Report on the 2009-2010 Northern Uniform Winter Wheat Scab Nurseries (NUWWSN and PNUWWSN)

C. Sneller[1]*, P. Paul[2], M. Guttieri[1], L. Herald[1], and B. Sugerman[1]
Dept. of Horticulture and Crop Science[1], Dept. Plant Pathology[2], The Ohio State University, Wooster, Ohio 44691
*Corresponding author: PH:(330)263-3944, E-mail: sneller.5@osu.edu

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 eash 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 allmust 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, while other simply have exotic parentage.

In this report we present 1) a summary of the 2009-201 trials and 2) an analysis of all lines tested in the P+NUWWSN from 1998-2010 to test for trends in FHB resistance over time.

MATERIAL AND METHODS

Current Year: The locations that reported data and the traits assessed are listed in Tables 1 and 2. The NUWWSN had 56 entries (& four checks, Table 3) and we obtained phenotypic data on seven traits from 13 locations. The PNUWWSN had 47 entries (& four checks, Table 4) and we obtained phenotypic data from eight 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.

For each trait, test environments were clustered to determine if there was a subset(s) of environments that had less GEI than the entire set. A matrix of GEI values were obtained and subjected to Ward's minimum variance clustering (eg clustering environments that produce low GEI variance) and to principal component analysis. Clusters of environments and outliers were determined based on visual inspection the resulting dendogram and graphs.

1998-2010 analysis: Since 1998, 722 lines have been assessed for FHB in the NUWWSN and PNUWWSN. We obtained best-linear unbiased predictors (BLUPs) of each line for all seven FHB traits using three data types:

Y = phenotypes within each trial/year/location combination
Y' = Y minus the mean of MR checks (Freedom, Ernie) for that trial/year/location
Y" = Y'/standard deviation of all lines in that trial/year/location

Each line was classified by the year it was first tested (1stYR). Three different regressions were conducted to assess trends over time.

1) Regression of BLUPs (Y, Y' and Y") on 1stYR using data from all 722 lines.
2) Obtain mean BLUP (Y, Y' and Y") for each trait for each level of 1stYR and regression those means on 1stYR: eg mean BLUP of lines first tested in 1998, mean BLUP of all lines first tested in 1999 ... mean BLUP of lines first tested in 2010.
3) Obtain mean BLUP (Y, Y' and Y") for each trait for rolling 2-year periods of 1stYR and regress those means on period. There were 12 periods: mean of period 1 is mean BLUP of lines first tested in 1998 or 1999, mean for period 2 is mean BLUP of lines first tested in 1999 or 2000 .... mean of period 12 is mean BLUP of lines first tested in 2009 or 2010.

RESULTS

Current tests: The mean for each entry over all environments for all FHB traits are shown in tables 8 and 10. In the NUWWSN, 12 entries had a lower index value than Truman (the most MR check) while only one entry in the PNUWWSN has a lower index than Truman. Based on analysis of all traits, the best and worst lines from each trial were identified and are show in Tables 9 and 11.

In the NUWWSN, seven entries had molecular marker evidence the Asian allele for resistance at Fhb1, four may have resistance at 3Bc from Ernie, and six may have resistance at 5A. No entries had Fhb1 and 5A. In the PNUWWSN, three entries had molecular marker evidence the Asian allele for resistance at Fhb1, two may have resistance at 3Bc from Ernie, and five may have resistance at 5A from Ernie and one has the Asian allele at 5A. Five of the seven entries in the NUWWSN with Fhb1 were among the most resistant lines in the NUWWSN, though the four very best entries had no evidence of FHB QTL (Table 9). One entry in the PNUWWSN has Fhb1 and 5A and it was in the most resistant class along with 10 other entries that had no evidence of FHB QTL (Table 11).

There is no test for GEI, but the ratio of GEI sum of squares (SS) to total SS and to genotype SS suggests GEI is important (Table 5). For each FHB trait and each trial, there was evidence of clusters of environments with reduced GEI and outlier environments. For FHB field traits and analyses involving all environments, the SS from GEI was on average 1.68 times greater than the SS due to genotypes. This ratio was reduced to 0.95 when analyses only involved environments within clusters. This indicates that genotype effects are estimated more accurately within clusters than by means over all environments.

Most of FHB traits were highly correlated in the NUWWSN where the correlations among INC, SEV, IND, FDK, ISK, and DON all exceeded 0.62 (Table 6). GHSEV was not highly correlated to any other FHB traits in the NUWWSN. The correlations among FHB traits were generally lower in the PNUWWSN than the NUWWSN and the correlations of GHSEV with other FHB traits were greater than in the NUWWSN. The correlations of HD and HGT with FHB traits were modest overall and variable within test environments (Table 7). In most locations, all or nearly all correlations of HD and HGT with FHB traits were not significant. In the NUWWSN, the KYLEX and MDSAL locations were considered outlier environments for many traits (Table 7). In KYLEX there was generally a positive correlation of HD and HGT with FHB traits while in MDSAL the correlations were negative. The magnitude of these correlations and their change in sign between the two locations may explain why they were considered outliers.

1998-2010 Analysis: No regression using data from the 722 individual lines was significant while the regressions using 1stYR means or rolling means for Y. Y', or Y" produced significant results for some traits. Generally the regression for a given trait using Y, Y', or Y" gave similar results. Regression using rolling means for Y' generally produced the greatest R^2 values and will be discussed.

Using data from all 12 periods, the regression of Y' on period was significant for severity and index only (Table 34). Graphing of trends over time showed that periods 1, 2 and 3 (1998+1999, 1999+2000, 2000+2001) appeared to be outliers for several traits (see Figures 1a-g). When those three periods were removed, the regression was significant for severity, index and DON (Table 34 and Figs 1a, 1b, and 1c). The slopes of these regressions are modest.

All traits showed a modest decrease with increasing period. A modest response would be expected in a uniform trial where lines are from many programs that use varying selection intensities and parentage, and lines are entered in the trials for various purposes: greater gains would be expected within a program solely focused on improving FHB resistance.

Index showed the greatest response over time (Table 34). Index is easy to assess in the field and is often used in early generation selection among head rows and unreplicated plots. Index is a function of incidence (Type I resistance) and severity (Type II resistance). The analyses indicate that progress in reducing index likely comes from progress in improving type II resistance and not from improving type I resistance as incidence showed no response over time (Fig. 1d). Assessing type I resistance is laborious and few programs can effectively exert much selection pressure on type I resistance. The same is likely true for Fusarium damaged kernels (FDK) and DON where fewer lines can be phenotyped for these traits than for index and thus less selection pressure can be exerted. There were significant correlations among the BLUPs for all seven FHB traits. It is likely that selection for low index likely accounts for most decrease in FDK and DON.

Most resistance in the 722 lines comes from native sources. The first axis of the principal component analyses accounted for 68% of the total variation and all traits had a negative correlation to this axis (thus lower PC1 scores indicate greater resistance). Of the 20 lines with the lowest scores for this axis, 14 had no marker or pedigree evidence of FHB1 or resistance from Asian sources.

The BLUPs for all traits for Y' will be made available upon request and will be distributed to all cooperators along with Excel versions of all tables.

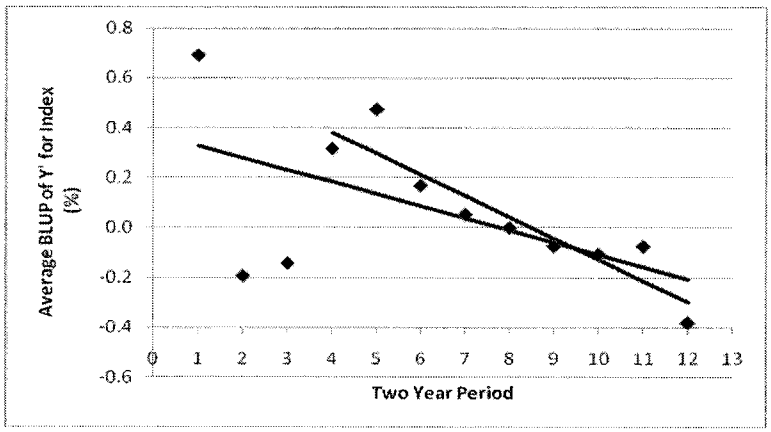

Figure 1a. Regression of average BLUPs of Y' for IND for rolling two year periods on period

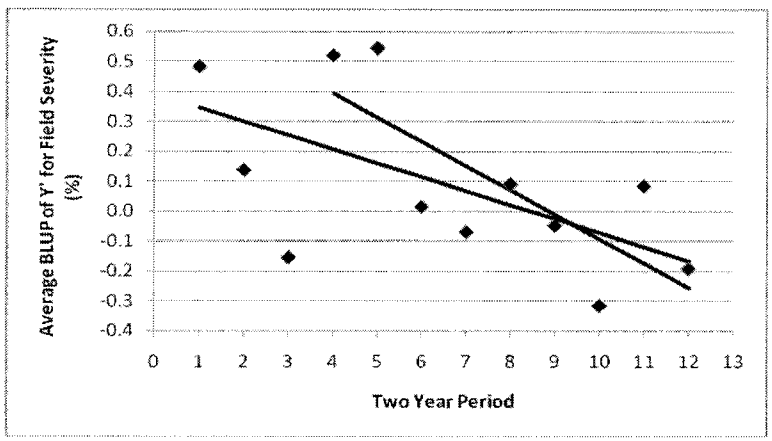

Figure 1b. Regression of average BLUPs of Y' for SEV for rolling two year periods on period

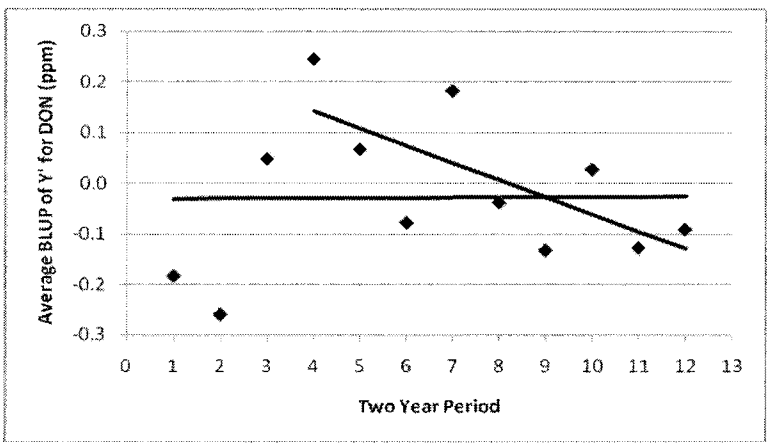

Figure 1c. Regression of average BLUPs of Y' for DON for rolling two year periods on period

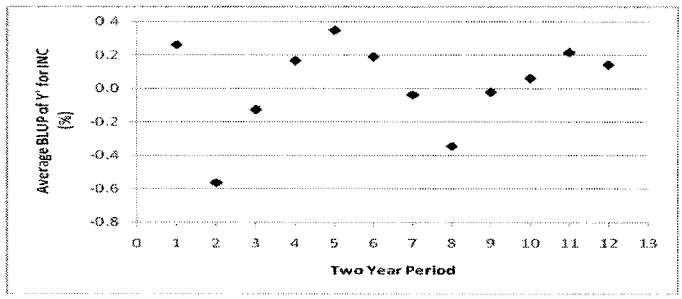

Figure 1d. Average BLUPs of Y' for INC for rolling two year periods versus period

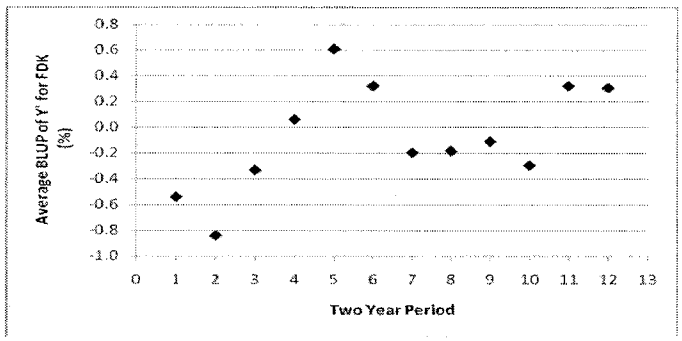

Figure 1e. Average BLUPs of Y' for FDK for rolling two year periods versus period

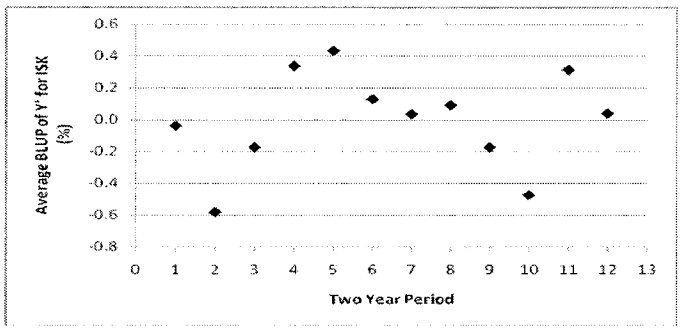

Figure 1f. Average BLUPs of Y' for ISK for rolling two year periods versus period

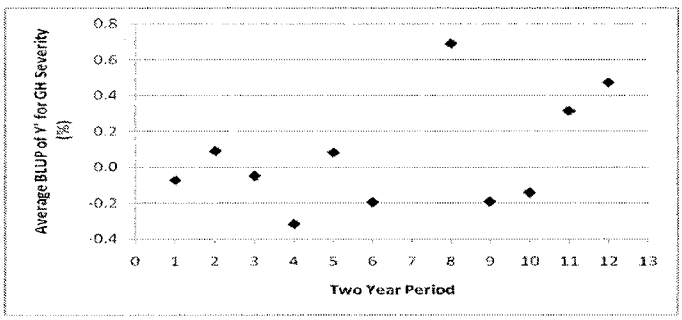

Figure 1g. Average BLUPs of Y' for GHSEV for rolling two year periods versus period

Table 1. Cooperators in the 2009-2010 NUWWSN and PNUWWSN

ENV CODE	LOCATION	NUWWSN	PNUWWSN	COOPERATORS	INSTITUTE	INSTITUTE CODE
ILURB	Urbana, IL	yes	yes	Fred Kolb, Eric Brucker	University of Illinois	UIL
INBRO	Brookston, IN	yes	yes	Barton Fogleman, Jennifer Vonderwall	Syngenta, Agripro	SYN
INLAY	Lafayette, IN	yes	yes	Herb Ohm	Purdue University	PUR
KYLEX	Lexington, KY	yes	yes	David Van Sanford, Nikki Mundell	Unversity of Kentucky	UKY
MDSAL	Salisbury, MD	yes	no	Jose Costa	University of Maryland	UMD
MIELA	East Lansing, MI	yes	yes	Janet Lewis, Lee Siler	Michigan State University	MSU
MOCOL	Columbia, MO	yes	yes	Anne McKendry, David Teague	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
ONRID	Ridgetown, Ontario	yes	no	Lilly Tamburic, Mike Holtzworth	University of Guelph, Ridgetown	UGR
ROMAN	Calarasi, Romania	yes	no	Mariana Ittu	National Agricultural Research-Development	ROM
VABLA	Blacksburg, VA	yes	yes	Carl Griffey, Shuyu Liu	Virginia Tech	VAT

Table 2. Traits assessed in the 2009-2010 P+NUWWSN.

Code	Trait	Description	PNUWWSN Locations	NUWWSN Locations
SEV	Disease severity from field tests	% of infected spikelets in an infected head.	IL,IN,IN,KY,MI,MO,VA	IL,IN,IN,KY,MD,MI,MO,NE,NY, OH, ON, VA
INC	Disease incidence	% of heads with at least one infected spikelets	IL,IN,IN,KY,MI,MO,VA	IL,IN,IN,KY,MD,MI,MO,NE,NY, OH, ON, VA
IND	Disease index	IND = (SEVxINC)/100	IL,IN,IN,KY,MI,MO,OH,VA	IL,IN,IN,KY,MD,MI,MO,NE,NY, OH, ON, VA
FDK	Fusarium damaged kernels	Either a visual assessment of the percent infected kernels, or a percent of scabby seed by weight	IL,IN,IN,KY,MO	IL,IN,IN,KY,MD, MO,NE,RO
ISK	Composite of head and kernel traits	ISK Index = .3 (Severity) + .3 (Incidence)+.4 (FDK)	IL,IN,IN,KY,MO	IL,IN,IN,KY,MD,MO,NE
DON	DON (vomitoxin)	PPM of vomitoxin in grain	IL,KY,OH,VA	KY,MD,NE,OH,VA
GHSEV	Greenhouse severity	Same as SEV except from greenhouse	IL	IL,MO
	Milling quality score	A relative composite score based on traits that affect milling		IN
	Baking quality score	A relative composite score based on traits that affect baking		IN
	Softness equivalent score	A relative score based on softness equivalent		IN
	Test weight	Test weight in lbs/bu of clean grain		IN
	Whole grain protein	Percent protein of whole grain		
	Flour protein	NIR estimate of flour protein percentage (based on 13% moisture)		IN
	Flour yield	The weight of the flour that passes through a 40 mesh screen after milling, adjusted for moisture and SE, expressed as percentage of milled grain.		IN
	Softness equivalent	Percentage of flour that passes through a 94 mesh screen		IN
	Lactic acid solvent retention capacity	A measure of gluten strength based on percentage of LA solvent retained by a flour sample after centrifugation		IN
	Sucrose solvent retention capacity	A measure of pentosan content, and thus water absorption, based on percentage of sucrose solvent retained by a flour sample after centrifugation		IN

Table 3. Entries in the 2009-2010 NUSWWSN

ENTRY	SOURCE	NAME	PEDIGREE
1	UMO	ERNIE	
2	UMO	TRUMAN	
3	OSU	FREEDOM	
4	PIO	PIONEER2545	
5	COR	NY99045-3110	Geneva/P2737W
6	OSU	OH07-176-56	OH708 / P.92145E8-7-7-1-9
7	COR	NY94052-9340	P2737W/Harus
8	COR	NY99068-3251	NY87048W-7387/P25W33
9	COR	NY88046-7088	MD286-21/Harus
10	MSU	E5011B	Caledonia / NY88024-117
11	MSU	E5024	D6234 / Pioneer Brand 25W33
12	MSU	E3024	980775,(Caledonia, Geneva / Geneva)//NY85020-395
13	MSU	E6012	Caledonia / Pioneer Brand 25W33
14	MSU	E8052	P2552 / D8006
15	OSU	OH04-264-58	OH645/HOPEWELL
16	OSU	OH05-101-1	HOPEWELL/PIONEER25R26
17	OSU	OH05-164-76	PIONEER25R18/OH686
18	OSU	OH05-200-74	OH629/HOPEWELL
19	PUR	99691A2-5-4-16-1	NC97BGTD8/Patterson//92212/3/9560
20	PUR	01946A1-16-48-5	981477/981128//INW0304/981250
21	PUR	057RA1-8-5	Truman/96169/49819/3INW9811//Fdm/201R
22	PUR	059A1-2-4-3	Truman/INW0316/4/9819/3/Freedom//Ernie/INW9824
23	SUN	TABOO	L930605/ASHLAND
24	SUN	MONDO	ROANE/IL95-3245
25	SUN	PROBE	MENDON/GR915
26	SUN	RUMOR	HOPEWELL/HONEY
27	SYN	03M1539#019	GIBSON/92226E2-5-3
28	SYN	03M1539#031	GIBSON/92226E2-5-3
29	SYN	W1104	HOPEWELL/M94-1107
30	SYN	ML06-2097	BENTON/M98-1569
31	UGR	GS-0-EM0681	Radiant/FE9
32	UGR	GS-0-EM0614	Radiant/BR32
33	UGR	GS-1-EM0362	GS-0-EM0672/Radiant = FE9/2*Radiant
34	UGR	ACF213003B	Harding/TF174
35	UGR	ACF126103	Movokrimka/Arina
36	UIL	IL02-18228	Pio25R26/IL9634-24437//IL95-4162
37	UIL	IL04-24668	IL98-13404/ IL97-3578
38	UIL	IL06-7550	IL97-3632/ IL98-4632
39	UIL	IL06-14262	IL00-8530/ IL97-1828
40	UKY	KY02C-3006-46	25R18/VA97W-375WS
41	UKY	KY02C-3004-02	25R18/Tribute
42	UKY	KY04C-2151	25R18/VA01W-476
43	UKY	KY03C-1192-34	KY93C-0876-66//KY96C-0059-21
44	UKY	KY02C-3008-01	25R18/92C-0010-17
45	UMD	MD03W91-09-8	25R42/TRIBUTE
46	UMD	MD03W61-09-1	25R42/CHESAPEAKE
47	UMD	MD02W135-08-9	SISSON/MCCORMICK
48	UMO	MO071522	003013/980525
49	UMO	MO080104	L910097/MO-92-599
50	UMO	MO080864	981020//P92201D5-2/980725
51	UMO	MO081652	PL-2552/980829
52	UNE	WESLEY	
53	UNE	WESLEYFHB1	
54	UNE	NE06607	NE98466=(KS89H50-4/NE90518(=BRL//SXL/BENN))/WESLEY
55	UNE	NE06469	Pedigree lost
56	UNE	NW07505	Trego/Thunderbolt F3
57	VAT	VA06W-612	FREEDOM/ NEUSE"S" (NC96-13374)// VA98W-688[ROANE"S" (91-54-219) //FFR555W/GORE],F9
58	VAT	VA07W-594	FREEDOM/ NEUSE"S" (NC96-13374) // RC-STRATEGY,F9
59	VAT	VA07W-601	OH 552/ SISSON"S" (SS550)// RC-STRATEGY,F9
60	VAT	VA08W-734	COKER 9474(FHB-RES)/ IL97-2945 (FHB-RES) //TRIBUTE,F7

Table 4. Entries in the 2009-2010 PNUWWSN

ENTRY	SOURCE	NAME	PEDIGREE
1	UMO	ERNIE	
2	UMO	TRUMAN	
3	OSU	FREEDOM	
4	PIO	PIONEER-2545	
5	MSU	E5017	D6206 / Pioneer Brand 2552
6	MSU	E8007	VA96W-403-WS / W14
7	OSU	OH06-158-50	P.92145E8-7-7-1-9-1/OH728
8	OSU	OH06-159-6	P.92145E8-7-7-1-9-1/OH728
9	OSU	OH06-180-57	KY90C-042-37-1/OH687
10	OSU	OH06-197-61	P.92145E8-7-7-1-9-1/OH701
11	OSU	OH06-228-73	OH708/OH707
12	OSU	OH06-190-29	OH707/OH687
13	PUR	03207A1-7-5	INW0304*2/RSI5/3/981281//INW0316/99794
14	PUR	03615A1-5-7	Ernie/INW0316//981358/97462
15	PUR	059A1-1-9-5	Truman/INW0316/4/9819/3/Freedom//Ernie/INW9824
16	PUR	059A1-1-9-6	Truman/INW0316/4/9819/3/Freedom//Ernie/INW9824
17	PUR	0527A1-9-9-3	99751/2754//97462/INW0412
18	PUR	0537A1-7-8	INW0411/2754//INW0412/98134
19	SUN	SE99-1015-7	T97/A941315
20	SUN	SE-MO98-274-8	IL-87-2834-1/960314
21	SUN	SE98-1094-C20	FREEDOM/SE2549
22	SUN	SE00-4040-10	LIBRA/N95L189
23	SUN	SE00-10303-35	PION25W60/CALEDONIA
24	SUN	SE00-10286-7	PION25W60/TW96286
25	SUN	MISC-HDS-148	Unknown
26	SYN	M08*8005#	BRANSON/M99*3098
27	SYN	MH07-7474	M97-1048/ELKHART
28	UIL	IL06-13072	IL00-8109/ IL97-3632
29	UIL	IL06-13708	IL00-8530/IL97-3632
30	UIL	IL06-13721	IL00-8530/ IL97-3632
31	UIL	IL06-25634	N-1538/ IL98-4632// IL97-3632
32	UIL	IL06-27969	IL96-6472/ P961341A3-2-2
33	UIL	IL06-14325	IL00-8530/ IL97-1828
34	UKY	KY02C-3007-55	25R18/ALLEGIANCE
35	UKY	KY03C-1237-23	25R18/92C-0017-17//KY96C-0767-1
36	UKY	KY01C-1070-02	KY91C-170-3/KY91C-117-27//KY91C-170-3/Roane
37	UKY	KY01C-1531-17	Tribute/2552//Tribute/SS 520
38	UKY	KY03C-1136-18	CG 554W/25R37//CG 554W/Tribute
39	UKY	KY03C-1092-13	Allegiance/25W33//Allegiance/25R44
40	UMO	MO070933	980429/P86958RC4-2-1-10
41	UMO	MO080103	L910097/MO-92-599
42	UMO	MO080373	980703/980525,-Truman-'S'/Truman
43	UMO	MO081378	003013/981020
44	UMO	MO081772	Truman/Seu-Seun-6
45	UMO	MO081777	PL-2552/980829
46	VAT	VA08W-622	FREEDOM / NEUSE"S" (NC96-13374)// VA98W-688[Roane"S" (91-54-219)// FFR555W/GORE],F9
47	VAT	VA08W-630	OH 552(P71761A4-31-5-33/MD55-286-21: FHB-RES)/SS550 (VA96W-247= CK9803/FREEDOM)//RC STRATEGY [VA98W-586=92-51-39 (IN71761A4-31-5-48//71-54-147/ MCN1813)/ Roane"S" (91-54-219)],F9
48	VAT	VA08W-653	COKER 9474(FHB-RES)/ NEUSE"S" (NC96-13374),F8
49	VAT	VA07W-600	OH 552/SS550//RC-STRATEGY,F9
50	VAT	VA07W-607	IL89-6489(PIONEER 9021L// ROLAND/IL77-2656: FHB-RES)/ Sisson"S" (VA97W-375= CK9803/FREEDOM)// ERNIE,F8
51	VAT	VA08W-740	B961092(SCAB RES)/ VA00W-566 [(CHILL"S"/YMI6)/PION2548// PION2684] //McCORMICK"S" (VA98W-590),F7

Table 5. Statistics and percentage of total sum of squares attributed to genotype, environment, and GxE interation effects from ANOVAs for the 2009-2010 P+NUWWSN. ANOVA were conducted for all environments and then for each cluster of environments.

