Report on the 2018-2019 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 58 entries (54 lines & four checks, Table 4) from 11 programs and we obtained phenotypic data on seven FHB-related traits from 10 locations. The PNUWWSN had 46 entries (42 lines & four checks, Table 5) from 8 programs and we obtained phenotypic data from 8 locations. Cooperators collect replicated data and submit 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 created 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 %. For IND the reported 0-9 values were multiplied by 10 to provide a percentage value.

Genomic estimated breeding values for all entries in the 2019 test were generated by Dr. Brian Ward of the USDA Eastern Regional Small Grains Genotyping Laboratory at NCSU. Marker and phenotypic data from the 2014-2018 P+NUWWSN were used to build the genomic selection model (using rrBLUP) and that model was used to estimate the GEBVs for all 2019 entries.

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

RESULTS

Disease Pressure (Table 3)

- Average IND > 20% in 5 of 8 NUWWSN tests and in 5 of 6 PNUWWSN tests
- Average DON > 5 ppm in 3 of 6 NUWWSN tests and in 3 of 4 PNUWWSN tests

Trait Correlations and heritability (Tables 6, 7)

- The correlation among all FHB traits, except GHSEV, exceeded 0.61 in both tests
- GHSEV was poorly correlated to other FHB traits in the NUWWSN, but moderately correlated to FHB traits in the PNUWWSN
- There was a moderate trend for greater disease with later HD and with taller plants.
- "H" exceeded 0.63 for all traits in both tests, except for INC in the PNUWWSN (r=0.32)

Level of Resistance (Tables 10,12, Figure 1)

- ❖ There was greater resistance in the PNUWWSN than in the NUWWSN
- ❖ Relative to the checks there does not appear to be a trend for increasing resistance for INC or DON from 2013 to 2018. Analyses of BLUPs from 1998 to 2018 show that IND scores are declining while DON has stayed relatively unchanged (analyses not shown)
- In the NUWWSN, the % of lines with greater resistance than Truman was 19% for IND, 35% DON, and 13% for PC1
- In the NUWWSN, the % of lines with greater resistance than Freedom was 72% for IND, 67% DON, and 59% for PC1
- In the PNUWWSN, the % of lines with greater resistance than Truman was 0% for IND, 17% DON, and 12% for PC1
- In the PNUWWSN, the % of lines with greater resistance than Freedom was 83% for IND, 71% DON, and 88% for PC1
- No line in either test had IND or DON values greater than those of the susceptible check (Pioneer 2545)

Genomic Predictions (Tables 11, 13 and 14)

- In general, data from the 2014-2018 P+NUWWSN was able to predict the trait values of lines in the 2019 P+NUWWSN tests.
- On average, accuracy was greater for the PNUWWSN (average r=0.77) than for the NUWWSN (average r=0.62). This could be due to the presence of some hard red wheat from NE and more soft white wheat from MI and NY in the NUWWSN than in the PNUWWSN.
- Accuracy was greater using means over environments than within individual environments
- Average accuracy for INC was low within environments (<0.35) in both trails
- Accuracy was relatively low for HD and especially for HGT, likely due to less genetic variation for these traits

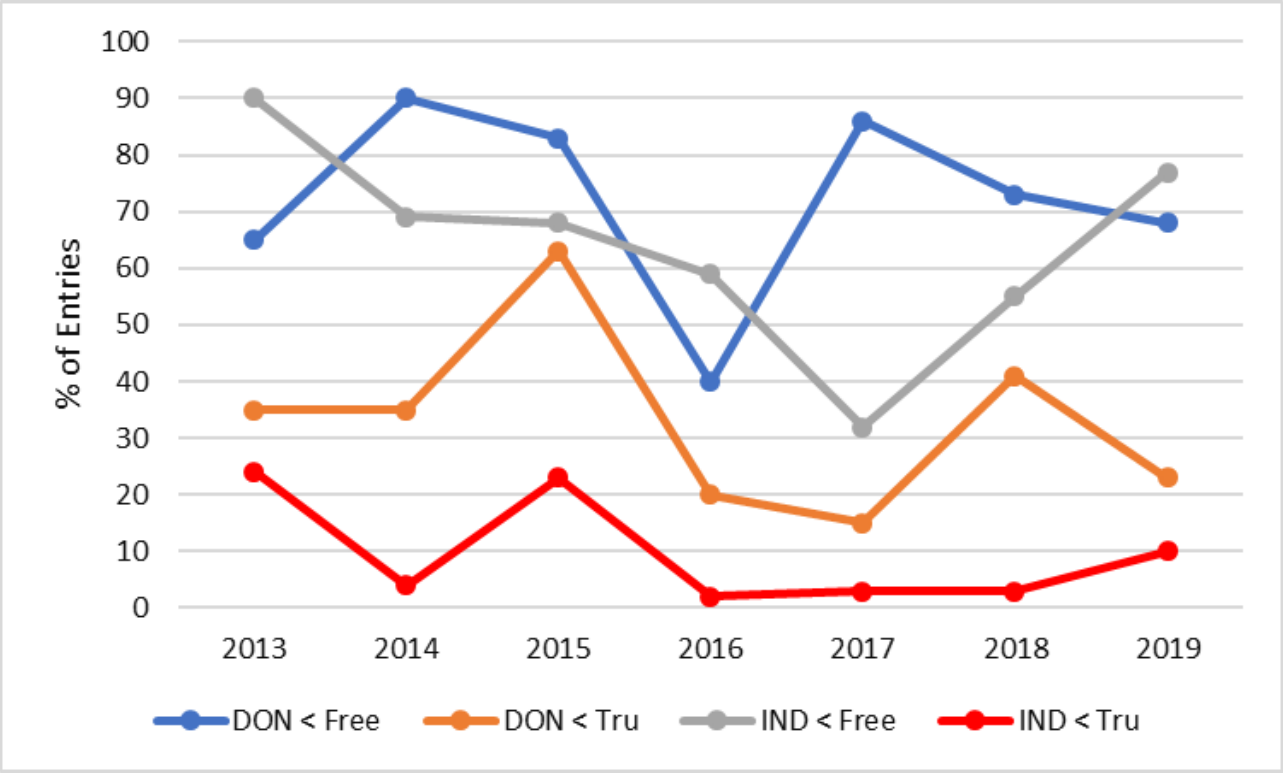

Figure 1. The percentage of P+NUWWSN breeding lines with IND or DON values that are less than that of Truman (TRU, the resistant check) or less than that of Freedom (FREE, the moderately resistant check)

Table 1. Fusarium Head Blight and other traits assessed in 2018-2019 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 = (SEVxINC)/100
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 = .3 (Severity) + .3 (Incidence)+.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 2018-2019 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
INLAY	Lafayette, IN	yes	yes	Don Obert	Limagrain	LIM
KYLEX	Lexington, KY	yes	yes	David Van Sanford	University of Kentucky	UKY
MIELA	East Lansing, MI	yes	yes	Eric Olson, Lee Siler	Michigan State University	MSU
MOCOL	Columbia, MO	yes	yes	Anne McKendry,	University of Missouri	UMO
NEMEA	Mead, NE	yes	no	Stephen Baenziger, 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
VAMTH	Mt Hope, VA	yes	yes	Carl Griffey	Virginia Tech	VAT
VAWAR	Warsaw, VA	yes	yes	Carl Griffey	Virginia Tech	VAT

†No data was collected from INWLA due to excessive waterlogging of field.

Table 3. Means for each trait and each location for the 2018-2019 P+NUWWSN.

A. NUWWSN

LOC	INC	SEV	IND	F09	FDK	ISK	DON	GHSEV	HD	HGT	LDG	YLD	TW
ILCHA	.	.	51.9	.	28.6	42.6	5.6	.	144.6	33.8	.	.	.
ILURB	64.6	42.5	29.7	.	63.5	57.4	14.9	.	141.7	.	.	.	.
INLAY	.	.	.	4.9	.	.	.	.	144.7	.	.	.	.
KYLEX	.	.	.	3.8	12.5	27.8	1.9	.	123.4	33.9	.	.	.
MIELA	69.5	44.7	32.0	.	.	.	.	.	159.4	.	.	.	.
MOCOL	99.7	47.9	47.8	5.6	.	.	.	22.4	144.6	.	.	.	.
NEMEA	22.1	31.1	7.4	.	8.9	19.7	3.4	.	.	.	.	.	.
NYITH	34.5	14.3	5.2	.	46.2	33.1	2.5	.	158.0	.	.	.	.
OHWOO	.	.	35.1	.	.	.	.	.	145.4	.	.	.	.
VAWAR	38.5	36.4	15.7	1.4	25.0	22.6	5.6	.	116.7	35.5	3.3	79.1	57.8

B. PNUWWSN

LOC	INC	SEV	IND	F09	FDK	ISK	DON	GHSEV	HD	HGT	LDG	YLD	TW
ILCHA	.	.	48.9	.	28.5	40.6	5.7	.	144.2	34.3	.	.	.
ILURB	87.4	44.7	41.8	.	75.9	70.8	18.1	.	142.8	.	.	.	.
INLAY	.	.	.	5.3	.	.	.	.	143.7	.	.	.	.
KYLEX	.	.	.	3.9	11.1	27.7	1.3	.	122.3	34.2	.	.	.
MIELA	64.1	41.0	27.6	.	.	.	.	.	159.4	.	.	.	.
MOCOL	98.9	38.0	37.7	4.5	.	.	.	24.3	145.0	.	.	.	.
OHWOO	.	.	33.6	.	.	.	.	.	145.4	.	.	.	.
VAWAR	40.8	35.9	16.3	1.5	22.3	23.1	7.0	.	116.1	35.9	3.3	81.4	57.3

Table 4. Entries in the 2018-2019 NUWWSN

ENTRY	NAME	PEDIGREE
1	TRUMAN	
2	ERNIE	
3	FREEDOM	
4	PIONEER2545	
5	12VTK17-55	Pioneer26R15/IL06-14262//Shirley
6	12VTK17-132	Pioneer26R15/IL06-14262//Shirley
7	15VDH-FHB-MAS22-14	MD08-26-H2-7-12-9[SS8641//McCormick*2/Ning7840]/Featherstone73(VA09W-73)//USG3118"S"(VA12W-54)
8	15VDH-FHB-MAS25-08	MD08-26-H2-7-12-9[SS8641//McCormick*2/Ning7840]/USG3118"S"(VA11W-278)//Hilliard(VA11W-108)
9	13VTK59-55	USG3118"S"(VA11W-278)/Featherstone73(VA09W-73)
10	OH13-314-18	BRANSON/SHIRLEY
11	OH14-222-49	VA03W-409/IL00-8061
12	OH14-112-34	02444A1-23-9/IL04-8445
13	OH13-88-61	IL03-14714/OH05-248-38
14	KWS202	Branson/SE031013-4
15	KWS207	VA08WMAS-412/10003-1
16	KWS213	Branson/IL06-14262//Shirley
17	KWS236	Featherstone73(=VA09W-73)/Hilliard(=VA11W-108)
18	KWS242	X08-39D/Featherstone73(=VA09W-73)//GA041052-11E51
19	LES177030	LCS19227/IL07-20728
20	LES170137	08364-4/P04287A1-16
21	LES172095	IL05-4236/Branson
22	LES170022	08364-4/P04287A1-16
23	LES172093	IL05-4236/Branson
24	KY06C-1178-16-10-3-34	KY93C-0004-22-1/NC03-11458//KY97C-0519-04-05
25	KY07C-1145-94-12-5	IL99-15867/B990081//KY97C-0554-04-05
26	KY09C-1245-99-12-3	LA01-425/VA06W-558
27	X11-0374-104-13-5	KY02C-3005-25//USG3350/VA04W-90
28	X11-0414-116-11-3	Pembroke2014//KY02C-3006-46/BRANSON
29	0566A1-3-1-48	INW0412/6/9017C1//92823A1/9218B4/3/P107/4/PATT/5/ACC3130/PATT/7/992060G1-1
30	0537A1-3-12-1	97397E1-11-1-1-2/3/7D(E)//INW0412/98134G4-1W
31	07469A1-6-1-1	992059A1-11/INW0315//981358C1/97462A1/5/0128A1/3/275-4//CHSPR/4/0128A
32	05247A1-7-3-98	99840C4/5/INW0315/3/INW0301MADSEN//INW0315/4/97395B1/6/99840C4//99794RA1
33	04719A1-16-1-2-27-1	99840C4-8-3-6-1/5/INW0315/3/INW0301/MADSEN//INW0315/97395B1-8-4/6/99840C4-8-6-3-
34	MO151062	B980582/Brazil8
35	MO151082	MO110799SPRS
36	MO161002	MO050600/MO080864
37	MO170924	MO131442sp
38	MO170592	MO070333/IL04-10721
39	IL14-28462	IL06-14262 / IL06-23571 // IL06-23571 / IL05-4236
40	IL14-28444	IL06-14262 / IL06-23571 // IL06-23571 / IL05-4236
41	IL14-28468	IL06-14262 / IL06-23571 // IL06-23571 / IL05-4236
42	IL14-DC-64-95-118	MO081320 / IL06-13721 // IL07-4415 / IL02-18228
43	IL14-11830	IL07-20728 / IL07-4348
44	MI16R0898	Jupiter//RedRuby/KY02C-3005-25
45	MI16R1172	Crystal//25R47/P.0537A1-7-12
46	MI16R0936	E2041//E6003/WSY
47	MI16W0258	E6032//E5024/E0009
48	MI14R0082	Crystal/KY02C-3005-25
49	NE10478-1	NI03418/Camelot
50	NE12561	NI04420/NE00403
51	NE13515	HV9W00-B267/NI04421//NI04427
52	NE14696	NE05537/Overland
53	NE16424	NI06737/HV9W03-696R-1//BC01007-7
54	NY99056-161	NY85020-395/Pio25W33 (10+6)
55	NY11014-9-60-1320	10061-4 x Ava = 03179-10/Ava-4//Ava
56	NY11025-02-23-1367	10080-1 x Pio25w36
57	NY11013-10-6-1311	10061-4 x Ava = 03179-10/Ava-4//Ava
58	NY11029-10-24-1340	OH02-12678/Truman-1//Truman

Table 5. Entries in the 2018-2019 PNUWWSN

ENTRY	NAME	PEDIGREE
1	TRUMAN	
2	ERNIE	
3	FREEDOM	
4	PIONEER2545	
5	DH11SRW066-153†	Pioneer25R32/VA08W-176(KY96C-0079-5/McCormick)
6	VA16W-105†	Pioneer25R32/VA05W-139[Pioneer26R24/McCormick(VA98W-591)]
7	VA12MAS7-519-1-3WS	Pioneer25R32/GA08279-G3-G1-G8//Featherstone73(VA09W-73)
8	VA17W-126	USG3555(VA02W-555)/VA08W-193[(AGS2000/USG3706(VA98W-706)//Dominion(VA00W-526)]//Featherstone73(VA09W-73)
9	15VDH-SRW02-075	Featherstone73(VA09W-73)/#Berkeley(VA12W-72)
10	OH15-191-52	OH05-164-76/OH07-176-46
11	OH15-42-1	OH05-164-76/OH07-176-46
12	OH15-165-51	OH08-107-4/VA05W-168(Sr24)
13	OH15-131-31	OH07-176-46*2/OH05-164-76
14	OH15-89-68	OH07-264-35//IL04-8445/99751RA1-6-3-100
15	KWS198	KY97C-0508-01-01A-1/USG3315(=VA04W-90)//MO080104
16	KWS219	P4-21/G09534
17	KWS233	LCS19229/MO080104
18	KWS235	Shirley/IL06-14262//G09534
19	KWS240	VA11W-106/GA041293-11E37
20	KWS258	KWS018/KWS019
21	X11-0414-117-12-5	Pembroke2014//KY02C-3006-46/BRANSON
22	X12-050-214-2-3	Pembroke2014//KY02C-1002-06/KY03C-1237-39
23	X12-619-205-20-3	Pembroke2016/VA05W-151//Pembroke2016
24	X12-3010-2-18-1	KY03C-1237-39/SHIRLEY
25	X12-3010-4-4-1	KY03C-1237-39/SHIRLEY
26	03549A1-18-25-4	981358C1-4-2-1-3/97462A1-21-1-5-1-15/3/92145E8-7-7-1-9/981004X48-4-5-1//INW0301
27	0570A1-2-32-5-1-4	INW0412/6/9017C1//92823A1/9218B4/3/P107/4/PATT/5/ACC3130/PATT/7/99751D8/04302A
28	05222A1-1-2-7-1	99840C4/5/99593RA1/6/97395C1/RSI5//INW0304/3/981281A1/4/981517A1/7/INW0316/8/997
29	09186A1-10-2	INW0731/8/02444A1-23-1/6/97395C1-1-4/RSI5//INW0304-1/3/981281A1-4-3-7/4/INW0315/99794RA4-14-1/5/INW0411/3/ChineseSprph1b/KS24-2-2(275-4)//ChineseSpr/4/0128A1-36/INW0411/7/02444A1-23-8/3/INW0304/INW0315//981358C1-4-2-13/97462A1-21-1-5-1-15
30	0570A1-2-39-2-4	INW0412/6/9017C1//92823A1/9218B4/3/P107/4/PATT/5/ACC3130/PATT/7/99751D8/04302A
31	0762A1-2-8	981129A1-45-3/99793RE2-3//INW0301/92145E8-7-7-3-57/3/981477A1/981312A1//INW0316
32	MO170763	MO050600/MO081293
33	MO170347	MO050600/IL04-8445
34	MO141284	MO030291/Truman
35	MO170392	MO072099/USG3555
36	MO170496	MO080128/MO081599
37	IL15-30529	IL07-4415 / IL07-2043
38	IL14-28307	IL06-14262 / IL06-23571 // IL07-20728
39	IL15-23803	IL05-4236 / IL02-18228 // IL07-16075
40	IL15-17909	Milton / IL07-12948 // IL08-8844
41	IL15-2639	LA01-425 / IL08-33373
42	MI14R1152	Shirley/RedRuby
43	MI16R0677	E5024/MO080103
44	MI16R0728	E8052/MO080373
45	MI16W0270	E8052/E0001
46	MI16W0522	E6012//E0009/E5024

Table 6. Correlation of traits in the 2018-2019 P+NUWWSN. Coefficients of |r| > 0.23 are significant at P<0.05.

A. NUWWSN

	INC	SEV	IND	FHB(0-9)	FDK	ISK	DON	GH	HD	HGT
INC		0.78	0.90	0.77	0.73	0.90	0.64	0.42	0.00	-0.17
SEV	0.78		0.93	0.83	0.72	0.87	0.62	0.42	-0.13	-0.12
IND	0.90	0.93		0.89	0.80	0.94	0.69	0.45	-0.09	-0.12
FHB(0-9)	0.77	0.83	0.89		0.73	0.84	0.63	0.33	-0.13	-0.20
FDK	0.73	0.72	0.80	0.73		0.92	0.82	0.36	0.16	-0.15
ISK	0.90	0.87	0.94	0.84	0.92		0.78	0.43	0.05	-0.16
DON	0.64	0.62	0.69	0.63	0.82	0.78		0.31	0.33	-0.03
GH	0.42	0.42	0.45	0.33	0.36	0.43	0.31		0.32	0.08
HD	0.00	-0.13	-0.09	-0.13	0.16	0.05	0.33	0.32		0.37
HGT	-0.17	-0.12	-0.12	-0.20	-0.15	-0.16	-0.03	0.08	0.37	

B. PNUWWSN

	INC	SEV	IND	FHB(0-9)	FDK	ISK	DON	GH	HD	HGT
INC		0.73	0.85	0.65	0.79	0.86	0.78	0.39	0.35	-0.17
SEV	0.73		0.93	0.78	0.77	0.86	0.69	0.61	0.21	-0.05
IND	0.85	0.93		0.79	0.87	0.96	0.79	0.56	0.31	-0.17
FHB(0-9)	0.65	0.78	0.79		0.65	0.76	0.66	0.40	0.19	-0.05
FDK	0.79	0.77	0.87	0.65		0.95	0.90	0.53	0.36	-0.29
ISK	0.86	0.86	0.96	0.76	0.95		0.85	0.54	0.34	-0.22
DON	0.78	0.69	0.79	0.66	0.90	0.85		0.35	0.31	-0.29
GH	0.39	0.61	0.56	0.40	0.53	0.54	0.35		0.17	-0.19
HD	0.35	0.21	0.31	0.19	0.36	0.34	0.31	0.17		-0.35
HGT	-0.17	-0.05	-0.17	-0.05	-0.29	-0.22	-0.29	-0.19	-0.35	

Table 7. Summary of variance components and their ratios from the 2018-2019 P+NUWWSN. Entry mean H was calculated as $V_g/(V_g+(V_{error}/e))$ where e is the number of environments.

A. NUWWSN

	Venv	Vgen	Verror	e	H
INC	811	62	145	6	0.72
SEV	148	57	151	6	0.69
IND	284	100	142	10	0.88
FHB(0-9)	3.36	0.86	1.91	4	0.64
FDK	431	136	131	6	0.86
ISK	198	99	72	6	0.89
DON	23	6.58	6.01	6	0.87
HD	196.00	3.90	3.00	9	0.92
HGT	0.89	4.35	2.27	3	0.85

B. PNUWWSN

	Venv	Vgen	Verror	e	H
INC	662	24	152	4	0.39
SEV	12	99	133	4	0.75
IND	136	107	129	8	0.87
FHB(0-9)	2.70	0.63	1.28	3	0.60
FDK	809	125	111	4	0.82
ISK	460	96	79	4	0.83
DON	51	13	15	4	0.78
HD	193.00	2.00	2.60	8	0.86
HGT	0.85	4.50	3.70	3	0.78

Table 8. Best (top) and worst (bottom) entries in the 2018-2019 NUWWSN. Summary statistics are over all entries.

		INC	SEV	IND	FHB(0-9)	FDK	ISK	DON	GHSEV	PC1		GEBV						
ENTRY	NAME	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	83%	Fhb1	INC	SEV	IND	FDK	ISK	DON	PC1 86%
43	IL14-11830	39.5 l	16.4 l	11.5 l	2.1 l	11.5 l	15.2 l	1.3 l	4.9	-4.60	**Fhb1**	-4.98	-9.33	-7.77	-7.40	-7.06	-1.95	-4.65
34	MO151062	40.0 l	20.4 l	10.2 l	1.8 l	14.0 l	16.3 l	2.3 l	14.3	-4.27	no	-3.15	-4.53	-3.97	-5.86	-4.83	-2.36	-3.20
36	MO161002	46.0 l	17.9 l	16.7 l	2.8 l	14.9 l	18.7 l	2.6 l	7.3	-3.55	no	-7.66	-6.41	-6.02	-3.33	-5.32	-1.37	-3.69
7	15VDH-FHB-MAS22-14	42.1 l	20.5 l	18.1 l	2.5 l	15.3 l	17.4 l	4.5	10.7	-3.47	**Fhb1**	1.97	0.19	1.33	1.22	1.83	0.50	0.69
48	MI14R0082	40.0 l	18.9 l	12.6 l	2.3 l	28.6	20.0 l	2.7 l	9.6	-3.41	**Fhb1**							
42	IL14-DC-64-95-118	44.8 l	28.3 l	17.1 l	2.1 l	15.9 l	21.2 l	2.8 l	6.2	-3.08	no							
35	MO151082	43.4 l	29.9 l	19.9 l	2.8 l	18.9 l	21.1 l	3.1 l	14.7	-2.69	no	-5.01	-4.47	-4.46	-4.14	-4.79	-0.89	-2.91
21	LES172095	45.6 l	27.3 l	20.6 l	3.2 l	16.8 l	21.8 l	3.4 l	14.6	-2.62	no	0.28	0.23	0.57	-1.47	0.00	-0.70	-0.37
1	TRUMAN	45.8 l	28.4 l	21.4	3.3 l	14.1 l	21.9 l	4.2	4.8	-2.53	no	-5.93	-6.04	-5.13	-4.86	-5.50	-1.30	-3.51
10	OH13-314-18	64.2	48.3 h	45.1	5.5	45.4	45.7	8.1	25.1	3.07	no							
51	NE13515	59.9	45.6 h	43.3	5.2	56.8 h	48.7	9.2	34.8	3.17	no							
15	KWS207	81.0 h	41.8	44.3	4.4	53.9 h	54.5 h	8.5	34.3	3.85	no							
50	NE12561	70.7 h	51.3 h	56.4 h	7.0 h	39.0	50.4	8.2	15.2	4.34	no	4.86	3.79	5.29	8.50	7.42	3.83	4.08
52	NE14696	73.4 h	48.3 h	52.2 h	6.0 h	48.8	52.1 h	11.7	40.1	4.65	no							
53	NE16424	74.6 h	51.6 h	53.3 h	5.9 h	56.0 h	57.4 h	9.4	12.8	5.08	no	-0.74	-0.97	-0.99	2.47	0.21	1.20	0.12
4	PIONEER2545	70.7 h	57.9 h	59.0 h	7.3 h	65.3 h	60.7 h	14.9 h	35.1	6.83	no	5.96	8.91	9.42	9.20	8.80	4.69	5.66
100	AVERAGE	54.8	36.1	31.2		30.7	33.8	5.6				-1.44	-1.86	-1.17	-0.57	-0.92	0.16	-0.78
101	MINUMUM	39.5	16.4	10.2		11.5	15.2	1.3				-7.66	-9.33	-7.77	-7.40	-7.06	-2.36	-4.65
102	MAXIMUM	81.0	57.9	59.0		65.3	60.7	14.9				5.96	8.91	9.42	9.20	8.80	4.69	5.66
103	LSD(0.05)	13.9	14.2	10.7		13.2	9.8	2.8										
	Correlation with GEBV	0.53	0.53	0.62	0.58	0.72	0.68	0.71										
	N Environments	6	6	19	4	6	6	6	1									

Table 9. Best and worst entries in the 2018-2019 PNUWWSN. Summary statistics are over all entries.

