Report on the 2012-2013 Northern Uniform Winter Wheat Scab Nurseries (NUWWSN and PNUWWSN)

C. Sneller[1]*, P. Paul[2], C. Sewell[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 each also conducts the trial in inoculated and misted FHB nurseries within their programs. Data is then sent to the coordinator for summation and distribution. Public and private breeders submit lines using their own criteria for inclusion though all must be adapted. Entries vary in the degree of pretesting and selection and their purpose (germplasm, cultivars). Most of the entries have only native resistance though some have undergone MAS for FHB1 and other QTL.

MATERIAL AND METHODS

The locations that reported data and the traits assessed are listed in Tables 1 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 46 entries (& four checks, Table 4) and we obtained phenotypic data from xx locations. Cooperators collect replicated data and submit means to the coordinator. The means from individual locations are used in an analysis over locations. The genotype x environment interaction (GEI) term is the error and is used to calculate an LSD (0.05). The LSD value is used to determine if a particular entry mean is statistically equal to the lowest entry mean (such values are designated with an "l") or the highest entry mean (such values are designated with an "h") for each trait. Variance components were estimated using PROC MIXED from SAS considering entries and locations to be random. FHB traits were correlated with heading date (HD) in some locations so the variance components were estimated with and without using HD as a covariate. An analysis of the GEI interaction was conducted for all FHB traits. We did an Additive Main Effect and Multiplicative Interaction (AMMI) analysis and produced a biplot of genotype and environment scores of the first two components. The GxE matrix was also used to cluster environments using Ward's minimum variance which minimizes GxE variance within a cluster and maximizes variance between clusters. We correlated the trait means between clusters.

RESULTS

Nearly all cooperators who received seed were able to report data on the 2012-13 nurseries (there were two exceptions).

The mean for each entry over all environments for all FHB traits are shown in tables 8 and 9. We observed very lower levels of FHB resistance in the 2013 uniform tests that in the 2012 tests

- 52% of the entries in the PNUWWSN and the NUWWSN had an FHB index < that of Freedom (90% in 2012)
- 2% of the PNUWWSN and 14% of the NUWWSN entries had an FHB index < Truman (35 and 14% in 2012)
- 76% of the PNUWWSN and 3% of the NUWWSN entries had less DON than Freedom (76 and 3% in 2012)
- 76% of the PNUWWSN and 54% of the NUWWSN entries had less DON than Truman (76 and 54% in 2012)

In the NUWWSN, 14 of 60 entries were not significantly different than the most resistant entry for all seven FHB traits while 22 of 50 entries in the PNUWWSN were not different than the most resistant entry for all seven FHB traits (Tables 7a,7b). It is likely that the entries in the 2012 tests represent one of the most resistant sets that group has ever tested.

Most of the entries have only native resistance (eg not from Asia, or South America). In the NUWWSN, five entries had conclusive molecular marker evidence the Asian allele for resistance at Fhb1 or 5A while just one entry in the PNUWWSN had conclusive evidence of an Asian QTL (Tables 8, 9). The two most resistant lines in the NUWWSN have FHB1 and 5A from Ning 7840 (Table 7a). The other three lines in the NUWWSN with FHB1 were not as resistant. Note: not all marker data is shown in Tables 26 and 27 due to size limitations. Excel files with all the data has been forwarded to all cooperators and can be obtained from Clay Sneller at sneller.5@osu.edu.

Entry mean hearitability was very high among the 2013 environments with "h2" exceeding 0.69 in all instances and 0.79 in 8/12 instances (Table 6a). Most of FHB traits were positively correlated in the NUWWSN and PNUWWSN where the correlations among INC, SEV, IND, FDK, ISK, and DON.

Using means over all environments, HD was positively correlated to INC, but not highly or consistently correlated to other FHB traits (Table 5a). The correlation of HD with FHB traits varied considerably by environment (Table 5b). In the NUWWSN the correlations of HD with traits ranged from ns to 0.95 for INC, -0.28 to 0.52 for SEV, -0.65 to 0.52 for IND, ns to 0.27 for FDK, ns to 0.43 for ISK, ns to 0.35 for DON. In the PNUWWSN the correlations of HD with traits ranged from ns to 0.66 for INC, ns to 0.55 for SEV, -0.38 to 0.58 for IND, ns to 0.63 for FDK, ns to 0.57 for ISK, ns to 0.50 for DON.

There is no significance test for GEI, but the ratio of genetic variance to GEI variance to total suggests GEI is important (Table 6a), but probably less so than in past years as evidenced by the high heritability in 2013. The GEI analysis found two to three clusters of environments for each trait in each trial (Figures 1-12). In general, the correlation of means from one cluster with those from another cluster were fairly high, again suggesting that the GEI was not as important in 2013 as in past years. Cluster assignment of each environment for each trait and each trial is shown in Table 6b.

Table 1. Cooperators in the 2012-2013 P+NUWWSN

ENV CODE	LOCATION	NUWWSN	PNUWWSN	COOPERATORS	INSTITUTE	CODE
ILCHA	Champaign, IL	yes	yes	Jana Murche	KWS Cereals	KWS
ILURB	Urbana, IL	yes	yes	Fred Kolb, Eric Brucker	University of Illinois	UIL
INHAR	,IN	yes	no	Don Obert	Limagrain	LIM
INLAY	Lafayette, IN	yes	yes	Herb Ohm	Purdue University	PUR
KYLEX	Lexington, KY	yes	yes	David Van Sanford	Unversity of Kentucky	UKY
MDSAL	Salisbury, MD	yes	no	Jose Costa	University of Maryland	UMD
MIELA	East Lansing, MI	yes	yes	Russ Freed, 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
VABLA	Blacksburg, VA	yes	yes	Carl Griffey	Virginia Tech	VAT

Table 2. Traits assessed in 2012-13 P+NUWWSN

Code	Trait	Description	PNUWWSN Locations	NUWWSN Locations
INC	Disease incidence	% of heads with at least one infected spikelets	IL, IL, IN, KY, MI, MO, VA	IL, IL, IN, IN, KY, MD, MI, MO, NE, NY, VA
SEV	Disease severity from field tests	% of infected spikelets in an infected head.	IL, IL, IN, KY, MI, MO, VA	IL, IL, IN, IN, KY, MD, MI, MO, NE, NY, VA
IND	Disease index	IND = (SEVxINC)/100	IL, IL, IN, KY, MI, MO, OH, VA	IL, IL, IN, IN, KY, MD, MI, MO, NE, NY, OH, VA
FDK	Fusarium damaged kernels	Either a visual assessment of the percent infected kernels, or a percent of scabby seed by weight	IL, IL, IN, KY, MI, OH, VA	IL, IN, IN, KY, NE, NY, OH, VA
ISK	Composite of head and kernel traits	ISK Index = .3 (Severity) + .3 (Incidence)+.4 (FDK)	IL, IN, KY, MI, OH, VA	IL, IN, IN, KY, NE, NY, OH, VA
DON	DON (vomitoxin)	PPM of vomitoxin in grain	IL, IN, KY, MI, OH, VA	IL, IN, IN, KY, NE, NY, OH, VA
GH	Greenhouse severity	Same as SEV except from greenhouse	MO	MO
HD	Heading Date	Julian date when 50% of spikes have emerged from the boot	IL, IL, IN, KY, OH, VA	IL, IL, IN, KY, MD, MO, NY, OH
HGT	Plant Height	Height in inches from soil to top of spike of a typical plant	KY	MD, KY

Table 3. Entries in the 2012-2013 NUWWSN

ENTRY	NAME	SOURCE	PEDIGREE
20	TRUMAN	UMO	CHECK
1	ERNIE		
2	FREEDOM		
3	PIONEER2545		
4	NY07104-141	COR	(NY7388/Madsen//NY7388 11///NY7388-8////NY7388-9/////NY7388)-2-141
5	NY99069-WC	COR	P25W33/Caledonia (20)
6	NY99045-3110	COR	Geneva/Pio25W33 (26+9s)
7	NY99056-161	COR	NY85020-395/Pio25W33 (10+6)
8	KWS009	KWS	VA99W-206 / GA90552AE33
9	KWS010	KWS	VAN97W-386 / VA99W-164
10	KWS013	KWS	VA96W-49 / AGS 2000 // VA98W-430
11	KWS014	KWS	unknown
12	LCS10727	LIM	VA 98W-593/3/L900819//C916/T812
13	LCS13531	LIM	T814/L900819
14	LCS19228	LIM	T814/L900819//VA 98W-591
15	LCS19707	LIM	IL 99-26442/VA 02W-555
16	F0013R	MSU	Pioneer 25W60 / Pearl
17	F0065	MSU	Pioneer 25R37 / MSU D6234
18	F1003R	MSU	MSU Line F0008 / Pioneer 25R18
19	F1029	MSU	Aubrey / Jewel
21	OH07-263-3	OSU	OH748 / BRAVO
22	OH08-172-42	OSU	DOUGLAS / JEKYL
23	OH08-269-58	OSU	P.92226E2-5-3 / OH708
24	05247A1-7-7-3-1	PUR	99840C4/5/INW0315/3/INW0301MADSEN//INW0315/4/97395B1/6/99840C4//99794RA1
25	05287A1-1-13	PUR	99840C4-8/03726A1//99840C4-8-3-6-1/4/INW0412/03705A1/3/INW0412
26	0762A1-2-8	PUR	981129A1-45-3/99793RE2-3//INW0301/92145E8-7-7-3-57/3/981477A1/981312A1//INW0316
27	05247A1-7-3-120	PUR	99840C4/5/INW0315/3/INW0301MADSEN//INW0315/4/97395B1/6/99840C4//99794RA1
28	05264A1-1-3-33	PUR	INW0304/03727A1//INW0304/6/96169RE2-6-4/4/TADINIA/BH1146//INE0301/GENEVA/5/96169
29	MH07-7474	SYN	M97-1048/ELKHART
30	MA08-8036#	SYN	COKER 9511/BRANSON
31	M10-1659	SYN	CK9511/B980006
32	M10-1615	SYN	IL99-15867/M03-3002
33	M10*1307#	SYN	M03-3149/P 25R78//BENTON
34	IL06-23571	UIL	IL96-6472/ Pioneer 25W33 // 94-1653
35	IL07-19334	UIL	IL01-36115 / IL79-008T-B-B
36	IL07-20728	UIL	McCormick/IL97-1828// IL00-8061
37	IL07-20743	UIL	McCormick/IL97-1828// IL00-8061
38	KY05C-1369-13-7-3	UKY	KY93C-0004-22-1/VA01W-476//KY98C-1517-01
39	KY05C-1020-2-19-1	UKY	981517A1-1-5-2/25R18
40	KY05C-1600-92-9-5	UKY	KY94C-0094-11-2/25R54//KY97C-0574-01
41	KY05C-1051-37-18-5	UKY	97397J1-4-1-4-7/Freedom
42	KY05C-1105-43-10-3	UKY	Roane/Truman//KY98C-1440-01
43	MD05W10208-12-16	UMD	Tribute/25R42//Chesapeake
44	MDC07026-12-42	UMD	SS8641//McCormick*2/Ning7840
45	MDC07027-12-12	UMD	SS8641//McCormick*2/Ning7840
46	MDC07027-12-24	UMD	SS8641//McCormick*2/Ning7840
47	MO111134	UMO	980525/IL 95-4162, (081535 SP RS)
48	MO111359	UMO	960429/960112,(041020 SP RS)
49	MO110719	UMO	960429/960112,(041020 SP RS)
50	MO100647	UMO	Roane/980525//980525/451-1-2
51	Bakhsh24	UNE	Alsen/NE00403//NE02583-067
52	Bakhsh33	UNE	Alsen/NE00403//NE02583-098
53	Bakhsh35	UNE	Alsen/NE00403//NE02583-107
54	NW10401	UNE	SHARK/F4105W2.1//NI02425
55	NE06607	UNE	NE98466=(KS89H50-4/NE90518(=BRL//SXL/BENN))/WESLEY
56	VA09W-188WS	VAT	PIONEER 25W60 // PION 25W33 / VAN98W-170WS
57	VA08MAS-369	VAT	McCORMICK / GA881130LE5
58	VA10W-123	VAT	PIONEER 25R47 /GF951079-2E31 (GA881130/Gore)
59	VA11W-FHB39	VAT	IL99-15867 / VA04W-433 (NING 7840/ Pion2684 //VA96-54-244)
60	VA11W-FHB40	VAT	P97397J1-4-1-4-7 / VA04W-433 (NING 7840/ PION2684//96-54-244)

Table 4. Entries in the 2012-2013 PNUWWSN

ENTRY	NAME	SOURCE	PEDIGREE
1	TRUMAN		
2	ERNIE		
3	FREEDOM		
4	PIONEER2545		
5	KWS 015	KWS	unknown
6	KWS 008	KWS	T127 / M98-2152
7	KWS 011	KWS	P25R18 / 25W33*
8	KWS 012	KWS	PIONEER 26R24 / McCORMICK
9	KWS 016	KWS	unknown
10	KWS 017	KWS	unknown
11	KWS 019	KWS	D6206 / P 2552
12	F1012	MSU	MSU D6234 / W14 // MSU Line E0038-1 / 3 / MSU Line E0038-1
13	F1014	MSU	MSU D6234 / W14 // MSU Line E0038-1 / 3 / MSU Line E0038-1
14	OH07-264-35	OSU	OH708 / P.92145E8-7-7-1-9
15	OH08-99-50	OSU	TRUMAN / IL97-3632
16	OH08-207-33	OSU	P.92226E2-5-3 / OH751
17	OH08-99-41	OSU	TRUMAN / IL97-3632
18	OH08-155-16	OSU	ROANE / PATTON
19	OH08-182-4	OSU	DOUGLAS / OH708
20	0722A1-1-7	PUR	INW0731/3/981129A1-45-3//99793RE2-3//INW0301/92145E8-7-7-3-57
21	05247A1-7-3-27	PUR	99840C4/5/INW0315/3/INW0301MADSEN//INW0315/4/97395B1/6/99840C4//99794RA1
22	082A1-55-4	PUR	INW0411/961341A3-1-4-6
23	0858A1-33-2	PUR	INW0304/INW0315//981358C1/97462A1/3/961341A3-1-4-6/97462A1-21-1-5-1-15
24	0527A1-9-15-181	PUR	99751D8-2-3/96169RE2-3-6-4-1/3/7D(E)//97462A1-21-1-5-1-15/INW0412
25	IL08-22206	UIL	IL00-8530 / VA01-476 // IL79-002DH
26	IL08-8844	UIL	IL00-8109 / IL02-24251
27	IL09-3259	UIL	B 990081/ IL00-8109
28	IL09-3264	UIL	B 990081/ IL00-8109
29	IL09-15973	UIL	IL03-18529/ IL01-32526
30	IL09-24328	UIL	IL00-8633/IL 01-11445// IL00-8530
31	KY06C-1003-140-3-3	UKY	Truman/McCormick//25R37
32	KY05C-1113-47-9-3	UKY	Tribute/Truman//KY93C-1238-17-1
33	KY05C-1105-44-15-1	UKY	Roane/Truman//KY98C-1440-01
34	KY05C-1105-42-14-1	UKY	Roane/Truman//KY98C-1440-01
35	KY05C-1033-31-15-1	UKY	IL99-27048/KY93C-1238-17-5
36	MO111495	UMO	960429/960112,(041020 SP RS)
37	MO111491	UMO	010708/000442
38	MO111409	UMO	980525/IL 95-4162, (081535 SP RS)
39	MO110799	UMO	Ernie/000926
40	MO110767	UMO	981020//980525/433-1-2(reselection from Norin 50)
41	MO111585	UMO	000925/001164
42	VA11W-FHB4	VAT	P97397B1-4-5/ McCORMICK // Coker9511
43	VA11W-FHB13	VAT	P97397B1-4-5/ McCORMICK // Coker9511
44	VA11W-FHB38	VAT	IL99-15867 / VA04W-433 (NING 7840/ Pion2684 //VA96-54-244)
45	VA11W-FHB71	VAT	VA00W-38 / P97397E1-11-2-4-1-1 // Coker 9511
46	OH08-180-48	OSU	DOUGLAS / MCCORMICK

Table 5a. Correlation of traits in the 2012-2013 P+NUWWSN. Above diagonal are correlations of means from the NUWWSN. Below diagonal are correlations of entry means from the PNUWWSN. .

	INC	SEV	IND	FDK	ISK	DON	GHSEV	HD	HGT
INC		0.71	0.68	0.67	0.87	0.08	0.55	0.58	0.43
SEV	0.69		0.96	0.81	0.87	0.48	0.70	0.00	0.01
IND	0.52	0.84		0.80	0.82	0.55	0.69	-0.05	-0.13
FDK	0.78	0.71	0.57		0.92	0.51	0.55	0.16	0.03
ISK	0.86	0.81	0.60	0.92		0.33	0.65	0.39	0.25
DON	0.26	0.57	0.81	0.46	0.37		0.45	-0.37	-0.38
GHSEV	0.50	0.60	0.56	0.45	0.55	0.30		-0.12	-0.13
HD	0.56	0.15	-0.24	0.38	0.46	-0.30	0.07		0.92
HGT	0.44	0.07	-0.31	0.25	0.35	-0.37	0.04	0.96	
	indicates a correlation significant at 0.05								

Table 5b. Correlation of FHB traits with heading date by environment in the 2012-2013 P+NUWWSN. "ns" indicates not significant at $P < 0.05$. Black squares indicate correlation could not calculate as one trait was missing.

	NUWWSN							
	ILCHA	ILURB	INLAF	KYLEX	MDSAL	MOCOL	NYITH	OHWOO
INC with HD	NS	0.41	NS	0.28	0.98	0.47	0.5	
SEV with HD	NS	NS	-0.28	NS	0.52	0.45	0.027	
IND with HD	NS	NS	-0.65	NS	0.51	0.52	0.45	NS
FDK with HD		0.26	NS	0.27			0.26	NS
ISK with HD		0.40	NS	NS			0.43	NS
DON with HD		NS	NS	NS			0.35	NS

	PNUWWSN					
	ILCHA	ILURB	INLAF	KYLEX	MOCOL	OHWOO
INC with HD	NS	0.66	NS	0.38	0.46	
SEV with HD	NS	NS	NS	0.27	0.55	
IND with HD	-0.38	NS	NS	NS	0.58	0.48
FDK with HD		NS	0.31	0.63		NS
ISK with HD		0.57	NS	NS		0.39
DON with HD		NS	0.50	NS		0.46
	indicates one trait was not measured					

Table 6a. Summary of genotype (V_g) and error (V_{error}) variances from the ANOVA of the 2012-2013 P+NUWWSN

	NUWWSN					PNUWWSN				
	# env	Vg	Verror	Vg/Verror	"h2" of entry mean	# env	Vg	Verror	Vg/Verror	"h2" of entry mean
INC	11	67.6	189.0	0.36	0.80	7	54.6	166.4	0.33	0.70
SEV	11	59.8	123.3	0.49	0.84	7	41.7	78.0	0.53	0.79
IND	12	58.1	95.9	0.61	0.88	8	34.0	60.1	0.57	0.82
FDK	8	76.4	182.5	0.42	0.77	5	61.5	106.5	0.58	0.74
ISK	8	77.7	80.2	0.97	0.89	5	59.7	44.7	1.34	0.87
DON	8	10.7	13.9	0.77	0.86	6	12.5	11.6	1.07	0.87
HD	8	3.9	1.5	2.63	0.95	6	3.1	1.8	1.70	0.91
HGT	2	6.1	1.4	4.28	0.90	1				

Table 6b. Cluster assignment (1, 2 or 3) for each location for each traits.

NUWWSN

	ILCHA	ILURB	INHAR	INLAF	KYLEX	MDSAL	MIELA	MOCOL	NEMEA	NYITH	OHWOO	VABLA
INC	**2**	**2**	**2**	**2**	**2**	1	**2**	1	1	1		1
SEV	1	1	**2**	*3*	*3*	**2**	*3*	*3*	1	*3*		*3*
IND	**2**	**2**	**2**	1	**2**	**2**	1	1	**2**	1	**2**	1
FDK		**2**	**2**	1	**2**				1	1	**2**	1
ISK		1	1	**2**	1				**2**	**2**	1	**2**
DON		1		**2**	**2**		**2**		**2**	**2**	1	**2**

PNUWWSN

	ILCHA	ILURB	INHAR	INLAF	KYLEX	MDSAL	MIELA	MOCOL	NEMEA	NYITH	OHWOO	VABLA
INC	1	1		1	**2**		*3*	1				**2**
SEV	1	1		**2**	**2**		**2**	**2**				**2**
IND	1	*3*		1	1		**2**	1			1	1
FDK		1		**2**	1						1	**2**
ISK		1		**2**	1						1	1
DON		1		**2**	1		**2**				1	**2**

Table 7a. Best and worst entries in the 2012-2013 NUWWSN

ENTRY	NAME	INC	SEV	IND	FDK	ISK	DON	GH	HD	HGT	#l	#h	Fhb 1	FHB Massey 3BL	FHB 2DL	FHB 5A Ernie
39	KY05C-1020-2-19-1	42.0 l	13.2 l	8.7 l	23.6 l	22.8 l	4.2 l	9.4	138.2	40.3	6	0	HET	no	no	no
46	MDC07027-12-24	36.7 l	19.1 l	11.0 l	16.4 l	19.1 l	2.6 l	10.5	139.1	36.8	6	0	YES	no	YES	*N7840*
20	TRUMAN	42.2 l	16.4 l	10.0 l	26.1 l	24.9 l	6.8	6.6	142.4	41.8	5	0	no	no	no	no
35	IL07-19334	45.8 l	18.3 l	11.0 l	18.0 l	21.5 l	6.0	9.5	139.3	38.0	5	0	no	no	no	*N7840?*
45	MDC07027-12-12	42.8 l	23.1	12.3 l	15.7 l	20.1 l	2.0 l	10.8	138.1	39.5	5	0	YES	no	YES	*N7840*
4	NY07104-141	53.4	22.3 l	14.3 l	25.0 l	26.5 l	9.5	13.0	143.7 h	42.5	4	0	YES	no	no	no
37	IL07-20743	50.0	23.1	14.4 l	14.0 l	21.7 l	4.2 l	14.8	137.6	40.8	4	0	no	no	no	no
50	MO100647	47.8 l	24.2	16.3 l	23.5 l	25.7 l	6.0	10.9	140.8	47.2 h	4	0	no	no	no	nd
31	M10-1659	50.3	26.1	18.6	18.4 l	24.0 l	2.7 l	12.5	136.3 l	40.0	3	0	no	no	no	no
38	KY05C-1369-13-7-3	55.3	25.0	18.9	21.3 l	27.9 l	5.4 l	17.6	138.3	38.8	3	0	HET	no	no	no
56	VA09W-188WS	70.5 h	47.8 h	36.9	49.6 h	51.8	13.3	23.9	137.3	37.8	0	3	no	no	no	no
17	F0065	73.2 h	49.3 h	40.9 h	49.0	55.6 h	14.9 h	33.6	139.8	37.3	0	5	no	no	no	no
3	PIONEER2545	75.2 h	48.9 h	41.9 h	57.6 h	59.0 h	16.6 h	32.5	139.4	36.8	0	6	no	no	no	no
10	KWS013	75.9 h	51.4 h	47.9 h	62.9 h	61.9 h	15.2 h	30.4	135.1 l	37.8	0	6	no	no	no	no
100	AVERAGE	60.1	32.0	23.8	34.5	38.0	8.6	16.9	138.9	38.2						
101	MINUMUM	36.7	13.2	8.7	14.0	19.1	2.0	6.6	135.1	33.0						
102	MAXIMUM	75.9	51.4	47.9	62.9	61.9	18.2	33.6	144.8	47.2						
103	LSD(0.05)	11.7	9.5	8.0	13.5	9.0	3.7		1.2	2.4						

Table 7b. Best and worst entries in the 2012-2013 PNUWWSN

ENTRY	NAME	INC		SEV		IND		FDK		ISK		DON		HD		HGT	#l	#h	Fhb 1	Massey 3BL	2DL	Ernie 5A
1	TRUMAN	32.1	l	11.9	l	5.1	l	23.7	l	17.2	l	6.7	l	146	h	41.0	6	0	no	no	no	no
17	OH08-99-41	29.5	l	18.8	l	7.5	l	28.1	l	19.3	l	8.6		143		41.5	5	0	no	no	no	no
26	IL08-8844	46.4		18.0	l	10.7	l	26.5	l	23.3	l	4.5	l	141		40.5	5	0	no	no	no	no
29	IL09-15973	48.9		17.8	l	11.3	l	25.1	l	22.0	l	4.7	l	138	l	41.5	5	0	no	no	no	no
30	IL09-24328	45.0		19.2	l	11.3	l	25.7	l	21.8	l	5.4	l	139	l	42.0	5	0	no	no	no	HET
31	KY06C-1003-140-3-3	47.7		16.9	l	11.4	l	19.1	l	21.2	l	6.8	l	140		40.5	5	0	no	no	no	no
37	MO111491	40.7	l	20.4	l	11.6	l	30.7	l	26.5		7.7		141		41.0	4	0	no	no	no	no
28	IL09-3264	50.4		20.7	l	13.0		26.5	l	24.7	l	3.3	l	139	l	37.0	4	0	no	YES	no	no
39	MO110799	41.0	l	20.5	l	12.7		30.9	l	28.5		7.2		142		43.5	3	0	no	no	no	no
20	0722A1-1-7	45.6		20.3	l	12.8		27.6	l	25.9		5.5	l	141		41.0	3	0	HET	no	no	no
42	VA11W-FHB4	43.1	l	23.6		13.7		28.8	l	25.8		3.7	l	141		43.5	3	0	no	no	no	no
9	KWS 016	69.0	h	40.2		30.9		46.1	h	46.3		17.9	h	145	h	38.5	0	3	no	no	no	no
4	PIONEER2545	77.0	h	50.7	h	42.3	h	59.1	h	56.8	h	20.5	h	142		40.0	0	6	no	no	no	no
100	AVERAGE	52.5		25.9		17.4		36.5		32.9		8.9		142		40.5						
101	MINUMUM	29.5		11.9		5.1		19.1		17.2		3.3		138		35.5						
102	MAXIMUM	77.0		50.7		42.3		59.1		56.8		20.5		146		45.5						
103	LSD(0.05)	13.8		9.0		7.4		13.1		8.5		3.9		2		.						