NUWWSN		# Environments (#clusters/#outliers)	R2	CV	% SS Geno	% SS Env	% SS GEI	SS GEI / SS Geno
SEV	ALL	13 (2/2)	0.67	40	20.0	47.4	32.6	1.63
	CLUSTER 1	8	0.71	36	19.9	50.1	30.0	1.51
	CLUSTER 2	3	0.75	31	52.1	23.1	24.7	0.47
INC	ALL	12 (1/3)	0.91	20	3.0	87.2	9.8	3.26
	CLUSTER 1	9	0.95	14	2.9	91.7	5.5	1.92
IND	ALL	12 (1/4)	0.77	47	11.7	65.3	23.0	1.97
	CLUSTER 1	8	0.86	37	11.2	75.1	13.7	1.22
FDK	ALL	8 (1/2)	0.64	46	18.7	45.3	36.0	1.93
	CLUSTER 1	6	0.69	43	20.5	48.6	30.9	1.51
ISK	ALL	7 (1/2)	0.77	32	15.7	61.0	23.4	1.49
	CLUSTER 1	5	0.86	23	19.1	67.7	13.2	0.69
DON	ALL	7 (2/1)	0.85	51	9.7	75.1	15.2	1.57
	CLUSTER 1	3	0.84	80	33.2	31.0	35.8	1.08
	CLUSTER 2	3	0.83	81	49.7	33.5	16.8	0.34
GHSEV	ALL	2	0.78	61	69.2	9.2	21.6	0.31
HD	ALL	8	0.99	1	4.2	94.4	1.4	0.33
HGT	ALL	3	0.85	6	34.1	50.9	15.0	0.44

PNUWWSN			R2	CV	% SS Geno	% SS Env	% SS GEI	SS GEI / SS Geno
SEV	ALL	7 (1/2)	0.65	41	20.5	45.0	34.6	1.69
	CLUSTER 1	5	0.81	35	4.5	92.3	3.2	0.72
INC	ALL	7 (2/1)	0.92	21	4.7	86.8	8.5	1.80
	CLUSTER 1	4	0.97	9	2.1	97.9	2.5	1.15
	CLUSTER 2	2	0.84	58	95.9	4.1	18.7	0.19
IND	ALL	8 (1/2)	0.72	52	14.8	57.7	27.5	1.86
	CLUSTER 1	6	0.86	43	15.9	70.1	14.0	0.88
FDK	ALL	5 (1/1)	0.75	45	28.5	46.4	25.1	0.88
	CLUSTER 1	4	0.71	51	31.9	39.5	28.5	0.89
ISK	ALL	5 (1/2)	0.82	23	19.0	68.2	12.8	0.67
	CLUSTER 1	3	0.93	23	24.4	68.5	7.2	0.29
DON	ALL	4(1/1)	0.81	46	14.2	66.2	19.6	1.38
	CLUSTER 1	3	0.77	47	16.8	60.9	22.4	1.33
GHSEV*								
HD		5	0.97	1	3.9	94.6	1.6	0.40
HGT*								

* one environment for GHSEV and HGT in the PNUWWSN

Table 6. Correlation among genotype means for the 2009-2010 NUWWSN (above the diagonal) and PNUWWSN (below the diagonal)

	INC	SEV	IND	FDK	ISK	DON	GHSEV	HD	HGT
INC	1	0.75	0.85	0.77	0.86	0.63			
SEV	0.39	1	0.95	0.75	0.86	0.74	0.39	0.39	
IND		0.93	1	0.77	0.89	0.72	0.28	0.34	
FDK	0.44	0.59	0.53	1	0.97	0.66	0.28		
ISK	0.88	0.87	0.91	0.63	1	0.7	0.26		
DON	0.38	0.73	0.56		0.62	1			
GHSEV	0.51	0.61	0.54	0.32	0.56		1		
HD	0.61							1	0.37
HGT	0.51	0.28						0.91	1

= non-significant correlation at p=0.05

Table 7. Correlation of heading date (HD) and height (HGT) with FHB traits by location for the 2009-2010 P+NUWWSN

NUWWSN		ILURB	KYLEX	MDSAL	MIELA	MOCOL	OHWOO	ONRID	VABLA
HD with	INC	NS	0.56	NS	NS	NS	NS	NS	NS
"	SEV	NS	0.31	NS	0.53	NS	NS	NS	NS
"	IND	NS	0.25	-0.3	0.34	NS	NS	NS	NS
"	FDK	NS	NS	-0.31		NS			NS
"	ISK	NS	0.64	-0.36		NS			NS
"	DON	NS	NS	-0.6			NS		NS
HGT with	INC		0.46	NS					
"	SEV		0.35	NS					
"	IND		0.29	-0.27					
"	FDK		0.37	NS					
"	ISK		0.36	-0.25					
"	DON		NS	-0.52					

PNUWWSN		ILURB	KYLEX	MIELA	MOCOL	OHWOO
HD with	INC	NS	0.38	0.63	-0.47	
"	SEV	NS	NS	NS	NS	
"	IND	NS	NS	NS	NS	NS
"	FDK	NS	NS		NS	
"	ISK	NS	0.38		NS	
"	DON	0.27	NS			NS
HGT with	INC		0.34			
"	SEV		0.28			
"	IND		NS			
"	FDK		NS			
"	ISK		NS			
"	DON		NS			

NS = non-significant at p=0.05.

data not collect on both traits
location was an outlier for that trait

Table 8. Mean of FHB traits for the 2009-2010 NUWWSN. "l" and "h" indicate means that are not significantly different from the lowest and highest mean in each column, respectively.

ENTRY	NAME	INC	SEV	IND	FDK	ISK	DON	GHSEV	#l	#h
1	ERNIE	53.7	24.7 l	17.4	25.5 l	30.1 l	7.3	10.7 l	4	0
2	TRUMAN	50.0 l	29.4	16.7	18.0 l	27.8 l	5.3 l	5.2 l	5	0
3	FREEDOM	60.6	34.0	26.8	36.3	41.5	7.1 l	7.9 l	2	0
4	PIONEER-2545	71.1 h	48.7 h	36.8 h	58.3 h	55.6 h	12.9 h	26.3 l	1	6
5	NY99045-3110	56.8	35.1	24.1	31.7 l	37.5	10.0	8.5 l	2	0
6	OH07-176-56	54.9	34.6	21.7	38.4	35.5	5.7 l	49.0 h	1	1
7	NY94052-9340	57.9	42.6	27.1	29.7 l	40.9	8.4	7.5 l	2	0
8	NY99068-3251	49.4 l	37.0	19.4	26.5 l	34.1 l	7.6	18.2 l	4	0
9	NY88046-7088	64.9 h	53.3 h	35.5 h	42.8 h	54.5 h	7.2	17.5 l	1	5
10	E5011B	64.7 h	46.6 h	31.7 h	46.5 h	49.6 h	10.0	12.9 l	1	5
11	E5024	64.3 h	35.9	23.3	33.8	40.8	12.1	10.9 l	1	1
12	E3024	64.4 h	56.0 h	38.0 h	40.2	52.2 h	9.0	31.4	0	4
13	E6012	60.5	42.1	27.8	34.1	41.3	10.8	10.5 l	1	0
14	E8052	65.5 h	40.4	30.3 h	41.3	45.3	11.4	21.2 l	1	2
15	OH04-264-58	63.4 h	37.2	27.3	43.1 h	44.3	5.7 l	24.1 l	2	2
16	OH05-101-1	55.7	29.0	16.7	39.8	39.7	5.6 l	35.2	1	0
17	OH05-164-76	61.3	27.1	19.0	27.8 l	34.2 l	5.3 l	9.8 l	4	0
18	OH05-200-74	59.4	26.1	17.6	34.7	36.7	6.2 l	7.4 l	2	0
19	99691A2-5-4-16-1	56.5	35.0	21.8	30.3 l	35.4	7.8	43.7 h	1	1
20	01946A1-16-48-5	57.4	26.6	19.4	27.5 l	32.8 l	7.1	10.5 l	3	0
21	057RA1-8-5	56.9	36.3	22.7	33.5 l	38.5	10.2	6.3 l	2	0
22	059A1-2-4-3	57.1	32.9	21.8	41.0	38.3	10.1	6.4 l	1	0
23	TABOO	60.4	47.0 h	25.9	39.6	41.8	5.7 l	52.5 h	1	2
24	MONDO	50.3 l	28.8	15.3 l	23.8 l	28.6 l	7.2	17.9 l	5	0
25	PROBE	64.7 h	44.5	28.5	45.4 h	46.0	7.1 l	60.3 h	1	3
26	RUMOR	60.6	36.4	25.1	34.2	39.7	6.4 l	17.6 l	2	0
27	03M1539#019	56.9	31.1	20.1	38.0	33.6 l	9.2	67.8 h	1	1
28	03M1539#031	56.8	36.3	22.0	27.6 l	36.6	7.9	56.0 h	1	1
29	W1104	59.0	37.9	23.1	41.8	39.5	13.7 h	15.2 l	1	1
30	ML06-2097	59.4	38.0	23.5	43.0 h	41.6	8.4	28.9 l	1	1
31	GS-0-EM0681	58.6	35.0	21.5	46.6 h	44.0	10.8	18.3 l	1	1
32	GS-0-EM0614	53.8	35.0	21.4	40.0	37.6	5.8 l	42.7 h	1	1
33	GS-1-EM0362	57.8	49.6 h	31.4 h	45.2 h	50.7 h	11.9	54.3 h	0	5
34	ACF213003B	61.9 h	39.8	27.3	45.1 h	44.7	9.2	12.0 l	1	2
35	ACF126103	60.9	39.9	26.7	39.9	44.9	9.3	35.1	0	0
36	IL02-18228	46.6 l	19.0 l	12.3 l	23.7 l	24.9 l	3.4 l	25.7 l	7	0
37	IL04-24668	53.8	31.6	19.7	22.2 l	31.7 l	5.0 l	26.0 l	4	0
38	IL06-7550	55.5	23.6 l	17.5	28.9 l	32.4 l	7.4	9.3 l	4	0
39	IL06-14262	49.2 l	22.4 l	10.9 l	20.4 l	29.0 l	4.5 l	6.4 l	7	0
40	KY02C-3006-46	53.9	18.2 l	13.5 l	20.1 l	27.9 l	4.3 l	3.9 l	6	0
41	KY02C-3004-02	50.5 l	16.3 l	11.5 l	19.3 l	26.4 l	3.4 l	5.7 l	7	0
42	KY04C-2151	51.8 l	22.5 l	17.0	23.0 l	31.4 l	4.1 l	5.3 l	6	0
43	KY03C-1192-34	62.0 h	36.5	25.9	35.9	41.9	7.8	50.1 h	0	2
44	KY02C-3008-01	62.5 h	22.7 l	17.3	30.0 l	35.5	6.1 l	4.7 l	4	1
45	MD03W91-09-8	55.1	24.6 l	15.6 l	20.5 l	30.3 l	5.7 l	41.5 h	5	1
46	MD03W61-09-1	52.8 l	16.6 l	11.7 l	25.3 l	29.6 l	3.8 l	13.2 l	7	0
47	MD02W135-08-9	52.3 l	30.9	18.0	20.9 l	32.2 l	6.6 l	59.4 h	4	1
48	MO071522	50.7 l	30.9	18.9	29.0 l	31.8 l	5.1 l	7.4 l	5	0
49	MO080104	43.6 l	16.4 l	8.1 l	22.2 l	21.2 l	3.1 l	8.1 l	7	0
50	MO080864	45.8 l	22.1 l	14.0 l	18.7 l	23.6 l	5.8 l	4.4 l	7	0
51	MO081652	50.9 l	14.5 l	9.0 l	18.9 l	23.2 l	3.9 l	6.6 l	7	0
52	WESLEY	70.3 h	46.1 h	33.6 h	53.9 h	58.1 h	10.5	6.3 l	1	5
53	WESLEYFHB1	68.2 h	43.2	30.9 h	45.4 h	48.8 h	8.8	38.8	0	4
54	NE06607	52.5 l	35.0	20.1	45.7 h	41.7	6.4 l	12.4 l	3	1
55	NE06469	63.7 h	35.6	23.0	55.3 h	61.3 h	7.9	26.3 l	1	3
56	NW07505	63.2 h	48.8 h	31.8 h	56.2 h	60.8 h	16.4 h	37.1	0	6
57	VA06W-612	59.5	31.7	19.9	37.2	34.6	6.1 l	27.3 l	2	0
58	VA07W-594	53.5	27.3	14.9 l	32.5 l	33.7 l	4.8 l	26.7 l	5	0
59	VA07W-601	53.8	25.2	17.1	41.1	36.9	4.5 l	13.3 l	2	0
60	VA08W-734	43.8 l	16.1 l	10.4 l	21.0 l	22.3 l	4.0 l	9.1 l	7	0
100	AVERAGE	57.2	33.1	21.6	34.3	38.1	7.4	22.2		
101	MINUMUM	43.6	14.5	14.5	18.0	21.2	3.1	3.9		
102	MAXIMUM	71.1	56.0	56.0	58.3	61.3	16.4	67.8		
103	LSD(0.05)	9.5	10.4	8.1	15.5	13.2	4.1	27.4		
	N	12	13	12	8	7	7	2		

Table 9. Best (top of the table) and worst (bottom of the table) entries in the 2009-2010 NUWWSN

ENTRY	NAME	Putative QTL	INC	SEV	IND	FDK	ISK	DON	GHSEV	#l	#h
49	MO080104		43.6 l	16.4 l	8.1 l	22.2 l	21.2 l	3.1 l	8.1 l	7	0
51	MO081652		50.9 l	14.5 l	9.0 l	18.9 l	23.2 l	3.9 l	6.6 l	7	0
60	VA08W-734		43.8 l	16.1 l	10.4 l	21.0 l	22.3 l	4.0 l	9.1 l	7	0
39	IL06-14262		49.2 l	22.4 l	10.9 l	20.4 l	29.0 l	4.5 l	6.4 l	7	0
41	KY02C-3004-02	Fhb1?	50.5 l	16.3 l	11.5 l	19.3 l	26.4 l	3.4 l	5.7 l	7	0
46	MD03W61-09-1	Fhb1	52.8 l	16.6 l	11.7 l	25.3 l	29.6 l	3.8 l	13.2 l	7	0
36	IL02-18228		46.6 l	19.0 l	12.3 l	23.7 l	24.9 l	3.4 l	25.7 l	7	0
50	MO080864	5Aernie	45.8 l	22.1 l	14.0 l	18.7 l	23.6 l	5.8 l	4.4 l	7	0
40	KY02C-3006-46	Fhb1	53.9	18.2 l	13.5 l	20.1 l	27.9 l	4.3 l	3.9 l	6	0
42	KY04C-2151	Fhb1, 2DL	51.8 l	22.5 l	17.0	23.0 l	31.4 l	4.1 l	5.3 l	6	0
58	VA07W-594		53.5	27.3	14.9 l	32.5 l	33.7 l	4.8 l	26.7 l	5	0
24	MONDO	5Aernie	50.3 l	28.8	15.3 l	23.8 l	28.6 l	7.2	17.9 l	5	0
45	MD03W91-09-8		55.1	24.6 l	15.6 l	20.5 l	30.3 l	5.7 l	41.5 h	5	1
2	TRUMAN		50.0 l	29.4	16.7	18.0 l	27.8 l	5.3 l	5.2 l	5	0
48	MO071522		50.7 l	30.9	18.9	29.0 l	31.8 l	5.1 l	7.4 l	5	0
44	KY02C-3008-01		62.5 h	22.7 l	17.3	30.0 l	35.5	6.1 l	4.7 l	4	1
1	ERNIE	5Aernie	53.7	24.7 l	17.4	25.5 l	30.1 l	7.3	10.7 l	4	0
38	IL06-7550		55.5	23.6 l	17.5	28.9 l	32.4 l	7.4	9.3 l	4	0
47	MD02W135-08-9		52.3 l	30.9	18.0	20.9 l	32.2 l	6.6 l	59.4 h	4	1
17	OH05-164-76	Fhb1, 3Bc?	61.3	27.1	19.0	27.8 l	34.2 l	5.3 l	9.8 l	4	0
8	NY99068-3251		49.4 l	37.0	19.4	26.5 l	34.1 l	7.6	18.2 l	4	0
53	WESLEYFHB1	Fhb1	68.2 h	43.2	30.9 h	45.4 h	48.8 h	8.8	38.8	0	4
12	E3024	5Aernie	64.4 h	56.0 h	38.0 h	40.2	52.2 h	9.0	31.4	0	4
33	GS-1-EM0362		57.8	49.6 h	31.4 h	45.2 h	50.7 h	11.9	54.3 h	0	5
10	E5011B		64.7 h	46.6 h	31.7 h	46.5 h	49.6 h	10.0	12.9 l	1	5
52	WESLEY		70.3 h	46.1 h	33.6 h	53.9 h	58.1 h	10.5	6.3 l	1	5
9	NY88046-7088		64.9 h	53.3 h	35.5 h	42.8 h	54.5 h	7.2	17.5 l	1	5
56	NW07505		63.2 h	48.8 h	31.8 h	56.2 h	60.8 h	16.4 h	37.1	0	6
4	PIONEER-2545		71.1 h	48.7 h	36.8 h	58.3 h	55.6 h	12.9 h	26.3 l	1	6
100	AVERAGE		57.2	33.1	19.9	34.3	38.1	7.4	22.2		
101	MINUMUM		43.6	14.5	14.5	18.0	21.2	3.1	3.9		
102	MAXIMUM		71.1	56.0	56.0	58.3	61.3	16.4	67.8		
103	LSD(0.05)		9.5	10.4	8.1	15.5	13.2	4.1	27.4		
	N		12	13	12	8	7	7	2		

Table 10. Mean of FHB traits for the 2009-2010 PNUWWSN. "l" and "h" indicate means that are not significantly different from the lowest and highest mean in each column, respectively.

ENTRY	NAME	INC	SEV	IND	FDK	ISK	DON	GHSEV	#l	#h
1	ERNIE	49.1 l	21.9 l	17.6 l	18.3 l	29.2 l	12.7 h	17.5	5	1
2	TRUMAN	43.2 l	18.2 l	10.8 l	10.8 l	24.3 l	4.4 l	14.4	6	0
3	FREEDOM	62.2 h	32.9	24.5	42.8 h	49.1	6.9 l	5.0	1	2
4	PIONEER2545	71.0 h	51.7 h	41.5 h	52.9 h	61.6 h	12.0	80.3	0	5
5	E5017	74.8 h	33.3	29.9	37.1	50.4	18.3 h	7.7	0	2
6	E8007	41.2 l	15.1 l	9.1 l	13.1 l	23.2 l	8.6 l	3.0	6	0
7	OH06-158-50	59.3	43.9 h	28.6	34.6	47.1	9.7 l	100.0	1	1
8	OH06-159-6	52.7 l	25.7	17.7 l	44.7 h	43.1	11.3	37.3	2	1
9	OH06-180-57	60.8	39.7 h	27.3	34.5	46.6	9.5 l	91.8	1	1
10	OH06-197-61	49.7 l	26.2	15.5 l	38.3	39.0	5.8 l	19.3	3	0
11	OH06-228-73	62.6 h	38.6 h	29.1	43.2 h	49.8	10.8	88.5	0	3
12	OH06-190-29	62.1	35.6	25.1	43.6 h	47.7	9.5 l	64.8	1	1
13	03207A1-7-5	54.1	25.9	20.2	34.3	38.0	9.6 l	33.8	1	0
14	03615A1-5-7	52.0 l	20.1 l	16.0 l	22.7 l	31.5 l	5.2 l	5.0	6	0
15	059A1-1-9-5	53.8	30.1	21.6	30.6	37.6	9.4 l	21.0	1	0
16	059A1-1-9-6	56.8	40.4 h	32.7 h	37.2	46.0	11.9	28.6	0	2
17	0527A1-9-9-3	53.4 l	22.2 l	17.2 l	28.6 l	33.9	11.6	3.0	4	0
18	0537A1-7-8	53.7	26.0	16.8 l	20.7 l	34.1	8.5 l	35.8	3	0
19	SE99-1015-7	59.3	27.7	24.8	41.8	43.2	13.0 h	74.4	0	1
20	SE-MO98-274-8	57.9	39.8 h	34.1 h	34.5	45.9	14.2 h	34.8	0	3
21	SE98-1094-C20	57.2	32.9	26.1	39.7	45.2	12.0	12.7	0	0
22	SE00-4040-10	58.4	34.8	25.6	52.0 h	49.1	12.0	26.0	0	1
23	SE00-10303-35	66.7 h	49.3 h	32.8 h	59.3 h	59.6 h	13.1 h	59.5	0	6
24	SE00-10286-7	64.4 h	37.6	30.4 h	38.7	46.4	17.1 h	53.0	0	3
25	MISC-HDS-148	74.8 h	41.0 h	37.9 h	60.1 h	62.2 h	13.3 h	58.8	0	6
26	M08*8005#	51.5 l	22.3 l	17.9 l	17.1 l	30.1 l	11.6	41.6	5	0
27	MH07-7474	49.9 l	29.3	21.5	31.0	37.4	7.7 l	27.2	2	0
28	IL06-13072	52.4 l	28.2	18.0 l	17.9 l	33.7	7.9 l	53.6	4	0
29	IL06-13708	49.9 l	22.8 l	13.7 l	23.7 l	32.5 l	5.4 l	18.0	6	0
30	IL06-13721	46.8 l	15.6 l	10.4 l	12.1 l	25.1 l	9.3 l	14.0	6	0
31	IL06-25634	57.1	22.2 l	18.8 l	17.0 l	32.1 l	11.3	6.3	4	0
32	IL06-27969	47.1 l	24.2 l	14.7 l	11.7 l	28.1 l	5.3 l	55.3	6	0
33	IL06-14325	47.9 l	22.5 l	14.1 l	19.7 l	31.5 l	6.5 l	61.3	6	0
34	KY02C-3007-55	52.7 l	19.7 l	11.9 l	20.0 l	31.8 l	6.5 l	3.8	6	0
35	KY03C-1237-23	66.9 h	30.7	26.3	33.2	44.1	11.3	54.2	0	1
36	KY01C-1070-02	62.7 h	31.9	25.7	39.0	46.5	9.7 l	69.2	1	1
37	KY01C-1531-17	60.3	37.6	24.8	39.3	46.4	8.8 l	100.0	1	0
38	KY03C-1136-18	71.5 h	43.5 h	39.0 h	60.0 h	61.8 h	11.8	86.0	0	5
39	KY03C-1092-13	60.5	33.8	27.4	46.1 h	47.5	11.1	21.6	0	1
40	MO070933	53.0 l	28.3	19.3 l	18.6 l	34.2	11.4	6.3	3	0
41	MO080103	40.8 l	12.2 l	8.0 l	14.6 l	21.7 l	4.0 l	5.6	6	0
42	MO080373	44.4 l	21.1 l	14.9 l	11.0 l	26.0 l	6.2 l	7.4	6	0
43	MO081378	47.8 l	34.5	23.5	22.3 l	37.5	7.6 l	5.4	3	0
44	MO081772	48.8 l	30.1	20.9	15.5 l	34.0	4.7 l	9.5	3	0
45	MO081777	45.5 l	16.8 l	11.1 l	12.7 l	25.3 l	4.5 l	9.8	6	0
46	VA08W-622	58.8	23.6 l	17.2 l	35.5	40.7	6.9 l	42.2	3	0
47	VA08W-630	61.2	34.1	26.6	40.8	45.9	7.7 l	43.8	1	0
48	VA08W-653	61.8	33.9	27.4	40.2	47.0	9.7 l	7.6	1	0
49	VA07W-600	60.4	27.3	20.3	33.4	41.1	7.0 l	24.7	1	0
50	VA07W-607	49.4 l	26.7	17.3 l	25.6 l	33.8	5.8 l	16.0	4	0
51	VA08W-740	50.1 l	26.6	19.0 l	38.0	37.9	12.9 h	22.4	2	1
100	AVERAGE	55.9	29.6	22.0	31.6	39.9	9.5	35.1		
101	MINUMUM	40.8	12.2	8.0	10.8	21.7	4.0	3.0		
102	MAXIMUM	74.8	51.7	41.5	60.1	62.2	18.3	100.0		
103	LSD(0.05)	12.7	13.2	11.5	18.0	11.8	6.2	.		
	N	7	7	8	5	5	4	1		