		INC	SEV	IND	FHB(0-9)	FDK	ISK	DON	GHSEV	PC1		GEBVS						
ENTRY	NAME	AVG	AVG	AVG	AVG	AVG	AVG	AVG		87%	FHB1	INC	SEV	IND	FDK	ISK	DON	PC1 91%
37	IL15-30529	51.8 l	28.3 l	21.6 l	2.8 l	14.0 l	20.4 l	2.1 l	6.4	-4.33	**Fhb1_het**	-6.20	-6.68	-5.58	-8.96	-8.19	-2.87	-4.6
38	IL14-28307	65.4 l	27.1 l	21.8 l	2.5 l	11.5 l	24.1 l	2.2 l	23.2	-3.58	no	-3.71	-3.75	-4.07	-7.69	-5.69	-2.31	-3.3
41	IL15-2639	64.6 l	24.5 l	21.4 l	2.7 l	15.4 l	25.6 l	3.1 l	10.4	-3.45	**Fhb1_het**	-2.69	-2.55	-2.58	-4.09	-3.31	-2.19	-2.3
40	IL15-17909	62.3 l	22.3 l	20.1 l	2.9 l	19.0 l	24.5 l	4.8 l	11.5	-3.40	no	-5.01	-4.06	-4.97	-5.18	-6.45	-2.31	-3.5
34	MO141284	64.6 l	23.5 l	24.8 l	3.2 l	14.8 l	22.2 l	2.6 l	7.9	-3.32	no	-5.06	-5.30	-5.45	-5.23	-5.87	-2.31	-3.6
1	TRUMAN	64.5 l	26.1 l	23.6 l	2.3 l	18.3 l	25.9 l	4.8 l	5.0	-3.15	no	-5.93	-6.04	-5.13	-4.86	-5.50	-1.30	-3.5
26	03549A1-18-25-4	63.5 l	28.8 l	24.0 l	2.7 l	21.5 l	30.3 l	4.4 l	20.5	-2.71	**Fhb1_het**	-0.14	-2.03	-1.33	0.90	-0.46	-1.14	-0.8
36	MO170496	63.0 l	29.4 l	30.3 l	4.7	19.9 l	30.1 l	3.5 l	12.5	-2.18	no	-1.95	-2.29	-1.98	-3.01	-2.17	-0.63	-1.6
39	IL15-23803	63.8 l	34.3 l	32.5	4.1	15.9 l	29.3 l	4.1 l	14.2	-2.14	no	-0.76	-1.36	-1.46	-3.99	-2.97	-1.27	-1.6
46	MI16W0522	81.9 h	54.8 h	49.7	4.7	48.6	51.7	13.7 h	38.6	3.06	no	2.30	4.46	3.47	1.46	2.92	2.36	1.8
12	OH15-165-51	78.8 h	67.6 h	57.0	5.9 h	44.0	54.7	10.0	35.7	3.63	no	0.41	2.70	2.23	1.82	1.80	-0.55	0.6
20	KWS258	87.4 h	58.5 h	57.7 h	6.0 h	47.9	54.9	18.5 h	20.9	4.47	no	4.21	6.45	5.79	4.96	6.06	5.08	3.7
45	MI16W0270	91.9 h	60.5 h	61.2 h	5.6 h	59.4 h	65.0 h	18.0 h	18.7	5.63	no	4.52	6.25	6.23	7.19	7.87	4.22	4.0
4	PIONEER2545	91.5 h	63.0 h	69.0 h	6.6 h	66.7 h	68.2 h	18.9 h	59.4	6.73	no	5.96	8.91	9.42	9.20	8.80	4.69	5.2
100	AVERAGE	72.8	39.9	37.3	3.8	34.6	40.7	8.0										
101	MINUMUM	51.8	22.3	20.1	2.1	11.5	20.4	2.1										
102	MAXIMUM	91.9	67.6	69.0	6.6	66.7	68.2	18.9										
103	LSD(0.05)	17.4	16.3	11.4	1.6	14.9	12.6	5.5										
	Correlation with GEBV	0.65	0.76	0.82	0.69	0.82	0.84	0.82										
	# of environments	4	4	8	4	4	4	4	1									

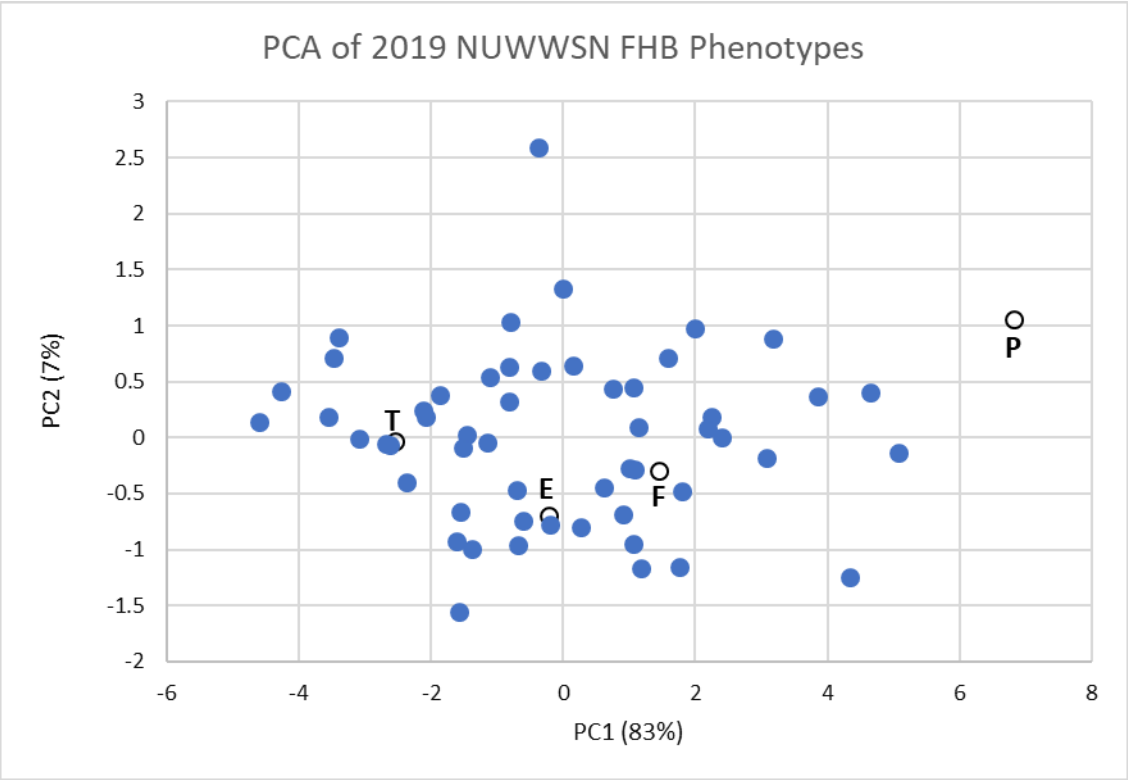

Figure 2. Graph of first two PC from the analysis of the seven FHB traits from the NUWWSN. Checks are identified: TRU-Truman (R), FRE=Freedom (MR), ERN=Ernie (MR), PIO=Pioneer 2545 (S).

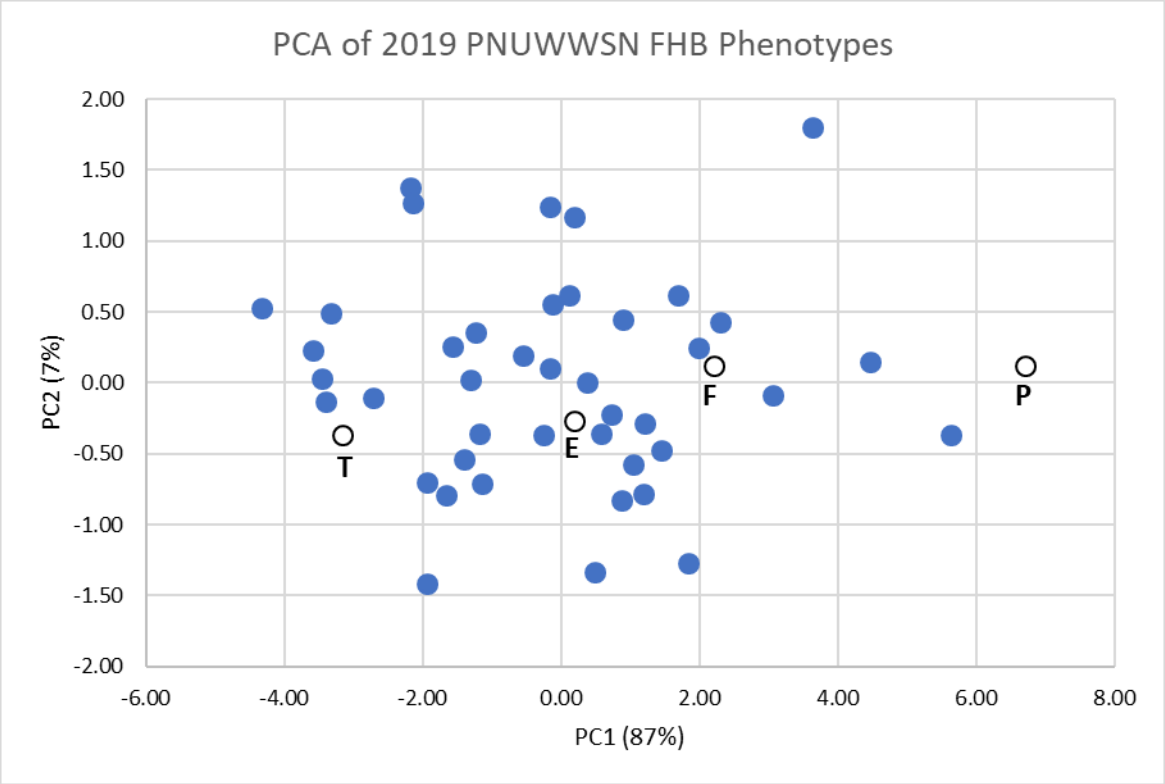

Figure 3. Graph of first two PC from the analysis of the seven FHB traits from the PNUWWSN. Checks are identified: T=Truman (R), F=Freedom (MR), E=Ernie (MR), P=Pioneer 2545 (S).

Table 10. Summary of all FHB traits from the 2018-2019 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*.

ENTRY	NAME	INC AVG	SEV AVG	IND AVG	FHB(0-9) AVG	FDK AVG	ISK AVG	DON AVG	GHSEV AVG	PC1 83%	Fhb1
1	TRUMAN	45.8 l	28.4 l	21.4	3.3 l	14.1 l	21.9 l	4.2	4.8	-2.53	no
2	ERNIE	53.7	41.8	32.8	4.0	23.4 l	32.8	4.6	13.3	-0.21	no
3	FREEDOM	66.1	38.5	36.2	5.0	36.9	36.9	6.4	42.0	1.46	no
4	PIONEER2545	70.7 h	57.9 h	59.0 h	7.3 h	65.3 h	60.7 h	14.9 h	35.1	6.83	no
5	12VTK17-55	52.2 l	33.8	26.4	3.5 l	37.1	34.5	8.4	7.1	0.00	no
6	12VTK17-132	50.7 l	30.2 l	27.4	3.4 l	27.1	31.3	6.5	38.7	-0.82	no
7	15VDH-FHB-MAS22-14	42.1 l	20.5 l	18.1 l	2.5 l	15.3 l	17.4 l	4.5	10.7	-3.47	**Fhb1**
8	15VDH-FHB-MAS25-08	47.2 l	34.8	27.4	3.7	32.6	32.6	4.9	12.2	-0.82	no
9	13VTK59-55	60.6	36.3	31.2	4.3	36.1	37.4	7.2	9.7	0.75	no
10	OH13-314-18	64.2	48.3 h	45.1	5.5	45.4	45.7	8.1	25.1	3.07	no
11	OH14-222-49	55.0	34.0	30.4	3.9	21.6 l	31.9	4.5	19.0	-0.70	no
12	OH14-112-34	46.0 l	27.5 l	21.4	3.2 l	26.0	25.9	3.4 l	21.0	-2.08	**Fhb1**
13	OH13-88-61	59.5	46.2 h	39.6	5.3	39.2	41.8	8.9	7.5	2.25	no
14	KWS202	64.4	49.0 h	40.9	4.4	30.8	39.9	5.4	56.2	1.76	no
15	KWS207	81.0 h	41.8	44.3	4.4	53.9 h	54.5 h	8.5	34.3	3.85	no
16	KWS213	59.7	31.8	29.7	4.3	19.4 l	31.4	4.1	16.0	-0.62	no
17	KWS236	62.0	38.7	38.4	4.2	34.3	37.7	4.5	18.5	0.90	no
18	KWS242	57.2	44.2 h	37.6	4.8	35.3	38.8	4.0 l	15.4	1.06	no
19	LES177030	57.6	28.9 l	27.2	3.6	16.0 l	28.6	2.5 l	7.2	-1.39	no
20	LES170137	61.0	45.1 h	38.0	4.9	28.9	37.6	4.7	57.2	1.18	no
21	LES172095	45.6 l	27.3 l	20.6 l	3.2 l	16.8 l	21.8 l	3.4 l	14.6	-2.62	no
22	LES170022	53.2 l	38.1	31.1	3.7	19.7 l	31.2	3.5 l	38.2	-0.68	no
23	LES172093	49.5 l	27.1 l	20.7 l	2.8 l	21.0 l	24.2 l	4.3	6.5	-2.12	no
24	KY06C-1178-16-10-3-34	55.8	26.9 l	23.8	3.1 l	27.4	28.8	5.7	29.9	-1.12	**Fhb1_het**
25	KY07C-1145-94-12-5	59.3	37.4	32.1	3.7	25.1	34.5	3.8 l	13.5	-0.20	no
26	KY09C-1245-99-12-3	53.5	40.6	33.0	4.5	30.1	34.8	4.0 l	20.4	0.26	no
27	X11-0374-104-13-5	47.8 l	35.7	26.0	3.7	19.9 l	26.0	3.1 l	24.8	-1.56	**Fhb1_het**
28	X11-0414-116-11-3	62.4	46.2 h	38.6	4.5	39.1	42.0	5.9	63.5	1.80	no
29	0566A1-3-1-48	58.6	44.3 h	33.3	4.1	37.1	37.0	5.8	16.4	1.08	**Fhb1_het**
30	0537A1-3-12-1	52.0 l	33.4	26.2	2.6 l	24.8	30.3	4.3	20.2	-1.15	no
31	07469A1-6-1-1	46.2 l	27.7 l	31.1	4.6	41.7	34.9	4.8	30.8	-0.33	**Fhb1_het**
32	05247A1-7-3-98	48.5 l	44.7 h	34.7	5.1	32.1	34.1	5.7	18.8	0.61	**Fhb1_het**
33	04719A1-16-1-2-27-1	57.2	39.7	35.5	4.9	49.4	42.1	8.8	15.9	1.99	no
34	MO151062	40.0 l	20.4 l	10.2 l	1.8 l	14.0 l	16.3 l	2.3 l	14.3	-4.27	no
35	MO151082	43.4 l	29.9 l	19.9 l	2.8 l	18.9 l	21.1 l	3.1 l	14.7	-2.69	no
36	MO161002	46.0 l	17.9 l	16.7 l	2.8 l	14.9 l	18.7 l	2.6 l	7.3	-3.55	no
37	MO170924	47.7 l	34.4	26.0	3.2 l	30.9	27.5	7.6	14.4	-0.80	no
38	MO170592	51.5 l	32.1	26.0	2.8 l	21.5 l	26.2	4.9	15.3	-1.46	no
39	IL14-28462	42.8 l	32.6	23.7	3.3 l	18.4 l	23.9 l	2.6 l	25.9	-2.37	no
40	IL14-28444	48.5 l	39.6	28.6	4.3	12.1 l	21.3 l	2.3 l	9.7	-1.58	no
41	IL14-28468	44.1 l	34.1	27.0	4.3	15.9 l	21.8 l	1.9 l	15.4	-1.62	no
42	IL14-DC-64-95-118	44.8 l	28.3 l	17.1 l	2.1 l	15.9 l	21.2 l	2.8 l	6.2	-3.08	no
43	IL14-11830	39.5 l	16.4 l	11.5 l	2.1 l	11.5 l	15.2 l	1.3 l	4.9	-4.60	**Fhb1**
44	MI16R0898	58.0	41.8	34.6	4.1	40.8	40.7	4.7	28.2	1.00	**Fhb1_het**
45	MI16R1172	55.8	25.4 l	26.5	3.4 l	22.8 l	27.2	3.9 l	25.4	-1.52	no
46	MI16R0936	59.1	42.6	31.6	2.9 l	43.8	43.8	6.0	21.2	1.06	**Fhb1_het**
47	MI16W0258	59.0	36.6	36.5	4.8	38.3	39.8	6.5	28.4	1.14	no
48	MI14R0082	40.0 l	18.9 l	12.6 l	2.3 l	28.6	20.0 l	2.7 l	9.6	-3.41	**Fhb1**
49	NE10478-1	61.8	41.2	43.7	5.2	47.2	46.5	6.7	18.3	2.40	no
50	NE12561	70.7 h	51.3 h	56.4 h	7.0 h	39.0	50.4	8.2	15.2	4.34	no
51	NE13515	59.9	45.6 h	43.3	5.2	56.8 h	48.7	9.2	34.8	3.17	no
52	NE14696	73.4 h	48.3 h	52.2 h	6.0 h	48.8	52.1 h	11.7	40.1	4.65	no
53	NE16424	74.6 h	51.6 h	53.3 h	5.9 h	56.0 h	57.4 h	9.4	12.8	5.08	no
54	NY99056-161	46.2 l	29.7 l	25.4	3.0 l	34.5	30.8	12.0	22.4	-0.38	no
55	NY11014-9-60-1320	60.6	43.0	33.8	3.6	34.6	42.3	9.6	28.1	1.59	**Fhb1_het**
56	NY11025-02-23-1367	64.3	41.4	45.8	4.8	35.2	41.8	8.9	40.6	2.19	**Fhb1_het**
57	NY11013-10-6-1311	53.3 l	35.2	30.2	3.7	35.9	36.6	6.7	53.7	0.15	no
58	NY11029-10-24-1340	47.8 l	32.1	19.5 l	2.5 l	21.7 l	27.6	4.9	27.7	-1.87	no
100	AVERAGE	54.8	36.1	31.2		30.7	33.8	5.6			
101	MINUMUM	39.5	16.4	10.2		11.5	15.2	1.3			
102	MAXIMUM	81.0	57.9	59.0		65.3	60.7	14.9			
103	LSD(0.05)	13.9	14.2	10.7		13.2	9.8	2.8			
	Correlation with GEBV	0.53	0.53	0.62	0.58	0.72	0.68	0.71			
	N Environments	6	6	19	4	6	6	6	1		

Table 11. Genomic estimated breeding values (GEBV) of lines in the 2018-2019 NUWWSN. Phenotypic and genotypic data from 2014 through 2018 was used to train the model that was then used to predict the values of the 2019 entries

	NAME	INC	SEV	IND	FDK	ISK	DON	HD	HGT
1	TRUMAN	-5.9	-6.0	-5.1	-4.9	-5.5	-1.3	1.5	2.1
2	ERNIE	0.5	0.0	-0.1	0.1	0.5	0.2	-0.6	0.3
3	FREEDOM	4.4	0.7	1.9	7.5	5.3	1.3	0.8	0.3
4	PIONEER2545	6.0	8.9	9.4	9.2	8.8	4.7	0.2	-0.2
5	12VTK17-55	6.6	3.5	3.5	2.4	3.0	0.6	-1.3	-2.4
6	12VTK17-132	5.9	5.7	4.3	1.4	2.7	0.4	-0.6	-1.9
7	15VDH-FHB-MAS22-14	2.0	0.2	1.3	1.2	1.8	0.5	1.3	-1.7
8	15VDH-FHB-MAS25-08	1.5	1.5	0.5	1.4	1.2	0.5	-0.5	-0.7
9	13VTK59-55	3.1	4.5	4.1	2.3	3.5	0.8	-0.2	-0.9
10									
11	OH14-222-49	2.3	3.4	3.1	-1.0	0.7	-0.4	0.0	-0.4
12									
13	OH13-88-61	3.4	6.9	6.2	4.4	5.1	1.2	-2.7	-1.6
14									
15									
16	KWS213	4.6	3.8	4.1	3.7	4.4	-0.1	-1.1	-3.1
17	KWS236	4.1	3.4	2.6	3.8	4.1	1.0	-1.1	-0.8
18									
19	LES177030	0.3	-0.1	1.0	-2.7	0.1	-1.4	-1.7	-1.8
20	LES170137	0.7	-1.1	-0.5	1.0	0.0	-0.4	-0.2	-0.2
21	LES172095	0.3	0.2	0.6	-1.5	0.0	-0.7	0.1	0.2
22	LES170022	-1.4	-1.7	-1.8	-2.4	-2.5	-1.2	0.1	-0.1
23									
24	KY06C-1178-16-10-3-34	-1.4	-4.9	-3.7	0.7	-2.1	-0.6	0.2	-0.5
25									
26	KY09C-1245-99-12-3	0.7	0.8	0.9	0.7	1.9	0.2	-1.3	-0.3
27	X11-0374-104-13-5	0.0	-1.0	-2.1	-1.4	-2.4	-0.8	-1.0	-1.6
28	X11-0414-116-11-3	0.7	-1.5	-1.0	-2.0	-2.0	-1.0	0.4	-0.4
29	0566A1-3-1-48	1.2	-2.4	-0.9	2.6	0.8	-1.2	-0.8	-2.3
30	0537A1-3-12-1	4.2	2.2	2.0	2.3	3.2	1.1	0.2	-0.8
31	07469A1-6-1-1	-1.2	-6.5	-4.1	-1.5	-3.3	-1.5	-1.1	-2.1
32	05247A1-7-3-98	-0.6	-3.0	-1.9	0.3	-0.8	-1.0	-0.6	-2.5
33	04719A1-16-1-2-27-1	-1.0	-5.2	-4.0	2.2	-1.0	0.1	-0.8	-1.5
34	MO151062	-3.1	-4.5	-4.0	-5.9	-4.8	-2.4	-0.9	-0.4
35	MO151082	-5.0	-4.5	-4.5	-4.1	-4.8	-0.9	0.8	1.5
36	MO161002	-7.7	-6.4	-6.0	-3.3	-5.3	-1.4	-0.3	0.4
37	MO170924	-1.6	-2.1	-1.1	-3.0	-2.3	-1.0	0.0	1.2
38	MO170592	-7.1	-7.0	-6.3	-6.1	-7.8	-2.8	-0.8	-0.2
39									
40	IL14-28444	-0.6	0.0	0.5	-2.5	-0.8	-0.9	-2.3	-1.7
41	IL14-28468	-1.0	-0.5	-0.2	-4.8	-2.4	-1.5	-1.9	-2.2
42									
43	IL14-11830	-5.0	-9.3	-7.8	-7.4	-7.1	-1.9	-1.0	-1.7
44	MI16R0898	3.3	4.7	5.1	4.5	6.2	1.5	0.8	1.0
45	MI16R1172	-0.4	-0.8	-1.1	1.3	0.6	-0.7	-1.3	-2.0
46	MI16R0936	-1.0	-0.3	0.1	2.0	0.7	-1.4	-0.4	-0.3
47	MI16W0258	1.7	4.8	4.3	3.9	3.6	2.9	0.8	0.5
48									
49	NE10478-1	1.0	2.5	2.6	5.6	4.4	1.5	1.0	0.3
50	NE12561	4.9	3.8	5.3	8.5	7.4	3.8	0.9	1.4
51									
52									
53	NE16424	-0.7	-1.0	-1.0	2.5	0.2	1.2	0.3	0.8
54									
55	NY11014-9-60-1320	-0.1	3.0	1.7	3.3	3.2	1.5	2.8	2.0
56	NY11025-02-23-1367	2.4	2.1	3.2	4.0	4.8	1.8	1.5	0.1
57	NY11013-10-6-1311	-4.3	2.3	-1.3	6.3	1.6	-0.1	2.8	2.4
58	NY11029-10-24-1340	-4.2	-4.0	-3.4	-2.0	-2.9	-0.6	1.8	1.8

Table 12. Summary of all FHB traits from the 2018-2019 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*.

