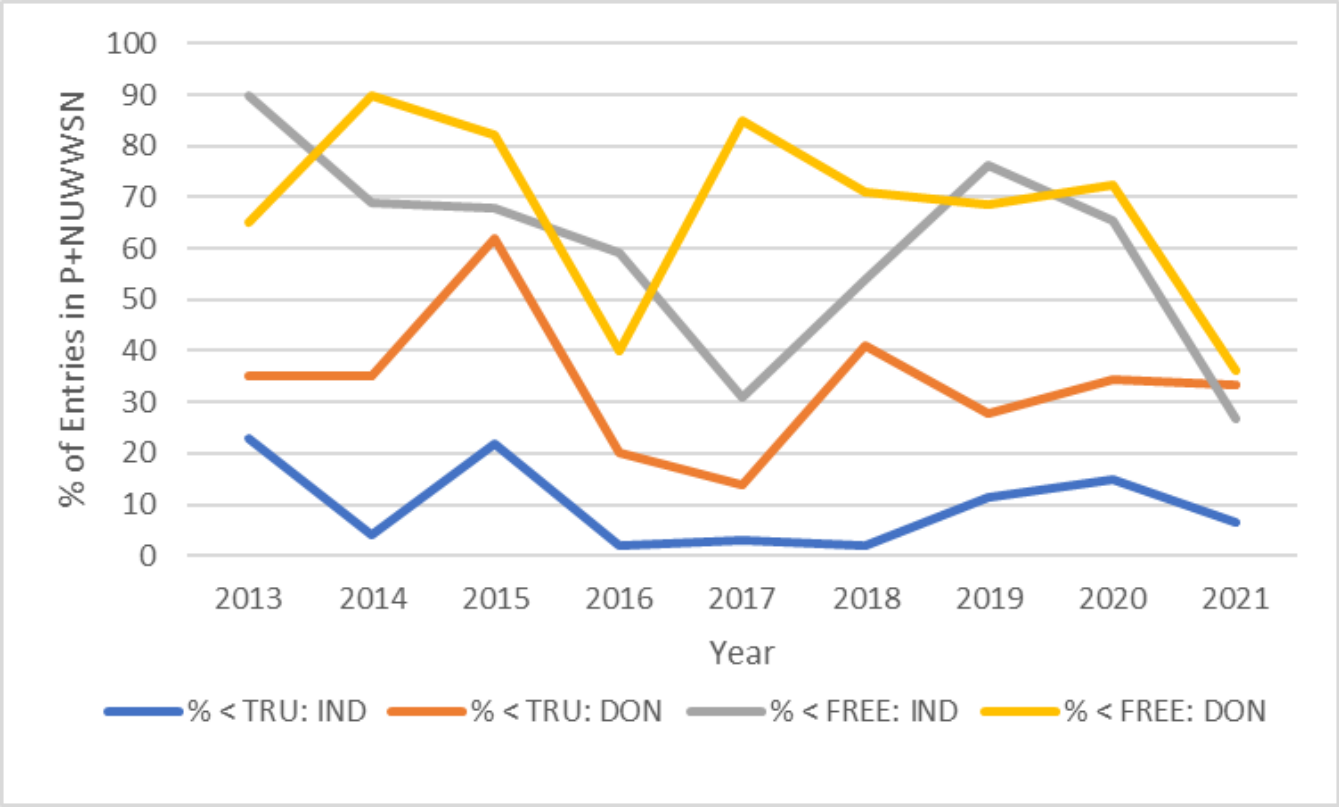

Figure 1. The percentage of P+NUWWSN breeding lines with IND or DON values that are less than that of Truman (TRU, the resistant check) or less than that of Freedom (FREE, the moderately resistant check)

Table 1. Fusarium Head Blight and other traits assessed in 2020-2021 P+NUWWSN

Code	Trait	Description
INC	Disease incidence	% of heads with at least one infected spikelets
SEV	Disease severity from field tests	% of infected spikelets in an infected head.
IND	Disease index	IND = (SEV*INC)/100 orF09*10
F09	FHB Index rated on a 0-9 scale	0= no disease, 9-very severe disease
FDK	Fusarium damaged kernels	Either a visual assessment of the percent infected kernels, or a percent of scabby seed by weight
ISK	Composite of head and kernel traits	ISK Index = 0.3 (Severity) +0 .3 (Incidence)+0.4 (FDK)
DON	DON (vomitoxin)	PPM of vomitoxin in grain
GH	Greenhouse severity	Same as SEV except from greenhouse
HD	Heading Date	Julian date when 50% of spikes have emerged from the boot
HGT	Plant Height	Height in inches from soil to top of spike of a typical plant

Table 2. Cooperators in the 2020-2021 P+NUWWSN

ENV CODE	LOCATION	NUWWSN	PNUWWSN	COOPERATORS	INSTITUTE	CODE
ILCHA	Champaign, IL	Yes	yes	Jana Murche	KWS Cereals	KWS
ILURB	Urbana, IL	yes	yes	Jessica Rutkoski	University of Illinois	UIL
INWLA	W. Lafayette, IN	no	no	Mohsen Mohammadi	Purdue University	PUR
KYLEX	Lexington, KY	yes	yes	David Van Sanford	University of Kentucky	UKY
MIMAS	Mason, MI	yes	yes	Eric Olson, Lee Siler	Michigan State University	MSU
NEMEA	Mead, NE	yes	no	Katherine Frels, S Wegulo	University of Nebraska	UNE
NYITH	Ithaca, NY	yes	no	Mark Sorrells, Gary Bergstrom	Cornell University	COR
OHWOO	Wooster, Ohio	yes	yes	Clay Sneller, Pierce Paul	The Ohio State University	OSU
VAWAR	Warsaw, VA	yes	yes	Nicholas Santantonio	Virginia Tech	VAT

Table 3. Data obtained from each cooperator and location. “Y” means data was collected and used in this report.

TEST	SOURCE	LOCATION	INC	SEV	IND	FDK	ISK	DON	GH	FHB (0-9)	HD	HGT	LDG	YLD	TW	PM	LR	YR	SEP	FR
NUWWSN	COR	NYITH	Y	Y	Y	Y	Y	Y	X	X	Y	Y	X	X	X	X	X	X	X	X
NUWWSN	KWS	ILCHA	X	X	Y	X	X	X	X	X	Y	X	X	X	X	X	Y	Y	X	X
NUWWSN	LIM	INLAF	x	x	x	X	X	X	x	x	x	x	x	x	x	x	x	x	x	X
NUWWSN	MSU	MIMAS	Y	Y	Y	X	X	X	X	X	Y	X	X	X	X	X	X	X	X	X
NUWWSN	OSU	OHWOO	X	X	Y	X	X	X	X	X	Y	X	X	X	X	X	X	X	X	X
NUWWSN	PUR	INWLA	Y	Y	Y	Y	Y	Y	X	X	Y	X	X	X	X	X	X	X	X	X
NUWWSN	UIL	UILURB	Y	Y	Y	Y	Y	Y	X	x	Y	X	X	X	X	X	X	X	X	X
NUWWSN	UKY	KYLEX	X	X	Y	X	X	X	X	Y	Y	Y	X	X	X	X	X	X	X	X
NUWWSN	UNE	NEMEA	Y	Y	Y	Y	Y	Y	X	X	X	X	X	X	X	X	X	X	X	X
NUWWSN	VAT	VAWAR	X	X	Y	Y	Y	Y	X	X	Y	X	X	X	X	X	X	X	X	X
			5	5	9	5	5	5	0	1	8	2	0	0	0	0	1	1	0	0

TEST	SOURCE	LOCATION	INC	SEV	IND	FDK	ISK	DON	GH	FHB (0-9)	HD	HGT	LDG	YLD	TW	PM	LR	YR	SEP	FR
PNUWWSN	KWS	ILCHA	X	X	Y	X	X	X	X	X	Y	Y	X	X	X	X	Y	Y	X	X
PNUWWSN	LIM	INLAF	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
PNUWWSN	MSU	MIMAS	Y	Y	Y	X	X	X	X	X	Y	X	X	X	X	X	X	X	X	X
PNUWWSN	OSU	OHWOO	X	X	Y	X	X	X	X	X	Y	X	X	X	X	X	X	X	X	X
PNUWWSN	PUR	INWLA	Y	Y	Y	Y	Y	Y	X	X	Y	X	X	X	X	X	X	X	X	X
PNUWWSN	UIL	UILURB	Y	Y	Y	Y	Y	Y	X	X	Y	X	X	X	X	X	X	X	X	X
PNUWWSN	UKY	KYLEX	X	X	Y	X	X	X	X	Y	Y	Y	X	X	X	X	X	X	X	X
PNUWWSN	VAT	VAWAR	X	X	Y	Y	Y	Y	X	X	Y	X	X	X	X	X	X	X	X	X
			3	3	7	3	3	3	0	1	7	2	0	0	0	0	1	1	0	0

Table 4. Means for each trait and each location for the 2020-2021 P+NUWWSN.

A. NUWWSN

LOC	INC	SEV	IND	F09	FDK	ISK	DON	HD	HGT	YR
ILCHA	.	.	16.6	.	.	.	.	138.6	38.3	3.7
ILURB	20.7	16.1	4.2	.	18.3	18.4	2.4	137.5	.	.
INWLA	29.3	29.2	9.0	.	16.2	24.0	5.0	138.4	.	.
KYLEX	.	.	31.7	3.2	.	.	.	128.5	36.0	.
MIMAS	92.8	40.0	38.5	.	.	.	.	147.9	.	.
NEMAS	30.1	32.8	11.4	.	1.5	19.4	0.4	.	.	.
NYITH	50.7	15.5	8.5	.	58.7	44.4	13.8	147.4	.	.
OHWOO	.	.	49.4	.	.	.	.	140.5	.	.
VAWAR	.	.	24.6	.	14.6	14.8	0.6	127.4	.	.

B. PNUWWSN

LOC	INC	SEV	IND	F09	FDK	ISK	DON	HD	HGT	YR
ILCHA	.	.	16.8	.	.	.	.	138.1	38.7	3.6
ILURB	28.5	18.2	6.8	.	15.8	20.3	3.3	137.7	.	.
INWLA	30.5	27.1	8.6	.	14.2	31.0	3.0	138.2	.	.
KYLEX	.	.	34.3	3.4	.	.	.	127.5	36.3	.
MIMAS	93.8	38.2	35.9	.	.	.	.	147.2	.	.
OHWOO	.	.	47.5	.	.	.	.	140.1	.	.
VAWAR	.	.	20.2	.	15.8	12.2	0.5	126.7	.	.

Table 5. Entries in the 2020-2021 NUWWSN

ENTRY	NAME	PEDIGREE	Previous name
1	TRUMAN	CHECK	
2	ERNIE	CHECK	
3	FREEDOM	CHECK	
4	PIONEER2545	CHECK	
5	DH15SRW65-53	GA03564-12E6 / L11550 (VA11W-106)	
6	15VDH-FHB-MAS31-30	MD08-26-H2-7-12-9 / USG 3118"S" (VA11W-278) // Hilliard (VA11W-108)	
7	DH15SRW67-151	LCS19229 / Shirley (VA03W-409)	
8	DH16-SRW120-064	L11541 (MDC07026-F2-19-13-4 = SS8641 // McCormick*2/Ning7840) / VA10W-21 _ BSR124 (Z00-5018 / VA01W-158)	
9	VA19W-89	IN03633A1--5 [992059/INW0316// 981358 /97462] / IL06-14262 [IL00-8530/IL97-1828] // VA10W-42 [Jamestown (VA02W-370) / M99*3098 (TX85-264/VA88-52-69)], F7	
10	KWS340	KWS031 / OH08-180-48	
11	KWS341	OH08-180-48 / IL07-19334	
12	KWS356	Hilliard / F1026R	
13	KWS361	GL 20646 / MO110799	
14	KWS365	MO110799 / VA12FHB-4	
15	NY99056-161	NY85020-395/Pio25W33	
16	NYDD1543-06R-1652	VA10W-21//GERMPLASM 11-3-10/SYNGENTA W1104	
17	NY11014-9-25-1319	10061-4 x Ava = 03179-10/Ava-4//Ava	
18	NY12457-1-8-18	94052-6090B x 09095-22 =	
19	NY12298-1-8-17-1430	09067-2-4 x Shirley = Erie/Cal-Res-L/03179-10(FHB1)/Shirley	
20	OH15-131-31	OH07-176-46*2/OH05-164-76	
21	OH16-184-77	OH08-180-48/0762A1-2-8	
22	OH16-167-76	OH08-256-47/OH08-206-69	
23	OH16-168-48	OH08-256-47/OH08-206-69	
24	IL16-23972	00-8641/07-20728//07-4415	
25	IL16-36206	07-4415//07-4415/06-14262	
26	IL16-8605	07-19334/04-10741	
27	IL16-23941	00-8641/07-20728//07-4415	
28	IL16-22039	P05247A1-3-1/07-4415//02-18228	
29	X12-3024-47-4-1	IL06-14262/KY03C-1237-32	
30	X12-156-9-19-3	KY03C-1002-02 // KY03C-1237-39/KY03C-1237-32	
31	X12-3072-55-13-5	MD03W61-10-2/KY03C-1237-07	
32	X12-3062-61-2-3	KY03C-1237-12/MO 080864	
33	X12-3114-65-8-5	KY03C-1237-32/USG 3251	
34	NE16562	HV9W02-942R/CAMELOT	
35	NW13493	NA	
36	NI17410	TX06A001281/NI04420	
37	NE14494	OK06822W/HV9W96-1383W//NW03681	
38	NE17441	Hitch/NE07409	
39	MI19R0194	OH10-187-45 /UX1162-4-36-36	
40	MI20R0009	IL10-21934/VA12FHB-55	
41	MI20R0018	VA08MAS1-188-6-4/AR05094-4-1	
42	MI20M0093	KY09C-0128-72-2-1/MI14R0489	
43	MI20R0146	MI14R0489/F1026R//IL10-21934	
44	LES19-0634	IL0719334/ES13-2398	
45	LES19-7384	DH12SRW056-072/0762A1-2-8	
46	LES19-7798	DH12SRW056-126/IL1136131	
47	LES19-7525	DH12SRW056-126/KY06C-2020-11-12	
48	LES19-0635	IL0719334/ES13-0710	
49	LES19-0911	ES13-2338/DH12SRW058-013	
50	P2102	0345A/0370A	03633A1-69-2
51	P2108	1018A/1094B	10442A1-19-5
52	P2109	BESS/104RA	10523RA1-15-2
53	P2112	1092A/0537A1-3-12-1-6-7	10535A1-15-6
54	P2113	10102RB/0537A1-3-12-1-6-7	10538B1-4-14

Table 6. Entries in the 2020-2021 PNUWWSN

ENTRY	NAME	PEDIGREE	Previous name
1	TRUMAN	CHECK	
2	ERNIE	CHECK	
3	FREEDOM	CHECK	
4	PIONEER2545	CHECK	
5	DH13SRW022-216	Yorktown (VA08W-294) / VA09W-52 (GF921221E16 / McCormick"S" // VA99W-200)	
6	16VDH-SRW03-018	USG 3118"S" (VA12W-54) / Hilliard (VA11W-108)	
7	VA19W-24	GA031134-10E29 [Pion26R38/ 2* 961565 (GA881130*2 /GA88151)] / Hilliard	
8	VA19W-29	GA031134-10E29 [Pion26R38/ 2* 961565 (GA881130*2 /GA88151)] / Hilliard	
9	17VDH-SRW03-143	HILLIARD / TXGA06343-17-3-5-EL2 (011638-G1-G1/ 981592-8-8-1//991336-47-5W-1W)	
10	17VDH-SRW05-170	L11550 (VA11W-106 = PION 25R47 / JAMESTOWN) / VA09MAS6-122-7-1 [SHIRLEY / GA991371-6E13 //SS5205 (VA01W-205)]	
11	KWS338	IL07-19334 / KY03C-1237-39	
12	KWS342	IL07-19334 / LCS19228	
13	KWS347	Pembroke2014 / LCS19228	
14	KWS358	MO110799 / VA11W-182	
15	KWS369	LCS19229 / VA12FHB-8	
16	KWS428	KWS036 / F0014	
17	OH17-124-70	OH08-235-33/P05222A107	
18	OH17-93-33	OH08-172-42/P05251A1-1-136-9-5	
19	OH17-21-11	OH08-207-33/OH08-102-18//OH08-3-35/OH08-206-69	
20	OH17-206-73	MD08-26-H2-7-12-9[SS8641//McCormick*2/Ning7840]/Jamestown(VA02W-370)//	
21	OH17-171-57	GC2F2:119-6/GC2F2:220-28(notfromagenotypedF2)	
22	OH17-94-58	OH08-172-42/x11-MAS-019(=OH03-41-45*3	
23	US16-IL-062-031	12-7918/10-21934	
24	US16-IL-061-029	12-7918/07-4415	
25	IL17-25205	07-4415/02-18228//07-19334/07-16075	
26	IL17-8626	07-4415/07-20728	
27	US16-IL-061-132	12-7918/07-4415	
28	X12-3114-65-7-1	KY03C-1237-32/USG 3251	
29	X12-052-1-18-3	KY03C-1237-32 // KY02C-1002-06/Shirley	
30	X12-3063-34-8-5	KY03C-1237-32/MO 080864	
31	X12-924-40-7-5	Syngenta W1377/VA08W-294 // Pembroke	
32	X12-3024-47-4-5	IL06-14262/KY03C-1237-32	
33	MI20R0177	KY09C-0128-72-2-1/IL11-6543//MI14R0011	
34	MI20R0162	IL10-21934//Branson/U6714-B-041	
35	MI20R0111	MI14R0011/VA15FHB-11	
36	MI20R0148	KY09C-1024-96-1-3/U6714-B-041//IL10-21934	
37	MI20R0107	MI14R0011/Hilliard	
38	MI20R0157	MD09W272-8-4-13-3-15/MI14R0160//IL10-21934	
39	P2101	981419B1-3-4-1/97397B1-4-5///92807A1-1-5-1-1/92145A2-4-6//FREEDOM/3/(///)96204A1-12//GOLDFIELD/92823A1-11-4-4	0175A1-37-4-1
40	P2104	04723A1/981312A1-6-2-2-1///INW0412/03705A1//INW0412/3/981312A1-6-2-2-1	05251A1-1-136-9-9
41	P2106	04689A1/04604A1///7D(E)//INW0412/98134G4-1W///TRUMAN/INW0303	053A1-2-5-3-5-4
42	P2107	03615A1-4-4-1 to 4/08343D1///03615A1-4-4-1/8/02444A1-23-1/6/97395C1-1-4/RSI5//INW0304-1/3/981281A1-4-3-7/4/INW0315/99794RA4-14-1/5/INW0411/3/Chinese Spr ph1b/KS24-2-2(275-4)//Chinese Spr/4/0128A1-36/INW0411/7/02444A1-23-8/3/INW0304/INW0315//981358C1-4-2-13/97462A1-21-1-5-1-15//-03615A1=INW0304-1/INW0315//981358C1-4-2-13/97462A1-21-1-5-1-15	09169A1-2-1
43	P2111	BESS/104RA	10523RA1-21-48

Table 7. Correlation of traits in the 2020-2021 P+NUWWSN. Coefficients of |r| > 0.23 are significant at P<0.05.

