

**Northern Uniform Winter Wheat Scab Nursery
(NUWWSN)**

Report on 2003-2004 Nursery

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This report is a compilation and analysis of data from the cooperative assessment of resistance to Fusarium Head Blight (scab) (causal agent *Fusarium graminearum* (teleomorph: *Gibberella zeae* Schwabe.)) in winter wheat germplasm adapted to the northern regions of North America. Funding for the evaluation comes from the U.S. Wheat and Barely Scab Initiative, state and provincial agricultural experiment stations, USDA-ARS, and private companies.

This report contains preliminary data that has not been confirmed and thus is not suitable for general release to the public. Interpretation of the presented results may be modified with additional research. Confirmed results should be published through established channels. This report is to be used as a tool for the cooperators in the NUWWSN, their staff, and persons having direct interest in the development of wheat germplasm and agricultural research programs.

This report and data is not intended for unrestricted publication or distribution and should not be used in or referred to in publicity or advertising. Use of this data may be granted for certain purposes upon written request to the agency or agencies involved.

Horticulture and Crop Science Series 690

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MATERIALS AND METHODS

Entries:

There were 49 lines and 6 checks in the 2004 trial (Table 1). The lines were from 13 breeding programs. Ten entries and four checks were repeated from the 2003 NUWWSN (Table 1). There were 51 entries in the 2003 nursery, 46 in the 2002 nursery, 49 entries in the 2001 nursery, 29 entries in the 2000 nursery, and 28 in the 1999 nursery.

Tests:

The entries were successfully evaluated in 14 field tests (locations) and four greenhouse tests (Table 2). Data was also obtained from Cornell University but was not used in the analyses due to very low disease pressure. All cooperators who received seed provided data.

Traits:

Data was collected on heading date (HD), height (HGT), disease severity (SEV), disease incidence (INC), disease index (IND), kernel rating (KR), percent scabby seed (PSS), ISK, and DON (Table 3). Severity was also assessed in the greenhouse assays (GH). Data was not collected on all traits in all tests (Table 3). Some groups collected additional data that are summarized and described in Table 17.

Data Analyses:

Most cooperators sent entry means (not raw data) with some summary statistics from their trials. These means and statistics are presented in the appropriate tables and no additional within test analyses were performed. The entry means from individual tests were used to analyze results over tests. We used the LSMEANS option in PROC GLM to calculate the means over tests even though the data was quite balanced. ANOVAs (model: trait = genotype + environment) were conducted for each trait and the genotype x environment mean square (residual or error in this model) was used as the error term to calculate a LSD (0.05) for entry means over environment. There was no test for significance for the genotype x environment interaction (GEI) effect.

Based on $1-R^2$ (not shown), the GEI appeared quite large for disease index (IND), and severity from field and greenhouse (SEV, GH) trials so multivariate statistics (Yan et al., 2000 Crop Science 40:597-605) were used to analyze the GEI and group those environments that produced similar results for each trait. Genotype means were then calculated (LSMEANS again) over the environments that produced similar rankings. A group of environments that produced similar genotype rankings and results is called a megaenvironment. Among the environments within a megaenvironment there is generally little GEI, and the means from environments within a megaenvironment are generally correlated. This suggests that the environments within a megaenvironment form a set that provide similar information.

Correlations were calculated between all traits using entry means averaged over all appropriate environments.

RESULTS and DISCUSSION

All Traits

Genotype was a significant source of variance for all traits. There was considerable GEI for most traits except field severity ($1-R^2 = .21\%$), index ($1-R^2 = .17$), and greenhouse severity ($1-R^2 = .44$) but not other traits. Thus, genotype means over all environments are appropriate estimators of genetic value for all other traits.

GEI for Disease Index (IND):

As in 2001, 2002, and 2003, the GEI pattern for IND was complex, accounting for 19% of the treatment sum of squares. The locations were placed in three megaenvironments: AK+MD+MI+MO, IL_IN+KS+KY, and AF+NE+OR+OH. The VA and OO locations were outliers. The average correlation among locations within a megaenvironment was > 0.5 while the average correlation between locations in different megaenvironments was < 0.34 . The OO location (Ottawa Canada) was clearly different from all other locations and experience severe disease pressure. The VA location had the lightest disease pressure.

The GEI would affect selection. Only 1 of the best 6 lines would be selected simultaneously between any two megaenvironments. 14% of the best lines (top 10%) or worst lines (bottom 10%) from the megaenvironment would be similarly classified in the other environments. Truman is the only entry that would be selected in each of the three megaenvironments (though it would not be selected in the OO location)

GEI for Disease Severity in the Field (SEV):

The GEI for SEV accounted for 21% of the treatment sum of squares. The analysis revealed a complex GxE pattern for SEV that was related to the pattern found for IND. This result is quite similar to that found in 2001, 2002, and 2003. The multivariate analyses and inspection of correlations suggested three megaenvironments: MI+MD+MO, IN+IL+KY, and OR+OH. The OO, VA, and NE locations were outliers.

The GEI would affect selection. Only 1.7 of the best 6 lines would be selected simultaneously between any two megaenvironments.

GEI Disease Severity in the Greenhouse (GH):

The GEI accounted for 44% of the treatment sum of squares. This is nearly twice as much as in 2003 or 2002 while in 2001 the GEI did not appear important for GH. The analysis grouped AF+KY+MO while VA was an outlier. .

The GEI would affect selection. Three of the best 6 lines would be selected simultaneously between the megaenvironment and the VA test.

Correlation Among Traits:

There was a strong correlation among the head traits (SEV, INC, IND) and these were moderately correlated to GH severity (Table 16). The head traits were moderately correlated to the kernel traits KR and PSS and strongly correlated to ISK which is a function of head traits. The head traits were not correlated to DON. DON was strongly correlated to only PSS and to heading date.

Most Resistant and Most Susceptible Genotypes:

The most resistant and susceptible, based on analysis of all disease traits is shown in Table 5 along with the possible sources of resistance. Six of the 12 most resistant genotypes in Table 5 have exotic sources of resistance (Ning 7840, W14, 201R from Romania) while six do not appear to have exotic parentage.

Table1. 2004 NUWWSN Entries. "r" by the entry number indicates an entry repeated from the 2003 NUWWSN

SOURCE	ENTRY	NAME	PEDIGREE
Check	1 r	PIONEER 2545	
Check	2 r	ERNIE	Pike/MO9965
Check	3 r	FREEDOM	GR876/OH217
Check	4 r	IL97-6755	IL90-4813//IL85-3132-1/Ning 7840
Check	5	PATTERSON	P.69184B8-21-1-1-2-4*2/CALDWELL
Check	6	TRUMAN	MO11769/MADISON
Ohm	7	97397J1-4-1-4-7	96204-A1-12(Freedom//Clark*3/Ning7840)//GOLDFIELD/(Clark*3/Ning7840)
Ohm	8	981238A1-1-44-1	ERNIE//91193D1-10/X117
Ohm	9	981312A1-6-2-2	GOLDFIELD/X117//ROANE/92145A2-4-6
Ohm	10	981517A1-1-5-2	GOLDFIELD/201R
Ohm	11	992128A2-4-1	PATTERSON/201R//91202D1-1/3/INW9811/X117//PATTERSON
Griffey	12	VAN98W-342	CK983//GA-ANDY/VA90-21-20 (79IWWRN67//CK65-20/ATR) ,F13
Griffey	13	VA03W-630	VR95B717/PION2684,F4:6
Griffey	14	VA03W-633	VA96W-234//VR95B717/VA96W-234,BC1F5
Griffey	15	VA03W-644	Roane/W14/Roane,BC1F5
Griffey	16	VA03W-674	PC-7(CHILL"S"/YM16:SCAB-RES)/3/92-51-39(IN71761A4-31-4-48// 71-54-147 /MCN1813)// CK9803/RCT/4/93-52-55 (MSY*3/ BALKAN//SAL),F9
Kolb	17 r	IL96-24851-1	IL90-6364//IL90-9464/Ning 7840
Kolb	18 r	IL99-27048	IL90-6364/Pioneer brand 2571
Kolb	19	IL00-8061	P81138I1-16-5-50/Foster//IL93-2485
Kolb	20	IL00-1665	IL91-13114/Y88-3a// Foster//Pontiac
Kolb	21	IL99-20756	P81311-16-2-1-2-3-3/Foster//IL93-2489
Vansanford	22	KY97C-0151-1	ROANE/KY9787C-42-8-5
Vansanford	23	KY96C-0895-1	JACKSON/COKER 9803//2552
Bockus	24	KS00HW175-4	ARL/89H20
Bockus	25	KS950409-P-4	HBK0935W-24/JGR'S//HEYNE
Costa	26	MD27-37	LOV29/TYLER//RCT*2/GAINES/CKR9835
McKendry	27	MO010925	MO 94-182/Ernie
McKendry	28	MO010789	Coker 9474/Clemens
McKendry	29	MO010574	MO 94-103/Pioneer 2552
McKendry	30 r	MO010719	MO 12278/Pioneer 2552
McKendry	31	MO011130	MO 94-046/Pioneer XW535
Sorrells	32 r	NY88046-8138	Susquehanna/Harus
Sorrells	33 r	Caledonia Resel-T	Reselection from Caledonia
Sorrells	34	NY91028-9073	Harus/4/CS/A.Curvif//Glenn/3/Ald/Pvn(M-30)
Sorrells	35	NY91028SP-9245W	NY91028SP-9245WHarus/4/CS/A.Curvif//Glenn/3/Ald/Pvn(M-30)
Sorrells	36	NY89025-9111W	88076(PF84432/Augusta)/FL302
Sneller	37 r	OH743	OH529/OH506
Sneller	38 r	OH751	10584-0801/COKER 9663
Sneller	39	OH776	OH513/OH515
Sneller	40	OH788	PIONEER2571/OH483
Sneller	41	OH790	PIONEER2571/OH483
Moreno	42	X00-1051	T814//MO11769/LX8728D
Moreno	43	X00-1058	T814//MO11769/LX8728D
Moreno	44	Y00-3044	XY90-1B//LB291/PS8424
Ward	45	E2057	D2295/GR942
Ward	46	E2038	PIONEER 2555/D1098
Ward	47	E2048	D3583/TAM 101
Ward	48	E2037	PIONEER 2737W/D1098
Ward	49 r	E0009	NY82-105-2/CAYUGA
Schaasma	50 r	RCATL33	(Ruby/Frontana #1 x AC Ron//WEKO609H3 x AC Ron)
Schaasma	51 r	RCATL10	(AC Ron x SVP72017//Balkan)
Schaasma	52	RCATL24	(Ena x AC Ron//Ruby/Frontana #1)
Schaasma	53	RCATL12	(Fundulea x AC Morley)
Schaasma	54	RCAT L2	(Ruby/Frontana #1 x 2737W//Balkan)
Baenziger	55	WESLEY	KS831036-3//COLT/CODY
Baenziger	56	NE98466	KS89H50-4/NE90518(-BRL//SXL/BENN)