ENTRY	NAME	INC AVG	SEV AVG	IND AVG	FHB(0-9) AVG	FDK AVG	ISK AVG	DON AVG	GHSEV	PC1 87%	FHB1
1	TRUMAN	64.5 l	26.1 l	23.6 l	2.3 l	18.3 l	25.9 l	4.8 l	5.0	-3.15	no
2	ERNIE	75.0 h	45.4	37.5	3.0 l	35.4	44.1	6.8 l	18.0	0.20	no
3	FREEDOM	85.2 h	46.5	46.2	4.8	42.7	50.3	9.8	27.9	2.23	no
4	PIONEER2545	91.5 h	63.0 h	69.0 h	6.6 h	66.7 h	68.2 h	18.9 h	59.4	6.73	no
5	DH11SRW066-153†	77.2 h	54.4 h	47.1	4.1	43.6	50.7	9.2	62.1	1.98	no
6	VA16W-105†	74.1	51.2	41.6	3.9	38.9	45.8	6.9 l	85.1	0.89	**Fhb1**
7	VA12MAS7-519-1-3WS	79.9 h	45.2	41.6	3.5 l	45.4	47.4	15.1 h	20.6	1.84	no
8	VA17W-126	69.0 l	46.6	39.7	3.9	34.8	40.9	6.7 l	31.7	0.12	no
9	15VDH-SRW02-075	65.9 l	42.8	44.8	4.2	48.5	49.5	13.7 h	37.4	1.44	no
10	OH15-191-52	71.7	44.5	37.4	3.7 l	31.5	39.9	5.6 l	27.2	-0.12	**Fhb1**
11	OH15-42-1	74.8 h	41.8	38.7	3.6 l	41.0	43.9	8.7	53.4	0.58	**Fhb1**
12	OH15-165-51	78.8 h	67.6 h	57.0	5.9 h	44.0	54.7	10.0	35.7	3.63	no
13	OH15-131-31	70.4	45.4	39.2	4.6	33.2	41.9	5.1 l	15.1	0.19	**Fhb1**
14	OH15-89-68	76.8 h	47.3	48.0	5.0 h	40.2	46.2	9.9	22.2	1.69	no
15	KWS198	81.0 h	39.2	41.2	3.8	35.4	45.5	7.7	5.7	0.73	no
16	KWS219	67.1 l	26.6 l	32.5	4.0	26.0 l	35.4	6.3 l	10.6	-1.58	no
17	KWS233	74.8 h	34.9 l	32.4	3.2 l	24.0 l	31.6 l	5.5 l	21.0	-1.31	no
18	KWS235	73.0	34.3 l	34.6	3.6 l	20.6 l	35.0	5.9 l	17.6	-1.24	no
19	KWS240	80.5 h	54.0 h	48.6	4.4	46.5	52.4	7.8	48.2	2.30	no
20	KWS258	87.4 h	58.5 h	57.7 h	6.0 h	47.9	54.9	18.5 h	20.9	4.47	no
21	X11-0414-117-12-5	70.3	36.9 l	38.0	3.8	36.9	43.1	6.2 l	25.0	-0.16	no
22	X12-050-214-2-3	77.8 h	47.2	44.8	4.0	38.1	46.5	10.0	22.5	1.21	**Fhb1_het**
23	X12-619-205-20-3	72.5	25.9 l	30.7 l	3.2 l	29.3	35.7	5.5 l	10.6	-1.66	**Fhb1_het**
24	X12-3010-2-18-1	75.4 h	46.7	41.1	3.5 l	44.8	43.9	10.0	24.0	0.88	no
25	X12-3010-4-4-1	76.5 h	36.5 l	44.5	3.7 l	44.2	52.0	10.0	15.5	1.19	no
26	03549A1-18-25-4	63.5 l	28.8 l	24.0 l	2.7 l	21.5 l	30.3 l	4.4 l	20.5	-2.71	**Fhb1_het**
27	0570A1-2-32-5-1-4	67.5 l	33.6 l	27.0 l	3.0 l	38.8	36.6	7.4 l	28.4	-1.14	no
28	05222A1-1-2-7-1	72.4	33.7 l	32.9	3.6 l	48.3	43.1	12.8	17.1	0.49	**Fhb1_het**
29	09186A1-10-2	73.3	29.1 l	26.1 l	2.6 l	23.5 l	29.6 l	6.9 l	13.8	-1.94	no
30	0570A1-2-39-2-4	75.6 h	35.5 l	36.9	4.3	39.4	44.7	7.4 l	28.6	0.37	**Fhb1_het**
31	0762A1-2-8	66.3 l	25.0 l	22.7 l	2.1 l	37.3	33.7	7.1 l	16.0	-1.93	**Fhb1**
32	MO170763	72.9	41.9	33.7	3.4 l	33.0	38.5	5.1 l	18.3	-0.55	no
33	MO170347	74.0	28.4 l	29.8 l	3.2 l	32.1	33.3	5.8 l	16.4	-1.40	no
34	MO141284	64.6 l	23.5 l	24.8 l	3.2 l	14.8 l	22.2 l	2.6 l	7.9	-3.32	no
35	MO170392	65.4 l	51.7 h	37.0	4.4	32.7	36.8	6.8 l	24.2	-0.17	no
36	MO170496	63.0 l	29.4 l	30.3 l	4.7	19.9 l	30.1 l	3.5 l	12.5	-2.18	no
37	IL15-30529	51.8 l	28.3 l	21.6 l	2.8 l	14.0 l	20.4 l	2.1 l	6.4	-4.33	**Fhb1_het**
38	IL14-28307	65.4 l	27.1 l	21.8 l	2.5 l	11.5 l	24.1 l	2.2 l	23.2	-3.58	no
39	IL15-23803	63.8 l	34.3 l	32.5	4.1	15.9 l	29.3 l	4.1 l	14.2	-2.14	no
40	IL15-17909	62.3 l	22.3 l	20.1 l	2.9 l	19.0 l	24.5 l	4.8 l	11.5	-3.40	no
41	IL15-2639	64.6 l	24.5 l	21.4 l	2.7 l	15.4 l	25.6 l	3.1 l	10.4	-3.45	**Fhb1_het**
42	MI14R1152	73.4	41.4	41.1	3.7 l	44.2	49.2	10.7	27.0	1.04	no
43	MI16R0677	71.6	37.4 l	33.3	3.6 l	35.9	38.2	9.5	20.3	-0.25	no
44	MI16R0728	72.5	36.6 l	29.5 l	2.6 l	28.9	37.8	5.1 l	21.8	-1.18	**Fhb1_het**
45	MI16W0270	91.9 h	60.5 h	61.2 h	5.6 h	59.4 h	65.0 h	18.0 h	18.7	5.63	no
46	MI16W0522	81.9 h	54.8 h	49.7	4.7	48.6	51.7	13.7 h	38.6	3.06	no
100	AVERAGE	72.8	39.9	37.3	3.8	34.6	40.7	8.0			
101	MINUMUM	51.8	22.3	20.1	2.1	11.5	20.4	2.1			
102	MAXIMUM	91.9	67.6	69.0	6.6	66.7	68.2	18.9			
103	LSD(0.05)	17.4	16.3	11.4	1.6	14.9	12.6	5.5			
	Correlation with GEBV	0.65	0.76	0.82	0.69	0.82	0.84	0.82			
	# of environments	4	4	8	4	4	4	4	1		

Table 13. Genomic estimated breeding values of lines in the 2018-2019 PNUWWSN. Phenotypic data from 2014 through 2018 was used to train the model that was then used to predict the values of the 2019 entries

ENTRY	NAME	INC	SEV	IND	FDK	ISK	DON	HD	HGT
1	TRUMAN	-5.93	-6.04	-5.13	-4.86	-5.50	-1.30	1.48	2.07
2	ERNIE	0.54	0.00	-0.07	0.06	0.50	0.22	-0.62	0.34
3	FREEDOM	4.38	0.73	1.91	7.48	5.29	1.35	0.82	0.31
4	PIONEER2545	5.96	8.91	9.42	9.20	8.80	4.69	0.20	-0.21
5	DH11SRW066-153	-0.91	1.20	-0.46	-1.94	-1.99	-0.06	-1.04	-1.53
6	VA16W-105	1.27	0.71	1.19	0.72	0.85	0.61	0.28	-1.47
7	VA12MAS7-519-1-3WS	2.92	4.38	3.39	1.68	2.81	0.58	0.42	-1.10
8	VA17W-126	1.35	2.32	1.68	1.47	1.52	0.42	0.30	-0.83
9	15VDH-SRW02-075	-0.30	0.78	-0.01	0.91	0.41	0.29	-1.33	-0.91
10	OH15-191-52	0.05	3.82	3.06	3.26	3.28	0.93	1.87	-0.28
11	OH15-42-1	1.72	4.47	4.03	4.01	4.39	0.82	0.96	-0.65
12	OH15-165-51	0.41	2.70	2.23	1.82	1.80	-0.55	0.34	-0.86
13	OH15-131-31	1.03	2.43	2.24	2.64	2.75	-0.24	-0.77	-0.66
14	OH15-89-68	2.78	2.32	2.86	3.21	3.03	0.36	-1.53	-0.74
15	KWS198	-0.15	0.54	-0.96	0.59	0.53	0.09	-0.68	-1.16
16									
17	KWS233	-2.58	-2.64	-2.29	-2.62	-2.88	-2.01	-2.13	-0.81
18	KWS235	1.87	2.80	2.61	-0.94	0.88	-0.60	-0.70	-1.09
19									
20	KWS258	4.21	6.45	5.79	4.96	6.06	5.08	1.20	-0.81
21									
22	X12-050-214-2-3	0.32	1.83	0.82	2.48	2.37	-0.72	-0.91	-1.96
23									
24	X12-3010-2-18-1	7.52	3.08	3.92	3.59	4.17	0.86	0.40	-1.86
25	X12-3010-4-4-1	4.97	4.62	4.63	1.01	2.83	1.23	1.51	-0.94
26	03549A1-18-25-4	-0.14	-2.03	-1.33	0.90	-0.46	-1.14	-0.32	-0.97
27									
28	05222A1-1-2-7-1	1.28	-2.32	-1.48	3.41	1.15	0.06	-1.43	-2.54
29	09186A1-10-2	-0.89	-4.95	-3.04	-0.34	-1.91	-1.25	-0.87	-1.77
30									
31									
32	MO170763	-4.09	-3.03	-2.91	-3.52	-3.56	-0.98	-0.37	1.40
33	MO170347	-1.69	-0.11	0.03	1.10	0.13	-0.26	0.50	0.16
34	MO141284	-5.06	-5.30	-5.45	-5.23	-5.87	-2.31	-0.36	1.20
35	MO170392	4.01	2.64	2.59	0.62	1.58	0.43	-0.88	-1.14
36	MO170496	-1.95	-2.29	-1.98	-3.01	-2.17	-0.63	-0.57	-0.34
37	IL15-30529	-6.20	-6.68	-5.58	-8.96	-8.19	-2.87	-0.91	-0.56
38	IL14-28307	-3.71	-3.75	-4.07	-7.69	-5.69	-2.31	-2.70	-1.33
39	IL15-23803	-0.76	-1.36	-1.46	-3.99	-2.97	-1.27	-1.15	-0.96
40	IL15-17909	-5.01	-4.06	-4.97	-5.18	-6.45	-2.31	-0.45	-1.10
41	IL15-2639	-2.69	-2.55	-2.58	-4.09	-3.31	-2.19	-1.37	-0.92
42	MI14R1152	7.19	7.21	6.81	5.78	6.79	2.83	0.27	-1.32
43	MI16R0677	-3.79	-4.89	-5.13	-5.66	-6.58	-1.06	-0.81	-0.45
44	MI16R0728	-1.37	-0.92	-0.49	0.54	-0.30	1.53	0.40	1.15
45	MI16W0270	4.52	6.25	6.23	7.19	7.87	4.22	0.16	1.40
46	MI16W0522	2.30	4.46	3.47	1.46	2.92	2.36	0.63	0.41

Table 14. Summary of the accuracy of genomic selection (eg. correlation predicted values with observed phenotypes) in predicting means over environments and means within environments.

TEST	TRAIT	MEAN OVER ENVS	KWS ILCHA	UIL ILURB	LIM INLAY	KYLEX	MIELA	MOCOL	NEMEA	NYITH	OHWOO	VAWAR	AVG GEBV
NUWWSN	DON	0.71	0.69	0.51		0.65			0.41	0.63		0.69	0.61
PNUWWSN	DON	0.82	0.77	0.69		0.71						0.78	0.75
NUWWSN	FDK	0.72	0.62	0.66		0.57			0.46	0.58		0.67	0.61
PNUWWSN	FDK	0.82	0.70	0.75		0.67						0.68	0.73
NUWWSN	FHB(0-9)	0.58			0.49	0.44		0.28				0.50	0.46
PNUWWSN	FHB(0-9)	0.69			0.60	0.66		0.19				0.67	0.56
NUWWSN	INC	0.53		0.56			0.04	0.20	0.18	0.51		0.34	0.34
PNUWWSN	INC	0.65		0.56			0.25	-0.30				0.59	0.35
NUWWSN	IND	0.62	0.61	0.49	0.49	0.44	0.49	0.20	0.16	0.49	0.49	0.50	0.45
PNUWWSN	IND	0.82	0.71	0.69	0.60	0.66	0.65	0.18			0.75	0.67	0.64
NUWWSN	ISK	0.68	0.68	0.60		0.55			0.29	0.58		0.61	0.57
PNUWWSN	ISK	0.84	0.78	0.76		0.73						0.69	0.76
NUWWSN	SEV	0.53		0.46			0.52	0.11	0.17	0.28		0.52	0.37
PNUWWSN	SEV	0.76		0.68			0.67	0.20				0.67	0.60
	AVG	0.70	0.70	0.62	0.55	0.61	0.44	0.13	0.28	0.51	0.62	0.61	0.56
NUWWSN	HD	0.65	0.64	0.44	0.41	0.58	0.53	0.30		0.56	0.59	0.61	0.50
PNUWWSN	HD	0.42	-0.06			0.15						-0.05	0.12
NUWWSN	HGT	0.62	0.01			0.38						0.44	0.41
PNUWWSN	HGT	0.44	0.33	0.39	0.33	0.29	0.40	0.00			0.38	0.49	0.34

Table 15. Summary of incidence (INC, %) from 2018-2019 NUWWSN.

ENTRY	NAME	AVG		GEBV	UIL ILURB	MIELA	MOCOL	NEMEA	NYITH	VAWAR
1	TRUMAN	45.8	l	-5.9	32.0	80.1	100.0	15.3	15.0	32.5
2	ERNIE	53.7		0.5	72.0	72.2	100.0	19.0	33.8	25.0
3	FREEDOM	66.1		4.4	70.0	89.2	100.0	31.3	53.8	52.5
4	PIONEER2545	70.7	h	6.0	85.0	69.6	100.0	28.0	61.3	80.0
5	12VTK17-55	52.2	l	6.6	53.0	61.1	100.0	12.7	23.8	62.5
6	12VTK17-132	50.7	l	5.9	63.0	68.5	100.0	14.0	33.8	25.0
7	15VDH-FHB-MAS22-14	42.1	l	2.0	41.0	70.9	100.0	9.3	21.3	10.0
8	15VDH-FHB-MAS25-08	47.2	l	1.5	90.0	48.5	100.0	10.7	23.8	10.0
9	13VTK59-55	60.6		3.1	70.0	71.2	100.0	23.7	63.8	35.0
10	OH13-314-18	64.2			74.0	81.8	100.0	53.3	36.3	40.0
11	OH14-222-49	55.0		2.3	68.0	48.4	100.0	62.0	33.8	17.5
12	OH14-112-34	46.0	l		53.0	70.7	100.0	10.7	18.8	22.5
13	OH13-88-61	59.5		3.4	92.0	66.3	100.0	14.7	28.8	55.0
14	KWS202	64.4			93.0	81.5	100.0	30.7	33.8	47.5
15	KWS207	81.0	h		88.0	93.3	100.0	83.3	61.3	60.0
16	KWS213	59.7		4.6	77.0	76.9	100.0	18.0	48.8	37.5
17	KWS236	62.0		4.1	88.0	79.4	100.0	14.7	27.5	62.5
18	KWS242	57.2			73.0	60.2	100.0	21.3	41.3	47.5
19	LES177030	57.6		0.3	53.0	75.7	100.0	48.3	38.8	30.0
20	LES170137	61.0		0.7	80.0	65.4	100.0	24.3	53.8	42.5
21	LES172095	45.6	l	0.3	48.0	57.5	100.0	15.3	32.5	20.0
22	LES170022	53.2	l	-1.4	72.0	62.9	100.0	32.0	37.5	15.0
23	LES172093	49.5	l		50.0	61.0	100.0	23.3	30.0	32.5
24	KY06C-1178-16-10-3-34	55.8		-1.4	62.0	76.2	100.0	16.7	32.5	47.5
25	KY07C-1145-94-12-5	59.3			83.0	75.2	100.0	25.0	42.5	30.0
26	KY09C-1245-99-12-3	53.5		0.7	62.0	58.4	100.0	26.7	43.8	30.0
27	X11-0374-104-13-5	47.8	l	0.0	58.0	58.1	100.0	12.0	26.3	32.5
28	X11-0414-116-11-3	62.4		0.7	87.0	74.6	100.0	31.7	41.3	40.0
29	0566A1-3-1-48	58.6		1.2	83.0	63.5	100.0	34.0	48.8	22.5
30	0537A1-3-12-1	52.0	l	4.2	65.0	70.7	100.0	15.0	28.8	32.5
31	07469A1-6-1-1	46.2	l	-1.2	49.0	55.7	100.0	8.7	38.8	25.0
32	05247A1-7-3-98	48.5	l	-0.6	67.0	66.9	100.0	17.3	22.5	17.5
33	04719A1-16-1-2-27-1	57.2		-1.0	75.0	54.0	100.0	26.7	47.5	40.0
34	MO151062	40.0	l	-3.1	33.0	61.0	100.0	17.3	18.8	10.0
35	MO151082	43.4	l	-5.0	38.0	65.3	100.0	17.3	17.5	22.5
36	MO161002	46.0	l	-7.7	40.0	79.0	100.0	3.3	18.8	35.0
37	MO170924	47.7	l	-1.6	48.0	77.1	100.0	8.7	17.5	35.0
38	MO170592	51.5	l	-7.1	65.0	67.8	100.0	8.7	22.5	45.0
39	IL14-28462	42.8	l		53.0	59.1	100.0	8.3	26.3	10.0
40	IL14-28444	48.5	l	-0.6	52.0	72.9	100.0	7.3	33.8	25.0
41	IL14-28468	44.1	l	-1.0	65.0	55.4	100.0	4.0	22.5	17.5
42	IL14-DC-64-95-118	44.8	l		37.0	60.8	100.0	12.3	31.3	27.5
43	IL14-11830	39.5	l	-5.0	33.0	59.1	100.0	12.3	17.5	15.0
44	MI16R0898	58.0		3.3	60.0	75.2	100.0	19.0	36.3	57.5
45	MI16R1172	55.8		-0.4	57.0	86.5	100.0	21.0	35.0	35.0
46	MI16R0936	59.1		-1.0	85.0	75.8	100.0	36.0	37.5	20.0
47	MI16W0258	59.0		1.7	72.0	69.4	100.0	16.0	41.3	55.0
48	MI14R0082	40.0	l		27.0	59.9	100.0	11.7	16.3	25.0
49	NE10478-1	61.8		1.0	87.0	72.6	100.0	18.7	42.5	50.0
50	NE12561	70.7	h	4.9	95.0	77.6	100.0	12.7	48.8	90.0
51	NE13515	59.9			67.0	67.4	100.0	16.0	26.3	82.5
52	NE14696	73.4	h		90.0	81.1	100.0	32.0	47.5	90.0
53	NE16424	74.6	h	-0.7	95.0	81.3	100.0	38.7	57.5	75.0
54	NY99056-161	46.2	l		40.0	68.4	90.0	34.0	12.5	32.5
55	NY11014-9-60-1320	60.6		-0.1	63.0	60.7	100.0	48.7	46.3	45.0
56	NY11025-02-23-1367	64.3		2.4	87.0	84.6	100.0	16.7	50.0	47.5
57	NY11013-10-6-1311	53.3	l	-4.3	47.0	73.3	90.0	24.7	32.5	52.5
58	NY11029-10-24-1340	47.8	l	-4.2	32.0	76.2	100.0	7.0	18.8	52.5
100	AVERAGE	54.8			64.6	69.5	99.7	22.1	34.5	38.5
101	MINUMUM	39.5			27.0	48.4	90.0	3.3	12.5	10.0
102	MAXIMUM	81.0			95.0	93.3	100.0	83.3	63.8	90.0
103	LSD(0.05)	13.9			.	.	.	.	.	.
	Correlation with GEBV	0.53			0.56	0.04	0.20	0.18	0.51	0.34

Table 16. Summary of severity (SEV, %) data from the 2018-2019 NUWWSN

ENTRY	NAME	AVG		GEBV	UIL ILURB	MIELA	MOCOL	NEMEA	NYITH	VAWAR
1	TRUMAN	28.4	l	-6.0	24.7	40.1	14.1	49.7	8.8	32.8
2	ERNIE	41.8		0.0	60.8	58.6	28.2	42.3	18.8	41.8
3	FREEDOM	38.5		0.7	33.4	60.4	63.2	23.0	14.3	36.5
4	PIONEER2545	57.9	h	8.9	69.2	81.0	76.7	33.3	30.5	56.5
5	12VTK17-55	33.8		3.5	41.0	48.9	30.0	44.7	10.0	28.0
6	12VTK17-132	30.2	l	5.7	43.1	42.6	37.7	14.3	10.0	33.5
7	15VDH-FHB-MAS22-14	20.5	l	0.2	10.1	38.8	37.0	19.0	7.8	10.3
8	15VDH-FHB-MAS25-08	34.8		1.5	53.3	42.6	45.4	26.7	11.5	29.5
9	13VTK59-55	36.3		4.5	27.9	61.5	35.0	28.3	16.8	48.3
10	OH13-314-18	48.3	h		69.7	70.1	63.7	38.0	13.3	35.0
11	OH14-222-49	34.0		3.4	55.3	28.3	35.2	38.3	20.8	25.8
12	OH14-112-34	27.5	l		20.7	29.5	45.3	30.7	8.8	30.0
13	OH13-88-61	46.2	h	6.9	53.4	55.7	60.6	52.7	14.5	40.3
14	KWS202	49.0	h		62.2	58.2	67.3	38.3	23.0	45.0
15	KWS207	41.8			40.5	69.2	43.3	37.0	20.0	40.5
16	KWS213	31.8		3.8	28.0	27.6	55.7	34.3	11.0	34.0
17	KWS236	38.7		3.4	50.3	58.9	45.9	27.7	10.3	39.0
18	KWS242	44.2	h		60.8	50.9	62.5	44.7	13.0	33.5
19	LES177030	28.9	l	-0.1	28.9	7.0	67.7	20.0	12.8	37.0
20	LES170137	45.1	h	-1.1	52.9	51.0	72.0	35.7	17.8	41.0
21	LES172095	27.3	l	0.2	21.4	30.4	27.3	42.3	12.3	30.0
22	LES170022	38.1		-1.7	50.1	41.4	58.7	23.3	23.3	32.0
23	LES172093	27.1	l		26.9	34.6	38.1	30.0	7.3	25.8
24	KY06C-1178-16-10-3-34	26.9	l	-4.9	30.5	31.5	39.8	14.7	10.5	34.5
25	KY07C-1145-94-12-5	37.4			26.9	45.9	31.4	51.7	16.8	51.8
26	KY09C-1245-99-12-3	40.6		0.8	53.5	40.0	74.2	22.0	14.8	39.0
27	X11-0374-104-13-5	35.7		-1.0	25.3	53.2	45.0	42.3	12.3	36.3
28	X11-0414-116-11-3	46.2	h	-1.5	67.8	56.5	54.1	39.3	15.8	44.0
29	0566A1-3-1-48	44.3	h	-2.4	33.5	47.6	95.1	43.0	13.5	32.8
30	0537A1-3-12-1	33.4		2.2	33.5	44.5	46.1	19.7	10.0	46.3
31	07469A1-6-1-1	27.7	l	-6.5	22.2	32.9	64.4	16.3	14.0	16.5
32	05247A1-7-3-98	44.7	h	-3.0	49.1	42.6	83.4	33.3	20.3	39.3
33	04719A1-16-1-2-27-1	39.7		-5.2	41.8	39.5	83.0	29.0	17.5	27.3
34	MO151062	20.4	l	-4.5	28.9	3.0	30.1	37.7	8.5	14.5
35	MO151082	29.9	l	-4.5	35.2	36.8	33.5	39.3	10.3	24.5
36	MO161002	17.9	l	-6.4	23.2	10.9	26.9	15.7	9.8	21.0
37	MO170924	34.4		-2.1	36.5	57.8	33.3	30.3	23.0	25.3
38	MO170592	32.1		-7.0	39.3	58.9	39.5	20.0	6.3	28.5
39	IL14-28462	32.6			27.1	40.4	45.6	25.3	14.8	42.3
40	IL14-28444	39.6		0.0	32.3	31.4	96.7	25.0	14.5	37.5
41	IL14-28468	34.1		-0.5	32.7	27.7	84.6	10.0	18.0	31.3
42	IL14-DC-64-95-118	28.3	l		42.6	34.7	27.1	22.0	13.0	30.3
43	IL14-11830	16.4	l	-9.3	13.9	7.0	32.7	26.0	6.3	12.5
44	MI16R0898	41.8		4.7	58.2	54.3	32.9	35.3	15.0	55.0
45	MI16R1172	25.4	l	-0.8	38.0	31.6	37.8	13.7	12.5	18.8
46	MI16R0936	42.6		-0.3	57.3	38.7	34.1	48.3	24.5	52.8
47	MI16W0258	36.6		4.8	51.5	52.2	48.6	26.7	9.8	31.0
48	MI14R0082	18.9	l		14.2	10.8	46.2	21.7	8.0	12.5
49	NE10478-1	41.2		2.5	52.0	61.3	49.3	37.3	14.0	33.0
50	NE12561	51.3	h	3.8	62.3	64.6	79.5	36.0	15.3	50.0
51	NE13515	45.6	h		62.5	52.9	40.8	37.3	13.3	66.5
52	NE14696	48.3	h		61.2	68.9	32.9	42.3	17.5	66.8
53	NE16424	51.6	h	-1.0	80.5	70.7	59.1	31.0	14.8	53.3
54	NY99056-161	29.7	l		42.2	56.7	16.5	23.3	6.0	33.3
55	NY11014-9-60-1320	43.0		3.0	53.1	54.5	44.9	32.7	16.5	56.3
56	NY11025-02-23-1367	41.4		2.1	68.7	64.8	31.9	28.3	14.8	40.0
57	NY11013-10-6-1311	35.2		2.3	40.5	55.8	22.4	23.0	18.5	50.8
58	NY11029-10-24-1340	32.1		-4.0	45.2	24.7	23.4	27.7	22.8	48.8
100	AVERAGE	36.1			42.5	44.7	47.9	31.1	14.3	36.4
101	MINUMUM	16.4			10.1	3.0	14.1	10.0	6.0	10.3
102	MAXIMUM	57.9			80.5	81.0	96.7	52.7	30.5	66.8
103	LSD(0.05)	14.2			.	.	.	.	.	.
	Correlation with GEBV	0.53			0.46	0.52	0.11	0.17	0.28	0.52

Table 17. Summary of index (IND, %) data from the 2018-2019 NUWWSN.