A. NUWWSN

	INC	SEV	IND	FHB(0-9)	FDK	ISK	DON	HD	HGT
INC	1.00	0.56	0.71	0.09	0.53	0.82	0.15	-0.11	-0.32
SEV	0.56	1.00	0.63	0.07	0.46	0.76	0.34	0.05	0.02
IND	0.71	0.63	1.00	0.50	0.68	0.87	0.36	0.37	-0.28
FHB(0-9)	0.09	0.07	0.50	1.00	0.49	0.33	0.29	0.38	-0.31
FDK	0.53	0.46	0.68	0.49	1.00	0.84	0.61	0.28	-0.17
ISK	0.82	0.76	0.87	0.33	0.84	1.00	0.42	0.02	-0.24
DON	0.15	0.34	0.36	0.29	0.61	0.42	1.00	0.57	0.14
HD	-0.11	0.05	0.37	0.38	0.28	0.02	0.57	1.00	0.24
HGT	-0.32	0.02	-0.28	-0.31	-0.17	-0.24	0.14	0.24	1.00

B. PNUWWSN

	INC	SEV	IND	FHB(0-9)	FDK	ISK	DON	HD	HGT
INC	1.00	0.65	0.77	0.53	0.78	0.89	0.54	0.24	-0.21
SEV	0.65	1.00	0.85	0.36	0.66	0.82	0.31	0.18	-0.01
IND	0.77	0.85	1.00	0.35	0.77	0.88	0.32	0.11	-0.19
FHB(0-9)	0.53	0.36	0.35	1.00	0.43	0.41	0.56	0.49	0.01
FDK	0.78	0.66	0.77	0.43	1.00	0.92	0.60	0.35	-0.07
ISK	0.89	0.82	0.88	0.41	0.92	1.00	0.52	0.27	-0.11
DON	0.54	0.31	0.32	0.56	0.60	0.52	1.00	0.43	-0.06
HD	0.24	0.18	0.11	0.49	0.35	0.27	0.43	1.00	0.41
HGT	-0.21	-0.01	-0.19	0.01	-0.07	-0.11	-0.06	0.41	1.00

Table 8. Summary of variance components and their ratios from the 2020-2021 P+NUWWSN. Entry mean H was calculated as $V_g/(V_g+(Vgxe/e)+(V_{error}/er))$ where e is the number of environments and r is the average number of reps.

A. NUWWSN

	Venv	Vgen	Vrep(loc)	Vgeno*loc	Verror	Avg # reps	# Locs	H
INC	857	43	19	117	186	2.8	5	0.54
SEV	113	49	4	25	220	2.8	5	0.70
IND	235	21	2.7	55	66	2.4	8	0.67
FDK	454	62	22	79	109	1	5	0.62
ISK	132	35	6	40	63	1	5	0.63
DON	30.4	6.7	0.5	18.5	2.2	1	5	0.62
HD	56.40	4.40	0.10	0.90	0.90	2.00	7	0.96
HGT	2.65	2.55	0.00	0.00	4.46	1.50	2	0.63

B. PNUWWSN

	Venv	Vgen	Vrep(loc)	Vgeno*loc	Verror	Avg # reps	# Locs	H
INC	1341	75	30	81	203	2.3	3	0.57
SEV	72	86	29	0	199	2.3	3	0.75
IND	230	34.1	11.4	24.2	71.6	2.1	6	0.78
FDK	0	47.6	14.3	15.2	118.3	1	3	0.52
ISK	81	64	15	24	99	1	3	0.61
DON	2.29	1.54	0.12	2.01	0.36	1	3	0.66
HD	51.20	3.20	0.14	1.08	0.91	2.10	7	0.94
HGT	2.73	0.28	0.00	1.05	3.85	1.40	2	0.13

Table 9. Summary of all FHB traits from the 2020-2021 NUWWSN: " h" and "l" indicate means that are not significantly different from the highest (h) or lowest (l) mean in that column. Lower PC1 scores indicate more resistance. A principal component analysis was performed using the eight FHB traits. "FHB1" indicates the presence of the resistance allele at QTL *Fhb1*.

		INC	SEV	IND	FDK	ISK	DON	PC1		GEBVS					
ENTRY	NAME	AVG	AVG	AVG	AVG	AVG	AVG		FHB1	INC	SEV	IND	FDK	ISK	DON
1	TRUMAN	30.6 l	21.0 l	12.9 l	10.2 l	11.2 l	2.6 l	-3.16	no	-6.12	-6.42	-6.14	-6.77	-6.66	-1.14
2	ERNIE	54.4	38.4 h	23.4	17.5 l	28.7	3.3 l	1.43	no						
3	FREEDOM	43.1 l	24.0 l	18.0	21.8	22.1	3.1 l	-0.77	no	1.90	1.55	1.47	5.75	3.51	0.88
4	PIONEER2545	57.8 h	41.7 h	32.1 h	36.7 h	38.7 h	6.0	3.91	no	7.00	11.19	10.45	14.79	12.53	5.13
5	DH15SRW65-53	59.5 h	38.3 h	29.3 h	34.7 h	35.5 h	5.4 l	3.40	no						
6	15VDH-FHB-MAS31-30	48.8	23.7 l	17.4 l	14.5 l	20.9 l	3.2 l	-0.99	**Fhb1**	0.26	-1.47	-0.15	-1.31	-4.35	-0.44
7	DH15SRW67-151	37.7 l	27.0 l	20.9	22.1	20.4 l	2.4 l	-0.66	no	1.30	0.75	0.76	0.45	1.25	-0.22
8	DH16-SRW120-064	72.7 h	42.3 h	32.6 h	28.8	37.8 h	4.7 l	4.22	**Fhb1**						
9	VA19W-89	46.7 l	18.1 l	19.9	12.0 l	17.8 l	3.0 l	-1.27	**Fhb1**	2.25	0.85	1.90	1.98	2.45	-0.89
10	KWS340	44.2 l	40.5 h	25.6	22.9	28.1	5.2 l	1.62	no	0.83	1.71	1.57	2.59	3.00	0.10
11	KWS341	50.0	26.0 l	26.2 h	28.0	27.8	4.1 l	0.94	no	-1.45	-0.56	0.01	-1.43	-1.00	-0.90
12	KWS356	51.5	35.1 h	30.2 h	35.4 h	31.6 h	6.4	2.99	no	1.61	-1.06	-0.29	3.42	2.47	0.87
13	KWS361	37.1 l	28.0	25.4	19.5 l	21.1 l	3.8 l	-0.10	no	-1.97	-1.95	-2.61	-2.26	-4.48	-0.47
14	KWS365	44.1 l	20.8 l	22.1	17.3 l	20.6 l	5.2 l	-0.56	no	-1.01	-2.30	-2.87	-2.61	-1.75	-0.26
15	NY99056-161	39.3 l	26.0 l	22.6	32.7 h	22.8	21.0 h	1.37	no	1.75	2.87	2.15	2.31	3.15	3.84
16	NYDD1543-06R-1652	43.9 l	16.0 l	16.0 l	12.2 l	17.6 l	2.5 l	-2.37	**Fhb1**	-2.70	-5.26	-4.89	-1.51	-3.91	-0.79
17	NY11014-9-25-1319	42.4 l	43.4 h	21.7	24.9	28.1	9.5	1.60	**Fhb1**	-2.54	-1.46	-2.21	0.07	-0.09	0.91
18	NY12457-1-8-18	43.1 l	28.4	.	28.4	26.1	13.2	0.62	**Fhb1**	0.21	0.40	0.18	0.19	1.22	2.11
19	NY12298-1-8-17-1430	51.7	23.6 l	24.5	27.3	27.4	3.8 l	0.82	**Fhb1**	4.97	5.38	4.83	7.15	6.15	2.17
20	OH15-131-31	44.0 l	22.9 l	21.1	32.6	28.8	5.1 l	0.64	**Fhb1**	1.68	5.64	5.12	4.85	6.38	0.10
21	OH16-184-77	32.9 l	14.2 l	18.4	17.1 l	18.6 l	1.5 l	-1.86	**Fhb1**	-1.17	-1.24	0.54	1.13	-0.60	-1.66
22	OH16-167-76	59.8 h	32.6 h	31.0 h	28.2	34.1 h	4.2 l	2.85	no	3.09	5.31	3.88	5.62	4.07	-0.29
23	OH16-168-48	59.0 h	31.3 h	27.6 h	27.7	34.1 h	3.8 l	1.66	no						
24	IL16-23972	36.4 l	16.3 l	13.7 l	6.6 l	13.3 l	1.1 l	-3.35	**Fhb1**	-4.46	-9.47	-5.50	-10.66	-11.87	-2.98
25	IL16-36206	35.6 l	16.0 l	10.4 l	10.2 l	14.7 l	0.6 l	-3.40	**Fhb1**	-5.93	-9.58	-6.24	-10.92	-13.14	-3.04
26	IL16-8605	41.3 l	17.7 l	15.8 l	15.6 l	20.7 l	2.4 l	-1.75	no	-4.49	-5.24	-5.00	-7.51	-8.10	-3.03
27	IL16-23941	42.7 l	30.8 h	21.8	11.3 l	22.3	1.4 l	-0.90	no	-4.61	-7.14	-5.45	-5.30	-6.14	-1.75
28	IL16-22039	36.0 l	14.8 l	9.2 l	5.8 l	11.6 l	1.0 l	-3.98	**Fhb1**	-6.85	-9.40	-7.71	-9.64	-10.49	-3.42
29	X12-3024-47-4-1	45.5 l	25.9 l	22.2	35.7 h	28.6	10.2	2.17	**Fhb1_het**	3.65	5.25	3.57	1.27	4.04	0.23
30	X12-156-9-19-3	47.0 l	23.5 l	20.7	27.0	24.8	3.6 l	0.19	**Fhb1_het**						
31	X12-3072-55-13-5	43.5 l	18.4 l	17.6 l	27.8	22.8	8.0	-0.25	no						
32	X12-3062-61-2-3	47.9	27.7	20.8	29.5	28.3	5.8	1.03	no						
33	X12-3114-65-8-5	59.8 h	30.8 h	34.4 h	46.8 h	41.3 h	4.6 l	4.61	no	2.14	0.17	1.54	-0.91	-1.84	-0.12
34	NE16562	52.6	42.3 h	28.0 h	38.2 h	36.5 h	5.0 l	3.18	no	1.58	4.36	3.62	9.60	7.82	1.43
35	NW13493	40.5 l	42.5 h	26.8 h	25.6	27.0	6.4	1.48	no	2.62	5.65	3.22	1.41	2.30	1.74
36	NI17410	38.5 l	33.5 h	26.5 h	16.7 l	25.8	3.3 l	0.54	no	0.68	4.56	2.96	8.96	7.07	2.69
37	NE14494	44.2 l	34.4 h	22.6	40.7 h	31.1 h	6.7	1.89	no	2.46	5.47	4.78	6.68	3.92	2.09
38	NE17441	41.1 l	30.5	19.7	13.1 l	20.3 l	3.2 l	-0.78	no	1.41	6.08	4.41	9.62	8.43	2.88
39	MI19R0194	50.5	32.8 h	.	18.9 l	26.0	1.9 l	-0.40	**Fhb1**	-0.51	-1.24	-1.20	-0.43	-2.48	-1.03
40	MI20R0009	44.3 l	24.8 l	.	10.1 l	20.8 l	2.4 l	-1.79	no	-6.49	-5.56	-5.95	-8.17	-8.60	-1.89
41	MI20R0018	41.8 l	28.7	16.3 l	12.9 l	19.6 l	3.0 l	-1.24	**Fhb1?**	1.51	2.87	2.65	0.82	0.95	-1.59
42	MI20M0093	37.2 l	15.4 l	17.9	19.5 l	18.8 l	3.1 l	-1.30	**Fhb1**	-0.96	-2.33	-2.02	-4.54	-2.81	-1.00
43	MI20R0146	52.3	38.2 h	27.8 h	14.3 l	25.7	3.9 l	0.62	no	-2.67	-4.22	-4.16	-4.49	-4.50	-1.07
44	LES19-0634	41.2 l	21.0 l	.	13.8 l	19.0 l	1.0 l	-2.42	no	-1.57	-1.42	-0.28	-4.18	-3.58	-1.66
45	LES19-7384	35.2 l	14.7 l	14.0 l	14.8 l	18.1 l	2.9 l	-2.46	**Fhb1**	-1.69	-6.85	-4.54	-0.19	-4.58	-1.39
46	LES19-7798	51.0	29.4	19.3	19.9 l	24.1	2.7 l	-0.26	no	-4.84	-5.46	-4.95	-6.07	-6.89	-2.51
47	LES19-7525	39.0 l	20.0 l	15.8 l	8.1 l	12.6 l	1.3 l	-2.76	no	-0.77	-2.18	-2.06	-5.46	-4.95	-1.19
48	LES19-0635	44.8 l	25.5 l	16.0 l	19.4 l	21.9	6	-0.81	no	-0.21	-0.03	-0.39	0.27	0.39	0.63
49	LES19-0911	42.0 l	25.5 l	22.5	23.7	23.6	4.6 l	0.04	**Fhb1**	1.35	0.68	1.38	-0.24	0.64	-1.14
50	P2102	42.7 l	22.3 l	22.5	22.3	24.9	3.9 l	-0.36	**Fhb1**						
51	P2108	37.5 l	18.1 l	11.1 l	14.0 l	15.9 l	2.2 l	-2.96	**Fhb1**	-1.90	-3.63	-2.76	-2.21	-3.29	-1.35
52	P2109	44.70 l	25.10 l	22.7	25.9	24.6	5.6 l	0.31	no	-1.19	-3.12	-2.33	3.02	-1.10	1.12
53	P2112	34.2 l	19.9 l	19.4	18.0 l	17.8 l	4.9 l	-1.44	**Fhb1_het**	-2.70	-7.76	-6.34	-4.93	-6.63	-1.85
54	P2113	47.5 l	21.1 l	25.5	20.3	24.7	2.7 l	0.21	**Fhb1**	-3.36	-5.97	-4.93	-2.88	-5.38	-1.32
1001	MEAN	45.1	26.9	21.6	21.8	24.2	4.4								
1002	MAXI	72.7	43.4	34.4	46.8	41.3	21								
1003	MINI	30.6	14.2	9.2	5.8	11.2	0.6								
1004	NOBS	5	5	9	5	5	5								
1005	MSE	482.9	278.7	194.9	311.4	165.0	27.4								
1006	LSD	16.9	12.8	8.6	12.9	12.9	8.9								

Table 10. Best (top) and worst (bottom) entries in the 2020-2021 NUWWSN. Summary statistics are over all entries.

		INC	SEV	IND	FDK	ISK	DON	PC1		GEBVS					
ENTRY	NAME	AVG	AVG	AVG	AVG	AVG	AVG		FHB1	INC	SEV	IND	FDK	ISK	DON
28	IL16-22039	36.0 l	14.8 l	9.2 l	5.8 l	11.6 l	1.0 l	-3.98	**Fhb1**	-6.85	-9.40	-7.71	-9.64	-10.49	-3.42
25	IL16-36206	35.6 l	16.0 l	10.4 l	10.2 l	14.7 l	0.6 l	-3.40	**Fhb1**	-5.93	-9.58	-6.24	-10.92	-13.14	-3.04
24	IL16-23972	36.4 l	16.3 l	13.7 l	6.6 l	13.3 l	1.1 l	-3.35	**Fhb1**	-4.46	-9.47	-5.50	-10.66	-11.87	-2.98
1	TRUMAN	30.6 l	21.0 l	12.9 l	10.2 l	11.2 l	2.6 l	-3.16	no	-6.12	-6.42	-6.14	-6.77	-6.66	-1.14
51	P2108	37.5 l	18.1 l	11.1 l	14.0 l	15.9 l	2.2 l	-2.96	**Fhb1**	-1.90	-3.63	-2.76	-2.21	-3.29	-1.35
47	LES19-7525	39.0 l	20.0 l	15.8 l	8.1 l	12.6 l	1.3 l	-2.76	no	-0.77	-2.18	-2.06	-5.46	-4.95	-1.19
45	LES19-7384	35.2 l	14.7 l	14.0 l	14.8 l	18.1 l	2.9 l	-2.46	**Fhb1**	-1.69	-6.85	-4.54	-0.19	-4.58	-1.39
44	LES19-0634	41.2 l	21.0 l	.	13.8 l	19.0 l	1.0 l	-2.42	no	-1.57	-1.42	-0.28	-4.18	-3.58	-1.66
16	NYDD1543-06R-1652	43.9 l	16.0 l	16.0 l	12.2 l	17.6 l	2.5 l	-2.37	**Fhb1**	-2.70	-5.26	-4.89	-1.51	-3.91	-0.79
29	X12-3024-47-4-1	45.5 l	25.9 l	22.2	35.7 h	28.6	10.2	2.17	**Fhb1_het**	3.65	5.25	3.57	1.27	4.04	0.23
22	OH16-167-76	59.8 h	32.6 h	31.0 h	28.2	34.1 h	4.2 l	2.85	no	3.09	5.31	3.88	5.62	4.07	-0.29
12	KWS356	51.5	35.1 h	30.2 h	35.4 h	31.6 h	6.4	2.99	no	1.61	-1.06	-0.29	3.42	2.47	0.87
34	NE16562	52.6	42.3 h	28.0 h	38.2 h	36.5 h	5.0 l	3.18	no	1.58	4.36	3.62	9.60	7.82	1.43
5	DH15SRW65-53	59.5 h	38.3 h	29.3 h	34.7 h	35.5 h	5.4 l	3.40	no						
4	PIONEER2545	57.8 h	41.7 h	32.1 h	36.7 h	38.7 h	6.0	3.91	no	7.00	11.19	10.45	14.79	12.53	5.13
8	DH16-SRW120-064	72.7 h	42.3 h	32.6 h	28.8	37.8 h	4.7 l	4.22	**Fhb1**						
33	X12-3114-65-8-5	59.8 h	30.8 h	34.4 h	46.8 h	41.3 h	4.6 l	4.61	no	2.14	0.17	1.54	-0.91	-1.84	-0.12
1001	MEAN	45.1	26.9	21.6	21.8	24.2	4.4								
1002	MAXI	72.7	43.4	34.4	46.8	41.3	21								
1003	MINI	30.6	14.2	9.2	5.8	11.2	0.6								
1004	NOBS	5	5	9	5	5	5								
1005	MSE	482.9	278.7	194.9	311.4	165.0	27.4								
1006	LSD	16.9	12.8	8.6	12.9	12.9	8.9								

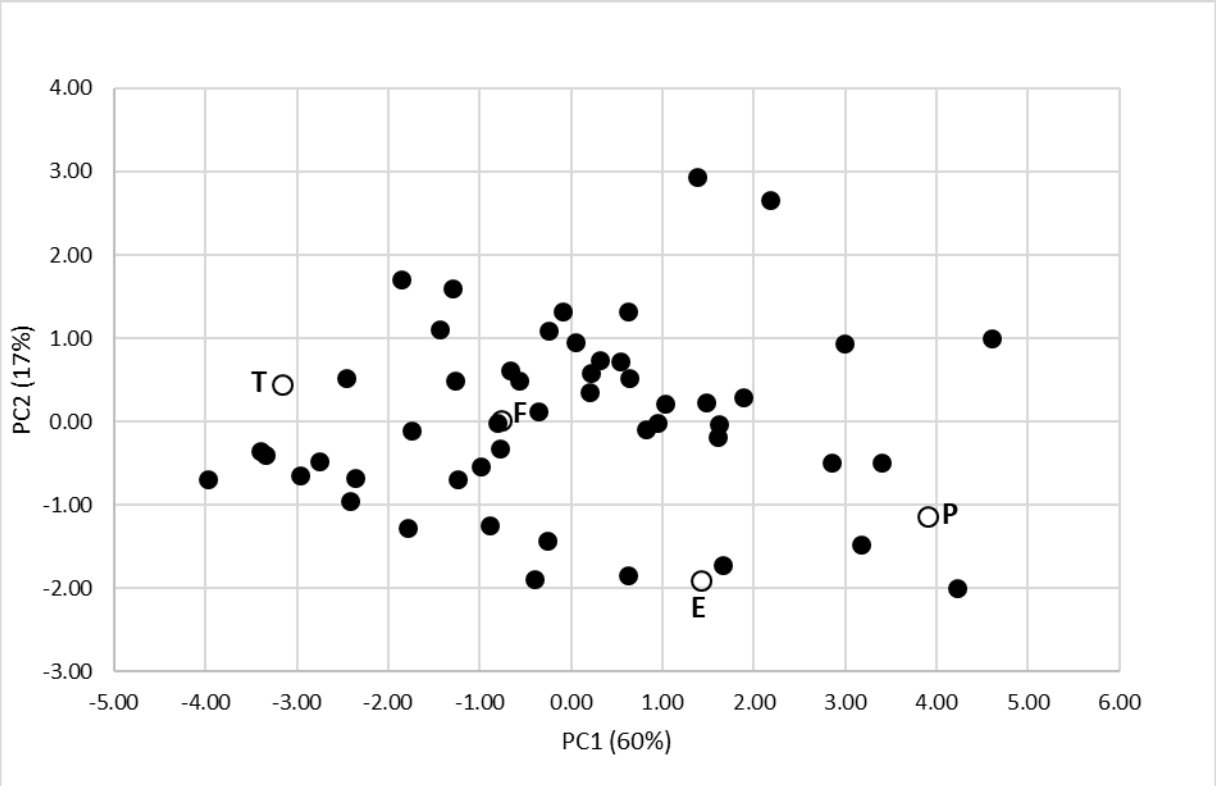

Figure 2. Graph of first two PC from the analysis of the six FHB traits from the 2021 NUWWSN entries (Table 9). Checks are identified: T=Truman (R), F=Freedom (MR), E=Ernie (MR), P=Pioneer 2545 (S).