Table 2. Description of tests and locations

INSTITUTE	University of Arkansas (AF, AK)		
COOPERATOR(S)	Gene Milus		
TEST LOCATION	Fayetteville (AF) and Kibler (AK) AR		
INSTITUTE	University of Illinois (IL)	FERTILIZER	40 lbs N/A preplant, P and K ok, no spring topdress
COOPERATOR(S)	Frederic L Kolb, Eric Brucker, Norman Smith	IRR./MISTING METHOD	Misted daily early morning and late evening.
TEST LOCATION	Urbana, Illinois	INOCULATION METHOD	Wheat grain spawn, + corn fodder scattered in the field (in the fall) and fodder was sprayed with inoculum one month before anthesis..
PLOT SIZE	1 row x 3 feet	PRECIP DURING GRAIN FILL	?
REPS	3	AVG. TEMP. DURING GRAIN FILL	?
SEEDING DATE	10/1/03	DATE/FEEKES WHEN RATED	Feekes 10.5 + approx. 26 days.
HARVEST DATE	6/29/04	COMMENTS	Heading date of late heading lines not obtained by mistake.
INSTITUTE:	Purdue University (IN)		
COOPERATOR(S):	Herb Ohm		
TEST LOCATION:	Lafayette, IN		
PLOT SIZE:	4' X 4'		
REPS:	2		
SEEDING DATE:	9/30/2003		
HARVEST DATE:			
INSTITUTE:	Kansas State University (KS)	FERTILIZER	none
COOPERATOR(S):	Bill Bockus and Mark Davis	IRR./MISTING METHOD	impulse sprinklers 3 minutes per hour from 9:00 pm TO 6:00 am
TEST LOCATION:	Manhattan, KS	INOCULATION METHOD	colonized corn kernels (8.5 g per square foot)
PLOT SIZE:	single, 7.5 foot row		
REPS:	4		
SEEDING DATE:	Oct. 3, 2003		
HARVEST DATE:	June 29, 2004 (plot combine)		
INSTITUTE:	University of Kentucky (KY)	FERTILIZER:	P, K acc. to soil tests; 110# N, split appl.
COOPERATOR(S):	A.J. Stewart and Dave VanSanford	IRR./MISTING METHOD:	Overhead- Evening/ Early Morning Mist
TEST LOCATION:	Lexington, KY	INOCULATION METHOD:	Scabby Corn
PLOT SIZE:	2 rows, 4 ft long	PRECIP DURING GRAIN FILL:	9.3 Inches
REPS:	2	AVG. TEMP. DURING GRAIN FILL:	69.9° F
SEEDING DATE:	10/23/2003	DATE/FEEKES WHEN RATED:	
HARVEST DATE:	6/28/2004	COMMENTS:	Feekes 10.5 +21 days
INSTITUTE:	University of Maryland (MD)	FERTILIZER:	40 lbs/A N preplant, P and K ok, 60 N spring topdress
COOPERATOR(S):	Costa, Cooper	IRR./MISTING METHOD:	Mist
TEST LOCATION:	Salisbury, MD	INOCULATION METHOD:	Corn grain infected with Fusarium~1 month before anthesis
PLOT SIZE:	2-row, 1.2m	PRECIP DURING GRAIN FILL:	
REPS:	3	AVG. TEMP. DURING GRAIN FILL:	
SEEDING DATE:	10/21/2003	DATE/FEEKES WHEN RATED:	
HARVEST DATE:	6/14/2004	COMMENTS:	Good Fusarium spread

Table 2 cont. Description of tests and locations.

INSTITUTE	Michigan State University (MI)	FERTILIZER	250# 19-19-19 Pre-Plant + 196# 46-0-0 at Spring Green-up
COOPERATOR(S)	Rick Ward	IRR./MISTING METHOD	Hourly misting for 4 minutes from 7am-9pm and once at 10pm and once at 3 am for 10 minutes each
TEST LOCATION	Clarksville, Michigan	INOCULATION METHOD	Lab-infected wheat seed scattered 10 days prior to heading
PLOT SIZE	1 Row X 5 Feet	PRECIP DURING GRAIN FILL	2.78 Inches rainfall + misting
REPS	4	AVG. TEMP. DURING GRAIN FILL	65.9 F
SEEDING DATE	October 14, 2003	DATE/FEEKES WHEN RATED	18-24 days post anthesis
HARVEST DATE	August 3, 2004		
INSTITUTE	University of Missouri (MO)	FERTILIZER	
COOPERATOR(S)	Anne McKendry	IRR./MISTING METHOD	persistent natural rainfall; overhead mist as well
TEST LOCATION	Columbia, MO	INOCULATION METHOD	Spray at 75% anthesis with macroconidia concentrated to 50,000 spores/mL. Point inoculation in GH with 10 uL of 50,000 spores/mL
PLOT SIZE	30 in x 28 in	PRECIP DURING GRAIN FILL	
REPS	4	AVG. TEMP. DURING GRAIN FILL	
SEEDING DATE		DATE/FEEKES WHEN RATED	
HARVEST DATE			
INSTITUTE:	University of Nebraska (NE)	FERTILIZER:	none
COOPERATOR(S):	Dr. S. Baenziger, Dr. J. Watkins, J. Schimelfenig	IRR./MISTING METHOD:	misting from overhead risers
TEST LOCATION:	Mead, NE.	INOCULATION METHOD:	spray 70 000 conidia/ml - 5/17, 19, 21, 24 and 26, in 2003
PLOT SIZE:	Total of 10 ft ² (1 row, 10 foot long, 1 foot between rows)	PRECIP DURING GRAIN FILL:	(unusually frequent and high precip for NE) AVG PRECIP - 1.85 or Total 6"
REPS:	1	AVG. TEMP. DURING GRAIN FILL:	85-90 (unusually cool, for NE)
SEEDING DATE:	9/30/2003	DATE/FEEKES WHEN RATED:	Feekes 11.2 : date - 6/10/04
HARVEST DATE:	7/14/2004	COMMENTS:	Ideal conditions - excellent infection in 2004.
INSTITUTE	Ohio State University (OH)	INOCULATION METHOD	Infected corn kernels were spread prior to anthesis
COOPERATOR(S)	Clay Sneller, Pat Lipps, Larry Herald	IRR./MISTING METHOD	Misted daily early morning and late evening.
TEST LOCATION	Wooster, OH	DATE/FEEKES WHEN RATED	18-24 days post anthesis
PLOT SIZE	single 1M row		
REPS	3		
INSTITUTE:	University of Guelph (OR)	FERTILIZER:	
COOPERATOR(S):	Lily Tamburic-Ilincic, Art Schaafsma, Arend Smid	IRR./MISTING METHOD:	mist system
TEST LOCATION:	Ridgetown, Ontario, Canada	INOCULATION METHOD:	sprayed with mixture of 4 F.graminearum isolates
PLOT SIZE:	4.0 m long, single row	AVG. TEMP. DURING GRAIN FILL:	
REPS:	4	DATE/FEEKES WHEN RATED:	May25-June17, 2004
SEEDING DATE:	20-Oct-03		
INSTITUTE:	ECORC-Ottawa (OO)		
COOPERATOR(S):	Radhey Pandeya		
TEST LOCATION:	Ottawa Ontario		
INSTITUTE	Virginia Tech (VA)	INOCULATION METHOD	Conidial suspension was applied to field and floret inoculation was applied in greenhouse. The concentration of conidial was 5 x 10 ⁴ spores/ml.
COOPERATOR(S)	Carl A. Griffey and Jianli Chen, Virginia Tech		
TEST LOCATION	Blacksburg, VA		