					KWS	UIL							FROM 0-9	
ENTRY	NAME	AVG		GEBV	ILCHA	ILURB	MIELA	MOCOL	NEMEA	NYITH	OHWOO	VAWAR	INLAY	KYLEX
1	TRUMAN	21.4		-5.1	22.5	7.7	33.9	14.1	8.0	1.3	26.1	10.7	50.0	40.0
2	ERNIE	32.8		-0.1	60.0	41.7	43.1	28.2	8.7	6.3	20.0	9.9	80.0	30.0
3	FREEDOM	36.2		1.9	42.5	23.7	51.9	63.2	7.7	7.7	45.0	20.3	50.0	50.0
4	PIONEER2545	59.0	h	9.4	90.0	59.2	58.1	76.7	8.3	18.7	72.5	46.0	90.0	70.0
5	12VTK17-55	26.4		3.5	40.0	21.5	30.0	30.0	6.0	2.4	31.1	17.6	40.0	45.0
6	12VTK17-132	27.4		4.3	52.5	29.1	29.4	37.7	2.3	3.4	31.7	8.0	40.0	40.0
7	15VDH-FHB-MAS22-14	18.1	l	1.3		3.5	27.7	37.0	2.0	1.6	20.0	1.0	30.0	20.0
8	15VDH-FHB-MAS25-08	27.4		0.5		48.4	23.1	45.4	3.0	2.7	25.6	3.0	50.0	25.0
9	13VTK59-55	31.2		4.1	43.0	19.8	42.6	35.0	5.7	10.7	33.9	16.6	60.0	45.0
10	OH13-314-18	45.1			70.0	52.2	54.0	63.7	17.0	4.8	50.6	14.0	70.0	55.0
11	OH14-222-49	30.4		3.1	55.0	37.6	12.8	35.2	20.3	7.0	32.2	4.3	70.0	30.0
12	OH14-112-34	21.4			35.0	11.0	22.0	45.3	3.3	1.6	19.4	6.8	40.0	30.0
13	OH13-88-61	39.6		6.2	65.0	49.0	37.9	60.6	7.7	4.2	29.2	22.8	80.0	40.0
14	KWS202	40.9			75.0	58.2	47.6	67.3	13.0	7.8	33.9	21.5	50.0	35.0
15	KWS207	44.3			90.0	36.2	62.5	43.3	31.0	12.2	38.3	24.1	60.0	45.0
16	KWS213	29.7		4.1	50.0	21.1	22.3	55.7	6.7	5.4	22.8	12.8	50.0	50.0
17	KWS236	38.4		2.6	60.0	44.4	47.4	45.9	4.0	2.8	60.8	23.9	60.0	35.0
18	KWS242	37.6			62.5	43.5	31.4	62.5	10.3	5.4	38.9	16.2	70.0	35.0
19	LES177030	27.2		1.0	60.0	15.5	5.3	67.7	9.3	4.9	33.9	10.8	30.0	35.0
20	LES170137	38.0		-0.5	55.0	42.3	35.7	72.0	8.7	9.5	38.9	17.7	50.0	50.0
21	LES172095	20.6	l	0.6	30.0	10.6	17.0	27.3	6.3	4.0	23.9	6.4	60.0	20.0
22	LES170022	31.1		-1.8	65.0	37.0	26.7	58.7	11.0	8.7	23.9	4.8	40.0	35.0
23	LES172093	20.7	l		32.5	13.2	21.0	38.1	7.0	2.2	29.4	8.6	30.0	25.0
24	KY06C-1178-16-10-3-34	23.8		-3.7	40.0	19.8	23.2	39.8	2.7	3.4	32.2	16.8	30.0	30.0
25	KY07C-1145-94-12-5	32.1			57.5	23.5	34.8	31.4	13.0	7.1	42.8	15.5	60.0	35.0
26	KY09C-1245-99-12-3	33.0		0.9	65.0	32.9	23.5	74.2	6.0	6.5	30.6	11.1	50.0	30.0
27	X11-0374-104-13-5	26.0		-2.1	37.5	15.5	30.6	45.0	4.7	3.2	26.7	12.0	50.0	35.0
28	X11-0414-116-11-3	38.6		-1.0	57.5	58.6	41.6	54.1	12.0	6.5	33.3	17.6	60.0	45.0
29	0566A1-3-1-48	33.3		-0.9	55.0	28.5	30.9	95.1	14.0	6.6	30.6	7.2	40.0	25.0
30	0537A1-3-12-1	26.2		2.0	60.0	22.3	31.5	46.1	2.7	2.9	41.7	14.5	10.0	30.0
31	07469A1-6-1-1	31.1		-4.1	60.0	10.8	21.2	64.4	1.3	5.4	33.9	3.8	70.0	40.0
32	05247A1-7-3-98	34.7		-1.9	57.5	35.6	28.8	83.4	6.3	4.6	18.3	7.5	70.0	35.0
33	04719A1-16-1-2-27-1	35.5		-4.0	57.5	32.9	22.7	83.0	7.7	8.3	36.7	10.9	60.0	35.0
34	MO151062	10.2	l	-4.0	10.0	9.4	0.3	30.1	6.7	1.6	12.8	1.5	10.0	20.0
35	MO151082	19.9	l	-4.5	20.0	13.2	24.1	33.5	8.3	1.8	27.8	5.4	40.0	25.0
36	MO161002	16.7	l	-6.0	15.0	9.5	9.1	26.9	0.7	1.8	21.7	7.6	40.0	35.0
37	MO170924	26.0		-1.1	22.5	18.6	42.8	33.3	3.0	4.0	47.2	9.0	40.0	40.0
38	MO170592	26.0		-6.3	32.5	26.4	37.5	39.5	2.3	1.4	47.2	12.9	20.0	40.0
39	IL14-28462	23.7			37.5	14.6	24.9	45.6	3.0	3.9	26.1	4.2		35.0
40	IL14-28444	28.6		0.5	40.0	17.5	23.3	96.7	1.3	4.9	25.6	9.9		20.0
41	IL14-28468	27.0		-0.2	37.5	20.9	14.6	84.6	0.3	4.0	28.3	5.1	60.0	15.0
42	IL14-DC-64-95-118	17.1	l		25.0	15.5	21.2	27.1	2.3	4.1	22.2	8.5	20.0	25.0
43	IL14-11830	11.5	l	-7.8	10.0	4.6	1.9	32.7	3.7	1.1	18.9	1.9	10.0	30.0
44	MI16R0898	34.6		5.1	55.0	34.9	41.9	32.9	7.3	5.4	42.2	31.8	50.0	45.0
45	MI16R1172	26.5		-1.1	47.5	20.9	27.9	37.8	3.3	4.4	26.7	6.7	60.0	30.0
46	MI16R0936	31.6		0.1	72.5	49.2	30.1	34.1	17.7	9.2	26.7	11.2	40.0	25.0
47	MI16W0258	36.5		4.3	65.0	38.0	36.4	48.6	4.3	4.0	36.7	17.3	70.0	45.0
48	MI14R0082	12.6	l		10.0	4.2	8.2	46.2	3.0	1.3	20.6	2.8	10.0	20.0
49	NE10478-1	43.7		2.6	75.0	45.3	45.5	49.3	7.3	6.0	60.8	17.3	70.0	60.0
50	NE12561	56.4	h	5.3	97.5	59.2	51.4	79.5	4.3	7.4	60.0	45.0	90.0	70.0
51	NE13515	43.3			65.0	42.0	35.3	40.8	6.7	3.5	77.8	55.2		45.0
52	NE14696	52.2	h		75.0	55.1	55.6	32.9	13.3	8.3	76.7	60.1	70.0	75.0
53	NE16424	53.3	h	-1.0	100.0	76.5	59.6	59.1	13.3	8.5	45.6	40.6	70.0	60.0
54	NY99056-161	25.4			50.0	17.3	38.0	14.8	9.0	0.8	33.3	10.7	40.0	40.0
55	NY11014-9-60-1320	33.8		1.7	75.0	32.9	32.7	44.9	18.0	7.6	42.2	25.1	10.0	50.0
56	NY11025-02-23-1367	45.8		3.2	82.5	59.5	53.0	31.9	4.0	7.4	65.0	19.2	90.0	45.0
57	NY11013-10-6-1311	30.2		-1.3	47.5	18.9	40.6	20.2	6.0	6.0	41.1	26.8	50.0	45.0
58	NY11029-10-24-1340	19.5	l	-3.4	37.0	14.1	28.5	23.4	2.0	4.3	12.2	28.0	10.0	35.0
100	AVERAGE	31.2			51.0	30.2	34.3	43.5	7.4	7.9	33.7	15.8	48.0	37.7
101	MINUMUM	10.2			3.5	4.2	0.3	1.3	0.3	0.8	1.0	1.5	10.0	15.0
102	MAXIMUM	59.0			100.0	76.5	96.7	95.1	31.0	77.8	76.7	60.1	90.0	75.0
103	LSD(0.05)	10.7			.	.	.	.	.	.	.	.	.	.
	Correlation with GEBV	0.62			0.61	0.49	0.49	0.20	0.16	0.49	0.49	0.50	0.49	0.44

Table 18. Summary of FHB score on a 0-9 scale (0=no disease, 9-severe disease) in the 2017-18 NUWWSN

ENTRY	NAME	AVG		IND GEBV	INLAY	KYLEX	MOCOL	VAWAR
1	TRUMAN	3.3	l	-5.1	5.0	4.0	3.0	1.0
2	ERNIE	4.0		-0.1	8.0	3.0	4.0	0.9
3	FREEDOM	5.0		1.9	5.0	5.0	8.0	1.8
4	PIONEER2545	7.3	h	9.4	9.0	7.0	9.0	4.2
5	12VTK17-55	3.5	l	3.5	4.0	4.5	4.0	1.6
6	12VTK17-132	3.4	l	4.3	4.0	4.0	5.0	0.7
7	15VDH-FHB-MAS22-14	2.5	l	1.3	3.0	2.0	5.0	0.1
8	15VDH-FHB-MAS25-08	3.7		0.5	5.0	2.5	7.0	0.3
9	13VTK59-55	4.3		4.1	6.0	4.5	5.0	1.5
10	OH13-314-18	5.5			7.0	5.5	8.0	1.3
11	OH14-222-49	3.9		3.1	7.0	3.0	5.0	0.4
12	OH14-112-34	3.2	l		4.0	3.0	5.0	0.6
13	OH13-88-61	5.3		6.2	8.0	4.0	7.0	2.1
14	KWS202	4.4			5.0	3.5	7.0	2.0
15	KWS207	4.4			6.0	4.5	5.0	2.2
16	KWS213	4.3		4.1	5.0	5.0	6.0	1.2
17	KWS236	4.2		2.6	6.0	3.5	5.0	2.2
18	KWS242	4.8			7.0	3.5	7.0	1.5
19	LES177030	3.6		1.0	3.0	3.5	7.0	1.0
20	LES170137	4.9		-0.5	5.0	5.0	8.0	1.6
21	LES172095	3.2	l	0.6	6.0	2.0	4.0	0.6
22	LES170022	3.7		-1.8	4.0	3.5	7.0	0.4
23	LES172093	2.8	l		3.0	2.5	5.0	0.8
24	KY06C-1178-16-10-3-34	3.1	l	-3.7	3.0	3.0	5.0	1.5
25	KY07C-1145-94-12-5	3.7			6.0	3.5	4.0	1.4
26	KY09C-1245-99-12-3	4.5		0.9	5.0	3.0	9.0	1.0
27	X11-0374-104-13-5	3.7		-2.1	5.0	3.5	5.0	1.1
28	X11-0414-116-11-3	4.5		-1.0	6.0	4.5	6.0	1.6
29	0566A1-3-1-48	4.1		-0.9	4.0	2.5	9.0	0.7
30	0537A1-3-12-1	2.6	l	2.0	1.0	3.0	5.0	1.3
31	07469A1-6-1-1	4.6		-4.1	7.0	4.0	7.0	0.3
32	05247A1-7-3-98	5.1		-1.9	7.0	3.5	9.0	0.7
33	04719A1-16-1-2-27-1	4.9		-4.0	6.0	3.5	9.0	1.0
34	MO151062	1.8	l	-4.0	1.0	2.0	4.0	0.1
35	MO151082	2.8	l	-4.5	4.0	2.5	4.0	0.5
36	MO161002	2.8	l	-6.0	4.0	3.5	3.0	0.7
37	MO170924	3.2	l	-1.1	4.0	4.0	4.0	0.8
38	MO170592	2.8	l	-6.3	2.0	4.0	4.0	1.2
39	IL14-28462	3.3	l			3.5	5.0	0.4
40	IL14-28444	4.3		0.5		2.0	9.0	0.9
41	IL14-28468	4.3		-0.2	6.0	1.5	9.0	0.5
42	IL14-DC-64-95-118	2.1	l		2.0	2.5	3.0	0.8
43	IL14-11830	2.1	l	-7.8	1.0	3.0	4.0	0.2
44	MI16R0898	4.1		5.1	5.0	4.5	4.0	2.9
45	MI16R1172	3.4	l	-1.1	6.0	3.0	4.0	0.6
46	MI16R0936	2.9	l	0.1	4.0	2.5	4.0	1.0
47	MI16W0258	4.8		4.3	7.0	4.5	6.0	1.6
48	MI14R0082	2.3	l		1.0	2.0	6.0	0.3
49	NE10478-1	5.2		2.6	7.0	6.0	6.0	1.6
50	NE12561	7.0	h	5.3	9.0	7.0	8.0	4.1
51	NE13515	5.2				4.5	5.0	5.0
52	NE14696	6.0	h		7.0	7.5	4.0	5.5
53	NE16424	5.9	h	-1.0	7.0	6.0	7.0	3.7
54	NY99056-161	3.0	l		4.0	4.0	3.0	1.0
55	NY11014-9-60-1320	3.6		1.7	1.0	5.0	6.0	2.3
56	NY11025-02-23-1367	4.8		3.2	9.0	4.5	4.0	1.7
57	NY11013-10-6-1311	3.7		-1.3	5.0	4.5	3.0	2.4
58	NY11029-10-24-1340	2.5	l	-3.4	1.0	3.5	3.0	2.5
100	AVERAGE							
101	MINUMUM							
102	MAXIMUM							
103	LSD(0.05)							
	Correlation with GEBV	0.58			0.49	0.44	0.28	0.50

Table 19. Summary of Fusarium Damaged Kernel (FDK, %) data from the 2018-2019 NUWWSN.

ENTRY	NAME	AVG		GEBV	KWS ILCHA	UIL ILURB	KYLEX	NEMEA	NYITH	VAWAR
1	TRUMAN	14.1	l	-4.9	7.5	41.7	10.0	2.0	15.0	8.5
2	ERNIE	23.4	l	0.1	20.0	43.3	7.5	6.0	45.0	18.5
3	FREEDOM	36.9		7.5	27.5	66.7	12.5	12.0	60.0	42.5
4	PIONEER2545	65.3	h	9.2	87.5	95.0	45.0	19.0	90.0	55.0
5	12VTK17-55	37.1		2.4	32.5	73.3	10.0	12.0	55.0	40.0
6	12VTK17-132	27.1		1.4	32.5	63.3	5.0	12.0	40.0	10.0
7	15VDH-FHB-MAS22-14	15.3	l	1.2		33.5	7.5	9.0	20.0	9.0
8	15VDH-FHB-MAS25-08	32.6		1.4		76.7	5.0	10.0	65.0	8.5
9	13VTK59-55	36.1		2.3	45.0	83.3	7.5	3.0	55.0	22.5
10	OH13-314-18	45.4			45.0	93.3	22.5	14.0	55.0	42.5
11	OH14-222-49	21.6	l	-1.0	10.0	45.0	7.5	12.0	35.0	20.0
12	OH14-112-34	26.0			10.0	73.5	5.0	15.0	40.0	12.5
13	OH13-88-61	39.2		4.4	22.5	93.3	22.5	12.0	55.0	30.0
14	KWS202	30.8			15.0	75.0	10.0	12.0	40.0	32.5
15	KWS207	53.9	h		52.5	95.0	32.5	21.0	90.0	32.5
16	KWS213	19.4	l	3.7	7.5	43.3	7.5	6.0	40.0	12.0
17	KWS236	34.3		3.8	25.0	85.0	20.0	7.0	45.0	24.0
18	KWS242	35.3			22.5	90.0	17.5	9.0	45.0	27.5
19	LES177030	16.0	l	-2.7	15.0	41.7	5.0	3.0	20.0	11.5
20	LES170137	28.9		1.0	30.0	63.3	5.0	6.0	40.0	29.0
21	LES172095	16.8	l	-1.5	10.0	36.7	5.0	8.0	25.0	16.0
22	LES170022	19.7	l	-2.4	10.0	43.3	5.0	6.0	40.0	14.0
23	LES172093	21.0	l		5.0	46.7	5.0	10.0	40.0	19.0
24	KY06C-1178-16-10-3-34	27.4		0.7	15.0	65.0	7.5	7.0	45.0	25.0
25	KY07C-1145-94-12-5	25.1			17.5	66.7	5.0	13.0	30.0	18.5
26	KY09C-1245-99-12-3	30.1		0.7	37.5	70.0	5.0	8.0	40.0	20.0
27	X11-0374-104-13-5	19.9	l	-1.4	7.5	41.7	7.5	5.0	35.0	22.5
28	X11-0414-116-11-3	39.1		-2.0	37.5	83.3	15.0	5.0	60.0	33.5
29	0566A1-3-1-48	37.1		2.6	20.0	93.3	20.0	8.0	60.0	21.0
30	0537A1-3-12-1	24.8		2.3	22.5	51.7	5.0	12.0	40.0	17.5
31	07469A1-6-1-1	41.7		-1.5	37.5	93.3	12.5	11.0	80.0	16.0
32	05247A1-7-3-98	32.1		0.3	25.0	75.0	7.5	6.0	60.0	19.0
33	04719A1-16-1-2-27-1	49.4		2.2	47.5	100.0	37.5	14.0	65.0	32.5
34	MO151062	14.0	l	-5.9	7.5	21.7	5.0	4.0	35.0	11.0
35	MO151082	18.9	l	-4.1	7.5	56.7	5.0	12.0	20.0	12.0
36	MO161002	14.9	l	-3.3	7.5	45.0	5.0	7.0	15.0	10.0
37	MO170924	30.9		-3.0	25.0	68.3	20.0	7.0	30.0	35.0
38	MO170592	21.5	l	-6.1	27.5	46.7	5.0	8.0	20.0	21.5
39	IL14-28462	18.4	l		10.0	25.0	5.0	9.0	45.0	16.5
40	IL14-28444	12.1	l	-2.5	5.0	13.3	5.0	6.0	30.0	13.0
41	IL14-28468	15.9	l	-4.8	7.5	26.7	5.0		50.0	12.5
42	IL14-DC-64-95-118	15.9	l		5.0	23.3	5.0	7.0	40.0	15.0
43	IL14-11830	11.5	l	-7.4	5.0	20.0	5.0	5.0	30.0	4.0
44	MI16R0898	40.8		4.5	40.0	83.3	15.0	9.0	60.0	37.5
45	MI16R1172	22.8	l	1.3	27.5	50.0	7.5	4.0	30.0	18.0
46	MI16R0936	43.8		2.0	65.0	95.0	5.0	15.0	60.0	22.5
47	MI16W0258	38.3		3.9	65.0	78.3	7.5	8.0	45.0	26.0
48	MI14R0082	28.6			20.0	56.7	12.5	4.0	60.0	18.5
49	NE10478-1	47.2		5.6	60.0	76.7	22.5	9.0	75.0	40.0
50	NE12561	39.0		8.5	47.5	81.7	20.0	7.0	40.0	37.5
51	NE13515	56.8	h		75.0	93.3	37.5	5.0	75.0	55.0
52	NE14696	48.8			50.0	85.0	32.5	8.0	45.0	72.5
53	NE16424	56.0	h	2.5	72.5	95.0	22.5	16.0	80.0	50.0
54	NY99056-161	34.5			50.0	36.7	17.5	10.0	45.0	47.5
55	NY11014-9-60-1320	34.6		3.3	40.0	66.7	7.5	6.0	55.0	32.5
56	NY11025-02-23-1367	35.2		4.0	27.5	80.0	17.5	6.0	40.0	40.0
57	NY11013-10-6-1311	35.9		6.3	25.0	80.0	25.0	13.0	50.0	22.5
58	NY11029-10-24-1340	21.7	l	-2.0	27.5	35.0	10.0	8.0	35.0	15.0
100	AVERAGE	30.7			29.5	61.8	12.7	10.8	44.4	25.8
101	MINUMUM	11.5			5.0	5.0	5.0	2.0	8.5	4.0
102	MAXIMUM	65.3			87.5	100.0	45.0	65.0	90.0	72.5
103	LSD(0.05)	13.2			.	.	.	.	.	.
	Correlation with GEBV	0.72			0.62	0.66	0.57	0.46	0.58	0.67

Table 20. Summary of INC/SEV/FDK (ISK, %) data from the 2018-2019 NUWWSN

ENTRY	NAME	AVG		GEBV	KWS ILCHA	UIL ILURB	KYLEX	NEMEA	NYITH	VAWAR
1	TRUMAN	21.9	l	-5.5	16.5	33.6	28.0	20.3	13.1	19.6
2	ERNIE	32.8		0.5	44.0	57.1	21.0	20.8	33.8	20.1
3	FREEDOM	36.9		5.3	36.5	57.7	35.0	21.1	44.4	26.9
4	PIONEER2545	60.7	h	8.8	89.0	84.3	60.0	26.0	63.5	41.2
5	12VTK17-55	34.5		3.0	37.0	57.6	31.0	22.0	32.1	27.3
6	12VTK17-132	31.3		2.7	44.5	57.3	26.0	13.3	29.1	17.6
7	15VDH-FHB-MAS22-14	17.4	l	1.8		28.6	15.0	12.1	16.7	6.1
8	15VDH-FHB-MAS25-08	32.6		1.2		73.7	17.0	15.2	36.6	11.9
9	13VTK59-55	37.4		3.5	43.8	62.7	30.0	16.8	46.2	25.1
10	OH13-314-18	45.7			60.0	79.7	42.0	33.0	36.9	22.7
11	OH14-222-49	31.9		0.7	37.0	55.1	21.0	34.9	30.4	13.1
12	OH14-112-34	25.9			25.0	51.6	20.0	18.4	24.3	15.8
13	OH13-88-61	41.8		5.1	48.0	80.9	33.0	25.0	35.0	28.7
14	KWS202	39.9			51.0	76.7	25.0	25.5	33.0	27.9
15	KWS207	54.5	h		75.0	76.7	40.0	44.5	60.4	30.3
16	KWS213	31.4		4.4	33.0	48.7	33.0	18.1	33.9	21.5
17	KWS236	37.7		4.1	46.0	75.6	29.0	15.5	29.3	30.5
18	KWS242	38.8			46.5	76.2	28.0	23.4	34.3	24.4
19	LES177030	28.6		0.1	42.0	41.3	23.0	21.7	23.5	20.1
20	LES170137	37.6		0.0	45.0	65.2	32.0	20.4	37.5	25.2
21	LES172095	21.8	l	0.0	22.0	35.6	14.0	20.5	23.4	15.1
22	LES170022	31.2		-2.5	43.0	53.9	23.0	19.0	34.2	14.2
23	LES172093	24.2	l		21.5	41.7	17.0	20.0	27.2	17.6
24	KY06C-1178-16-10-3-34	28.8		-2.1	30.0	53.7	21.0	12.2	30.9	24.7
25	KY07C-1145-94-12-5	34.5			41.5	59.7	23.0	28.2	29.8	24.6
26	KY09C-1245-99-12-3	34.8		1.9	54.0	62.5	20.0	17.8	33.6	20.8
27	X11-0374-104-13-5	26.0		-2.4	25.5	41.8	24.0	18.3	25.6	20.7
28	X11-0414-116-11-3	42.0		-2.0	49.5	79.7	33.0	23.3	41.1	25.3
29	0566A1-3-1-48	37.0		0.8	41.0	72.4	23.0	26.3	42.7	16.7
30	0537A1-3-12-1	30.3		3.2	45.0	50.2	20.0	15.2	27.6	23.7
31	07469A1-6-1-1	34.9		-3.3	51.0	57.0	29.0	11.9	47.8	12.5
32	05247A1-7-3-98	34.1		-0.8	44.5	64.7	24.0	17.6	36.8	17.1
33	04719A1-16-1-2-27-1	42.1		-1.0	53.5	75.0	36.0	22.3	45.5	20.3
34	MO151062	16.3	l	-4.8	9.0	27.3	14.0	18.1	22.2	7.4
35	MO151082	21.1	l	-4.8	15.0	42.4	17.0	21.8	16.3	14.1
36	MO161002	18.7	l	-5.3	12.0	37.0	23.0	8.5	14.6	16.8
37	MO170924	27.5		-2.3	23.5	52.8	32.0	14.5	24.2	18.2
38	MO170592	26.2		-7.8	30.5	50.0	26.0	11.8	16.6	22.1
39	IL14-28462	23.9	l		26.5	34.1	23.0	13.7	30.3	15.7
40	IL14-28444	21.3	l	-0.8	26.0	30.5	14.0	12.1	26.5	18.8
41	IL14-28468	21.8	l	-2.4	25.5	40.0	11.0		32.2	14.7
42	IL14-DC-64-95-118	21.2	l		17.0	33.1	17.0	13.1	29.3	17.4
43	IL14-11830	15.2	l	-7.1	8.0	22.2	20.0	13.5	19.1	8.3
44	MI16R0898	40.7		6.2	49.0	68.8	33.0	19.9	39.4	33.9
45	MI16R1172	27.2		0.6	39.5	48.4	21.0	12.0	26.3	16.2
46	MI16R0936	43.8		0.7	69.5	80.7	17.0	31.3	42.6	21.9
47	MI16W0258	39.8		3.6	65.0	68.3	30.0	16.0	33.3	25.9
48	MI14R0082	20.0	l		14.0	34.9	17.0	11.6	31.3	11.3
49	NE10478-1	46.5		4.4	69.0	72.3	45.0	20.4	47.0	25.1
50	NE12561	50.4		7.4	77.5	79.8	50.0	17.4	35.2	42.2
51	NE13515	48.7			69.0	76.1	42.0	18.0	41.9	44.9
52	NE14696	52.1	h		65.0	79.4	58.0	25.5	37.5	47.3
53	NE16424	57.4	h	0.2	89.0	90.7	45.0	27.3	53.7	38.7
54	NY99056-161	30.8			50.0	39.3	31.0	21.2	23.6	19.9
55	NY11014-9-60-1320	42.3		3.2	61.0	61.6	33.0	26.8	40.8	30.5
56	NY11025-02-23-1367	41.8		4.8	60.5	78.6	34.0	15.9	35.4	26.4
57	NY11013-10-6-1311	36.6		1.6	38.5	58.1	37.0	19.5	35.3	31.1
58	NY11029-10-24-1340	27.6		-2.9	33.2	37.1	25.0	13.6	26.5	30.4
100	AVERAGE	33.8			42.9	56.2	27.7	20.4	32.2	23.2
101	MINUMUM	15.2			8.0	15.0	11.0	8.5	6.1	7.4
102	MAXIMUM	60.7			89.0	90.7	60.0	44.5	63.5	47.3
103	LSD(0.05)	9.8			.	.	.	.	.	.
	Correlation with GEBV	0.68			0.68	0.60	0.55	0.29	0.58	0.61

Table 21. Summary of deoxynivalenol (DON, ppm) data from the 2018-2019 NUWWSN.