Table 11. Genomic estimated breeding values (GEBV) of lines in the 2020-2021 NUWWSN. Phenotypic and genotypic data from 2014 through 2019 was used to train the model that was then used to predict the values of the 2021 entries.

ENTRY	NAME	INC	SEV	IND	FDK	ISK	DON
1	TRUMAN	-6.12	-6.42	-6.14	-6.77	-6.66	-1.14
2	ERNIE						
3	FREEDOM	1.90	1.55	1.47	5.75	3.51	0.88
4	PIONEER2545	7.00	11.19	10.45	14.79	12.53	5.13
5	DH15SRW65-53						
6	15VDH-FHB-MAS31-30	0.26	-1.47	-0.15	-1.31	-4.35	-0.44
7	DH15SRW67-151	1.30	0.75	0.76	0.45	1.25	-0.22
8	DH16-SRW120-064						
9	VA19W-89	2.25	0.85	1.90	1.98	2.45	-0.89
10	KWS340	0.83	1.71	1.57	2.59	3.00	0.10
11	KWS341	-1.45	-0.56	0.01	-1.43	-1.00	-0.90
12	KWS356	1.61	-1.06	-0.29	3.42	2.47	0.87
13	KWS361	-1.97	-1.95	-2.61	-2.26	-4.48	-0.47
14	KWS365	-1.01	-2.30	-2.87	-2.61	-1.75	-0.26
15	NY99056-161	1.75	2.87	2.15	2.31	3.15	3.84
16	NYDD1543-06R-1652	-2.70	-5.26	-4.89	-1.51	-3.91	-0.79
17	NY11014-9-25-1319	-2.54	-1.46	-2.21	0.07	-0.09	0.91
18	NY12457-1-8-18	0.21	0.40	0.18	0.19	1.22	2.11
19	NY12298-1-8-17-1430	4.97	5.38	4.83	7.15	6.15	2.17
20	OH15-131-31	1.68	5.64	5.12	4.85	6.38	0.10
21	OH16-184-77	-1.17	-1.24	0.54	1.13	-0.60	-1.66
22	OH16-167-76	3.09	5.31	3.88	5.62	4.07	-0.29
23	OH16-168-48						
24	IL16-23972	-4.46	-9.47	-5.50	-10.66	-11.87	-2.98
25	IL16-36206	-5.93	-9.58	-6.24	-10.92	-13.14	-3.04
26	IL16-8605	-4.49	-5.24	-5.00	-7.51	-8.10	-3.03
27	IL16-23941	-4.61	-7.14	-5.45	-5.30	-6.14	-1.75
28	IL16-22039	-6.85	-9.40	-7.71	-9.64	-10.49	-3.42
29	X12-3024-47-4-1	3.65	5.25	3.57	1.27	4.04	0.23
30	X12-156-9-19-3						
31	X12-3072-55-13-5						
32	X12-3062-61-2-3						
33	X12-3114-65-8-5	2.14	0.17	1.54	-0.91	-1.84	-0.12
34	NE16562	1.58	4.36	3.62	9.60	7.82	1.43
35	NW13493	2.62	5.65	3.22	1.41	2.30	1.74
36	NI17410	0.68	4.56	2.96	8.96	7.07	2.69
37	NE14494	2.46	5.47	4.78	6.68	3.92	2.09
38	NE17441	1.41	6.08	4.41	9.62	8.43	2.88
39	MI19R0194	-0.51	-1.24	-1.20	-0.43	-2.48	-1.03
40	MI20R0009	-6.49	-5.56	-5.95	-8.17	-8.60	-1.89
41	MI20R0018	1.51	2.87	2.65	0.82	0.95	-1.59
42	MI20M0093	-0.96	-2.33	-2.02	-4.54	-2.81	-1.00
43	MI20R0146	-2.67	-4.22	-4.16	-4.49	-4.50	-1.07
44	LES19-0634	-1.57	-1.42	-0.28	-4.18	-3.58	-1.66
45	LES19-7384	-1.69	-6.85	-4.54	-0.19	-4.58	-1.39
46	LES19-7798	-4.84	-5.46	-4.95	-6.07	-6.89	-2.51
47	LES19-7525	-0.77	-2.18	-2.06	-5.46	-4.95	-1.19
48	LES19-0635	-0.21	-0.03	-0.39	0.27	0.39	0.63
49	LES19-0911	1.35	0.68	1.38	-0.24	0.64	-1.14
50	P2102						
51	P2108	-1.90	-3.63	-2.76	-2.21	-3.29	-1.35
52	P2109	-1.19	-3.12	-2.33	3.02	-1.10	1.12
53	P2112	-2.70	-7.76	-6.34	-4.93	-6.63	-1.85
54	P2113	-3.36	-5.97	-4.93	-2.88	-5.38	-1.32

Table 12. Correlation of genomic estimated breeding values (GEBVs) and observed phenotypes of lines in the 2020-2021 NUWWSN. The correlation was obtained using phenotypes from each environment as well as the average over all environments. Phenotypic data from 2014 through 2020 was used to train the model that was then used to predict the values of the 2021 entries.

	Correlation of GEBVs with Trait Phenotype									
	With Trait	By Location								
	Mean	ILCHA	ILURB	INWLA	KYLEX	MIMAS	NEMAS	NYITH	OHWOO	VAWAR
INC	0.484		0.445	0.554		0.096	-0.154	0.428		
SEV	0.572		0.465	0.563		0.423	0.058	0.517		
IND	0.571	0.440	0.516	0.591	0.360	0.392	-0.097	0.511	0.407	0.219
FDK	0.617		0.489	0.400			0.428	0.544		0.506
ISK	0.646		0.604	0.723			-0.005	0.579		0.204
DON	0.630		0.665	0.467			0.318	0.695		0.601

Table 13. Summary of all FHB traits from the 2020-2021 PNUWWSN: “h” and “l” indicate means that are not significantly different from the highest (h) or lowest (l) mean in that column. Lower PC1 scores indicate more resistance. A principal component analysis was performed using the eight FHB traits. “FHB1” indicates the presence of the resistance allele at QTL *Fhb1*.

		INC	SEV	IND	FDK	ISK	DON	PC1		GEBVS					
ENTRY	NAME	AVG	AVG	AVG	AVG	AVG	AVG		FHB1	INC	SEV	IND	FDK	ISK	DON
1	TRUMAN	39.5 l	16.4 l	14.6 l	7.4 l	10.0 l	2.0 l	-2.76	no	-6.12	-6.42	-6.14	-6.77	-6.66	-1.14
2	ERNIE	45.9 l	36.0	25.5	9.6 l	19.5 l	1.3 l	-0.18	no						
3	FREEDOM	40.8 l	23.9	20.1 l	12.7 l	14.1 l	1.8 l	-1.43	no	1.90	1.55	1.47	5.75	3.51	0.88
4	PIONEER2545	59.2 h	38.4	34.1	28.3 h	32.0 h	3.0	2.69	no	7.00	11.19	10.45	14.79	12.53	5.13
5	DH13SRW022-216	58.0 h	32.5	26.1	11.4 l	19.2 l	2.2 l	0.28	no						
6	16VDH-SRW03-018	55.3 l	37.8	29.5	14.2 l	24.1	3.1	0.84	no						
7	VA19W-24	52.5 l	31.8	27.2	22.2 h	26.8	2.3 l	1.02	no						
8	VA19W-29	68.6 h	54.5 h	34.4 h	24.7 h	39.0 h	2.5 l	3.69	no						
9	17VDH-SRW03-143	43.0 l	23.3 l	23.1	20.6	20.9	3.0	-0.37	no						
10	17VDH-SRW05-170	53.0 l	29.2	24.3	11.9 l	19.3 l	2.1 l	-0.02	no						
11	KWS338	54.2 l	29.0	24.5	18.9	23.0	1.4 l	0.39	no	-1.05	-1.67	-0.88	-3.25	-3.77	-1.17
12	KWS342	49.1 l	26.7	25.5	13.2 l	20.9	1.0 l	-0.49	no	-2.02	1.27	0.27	-4.89	-2.65	-1.50
13	KWS347	41.9 l	37.1	22.5	11.8 l	19.4 l	1.0 l	-0.52	**Fhb1**	0.55	1.25	1.25	-0.16	-0.13	0.30
14	KWS358	53.6 l	35.4	30.0	13.3 l	25.6	2.1 l	0.81	no	-1.00	-0.54	-1.45	-3.67	-3.06	0.21
15	KWS369	57.5 h	20.9 l	29.0	13.8 l	20.2	1.8 l	0.19	no	1.51	2.67	2.20	-1.12	1.67	-1.97
16	KWS428	53.7 l	25.4	27.6	21.7	25.6	6.4 h	2.04	no	1.56	4.54	2.98	4.62	4.95	4.85
17	OH17-124-70	40.4 l	26.1	22.4	13.1 l	16.4 l	2.6 l	-1.12	no	-0.70	0.51	0.27	1.59	0.80	-0.26
18	OH17-93-33	62.4 h	34.7	27.3	21.6	27.2	4.4	2.38	no	-0.49	-2.22	-1.81	1.02	-0.21	0.12
19	OH17-21-11	45.4 l	20.2 l	18.5 l	9.3 l	12.3 l	1.6 l	-2.06	no	2.40	2.17	1.15	2.56	2.87	0.23
20	OH17-206-73	51.2 l	28.5	24.4	9.9 l	15.4 l	1.9 l	-0.62	**Fhb1**	0.76	-1.06	-0.86	-1.44	-0.77	-0.47
21	OH17-171-57	47.6 l	28.1	25.2	20.0	25.5	2.0 l	-0.05	no	-0.98	-2.75	-3.05	1.78	-0.14	0.02
22	OH17-94-58	42.1 l	22.5 l	20.2 l	11.1 l	14.2 l	1.9 l	-1.35	no	-0.92	-0.73	-1.23	1.40	-1.36	1.03
23	US16-IL-062-031	49.2 l	19.8 l	20.2 l	7.3 l	14.8 l	0.5 l	-1.54	no	-7.45	-6.95	-7.71	-10.33	-9.85	-2.75
24	US16-IL-061-029	39.7 l	11.3 l	13.9 l	4.0 l	11.8 l	0.5 l	-3.23	**Fhb1**	-6.75	-9.08	-7.24	-8.98	-10.06	-3.12
25	IL17-25205	38.6 l	21.3 l	18.5 l	3.9 l	11.1 l	0.7 l	-2.88	no	-7.57	-8.41	-7.41	-11.96	-12.89	-3.49
26	IL17-8626	42.2 l	16.6 l	13.8 l	4.0 l	10.0 l	0.6 l	-3.00	**Fhb1**	-4.62	-7.77	-4.96	-7.19	-7.34	-2.16
27	US16-IL-061-132	46.4 l	17.7 l	20.3 l	4.8 l	14.7 l	0.5 l	-1.94	**Fhb1**	-4.92	-7.85	-5.54	-8.79	-9.27	-3.24
28	X12-3114-65-7-1	75.9 h	39.9	37.3 h	34.4 h	41.9 h	1.9 l	4.52	no	0.48	-1.36	-0.24	-2.75	-3.19	-0.41
29	X12-052-1-18-3	65.8 h	54.4 h	37.1 h	28.9 h	41.4 h	3.2	4.55	no						
30	X12-3063-34-8-5	70.3 h	53.8 h	42.5 h	29.2 h	38.7 h	4.0	5.68	**Fhb1**	1.13	-1.69	-0.81	1.19	-1.44	-1.86
31	X12-924-40-7-5	51.4 l	17.2 l	19.5 l	22.0 h	20.5	1.6 l	-0.50	no						
32	X12-3024-47-4-5	67.0 h	26.8	23.6	22.3 h	28.2	8.6 h	2.48	no	3.87	5.52	3.85	1.71	4.55	0.36
33	MI20R0177	60.9 h	22.0 l	.	14.7 l	23.2	2.7 l	0.13	no	-0.99	-1.83	-1.30	-4.00	-3.03	-1.24
34	MI20R0162	35.6 l	14.4 l	13.8 l	3.2 l	7.2 l	0.6 l	-3.59	no	-7.05	-5.97	-6.28	-7.87	-8.85	-1.83
35	MI20R0111	48.5 l	21.5 l	19.5 l	12.9 l	19.8 l	2.9	-0.92	no	2.33	-0.78	0.11	-3.18	-2.34	-0.56
36	MI20R0148	38.0 l	25.8	18.8 l	9.1 l	14.4 l	1.1 l	-1.96	no	-5.78	-6.17	-5.84	-8.70	-8.75	-1.76
37	MI20R0107	41.0 l	29.1	18.3 l	10.3 l	13.3 l	1.6 l	-1.80	no	1.44	1.61	1.24	4.40	2.49	0.39
38	MI20R0157	44.3 l	16.4 l	17.0 l	10.2 l	18.0 l	0.7 l	-2.05	no	-3.06	-4.19	-3.36	-3.41	-4.49	-1.24
39	P2101	58.0 h	32.6	30.2	31.7 h	34.5 h	2.6 l	2.35	**Fhb1**	-1.55	-3.25	-3.18	-1.83	-2.80	-1.49
40	P2104	61.4 h	30.8	27.5	23.9 h	28.9	3.1	2.03	no	-1.23	-6.20	-5.08	-0.43	-2.14	-0.72
41	P2106	48.4 l	18.2 l	19.2 l	9.3 l	16.0 l	2.0 l	-1.28	**Fhb1**	-2.16	-4.95	-4.22	-4.28	-3.72	-1.37
42	P2107	44.8 l	25.5	27.2	18.1	16.6 l	2.6 l	0.05	no	-2.59	-3.88	-3.42	2.87	-1.39	-0.36
43	P2111	46.4 l	22.4 l	27.0	11.4 l	14.8 l	4.1	-0.46	**Fhb1?**	-5.42	-4.48	-4.93	-5.80	-6.60	-0.89
1001	MEAN	50.9	27.8	24.3	15.3	21.2	2.3								
1002	MAXI	75.9	54.5	42.5	34.4	41.9	8.6								
1003	MINI	35.6	11.3	13.8	3.2	7.2	0.5								
1004	NOBS	6.9	6.9	14.3	3	3	3								
1005	MSE	329.0	125.5	119.2	152.8	155.4	3.3								
1006	LSD	19.8	12.2	8.3	12.6	12.7	2.3								

Table 14. Best and worst entries in the 2020-2021 PNUWWSN. Summary statistics are over all entries.

		INC		SEV		IND		FDK		ISK		DON		PC1			GEBVS					
ENTRY	NAME	AVG		AVG		AVG		AVG		AVG		AVG			FHB1		INC	SEV	IND	FDK	ISK	DON
34	MI20R0162	35.6	l	14.4	l	13.8	l	3.2	l	7.2	l	0.6	l	-3.59	no		-7.05	-5.97	-6.28	-7.87	-8.85	-1.83
24	US16-IL-061-029	39.7	l	11.3	l	13.9	l	4.0	l	11.8	l	0.5	l	-3.23	**Fhb1**		-6.75	-9.08	-7.24	-8.98	-10.06	-3.12
26	IL17-8626	42.2	l	16.6	l	13.8	l	4.0	l	10.0	l	0.6	l	-3.00	**Fhb1**		-4.62	-7.77	-4.96	-7.19	-7.34	-2.16
25	IL17-25205	38.6	l	21.3	l	18.5	l	3.9	l	11.1	l	0.7	l	-2.88	no		-7.57	-8.41	-7.41	-11.96	-12.89	-3.49
1	TRUMAN	39.5	l	16.4	l	14.6	l	7.4	l	10.0	l	2.0	l	-2.76	no		-6.12	-6.42	-6.14	-6.77	-6.66	-1.14
19	OH17-21-11	45.4	l	20.2	l	18.5	l	9.3	l	12.3	l	1.6	l	-2.06	no		2.40	2.17	1.15	2.56	2.87	0.23
38	MI20R0157	44.3	l	16.4	l	17.0	l	10.2	l	18.0	l	0.7	l	-2.05	no		-3.06	-4.19	-3.36	-3.41	-4.49	-1.24
36	MI20R0148	38.0	l	25.8		18.8	l	9.1	l	14.4	l	1.1	l	-1.96	no		-5.78	-6.17	-5.84	-8.70	-8.75	-1.76
27	US16-IL-061-132	46.4	l	17.7	l	20.3	l	4.8	l	14.7	l	0.5	l	-1.94	**Fhb1**		-4.92	-7.85	-5.54	-8.79	-9.27	-3.24
39	P2101	58.0	h	32.6		30.2		31.7	h	34.5	h	2.6	l	2.35	**Fhb1**		-1.55	-3.25	-3.18	-1.83	-2.80	-1.49
18	OH17-93-33	62.4	h	34.7		27.3		21.6		27.2		4.4		2.38	no		-0.49	-2.22	-1.81	1.02	-0.21	0.12
32	X12-3024-47-4-5	67.0	h	26.8		23.6		22.3	h	28.2		8.6	h	2.48	no		3.87	5.52	3.85	1.71	4.55	0.36
4	PIONEER2545	59.2	h	38.4		34.1		28.3	h	32.0	h	3.0		2.69	no		7.00	11.19	10.45	14.79	12.53	5.13
8	VA19W-29	68.6	h	54.5	h	34.4	h	24.7	h	39.0	h	2.5	l	3.69	no							
28	X12-3114-65-7-1	75.9	h	39.9		37.3	h	34.4	h	41.9	h	1.9	l	4.52	no		0.48	-1.36	-0.24	-2.75	-3.19	-0.41
29	X12-052-1-18-3	65.8	h	54.4	h	37.1	h	28.9	h	41.4	h	3.2		4.55	no							
30	X12-3063-34-8-5	70.3	h	53.8	h	42.5	h	29.2	h	38.7	h	4.0		5.68	**Fhb1**		1.13	-1.69	-0.81	1.19	-1.44	-1.86
1001	MEAN	50.9		27.8		24.3		15.3		21.2		2.3										
1002	MAXI	75.9		54.5		42.5		34.4		41.9		8.6										
1003	MINI	35.6		11.3		13.8		3.2		7.2		0.5										
1004	NOBS	6.9		6.9		14.3		3		3		3										
1005	MSE	329.0		125.5		119.2		152.8		155.4		3.3										
1006	LSD	19.8		12.2		8.3		12.6		12.7		2.3										

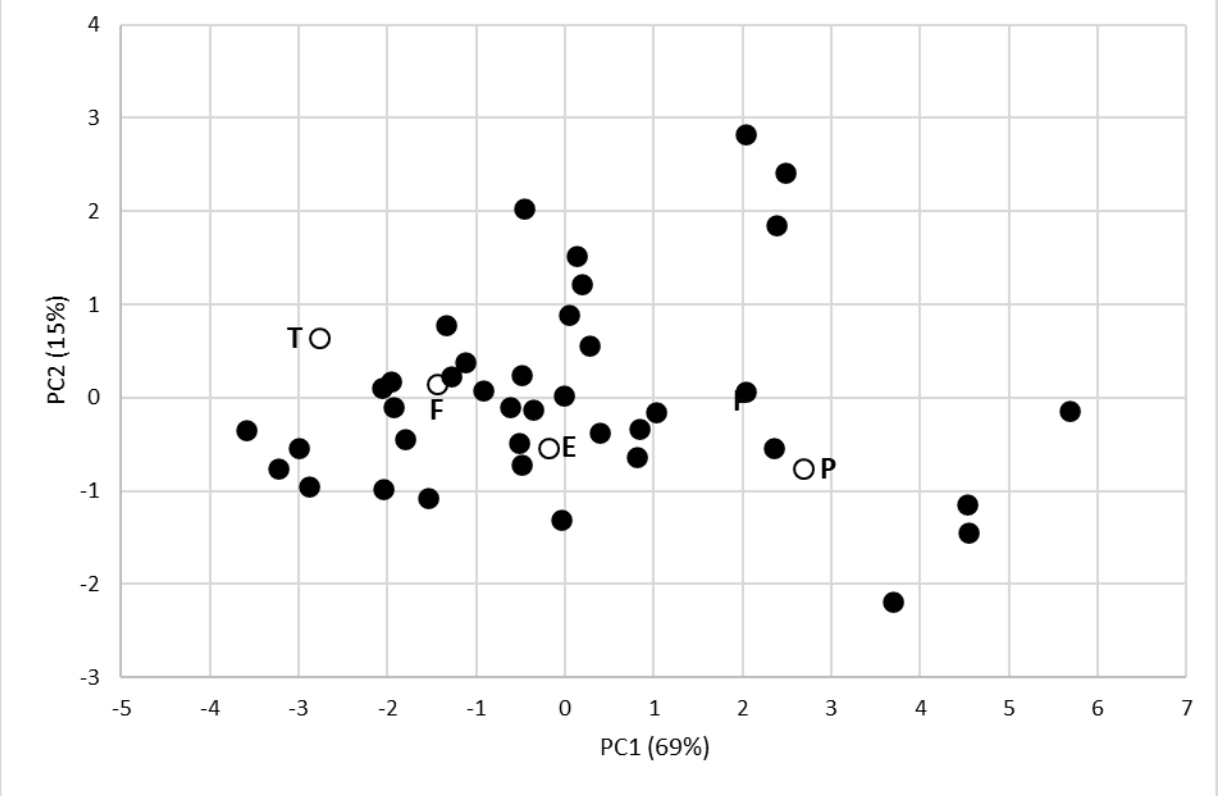

Figure 3. Graph of first two PC from the analysis of the six FHB traits from the 2020-2021 PNUWWSN (Table 13). Checks are identified: T=Truman (R), F=Freedom (MR), E=Ernie (MR), P=Pioneer 2545 (S).