Table 11. Best (top of the table) and worst (bottom of the table) entries in the 2009-2010 PNUWWSN

ENTRY	NAME	Putative QTL	INC	SEV	IND	FDK	ISK	DON	GHSEV	#l	#h
41	MO080103		40.8 l	12.2 l	8.0 l	14.6 l	21.7 l	4.0 l	5.6	6	0
6	E8007	Fhb1, 5Aning	41.2 l	15.1 l	9.1 l	13.1 l	23.2 l	8.6 l	3.0	6	0
30	IL06-13721		46.8 l	15.6 l	10.4 l	12.1 l	25.1 l	9.3 l	14.0	6	0
2	TRUMAN		43.2 l	18.2 l	10.8 l	10.8 l	24.3 l	4.4 l	14.4	6	0
45	MO081777		45.5 l	16.8 l	11.1 l	12.7 l	25.3 l	4.5 l	9.8	6	0
34	KY02C-3007-55		52.7 l	19.7 l	11.9 l	20.0 l	31.8 l	6.5 l	3.8	6	0
29	IL06-13708		49.9 l	22.8 l	13.7 l	23.7 l	32.5 l	5.4 l	18.0	6	0
33	IL06-14325		47.9 l	22.5 l	14.1 l	19.7 l	31.5 l	6.5 l	61.3	6	0
32	IL06-27969		47.1 l	24.2 l	14.7 l	11.7 l	28.1 l	5.3 l	55.3	6	0
42	MO080373		44.4 l	21.1 l	14.9 l	11.0 l	26.0 l	6.2 l	7.4	6	0
14	03615A1-5-7		52.0 l	20.1 l	16.0 l	22.7 l	31.5 l	5.2 l	5.0	6	0
1	ERNIE	5Aernie	49.1 l	21.9 l	17.6 l	18.3 l	29.2 l	12.7 h	17.5	5	1
26	M08*8005#		51.5 l	22.3 l	17.9 l	17.1 l	30.1 l	11.6	41.6	5	0
17	0527A1-9-9-3		53.4 l	22.2 l	17.2 l	28.6 l	33.9	11.6	3.0	4	0
50	VA07W-607		49.4 l	26.7	17.3 l	25.6 l	33.8	5.8 l	16.0	4	0
28	IL06-13072		52.4 l	28.2	18.0 l	17.9 l	33.7	7.9 l	53.6	4	0
31	IL06-25634		57.1	22.2 l	18.8 l	17.0 l	32.1 l	11.3	6.3	4	0
38	KY03C-1136-18		71.5 h	43.5 h	39.0 h	60.0 h	61.8 h	11.8	86.0	0	5
4	PIONEER2545		71.0 h	51.7 h	41.5 h	52.9 h	61.6 h	12.0	80.3	0	5
23	SE00-10303-35		66.7 h	49.3 h	32.8 h	59.3 h	59.6 h	13.1 h	59.5	0	6
25	MISC-HDS-148		74.8 h	41.0 h	37.9 h	60.1 h	62.2 h	13.3 h	58.8	0	6
100	AVERAGE		55.9	29.6	22.0	31.6	39.9	9.5	35.1		
101	MINUMUM		40.8	12.2	8.0	10.8	21.7	4.0	3.0		
102	MAXIMUM		74.8	51.7	41.5	60.1	62.2	18.3	100.0		
103	LSD(0.05)		12.7	13.2	11.5	18.0	11.8	6.2	.		
	N		7	7	8	5	5	4	1		

Table 12. Summary of incidence (INC, %) data from 2009-2010 NUWWSN.

ENTRY	NAME	ALL AVG	CLUSTER 1 AVG	ILURB	INBRO	INLAY	MIELA	MOCOL	NYITH	OHWOO	ONRID	VABLA	OUT KYLEX	OUT MDSAL	OUT NEMEA
1	ERNIE	53.7	50.8	100	9.0	2.5	87.7	98.3	5.0	100.0	50.0	5.0	75	45	67
2	TRUMAN	50.0 l	48.3 l	90	1.0	7.5	63.8	95.0	17.5	88.3	66.7	5.0	90	13	63
3	FREEDOM	60.6	60.0	100	25.0	12.5	86.8	98.3	36.3	100.0	73.3	7.5	90	25	73
4	PIONEER-2545	71.1 h	73.5 h	100	57.5	65.0	94.5	98.3	50.0	100.0	83.3	12.5	90	35	67
5	NY99045-3110	56.8	56.1	92	3.0	30.0	83.4	93.3	26.3	98.3	66.7	12.5	95	35	47
6	OH07-176-56	54.9	55.4	97	15.0	5.0	81.8	98.3	27.5	93.3	73.3	7.5	100	10	50
7	NY94052-9340	57.9	53.9	95	1.0	7.5	81.2	98.3	26.3	96.7	66.7	12.5	100	30	80
8	NY99068-3251	49.4 l	44.7 l	60	3.5	12.5	62.5	96.7	17.5	90.0	50.0	10.0	100	20	70
9	NY88046-7088	64.9 h	63.8	98	25.0	45.0	85.2	98.3	26.3	96.7	76.7	22.5	100	35	70
10	E5011B	64.7 h	66.3 h	100	37.5	45.0	92.8	100.0	35.0	95.0	76.7	15.0	100	40	40
11	E5024	64.3 h	62.3	97	17.5	20.0	93.5	100.0	33.8	100.0	86.7	12.5	90	28	93
12	E3024	64.4 h	60.9	98	12.5	20.0	86.3	96.7	46.3	95.0	73.3	20.0	100	55	70
13	E6012	60.5	61.3	100	20.0	35.0	83.4	98.3	36.3	100.0	63.3	15.0	85	30	60
14	E8052	65.5 h	68.4 h	100	22.5	60.0	91.0	100.0	52.5	100.0	80.0	10.0	95	15	60
15	OH04-264-58	63.4 h	63.7	100	27.5	50.0	93.0	100.0	22.5	100.0	70.0	10.0	95	30	63
16	OH05-101-1	55.7	57.4	90	12.5	50.0	90.4	100.0	16.3	100.0	50.0	7.5	50	35	67
17	OH05-164-76	61.3	55.7	95	1.5	15.0	85.3	100.0	12.5	98.3	73.3	20.0	90	65	80
18	OH05-200-74	59.4	60.3	100	10.0	30.0	85.7	98.3	37.5	96.7	76.7	7.5	95	15	60
19	99691A2-5-4-16-1	56.5	52.9	87	17.5	5.0	83.3	96.7	11.3	100.0	63.3	12.5	80	35	87
20	01946A1-16-48-5	57.4	56.9	97	13.5	2.0	86.7	100.0	30.0	100.0	73.3	10.0	80	20	77
21	057RA1-8-5	56.9	53.7	100	3.5	10.0	89.6	100.0	15.0	98.3	56.7	10.0	90	20	90
22	059A1-2-4-3	57.1	54.2	100	5.0	3.0	90.6	100.0	25.0	100.0	56.7	7.5	85	30	83
23	TABOO	60.4	58.2	98	35.0	6.0	80.6	96.7	37.5	96.7	63.3	10.0	90	48	63
24	MONDO	50.3 l	53.4	97	2.5	12.5	79.3	91.7	18.8	96.7	70.0	12.5	45	15	63
25	PROBE	64.7 h	63.2	100	15.0	27.5	91.3	98.3	40.0	96.7	70.0	30.0	85	30	93
26	RUMOR	60.6	59.9	100	7.5	22.5	91.6	100.0	31.3	96.7	76.7	12.5	95	10	83
27	03M1539#019	56.9	58.4	100	15.0	22.5	89.3	100.0	21.3	96.7	73.3	7.5	90	0	67
28	03M1539#031	56.8	55.0	98	12.5	15.0	85.8	100.0	10.0	98.3	70.0	5.0	80	20	87
29	W1104	59.0	59.2	98	15.0	15.0	90.4	98.3	27.5	100.0	83.3	5.0	100	15	60
30	ML06-2097	59.4	60.6	100	25.0	10.0	88.5	100.0	40.0	100.0	66.7	15.0	90	18	60
31	GS-0-EM0681	58.6	59.5	98	5.0	7.5	91.8	96.7	42.5	91.7	86.7	15.0	100	15	53
32	GS-0-EM0614	53.8	56.5	100	12.5	32.5	79.7	91.7	32.5	95.0	51.7	12.5	75	15	47
33	GS-1-EM0362	57.8	54.3	100	7.5	6.0	84.4	96.7	33.8	98.3	46.7	15.0	100	35	70
34	ACF213003B	61.9 h	61.2	98	20.0	30.0	89.9	98.3	40.0	100.0	66.7	7.5	90	25	77
35	ACF126103	60.9	60.6	100	10.0	32.5	91.3	96.7	27.5	98.3	76.7	12.5	95	30	60
36	IL02-18228	46.6 l	40.1 l	50	2.5	1.5	58.1	98.3	5.0	86.7	46.7	12.5	70	45	83
37	IL04-24668	53.8	51.7	85	13.0	7.0	66.3	93.3	17.5	90.0	83.3	10.0	80	20	80
38	IL06-7550	55.5	53.1	93	7.5	3.0	80.6	91.7	21.3	100.0	73.3	7.5	80	25	83
39	IL06-14262	49.2 l	50.2	87	8.5	5.0	77.9	98.3	18.8	96.7	50.0	10.0	70	5	63
40	KY02C-3006-46	53.9	55.2	98	1.0	20.0	85.7	95.0	16.3	96.7	76.7	7.5	60	20	70
41	KY02C-3004-02	50.5 l	50.9	77	1.5	32.5	76.1	96.7	8.8	95.0	63.3	7.5	80	5	63
42	KY04C-2151	51.8 l	43.7 l	45	2.5	3.0	75.9	100.0	5.0	95.0	56.7	10.0	90	85	53
43	KY03C-1192-34	62.0 h	65.9 h	100	40.0	45.0	88.1	98.3	33.8	98.3	80.0	10.0	90	10	50
44	KY02C-3008-01	62.5 h	60.4	98	11.5	40.0	91.1	98.3	22.5	95.0	76.7	10.0	85	55	67
45	MD03W91-09-8	55.1	57.7	100	11.0	27.5	94.4	98.3	21.3	98.3	53.3	15.0	85	10	47
46	MD03W61-09-1	52.8 l	56.5	100	4.5	45.0	78.8	95.0	2.5	100.0	70.0	12.5	55	10	60
47	MD02W135-08-9	52.3 l	57.3	100	3.0	47.5	91.2	100.0	20.0	98.3	43.3	12.5	55	20	37
48	MO071522	50.7 l	50.3	98	7.5	7.5	65.9	91.7	16.3	96.7	56.7	12.5	100	15	40
49	MO080104	43.6 l	46.5 l	70	7.5	5.0	75.7	100.0	13.8	90.0	46.7	10.0	50	8	47
50	MO080864	45.8 l	50.8	85	3.0	2.5	77.8	100.0	23.8	88.3	66.7	10.0	45	35	13
51	MO081652	50.9 l	49.5	70	0.5	2.0	70.9	100.0	13.8	100.0	73.3	15.0	90	5	70
52	WESLEY	70.3 h	73.5 h	100	45.0	85.0	90.8	100.0	42.5	100.0	83.3	15.0	100	35	47
53	WESLEYFHB1	68.2 h	69.6 h	100	15.0	95.0	94.1	98.3	33.8	100.0	70.0	20.0	95	20	77
54	NE06607	52.5 l	57.1	100	20.0	20.0	90.5	98.3	21.3	91.7	56.7	15.0	70	20	27
55	NE06469	63.7 h	62.0	100	22.5	40.0	85.3	95.0	25.0	100.0	70.0	20.0	85	55	67
56	NW07505	63.2 h	67.4 h	100	67.5	50.0	89.5	96.7	21.3	98.3	73.3	10.0	75	40	37
57	VA06W-612	59.5	60.8	98	15.0	20.0	93.3	95.0	40.0	98.3	80.0	7.5	80	30	57
58	VA07W-594	53.5	56.5	90	12.5	10.0	83.1	98.3	37.5	96.7	63.3	17.5	75	15	43
59	VA07W-601	53.8	57.5	97	20.0	17.5	89.4	98.3	35.0	95.0	53.3	12.5	50	15	63
60	VA08W-734	43.8 l	42.8 l	87	2.0	4.0	62.9	91.7	6.3	86.7	40.0	5.0	90	20	30
100	AVERAGE	57.2	57.1	94	14.5	23.5	84.1	97.6	25.5	96.7	66.9	11.8	84	26	62.9
101	MINUMUM	43.6	40.1	45	0.5	1.5	58.1	91.7	2.5	86.7	40.0	5.0	45	0	13
102	MAXIMUM	71.1	7.4	100	67.5	95.0	94.5	100.0	52.5	100.0	86.7	30.0	100	85	93
103	LSD(0.05)	9.5	8.3	.	.	.	.	.	.	.	.	.	.	.	.

Table 13. Summary of severity (SEV, %) data from 2009-2010 NUWWSN.

ENTRY	NAME	ALL AVG	CLUSTER 1 AVG	INBRO	MIELA	MOCOL	NEMEA	NYITH	OHWOO	ONRID	VABLA	CLUSTER 2 AVG	ILURB	INLAY	KYLEX	OUT MDSAL	OUT ROFUN
1	ERNIE	24.7 l	22.1	3.5	40.0	47.7	16.0	7.5	35.7	16.3	10	22.8 l	39.8	5.0	23.5	20.0	56.5
2	TRUMAN	29.4	16.1 l	1.0	24.6	32.0	12.0	10.3	16.3	22.7	10	40.5	52.7	4.2	64.6	60.0	71.6
3	FREEDOM	34.0	30.1	12.5	41.8	55.3	40.0	27.3	20.8	33.0	10	43.5	55.9	2.5	72.2	45.0	26.1
4	PIONEER-2545	48.7 h	40.2 h	40.0	58.9	51.4	12.0	45.3	49.3	49.7	15	62.8 h	81.3	26.7	80.3	40.0	83.7
5	NY99045-3110	35.1	25.1	1.5	57.3	42.8	5.0	23.8	21.9	38.7	10	44.2	49.4	15.0	68.1	70.0	52.3
6	OH07-176-56	34.6	26.1	7.5	44.5	45.0	6.0	41.0	25.4	29.0	10	44.0	56.2	15.8	59.9	10.0	100.0
7	NY94052-9340	42.6	33.1	2.5	49.7	37.3	62.0	33.5	27.0	33.0	20	53.1	38.7	50.8	69.7	70.0	59.8
8	NY99068-3251	37.0	23.2	11.0	39.0	30.7	36.0	14.8	26.3	20.3	7.5	45.5	27.6	38.8	70.2	75.0	84.4
9	NY88046-7088	53.3 h	36.9 h	20.0	58.8	48.9	29.0	44.3	32.4	44.3	17.5	72.0 h	76.5	55.8	83.6	90.0	91.2
10	E5011B	46.6 h	37.7 h	22.5	54.4	47.6	17.0	55.5	32.5	49.7	22.5	49.4	73.5	10.0	64.7	75.0	81.3
11	E5024	35.9	22.2	10.0	40.8	31.7	13.0	15.8	32.4	18.7	15	64.8 h	55.0	71.7	67.8	50.0	44.7
12	E3024	56.0 h	41.4 h	22.5	55.8	53.1	31.0	41.8	42.3	65.0	20	68.9 h	66.5	55.8	84.4	90.0	100.0
13	E6012	42.1	25.6	3.5	31.8	41.3	22.0	22.3	42.1	26.7	15	69.2 h	76.6	55.8	75.2	60.0	74.7
14	E8052	40.4	26.8	3.5	40.4	33.8	29.0	27.0	41.8	29.0	10	65.2 h	78.5	34.2	83.0	40.0	74.7
15	OH04-264-58	37.2	30.8	5.0	46.1	46.8	27.0	35.5	40.8	33.0	12.5	51.2	62.4	18.3	72.8	15.0	68.9
16	OH05-101-1	29.0	22.0	10.0	22.5	49.6	20.0	23.0	24.9	16.3	10	32.6 l	40.2	5.0	52.5	25.0	78.0
17	OH05-164-76	27.1	22.0 l	1.5	28.6	65.0	6.0	10.0	19.7	22.7	22.5	36.6	27.2	26.7	55.9	15.0	51.4
18	OH05-200-74	26.1	18.3 l	2.0	29.5	37.9	11.0	16.0	21.6	18.7	10	36.1	35.1	24.2	49.0	55.0	29.0
19	99691A2-5-4-16-1	35.0	33.8 h	5.0	22.2	47.4	30.0	48.6	45.8	54.0	17.5	34.7	39.2	28.3	36.6	30.0	50.8
20	01946A1-16-48-5	26.6	24.6	6.0	32.0	40.9	18.0	23.5	30.8	33.0	12.5	30.6 l	40.5	6.7	44.6	30.0	26.8
21	057RA1-8-5	36.3	22.3	3.5	38.1	46.3	14.0	21.3	26.2	18.7	10	59.2 h	61.3	44.2	72.1	35.0	81.5
22	059A1-2-4-3	32.9	22.3	2.0	43.1	45.8	11.0	17.5	22.6	26.7	10	52.1	63.4	31.7	61.1	15.0	78.0
23	TABOO	47.0 h	37.4 h	35.0	53.6	42.7	9.0	57.4	28.3	55.3	17.5	61.9 h	63.0	80.8	42.0	30.0	96.2
24	MONDO	28.8	20.9	2.5	32.1	39.5	14.0	26.5	17.9	25.0	10	40.4	34.3	43.3	43.5	35.0	51.1
25	PROBE	44.5	34.1 h	17.5	41.8	54.7	21.0	46.3	29.4	44.3	17.5	57.0 h	74.1	51.7	45.1	45.0	90.0
26	RUMOR	36.4	28.1	2.0	41.8	49.7	27.0	32.5	28.7	33.0	10	57.5 h	56.9	60.0	55.6	25.0	50.5
27	03M1539#019	31.1	27.4	15.0	50.1	40.9	5.0	20.5	30.8	44.3	12.5	28.7 l	49.1	7.5	29.5	0.0	99.4
28	03M1539#031	36.3	25.7	10.0	40.9	37.7	27.0	13.5	34.0	32.3	10	54.7	57.8	69.2	37.2	35.0	67.6
29	W1104	37.9	28.0	12.5	39.5	44.4	7.0	39.0	28.3	33.0	20	49.4	50.8	35.8	61.5	30.0	90.7
30	ML06-2097	38.0	31.4	17.5	50.4	54.7	7.0	33.5	37.3	33.0	17.5	43.9	53.8	37.5	40.3	30.0	81.3
31	GS-0-EM0681	35.0	22.5	1.0	51.8	40.0	7.0	21.8	23.3	25.0	10	38.1	42.4	15.0	56.8	70.0	90.4
32	GS-0-EM0614	35.0	23.9	5.0	50.8	35.6	8.0	33.5	28.1	20.3	10	44.4	76.0	10.0	47.3	40.0	90.8
33	GS-1-EM0362	49.6 h	29.8	5.0	55.5	46.8	10.0	42.5	40.1	26.0	12.5	78.8 h	87.5	60.8	88.0	70.0	100.0
34	ACF213003B	39.8	28.6	17.5	44.9	43.5	12.0	26.0	43.3	29.0	12.5	60.3 h	72.7	33.3	75.0	40.0	67.9
35	ACF126103	39.9	26.4	10.0	48.3	40.8	9.0	31.8	31.9	26.7	12.5	62.4 h	66.3	52.5	68.4	60.0	61.1
36	IL02-18228	19.0 l	20.0 l	1.5	14.7	38.2	49.0	11.8	23.1	11.7	10	12.0 l	15.2	4.2	16.5	5.0	46.5
37	IL04-24668	31.6	30.3	10.5	30.6	29.4	51.0	51.3	21.8	33.0	15	33.0 l	34.0	11.7	53.4	30.0	39.5
38	IL06-7550	23.6 l	19.9 l	5.0	24.8	40.5	13.0	22.0	18.9	25.0	10	36.6	41.0	9.2	59.6	5.0	32.5
39	IL06-14262	22.4 l	18.4 l	25.5	18.8	39.5	7.0	16.0	14.1	14.0	12.5	31.5 l	18.1	44.2	32.3	15.0	33.8
40	KY02C-3006-46	18.2 l	18.9 l	1.0	23.0	41.7	27.0	13.5	14.7	22.7	7.5	18.9 l	22.9	5.0	28.7	10.0	18.4
41	KY02C-3004-02	16.3 l	14.0 l	3.0	16.8	41.0	8.0	4.5	12.6	16.3	10	24.1 l	17.1	15.0	40.2	2.5	25.5
42	KY04C-2151	22.5 l	17.6 l	1.5	10.5	48.0	18.0	29.0	15.0	14.0	5	18.0 l	20.5	5.0	28.5	85.0	12.2
43	KY03C-1192-34	36.5	30.8	25.0	43.8	48.1	6.0	34.3	40.8	38.7	10	49.7	67.1	42.5	39.5	10.0	68.7
44	KY02C-3008-01	22.7 l	20.5	9.5	30.4	34.3	20.0	16.0	14.6	29.0	10	30.4 l	37.8	8.3	45.0	17.5	22.2
45	MD03W91-09-8	24.6 l	19.1 l	16.0	29.5	40.8	6.0	16.0	14.0	20.3	10	34.8	44.9	27.5	31.9	15.0	48.1
46	MD03W61-09-1	16.6 l	15.1 l	10.0	18.7	29.7	8.0	3.0	12.3	29.0	10	23.2 l	27.9	9.2	32.4	10.0	15.8
47	MD02W135-08-9	30.9	27.3	3.5	37.5	53.9	43.0	33.8	20.3	18.7	7.5	32.5 l	50.9	9.2	37.3	35.0	50.5
48	MO071522	30.9	19.6 l	1.0	24.8	34.5	6.0	19.3	25.3	30.7	15	46.9	45.5	26.7	68.4	45.0	59.0
49	MO080104	16.4 l	14.2 l	3.0	8.9	39.1	4.0	24.5	12.2	11.7	10	13.2 l	21.0	3.3	15.3	10.0	49.9
50	MO080864	22.1 l	18.6 l	3.0	37.5	47.7	3.0	11.5	11.2	25.0	10	29.9 l	43.0	10.8	35.8	25.0	24.3
51	MO081652	14.5 l	12.6 l	0.5	8.4	32.8	10.0	11.3	11.5	16.3	10	15.2 l	23.2	4.2	18.3	5.0	37.4
52	WESLEY	46.1 h	33.8	37.5	46.6	50.6	6.0	36.8	45.2	25.0	22.5	64.1 h	80.6	41.7	70.1	60.0	77.1
53	WESLEYFHB1	43.2	29.2	11.0	40.7	44.4	10.0	40.0	44.3	28.3	15	63.2 h	77.0	59.2	53.5	50.0	88.0
54	NE06607	35.0	22.8	6.0	44.2	45.5	6.0	24.5	18.1	22.7	15	48.4	65.6	37.5	42.0	50.0	77.9
55	NE06469	35.6	22.7	11.0	37.4	29.0	9.0	30.5	28.0	26.7	10	44.2	76.3	18.3	38.0	60.0	88.5
56	NW07505	48.8 h	37.0 h	40.0	70.0	41.0	6.0	51.8	27.4	50.0	10	63.3 h	70.3	47.5	72.0	55.0	93.8
57	VA06W-612	31.7	24.6	11.0	40.0	37.9	6.0	32.8	29.0	25.0	15	34.0 l	52.4	15.8	33.7	30.0	82.9
58	VA07W-594	27.3	19.2 l	6.0	36.5	34.8	7.0	16.3	18.0	25.0	10	38.6	39.9	36.7	39.1	10.0	75.6
59	VA07W-601	25.2	24.9	11.5	36.6	61.2	21.0	11.8	22.2	22.7	12.5	22.6 l	42.9	5.0	20.0	15.0	45.3
60	VA08W-734	16.1 l	14.1 l	1.5	43.2	21.7	5.0	8.5	8.8	14.0	10	20.5 l	24.9	5.0	31.6	10.0	25.7
100	AVERAGE	33.1	27.0 h	10.0	37.9	42.6	16.4	26.7	26.7	28.7	12.5	43.4	50.7	28.1	51.4	36.5	62.4
101	MINUMUM	14.5	12.6	0.5	8.4	21.7	3.0	3.0	8.8	11.7	5	12.0	15.2	2.5	15.3	0.0	12.2
102	MAXIMUM	56.0	44.5	40.0	70.0	65.0	62.0	57.4	49.3	65.0	22.5	78.8	87.5	80.8	88.0	90.0	100.0
103	LSD(0.05)	10.4	8.9	.	.	.	.	.	.	.	.	22.3	.	.	.	.	.