ENTRY	NAME	AVG		GEBV	ILCHA	ILURB	KYLEX	NEMEA	NYITH	VAWAR
1	TRUMAN	4.2		-1.3	2.7	14.4	1.6	2.8	1.3	2.2
2	ERNIE	4.6		0.2	4.6	14.1	1.4	1.4	2.9	3.5
3	FREEDOM	6.4		1.3	5.6	14.8	1.9	4.4	3.2	8.5
4	PIONEER2545	14.9	h	4.7	14.7	29.4	8.3	4.0	10.5	22.7
5	12VTK17-55	8.4		0.6	13.4	21.5	1.9	2.4	1.7	9.6
6	12VTK17-132	6.5		0.4	8.8	20.6	1.2	2.9	1.8	4.1
7	15VDH-FHB-MAS22-14	4.5		0.5	6.6	14.4	0.4	2.7	0.9	2.3
8	15VDH-FHB-MAS25-08	4.9		0.5	6.9	14.1	1.1	2.4	1.7	3.3
9	13VTK59-55	7.2		0.8	8.4	21.6	2.7	1.7	4.6	4.3
10	OH13-314-18	8.1			9.2	19.5	2.8	4.3	4.7	8.0
11	OH14-222-49	4.5		-0.4	4.7	13.2	1.4	2.7	2.3	2.7
12	OH14-112-34	3.4	l		1.5	10.1	0.4	4.2	1.3	2.9
13	OH13-88-61	8.9		1.2	7.8	25.5	3.3	5.2	3.7	8.0
14	KWS202	5.4			2.4	14.9	1.9	2.9	2.0	8.5
15	KWS207	8.5			7.9	20.7	3.9	5.0	5.9	7.9
16	KWS213	4.1		-0.1	2.2	13.5	1.3	1.8	1.6	4.5
17	KWS236	4.5		1.0	5.1	11.5	1.9	1.5	2.3	4.4
18	KWS242	4.0	l		3.4	10.8	1.9	2.2	1.4	4.7
19	LES177030	2.5	l	-1.4	2.1	7.0	0.9	1.8	1.6	1.9
20	LES170137	4.7		-0.4	5.3	10.8	1.4	3.9	3.1	4.1
21	LES172095	3.4	l	-0.7	2.5	10.4	0.8	2.8	0.9	3.3
22	LES170022	3.5	l	-1.2	3.4	11.4	0.5	2.2	1.2	2.5
23	LES172093	4.3			3.5	14.6	0.7	1.5	1.8	3.9
24	KY06C-1178-16-10-3-34	5.7		-0.6	4.1	19.1	2.0	2.0	2.2	4.8
25	KY07C-1145-94-12-5	3.8	l		2.3	12.5	0.4	2.9	1.7	2.7
26	KY09C-1245-99-12-3	4.0	l	0.2	2.9	10.7	1.1	2.9	2.2	4.3
27	X11-0374-104-13-5	3.1	l	-0.8	2.4	7.5	1.0	1.4	2.7	3.8
28	X11-0414-116-11-3	5.9		-1.0	6.3	14.6	1.7	2.7	3.3	7.1
29	0566A1-3-1-48	5.8		-1.2	2.0	19.7	0.7	4.0	4.9	3.5
30	0537A1-3-12-1	4.3		1.1	2.1	12.5	0.9	2.4	2.5	5.6
31	07469A1-6-1-1	4.8		-1.5	3.7	15.3	0.9	3.4	2.1	3.5
32	05247A1-7-3-98	5.7		-1.0	4.3	20.5	1.2	2.9	1.9	3.7
33	04719A1-16-1-2-27-1	8.8		0.1	6.3	30.1	4.3	4.0	3.6	4.7
34	MO151062	2.3	l	-2.4	1.0	7.5	0.2	3.4	0.5	1.1
35	MO151082	3.1	l	-0.9	2.4	9.7	0.9	2.5	1.3	2.1
36	MO161002	2.6	l	-1.4	1.9	8.8	0.8	1.6	0.9	1.9
37	MO170924	7.6		-1.0	6.6	22.2	2.6	2.4	1.7	10.3
38	MO170592	4.9		-2.8	5.6	13.3	1.2	1.8	1.3	6.0
39	IL14-28462	2.6	l		1.6	7.9	0.6	2.9	0.8	2.1
40	IL14-28444	2.3	l	-0.9	1.4	6.7	0.9	0.3	1.3	3.0
41	IL14-28468	1.9	l	-1.5	1.5	7.8	0.4		0.6	1.5
42	IL14-DC-64-95-118	2.8	l		1.7	9.2	0.8	1.3	1.3	2.7
43	IL14-11830	1.3	l	-1.9	0.5	5.7	0.2	0.4	0.2	0.6
44	MI16R0898	4.7		1.5	4.2	13.9	1.5	3.4	1.4	4.0
45	MI16R1172	3.9	l	-0.7	4.1	10.5	1.2	2.9	2.1	2.5
46	MI16R0936	6.0		-1.4	7.4	16.2	1.0	5.2	2.9	3.6
47	MI16W0258	6.5		2.9	9.4	16.2	1.7	2.2	2.9	6.6
48	MI14R0082	2.7	l		2.5	9.1	0.4	1.3	0.8	2.2
49	NE10478-1	6.7		1.5	14.3	10.4	1.9	4.0	3.6	6.2
50	NE12561	8.2		3.8	9.9	20.3	2.1	6.0	3.1	8.0
51	NE13515	9.2			13.5	21.2	3.2	4.8	4.6	8.0
52	NE14696	11.7			15.5	18.3	6.6	8.5	4.7	16.6
53	NE16424	9.4		1.2	12.8	17.9	2.6	7.7	3.8	11.7
54	NY99056-161	12.0			11.3	21.0	8.1	11.0	1.8	19.1
55	NY11014-9-60-1320	9.6		1.5	7.7	21.3	4.9	8.6	3.3	11.5
56	NY11025-02-23-1367	8.9		1.8	7.4	18.8	4.7	5.0	3.7	13.7
57	NY11013-10-6-1311	6.7		-0.1	4.8	17.0	3.3	5.0	5.0	5.4
58	NY11029-10-24-1340	4.9		-0.6	7.2	13.1	1.3	4.2	1.4	2.6
100	AVERAGE	5.6			5.6	14.9	1.9	3.3	2.5	5.7
101	MINUMUM	1.3			0.5	5.7	0.2	0.3	0.2	0.6
102	MAXIMUM	14.9			15.5	30.1	8.3	11.0	10.5	22.7
103	LSD(0.05)	2.8			.	.	.	.	.	.
	Correlation with GEBV	0.71			0.69	0.51	0.65	0.41	0.63	0.69

Table 22. Summary of greenhouse severity (GHSEV, %) data from the 2018-2019 NUWWSN.

			GEBVS					
		GHSEV	INC	SEV	IND	FDK	ISK	DON
1	TRUMAN	4.8	-5.93	-6.04	-5.13	-4.86	-5.50	-1.30
2	ERNIE	13.3	0.54	0.00	-0.07	0.06	0.50	0.22
3	FREEDOM	42.0	4.38	0.73	1.91	7.48	5.29	1.35
4	PIONEER2545	35.1	5.96	8.91	9.42	9.20	8.80	4.69
5	12VTK17-55	7.1	6.65	3.49	3.51	2.44	3.02	0.61
6	12VTK17-132	38.7	5.92	5.74	4.29	1.43	2.70	0.40
7	15VDH-FHB-MAS22-14	10.7	1.97	0.19	1.33	1.22	1.83	0.50
8	15VDH-FHB-MAS25-08	12.2	1.48	1.51	0.51	1.39	1.15	0.55
9	13VTK59-55	9.7	3.07	4.51	4.07	2.27	3.53	0.82
10	OH13-314-18	25.1						
11	OH14-222-49	19.0	2.31	3.38	3.08	-0.95	0.74	-0.41
12	OH14-112-34	21.0						
13	OH13-88-61	7.5	3.39	6.90	6.21	4.35	5.09	1.16
14	KWS202	56.2						
15	KWS207	34.3						
16	KWS213	16.0	4.63	3.84	4.13	3.67	4.38	-0.13
17	KWS236	18.5	4.07	3.36	2.63	3.77	4.05	1.01
18	KWS242	15.4						
19	LES177030	7.2	0.29	-0.11	1.01	-2.70	0.13	-1.38
20	LES170137	57.2	0.66	-1.05	-0.51	1.01	0.03	-0.41
21	LES172095	14.6	0.28	0.23	0.57	-1.47	0.00	-0.70
22	LES170022	38.2	-1.40	-1.71	-1.81	-2.37	-2.47	-1.15
23	LES172093	6.5						
24	KY06C-1178-16-10-3-34	29.9	-1.44	-4.90	-3.74	0.65	-2.08	-0.58
25	KY07C-1145-94-12-5	13.5						
26	KY09C-1245-99-12-3	20.4	0.70	0.77	0.86	0.67	1.87	0.17
27	X11-0374-104-13-5	24.8	0.02	-1.04	-2.06	-1.36	-2.36	-0.83
28	X11-0414-116-11-3	63.5	0.66	-1.46	-0.99	-2.04	-1.97	-1.00
29	0566A1-3-1-48	16.4	1.23	-2.37	-0.85	2.61	0.83	-1.24
30	0537A1-3-12-1	20.2	4.16	2.18	2.02	2.26	3.21	1.10
31	07469A1-6-1-1	30.8	-1.15	-6.49	-4.10	-1.53	-3.34	-1.53
32	05247A1-7-3-98	18.8	-0.63	-3.01	-1.90	0.30	-0.77	-1.00
33	04719A1-16-1-2-27-1	15.9	-1.02	-5.18	-4.04	2.15	-0.99	0.08
34	MO151062	14.3	-3.15	-4.53	-3.97	-5.86	-4.83	-2.36
35	MO151082	14.7	-5.01	-4.47	-4.46	-4.14	-4.79	-0.89
36	MO161002	7.3	-7.66	-6.41	-6.02	-3.33	-5.32	-1.37
37	MO170924	14.4	-1.60	-2.11	-1.11	-3.03	-2.25	-1.05
38	MO170592	15.3	-7.13	-6.97	-6.27	-6.09	-7.83	-2.79
39	IL14-28462	25.9						
40	IL14-28444	9.7	-0.58	0.04	0.50	-2.47	-0.83	-0.85
41	IL14-28468	15.4	-1.02	-0.49	-0.16	-4.85	-2.41	-1.49
42	IL14-DC-64-95-118	6.2						
43	IL14-11830	4.9	-4.98	-9.33	-7.77	-7.40	-7.06	-1.95
44	MI16R0898	28.2	3.29	4.73	5.14	4.54	6.21	1.54
45	MI16R1172	25.4	-0.43	-0.85	-1.08	1.34	0.57	-0.73
46	MI16R0936	21.2	-1.00	-0.28	0.14	1.97	0.67	-1.39
47	MI16W0258	28.4	1.69	4.80	4.30	3.94	3.61	2.94
48	MI14R0082	9.6						
49	NE10478-1	18.3	0.96	2.51	2.65	5.62	4.39	1.53
50	NE12561	15.2	4.86	3.79	5.29	8.50	7.42	3.83
51	NE13515	34.8						
52	NE14696	40.1						
53	NE16424	12.8	-0.74	-0.97	-0.99	2.47	0.21	1.20
54	NY99056-161	22.4						
55	NY11014-9-60-1320	28.1	-0.12	3.02	1.66	3.35	3.19	1.47
56	NY11025-02-23-1367	40.6	2.43	2.12	3.20	3.95	4.83	1.84
57	NY11013-10-6-1311	53.7	-4.25	2.26	-1.35	6.27	1.57	-0.07
58	NY11029-10-24-1340	27.7	-4.19	-3.95	-3.36	-2.01	-2.94	-0.56
	Correlation with GEBVs		0.14	0.17	0.12	0.31	0.19	0.16

Table 23. Summary of heading date (HD, Julian days) height (HGT, inches), and lodging (LDG) data from the 2018-2019 NUWWSN

		HEADING DATE (JULIAN DAYS)												HEIGHT (INCHES)					
ENTRY	NAME	AVG		GEBV	ILCHA	ILURB	INLAY	KYLEX	MIELA	MOCOL	NYITH	OHWOO	VAWAR	AVG			ILCHA	KYLEX	VAWAR
1	TRUMAN	146		1.48	149	145	145	129	164	147	163	149	123	37	h	2.07	35	37	39
2	ERNIE	141		-0.62	146	141	141	123	159	143	156	146	115	36		0.34	35	36	37
3	FREEDOM	143		0.82	147	142	145	125	161	147	159	147	117	36		0.31	36	37	36
4	PIONEER2545	143		0.20	146	142	147	125	158	147	157	146	117	34		-0.21	34	34	35
5	12VTK17-55	143		-1.32	145	145	146	126	160	142	159	146	118	32		-2.37	31	30	34
6	12VTK17-132	142		-0.62	147	142	145	125	159	142	158	146	116	32		-1.88	31	31	35
7	15VDH-FHB-MAS22-14	142		1.30	147	141	144	122	161	142	159	146	114	30	l	-1.74	25	31	33
8	15VDH-FHB-MAS25-08	141		-0.53	147	139	148	120	159	142	156	144	113	31	l	-0.65	28	31	33
9	13VTK59-55	143		-0.22	147	143	145	124	161	143	158	146	116	31		-0.90	27	33	32
10	OH13-314-18	142			146	142	145	124	161	142	158	146	115	32			30	34	33
11	OH14-222-49	141		0.02	145	141	145	124	158	142	155	145	117	35		-0.37	34	34	36
12	OH14-112-34	142			145	142	148	123	160	142	158	145	116	34			34	34	34
13	OH13-88-61	140	l	-2.69	143	141	143	122	159	142	155	145	114	35		-1.61	36	33	36
14	KWS202	141			142	141	144	121	159	142	161	145	116	36			38	34	35
15	KWS207	143			145	142	145	125	161	143	159	146	117	31	l		30	30	32
16	KWS213	142		-1.08	144	141	147	125	159	142	158	145	117	29	l	-3.13	29	30	29
17	KWS236	142		-1.07	144	142	145	123	160	142	159	147	117	34		-0.80	35	33	34
18	KWS242	140	l		143	140	142	122	159	142	154	144	114	33			32	33	34
19	LES177030	140	l	-1.71	142	139	141	122	156	151	156	142	115	33		-1.76	33	33	32
20	LES170137	142		-0.22	144	139	148	124	157	147	157	144	115	33		-0.20	32	34	33
21	LES172095	139	l	0.10	143	139	139	120	157	143	155	142	115	35		0.18	35	35	34
22	LES170022	140	l	0.09	145	140	140	122	157	142	158	143	114	33		-0.06	32	33	35
23	LES172093	141			144	140	141	121	158	144	158	144	115	36			35	36	37
24	KY06C-1178-16-10-3-34	144		0.15	147	145	146	124	161	147	159	146	117	33		-0.49	30	35	35
25	KY07C-1145-94-12-5	142			144	142	145	122	159	143	158	146	115	34			33	33	36
26	KY09C-1245-99-12-3	140	l	-1.35	143	140	147	120	158	142	154	144	115	34		-0.27	34	33	36
27	X11-0374-104-13-5	141		-0.99	143	139	141	122	159	144	163	144	115	33		-1.59	32	33	33
28	X11-0414-116-11-3	143		0.38	146	145	146	125	161	147	159	146	116	35		-0.43	32	35	38
29	0566A1-3-1-48	141		-0.82	141	142	145	121	159	147	155	145	115	34		-2.27	35	32	35
30	0537A1-3-12-1	142		0.20	143	141	148	122	160	142	159	148	115	34		-0.84	33	33	36
31	07469A1-6-1-1	143		-1.10	144	143	146	126	160	147	158	148	115	35		-2.10	34	33	37
32	05247A1-7-3-98	141		-0.60	142	142	141	120	159	147	157	145	114	33		-2.47	34	31	34
33	04719A1-16-1-2-27-1	143		-0.77	143	143	145	125	160	147	159	146	116	29	l	-1.46	29	26	31
34	MO151062	142		-0.87	142	141	148	121	158	147	159	144	117	36		-0.39	38	35	35
35	MO151082	143		0.79	144	143	145	125	160	147	162	146	117	37	h	1.47	37	37	38
36	MO161002	142		-0.34	143	140	145	125	160	147	158	146	117	38	h	0.38	38	39	38
37	MO170924	143		-0.02	146	144	146	125	162	142	159	148	117	37	h	1.16	36	38	38
38	MO170592	143		-0.78	146	142	149	124	160	142	158	146	117	38	h	-0.23	36	39	38
39	IL14-28462	139	l		140	138	139	121	157	142	155	141	115	33			32	33	35
40	IL14-28444	138	l	-2.33	138	138	138	119	157	147	155	141	112	36		-1.70	36	34	37
41	IL14-28468	139	l	-1.92	139	138	139	119	157	147	154	141	114	34		-2.24	35	32	34
42	IL14-DC-64-95-118	140	l		141	139	148	120	157	142	156	142	116	34			34	33	34
43	IL14-11830	141		-1.01	143	140	143	124	157	142	155	145	120	36		-1.67	36	35	37
44	MI16R0898	143		0.80	144	143	146	125	159	144	157	145	120	35		1.04	36	33	35
45	MI16R1172	142		-1.28	146	144	145	125	159	142	159	145	115	37	h	-2.02	38	36	37
46	MI16R0936	140	l	-0.36	142	141	144	120	157	142	155	142	114	35		-0.34	35	33	36
47	MI16W0258	143		0.77	146	142	145	125	160	147	159	146	115	35		0.54	33	35	37
48	MI14R0082	145			147	147	145	127	160	149	161	147	121	37	h		35	36	40
49	NE10478-1	141	l	0.95	144	138	141	123	158	142	158	145	115	34		0.33	35	32	36
50	NE12561	140	l	0.89	142	139	147	121	158	142	155	144	114	35		1.39	36	34	35
51	NE13515	145			147	143	150	127	160	149	159	147	121	36			36	37	35
52	NE14696	144			146	143	145	126	160	147	158	146	121	37	h		35	39	36
53	NE16424	139	l	0.31	143	139	138	120	158	142	154	145	114	34		0.76	33	35	35
54	NY99056-161	145			148	144	140	127	164	147	162	151	124	36			35	36	38
55	NY11014-9-60-1320	145		2.76	146	144	150	127	160	149	162	147	124	38	h	2.01	35	38	40
56	NY11025-02-23-1367	144		1.53	147	143	146	126	161	147	159	147	117	34		0.15	33	32	37
57	NY11013-10-6-1311	147	h	2.82	150	146	149	133	161	150	163	151	124	38	h	2.41	37	38	39
58	NY11029-10-24-1340	149	h	1.78	152	146	151	133	168	151	163	151	126	38	h	1.83	35	39	40
100	AVERAGE	142			145	142	145	123	159	.	.	.	.						
101	MINUMUM	138			138	138	138	119	156	.	.	.	.						
102	MAXIMUM	149			152	147	151	133	168	.	.	.	.						
103	LSD(0.05)	2			.	.	.	.	.	.	.	.	.				.	.	.
	Correlation with GEBV	0.65			0.64	0.44	0.41	0.58	0.53	0.30	0.56	0.59	0.61	0.62			0.01	0.38	0.44

Table 24. Summary of other traits collected on the 2018-2019 NUWWSN.

		Warsaw, VA, VAT				Champaign, IL, KWS		VAT	VAT
		Lodging	Yield	Test Weight	PreHarv.	Winter Kill	Xanthamonas	LR Seedling	LR Seedling
		0-5	bu/ac	lbs/bu	Sprout.	1-9	1-9	(0-3)	(0-3)
1	TRUMAN	5.0	83.1	57.1		3.5	4.5	3	23
2	ERNIE	4.0	72.5	56.7		2.5	3.0	3	3-
3	FREEDOM	4.0	57.7	54.7		2.0	2.5	3	0;Tr3
4	PIONEER2545	4.0	68.9	54.3		1.5	3.0	3	23
5	12VTK17-55	3.0	83.3	57.6		3.0	4.5	3-	;1=
6	12VTK17-132	3.0	78.1	58.7		4.5	7.9	3	23;
7	15VDH-FHB-MAS22-14	4.0	86.1	59.9		8.0	4.9	1-;	2;
8	15VDH-FHB-MAS25-08	3.0	88.3	57.9		8.5	2.5	1-;	;1=
9	13VTK59-55	3.0	91.0	59.2		5.5	3.5	0;Tr3	;1=
10	OH13-314-18	3.0	92.1	56.9		4.0	5.5	32;	0;
11	OH14-222-49	3.0	86.3	58.1		2.0	2.5	3	23-
12	OH14-112-34	3.0	84.2	56.3		1.0	3.0	1;Tr23	12;
13	OH13-88-61	3.0	96.6	55.8		1.5	5.0	3	23-
14	KWS202	3.0	84.4	54.0		1.0	2.5	3	3-
15	KWS207	2.0	82.5	56.7		1.0	2.5	12;	;1=
16	KWS213	2.0	83.7	57.6		1.0	3.0	3	23
17	KWS236	1.0	86.7	59.1		1.0	2.0	3	3-
18	KWS242	2.0	78.5	57.6		1.5	5.0	23-	3
19	LES177030	2.0	84.0	60.5		1.5	2.5	3;	3-
20	LES170137	3.0	72.6	58.6		1.5	2.5	3-	3
21	LES172095	4.0	74.8	59.1		1.5	2.0	3	23
22	LES170022	4.0	80.1	58.8		2.5	2.0	23-;	3-
23	LES172093	4.0	81.5	58.7		2.0	3.5	3	3
24	KY06C-1178-16-10-3-34	3.0	80.7	57.8		5.5	4.5	3-	2
25	KY07C-1145-94-12-5	3.0	76.9	59.7		2.5	3.0	21;	21;
26	KY09C-1245-99-12-3	3.0	84.8	58.2		2.0	3.5	1;/3	23;
27	X11-0374-104-13-5	2.0	72.5	58.0		3.0	3.5	0;Tr3	23
28	X11-0414-116-11-3	2.0	77.6	58.2		3.0	5.5	3	0;/3
29	0566A1-3-1-48	4.0	81.2	58.9		1.0	6.5	;1-/Tr3	1;
30	0537A1-3-12-1	3.0	82.3	58.4		2.5	3.5	3	2;
31	07469A1-6-1-1	4.0	83.1	55.2		3.5	2.5	21;	;1=
32	05247A1-7-3-98	4.0	84.5	57.8		1.0	4.0	1;	;1=
33	04719A1-16-1-2-27-1	1.0	83.6	58.8		1.0	3.0	;1-	0;
34	MO151062	4.0	83.6	59.9		1.0	2.0	3	3
35	MO151082	4.0	86.1	58.9		2.5	2.5	3	23-;
36	MO161002	4.0	75.0	58.1		1.0	2.0	2+;	23;
37	MO170924	4.0	77.8	56.2		2.0	2.0	3	3-;
38	MO170592	4.0	78.2	58.9		3.5	6.0	3	23
39	IL14-28462	4.0	81.5	58.7		2.0	7.5	3-	23
40	IL14-28444	3.0	78.1	60.6		2.0	5.5	23	23-;
41	IL14-28468	3.0	80.1	59.3		1.5	2.5	3	23-Tr0;
42	IL14-DC-64-95-118	3.0	81.9	58.8		1.0	3.0	23-;	12;
43	IL14-11830	4.0	84.1	58.6		1.0	5.5	23-;	21
44	MI16R0898	3.0	75.8	57.6		1.0	2.5	3	3-
45	MI16R1172	3.0	83.6	58.6		2.5	3.0	3	3;
46	MI16R0936	4.0	87.4	57.1		3.0	2.5	21;	23;
47	MI16W0258	4.0	89.5	58.2		4.5	2.0	3	3-
48	MI14R0082	3.0	53.5	59.7		4.5	2.5	3	3
49	NE10478-1	5.0	70.7	58.7		2.5	6.0	21;/Tr3	1;
50	NE12561	5.0	72.1	60.3		1.0	2.5	3/21;	3/0;
51	NE13515	4.0	64.2	59.0		3.0	2.0	23	0;Tr3
52	NE14696	4.0	79.3	56.4		3.0	2.5	23-;	3
53	NE16424	4.0	83.8	58.0		2.0	2.0	3	0;/3
54	NY99056-161	2.0	68.0	53.8	YES	4.0	2.0	3	3-
55	NY11014-9-60-1320	3.0	68.1	54.3		2.0	2.0	3-	23
56	NY11025-02-23-1367	4.0	74.7	51.0	YES	6.0	2.0	3	23-
57	NY11013-10-6-1311	2.0	60.4	56.2		3.0	2.5	3	23-N
58	NY11029-10-24-1340	3.0	67.4	58.0		6.0	3.4	3	3
100	MEAN	3.3	80.4	57.5		2.6	42.2		
101	CV					46.9	2.87		
102	LSD(0.05)					2.5	1.7		

Table 25. Summary of incidence (INC, %) from 2018-2019 PNUWWSN.