Table 15. Genomic estimated breeding values (GEBV) of lines in the 2020-2021 PNUWWSN. Phenotypic and genotypic data from 2014 through 2020 was used to train the model that was then used to predict the values of the 2021 entries.

ENTRY	NAME	INC	SEV	IND	FDK	ISK	DON
1	TRUMAN	-6.12	-6.42	-6.14	-6.77	-6.66	-1.14
2	ERNIE						
3	FREEDOM	1.90	1.55	1.47	5.75	3.51	0.88
4	PIONEER2545	7.00	11.19	10.45	14.79	12.53	5.13
5	DH13SRW022-216						
6	16VDH-SRW03-018						
7	VA19W-24						
8	VA19W-29						
9	17VDH-SRW03-143						
10	17VDH-SRW05-170						
11	KWS338	-1.05	-1.67	-0.88	-3.25	-3.77	-1.17
12	KWS342	-2.02	1.27	0.27	-4.89	-2.65	-1.50
13	KWS347	0.55	1.25	1.25	-0.16	-0.13	0.30
14	KWS358	-1.00	-0.54	-1.45	-3.67	-3.06	0.21
15	KWS369	1.51	2.67	2.20	-1.12	1.67	-1.97
16	KWS428	1.56	4.54	2.98	4.62	4.95	4.85
17	OH17-124-70	-0.70	0.51	0.27	1.59	0.80	-0.26
18	OH17-93-33	-0.49	-2.22	-1.81	1.02	-0.21	0.12
19	OH17-21-11	2.40	2.17	1.15	2.56	2.87	0.23
20	OH17-206-73	0.76	-1.06	-0.86	-1.44	-0.77	-0.47
21	OH17-171-57	-0.98	-2.75	-3.05	1.78	-0.14	0.02
22	OH17-94-58	-0.92	-0.73	-1.23	1.40	-1.36	1.03
23	US16-IL-062-031	-7.45	-6.95	-7.71	-10.33	-9.85	-2.75
24	US16-IL-061-029	-6.75	-9.08	-7.24	-8.98	-10.06	-3.12
25	IL17-25205	-7.57	-8.41	-7.41	-11.96	-12.89	-3.49
26	IL17-8626	-4.62	-7.77	-4.96	-7.19	-7.34	-2.16
27	US16-IL-061-132	-4.92	-7.85	-5.54	-8.79	-9.27	-3.24
28	X12-3114-65-7-1	0.48	-1.36	-0.24	-2.75	-3.19	-0.41
29	X12-052-1-18-3						
30	X12-3063-34-8-5	1.13	-1.69	-0.81	1.19	-1.44	-1.86
31	X12-924-40-7-5						
32	X12-3024-47-4-5	3.87	5.52	3.85	1.71	4.55	0.36
33	MI20R0177	-0.99	-1.83	-1.30	-4.00	-3.03	-1.24
34	MI20R0162	-7.05	-5.97	-6.28	-7.87	-8.85	-1.83
35	MI20R0111	2.33	-0.78	0.11	-3.18	-2.34	-0.56
36	MI20R0148	-5.78	-6.17	-5.84	-8.70	-8.75	-1.76
37	MI20R0107	1.44	1.61	1.24	4.40	2.49	0.39
38	MI20R0157	-3.06	-4.19	-3.36	-3.41	-4.49	-1.24
39	P2101	-1.55	-3.25	-3.18	-1.83	-2.80	-1.49
40	P2104	-1.23	-6.20	-5.08	-0.43	-2.14	-0.72
41	P2106	-2.16	-4.95	-4.22	-4.28	-3.72	-1.37
42	P2107	-2.59	-3.88	-3.42	2.87	-1.39	-0.36
43	P2111	-5.42	-4.48	-4.93	-5.80	-6.60	-0.89

Table 16. Correlation of Genomic estimated breeding values and observed phenotypes of lines in the 2020-2021 PNUWWSN. The correlation was obtained using phenotypes from each environment as well as the average over all environments. Phenotypic data from 2014 through 2019 was used to train the model that was then used to predict the values of the 2020 entries.

	Correlation of GEBVs with Trait Phenotype							
	With Trait	By Location						
	Mean	ILCHA	ILURB	INWLA	KYLEX	MIMAS	OHWOO	VAWAR
INC	0.519		0.503	0.339		0.485		
SEV	0.368		0.387	0.174		0.364		
IND	0.461	0.404	0.386	0.204	0.369	0.554	0.225	0.094
FDK	0.575		0.529	0.402				0.453
ISK	0.435		0.485	0.397				0.034
DON	0.520		0.590	0.428				0.264

Table 17. Summary of incidence (INC, %) from 2020-2021 NUWWSN.

ENTRY	NAME	AVG		ILURB	INWLA	MIMAS	NEMAS	NYITH
1	TRUMAN	30.6	l	2.3	23.3	94.6	16.7	16.3
2	ERNIE	54.4		23.30	30.0	94.3	63.3	61.2
3	FREEDOM	43.1	l	18.30	23.3	94.7	26.7	52.5
4	PIONEER2545	57.8	h	36.70	46.7	94.6	30.0	81.3
5	DH15SRW65-53	59.5	h	60.00	46.7	94.9	33.3	62.5
6	15VDH-FHB-MAS31-30	48.8		31.70	33.3	94.3	13.3	71.2
7	DH15SRW67-151	37.7	l	18.30	43.3	94.9	13.3	18.7
8	DH16-SRW120-064	72.7	h	86.70	36.7	93.4	46.7	100.0
9	VA19W-89	46.7	l	12.30	33.3	94.7	26.7	66.2
10	KWS340	44.2	l	13.30	20.0	94.4	33.3	60.0
11	KWS341	50.0		13.70	43.3	94.4	40.0	58.7
12	KWS356	51.5		28.30	36.7	94.8	30.0	67.5
13	KWS361	37.1	l	7.30	36.7	94.9	16.7	30.0
14	KWS365	44.1	l	18.30	30.0	94.2	16.7	61.2
15	NY99056-161	39.3	l	4.70	43.3	94.3	16.7	37.5
16	NYDD1543-06R-1652	43.9	l	14.00	20.0	94.5	43.3	47.5
17	NY11014-9-25-1319	42.4	l	10.00	33.3	94.7	26.7	47.5
18	NY12457-1-8-18	43.1	l	31.70	46.7	94.3	16.7	26.2
19	NY12298-1-8-17-1430	51.7		21.70	36.7	94.8	46.7	58.8
20	OH15-131-31	44.0	l	11.70	30.0	94.3	26.7	57.5
21	OH16-184-77	32.9	l	2.70	13.3	94.4	16.7	37.5
22	OH16-167-76	59.8	h	50.00	56.7	94.2	26.7	71.2
23	OH16-168-48	59.0	h	76.70	23.3	94.7	26.7	73.7
24	IL16-23972	36.4	l	11.70	16.7	94.4	26.7	32.5
25	IL16-36206	35.6	l	5.70	16.7	94.6	33.3	27.5
26	IL16-8605	41.3	l	13.30	16.7	93.9	30.0	52.5
27	IL16-23941	42.7	l	16.70	26.7	94.3	33.3	42.5
28	IL16-22039	36.0	l	8.70	13.3	94.0	36.7	27.5
29	X12-3024-47-4-1	45.5	l	36.70	30.0	94.2	16.7	50.0
30	X12-156-9-19-3	47.0	l	15.00	26.7	94.8	20.0	78.7
31	X12-3072-55-13-5	43.5	l	26.70	16.7	94.8	33.3	46.3
32	X12-3062-61-2-3	47.9		28.30	36.7	94.3	20.0	60.0
33	X12-3114-65-8-5	59.8	h	36.70	46.7	94.7	43.3	77.5
34	NE16562	52.6		28.30	33.3	94.6	26.7	80.0
35	NW13493	40.5	l	12.00	43.3	94.2	16.7	36.3
36	NI17410	38.5	l	7.00	20.0	94.9	23.3	47.5
37	NE14494	44.2	l	20.00	23.3	94.7	26.7	56.3
38	NE17441	41.1	l	9.00	20.0	94.9	46.7	35.0
39	MI19R0194	50.5		1.70	40.0	94.8	73.3	42.5
40	MI20R0009	44.3	l	20.00	13.3	94.9	53.3	40.0
41	MI20R0018	41.8	l	21.70	13.3	94.3	33.3	46.2
42	MI20M0093	37.2	l	2.70	23.3	94.8	26.7	38.8
43	MI20R0146	52.3		2.30	30.0	94.1	80.0	55.0
44	LES19-0634	41.2	l	13.70	40.0	94.9	20.0	37.5
45	LES19-7384	35.2	l	18.30	16.7	94.8	10.0	36.3
46	LES19-7798	51.0		8.30	16.7	94.8	56.7	78.7
47	LES19-7525	39.0	l	6.70	20.0	94.8	20.0	53.8
48	LES19-0635	44.8	l	60.0	26.7	94.2	13.3	30.0
49	LES19-0911	42.0	l	18.3	30.0	94.1	30.0	37.5
50	P2102	42.7	l	13.3	26.7	94.7	30.0	48.8
51	P2108	37.5	l	2.7	30.0	94.7	10.0	50.0
52	P2109	44.70	l	23.3	26.70	94.30	36.70	42.50
53	P2112	34.2	l	11.7	26.7	94.2	13.3	25.0
54	P2113	47.5	l	23.3	30.0	94.3	30.0	60.0
1001	MEAN	45.1		20.7	29.3	94.5	30.1	50.7
1002	MAXI	72.7		86.7	56.7	94.9	80.0	100.0
1003	MINI	30.6		1.7	13.3	93.4	10.0	16.3
1004	NOBS	13.8		3.0	3.0	1.0	3.0	3.9
1005	MSE	482.9		133.8	152.2	.	316.8	178.6
1006	LSD	16.9		19.2	20.5	.	29.6	19.3

Table 18. Summary of severity (SEV, %) data from the 2020-2021 NUWWSN

ENTRY	NAME	AVG		ILURB	INWLA	MIMAS	NEMAS	NYITH
1	TRUMAN	21.0	l	7.0	16.7	33.9	36.7	10.8
2	ERNIE	38.4	h	20.30	50.0	30.8	63.7	27.3
3	FREEDOM	24.0	l	11.70	16.7	37.0	38.3	16.2
4	PIONEER2545	41.7	h	34.70	56.7	41.6	45.3	30.0
5	DH15SRW65-53	38.3	h	29.00	36.7	63.2	35.0	27.5
6	15VDH-FHB-MAS31-30	23.7	l	7.00	10.0	47.7	40.0	13.8
7	DH15SRW67-151	27.0	l	18.70	40.0	47.8	21.7	6.7
8	DH16-SRW120-064	42.3	h	22.30	66.7	61.6	34.3	26.5
9	VA19W-89	18.1	l	7.00	16.7	41.6	12.7	12.8
10	KWS340	40.5	h	34.70	73.3	41.6	30.7	22.0
11	KWS341	26.0	l	11.70	26.7	47.7	32.7	11.5
12	KWS356	35.1	h	16.30	40.0	60.1	35.3	23.5
13	KWS361	28.0		7.00	36.7	44.7	43.3	8.2
14	KWS365	20.8	l	12.70	13.3	43.1	15.7	19.0
15	NY99056-161	26.0	l	7.00	16.7	55.4	26.7	24.5
16	NYDD1543-06R-1652	16.0	l	7.00	13.3	30.8	21.0	8.0
17	NY11014-9-25-1319	43.4	h	46.30	50.0	41.6	51.7	27.5
18	NY12457-1-8-18	28.4		22.70	23.3	38.5	28.3	29.0
19	NY12298-1-8-17-1430	23.6	l	17.70	16.7	41.0	25.0	17.7
20	OH15-131-31	22.9	l	7.00	20.0	40.0	29.3	18.0
21	OH16-184-77	14.2	l	7.00	23.3	23.1	8.3	9.3
22	OH16-167-76	32.6	h	26.70	36.7	38.5	36.7	24.5
23	OH16-168-48	31.3	h	26.70	40.0	43.1	26.7	20.0
24	IL16-23972	16.3	l	9.30	13.3	30.8	21.3	6.8
25	IL16-36206	16.0	l	7.00	20.0	23.1	23	6.8
26	IL16-8605	17.7	l	15.30	10.0	26.2	27.7	9.5
27	IL16-23941	30.8	h	20.30	23.3	33.9	60.3	16.0
28	IL16-22039	14.8	l	7.00	16.7	21.5	22.0	6.8
29	X12-3024-47-4-1	25.9	l	24.30	10.0	36.9	49.0	9.3
30	X12-156-9-19-3	23.5	l	11.70	23.3	44.7	23.3	14.3
31	X12-3072-55-13-5	18.4	l	11.70	10.0	37.0	21.7	11.8
32	X12-3062-61-2-3	27.7		14.00	40.0	30.8	34.3	19.5
33	X12-3114-65-8-5	30.8	h	22.70	16.7	57.0	42.3	15.5
34	NE16562	42.3	h	26.70	76.7	46.2	41.7	20.5
35	NW13493	42.5	h	30.70	56.7	63.1	41.0	21.0
36	NI17410	33.5	h	29.00	70.0	38.5	14.3	15.5
37	NE14494	34.4	h	21.70	66.7	49.3	21.3	13.0
38	NE17441	30.5		17.70	40.0	40.1	40.7	14.3
39	MI19R0194	32.8	h	7.00	26.7	63.2	56.7	10.5
40	MI20R0009	24.8	l	25.00	23.3	24.7	38.0	13.0
41	MI20R0018	28.7		16.30	43.3	33.9	37.7	12.5
42	MI20M0093	15.4	l	7.00	10.0	21.6	29.3	9.3
43	MI20R0146	38.2	h	7.00	30.0	67.8	72.7	13.5
44	LES19-0634	21.0	l	9.30	26.7	33.9	26.0	9.3
45	LES19-7384	14.7	l	9.30	10.0	26.2	18.3	9.8
46	LES19-7798	29.4		29.70	16.7	44.7	34.3	21.7
47	LES19-7525	20.0	l	7.00	20.0	37.0	21.7	14.3
48	LES19-0635	25.5	l	14.0	33.3	40.0	21.7	18.2
49	LES19-0911	25.5	l	16.3	23.3	47.7	28.7	11.3
50	P2102	22.3	l	11.7	13.3	46.2	31.3	9.0
51	P2108	18.1	l	7.0	23.3	30.8	16.7	12.5
52	P2109	25.10	l	14.0	23.30	43.10	31.00	14.00
53	P2112	19.9	l	7.0	10.0	29.2	43.3	10.0
54	P2113	21.1	l	7.0	10.0	35.4	39.3	14.0
1001	MEAN	26.9		16.1	29.2	40.7	32.8	15.5
1002	MAXI	43.4		46.3	76.7	67.8	72.7	30.0
1003	MINI	14.2		7.0	10.0	21.5	8.3	6.7
1004	NOBS	13.8		3.0	3.0	1.0	3.0	3.9
1005	MSE	278.7		82.0	279.2	.	580.7	52.1
1006	LSD	12.8		15.1	27.8	.	40.1	10.4

Table 19. Summary of index (IND, %) data from the 2020-2021 NUWWSN.