Table 3. Description of traits

Code	Trait	Description	Tests where data was collected
HD	Heading date	Days from Jan 1 st when 50% of heads have emerged	KY,MD,MI,MO,OO,OR,IL,VA,OH
HGT	Plant height	Height in inches from ground to top of spike at maturity	KY,MO,OR,VA
SEV	Disease severity from field tests	% of infected spikelets in an infected head. Generally visually rated according to Stack & McMullen, 'A Visual scale to estimate severity of Fusarium Head Blight in Wheat', NDES. PP-1095	IN,KY,MD,MI,MO,NE,OO,OR,IL,VA,OH
INC	Disease incidence	% of heads with at least one infected spikelets	IN,KY,MD,MI,MO,NE,OO,OR,IL,VA,OH
IND	Disease index	$IND = (SEV \times INC) / 100$	AF,AK,IN,KY,KS,MD,MI,MO,NE,OO,OR,IL,VA,OH
GH	Disease severity from greenhouse tests	Same as SEV except using greenhouse data	AF,KY,MO,VA
KR	Kernel rating	A visual assessment of the percent infected kernels	KY,NE,IL
PSS	Percent scabby seed	Percent of scabby seed by weight	AF,KY,MD,KS,MO
ISK	Composite of head and kernel traits	ISK Index = .3 (Severity) + .3 (Incidence) + .4 (% FDK or PSS)	KY,MD,MO,NE,IL
DON	DON (vomitoxin)	PPM of vomitoxin in grain sample as assayed by Pat Hart, Michigan State University	AF,KY,MI,NE,IL,VA

Table 4. Entry means for all traits. #l and #h are number of times an entry was not significantly different from the lowest (#l) or highest (#h) mean for the 8 FHB traits

#	NAME	INC	SEV	IND	GH	KR	PSS	ISK	DON	#l	#h	HD	HGT
1	PIONEER 2545	80.7 h	53.9 h	43.5 h	32.7	50.9 h	48.2 h	42.0 h	11.1	0	6	141	33
2	ERNIE	60.2	33.0	24.4	13.9 l	29.4 l	18.6 l	18.6 l	4.4 l	5	0	139 l	30 l
3	FREEDOM	62.9	39.4	26.3	12.2 l	41.9	35.9	32.2	4.6 l	2	0	142	35
4	IL97-6755	47.0 l [†]	21.1 l	18.2 l	9.8 l	24.4 l	17.9 l	12.0 l	2.6 l	8	0	140	38
5	PATTERSON	69.7	44.4 h	37.3 h	44.7 h	38.1 l	22.9 l	26.6	4.4 l	3	3	140	35
6	TRUMAN	48.3 l	20.4 l	13.0 l	8.2 l	28.6 l	22.6 l	14.0 l	3.9 l	8	0	145	35
7	97397J1-4-1-4-7	59.1	28.6 l	21.5	10.3 l	33.1 l	24.6 l	18.8 l	3.7 l	6	0	139 l	32
8	981238A1-1-44-1	63.4	36.6	27.3	22.6 l	45.6	25.0 l	24.5	3.4 l	3	0	139 l	32
9	981312A1-6-2-2	62.3	32.8	24.1	17.6 l	37.5 l	27.8	21.3 l	3.7 l	4	0	142	31 l
10	981517A1-1-5-2	56.5 l	29.0 l	20.6 l	10.8 l	38.2 l	21.9 l	18.5 l	4.3 l	8	0	142	32
11	992128A2-4-1	79.0 h	46.9 h	38.9 h	24.9	52.3 h	30.9	35.2 h	4.5 l	1	5	139 l	32
12	VAN98W-342	76.6 h	47.5 h	35.4	25.1	48.9 h	40.4 h	41.6 h	5.4 l	1	5	141	29 l
13	VA03W-630	74.0 h	51.0 h	40.2 h	49.2 h	47.2 h	36.1	35.9 h	8.7	0	6	143	32
14	VA03W-633	71.7 h	43.2 h	32.0	26.8	40.3 l	34.6	33.7	7.3	1	2	141	30 l
15	VA03W-644	66.5	35.6	25.3	15.2 l	39.7 l	22.9 l	22.7 l	4.1 l	5	0	140	30 l
16	VA03W-674	67.7	45.7 h	33.7	34.2	43.6	30.4	29.6	8.6	0	1	139 l	30 l
17	IL96-24851-1	60.8	28.9 l	21.2	9.9 l	40.8 l	25.8 l	19.9 l	2.8 l	6	0	142	32
18	IL99-27048	60.0	32.7	26.7	19.1 l	31.9 l	19.3 l	22.8 l	3.5 l	5	0	138 l	34
19	IL00-8061	54.5 l	25.5 l	18.3 l	18.1 l	33.3 l	17.0 l	15.2 l	4.1 l	8	0	141	36
20	IL00-1665	61.2	34.7	24.0	23.3 l	42.7	27.1 l	24.9	4.4 l	3	0	141	33
21	IL99-20756	59.2	31.4 l	25.0	11.9 l	26.4 l	13.8 l	17.2 l	4.7 l	6	0	138 l	34
22	KY97C-0151-1	72.1 h	46.4 h	36.7 h	32.3	46.7 h	32.7	32.4	5.4 l	1	4	141	35
23	KY96C-0895-1	58.5	34.7	24.2	27.9	36.5 l	27.1 l	23.8 l	6.1 l	4	0	144	37
24	KS00HW175-4	63.7	39.9	28.1	22.6 l	42.9	37.1	30.5	9.1	1	0	143	35
25	KS950409-P-4	70.2	42.8	32.5	18.8 l	49.3 h	43.5 h	34.2	9.1	1	2	142	34
26	MD27-37	66.3	41.4	34.0	25.0	37.9 l	25.3 l	28.5	4.0 l	3	0	139 l	32
27	MO010925	61.3	37.7	27.6	29.5	40.9 l	30.7	26.1	3.6 l	2	0	142	35
28	MO010789	58.1	38.1	26.0	37.5 h	34.9 l	28.2	29.2	6.6	1	1	143	37
29	MO010574	67.1	37.2	27.8	19.4 l	38.9 l	28.8	25.5	6.2 l	3	0	142	37
30	MO010719	58.4	31.0 l	23.2	14.5 l	40.6 l	29.0	21.8 l	6.8	4	0	141	40
31	MO011130	73.4 h	45.4 h	37.6 h	32.6	49.3 h	38.7	37.8 h	9.2	0	5	142	38
32	NY88046-8138	67.2	36.3	26.6	31.9	53.9 h	51.5 h	30.7	11.7	0	2	147 h	36
33	Caledonia Resel-T	72.1 h	37.2	25.8	32.6	49.5 h	46.3 h	34.0	14.8 h	0	4	147 h	36
34	NY91028-9073	60.1	28.6 l	20.1 l	23.7 l	54.4 h	50.6 h	28.4	15.5 h	3	3	148 h	35
35	NY91028SP-9245W	59.4	27.8 l	19.4 l	35.6 h	47.6 h	41.0 h	22.0 l	17.5 h	3	4	148 h	35
36	NY89025-9111W	62.2	32.6	23.2	35.4 h	51.3 h	43.6 h	27.7	13.7 h	0	4	148 h	37
37	OH743	64.5	40.1	30.6	24.1 l	44.3	34.8	29.1	5.3 l	2	0	143	36
38	OH751	70.5	39.9	29.8	25.1	41.6	28.5	29.6	5.9 l	1	0	142	35
39	OH776	68.6	43.4 h	34.0	35.1 h	44.8	31.9	26.0	6.7	0	2	141	34
40	OH788	64.9	45.6 h	35.7	50.1 h	52.6 h	38.8	33.9	6.6	0	3	140	34
41	OH790	71.5 h	43.2 h	35.4	43.7 h	50.1 h	38.1	35.9 h	6.0 l	1	5	141	34
42	X00-1051	57.7	34.1	22.0	18.0 l	36.2 l	23.1 l	23.0 l	3.6 l	5	0	142	33
43	X00-1058	65.7	42.5	27.8	12.0 l	44.8	34.0	30.8	7.5	1	0	144	33
44	Y00-3044	65.9	49.1 h	29.2	30.0	56.7 h	45.8 h	38.7 h	8.8	0	4	145	33
45	E2057	56.4 l	29.0 l	19.7 l	22.4 l	39.1 l	40.5 h	22.5 l	12.5	6	1	146 h	32
46	E2038	58.3	29.2 l	18.8 l	13.4 l	42.1	27.4	20.8 l	11.3	4	0	147 h	34
47	E2048	57.4	29.0 l	19.7 l	26.7	47.6 h	39.7	23.8 l	8.9	3	1	146 h	38
48	E2037	59.4	34.2	21.6	23.0 l	53.8 h	38.4	29.6	12.3	1	1	147 h	35
49	E0009	55.0 l	26.4 l	18.9 l	27.8	45.8	30.4	20.3 l	8.2	4	0	148 h	38
50	RCATL33	57.0 l	30.7 l	23.0	51.0 h	53.1 h	28.5	25.0	4.4 l	3	2	140	41 h
51	RCATL10	67.5	36.5	26.5	31.2	52.7 h	43.0 h	32.7	11.5	0	2	145	39
52	RCATL24	49.7 l	22.8 l	16.2 l	33.9	41.6	30.5	16.4 l	10.6	4	0	147 h	42 h
53	RCATL12	58.3	35.2	24.5	26.1	48.2 h	44.5 h	27.5	6.7	0	2	144	40
54	RCAT L2	62.7	39.0	28.5	23.6 l	39.3 l	25.1 l	24.0	5.4 l	4	0	140	40
55	WESLEY	77.2 h	54.1 h	41.7 h	34.2	63.1 h	53.2 h	46.6 h	7.5	0	6	143	33
56	NE98466	69.4	44.3 h	33.4	31.0	47.8 h	36.5	35.6 h	5.0 l	1	3	142	37
	AVERAGE	63.7	36.7	27.1	25.2	42.8	32.0	27.0	7.0			142	34
	MINIMUM	47.0	20.4	13.0	8.2	24.4	13.8	12.0	2.6			138	29
	MAXIMUM	80.7	53.9	43.5	51.0	56.7	51.5	42.0	17.5			148	41
	LSD (0.05)	10.1	11.2	7.6	16.6	16.6	13.4	11.8	4.3			2	2
	# LOCATIONS	11	11	14	4	3	5	5	6			9	4