ENTRY	NAME	AVG		GEBV	UIL ILURB	MIELA	MOCOL	VAWAR
1	TRUMAN	64.5	l	-5.9	37.0	86.0	100.0	35.0
2	ERNIE	75.0	h	0.5	96.0	64.0	100.0	40.0
3	FREEDOM	85.2	h	4.4	90.0	81.0	100.0	70.0
4	PIONEER2545	91.5	h	6.0	99.0	77.0	100.0	90.0
5	DH11SRW066-153†	77.2	h	-0.9	98.0	61.0	90.0	60.0
6	VA16W-105†	74.1		1.3	90.0	64.0	100.0	42.5
7	VA12MAS7-519-1-3WS	79.9	h	2.9	95.0	77.0	100.0	47.5
8	VA17W-126	69.0	l	1.3	96.0	60.0	100.0	20.0
9	15VDH-SRW02-075	65.9	l	-0.3	32.0	79.0	100.0	52.5
10	OH15-191-52	71.7		0.0	95.0	67.0	100.0	25.0
11	OH15-42-1	74.8	h	1.7	94.0	75.0	100.0	30.0
12	OH15-165-51	78.8	h	0.4	99.0	66.0	100.0	50.0
13	OH15-131-31	70.4		1.0	96.0	53.0	100.0	32.5
14	OH15-89-68	76.8	h	2.8	99.0	73.0	100.0	35.0
15	KWS198	81.0	h	-0.1	96.0	88.0	100.0	40.0
16	KWS219	67.1	l		92.0	54.0	100.0	22.5
17	KWS233	74.8	h	-2.6	88.0	81.0	100.0	30.0
18	KWS235	73.0		1.9	96.0	56.0	90.0	50.0
19	KWS240	80.5	h		99.0	68.0	100.0	55.0
20	KWS258	87.4	h	4.2	95.0	82.0	100.0	72.5
21	X11-0414-117-12-5	70.3			77.0	64.0	100.0	40.0
22	X12-050-214-2-3	77.8	h	0.3	93.0	68.0	100.0	50.0
23	X12-619-205-20-3	72.5			93.0	67.0	100.0	30.0
24	X12-3010-2-18-1	75.4	h	7.5	96.0	63.0	100.0	42.5
25	X12-3010-4-4-1	76.5	h	5.0	95.0	71.0	90.0	50.0
26	03549A1-18-25-4	63.5	l	-0.1	77.0	47.0	100.0	30.0
27	0570A1-2-32-5-1-4	67.5	l		92.0	38.0	100.0	40.0
28	05222A1-1-2-7-1	72.4		1.3	98.0	54.0	100.0	37.5
29	09186A1-10-2	73.3		-0.9	90.0	58.0	100.0	45.0
30	0570A1-2-39-2-4	75.6	h		96.0	59.0	100.0	47.5
31	0762A1-2-8	66.3	l		85.0	70.0	100.0	10.0
32	MO170763	72.9		-4.1	88.0	71.0	100.0	32.5
33	MO170347	74.0		-1.7	85.0	76.0	100.0	35.0
34	MO141284	64.6	l	-5.1	75.0	71.0	100.0	12.5
35	MO170392	65.4	l	4.0	88.0	41.0	100.0	32.5
36	MO170496	63.0	l	-2.0	80.0	47.0	100.0	25.0
37	IL15-30529	51.8	l	-6.2	50.0	37.0	100.0	20.0
38	IL14-28307	65.4	l	-3.7	83.0	51.0	100.0	27.5
39	IL15-23803	63.8	l	-0.8	75.0	50.0	100.0	30.0
40	IL15-17909	62.3	l	-5.0	78.0	41.0	100.0	30.0
41	IL15-2639	64.6	l	-2.7	82.0	44.0	100.0	32.5
42	MI14R1152	73.4		7.2	94.0	67.0	90.0	42.5
43	MI16R0677	71.6		-3.8	90.0	64.0	100.0	32.5
44	MI16R0728	72.5		-1.4	83.0	72.0	100.0	35.0
45	MI16W0270	91.9	h	4.5	99.0	76.0	100.0	92.5
46	MI16W0522	81.9	h	2.3	96.0	69.0	90.0	72.5
100	AVERAGE	72.8			87.4	64.1	98.9	40.8
101	MINUMUM	51.8			32.0	37.0	90.0	10.0
102	MAXIMUM	91.9			99.0	88.0	100.0	92.5
103	LSD(0.05)	17.4			.	.	.	.
	Correlation with GEBV	0.65			0.56	0.25	-0.30	0.59

Table 26. Summary of severity (SEV, %) data from the 2018-2019 PNUWWSN

ENTRY	NAME	AVG		GEBV	UIL ILURB	MIELA	MOCOL	VAWAR
1	TRUMAN	26.1	l	-6.0	25.0	41.0	15.3	23.0
2	ERNIE	45.4		0.0	62.1	48.0	20.8	50.8
3	FREEDOM	46.5		0.7	27.5	64.0	47.6	47.0
4	PIONEER2545	63.0	h	8.9	78.0	64.0	59.1	51.0
5	DH11SRW066-153†	54.4	h	1.2	82.8	41.0	44.2	49.5
6	VA16W-105†	51.2		0.7	67.9	49.0	34.9	53.0
7	VA12MAS7-519-1-3WS	45.2		4.4	49.6	67.0	21.8	42.3
8	VA17W-126	46.6		2.3	66.8	35.0	50.0	34.8
9	15VDH-SRW02-075	42.8		0.8	19.7	73.0	26.9	51.8
10	OH15-191-52	44.5		3.8	50.0	45.0	55.4	27.8
11	OH15-42-1	41.8		4.5	45.1	43.0	48.0	31.0
12	OH15-165-51	67.6	h	2.7	81.5	58.0	66.5	64.5
13	OH15-131-31	45.4		2.4	50.6	32.0	58.9	40.3
14	OH15-89-68	47.3		2.3	51.8	50.0	45.4	42.0
15	KWS198	39.2		0.5	41.9	39.0	31.5	44.5
16	KWS219	26.6	l		28.7	16.0	34.9	26.8
17	KWS233	34.9	l	-2.6	29.5	47.0	36.0	27.3
18	KWS235	34.3	l	2.8	41.1	33.0	19.6	43.5
19	KWS240	54.0	h		67.7	58.0	45.5	44.8
20	KWS258	58.5	h	6.5	65.7	70.0	40.7	57.8
21	X11-0414-117-12-5	36.9	l		30.7	44.0	41.8	31.3
22	X12-050-214-2-3	47.2		1.8	53.9	55.0	43.7	36.3
23	X12-619-205-20-3	25.9	l		16.2	33.0	36.9	17.5
24	X12-3010-2-18-1	46.7		3.1	62.4	49.0	40.1	35.3
25	X12-3010-4-4-1	36.5	l	4.6	39.2	50.0	16.4	40.5
26	03549A1-18-25-4	28.8	l	-2.0	18.9	38.0	34.6	23.5
27	0570A1-2-32-5-1-4	33.6	l		37.1	39.0	32.9	25.5
28	05222A1-1-2-7-1	33.7	l	-2.3	35.8	38.0	41.2	19.8
29	09186A1-10-2	29.1	l	-5.0	29.7	39.0	26.7	21.0
30	0570A1-2-39-2-4	35.5	l		42.6	24.0	45.0	30.5
31	0762A1-2-8	25.0	l		36.3	17.0	36.4	10.3
32	MO170763	41.9		-3.0	62.0	31.0	33.5	41.0
33	MO170347	28.4	l	-0.1	22.6	44.0	26.3	20.8
34	MO141284	23.5	l	-5.3	19.2	7.0	50.3	17.5
35	MO170392	51.7	h	2.6	60.4	45.0	47.9	53.5
36	MO170496	29.4	l	-2.3	39.1	10.0	39.7	28.8
37	IL15-30529	28.3	l	-6.7	25.2	25.0	41.5	21.5
38	IL14-28307	27.1	l	-3.7	24.6	20.0	29.3	34.5
39	IL15-23803	34.3	l	-1.4	34.8	25.0	47.6	29.8
40	IL15-17909	22.3	l	-4.1	20.4	14.0	32.1	22.5
41	IL15-2639	24.5	l	-2.5	19.0	29.0	27.0	23.0
42	MI14R1152	41.4		7.2	59.7	46.0	21.2	38.8
43	MI16R0677	37.4	l	-4.9	42.2	33.0	44.1	30.3
44	MI16R0728	36.6	l	-0.9	41.4	39.0	32.7	33.3
45	MI16W0270	60.5	h	6.3	79.1	65.0	40.4	57.5
46	MI16W0522	54.8	h	4.5	70.9	55.0	36.7	56.5
100	AVERAGE	39.9			44.7	41.0	38.0	35.9
101	MINUMUM	22.3			16.2	7.0	15.3	10.3
102	MAXIMUM	67.6			82.8	73.0	66.5	64.5
103	LSD(0.05)	16.3			.	.	.	.
	Correlation with GEBV	0.76			0.68	0.67	0.20	0.67

Table 27. Summary of index (IND, %) data from the 2018-2019 PNUWWSN.

					KWS	UIL					From 0-9	
ENTRY	NAME	AVG		GEBV	ILCHA	ILURB	MIELA	MOCOL	OHWOO	VAWAR	INLAY	KYLEX
1	TRUMAN	23.6	l	-5.13	33.0	9.0	38.0	15.3	20.6	8.0	30	35
2	ERNIE	37.5		-0.07	58.0	60.0	33.0	20.8	38.3	20.0	40	30
3	FREEDOM	46.2		1.91	68.0	24.0	49.0	47.6	38.3	33.0	50	60
4	PIONEER2545	69.0	h	9.42	95.0	77.0	51.0	59.1	74.2	46.0	90	60
5	DH11SRW066-153†	47.1		-0.46	63.0	81.0	25.0	39.8	42.8	30.0	60	35
6	VA16W-105†	41.6		1.19	53.0	61.0	33.0	34.9	33.9	22.0	60	35
7	VA12MAS7-519-1-3WS	41.6		3.39	63.0	47.0	48.0	21.8	42.8	20.0	50	40
8	VA17W-126	39.7		1.68	63.0	65.0	23.0	50.0	19.4	7.0	70	20
9	15VDH-SRW02-075	44.8		-0.01		57.0	47	26.9	37.2	28.0	70.0	35
10	OH15-191-52	37.4		3.06	55.0	48.0	29.0	55.4	35.0	7.0	30	40
11	OH15-42-1	38.7		4.03	50.0	42.0	33.0	48.0	42.8	9.0	40	45
12	OH15-165-51	57.0		2.23	73.0	81.0	42.0	66.5	36.7	32.0	80	45
13	OH15-131-31	39.2		2.24	50.0	49.0	19.0	58.9	33.9	13.0	50	40
14	OH15-89-68	48.0		2.86	73.0	51.0	38.0	45.4	37.2	14.0	90	35
15	KWS198	41.2		-0.96	78.0	40.0	34.0	31.5	33.3	18.0	60	35
16	KWS219	32.5			44.0	26.0	9.0	34.9	25.0	6.0	70	45
17	KWS233	32.4		-2.29	38.0	27.0	36.0	36.0	33.9	8.0	50	30
18	KWS235	34.6		2.61	38.0	40.0	19.0	17.7	35.0	22.0	60	45
19	KWS240	48.6			75.0	67.0	41.0	45.5	31.1	24.0	70	35
20	KWS258	57.7	h	5.79		62.0	50	40.7	47.2	42.0	90.0	60
21	X11-0414-117-12-5	38.0			74.0	24.0	28.0	41.8	32.8	13.0	50	40
22	X12-050-214-2-3	44.8		0.82	70.0	50.0	38	43.7	38.3	18.0		40
23	X12-619-205-20-3	30.7	l		54.0	15.0	22	36.9	31.1	5.0		35
24	X12-3010-2-18-1	41.1		3.92	43.0	60.0	29	40.1	50.0	15.0		35
25	X12-3010-4-4-1	44.5		4.63	85.0	37.0	37.0	14.7	52.2	20.0	60	50
26	03549A1-18-25-4	24.0	l	-1.33	45.0	15.0	19.0	34.6	11.7	7.0	30	30
27	0570A1-2-32-5-1-4	27.0	l		30.0	34.0	16.0	32.9	23.3	10.0	40	30
28	05222A1-1-2-7-1	32.9		-1.48	43.0	35.0	21.0	41.2	30.6	7.0	50	35
29	09186A1-10-2	26.1	l	-3.04	28.0	27.0	26.0	26.7	26.1	10.0	40	25
30	0570A1-2-39-2-4	36.9			48.0	41.0	19.0	45.0	28.3	14.0	50	50
31	0762A1-2-8	22.7	l		33.0	32.0	16.0	36.4	28.3	1.0	10	25
32	MO170763	33.7		-2.91	29.0	55.0	22.0	33.5	31.7	13.0	50	35
33	MO170347	29.8	l	0.03	25.0	19.0	35.0	26.3	36.1	7.0	50	40
34	MO141284	24.8	l	-5.45	28.0	15.0	6.0	50.3	32.2	2.0	40	25
35	MO170392	37.0		2.59	16.0	55.0	19.0	47.9	30.0	18.0	70	40
36	MO170496	30.3	l	-1.98	20.0	31.0	1.0	39.7	33.3	7.0	60	50
37	IL15-30529	21.6	l	-5.58	20.0	13.0	9	41.5	21.7	5.0		25
38	IL14-28307	21.8	l	-4.07	18.0	20.0	8.0	29.3	29.4	10.0	30	30
39	IL15-23803	32.5		-1.46	30.0	26.0	13.0	47.6	29.4	9.0	60	45
40	IL15-17909	20.1	l	-4.97	13.0	16.0	3.0	32.1	19.4	7.0	40	30
41	IL15-2639	21.4	l	-2.58	15.0	16.0	13.0	27.0	22.2	8.0	30	40
42	MI14R1152	41.1		6.81	60.0	57.0	31.0	19.1	40.0	17.0	60	45
43	MI16R0677	33.3		-5.13	45.0	38.0	22.0	44.1	22.2	10.0	50	35
44	MI16R0728	29.5	l	-0.49	48.0	33.0	32.0	32.7	23.3	12.0	10	45
45	MI16W0270	61.2	h	6.23	95.0	78.0	50.0	40.4	38.3	53.0	80	55
46	MI16W0522	49.7		3.47	65.0	68.0	38.0	33.0	42.8	41.0	70	40
100	AVERAGE	37.3			49.3	42.7	28.4	37.6	31.1	15.9	50.2	37.9
101	MINUMUM	20.1			13.0	9.0	1.0	14.7	5.0	1.0	10	9
102	MAXIMUM	69.0			95.0	90.0	51.0	66.5	74.2	53.0	90	60
103	LSD(0.05)	11.4			.	.	.	.	.	.	.	.
	Correlation with GEBVs	0.82			0.71	0.69	0.65	0.18	0.75	0.67	0.60	0.66

Table 28. Summary of FHB score on a 0-9 scale (0=no disease, 9-severe disease) in the 2017-18 PNUWWSN

ENTRY	NAME	AVG		IND GEBV	LIM INLAY	KYLEX	MOCOL	VAWAR
1	TRUMAN	2.3	l	-5.1	3.0	3.5	2.0	0.7
2	ERNIE	3.0	l	-0.1	4.0	3.0	3.0	1.8
3	FREEDOM	4.8		1.9	5.0	6.0	5.0	3.0
4	PIONEER2545	6.6	h	9.4	9.0	6.0	7.0	4.2
5	DH11SRW066-153†	4.1		-0.5	6.0	3.5	4.0	2.7
6	VA16W-105†	3.9		1.2	6.0	3.5	4.0	2.0
7	VA12MAS7-519-1-3WS	3.5	l	3.4	5.0	4.0	3.0	1.8
8	VA17W-126	3.9		1.7	7.0	2.0	6.0	0.6
9	15VDH-SRW02-075	4.2		0.0	7.0	3.5	4.0	2.5
10	OH15-191-52	3.7	l	3.1	3.0	4.0	7.0	0.7
11	OH15-42-1	3.6	l	4.0	4.0	4.5	5.0	0.8
12	OH15-165-51	5.9	h	2.2	8.0	4.5	8.0	2.9
13	OH15-131-31	4.6		2.2	5.0	4.0	8.0	1.2
14	OH15-89-68	5.0	h	2.9	9.0	3.5	6.0	1.3
15	KWS198	3.8		-1.0	6.0	3.5	4.0	1.6
16	KWS219	4.0			7.0	4.5	4.0	0.6
17	KWS233	3.2	l	-2.3	5.0	3.0	4.0	0.7
18	KWS235	3.6	l	2.6	6.0	4.5	2.0	2.0
19	KWS240	4.4			7.0	3.5	5.0	2.2
20	KWS258	6.0	h	5.8	9.0	6.0	5.0	3.8
21	X11-0414-117-12-5	3.8			5.0	4.0	5.0	1.1
22	X12-050-214-2-3	4.0		0.8		4.0	5.0	1.6
23	X12-619-205-20-3	3.2	l			3.5	4.0	0.5
24	X12-3010-2-18-1	3.5	l	3.9		3.5	4.0	1.4
25	X12-3010-4-4-1	3.7	l	4.6	6.0	5.0	2.0	1.8
26	03549A1-18-25-4	2.7	l	-1.3	3.0	3.0	4.0	0.6
27	0570A1-2-32-5-1-4	3.0	l		4.0	3.0	4.0	0.9
28	05222A1-1-2-7-1	3.6	l	-1.5	5.0	3.5	5.0	0.7
29	09186A1-10-2	2.6	l	-3.0	4.0	2.5	3.0	0.9
30	0570A1-2-39-2-4	4.3			5.0	5.0	6.0	1.3
31	0762A1-2-8	2.1	l		1.0	2.5	5.0	0.1
32	MO170763	3.4	l	-2.9	5.0	3.5	4.0	1.2
33	MO170347	3.2	l	0.0	5.0	4.0	3.0	0.7
34	MO141284	3.2	l	-5.5	4.0	2.5	6.0	0.2
35	MO170392	4.4		2.6	7.0	4.0	5.0	1.6
36	MO170496	4.7		-2.0	6.0	5.0	7.0	0.6
37	IL15-30529	2.8	l	-5.6		2.5	4.0	0.5
38	IL14-28307	2.5	l	-4.1	3.0	3.0	3.0	0.9
39	IL15-23803	4.1		-1.5	6.0	4.5	5.0	0.8
40	IL15-17909	2.9	l	-5.0	4.0	3.0	4.0	0.6
41	IL15-2639	2.7	l	-2.6	3.0	4.0	3.0	0.7
42	MI14R1152	3.7	l	6.8	6.0	4.5	3.0	1.5
43	MI16R0677	3.6	l	-5.1	5.0	3.5	5.0	0.9
44	MI16R0728	2.6	l	-0.5	1.0	4.5	4.0	1.1
45	MI16W0270	5.6	h	6.2	8.0	5.5	4.0	4.8
46	MI16W0522	4.7		3.5	7.0	4.0	4.0	3.7
100	AVERAGE	3.8			5.2	3.9	4.2	1.5
101	MINUMUM	2.1			1.0	2.0	0.5	0.1
102	MAXIMUM	6.6			9.0	6.0	8.0	4.8
103	LSD(0.05)	1.6			.	.	.	.
	Correlation with GEBV	0.69			0.60	0.66	0.19	0.67

Table 29. Summary of Fusarium Damaged Kernel (FDK, %) data from the 2018-2019 PNUWWSN.

ENTRY	NAME	AVG		GEBV	KWS ILCHA	UIL ILURB	KYLEX	VAWAR
1	TRUMAN	18.3	l	-4.9	5.0	58.3	5.0	5.0
2	ERNIE	35.4		0.1	22.5	91.7	7.5	20.0
3	FREEDOM	42.7		7.5	32.5	83.3	20.0	35.0
4	PIONEER2545	66.7	h	9.2	85.0	96.7	27.5	57.5
5	DH11SRW066-153†	43.6		-1.9	45.0	86.7	10.0	32.5
6	VA16W-105†	38.9		0.7	45.0	81.7	10.0	19.0
7	VA12MAS7-519-1-3WS	45.4		1.7	40.0	81.7	22.5	37.5
8	VA17W-126	34.8		1.5	25.0	91.7	5.0	17.5
9	15VDH-SRW02-075	48.5		0.9		101.0	22.5	27.5
10	OH15-191-52	31.5		3.3	17.5	83.3	7.5	17.5
11	OH15-42-1	41.0		4.0	30.0	95.0	20.0	19.0
12	OH15-165-51	44.0		1.8	37.5	98.3	12.5	27.5
13	OH15-131-31	33.2		2.6	47.5	66.7	5.0	13.5
14	OH15-89-68	40.2		3.2	30.0	88.3	10.0	32.5
15	KWS198	35.4		0.6	22.5	91.7	5.0	22.5
16	KWS219	26.0	l		20.0	60.0	12.5	11.5
17	KWS233	24.0	l	-2.6	30.0	48.3	5.0	12.5
18	KWS235	20.6	l	-0.9	7.5	40.0	5.0	30.0
19	KWS240	46.5			47.5	95.0	15.0	28.5
20	KWS258	47.9		5.0		91.7	10.0	47.5
21	X11-0414-117-12-5	36.9			40.0	75.0	10.0	22.5
22	X12-050-214-2-3	38.1		2.5	25.0	85.0	15.0	27.5
23	X12-619-205-20-3	29.3			47.5	50.0	7.5	12.0
24	X12-3010-2-18-1	44.8		3.6	50.0	86.7	7.5	35.0
25	X12-3010-4-4-1	44.2		1.0	42.5	91.7	15.0	27.5
26	03549A1-18-25-4	21.5	l	0.9	10.0	63.3	5.0	7.5
27	0570A1-2-32-5-1-4	38.8			25.0	90.0	15.0	25.0
28	05222A1-1-2-7-1	48.3		3.4	47.5	98.3	25.0	22.5
29	09186A1-10-2	23.5	l	-0.3	7.5	65.0	5.0	16.5
30	0570A1-2-39-2-4	39.4			35.0	95.0	7.5	20.0
31	0762A1-2-8	37.3			47.5	85.0	12.5	4.0
32	MO170763	33.0		-3.5	32.5	83.3	5.0	11.0
33	MO170347	32.1		1.1	27.5	80.0	5.0	16.0
34	MO141284	14.8	l	-5.2	10.0	35.0	5.0	9.0
35	MO170392	32.7		0.6	22.5	78.3	7.5	22.5
36	MO170496	19.9	l	-3.0	3.5	50.0	12.5	13.5
37	IL15-30529	14.0	l	-9.0	3.5	40.0	5.0	7.5
38	IL14-28307	11.5	l	-7.7	2.0	35.0	5.0	4.0
39	IL15-23803	15.9	l	-4.0	2.0	46.7	5.0	10.0
40	IL15-17909	19.0	l	-5.2	2.0	58.3	7.5	8.0
41	IL15-2639	15.4	l	-4.1	5.0	46.7	5.0	5.0
42	MI14R1152	44.2		5.8	37.5	96.7	22.5	20.0
43	MI16R0677	35.9		-5.7	35.0	75.0	5.0	28.5
44	MI16R0728	28.9		0.5	12.5	71.7	10.0	21.5
45	MI16W0270	59.4	h	7.2	52.5	95.0	30.0	60.0
46	MI16W0522	48.6		1.5	37.5	81.7	17.5	57.5
100	AVERAGE	34.6			31.4	72.4	12.0	21.7
101	MINUMUM	11.5			2.0	10.0	5.0	4.0
102	MAXIMUM	66.7			101.0	98.3	47.5	60.0
103	LSD(0.05)	14.9			.	.	.	.
	Correlation with GEBV	0.82			0.70	0.75	0.67	0.68

Table 30. Summary of INC/SEV/FDK (ISK, %) data from the 2018-2019 PNUWWSN

ENTRY	NAME	AVG		GEBV	KWS ILCHA	UIL ILURB	KYLEX	VAWAR
1	TRUMAN	25.9	l	-5.5	21.5	41.7	23.0	17.5
2	ERNIE	44.1		0.5	43.5	84.4	21.0	27.3
3	FREEDOM	50.3		5.3	53.5	68.6	44.0	35.2
4	PIONEER2545	68.2	h	8.8	91.0	92.1	47.0	42.5
5	DH11SRW066-153†	50.7		-2.0	55.5	89.2	25.0	33.0
6	VA16W-105†	45.8		0.8	49.5	80.1	25.0	28.7
7	VA12MAS7-519-1-3WS	47.4		2.8	53.5	76.1	33.0	27.1
8	VA17W-126	40.9		1.5	47.5	85.8	14.0	16.5
9	15VDH-SRW02-075	49.5		0.4		86.6	30.0	31.4
10	OH15-191-52	39.9		3.3	40.0	76.9	27.0	15.9
11	OH15-42-1	43.9		4.4	42.0	80.1	35.0	18.4
12	OH15-165-51	54.7		1.8	58.5	93.9	32.0	34.5
13	OH15-131-31	41.9		2.7	49.0	70.9	26.0	21.9
14	OH15-89-68	46.2		3.0	55.5	80.9	25.0	23.2
15	KWS198	45.5		0.5	55.5	78.2	23.0	25.4
16	KWS219	35.4			34.6	60.1	32.0	14.8
17	KWS233	31.6	l	-2.9	34.5	54.7	20.0	17.2
18	KWS235	35.0		0.9	25.5	57.4	29.0	28.2
19	KWS240	52.4			64.0	88.4	27.0	30.0
20	KWS258	54.9		6.1		84.9	40.0	39.3
21	X11-0414-117-12-5	43.1			60.6	62.2	28.0	21.5
22	X12-050-214-2-3	46.5		2.4	52.0	78.2	30.0	26.0
23	X12-619-205-20-3	35.7			51.6	52.9	24.0	14.3
24	X12-3010-2-18-1	43.9		4.2	45.5	82.5	24.0	23.5
25	X12-3010-4-4-1	52.0		2.8	68.0	76.9	36.0	27.3
26	03549A1-18-25-4	30.3	l	-0.5	31.0	54.0	20.0	16.1
27	0570A1-2-32-5-1-4	36.6			28.0	74.7	24.0	19.8
28	05222A1-1-2-7-1	43.1		1.1	44.5	79.6	31.0	17.3
29	09186A1-10-2	29.6	l	-1.9	19.5	61.9	17.0	19.9
30	0570A1-2-39-2-4	44.7			42.5	79.8	33.0	23.5
31	0762A1-2-8	33.7			38.5	70.4	20.0	6.1
32	MO170763	38.5		-3.6	30.6	78.5	23.0	22.1
33	MO170347	33.3		0.1	26.0	64.3	26.0	16.8
34	MO141284	22.2	l	-5.9	20.5	42.3	17.0	9.0
35	MO170392	36.8		1.6	18.4	76.0	27.0	25.9
36	MO170496	30.1	l	-2.2	13.4	55.7	35.0	16.2
37	IL15-30529	20.4	l	-8.2	13.4	38.6	17.0	12.5
38	IL14-28307	24.1	l	-5.7	11.3	46.4	20.0	18.6
39	IL15-23803	29.3	l	-3.0	18.8	51.6	29.0	18.0
40	IL15-17909	24.5	l	-6.4	8.3	52.9	21.0	15.8
41	IL15-2639	25.6	l	-3.3	11.0	48.9	26.0	16.7
42	MI14R1152	49.2		6.8	51.0	85.2	36.0	24.5
43	MI16R0677	38.2		-6.6	41.0	69.7	23.0	18.9
44	MI16R0728	37.8		-0.3	33.5	66.1	31.0	20.6
45	MI16W0270	65.0	h	7.9	78.0	91.8	45.0	45.2
46	MI16W0522	51.7		2.9	54.0	83.0	31.0	38.9
100	AVERAGE	40.7			42.5	68.6	27.7	22.5
101	MINUMUM	20.4			8.3	30.0	14.0	6.1
102	MAXIMUM	68.2			91.0	93.9	47.0	45.2
103	LSD(0.05)	12.6			.	.	.	.
	Correlation with GEBV	0.84			0.78	0.76	0.73	0.69

Table 31. Summary of deoxynivalenol (DON, ppm) data from the 2018-2019 PNUWWSN.