ENTRY	NAME	AVG		ILCHA	ILURB	INWLA	KYLEX	MIMAS	NEMAS	NYITH	OHWOO	VAWAR
1	TRUMAN	12.9	l	2.0	0.2	3.0	25.0	32.1	7.0	1.7	40.0	5.0
2	ERNIE	23.4		17.5	3.8	16.0	20.0	29.0	40.7	15.2	48.1	20.0
3	FREEDOM	18.0		17.5	2.1	4.0	30.0	35.0	10.7	9.0	43.3	10.0
4	PIONEER2545	32.1	h	35.0	13.7	26.0	30.0	39.4	13.7	24.5	66.5	40.0
5	DH15SRW65-53	29.3	h	25.0	17.8	17.3	40.0	59.9	11.7	18.1	53.9	20.0
6	15VDH-FHB-MAS31-30	17.4	l	7.5	2.2	3.3	25.0	45.0	4.3	10.0	44.4	15.0
7	DH15SRW67-151	20.9		10.0	3.6	14.3	40.0	45.4	2.7	1.3	60.6	10.0
8	DH16-SRW120-064	32.6	h	35.0	19.4	25.3	35.0	57.5	13.3	26.5	61.7	20.0
9	VA19W-89	19.9		10.0	0.9	6.0	45.0	39.4	3.7	9.3	45.0	20.0
10	KWS340	25.6		22.5	4.6	14.3	45.0	39.2	12.7	13.1	54.4	25.0
11	KWS341	26.2	h	27.5	1.9	12.0	35.0	45.1	21.0	6.8	51.7	35.0
12	KWS356	30.2	h	15.0	5.4	14.0	60.0	57.0	10.7	15.5	68.9	25.0
13	KWS361	25.4		7.5	0.5	12.0	60.0	42.4	6.0	2.5	67.2	30.0
14	KWS365	22.1		7.5	2.3	4.0	35.0	40.6	3.3	12.1	69.1	25.0
15	NY99056-161	22.6		15.0	0.3	7.0	35.0	52.3	5.0	9.9	68.9	10.0
16	NYDD1543-06R-1652	16.0	l	20.0	1.0	2.3	10.0	29.1	9.3	3.8	48.5	20.0
17	NY11014-9-25-1319	21.7		10.0	5.6	17.0	30.0	39.4	12.7	13.0	57.2	10.0
18	NY12457-1-8-18	.		25.0	7.7	11.0	30.0	36.3	5.7	5.1		25.0
19	NY12298-1-8-17-1430	24.5		27.5	4.0	4.3	35.0	38.9	14.3	10.1	56.1	30.0
20	OH15-131-31	21.1		15.0	0.8	5.3	30.0	37.7	7.3	10.5	47.8	35.0
21	OH16-184-77	18.4		6.0	0.2	2.7	60.0	21.8	1.7	3.7	29.4	40.0
22	OH16-167-76	31.0	h	37.5	15.2	20.7	50.0	36.2	6.0	17.6	56.1	40.0
23	OH16-168-48	27.6	h	42.5	20.9	10.7	15.0	40.9	7.7	14.7	50.7	45.0
24	IL16-23972	13.7	l	7.5	1.3	2.7	15.0	29.1	5.7	2.3	40.0	20.0
25	IL16-36206	10.4	l	5.0	0.4	3.0	15.0	21.9	8.3	1.9	18.3	20.0
26	IL16-8605	15.8	l	12.5	2.0	1.7	25.0	24.6	11.3	5.1	30.0	30.0
27	IL16-23941	21.8		22.5	4.9	6.7	20.0	32.0	18.7	6.7	45.2	40.0
28	IL16-22039	9.2	l	3.5	0.6	2.0	5.0	20.3	9.7	2.0	29.9	10.0
29	X12-3024-47-4-1	22.2		10.0	7.8	3.0	75.0	34.8	7.3	4.7	47.2	10.0
30	X12-156-9-19-3	20.7		10.0	2.0	5.3	40.0	42.4	4.7	11.2	51.1	20.0
31	X12-3072-55-13-5	17.6	l	17.5	3.1	1.7	30.0	35.1	7.0	5.5	48.3	10.0
32	X12-3062-61-2-3	20.8		25.0	4.8	14.7	35.0	29.0	7.3	11.9	39.4	20.0
33	X12-3114-65-8-5	34.4	h	32.5	8.8	8.0	70.0	54.0	19.0	12.2	55.0	50.0
34	NE16562	28.0	h	25.0	8.4	24.7	15.0	43.7	13.0	17.1	65.0	40.0
35	NW13493	26.8	h	17.5	4.0	25.0	35.0	59.5	7.7	6.9	65.6	20.0
36	NI17410	26.5	h	17.5	1.9	13.0	60.0	36.6	4.7	7.4	47.2	50.0
37	NE14494	22.6		15.0	4.6	15.3	25.0	46.7	5.3	7.2	64.4	20.0
38	NE17441	19.7		12.5	1.5	9.0	30.0	38.0	25.3	5.2	41.1	15.0
39	MI19R0194	.		12.5	0.1	14.0	5.0	59.9	41.0	4.7		35.0
40	MI20R0009	.		22.5	4.6	3.0	10.0	23.4	25.0	5.5		25.0
41	MI20R0018	16.3	l	12.5	4.3	5.3	20.0	31.9	11.7	5.8	40.0	15.0
42	MI20M0093	17.9		10.0	0.2	2.3	55.0	20.5	7.7	3.6	42.2	20.0
43	MI20R0146	27.8	h	27.5	0.2	9.3	10.0	63.8	63.0	7.3	39.4	30.0
44	LES19-0634	.		12.5	1.7	13.0	10.0	32.2	5.3	3.5		35.0
45	LES19-7384	14.0	l	3.5	2.2	1.7	25.0	24.8	2.7	4.3	32.2	30.0
46	LES19-7798	19.3		20.0	2.7	2.3	15.0	42.4	19.0	17.2	40.0	15.0
47	LES19-7525	15.8	l	17.5	0.5	3.7	20.0	35.0	3.7	7.7	49.4	5.0
48	LES19-0635	16.0	l	12.5	7.7	7.7	20.0	37.7	2.7	4.6	36.1	15.0
49	LES19-0911	22.5		17.5	3.4	7.7	45.0	44.9	9.0	4.9	45.0	25.0
50	P2102	22.5		10.0	1.4	3.7	25.0	43.8	11.0	4.5	53.3	50.0
51	P2108	11.1	l	7.5	0.2	7.7	5.0	29.2	2.0	5.8	32.2	10.0
52	P2109	22.7		12.5	4.0	8.0	40.0	40.7	11.3	6.0	57.2	25.0
53	P2112	19.4		17.5	0.8	2.7	35.0	27.5	6.3	2.7	61.7	20.0
54	P2113	25.5		10.0	1.6	3.0	55.0	33.4	10.0	8.4	63.3	45.0
1001	MEAN	21.6		16.6	4.2	9.0	31.7	38.5	11.4	8.5	48.0	24.2
1002	MAXI	34.4		42.5	20.9	26.0	75.0	63.8	63.0	26.5	69.1	50.0
1003	MINI	9.2		2.0	0.1	1.7	5.0	20.3	1.7	1.3	18.3	5.0
1004	NOBS	21.5		1.0	3.0	3.0	2.0	1.0	3.0	3.9	2.7	2.0
1005	MSE	194.9		.	15.2	48.3	176.7	.	130.9	17.5	64.2	105.6
1006	LSD	8.6		.	6.5	11.6	27.0	.	19.0	6.0	13.9	20.9

Table 20. Summary of Fusarium Damaged Kernel (FDK, %) data from the 2020-2021 NUWWSN.

ENTRY	NAME	AVG		ILURB	INWLA	NEMAS	NYITH	VAWAR
1	TRUMAN	10.2	l	2.7	3.3	0.0	30.0	15.0
2	ERNIE	17.5	l	18.3	13.3	3.0	45.0	8.0
3	FREEDOM	21.8		8.3	13.3	1.0	75.0	11.5
4	PIONEER2545	36.7	h	38.3	13.3	7.0	90.0	35.0
5	DH15SRW65-53	34.7	h	55.0	33.3	0.0	60.0	25.0
6	15VDH-FHB-MAS31-30	14.5	l	10.0	13.3	0.0	45.0	4.0
7	DH15SRW67-151	22.1		41.7	6.7	2.3	45.0	15.0
8	DH16-SRW120-064	28.8		38.3	6.7	2.3	85.0	11.5
9	VA19W-89	12.0	l	4.3	3.3	0.0	35.0	17.5
10	KWS340	22.9		18.3	13.3	3.0	65.0	15.0
11	KWS341	28.0		18.3	23.3	1.0	80.0	17.5
12	KWS356	35.4	h	40.0	30.0	2.0	70.0	35.0
13	KWS361	19.5	l	5.7	16.7	0.0	50.0	25.0
14	KWS365	17.3	l	5.0	10.0	1.0	65.0	5.5
15	NY99056-161	32.7	h	26.7	30.0	1.0	80.0	26.0
16	NYDD1543-06R-1652	12.2	l	2.7	13.3	1.0	40.0	4.0
17	NY11014-9-25-1319	24.9		10.7	26.7	1.0	75.0	11.0
18	NY12457-1-8-18	28.4		25.0	13.3	1.0	85.0	17.5
19	NY12298-1-8-17-1430	27.3		25.0	23.3	4.0	70.0	14.0
20	OH15-131-31	32.6		40.0	36.7	0.0	80.0	6.5
21	OH16-184-77	17.1	l	5.7	20.0	1.0	50.0	9.0
22	OH16-167-76	28.2		14.0	20.0	2.0	85.0	20.0
23	OH16-168-48	27.7		10.0	13.3	0.0	95.0	20.0
24	IL16-23972	6.6	l	1.3	0.0	0.0	25.0	6.5
25	IL16-36206	10.2	l	1.0	13.3	0.0	30.0	6.5
26	IL16-8605	15.6	l	5.7	13.3	2.0	55.0	2.0
27	IL16-23941	11.3	l	5.7	10.0	1.0	30.0	10.0
28	IL16-22039	5.8	l	1.0	10.0	0.0	15.0	3.0
29	X12-3024-47-4-1	35.7	h	61.7	50.0	3.0	55.0	9.0
30	X12-156-9-19-3	27.0		18.7	23.3	2.0	80.0	11.0
31	X12-3072-55-13-5	27.8		30.7	40.0	1.0	60.0	7.5
32	X12-3062-61-2-3	29.5		31.7	20.0	1.0	80.0	15.0
33	X12-3114-65-8-5	46.8	h	78.3	50.0	8.0	70.0	27.5
34	NE16562	38.2	h	53.3	23.3	4.3	65.0	45.0
35	NW13493	25.6		25.0	13.3	2.3	65.0	22.5
36	NI17410	16.7	l	14.0	13.3	1.0	45.0	10.0
37	NE14494	40.7	h	43.3	33.3	2.0	90.0	35.0
38	NE17441	13.1	l	10.0	16.7	0.0	30.0	9.0
39	MI19R0194	18.9	l	2.3	13.3	0.0	60.0	19.0
40	MI20R0009	10.1	l	1.0	3.3	3.0	40.0	3.0
41	MI20R0018	12.9	l	4.0	16.7	4.0	35.0	5.0
42	MI20M0093	19.5	l	22.3	10.0	0.0	60.0	5.0
43	MI20R0146	14.3	l	2.3	10.0	0.0	50.0	9.0
44	LES19-0634	13.8	l	7.3	3.3	1.0	35.0	22.5
45	LES19-7384	14.8	l	6.0	13.3	1.3	45.0	8.5
46	LES19-7798	19.9	l	4.0	3.3	1.0	70.0	21.0
47	LES19-7525	8.1	l	2.3	3.3	0.0	30.0	5.0
48	LES19-0635	19.4	l	8.3	6.7	2.0	70.0	10.0
49	LES19-0911	23.7		35.0	13.3	1.0	55.0	14.0
50	P2102	22.3		32.0	13.3	0.0	55.0	11.0
51	P2108	14.0	l	1.0	6.7	0.0	55.0	7.5
52	P2109	25.9		10.7	6.7	2.0	90.0	20.0
53	P2112	18.0	l	2.3	13.3	2.0	60.0	12.5
54	P2113	20.3		1.7	10.0	0.0	65.0	25.0
1001	MEAN	21.8		18.3	16.2	1.5	58.7	14.6
1002	MAXI	46.8		78.3	50.0	8.0	95.0	45.0
1003	MINI	5.8		1.0	0.0	0.0	15.0	2.0
1004	NOBS	12.9		3.0	3.0	3.0	2.0	2.0
1005	MSE	311.4		248.2	94.5	0.1	138.1	44.0
1006	LSD	14.1		26.2	16.2	0.6	23.9	13.5

Table 21. Summary of INC/SEV/FDK (ISK, %) data from the 2020-2021 NUWWSN

ENTRY	NAME	AVG		ILURB	INWLA	NEMAS	NYITH	VAWAR
1	TRUMAN	11.2	l	3.9	13.3	16.0	19.7	3.1
2	ERNIE	28.7		20.4	29.3	39.2	42.5	12.0
3	FREEDOM	22.1		12.3	17.3	19.9	55.1	6.0
4	PIONEER2545	38.7	h	36.7	36.3	25.5	70.8	24.1
5	DH15SRW65-53	35.5	h	48.7	38.3	20.4	58.1	12.1
6	15VDH-FHB-MAS31-30	20.9	l	15.6	18.3	16.0	45.8	9.0
7	DH15SRW67-151	20.4	l	27.8	27.7	11.4	29.3	6.1
8	DH16-SRW120-064	37.8	h	48.0	33.7	25.2	70.3	12.0
9	VA19W-89	17.8	l	7.5	16.3	11.8	41.5	12.1
10	KWS340	28.1		21.7	33.3	20.4	49.9	15.1
11	KWS341	27.8		14.9	30.3	22.2	50.3	21.1
12	KWS356	31.6	h	29.4	35.0	20.4	57.9	15.1
13	KWS361	21.1	l	6.6	28.7	18.0	34.1	18.1
14	KWS365	20.6	l	11.3	17.0	10.1	49.4	15.0
15	NY99056-161	22.8		14.2	30.0	13.4	50.5	6.1
16	NYDD1543-06R-1652	17.6	l	7.4	15.3	19.7	33.9	12.0
17	NY11014-9-25-1319	28.1		21.2	35.7	23.9	53.6	6.0
18	NY12457-1-8-18	26.1		26.3	26.3	13.9	48.7	15.1
19	NY12298-1-8-17-1430	27.4		21.8	25.3	23.0	48.6	18.1
20	OH15-131-31	28.8		21.6	29.7	16.8	54.8	21.0
21	OH16-184-77	18.6	l	5.2	19.0	7.9	36.7	24.0
22	OH16-167-76	34.1	h	28.6	36.0	19.8	62.2	24.1
23	OH16-168-48	34.1	h	35.0	24.3	15.9	68.2	27.1
24	IL16-23972	13.3	l	6.8	9.0	14.4	24.3	12.0
25	IL16-36206	14.7	l	4.2	16.3	16.9	24.0	12.0
26	IL16-8605	20.7	l	10.9	13.3	18.1	43.2	18.0
27	IL16-23941	22.3		13.4	19.0	28.5	26.4	24.0
28	IL16-22039	11.6	l	5.1	13.0	17.6	16.5	6.0
29	X12-3024-47-4-1	28.6		43.0	32.0	20.9	41.4	6.0
30	X12-156-9-19-3	24.8		15.5	24.3	13.8	58.4	12.0
31	X12-3072-55-13-5	22.8		23.8	24.0	16.8	43.4	6.0
32	X12-3062-61-2-3	28.3		25.4	31.0	16.7	56.2	12.1
33	X12-3114-65-8-5	41.3	h	49.1	39.0	28.9	59.5	30.1
34	NE16562	36.5	h	37.8	42.3	22.2	55.7	24.2
35	NW13493	27.0		22.8	35.3	18.3	46.6	12.1
36	NI17410	25.8		16.4	32.3	11.7	38.6	30.0
37	NE14494	31.1	h	29.8	40.3	15.2	58.2	12.1
38	NE17441	20.3	l	12.0	24.7	26.2	29.4	9.0
39	MI19R0194	26.0		3.5	25.3	39.0	40.8	21.1
40	MI20R0009	20.8	l	13.9	12.3	28.6	34.2	15.0
41	MI20R0018	19.6	l	13.0	23.7	22.9	29.5	9.0
42	MI20M0093	18.8	l	11.8	14.0	16.8	39.6	12.0
43	MI20R0146	25.7		3.7	22.0	45.8	38.8	18.0
44	LES19-0634	19.0	l	9.8	21.3	14.2	28.4	21.1
45	LES19-7384	18.1	l	10.7	13.3	9.0	39.3	18.0
46	LES19-7798	24.1		13.0	11.3	27.7	59.5	9.1
47	LES19-7525	12.6	l	5.0	13.3	12.5	29.1	3.0
48	LES19-0635	21.9		25.5	20.7	11.3	42.9	9.0
49	LES19-0911	23.6		24.4	21.3	18.0	39.1	15.1
50	P2102	24.9		20.3	17.3	18.4	38.4	30.0
51	P2108	15.9	l	3.3	18.7	8.0	43.3	6.0
52	P2109	24.6		15.5	17.7	21.1	53.6	15.1
53	P2112	17.8	l	6.5	16.3	17.8	36.5	12.1
54	P2113	24.7		9.8	16.0	20.8	49.7	27.1
1001	MEAN	24.2		18.4	24.0	19.4	44.4	14.8
1002	MAXI	41.3		49.1	42.3	45.8	70.8	30.1
1003	MINI	11.2		3.3	9.0	7.9	16.5	3.0
1004	NOBS	12.9		3.0	3.0	3.0	2.0	2.0
1005	MSE	165.0		54.1	58.0	98.8	43.7	38.1
1006	LSD	10.3		12.2	12.7	16.5	13.4	12.5

Table 22. Summary of deoxynivalenol (DON, ppm) data from the 2020-2021 NUWWSN.

ENTRY	NAME	AVG		ILURB	INWLA	NEMAS	NYITH	VAWAR
1	TRUMAN	2.6	l	2.0	3.1	0.2	6.8	0.7
2	ERNIE	3.3	l	1.8	0.6	1.4	12.6	0.1
3	FREEDOM	3.1	l	1.6	0.8	0.3	12.7	0.4
4	PIONEER2545	6.0		2.7	3.9	0.9	21.9	0.9
5	DH15SRW65-53	5.4	l	3.6	3.0	0.5	17.4	2.3
6	15VDH-FHB-MAS31-30	3.2	l	2.3	1.6	0.2	11.5	0.4
7	DH15SRW67-151	2.4	l	2.0	1.3	0.3	8.2	0.4
8	DH16-SRW120-064	4.7	l	3.3	1.8	1.0	17.4	0.2
9	VA19W-89	3.0	l	1.7	1.8	0.1	11.5	0.1
10	KWS340	5.2	l	3.2	4.1	0.4	17.3	1.2
11	KWS341	4.1	l	2.3	3.0	0.4	14.2	0.4
12	KWS356	6.4		3.8	6.1	0.8	20.3	1.0
13	KWS361	3.8	l	0.9	4.0	0.2	12.7	1.3
14	KWS365	5.2	l	2.0	3.7	0.4	19.4	0.5
15	NY99056-161	21.0	h	8.7	58.5	0.4	34.2	3.1
16	NYDD1543-06R-1652	2.5	l	0.5	0.8	0.0	10.9	0.1
17	NY11014-9-25-1319	9.5		2.3	24.9	0.3	18.5	1.6
18	NY12457-1-8-18	13.2		5.5	29.6	0.5	28.8	1.7
19	NY12298-1-8-17-1430	3.8	l	2.4	3.0	0.6	11.7	1.1
20	OH15-131-31	5.1	l	1.4	2.9	0.2	20.8	0.1
21	OH16-184-77	1.5	l	0.8	0.8	0.1	5.6	0.0
22	OH16-167-76	4.2	l	2.5	3.7	0.3	14.3	0.4
23	OH16-168-48	3.8	l	2.1	2.2	0.4	14.0	0.2
24	IL16-23972	1.1	l	0.9	0.2	0.3	4.4	0.0
25	IL16-36206	0.6	l	0.5	0.3	0.1	2.4	0.0
26	IL16-8605	2.4	l	0.8	0.4	0.8	9.9	0.1
27	IL16-23941	1.4	l	1.2	0.4	0.4	5.0	0.1
28	IL16-22039	1.0	l	0.5	0.3	0.3	4.1	0.0
29	X12-3024-47-4-1	10.2		4.7	28.1	0.3	18.0	0.0
30	X12-156-9-19-3	3.6	l	1.2	1.1	0.3	15.3	0.2
31	X12-3072-55-13-5	8.0		3.6	17.6	0.6	18.2	0.2
32	X12-3062-61-2-3	5.8		2.8	6.3	0.4	19.3	0.4
33	X12-3114-65-8-5	4.6	l	3.5	3.7	1.1	14.5	0.4
34	NE16562	5.0	l	3.5	4.3	0.6	16.0	0.4
35	NW13493	6.4		6.6	3.5	0.3	18.8	2.7
36	NI17410	3.3	l	2.1	2.3	0.3	11.8	0.1
37	NE14494	6.7		4.5	5.0	0.5	21.1	2.6
38	NE17441	3.2	l	2.5	2.5	0.4	10.3	0.2
39	MI19R0194	1.9	l	0.5	0.7	0.3	7.8	0.2
40	MI20R0009	2.4	l	1.0	0.7	1.2	9.1	0.0
41	MI20R0018	3.0	l	1.6	1.6	0.3	11.4	0.3
42	MI20M0093	3.1	l	1.9	1.6	0.0	12.2	0.0
43	MI20R0146	3.9	l	2.1	0.9	0.4	16.1	0.2
44	LES19-0634	1.0	l	0.7	0.5	0.0	4.1	0.0
45	LES19-7384	2.9	l	1.5	0.5	0.1	12.2	0.0
46	LES19-7798	2.7	l	1.4	0.9	0.3	11.0	0.0
47	LES19-7525	1.3	l	0.7	0.5	0.0	5.1	0.1
48	LES19-0635	6.0		3.4	4.5	0.6	20.5	1.0
49	LES19-0911	4.6	l	2.5	3.0	0.0	17.0	0.5
50	P2102	3.9	l	3.1	1.4	0.2	14.1	0.6
51	P2108	2.2	l	0.8	2.0	0.0	8.0	0.0
52	P2109	5.6	l	2.5	2.8	0.3	21.1	1.2
53	P2112	4.9	l	3.0	3.0	0.0	17.1	1.2
54	P2113	2.7	l	1.6	1.7	0.3	9.0	0.7
1001	MEAN	4.4		2.3	5.0	0.4	13.8	0.6
1002	MAXI	21.0		8.7	58.5	1.4	34.2	3.1
1003	MINI	0.6		0.5	0.2	0.0	2.4	0.0
1004	NOBS	8.9		2.9	1	1	2	2
1005	MSE	27.4		0.4			7.4	0.2
1006	LSD	5		1			5.5	0.9