Table 14. Summary of index (IND, %) data from 2009-2010 NUWWSN.

ENTRY	NAME	ALL AVG	CLUSTER 1 AVG		INBRO	INLAY	MIELA	MOCOL	NYITH	OHWOO	ONRID	VABLA	OUT ILURB	OUT KYLEX	OUT MDSAL	OUT NEMEA
1	ERNIE	17.4	16.5		0.3	0.1	37.6	48.5	0.4	35.7	8.8	0.5	39.8	17.6	9.0	10.0
2	TRUMAN	16.7	9.9	l	0.0	0.3	12.9	33.7	1.8	14.8	15.2	0.5	47.5	58.1	8.0	8.0
3	FREEDOM	26.8	18.7		3.1	0.3	34.1	56.2	9.9	20.8	24.2	0.8	55.9	65.0	15.0	36.0
4	PIONEER-2545	36.8 h	32.8	h	23.0	17.3	55.2	52.3	22.6	49.3	40.8	2	81.3	72.2	17.0	9.0
5	NY99045-3110	24.1	19.0		0.0	4.5	46.3	45.9	6.2	21.8	26.0	1.3	45.5	64.7	24.5	3.0
6	OH07-176-56	21.7	17.8		1.1	0.8	37.0	45.7	11.3	23.9	21.4	0.9	54.0	59.9	1.0	3.0
7	NY94052-9340	27.1	17.6		0.0	3.8	39.4	37.9	8.8	26.3	22.0	2.8	37.1	69.7	20.0	58.0
8	NY99068-3251	19.4	12.4	l	0.4	4.8	22.7	31.8	2.6	25.3	10.8	0.8	18.7	70.2	15.0	30.0
9	NY88046-7088	35.5 h	26.2		5.0	25.1	47.6	49.7	11.6	31.8	34.4	4	75.1	83.6	31.5	26.0
10	E5011B	31.7 h	25.1		8.4	4.5	48.0	47.6	19.4	31.3	38.6	3	73.5	64.7	31.5	10.0
11	E5024	23.3	17.8		1.8	14.3	38.3	31.7	5.3	32.4	16.3	2	53.0	61.0	10.0	13.0
12	E3024	38.0 h	28.4	h	2.8	11.2	46.4	54.9	19.3	40.5	48.1	4	65.7	84.4	49.5	29.0
13	E6012	27.8	20.1		0.7	19.5	27.9	42.0	8.1	42.1	17.7	2.5	76.6	63.9	15.0	18.0
14	E8052	30.3 h	21.9		0.8	20.5	39.6	33.8	14.2	41.8	23.2	1	78.5	78.8	7.0	24.0
15	OH04-264-58	27.3	21.6		1.4	9.2	42.0	46.8	8.0	40.8	23.1	1.3	62.4	69.1	4.5	19.0
16	OH05-101-1	16.7	14.2	l	1.3	2.5	22.9	49.6	3.7	24.9	8.2	0.8	36.2	26.3	9.0	15.0
17	OH05-164-76	19.0	17.1		0.0	4.0	26.7	65.0	1.3	19.3	16.3	4.5	25.5	50.3	10.0	5.0
18	OH05-200-74	17.6	14.2	l	0.2	7.3	25.9	38.6	6.0	20.8	14.2	0.8	35.1	46.5	7.5	8.0
19	99691A2-5-4-16-1	21.8	20.1		0.9	1.4	19.8	49.0	5.5	45.8	36.2	2.4	34.2	29.2	10.0	27.0
20	01946A1-16-48-5	19.4	16.8		0.8	0.1	29.0	40.9	7.1	30.8	24.2	1.3	39.0	35.7	7.0	17.0
21	057RA1-8-5	22.7	15.7		0.1	4.4	33.5	46.3	3.2	25.8	11.0	1	61.3	64.9	7.0	14.0
22	059A1-2-4-3	21.8	16.3		0.1	1.0	38.3	45.8	4.4	22.6	17.4	0.8	63.4	52.0	5.5	10.0
23	TABOO	25.9	23.9		12.3	4.8	43.5	44.1	21.5	27.5	35.9	1.8	62.2	37.8	13.8	6.0
24	MONDO	15.3 l	14.6	l	0.1	5.4	27.3	43.1	5.0	17.4	17.5	1.3	33.5	19.6	4.0	9.0
25	PROBE	28.5	24.5		2.6	14.2	40.9	55.6	18.5	28.4	30.5	5.3	74.1	38.4	13.5	20.0
26	RUMOR	25.1	21.0		0.2	13.5	40.0	49.7	10.2	27.8	25.3	1.3	56.9	52.8	2.5	21.0
27	03M1539#019	20.1	20.1		2.3	1.7	47.4	40.9	4.4	30.0	33.3	1	49.1	26.5	0.0	4.0
28	03M1539#031	22.0	18.2		1.3	10.4	37.2	37.7	1.4	33.5	23.2	0.5	56.7	29.8	8.5	24.0
29	W1104	23.1	19.5		1.9	5.4	36.0	45.1	10.7	28.3	27.5	1	49.9	61.5	4.5	5.0
30	ML06-2097	23.5	22.8		4.4	3.8	43.9	54.7	13.4	37.3	22.0	2.5	53.8	36.2	5.5	5.0
31	GS-0-EM0681	21.5	18.0		0.1	1.1	46.2	41.4	9.2	22.3	21.8	1.5	41.8	56.8	11.5	4.0
32	GS-0-EM0614	21.4	16.7		0.6	3.3	37.7	38.8	10.9	27.4	13.4	1.3	76.0	35.5	7.0	5.0
33	GS-1-EM0362	31.4 h	21.2		0.4	3.6	46.1	48.4	14.3	39.7	14.9	1.8	87.5	88.0	24.0	8.0
34	ACF213003B	27.3	21.2		3.5	10.0	38.7	44.2	10.4	43.3	18.8	1	71.7	67.5	9.0	9.0
35	ACF126103	26.7	20.6		1.0	17.1	42.6	42.2	8.7	31.6	20.2	1.5	66.3	64.9	18.0	6.0
36	IL02-18228	12.3 l	9.8	l	0.0	0.1	11.1	38.8	0.6	20.8	5.4	1.3	7.8	11.5	4.5	46.0
37	IL04-24668	19.7	14.3	l	1.4	0.8	23.1	31.5	9.0	19.9	27.5	1.5	28.4	42.8	5.0	45.0
38	IL06-7550	17.5	13.6	l	0.4	0.3	21.6	44.2	4.7	18.9	18.2	0.8	38.4	47.7	2.5	12.0
39	IL06-14262	10.9 l	10.7	l	2.2	2.2	16.1	40.2	3.0	13.7	7.0	1.3	15.8	22.6	1.5	5.0
40	KY02C-3006-46	13.5 l	12.5	l	0.0	1.0	19.8	43.9	2.2	14.3	17.7	0.7	22.5	17.2	2.0	21.0
41	KY02C-3004-02	11.5 l	10.6	l	0.0	4.9	13.1	42.4	0.4	12.1	10.7	0.8	13.2	32.2	0.3	8.0
42	KY04C-2151	17.0	10.5	l	0.0	0.2	10.7	48.0	1.5	14.4	8.9	0.5	9.5	25.7	72.5	12.0
43	KY03C-1192-34	25.9	25.5		10.0	19.1	41.8	48.9	11.6	40.3	30.9	1	67.1	35.5	1.0	3.0
44	KY02C-3008-01	17.3	13.7	l	1.1	3.3	29.4	34.9	3.6	14.1	22.5	1	37.2	38.2	7.8	15.0
45	MD03W91-09-8	15.6 l	13.9	l	1.8	7.6	30.1	41.5	3.4	13.8	11.3	1.5	44.9	27.1	1.5	3.0
46	MD03W61-09-1	11.7 l	11.0	l	0.5	4.1	17.2	31.2	0.1	12.3	21.1	1.3	27.9	17.8	1.0	6.0
47	MD02W135-08-9	18.0	16.3		0.1	4.4	36.0	53.9	6.8	20.1	8.2	1.2	50.9	20.5	5.5	9.0
48	MO071522	18.9	13.1	l	0.1	2.0	14.9	37.6	3.1	24.8	19.6	2.3	44.9	68.4	6.0	3.0
49	MO080104	8.1 l	8.7	l	0.2	0.2	9.2	39.1	3.4	11.2	5.4	1	16.2	7.7	0.8	3.0
50	MO080864	14.0 l	13.2	l	0.1	0.3	26.9	47.7	2.7	10.5	16.0	1	37.5	16.1	8.5	1.0
51	MO081652	9.0 l	8.5	l	0.0	0.1	8.4	32.8	1.5	11.5	12.1	1.5	15.6	16.4	0.5	7.0
52	WESLEY	33.6 h	28.5	h	16.9	35.4	40.8	50.6	15.6	45.2	20.7	3	80.6	70.1	21.5	3.0
53	WESLEYFHB1	30.9 h	28.3	h	1.7	56.2	40.1	45.1	13.5	44.3	22.5	3	77.0	50.8	8.0	8.0
54	NE06607	20.1	16.6		1.2	7.5	40.2	46.2	5.2	16.5	14.0	2.3	65.6	29.4	11.0	2.0
55	NE06469	23.0	16.2		2.5	7.3	32.6	30.5	7.6	28.0	19.3	2	76.3	32.3	32.0	6.0
56	NW07505	31.8 h	28.8	h	27.0	23.8	61.7	42.4	11.0	26.8	36.7	1	70.3	54.0	23.5	3.0
57	VA06W-612	19.9	18.4		1.7	3.2	39.3	39.9	13.1	28.7	20.0	1.3	51.3	27.0	9.0	4.0
58	VA07W-594	14.9 l	13.7	l	0.8	3.7	28.2	35.4	6.1	17.3	16.1	1.8	35.9	29.3	1.5	3.0
59	VA07W-601	17.1	17.6		2.3	0.9	35.2	62.2	4.1	21.1	13.5	1.7	41.7	10.0	2.5	10.0
60	VA08W-734	10.4 l	8.7	l	0.0	0.2	31.0	23.7	0.5	7.7	5.6	0.5	21.8	28.5	2.0	3.0
100	AVERAGE	21.6	17.7		2.6	7.3	33.0	43.5	7.6	26.2	20.2	1.6	49.0	44.7	11.1	12.7
101	MINUMUM	14.5	8.5		0.0	0.1	8.4	23.7	0.1	7.7	5.4	0.5	7.8	7.7	0.0	1.0
102	MAXIMUM	56.0	32.8		27.0	56.2	61.7	65.0	22.6	49.3	48.1	5.3	87.5	88.0	72.5	58.0
103	LSD(0.05)	8.1	6.5													

Table 15. Summary of fusarium damaged kernel (FDK, %) data from 2009-2010 NUWWSN.

ENTRY	NAME	ALL AVG		CLUSTER 1 AVG		ILURB	INBRO	INLAY	KYLEX	MDSAL	NEMEA	OUT MOCOL	OUT ROFUN
1	ERNIE	25.5	l	18.9	l	40.0	3.6	1.5	10.5	18.5	39	40	51.2
2	TRUMAN	18.0	l	15.2	l	26.7	6.0	1.0	12.7	12.0	33	10	42.2
3	FREEDOM	36.3		28.4	l	48.3	23.9	10.0	17.3	16.8	54	75	45
4	PIONEER-2545	58.3	h	48.4	h	83.3	65.3	57.5	26.2	21.8	36	80	96.4
5	NY99045-3110	31.7	l	28.8		41.7	19.8	30.0	17.9	17.3	46	20	60.7
6	OH07-176-56	38.4		24.3	l	36.7	24.9	2.5	15.2	18.3	48	75	86.9
7	NY94052-9340	29.7	l	24.2	l	32.5	10.0	2.0	22.3	13.5	65	50	42.6
8	NY99068-3251	26.5	l	21.0	l	25.0	10.8	5.0	13.6	16.5	55	20	66.1
9	NY88046-7088	42.8	h	42.4	h	81.7	22.8	55.0	15.2	30.8	49	10	78.2
10	E5011B	46.5	h	35.6	h	73.3	12.7	45.0	9.1	16.5	57	75	83.3
11	E5024	33.8		25.9	l	43.3	17.7	7.5	10.1	11.0	66	50	64.7
12	E3024	40.2		31.4		55.0	26.8	6.5	29.2	17.0	54	60	73.5
13	E6012	34.1		30.8		55.0	13.3	40.0	18.5	16.8	41	10	78.2
14	E8052	41.3		37.9	h	66.7	19.5	70.0	11.9	5.3	54	40	63.2
15	OH04-264-58	43.1	h	40.0	h	75.0	25.3	62.5	12.0	19.3	46	40	64.3
16	OH05-101-1	39.8		35.2		50.0	29.4	47.5	12.5	23.5	48	50	57.9
17	OH05-164-76	27.8	l	19.4	l	40.0	5.7	17.5	9.1	9.3	35	60	45.6
18	OH05-200-74	34.7		24.1	l	41.7	8.4	20.0	9.7	22.5	42	75	58.1
19	99691A2-5-4-16-1	30.3	l	22.8	l	60.0	6.0	5.0	12.2	23.8	30	50	55.7
20	01946A1-16-48-5	27.5	l	20.6	l	45.0	24.1	15.0	10.9	6.3	22	50	46.5
21	057RA1-8-5	33.5	l	26.1	l	66.7	9.5	15.0	15.3	32.8	17	40	71.3
22	059A1-2-4-3	41.0		26.7	l	60.0	13.3	15.0	16.1	10.5	45	75	93
23	TABOO	39.6		23.4	l	66.7	14.9	8.5	10.9	5.3	34	80	96.4
24	MONDO	23.8	l	19.8	l	36.7	11.6	17.5	10.5	14.3	28	20	51.8
25	PROBE	45.4	h	32.4		73.3	10.7	40.0	17.9	14.5	38	80	88.9
26	RUMOR	34.2		31.8		53.3	29.0	25.0	23.1	16.5	44	20	62.8
27	03M1539#019	38.0		29.8		48.3	25.3	15.0	16.3	22.8	51	25	100
28	03M1539#031	27.6	l	22.9	l	40.0	5.3	7.0	15.8	7.3	62	25	58.4
29	W1104	41.8		28.7		66.7	8.3	20.0	17.9	14.0	45	75	87.4
30	ML06-2097	43.0	h	33.8		70.0	18.9	27.5	10.7	22.5	53	75	66.3
31	GS-0-EM0681	46.6	h	45.0	h	86.7	27.8	17.5	30.4	45.5	62	60	43.2
32	GS-0-EM0614	40.0		37.3	h	63.3	31.5	30.0	16.6	31.5	51	20	76.1
33	GS-1-EM0362	45.2	h	43.2	h	85.0	24.5	15.0	52.9	13.5	68	75	27.6
34	ACF213003B	45.1	h	38.2	h	75.0	22.1	32.5	17.6	20.8	61	40	92
35	ACF126103	39.9		31.5		65.0	23.3	27.5	13.1	24.8	35	60	70.9
36	IL02-18228	23.7	l	17.5	l	13.3	5.0	1.0	6.1	34.8	45	10	74.3
37	IL04-24668	22.2	l	21.0	l	32.5	5.6	3.0	11.0	41.8	32	20	31.4
38	IL06-7550	28.9	l	23.8	l	38.3	4.2	2.5	13.2	28.5	56	50	38.5
39	IL06-14262	20.4	l	20.5	l	25.0	10.5	10.0	12.5	12.8	52	20	20.1
40	KY02C-3006-46	20.1	l	20.2	l	30.0	4.8	27.5	11.1	8.0	40	20	19.5
41	KY02C-3004-02	19.3	l	20.2	l	16.7	8.1	20.0	5.0	26.5	45	10	23.2
42	KY04C-2151	23.0	l	21.9	l	27.5	13.1	20.0	6.5	7.3	57	20	32.9
43	KY03C-1192-34	35.9		33.6		50.0	38.3	25.0	13.1	20.0	55	60	25.4
44	KY02C-3008-01	30.0	l	28.6		66.7	5.1	30.0	8.1	23.5	38	10	58.3
45	MD03W91-09-8	20.5	l	23.0	l	38.3	5.3	15.0	5.9	26.3	47	10	15.8
46	MD03W61-09-1	25.3	l	28.2	l	46.7	12.6	42.5	6.3	21.8	39	10	23.7
47	MD02W135-08-9	20.9	l	24.9	l	35.0	6.8	35.0	10.0	9.5	53	10	8.3
48	MO071522	29.0	l	22.9	l	36.7	9.2	3.5	8.5	32.5	47	20	74.8
49	MO080104	22.2	l	16.8	l	23.3	1.5	6.5	6.8	25.8	37	20	56.3
50	MO080864	18.7	l	14.1	l	13.3	6.5	2.0	10.7	17.8	34	25	40.4
51	MO081652	18.9	l	17.7	l	25.0	0.0	4.0	6.5	23.5	47	5	40
52	WESLEY	53.9	h	48.6	h	96.3	28.3	75.0	18.7	26.3	47	95	44.2
53	WESLEYFHB1	45.4	h	41.3	h	73.3	34.9	65.0	10.5	37.0	27	40	75.4
54	NE06607	45.7	h	41.7	h	82.5	32.6	50.0	5.9	40.0	39	40	75.7
55	NE06469	55.3	h	47.7	h	80.0	26.1	50.0	11.4	58.5	60	60	96.1
56	NW07505	56.2	h	49.9	h	91.7	52.5	42.5	14.1	57.5	41	50	100
57	VA06W-612	37.2		24.6	l	30.0	9.7	25.0	11.9	27.0	44	50	100
58	VA07W-594	32.5	l	27.8	l	43.3	10.6	7.5	11.7	29.8	64	75	18
59	VA07W-601	41.1		34.4		43.3	40.2	22.5	11.2	26.0	63	75	47.7
60	VA08W-734	21.0	l	14.3	l	26.7	8.1	2.0	4.1	15.8	29	20	62
100	AVERAGE	34.3		28.9		51.1	17.2	23.4	13.7	21.9	45.9	42.3	59.1
101	MINUMUM	18.0		14.1		13.3	0.0	1.0	4.1	5.3	17	5	8.3
102	MAXIMUM	58.3		49.9		96.3	65.3	75.0	52.9	58.5	68	95	100
103	LSD(0.05)	15.5		14.3									

Table 16. Summary of incidence x severity x FDK (ISK, %) data from 2009-2010 NUWWSN.

ENTRY	NAME	ALL AVG	CLUSTER 1 AVG	ILURB	INBRO	INLAY	KYLEX	MOCOL	OUT MDSAL	OUT NEMEA
1	ERNIE	30.1 l	31.9 l	58.0	5.2	2.9	33.8	59.8	10.8	40
2	TRUMAN	27.8 l	30.8 l	53.5	3.0	3.9	51.5	42.1	4.3	36
3	FREEDOM	41.5	45.4	66.1	20.8	8.5	55.6	76.1	7.6	56
4	PIONEER-2545	55.6 h	66.4 h	87.7	55.4	50.5	61.5	76.9	18.9	38
5	NY99045-3110	37.5	39.7	59.0	9.3	25.5	56.1	48.8	30.1	34
6	OH07-176-56	35.5	42.3	60.5	16.7	7.2	54.0	73.0	1.3	36
7	NY94052-9340	40.9	39.4	53.1	5.1	18.3	59.8	60.7	20.0	69
8	NY99068-3251	34.1 l	33.0	36.3	8.7	17.4	56.5	46.2	19.7	54
9	NY88046-7088	54.5 h	53.9	85.1	22.6	52.2	61.2	48.2	63.5	49
10	E5011B	49.6 h	53.3	81.4	23.1	34.5	53.0	74.3	40.8	40
11	E5024	40.8	43.9	62.9	15.3	30.5	51.4	59.5	8.3	58
12	E3024	52.2 h	50.8	71.4	21.2	25.3	67.0	68.9	59.3	52
13	E6012	41.3	46.4	75.0	12.4	43.2	55.5	45.9	16.2	41
14	E8052	45.3	53.3	80.2	15.6	56.3	58.1	56.1	2.9	48
15	OH04-264-58	44.3	51.8	78.7	19.9	45.5	55.1	60.0	4.8	46
16	OH05-101-1	39.7	42.8	59.1	18.5	35.5	35.8	64.9	18.9	45
17	OH05-164-76	34.2 l	39.3	52.7	3.2	19.5	47.4	73.5	3.1	40
18	OH05-200-74	36.7	41.3	57.2	6.9	24.3	47.1	70.9	12.3	38
19	99691A2-5-4-16-1	35.4	37.2	61.7	9.2	12.0	39.9	63.2	14.8	47
20	01946A1-16-48-5	32.8 l	37.5	59.2	15.5	8.6	41.7	62.3	5.0	37
21	057RA1-8-5	38.5	43.6	75.1	5.9	22.3	54.7	59.9	13.4	38
22	059A1-2-4-3	38.3	44.2	73.0	7.4	16.4	50.3	73.7	1.6	46
23	TABOO	41.8	49.8	75.1	27.0	29.4	43.9	73.8	8.5	35
24	MONDO	28.6 l	32.4 l	53.9	6.2	23.7	30.8	47.4	4.5	34
25	PROBE	46.0	51.9	81.6	14.0	39.8	46.2	77.9	13.4	49
26	RUMOR	39.7	45.0	68.4	14.5	34.8	54.4	52.9	2.2	51
27	03M1539#019	33.6 l	38.6	64.1	19.1	15.0	42.4	52.3	0.0	42
28	03M1539#031	36.6	38.5	62.9	8.9	28.1	41.5	51.3	4.6	59
29	W1104	39.5	46.9	71.4	11.6	23.2	55.6	72.8	3.5	38
30	ML06-2097	41.6	47.9	74.2	20.3	25.3	43.3	76.4	10.5	41
31	GS-0-EM0681	44.0	45.6	76.9	12.9	13.8	59.2	65.0	37.4	43
32	GS-0-EM0614	37.6	42.0	78.1	17.8	24.8	43.3	46.2	16.2	37
33	GS-1-EM0362	50.7 h	56.1	90.2	13.6	26.0	77.6	73.0	23.3	51
34	ACF213003B	44.7	49.7	81.3	20.1	32.0	56.5	58.5	13.4	51
35	ACF126103	44.9	49.4	75.9	15.3	36.5	54.2	65.3	32.1	35
36	IL02-18228	24.9 l	20.7 l	24.9	3.2	2.1	28.4	45.0	13.0	58
37	IL04-24668	31.7 l	30.8 l	48.7	9.3	6.8	44.4	44.8	16.1	52
38	IL06-7550	32.4 l	34.5	55.7	5.4	4.7	47.2	59.6	2.9	51
39	IL06-14262	29.0 l	31.9 l	41.5	14.4	18.8	35.7	49.3	1.2	42
40	KY02C-3006-46	27.9 l	29.9 l	48.4	2.5	18.5	31.0	49.0	0.7	45
41	KY02C-3004-02	26.4 l	29.0 l	34.8	4.6	22.3	38.0	45.3	0.6	39
42	KY04C-2151	31.4 l	27.6 l	30.7	6.5	10.4	38.1	52.4	37.6	44
43	KY03C-1192-34	41.9	50.6	70.1	34.8	36.3	44.1	67.9	1.4	39
44	KY02C-3008-01	35.5	37.7	67.5	8.4	26.5	42.2	43.8	18.9	41
45	MD03W91-09-8	30.3 l	34.9	58.8	10.2	22.5	37.4	45.7	2.5	35
46	MD03W61-09-1	29.6 l	34.0	57.1	9.4	33.3	28.7	41.4	1.6	36
47	MD02W135-08-9	32.2 l	35.4	59.3	4.7	31.0	31.7	50.2	3.6	45
48	MO071522	31.8 l	35.1	57.8	6.2	11.7	53.9	45.9	14.0	33
49	MO080104	21.2 l	23.5 l	36.6	3.8	5.1	22.3	49.7	1.2	30
50	MO080864	23.6 l	27.1 l	43.7	4.4	4.8	28.5	54.3	10.3	19
51	MO081652	23.2 l	23.8 l	38.0	0.3	3.5	35.1	41.9	0.4	43
52	WESLEY	58.1 h	67.7 h	92.7	36.1	68.0	58.5	83.2	33.0	35
53	WESLEYFHB1	48.8 h	56.8	82.4	21.8	72.3	48.7	58.8	20.9	37
54	NE06607	41.7	47.2	82.7	20.8	37.3	35.9	59.1	30.9	25
55	NE06469	61.3 h	49.1	84.9	20.5	37.5	41.5	61.2	136.8	47
56	NW07505	60.8 h	59.7 h	87.8	53.3	46.3	49.7	61.3	98.5	29
57	VA06W-612	34.6	37.7	57.2	11.7	20.7	38.9	59.9	17.5	36
58	VA07W-594	33.7 l	38.4	56.3	9.8	17.0	38.9	69.9	3.1	41
59	VA07W-601	36.9	40.8	59.2	25.5	15.8	25.5	77.8	4.7	50
60	VA08W-734	22.3 l	26.4 l	44.1	4.3	3.5	38.1	42.0	2.3	22
100	AVERAGE	38.1	41.5	63.7	14.2	24.8	46.0	59.0	17.0	42.1
101	MINUMUM	21.2	20.7	24.9	0.3	2.1	22.3	41.4	0.0	19
102	MAXIMUM	61.3	67.7	92.7	55.4	72.3	77.6	83.2	136.8	69
103	LSD(0.05)	13.2	11.9							

Table 17. Summary of deoxynivalenol (DON, ppm) data from 2009-2010 NUWWSN.