[†] Indicates a mean that is not different from the lowest (l) or highest (h) mean in the column based on LSD_(0.05)

Table 5. Most resistant (top) and most susceptible (bottom) entries. #l and #h are number of times an entry was not significantly different from the lowest (#l) or highest (#h) mean for the 8 FHB traits

#	NAME	INC	SEV	IND	GH	KR	PSS	ISK	DON	#l	#h	HD	HGT
6	TRUMAN	48.3 l	20.4 l	13.0 l	8.2 l	28.6 l	22.6 l	14.0 l	3.9 l	8	0	145	35
4	IL97-6755	47.0 l [†]	21.1 l	18.2 l	9.8 l	24.4 l	17.9 l	12.0 l	2.6 l	8	0	140	38
19	IL00-8061	54.5 l	25.5 l	18.3 l	18.1 l	33.3 l	17.0 l	15.2 l	4.1 l	8	0	141	36
10	981517A1-1-5-2	56.5 l	29.0 l	20.6 l	10.8 l	38.2 l	21.9 l	18.5 l	4.3 l	8	0	142	32
45	E2057	56.4 l	29.0 l	19.7 l	22.4 l	39.1 l	40.5 h	22.5 l	12.5	6	1	146 h	32
17	IL96-24851-1	60.8	28.9 l	21.2	9.9 l	40.8 l	25.8 l	19.9 l	2.8 l	6	0	142	32
7	97397J1-4-1-4-7	59.1	28.6 l	21.5	10.3 l	33.1 l	24.6 l	18.8 l	3.7 l	6	0	139 l	32
21	IL99-20756	59.2	31.4 l	25.0	11.9 l	26.4 l	13.8 l	17.2 l	4.7 l	6	0	138 l	34
42	X00-1051	57.7	34.1	22.0	18.0 l	36.2 l	23.1 l	23.0 l	3.6 l	5	0	142	33
2	ERNIE	60.2	33.0	24.4	13.9 l	29.4 l	18.6 l	18.6 l	4.4 l	5	0	139 l	30 l
15	VA03W-644	66.5	35.6	25.3	15.2 l	39.7 l	22.9 l	22.7 l	4.1 l	5	0	140	30 l
18	IL99-27048	60.0	32.7	26.7	19.1 l	31.9 l	19.3 l	22.8 l	3.5 l	5	0	138 l	34
12	VAN98W-342	76.6 h	47.5 h	35.4	25.1	48.9 h	40.4 h	41.6 h	5.4 l	1	5	141	29 l
41	OH790	71.5 h	43.2 h	35.4	43.7 h	50.1 h	38.1	35.9 h	6.0 l	1	5	141	34
11	992128A2-4-1	79.0 h	46.9 h	38.9 h	24.9	52.3 h	30.9	35.2 h	4.5 l	1	5	139 l	32
31	MO011130	73.4 h	45.4 h	37.6 h	32.6	49.3 h	38.7	37.8 h	9.2	0	5	142	38
13	VA03W-630	74.0 h	51.0 h	40.2 h	49.2 h	47.2 h	36.1	35.9 h	8.7	0	6	143	32
55	WESLEY	77.2 h	54.1 h	41.7 h	34.2	63.1 h	53.2 h	46.6 h	7.5	0	6	143	33
1	PIONEER 2545	80.7 h	53.9 h	43.5 h	32.7	50.9 h	48.2 h	42.0 h	11.1	0	6	141	33
	AVERAGE	58.7	30.5	22.4	14.8	34.6	23.7	20.5	4.6			141	33
	MINIMUM	47.0	20.4	13.0	8.2	24.4	13.8	12.0	2.6			138	29
	MAXIMUM	76.6	47.5	35.4	25.1	48.9	40.5	41.6	12.5			146	38
	LSD (0.05)	10.1	11.2	7.6	16.6	16.6	13.4	11.8	4.3			2	2
	# LOCATIONS	11	11	14	4	3	5	5	6			9	4

[†] Indicates a mean that is not different from the lowest (l) or highest (h) mean in the column based on LSD_(0.05)

Name	Possible source of resistance (SW = native Soft Winter)
TRUMAN	SW
IL97-6755	SW + Ning7840
IL00-8061	SW
981517A1-1-5-2	SW (Goldfield) plus F201R from Romania
E2057	SW
IL96-24851-1	SW + Ning 7840
97397J1-4-1-4-7	SW (Freedom, Goldfield) plus Ning7840
IL99-20756	SW
X00-1051	SW (perhaps MO11769 that is a parent of Truman)
ERNIE	SW
VA03W-644	SW (Roane) plus Chinese line W14
IL99-27048	SW

Table 6. Disease incidence (INC, %) from field trials.

#	NAME	MEAN	IL	IN	KY	MD	MI	MO	NE	OH	OO	OR	VA
1	PIONEER 2545	80.7 h	52	83	91	53	98	100	80	97	80	90	63
2	ERNIE	60.2	36	37	87	27	98	100	0	98	90	83	7
3	FREEDOM	62.9	39	59	75	23	98	98	10	90	80	90	30
4	IL97-6755	47.0 l	34	29	83	13	96	89	0	40	85	43	7
5	PATTERSON	69.7	75	69	94	43	98	98	0	90	85	93	22
6	TRUMAN	48.3 l	20	30	72	12	94	81	0	68	85	50	20
7	97397J1-4-1-4-7	59.1	24	21	100	23	98	100	0	85	85	88	27
8	981238A1-1-44-1	63.4	65	61	93	20	98	99	5	83	80	70	23
9	981312A1-6-2-2	62.3	39	77	84	25	98	100	0	98	80	78	8
10	981517A1-1-5-2	56.5 l	24	56	89	13	98	100	0	100	80	40	22
11	992128A2-4-1	79.0 h	62	78	97	78	98	100	0	100	85	90	80
12	VAN98W-342	76.6 h	62	61	97	58	98	100	65	100	85	78	38
13	VA03W-630	74.0 h	77	78	89	63	98	100	25	100	80	68	37
14	VA03W-633	71.7 h	50	72	85	40	98	99	30	100	80	95	40
15	VA03W-644	66.5	23	53	97	43	98	100	20	100	80	90	27
16	VA03W-674	67.7	57	63	93	47	98	99	10	92	85	85	17
17	IL96-24851-1	60.8	12	28	91	35	98	100	25	97	85	88	10
18	IL99-27048	60.0	37	37	91	67	98	99	0	88	85	43	17
19	IL00-8061	54.5 l	45	22	87	15	98	90	0	75	80	68	20
20	IL00-1665	61.2	45	40	91	38	96	100	15	75	85	70	18
21	IL99-20756	59.2	17	32	94	25	98	100	0	75	80	60	70
22	KY97C-0151-1	72.1 h	60	57	93	42	98	100	40	100	85	95	23
23	KY96C-0895-1	58.5	56	46	86	22	98	100	0	82	80	60	13
24	KS00HW175-4	63.7	43	49	93	38	98	100	25	82	80	73	20
25	KS950409-P-4	70.2	50	77	88	37	98	100	30	95	85	98	15
26	MD27-37	66.3	40	34	100	52	98	100	5	90	90	88	33
27	MO010925	61.3	55	38	91	23	94	100	30	83	85	63	13
28	MO010789	58.1	57	50	85	13	98	100	15	70	85	55	10
29	MO010574	67.1	38	70	96	32	98	99	40	92	80	80	13
30	MO010719	58.4	34	63	91	22	96	99	10	75	80	60	13
31	MO011130	73.4 h	84	71	87	45	98	100	50	90	80	83	20
32	NY88046-8138	67.2	47	63	96	20	98	98	25	78	80	78	57
33	Caledonia Resel-T	72.1 h	52	49	92	22	98	100	90	82	80	85	43
34	NY91028-9073	60.1	25	63	91	8	98	96	30	60	80	73	37
35	NY91028SP-9245W	59.4	25	68	89	8	98	93	10	88	80	55	40
36	NY89025-9111W	62.2	46	47	95	12	98	90	35	82	75	68	37
37	OH743	64.5	39	65	91	37	98	100	0	90	85	88	17
38	OH751	70.5	47	80	93	42	98	100	35	100	80	88	13
39	OH776	68.6	58	65	96	47	98	100	0	87	90	95	20
40	OH788	64.9	72	51	90	47	98	100	10	83	85	65	13
41	OH790	71.5 h	73	75	91	60	96	100	15	83	80	90	23
42	X00-1051	57.7	23	42	90	13	98	100	25	90	65	78	12
43	X00-1058	65.7	42	56	86	23	98	100	20	87	80	80	50
44	Y00-3044	65.9	55	66	85	25	98	99	10	85	80	88	35
45	E2057	56.4 l	42	29	72	10	98	98	0	85	85	65	37
46	E2038	58.3	23	51	84	10	98	99	15	95	80	65	22
47	E2048	57.4	41	46	75	22	98	99	0	72	75	70	33
48	E2037	59.4	31	49	88	17	98	99	15	82	80	63	33
49	E0009	55.0 l	32	33	85	17	98	96	5	75	80	60	25
50	RCATL33	57.0 l	46	44	87	25	98	94	15	80	80	48	12
51	RCATL10	67.5	55	62	87	14	98	99	35	87	80	93	33
52	RCATL24	49.7 l	15	31	91	7	98	95	5	58	80	48	20
53	RCATL12	58.3	60	43	75	13	98	98	10	83	80	58	23
54	RCAT L2	62.7	33	59	97	37	98	100	0	75	80	95	17
55	WESLEY	77.2 h	82	73	91	63	98	100	50	90	80	93	30
56	NE98466	69.4	70	62	85	43	98	99	40	90	85	70	20
	AVERAGE	63.7	45	54	89	31	98	98	18	85	82	74	26
	MINIMUM	47.0	12	21	72	7	94	81	0	40	65	40	7
	MAXIMUM	80.7	84	83	100	78	98	100	90	100	90	98	80
	CV%	18.7	24	26	8	54	2	3		15	4	17	46
	LSD (0.05)	10.1	18	28	15	27	2	5		3	5	18	16