Table 8. Summary of all FHB traits from the 2012-2013 NUWWSN: " h" and "l" indicate means that are not significantly different from the highest (h) or lowest (l) mean in that column.

ENTRY	NAME	INC	SEV	IND	FDK	ISK	DON	GH	HD	HGT	#l	#h	Fhb 1	FHB Massey 3BL	FHB 2DL	FHB 5A Ernie
20	TRUMAN	42.2 l	16.4 l	10.0 l	26.1 l	24.9 l	6.8	6.6	142.4	41.8	5	0	no	no	no	no
1	ERNIE	57.0	27.9	20.4	31.3	34.3	7.6	20.2	136.6	36.5	0	0	no	HET	no	HET
2	FREEDOM	63.0	28.0	21.4	43.0	42.4	9.4	12.5	140.6	39.8	0	0	no	YES	no	no
3	PIONEER2545	75.2 h	48.9 h	41.9 h	57.6 h	59.0 h	16.6 h	32.5	139.4	36.8	0	6	no	no	no	no
4	NY07104-141	53.4	22.3 l	14.3 l	25.0 l	26.5 l	9.5	13.0	143.7 h	42.5	4	0	YES	no	no	no
5	NY99069-WC	54.5	28.1	15.5 l	29.6	32.9	10.3	9.1	144.8 h	41.5	1	0	no	no	no	no
6	NY99045-3110	59.6	33.3	22.6	42.7	43.0	14.5 h	22.7	144.3 h	43.0	0	1	no	no	no	no
7	NY99056-161	43.6 l	23.0	14.0 l	35.2	31.9	16.6 h	19.3	141.8	39.8	2	1	no	no	no	YES
8	KWS009	75.9 h	45.8 h	39.1	43.1	50.8	12.3	35.2	138.1	36.8	0	2	no	no	no	YES
9	KWS010	70.5 h	41.4	31.9	45.4	47.3	11.7	14.9	140.4	34.5 l	0	1	no	YES	no	no
10	KWS013	75.9 h	51.4 h	47.9 h	62.9 h	61.9 h	15.2 h	30.4	135.1 l	37.8	0	6	no	no	no	no
11	KWS014	68.6 h	38.7	29.5	37.9	44.8	18.2 h	32.6	141.3	39.3	0	2	no	no	no	no
12	LCS10727	60.4	35.9	27.5	36.7	41.6	6.8	37.3	137.3	40.5	0	0	no	no	no	no
13	LCS13531	66.9 h	32.9	25.2	35.5	42.0	6.9	32.9	138.9	37.3	0	1	no	YES	no	no
14	LCS19228	70.9 h	42.8 h	35.2	43.4	48.3	8.0	12.7	137.6	37.0	0	2	no	no	no	no
15	LCS19707	60.5	35.2	27.5	43.1	45.2	8.6	13.6	138.4	36.8	0	0	no	no	no	no
16	F0013R	67.4 h	37.1	29.0	34.4	41.1	7.7	14.4	139.8	37.5	0	1	no	no	no	no
17	F0065	73.2 h	49.3 h	40.9 h	49.0	55.6 h	14.9 h	33.6	139.8	37.3	0	5	no	no	no	no
18	F1003R	53.7	25.3	18.5	35.5	34.8	9.4	7.4	140.2	39.8	0	0	YES	no	no	no
19	F1029	60.6	30.6	24.2	35.4	38.3	13.4	12.2	139.1	38.3	0	0	no	no	no	no
21	OH07-263-3	58.7	34.0	23.9	25.6 l	35.2	8.0	15.9	137.3	41.5	1	0	no	no	no	no
22	OH08-172-42	67.7 h	34.9	27.5	36.8	42.3	10.9	11.8	138.6	40.8	0	1	no	HET	no	no
23	OH08-269-58	64.8 h	47.2 h	35.0	39.5	46.2	8.6	35.7	140.1	39.3	0	2	no	YES	no	no
24	05247A1-7-7-3-1	58.0	32.6	21.3	37.8	38.7	11.2	13.9	140.8	37.3	0	0	no	no	no	YES
25	05287A1-1-13	57.4	31.8	22.3	30.2	35.7	8.7	17.7	140.2	34.0 l	0	0	no	no	no	YES
26	0762A1-2-8	54.2	20.3 l	14.8 l	29.8	30.4	6.4	4.9	138.2	34.0 l	2	0	YES	no	no	YES
27	05247A1-7-3-120	68.4 h	34.6	26.6	39.9	44.3	9.2	21.1	136.3 l	34.3 l	0	1	no	no	no	no
28	05264A1-1-3-33	65.3 h	36.5	29.8	39.3	44.8	9.6	17.6	139.0	35.3 l	0	1	no	no	no	no
29	MH07-7474	56.8	36.0	25.1	32.3	38.3	7.9	16.7	138.9	39.5	0	0	no	no	no	no
30	MA08-8036#	59.3	28.6	22.2	30.1	32.2	4.8 l	13.9	136.4	40.3	1	0	no	YES	no	no
31	M10-1659	50.3	26.1	18.6	18.4 l	24.0 l	2.7 l	12.5	136.3 l	40.0	3	0	no	no	no	no
32	M10-1615	55.2	24.1	17.2	23.6 l	28.2	7.0	13.3	136.1 l	37.8	1	0	no	no	no	no
33	M10*1307#	70.1 h	33.3	26.8	38.4	42.5	8.9	22.0	138.0	36.8	0	1	no	no	no	YES
34	IL06-23571	63.3	30.5	22.9	23.9 l	32.6	4.2 l	8.2	135.8 l	41.3	2	0	no	no	no	no
35	IL07-19334	45.8 l	18.3 l	11.0 l	18.0 l	21.5 l	6.0	9.5	139.3	38.0	5	0	no	no	no	*N7840?*
36	IL07-20728	54.4	25.6	17.4	21.4 l	28.9	4.9 l	18.0	137.9	38.8	2	0	no	no	no	no
37	IL07-20743	50.0	23.1	14.4 l	14.0 l	21.7 l	4.2 l	14.8	137.6	40.8	4	0	no	no	no	no
38	KY05C-1369-13-7-3	55.3	25.0	18.9	21.3 l	27.9 l	5.4 l	17.6	138.3	38.8	3	0	HET	no	no	no
39	KY05C-1020-2-19-1	42.0 l	13.2 l	8.7 l	23.6 l	22.8 l	4.2 l	9.4	138.2	40.3	6	0	HET	no	no	no
40	KY05C-1600-92-9-5	61.2	27.3	21.0	38.1	37.5	8.1	20.4	139.8	37.3	0	0	no	no	no	no
41	KY05C-1051-37-18-5	68.7 h	29.9	23.5	26.4 l	35.3	7.5	15.2	138.8	41.0	1	1	no	no	no	no
42	KY05C-1105-43-10-3	65.8 h	30.9	24.0	31.7	37.8	6.8	15.7	138.6	39.8	0	1	no	no	no	no
43	MD05W10208-12-16	63.3	33.5	24.5	32.9	37.7	6.0	15.9	137.6	36.5	0	0	YES	no	no	no
44	MDC07026-12-42	65.9 h	30.2	24.6	29.3	36.0	3.3 l	17.7	137.7	36.8	1	1	YES	no	no	*N7840*
45	MDC07027-12-12	42.8 l	23.1	12.3 l	15.7 l	20.1 l	2.0 l	10.8	138.1	39.5	5	0	YES	no	YES	*N7840*
46	MDC07027-12-24	36.7 l	19.1 l	11.0 l	16.4 l	19.1 l	2.6 l	10.5	139.1	36.8	6	0	YES	no	YES	*N7840*
47	MO111134	56.7	25.0	18.8	28.7	34.6	8.6	9.2	136.4	34.3 l	0	0	no	no	no	no
48	MO111359	59.2	30.4	21.3	35.0	38.1	10.1	15.0	140.9	40.8	0	0	no	no	no	no
49	MO110719	60.7	29.2	20.5	36.0	39.2	10.5	7.5	141.5	36.5	0	0	no	YES	no	HET
50	MO100647	47.8 l	24.2	16.3 l	23.5 l	25.7 l	6.0	10.9	140.8	47.2 h	4	0	no	no	no	nd
51	BAKHSH24	61.9	31.6	21.6	40.9	43.5	6.4	20.2	139.3	37.3	0	0	YES	no	no	no
52	BAKHSH33	69.1 h	33.2	26.6	43.4	46.3	8.2	22.6	138.7	34.5 l	0	1	YES	no	no	no
53	BAKHSH35	62.8	34.2	25.5	36.1	39.9	7.4	13.3	140.0	37.0	0	0	YES	no	no	no
54	NW10401	45.3 l	37.4	20.8	39.6	36.6	8.1	20.8	137.3	40.3	1	0	no	no	no	no
55	NE06607	58.9	39.5	27.0	48.2	44.1	10.2	14.4	139.1	37.0	0	0	no	no	no	no
56	VA09W-188WS	70.5 h	47.8 h	36.9	49.6 h	51.8	13.3	23.9	137.3	37.8	0	3	no	no	no	no
57	VA08MAS-369	72.5 h	39.5	31.4	41.0	46.2	11.1	17.6	138.7	36.5	0	1	no	no	no	no
58	VA10W-123	69.0 h	43.8 h	34.3	45.7	48.3	9.6	31.3	136.4	36.5	0	2	no	no	no	no
59	VA11W-FHB39	56.6	34.4	23.0	38.8	39.1	7.7	16.7	137.6	33.0 l	0	0	no	no	no	no
60	VA11W-FHB40	60.5	26.0	20.9	36.3	37.5	7.4	12.7	136.9	36.3	0	0	YES	no	no	no
100	AVERAGE	60.1	32.0	23.8	34.5	38.0	8.6	17.5	138.9	38.2						
101	MINUMUM	36.7	13.2	8.7	14.0	19.1	2.0	4.9	135.1	33.0						
102	MAXIMUM	75.9	51.4	47.9	62.9	61.9	18.2	37.3	144.8	47.2						
103	LSD(0.05)	11.7	9.5	8.0	13.5	9.0	3.7		1.2	2.4						

Table 9. Summary of all FHB traits from the 2012-2013 PNUWWSN: " h" and "l" indicate means that are not significantly different from the highest (h) or lowest (l) mean in that column.

ENTRY	NAME	INC	SEV	IND	FDK	ISK	DON	HD	HGT	#l	#h	Fhb 1	Massey 3BL	2DL	Ernie 5A
1	TRUMAN	32.1 l	11.9 l	5.1 l	23.7 l	17.2 l	6.7 l	146 h	41.0	6	0	no	no	no	no
2	ERNIE	51.7	24.2	15.2	35.4	27.8	7.6	140 l	40.0	0	0	no	YES	no	HET
3	FREEDOM	56.0	25.0	17.4	44.8	36.6	8.5	144	41.0	0	0	no	HET	no	no
4	PIONEER2545	77.0 h	50.7 h	42.3 h	59.1 h	56.8 h	20.5 h	142	40.0	0	6	no	no	no	no
5	KWS 015	67.4 h	33.6	27.8	45.3	43.7	16.0	145 h	41.0	0	1	no	no	no	no
6	KWS 008	59.1	41.0	29.0	52.3 h	46.3	12.3	143	39.5	0	1	no	no	no	no
7	KWS 011	56.9	30.5	18.6	47.1 h	41.5	10.7	141	38.0	0	1	no	no	no	no
8	KWS 012	52.1	35.7	21.2	38.3	38.6	7.3	143	39.0	0	0	no	YES	no	no
9	KWS 016	69.0 h	40.2	30.9	46.1 h	46.3	17.9 h	145 h	38.5	0	3	no	no	no	no
10	KWS 017	60.7	38.7	27.3	41.2	41.6	13.1	144	40.0	0	0	no	no	no	no
11	KWS 019	62.0	31.3	23.9	44.0	41.5	14.5	143	39.0	0	0	no	no	no	no
12	F1012	56.6	21.7	17.2	44.6	33.8	16.2	142	39.0	0	0	HET	no	no	no
13	F1014	44.2	17.5 l	12.3 l	44.4	30.6	13.3	146 h	39.0	2	0	YES	no	no	no
14	OH07-264-35	61.1	34.7	25.0	31.3 l	36.3	8.4	141	43.0	1	0	no	YES	no	no
15	OH08-99-50	45.2	28.2	14.8	21.1 l	23.8 l	7.5	144	42.0	2	0	no	no	no	no
16	OH08-207-33	45.3	21.1	12.6	36.1	28.1	7.5	141	42.5	0	0	no	no	no	no
17	OH08-99-41	29.5 l	18.8 l	7.5 l	28.1 l	19.3 l	8.6	143	41.5	5	0	no	no	no	no
18	OH08-155-16	59.8	23.6	16.8	35.0	32.1	7.2 l	141	42.0	1	0	no	no	no	YES
19	OH08-182-4	49.0	27.0	15.3	46.4 h	36.1	12.1	141	40.0	0	1	no	YES	no	no
20	0722A1-1-7	45.6	20.3 l	12.8	27.6 l	25.9	5.5 l	141	41.0	3	0	HET	no	no	no
21	05247A1-7-3-27	63.6 h	30.4	20.4	42.4	40.0	9.2	140	35.5	0	1	no	no	no	no
22	082A1-55-4	60.5	26.8	19.6	49.0 h	39.0	8.0	141	38.5	0	1	no	no	no	no
23	0858A1-33-2	59.3	26.3	18.3	42.7	37.4	7.7	141	42.0	0	0	YES	no	no	no
24	0527A1-9-15-181	67.0 h	32.5	25.8	50.6 h	46.1	12.7	142	36.0	0	2	no	no	no	*N7840?*
25	IL08-22206	48.2	21.7	13.5	29.0 l	27.8	5.3 l	139 l	39.0	2	0	no	YES	no	HET
26	IL08-8844	46.4	18.0 l	10.7 l	26.5 l	23.3 l	4.5 l	141	40.5	5	0	no	no	no	no
27	IL09-3259	45.8	25.5	14.4	33.4	31.9	5.0 l	141	41.5	1	0	no	no	no	no
28	IL09-3264	50.4	20.7 l	13.0	26.5 l	24.7 l	3.3 l	139 l	37.0	4	0	no	YES	no	no
29	IL09-15973	48.9	17.8 l	11.3 l	25.1 l	22.0 l	4.7 l	138 l	41.5	5	0	no	no	no	no
30	IL09-24328	45.0	19.2 l	11.3 l	25.7 l	21.8 l	5.4 l	139 l	42.0	5	0	no	no	no	HET
31	KY06C-1003-140-3-3	47.7	16.9 l	11.4 l	19.1 l	21.2 l	6.8 l	140	40.5	5	0	no	no	no	no
32	KY05C-1113-47-9-3	52.9	27.2	16.0	37.1	34.5	11.5	142	44.0	0	0	no	no	no	no
33	KY05C-1105-44-15-1	57.0	31.0	22.8	46.6 h	40.8	8.4	143	43.0	0	1	no	no	no	YES
34	KY05C-1105-42-14-1	55.5	20.3 l	15.6	38.2	34.4	8.5	141	42.5	1	0	no	no	no	no
35	KY05C-1033-31-15-1	52.9	22.7	15.6	29.6 l	28.6	4.3 l	140	40.5	2	0	no	no	no	no
36	MO111495	47.5	22.2	15.1	36.0	33.7	10.6	144	40.0	0	0	no	no	no	no
37	MO111491	40.7 l	20.4 l	11.6 l	30.7 l	26.5	7.7	141	41.0	4	0	no	no	no	no
38	MO111409	52.6	20.8 l	15.9	34.2	31.3	9.0	140	39.5	1	0	no	YES	no	no
39	MO110799	41.0 l	20.5 l	12.7	30.9 l	28.5	7.2	142	43.5	3	0	no	no	no	no
40	MO110767	46.7	20.7 l	13.5	28.0 l	30.1	9.0	142	42.0	2	0	no	no	no	no
41	MO111585	47.4	28.3	16.0	28.5 l	28.1	6.5 l	143	45.5	2	0	no	no	no	no
42	VA11W-FHB4	43.1 l	23.6	13.7	28.8 l	25.8	3.7 l	141	43.5	3	0	no	no	no	no
43	VA11W-FHB13	51.9	20.5 l	15.9	35.5	32.0	6.2 l	141	39.5	2	0	no	no	no	no
44	VA11W-FHB38	54.5	23.3	16.1	35.8	33.2	7.0 l	143	40.5	1	0	no	no	no	no
45	VA11W-FHB71	52.0	25.7	16.2	32.3	29.0	8.1	142	39.5	0	0	no	no	no	no
46	OH08-180-48	56.4	34.1	22.2	51.8 h	45.8	10.8	145	38.5	0	1	no	no	no	no
100	AVERAGE	52.5	25.9	17.4	36.5	32.9	8.9	142	40.5						
101	MINUMUM	29.5	11.9	5.1	19.1	17.2	3.3	138	35.5						
102	MAXIMUM	77.0	50.7	42.3	59.1	56.8	20.5	146	45.5						
103	LSD(0.05)	13.8	9.0	7.4	13.1	8.5	3.9	2	.						

Table 10. Summary of incidence (INC, %) from 2012-13 NUWWSN.

				1	1	1	1	1	2	2	2	2	2	2	Clust. 1	Clust. 2
ENTRY	NAME	AVG		MDSAL	MOCOL	NEMEA	NYITH	VABLA	ILCHA	ILURB	INHAR	INLAF	KYLEX	MIELA	Avg	Avg
20	TRUMAN	42.2	l	100.0	70.0	100.0	28.0	42.5	7.5	38.3	5.0	5.0	52.5	15.0	68.1	20.6
1	ERNIE	57.0		100.0	80.0	90.0	21.0	35.0	30.0	90.0	40.0	20.0	47.5	73.3	65.2	50.1
2	FREEDOM	63.0		95.0	90.0	100.0	40.0	70.0	25.0	96.7	60.0	22.5	50.0	43.3	79.0	49.6
3	PIONEER2545	75.2	h	95.0	100.0	100.0	55.0	87.5	65.0	95.0	70.0	42.5	55.0	61.7	87.5	64.9
4	NY07104-141	53.4		95.0	95.0	80.0	49.0	30.0	15.0	33.3	25.0	7.5	77.5	80.0	69.8	39.7
5	NY99069-WC	54.5		95.0	95.0	100.0	48.0	72.5	15.0	43.3	22.5	15.0	72.5	20.3	82.1	31.4
6	NY99045-3110	59.6		100.0	100.0	87.0	59.0	65.0	12.5	50.0	72.5	12.5	80.0	16.7	82.2	40.7
7	NY99056-161	43.6	l	95.0	60.0	87.0	44.0	40.0	5.0	53.3	22.5	12.5	30.0	30.0	65.2	25.6
8	KWS009	75.9	h	100.0	85.0	100.0	25.0	62.5	50.0	96.7	77.5	65.0	95.0	78.3	74.5	77.1
9	KWS010	70.5	h	100.0	95.0	100.0	45.0	72.5	40.0	98.3	42.5	30.0	65.0	86.7	82.5	60.4
10	KWS013	75.9	h	100.0	95.0	100.0	46.0	35.0	70.0	86.7	65.0	60.0	95.0	81.7	75.2	76.4
11	KWS014	68.6	h	100.0	100.0	100.0	60.0	60.0	25.0	90.0	70.0	30.0	60.0	60.0	84.0	55.8
12	LCS10727	60.4		100.0	75.0	100.0	12.0	55.0	30.0	91.7	60.0	30.0	72.5	38.3	68.4	53.8
13	LCS13531	66.9	h	100.0	85.0	100.0	43.0	57.5	20.0	83.3	57.5	30.0	92.5	66.7	77.1	58.3
14	LCS19228	70.9	h	100.0	80.0	100.0	26.0	47.5	40.0	99.3	65.0	45.0	97.5	80.0	70.7	71.1
15	LCS19707	60.5		100.0	70.0	100.0	15.0	57.5	20.0	96.7	40.0	25.0	87.5	53.3	68.5	53.8
16	F0013R	67.4	h	100.0	95.0	100.0	37.5	72.5	45.0	88.3	52.5	20.0	77.5	53.3	81.0	56.1
17	F0065	73.2	h	100.0	90.0	90.0	72.0	52.5	60.0	94.3	67.5	42.5	80.0	56.7	80.9	66.8
18	F1003R	53.7		100.0	90.0	100.0	17.5	47.5	10.0	96.7	27.5	10.0	55.0	36.7	71.0	39.3
19	F1029	60.6		100.0	65.0	100.0	25.0	47.5	15.0	98.3	37.5	15.0	80.0	83.3	67.5	54.9
21	OH07-263-3	58.7		100.0	75.0	100.0	22.0	45.0	30.0	93.3	30.0	32.5	57.5	60.0	68.4	50.6
22	OH08-172-42	67.7	h	100.0	95.0	100.0	20.0	65.0	30.0	91.7	67.5	15.0	95.0	65.0	76.0	60.7
23	OH08-269-58	64.8	h	100.0	95.0	100.0	35.0	45.0	50.0	93.3	55.0	27.5	67.5	45.0	75.0	56.4
24	05247A1-7-7-3-1	58.0		100.0	85.0	100.0	37.5	62.5	17.5	70.0	37.5	17.5	50.0	60.0	77.0	42.1
25	05287A1-1-13	57.4		100.0	85.0	100.0	32.5	40.0	15.0	60.0	27.5	15.0	95.0	61.7	71.5	45.7
26	0762A1-2-8	54.2		100.0	70.0	70.0	20.0	55.0	10.0	81.7	40.0	5.0	80.0	65.0	63.0	47.0
27	05247A1-7-3-120	68.4	h	100.0	80.0	100.0	36.0	62.5	35.0	98.3	52.5	30.0	90.0	68.3	75.7	62.4
28	05264A1-1-3-33	65.3	h	100.0	80.0	100.0	25.0	60.0	20.0	96.7	67.5	20.0	82.5	66.7	73.0	58.9
29	MH07-7474	56.8		100.0	80.0	100.0	27.5	55.0	35.0	76.7	27.5	20.0	75.0	28.3	72.5	43.8
30	MA08-8036#	59.3		100.0	85.0	77.0	14.0	25.0	30.0	85.0	42.5	37.5	72.5	83.3	60.2	58.5
31	M10-1659	50.3		100.0	70.0	80.0	13.0	25.0	40.0	80.0	10.0	30.0	32.5	73.3	57.6	44.3
32	M10-1615	55.2		100.0	65.0	73.0	17.0	47.5	35.0	85.0	32.5	20.0	62.5	70.0	60.5	50.8
33	M10*1307#	70.1	h	100.0	65.0	100.0	35.0	77.5	60.0	81.7	52.5	30.0	97.5	71.7	75.5	65.6
34	IL06-23571	63.3		100.0	70.0	100.0	25.0	40.0	30.0	95.0	60.0	27.5	70.0	78.3	67.0	60.1
35	IL07-19334	45.8	l	100.0	80.0	90.0	30.0	50.0	20.0	53.0	12.5	7.5	27.5	33.3	70.0	25.6
36	IL07-20728	54.4		100.0	45.0	70.0	15.0	57.5	25.0	78.3	50.0	20.0	72.5	65.0	57.5	51.8
37	IL07-20743	50.0		100.0	70.0	90.0	8.0	45.0	20.0	53.3	15.0	12.5	65.0	71.7	62.6	39.6
38	KY05C-1369-13-7-3	55.3		100.0	55.0	73.0	15.0	40.0	40.0	98.3	32.5	15.0	67.5	71.7	56.6	54.2
39	KY05C-1020-2-19-1	42.0	l	100.0	75.0	33.0	9.0	50.0	30.0	51.7	30.0	5.0	70.0	8.3	53.4	32.5
40	KY05C-1600-92-9-5	61.2		100.0	80.0	100.0	16.0	55.0	30.0	90.0	40.0	12.5	72.5	76.7	70.2	53.6
41	KY05C-1051-37-18-5	68.7	h	100.0	100.0	100.0	57.5	52.5	50.0	98.3	57.5	22.5	57.5	60.0	82.0	57.6
42	KY05C-1105-43-10-3	65.8	h	100.0	70.0	100.0	27.5	52.5	35.0	85.0	57.5	20.0	95.0	81.7	70.0	62.4
43	MD05W10208-12-16	63.3		100.0	75.0	87.0	11.0	77.5	30.0	97.7	32.5	12.5	95.0	78.3	70.1	57.7
44	MDC07026-12-42	65.9	h	100.0	75.0	100.0	0.0	70.0	40.0	93.3	65.0	20.0	80.0	81.7	69.0	63.3
45	MDC07027-12-12	42.8	l	100.0	70.0	63.0	10.0	20.0	20.0	28.3	12.5	15.0	62.5	70.0	52.6	34.7
46	MDC07027-12-24	36.7	l	100.0	55.0	53.0	7.5	27.5	7.5	31.7	7.5	7.5	50.0	56.7	48.6	26.8
47	MO111134	56.7		100.0	50.0	83.0	34.0	40.0	25.0	86.0	45.0	30.0	87.5	43.3	61.4	52.8
48	MO111359	59.2		100.0	100.0	100.0	25.0	70.0	20.0	85.0	35.0	20.0	67.5	28.3	79.0	42.6
49	MO110719	60.7		100.0	100.0	87.0	44.0	80.0	15.0	80.0	35.0	17.5	67.5	41.7	82.2	42.8
50	MO100647	47.8	l	100.0	90.0	87.0	20.0	15.0	20.0	76.7	25.0	22.5	7.5	61.7	62.4	35.6
51	BAKHSH24	61.9		100.0	70.0	100.0	20.0	85.0	20.0	91.7	40.0	20.0	87.5	46.7	75.0	51.0
52	BAKHSH33	69.1	h	100.0	75.0	100.0	45.0	85.0	20.0	83.3	67.5	15.0	92.5	76.7	81.0	59.2
53	BAKHSH35	62.8		100.0	100.0	87.0	15.0	70.0	35.0	88.3	57.5	17.5	70.0	50.0	74.4	53.1
54	NW10401	45.3	l	100.0	65.0	100.0	12.0	25.0	20.0	60.0	20.5	20.0	32.5	43.3	60.4	32.7
55	NE06607	58.9		100.0	75.0	70.0	11.0	55.0	30.0	96.7	37.5	30.0	77.5	65.0	62.2	56.1
56	VA09W-188WS	70.5	h	100.0	80.0	90.0	19.0	65.0	55.0	98.3	72.5	50.0	77.5	68.3	70.8	70.3
57	VA08MAS-369	72.5	h	100.0	95.0	100.0	37.5	82.5	45.0	88.3	62.5	45.0	75.0	66.7	83.0	63.8
58	VA10W-123	69.0	h	100.0	75.0	87.0	37.0	62.5	55.0	98.3	70.0	50.0	57.5	66.7	72.3	66.3
59	VA11W-FHB39	56.6		100.0	80.0	73.0	27.0	77.5	20.0	86.7	30.0	35.0	40.0	53.3	71.5	44.2
60	VA11W-FHB40	60.5		100.0	70.0	96.0	18.0	60.0	25.0	98.3	35.0	25.0	70.0	68.3	68.8	53.6
100	AVERAGE	60.1		99.6	79.8	90.9	28.3	54.8	29.8	81.4	43.8	23.9	69.6	59.1	70.7	51.3
101	MINUMUM	36.7		95.0	45.0	33.0	0.0	15.0	5.0	28.3	5.0	5.0	7.5	8.3		
102	MAXIMUM	75.9		100.0	100.0	100.0	72.0	87.5	70.0	99.3	77.5	65.0	97.5	86.7		
103	LSD(0.05)	11.7		.	.	.	.	.	.	.	.	.	.	.		