Table 23. Summary of heading date (HD, Julian days) and height (HGT, inches) data from the 2020-2021 NUWWSN

		Heading Date (Juian Days)										Height (inches)			
ENTRY	NAME	AVG		ILCHA	ILURB	INWLA	KYLEX	MIMAS	NYITH	OHWOO	VAWAR	AVG		ILCHA	KYLEX
1	TRUMAN	142.4	h	142	141	142	133	150	153	144	135	40.8	h	42	40
2	ERNIE	137.1		139	137	137	128	146	147	140	125	40.0	h	42	39
3	FREEDOM	139.3		140	139	139	131	150	147	142	127	39.5	h	42	38
4	PIONEER2545	138.1		139	136	138	130	149	147	141	127	40.5	h	42	39
5	DH15SRW65-53	138.2		139	138	138	129	147	150	140	126	35.8		35	37
6	15VDH-FHB-MAS31-30	138.1		138	139	139	128	149	147	140	126	35.3	l	35	36
7	DH15SRW67-151	140.8		142	139	139	131	150	150	143	133	33.5	l	35	33
8	DH16-SRW120-064	137.4		138	138	138	127	147	147	140	124	34.0	l	34	35
9	VA19W-89	137.7		138	138	139	128	146	147	140	127	36.8		37	37
10	KWS340	139.8		140	139	140	131	148	149	141	131	36.3		36	37
11	KWS341	139.2		139	139	139	130	149	148	142	129	36.3		37	36
12	KWS356	139.0		139	139	139	131	149	147	142	128	32.2	l	34	31
13	KWS361	140.0		139	137	139	130	150	149	143	133	37.8		40	36
14	KWS365	139.9		140	138	139	131	150	148	143	130	36.3		38	35
15	NY99056-161	143.2	h	145	142	142	132	151	153	146	136	39.7	h	40	40
16	NYDD1543-06R-1652	136.0		136	135	137	126	146	147	139	124	39.2	h	40	39
17	NY11014-9-25-1319	142.0		142	141	142	133	150	152	143	133	41.0	h	43	39
18	NY12457-1-8-18	140.2		142	140	140	131	150	149	142	129	39.2	h	40	39
19	NY12298-1-8-17-1430	138.4		140	138	139	129	150	146	140	126	37.3		37	38
20	OH15-131-31	138.0		137	138	139	128	147	148	141	126	38.5	h	38	39
21	OH16-184-77	139.2		139	138	139	130	150	149	141	128	35.5		36	35
22	OH16-167-76	136.6		137	137	138	128	145	147	138	125	33.8	l	36	32
23	OH16-168-48	136.0		137	136	137	126	145	146	138	124	35.0	l	38	33
24	IL16-23972	135.6		136	135	136	127	145	144	138	125	36.8		39	35
25	IL16-36206	134.6	l	136	133	134	125	145	143	137	124	37.0		39	36
26	IL16-8605	133.8	l	135	130	134	124	144	144	137	123	35.3	l	38	33
27	IL16-23941	134.5	l	135	133	134	126	144	144	138	124	36.3		39	34
28	IL16-22039	134.9	l	136	134	134	126	145	144	138	124	41.0	h	42	40
29	X12-3024-47-4-1	138.1		138	138	140	130	145	150	140	125	35.8		37	35
30	X12-156-9-19-3	137.0		137	138	138	127	146	146	140	125	35.8		37	35
31	X12-3072-55-13-5	138.2		138	138	140	128	146	148	140	128	36.8		37	37
32	X12-3062-61-2-3	137.9		139	138	139	128	146	145	141	126	37.5		41	35
33	X12-3114-65-8-5	137.3		137	137	138	128	148	145	140	125	34.5	l	36	33
34	NE16562	136.0		137	135	137	126	146	144	139	124	37.5		41	35
35	NW13493	140.2		139	139	140	130	148	148	143	135	39.5	h	43	37
36	NI17410	138.2		138	138	138	130	149	147	141	126	37.5		40	35
37	NE14494	140.5		140	140	141	132	147	149	143	132	39.5	h	42	37
38	NE17441	138.0		138	137	139	128	150	146	141	126	38.0	h	41	36
39	MI19R0194	136.0		137	135	137	126	147	145	137	124	39.3	h	42	37
40	MI20R0009	134.3	l	134	132	135	125	144	144	137	123	36.8		40	34
41	MI20R0018	137.0		137	136	137	127	149	147	136	128	37.5		39	37
42	MI20M0093	138.7		139	139	138	130	150	148	139	127	37.3		38	37
43	MI20R0146	136.3		137	136	135	126	147	144	141	124	36.0		37	35
44	LES19-0634	138.1		139	137	138	128	150	147	138	129	39.5	h	40	40
45	LES19-7384	139.6		142	139	140	130	150	150	140	127	37.8		39	37
46	LES19-7798	138.9		140	138	139	129	149	147	142	128	37.8		38	38
47	LES19-7525	138.0		138	137	138	127	149	147	141	127	38.5	h	40	37
48	LES19-0635	142.2	h	143	142	142	133	151	153	139	135	35.5		39	33
49	LES19-0911	140		142	139	140	130	148	149	142	131	37.3		37	38
50	P2102	138.4		140	138	139	128	148	147	140	127	35.5		36	35
51	P2108	137.2		138	137	138	126	148	145	140	126	35	l	36	34
52	P2109	140.9		142	140	141	131	149	150	144	130	37.3		38	37
53	P2112	140.8		142	140	141	131	149	150	143	131	37		37	37
54	P2113	139.5		140.5	138.7	139.3	130.5	149	148	142	128	37.5		37	38
1001	MEAN	138.3		139	138	138	129	148	147	140	127	37.2		38	36
1002	MAXI	143.2		145	142	142	133	151	153	146	136	41		43	40
1003	MINI	133.8		134	130	134	124	144	143	136	123	32.2		34	31
1004	NOBS	15.8		1	3	2.9	2	1	1	3	2	3		1	2
1005	MSE	2.7		.	0.9	0.6	0.6	.	.	0.8	1.9	3.4		.	5.6
1006	LSD	1.2		.	1.6	1.3	1.6	.	.	1.5	2.8	3		.	4.8

Table 24. Summary of other traits collected on the 2020-2021 NUWWSN.

		ILCHA	
ENTRY	NAME	LR(0-9)	YR(0-9)
1	TRUMAN	5.5	4.0
2	ERNIE	5.0	6.0
3	FREEDOM	6.0	5.0
4	PIONEER2545	5.5	5.0
5	DH15SRW65-53	1.0	2.0
6	15VDH-FHB-MAS31-30	1.0	4.5
7	DH15SRW67-151	1.5	2.5
8	DH16-SRW120-064	1.0	7.0
9	VA19W-89	2.0	3.0
10	KWS340	2.0	2.0
11	KWS341	3.0	2.0
12	KWS356	2.0	1.0
13	KWS361	4.0	4.0
14	KWS365	3.5	2.5
15	NY99056-161	5.0	2.0
16	NYDD1543-06R-1652	1.5	8.0
17	NY11014-9-25-1319	4.5	4.0
18	NY12457-1-8-18	4.0	3.0
19	NY12298-1-8-17-1430	4.5	7.5
20	OH15-131-31	3.0	5.5
21	OH16-184-77	1.5	4.0
22	OH16-167-76	2.5	4.5
23	OH16-168-48	2.5	5.5
24	IL16-23972	4.0	5.5
25	IL16-36206	3.0	4.5
26	IL16-8605	3.0	3.5
27	IL16-23941	5.0	1.5
28	IL16-22039	2.5	7.0
29	X12-3024-47-4-1	1.0	1.5
30	X12-156-9-19-3	4.5	4.5
31	X12-3072-55-13-5	1.5	1.5
32	X12-3062-61-2-3	6.0	1.0
33	X12-3114-65-8-5	3.5	2.5
34	NE16562	3.0	4.5
35	NW13493	3.0	3.0
36	NI17410	3.0	2.0
37	NE14494	3.5	2.0
38	NE17441	2.0	1.0
39	MI19R0194	3.5	1.0
40	MI20R0009	3.5	4.5
41	MI20R0018	1.5	3.0
42	MI20M0093	3.5	2.5
43	MI20R0146	2.5	1.5
44	LES19-0634	2.5	2.5
45	LES19-7384	3.0	4.5
46	LES19-7798	1.0	3.0
47	LES19-7525	1.0	4.0
48	LES19-0635	3.0	2.0
49	LES19-0911	2.0	2.5
50	P2102	2.0	3.0
51	P2108	4.5	6.5
52	P2109	3.5	9.0
53	P2112	2.5	5.0
54	P2113	3.5	5.0

Table 25. Summary of incidence (INC, %) from 2020-2021 PNUWWSN.

ENTRY	NAME	AVG		ILURB	INWLA	MIMAS
1	TRUMAN	39.5	l	7.7	16.7	94.1
2	ERNIE	45.9	l	20.0	23.3	94.3
3	FREEDOM	40.8	l	8.3	20.0	94.2
4	PIONEER2545	59.2	h	46.7	36.7	94.3
5	DH13SRW022-216	58.0	h	43.3	36.7	94.0
6	16VDH-SRW03-018	55.3	l	38.3	33.3	94.1
7	VA19W-24	52.5	l	26.7	36.7	94.1
8	VA19W-29	68.6	h	68.3	43.3	94.1
9	17VDH-SRW03-143	43.0	l	21.7	13.3	94.1
10	17VDH-SRW05-170	53.0	l	45.0	20.0	94.0
11	KWS338	54.2	l	38.3	30.0	94.2
12	KWS342	49.1	l	23.3	30.0	94.1
13	KWS347	41.9	l	15.0	16.7	94.1
14	KWS358	53.6	l	26.7	40.0	94.1
15	KWS369	57.5	h	48.3	30.0	94.2
16	KWS428	53.7	l	43.3	23.3	94.3
17	OH17-124-70	40.4	l	7.7	20.0	93.4
18	OH17-93-33	62.4	h	66.7	26.7	94.0
19	OH17-21-11	45.4	l	12.3	30.0	94.0
20	OH17-206-73	51.2	l	30.0	30.0	93.7
21	OH17-171-57	47.6	l	11.7	36.7	94.4
22	OH17-94-58	42.1	l	2.3	30.0	94.1
23	US16-IL-062-031	49.2	l	14.0	43.3	90.4
24	US16-IL-061-029	39.7	l	4.0	23.3	91.9
25	IL17-25205	38.6	l	1.7	20.0	94.1
26	IL17-8626	42.2	l	10.7	23.3	92.6
27	US16-IL-061-132	46.4	l	12.3	33.3	93.6
28	X12-3114-65-7-1	75.9	h	76.7	56.7	94.3
29	X12-052-1-18-3	65.8	h	56.7	46.7	94.1
30	X12-3063-34-8-5	70.3	h	76.7	40.0	94.1
31	X12-924-40-7-5	51.4	l	30.0	30.0	94.2
32	X12-3024-47-4-5	67.0	h	63.3	43.3	94.3
33	MI20R0177	60.9	h	38.3	50.0	94.4
34	MI20R0162	35.6	l	6.7	13.3	86.8
35	MI20R0111	48.5	l	8.3	43.3	93.7
36	MI20R0148	38.0	l	3.0	16.7	94.2
37	MI20R0107	41.0	l	5.3	23.3	94.2
38	MI20R0157	44.3	l	8.7	30.0	94.3
39	P2101	58.0	h	46.7	33.3	94.1
40	P2104	61.4	h	40.0	50.0	94.2
41	P2106	48.4	l	31.7	20.0	93.5
42	P2107	44.8	l	23.3	16.7	94.4
43	P2111	46.4	l	15.0	30.0	94.3
1001	MEAN	50.9		28.5	30.5	93.8
1002	MAXI	75.9		76.7	56.7	94.4
1003	MINI	35.6		1.7	13.3	86.8
1004	NOBS	6.9		3.0	3.0	1.0
1005	MSE	329.0		318.7	130.6	.
1006	LSD	19.8		29.7	19.0	.

Table 26. Summary of severity (SEV, %) data from the 2020-2021 PNUWWSN

ENTRY	NAME	AVG		ILURB	INWLA	MIMAS
1	TRUMAN	16.4	l	7	13.3	29
2	ERNIE	36.0		37.7	36.7	33.7
3	FREEDOM	23.9		8.0	30.0	33.7
4	PIONEER2545	38.4		30.3	43.3	41.6
5	DH13SRW022-216	32.5		18.7	26.7	52.2
6	16VDH-SRW03-018	37.8		26.7	30.0	56.8
7	VA19W-24	31.8		30.7	23.3	41.3
8	VA19W-29	54.5	h	45.7	53.3	64.5
9	17VDH-SRW03-143	23.3	l	20.3	10.0	39.7
10	17VDH-SRW05-170	29.2		24.3	23.3	39.8
11	KWS338	29.0		15.3	33.3	38.3
12	KWS342	26.7		23.7	16.7	39.9
13	KWS347	37.1		26.7	43.3	41.4
14	KWS358	35.4		29.0	26.7	50.6
15	KWS369	20.9	l	9.3	16.7	36.8
16	KWS428	25.4		18.0	20.0	38.3
17	OH17-124-70	26.1		8.3	33.3	36.7
18	OH17-93-33	34.7		11.7	46.7	45.8
19	OH17-21-11	20.2	l	9.3	10.0	41.3
20	OH17-206-73	28.5		15.3	33.3	36.8
21	OH17-171-57	28.1		14.0	33.3	36.9
22	OH17-94-58	22.5	l	15.7	16.7	35.3
23	US16-IL-062-031	19.8	l	9.3	30.0	20.0
24	US16-IL-061-029	11.3	l	7.0	10.0	16.8
25	IL17-25205	21.3	l	7.0	20.0	36.8
26	IL17-8626	16.6	l	7.0	16.7	26.0
27	US16-IL-061-132	17.7	l	7.0	23.3	22.9
28	X12-3114-65-7-1	39.9		29.0	36.7	53.9
29	X12-052-1-18-3	54.4	h	49.7	60.0	53.6
30	X12-3063-34-8-5	53.8	h	44.3	63.3	53.6
31	X12-924-40-7-5	17.2	l	9.3	10.0	32.2
32	X12-3024-47-4-5	26.8		22.3	16.7	41.4
33	MI20R0177	22.0	l	9.3	16.7	40.0
34	MI20R0162	14.4	l	10.3	10.0	22.8
35	MI20R0111	21.5	l	15.3	20.0	29.1
36	MI20R0148	25.8		7.0	36.7	33.7
37	MI20R0107	29.1		18.0	23.3	46.0
38	MI20R0157	16.4	l	11.7	10.0	27.6
39	P2101	32.6		9.3	50.0	38.4
40	P2104	30.8		24.0	30.0	38.4
41	P2106	18.2	l	7.0	23.3	24.4
42	P2107	25.5		18.0	20.0	38.4
43	P2111	22.4	l	15.3	16.7	35.2
1001	MEAN	27.8		18.2	27.1	38.2
1002	MAXI	54.5		49.7	63.3	64.5
1003	MINI	11.3		7.0	10.0	16.8
1004	NOBS	6.9		3.0	3.0	1.0
1005	MSE	125.5		108.5	364.4	.
1006	LSD	12.2		17.4	31.8	.

Table 27. Summary of index (IND, %) data from the 2020-2021 PNUWWSN.

ENTRY	NAME	AVG		ILCHA	ILURB	INWLA	KYLEX	MIMAS	OHWOO	VAWAR
1	TRUMAN	14.6	l	3.5	0.5	2.3	25	27.3	38.3	5
2	ERNIE	25.5		22.5	8.2	6.3	40	31.7	50	20
3	FREEDOM	20.1	l	15.0	0.7	6.0	33.1	31.8	43.9	10
4	PIONEER2545	34.1		37.5	13.3	17.0	35	39.2	61.7	35
5	DH13SRW022-216	26.1		20.0	7.5	8.7	50	49.1	42.8	5
6	16VDH-SRW03-018	29.5		30.0	8.2	10.7	30	53.4	54.2	20
7	VA19W-24	27.2		30.0	11.4	8.3	35	38.9	51.7	15
8	VA19W-29	34.4	h	35.0	27.7	22.7	23.1	60.7	51.7	20
9	17VDH-SRW03-143	23.1		25.0	5.5	1.3	20	37.4	52.2	20
10	17VDH-SRW05-170	24.3		15.0	13.6	6.0	35	37.4	48.3	15
11	KWS338	24.5		17.5	7.1	8.3	35	36.1	47.8	20
12	KWS342	25.5		25.0	9.0	4.3	30	37.5	47.8	25
13	KWS347	22.5		7.5	4.3	6.3	43.1	39	47.2	10
14	KWS358	30.0		20.0	6.4	10.7	35	47.7	55	35
15	KWS369	29.0		12.5	4.3	5.0	60	34.6	56.7	30
16	KWS428	27.6		15.0	7.4	4.7	60	36.1	55	15
17	OH17-124-70	22.4		7.5	1.0	4.3	33.1	34.3	56.7	20
18	OH17-93-33	27.3		12.5	7.5	12.7	60	43.1	40.6	15
19	OH17-21-11	18.5	l	10.0	1.2	3.0	25	38.8	36.7	15
20	OH17-206-73	24.4		25.0	5.4	10.3	35	34.4	45.6	15
21	OH17-171-57	25.2		27.5	1.4	11.7	10	34.8	50.8	40
22	OH17-94-58	20.2	l	5.0	0.6	3.7	40	33.2	43.9	15
23	US16-IL-062-031	20.2	l	10.0	1.2	14.3	20	18.1	57.8	20
24	US16-IL-061-029	13.9	l	5.0	0.3	2.3	10	15.4	39.4	25
25	IL17-25205	18.5	l	22.5	0.1	4.0	10	34.6	38.3	20
26	IL17-8626	13.8	l	3.5	0.7	4.3	15	24.1	38.9	10
27	US16-IL-061-132	20.3	l	7.5	0.9	8.7	35	21.4	38.9	30
28	X12-3114-65-7-1	37.3	h	30.0	22.1	19.7	45	50.8	58.3	35
29	X12-052-1-18-3	37.1	h	25.0	30.9	27.0	40	50.4	46.7	40
30	X12-3063-34-8-5	42.5	h	37.5	34.4	25.3	65	50.5	70	15
31	X12-924-40-7-5	19.5	l	10.0	3.0	3.0	30	30.3	40	20
32	X12-3024-47-4-5	23.6		15.0	13.8	7.0	40	39	40.6	10
33	MI20R0177	.		12.5	4.3	8.3	53.1	37.8		25
34	MI20R0162	13.8	l	17.5	0.6	1.3	15	19.8	32.2	10
35	MI20R0111	19.5	l	25.0	1.4	9.7	20	27.3	27.8	25
36	MI20R0148	18.8	l	7.5	0.2	6.7	35	31.7	35.8	15
37	MI20R0107	18.3	l	5.0	1.4	6.3	23.1	43.4	38.9	10
38	MI20R0157	17.0	l	15.0	1.5	3.0	10	26	43.3	20
39	P2101	30.2		7.5	4.2	14.7	35	36.1	64.2	50
40	P2104	27.5		12.5	8.6	15.7	43.1	36.2	61.7	15
41	P2106	19.2	l	3.5	2.2	6.0	30	22.8	50	20
42	P2107	27.2		17.5	6.1	3.7	53.1	36.3	63.9	10
43	P2111	27.0		15.0	2.5	5.7	55	33.2	52.5	25
1001	MEAN	24.3		16.8	6.8	8.6	34.3	35.9	47.5	20.1
1002	MAXI	42.5		37.5	34.4	27.0	65	60.7	70	50
1003	MINI	13.8		3.5	0.1	1.3	10	15.4	25	5
1004	NOBS	14.3		1.0	3.0	3.0	1.8	1	2.6	2
1005	MSE	119.2		.	36.7	42.7	250.3	.	56.8	80
1006	LSD	8.3		.	10.1	10.9	33.8	.	13.3	18.2

Table 28. Summary of Fusarium Damaged Kernel (FDK, %) data from the 2020-2021 PNUWWSN.