ENTRY	NAME	ALL AVG	CLUSTER 1 AVG	ILURB	MDSAL	OHWOO	CLUSTER 2 AVG	NEMEA	NYITH	VABLA	OUT KYLEX
1	ERNIE	7.3	9.6	12.2	1.4	15.2	0.6 l	1	0.5	0.3	20.2
2	TRUMAN	5.3 l	5.7 l	7.5	4.2	5.3	0.9 l	2	0.7	0	17.5
3	FREEDOM	7.1 l	7.0	10.1	3.8	7.2	0.8 l	1	1.5	0	25.8
4	PIONEER-2545	12.9 h	13.2	13.8	6.3	19.5	3.6 h	2	8.6	0.3	40.1
5	NY99045-3110	10.0	10.3	14.1	10.0	6.8	1.9 lh	3	2.1	0.6	33.8
6	OH07-176-56	5.7 l	5.9 l	9.6	0.6	7.6	0.9 l	1	1.7	0	19.3
7	NY94052-9340	8.4	11.0	18.6	8.1	6.4	1.6 l	3	1.2	0.5	21.0
8	NY99068-3251	7.6	8.4	12.8	9.1	3.4	0.9 l	2	0.5	0.1	25.3
9	NY88046-7088	7.2	9.8	13.5	8.9	6.9	1.2 l	1	2.1	0.4	17.9
10	E5011B	10.0	12.2	16.3	8.2	12.1	2.3 h	2	4.5	0.4	26.3
11	E5024	12.1	16.4	23.6	7.5	18.2	1.0 l	1	1.8	0.2	32.2
12	E3024	9.0	11.7	12.5	11.2	11.5	2.9 h	2	5.9	0.8	19.5
13	E6012	10.8	15.1	17.6	9.5	18.2	2.1 h	3	3	0.2	24.4
14	E8052	11.4	15.8	26.1	5.9	15.4	3.1 h	3	6	0.2	23.0
15	OH04-264-58	5.7 l	7.7	8.5	1.2	13.4	0.8 l	1	1.2	0.3	14.0
16	OH05-101-1	5.6 l	7.2	8.8	1.0	11.9	0.7 l	1	1	0.1	15.5
17	OH05-164-76	5.3 l	4.5 l	5.2	1.6	6.6	0.5 l	1	0.5	0.1	22.3
18	OH05-200-74	6.2 l	6.7 l	11.4	2.7	5.9	0.7 l	1	1.1	0.1	21.1
19	99691A2-5-4-16-1	7.8	6.7 l	10.4	1.4	8.2	0.8 l	1	1.2	0.3	32.1
20	01946A1-16-48-5	7.1	7.8	11.2	3.0	9.1	0.7 l	1	1	0.1	24.6
21	057RA1-8-5	10.2	9.6	15.2	2.8	10.9	0.7 l	1	1.1	0	40.7
22	059A1-2-4-3	10.1	10.4	16.4	1.3	13.4	1.8 l	3	2.2	0.2	34.3
23	TABOO	5.7 l	6.3 l	8.0	1.5	9.5	1.3 l	1	2.8	0.1	16.8
24	MONDO	7.2	7.0	9.8	2.9	8.4	0.9 l	1	1.7	0.1	26.5
25	PROBE	7.1 l	7.8	10.7	1.5	11.1	1.2 l	1	2.4	0.1	22.6
26	RUMOR	6.4 l	6.3 l	8.5	1.7	8.6	1.0 l	1	1.9	0.2	22.9
27	03M1539#019	9.2	7.8	10.5	1.5	11.5	1.1 l	1	1.8	0.5	37.6
28	03M1539#031	7.9	7.1	9.7	2.4	9.2	1.2 l	2	1.7	0	30.4
29	W1104	13.7 h	10.2	16.4	2.8	11.5	2.1 h	3	3	0.2	59.2
30	ML06-2097	8.4	7.7	8.5	2.8	11.9	1.3 l	2	1.8	0.1	31.4
31	GS-0-EM0681	10.8	8.9	16.7	9.3	0.6		9.4		4.9	24.8
32	GS-0-EM0614	5.8 l	5.9 l	9.0	2.9	5.8	1.3 l	2	1.6	0.2	18.8
33	GS-1-EM0362	11.9	11.9	18.7	4.5	12.5	2.5 h	5	1.7	0.8	40.2
34	ACF213003B	9.2	9.5	12.7	6.6	9.2	2.6 h	5	2.2	0.5	28.5
35	ACF126103	9.3	10.0	12.8	4.0	13.2	1.2 l	2	1.4	0.3	31.4
36	IL02-18228	3.4 l	2.4 l	3.5	0.9	2.7	0.4 l	1	0.3	0	15.4
37	IL04-24668	5.0 l	4.0 l	6.0	0.9	5.1	0.6 l	1	0.8	0.1	21.4
38	IL06-7550	7.4	6.7 l	10.6	2.4	7.2	1.2 l	3	0.7	0	27.9
39	IL06-14262	4.5 l	3.8 l	5.9	0.8	4.6	1.1 l	2	1.2	0	16.9
40	KY02C-3006-46	4.3 l	4.1 l	4.9	0.7	6.6	0.6 l	1	0.7	0	16.0
41	KY02C-3004-02	3.4 l	2.5 l	2.9	1.2	3.5	0.5 l	1	0.6	0	14.4
42	KY04C-2151	4.1 l	3.9 l	3.6	0.7	7.3	0.6 l	1	0.8	0	15.3
43	KY03C-1192-34	7.8	9.0	12.1	1.2	13.8	1.3 l	1	2.7	0.3	23.8
44	KY02C-3008-01	6.1 l	5.3 l	7.8	1.0	7	0.3 l	0	0.8	0	25.9
45	MD03W91-09-8	5.7 l	6.7 l	11.0	1.9	7.1	1.3 l	1	2.9	0	15.9
46	MD03W61-09-1	3.8 l	4.3 l	7.1	0.3	5.4	0.5 l	1	0.5	0	12.6
47	MD02W135-08-9	6.6 l	5.0 l	7.0	2.2	5.9	0.8 l	1	1.3	0.1	28.9
48	MO071522	5.1 l	5.7 l	11.0	1.4	4.8	0.6 l	1	0.5	0.2	17.1
49	MO080104	3.1 l	3.0 l	5.4	1.0	2.5	0.2 l	0	0.5	0.1	11.9
50	MO080864	5.8 l	4.6 l	8.8	3.5	1.5	1.0 l	2	0.7	0.3	23.6
51	MO081652	3.9 l	2.8 l	6.3	0.5	1.5	0.5 l	1	0.5	0	17.8
52	WESLEY	10.5	12.4	16.3	3.2	17.8	3.3 h	2	7.2	0.7	26.4
53	WESLEYFHB1	8.8	9.3	12.2	2.5	13.2	3.0 h	3	5.8	0.2	24.9
54	NE06607	6.4 l	7.3	12.5	2.5	6.9	1.7 l	3	2	0.1	18.0
55	NE06469	7.9	10.5	13.9	8.0	9.6	1.6 l	2	2.4	0.3	19.4
56	NW07505	16.4 h	24.2 h	30.4	19.7	22.6	2.6 h	3	4.1	0.7	34.7
57	VA06W-612	6.1 l	6.0 l	7.5	2.3	8.1	1.2 l	1	2.6	0.1	21.2
58	VA07W-594	4.8 l	4.7 l	6.5	2.0	5.6	1.0 l	2	0.9	0.1	16.6
59	VA07W-601	4.5 l	5.0 l	8.6	0.6	5.7	0.9 l	2	0.8	0	14.1
60	VA08W-734	4.0 l	3.8 l	7.2	2.6	1.6	0.6 l	1	0.7	0	14.6
100	AVERAGE	7.4	7.9	11.2	3.5	9	1.3	1.7	1.9	0.2	23.9
101	MINUMUM	3.1	2.4	2.9	0.3	1.5	0.2	0	0.3	0	11.9
102	MAXIMUM	16.4	24.2	30.4	19.7	22.6	3.6	5	8.6	0.8	59.2
103	LSD(0.05)	4.1	4.5				1.7				

Table 18. Summary of greenhouse severity from SPI (GHSEV, %) data from 2009-2010 NUWWSN.

ENTRY	NAME	AVG	ILURB	MOCOL
1	ERNIE	10.7 l	8	13.4
2	TRUMAN	5.2 l	4.8	5.6
3	FREEDOM	7.9 l	5	10.8
4	PIONEER-2545	26.3 l	28.7	23.9
5	NY99045-3110	8.5 l	12.8	4.2
6	OH07-176-56	49.0 h	77.8	20.3
7	NY94052-9340	7.5 l	8.6	6.4
8	NY99068-3251	18.2 l	24.2	12.2
9	NY88046-7088	17.5 l	21.8	13.2
10	E5011B	12.9 l	6.8	19
11	E5024	10.9 l	13	8.8
12	E3024	31.4	51.5	11.3
13	E6012	10.5 l	10	11
14	E8052	21.2 l	30	12.5
15	OH04-264-58	24.1 l	30.4	17.9
16	OH05-101-1	35.2	53.8	16.5
17	OH05-164-76	9.8 l	4	15.5
18	OH05-200-74	7.4 l	8.3	6.6
19	99691A2-5-4-16-1	43.7 h	62.4	25
20	01946A1-16-48-5	10.5 l	13.5	7.5
21	057RA1-8-5	6.3 l	7.5	5.2
22	059A1-2-4-3	6.4 l	5.5	7.4
23	TABOO	52.5 h	60	45.1
24	MONDO	17.9 l	18	17.9
25	PROBE	60.3 h	76.4	44.2
26	RUMOR	17.6 l	26.3	8.9
27	03M1539#019	67.8 h	100	35.6
28	03M1539#031	56.0 h	70.7	41.4
29	W1104	15.2 l	19.7	10.7
30	ML06-2097	28.9 l	39	18.8
31	GS-0-EM0681	18.3 l	23.2	13.3
32	GS-0-EM0614	42.7 h	59.8	25.5
33	GS-1-EM0362	54.3 h	87.7	20.9
34	ACF213003B	12.0 l	10.8	13.1
35	ACF126103	35.1	50	20.2
36	IL02-18228	25.7 l	39.6	11.7
37	IL04-24668	26.0 l	26.8	25.3
38	IL06-7550	9.3 l	5.3	13.3
39	IL06-14262	6.4 l	6.7	6
40	KY02C-3006-46	3.9 l	3.6	4.2
41	KY02C-3004-02	5.7 l	3.8	7.5
42	KY04C-2151	5.3 l	6.7	3.8
43	KY03C-1192-34	50.1 h	64.8	35.5
44	KY02C-3008-01	4.7 l	4.4	5
45	MD03W91-09-8	41.5 h	65.2	17.7
46	MD03W61-09-1	13.2 l	11.3	15
47	MD02W135-08-9	59.4 h	84.5	34.3
48	MO071522	7.4 l	11.2	3.6
49	MO080104	8.1 l	3.8	12.4
50	MO080864	4.4 l	3.3	5.6
51	MO081652	6.6 l	3	10.3
52	WESLEY	6.3 l	6.6	6
53	WESLEYFHB1	38.8	50.2	27.4
54	NE06607	12.4 l	8	16.9
55	NE06469	26.3 l	28	24.6
56	NW07505	37.1	39.5	34.6
57	VA06W-612	27.3 l	37.2	17.5
58	VA07W-594	26.7 l	44	9.4
59	VA07W-601	13.3 l	19.7	6.9
60	VA08W-734	9.1 l	5.8	12.4
100	AVERAGE	22.2	28.6	15.9
101	MINUMUM	3.9	3	3.6
102	MAXIMUM	67.8	100	45.1
103	LSD(0.05)	27.4	.	.

Table 19. Summary of heading date (HD, julian days) data from 2009-2010 NUWWSN.

ENTRY	NAME	AVG	ILURB	KYLEX	MDSAL	MIELA	MOCOL	OHWOO	ONRID	ROFUN
1	ERNIE	135	127	127	120	152	140	139	146	131
2	TRUMAN	140	134	135	124	156	147	142	150	135
3	FREEDOM	138	132	130	122	155	143	141	149	135
4	PIONEER-2545	137	130	129	121	153	143	141	147	133
5	NY99045-3110	142 h	137	137	126	156	146	145	152	136
6	OH07-176-56	138	132	130	121	153	144	141	147	133
7	NY94052-9340	142 h	138	139	125	157	147	145	149	136
8	NY99068-3251	142 h	140	138	126	157	147	145	151	136
9	NY88046-7088	141 h	137	136	126	156	146	144	150	136
10	E5011B	140	136	133	125	155	145	143	149	136
11	E5024	139	133	131	124	153	144	143	147	134
12	E3024	143 h	139	137	126	158	147	144	152	138
13	E6012	138	131	131	124	152	144	142	146	134
14	E8052	138	132	130	122	152	144	141	146	133
15	OH04-264-58	138	132	132	122	154	144	141	149	134
16	OH05-101-1	136	127	128	120	151	143	140	146	131
17	OH05-164-76	137	131	129	121	152	144	139	146	133
18	OH05-200-74	138	131	130	122	153	144	141	147	134
19	99691A2-5-4-16-1	133 l	126	124	118	149	137	135	146	130
20	01946A1-16-48-5	137	128	130	120	153	144	139	146	134
21	057RA1-8-5	138	131	134	121	154	145	140	147	132
22	059A1-2-4-3	137	128	130	121	154	144	140	148	132
23	TABOO	137	131	128	121	153	143	140	146	132
24	MONDO	137	129	128	121	153	144	140	147	132
25	PROBE	136	130	128	120	151	143	139	148	132
26	RUMOR	138	132	130	122	152	143	141	146	134
27	03M1539#019	137	130	128	121	152	142	140	146	133
28	03M1539#031	136	129	127	121	152	143	140	146	133
29	W1104	138	130	130	121	153	144	141	146	135
30	ML06-2097	138	133	131	122	154	144	141	148	135
31	GS-0-EM0681	143 h	139	139	128	157	148	151	134	.
32	GS-0-EM0614	139	133	131	123	155	145	142	149	135
33	GS-1-EM0362	140	135	135	125	153	147	144	147	133
34	ACF213003B	139	133	131	124	155	145	142	146	134
35	ACF126103	138	133	131	122	154	144	141	146	131
36	IL02-18228	135	127	125	120	149	142	135	146	132
37	IL04-24668	134	127	125	120	151	138	137	146	131
38	IL06-7550	136	128	130	121	152	144	138	146	132
39	IL06-14262	137	128	129	120	152	144	140	146	133
40	KY02C-3006-46	137	131	129	120	153	143	141	146	134
41	KY02C-3004-02	139	133	131	122	154	144	142	147	135
42	KY04C-2151	134 l	127	125	118	149	137	137	146	130
43	KY03C-1192-34	137	128	129	120	151	145	141	146	134
44	KY02C-3008-01	138	133	131	121	152	143	141	148	134
45	MD03W91-09-8	136	128	128	120	151	143	140	148	133
46	MD03W61-09-1	136	129	129	120	151	145	140	146	132
47	MD02W135-08-9	137	129	129	120	152	144	141	146	133
48	MO071522	140	135	136	125	156	146	142	150	133
49	MO080104	136	128	127	120	151	139	140	148	133
50	MO080864	139	133	132	124	157	145	142	150	132
51	MO081652	135	127	127	120	149	141	138	147	132
52	WESLEY	138	133	131	124	154	144	141	146	132
53	WESLEYFHB1	135	126	125	119	150	141	138	146	133
54	NE06607	138	133	130	123	153	145	141	147	135
55	NE06469	136	127	129	120	152	145	140	147	131
56	NW07505	137	128	129	120	154	144	140	147	133
57	VA06W-612	137	129	128	120	152	144	140	146	134
58	VA07W-594	138	129	130	121	155	145	141	149	133
59	VA07W-601	136	128	126	120	151	142	141	147	133
60	VA08W-734	140	133	133	125	154	145	141	151	134
100	AVERAGE	138	131	130	122	153	144	141	147	133
101	MINUMUM	133	126	124	118	149	137	135	134	130
102	MAXIMUM	143	140	139	128	158	148	151	152	138
103	LSD(0.05)	1	.	.	.	.	.	.	.	.

Table 20. Summary of plant height (HGT, inches) data from 2009-2010 NUWWSN.

ENTRY	NAME	AVG	KYLEX	MDSAL	ROFUN
1	ERNIE	33 l	30	31	39.4
2	TRUMAN	37	36	35	39.4
3	FREEDOM	37	35	34	41.4
4	PIONEER-2545	34	34	33	35.5
5	NY99045-3110	38	34	35	45.3
6	OH07-176-56	35	32	33	41.4
7	NY94052-9340	40 h	38	37	45.3
8	NY99068-3251	37	34	35	43.3
9	NY88046-7088	40 h	37	38	45.3
10	E5011B	32 l	30	30	35.5
11	E5024	32 l	32	31	33.5
12	E3024	35	35	33	37.8
13	E6012	33 l	33	32	33.5
14	E8052	33 l	31	31	35.5
15	OH04-264-58	32 l	30	31	34.3
16	OH05-101-1	35	30	34	41.4
17	OH05-164-76	33 l	31	33	35.5
18	OH05-200-74	36	32	35	41.4
19	99691A2-5-4-16-1	36	32	35	41.4
20	01946A1-16-48-5	31 l	27	32	33.9
21	057RA1-8-5	30 l	28	30	33.1
22	059A1-2-4-3	31 l	28	31	34.3
23	TABOO	37	32	34	44.9
24	MONDO	38	34	36	43.3
25	PROBE	32 l	30	32	33.5
26	RUMOR	35	34	32	39.4
27	03M1539#019	34	32	33	38.2
28	03M1539#031	35	32	34	39.4
29	W1104	33 l	33	32	33.9
30	ML06-2097	35	31	34	39.4
31	GS-0-EM0681	38	40	35	39.4
32	GS-0-EM0614	43 h	44	37	47.3
33	GS-1-EM0362	38	37	38	39.4
34	ACF213003B	36	32	33	43.3
35	ACF126103	37	33	32	47.3
36	IL02-18228	37	35	34	41.4
37	IL04-24668	33 l	31	32	35.5
38	IL06-7550	34	31	33	38.2
39	IL06-14262	36	33	35	41
40	KY02C-3006-46	33 l	31	31	37.4
41	KY02C-3004-02	32 l	30	33	33.1
42	KY04C-2151	31 l	25	31	38.2
43	KY03C-1192-34	35	32	35	39.4
44	KY02C-3008-01	37	33	34	44.1
45	MD03W91-09-8	33 l	30	33	35.5
46	MD03W61-09-1	34 l	31	33	37
47	MD02W135-08-9	34 l	29	32	40.2
48	MO071522	32 l	32	32	33.5
49	MO080104	35	31	34	41.4
50	MO080864	38	36	36	42.2
51	MO081652	36	30	33	44.9
52	WESLEY	32 l	30	31	35.5
53	WESLEYFHB1	34	30	34	37.4
54	NE06607	35	33	35	37.8
55	NE06469	37	33	37	42.2
56	NW07505	37	32	36	42.6
57	VA06W-612	32 l	29	31	35.5
58	VA07W-594	32 l	30	32	34.3
59	VA07W-601	32 l	28	31	35.5
60	VA08W-734	36	30	34	45.3
100	AVERAGE	35	32	33	39.1
101	MINUMUM	30	25	30	33.1
102	MAXIMUM	43	44	38	47.3
103	LSD(0.05)	4	.	.	.

Table 21. Summary of incidence (INC, %) data from 2009-2010 PNUWWSN.