Table 11. Summary of severity (SEV, %) data from the 2012-2013 NUWWSN

				1	1	1	2	2	3	3	3	3	3	3	Clust. 1	Clust. 2	Clust. 3
ENTRY	NAME	AVG		ILCHA	ILURB	NEMEA	INHAR	MDSAL	INLAF	KYLEX	MIELA	MOCOL	NYITH	VABLA	Avg	Avg	Avg
20	TRUMAN	16.4	l	15.0	15.5	16.0	3.5	60.0	5.3	23.5	16.3	8.9	9.0	7.4	15.5	31.8	11.7
1	ERNIE	27.9		20.0	39.8	20.0	40.0	70.0	12.7	31.9	36.0	15.1	12.4	9.5	26.6	55.0	19.6
2	FREEDOM	28.0		45.0	37.4	24.0	20.0	65.0	6.5	24.9	33.0	22.8	11.0	18.5	35.5	42.5	19.5
3	PIONEER2545	48.9	h	60.0	81.0	45.0	60.0	90.0	29.6	32.4	39.0	40.5	18.0	42.5	62.0	75.0	33.7
4	NY07104-141	22.3	l	35.0	17.5	21.0	17.5	30.0	12.5	24.2	29.7	45.5	9.8	2.4	24.5	23.8	20.7
5	NY99069-WC	28.1		50.0	23.0	26.0	30.0	45.0	27.5	27.5	22.7	34.0	14.6	9.1	33.0	37.5	22.6
6	NY99045-3110	33.3		40.0	43.6	21.0	52.5	50.0	19.4	45.4	17.7	50.2	15.2	11.0	34.9	51.3	26.5
7	NY99056-161	23.0		25.0	35.7	14.0	10.0	70.0	15.5	29.2	26.0	9.0	14.8	4.0	24.9	40.0	16.4
8	KWS009	45.8	h	60.0	61.1	41.0	75.0	100.0	12.0	51.8	41.7	28.8	8.0	24.5	54.0	87.5	27.8
9	KWS010	41.4		60.0	51.4	37.0	60.0	95.0	12.5	41.0	37.3	25.9	16.0	19.4	49.5	77.5	25.4
10	KWS013	51.4	h	85.0	89.6	70.0	55.0	100.0	13.9	54.6	47.3	27.2	17.0	5.4	81.5	77.5	27.6
11	KWS014	38.7		45.0	55.8	33.0	50.0	90.0	33.6	32.1	28.7	29.3	15.5	13.2	44.6	70.0	25.4
12	LCS10727	35.9		45.0	69.0	41.0	25.0	95.0	27.8	28.2	31.3	14.4	6.0	12.7	51.7	60.0	20.1
13	LCS13531	32.9		30.0	44.8	18.0	65.0	80.0	14.1	40.3	29.7	15.4	11.8	12.4	30.9	72.5	20.6
14	LCS19228	42.8	h	50.0	77.7	45.0	47.5	95.0	22.5	38.1	41.7	23.6	10.6	18.8	57.6	71.3	25.9
15	LCS19707	35.2		25.0	85.6	29.0	45.0	80.0	20.2	42.3	26.0	16.2	6.0	12.1	46.5	62.5	20.5
16	F0013R	37.1		55.0	31.9	51.0	42.5	95.0	7.6	39.0	37.0	24.3	12.5	12.7	46.0	68.8	22.2
17	F0065	49.3	h	85.0	84.7	53.0	37.5	85.0	43.8	51.9	37.0	19.2	23.2	22.2	74.2	61.3	32.9
18	F1003R	25.3		10.0	26.7	34.0	40.0	80.0	4.6	26.6	29.7	16.1	6.0	4.3	23.6	60.0	14.6
19	F1029	30.6		25.0	50.9	32.0	40.0	80.0	6.7	31.2	44.7	14.3	6.0	5.8	36.0	60.0	18.1
21	OH07-263-3	34.0		30.0	50.9	25.0	60.0	80.0	13.2	39.8	29.7	28.7	9.0	7.9	35.3	70.0	21.4
22	OH08-172-42	34.9		30.0	56.4	28.0	55.0	85.0	5.3	39.0	38.7	17.4	13.8	15.1	38.1	70.0	21.6
23	OH08-269-58	47.2	h	80.0	70.7	53.0	57.5	95.0	27.3	46.4	31.3	20.6	16.0	20.9	67.9	76.3	27.1
24	05247A1-7-7-3-1	32.6		75.0	37.9	35.0	35.0	70.0	13.9	28.1	27.0	13.9	16.5	6.8	49.3	52.5	17.7
25	05287A1-1-13	31.8		25.0	30.8	24.0	55.0	85.0	9.0	35.4	37.0	21.6	18.5	8.1	26.6	70.0	21.6
26	0762A1-2-8	20.3	l	27.5	18.6	16.0	10.0	55.0	4.0	28.3	39.0	8.0	6.0	11.1	20.7	32.5	16.1
27	05247A1-7-3-120	34.6		40.0	36.2	37.0	60.0	80.0	18.1	39.2	29.7	17.6	12.0	11.2	37.7	70.0	21.3
28	05264A1-1-3-33	36.5		25.0	57.8	25.0	85.0	100.0	7.9	35.0	29.7	13.1	8.8	14.1	35.9	92.5	18.1
29	MH07-7474	36.0		50.0	66.0	38.0	25.0	80.0	19.0	39.8	29.7	15.1	14.5	18.7	51.3	52.5	22.8
30	MA08-8036#	28.6		20.0	33.1	24.0	25.0	90.0	10.4	33.7	49.7	18.2	7.2	3.4	25.7	57.5	20.4
31	M10-1659	26.1		35.0	38.0	25.0	15.0	85.0	13.0	14.8	38.7	9.8	6.8	5.9	32.7	50.0	14.8
32	M10-1615	24.1		30.0	32.1	17.0	25.0	70.0	7.4	13.4	35.7	17.5	7.2	10.2	26.4	47.5	15.2
33	M10*1307#	33.3		25.0	35.1	25.0	47.5	95.0	9.5	36.5	47.7	12.8	10.0	22.7	28.4	71.3	23.2
34	IL06-23571	30.5		50.0	33.3	47.0	27.5	90.0	8.6	21.8	34.3	9.4	7.6	5.8	43.4	58.8	14.6
35	IL07-19334	18.3	l	25.0	17.9	8.0	12.5	55.0	5.3	18.7	24.0	22.0	7.0	5.9	17.0	33.8	13.8
36	IL07-20728	25.6		30.0	33.1	16.0	15.0	75.0	8.8	34.8	37.0	6.6	14.2	11.5	26.4	45.0	18.8
37	IL07-20743	23.1		30.0	22.3	10.0	22.5	70.0	10.9	22.6	38.7	10.0	8.0	9.2	20.8	46.3	16.6
38	KY05C-1369-13-7-3	25.0		20.0	34.5	11.0	27.5	90.0	6.7	27.5	37.0	6.5	9.0	5.8	21.8	58.8	15.4
39	KY05C-1020-2-19-1	13.2	l	5.0	11.5	5.0	20.0	45.0	3.0	24.1	14.7	5.9	4.8	6.1	7.2	32.5	9.8
40	KY05C-1600-92-9-5	27.3		35.0	41.1	22.0	27.5	75.0	6.0	31.5	32.7	11.6	9.6	8.0	32.7	51.3	16.6
41	KY05C-1051-37-18-5	29.9		35.0	38.0	20.0	42.5	90.0	5.8	23.6	31.3	16.5	18.5	8.1	31.0	66.3	17.3
42	KY05C-1105-43-10-3	30.9		25.0	28.5	23.0	70.0	95.0	9.8	20.2	44.3	8.8	9.5	5.6	25.5	82.5	16.4
43	MD05W10208-12-16	33.5		30.0	32.4	17.0	65.0	80.0	4.6	49.8	44.3	26.3	3.6	15.9	26.5	72.5	24.1
44	MDC07026-12-42	30.2		20.0	39.0	17.0	62.5	85.0	5.6	30.2	44.7	15.6	0.0	12.3	25.3	73.8	18.1
45	MDC07027-12-12	23.1		30.0	17.1	7.0	55.0	50.0	5.2	26.3	38.7	16.9	6.0	2.3	18.0	52.5	15.9
46	MDC07027-12-24	19.1	l	15.0	13.1	9.0	27.5	60.0	2.8	22.3	31.3	6.7	20.5	1.9	12.4	43.8	14.3
47	MO111134	25.0		15.0	29.1	17.0	40.0	80.0	12.3	29.2	33.0	5.6	8.4	5.2	20.4	60.0	15.6
48	MO111359	30.4		55.0	47.0	21.0	35.0	70.0	4.2	35.6	24.0	20.5	6.5	15.5	41.0	52.5	17.7
49	MO110719	29.2		30.0	47.2	18.0	50.0	75.0	6.9	23.7	28.0	13.9	13.4	15.0	31.7	62.5	16.8
50	MO100647	24.2		50.0	38.7	27.0	12.5	60.0	17.4	10.6	29.7	12.4	6.5	1.2	38.6	36.3	13.0
51	BAKHSH24	31.6		20.0	28.6	24.0	32.5	70.0	17.4	38.9	31.3	15.0	55.0	15.3	24.2	51.3	28.8
52	BAKHSH33	33.2		30.0	35.9	25.0	57.5	80.0	11.7	38.1	40.0	10.6	11.5	25.3	30.3	68.8	22.9
53	BAKHSH35	34.2		35.0	44.4	20.0	55.0	80.0	18.9	33.1	29.7	35.4	14.0	10.9	33.1	67.5	23.7
54	NW10401	37.4		65.0	63.4	43.0	62.5	75.0	15.3	27.8	32.7	13.0	10.2	3.0	57.1	68.8	17.0
55	NE06607	39.5		70.0	72.2	20.0	65.0	90.0	6.9	46.1	31.3	14.0	8.0	11.4	54.1	77.5	19.6
56	VA09W-188WS	47.8	h	85.0	86.5	38.0	52.5	90.0	32.8	46.2	31.7	16.4	19.2	27.1	69.8	71.3	28.9
57	VA08MAS-369	39.5		70.0	47.2	43.0	40.0	85.0	9.5	46.5	37.3	19.0	12.5	24.9	53.4	62.5	25.0
58	VA10W-123	43.8	h	70.0	58.1	61.0	45.0	100.0	17.3	44.3	42.7	11.6	10.8	21.2	63.0	72.5	24.7
59	VA11W-FHB39	34.4		50.0	48.1	29.0	50.0	90.0	10.9	17.9	33.0	12.7	9.0	27.5	42.4	70.0	18.5
60	VA11W-FHB40	26.0		15.0	37.7	14.0	32.5	80.0	4.9	31.4	38.7	12.2	7.8	12.2	22.2	56.3	17.9
100	AVERAGE	32.0		39.5	43.9	27.6	41.3	78.5	12.9	32.8	33.9	17.8	11.7	12.3	37.0	59.9	20.2
101	MINUMUM	13.2		5.0	11.5	5.0	3.5	30.0	2.8	10.6	14.7	5.6	0.0	1.2			
102	MAXIMUM	51.4		85.0	89.6	70.0	85.0	100.0	43.8	54.6	49.7	50.2	55.0	42.5			
103	LSD(0.05)	9.5		.	.	.	.	.	.	.	.	.	.	.			

Table 12. Summary of index (IND, %) data from the 2012-13 NUWWSN.

			1	1	1	1	1	2	2	2	2	2	2	2	Clust. 1	Clust. 2
NAME	AVG		INLAF	MIELA	MOCOL	NYITH	VABLA	ILCHA	ILURB	INHAR	KYLEX	MDSAL	NEMEA	OHWOO	Avg	Avg
TRUMAN	10.0	l	0.3	2.5	6.6	2.5	3.1	1.3	6.0	0.2	12.8	50.0	16.0	18.8	3.0	15.0
ERNIE	20.4		2.5	26.4	12.1	2.6	3.4	6.0	37.5	17.0	18.0	70.0	18.0	31.6	9.4	28.3
FREEDOM	21.4		1.5	14.3	20.4	4.4	12.9	10.5	35.8	12.0	14.0	62.0	24.0	44.9	10.7	29.0
PIONEER2545	41.9	h	12.6	24.1	40.5	9.9	37.4	39.0	77.0	42.0	20.1	85.5	45.0	69.6	24.9	54.0
NY07104-141	14.3	l	0.9	23.7	44.2	4.8	0.7	5.0	6.0	4.5	20.8	28.5	17.0	15.3	14.9	13.9
NY99069-WC	15.5	l	4.1	4.6	33.2	7.0	6.6	7.5	9.8	6.1	23.3	43.0	26.0	14.5	11.1	18.6
NY99045-3110	22.6		2.4	2.9	50.2	9.0	7.2	5.0	23.9	38.6	36.2	50.0	18.0	28.2	14.3	28.6
NY99056-161	14.0	l	1.9	7.8	5.7	6.5	1.8	1.3	19.5	2.2	9.5	68.0	12.0	31.7	4.7	20.6
KWS009	39.1		7.8	32.6	24.5	2.0	15.2	30.0	58.4	58.0	50.3	100.0	41.0	49.0	16.4	55.2
KWS010	31.9		3.8	32.4	25.0	7.2	14.2	24.0	50.5	24.3	27.7	95.0	37.0	41.8	16.5	42.9
KWS013	47.9	h	8.3	38.7	25.9	7.8	1.9	60.0	77.8	36.5	52.1	100.0	70.0	96.2	16.5	70.4
KWS014	29.5		10.1	17.2	29.3	9.3	7.9	12.0	50.4	35.0	18.7	90.0	33.0	41.5	14.8	40.1
LCS10727	27.5		8.3	12.0	11.0	0.7	6.9	13.5	63.3	14.5	21.1	95.0	41.0	42.1	7.8	41.5
LCS13531	25.2		4.2	19.8	13.2	5.1	7.2	7.0	37.6	38.5	37.8	80.0	18.0	34.2	9.9	36.2
LCS19228	35.2		10.1	33.3	19.2	2.8	8.8	20.0	77.2	30.3	37.3	95.0	45.0	43.2	14.8	49.7
LCS19707	27.5		5.1	13.9	11.3	0.9	6.9	5.0	82.5	18.0	37.1	80.0	29.0	40.0	7.6	41.7
F0013R	29.0		1.5	19.7	23.5	4.7	9.4	24.5	27.7	22.5	30.2	95.0	51.0	37.7	11.8	41.2
F0065	40.9	h	18.6	21.0	17.3	16.7	13.2	51.0	80.3	25.5	42.3	85.0	48.0	72.3	17.4	57.8
F1003R	18.5		0.5	10.9	14.5	1.1	2.1	1.0	25.5	10.5	14.5	80.0	34.0	27.4	5.8	27.6
F1029	24.2		1.0	37.2	9.1	1.5	2.9	3.5	50.2	15.8	24.7	80.0	32.0	33.0	10.3	34.2
OH07-263-3	23.9		4.3	17.8	22.4	2.0	3.7	9.0	47.4	18.0	20.2	80.0	25.0	36.6	10.0	33.7
OH08-172-42	27.5		0.8	25.1	16.2	2.8	10.3	9.0	50.9	35.3	37.1	85.0	28.0	29.0	11.0	39.2
OH08-269-58	35.0		7.5	14.1	20.0	5.6	10	40.0	66.7	31.5	30.8	95.0	53.0	45.8	11.4	51.8
05247A1-7-7-3-1	21.3		2.4	16.2	12.1	6.2	4.3	13.3	28.4	15.0	14.1	70.0	35.0	39.1	8.2	30.7
05287A1-1-13	22.3		1.4	22.8	19.1	6.0	3.2	4.0	18.0	15.5	33.4	85.0	24.0	35.8	10.5	30.8
0762A1-2-8	14.8	l	0.2	25.4	5.9	1.2	6.1	2.8	15.1	10.0	22.6	55.0	11.0	22.7	7.8	19.9
05247A1-7-3-120	26.6		5.4	20.3	14.1	4.3	6.8	14.5	35.7	30.8	35.9	80.0	37.0	34.3	10.2	38.3
05264A1-1-3-33	29.8		1.6	19.8	10.5	2.2	8.3	4.5	56.2	57.3	30.8	100.0	25.0	41.9	8.5	45.1
MH07-7474	25.1		3.8	8.4	12.1	4.0	10.3	17.5	50.4	7.0	30.3	80.0	38.0	39.0	7.7	37.5
MA08-8036#	22.2		3.9	41.4	15.6	1.0	1.3	6.0	27.7	10.5	26.3	90.0	18.0	24.9	12.6	29.1
M10-1659	18.6		3.9	28.4	6.8	0.9	1.5	14.0	29.3	1.5	4.8	85.0	20.0	26.6	8.3	25.9
M10-1615	17.2		1.5	25.0	12.0	1.2	4.8	11.0	27.0	8.3	9.6	70.0	12.0	24.3	8.9	23.2
M10*1307#	26.8		2.8	34.2	8.1	3.5	17.6	14.0	30.5	24.0	35.6	95.0	25.0	31.0	13.2	36.4
IL06-23571	22.9		2.4	26.9	6.7	1.9	2.3	15.0	31.4	16.1	15.3	90.0	47.0	19.5	8.0	33.5
IL07-19334	11.0	l	0.4	8.0	17.6	2.1	3	5.0	9.8	1.6	5.0	55.0	7.0	17.8	6.2	14.5
IL07-20728	17.4		1.8	24.1	3.0	2.1	6.6	7.0	25.7	7.5	25.5	75.0	11.0	19.6	7.5	24.5
IL07-20743	14.4	l	1.4	27.7	7.0	0.6	4	6.0	11.2	4.2	15.1	70.0	9.0	16.8	8.1	18.9
KY05C-1369-13-7-3	18.9		1.0	26.5	3.5	1.4	2.4	8.0	34.0	9.1	19.2	90.0	8.0	23.9	7.0	27.5
KY05C-1020-2-19-1	8.7	l	0.2	1.2	4.5	0.4	3.1	1.5	6.0	6.0	17.6	45.0	2.0	16.4	1.9	13.5
KY05C-1600-92-9-5	21.0		0.8	25.0	9.3	1.5	4.6	10.0	37.1	11.4	23.2	75.0	22.0	32.4	8.2	30.2
KY05C-1051-37-18-5	23.5		1.3	18.8	16.5	10.6	4.3	17.5	37.6	24.6	14.2	90.0	20.0	26.1	10.3	32.9
KY05C-1105-43-10-3	24.0		2.0	36.2	6.1	2.6	2.9	8.5	24.4	40.3	19.2	95.0	23.0	27.4	10.0	34.0
MD05W10208-12-16	24.5		0.6	34.7	19.7	0.4	13.5	9.0	31.7	18.0	47.2	80.0	15.0	23.8	13.8	32.1
MDC07026-12-42	24.6		1.1	36.5	11.5	0.0	9.3	8.0	36.3	41.5	23.9	85.0	17.0	24.7	11.7	33.8
MDC07027-12-12	12.3	l	0.8	27.1	11.8	0.6	0.5	6.0	5.1	6.8	17.5	50.0	5.0	16.4	8.2	15.3
MDC07027-12-24	11.0	l	0.2	17.8	3.8	1.5	0.5	1.3	4.1	2.1	11.0	60.0	5.0	24.6	4.8	15.4
MO111134	18.8		3.7	14.3	2.8	2.9	2.2	4.0	25.8	17.5	26.0	80.0	14.0	31.9	5.2	28.5
MO111359	21.3		0.8	6.8	20.5	1.6	12.1	11.0	39.7	12.5	24.0	70.0	21.0	35.4	8.4	30.5
MO110719	20.5		1.2	11.7	13.9	5.9	12.3	4.0	37.9	17.5	16.2	75.0	15.0	35.4	9.0	28.7
MO100647	16.3	l	3.9	18.3	11.1	1.3	0.4	10.0	31.3	3.0	0.8	60.0	23.0	32.8	7.0	23.0
BAKHSH24	21.6		3.5	14.6	10.5	11.0	12.8	4.0	26.4	12.6	33.9	70.0	24.0	36.2	10.5	29.6
BAKHSH33	26.6		1.8	30.7	8.1	5.2	21.5	6.0	29.6	39.0	34.6	80.0	25.0	37.9	13.5	36.0
BAKHSH35	25.5		3.3	14.8	35.4	2.1	7.6	12.5	39.0	31.5	23.8	80.0	18.0	37.5	12.6	34.6
NW10401	20.8		3.1	14.2	8.5	1.2	0.8	13.0	38.3	12.8	9.3	75.0	43.0	30.4	5.6	31.7
NE06607	27.0		2.1	20.4	10.7	0.9	6.5	21.0	70.0	23.3	35.6	90.0	14.0	29.0	8.1	40.4
VA09W-188WS	36.9		16.4	21.6	13.1	3.6	17.6	47.0	85.1	37.9	35.1	90.0	34.0	41.5	14.5	52.9
VA08MAS-369	31.4		4.3	24.9	18.1	4.7	20.6	31.0	42.2	25.8	36.5	85.0	43.0	40.1	14.5	43.4
VA10W-123	34.3		8.6	28.4	8.6	4.0	14.3	38.5	57.2	31.8	27.0	100.0	53.0	39.9	12.8	49.6
VA11W-FHB39	23.0		3.8	17.6	10.2	2.4	21.6	10.0	41.7	16.0	8.1	90.0	22.0	32.8	11.1	31.5
VA11W-FHB40	20.9		1.2	26.4	8.5	1.4	7.3	3.5	37.3	11.5	25.1	80.0	13.0	35.5	9.0	29.4
AVERAGE	23.8		3.6	21.1	15.2	3.7	7.9	13.4	37.9	20.0	24.5	78.1	26.0	33.8	10.3	33.4
MINUMUM	8.7		0.2	1.2	2.8	0.0	0.4	1.0	4.1	0.2	0.8	28.5	2.0	14.5		
MAXIMUM	47.9		18.6	41.4	50.2	16.7	37.4	60.0	85.1	58.0	52.1	100.0	70.0	96.2		
LSD(0.05)	8.0		.	.	.	.	.	.	.	.	.	.	.	.		

Table 13. Summary of Fusarium Damaged Kernel (FDK, %) data from the 2012-2013 NUWWSN.