[†] Indicates a mean that is not different from the lowest (l) or highest (h) mean in the column based on LSD_(0.05)

Table 7. Field disease severity (SEV, %). Mean is mean over all trials. "Avg" is mean for a set of locations that were grouped based on GxE analysis: sets are boxed together in the table. NE, VA, and OO were outliers.

#	NAME	MEAN	Avg IL IN KY	Avg OH OR	Avg MD MI MO	NE VA OO
1	PIONEER 2545	53.9 h	47 60 50 30	54 73 36	70 87 87 38	40 14 80
2	ERNIE	33.0	15 1 13 31	15 21 10	63 57 94 39	0 9 90
3	FREEDOM	39.4	49 87 25 36	24 27 21	46 53 56 28	14 7 80
4	IL97-6755	21.1 l	16 1 20 26	6 9 3	28 13 58 11	0 6 85
5	PATTERSON	44.4 h	44 35 61 35	36 34 38	65 77 96 23	0 6 85
6	TRUMAN	20.4 l	15 10 20 17	8 11 5	23 27 33 10	0 7 85
7	97397J1-4-1-4-7	28.6 l	15 4 7 34	15 11 18	50 60 67 23	0 6 85
8	981238A1-1-44-1	36.6	39 52 30 36	15 24 7	54 50 89 21	7 7 80
9	981312A1-6-2-2	32.8	22 16 7 44	26 37 14	52 60 74 22	0 7 80
10	981517A1-1-5-2	29.0 l	14 12 9 22	11 19 2	56 63 81 24	0 7 80
11	992128A2-4-1	46.9 h	44 70 21 40	30 33 28	73 93 89 37	0 19 85
12	VAN98W-342	47.5 h	40 53 42 25	30 42 17	70 83 87 40	35 12 85
13	VA03W-630	51.0 h	68 65 74 64	32 51 13	66 80 81 38	7 13 75
14	VA03W-633	43.2 h	39 58 22 36	35 41 29	59 78 69 29	18 14 80
15	VA03W-644	35.6	16 13 10 27	27 36 19	65 83 85 27	7 6 80
16	VA03W-674	45.7 h	47 42 46 52	25 32 18	70 83 91 35	11 8 85
17	IL96-24851-1	28.9 l	12 1 8 27	20 23 17	47 45 76 19	12 5 85
18	IL99-27048	32.7	16 5 24 19	8 11 5	67 83 83 34	0 12 85
19	IL00-8061	25.5 l	13 3 7 28	11 13 9	44 40 72 20	0 9 80
20	IL00-1665	34.7	33 23 29 48	14 16 12	50 63 63 24	9 10 85
21	IL99-20756	31.4 l	15 3 14 28	10 16 4	63 53 87 48	0 12 80
22	KY97C-0151-1	46.4 h	45 53 43 38	41 44 39	62 77 83 26	12 12 85
23	KY96C-0895-1	34.7	36 38 33 37	19 23 15	48 55 61 29	0 10 80
24	KS00HW175-4	39.9	39 52 19 48	18 24 11	66 80 78 38	7 7 75
25	KS950409-P-4	42.8	51 77 24 52	24 27 21	62 68 81 38	7 5 70
26	MD27-37	41.4	25 18 17 39	17 18 16	79 87 92 58	14 8 90
27	MO010925	37.7	48 35 61 49	15 21 9	44 53 52 28	11 11 85
28	MO010789	38.1	60 80 49 52	12 17 7	37 37 46 27	9 10 85
29	MO010574	37.2	31 16 30 49	20 25 15	59 73 76 27	8 10 80
30	MO010719	31.0 l	29 22 22 43	15 20 9	46 50 65 22	7 6 75
31	MO011130	45.4 h	61 67 66 50	22 24 20	55 70 57 39	17 11 80
32	NY88046-8138	36.3	44 40 45 47	21 28 15	42 57 51 17	8 12 80
33	Caledonia Resel-T	37.2	52 50 66 40	22 28 16	38 28 62 24	7 9 80
34	NY91028-9073	28.6 l	36 47 28 33	15 17 12	30 14 54 21	7 8 75
35	NY91028SP-9245W	27.8 l	29 30 20 36	15 25 6	31 22 51 19	7 10 80
36	NY89025-9111W	32.6	45 47 39 48	17 23 11	34 18 67 16	6 9 75
37	OH743	40.1	51 85 17 52	28 32 24	47 50 62 28	0 6 85
38	OH751	39.9	44 65 34 33	27 34 20	53 63 66 31	4 9 80
39	OH776	43.4 h	39 27 42 48	32 35 30	64 83 83 25	0 15 90
40	OH788	45.6 h	62 70 74 43	18 27 9	60 70 81 31	7 7 85
41	OH790	43.2 h	53 67 51 41	23 22 24	59 77 65 36	7 10 75
42	X00-1051	34.1	43 55 22 51	16 17 15	42 25 76 26	18 6 65
43	X00-1058	42.5	46 73 25 40	26 37 15	56 60 81 28	20 9 80
44	Y00-3044	49.1 h	58 88 43 42	30 29 30	47 53 66 21	80 7 80
45	E2057	29.0 l	33 45 30 24	15 18 12	31 8 68 16	0 11 85
46	E2038	29.2 l	23 38 7 24	19 26 13	42 35 72 19	7 6 75
47	E2048	29.0 l	37 42 41 29	14 15 12	35 35 51 17	0 7 70
48	E2037	34.2	31 35 32 27	13 16 10	53 65 76 19	7 9 80
49	E0009	26.4 l	29 30 24 34	14 21 7	32 18 61 16	7 7 65
50	RCATL33	30.7 l	31 13 41 40	9 15 3	43 40 74 17	12 9 75
51	RCATL10	36.5	46 63 48 26	21 16 26	35 40 46 20	30 7 80
52	RCATL24	22.8 l	18 12 13 28	9 15 4	28 15 54 15	7 8 80
53	RCATL12	35.2	56 47 68 52	16 24 8	30 17 43 29	11 8 80
54	RCAT L2	39.0	42 32 40 55	11 9 12	64 73 87 31	0 10 80
55	WESLEY	54.1 h	76 96 61 72	29 27 31	69 73 89 45	11 10 80
56	NE98466	44.3 h	63 78 54 57	19 28 11	51 48 72 33	10 12 85
	AVERAGE	36.9	38 42 33 39	20 25 15	51 55 71 27	9 9 80
	MINIMUM	20.4	12 1 7 17	6 9 2	23 8 33 10	0 5 65
	MAXIMUM	54.1	76 96 74 72	54 73 39	79 93 96 58	80 19 90
	CV%	35.7	35 38 29	40 15	31 13 36	37 7
	LSD (0.05)	11.2	23 25 23	17 9	27 13 14	5 9

† Indicates a mean that is not different from the lowest (l) or highest (h) mean in the column based on LSD_(0.05)

Table 8. Disease index (IND, %). Mean is mean over all trials. "Avg" is mean for a set of locations that were grouped based on GxE analysis: sets are boxed together in the table. VA and OO were outliers.