ENTRY	NAME	AVG		ILURB	INWLA	VAWAR
1	TRUMAN	7.4	l	1.3	13.3	7.5
2	ERNIE	9.6	l	12.0	6.7	10.0
3	FREEDOM	12.7	l	8.7	17.3	12.0
4	PIONEER2545	28.3	h	28.3	16.7	40.0
5	DH13SRW022-216	11.4	l	10.0	13.3	11.0
6	16VDH-SRW03-018	14.2	l	5.0	20.0	17.5
7	VA19W-24	22.2	h	25.0	26.7	15.0
8	VA19W-29	24.7	h	21.7	33.3	19.0
9	17VDH-SRW03-143	20.6		20.0	23.3	18.5
10	17VDH-SRW05-170	11.9	l	13.3	10.0	12.5
11	KWS338	18.9		22.0	13.3	21.5
12	KWS342	13.2	l	8.0	16.7	15.0
13	KWS347	11.8	l	5.3	20.0	10.0
14	KWS358	13.3	l	15.0	13.3	11.5
15	KWS369	13.8	l	12.3	6.7	22.5
16	KWS428	21.7		33.3	23.3	8.5
17	OH17-124-70	13.1	l	8.3	13.3	17.5
18	OH17-93-33	21.6		35.0	13.3	16.5
19	OH17-21-11	9.3	l	7.3	6.7	14.0
20	OH17-206-73	9.9	l	12.3	0.0	17.5
21	OH17-171-57	20.0		26.7	13.3	20.0
22	OH17-94-58	11.1	l	11.7	10.0	11.5
23	US16-IL-062-031	7.3	l	1.0	3.3	17.5
24	US16-IL-061-029	4.0	l	2.3	6.7	3.0
25	IL17-25205	3.9	l	1.0	6.7	4.0
26	IL17-8626	4.0	l	1.3	6.7	4.0
27	US16-IL-061-132	4.8	l	1.0	3.3	10.0
28	X12-3114-65-7-1	34.4	h	46.7	26.7	30.0
29	X12-052-1-18-3	28.9	h	33.3	23.3	30.0
30	X12-3063-34-8-5	29.2	h	50.0	20.0	17.5
31	X12-924-40-7-5	22.0	h	40.0	10.0	16.0
32	X12-3024-47-4-5	22.3	h	30.0	23.3	13.5
33	MI20R0177	14.7	l	10.0	16.7	17.5
34	MI20R0162	3.2	l	1.3	3.3	5.0
35	MI20R0111	12.9	l	13.3	13.3	12.0
36	MI20R0148	9.1	l	5.3	13.3	8.5
37	MI20R0107	10.3	l	8.3	10.0	12.5
38	MI20R0157	10.2	l	2.3	23.3	5.0
39	P2101	31.7	h	30.0	20.0	45.0
40	P2104	23.9	h	20.0	26.7	25.0
41	P2106	9.3	l	4.3	10.0	13.5
42	P2107	18.1		26.7	10.0	17.5
43	P2111	11.4	l	8.3	3.3	22.5
1001	MEAN	15.3		15.8	14.2	15.8
1002	MAXI	34.4		50.0	33.3	45.0
1003	MINI	3.2		1	0	3
1004	NOBS	3		3	3	2
1005	MSE	152.8		142.6	116.7	82.8
1006	LSD	12.6		19.9	18.1	18.5

Table 29. Summary of INC/SEV/FDK (ISK, %) data from the 2020-2021 PNUWWSN

ENTRY	NAME	AVG		ILURB	INWLA	VAWAR
1	TRUMAN	10.0	l	4.9	21.9	3.0
2	ERNIE	19.5	l	22.1	24.3	12.0
3	FREEDOM	14.1	l	8.4	27.9	6.0
4	PIONEER2545	32.0	h	34.4	40.3	21.2
5	DH13SRW022-216	19.2	l	22.6	31.9	3.0
6	16VDH-SRW03-018	24.1		21.5	38.6	12.1
7	VA19W-24	26.8		27.2	44.3	9.1
8	VA19W-29	39.0	h	42.9	61.9	12.1
9	17VDH-SRW03-143	20.9		20.6	29.9	12.1
10	17VDH-SRW05-170	19.3	l	26.1	22.6	9.1
11	KWS338	23.0		24.9	31.9	12.1
12	KWS342	20.9		17.3	30.3	15.1
13	KWS347	19.4	l	14.6	37.6	6.0
14	KWS358	25.6		22.7	32.9	21.0
15	KWS369	20.2		22.2	20.3	18.1
16	KWS428	25.6		31.7	35.9	9.0
17	OH17-124-70	16.4	l	8.1	28.9	12.1
18	OH17-93-33	27.2		37.5	34.9	9.1
19	OH17-21-11	12.3	l	9.4	18.3	9.1
20	OH17-206-73	15.4	l	18.5	18.6	9.1
21	OH17-171-57	25.5		18.4	33.9	24.1
22	OH17-94-58	14.2	l	10.1	23.6	9.0
23	US16-IL-062-031	14.8	l	7.4	24.9	12.1
24	US16-IL-061-029	11.8	l	4.2	16.3	15.0
25	IL17-25205	11.1	l	3.0	18.3	12.0
26	IL17-8626	10.0	l	5.8	18.3	6.0
27	US16-IL-061-132	14.7	l	6.2	19.9	18.0
28	X12-3114-65-7-1	41.9	h	50.4	54.3	21.1
29	X12-052-1-18-3	41.4	h	45.2	54.9	24.1
30	X12-3063-34-8-5	38.7	h	56.3	50.6	9.1
31	X12-924-40-7-5	20.5		27.8	21.6	12.1
32	X12-3024-47-4-5	28.2		37.7	40.9	6.1
33	MI20R0177	23.2		18.3	36.3	15.1
34	MI20R0162	7.2	l	5.6	9.9	6.0
35	MI20R0111	19.8	l	12.4	31.9	15.0
36	MI20R0148	14.4	l	5.1	28.9	9.0
37	MI20R0107	13.3	l	10.3	23.6	6.1
38	MI20R0157	18.0	l	7.0	34.9	12.0
39	P2101	34.5	h	28.8	44.6	30.2
40	P2104	28.9		27.2	50.3	9.1
41	P2106	16.0	l	13.3	22.6	12.1
42	P2107	16.6	l	23.1	20.6	6.1
43	P2111	14.8	l	12.4	16.9	15.1
1001	MEAN	21.2		20.3	31.0	12.2
1002	MAXI	41.9		56.3	61.9	30.2
1003	MINI	7.2		3.0	9.9	3.0
1004	NOBS	3		3	3	2
1005	MSE	155.4		81.3	152.7	28.8
1006	LSD	12.7		15.0	20.6	10.9

Table 301. Summary of deoxynivalenol (DON, ppm) data from the 2020-2021 PNUWWSN.

ENTRY	NAME	AVG		ILURB	INWLA	VAWAR
1	TRUMAN	2.0	l	2.3	3.2	0.6
2	ERNIE	1.3	l	2.0	1.8	0.2
3	FREEDOM	1.8	l	3.0	2.0	0.4
4	PIONEER2545	3.0		4.3	4.4	0.4
5	DH13SRW022-216	2.2	l	2.1	4.1	0.3
6	16VDH-SRW03-018	3.1		3.9	4.5	0.8
7	VA19W-24	2.3	l	3.9	2.6	0.6
8	VA19W-29	2.5	l	4.1	2.8	0.7
9	17VDH-SRW03-143	3.0		4.3	4.0	0.6
10	17VDH-SRW05-170	2.1	l	4.1	1.7	0.5
11	KWS338	1.4	l	2.9	1.2	0.2
12	KWS342	1.0	l	1.9	0.9	0.1
13	KWS347	1.0	l	1.7	1.1	0.2
14	KWS358	2.1	l	2.9	3.2	0.3
15	KWS369	1.8	l	2.7	2.3	0.5
16	KWS428	6.4	h	9.1	8.5	1.4
17	OH17-124-70	2.6	l	4.0	3.3	0.7
18	OH17-93-33	4.4		7.0	4.7	1.6
19	OH17-21-11	1.6	l	2.0	2.4	0.3
20	OH17-206-73	1.9	l	2.4	3.1	0.1
21	OH17-171-57	2.0	l	3.5	2.2	0.3
22	OH17-94-58	1.9	l	4.1	1.2	0.3
23	US16-IL-062-031	0.5	l	1.2	0.2	0.1
24	US16-IL-061-029	0.5	l	0.8	0.6	0.1
25	IL17-25205	0.7	l	1.6	0.6	0.1
26	IL17-8626	0.6	l	1.1	0.6	0.1
27	US16-IL-061-132	0.5	l	1.2	0.1	0.1
28	X12-3114-65-7-1	1.9	l	3.5	2.0	0.2
29	X12-052-1-18-3	3.2		3.4	4.6	1.6
30	X12-3063-34-8-5	4.0		6.6	4.6	0.8
31	X12-924-40-7-5	1.6	l	3.4	1.5	0.1
32	X12-3024-47-4-5	8.6	h	7.8	17.8	0.1
33	MI20R0177	2.7	l	3.4	3.1	1.5
34	MI20R0162	0.6	l	1.2	0.4	0.1
35	MI20R0111	2.9		4.1	4.5	0.2
36	MI20R0148	1.1	l	2.1	1.2	0.1
37	MI20R0107	1.6	l	2.5	2.1	0.2
38	MI20R0157	0.7	l	1.5	0.4	0.3
39	P2101	2.6	l	3.6	3.3	1.0
40	P2104	3.1		3.2	4.2	1.8
41	P2106	2.0	l	3.0	2.5	0.5
42	P2107	2.6	l	4.4	3.3	0.1
43	P2111	4.1		4.9	6.5	0.7
1001	MEAN	2.3		3.3	3.0	0.5
1002	MAXI	8.6		9.1	17.8	1.8
1003	MINI	0.5		0.8	0.1	0.1
1004	NOBS	3		2	1	2
1005	MSE	3.3		0.6	.	0.1
1006	LSD	2.3		1.6	.	0.5

Table 31. Summary of heading date (HD, Julian days) and height (HGT, inches) data from the 2020-2021 PNUWWN

		Heading Date (Julian Days)									Height (inches)			
ENTRY	NAME	AVG		ILCHA	ILURB	INWLA	KYLEX	MIMAS	OHWOO	VAWAR	AVG		ILCHA	KYLEX
1	TRUMAN	140.2	h	138	140	141	133	150	144	135	41.5	h	43	41
2	ERNIE	136.6		141	137	138	128	146	141	126	39.5	h	41	39
3	FREEDOM	137.9		138	139	139	131	150	141	127	38.8	hl	43	35
4	PIONEER2545	136.9		139	138	138	128	149	141	127	38.3	hl	38	39
5	DH13SRW022-216	136.5		138	138	139	128	147	141	126	35.8	l	40	32
6	16VDH-SRW03-018	135.8		138	137	138	127	147	140	125	35.5	l	37	35
7	VA19W-24	135.5		138	138	137	127	146	138	126	37.0	l	40	34
8	VA19W-29	136.1		138	138	138	126	147	139	128	37.3	l	39	36
9	17VDH-SRW03-143	136.0		138	138	139	126	146	140	127	35.3	l	37	34
10	17VDH-SRW05-170	136.4		138	139	139	127	146	140	127	35.5	l	37	35
11	KWS338	135.7		136	137	137	127	148	139	126	37.3	l	38	37
12	KWS342	134.9		138	136	136	126	145	139	124	37.5	l	38	38
13	KWS347	136.2		138	137	138	128	147	140	126	37.3	l	38	37
14	KWS358	136.7		140	138	139	127	147	141	127	35.3	l	35	36
15	KWS369	138.7		139	141	139	131	150	141	131	35.8	l	36	36
16	KWS428	137.4		139	139	139	129	149	141	127	38.0	hl	39	38
17	OH17-124-70	137.8		138	138	139	130	148	141	130	37.0	l	37	37
18	OH17-93-33	136.7		138	138	139	128	147	141	126	37.2	l	40	35
19	OH17-21-11	136.0		137	138	138	127	147	140	126	36.3	l	37	36
20	OH17-206-73	135.1		137	137	137	126	145	139	124	38.8	hl	43	35
21	OH17-171-57	135.4		141	138	137	126	145	138	124	38.5	hl	40	38
22	OH17-94-58	138.5		134	140	141	132	149	145	129	38.0	hl	40	37
23	US16-IL-062-031	133.0	l	136	134	135	125	143	136	124	38.2	hl	42	35
24	US16-IL-061-029	134.5		137	136	135	126	145	139	124	37.0	l	38	36
25	IL17-25205	134.2		133	136	135	126	145	138	127	35.8	l	36	36
26	IL17-8626	132.8	l	135	132	134	125	144	136	124	36.3	l	39	34
27	US16-IL-061-132	133.2	l	138	132	134	125	144	136	124	37.3	l	38	37
28	X12-3114-65-7-1	136.0		139	138	137	127	147	140	124	37.0	l	38	36
29	X12-052-1-18-3	137.2		141	138	139	127	147	141	129	37.0	l	36	38
30	X12-3063-34-8-5	138.1		137	140	141	129	149	142	129	37.3	l	37	38
31	X12-924-40-7-5	135.9		140	138	138	126	146	138	125	36.0	l	37	35
32	X12-3024-47-4-5	137.0		142	138	140	128	147	140	124	35.8	l	37	35
33	MI20R0177	139.6		136	141	141	132	151	144	133	40.3	h	43	38
34	MI20R0162	134.0	l	137	133	137	125	145	137	125	37.3	l	39	36
35	MI20R0111	135.8		139	137	138	127	145	140	125	39.0	hl	42	37
36	MI20R0148	136.6		139	138	139	128	147	141	126	40.5	h	43	39
37	MI20R0107	136.3		136	138	139	127	148	140	125	40.3	h	42	39
38	MI20R0157	135.5		142	136	137	125	146	139	124	39.0	hl	42	37
39	P2101	138.9		142	139	139	130	150	142	130	37.8	hl	38	38
40	P2104	141.0	h	142	141	142	133	150	144	135	37.8	hl	40	36
41	P2106	139.3		139	141	140	132	150	142	132	37.3	l	35	40
42	P2107	137.9		141	138	139	131	150	141	126	37.8	hl	42	34
43	P2111	.	l	138	139	129	149	141	128	.	.		39	.
1001	MEAN	136.5		138	138	138	128	147	140	127	37.5		39	36
1002	MAXI	141.0		142	141	142	149	151	145	135	41.5		43	41
1003	MINI	132.8		133	132	129	125	141	128	124	35.3		35	32
1004	NOBS	14.6		1	3	2.9	1.8	1	3	2	2.8		1	1.8
1005	MSE	2.9		.	1.1	0.4	1	.	0.7	1.5	5.0		.	4.1
1006	LSD	1.3		.	1.7	1.1	2.1	.	1.4	2.5	3.8		.	4.3

Table 32. Summary of other traits collected on the 2020-2021 PNUWWSN.

		ILCHA	
ENTRY	NAME	LR(0-9)	YR(0-9)
1	TRUMAN	6.0	4.0
2	ERNIE	5.5	6.0
3	FREEDOM	4.5	5.5
4	PIONEER2545	5.5	4.5
5	DH13SRW022-216	1.5	1.0
6	16VDH-SRW03-018	1.0	1.0
7	VA19W-24	1.5	1.0
8	VA19W-29	3.0	1.0
9	17VDH-SRW03-143	1.5	1.0
10	17VDH-SRW05-170	1.0	1.0
11	KWS338	5.0	4.0
12	KWS342	4.0	1.5
13	KWS347	5.5	1.0
14	KWS358	3.0	1.5
15	KWS369	2.0	1.5
16	KWS428	2.0	1.0
17	OH17-124-70	4.5	2.0
18	OH17-93-33	1.5	3.0
19	OH17-21-11	1.5	3.0
20	OH17-206-73	1.0	5.0
21	OH17-171-57	2.5	3.0
22	OH17-94-58	3.0	6.0
23	US16-IL-062-031	3.0	4.5
24	US16-IL-061-029	2.0	7.5
25	IL17-25205	3.0	8.5
26	IL17-8626	4.0	8.0
27	US16-IL-061-132	3.0	7.5
28	X12-3114-65-7-1	3.5	3.0
29	X12-052-1-18-3	6.0	2.0
30	X12-3063-34-8-5	5.0	4.5
31	X12-924-40-7-5	5.0	4.5
32	X12-3024-47-4-5	1.0	1.0
33	MI20R0177	2.5	2.0
34	MI20R0162	3.5	4.5
35	MI20R0111	2.5	2.0
36	MI20R0148	3.0	4.5
37	MI20R0107	2.0	1.5
38	MI20R0157	3.0	4.0
39	P2101	4.0	6.0
40	P2104	3.0	5.5
41	P2106	4.5	5.5
42	P2107	2.0	4.5
43	P2111	4.5	7.0

Table 33. Genotype of the 2020-2021 NUWWSN entries for FHB QTL. Entries were also genotyped for Rht, Ppd, Vrn, rust, PM, Hessian Fly, BYDV, rye translocation, and quality genes. That data is available in an excel file from sneller.5@osu.edu. Data is from the USDA Eastern Regional Small Grains Genotyping Lab , Raleigh NC.

NAME	#R Alleles	Fhb1	Fhb_5A Ernie	Fhb_5A Ning7840	Fhb_2DL Wuhan1 /W14	Fhb_3B Massey	Fhb_1B Jamestown	Fhb_1A Neuse	Fhb_4A Neuse	Fhb_6A Neuse	Fhb_2B Bess	Fhb_3B Bess
MI20R0009	10	no	no	no	no	no	YES	YES	no	YES	YES	YES
IL16-22039	9	YES	YES	no	no	no	HET	no	YES	YES	no	no
IL16-36206	9	YES	no	no	no	no	YES	YES	YES	no	no	HET
NE14494	8	no	no	no	no	no	no	YES	YES	YES	YES	no
OH15-131-31	8	YES	no	no	no	YES	no	no	YES	YES	no	no
NYDD1543-06R-1652	8	YES	YES	no	no	no	no	no	YES	YES	no	no
ERNIE	8	no	HET	no	no	HET	HET	YES	HET	YES	no	no
P2112	8	HET	YES	no	no	no	HET	YES	no	YES	no	no
IL16-23941	8	no	YES	no	no	no	YES	YES	YES	?	no	no
IL16-23972	8	YES	YES	no	no	no	YES	no	YES	no	no	no
MI20R0146	7	no	no	no	no	HET	HET	YES	no	YES	no	HET
NE17441	6	no	no	no	no	no	no	YES	HET	YES	HET	no
LES19-7525	6	no	no	no	no	YES	YES	no	YES	no	no	no
LES19-7798	6	no	no	no	no	YES	YES	YES	no	no	no	no
TRUMAN	5	no	no	no	no	no	HET	YES	no	no	YES	HRT
X12-156-9-19-3	5	HET	no	no	no	HET	no	HET	no	no	YES	no
NW13493	5	no	no	no	YES	no	no	HET	HET	?	HET	no
IL16-8605	5	no	no	no	no	no	YES	YES	no	no	HET	no
LES19-0635	5	no	HET	no	no	no	no	YES	no	YES	no	no
VA19W-89	5	YES	no	no	no	no	no	HET	no	YES	no	no
P2102	5	YES	no	no	no	no	no	YES	no	HET	no	no
P2113	5	YES	no	no	no	no	no	YES	no	HET	no	no
X12-3062-61-2-3	5	no	no	no	no	HET	YES	no	YES	no	no	no
15VDH-FHB-MAS31-30	5	YES	no	no	no	no	HET	no	YES	no	no	no
OH16-184-77	5	YES	no	no	no	no	no	YES	HET	no	no	no
MI19R0194	5	YES	no	no	no	no	YES	no	HET	no	no	no
P2108	5	YES	HET	no	no	no	no	YES	no	no	no	no
X12-3114-65-8-5	4	no	no	no	no	no	no	no	YES	no	YES	no
NI17410	4	no	no	no	no	no	no	?	YES	YES	no	no
P2109	4	no	no	no	no	no	no	YES	no	YES	no	no
KWS341	4	no	no	no	no	no	YES	?	HET	HET	no	no
NY99056-161	4	no	YES	no	**	no	no	no	YES	no	no	no
LES19-0634	4	no	no	no	no	HET	YES	no	HET	no	no	no
DH15SRW67-151	4	no	no	no	no	YES	no	YES	no	no	no	no
KWS340	4	no	no	no	no	YES	no	YES	no	no	no	no
LES19-7384	4	YES	YES	no	no	no	no	?	no	no	no	no
KWS361	4	no	YES	no	no	no	no	?	no	no	no	YES
NE16562	3	no	no	no	no	no	no	HET	YES	?	no	no
X12-3024-47-4-1	3	HET	no	no	no	no	no	no	YES	no	no	no
LES19-0911	3	YES	no	no	no	no	no	HET	no	no	no	no
MI20M0093	2	YES	no	no	no	no	no	no	no	?	no	no
X12-3072-55-13-5	2	no	no	no	no	no	no	no	YES	no	no	no
PIONEER2545	2	no	no	no	no	HET	no	no	HET	no	no	no
KWS365	2	no	no	no	no	no	no	YES	no	no	no	no
DH15SRW65-53	2	no	no	no	no	no	YES	no	no	no	no	no
DH16-SRW120-064	2	YES	no	no	no	no	no	no	no	no	no	no
NY11014-9-25-1319	2	YES	no	no	no	no	no	no	no	no	no	no
NY12457-1-8-18	2	YES	no	no	no	no	no	no	no	no	no	no
NY12298-1-8-17-1430	2	YES	no	no	no	no	no	no	no	no	no	no
MI20R0018	1	?	no	no	no	HET	no	no	no	no	no	no
FREEDOM	0	no	no	no	no	no	no	no	no	no	no	no
KWS356	0	no	no	no	no	no	no	no	no	no	no	no
OH16-167-76	0	no	no	no	no	no	no	no	no	no	no	no
OH16-168-48	0	no	no	no	no	no	no	no	no	no	no	no
Freq of "R" allele		0.39	0.18	0.00	0.02	0.16	0.28	0.45	0.37	0.29	0.12	0.06

Table 34. Genotype of the 2020-2021 PNUWWSN entries for FHB QTL. Entries were also genotyped for Rht, Ppd, Vrn, rust, PM, Hessian Fly, BYDV, rye translocation, and quality genes. That data is available in an excel file from sneller.5@osu.edu. Data is from the USDA Eastern Regional Small Grains Genotyping Lab, Raleigh NC.