				1	1	1	1	2	2	2	2	Clust. 1	Clust. 2
ENTRY	NAME	AVG		ILURB	INHAR	KYLEX	OHWOO	INLAF	NEMEA	NYITH	VABLA	Avg	Avg
20	TRUMAN	26.1	l	43.3	15.0	60.0	15.0	2.0	5.0	45.0	23.7	33.3	18.9
1	ERNIE	31.3		40.0	4.0	45.0	30.0	2.0	10.0	80.0	39.2	29.8	32.8
2	FREEDOM	43.0		53.3	40.0	55.0	60.0	5.0	14.0	85.0	31.9	52.1	34.0
3	PIONEER2545	57.6	h	88.3	45.0	70.0	80.0	20.0	21.0	90.0	46.6	70.8	44.4
4	NY07104-141	25.0	l	30.0	5.0	15.0	30.0	2.0	13.0	50.0	54.7	20.0	29.9
5	NY99069-WC	29.6		63.3	21.0	20.0	20.0	5.0	7.0	45.0	55.2	31.1	28.1
6	NY99045-3110	42.7		53.3	52.5	45.0	30.0	12.0	12.0	80.0	56.9	45.2	40.2
7	NY99056-161	35.2		51.7	20.0	55.0	40.0	7.0	8.0	50.0	49.5	41.7	28.6
8	KWS009	43.1		65.0	70.0	80.0	40.0	12.0	4.0	45.0	28.6	63.8	22.4
9	KWS010	45.4		75.0	42.5	77.5	35.0	2.0	5.0	80.0	46.2	57.5	33.3
10	KWS013	62.9	h	94.7	82.5	95.0	80.0	15.0	18.0	90.0	27.9	88.1	37.7
11	KWS014	37.9		46.7	40.0	60.0	40.0	10.0	9.0	40.0	57.5	46.7	29.1
12	LCS10727	36.7		68.3	35.0	70.0	55.0	2.0	4.0	30.0	29.3	57.1	16.3
13	LCS13531	35.5		36.7	45.0	80.0	30.0	12.0	9.0	35.0	36.4	47.9	23.1
14	LCS19228	43.4		76.7	60.0	75.0	65.0	5.0	11.0	20.0	34.3	69.2	17.6
15	LCS19707	43.1		60.0	32.5	85.0	55.0	2.0	8.0	70.0	32.3	58.1	28.1
16	F0013R	34.4		46.7	11.5	75.0	35.0	20.0	8.0	45.0	34.2	42.1	26.8
17	F0065	49.0		68.3	52.5	75.0	70.0	5.0	22.0	45.0	54.5	66.5	31.6
18	F1003R	35.5		63.3	35.0	62.5	35.0	2.0	5.0	55.0	26.2	49.0	22.1
19	F1029	35.4		60.0	27.5	50.0	30.0	2.0	16.0	40.0	57.7	41.9	28.9
21	OH07-263-3	25.6	l	46.7	22.5	35.0	35.0	2.0	12.0	30.0	21.5	34.8	16.4
22	OH08-172-42	36.8		48.3	17.5	80.0	35.0	5.0	5.0	65.0	38.9	45.2	28.5
23	OH08-269-58	39.5		36.7	40.0	80.0	20.0	7.0	14.0	80.0	38.3	44.2	34.8
24	05247A1-7-7-3-1	37.8		58.3	25.0	65.0	45.0	2.0	11.0	60.0	35.7	48.3	27.2
25	05287A1-1-13	30.2		36.7	4.0	65.0	30.0	2.0	11.0	50.0	42.8	33.9	26.5
26	0762A1-2-8	29.8		28.3	15.0	75.0	8.0	5.0	9.0	75.0	22.7	31.6	27.9
27	05247A1-7-3-120	39.9		63.3	35.0	85.0	25.0	5.0	18.0	60.0	27.7	52.1	27.7
28	05264A1-1-3-33	39.3		33.3	45.0	80.0	20.0	12.0	7.0	70.0	47.0	44.6	34.0
29	MH07-7474	32.3		61.7	37.5	60.0	25.0	2.0	9.0	45.0	18.1	46.1	18.5
30	MA08-8036#	30.1		35.0	37.5	75.0	6.0	5.0	5.0	45.0	32.2	38.4	21.8
31	M10-1659	18.4	l	36.7	4.0	25.0	8.0	5.0	6.0	40.0	22.8	18.4	18.5
32	M10-1615	23.6	l	48.3	17.5	40.0	8.0	10.0	17.0	10.0	37.9	28.5	18.7
33	M10*1307#	38.4		51.7	40.0	87.5	12.0	5.0	3.0	70.0	37.9	47.8	29.0
34	IL06-23571	23.9	l	28.3	20.0	67.5	6.0	2.0	2.0	40.0	25.6	30.5	17.4
35	IL07-19334	18.0	l	23.3	10.0	25.0	6.0	5.0	5.0	35.0	34.7	16.1	19.9
36	IL07-20728	21.4	l	25.0	4.0	65.0	8.0	2.0	7.0	25.0	35.4	25.5	17.4
37	IL07-20743	14.0	l	21.7	12.5	25.0	6.0	2.0	3.0	20.0	21.5	16.3	11.6
38	KY05C-1369-13-7-3	21.3	l	41.7	9.0	60.0	10.0	2.0	4.0	30.0	13.6	30.2	12.4
39	KY05C-1020-2-19-1	23.6	l	60.0	22.5	40.0	5.0	2.0	7.0	35.0	17.6	31.9	15.4
40	KY05C-1600-92-9-5	38.1		58.3	47.5	80.0	15.0	2.0	5.0	70.0	27.3	50.2	26.1
41	KY05C-1051-37-18-5	26.4	l	45.0	22.5	50.0	10.0	5.0	3.0	45.0	30.9	31.9	21.0
42	KY05C-1105-43-10-3	31.7		41.7	17.5	75.0	40.0	5.0	5.0	45.0	24.6	43.6	19.9
43	MD05W10208-12-16	32.9		53.3	25.0	92.0	20.0	2.0	5.0	30.0	36.1	47.6	18.3
44	MDC07026-12-42	29.3		46.7	50.0	55.0	15.0	2.0	5.0	40.0	20.3	41.7	16.8
45	MDC07027-12-12	15.7	l	26.7	15.0	35.0	8.0	2.0	5.0	15.0	19.1	21.2	10.3
46	MDC07027-12-24	16.4	l	23.3	4.0	45.0	8.0	2.0	4.0	20.0	25.1	20.1	12.8
47	MO111134	28.7		35.0	22.5	85.0	15.0	5.0	2.0	40.0	25.1	39.4	18.0
48	MO111359	35.0		65.0	17.5	75.0	25.0	7.0	1.0	50.0	39.6	45.6	24.4
49	MO110719	36.0		50.0	12.5	80.0	30.0	10.0	4.0	70.0	31.4	43.1	28.9
50	MO100647	23.5	l	28.3	7.5	20.0	25.0	5.0	2.0	55.0	45.1	20.2	26.8
51	BAKHSH24	40.9		53.3	60.0	75.0	30.0	5.0	13.0	65.0	26.0	54.6	27.3
52	BAKHSH33	43.4		70.0	55.0	85.0	40.0	5.0	19.0	50.0	23.5	62.5	24.4
53	BAKHSH35	36.1		63.3	45.0	70.0	35.0	10.0	7.0	35.0	23.2	53.3	18.8
54	NW10401	39.6		56.7	50.0	75.0	65.0	5.0	2.0	20.0	43.3	61.7	17.6
55	NE06607	48.2		65.0	60.0	85.0	75.0	12.0	8.0	60.0	20.3	71.3	25.1
56	VA09W-188WS	49.6	h	55.0	90.0	55.0	65.0	12.0	18.0	40.0	61.7	66.3	32.9
57	VA08MAS-369	41.0		60.0	50.0	55.0	40.0	15.0	13.0	60.0	34.6	51.3	30.7
58	VA10W-123	45.7		81.7	50.0	45.0	60.0	10.0	10.0	60.0	48.5	59.2	32.1
59	VA11W-FHB39	38.8		60.0	40.0	52.5	55.0	5.0	12.0	55.0	30.6	51.9	25.7
60	VA11W-FHB40	36.3		51.7	40.0	80.0	30.0	5.0	8.0	45.0	30.9	50.4	22.2
100	AVERAGE	34.5		51.0	32.3	62.6	31.7	6.0	8.6	49.6	34.4	44.4	24.7
101	MINUMUM	14.0		21.7	4.0	15.0	5.0	2.0	1.0	10.0	13.6		
102	MAXIMUM	62.9		94.7	90.0	95.0	80.0	20.0	22.0	90.0	61.7		
103	LSD(0.05)	13.5		.	.	.	.	.	.	.	.		

Table 14. Summary of INC/SEV/FDK (ISK, %) data from the 2012-2013 NUWWSN

				1	1	1	1	2	2	2	2	Clust. 1	Clust. 2
ENTRY	NAME	AVG		ILURB	INHAR	KYLEX	OHWOO	INLAF	NEMEA	NYITH	VABLA	Avg	Avg
20	TRUMAN	24.9	l	33.5	7.9	46.8	17.3	3.9	36.7	29.1	24.4	26.4	23.5
1	ERNIE	34.3		54.9	28.0	41.8	30.9	10.6	36.9	42.0	29.0	38.9	29.6
2	FREEDOM	42.4		61.6	40.0	44.5	50.9	10.7	42.7	49.3	39.3	49.3	35.5
3	PIONEER2545	59.0	h	88.2	58.3	54.2	73.8	29.6	52.0	57.9	57.6	68.6	49.3
4	NY07104-141	26.5	l	27.2	15.8	36.5	21.2	6.8	35.5	37.6	31.6	25.2	27.9
5	NY99069-WC	32.9		45.2	24.5	38.0	16.7	14.8	40.6	36.8	46.5	31.1	34.7
6	NY99045-3110	43.0		49.4	59.2	55.6	28.9	14.4	37.0	54.3	45.5	48.3	37.8
7	NY99056-161	31.9		47.4	17.5	39.8	35.0	11.2	33.4	37.6	33.0	34.9	28.8
8	KWS009	50.8		73.3	74.2	76.0	45.4	27.9	43.8	27.9	37.5	67.2	34.3
9	KWS010	47.3		74.9	48.4	62.8	39.1	13.6	43.2	50.3	46.1	56.3	38.3
10	KWS013	61.9	h	90.8	67.5	82.9	89.7	28.2	58.3	54.9	23.3	82.7	41.2
11	KWS014	44.8		62.4	53.3	51.6	40.9	23.1	43.4	38.7	45.0	52.1	37.6
12	LCS10727	41.6		75.5	40.0	58.2	47.3	18.1	44.0	17.4	32.0	55.3	27.9
13	LCS13531	42.0		53.1	55.9	71.8	32.5	18.0	38.9	30.4	35.5	53.3	30.7
14	LCS19228	48.3		83.8	57.5	70.7	51.9	22.2	47.8	19.0	33.6	66.0	30.7
15	LCS19707	45.2		78.7	39.2	72.9	46.0	14.4	42.0	34.3	33.8	59.2	31.1
16	F0013R	41.1		54.7	35.5	64.9	36.6	16.3	48.4	33.0	39.2	47.9	34.2
17	F0065	55.6	h	81.0	52.5	69.6	71.4	27.9	51.8	46.6	44.2	68.6	42.6
18	F1003R	34.8		62.3	34.2	49.5	30.4	5.2	42.1	29.1	26.0	44.1	25.6
19	F1029	38.3		68.8	35.0	53.4	31.8	7.3	46.1	25.3	39.1	47.3	29.5
21	OH07-263-3	35.2		61.9	37.5	43.2	35.9	14.5	42.4	21.3	24.5	44.6	25.7
22	OH08-172-42	42.3		63.8	46.7	72.2	31.4	8.1	40.4	36.1	39.6	53.5	31.1
23	OH08-269-58	46.2		63.9	50.9	66.2	35.5	19.2	51.5	47.3	35.1	54.1	38.3
24	05247A1-7-7-3-1	38.7		55.7	32.5	49.4	41.4	10.2	45.0	40.2	35.1	44.8	32.6
25	05287A1-1-13	35.7		41.9	28.8	65.1	33.5	8.0	41.7	35.3	31.6	42.3	29.2
26	0762A1-2-8	30.4		41.4	21.7	62.5	16.8	4.7	29.4	37.8	28.9	35.6	25.2
27	05247A1-7-3-120	44.3		65.7	49.2	72.8	30.6	16.4	48.4	38.4	33.2	54.6	34.1
28	05264A1-1-3-33	44.8		59.7	65.9	67.2	33.2	13.2	40.4	38.1	41.0	56.5	33.2
29	MH07-7474	38.3		67.5	30.0	58.4	33.4	12.5	45.0	30.6	29.4	47.3	29.4
30	MA08-8036#	32.2		49.4	35.0	61.9	17.3	16.4	32.2	24.4	21.4	40.9	23.6
31	M10-1659	24.0	l	50.1	9.7	24.2	19.1	14.9	33.8	21.9	18.4	25.8	22.3
32	M10-1615	28.2		54.5	25.0	38.8	17.8	12.2	33.8	11.3	32.5	34.0	22.5
33	M10*1307#	42.5		55.7	46.7	75.2	23.4	13.8	38.7	41.5	45.2	50.3	34.8
34	IL06-23571	32.6		49.8	35.9	54.5	14.1	11.6	45.0	25.8	24.0	38.6	26.6
35	IL07-19334	21.5	l	30.6	11.7	23.9	13.1	5.8	31.4	25.1	30.7	19.8	23.3
36	IL07-20728	28.9		43.4	23.0	58.2	14.9	9.5	28.6	18.8	34.9	34.9	23.0
37	IL07-20743	21.7	l	31.4	16.7	36.3	12.5	7.8	31.3	12.8	24.8	24.2	19.2
38	KY05C-1369-13-7-3	27.9	l	56.5	23.0	52.5	18.3	7.3	26.9	19.2	19.2	37.6	18.2
39	KY05C-1020-2-19-1	22.8	l	43.0	24.2	44.2	11.8	3.2	14.3	18.1	23.9	30.8	14.9
40	KY05C-1600-92-9-5	37.5		62.7	38.4	63.2	25.4	6.4	38.7	35.7	29.8	47.4	27.7
41	KY05C-1051-37-18-5	35.3		58.9	40.9	44.3	19.7	10.5	37.1	40.8	30.5	41.0	29.7
42	KY05C-1105-43-10-3	37.8		50.7	48.4	64.5	32.5	11.0	38.8	29.1	27.3	49.0	26.6
43	MD05W10208-12-16	37.7		60.4	40.9	80.2	22.3	5.9	33.2	16.4	42.5	51.0	24.5
44	MDC07026-12-42	36.0		58.4	59.2	55.1	20.8	8.5	37.0	16.0	32.8	48.4	23.6
45	MDC07027-12-12	20.1	l	24.3	27.5	40.6	13.0	6.9	23.2	10.8	14.3	26.4	13.8
46	MDC07027-12-24	19.1	l	22.8	13.0	39.7	17.9	3.9	20.3	16.4	18.9	23.4	14.9
47	MO111134	34.6		48.5	35.9	69.0	25.1	14.7	30.9	28.7	23.6	44.6	24.5
48	MO111359	38.1		65.6	29.2	60.9	31.2	10.1	36.6	29.5	41.5	46.7	29.4
49	MO110719	39.2		58.1	32.5	59.4	33.3	11.3	32.9	45.2	41.0	45.8	32.6
50	MO100647	25.7	l	45.9	15.0	13.4	29.7	14.0	34.8	30.0	22.9	26.0	25.4
51	BAKHSH24	43.5		57.4	44.2	67.9	33.7	13.2	42.3	48.5	40.5	50.8	36.1
52	BAKHSH33	46.3		63.7	60.0	73.2	38.7	10.0	45.0	37.0	42.5	58.9	33.6
53	BAKHSH35	39.9		65.1	52.5	58.9	36.5	14.9	34.9	22.7	33.5	53.3	26.5
54	NW10401	36.6		59.7	44.3	48.1	44.3	12.6	43.6	14.7	25.7	49.1	24.2
55	NE06607	44.1		76.7	54.2	71.1	47.4	15.9	30.1	29.7	28.0	62.4	25.9
56	VA09W-188WS	51.8		77.4	71.7	59.1	50.9	29.6	45.7	27.5	52.3	64.8	38.8
57	VA08MAS-369	46.2		64.6	50.8	58.5	40.1	22.3	48.2	39.0	46.0	53.5	38.9
58	VA10W-123	48.3		79.6	55.0	48.6	48.0	24.2	48.3	38.3	44.5	57.8	38.8
59	VA11W-FHB39	39.1		64.5	40.0	38.4	41.7	15.8	35.6	32.8	43.8	46.2	32.0
60	VA11W-FHB40	37.5		61.5	35.8	62.4	33.3	11.0	36.2	25.7	34.0	48.3	26.7
100	AVERAGE	38.0		58.0	39.1	55.7	33.0	13.4	39.0	31.8	33.9	46.5	29.5
101	MINUMUM	19.1		22.8	7.9	13.4	11.8	3.2	14.3	10.8	14.3		
102	MAXIMUM	61.9		90.8	74.2	82.9	89.7	29.6	58.3	57.9	57.6		
103	LSD(0.05)	9.0		.	.	.	.	.	.	.	.		

Table 15. Summary of deoxynivalenol (DON, ppm) data from the 2012-2013 NUWWSN.

				1	1	2	2	2	2	2	3	Clust. 1	Clust. 2
ENTRY	NAME	AVG		ILURB	OHWOO	INLAF	MIELA	NEMEA	NYITH	VABLA	KYLEX	Avg	Avg
20	TRUMAN	6.8		12.8	8.9	2.4	1.7	1.0	4.6	3.6	19.3	10.9	5.4
1	ERNIE	7.6		10.1	17.2	1.3	6.0	2.2	6.2	6.7	10.8	13.7	5.5
2	FREEDOM	9.4		15.8	21.4	2.3	7.1	4.8	8.8	3.7	11.3	18.6	6.3
3	PIONEER2545	16.6	h	23.6	26.3	7.6	24.4	9.9	18.1	6.7	16.3	25.0	13.8
4	NY07104-141	9.5		14.0	14.9	1.0	4.3	0.8	7.8	9.7	23.8	14.5	7.9
5	NY99069-WC	10.3		24.2	14.1	1.4	6.2	2.7	9.8	12.2	11.5	19.2	7.3
6	NY99045-3110	14.5	h	27.0	33.8	4.0	11.5	2.6	13.7	9.9	13.4	30.4	9.2
7	NY99056-161	16.6	h	31.1	31.1	4.0	13.8	2.9	14.2	10.6	24.7	31.1	11.7
8	KWS009	12.3		18.8	25.8	4.4	16.4	2.4	7.4	4.8	18.3	22.3	9.0
9	KWS010	11.7		16.9	16.8	1.2	11.1	5.0	12.0	4.8	25.8	16.9	10.0
10	KWS013	15.2	h	15.4	42.8	4.8	17.5	9.0	13.7	4.1	14.1	29.1	10.5
11	KWS014	18.2	h	23.7	29.2	4.4	10.4	3.0	19.2	16.4	39.4	26.5	15.5
12	LCS10727	6.8		11.7	16.2	2.5	2.5	1.2	2.6	4.2	13.8	14.0	4.5
13	LCS13531	6.9		4.9	14.9	0.5	4.9	1.1	5.3	3.5	20.0	9.9	5.9
14	LCS19228	8.0		16.2	15.5	3.5	8.4	2.0	3.8	2.9	11.5	15.9	5.4
15	LCS19707	8.6		10.1	14.5	1.9	5.8	2.6	5.9	4.6	23.8	12.3	7.4
16	F0013R	7.7		9.7	15.2	1.1	6.7	1.3	6.7	2.4	18.9	12.5	6.2
17	F0065	14.9	h	16.0	27.5	4.6	11.5	4.5	15.8	12.6	26.9	21.8	12.7
18	F1003R	9.4		16.5	20.2	1.4	10.0	2.0	4.9	2.3	17.7	18.4	6.4
19	F1029	13.4		24.7	28.9	3.1	7.7	3.3	8.3	10.9	20.7	26.8	9.0
21	OH07-263-3	8.0		10.0	11.1	2.4	11.7	3.3	7.0	1.6	17.1	10.6	7.2
22	OH08-172-42	10.9		12.9	19.1	1.6	9.7	4.6	7.2	4.5	28.0	16.0	9.3
23	OH08-269-58	8.6		11.8	10.6	2.5	10.0	2.9	8.1	4.7	18.5	11.2	7.8
24	05247A1-7-7-3-1	11.2		15.8	19.9	3.8	10.2	3.4	12.0	7.4	17.3	17.9	9.0
25	05287A1-1-13	8.7		8.9	15.1	1.2	6.2	4.5	7.9	4.7	20.8	12.0	7.6
26	0762A1-2-8	6.4		6.7	10.0	1.1	5.0	2.4	4.7	1.7	20.0	8.4	5.8
27	05247A1-7-3-120	9.2		15.0	12.0	2.8	10.7	4.6	9.3	2.5	16.7	13.5	7.8
28	05264A1-1-3-33	9.6		14.0	12.9	1.5	6.2	4.6	7.7	9.4	20.2	13.5	8.3
29	MH07-7474	7.9		13.8	13.1	2.7	8.8	2.5	6.8	3.4	11.8	13.5	6.0
30	MA08-8036#	4.8	l	7.9	9.1	0.7	3.2	1.6	2.8	6.7	6.6	8.5	3.6
31	M10-1659	2.7	l	5.4	4.8	0.7	1.4	0.6	2.6	2.0	4.2	5.1	1.9
32	M10-1615	7.0		11.9	16.1	1.7	6.6	2.3	3.1	3.4	11.3	14.0	4.7
33	M10*1307#	8.9		14.5	12.7	3.6	11.9	3.0	8.0	3.2	14.6	13.6	7.4
34	IL06-23571	4.2	l	3.2	3.6	1.0	6.5	1.8	4.9	1.2	11.3	3.4	4.5
35	IL07-19334	6.0		9.4	9.1	0.5	3.9	1.2	3.8	5.6	14.6	9.3	4.9
36	IL07-20728	4.9	l	6.3	6.2	1.1	3.4	0.9	4.0	4.0	13.6	6.3	4.5
37	IL07-20743	4.2	l	6.3	5.1	0.5	3.6	0.8	4.3	3.0	10.4	5.7	3.8
38	KY05C-1369-13-7-3	5.4	l	9.9	7.9	1.5	6.1	0.9	3.2	1.5	12.2	8.9	4.2
39	KY05C-1020-2-19-1	4.2	l	7.5	6.2	0.2	4.8	0.6	2.6	1.1	10.4	6.9	3.3
40	KY05C-1600-92-9-5	8.1		12.7	15.0	2.9	7.8	2.5	6.0	2.5	15.1	13.9	6.1
41	KY05C-1051-37-18-5	7.5		9.0	7.8	1.6	8.6	0.7	8.4	3.4	20.8	8.4	7.3
42	KY05C-1105-43-10-3	6.8		6.8	15.9	1.4	4.3	1.8	5.4	1.4	17.1	11.4	5.2
43	MD05W10208-12-16	6.0		7.9	11.4	1.3	9.7	0.9	4.2	3.4	9.0	9.7	4.8
44	MDC07026-12-42	3.3	l	2.9	5.5	0.2	3.7	0.6	2.3	0.8	10.4	4.2	3.0
45	MDC07027-12-12	2.0	l	3.0	3.6	0.5	0.8	0.5	0.8	0.8	5.9	3.3	1.6
46	MDC07027-12-24	2.6	l	3.7	4.0	0.1	4.0	0.0	1.0	1.4	6.4	3.9	2.2
47	MO111134	8.6		13.1	12.9	1.0	7.0	3.4	11.3	2.5	17.5	13.0	7.1
48	MO111359	10.1		19.5	21.3	2.0	7.6	1.2	5.4	5.7	18.1	20.4	6.7
49	MO110719	10.5		21.7	16.5	3.1	6.5	1.8	8.4	6.4	19.7	19.1	7.7
50	MO100647	6.0		11.2	9.3	2.3	4.6	1.1	4.6	7.1	8.2	10.3	4.7
51	BAKHSH24	6.4		14.3	7.1	0.7	4.5	5.2	4.0	1.8	13.4	10.7	4.9
52	BAKHSH33	8.2		20.0	10.1	2.4	8.1	2.8	4.6	2.6	15.1	15.1	5.9
53	BAKHSH35	7.4		13.4	11.5	3.6	8.8	1.5	3.8	2.5	14.1	12.5	5.7
54	NW10401	8.1		19.0	11.2	2.4	7.0	1.9	2.6	9.1	11.9	15.1	5.8
55	NE06607	10.2		24.1	16.3	4.6	11.8	1.8	3.4	2.5	17.4	20.2	6.9
56	VA09W-188WS	13.3		21.0	21.6	8.5	19.3	1.7	6.8	11.7	15.7	21.3	10.6
57	VA08MAS-369	11.1		20.7	19.4	6.3	16.0	1.6	9.5	5.7	9.6	20.1	8.1
58	VA10W-123	9.6		16.6	20.8	4.0	13.1	1.2	6.5	2.9	11.4	18.7	6.5
59	VA11W-FHB39	7.7		16.4	10.0	1.2	5.8	5.1	5.8	4.2	13.3	13.2	5.9
60	VA11W-FHB40	7.4		14.8	9.3	1.1	5.9	3.4	4.7	3.3	16.5	12.1	5.8
100	AVERAGE	8.6		13.8	15.0	2.3	8.0	2.5	6.8	4.8	15.8	14.4	6.7
101	MINUMUM	2.0		2.9	3.6	0.1	0.8	0.0	0.8	0.8	4.2		
102	MAXIMUM	18.2		31.1	42.8	8.5	24.4	9.9	19.2	16.4	39.4		
103	LSD(0.05)	3.7		.	.	.	.	.	.	.	.		

Table 15. Summary of greenhouse severity (GHSEV, %) data from the 2012-2013 NUWWSN.