ENTRY	NAME	ALL AVG	CLUSTER 1 AVG	ILURB	MIELA	MOCOL	VABLA	CLUSTER 2 AVG	INBRO	INLAY	OUT KYLEX
1	ERNIE	49.1 l	70.5 h	91.7	85.4	100.0	5.0	3.3 l	4.0	2.5	55.0
2	TRUMAN	43.2 l	58.0 l	93.3	61.3	70.0	7.5	2.7 l	0.3	5.0	65.0
3	FREEDOM	62.2 h	70.2 h	90.0	83.1	100.0	7.5	37.5	25.0	50.0	80.0
4	PIONEER2545	71.0 h	76.8 h	100.0	94.8	100.0	12.5	50.0	45.0	55.0	90.0
5	E5017	74.8 h	77.2 h	96.7	94.6	100.0	17.5	60.0 h	65.0	55.0	95.0
6	E8007	41.2 l	57.9 l	80.0	66.5	80.0	5.0	3.5 l	3.5	3.5	50.0
7	OH06-158-50	59.3	75.1 h	98.3	84.5	100.0	17.5	20.0 l	25.0	15.0	75.0
8	OH06-159-6	52.7 l	69.6 h	91.7	79.0	100.0	7.5	10.5 l	12.5	8.5	70.0
9	OH06-180-57	60.8	73.0 h	96.7	80.2	100.0	15.0	16.8 l	25.0	8.5	100.0
10	OH06-197-61	49.7 l	68.3	93.3	82.3	90.0	7.5	7.3 l	10.0	4.5	60.0
11	OH06-228-73	62.6 h	71.4 h	96.7	89.0	90.0	10.0	26.3	32.5	20.0	100.0
12	OH06-190-29	62.1	74.9 h	100.0	87.1	90.0	22.5	35.0	30.0	40.0	65.0
13	03207A1-7-5	54.1	73.2 h	96.7	86.2	100.0	10.0	7.8 l	3.0	12.5	70.0
14	03615A1-5-7	52.0 l	70.6 h	93.3	83.9	90.0	15.0	1.0 l	0.5	1.5	80.0
15	059A1-1-9-5	53.8	72.4 h	96.7	87.9	90.0	15.0	3.5 l	3.5	3.5	80.0
16	059A1-1-9-6	56.8	72.6 h	93.3	89.5	100.0	7.5	3.8 l	5.0	2.5	100.0
17	0527A1-9-9-3	53.4 l	77.4 h	98.3	91.1	100.0	20.0	2.3 l	3.5	1.0	60.0
18	0537A1-7-8	53.7	72.0 h	95.0	80.6	100.0	12.5	11.3 l	12.5	10.0	65.0
19	SE99-1015-7	59.3	76.1 h	98.3	88.4	100.0	17.5	15.5 l	6.0	25.0	80.0
20	SE-MO98-274-8	57.9	71.3 h	90.0	77.8	100.0	17.5	17.5 l	25.0	10.0	85.0
21	SE98-1094-C20	57.2	71.3 h	91.7	85.8	100.0	7.5	7.8 l	3.0	12.5	100.0
22	SE00-4040-10	58.4	71.6 h	88.3	85.7	90.0	22.5	26.3	12.5	40.0	70.0
23	SE00-10303-35	66.7 h	75.5 h	100.0	89.3	100.0	12.5	45.0	50.0	40.0	75.0
24	SE00-10286-7	64.4 h	77.1 h	98.3	90.1	100.0	20.0	36.3	22.5	50.0	70.0
25	MISC-HDS-148	74.8 h	75.4 h	96.7	89.7	100.0	15.0	81.3 h	80.0	82.5	60.0
26	M08*8005#	51.5 l	68.5	93.3	65.5	90.0	25.0	13.3 l	1.5	25.0	60.0
27	MH07-7474	49.9 l	67.5	91.7	70.8	100.0	7.5	12.3 l	9.5	15.0	55.0
28	IL06-13072	52.4 l	66.5 l	90.0	65.9	100.0	10.0	10.5 l	12.5	8.5	80.0
29	IL06-13708	49.9 l	69.6 h	93.3	77.6	100.0	7.5	8.0 l	10.0	6.0	55.0
30	IL06-13721	46.8 l	66.1 l	91.7	65.2	100.0	7.5	6.8 l	8.5	5.0	50.0
31	IL06-25634	57.1	72.8 h	95.0	86.3	100.0	10.0	9.3 l	8.5	10.0	90.0
32	IL06-27969	47.1 l	64.5 l	83.3	62.0	100.0	12.5	6.0 l	8.0	4.0	60.0
33	IL06-14325	47.9 l	64.5 l	91.7	56.3	100.0	10.0	3.8 l	2.5	5.0	70.0
34	KY02C-3007-55	52.7 l	66.1 l	88.3	73.4	90.0	12.5	4.8 l	5.5	4.0	95.0
35	KY03C-1237-23	66.9 h	75.9 h	98.3	90.1	90.0	25.0	40.0	10.0	70.0	85.0
36	KY01C-1070-02	62.7 h	72.3 h	98.3	80.9	100.0	10.0	45.0	20.0	70.0	60.0
37	KY01C-1531-17	60.3	75.8 h	95.0	88.1	100.0	20.0	29.5	14.0	45.0	60.0
38	KY03C-1136-18	71.5 h	77.6 h	98.3	92.2	100.0	20.0	52.5	40.0	65.0	85.0
39	KY03C-1092-13	60.5	75.9 h	95.0	91.2	100.0	17.5	27.5	15.0	40.0	65.0
40	MO070933	53.0 l	63.3 l	88.3	77.3	80.0	7.5	8.9 l	0.2	17.5	100.0
41	MO080103	40.8 l	66.3 l	86.7	71.0	100.0	7.5	5.1 l	0.2	10.0	10.0
42	MO080373	44.4 l	65.1 l	91.7	58.8	100.0	10.0	5.3 l	0.5	10.0	40.0
43	MO081378	47.8 l	62.4 l	91.7	60.3	90.0	7.5	5.0 l	1.5	8.5	75.0
44	MO081772	48.8 l	63.1 l	95.0	52.5	100.0	5.0	9.5 l	9.0	10.0	70.0
45	MO081777	45.5 l	64.5 l	85.0	65.3	100.0	7.5	5.5 l	1.0	10.0	50.0
46	VA08W-622	58.8	73.0 h	96.7	85.2	100.0	10.0	27.5	20.0	35.0	65.0
47	VA08W-630	61.2	76.4 h	96.7	93.9	100.0	15.0	23.8	17.5	30.0	75.0
48	VA08W-653	61.8	76.8 h	98.3	91.2	100.0	17.5	20.3 l	5.5	35.0	85.0
49	VA07W-600	60.4	73.9 h	91.7	91.3	100.0	12.5	28.8	30.0	27.5	70.0
50	VA07W-607	49.4 l	75.2 h	93.3	92.6	100.0	15.0	10.0 l	10.0	10.0	25.0
51	VA08W-740	50.1 l	73.9 h	91.7	89.0	100.0	15.0	5.0 l	5.0	5.0	45.0
100	AVERAGE	55.9	70.9	93.6	80.5	96.7	12.8	18.7	15.1	22.3	70.2
101	MINUMUM	40.8	57.9	80.0	52.5	70.0	5.0	1.0	0.2	1.0	10.0
102	MAXIMUM	74.8	77.6	100.0	94.8	100.0	25.0	81.3	80.0	82.5	100.0
103	LSD(0.05)	12.7	8.8	.	.	.	.	22.0	.	.	.

Table 22. Summary of severity (SEV, %) data from 2009-2010 PNUWWSN.

ENTRY	NAME	AVG	CLUSTER 1 AVG	ILURB	INBRO	INLAY	MIELA	VABLA	OUT KYLEX	OUT MOCOL
1	ERNIE	21.9 l	18.4 l	42.7	3.5	4.2	31.8	10.0	25.2	35.7
2	TRUMAN	18.2 l	16.9 l	41.1	2.0	13.3	20.8	7.5	38.0	4.5
3	FREEDOM	32.9	22.7	48.0	7.5	15.0	33.1	10.0	40.3	76.7
4	PIONEER2545	51.7 h	46.1	70.7	40.0	41.7	55.6	22.5	60.9	70.6
5	E5017	33.3	23.0	43.8	7.5	12.5	36.4	15.0	52.6	65.2
6	E8007	15.1 l	10.3 l	20.2	3.5	5.0	12.6	10.0	22.2	32.2
7	OH06-158-50	43.9 h	41.8	57.0	30.0	55.8	56.1	10.0	62.0	36.1
8	OH06-159-6	25.7	22.9	42.6	20.0	10.0	31.8	10.0	28.3	37.5
9	OH06-180-57	39.7 h	38.6	61.9	17.5	51.7	41.8	20.0	54.7	30.2
10	OH06-197-61	26.2	25.0	39.6	37.5	2.5	35.2	10.0	39.8	18.5
11	OH06-228-73	38.6 h	37.8	67.7	15.0	39.2	57.2	10.0	66.5	14.3
12	OH06-190-29	35.6	38.1	73.3	17.5	29.2	43.2	27.5	35.9	22.9
13	03207A1-7-5	25.9	26.1	54.8	11.0	6.0	43.6	15.0	35.7	15.3
14	03615A1-5-7	20.1 l	13.7 l	30.0	1.0	5.0	22.6	10.0	54.4	17.4
15	059A1-1-9-5	30.1	27.7	54.8	6.0	16.7	48.4	12.5	53.1	19.2
16	059A1-1-9-6	40.4 h	26.9	50.8	5.0	13.0	50.8	15.0	94.3	54.1
17	0527A1-9-9-3	22.2 l	20.8 l	39.3	2.0	19.2	28.6	15.0	23.0	28.5
18	0537A1-7-8	26.0	21.9	34.8	5.0	35.0	22.2	12.5	37.8	34.6
19	SE99-1015-7	27.7	27.9	66.3	3.5	8.3	49.0	12.5	27.2	27.1
20	SE-MO98-274-8	39.8 h	29.7	59.4	7.5	27.5	44.2	10.0	66.9	63.4
21	SE98-1094-C20	32.9	24.4	43.8	13.0	15.8	36.8	12.5	68.0	40.1
22	SE00-4040-10	34.8	35.4	52.6	13.5	39.2	54.4	17.5	39.1	27.0
23	SE00-10303-35	49.3 h	58.3 h	68.8	50.0	60.8	67.1	45.0	36.8	16.3
24	SE00-10286-7	37.6	37.2	66.5	25.0	5.8	63.9	25.0	47.7	29.0
25	MISC-HDS-148	41.0 h	38.5	56.6	30.0	36.7	54.0	15.0	34.2	60.3
26	M08*8005#	22.3 l	18.3 l	47.4	1.5	4.2	28.3	10.0	43.3	21.1
27	MH07-7474	29.3	29.6	61.1	12.5	15.0	41.7	17.5	30.9	26.3
28	IL06-13072	28.2	28.6	61.9	20.0	15.0	26.0	20.0	32.1	22.4
29	IL06-13708	22.8 l	21.1 l	36.3	5.0	24.2	32.3	7.5	34.9	19.4
30	IL06-13721	15.6 l	13.0 l	28.0	6.0	4.2	19.2	7.5	28.0	16.4
31	IL06-25634	22.2 l	16.7 l	29.8	11.0	5.0	25.0	12.5	55.4	16.9
32	IL06-27969	24.2 l	23.1	51.6	10.5	19.2	24.2	10.0	35.4	18.2
33	IL06-14325	22.5 l	20.0 l	40.8	2.5	23.3	23.2	10.0	37.7	20.3
34	KY02C-3007-55	19.7 l	14.6 l	20.0	25.5	4.2	11.0	12.5	41.2	23.8
35	KY03C-1237-23	30.7	25.9	53.6	10.0	10.8	35.2	20.0	56.1	29.3
36	KY01C-1070-02	31.9	26.2	55.2	7.5	11.7	36.7	20.0	41.3	50.7
37	KY01C-1531-17	37.6	40.6	60.7	27.5	48.3	43.8	22.5	39.5	20.8
38	KY03C-1136-18	43.5 h	38.5	57.6	12.5	59.2	40.8	22.5	37.6	74.4
39	KY03C-1092-13	33.8	33.5	55.1	12.5	32.5	45.1	22.5	40.8	28.0
40	MO070933	28.3	21.3 l	23.8	0.3	44.0	31.1	7.5	60.3	31.2
41	MO080103	12.2 l	12.9 l	33.5	0.3	3.3	17.6	10.0	8.3	12.1
42	MO080373	21.1 l	18.2 l	46.5	0.5	14.2	19.9	10.0	11.8	44.8
43	MO081378	34.5	24.7	67.0	1.5	23.3	24.4	7.5	88.9	29.0
44	MO081772	30.1	22.7	52.2	14.0	15.0	24.9	7.5	36.6	60.8
45	MO081777	16.8 l	14.1 l	32.3	2.5	9.2	16.7	10.0	17.8	29.1
46	VA08W-622	23.6 l	20.1 l	42.3	12.5	5.8	27.5	12.5	32.4	32.0
47	VA08W-630	34.1	28.7	51.5	1.0	26.7	44.3	20.0	28.2	66.7
48	VA08W-653	33.9	28.6	63.5	5.0	28.3	31.3	15.0	46.1	47.9
49	VA07W-600	27.3	21.8	33.6	12.5	15.0	33.0	15.0	26.6	55.2
50	VA07W-607	26.7	20.0 l	36.8	20.0	10.8	22.2	10.0	25.3	62.1
51	VA08W-740	26.6	21.4 l	30.0	3.5	18.3	35.0	20.0	19.4	59.9
100	AVERAGE	29.6	26.2	48.2	12.0	20.8	35.3	14.5	41.2	35.2
101	MINUMUM	12.2	10.3	20.0	0.3	2.5	11.0	7.5	8.3	4.5
102	MAXIMUM	51.7	58.3	73.3	50.0	60.8	67.1	45.0	94.3	76.7
103	LSD(0.05)	13.2	11.4	.	.	.	.	.	.	.

Table 23. Summary of index (IND, %) data from 2009-2010 PNUWWSN.

ENTRY	NAME	AVG	CLUSTER 1 AVG	ILURB	INBRO	INLAY	MIELA	OHWOO	VABLA	OUT KYLEX	OUT MOCOL
1	ERNIE	17.6 l	15.2	39.3	0.1	0.1	28.0	23.3	0.5	13.8	35.7
2	TRUMAN	10.8 l	9.7 l	38.4	0.0	0.7	10.5	7.9	0.7	24.7	3.2
3	FREEDOM	24.5	14.6 l	43.0	1.9	7.5	26.3	8.0	0.8	32.2	76.7
4	PIONEER2545	41.5 h	34.5	70.7	18.0	22.9	52.3	40.0	3.0	54.8	70.6
5	E5017	29.9	20.6	42.5	4.9	6.9	34.6	32.2	2.7	49.9	65.2
6	E8007	9.1 l	6.0 l	17.1	0.1	0.2	5.1	12.8	0.5	11.1	25.7
7	OH06-158-50	28.6	24.4	56.3	7.5	8.4	48.7	23.6	1.8	46.5	36.1
8	OH06-159-6	17.7 l	14.0 l	38.9	2.5	0.9	28.8	12.2	0.9	19.8	37.5
9	OH06-180-57	27.3	22.3	59.8	4.4	4.4	32.2	30.0	3.0	54.7	30.2
10	OH06-197-61	15.5 l	13.9 l	36.8	3.8	0.1	28.2	13.6	0.8	23.9	16.7
11	OH06-228-73	29.1	25.6	65.5	4.9	7.8	51.3	22.8	1.0	66.5	12.9
12	OH06-190-29	25.1	26.2	73.3	5.3	11.7	37.4	23.3	6.3	23.3	20.6
13	03207A1-7-5	20.2	20.2	53.2	0.3	0.8	38.7	26.7	1.5	25.0	15.3
14	03615A1-5-7	16.0 l	11.5 l	27.9	0.0	0.1	20.4	18.9	1.5	43.5	15.6
15	059A1-1-9-5	21.6	18.8	52.9	0.2	0.6	43.1	13.8	2.3	42.4	17.3
16	059A1-1-9-6	32.7 h	18.8	46.8	0.3	0.3	46.0	18.3	1.3	94.3	54.1
17	0527A1-9-9-3	17.2 l	15.9	38.6	0.1	0.2	27.2	26.1	3.0	13.8	28.5
18	0537A1-7-8	16.8 l	12.5 l	33.1	0.6	3.5	17.2	18.9	1.5	24.6	34.6
19	SE99-1015-7	24.8	24.9	65.2	0.2	2.1	43.4	36.1	2.3	21.7	27.1
20	SE-MO98-274-8	34.1 h	25.4	53.7	1.9	2.8	34.6	57.8	1.8	56.9	63.4
21	SE98-1094-C20	26.1	16.8	40.1	0.4	2.0	31.2	26.1	0.9	68.0	40.1
22	SE00-4040-10	25.6	25.5	46.5	1.7	15.7	47.3	37.8	4.2	27.3	24.3
23	SE00-10303-35	32.8 h	36.4 h	68.8	25.0	24.3	59.8	35.0	5.3	27.6	16.3
24	SE00-10286-7	30.4 h	30.1	65.3	5.6	2.9	58.6	41.7	6.5	33.4	29.0
25	MISC-HDS-148	37.9 h	37.1 h	55.0	24.0	30.3	51.1	60.0	2.0	20.5	60.3
26	M08*8005#	17.9 l	16.4	44.4	0.0	1.0	21.7	28.9	2.6	26.0	18.9
27	MH07-7474	21.5	21.5	56.1	1.2	2.3	28.6	39.4	1.3	17.0	26.3
28	IL06-13072	18.0 l	16.0	55.9	2.5	1.3	19.4	15.0	2.0	25.7	22.4
29	IL06-13708	13.7 l	11.9 l	34.1	0.5	1.5	26.2	8.2	0.7	19.2	19.4
30	IL06-13721	10.4 l	8.8 l	25.6	0.5	0.2	17.5	8.2	0.7	14.0	16.4
31	IL06-25634	18.8 l	14.0 l	28.0	0.9	0.5	24.9	28.3	1.3	49.9	16.9
32	IL06-27969	14.7 l	13.0 l	43.1	0.8	0.8	16.3	15.6	1.3	21.2	18.2
33	IL06-14325	14.1 l	11.0 l	36.9	0.1	1.2	14.7	11.9	1.0	26.4	20.3
34	KY02C-3007-55	11.9 l	5.8 l	17.5	1.4	0.2	6.3	8.0	1.5	39.1	21.4
35	KY03C-1237-23	26.3	22.7	52.7	1.0	7.6	34.0	35.6	5.5	47.7	26.3
36	KY01C-1070-02	25.7	21.6	54.4	1.5	8.2	29.8	33.9	2.0	24.8	50.7
37	KY01C-1531-17	24.8	25.7	57.9	3.9	21.7	39.3	26.7	4.5	23.7	20.8
38	KY03C-1136-18	39.0 h	34.3	57.0	5.0	38.5	37.6	63.3	4.5	32.0	74.4
39	KY03C-1092-13	27.4	27.4	52.9	1.9	13.0	41.5	51.1	4.0	26.5	28.0
40	MO070933	19.3 l	11.5 l	21.2	0.0	7.7	22.7	16.7	0.5	60.3	24.9
41	MO080103	8.0 l	8.6 l	29.0	0.0	0.3	15.1	6.3	0.8	0.8	12.1
42	MO080373	14.9 l	11.6 l	43.2	0.0	1.4	9.9	14.0	1.0	4.7	44.8
43	MO081378	23.5	15.8	61.5	0.0	2.0	13.7	17.2	0.5	66.7	26.1
44	MO081772	20.9	13.5 l	50.3	1.3	1.5	13.4	13.9	0.4	25.6	60.8
45	MO081777	11.1 l	8.5 l	27.8	0.0	0.9	14.5	6.9	0.8	8.9	29.1
46	VA08W-622	17.2 l	14.1 l	40.6	2.5	2.0	24.7	13.6	1.3	21.0	32.0
47	VA08W-630	26.6	20.9	49.8	0.2	8.0	41.7	22.2	3.3	21.1	66.7
48	VA08W-653	27.4	22.1	62.6	0.3	9.9	28.1	28.9	2.5	39.2	47.9
49	VA07W-600	20.3	14.8 l	30.8	3.8	4.1	31.6	17.2	1.5	18.6	55.2
50	VA07W-607	17.3 l	11.7 l	34.2	2.0	1.1	21.3	10.2	1.5	6.3	62.1
51	VA08W-740	19.0 l	13.9 l	27.5	0.2	0.9	31.6	19.9	3.3	8.7	59.9
100	AVERAGE	22.0	18.4	45.6	2.8	5.8	30.0	24.1	2.1	31.3	34.5
101	MINUMUM	8.0	5.8	17.1	0.0	0.1	5.1	6.3	0.4	0.8	3.2
102	MAXIMUM	41.5	37.1	73.3	25.0	38.5	59.8	63.3	6.5	94.3	76.7
103	LSD(0.05)	11.5	9.1	.	.	.	.	.	.	.	.

Table 24. Summary of fusarium damaged kernel (FDK, %) data from 2009-2010 PNUWWSN.

ENTRY	NAME	ALL AVG		CLUSTER 1 AVG		ILURB	INBRO	INLAY	KYLEX	OUT MOCOL
1	ERNIE	18.3	l	12.8	l	35.0	9.0	1.5	5.8	40
2	TRUMAN	10.8	l	8.5	l	20.0	8.5	2.0	3.4	20
3	FREEDOM	42.8	h	33.6		45.0	40.2	42.5	6.5	80
4	PIONEER2545	52.9	h	42.4	h	75.0	30.0	52.5	11.9	95
5	E5017	37.1		36.4		70.0	10.6	52.5	12.3	40
6	E8007	13.1	l	10.1	l	18.3	10.9	2.0	9.1	25
7	OH06-158-50	34.6		28.3		70.0	12.7	22.5	7.8	60
8	OH06-159-6	44.7	h	32.1		70.0	31.5	15.0	11.9	95
9	OH06-180-57	34.5		28.2		70.0	21.1	8.5	13.0	60
10	OH06-197-61	38.3		24.1	l	53.3	19.2	3.5	20.3	95
11	OH06-228-73	43.2	h	34.0		71.7	36.5	15.0	12.6	80
12	OH06-190-29	43.6	h	35.8		75.0	22.3	30.0	15.8	75
13	03207A1-7-5	34.3		20.4	l	53.3	12.5	5.0	10.9	90
14	03615A1-5-7	22.7	l	18.4	l	33.3	22.0	1.0	17.4	40
15	059A1-1-9-5	30.6		23.2	l	61.7	22.9	4.0	4.2	60
16	059A1-1-9-6	37.2		34.0		73.3	40.0	6.5	16.0	50
17	0527A1-9-9-3	28.6	l	17.0	l	36.7	9.8	7.5	14.1	75
18	0537A1-7-8	20.7	l	15.8	l	33.3	9.3	11.0	9.7	40
19	SE99-1015-7	41.8		33.5		73.3	16.0	32.5	12.1	75
20	SE-MO98-274-8	34.5		23.1	l	46.7	21.3	7.5	16.9	80
21	SE98-1094-C20	39.7		30.9		53.3	32.4	15.0	22.8	75
22	SE00-4040-10	52.0	h	42.5	h	60.0	39.1	52.5	18.2	90
23	SE00-10303-35	59.3	h	54.1	h	76.7	92.6	35.0	12.0	80
24	SE00-10286-7	38.7		35.9		60.0	26.7	42.5	14.4	50
25	MISC-HDS-148	60.1	h	50.1	h	91.7	16.2	75.0	17.6	100
26	M08*8005#	17.1	l	15.2	l	33.3	9.1	6.0	12.3	25
27	MH07-7474	31.0		23.8	l	56.7	19.5	12.5	6.3	60
28	IL06-13072	17.9	l	17.3	l	28.3	16.0	16.0	9.0	20
29	IL06-13708	23.7	l	17.2	l	26.7	26.0	3.5	12.4	50
30	IL06-13721	12.1	l	12.6	l	30.0	10.7	4.0	5.8	10
31	IL06-25634	17.0	l	15.1	l	38.3	5.8	6.5	9.6	25
32	IL06-27969	11.7	l	9.7	l	21.7	4.0	3.5	9.4	20
33	IL06-14325	19.7	l	14.6	l	30.0	21.7	3.0	3.8	40
34	KY02C-3007-55	20.0	l	12.5	l	25.0	13.5	5.0	6.3	50
35	KY03C-1237-23	33.2		26.5		41.7	19.0	37.5	7.8	60
36	KY01C-1070-02	39.0		36.2		60.0	23.8	47.5	13.5	50
37	KY01C-1531-17	39.3		34.2		60.0	38.0	27.5	11.1	60
38	KY03C-1136-18	60.0	h	56.2	h	63.3	90.0	52.5	19.1	75
39	KY03C-1092-13	46.1	h	38.8	h	46.7	43.0	52.5	13.1	75
40	MO070933	18.6	l	18.2	l	41.7	10.5	10.0	10.7	20
41	MO080103	14.6	l	12.0	l	28.3	7.0	1.5	11.0	25
42	MO080373	11.0	l	11.2	l	16.7	20.2	2.5	5.5	10
43	MO081378	22.3	l	15.4	l	26.7	25.3	4.0	5.7	50
44	MO081772	15.5	l	14.4	l	26.7	20.3	3.0	7.5	20
45	MO081777	12.7	l	9.7	l	18.3	7.8	4.0	8.6	25
46	VA08W-622	35.5		29.4		35.0	33.3	35.0	14.2	60
47	VA08W-630	40.8		31.0		45.0	33.6	37.5	8.0	80
48	VA08W-653	40.2		30.3		53.3	21.2	35.0	11.5	80
49	VA07W-600	33.4		21.8	l	26.7	20.1	30.0	10.3	80
50	VA07W-607	25.6	l	17.0	l	26.7	30.0	2.0	9.1	60
51	VA08W-740	38.0		25.0	l	36.7	47.0	10.0	6.3	90
100	AVERAGE	31.6		25.3		46.5	24.1	19.5	11.1	56.7
101	MINUMUM	10.8		8.5		16.7	4.0	1.0	3.4	10.0
102	MAXIMUM	60.1		56.2		91.7	92.6	75.0	22.8	100.0
103	LSD(0.05)	18.0		17.8		.	.	.	.	.