#	NAME	MEAN	Avg	AF	NE	OH	OR	Avg	IL	IN	KS	KY	Avg	AK	MD	MI	MO	VA	OO
1	PIONEER 2545	43.5 h	42	31	32	71	32	44	32	41	74	27	49	23	46	90	38	8	64
2	ERNIE	24.4	8	3	0	20	9	15	0	5	27	27	42	19	16	96	39	1	81
3	FREEDOM	26.3	15	13	1	26	19	31	34	16	46	26	30	23	13	58	27	2	64
4	IL97-6755	18.2 l	3	5	0	4	1	21	0	6	56	22	22	15	2	61	10	0	73
5	PATTERSON	37.3 h	22	23	0	32	35	37	27	42	48	33	52	55	34	98	22	2	73
6	TRUMAN	13.0 l	4	4	0	8	3	10	2	6	20	12	13	5	4	35	9	2	73
7	97397J1-4-1-4-7	21.5	8	5	0	10	16	17	1	1	31	34	32	23	14	69	23	2	73
8	981238A1-1-44-1	27.3	9	8	0	22	5	33	33	19	46	34	37	26	10	91	21	2	64
9	981312A1-6-2-2	24.1	14	7	0	37	12	20	5	5	33	37	34	23	16	76	22	1	64
10	981517A1-1-5-2	20.6 l	6	3	0	19	1	15	2	5	34	20	35	24	8	83	24	2	64
11	992128A2-4-1	38.9 h	18	15	0	33	26	38	43	17	51	40	58	30	74	91	37	16	73
12	VAN98W-342	35.4	20	9	16	42	14	32	33	26	44	24	53	30	52	89	40	5	73
13	VA03W-630	40.2 h	17	6	2	51	9	56	52	58	56	56	52	35	50	83	38	5	60
14	VA03W-633	32.0	22	14	5	41	28	32	33	16	49	32	40	30	32	71	29	6	64
15	VA03W-644	25.3	15	5	1	36	17	16	3	5	30	27	41	15	37	87	27	2	64
16	VA03W-674	33.7	13	5	1	31	16	38	24	31	50	48	48	26	39	94	34	2	73
17	IL96-24851-1	21.2	10	2	3	22	15	12	0	2	22	24	34	10	28	78	19	1	73
18	IL99-27048	26.7	4	3	0	10	3	19	2	12	46	17	51	26	62	85	33	2	73
19	IL00-8061	18.3 l	6	6	0	11	6	12	1	1	20	24	30	23	6	74	18	2	64
20	IL00-1665	24.0	7	6	1	13	10	22	11	12	23	43	36	23	31	66	24	2	73
21	IL99-20756	25.0	5	4	0	12	3	21	1	5	54	26	43	19	17	89	48	8	64
22	KY97C-0151-1	36.7 h	26	19	5	44	37	36	32	25	51	35	47	45	33	85	26	3	73
23	KY96C-0895-1	24.2	10	9	0	20	9	25	22	15	33	32	33	30	12	63	29	1	64
24	KS00HW175-4	28.1	11	11	2	23	9	32	21	8	53	44	40	13	31	80	38	1	60
25	KS950409-P-4	32.5	16	13	2	26	21	40	37	19	59	45	43	26	26	83	38	1	61
26	MD27-37	34.0	11	.	1	17	14	28	7	6	60	39	58	31	48	94	58	3	81
27	MO010925	27.6	10	13	3	18	6	36	21	24	54	45	32	35	12	55	28	2	73
28	MO010789	26.0	6	6	1	14	4	41	46	24	50	44	26	23	5	47	27	1	73
29	MO010574	27.8	12	6	3	24	15	28	5	21	40	47	41	35	24	79	27	1	64
30	MO010719	23.2	7	3	1	19	6	26	7	13	46	39	33	30	10	69	22	1	60
31	MO011130	37.6 h	21	36	9	22	18	49	56	47	50	42	45	50	32	58	39	3	64
32	NY88046-8138	26.6	16	28	2	22	12	38	19	29	60	45	21	5	11	52	17	6	64
33	Caledonia Resel-T	25.8	16	19	6	24	14	34	26	33	40	37	24	3	6	64	24	4	64
34	NY91028-9073	20.1 l	10	16	2	12	9	25	13	16	43	30	20	2	1	55	20	3	60
35	NY91028SP-9245W	19.4 l	11	18	1	22	3	21	8	14	31	32	19	2	2	53	17	4	64
36	NY89025-9111W	23.2	11	14	2	19	8	33	20	17	50	46	22	3	3	69	15	3	57
37	OH743	30.6	16	15	0	29	21	35	33	11	46	47	38	40	20	63	28	1	73
38	OH751	29.8	16	11	1	34	17	29	30	27	29	30	43	40	33	68	31	1	64
39	OH776	34.0	18	13	0	33	28	34	15	27	46	45	46	35	40	85	25	3	81
40	OH788	35.7	10	9	1	22	6	47	51	37	63	39	50	50	35	83	31	1	73
41	OH790	35.4	13	13	1	18	21	46	48	38	60	37	49	45	46	69	36	3	60
42	X00-1051	22.0	9	4	4	15	12	29	13	10	47	46	28	5	3	78	26	1	45
43	X00-1058	27.8	15	8	4	35	12	33	32	14	51	34	33	5	15	83	28	5	64
44	Y00-3044	29.2	20	18	8	27	27	38	48	28	40	35	28	6	16	68	21	3	64
45	E2057	19.7 l	8	7	0	15	9	20	19	8	34	18	22	3	1	70	16	5	73
46	E2038	18.8 l	12	13	1	24	10	14	9	3	22	20	25	5	4	74	19	1	60
47	E2048	19.7 l	8	11	0	13	9	26	17	19	48	21	21	5	8	53	17	3	53
48	E2037	21.6	9	14	1	13	6	23	13	16	39	24	28	3	11	78	19	3	64
49	E0009	18.9 l	8	9	0	16	5	25	12	7	50	29	21	2	3	63	15	2	52
50	RCATL33	23.0	5	5	2	13	2	26	6	18	48	34	34	30	13	76	16	1	60
51	RCATL10	26.5	19	26	10	14	24	38	36	32	60	23	19	5	7	46	20	3	64
52	RCATL24	16.2 l	6	8	0	13	2	16	2	4	34	25	18	2	1	56	14	2	64
53	RCATL12	24.5	11	18	1	22	5	33	29	29	38	38	25	23	3	44	29	2	64
54	RCAT L2	28.5	5	2	0	7	12	35	10	20	58	53	43	23	28	89	31	2	64
55	WESLEY	41.7 h	17	11	5	25	29	62	79	46	60	65	49	15	46	92	45	3	64
56	NE98466	33.4	12	10	4	27	8	49	55	34	58	48	37	13	31	74	33	2	73
	AVERAGE	27.3	12	11	3	23	13	30	22	19	45	35	36	21	22	73	27	3	66
	MINIMUM	13.0	3	2	0	4	1	10	0	1	20	12	13	2	1	35	9	0	45
	MAXIMUM	43.5	42	36	32	71	37	62	79	58	74	65	58	55	74	98	58	16	81
	CV%	36.6				45	49	44	50	26	20				77	14	37	73	9
	LSD (0.05)	7.6		10		17	9	15	19	16	20			12	27	13	14	3	10

† Indicates a mean that is not different from the lowest (l) or highest (h) mean in the column based on LSD_(0.05)

Table 9. Kernel rating (KR, %) from field trials.

#	NAME	MEAN	IL	KY	NE
1	PIONEER 2545	50.9 h	63.3	87.5	2
2	ERNIE	29.4 l	20.0	80.0	
3	FREEDOM	41.9	53.3	72.5	0
4	IL97-6755	24.4 l	20.0	70.0	
5	PATTERSON	38.1 l	30.0	87.5	
6	TRUMAN	28.6 l	23.3	62.5	0
7	97397J1-4-1-4-7	33.1 l	20.0	87.5	
8	981238A1-1-44-1	45.6	40.0	92.5	
9	981312A1-6-2-2	37.5 l	30.0	82.5	0
10	981517A1-1-5-2	38.2 l	30.0	82.5	2
11	992128A2-4-1	52.3 h	60.0	95.0	2
12	VAN98W-342	48.9 h	56.7	90.0	0
13	VA03W-630	47.2 h	46.7	95.0	0
14	VA03W-633	40.3 l	43.3	77.5	0
15	VA03W-644	39.7 l	26.7	92.5	0
16	VA03W-674	43.6	43.3	87.5	0
17	IL96-24851-1	40.8 l	30.0	87.5	5
18	IL99-27048	31.9 l	23.3	72.5	0
19	IL00-8061	33.3 l	20.0	80.0	0
20	IL00-1665	42.7	36.7	90.0	
21	IL99-20756	26.4 l	16.7	62.5	0
22	KY97C-0151-1	46.7 h	50.0	90.0	0
23	KY96C-0895-1	36.5 l	30.0	77.5	2
24	KS00HW175-4	42.9	26.7	99.0	3
25	KS950409-P-4	49.3 h	50.0	97.0	1
26	MD27-37	37.9 l	36.7	75.0	2
27	MO010925	40.9 l	26.7	95.0	1
28	MO010789	34.9 l	43.3	57.5	4
29	MO010574	38.9 l	23.3	92.5	1
30	MO010719	40.6 l	36.7	85.0	0
31	MO011130	49.3 h	53.3	92.5	2
32	NY88046-8138	53.9 h	66.7	95.0	0
33	Caledonia Resel-T	49.5 h	60.0	87.5	1
34	NY91028-9073	54.4 h	73.3	90.0	0
35	NY91028SP-9245W	47.6 h	56.7	85.0	1
36	NY89025-9111W	51.3 h	60.0	85.0	9
37	OH743	44.3	50.0	80.0	3
38	OH751	41.6	36.7	85.0	3
39	OH776	44.8	33.3	97.0	4
40	OH788	52.6 h	56.7	99.0	2
41	OH790	50.1 h	56.7	92.5	1
42	X00-1051	36.2 l	36.7	70.0	2
43	X00-1058	44.8	50.0	82.5	2
44	Y00-3044	56.7 h	80.0	90.0	0
45	E2057	39.1 l	33.3	80.0	4
46	E2038	42.1	43.3	80.0	3
47	E2048	47.6 h	43.3	94.5	5
48	E2037	53.8 h	70.0	82.5	9
49	E0009	45.8	50.0	87.5	0
50	RCATL33	53.1 h	36.7	87.5	35
51	RCATL10	52.7 h	60.0	90.0	8
52	RCATL24	41.6	33.3	87.5	4
53	RCATL12	48.2 h	46.7	97.0	1
54	RCAT L2	39.3 l	23.3	82.5	12
55	WESLEY	63.1 h	73.3	97.0	19
56	NE98466	47.8 h	53.3	85.0	5
	AVERAGE	43.5	42.7	85.5	3.2
	MINIMUM	24.4	16.7	57.5	0.0
	MAXIMUM	63.1	80.0	99.0	35.0
	CV%	22.5	22.9	16.0	
	LSD (0.05)	16.6	45.4	9.1	