ENTRY	NAME	GH
20	TRUMAN	6.6
1	ERNIE	20.2
2	FREEDOM	12.5
3	PIONEER2545	32.5
4	NY07104-141	13.0
5	NY99069-WC	9.1
6	NY99045-3110	22.7
7	NY99056-161	19.3
8	KWS009	35.2
9	KWS010	14.9
10	KWS013	30.4
11	KWS014	32.6
12	LCS10727	37.3
13	LCS13531	32.9
14	LCS19228	12.7
15	LCS19707	13.6
16	F0013R	14.4
17	F0065	33.6
18	F1003R	7.4
19	F1029	12.2
21	OH07-263-3	15.9
22	OH08-172-42	11.8
23	OH08-269-58	35.7
24	05247A1-7-7-3-1	13.9
25	05287A1-1-13	17.7
26	0762A1-2-8	4.9
27	05247A1-7-3-120	21.1
28	05264A1-1-3-33	17.6
29	MH07-7474	16.7
30	MA08-8036#	13.9
31	M10-1659	12.5
32	M10-1615	13.3
33	M10*1307#	22.0
34	IL06-23571	8.2
35	IL07-19334	9.5
36	IL07-20728	18.0
37	IL07-20743	14.8
38	KY05C-1369-13-7-3	17.6
39	KY05C-1020-2-19-1	9.4
40	KY05C-1600-92-9-5	20.4
41	KY05C-1051-37-18-5	15.2
42	KY05C-1105-43-10-3	15.7
43	MD05W10208-12-16	15.9
44	MDC07026-12-42	17.7
45	MDC07027-12-12	10.8
46	MDC07027-12-24	10.5
47	MO111134	9.2
48	MO111359	15.0
49	MO110719	7.5
50	MO100647	10.9
51	BAKHSH24	20.2
52	BAKHSH33	22.6
53	BAKHSH35	13.3
54	NW10401	20.8
55	NE06607	14.4
56	VA09W-188WS	23.9
57	VA08MAS-369	17.6
58	VA10W-123	31.3
59	VA11W-FHB39	16.7
60	VA11W-FHB40	12.7
100	AVERAGE	17.5
101	MINUMUM	4.9
102	MAXIMUM	37.3
103	LSD(0.05)	

Table 16. Summary of heading date (HD, Julian days) and height (HGT, inches) data from the 2012-2013 NUWWSN

							HD							HGT	
ENTRY	NAME	AVG		ILCHA	ILURB	INLAF	KYLEX	MDSAL	MOCOL	NYITH	OHWOO	AVG		KYLEX	MDSAL
20	TRUMAN	142.4		149.0	146.0	141.0	140.5	109.0	151.0	157.0	146.0	41.8		42.5	41
1	ERNIE	136.6		142.0	140.0	137.5	132.5	101.0	148.0	150.0	142.0	36.5		39.0	34
2	FREEDOM	140.6		148.0	142.0	140.5	137.5	106.0	152.0	155.0	144.0	39.8		41.5	38
3	PIONEER2545	139.4		145.0	142.0	140.0	137.0	105.0	149.0	154.0	143.0	36.8		36.5	37
4	NY07104-141	143.7	h	150.0	148.0	142.0	141.5	111.0	154.0	156.0	147.0	42.5		44.0	41
5	NY99069-WC	144.8	h	150.0	149.0		143.5	111.0	154.0	157.0	148.0	41.5		42.0	41
6	NY99045-3110	144.3	h	152.0	148.0	142.0	143.5	110.0	154.0	157.0	148.0	43.0		46.0	40
7	NY99056-161	141.8		153.0	145.0	141.0	138.5	107.0	149.0	157.0	144.0	39.8		42.5	37
8	KWS009	138.1		145.0	141.0	137.0	133.0	105.0	148.0	154.0	142.0	36.8		37.5	36
9	KWS010	140.4		148.0	143.0	140.0	137.0	108.0	149.0	155.0	143.0	34.5	l	34.0	35
10	KWS013	135.1	l	141.0	140.0	135.5	130.5	99.0	144.0	151.0	140.0	37.8		39.5	36
11	KWS014	141.3		148.0	143.0	141.0	138.5	106.0	154.0	155.0	145.0	39.3		41.5	37
12	LCS10727	137.3		142.0	141.0	138.5	133.5	102.0	148.0	151.0	142.0	40.5		43.0	38
13	LCS13531	138.9		145.0	142.0	138.5	134.5	104.0	149.0	156.0	142.0	37.3		38.5	36
14	LCS19228	137.6		142.0	141.0	137.5	136.0	104.0	148.0	150.0	142.0	37.0		39.0	35
15	LCS19707	138.4		144.0	141.0	139.0	134.0	105.0	148.0	154.0	142.0	36.8		37.5	36
16	F0013R	139.8		146.0	142.0	140.5	136.5	105.0	149.0	155.0	144.0	37.5		38.0	37
17	F0065	139.8		147.0	143.0	140.0	136.0	105.0	149.0	156.0	142.0	37.3		38.5	36
18	F1003R	140.2		148.0	143.0	140.5	138.0	105.0	149.0	155.0	143.0	39.8		41.5	38
19	F1029	139.1		144.0	141.0	140.0	136.5	105.0	148.0	155.0	143.0	38.3		39.5	37
21	OH07-263-3	137.3		142.0	141.0	137.0	133.5	103.0	148.0	152.0	142.0	41.5		43.0	40
22	OH08-172-42	138.6		146.0	141.0	139.0	135.0	105.0	149.0	152.0	142.0	40.8		42.5	39
23	OH08-269-58	140.1		147.0	142.0	141.0	137.0	107.0	149.0	155.0	143.0	39.3		40.5	38
24	05247A1-7-7-3-1	140.8		149.0	143.0	140.0	138.0	107.0	149.0	155.0	145.0	37.3		38.5	36
25	05287A1-1-13	140.2		149.0	144.0	141.0	136.5	105.0	148.0	155.0	143.0	34.0	l	34.0	34
26	0762A1-2-8	138.2		143.0	141.0	138.5	133.0	105.0	148.0	155.0	142.0	34.0	l	35.0	33
27	05247A1-7-3-120	136.3	l	143.0	140.0	136.0	132.5	104.0	146.0	148.0	141.0	34.3	l	36.5	32
28	05264A1-1-3-33	139.0		149.0	141.0	138.5	136.5	105.0	148.0	151.0	143.0	35.3	l	36.5	34
29	MH07-7474	138.9		144.0	141.0	139.0	136.0	105.0	149.0	155.0	142.0	39.5		41.0	38
30	MA08-8036#	136.4		142.0	140.0	136.0	133.0	101.0	148.0	151.0	140.0	40.3		41.5	39
31	M10-1659	136.3	l	142.0	140.0	135.0	131.0	103.0	149.0	150.0	140.0	40.0		41.0	39
32	M10-1615	136.1	l	142.0	140.0	136.0	131.0	104.0	146.0	149.0	141.0	37.8		38.5	37
33	M10*1307#	138.0		143.0	140.0	138.5	134.5	104.0	148.0	154.0	142.0	36.8		38.5	35
34	IL06-23571	135.8	l	141.0	139.0	136.5	130.0	101.0	148.0	150.0	141.0	41.3		43.5	39
35	IL07-19334	139.3		144.0	142.0	140.0	137.0	106.0	149.0	154.0	142.0	38.0		39.0	37
36	IL07-20728	137.9		142.0	141.0	138.5	136.5	105.0	148.0	150.0	142.0	38.8		38.5	39
37	IL07-20743	137.6		142.0	141.0	138.5	134.5	105.0	148.0	150.0	142.0	40.8		41.5	40
38	KY05C-1369-13-7-3	138.3		144.0	140.0	139.0	134.0	104.0	149.0	154.0	142.0	38.8		40.5	37
39	KY05C-1020-2-19-1	138.2		144.0	141.0	139.0	135.5	104.0	149.0	151.0	142.0	40.3		41.5	39
40	KY05C-1600-92-9-5	139.8		147.0	142.0	140.5	137.0	107.0	149.0	153.0	143.0	37.3		38.5	36
41	KY05C-1051-37-18-5	138.8		145.0	142.0	139.5	134.0	104.0	149.0	155.0	142.0	41.0		41.0	41
42	KY05C-1105-43-10-3	138.6		143.0	141.0	139.0	135.5	105.0	148.0	155.0	142.0	39.8		41.5	38
43	MD05W10208-12-16	137.6		143.0	141.0	136.5	134.0	103.0	148.0	153.0	142.0	36.5		38.0	35
44	MDC07026-12-42	137.7		143.0	141.0	137.5	134.0	104.0	148.0	152.0	142.0	36.8		37.5	36
45	MDC07027-12-12	138.1		144.0	141.0	137.5	134.5	104.0	148.0	154.0	142.0	39.5		41.0	38
46	MDC07027-12-24	139.1		147.0	142.0	139.0	134.5	105.0	149.0	154.0	142.0	36.8		39.5	34
47	MO111134	136.4		141.0	141.0	136.5	130.5	102.0	148.0	151.0	141.0	34.3	l	35.5	33
48	MO111359	140.9		147.0	143.0	140.0	137.0	108.0	154.0	155.0	143.0	40.8		42.5	39
49	MO110719	141.5		148.0	143.0	140.0	139.0	108.0	154.0	156.0	144.0	36.5		35.0	38
50	MO100647	140.8		148.0	144.0	141.0	138.0	108.0	149.0	154.0	144.0	47.2	h	49.5	45
51	BAKHSH24	139.3		145.0	142.0	140.0	137.0	104.0	149.0	155.0	142.0	37.3		38.5	36
52	BAKHSH33	138.7		144.0	141.0	140.0	134.5	104.0	149.0	155.0	142.0	34.5	l	36.0	33
53	BAKHSH35	140.0		145.0	142.0	140.0	137.0	105.0	154.0	154.0	143.0	37.0		38.0	36
54	NW10401	137.3		145.0	141.0	138.0	131.0	101.0	149.0	151.0	142.0	40.3		41.5	39
55	NE06607	139.1		146.0	142.0	140.0	137.0	104.0	149.0	153.0	142.0	37.0		38.0	36
56	VA09W-188WS	137.3		146.0	140.0	137.5	132.0	102.0	148.0	152.0	141.0	37.8		38.5	37
57	VA08MAS-369	138.7		145.0	143.0	137.5	135.0	105.0	148.0	154.0	142.0	36.5		37.0	36
58	VA10W-123	136.4		142.0	140.0	136.5	131.0	101.0	149.0	151.0	141.0	36.5		38.0	35
59	VA11W-FHB39	137.6		147.0	143.0	137.0	130.0	102.0	148.0	152.0	142.0	33.0	l	33.0	33
60	VA11W-FHB40	136.9		143.0	142.0	136.5	132.0	102.0	148.0	150.0	142.0	36.3		36.5	36
100	AVERAGE	138.9		145.2	141.9	138.9	135.3	104.7	149.1	153.3	142.6	38.2		39.5	37
101	MINUMUM	135.1		141.0	139.0	135.0	130.0	99.0	144.0	148.0	140.0	33.0		33.0	32
102	MAXIMUM	144.8		153.0	149.0	146.0	143.5	111.0	154.0	157.0	148.0	47.2		49.5	45
103	LSD(0.05)	1.2		.	.	.	.	.	.	.	.	2.4		.	.

Table 18. Summary of incidence (INC, %) from 2012-13 PNUWWSN.

				1	1	1	1	2	2	3	Clust. 1	Clust. 2
ENTRY	NAME	AVG		ILCHA	ILURB	INLAF	MOCOL	KYLEX	VABLA	MIELA	Avg	Avg
1	TRUMAN	32.1	l	7.5	35.0	5.0	85.0	27.5	47.5	17.5	33.1	37.5
2	ERNIE	51.7		30.0	76.7	10.0	80.0	57.5	32.5	75.0	49.2	45.0
3	FREEDOM	56.0		20.0	76.7	20.0	100.0	77.5	62.5	35.0	54.2	70.0
4	PIONEER2545	77.0	h	60.0	96.7	45.0	95.0	87.5	80.0	75.0	74.2	83.8
5	KWS 015	67.4	h	30.0	86.7	25.0	100.0	85.0	82.5	62.5	60.4	83.8
6	KWS 008	59.1		45.0	96.0	20.0	65.0	67.5	80.0	40.0	56.5	73.8
7	KWS 011	56.9		25.0	86.0	30.0	75.0	75.0	57.5	50.0	54.0	66.3
8	KWS 012	52.1		30.0	75.0	35.0	80.0	75.0	40.0	30.0	55.0	57.5
9	KWS 016	69.0	h	35.0	83.3	40.0	100.0	75.0	85.0	65.0	64.6	80.0
10	KWS 017	60.7		50.0	82.7	30.0	90.0	55.0	57.5	60.0	63.2	56.3
11	KWS 019	62.0		40.0	86.7	35.0	75.0	77.5	50.0	70.0	59.2	63.8
12	F1012	56.6		25.0	86.0	20.0	85.0	52.5	47.5	80.0	54.0	50.0
13	F1014	44.2		20.0	41.7	5.0	100.0	85.0	37.5	20.0	41.7	61.3
14	OH07-264-35	61.1		55.0	97.7	35.0	90.0	60.0	35.0	55.0	69.4	47.5
15	OH08-99-50	45.2		15.0	51.7	20.0	95.0	47.5	22.5	65.0	45.4	35.0
16	OH08-207-33	45.3		20.0	84.3	10.0	70.0	32.5	50.0	50.0	46.1	41.3
17	OH08-99-41	29.5	l	15.0	41.7	15.0	60.0	15.0	25.0	35.0	32.9	20.0
18	OH08-155-16	59.8		35.0	88.3	10.0	90.0	90.0	40.0	65.0	55.8	65.0
19	OH08-182-4	49.0		25.0	78.3	20.0	70.0	72.5	47.5	30.0	48.3	60.0
20	0722A1-1-7	45.6		15.0	81.7	15.0	55.0	60.0	22.5	70.0	41.7	41.3
21	05247A1-7-3-27	63.6	h	30.0	90.0	20.0	85.0	85.0	75.0	60.0	56.3	80.0
22	082A1-55-4	60.5		35.0	88.3	10.0	95.0	82.5	57.5	55.0	57.1	70.0
23	0858A1-33-2	59.3		30.0	90.0	5.0	90.0	75.0	65.0	60.0	53.8	70.0
24	0527A1-9-15-181	67.0	h	30.0	98.7	15.0	70.0	87.5	87.5	80.0	53.4	87.5
25	IL08-22206	48.2		20.0	80.0	10.0	70.0	70.0	37.5	50.0	45.0	53.8
26	IL08-8844	46.4		20.0	75.0	20.0	80.0	62.5	27.5	40.0	48.8	45.0
27	IL09-3259	45.8		20.0	63.3	25.0	65.0	70.0	52.5	25.0	43.3	61.3
28	IL09-3264	50.4		20.0	70.0	15.0	80.0	70.0	37.5	60.0	46.3	53.8
29	IL09-15973	48.9		25.0	75.0	10.0	75.0	70.0	27.5	60.0	46.3	48.8
30	IL09-24328	45.0		20.0	80.0	15.0	70.0	37.5	27.5	65.0	46.3	32.5
31	KY06C-1003-140-3-3	47.7		30.0	66.7	10.0	90.0	55.0	27.5	55.0	49.2	41.3
32	KY05C-1113-47-9-3	52.9		25.0	80.0	35.0	60.0	70.0	50.0	50.0	50.0	60.0
33	KY05C-1105-44-15-1	57.0		30.0	91.7	15.0	80.0	72.5	60.0	50.0	54.2	66.3
34	KY05C-1105-42-14-1	55.5		15.0	83.3	20.0	75.0	72.5	57.5	65.0	48.3	65.0
35	KY05C-1033-31-15-1	52.9		25.0	90.0	10.0	55.0	80.0	35.0	75.0	45.0	57.5
36	MO111495	47.5		10.0	87.7	20.0	65.0	55.0	65.0	30.0	45.7	60.0
37	MO111491	40.7	l	15.0	95.0	15.0	60.0	47.5	27.5	25.0	46.3	37.5
38	MO111409	52.6		15.0	86.0	20.0	65.0	77.5	45.0	60.0	46.5	61.3
39	MO110799	41.0	l	15.0	81.7	10.0	60.0	57.5	35.0	27.5	41.7	46.3
40	MO110767	46.7		15.0	86.7	20.0	70.0	75.0	37.5	22.5	47.9	56.3
41	MO111585	47.4		15.0	76.7	35.0	95.0	37.5	22.5	50.0	55.4	30.0
42	VA11W-FHB4	43.1	l	20.0	71.7	15.0	65.0	52.5	27.5	50.0	42.9	40.0
43	VA11W-FHB13	51.9		15.0	91.0	5.0	60.0	77.5	45.0	70.0	42.8	61.3
44	VA11W-FHB38	54.5		15.0	76.7	40.0	75.0	67.5	42.5	65.0	51.7	55.0
45	VA11W-FHB71	52.0		45.0	66.7	30.0	70.0	60.0	32.5	60.0	52.9	46.3
46	OH08-180-48	56.4		15.0	78.3		100.0	77.5	75.0	25.0	64.4	76.3
100	AVERAGE	52.5		25.4	79.4	21.0	77.4	64.5	46.8	53.5	50.8	55.7
101	MINUMUM	29.5		7.5	35.0	5.0	55.0	15.0	22.5	17.5		
102	MAXIMUM	77.0		60.0	98.7	77.5	100.0	90.0	87.5	100.0		
103	LSD(0.05)	13.8		.	.	.	.	.	.	.		

Table 19. Summary of severity (SEV, %) data from the 2012-2013 PNUWWSN

				1	1	2	2	2	2	2	Clust. 1	Clust. 2
ENTRY	NAME	AVG		ILCHA	ILURB	INLAF	KYLEX	MIELA	MOCOL	VABLA	Avg	Avg
1	TRUMAN	11.9	l	12.5	12.9	4.4	15.7	21.0	11.3	5.2	12.7	11.5
2	ERNIE	24.2		25.0	33.6	11.1	33.3	41.5	13.5	11.1	29.3	22.1
3	FREEDOM	25.0		25.0	34.7	11.1	31.4	33.0	28.0	11.8	29.9	23.1
4	PIONEER2545	50.7	h	60.0	72.9	41.7	43.3	46.0	53.1	38.2	66.5	44.5
5	KWS 015	33.6		45.0	40.8	7.8	38.3	35.0	43.2	24.8	42.9	29.8
6	KWS 008	41.0		80.0	80.7	5.1	45.4	29.0	20.2	26.3	80.4	25.2
7	KWS 011	30.5		30.0	33.6	40.0	40.9	41.5	12.7	14.6	31.8	29.9
8	KWS 012	35.7		55.0	50.8	33.3	44.5	30.5	21.4	14.7	52.9	28.9
9	KWS 016	40.2		70.0	61.8	20.8	30.3	42.0	36.8	19.9	65.9	30.0
10	KWS 017	38.7		55.0	64.2	25.9	45.0	33.0	27.6	20.0	59.6	30.3
11	KWS 019	31.3		45.0	54.7	5.6	43.6	46.0	13.3	10.9	49.9	23.9
12	F1012	21.7		15.0	35.8	3.2	30.1	42.0	12.5	13.4	25.4	20.2
13	F1014	17.5	l	25.0	16.7	4.6	28.1	20.0	23.4	4.7	20.9	16.2
14	OH07-264-35	34.7		60.0	67.9	25.0	30.0	30.5	15.2	14.6	64.0	23.1
15	OH08-99-50	28.2		45.0	44.2	19.4	29.4	26.5	30.4	2.6	44.6	21.7
16	OH08-207-33	21.1		15.0	41.0	16.7	17.5	41.5	10.7	5.4	28.0	18.4
17	OH08-99-41	18.8	l	30.0	33.9	8.3	15.2	28.0	12.6	3.7	32.0	13.6
18	OH08-155-16	23.6		30.0	42.7	6.5	27.7	36.5	10.6	11.5	36.4	18.6
19	OH08-182-4	27.0		35.0	48.8	15.7	32.8	34.0	11.3	11.4	41.9	21.0
20	0722A1-1-7	20.3	l	25.0	32.8	14.8	20.9	39.0	7.8	1.9	28.9	16.9
21	05247A1-7-3-27	30.4		35.0	44.0	34.3	29.6	41.5	15.4	13.1	39.5	26.8
22	082A1-55-4	26.8		40.0	48.7	6.5	31.5	33.0	18.4	9.5	44.4	19.8
23	0858A1-33-2	26.3		30.0	48.5	9.3	40.8	35.0	12.3	8.4	39.3	21.2
24	0527A1-9-15-181	32.5		40.0	54.9	6.9	39.9	46.0	12.5	27.4	47.5	26.5
25	IL08-22206	21.7		30.0	33.6	12.0	28.7	36.5	7.9	3.0	31.8	17.6
26	IL08-8844	18.0	l	20.0	24.4	8.3	23.0	28.0	18.4	4.0	22.2	16.3
27	IL09-3259	25.5		25.0	48.8	12.2	40.7	24.5	13.3	14.2	36.9	21.0
28	IL09-3264	20.7	l	30.0	32.2	3.7	22.9	39.0	12.1	4.9	31.1	16.5
29	IL09-15973	17.8	l	20.0	19.6	6.9	18.9	44.0	9.9	5.3	19.8	17.0
30	IL09-24328	19.2	l	25.0	33.7	9.7	14.3	35.0	12.0	4.5	29.4	15.1
31	KY06C-1003-140-3-3	16.9	l	20.0	26.3	2.1	17.3	33.0	12.6	7.3	23.2	14.5
32	KY05C-1113-47-9-3	27.2		45.0	33.6	19.9	38.5	28.0	10.1	15.2	39.3	22.3
33	KY05C-1105-44-15-1	31.0		50.0	60.5	3.7	37.9	39.0	10.7	15.0	55.3	21.3
34	KY05C-1105-42-14-1	20.3	l	20.0	30.5	8.8	28.5	33.0	9.5	12.0	25.3	18.4
35	KY05C-1033-31-15-1	22.7		25.0	36.3	7.9	30.5	41.0	9.6	8.9	30.7	19.6
36	MO111495	22.2		20.0	40.2	13.4	31.0	29.0	11.8	10.2	30.1	19.1
37	MO111491	20.4	l	30.0	38.7	7.8	21.1	33.0	7.1	5.0	34.4	14.8
38	MO111409	20.8	l	15.0	49.1	5.1	25.9	36.5	8.4	5.6	32.1	16.3
39	MO110799	20.5	l	30.0	36.1	12.5	29.5	24.5	6.3	4.7	33.1	15.5
40	MO110767	20.7	l	25.0	31.7	13.0	32.3	21.0	13.1	8.5	28.4	17.6
41	MO111585	28.3		60.0	49.7	13.9	23.0	33.0	15.3	3.2	54.9	17.7
42	VA11W-FHB4	23.6		40.0	50.7	5.6	16.2	33.0	14.5	5.3	45.4	14.9
43	VA11W-FHB13	20.5	l	15.0	38.9	3.5	35.9	37.5	6.4	6.0	27.0	17.9
44	VA11W-FHB38	23.3		35.0	27.9	9.3	31.8	41.5	11.0	6.7	31.5	20.1
45	VA11W-FHB71	25.7		45.0	40.3	17.1	29.9	33.0	8.4	6.2	42.7	18.9
46	OH08-180-48	34.1		30.0	52.1		38.3	33.0	42.9	21.0	41.1	33.8
100	AVERAGE	25.9		34.4	42.1	13.3	30.3	34.7	15.7	10.7	38.3	20.9
101	MINUMUM	11.9		12.5	12.9	2.1	14.3	20.0	6.3	1.9		
102	MAXIMUM	50.7		80.0	80.7	41.7	45.4	46.0	53.1	38.2		
103	LSD(0.05)	9.0		.	.	.	.	.	.	.		

Table 20. Summary of index (IND, %) data from the 2012-13 PNUWWSN.

				1	1	1	1	1	1	2	3	Clust. 1
ENTRY	NAME	AVG		ILCHA	INLAF	KYLEX	MOCOL	OHWOO	VABLA	MIELA	ILURB	Avg
1	TRUMAN	5.1	l	1.1	0.2	4.6	9.6	14.6	2.6	3.7	4.2	5.5
2	ERNIE	15.2		8.0	1.1	19.0	10.8	21.4	4.6	31.1	25.8	10.8
3	FREEDOM	17.4		5.0	2.2	25.4	28.0	33.9	7.4	11.6	25.5	17.0
4	PIONEER2545	42.3	h	35.0	18.8	37.9	51.3	60.0	30.6	34.5	70.5	38.9
5	KWS 015	27.8		13.5	1.9	32.5	43.2	49.6	20.4	21.9	39.1	26.9
6	KWS 008	29.0		36.5	1.0	32.8	19.1	32.4	21.1	11.6	77.3	23.8
7	KWS 011	18.6		7.5	12.0	30.5	9.5	32.5	8.5	20.8	27.8	16.8
8	KWS 012	21.2		17.0	11.7	33.4	20.0	37.7	6.0	9.2	34.9	21.0
9	KWS 016	30.9		24.5	8.3	23.5	36.8	58.0	16.9	27.3	51.9	28.0
10	KWS 017	27.3		27.5	7.8	25.1	25.6	49.2	11.6	19.8	52.0	24.5
11	KWS 019	23.9		18.5	1.9	33.8	10.2	41.4	5.5	32.2	47.5	18.6
12	F1012	17.2		4.0	0.6	15.9	10.6	34.7	6.9	33.6	31.4	12.1
13	F1014	12.3	l	5.0	0.2	23.7	23.4	33.2	1.8	4.0	7.1	14.6
14	OH07-264-35	25.0		33.0	8.8	17.7	14.3	37.4	5.2	16.8	66.5	19.4
15	OH08-99-50	14.8		6.5	3.9	18.7	28.8	20.3	0.6	17.2	22.3	13.1
16	OH08-207-33	12.6		3.5	1.7	6.5	7.7	24.0	2.7	20.8	34.3	7.7
17	OH08-99-41	7.5	l	4.5	1.3	2.3	9.4	17.1	1.0	9.8	14.9	5.9
18	OH08-155-16	16.8		10.5	0.6	24.7	9.6	22.5	4.6	23.7	38.2	12.1
19	OH08-182-4	15.3		8.0	3.1	24.4	8.0	23.0	6.0	10.2	39.6	12.1
20	0722A1-1-7	12.8		3.5	2.2	12.7	5.8	23.7	0.4	27.3	27.1	8.1
21	05247A1-7-3-27	20.4		10.5	6.9	25.2	13.3	32.7	10.0	24.9	39.7	16.4
22	082A1-55-4	19.6		14.5	0.6	26.3	17.9	30.5	5.4	18.2	43.6	15.9
23	0858A1-33-2	18.3		9.0	0.5	30.6	11.1	27.9	5.4	21.0	41.0	14.1
24	0527A1-9-15-181	25.8		11.0	1.0	34.3	8.8	36.6	24.0	36.8	54.2	19.3
25	IL08-22206	13.5		7.0	1.2	21.4	5.5	26.5	1.3	18.3	26.8	10.5
26	IL08-8844	10.7	l	4.0	1.7	14.4	14.7	20.3	1.2	11.2	18.1	9.4
27	IL09-3259	14.4		4.5	3.1	29.0	8.6	25.4	7.1	6.1	31.3	13.0
28	IL09-3264	13.0		6.0	0.6	16.1	10.0	22.3	1.9	23.4	23.4	9.5
29	IL09-15973	11.3	l	5.0	0.7	12.8	7.7	21.1	1.4	26.4	15.1	8.1
30	IL09-24328	11.3	l	5.0	1.5	5.3	8.2	19.5	1.7	22.8	26.7	6.9
31	KY06C-1003-140-3-3	11.4	l	8.0	0.2	10.5	11.4	22.9	2.1	18.2	18.0	9.2
32	KY05C-1113-47-9-3	16.0		11.5	7.0	26.9	6.1	27.7	7.7	14.0	27.5	14.5
33	KY05C-1105-44-15-1	22.8		15.0	0.6	27.6	8.6	46.8	9.1	19.5	55.2	18.0
34	KY05C-1105-42-14-1	15.6		3.0	1.8	21.4	7.1	38.6	6.8	21.5	24.4	13.1
35	KY05C-1033-31-15-1	15.6		6.5	0.8	24.7	5.2	20.6	3.2	30.8	32.8	10.2
36	MO111495	15.1		2.0	2.7	17.7	11.1	36.1	6.6	8.7	35.5	12.7
37	MO111491	11.6	l	4.5	1.2	10.0	4.3	26.9	1.3	8.3	36.7	8.0
38	MO111409	15.9		2.0	1.0	20.4	5.5	28.2	2.6	21.9	45.9	10.0
39	MO110799	12.7		5.0	1.3	17.5	3.7	36.1	1.8	6.7	29.4	10.9
40	MO110767	13.5		3.5	2.6	24.5	9.2	32.2	3.4	4.7	27.7	12.6
41	MO111585	16.0		10.0	4.9	9.2	14.5	33.7	0.8	16.5	38.3	12.2
42	VA11W-FHB4	13.7		8.0	0.8	8.5	10.7	27.4	1.7	16.5	35.8	9.5
43	VA11W-FHB13	15.9		2.0	0.2	28.6	3.9	27.4	2.8	26.3	35.8	10.8
44	VA11W-FHB38	16.1		5.5	3.7	22.2	8.3	37.9	3.3	27.0	21.2	13.5
45	VA11W-FHB71	16.2		21.0	5.1	18.0	5.9	30.3	2.0	19.8	27.3	13.7
46	OH08-180-48	22.2		4.0		29.7	42.9	29.6	15.6	8.3	39.3	24.4
100	AVERAGE	17.4		10.0	3.7	20.8	13.8	30.8	6.2	19.5	34.5	14.2
101	MINUMUM	5.1		1.1	0.2	2.3	3.7	14.6	0.4	3.7	4.2	
102	MAXIMUM	42.3		36.5	29.7	37.9	51.3	60.0	30.6	42.9	77.3	
103	LSD(0.05)	7.4		.	.	.	.	.	.	.	.	