Table 25. Summary of incidence x severity x FDK (ISK, %) data from 2009-2010 PNUWWSN.

ENTRY	NAME	ALL AVG	CLUSTER 1 AVG	ILURB	INBRO	INLAY	OUT KYLEX	OUT MOCOL
1	ERNIE	29.2 l	20.9 l	54.3	5.8	2.6	26.4	56.7
2	TRUMAN	24.3 l	19.6 l	48.3	4.1	6.3	32.3	30.4
3	FREEDOM	49.1	40.6	59.4	25.8	36.5	38.7	85.0
4	PIONEER2545	61.6 h	56.2 h	81.2	37.5	50.0	50.0	89.2
5	E5017	50.4	45.8	70.1	26.0	41.3	49.2	65.6
6	E8007	23.2 l	15.8 l	37.4	6.5	3.4	25.3	43.6
7	OH06-158-50	47.1	42.1	74.6	21.6	30.2	44.2	64.8
8	OH06-159-6	43.1	34.1	68.3	22.4	11.6	34.2	79.3
9	OH06-180-57	46.6	39.4	75.6	21.2	21.5	51.6	63.1
10	OH06-197-61	39.0	28.9	61.2	21.9	3.5	38.1	70.6
11	OH06-228-73	49.8	43.6	78.0	28.9	23.8	55.0	63.3
12	OH06-190-29	47.7	46.0	82.0	23.2	32.8	36.6	63.9
13	03207A1-7-5	38.0	27.9 l	66.8	9.2	7.6	36.0	70.6
14	03615A1-5-7	31.5 l	20.7 l	50.3	9.3	2.4	47.3	48.2
15	059A1-1-9-5	37.6	29.9	70.1	12.0	7.7	41.6	56.8
16	059A1-1-9-6	46.0	33.0	72.6	19.0	7.3	64.7	66.2
17	0527A1-9-9-3	33.9	23.6 l	56.0	5.6	9.1	30.5	68.5
18	0537A1-7-8	34.1	26.4 l	52.3	9.0	17.9	34.7	56.4
19	SE99-1015-7	43.2	37.0	78.7	9.3	23.0	37.0	68.1
20	SE-MO98-274-8	45.9	32.0	63.5	18.3	14.3	52.4	81.0
21	SE98-1094-C20	45.2	31.4	62.0	17.7	14.5	59.5	72.0
22	SE00-4040-10	49.1	44.9	66.3	23.5	44.8	40.0	71.1
23	SE00-10303-35	59.6 h	64.2 h	81.3	67.0	44.2	38.3	66.9
24	SE00-10286-7	46.4	44.0	73.4	24.9	33.7	41.1	58.7
25	MISC-HDS-148	62.2 h	62.6 h	82.6	39.5	65.8	35.3	88.1
26	M08*8005#	30.1 l	23.8 l	55.5	4.6	11.2	35.9	43.3
27	MH07-7474	37.4	32.3	68.5	14.4	14.0	28.3	61.9
28	IL06-13072	33.7	28.9	56.9	16.2	13.5	37.2	44.7
29	IL06-13708	32.5 l	25.0 l	49.5	14.9	10.5	32.0	55.8
30	IL06-13721	25.1 l	20.3 l	47.9	8.6	4.4	25.7	38.9
31	IL06-25634	32.1 l	22.7 l	52.8	8.2	7.1	47.5	45.1
32	IL06-27969	28.1 l	21.6 l	49.1	7.2	8.4	32.4	43.5
33	IL06-14325	31.5 l	23.9 l	51.7	10.2	9.7	33.9	52.1
34	KY02C-3007-55	31.8 l	20.6 l	42.5	14.7	4.5	43.4	54.1
35	KY03C-1237-23	44.1	38.3	62.2	13.6	39.2	45.5	59.8
36	KY01C-1070-02	46.5	43.8	70.0	17.8	43.5	35.8	65.2
37	KY01C-1531-17	46.4	45.8	70.7	27.7	39.0	34.3	60.2
38	KY03C-1136-18	61.8 h	60.7 h	72.1	51.8	58.3	44.4	82.3
39	KY03C-1092-13	47.5	44.0	63.7	25.5	42.8	37.0	68.4
40	MO070933	34.2	25.7 l	50.3	4.4	22.5	52.4	41.4
41	MO080103	21.7 l	18.3 l	47.4	3.0	4.6	9.9	43.6
42	MO080373	26.0 l	21.6 l	48.1	8.4	8.3	17.7	47.4
43	MO081378	37.5	26.8 l	58.3	11.0	11.1	51.5	55.7
44	MO081772	34.0	26.2 l	54.8	15.0	8.7	35.0	56.3
45	MO081777	25.3 l	18.0 l	42.5	4.2	7.4	23.8	48.7
46	VA08W-622	40.7	35.0	55.7	23.1	26.2	34.9	63.6
47	VA08W-630	45.9	37.8	62.4	19.0	32.0	34.1	82.0
48	VA08W-653	47.0	38.2	69.9	11.6	33.0	43.9	76.4
49	VA07W-600	41.1	31.3	48.3	20.8	24.8	33.1	78.6
50	VA07W-607	33.8	25.9 l	49.7	21.0	7.0	18.7	72.6
51	VA08W-740	37.9	27.9 l	51.2	21.4	11.0	21.8	84.0
100	AVERAGE	39.9	33.2	61.1	17.8	20.7	37.8	62.2
101	MINUMUM	21.7	15.8	37.4	3.0	2.4	9.9	30.4
102	MAXIMUM	62.2	64.2	82.6	67.0	65.8	64.7	89.2
103	LSD(0.05)	11.8	12.8	.	.	.	.	.

Table 26. Summary of deoxynivalenol (DON, ppm) data from 2009-2010 PNUWWSN.

ENTRY	NAME	ALL AVG		CLUSTER 1 AVG		ILURB	OHWOO	VABLA	OUT KYLEX
1	ERNIE	12.7	h	7.1	lh	7.7	13.1	0.5	29.6
2	TRUMAN	4.4	l	3.6	l	7.4	2.9	0.5	6.8
3	FREEDOM	6.9	l	4.0	l	7.0	4.4	0.6	15.6
4	PIONEER2545	12.0		9.3	h	11.4	15.7	0.9	20.1
5	E5017	18.3	h	9.7	h	20.5	7.8	0.9	44.1
6	E8007	8.6	l	4.0	l	7.0	4.3	0.6	22.7
7	OH06-158-50	9.7	l	5.3	l	10.4	4.8	0.6	22.9
8	OH06-159-6	11.3		5.2	l	9.6	5.5	0.6	29.3
9	OH06-180-57	9.5	l	5.7	l	5.5	10.9	0.6	20.9
10	OH06-197-61	5.8	l	4.4	l	6.7	5.8	0.6	9.9
11	OH06-228-73	10.8		6.1	lh	8.7	8.4	1.2	24.8
12	OH06-190-29	9.5	l	7.5	h	11.0	10.9	0.6	15.6
13	03207A1-7-5	9.6	l	6.7	lh	8.9	10.5	0.6	18.2
14	03615A1-5-7	5.2	l	3.6	l	3.4	7.0	0.5	10.1
15	059A1-1-9-5	9.4	l	6.3	lh	8.3	9.9	0.8	18.5
16	059A1-1-9-6	11.9		6.5	lh	9.4	9.6	0.5	28.2
17	0527A1-9-9-3	11.6		7.8	h	9.3	13.3	0.9	22.8
18	0537A1-7-8	8.5	l	5.1	l	8.8	5.7	0.7	18.8
19	SE99-1015-7	13.0	h	5.0	l	6.2	8.4	0.5	36.8
20	SE-MO98-274-8	14.2	h	8.3	h	10.2	14.0	0.6	31.8
21	SE98-1094-C20	12.0		6.8	lh	9.0	10.5	0.9	27.6
22	SE00-4040-10	12.0		8.7	h	12.0	13.4	0.6	22.0
23	SE00-10303-35	13.1	h	8.4	h	14.7	9.7	0.8	27.1
24	SE00-10286-7	17.1	h	9.6	h	14.2	13.9	0.7	39.8
25	MISC-HDS-148	13.3	h	10.7	h	7.3	24.3	0.6	21.2
26	M08*8005#	11.6		6.1	lh	5.5	12.3	0.6	28.1
27	MH07-7474	7.7	l	5.5	l	7.9	8.1	0.6	14.0
28	IL06-13072	7.9	l	5.0	l	5.5	9.1	0.5	16.5
29	IL06-13708	5.4	l	3.8	l	5.1	5.8	0.5	10.1
30	IL06-13721	9.3	l	3.9	l	5.9	5.4	0.5	25.3
31	IL06-25634	11.3		7.6	h	11.3	10.8	0.6	22.7
32	IL06-27969	5.3	l	4.0	l	5.9	5.5	0.5	9.2
33	IL06-14325	6.5	l	4.0	l	7.1	4.4	0.6	14.1
34	KY02C-3007-55	6.5	l	3.2	l	4.1	4.9	0.5	16.5
35	KY03C-1237-23	11.3		7.9	h	8.5	14.4	0.7	21.6
36	KY01C-1070-02	9.7	l	7.8	h	9.4	13.4	0.5	15.6
37	KY01C-1531-17	8.8	l	7.0	lh	8.4	11.9	0.6	14.3
38	KY03C-1136-18	11.8		9.5	h	9.3	18.6	0.6	18.6
39	KY03C-1092-13	11.1		7.2	lh	7.6	13.6	0.5	22.7
40	MO070933	11.4		5.5	l	9.6	6.2	0.6	29.1
41	MO080103	4.0	l	2.9	l	3.3	4.8	0.7	7.4
42	MO080373	6.2	l	4.3	l	5.7	6.6	0.5	12.2
43	MO081378	7.6	l	4.6	l	8.7	4.6	0.6	16.5
44	MO081772	4.7	l	3.1	l	6.7	2.1	0.5	9.5
45	MO081777	4.5	l	2.6	l	3.0	4.2	0.5	10.3
46	VA08W-622	6.9	l	4.8	l	7.2	6.6	0.5	13.4
47	VA08W-630	7.7	l	5.7	l	5.7	10.8	0.6	13.7
48	VA08W-653	9.7	l	6.0	l	5.7	11.8	0.5	20.8
49	VA07W-600	7.0	l	5.1	l	5.5	9.3	0.5	12.8
50	VA07W-607	5.8	l	4.4	l	5.7	7.0	0.5	10.0
51	VA08W-740	12.9	h	7.0	lh	7.0	13.3	0.8	30.6
100	AVERAGE	9.5		5.9		8.0	9.2	0.6	20.0
101	MINUMUM	4.0		2.6		3.0	2.1	0.5	6.8
102	MAXIMUM	18.3		10.7		20.5	24.3	1.2	44.1
103	LSD(0.05)	6.2		12.8		.	.	.	.

Table 27. Summary of greenhouse severity from SPI (GHSEV, %) data from 2009-2010 PNUWWSN.

ENTRY	NAME	ILURB
1	ERNIE	17.5
2	TRUMAN	14.4
3	FREEDOM	5.0
4	PIONEER2545	80.3
5	E5017	7.7
6	E8007	3.0
7	OH06-158-50	100.0
8	OH06-159-6	37.3
9	OH06-180-57	91.8
10	OH06-197-61	19.3
11	OH06-228-73	88.5
12	OH06-190-29	64.8
13	03207A1-7-5	33.8
14	03615A1-5-7	5.0
15	059A1-1-9-5	21.0
16	059A1-1-9-6	28.6
17	0527A1-9-9-3	3.0
18	0537A1-7-8	35.8
19	SE99-1015-7	74.4
20	SE-MO98-274-8	34.8
21	SE98-1094-C20	12.7
22	SE00-4040-10	26.0
23	SE00-10303-35	59.5
24	SE00-10286-7	53.0
25	MISC-HDS-148	58.8
26	M08*8005#	41.6
27	MH07-7474	27.2
28	IL06-13072	53.6
29	IL06-13708	18.0
30	IL06-13721	14.0
31	IL06-25634	6.3
32	IL06-27969	55.3
33	IL06-14325	61.3
34	KY02C-3007-55	3.8
35	KY03C-1237-23	54.2
36	KY01C-1070-02	69.2
37	KY01C-1531-17	100.0
38	KY03C-1136-18	86.0
39	KY03C-1092-13	21.6
40	MO070933	6.3
41	MO080103	5.6
42	MO080373	7.4
43	MO081378	5.4
44	MO081772	9.5
45	MO081777	9.8
46	VA08W-622	42.2
47	VA08W-630	43.8
48	VA08W-653	7.6
49	VA07W-600	24.7
50	VA07W-607	16.0
51	VA08W-740	22.4
100	AVERAGE	35.1
101	MINUMUM	3.0
102	MAXIMUM	100.0
103	LSD(0.05)	.

Table 28. Summary of heading date (HD, julian days) data from 2009-2010 PNUWWSN.

ENTRY	NAME	AVG	ILURB	KYLEX	MIELA	MOCOL	OHWOO
1	ERNIE	137	127	126	153	141	138
2	TRUMAN	144	134	134	156	151	142
3	FREEDOM	141	132	130	155	145	141
4	PIONEER2545	140	131	129	154	145	140
5	E5017	144	136	134	154	145	151
6	E8007	143	135	131	156	148	146
7	OH06-158-50	139	132	130	153	141	141
8	OH06-159-6	137	127	128	150	144	137
9	OH06-180-57	141	133	129	154	144	142
10	OH06-197-61	139	129	129	153	144	141
11	OH06-228-73	140	132	131	153	144	141
12	OH06-190-29	139	131	129	153	144	140
13	03207A1-7-5	138	127	128	151	144	140
14	03615A1-5-7	136	126	125	151	144	136
15	059A1-1-9-5	139	128	130	154	144	140
16	059A1-1-9-6	139	127	131	153	145	138
17	0527A1-9-9-3	138	128	128	151	144	139
18	0537A1-7-8	139	128	129	154	144	140
19	SE99-1015-7	139	130	128	153	144	141
20	SE-MO98-274-8	141	133	130	156	145	142
21	SE98-1094-C20	142	132	130	155	144	146
22	SE00-4040-10	137	127	126	152	144	138
23	SE00-10303-35	140	131	128	153	144	141
24	SE00-10286-7	138	127	127	152	144	138
25	MISC-HDS-148	136	127	127	150	141	136
26	M08*8005#	136	126	126	151	141	137
27	MH07-7474	141	129	129	155	144	146
28	IL06-13072	138	130	128	151	144	137
29	IL06-13708	138	128	129	152	144	137
30	IL06-13721	134 l	125	123	149	137	135
31	IL06-25634	134 l	125	124	148	137	135
32	IL06-27969	137	127	128	152	144	137
33	IL06-14325	138	128	127	152	144	137
34	KY02C-3007-55	140	131	130	154	144	141
35	KY03C-1237-23	138	128	128	151	144	139
36	KY01C-1070-02	137	124	129	153	144	136
37	KY01C-1531-17	136	128	126	152	139	137
38	KY03C-1136-18	140	131	130	154	145	141
39	KY03C-1092-13	138	127	127	152	144	141
40	MO070933	147 h	138	138	155	147	155
41	MO080103	137	127	128	151	139	140
42	MO080373	139	128	127	154	145	139
43	MO081378	140	131	130	154	144	141
44	MO081772	140	130	131	155	145	141
45	MO081777	137	127	126	150	141	139
46	VA08W-622	137	126	130	152	144	136
47	VA08W-630	139	130	128	153	145	137
48	VA08W-653	140	132	129	155	145	140
49	VA07W-600	138	128	128	151	145	140
50	VA07W-607	138	129	127	151	145	137
51	VA08W-740	139	129	129	153	145	138
100	AVERAGE	139	129	128	153	144	140
101	MINUMUM	134	124	123	148	137	135
102	MAXIMUM	147	138	138	156	151	155
103	LSD(0.05)	2	.	.	.	.	.

Table 29. Summary of plant height (HGT, inches) data from 2008-2009 PNUWWSN.

ENTRY	NAME	KYLEX	
1	ERNIE	27.5	l
2	TRUMAN	33.0	
3	FREEDOM	31.0	
4	PIONEER2545	32.5	
5	E5017	30.0	
6	E8007	30.5	
7	OH06-158-50	33.5	
8	OH06-159-6	28.5	l
9	OH06-180-57	32.0	
10	OH06-197-61	32.0	
11	OH06-228-73	32.0	
12	OH06-190-29	30.5	
13	03207A1-7-5	31.5	
14	03615A1-5-7	28.5	l
15	059A1-1-9-5	33.0	
16	059A1-1-9-6	31.5	
17	0527A1-9-9-3	28.5	l
18	0537A1-7-8	31.5	
19	SE99-1015-7	28.5	l
20	SE-MO98-274-8	33.0	
21	SE98-1094-C20	32.5	
22	SE00-4040-10	33.5	
23	SE00-10303-35	34.0	h
24	SE00-10286-7	36.5	h
25	MISC-HDS-148	30.5	
26	M08*8005#	32.0	
27	MH07-7474	32.5	
28	IL06-13072	32.0	
29	IL06-13708	34.0	h
30	IL06-13721	30.5	
31	IL06-25634	29.5	l
32	IL06-27969	31.5	
33	IL06-14325	30.5	
34	KY02C-3007-55	33.0	
35	KY03C-1237-23	31.0	
36	KY01C-1070-02	33.0	
37	KY01C-1531-17	30.5	
38	KY03C-1136-18	30.5	
39	KY03C-1092-13	31.5	
40	MO070933	36.0	h
41	MO080103	30.5	
42	MO080373	34.0	h
43	MO081378	35.5	h
44	MO081772	36.0	h
45	MO081777	32.0	
46	VA08W-622	31.5	
47	VA08W-630	31.0	
48	VA08W-653	27.0	l
49	VA07W-600	32.5	
50	VA07W-607	31.0	
51	VA08W-740	29.5	l
	AVERAGE	31.7	
	MINIMUM	27.0	
	MAXIMUM	36.5	
	LSD	2.5	

Table 30. Means for other traits collected on the 2009-2010 PNUWWSN

ENTRY	NAME	MOCOL GH RACHIS SCORE 0-9	ROFUN SEV AUDPC
1	ERNIE	1.8	330.9
2	TRUMAN	1.0	428.9
3	FREEDOM	2.0	279.9
4	PIONEER-2545	4.1	713.1
5	NY99045-3110	0.9	500.0
6	OH07-176-56	3.6	764.9
7	NY94052-9340	1.2	570.4
8	NY99068-3251	1.8	514.1
9	NY88046-7088	2.8	724.3
10	E5011B	4.6	497.0
11	E5024	1.6	338.1
12	E3024	2.3	756.6
13	E6012	2.1	586.9
14	E8052	1.9	510.5
15	OH04-264-58	2.4	544.1
16	OH05-101-1	2.4	468.5
17	OH05-164-76	2.5	428.9
18	OH05-200-74	1.3	287.9
19	99691A2-5-4-16-1	4.4	289.3
20	01946A1-16-48-5	1.5	267.6
21	057RA1-8-5	1.0	565.0
22	059A1-2-4-3	1.1	556.4
23	TABOO	9.8	876.6
24	MONDO	3.8	296.6
25	PROBE	7.7	776.8
26	RUMOR	1.7	459.6
27	03M1539#019	6.6	834.3
28	03M1539#031	6.9	439.9
29	W1104	1.7	656.6
30	ML06-2097	3.9	593.2
31	GS-0-EM0681	2.4	625.7
32	GS-0-EM0614	4.8	695.1
33	GS-1-EM0362	3.9	784.4
34	ACF213003B	2.7	561.6
35	ACF126103	4.4	491.3
36	IL02-18228	2.1	309.8
37	IL04-24668	3.1	246.9
38	IL06-7550	3.3	203.5
39	IL06-14262	1.2	221.4
40	KY02C-3006-46	0.8	205.6
41	KY02C-3004-02	1.1	232.7
42	KY04C-2151	0.7	138.8
43	KY03C-1192-34	6.3	520.2
44	KY02C-3008-01	0.8	252.8
45	MD03W91-09-8	2.8	407.5
46	MD03W61-09-1	2.3	189.6
47	MD02W135-08-9	6.0	540.5
48	MO071522	0.9	494.3
49	MO080104	1.8	486.6
50	MO080864	1.1	187.4
51	MO081652	1.4	315.2
52	WESLEY	1.1	576.4
53	WESLEYFHB1	3.3	705.0
54	NE06607	3.1	516.3
55	NE06469	4.4	792.6
56	NW07505	5.5	725.7
57	VA06W-612	2.3	546.6
58	VA07W-594	1.6	540.9
59	VA07W-601	1.2	360.3
60	VA08W-734	2.8	233.0

Table 31. Presence or absence of genes for entries in the 2009-2010 NUWWSN based on marker analysis performed by the USDA Small Grains Genotyping Lab, Raleigh NC.