[†] Indicates a mean that is not different from the lowest (l) or highest (h) mean in the column based on LSD_(0.05)

Table 10. Percent scabby seed (PSS, %) on a per weight basis from field trials.

#	NAME	MEAN	AF	KS	KY	MD	MO
1	PIONEER 2545	48.2 h	41.0	41.3	82.6	8.0	68.0
2	ERNIE	18.6 l	1.0	4.3	72.9	2.3	12.5
3	FREEDOM	35.9	9.0	27.5	59.0	5.0	78.8
4	IL97-6755	17.9 l	1.0	6.8	59.9	0.7	21.3
5	PATTERSON	22.9 l	6.0	11.3	81.5	1.7	13.8
6	TRUMAN	22.6 l	6.0	15.0	61.2	4.7	26.3
7	97397J1-4-1-4-7	24.6 l	4.0	6.8	77.3	4.7	30.0
8	981238A1-1-44-1	25.0 l	5.0	15.0	87.4	2.7	15.0
9	981312A1-6-2-2	27.8	10.0	17.5	73.0	2.3	36.3
10	981517A1-1-5-2	21.9 l	1.0	16.5	71.1	2.0	18.8
11	992128A2-4-1	30.9	6.0	12.5	91.1	5.0	40.0
12	VAN98W-342	40.4 h	2.0	22.5	88.5	19.0	70.0
13	VA03W-630	36.1	4.0	26.3	91.5	7.3	51.3
14	VA03W-633	34.6	8.0	22.5	68.2	4.3	70.0
15	VA03W-644	22.9 l	1.0	8.8	86.8	3.0	15.0
16	VA03W-674	30.4	6.0	26.3	81.6	3.3	35.0
17	IL96-24851-1	25.8 l	3.0	17.5	83.6	5.0	20.0
18	IL99-27048	19.3 l	1.0	6.3	72.5	4.3	12.5
19	IL00-8061	17.0 l	1.0	3.0	71.9	1.7	7.5
20	IL00-1665	27.1 l	2.0	16.3	82.7	3.0	31.3
21	IL99-20756	13.8 l	1.0	1.8	53.9	1.0	11.3
22	KY97C-0151-1	32.7	6.0	28.8	82.8	2.0	43.8
23	KY96C-0895-1	27.1 l	7.0	23.8	64.8	3.7	36.3
24	KS00HW175-4	37.1	9.0	18.8	94.8	8.0	55.0
25	KS950409-P-4	43.5 h	17.0	38.8	92.4	6.7	62.5
26	MD27-37	25.3 l	1.0	10.0	79.3	8.7	27.5
27	MO010925	30.7	6.0	12.5	90.9	1.7	42.5
28	MO010789	28.2	6.0	23.8	49.2	0.7	61.3
29	MO010574	28.8	2.0	13.8	85.3	4.0	38.8
30	MO010719	29.0	8.0	22.5	78.6	3.3	32.5
31	MO011130	38.7	20.0	28.8	83.7	3.3	57.5
32	NY88046-8138	51.5 h	45.0	38.8	92.0	2.7	78.8
33	Caledonia Resel-T	46.3 h	38.0	28.8	82.2	3.3	79.3
34	NY91028-9073	50.6 h	35.0	42.5	82.1	2.3	91.3
35	NY91028SP-9245W	41.0 h	35.0	33.8	74.7	2.7	58.8
36	NY89025-9111W	43.6 h	34.0	31.3	79.8	7.3	65.5
37	OH743	34.8	7.0	28.8	84.3	1.7	52.5
38	OH751	28.5	10.0	17.5	77.0	0.7	37.5
39	OH776	31.9	11.0	23.8	93.0	5.3	26.3
40	OH788	38.8	7.0	32.5	95.9	8.7	50.0
41	OH790	38.1	11.0	24.0	91.6	7.7	56.3
42	X00-1051	23.1 l	11.0	16.3	54.0	0.3	33.8
43	X00-1058	34.0	16.0	22.5	74.5	3.0	53.8
44	Y00-3044	45.8 h	23.0	40.0	87.6	6.0	72.5
45	E2057	40.5 h	15.0	33.8	74.6	2.7	76.3
46	E2038	27.4	20.0	21.3	67.7	3.0	25.0
47	E2048	39.7	15.0	38.8	89.0	5.0	50.5
48	E2037	38.4	19.0	23.8	75.0	5.3	68.8
49	E0009	30.4	13.0	17.5	84.5	2.0	35.0
50	RCATL33	28.5	3.0	15.0	80.6	3.7	40.0
51	RCATL10	43.0 h	30.0	31.3	81.8	3.0	68.8
52	RCATL24	30.5	10.0	22.5	81.8	1.7	36.3
53	RCATL12	44.5 h	12.0	36.3	93.2	3.7	77.5
54	RCAT L2	25.1 l	2.0	15.0	74.1	5.7	28.8
55	WESLEY	53.2 h	29.0	43.8	94.7	6.0	92.3
56	NE98466	36.5	6.0	32.5	75.2	2.7	66.3
	AVERAGE	32.7	11.8	22.5	79.3	4.1	45.8
	MINIMUM	13.8	1.0	1.8	49.2	0.3	7.5
	MAXIMUM	53.2	45.0	43.8	95.9	19.0	92.3
	CV%	32.5		39.8	10.9	83.3	41.3
	LSD (0.05)	13.4		12.8	17.8	5.5	26.4

† Indicates a mean that is not different from the lowest (l) or highest (h) mean in the column based on LSD_(0.05)

Table 11. ISK Index (ISK, %) that rates resistance based on INC, SEV and KR (or PSS) from field trials.