Table 21. Summary of Fusarium Damaged Kernel (FDK, %) data from the 2012-2013 PNUWWSN.

				1	1	1	2	2	Clust. 1	Clust. 2
ENTRY	NAME	AVG		ILURB	KYLEX	OHWOO	INLAF	VABLA	Avg	Avg
1	TRUMAN	23.7	l	28.3	45.0	10.0	1.0	34.2	27.8	17.6
2	ERNIE	35.4		33.3	80.0	25.0	3.0	35.8	46.1	19.4
3	FREEDOM	44.8		63.3	87.5	40.0	5.0	28.3	63.6	16.7
4	PIONEER2545	59.1	h	91.7	92.5	60.0	15.0	36.3	81.4	25.7
5	KWS015	45.3		40.0	80.0	40.0	7.0	59.7	53.3	33.4
6	KWS008	52.3	h	60.0	80.0	70.0	15.0	36.5	70.0	25.8
7	KWS011	47.1	h	66.7	80.0	45.0	10.0	33.8	63.9	21.9
8	KWS012	38.3		48.3	75.0	35.0	3.0	30.1	52.8	16.6
9	KWS016	46.1	h	43.3	75.0	40.0	7.0	65.4	52.8	36.2
10	KWS017	41.2		41.7	70.0	35.0	5.0	54.2	48.9	29.6
11	KWS019	44.0		43.3	70.0	28.0	15.0	63.6	47.1	39.3
12	F1012	44.6		48.3	85.0	18.0	15.0	56.6	50.4	35.8
13	F1014	44.4		56.7	80.0	30.0	7.0	48.5	55.6	27.8
14	OH07-264-35	31.3	l	50.0	50.0	25.0	5.0	26.5	41.7	15.8
15	OH08-99-50	21.1	l	28.3	35.0	10.0	2.0	30.3	24.4	16.2
16	OH08-207-33	36.1		53.3	65.0	25.0	5.0	32.2	47.8	18.6
17	OH08-99-41	28.1	l	28.3	45.0	18.0	15.0	34.1	30.4	24.6
18	OH08-155-16	35.0		40.0	70.0	30.0	5.0	30.0	46.7	17.5
19	OH08-182-4	46.4	h	55.0	85.0	55.0	5.0	31.9	65.0	18.5
20	0722A1-1-7	27.6	l	38.3	50.0	18.0	7.0	24.7	35.4	15.9
21	05247A1-7-3-27	42.4		65.0	80.0	20.0	20.0	27.0	55.0	23.5
22	082A1-55-4	49.0	h	65.0	80.0	60.0	10.0	30.2	68.3	20.1
23	0858A1-33-2	42.7		58.3	75.0	45.0	15.0	20.0	59.4	17.5
24	0527A1-9-15-181	50.6	h	73.3	80.0	60.0	1.0	38.9	71.1	20.0
25	IL08-22206	29.0	l	26.7	65.0	20.0	3.0	30.3	37.2	16.7
26	IL08-8844	26.5	l	23.3	70.0	15.0	7.0	17.0	36.1	12.0
27	IL09-3259	33.4		41.7	80.0	20.0	5.0	20.3	47.2	12.7
28	IL09-3264	26.5	l	33.3	65.0	8.0	5.0	21.2	35.4	13.1
29	IL09-15973	25.1	l	15.0	70.0	15.0	3.0	22.3	33.3	12.7
30	IL09-24328	25.7	l	26.7	57.5	10.0	5.0	29.1	31.4	17.1
31	KY06C-1003-140-3-3	19.1	l	26.7	35.0	8.0	1.0	24.9	23.2	13.0
32	KY05C-1113-47-9-3	37.1		40.0	80.0	20.0	15.0	30.5	46.7	22.8
33	KY05C-1105-44-15-1	46.6	h	76.7	87.5	40.0	7.0	22.0	68.1	14.5
34	KY05C-1105-42-14-1	38.2		38.3	75.0	50.0	1.0	26.7	54.4	13.9
35	KY05C-1033-31-15-1	29.6	l	38.3	70.0	15.0	5.0	19.6	41.1	12.3
36	MO111495	36.0		51.7	72.5	20.0	7.0	29.0	48.1	18.0
37	MO111491	30.7	l	40.0	65.0	25.0	5.0	18.3	43.3	11.7
38	MO111409	34.2		21.7	77.5	35.0	7.0	29.8	44.7	18.4
39	MO110799	30.9	l	31.7	70.0	20.0	5.0	27.9	40.6	16.5
40	MO110767	28.0	l	38.3	65.0	18.0	2.0	16.7	40.4	9.4
41	MO111585	28.5	l	45.0	47.5	20.0	5.0	25.1	37.5	15.1
42	VA11W-FHB4	28.8	l	41.7	55.0	20.0	5.0	22.4	38.9	13.7
43	VA11W-FHB13	35.5		40.0	75.0	25.0	15.0	22.7	46.7	18.9
44	VA11W-FHB38	35.8		40.0	70.0	35.0	10.0	23.9	48.3	17.0
45	VA11W-FHB71	32.3		35.0	75.0	20.0	10.0	21.7	43.3	15.9
46	OH08-180-48	51.8	h	56.7	80.0	40.0		30.5	58.9	30.5
100	AVERAGE	36.5		44.5	70.1	29.2	7.2	31.3	47.9	19.3
101	MINUMUM	19.1		15.0	35.0	8.0	1.0	16.7		
102	MAXIMUM	59.1		91.7	92.5	70.0	20.0	65.4		
103	LSD(0.05)	13.1		.	.	.	.	.		

Table 22. Summary of INC/SEV/FDK (ISK, %) data from the 2012-2013 PNUWWSN

				1	1	1	1	2	Clust. 1	Clust. 2
ENTRY	NAME	AVG		ILURB	KYLEX	OHWOO	VABLA	INLAF	Avg	Avg
1	TRUMAN	17.2	l	25.7	14.8	12.7	29.5	3.2	20.7	3.2
2	ERNIE	27.8		46.4	34.9	22.9	27.4	7.5	32.9	7.5
3	FREEDOM	36.6		58.8	42.8	36.4	33.6	11.3	42.9	11.3
4	PIONEER2545	56.8	h	87.6	54.4	60.0	50.0	32.0	63.0	32.0
5	KWS015	43.7		54.2	50.0	45.8	56.1	12.6	51.5	12.6
6	KWS008	46.3		77.0	47.0	47.5	46.5	13.5	54.5	13.5
7	KWS011	41.5		62.6	47.0	37.5	35.1	25.0	45.6	25.0
8	KWS012	38.6		57.1	49.2	36.6	28.5	21.7	42.9	21.7
9	KWS016	46.3		60.9	41.0	50.8	57.6	21.1	52.6	21.1
10	KWS017	41.6		60.7	40.0	43.5	44.9	18.8	47.3	18.8
11	KWS019	41.5		59.7	49.9	36.0	43.7	18.2	47.3	18.2
12	F1012	33.8		55.9	31.2	28.0	40.9	13.0	39.0	13.0
13	F1014	30.6		40.2	43.4	31.9	32.0	5.7	36.9	5.7
14	OH07-264-35	36.3		69.7	34.1	32.4	25.5	20.0	40.4	20.0
15	OH08-99-50	23.8	l	40.1	30.5	16.2	19.7	12.6	26.6	12.6
16	OH08-207-33	28.1		58.9	17.6	24.4	29.5	10.0	32.6	10.0
17	OH08-99-41	19.3	l	34.0	10.0	17.5	22.3	13.0	21.0	13.0
18	OH08-155-16	32.1		55.3	45.2	25.5	27.4	6.9	38.4	6.9
19	OH08-182-4	36.1		60.1	41.3	35.8	30.4	12.7	41.9	12.7
20	0722A1-1-7	25.9		49.7	29.3	21.4	17.2	11.7	29.4	11.7
21	05247A1-7-3-27	40.0		66.2	44.5	27.6	37.2	24.3	43.9	24.3
22	082A1-55-4	39.0		67.1	44.7	42.3	32.2	8.9	46.6	8.9
23	0858A1-33-2	37.4		64.9	47.0	34.8	30.0	10.3	44.2	10.3
24	0527A1-9-15-181	46.1		75.4	51.9	46.0	50.0	7.0	55.8	7.0
25	IL08-22206	27.8		44.8	38.2	23.9	24.3	7.8	32.8	7.8
26	IL08-8844	23.3	l	39.2	31.4	18.2	16.3	11.3	26.3	11.3
27	IL09-3259	31.9		50.3	44.8	23.2	28.1	13.2	36.6	13.2
28	IL09-3264	24.7	l	44.0	34.3	16.6	21.2	7.6	29.0	7.6
29	IL09-15973	22.0	l	34.4	31.8	18.7	18.7	6.3	25.9	6.3
30	IL09-24328	21.8	l	44.8	17.7	15.7	21.2	9.4	24.9	9.4
31	KY06C-1003-140-3-3	21.2	l	38.5	25.9	17.0	20.4	4.0	25.5	4.0
32	KY05C-1113-47-9-3	34.5		50.1	43.3	24.6	31.8	22.5	37.5	22.5
33	KY05C-1105-44-15-1	40.8		76.3	44.1	44.1	31.3	8.4	49.0	8.4
34	KY05C-1105-42-14-1	34.4		49.5	38.9	43.2	31.5	9.0	40.8	9.0
35	KY05C-1033-31-15-1	28.6		53.2	43.0	18.4	21.0	7.4	33.9	7.4
36	MO111495	33.7		59.0	32.9	29.6	34.1	12.8	38.9	12.8
37	MO111491	26.5		56.1	24.6	26.2	17.1	8.8	31.0	8.8
38	MO111409	31.3		49.2	39.2	30.9	27.1	10.3	36.6	10.3
39	MO110799	28.5		48.0	33.1	29.7	23.0	8.8	33.5	8.8
40	MO110767	30.1		50.8	42.0	26.5	20.5	10.7	35.0	10.7
41	MO111585	28.1		55.9	21.8	28.2	17.7	16.7	30.9	16.7
42	VA11W-FHB4	25.8		53.4	24.0	24.5	18.8	8.2	30.2	8.2
43	VA11W-FHB13	32.0		55.0	45.4	26.4	24.4	8.5	37.8	8.5
44	VA11W-FHB38	33.2		47.4	38.7	36.8	24.3	18.8	36.8	18.8
45	VA11W-FHB71	29.0		46.1	34.2	26.2	20.3	18.1	31.7	18.1
46	OH08-180-48	45.8		61.8	46.6	33.8	41.0		45.8	
100	AVERAGE	32.9		54.3	37.3	30.3	30.0	12.7	38.0	12.7
101	MINUMUM	17.2		25.7	10.0	12.7	16.3	3.2		
102	MAXIMUM	56.8		87.6	54.4	60.0	57.6	32.0		
103	LSD(0.05)	8.5		.	.	.	.	.		

Table 23. Summary of deoxynivalenol (DON, ppm) data from the 2012-2013 PNUWWSN.

				1	1	1	2	2	2	Clust. 1	Clust. 2
ENTRY	NAME	AVG		ILURB	KYLEX	OHWOO	INLAF	MIELA	VABLA	Avg	Avg
1	TRUMAN	6.7	l	10.2	13.4	6.7	0.6	3.8	5.4	10.1	3.3
2	ERNIE	7.6		7.3	16.0	9.9	0.5	6.7	5.0	11.1	4.1
3	FREEDOM	8.5		9.4	20.6	11.1	0.9	5.4	3.8	13.7	3.4
4	PIONEER2545	20.5	h	26.0	30.1	27.0	4.3	26.1	9.2	27.7	13.2
5	KWS015	16.0		22.1	24.3	17.8	4.0	8.2	19.5	21.4	10.6
6	KWS008	12.3		15.0	21.5	16.1	2.4	15.2	3.4	17.5	7.0
7	KWS011	10.7		8.2	23.2	13.5	1.6	13.7	4.2	15.0	6.5
8	KWS012	7.3		6.6	13.7	10.1	1.0	9.8	2.8	10.1	4.5
9	KWS016	17.9	h	15.4	28.6	23.9	5.3	16.6	17.4	22.6	13.1
10	KWS017	13.1		14.5	18.0	20.4	2.3	10.1	13.2	17.6	8.5
11	KWS019	14.5		14.4	19.4	27.7	2.0	10.2	13.2	20.5	8.5
12	F1012	16.2		23.1	28.6	23.7	1.4	8.3	12.0	25.1	7.2
13	F1014	13.3		13.7	24.5	19.9	0.8	6.9	14.2	19.4	7.3
14	OH07-264-35	8.4		8.4	9.8	14.1	0.9	12.5	4.8	10.8	6.1
15	OH08-99-50	7.5		7.4	16.7	9.7	0.5	7.9	3.2	11.3	3.9
16	OH08-207-33	7.5		9.8	13.0	10.7	0.7	6.3	4.8	11.2	3.9
17	OH08-99-41	8.6		6.5	16.3	19.9	1.2	3.2	4.7	14.2	3.0
18	OH08-155-16	7.2	l	5.4	13.9	15.2	1.0	4.6	3.2	11.5	2.9
19	OH08-182-4	12.1		9.6	27.7	26.1	0.9	4.5	3.7	21.1	3.0
20	0722A1-1-7	5.5	l	7.2	9.7	6.0	1.3	6.2	2.6	7.6	3.4
21	05247A1-7-3-27	9.2		10.9	12.8	20.8	1.2	7.1	2.5	14.8	3.6
22	082A1-55-4	8.0		6.1	14.9	14.1	0.8	9.1	3.0	11.7	4.3
23	0858A1-33-2	7.7		5.7	16.3	12.3	2.1	6.5	3.3	11.4	4.0
24	0527A1-9-15-181	12.7		13.6	17.6	22.6	0.2	15.4	7.0	17.9	7.5
25	IL08-22206	5.3	l	5.2	10.7	8.3	1.1	4.6	2.2	8.1	2.6
26	IL08-8844	4.5	l	3.6	10.7	7.3	0.5	2.6	2.1	7.2	1.7
27	IL09-3259	5.0	l	8.4	9.2	5.7	0.1	4.1	2.7	7.8	2.3
28	IL09-3264	3.3	l	2.7	6.3	4.6	0.2	4.0	2.0	4.5	2.1
29	IL09-15973	4.7	l	4.2	12.2	5.5	0.5	2.5	3.1	7.3	2.0
30	IL09-24328	5.4	l	8.1	11.2	4.8	0.3	3.9	3.9	8.0	2.7
31	KY06C-1003-140-3-3	6.8	l	9.3	12.7	10.1	0.8	5.2	3.0	10.7	3.0
32	KY05C-1113-47-9-3	11.5		15.9	28.1	12.3	1.2	7.8	3.9	18.8	4.3
33	KY05C-1105-44-15-1	8.4		12.7	13.8	16.4	0.7	4.9	1.8	14.3	2.5
34	KY05C-1105-42-14-1	8.5		6.8	13.8	20.3	0.3	7.7	2.1	13.6	3.4
35	KY05C-1033-31-15-1	4.3	l	5.1	10.7	5.3	1.7	1.8	1.1	7.0	1.5
36	MO111495	10.6		17.0	15.6	21.5	0.8	4.3	4.4	18.0	3.2
37	MO111491	7.7		7.9	18.8	11.8	0.4	4.5	2.5	12.8	2.5
38	MO111409	9.0		10.5	18.9	17.6	0.5	3.0	3.6	15.7	2.4
39	MO110799	7.2		5.6	14.0	14.6	1.2	3.8	4.2	11.4	3.1
40	MO110767	9.0		11.3	16.9	16.9	0.5	5.0	3.3	15.0	2.9
41	MO111585	6.5	l	11.5	9.7	9.9	0.8	4.4	2.7	10.4	2.6
42	VA11W-FHB4	3.7	l	4.1	7.6	7.1	0.2	1.9	1.6	6.3	1.2
43	VA11W-FHB13	6.2	l	3.1	16.8	10.7	0.4	4.8	1.4	10.2	2.2
44	VA11W-FHB38	7.0	l	5.2	16.5	11.5	0.9	5.6	2.2	11.1	2.9
45	VA11W-FHB71	8.1		4.8	17.4	17.3	1.6	5.2	2.5	13.2	3.1
46	OH08-180-48	10.8		10.0	18.9	15.4		4.2	5.3	14.8	4.8
100	AVERAGE	8.9		9.8	16.5	14.2	1.2	7.0	4.9	13.5	4.4
101	MINUMUM	3.3		2.7	6.3	4.6	0.1	1.8	1.1		
102	MAXIMUM	20.5		26.0	30.1	27.7	5.3	26.1	19.5		
103	LSD(0.05)	3.9		.	.	.	.	.	.		

Table 24. Summary of greenhouse severity (GHSEV, %) data from the 2012-2013 PNUWWSN.

ENTRY	NAME	MOCOL
1	TRUMAN	6.1
2	ERNIE	19.8
3	FREEDOM	22.0
4	PIONEER2545	36.1
5	KWS 015	18.5
6	KWS 008	17.9
7	KWS 011	22.3
8	KWS 012	22.1
9	KWS 016	37.0
10	KWS 017	14.8
11	KWS 019	30.9
12	F1012	8.8
13	F1014	8.7
14	OH07-264-35	32.4
15	OH08-99-50	16.7
16	OH08-207-33	19.8
17	OH08-99-41	21.9
18	OH08-155-16	24.8
19	OH08-182-4	30.4
20	0722A1-1-7	21.5
21	05247A1-7-3-27	25.4
22	082A1-55-4	26.1
23	0858A1-33-2	16.4
24	0527A1-9-15-181	23.5
25	IL08-22206	14.3
26	IL08-8844	10.0
27	IL09-3259	16.9
28	IL09-3264	21.6
29	IL09-15973	20.2
30	IL09-24328	8.7
31	KY06C-1003-140-3-3	14.4
32	KY05C-1113-47-9-3	26.3
33	KY05C-1105-44-15-1	43.3
34	KY05C-1105-42-14-1	16.3
35	KY05C-1033-31-15-1	17.9
36	MO111495	23.6
37	MO111491	15.9
38	MO111409	9.6
39	MO110799	14.9
40	MO110767	16.4
41	MO111585	24.4
42	VA11W-FHB4	22.2
43	VA11W-FHB13	23.6
44	VA11W-FHB38	19.2
45	VA11W-FHB71	28.8
46	OH08-180-48	29.6
100	AVERAGE	20.9
101	MINUMUM	43.3
102	MAXIMUM	6.1
103	LSD(0.05)	

Table 26. Summary of heading date (HD, Julian days) and height (HGT, inches) data from the 2012-2013 PNUWWN

				HD						HGT
ENTRY	NAME	AVG		ILCHA	ILURB	INLAF	KYLEX	MOCOL	OHWOO	KYLEX
1	TRUMAN	146	h	149	146	141	139	154	145	41.0
2	ERNIE	140	l	141	140	138	131	146	141	40.0
3	FREEDOM	144		148	143	140	136	154	143	41.0
4	PIONEER2545	142		143	141	140	137	149	143	40.0
5	KWS 015	145	h	149	144	141	138	154	145	41.0
6	KWS 008	143		146	141	140	136	152	142	39.5
7	KWS 011	141		142	141	139	136	148	142	38.0
8	KWS 012	143		147	141	140	136	151	142	39.0
9	KWS 016	145	h	149	143	141	140	154	146	38.5
10	KWS 017	144		148	142	140	137	152	143	40.0
11	KWS 019	143		147	142	140	137	149	143	39.0
12	F1012	142		145	141	140	136	148	142	39.0
13	F1014	146	h	150	147	142	138	154	147	39.0
14	OH07-264-35	141		142	141	139	133	148	141	43.0
15	OH08-99-50	144		146	142	140	139	154	143	42.0
16	OH08-207-33	141		144	141	138	134	148	141	42.5
17	OH08-99-41	143		146	141	140	138	149	143	41.5
18	OH08-155-16	141		142	141	137	135	148	142	42.0
19	OH08-182-4	141		143	141	139	134	148	142	40.0
20	0722A1-1-7	141		142	141	139	134	149	142	41.0
21	05247A1-7-3-27	140		143	140	138	132	146	142	35.5
22	082A1-55-4	141		143	140	138	133	148	142	38.5
23	0858A1-33-2	141		142	140	140	133	148	141	42.0
24	0527A1-9-15-181	142		147	141	136	137	148	142	36.0
25	IL08-22206	139	l	140	140	136	131	144	141	39.0
26	IL08-8844	141		145	139	140	132	148	140	40.5
27	IL09-3259	141		144	141	136	134	148	141	41.5
28	IL09-3264	139	l	141	140	136	131	146	141	37.0
29	IL09-15973	138	l	140	138	137	130	144	140	41.5
30	IL09-24328	139	l	141	140	136	130	148	141	42.0
31	KY06C-1003-140-3-3	140		142	140	139	133	148	141	40.5
32	KY05C-1113-47-9-3	142		146	141	140	134	149	142	44.0
33	KY05C-1105-44-15-1	143		146	141	139	137	149	144	43.0
34	KY05C-1105-42-14-1	141		146	141	136	135	148	143	42.5
35	KY05C-1033-31-15-1	140		141	140	140	132	148	141	40.5
36	MO111495	144		148	143	138	138	152	145	40.0
37	MO111491	141		147	140	136	134	149	143	41.0
38	MO111409	140		142	140	139	131	148	142	39.5
39	MO110799	142		148	141	139	135	149	143	43.5
40	MO110767	142		144	141	140	134	149	143	42.0
41	MO111585	143		148	142	136	137	154	143	45.5
42	VA11W-FHB4	141		146	140	135	132	149	142	43.5
43	VA11W-FHB13	141		144	140	140	133	148	141	39.5
44	VA11W-FHB38	143		149	142	136	136	149	144	40.5
45	VA11W-FHB71	142		145	141	140	135	148	142	39.5
46	OH08-180-48	145		148	142	139	152	145	.	38.5
100	AVERAGE	142		145	141	139	135	149	142	40.5
101	MINUMUM	138		140	138	135	130	144	140	35.5
102	MAXIMUM	146		150	147	142	152	154	147	45.5
103	LSD(0.05)	2		.	.	.	.	.	.	.

Table 27. Quality parameters for the 2012-2013 NUWWSN. Data is from the USDA Soft Wheat Quality Lab.

Entry	Name	Test Weight (LB/BU) TW	Whole Grain Protein (at 12%) GP	Whole Grain Hardness (0-100) HA	Flour Yield (%) FY	Softness Equivalent (%) SE	Flour Protein (at 14%) FP	Lactic Acid SRC (%) LA	Sodium Carbonate SRC (%) SO
20	TRUMAN	59.7	9.4	30.9	68.4	58.8	7.3	108.0	68.8
1	ERNIE	58.6	10.5	25.3	68.3	57.7	7.9	120.6	66.3
2	FREEDOM	58.5	10.6	29.3	68.2	54.6	8.0	101.3	64.9
3	NEER2545	57.8	11.1	36.6	66.7	56.3	9.1	109.5	67.5
4	)7104-141	60.0	12.0	30.5	66.8	59.3	9.1	86.8	66.3
5	99069-WC	59.9	12.4	35.6	65.8	55.4	9.8	102.2	65.2
6	9045-3110	57.9	10.8	28.1	69.0	61.2	8.2	98.3	65.6
7	99056-161	59.0	10.0	29.0	69.3	59.3	8.2	118.6	68.1
8	KWS 009	60.8	10.3	33.8	68.8	57.3	8.1	108.0	69.4
9	KWS 010	61.0	11.9	39.0	68.9	57.3	9.6	106.2	64.7
10	KWS 013	58.0	10.0	31.1	68.5	57.8	8.2	124.3	66.7
11	KWS 014	59.0	9.8	27.2	69.8	60.1	7.6	112.2	65.6
12	LCS10727	58.4	8.9	29.1	71.3	64.2	6.9	111.8	65.9
13	LCS13531	59.9	10.2	26.5	69.0	55.6	7.5	117.1	67.5
14	LCS19228	59.2	9.0	30.3	71.7	63.3	7.0	114.9	67.6
15	LCS19707	58.8	10.7	28.9	69.2	55.6	8.2	106.3	67.1
16	F0013R	61.7	10.4	35.4	66.7	59.0	8.0	123.2	70.7
17	F0065	58.0	9.2	27.5	69.3	59.6	7.1	106.5	71.1
18	F1003R	61.2	11.3	34.8	66.0	55.3	8.5	99.4	72.3
19	F1029	57.7	9.9	24.5	70.0	61.0	7.7	111.5	68.6
21	H07-263-3	60.1	10.2	32.3	70.4	56.5	8.1	104.0	65.0
22	08-172-42	59.1	9.9	28.2	68.4	58.5	7.5	108.9	67.6
23	08-269-58	57.9	9.9	24.8	68.5	65.9	7.4	121.9	74.2
24	A1-7-7-3-1	59.3	11.2	28.4	69.1	59.0	8.3	97.5	71.2
25	87A1-1-13	60.0	11.3	24.5	68.3	53.6	8.8	113.2	64.6
26	762A1-2-8	57.0	9.8	28.0	66.8	56.2	7.9	110.8	68.6
27	\1-7-3-120	58.8	10.9	25.8	68.9	57.5	8.4	104.1	69.7
28	-A1-1-3-33	59.3	12.0	27.2	68.3	41.2	9.7	100.2	74.4
29	IH07-7474	60.0	10.8	32.2	68.0	54.3	8.7	137.9	66.8
30	A08-8036#	60.8	12.0	31.6	67.9	54.0	9.4	136.4	65.4
31	M10-1659	60.9	10.7	31.9	69.7	55.4	8.3	116.4	62.8
32	M10-1615	59.5	9.3	28.6	70.4	55.5	7.4	100.9	66.8
33	I10*1307#	58.8	9.6	27.5	69.1	57.2	7.5	96.3	64.5
34	L06-23571	60.8	10.7	28.2	70.0	62.1	8.2	106.2	64.1
35	L07-19334	60.8	10.6	29.0	69.9	57.1	8.3	128.5	66.1
36	L07-20728	62.7	10.5	33.3	68.2	57.1	8.3	136.5	65.0
37	L07-20743	63.0	11.4	34.8	68.9	53.3	9.3	143.8	63.2
38	369-13-7-3	61.7	12.5	33.2	66.0	56.3	10.1	158.2	74.2
39	)20-2-19-1	60.0	11.7	27.6	66.3	54.0	9.5	126.3	67.5
40	500-92-9-5	60.3	11.1	28.4	70.6	53.5	9.0	117.1	66.5
41	51-37-18-5	62.3	10.9	37.5	67.4	58.4	8.7	129.5	71.0
42	)5-43-10-3	60.6	10.6	30.4	66.5	59.1	8.1	138.8	69.5
43	208-12-16	61.3	11.1	29.4	70.8	55.1	8.7	128.7	65.6
44	026-12-42	60.8	10.5	32.9	64.1	44.9	8.1	117.6	78.2
45	027-12-12	62.2	11.0	33.7	64.3	43.4	8.9	121.0	76.9
46	027-12-24	62.0	11.2	35.0	65.2	46.1	8.9	125.4	78.3
47	MO111134	60.0	10.6	27.3	68.2	55.1	8.2	122.6	69.4
48	MO111359	62.0	11.0	33.6	67.0	52.9	8.7	103.6	65.9
49	MO110719	61.8	11.5	32.2	67.8	53.9	8.8	105.8	64.5
50	MO100647	61.9	10.8	32.7	68.3	54.3	8.6	128.3	66.0
51	Bakhsh24	60.4	9.7	37.9	66.9	36.6	8.1	121.8	85.3
52	Bakhsh33	61.0	9.2	33.7	68.9	43.1	7.6	132.5	82.5
53	Bakhsh35	61.5	10.0	33.9	67.6	36.7	8.0	126.0	91.4
54	NW10401	61.2	10.2	25.7	69.1	39.2	8.4	123.7	91.9
55	NE06607	59.1	10.2	27.3	72.3	46.3	8.2	132.0	82.3
56	W-188WS	57.1	9.5	22.2	71.5	56.8	7.4	102.5	70.0
57	8MAS-369	61.6	10.8	33.9	69.6	52.3	8.6	128.5	67.2
58	A10W-123	59.3	9.4	28.0	70.9	62.8	7.2	120.0	70.2
59	1W-FHB39	56.9	10.2	28.1	69.0	60.1	8.3	120.9	68.3
60	1W-FHB40	57.5	11.1	26.5	68.1	58.0	8.6	114.9	68.7
	Average	59.9	10.6	30.3	68.5	55.0	8.3	116.6	69.7

= More preferred than average

= Less preferred than average

= Stronger gluten than average

= Weaker gluten than average

A total of 60 samples were grown in a composite of nursery locations and submitted to the laboratory for milling and baking quality evaluations. The standard quality data were compared to the average for the cultivar checks given for this nursery.