NAME	Rht-B1b dwarf allele (Rht1)	Rht-D1b dwarf allele (Rht2)	Rht8	Ppd-D1a insens. allele	Fhb1	Fhb Ernie 3Bc	Fhb 2DL-Wuhan1 W14	Fhb 5A Ernie	Fhb 5A Ning	Sr2	Sr36	Sr24 Lr24	1RS	H13	H9	Bdv2/ 3	Yr17 Lr37 Sr38	Lr34 Yr18	Bx7 overexp	Glu-D1	Glu-A1
ERNIE	yes	het	no	yes	no	no	no	het	no	no	het	no	non-1RS	no	no	no	no	no	no	2+12	het
TRUMAN	yes	no	no	no	no	no	no	no	no	no	no	no	non-1RS	no	no	no	no	no	no	2+12	Ax1 or null
FREEDOM	yes	no	no	no	no	yes?	no	no	no	no	yes	no	1RS:1BL	no	no	no	no	no	no	2+12	Ax1 or null
PIONEER2545	het	yes	no	yes	no	no	no	no	no	no	no	no	non-1RS	no	no	no	no	no	no	2+12	Ax2*
NY99045-3110	no	yes	no	no	no	no	no	no	no	no	no	no	non-1RS	no	no	no	no	no	no	2+12	Ax1 or null
OH07-176-56	yes	no	het	het	no	het?	no	no	no	no	no	no	non-1RS	no	no	no	no	no	het	het	Ax2*
NY94052-9340	no	yes	no	no	no	no	no	no	no	no	no	no	non-1RS	no	no	no	no	no	het	2+12	Ax1 or null
NY99068-3251	no	yes	no	no	no	no	no	no	no	no	no	no	non-1RS	no	no	no	no	no	no	2+12	Ax2*
NY88046-7088	no	yes	no	no	no	no	no	no	no	no	no	no	non-1RS	no	no	no	no	no	no	2+12	
E5011B	no	yes	no	het	no	no	no	no	no	no	no	no	1RS:1BL	no	no	no	no	no	no	2+12	Ax2*
E5024	no	yes	no	yes	no	no	no	yes	no	no	no	no	1RS:1BL	no	no	no	no	no	no	5+10	Ax1 or null
E3024	no	yes	no	no	yes	no	no	no	no	no	no	no	non-1RS	no	no	no	no	no	no	2+12	Ax2*
E6012	no	Unknown	no	yes	no	no	no	yes	no	no	no	no	non-1RS	no	no	no	no	no	no	2+12	Ax1 or null
E8052	no	yes	no	yes	no	no	no	no	no	no	no	no	non-1RS	no	no	no	no	no	yes	5+10	Ax2*
OH04-264-58	no	yes	no	yes	no	no	no	no	no	no	no	no	non-1RS	no	no	no	no	no	yes	5+10	Ax2*
OH05-101-1	yes	no	no	yes	no	no	no	no	no	no	no	no	non-1RS	no	no	no	no	no	no	5+10	Ax1 or null
OH05-164-76	yes	no	no	yes	yes	yes?	no	no	no	no	no	no	1RS:1BL	no	no	no	no	yes	no	5+10	Ax2*
OH05-200-74	yes	no	no	no	no	no	no	no	no	no	no	no	1RS:1AL	no	no	no	no	no	no	2+12	Ax1 or null
99691A2-5-4-16-1	yes	no	no	yes	no	no	no	no	no	no	no	no	non-1RS	no	no	no	no	no	het	2+12	Ax2*
01946A1-16-48-5	yes	no	no	yes	no	no	no	no	no	no	yes	no	1RS:1BL	no	no	het	no	no	no	2+12	Ax1 or null
057RA1-8-5	yes	Negative	no	no	no	no	no	no	no	no	yes	no	non-1RS	no	no	no	no	no	no	5+10	Ax1 or null
059A1-2-4-3	yes	no	no	no	no	no	no	no	no	no	yes	no	1RS:1BL	no	no	yes	no	no	yes	5+10	Ax1 or null
TABOO	yes	no	yes	no	no	no	no	no	no	no	no	no	1RS:1BL	no	no	no	no	no	no	2+12	Ax2*
MONDO	no	no	no	no	no	no	no	yes	no	no	no	no	non-1RS	no	no	no	no	no	no	2+12	het
PROBE	no	yes	yes	no	no	no	no	no	no	no	yes	no	non-1RS	no	no	no	no	no	no	5+10	Ax2*
RUMOR	no	yes	no	no	no	no	no	no	no	no	no	no	non-1RS	no	no	no	no	no	no	2+12	Ax1 or null
03M1539 019	yes	no	no	yes	no	no	no	no	no	no	no	no	1RS:1BL	no	yes	no	yes	no	no	het	Ax2*
03M1539 031	yes	no	no	yes	no	yes	no	no	no	no	no	no	non-1RS	no	yes	no	no	no	no	2+12	Ax2*
W1104	yes	no	no	yes	no	?	no	yes	no	no	no	no	1RS:1BL	no	no	no	no	no	yes	2+12	Ax2*
ML06-2097	yes	no	yes	yes	no	no	no	no	no	no	no	no	1RS:1BL	no	no	no	no	no	no	5+10	Ax2*
GS-0-EM0681	no	yes	no	no	no	no	no	no	no	no	no	no	1RS:1BL	no	no	no	yes	no	no	5+10	Ax2*
GS-0-EM0614	yes	yes	no	no	no	no	no	no	no	no	no	no	1RS:1BL	no	no	no	no	yes	no	2+12	Ax2*
GS-1-EM0362	no	yes	no	no	no	no	no	no	no	no	no	no	1RS:1BL	no	no	no	no	yes	no	het	Ax2*
ACF213003B	yes	no	het	no	no	no	no	no	no	no	no	no	non-1RS	no	no	no	no	no	no	het	Ax1 or null
ACF126103	yes	no	yes	no	no	no	no	no	no	no	no	no	1RS:1BL	no	no	no	no	no	no	5+10	Ax1 or null
IL02-18228	yes	no	no	no	no	no	no	no	no	no	no	no	non-1RS	no	no	no	no	no	no	5+10	Ax1 or null
IL04-24668	yes	no	no	yes	no	no	no	no	no	no	no	no	non-1RS	no	no	no	no	no	no	5+10	Ax2*
IL06-7550	yes	no	no	no	no	no	no	no	no	no	no	no	non-1RS	no	no	no	no	no	no		Ax2*
IL06-14262	yes	no	no	no	no	no	no	no	no	no	no	no	non-1RS	no	no	no	no	no	no	5+10	Ax2*
KY02C-3006-46	yes	no	no	yes	yes	no	no	no	no	no	no	no	1RS:1BL	no	no	no	no	no	no	5+10	het
KY02C-3004-02	no	yes	no	no	yes?	no	no	no	no	no	no	yes	1RS:1AL	no	no	no	no	yes	no	5+10	Ax2*
KY04C-2151	no	no	no	yes	yes	no	het	no	no	no	no	no	1RS:1BL	no	no	no	no	yes	no	2+12	Ax2*
KY03C-1192-34	no	no	no	yes	no	no	no	no	no	no	no	no	non-1RS	no	no	no	no	no	no	5+10	Ax2*
KY02C-3008-01	het	het	no	yes	no	no	no	no	no	no	no	no	1RS:1BL	no	no	no	no	yes	no	5+10	Ax2*
MD03W91-09-8	no	yes	no	yes	no	no	no	no	no	no	no	yes	1RS:1BL 1RS:1AL	no	no	no	no	no	no	5+10	Ax2*
MD03W61-09-1	no	yes	no	yes	yes	no	no	no	no	no	no	no	1RS:1BL	no	no	no	no	no	no	2+12	Ax1 or null
MD02W135-08-9	no	yes	no	no	no	no	no	no	no	no	no	yes	1RS:1BL 1RS:1AL	no	no	no	no	no	no	2+12	Ax2*
MO071522	yes	no	no	het	no	no	no	no	no	no	no	no	non-1RS	no	no	no	no	no	no	5+10	Ax1 or null
MO080104	no	no	no	yes	no	no	no	no	no	no	no	no	non-1RS	no	no	no	no	no	no	5+10	Ax2*
MO080864	yes	no	no	no	no	no	no	het	no	no	no	no	non-1RS	no	no	no	yes	no	no	2+12	Ax1 or null
MO081652	no	no	no	yes	no	no	no	no	no	no	no	no	non-1RS	no	no	no	no	no	no	5+10	Ax2*
WESLEY	yes	no	yes	no	no	no	no	no	no	no	no	yes	non-1RS	no	no	no	no	no	no	5+10	Ax2*
WESLEYFHB1	yes	no	no	no	yes	no	no	no	no	no	no	yes	non-1RS	no	no	no	no	no	no	5+10	Ax2*
NE06607	yes	no	no	no	no	no	no	no	no	no	no	no	non-1RS	no	no	no	no	no	no	5+10	Ax2*
NE06469	yes	no	no	yes	no	no	no	no	no	no	no	yes	non-1RS	no	no	no	no	no	no	5+10	Ax2*
NW07505	yes	no	no	no	no	no	no	no	no	no	no	no	non-1RS	no	no	no	no	no	no	5+10	Ax2*
VA06W-612	no	yes	no	no	no	no	no	no	no	no	yes	no	non-1RS	no	no	no	no	no	no	5+10	Ax2*
VA07W-594	no	yes	no	yes	no	no	no	no	no	no	yes	no	1RS:1BL	no	no	no	no	no	no	het?	het
VA07W-601	no	yes	no	no	no	no	no	no	no	no	yes	no	1RS:1BL?	no	no	no	no	no	no	2+12	Ax1 or null
VA08W-734	yes	no	no	no	no	no	no	no	no	no	no	no	1RS:1AL	no	yes	no	no	no	no	5+10	Ax2*

Table 32. Presence or absence of genes for entries in the 2009-2010 PNUWWSN based on marker analysis performed by the USDA Small Grains Genotyping Lab, Raleigh NC.

NAME	Rht-B1b dwarf allele (Rht1)	Rht-D1b dwarf allele (Rht2)	Rht8	Ppd-D1a insens. allele	Fhb1	Fhb Ernie 3Bc	Fhb 2DL-Wuhan1 W14	Fhb 5A Ernie	Fhb 5A Ning	Sr2	Sr36	Sr24 Lr24	1RS	H13	H9	Bdv2/3	Yr17 Lr37 Sr38	Lr34 Yr18	Bx7 overexp	Glu-D1	Glu-A1
ERNIE	yes	no	no	no	no	yes	no	yes	no	no	yes	no	non-1RS	no	no	no	no	no	no	2+12	Ax1 or null
TRUMAN	yes	no	no	no	no	no	no	no	no	no	no	no	non-1RS	no	no	no	no	no	no	2+12	Ax1 or null
FREEDOM	yes	no	no	no	no	yes?	no	no	no	no	yes	no	1RS:1BL	no	no	no	no	no	no	2+12	het
PIONEER2545	no	yes	no	yes	no	no	no	het	no	no	no	no	non-1RS	no	no	no	no	no	no	2+12	het
E5017	no	yes	no	yes	no	no	no	no	no	no	no	no	1RS:1BL	no	no	no	no	no	no	2+12	Ax1 or null
E8007	no	yes	no	no	yes	no	no	no	yes	no	no	no	non-1RS	no	no	no	no	no	no	2+12	Ax1 or null
OH06-158-50	yes	no	no	no	no	no	no	no	no	no	no	no	non-1RS	no	no	no	no	no	yes	2+12	Ax1 or null
OH06-159-6	yes	no	no	yes	no	no	no	no	no	no	no	no	non-1RS	no	no	no	yes	no	yes	het	Ax1 or null
OH06-180-57	no	no	yes	yes	no	no	no	no	no	no	no	no	1RS:1BL	no	no	no	yes?	no	no	2+12	Ax1 or null
OH06-197-61	yes	no	no	yes	no	no	no	no	no	no	no	no	non-1RS	no	no	no	no	no	yes	2+12	Ax1 or null
OH06-228-73	yes	no	no	yes	no	no	no	no	no	no	no	no	non-1RS	no	no	no	no	no	no	2+12	Ax2*
OH06-190-29	yes	no	no	yes	no	no	no	no	no	no	no	no	non-1RS	no	no	no	no	no	no	het	Ax1 or null
03207A1-7-5	yes	no	no	no	no	no	no	no	no	no	no	no	1RS:1BL	no	no	yes	yes	no	yes	5+10	Ax1 or null
03615A1-5-7	yes	no	no	no	no	no	no	no	no	no	yes	no	1RS:1BL	no	no	no	no	no	yes	het	Ax1 or null
059A1-1-9-5	yes	no	no	no	no	no	no	no	no	no	yes	no	non-1RS	no	no	yes	no	no	no	2+12	Ax1 or null
059A1-1-9-6	yes	no	no	no	het	no	no	no	no	no	yes	no	non-1RS	no	no	het	no	no	het	het	Ax1 or null
0527A1-9-9-3	yes	no	no	yes	no	no	no	het	no	no	no	no	1RS:1BL	no	yes	het	yes	no	het	2+12	Ax1 or null
0537A1-7-8	yes	no	no	yes	no	no	no	het	no	no	yes	no	non-1RS	no	no	no	no	no	no	het	Ax1 or null
SE99-1015-7	yes	no	no	no	no	no	no	no	no	no	yes	no	non-1RS	no	no	no	no	no	no	5+10	Ax2*
SE-MO98-274-8	yes	no	no	no	no	no	no	no	no	no	no	no	non-1RS	no	no	no	no	no	no	5+10	Ax2*
SE98-1094-C20	yes	no	no	no	no	het?	no	no	no	no	het	no	1RS:1BL	no	no	no	no	no	no	het	het
SE00-4040-10	yes	no	no	yes	no	no	no	no	no	no	no	no	1RS:1BL	no	no	no	no	yes	no	5+10	Ax2*
SE00-10303-35	no	yes	no	het	no	no	no	no?	no	no	no	no	non-1RS	no	no	no	no	no	no	2+12	Ax2*
SE00-10286-7	no	no	no	yes	no	no	no	no	no	no	no	no	non-1RS	no	no	no	no	no	no	2+12	het
MISC-HDS-148	yes	no	no	yes	no	no	no	no	no	no	no	no	non-1RS	no	no	no	no	no	no	2+12	Ax1 or null
M08*8005#	yes	no	no	yes	no	no	no	no	no	no	no	no	non-1RS	no	no	no	no	no	no	5+10	Ax2*
MH07-7474	yes	no	no	no	no	no	no	no	no	no	no	no	non-1RS	no	no	no	no	no	no	5+10	Ax1 or null
IL06-13072	yes	no	no	no	no	no	no	no	no	no	no	no	non-1RS	no	no	no	no	no	no	5+10	Ax2*
IL06-13708	yes	no	no	no	no	no	no	no	no	no	no	no	non-1RS	no	no	no	no	no	no	5+10	Ax2*
IL06-13721	yes	no	no	no	no	no	no	no	no	no	no	no	non-1RS	no	no	no	no	no	no	5+10	Ax2*
IL06-25634	yes	no	het	het	no	?	no	no	no	no	no	no	non-1RS	no	no	no	no	no	no	2+12	Ax1 or null
IL06-27969	yes	Unknown	no	no	no	no	no	?	no	no	no	no	non-1RS	no	no	yes	no	no	no	5+10	Ax2*
IL06-14325	yes	no	no	no	no	no	no	?	no	no	no	no	non-1RS	no	no	yes	no	no	no	5+10	Ax2*
KY02C-3007-55	yes	no	no	yes	yes	no	no	no	no	no	no	no	1RS:1BL	no	no	no	no	yes	no	5+10	Ax2*
KY03C-1237-23	yes	no	no	yes	het	no	no	no	no	no	no	no	non-1RS	no	no	no	no	no	no	5+10	Ax2*
KY01C-1070-02	no	no	no	yes	no	no	no	no	no	no	het	no	non-1RS	no	no	no	no	no	no	2+12	Ax2*
KY01C-1531-17	no	yes	no	yes	no	no	no	no	no	no	no	no	1RS:1AL	no	no	no	no	no	no		Ax2*
KY03C-1136-18	no	yes	no	yes	no	het?	no	no	no	no	no	yes	1RS:1BL	no	no	no	no	no	no	het	Ax1 or null
KY03C-1092-13	no	yes	no	yes	no	no	no	no?	no	no	no	no	non-1RS	no	no	no	no	no	no	het	het
MO070933	yes	no	no	no	no	no	no	yes	no	no	yes	no	non-1RS	het	no	no	no	no	no	5+10	Ax2*
MO080103	no	no	no	yes	no	no	no	no	no	no	no	no	non-1RS	no	no	no	no	no	no	5+10	het
MO080373	yes	no	no	no	no	no	no	no	no	no	no	no	non-1RS	no	no	no	no	no	no	2+12	Ax1 or null
MO081378	yes	no	no	no	no	no	no	no	no	no	no	no	non-1RS	no	no	no	no	no	no	5+10	Ax1 or null
MO081772	het	no	no	het	no	no	no	no	no	no	no	no	non-1RS	no	no	no	no	no	no	5+10	Ax1 or null
MO081777	no	no	no	yes	no	no	no	no	no	no	no	no	non-1RS	no	no	no	no	no	no	5+10	Ax2*
VA08W-622	Unknown	yes	no	no	no	no	no	no	no	no	het	no	non-1RS	no	no	no	no	no	no	2+12	Ax1 or null
VA08W-630	no	yes	no	no	no	no	no	no	no	no	no	no	non-1RS	no	no	no	no	no	no	2+12	Ax2*
VA08W-653	no	yes	no	no	no	no	no	no	no	no	het	no	non-1RS	no	yes	no	no	no	no	2+12	Ax1 or null
VA07W-600	no	yes	no	no	no	no	no	het?	no	no	yes	no	non-1RS	no	no	no	no	no	no	2+12	Ax1 or null
VA07W-607	het	het	no	no	no	no	no	no	no	no	no	yes	1RS:1AL	no	no	no	no	no	no	2+12	Ax2*
VA08W-740	no	yes	no	no	no	no	no	no	no	no	no	yes	1RS:1AL	no	no	no	no	no	no	het	het

Table 33. Quality data for entries in the 2009-2010 NUWWSN. Grain was from Lafayette IN provided by Herb Ohm. Data from the USDA Soft Wheat Quality Lab, Wooster OH.

ENTRY	Modified Milling Quality Score		Modified Baking Quality Score		Modified Softness Equivalent Score		Test Weight (LB/BU)	Whole Grain Protein (%)	Flour Protein (%)	Flour Yield (%)	Softness Equivalent (%)	As Is Lactic Acid SRC (%)	Sucrose SRC (%)	Estimated Cookie Diameter (cm)
ERNIE	67.0	C	68.4	C	63.1	C	55.1	11.2	8.4	68.8	59.2	89.7	86.5	18.2
TRUMAN	63.6	C	62.3	C	68.1	C	57.1	9.9	7.6	68.0	61.6	79.3	92.2	18.0
FREEDOM	62.1	C	70.5	B	60.3	C	53.9	10.8	8.1	67.6	57.9	77.9	85.2	18.2
PIONEER-2545	58.7	**D**	65.5	C	63.6	C	51.9	10.4	8.8	66.9	59.5	72.9	87.3	18.2
NY99045-3110	67.5	C	80.9	A	70.9	B	55.9	10.1	7.7	68.9	62.9	76.9	83.8	18.5
OH07-176-56	73.0	B	90.8	A	65.0	C	55.0	10.1	8.0	70.1	60.1	71.0	77.0	18.8
NY94052-9340	60.9	C	73.4	B	70.0	B	57.4	11.0	8.5	67.4	62.5	87.4	85.6	18.4
NY99068-3251	57.7	**D**	76.7	B	65.0	C	58.5	10.2	7.9	66.6	60.1	80.9	83.9	18.4
NY88046-7088	68.0	C	72.3	B	68.2	C	56.3	10.3	8.2	69.0	61.6	81.4	86.4	18.3
E5011B	77.6	B	85.6	A	73.8	B	55.0	9.2	7.0	71.2	64.4	74.4	83.6	18.6
E5024	66.5	C	76.1	B	62.1	C	54.9	9.9	7.7	68.7	58.7	73.2	83.8	18.3
E3024	78.2	B	96.4	A	73.5	B	55.7	8.9	6.9	71.3	64.2	78.2	78.5	18.9
E6012	67.9	C	73.8	B	78.9	B	51.8	9.3	7.4	69.0	66.8	80.8	89.8	18.4
E8052	69.7	C	67.8	C	72.0	B	52.7	10.1	8.0	69.4	63.5	93.4	89.7	18.2
OH04-264-58	66.7	C	64.9	C	68.6	C	51.7	10.0	7.8	68.7	61.9	99.1	90.8	18.1
OH05-101-1	60.8	C	49.2	**E**	72.8	B	51.8	10.2	7.7	67.3	63.8	99.4	99.5	17.7
OH05-164-76	54.7	**D**	69.9	C	65.5	C	54.2	10.1	7.8	65.9	60.3	84.0	87.5	18.2
OH05-200-74	64.2	C	74.2	B	70.6	B	54.9	9.6	7.5	68.1	62.8	89.2	87.4	18.3
99691A2-5-4-16-1	60.4	C	49.3	E	70.2	B	53.2	10.8	8.4	67.2	62.6	88.8	97.4	17.8
01946A1-16-48-5	63.1	C	61.4	C	62.1	C	55.3	10.7	8.5	67.9	58.7	69.6	89.3	18.0
057RA1-8-5	65.7	C	54.9	D	71.9	B	52.2	10.0	7.9	68.5	63.4	93.4	96.2	17.9
059A1-2-4-3	60.6	C	76.7	B	63.9	C	53.0	10.7	8.5	67.3	59.6	64.5	82.5	18.4
TABOO	62.9	C	78.0	B	64.1	C	53.7	9.7	7.7	67.8	59.7	69.1	83.4	18.4
MONDO	59.7	D	53.2	D	64.8	C	54.5	10.6	8.6	67.1	60.0	76.2	93.9	17.9
PROBE	73.4	B	67.3	C	74.5	B	52.5	10.1	7.9	70.2	64.6	99.5	90.8	18.2
RUMOR	64.7	C	80.4	A	82.9	A	53.8	9.4	7.7	68.2	68.7	87.3	87.2	18.6
03M1539#019	62.5	C	71.3	B	78.8	B	54.1	10.0	7.4	67.7	66.7	78.7	91.1	18.3
03M1539#031	71.4	B	81.2	A	83.8	A	51.6	9.6	7.4	69.8	69.1	97.5	87.5	18.6
W1104	60.8	C	86.3	A	64.2	C	53.9	9.4	7.3	67.3	59.7	70.8	80.2	18.6
ML06-2097	63.0	C	75.7	B	65.1	C	54.1	9.5	7.4	67.8	60.2	68.4	85.3	18.3
GS-0-EM0681	74.8	B	44.5	E	28.3	F	57.4	11.9	10.8	70.6	42.5	111.4	84.4	17.5
GS-0-EM0614	58.8	D	42.5	E	27.5	F	58.0	10.5	8.7	66.9	42.1	73.1	89.1	17.3
GS-1-EM0362	73.1	B	56.5	D	33.9	F	57.0	10.7	8.7	70.2	45.2	82.2	84.1	17.7
ACF213003B	66.9	C	69.3	C	63.2	C	56.1	10.5	8.0	68.7	59.3	72.6	86.9	18.2
ACF126103	66.5	C	64.5	C	67.4	C	54.9	9.9	7.9	68.6	61.2	69.2	90.4	18.1
IL02-18228	63.1	C	52.7	D	60.5	C	56.7	10.1	8.1	67.9	58.0	81.1	93.9	17.8
IL04-24668	68.9	C	66.3	C	71.4	B	55.8	10.1	7.8	69.2	63.2	87.5	90.7	18.2
IL06-7550	75.7	B	93.7	A	82.5	A	54.3	8.9	6.9	70.7	68.5	77.6	82.1	18.9
IL06-14262	68.7	C	88.8	A	77.9	B	55.2	9.2	7.1	69.2	66.3	90.8	82.8	18.7
KY02C-3006-46	60.5	C	67.2	C	63.6	C	56.0	9.8	7.8	67.3	59.4	75.5	88.3	18.1
KY02C-3004-2	60.5	C	54.0	D	61.8	C	58.8	9.7	7.4	67.3	58.6	77.2	94.9	17.7
KY04C-2151	42.6	E	46.4	E	58.1	D	59.2	10.4	8.7	63.2	56.8	77.1	95.2	17.6
KY03C-1192-34	67.2	C	70.9	B	65.1	C	55.8	9.8	7.6	68.8	60.2	84.4	87.2	18.2
KY02C-3008-01	51.9	D	43.9	E	65.0	C	55.7	9.9	7.8	65.3	60.1	76.0	99.8	17.6
MD03W91-09-8	64.9	C	50.3	D	64.4	C	58.5	10.4	8.6	68.3	59.8	87.8	95.2	17.8
MD03W61-09-1	53.3	D	36.8	F	59.6	D	56.8	11.3	9.2	65.6	57.5	87.5	99.3	17.5
MD02W135-08-9	50.8	D	54.4	D	72.9	B	56.9	9.3	7.3	65.0	63.9	76.4	97.9	17.8
MO071522	67.2	C	79.2	B	75.1	B	56.8	10.1	7.8	68.8	64.9	92.4	85.4	18.5
MO080104	53.3	D	52.3	D	69.5	C	55.7	9.8	7.6	65.6	62.3	93.4	97.3	17.8
MO080864	62.2	C	81.1	A	69.9	C	57.9	8.7	6.7	67.7	62.5	73.0	85.2	18.4
MO081652	50.9	D	47.8	E	69.3	C	55.9	9.6	7.4	65.1	62.2	91.4	99.8	17.6
WESLEY	69.4	C	49.6	E	32.6	F	53.0	10.8	9.5	69.3	44.6	92.4	85.6	17.6
WESLEYFHB1	64.6	C	59.8	D	40.7	E	55.6	10.0	7.7	68.2	48.5	81.6	86.1	17.7
NE06607	77.0	B	65.7	C	47.7	E	54.0	9.1	7.2	71.0	51.8	81.9	86.1	17.9
NE06469	70.8	B	59.2	D	41.5	E	53.8	10.0	8.0	69.6	48.9	85.8	86.1	17.7
NW07505	65.1	C	60.7	C	37.5	F	51.9	9.2	6.7	68.3	46.9	72.8	86.8	17.6
VA06W-612	59.7	D	67.1	C	65.8	C	55.3	9.9	7.8	67.1	60.5	103.0	88.9	18.1
VA07W-594	60.3	C	62.9	C	69.3	C	55.1	10.2	8.1	67.2	62.2	97.7	91.3	18.1
VA07W-601	62.4	C	55.6	D	60.4	C	61.1	10.8	8.6	67.7	57.9	94.4	91.5	17.9
AVERAGE	64.1		66.1		64.1		55.2	10.0	7.9	68.1	59.7	83.1	88.7	18.1
MINIMUM	42.6		36.8		27.5		51.6	8.7	6.7	63.2	42.1	64.5	77.0	17.3
MAXIMUM	78.2		96.4		83.8		61.1	11.9	10.8	71.3	69.1	111.4	99.8	18.9

Table 34. Summary of regression of the BLUP of standardized trait data (Y') from two-year rolling means onto time period for the 1998-2010 P+NUWWSN entries.

	ALL 12 PERIODS		LAST NINE PERIODS			
	R2	PROB	R2	PROB	INTERCEPT	SLOPE
INC	0.03	0.58	0.03	0.66	0.18	-0.01
SEV	0.34	**0.05**	**0.58**	**0.02**	**0.72**	**-0.08**
IND	0.34	**0.05**	**0.86**	**0.00**	**0.71**	**-0.09**
FDK	0.24	0.10	0.02	0.70	0.23	-0.02
ISK	0.02	0.69	0.23	0.19	0.48	-0.49
DON	0.00	0.98	**0.47**	**0.04**	**0.28**	**-0.03**
GHSEV	0.02	0.70	0.21	0.22	0.18	-0.13