ENTRY	NAME	AVG		GEBV	KWS ILCHA	UIL ILURB	KYLEX	VAWAR
1	TRUMAN	4.8	l	-1.30	2.6	13.6	0.6	2.3
2	ERNIE	6.8	l	0.22	4.2	16.5	0.8	5.9
3	FREEDOM	9.8		1.35	6.0	23.1	1.8	8.1
4	PIONEER2545	18.9	h	4.69	14.7	38.2	2.9	19.8
5	DH11SRW066-153†	9.2		-0.06	10.0	15.8	1.2	9.6
6	VA16W-105†	6.9	l	0.61	7.7	14.9	0.8	4.4
7	VA12MAS7-519-1-3WS	15.1	h	0.58	11.6	24.3	2.7	21.7
8	VA17W-126	6.7	l	0.42	5.0	16.5	0.8	4.6
9	15VDH-SRW02-075	13.7	h	0.29	11.4	28.9	2.6	12.1
10	OH15-191-52	5.6	l	0.93	3.3	15.7	0.7	2.6
11	OH15-42-1	8.7		0.82	7.0	20.9	2.6	4.2
12	OH15-165-51	10.0		-0.55	7.9	24.1	1.4	6.7
13	OH15-131-31	5.1	l	-0.24	3.0	13.2	0.6	3.4
14	OH15-89-68	9.9		0.36	4.7	29.4	0.6	4.8
15	KWS198	7.7		0.09	6.7	17.2	0.9	6.2
16	KWS219	6.3	l		5.5	15.0	0.9	3.7
17	KWS233	5.5	l	-2.01	3.4	15.6	0.3	2.7
18	KWS235	5.9	l	-0.60	3.4	12.0	1.0	7.3
19	KWS240	7.8			9.6	12.7	1.7	7.3
20	KWS258	18.5	h	5.08	13.6	31.8	2.1	26.6
21	X11-0414-117-12-5	6.2	l		6.3	13.7	0.9	4.0
22	X12-050-214-2-3	10.0		-0.72	6.3	25.1	2.5	6.0
23	X12-619-205-20-3	5.5	l		4.6	13.9	1.0	2.4
24	X12-3010-2-18-1	10.0		0.86	8.2	21.1	1.5	9.4
25	X12-3010-4-4-1	10.0		1.23	7.4	23.9	1.5	7.3
26	03549A1-18-25-4	4.4	l	-1.14	2.5	13.3	0.4	1.6
27	0570A1-2-32-5-1-4	7.4	l		6.4	18.2	0.3	4.8
28	05222A1-1-2-7-1	12.8		0.06	8.4	36.7	0.9	5.2
29	09186A1-10-2	6.9	l	-1.25	3.6	18.9	0.4	4.5
30	0570A1-2-39-2-4	7.4	l		5.1	19.6	1.2	3.9
31	0762A1-2-8	7.1	l		4.4	23.2	0.2	0.8
32	MO170763	5.1	l	-0.98	4.2	11.3	0.8	4.3
33	MO170347	5.8	l	-0.26	4.2	15.4	0.6	2.9
34	MO141284	2.6	l	-2.31	2.1	6.3	0.3	1.7
35	MO170392	6.8	l	0.43	5.7	13.2	1.1	7.0
36	MO170496	3.5	l	-0.63	1.7	8.0	1.3	3.1
37	IL15-30529	2.1	l	-2.87	0.5	5.2	0.2	2.4
38	IL14-28307	2.2	l	-2.31	0.9	6.0	0.2	1.8
39	IL15-23803	4.1	l	-1.27	2.2	10.3	1.0	2.9
40	IL15-17909	4.8	l	-2.31	2.9	12.2	0.6	3.7
41	IL15-2639	3.1	l	-2.19	0.8	9.7	0.3	1.6
42	MI14R1152	10.7		2.83	7.2	21.2	3.6	10.9
43	MI16R0677	9.5		-1.06	4.0	22.2	1.2	10.7
44	MI16R0728	5.1	l	1.53	2.5	14.1	0.5	3.2
45	MI16W0270	18.0	h	4.22	10.4	27.9	6.6	27.1
46	MI16W0522	13.7	h	2.36	7.8	20.3	3.2	23.4
100	AVERAGE	8.0			5.7	18.1	1.3	7.0
101	MINUMUM	2.1			0.5	5.2	0.2	0.8
102	MAXIMUM	18.9			14.7	38.2	6.6	27.1
103	LSD(0.05)	5.5			.	.	.	.
	Correlation with GEBV	0.82			0.77	0.69	0.71	0.78

Table 32. Summary of greenhouse severity (GHSEV, %) data from the 2018-2019 PNUWWSN.

			GEBVs					
		GHSEV	INC	SEV	IND	FDK	ISK	DON
1	TRUMAN	5.0	-5.93	-6.04	-5.13	-4.86	-5.50	-1.30
2	ERNIE	18.0	0.54	0.00	-0.07	0.06	0.50	0.22
3	FREEDOM	27.9	4.38	0.73	1.91	7.48	5.29	1.35
4	PIONEER2545	59.4	5.96	8.91	9.42	9.20	8.80	4.69
5	DH11SRW066-153†	62.1	-0.91	1.20	-0.46	-1.94	-1.99	-0.06
6	VA16W-105†	85.1	1.27	0.71	1.19	0.72	0.85	0.61
7	VA12MAS7-519-1-3WS	20.6	2.92	4.38	3.39	1.68	2.81	0.58
8	VA17W-126	31.7	1.35	2.32	1.68	1.47	1.52	0.42
9	15VDH-SRW02-075	37.4	-0.30	0.78	-0.01	0.91	0.41	0.29
10	OH15-191-52	27.2	0.05	3.82	3.06	3.26	3.28	0.93
11	OH15-42-1	53.4	1.72	4.47	4.03	4.01	4.39	0.82
12	OH15-165-51	35.7	0.41	2.70	2.23	1.82	1.80	-0.55
13	OH15-131-31	15.1	1.03	2.43	2.24	2.64	2.75	-0.24
14	OH15-89-68	22.2	2.78	2.32	2.86	3.21	3.03	0.36
15	KWS198	5.7	-0.15	0.54	-0.96	0.59	0.53	0.09
16	KWS219	10.6						
17	KWS233	21.0	-2.58	-2.64	-2.29	-2.62	-2.88	-2.01
18	KWS235	17.6	1.87	2.80	2.61	-0.94	0.88	-0.60
19	KWS240	48.2						
20	KWS258	20.9	4.21	6.45	5.79	4.96	6.06	5.08
21	X11-0414-117-12-5	25.0						
22	X12-050-214-2-3	22.5	0.32	1.83	0.82	2.48	2.37	-0.72
23	X12-619-205-20-3	10.6						
24	X12-3010-2-18-1	24.0	7.52	3.08	3.92	3.59	4.17	0.86
25	X12-3010-4-4-1	15.5	4.97	4.62	4.63	1.01	2.83	1.23
26	03549A1-18-25-4	20.5	-0.14	-2.03	-1.33	0.90	-0.46	-1.14
27	0570A1-2-32-5-1-4	28.4						
28	05222A1-1-2-7-1	17.1	1.28	-2.32	-1.48	3.41	1.15	0.06
29	09186A1-10-2	13.8	-0.89	-4.95	-3.04	-0.34	-1.91	-1.25
30	0570A1-2-39-2-4	28.6						
31	0762A1-2-8	16.0						
32	MO170763	18.3	-4.09	-3.03	-2.91	-3.52	-3.56	-0.98
33	MO170347	16.4	-1.69	-0.11	0.03	1.10	0.13	-0.26
34	MO141284	7.9	-5.06	-5.30	-5.45	-5.23	-5.87	-2.31
35	MO170392	24.2	4.01	2.64	2.59	0.62	1.58	0.43
36	MO170496	12.5	-1.95	-2.29	-1.98	-3.01	-2.17	-0.63
37	IL15-30529	6.4	-6.20	-6.68	-5.58	-8.96	-8.19	-2.87
38	IL14-28307	23.2	-3.71	-3.75	-4.07	-7.69	-5.69	-2.31
39	IL15-23803	14.2	-0.76	-1.36	-1.46	-3.99	-2.97	-1.27
40	IL15-17909	11.5	-5.01	-4.06	-4.97	-5.18	-6.45	-2.31
41	IL15-2639	10.4	-2.69	-2.55	-2.58	-4.09	-3.31	-2.19
42	MI14R1152	27.0	7.19	7.21	6.81	5.78	6.79	2.83
43	MI16R0677	20.3	-3.79	-4.89	-5.13	-5.66	-6.58	-1.06
44	MI16R0728	21.8	-1.37	-0.92	-0.49	0.54	-0.30	1.53
45	MI16W0270	18.7	4.52	6.25	6.23	7.19	7.87	4.22
46	MI16W0522	38.6	2.30	4.46	3.47	1.46	2.92	2.36
	Correlation with GEBV		0.35	0.45	0.44	0.38	0.38	0.39

Table 33. Summary of heading date (HD, Julian days) height (HGT, inches), and lodging (LDG) data from the 2018-2019 PNUWWN

		HEADING DATE (JULIAN DAYS)										HEIGHT (INCHES)				
ENTRY	NAME	AVG		GEBV	ILCHA	ILURB	INLAY	KYLEX	MIELA	MOCOL	OHWOO	VAWAR	AVG		GEBV	ILCHA	KYLEX	VAWAR
1	TRUMAN	143.6	h	1.48	148.0	147.0	145.0	124.0	164.0	149.0	149.0	123.0	36.7		2.07	35.0	38.0	37.0
2	ERNIE	139.6		-0.62	144.0	143.0	144.0	122.0	158.5	144.0	145.0	116.0	37.5		0.34	38.0	38.5	36.0
3	FREEDOM	141.2		0.82	146.0	144.0	145.0	123.5	161.2	147.0	146.0	117.0	35.8		0.31	36.0	35.5	36.0
4	PIONEER2545	139.5		0.20	145.0	142.0	143.0	122.0	158.0	142.0	147.0	117.0	33.5		-0.21	34.0	32.5	34.0
5	DH11SRW066-153†	140.7		-1.04	146.0	145.0	144.0	122.5	160.0	143.0	147.0	118.0	33.8		-1.53	33.0	33.5	35.0
6	VA16W-105†	140.1		0.28	145.0	145.0	144.0	124.0	158.7	142.0	147.0	115.0	32.3		-1.47	31.0	31.0	35.0
7	VA12MAS7-519-1-3WS	141.2		0.42	144.0	144.0		123.0	160.7	147.0	148.0	118.0	32.7		-1.10	33.0	32.0	33.0
8	VA17W-126	138.2	l	0.30	143.0	141.0	140.0	120.0	159.7	143.0	145.0	114.0	34.7		-0.83	35.0	33.0	36.0
9	15VDH-SRW02-075	142.8	h	-1.33	149.0	148.0	146.0	125.0	163.3	147.0	149.0	115.0	32.0		-0.91	28.0	32.0	36.0
10	OH15-191-52	141.8	h	1.87	146.0	147.0	146.0	125.0	160.2	147.0	146.0	117.0	34.7		-0.28	35.0	34.0	35.0
11	OH15-42-1	141.5		0.96	146.0	144.0	148.0	123.0	159.8	147.0	146.0	118.0	34.2		-0.65	33.0	35.5	34.0
12	OH15-165-51	140.2		0.34	144.0	144.0	145.0	121.0	158.8	147.0	145.0	117.0	34.5		-0.86	35.0	33.5	35.0
13	OH15-131-31	140.6		-0.77	145.0	143.0	147.0	121.0	159.5	147.0	146.0	116.0	34.5		-0.66	33.0	35.5	35.0
14	OH15-89-68	140.1		-1.53	144.0	144.0	145.0	120.5	159.2	147.0	146.0	115.0	35.0		-0.74	37.0	34.0	34.0
15	KWS198	139.7		-0.68	144.0	143.0	145.0	121.0	159.7	142.0	146.0	117.0	34.5		-1.16	37.0	32.5	34.0
16	KWS219	139.5			144.0	142.0	141.0	123.0	158.7	147.0	145.0	115.0	29.8	l		29.0	30.5	30.0
17	KWS233	141.2		-2.13	145.0	143.0	145.0	123.0	161.3	148.0	147.0	117.0	31.8		-0.81	32.0	31.5	32.0
18	KWS235	139.3		-0.70	143.0	142.0	144.0	122.5	157.7	142.0	146.0	117.0	33.8		-1.09	34.0	33.5	34.0
19	KWS240	139.3			144.0	140.0	145.0	120.5	159.0	144.0	145.0	117.0	35.3			35.0	36.0	35.0
20	KWS258	142.9	h	1.20	150.0	147.0	145.0	124.5	161.7	147.0	147.0	121.0	31.2		-0.81	28.0	31.5	34.0
21	X11-0414-117-12-5	142.5	h		149.0	147.0	146.0	124.5	161.3	147.0	147.0	118.0	34.0			30.0	36.0	36.0
22	X12-050-214-2-3	140.0		-0.91	144.0	143.0		125.0	159.0	142.0	146.0	117.0	34.0		-1.96	34.0	33.0	35.0
23	X12-619-205-20-3	140.5			147.0	142.0		122.5	159.3	147.0	146.0	116.0	31.7			29.0	32.0	34.0
24	X12-3010-2-18-1	139.8		0.40	147.0	141.0		122.0	162.5	142.0	146.0	114.0	33.5		-1.86	30.0	34.5	36.0
25	X12-3010-4-4-1	141.3		1.51	145.0	145.0	143.0	125.0	160.7	142.0	149.0	121.0	34.7		-0.94	35.0	34.0	35.0
26	03549A1-18-25-4	137.6	l	-0.32	140.0	139.0	144.0	119.5	157.3	142.0	144.0	115.0	35.2		-0.97	35.0	35.5	35.0
27	0570A1-2-32-5-1-4	139.3			143.0	143.0	144.0	122.5	157.7	142.0	146.0	116.0	36.7			37.0	35.0	38.0
28	05222A1-1-2-7-1	139.3		-1.43	144.0	141.0	145.0	121.5	158.7	147.0	142.0	115.0	28.5	l	-2.54	25.0	30.5	30.0
29	09186A1-10-2	137.5	l	-0.87	142.0	140.0	140.0	120.0	157.7	142.0	144.0	114.0	36.0		-1.77	34.0	36.0	38.0
30	0570A1-2-39-2-4	140.4			145.0	143.0	145.0	122.5	159.8	147.0	145.0	116.0	32.3			30.0	33.0	34.0
31	0762A1-2-8	140.2			147.0	144.0	145.0	122.5	159.1	142.0	147.0	115.0	31.8			28.0	31.5	36.0
32	MO170763	141.2		-0.37	149.0	143.0	146.0	121.0	161.3	147.0	146.0	116.0	36.0		1.40	35.0	38.0	35.0
33	MO170347	141.6	h	0.50	146.0	144.0	145.0	124.0	164.0	147.0	147.0	116.0	37.2		0.16	37.0	36.5	38.0
34	MO141284	139.3		-0.36	145.0	140.0	143.0	121.5	159.7	147.0	143.0	115.0	35.7		1.20	35.0	34.0	38.0
35	MO170392	138.0	l	-0.88	147.0	140.0	139.0	119.5	158.3	147.0	141.0	112.0	39.5	h	-1.14	35.0	38.5	45.0
36	MO170496	138.0	l	-0.57	143.0	140.0	140.0	121.5	156.3	147.0	141.0	115.0	40.0	h	-0.34	41.0	35.0	44.0
37	IL15-30529	136.9	l	-0.91	139.0	138.0	138.0	121.0	156.8	147.0	141.0	114.0	35.0		-0.56	36.0	33.0	36.0
38	IL14-28307	138.6	l	-2.70	142.0	142.0	140.0	124.0	157.8	144.0	144.0	115.0	37.0		-1.33	38.0	35.0	38.0
39	IL15-23803	137.8	l	-1.15	141.0	140.0	140.0	121.0	156.2	147.0	142.0	115.0	35.8		-0.96	37.0	34.5	36.0
40	IL15-17909	137.9	l	-0.45	140.0	139.0	145.0	120.5	157.0	147.0	142.0	113.0	38.3	h	-1.10	40.0	35.0	40.0
41	IL15-2639	138.3	l	-1.37	140.0	141.0	140.0	122.5	157.8	144.0	145.0	116.0	37.0		-0.92	40.0	33.0	38.0
42	MI14R1152	138.5	l	0.27	144.0	142.0	141.0	122.0	159.2	142.0	145.0	113.0	36.8		-1.32	37.0	35.5	38.0
43	MI16R0677	140.3		-0.81	144.0	145.0	145.0	124.0	159.0	144.0	146.0	115.0	35.3		-0.45	36.0	33.0	37.0
44	MI16R0728	139.0		0.40	141.0	141.0	148.0	121.0	158.7	143.0	144.0	115.0	35.0		1.15	35.0	34.0	36.0
45	MI16W0270	139.1		0.16	141.0	143.0	143.0	122.0	159.7	142.0	145.0	117.0	39.0	h	1.40	40.0	38.0	39.0
46	MI16W0522	140.0		0.63	143.0	143.0	145.0	123.0	159.3	144.0	146.0	117.0	35.5		0.41	36.0	34.5	36.0
100	AVERAGE	139.9																
101	MINUMUM	136.9																
102	MAXIMUM	143.6																
103	LSD(0.05)	2.0																
	Correlation with GEBV	0.44			0.33	0.39	0.33	0.29	0.40	0.00	0.38	0.49	0.42			-0.06	0.15	-0.05

Table 34. Summary of other traits collected on the 2018-2019 PNUWWSN.

		Warsaw, VA, VAT				Champaign, IL, KWS		VAT	VAT
		Lodging	Yield	Test Weight	Pre Harv	Winter Kill	Xanthamonas	LR Seedling	LR Seedling
		0-5	bu/ac	lbs/bu	Sprout	1-9	1-9	(0-3)	(0-3)
1	TRUMAN	4.0	78.4	57.5		2.5	35	3	3-
2	ERNIE	4.0	73.7	57.2		2.0	38	3	3-
3	FREEDOM	4.0	62.8	55.9		2.5	36	3	0;Tr3
4	PIONEER2545	4.0	76.8	55.1		3.0	34	3	23
5	DH11SRW066-153†	3.0	80.4	58.9		4.5	33	3	23;
6	VA16W-105†	3.0	85.4	56.8		3.5	31	23;	3-
7	VA12MAS7-519-1-3WS	3.0	65.8	49.7	YES	2.0	33	3-	23-
8	VA17W-126	4.0	89.3	57.4		3.0	35	3-;	23
9	15VDH-SRW02-075	3.0	87.5	55.8		8.0	28	0;	3-
10	OH15-191-52	4.0	94.5	57.0		3.0	35	1;/3	;1=
11	OH15-42-1	3.0	94.3	57.2		3.5	33	1;	;1=
12	OH15-165-51	3.0	97.4	58.0		3.0	35	;1=	1-;
13	OH15-131-31	4.0	95.9	56.6		4.0	33	;1=	;1=
14	OH15-89-68	4.0	91.8	56.6		2.0	37	3	23/;1-
15	KWS198	3.0	90.4	59.2		2.0	37	0;	23
16	KWS219	2.0	88.4	59.0		6.0	29	3	23-/Tr0;
17	KWS233	3.0	89.4	60.4		2.5	32	3	3
18	KWS235	4.0	87.9	57.0		1.5	34	3-	3-
19	KWS240	3.0	82.5	57.1		2.0	35	12;	12-;
20	KWS258	3.0	71.2	51.2	YES	7.0	28	23-	23-
21	X11-0414-117-12-5	4.0	76.6	56.7		6.5	30	3	3-
22	X12-050-214-2-3	3.0	67.9	58.3		3.0	34	0;/3	23-
23	X12-619-205-20-3	3.0	82.5	57.6		6.0	29	3-	3-Tr0;
24	X12-3010-2-18-1	2.0	53.0	57.8		6.0	30	23;	0;
25	X12-3010-4-4-1	2.0	80.7	58.4		1.5	35	3	0;
26	03549A1-18-25-4	2.0	74.2	57.6		1.5	35	1;	12-N
27	0570A1-2-32-5-1-4	4.0	80.6	59.0		2.5	37	23-;	21N
28	05222A1-1-2-7-1	1.0	71.6	56.4		5.5	25	23;	;1-
29	09186A1-10-2	5.0	78.7	58.7		3.5	34	3-;	12;
30	0570A1-2-39-2-4	4.0	78.0	58.1		5.0	30	3/1;	2;
31	0762A1-2-8	3.0	100.3	56.3		6.0	28	3/;1-	;12
32	MO170763	5.0	84.2	57.9		6.5	35	3	23-
33	MO170347	5.0	81.6	58.6		4.0	37	3	23-
34	MO141284	4.0	83.5	59.5		4.0	35	3	3-
35	MO170392	4.0	79.2	60.5		6.0	35	21;/3	12;
36	MO170496	3.0	72.6	60.4		2.0	41	3	3-
37	IL15-30529	2.0	76.1	59.7		1.5	36	23-;	12;
38	IL14-28307	4.0	95.4	59.4		2.0	38	3	23
39	IL15-23803	3.0	85.9	60.4		1.5	37	3-	23
40	IL15-17909	4.0	78.8	59.4		1.0	40	3	23
41	IL15-2639	4.0	85.0	61.1		1.0	40	21;	23;
42	MI14R1152	3.0	77.0	57.5		4.5	37	3	3-
43	MI16R0677	2.0	82.9	55.3		3.0	36	3	;1
44	MI16R0728	3.0	85.9	58.5		1.5	35	3	3
45	MI16W0270	2.0	66.9	46.2	YES	1.0	40	3	3
46	MI16W0522	3.0	80.0	51.2	YES	3.0	36	3	3
100	MEAN	3.3	80.4	57.5		3.4	34		
101	CV					34.3	5.7		
102	LSD(0.05)					2.4	3.9		

Table 35. Presence or absence of FHB QTL in the 2018-2019 NUWWSN entries. 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. The % or resistant alleles is calculated only for the 54 entries (no checks).