			Data Transferred from Quality Data Sheet							
Lab Number	Entry Number	Entry	Test Weight (LB/BU)	Whole Grain Protein (at 12%)	Whole Grain Hardness (0-100)	Flour Yield (%)	Softness Equivalent (%)	Flour Protein (at 14%)	Lactic Acid SRC (%)	Sodium Carbonate SRC (%)
1310097	1	ERNIE	58.63	10.45	25.29	68.32	57.74	7.9	120.61	66.27
1310098	2	FREEDOM	58.54	10.57	29.31	68.16	54.6	8.03	101.26	64.95
1310099	3	PIONEER 2545	57.84	11.05	36.55	66.67	56.25	9.09	109.46	67.47
1310116	20	TRUMAN	59.66	9.44	30.88	68.4	58.76	7.31	107.97	68.82
		Average	58.67	10.38	30.51	67.89	56.84	8.08	109.83	66.88

Additional Information on Analysis

Flour analysis indicates that the quality trait averages of milling yield, softness equivalence, and flour protein fall within the expected target ranges for soft wheat characteristics. Lactic acid and sucrose SRC's exhibited higher values than that of the expected target ranges.

Of the characteristics of quality we measure at the Soft Wheat Quality Laboratory, milling yield is the most reproducible and perhaps most important because it is genetically and environmentally associated with good soft wheat flour quality. The milling yield average for this nursery was at 68.5% with NE06607 having the highest yield at 72.3%.

After milling yield, the second trait that we recommend for use in selection is softness equivalent. It tends to have high heritability and is an important predictor of break flour yield. Larger values are preferred for most soft wheat manufactured goods, particularly cakes and other high sugar baked products. An average softness equivalence of 58.1% was acquired for this nursery, with OH08-269-58 producing the largest softness equivalent at 65.9%.

Gluten strength is measured by the lactic acid SRC. The lactic acid SRC also correlates to flour protein concentration, but the effect is dependent on genotypes and growing conditions. The collective average for these entries was 116.6% with an array of test lines that are considered "strong" in gluten strength (above 105%). KY05C-1369-13-7-3 had the "strongest" value at 158.3%.

High sodium carbonate SRC absorption values point towards an increase in damaged starch. Entry NW10401 should be a concern because normal values for good milling soft varieties are 68% or less. NW10401 had a value of 91.9%. A total of 33 samples were below 68% with M10-1659 having the lowest sodium carbonate SRC absorption at 62.8%.

Please contact me if you have questions concerning this trial.

Best regards,

Tony Karcher

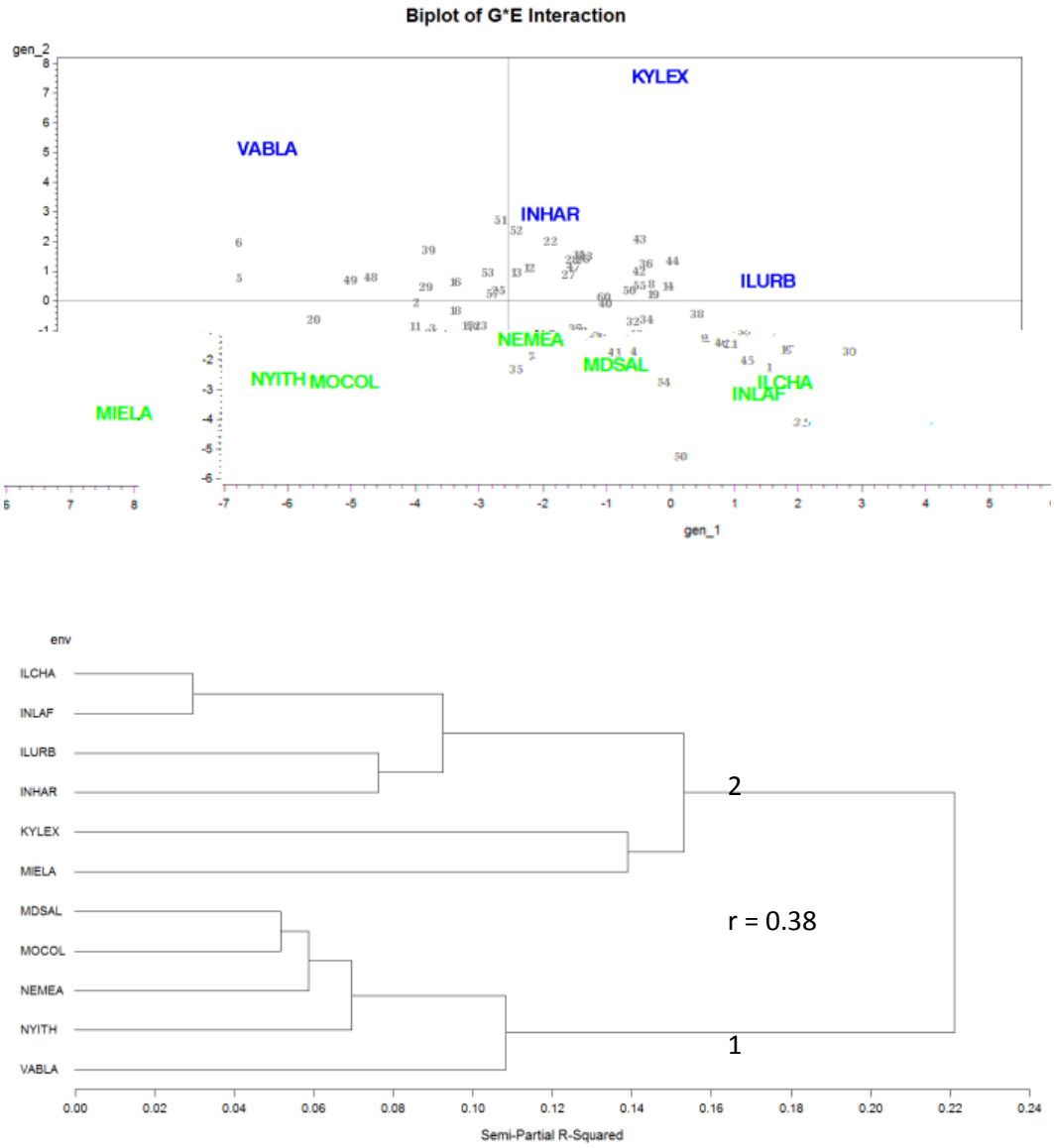

Figure 1. NUWWSN FHB Incidence Bi-plot from AMMI (PC1 versus PC2, entry numbers are shown) and clusters of environments using the GxE matrix and Ward's minimum variance

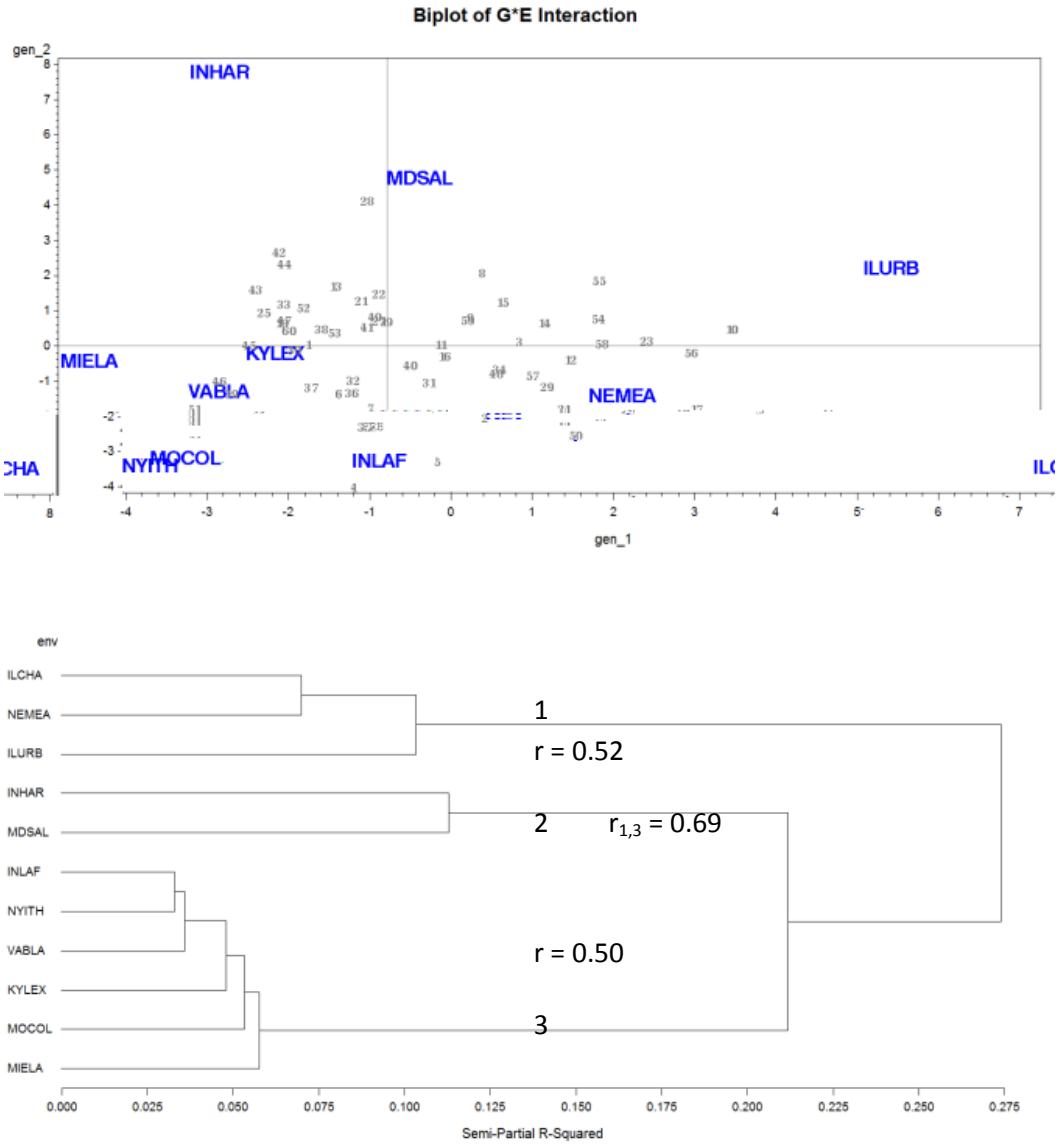

Figure 2. NUWWSN FHB Severity Bi-plot from AMMI (PC1 versus PC2, entry numbers are shown) and clusters of environments using the GxE matrix and Ward's minimum variance.

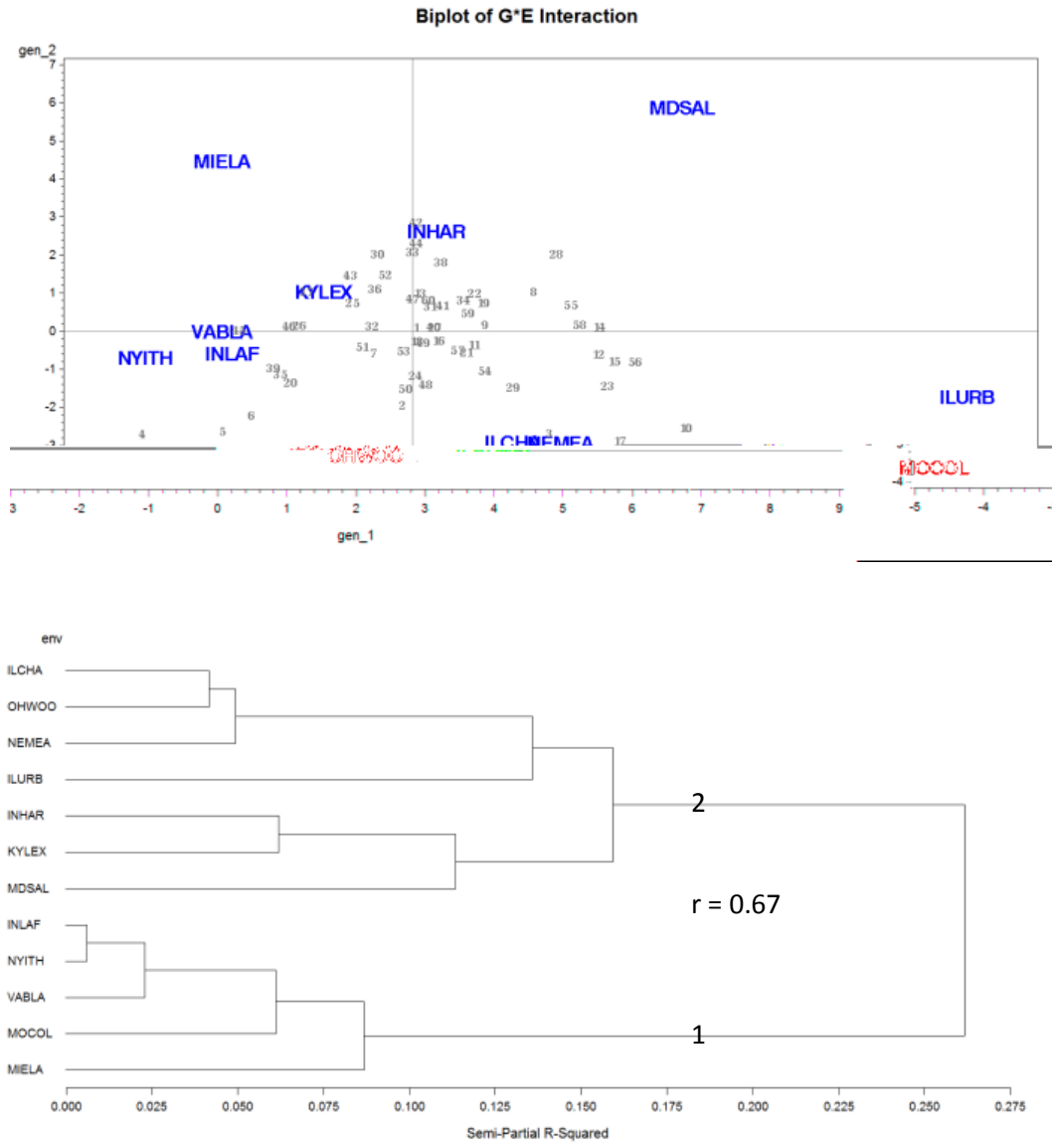

Figure 3. NUWWSN FHB Index Bi-plot from AMMI (PC1 versus PC2, entry numbers are shown) and clusters of environments using the GxE matrix and Ward's minimum variance.

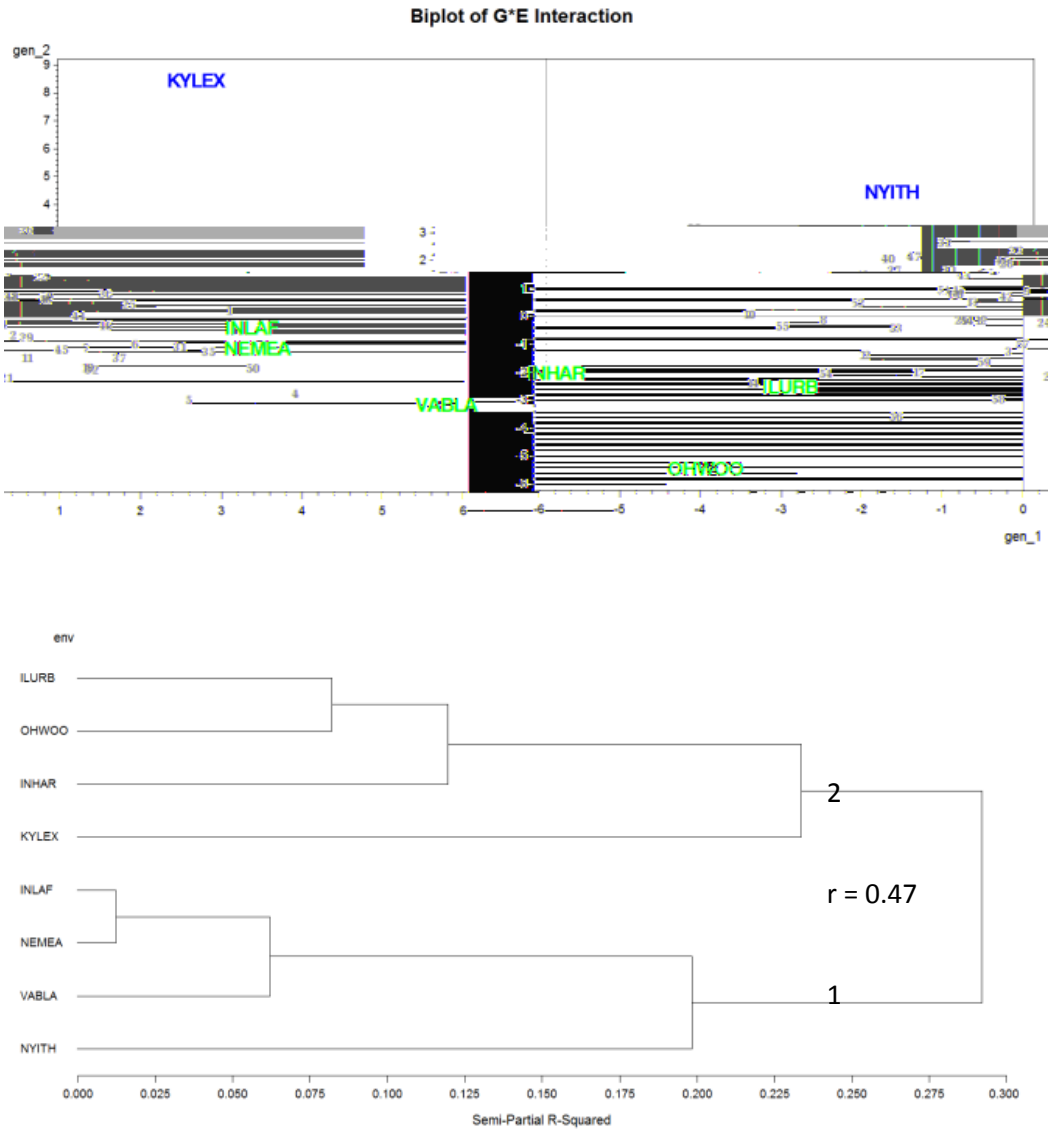

Figure 4. NUWWSN FHB FDK Bi-plot from AMMI (PC1 versus PC2, entry numbers are shown) and clusters of environments using the GxE matrix and Ward's minimum variance.

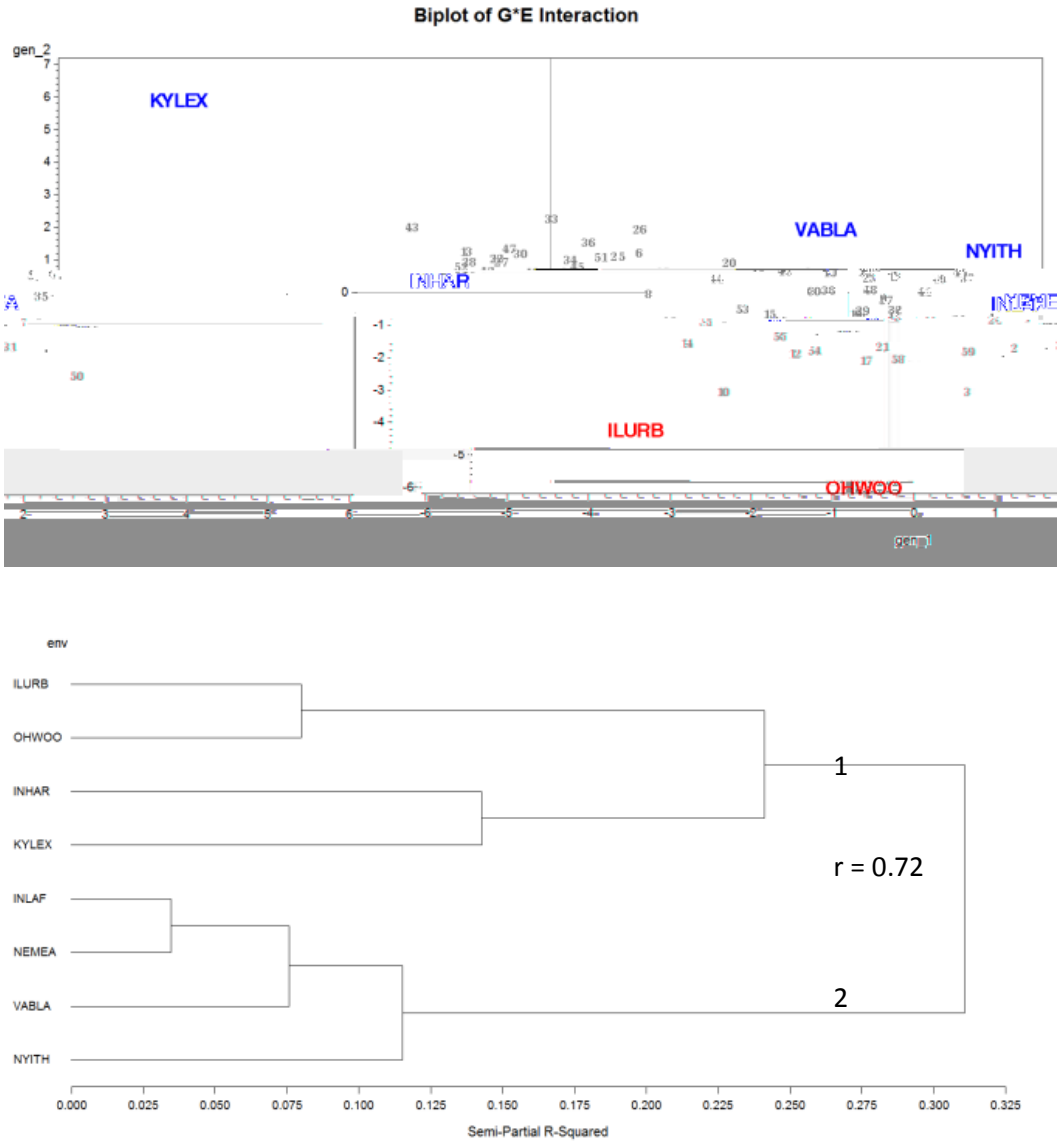

Figure 5. NUWWSN FHB ISK Bi-plot from AMMI (PC1 versus PC2, entry numbers are shown) and clusters of environments using the GxE matrix and Ward's minimum variance.