	#R Alleles	Fhb1	Fhb_5A Ernie	Fhb_5A Ning7840	Fhb_2DL Wuhan1 /W14	Fhb_3B Massey	Fhb_1B Jamestown	Fhb_1A Neuse	Fhb_4A Neuse	Fhb_6A Neuse	Fhb_2B Bess	Fhb_3B Bess
US16-IL-062-031	10	no	no	no	no	no	YES	YES	no	YES	YES	YES
MI20R0162	8	no	no	no	no	no	YES	YES	no	?	YES	YES
TRUMAN	8	no	no	no	no	no	YES	YES	no	no	YES	YES
US16-IL-061-029	8	YES	no	no	no	no	YES	YES	no	no	no	YES
US16-IL-061-132	8	YES	no	no	no	no	YES	YES	no	no	no	YES
ERNIE	8	no	HET	no	no	HET	no	HET	HET	YES	HET	HET
IL17-8626	8	YES	no	no	no	no	YES	no	no	YES	HET	HET
P2106	8	YES	YES	no	no	no	no	YES	no	YES	no	no
MI20R0177	7	no	no	no	no	no	HET	YES	no	YES	no	YES
P2101	7	YES	HET	no	no	HET	no	HET	HET	HET	no	no
IL17-25205	6	no	no	no	no	no	no	no	YES	no	YES	YES
MI20R0148	6	no	no	no	no	no	YES	no	no	YES	ND	YES
KWS358	6	no	no	no	no	YES	no	YES	no	no	YES	no
X12-924-40-7-5	6	YES	no	no	no	no	YES	no	no	no	YES	no
P2107	6	no	YES	no	no	no	no	no	YES	YES	no	no
P2104	6	no	YES	no	no	no	no	YES	no	YES	no	no
P2111	5	?	no	no	no	no	HET	no	no	YES	HET	HET
X12-3114-65-7-1	5	no	no	no	no	no	HET	no	YES	no	YES	no
X12-052-1-18-3	4	no	no	no	no	no	no	no	YES	no	YES	no
OH17-171-57	4	no	no	no	no	no	no	YES	no	YES	no	no
OH17-94-58	4	no	HET	no	no	no	no	HET	YES	no	no	no
VA19W-24	4	no	no	no	no	no	YES	no	YES	no	no	no
KWS338	4	no	no	no	no	no	YES	YES	no	no	no	no
KWS342	4	no	no	no	no	no	YES	YES	no	no	no	no
MI20R0107	4	no	no	no	no	no	YES	YES	no	no	no	no
MI20R0111	4	no	YES	no	no	no	no	YES	no	no	no	no
16VDH-SRW03-018	4	no	no	no	no	YES	YES	no	no	no	no	no
KWS369	4	no	no	no	no	YES	YES	no	no	no	no	no
OH17-206-73	4	YES	no	YES	no	no	no	no	no	no	no	no
OH17-21-11	3	no	no	no	no	no	no	YES	HET	no	no	no
MI20R0157	2	no	no	no	no	no	no	no	no	YES	no	no
OH17-124-70	2	no	no	no	no	no	no	no	YES	no	no	no
X12-3024-47-4-5	2	no	no	no	no	no	no	no	YES	no	no	no
DH13SRW022-216	2	no	no	no	no	no	no	YES	no	no	no	no
VA19W-29	2	no	no	no	no	no	HET	HET	no	no	no	no
KWS347	2	YES	no	no	no	no	no	no	no	no	no	no
PIONEER2545	1	no	no	no	no	no	no	no	HET	no	no	no
17VDH-SRW05-170	1	no	no	no	no	no	no	no	HET	no	no	no
FREEDOM	0	no	no	no	no	no	no	no	no	no	no	no
17VDH-SRW03-143	0	no	no	no	no	no	no	no	no	no	no	no
KWS428	0	no	no	no	no	no	no	no	no	no	no	no
OH17-93-33	0	no	no	no	no	no	no	no	no	no	no	no
X12-3063-34-8-5	0	no	no	no	no	no	no	no	no	no	no	no
Freq of "R" allele		0.19	0.13	0.02	0.00	0.09	0.37	0.42	0.24	0.27	0.23	0.22

Table 35. Quality parameters for the 2020-2021 NUWWSN. Data is from the USDA Soft Wheat Quality Lab. Additional information is available in an excel file from sneller.5@osu.edu.

Entry	Test Weight (LB/BU)	NIR Kernel Protein (at 12%)	SKCS Kernel Hardness	SKCS Kernel Diameter (mm)	SKCS Kernel Weight (mg)	Adjusted Flour Yield (%)	Softness Equivalent (%)	Flour Protein (at 14%)	Lactic Acid SRC (%)	Sodium Carbonate SRC (%)
TRUMAN	59.0	9.4	10.2	2.4	31.9	66.3	58.2	7.4	108.0	69.3
ERNIE	59.5	10.7	1.9	3.1	42.4	65.7	55.1	8.3	114.4	66.1
FREEDOM	62.4	10.3	13.0	2.9	36.2	66.5	54.5	8.2	116.9	69.4
PIONEER2545	60.5	9.5	-3.5	3.0	46.4	70.1	55.8	7.7	117.7	65.1
DH15SRW65-53	61.9	10.6	20.2	2.8	38.3	66.3	51.3	8.8	106.7	65.3
15VDH-FHB-MAS31	62.1	10.8	25.5	2.8	34.4	64.2	51.1	8.7	131.6	70.4
DH15SRW67-151	59.2	10.2	10.6	2.7	34.5	66.7	55.9	7.8	121.0	65.5
DH16-SRW120-064	61.4	9.8	19.6	2.7	34.5	68.8	55.7	7.9	122.7	68.6
VA19W-89	59.5	10.1	4.6	2.8	34.7	68.4	57.6	8.0	110.3	63.7
KWS340	60.0	9.6	11.9	2.6	35.2	67.4	61.0	7.9	123.5	68.3
KWS341	60.0	9.5	14.3	2.8	36.6	69.2	57.6	7.7	111.8	67.0
KWS356	60.1	10.4	14.5	2.6	35.7	66.5	53.8	8.3	84.5	69.0
KWS361	59.2	10.2	6.9	2.6	32.5	67.2	55.5	8.2	87.8	64.6
KWS365	61.2	10.0	13.1	2.7	34.1	65.4	56.3	8.0	114.2	68.4
SHIRLEY	59.4	10.1	3.2	2.7	39.8	67.3	53.8	7.8	97.3	67.9
NY99056-161	59.9	10.5	28.0	2.6	33.2	67.1	56.8	8.3	122.3	71.9
NYDD1543-06R-16	62.8	11.5	66.7	2.8	35.6	64.9	32.3	10.3	134.5	90.7
NY11014-9-25-1319	58.5	9.0	14.6	2.7	35.2	68.2	59.9	7.4	90.3	68.0
NY12457-1-8-18	59.0	9.8	19.5	2.8	34.5	65.7	60.9	7.5	82.0	67.8
NY12298-1-8-17-14	59.8	10.6	11.1	2.8	38.0	68.0	52.0	8.4	98.8	64.0
OH15-131-31	57.3	10.0	14.6	2.8	38.6	68.4	51.7	8.1	85.0	63.2
OH16-184-77	59.7	10.1	16.0	2.9	37.8	66.3	55.5	8.0	116.5	68.7
OH16-167-76	59.4	10.9	18.7	2.9	38.6	68.5	50.3	8.9	121.2	65.8
OH16-168-48	58.9	10.9	17.0	2.9	40.0	67.8	51.5	9.2	127.4	65.0
SY-VIPER	61.4	10.4	9.4	2.9	44.2	65.4	53.9	8.3	109.2	75.0
IL16-23972	60.7	9.6	6.8	2.9	39.2	67.9	57.1	7.8	114.1	66.3
IL16-36206	61.2	9.8	14.1	2.8	39.2	66.7	56.6	8.0	108.6	67.5
IL16-8605	62.1	10.7	9.1	2.9	42.1	67.8	55.9	8.7	90.8	69.0
IL16-23941	61.6	10.1	10.6	2.8	37.4	67.6	59.7	8.3	125.3	67.6
IL16-22039	60.4	10.5	17.8	2.8	37.5	67.7	53.5	8.6	119.1	66.8
X12-3024-47-4-1	60.3	10.7	33.3	2.6	35.7	62.3	52.3	8.6	138.1	76.7
X12-156-9-19-3	61.0	10.9	23.8	2.8	43.3	63.3	47.3	9.0	123.0	74.6
X12-3072-55-13-5	60.8	10.7	32.9	2.6	36.0	62.7	51.8	8.7	141.1	78.1
X12-3062-61-2-3	61.4	10.7	26.2	2.8	35.3	66.2	52.8	8.9	103.7	72.6
X12-3114-65-8-5	60.5	9.6	11.6	2.7	40.4	66.8	58.0	7.9	103.5	73.2
PIONEER 26R59	59.9	8.9	5.6	2.7	42.0	67.9	59.5	7.0	96.3	71.5
NE16562	60.1	11.4	62.1	2.8	33.1	66.1	42.9	10.2	116.8	85.9
NW13493	60.4	10.8	60.6	2.7	33.3	64.8	40.0	9.5	137.5	87.8
NI17410	60.8	11.7	59.9	2.8	33.4	65.6	38.5	10.4	157.0	89.0
NE14494	61.1	10.4	62.8	2.9	38.1	65.7	42.5	9.2	135.6	92.2
NE17441	60.7	11.3	57.2	2.8	34.7	65.7	41.0	9.9	145.8	86.1
MI19R0194	61.6	11.7	31.9	3.0	38.6	64.6	47.3	10.1	120.6	71.1
MI20R0009	60.4	9.8	8.4	2.9	38.3	67.2	54.6	7.9	115.2	65.5
MI20R0018	60.5	10.7	3.5	2.8	38.4	68.7	54.4	8.1	121.6	70.4
MI20M0093	60.4	11.4	21.8	3.0	38.6	67.0	47.0	9.3	100.1	63.3
MI20R0146	60.6	10.0	12.2	2.8	34.7	68.5	52.7	8.2	110.5	65.2
USG 3316	59.6	9.6	2.5	2.8	38.4	70.0	61.9	7.6	111.6	67.0
LES19-0634	59.7	10.0	24.4	2.7	36.2	67.2	55.8	8.0	105.9	70.2
LES19-7384	58.4	10.0	14.6	2.8	34.1	66.4	57.4	7.9	92.8	69.3
LES19-7798	60.8	10.2	17.7	2.8	35.3	66.0	57.1	8.2	139.6	71.9
LES19-7525	62.1	11.4	17.7	2.8	36.3	66.1	55.2	9.2	142.9	67.2
LES19-0635	60.0	9.9	9.9	2.6	33.5	68.1	57.7	7.8	121.9	68.6
LES19-0911	59.4	10.5	17.7	2.6	31.8	63.9	58.0	8.1	97.3	75.7
03633A1-69-2	60.1	11.0	14.0	2.8	34.0	66.2	56.3	8.8	112.9	70.3
10442A1-19-5	60.3	11.1	25.4	2.8	34.0	65.4	49.0	9.3	121.9	66.5
10523RA1-15-2	58.7	10.4	19.0	2.9	38.0	64.1	50.0	8.6	105.6	70.7
10535A1-15-6	59.8	9.8	7.6	2.9	38.6	69.0	58.1	7.8	111.6	67.2
10538B1-4-14	58.6	10.1	8.3	2.9	38.4	65.6	57.5	7.8	121.6	69.6
Average	60.3	10.4	19.5	2.8	36.9	66.6	53.4	8.4	114.9	70.7
Standard Deviation	1.1	0.6	16.4	0.1	3.1	1.7	5.9	0.8	16.4	7.0

Table 36. Quality parameters for the 2020-2021 PNUWWSN. Data is from the USDA Soft Wheat Quality Lab. Additional analytical data is available in an excel file from sneller.5@osu.edu.

Entry	Test Weight (LB/BU)	NIR Kernel Protein (at 12%)	SKCS Kernel Hardness	SKCS Kernel Diameter (mm)	SKCS Kernel Weight (mg)	Adjusted Flour Yield (%)	Softness Equivalent (%)	Flour Protein (at 14%)	Lactic Acid SRC (%)	Sodium Carbonate SRC (%)
TRUMAN	62.2	9.9	12.6	2.9	36.1	66.3	55.4	7.8	117.3	70.8
ERNIE	61.2	10.0	18.0	2.7	33.6	68.2	55.4	8.0	122.3	66.7
FREEDOM	62.3	10.3	21.8	2.8	39.3	67.4	54.4	8.1	131.5	73.6
PIONEER2545	60.2	9.7	-2.7	3.1	46.5	70.0	55.8	7.9	117.8	64.0
DH13SRW022-216	61.7	9.9	23.4	2.7	35.9	65.8	55.6	7.6	123.5	75.0
16VDH-SRW03-018	62.8	10.1	22.5	2.8	40.1	66.2	50.7	8.1	115.7	74.0
VA19W-24	61.4	10.2	26.2	2.8	37.3	65.0	50.7	8.4	115.5	70.7
VA19W-29	61.0	10.3	13.3	2.9	40.6	67.3	56.3	8.1	125.0	69.4
17VDH-SRW03-143	62.9	10.6	16.1	3.0	44.2	68.0	52.4	8.4	127.4	68.7
17VDH-SRW05-170	60.6	10.4	13.9	2.7	35.6	66.1	56.6	8.1	116.0	65.4
KWS338	61.2	10.4	23.1	2.7	35.8	66.0	56.0	8.5	137.0	67.4
KWS342	60.5	9.5	11.2	2.8	37.7	69.1	58.4	7.7	106.0	64.7
KWS347	60.6	10.4	20.4	2.8	40.3	66.9	57.1	8.4	117.6	70.1
KWS358	59.3	9.3	6.6	2.5	30.1	67.1	62.6	7.2	100.1	70.5
KWS369	58.2	9.4	3.6	2.9	36.9	68.4	59.1	7.0	97.8	66.9
KWS428	59.4	10.2	15.1	2.7	37.5	68.0	53.7	8.1	90.1	66.2
HILLIARD	60.9	10.0	12.9	2.8	39.8	66.3	57.2	7.8	119.9	71.0
OH17-124-70	59.2	10.6	13.0	2.8	36.9	66.6	56.4	8.1	93.3	66.4
OH17-93-33	60.2	10.4	13.5	2.8	35.5	62.9	54.5	8.1	105.0	72.5
OH17-21-11	60.2	11.2	12.6	2.8	34.2	66.8	52.2	9.1	104.6	64.6
OH17-206-73	61.2	11.1	30.3	2.8	34.1	63.3	49.9	9.3	121.1	70.4
OH17-171-57	61.0	11.8	17.8	2.8	36.8	65.2	53.4	9.6	126.3	71.2
OH17-94-58	59.0	12.0	26.4	2.7	35.7	63.4	49.1	9.8	123.9	70.8
US16-IL-062-031	61.6	9.7	11.4	2.6	32.8	68.0	55.5	7.8	116.4	64.7
US16-IL-061-029	60.7	9.7	15.5	2.9	38.8	68.3	56.2	7.9	104.5	64.3
IL17-25205	60.7	10.2	7.5	2.7	35.1	66.3	54.5	8.1	125.9	66.1
IL17-8626	62.3	10.7	16.4	2.8	34.4	67.1	55.4	8.5	129.7	67.5
US16-IL-061-132	59.6	10.6	6.0	2.8	37.0	65.3	60.5	8.4	124.6	69.8
BRANSON	58.9	9.9	6.0	2.7	36.9	67.5	60.5	8.0	120.2	67.8
X12-3114-65-7-1	60.0	9.8	11.6	2.7	39.9	66.7	56.8	7.9	106.7	71.3
X12-052-1-18-3	60.0	10.0	17.3	2.8	37.2	67.4	54.0	8.3	114.1	68.8
X12-3063-34-8-5	60.7	10.0	12.4	2.9	36.3	68.6	55.5	7.8	121.5	66.4
X12-924-40-7-5	60.7	10.6	24.6	3.1	41.0	66.5	51.7	8.8	114.6	70.2
X12-3024-47-4-5	60.9	11.0	29.1	2.6	35.9	62.7	51.5	8.7	139.2	75.1
MI20R0177	61.4	10.3	27.0	2.6	31.2	65.1	51.5	8.6	103.5	69.6
MI20R0162	61.0	10.2	13.5	2.8	34.6	66.1	53.0	8.1	121.1	63.9
MI20R0111	63.5	10.7	22.9	2.9	39.3	65.6	51.3	8.5	111.7	70.5
MI20R0148	61.6	10.9	24.4	2.7	35.2	66.1	49.3	8.9	127.3	67.8
MI20R0107	63.0	11.4	22.7	2.9	42.2	64.3	50.6	9.3	123.7	74.5
MI20R0157	61.3	12.5	5.8	2.9	35.5	65.6	51.8	10.3	121.9	65.8
JAMESTOWN	62.8	10.6	17.5	2.9	34.3	66.7	52.8	8.6	121.7	71.8
0175A1-37-4-1	59.1	9.8	14.3	2.8	35.1	67.4	57.0	7.7	86.7	68.7
05251A1-1-136-9-9	61.0	10.6	16.6	2.7	34.1	66.8	57.4	8.6	121.7	72.1
053A1-2-5-3-5-4	58.3	10.5	16.8	2.6	33.7	67.0	58.6	7.9	91.7	70.2
09169A1-2-1	59.5	11.0	20.0	2.7	33.1	64.8	55.7	8.5	114.9	73.1
10523RA1-21-48	59.2	10.1	9.0	2.6	34.5	66.1	57.1	8.2	117.1	75.8
Average	60.8	10.4	16.1	2.8	36.7	66.4	54.8	8.3	116.0	69.3
Standard Deviation	1.3	0.7	7.2	0.1	3.2	1.6	3.1	0.6	12.0	3.2