ENTRY	NAME	FHB1	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
1	TRUMAN	no	no	no	no	no	YES	YES	no	no	YES	YES
2	ERNIE	no	HET	no	no	HET	no	HET	HET	HET	HET	no
3	FREEDOM	no	no	no	ND	YES	no	HET	HET	HET	HET	no
4	PIONEER2545	no	no	no	ND	no	no	HET	HET	no	no	no
5	12VTK17-55	no	no	no	no	HET	no	no	HET	no	no	HET
6	12VTK17-132	no	no	no	no	no	no	no	no	YES	no	YES
7	15VDH-FHB-MAS22-14	YES	no	no	YES	YES	no	no	no	no	no	no
8	15VDH-FHB-MAS25-08	no	no	no	no	YES	YES	no	no	no	no	no
9	13VTK59-55	no	no	no	no	YES	no	no	YES	no	no	no
10	OH13-314-18	no	no	no	no	no	no	YES	no	no	no	no
11	OH14-222-49	no	no	no	no	no	HET	HET	no	no	no	no
12	OH14-112-34	YES	no	no	ND	no	no	YES	no	no	no	no
13	OH13-88-61	no	no	no	no	no	HET	no	no	no	no	no
14	KWS202	no	no	no	no	no	no	YES	HET	YES	no	no
15	KWS207	no	no	no	no	no	no	no	no	no	no	HET
16	KWS213	no	no	no	no	YES	no	no	no	no	no	no
17	KWS236	no	no	no	no	no	no	no	no	no	no	no
18	KWS242	no	no	no	no	no	no	no	no	no	no	no
19	LES177030	no	no	no	no	no	YES	no	no	YES	no	no
20	LES170137	no	no	no	no	no	no	YES	no	HET	no	no
21	LES172095	no	no	no	no	HET	HET	YES	no	YES	no	HET
22	LES170022	no	no	no	no	no	no	YES	no	YES	no	no
23	LES172093	no	no	no	no	no	HET	YES	no	YES	no	YES
24	KY06C-1178-16-10-3-34	HET	no	no	no	no	no	no	no	no	no	no
25	KY07C-1145-94-12-5	no	no	no	no	HET	HET	YES	HET	no	no	no
26	KY09C-1245-99-12-3	no	no	no	no	no	no	YES	no	HET	no	no
27	X11-0374-104-13-5	HET	no	no	no	YES	no	YES	YES	no	no	no
28	X11-0414-116-11-3	no	no	no	no	no	no	no	no	no	no	no
29	0566A1-3-1-48	HET	HET	no	no	no	no	YES	no	no	no	no
30	0537A1-3-12-1	no	no	no	no	no	no	HET	no	no	no	no
31	07469A1-6-1-1	HET	no	no	no	HET	no	YES	YES	YES	no	no
32	05247A1-7-3-98	HET	YES	no	no	HET	no	HET	YES	HET	no	no
33	04719A1-16-1-2-27-1	no	HET	no	no	HET	no	YES	no	YES	HET	no
34	MO151062	no	no	no	ND	no	YES	YES	YES	no	no	no
35	MO151082	no	no	no	no	no	YES	no	no	no	HET	no
36	MO161002	no	no	no	no	no	YES	YES	no	YES	YES	no
37	MO170924	no	no	no	no	no	HET	YES	no	no	no	HET
38	MO170592	no	no	no	no	no	YES	YES	YES	YES	HET	YES
39	IL14-28462	no	no	no	no	no	no	no	no	no	YES	YES
40	IL14-28444	no	no	no	no	no	no	no	no	no	YES	no
41	IL14-28468	no	no	no	no	no	no	no	no	no	YES	YES
42	IL14-DC-64-95-118	no	YES	no	no	no	no	HET	no	HET	no	no
43	IL14-11830	YES	no	no	no	no	YES	YES	no	YES	no	no
44	MI16R0898	HET	no	no	no	no	no	YES	no	no	no	no
45	MI16R1172	no	no	no	no	no	YES	no	no	no	no	no
46	MI16R0936	HET	no	no	no	no	no	HET	YES	HET	no	no
47	MI16W0258	no	YES	no	no	no	no	no	no	no	no	YES
48	MI14R0082	YES	no	no	no	no	no	no	no	HET	no	no
49	NE10478-1	no	no	no	no	no	no	YES	HET	HET	YES	no
50	NE12561	no	no	no	no	no	no	HET	YES	HET	no	no
51	NE13515	no	no	no	no	no	no	no	YES	no	YES	no
52	NE14696	no	no	no	no	no	no	HET	YES	HET	no	no
53	NE16424	no	no	no	no	no	no	no	YES	YES	no	no
54	NY99056-161	no	YES	no	no	no	no	no	YES	no	no	no
55	NY11014-9-60-1320	HET	no	no	no	no	no	no	no	no	no	no
56	NY11025-02-23-1367	HET	HET	no	no	no	no	HET	HET	HET	no	no
57	NY11013-10-6-1311	no	no	no	no	no	no	no	no	no	HET	no
58	NY11029-10-24-1340	no	no	no	no	no	no	HET	no	no	HET	no
	Frequency of "R" allele	0.147	0.095	0.000	0.017	0.138	0.190	0.422	0.250	0.293	0.147	0.138

Table 36. Presence or absence of FHB QTL in the 2018-2019 PNUWWSN entries. 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. The frequency of resistant alleles is calculated only for the 42 entries (no checks).

ENTRY	NAME	Fhb1	5A Ernie	4A 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
1	TRUMAN	no	no	no	no	no	YES	YES	no	no	YES	YES
2	ERNIE	no	HET	no	no	HET	no	YES	HET	HET	no	no
3	FREEDOM	no	no	no	no	YES	no	YES	no	no	no	no
4	PIONEER2545	no	no	no	no	no	no	HET	YES	no	no	no
5	DH11SRW066-153†	no	no	no	no	no	no	no	no	YES	no	no
6	VA16W-105†	YES	no	no	no	no	no	YES	YES	YES	no	no
7	VA12MAS7-519-1-3WS	no	no	no	no	no	no	no	no	YES	HET	no
8	VA17W-126	no	no	no	no	no	no	no	HET	no	no	no
9	15VDH-SRW02-075	no	no	no	no	no	no	no	YES	no	no	no
10	OH15-191-52	YES	no	no	no	HET	no	no	no	YES	no	no
11	OH15-42-1	YES	no	no	no	no	no	no	no	no	no	no
12	OH15-165-51	no	no	no	no	no	no	no	YES	YES	no	no
13	OH15-131-31	YES	no	no	no	YES	no	no	YES	YES	no	no
14	OH15-89-68	no	no	no	ND	YES	no	YES	YES	no	no	no
15	KWS198	no	no	no	no	no	no	no	YES	no	no	no
16	KWS219	no	no	no	no	YES	no	YES	no	no	no	no
17	KWS233	no	no	no	no	no	YES	YES	no	no	no	no
18	KWS235	no	no	no	no	no	no	no	no	no	no	no
19	KWS240	no	no	no	no	no	HET	HET	no	no	HET	no
20	KWS258	no	no	no	no	no	no	YES	no	HET	no	no
21	X11-0414-117-12-5	no	no	no	no	no	YES	no	no	no	no	no
22	X12-050-214-2-3	HET	no	no	no	HET	no	HET	YES	no	HET	no
23	X12-619-205-20-3	HET	no	no	no	no	YES	no	no	no	no	no
24	X12-3010-2-18-1	no	no	no	no	no	no	no	no	no	no	no
25	X12-3010-4-4-1	no	no	no	no	no	YES	no	no	no	YES	no
26	03549A1-18-25-4	HET	HET	no	no	no	no	YES	no	YES	no	no
27	0570A1-2-32-5-1-4	no	YES	no	no	no	no	YES	no	YES	no	no
28	05222A1-1-2-7-1	HET	HET	no	no	no	no	YES	YES	YES	no	no
29	09186A1-10-2	no	HET	no	no	no	YES	YES	YES	no	no	no
30	0570A1-2-39-2-4	HET	YES	no	no	no	no	HET	HET	HET	no	no
31	0762A1-2-8	YES	YES	no	no	no	no	YES	no	no	no	no
32	MO170763	no	no	no	no	no	HET	YES	HET	HET	YES	HET
33	MO170347	no	no	no	ND	no	no	YES	no	no	YES	no
34	MO141284	no	no	no	no	no	no	HET	HET	HET	HET	no
35	MO170392	no	no	no	no	no	no	HET	no	HET	no	no
36	MO170496	no	no	no	no	no	YES	no	no	no	no	YES
37	IL15-30529	HET	no	no	no	no	YES	no	HET	no	no	no
38	IL14-28307	no	no	no	no	no	no	no	no	YES	no	no
39	IL15-23803	no	HET	no	no	no	YES	no	no	no	YES	YES
40	IL15-17909	no	no	no	no	no	HET	YES	no	no	HET	no
41	IL15-2639	HET	no	no	no	HET	no	YES	HET	YES	no	no
42	MI14R1152	no	no	no	no	no	no	no	no	no	no	no
43	MI16R0677	no	no	no	no	no	no	HET	YES	no	no	no
44	MI16R0728	HET	no	no	no	no	YES	no	no	no	no	no
45	MI16W0270	no	no	no	no	no	no	no	no	no	no	no
46	MI16W0522	no	HET	no	no	no	no	no	HET	no	no	no
	Frequency of "R" allele	0.155	0.095	0.000	0.000	0.078	0.181	0.293	0.233	0.233	0.112	0.043

Table 37. Quality parameters for the 2018-2019 NUWWSN. Data is from the USDA Soft Wheat Quality Lab. Additional information is available in an excel file from sneller.5@osu.edu.

Entry Number	Entry	Test Weight (LB/BU)	NIR Kernel Protein (at 12%)	SKCS Kernel Hardness	SKCS Kernel Diameter (mm)	SKCS Kernel Weight (mg)	Adjusted Flour Yield (%)	Corrected Flour Yield (%)**	Softness Equivalent (%)	Flour Protein (at 14%)	Lactic Acid SRC (%)	Sodium Carbonate SRC (%)
55	TRUMAN	58.1	10.0	9.5	2.6	35.0	65.7	67.1	58.2	7.5	107.9	68.3
56	ERNIE	58.5	10.5	4.6	2.9	37.1	67.3	68.7	59.8	7.8	122.4	67.1
57	FREEDOM	56.7	10.6	14.4	2.8	35.7	65.8	67.2	57.6	7.6	99.4	69.0
58	PIONEER2545	56.5	10.0	16.5	2.7	36.3	65.4	66.7	59.0	7.8	106.0	70.8
59	12VTK17-55	59.5	11.0	8.1	2.8	36.0	67.9	69.3	56.6	8.1	96.0	67.6
60	12VTK17-132	59.7	11.1	12.4	2.8	36.6	68.1	69.4	56.6	8.5	111.5	66.7
61	15VDH-FHB-MAS22-14	62.1	11.8	26.0	2.8	32.0	64.6	66.0	51.6	8.9	134.8	68.2
62	15VDH-FHB-MAS25-08	59.5	10.1	11.7	2.7	35.2	67.5	68.8	60.5	7.7	118.1	71.4
63	13VTK59-55	60.6	10.4	22.0	2.9	33.7	66.4	67.7	53.4	8.3	119.8	70.0
64	OH13-314-18	58.2	10.8	5.4	2.7	37.7	66.7	68.1	58.5	7.9	103.1	67.1
65	OH14-222-49	59.8	10.5	6.5	2.9	40.0	69.1	70.5	58.3	7.9	119.9	64.5
66	OH14-112-34	57.8	9.4	5.9	2.7	34.6	67.1	68.4	57.8	7.1	126.2	68.6
67	OH13-88-61	57.2	10.3	13.4	2.8	41.1	66.2	67.6	55.1	7.7	120.1	69.5
68	KWS202	55.5	9.7	-0.9	2.7	37.9	68.8	70.2	65.1	6.7	119.9	71.1
69	KWS207	58.0	9.5	2.4	2.8	36.7	67.9	69.2	64.2	6.8	93.7	73.7
70	KWS213	57.3	9.3	1.1	2.6	33.8	67.5	68.9	58.4	6.9	107.8	66.8
71	KWS236	59.4	9.5	12.3	2.8	34.8	66.5	67.9	62.8	6.6	116.1	74.8
72	KWS242	57.7	9.1	0.8	2.7	34.9	68.7	70.0	66.6	6.4	113.6	72.9
73	BRANSON	58.0	9.3	11.9	2.8	35.4	69.5	70.9	64.4	6.8	124.9	68.4
74	LES177030	60.0	9.4	12.3	2.8	34.9	69.4	70.8	61.4	7.0	128.8	66.7
75	LES170137	58.3	9.5	28.7	2.9	34.5	70.3	71.6	52.2	7.3	106.2	67.3
76	LES172095	58.5	9.7	4.2	2.7	35.3	67.4	68.7	63.8	6.9	107.0	70.5
77	LES170022	58.7	10.0	21.0	2.9	34.5	70.6	72.0	52.6	7.4	101.1	68.0
78	LES172093	58.2	9.6	6.2	2.7	35.4	67.2	68.5	63.6	6.8	100.7	69.1
79	KY06C-1178-16-10-3-34	57.5	9.7	2.2	2.9	41.7	68.9	70.2	60.5	7.0	119.0	69.1
80	KY07C-1145-94-12-5	59.9	9.4	-0.9	2.6	31.3	67.8	69.2	65.9	7.2	125.1	70.5
81	KY09C-1245-99-12-3	58.6	10.0	14.7	2.7	33.3	66.1	67.5	60.5	7.3	118.8	72.9
82	X11-0374-104-13-5	58.5	9.4	8.1	2.7	35.3	66.3	67.6	62.2	7.2	127.8	70.0
83	X11-0414-116-11-3	58.0	10.2	16.3	2.9	37.0	68.9	70.3	58.9	7.6	121.0	65.6
84	0566A1-3-1-48	58.6	10.2	11.2	2.9	36.5	67.0	68.4	61.9	7.4	117.9	68.2
85	0537A1-3-12-1	59.6	10.4	14.4	2.9	40.2	66.5	67.8	58.4	7.8	124.6	69.0
86	07469A1-6-1-1	56.5	10.2	8.3	2.8	34.7	67.7	69.1	63.4	7.4	115.7	65.9
87	05247A1-7-3-98	59.3	10.6	15.2	2.8	34.6	66.4	67.7	57.4	7.7	102.7	70.4
88	04719A1-16-1-2-27-1	59.7	10.5	21.5	2.7	31.7	66.1	67.5	56.3	7.6	104.1	70.6
89	L11541	59.4	9.9	12.8	2.7	32.5	67.7	69.1	60.5	7.3	116.9	69.2
90	MO151062	60.9	10.1	11.2	2.8	36.6	66.4	67.8	61.2	7.4	124.1	69.6
91	MO151082	59.9	10.0	9.6	2.6	34.8	67.7	69.0	61.1	7.6	116.3	69.3
92	MO161002	59.5	10.4	6.4	2.7	31.6	66.4	67.7	63.0	7.7	104.3	64.7
93	MO170924	58.0	10.3	10.3	2.8	36.8	66.6	67.9	57.1	7.8	98.6	67.1
94	MO170592	60.2	10.3	7.7	2.8	36.5	66.9	68.2	61.3	7.5	126.5	69.7
95	IL14-28462	59.5	9.5	3.9	2.5	31.4	69.0	70.3	62.0	7.1	106.6	63.5
96	IL14-28444	60.9	9.6	-5.2	2.7	36.3	69.6	70.9	64.8	7.2	106.7	68.2
97	IL14-28468	60.6	9.5	2.0	2.7	34.6	68.2	69.6	59.5	7.1	107.2	63.3
98	IL14-DC-64-95-118	59.1	9.2	12.3	2.6	30.8	66.8	68.1	58.6	6.9	117.8	73.1
99	IL14-11830	59.3	9.6	8.0	2.7	32.0	68.0	69.4	61.6	7.1	125.6	66.3
100	SHIRLEY	58.8	10.0	4.2	2.8	41.1	67.7	69.0	59.1	7.4	99.6	70.3
101	MI16R0898	58.4	9.7	12.6	2.8	36.2	66.2	67.6	59.1	7.0	108.6	68.8
102	MI16R1172	59.8	10.3	8.3	2.8	35.3	67.3	68.7	60.4	8.0	120.5	65.5
103	MI16R0936	58.5	10.5	9.7	3.0	40.9	69.8	71.1	57.9	7.7	111.5	65.4
104	MI16W0258	59.4	9.9	6.5	2.8	40.1	69.0	70.4	57.0	7.6	112.6	68.5
105	MI14R0082	60.3	12.9	38.6	2.8	34.2	61.1	62.5	46.4	10.2	91.1	75.0
106	NE10478-1	59.8	10.6	60.1	2.8	35.3	66.6	67.9	41.2	9.3	133.5	79.6
107	NE12561	60.7	10.8	57.9	2.9	35.4	68.4	69.7	44.6	9.4	139.5	79.4
108	NE13515	60.4	10.9	63.9	2.8	32.3	65.4	66.7	45.0	9.3	133.6	86.6
109	NE14696	57.7	10.0	34.8	2.8	35.6	67.0	68.4	59.3	8.1	131.8	83.5
110	NE16424	58.8	10.2	47.5	2.8	35.4	68.4	69.7	47.1	8.4	115.9	79.1
111	NY99056-161	56.2	10.4	23.6	2.8	35.3	67.0	68.3	57.7	8.0	101.1	72.4
112	NY11014-9-60-1320	56.8	10.8	18.0	2.8	36.4	66.3	67.6	56.0	8.1	80.8	69.1
113	NY11025-02-23-1367	54.6	9.9	25.7	2.7	34.8	66.5	67.8	56.7	7.7	83.5	69.7
114	NY11013-10-6-1311	58.2	10.1	23.0	2.7	37.5	67.1	68.5	58.6	8.1	92.9	70.8
115	NY11029-10-24-1340	58.7	9.6	14.0	2.6	33.5	66.8	68.1	59.9	7.5	100.8	69.5
	Average	58.8	10.1	14.7	2.8	35.5	67.3	68.7	58.4	7.6	113.0	70.0
	Standard Deviation	1.4	0.7	14.3	0.1	2.5	1.5	1.5	5.2	0.7	12.8	4.4

Table 38. Quality parameters for the 2018-2019 PNUWWSN. Data is from the USDA Soft Wheat Quality Lab. Additional analytical data is available in an excel file from sneller.5@osu.edu.

Lab Number	Entry Number	Entry	Test Weight (LB/BU)	NIR Kernel Protein (at 12%)	SKCS Kernel Hardness	SKCS Kernel Diameter (mm)	SKCS Kernel Weight (mg)	Adjusted Flour Yield (%)	Corrected Flour Yield (%)**	Softness Equivalent (%)	Flour Protein (at 14%)	Lactic Acid SRC (%)	Sodium Carbonate SRC (%)
1910116	116	TRUMAN	58.0	10.1	8.4	2.6	33.9	66.5	68.2	60.2	7.6	108.0	68.6
1910117	117	ERNIE	58.7	10.6	3.8	2.9	36.4	67.4	69.1	59.6	7.9	120.8	67.4
1910118	118	FREEDOM	56.8	10.2	14.6	2.8	35.9	66.3	67.9	58.3	7.5	96.7	69.9
1910119	119	PIONEER2	56.8	10.0	14.8	2.7	35.6	65.4	67.1	57.6	7.9	102.3	71.9
1910120	120	DH11SRW	60.0	10.4	18.8	2.7	34.8	67.7	69.4	61.0	8.0	128.9	71.1
1910121	121	VA16W-105	57.0	9.4	10.4	2.6	36.4	66.0	67.7	61.4	7.3	131.1	74.0
1910122	122	VA12MAS7-	53.1	9.8	17.4	2.9	36.3	64.9	66.6	54.5	7.0	89.3	72.8
1910123	123	VA17W-126	58.1	10.1	21.9	2.9	38.2	66.5	68.2	58.5	7.3	124.0	73.8
1910124	124	15VDH-SR	58.2	9.8	7.7	3.0	39.8	66.6	68.3	61.3	7.4	112.0	70.5
1910125	125	OH15-191-	58.2	9.5	9.1	2.7	34.5	67.2	68.8	57.8	7.4	101.0	66.7
1910126	126	OH15-42-1	57.8	9.8	7.9	2.8	35.9	68.2	69.9	59.0	7.2	106.3	66.8
1910127	127	OH15-165-	59.5	10.1	18.3	2.8	36.5	70.6	72.3	56.2	7.7	104.5	64.9
1910128	128	OH15-131-	57.5	9.9	14.2	2.9	41.7	68.2	69.9	53.4	7.5	93.4	66.8
1910129	129	OH15-89-6	57.8	9.5	8.8	2.8	36.5	68.4	70.0	59.1	6.9	90.9	67.0
1910130	130	KWS198	56.4	10.0	18.5	2.9	39.9	63.1	64.8	55.3	7.3	113.9	79.7
1910131	131	KWS219	60.1	10.2	13.0	2.9	33.9	66.8	68.5	56.0	7.7	134.7	70.2
1910132	132	KWS233	60.5	10.1	9.8	2.8	33.3	67.8	69.5	60.3	7.3	123.5	68.9
1910133	133	KWS235	58.3	9.9	0.5	2.8	34.8	69.9	71.6	61.9	7.3	102.0	68.2
1910134	134	KWS240	58.1	10.0	5.5	2.8	36.5	67.8	69.5	63.0	7.0	124.2	70.8
1910135	135	KWS258	54.3	10.7	5.9	2.9	43.5	67.5	69.2	56.8	7.5	81.9	69.3
1910136	136	BRANSON	58.2	9.8	3.3	2.7	36.6	68.6	70.3	63.1	7.3	124.9	69.5
1910137	137	X11-0414-1	57.7	10.8	13.2	2.8	36.1	67.2	68.9	60.0	7.9	119.1	67.9
1910138	138	X12-050-21	59.7	10.4	15.5	2.7	34.2	66.3	68.0	59.3	7.7	128.7	68.8
1910139	139	X12-619-20	58.9	10.4	17.7	2.9	38.5	65.5	67.2	57.9	7.8	131.1	69.4
1910140	140	X12-3010-2	59.0	11.5	14.1	2.8	37.1	65.9	67.6	55.7	8.3	99.8	70.1
1910141	141	X12-3010-4	59.1	10.0	18.3	2.8	38.7	65.1	66.8	55.4	7.3	112.2	74.6
1910142	142	03549A1-1	58.5	10.3	4.6	2.9	39.1	66.9	68.6	61.2	8.3	125.4	70.7
1910143	143	0570A1-2-3	59.7	10.3	8.1	3.0	44.3	66.2	67.9	58.7	8.3	129.2	69.9
1910144	144	05222A1-1	57.7	10.8	14.4	2.8	33.3	68.1	69.8	58.4	7.9	93.2	68.0
1910145	145	09186A1-1	59.6	11.0	17.6	2.9	36.5	65.9	67.5	56.5	8.8	108.2	75.2
1910146	146	0570A1-2-3	59.4	10.5	13.7	2.8	34.2	67.9	69.6	57.8	7.9	121.9	67.4
1910147	147	0762A1-2-8	57.2	9.9	8.6	3.0	38.1	66.9	68.6	57.8	7.3	109.5	69.5
1910148	148	SHIRLEY	58.3	9.9	1.3	2.8	38.7	68.1	69.8	59.4	7.2	96.0	71.3
1910149	149	MO170763	58.6	10.0	2.5	2.6	35.6	68.0	69.7	60.9	7.5	115.8	72.2
1910150	150	MO170347	59.0	9.8	21.2	2.7	33.3	64.9	66.6	56.7	7.2	107.7	72.4
1910151	151	MO141284	59.8	9.5	19.3	2.7	33.9	66.0	67.7	57.8	7.5	113.6	72.2
1910152	152	MO170392	60.7	10.1	9.1	2.9	39.2	67.1	68.8	58.2	8.0	124.1	73.7
1910153	153	MO170496	60.6	10.2	3.0	2.9	44.4	66.4	68.1	60.5	7.9	117.3	71.3
1910154	154	IL15-30529	60.0	10.6	22.7	2.9	36.7	65.9	67.6	51.7	8.6	125.8	66.7
1910155	155	IL14-28307	60.1	9.5	1.9	2.7	34.0	66.9	68.6	59.5	7.6	133.3	66.7
1910156	156	IL15-23803	61.6	9.9	4.8	2.8	37.0	68.3	70.0	55.0	8.0	118.1	69.4
1910157	157	IL15-17909	59.5	11.0	7.6	2.7	36.8	68.0	69.7	57.8	8.6	129.2	67.1
1910158	158	IL15-2639	62.0	10.8	-1.6	2.8	36.0	67.4	69.1	58.9	8.4	130.4	67.6
1910159	159	MI14R1152	58.3	12.2	8.4	3.0	41.0	66.6	68.3	53.1	9.1	117.5	67.8
1910160	160	MI16R0677	56.1	9.9	12.3	2.8	35.0	66.3	68.0	58.3	7.2	103.3	75.0
1910161	161	MI16R0728	59.4	10.3	16.1	2.8	36.3	65.7	67.4	58.2	7.8	109.2	72.1
1910162	162	MI16W027(	49.7	10.4	6.4	2.9	41.1	66.5	68.2	55.6	7.3	91.3	69.4
1910163	163	MI16W052:	53.8	10.1	13.3	2.8	37.4	68.6	70.3	58.4	6.9	92.1	68.2
1910164	164	L11541	59.4	9.2	16.2	2.7	32.3	68.3	70.0	61.4	7.0	113.4	69.8
		Average	58.3	10.2	11.1	2.8	36.9	67.0	68.7	58.3	7.7	112.9	70.1
		Standard Devia	2.2	0.5	6.2	0.1	2.9	1.3	1.3	2.5	0.5	13.8	2.8