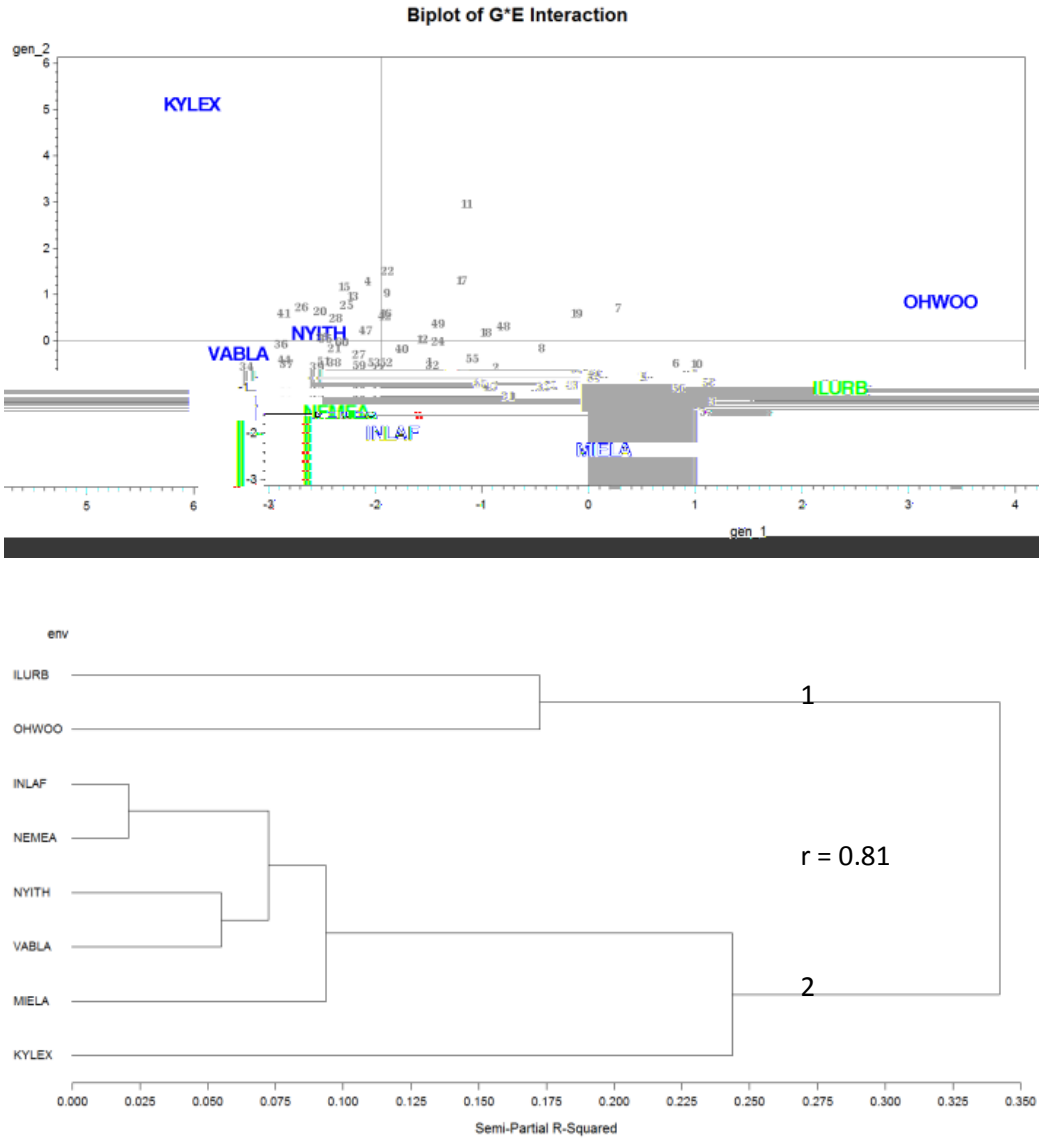

Figure 6. NUWWSN FHB DON Bi-plot from AMMI (PC1 versus PC2, entry numbers are shown) and clusters of environments using the GxE matrix and Ward's minimum variance.

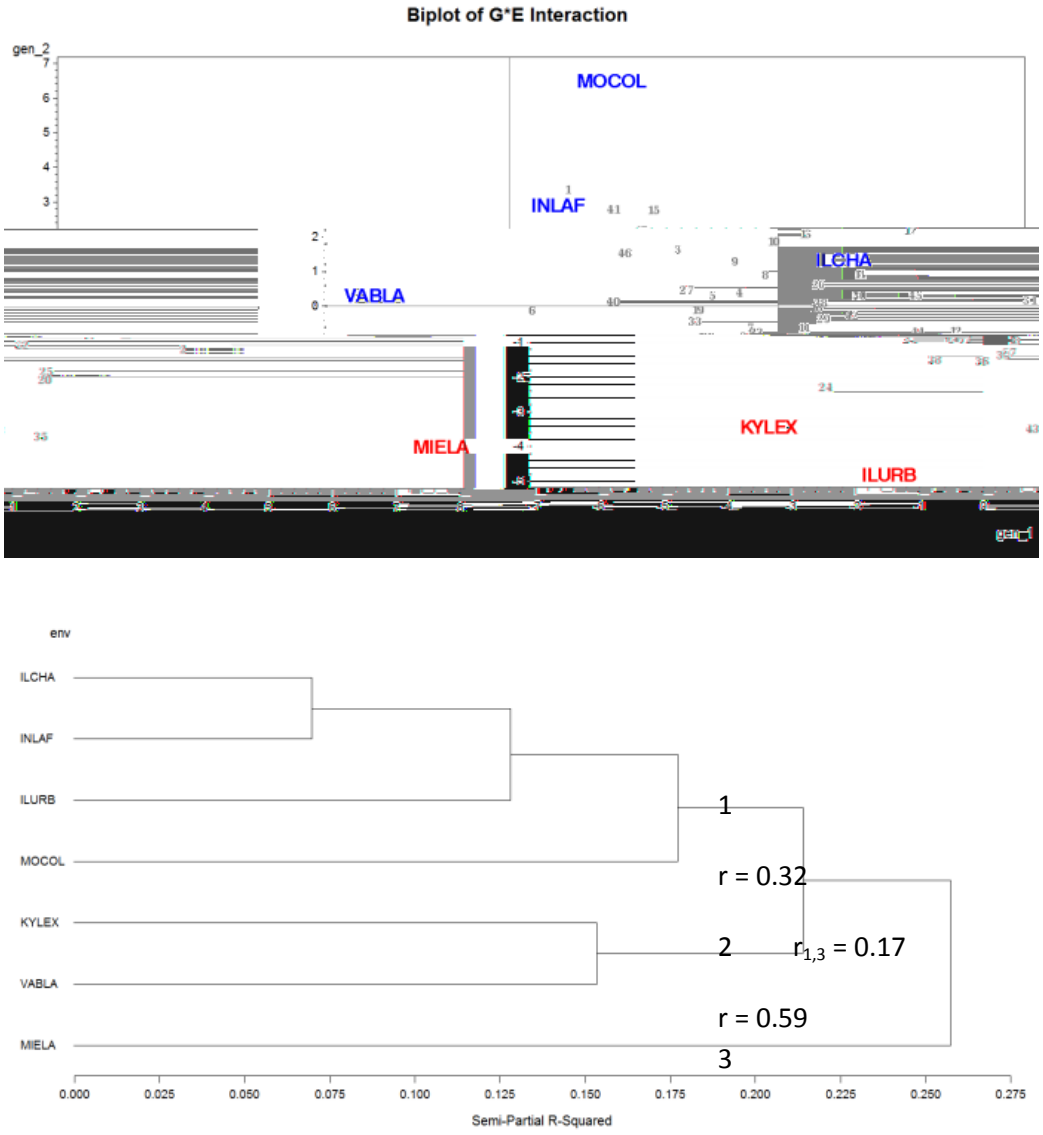

Figure 7. PNUWWSN FHB Incidence Bi-plot from AMMI (PC1 versus PC2, entry numbers are shown) and clusters of environments using the GxE matrix and Ward's minimum variance

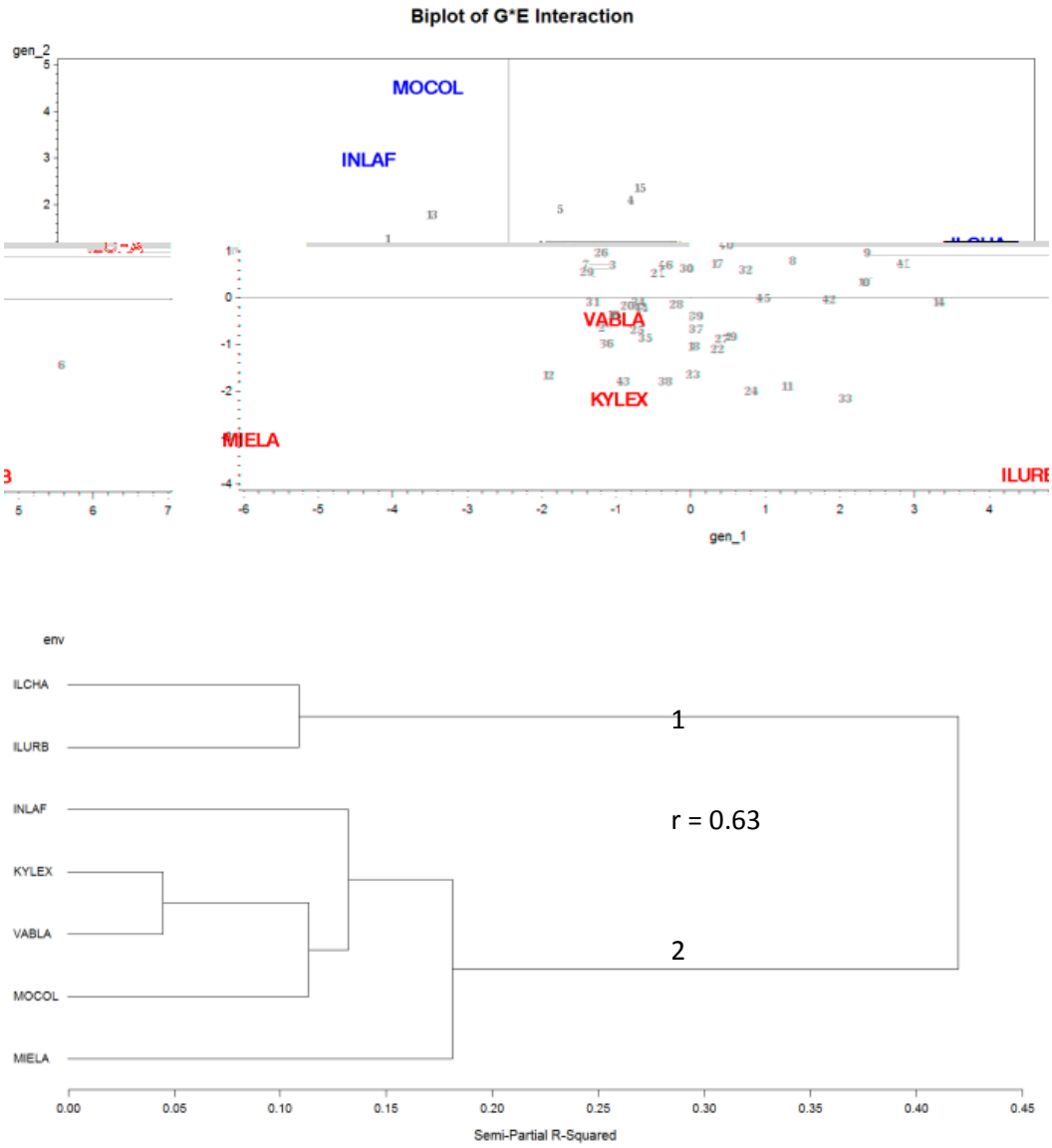

Figure 8. PNUWWSN FHB Severity Bi-plot from AMMI (PC1 versus PC2, entry numbers are shown) and clusters of environments using the GxE matrix and Ward's minimum variance.

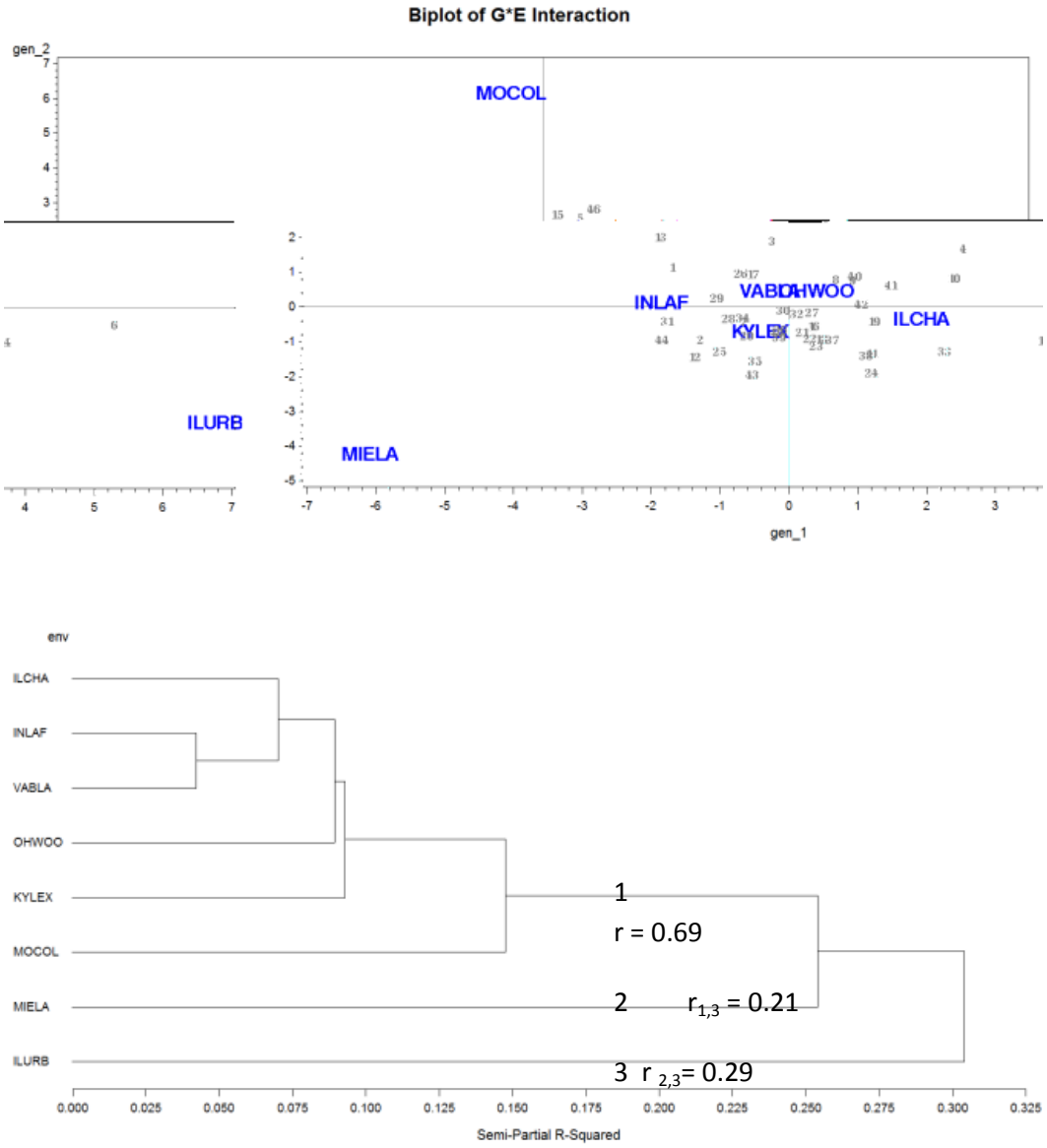

Figure 9. PNUWWSN FHB Index Bi-plot from AMMI (PC1 versus PC2, entry numbers are shown) and clusters of environments using the GxE matrix and Ward's minimum variance.

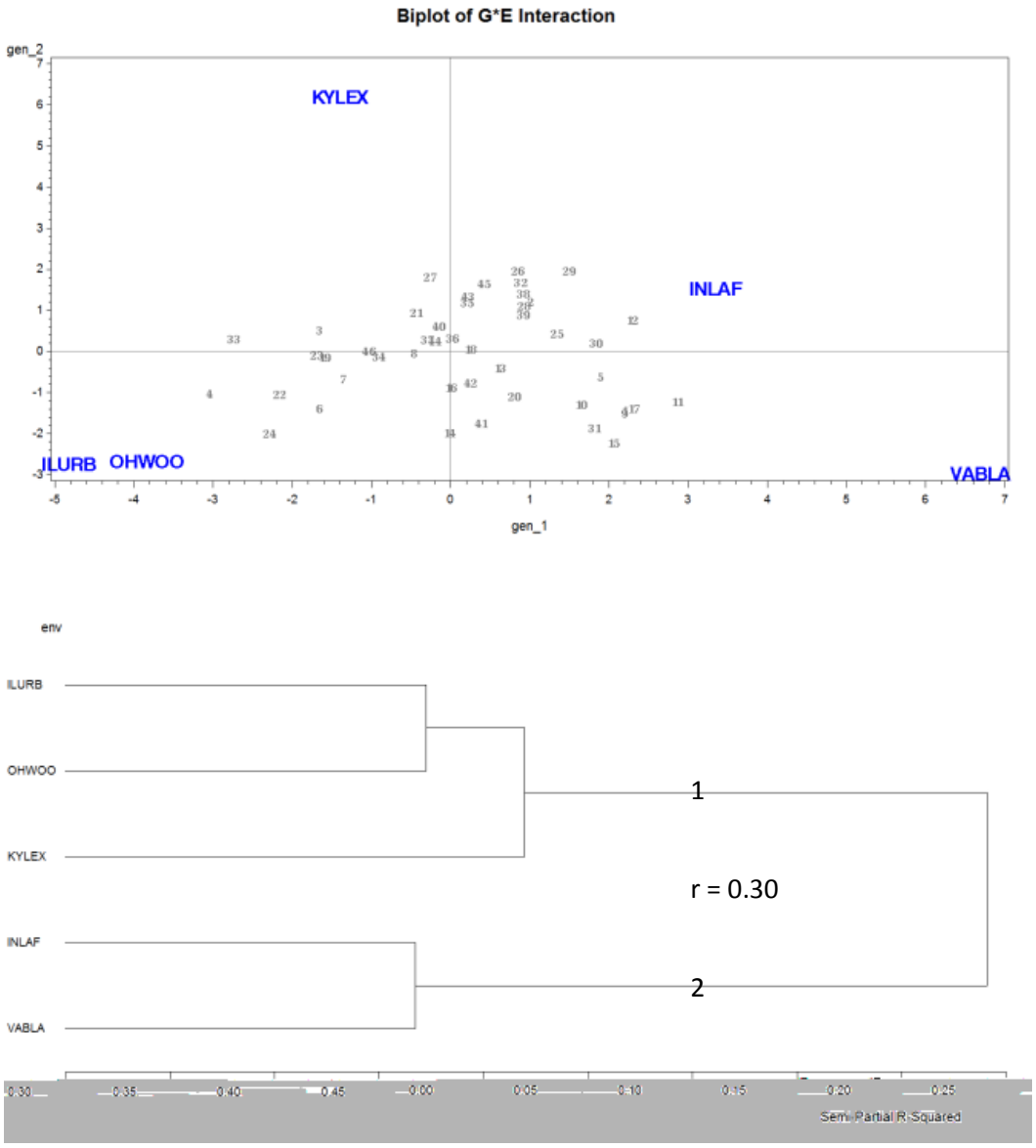

Figure 10. PNUWWSN FHB FDK Bi-plot from AMMI (PC1 versus PC2, entry numbers are shown) and clusters of environments using the GxE matrix and Ward's minimum variance.

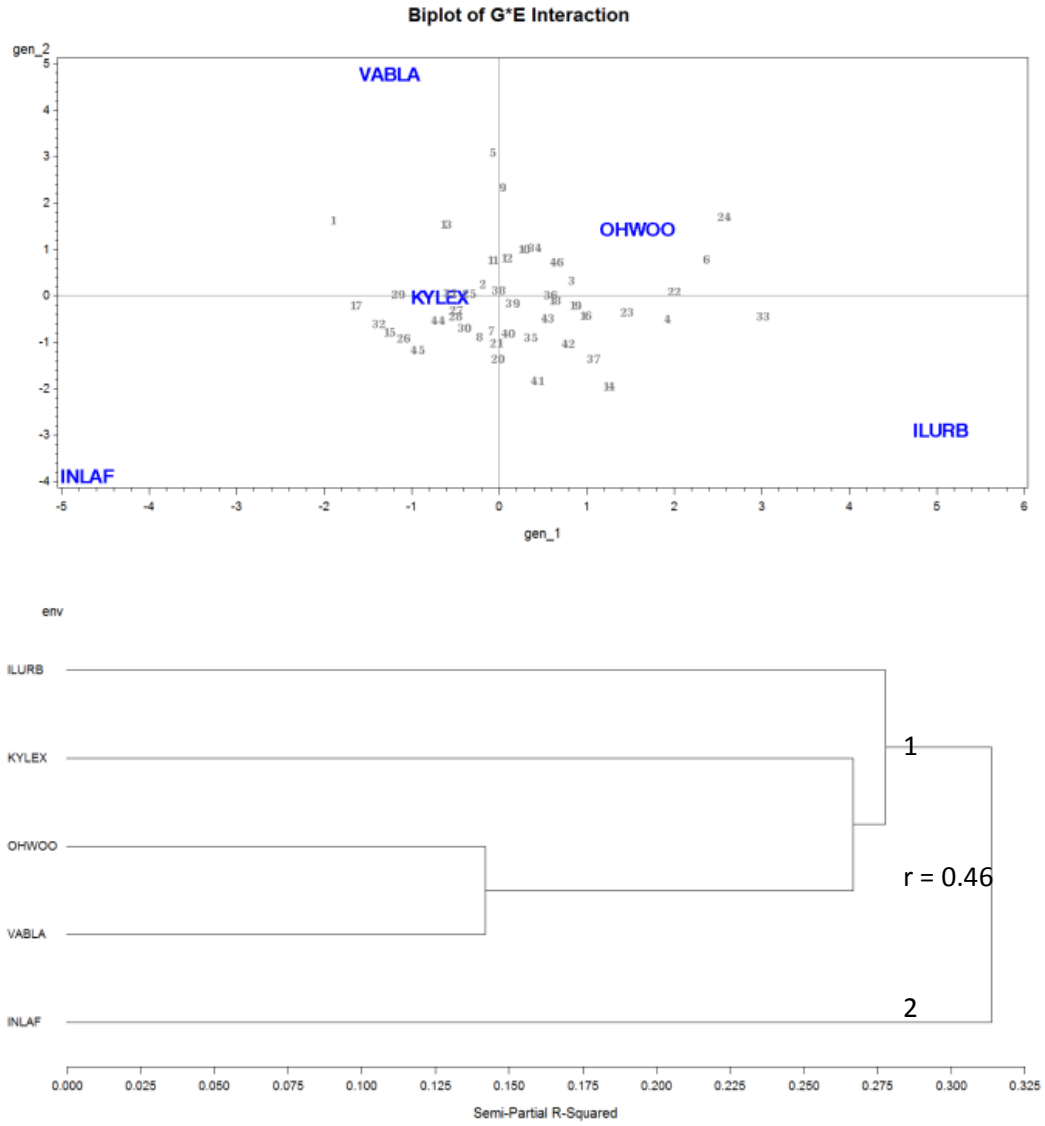

Figure 11. PNUWWSN FHB ISK Bi-plot from AMMI (PC1 versus PC2, entry numbers are shown) and clusters of environments using the GxE matrix and Ward's minimum variance.

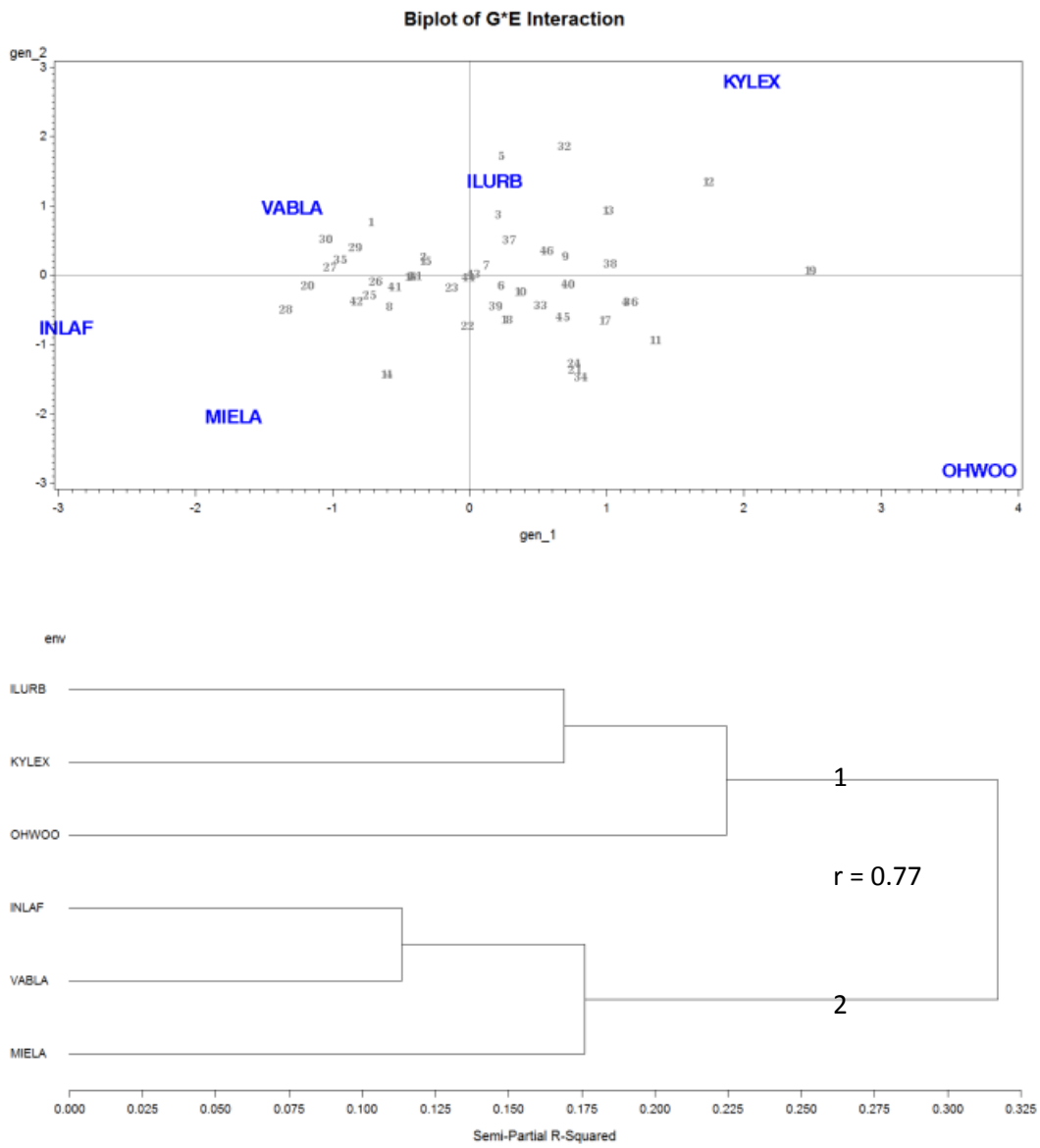

Figure 12. PNUWWSN FHB DON Bi-plot from AMMI (PC1 versus PC2, entry numbers are shown) and clusters of environments using the GxE matrix and Ward's minimum variance.