#	NAME	MEAN	IL	KY	MD	MO	NE
1	PIONEER 2545	42.0 h	58.9	0.7	45.2	68.5	36.7
2	ERNIE	18.6 l	19.2	0.7	25.9	46.5	
3	FREEDOM	32.2	59.0	0.6	25.0	69.1	7.2
4	IL97-6755	12.0 l	18.4	0.6	8.3	38.5	
5	PATTERSON	26.6	45.1	0.7	36.7	41.6	
6	TRUMAN	14.0 l	18.3	0.5	13.4	38.0	0.0
7	97397J1-4-1-4-7	18.8 l	16.4	0.8	26.9	48.9	
8	981238A1-1-44-1	24.5	51.0	0.8	22.1	42.0	
9	981312A1-6-2-2	21.3 l	28.3	0.7	26.4	51.1	0.0
10	981517A1-1-5-2	18.5 l	22.8	0.7	23.8	44.7	0.7
11	992128A2-4-1	35.2 h	63.7	0.8	53.5	57.2	0.8
12	VAN98W-342	41.6 h	57.2	0.7	50.1	69.9	29.9
13	VA03W-630	35.9 h	61.2	0.8	45.9	62.0	9.6
14	VA03W-633	33.7	49.8	0.7	37.2	66.5	14.3
15	VA03W-644	22.7 l	21.4	0.7	39.2	44.0	8.1
16	VA03W-674	29.6	46.8	0.8	40.3	54.0	6.2
17	IL96-24851-1	19.9 l	16.1	0.7	26.0	43.7	13.2
18	IL99-27048	22.8 l	21.8	0.6	46.7	44.7	0.0
19	IL00-8061	15.2 l	22.5	0.7	17.2	35.9	0.0
20	IL00-1665	24.9	35.0	0.8	31.7	49.8	
21	IL99-20756	17.2 l	12.7	0.6	23.9	49.0	0.0
22	KY97C-0151-1	32.4	54.0	0.8	36.3	55.3	15.6
23	KY96C-0895-1	23.8 l	40.2	0.7	24.5	53.1	0.8
24	KS00HW175-4	30.5	39.0	0.8	38.7	63.4	10.8
25	KS950409-P-4	34.2	58.1	0.8	34.2	66.4	11.5
26	MD27-37	28.5	32.1	0.7	45.0	58.4	6.5
27	MO010925	26.1	37.7	0.8	23.7	55.3	12.8
28	MO010789	29.2	58.5	0.7	15.3	62.7	8.9
29	MO010574	25.5	25.5	0.8	33.1	53.3	14.8
30	MO010719	21.8 l	31.3	0.8	22.8	49.2	5.1
31	MO011130	37.8 h	66.6	0.8	35.8	64.7	21.0
32	NY88046-8138	30.7	52.6	0.8	24.1	65.9	10.0
33	Caledonia Resel-T	34.0	54.7	0.8	16.3	68.8	29.4
34	NY91028-9073	28.4	50.8	0.7	7.5	71.7	11.1
35	NY91028SP-9245W	22.0 l	39.1	0.7	10.1	54.7	5.5
36	NY89025-9111W	27.7	51.9	0.8	11.9	58.1	15.8
37	OH743	29.1	57.3	0.8	26.7	59.5	1.1
38	OH751	29.6	48.2	0.7	31.8	54.2	12.9
39	OH776	26.0	38.6	0.8	41.1	48.1	1.6
40	OH788	33.9	65.3	0.8	38.5	59.2	5.9
41	OH790	35.9 h	64.4	0.8	44.1	63.4	7.0
42	X00-1051	23.0 l	38.1	0.7	11.6	51.2	13.6
43	X00-1058	30.8	54.6	0.7	26.2	60.0	12.7
44	Y00-3044	38.7 h	74.9	0.7	25.9	65.0	27.0
45	E2057	22.5 l	39.3	0.6	6.6	64.6	1.6
46	E2038	20.8 l	35.8	0.6	14.7	45.3	7.8
47	E2048	23.8 l	42.2	0.7	19.0	55.1	1.9
48	E2037	29.6	47.6	0.7	26.6	62.9	10.2
49	E0009	20.3 l	38.4	0.7	11.3	47.6	3.6
50	RCATL33	25.0	32.3	0.7	21.0	49.1	22.0
51	RCATL10	32.7	59.4	0.7	17.5	63.1	22.6
52	RCATL24	16.4 l	21.4	0.7	7.2	47.6	5.2
53	RCATL12	27.5	50.7	0.8	10.5	69.0	6.6
54	RCAT L2	24.0	28.6	0.8	35.3	50.9	4.6
55	WESLEY	46.6 h	82.7	0.9	43.4	80.3	25.7
56	NE98466	35.6 h	65.9	0.8	28.6	66.0	16.9
	AVERAGE	27.4	43.3	0.7	27.4	55.9	10.3
	MINIMUM	12.0	12.7	0.5	6.6	35.9	0.0
	MAXIMUM	46.6	82.7	0.9	53.5	80.3	36.7
	CV%	33.5	16.7	6.4		15.1	
	LSD (0.05)	11.8	11.4	0.1		11.8	

^T Indicates a mean that is not different from the lowest (l) or highest (h) mean in the column based on LSD_(0.05)

Table 12. DON (DON, ppm) from field trials.

#	NAME	MEAN	AF	IL	KY	MI	NE	VA
1	PIONEER 2545	11.1	12.9	16.0	29.0	4.0	0.8	3.7
2	ERNIE	4.4 l	0.6	1.5	21.0	4.0	.	1.2
3	FREEDOM	4.6 l	2.2	6.6	14.5	2.6	0.3	1.3
4	IL97-6755	2.6 l	1.1	2.1	12.5	3.1	.	0.4
5	PATTERSON	4.4 l	2.0	2.9	18.0	3.0	.	2.4
6	TRUMAN	3.9 l	2.4	3.6	12.0	3.0	0.3	2.3
7	97397J1-4-1-4-7	3.7 l	0.8	2.9	17.5	2.6	.	1.0
8	981238A1-1-44-1	3.4 l	0.9	3.8	15.5	2.5	.	0.8
9	981312A1-6-2-2	3.7 l	1.8	4.2	12.5	2.6	0.3	0.9
10	981517A1-1-5-2	4.3 l	0.1	2.0	20.0	2.6	0.3	0.6
11	992128A2-4-1	4.5 l	0.8	2.5	16.5	2.6	0.5	3.8
12	VAN98W-342	5.4 l	0.9	3.4	20.0	4.5	1.5	1.9
13	VA03W-630	8.7	2.0	11.0	27.5	8.0	0.8	2.7
14	VA03W-633	7.3	4.0	6.6	26.5	4.5	0.5	1.8
15	VA03W-644	4.1 l	0.3	3.0	17.5	2.7	0.3	1.0
16	VA03W-674	8.6	6.5	8.5	29.5	5.6	0.3	1.3
17	IL96-24851-1	2.8 l	0.7	1.8	11.5	2.1	0.3	0.3
18	IL99-27048	3.5 l	0.7	1.7	14.5	2.8	0.3	1.0
19	IL00-8061	4.1 l	1.0	1.8	18.0	2.5	0.3	1.3
20	IL00-1665	4.4 l	2.0	3.3	16.0	3.0	1.3	0.8
21	IL99-20756	4.7 l	0.3	1.7	18.5	3.2	0.3	4.0
22	KY97C-0151-1	5.4 l	3.2	5.3	18.5	3.3	0.8	1.4
23	KY96C-0895-1	6.1 l	2.6	8.5	21.0	3.0	0.6	1.0
24	KS00HW175-4	9.1	10.1	11.5	22.5	5.5	1.6	3.2
25	KS950409-P-4	9.1	6.5	11.8	28.0	6.5	0.8	1.2
26	MD27-37	4.0 l	0.3	5.3	14.0	2.3	0.3	1.9
27	MO010925	3.6 l	2.5	3.0	12.0	2.6	0.3	1.1
28	MO010789	6.6	1.9	5.9	27.0	3.0	0.9	0.9
29	MO010574	6.2 l	1.5	3.6	26.5	4.5	0.3	0.9
30	MO010719	6.8	1.9	5.7	25.0	6.0	0.3	1.9
31	MO011130	9.2	4.7	10.3	32.5	5.5	0.7	1.4
32	NY88046-8138	11.7	12.3	11.3	29.5	10.0	1.1	5.9
33	Caledonia Resel-T	14.8 h	16.0	17.3	32.5	11.5	1.5	.
34	NY91028-9073	15.5 h	13.9	18.5	37.5	12.0	1.1	10.0
35	NY91028SP-9245W	17.5 h	24.0	20.0	37.0	12.5	1.0	10.7
36	NY89025-9111W	13.7 h	13.6	16.5	35.0	9.0	1.3	6.9
37	OH743	5.3 l	2.7	5.0	18.5	3.5	0.6	1.4
38	OH751	5.9 l	2.3	7.5	18.5	4.5	1.5	1.0
39	OH776	6.7	3.2	4.2	25.5	3.5	1.4	2.1
40	OH788	6.6	1.6	7.2	21.0	3.0	4.3	2.3
41	OH790	6.0 l	1.7	10.5	19.0	2.9	0.5	1.5
42	X00-1051	3.6 l	1.5	3.9	11.0	3.0	0.8	1.3
43	X00-1058	7.5	6.3	8.0	23.0	3.5	1.7	2.7
44	Y00-3044	8.8	6.5	13.3	24.0	4.5	2.3	2.2
45	E2057	12.5	14.1	16.3	19.5	14.5	0.6	9.9
46	E2038	11.3	6.7	20.8	26.5	10.0	0.3	3.5
47	E2048	8.9	4.2	12.0	17.5	12.0	1.1	6.8
48	E2037	12.3	14.5	17.3	20.5	13.5	0.7	7.2
49	E0009	8.2	6.5	13.3	17.5	8.5	0.3	3.0
50	RCATL33	4.4 l	1.2	2.5	16.5	3.5	2.2	0.6
51	RCATL10	11.5	18.3	15.8	19.0	9.0	1.3	5.5
52	RCATL24	10.6	13.4	10.0	22.0	13.0	0.5	4.4
53	RCATL12	6.7	8.0	4.2	22.5	4.0	0.5	1.1
54	RCAT L2	5.4 l	1.2	3.3	17.5	5.5	3.1	1.9
55	WESLEY	7.5	5.3	18.8	12.5	3.0	4.3	0.9
56	NE98466	5.0 l	3.0	9.3	10.5	2.6	3.5	1.4
	AVERAGE	7.1	5.0	8.0	20.9	5.3	1.0	2.6
	MINIMUM	2.6	0.1	1.5	10.5	2.1	0.3	0.3
	MAXIMUM	17.5	24.0	20.8	37.5	14.5	4.3	10.7
	CV%	47.2			23.8	26.5		53.6
	LSD (0.05)	4.3	5.1		9.9	2.8		2.0

† Indicates a mean that is not different from the lowest (l) or highest (h) mean in the column based on LSD_(0.05)

Table 13. Greenhouse disease severity (GH, %). Mean is mean over all trials. "Avg" is mean for a set of locations that were grouped based on GxE analysis: sets are boxed together in the table. VA was an outlier.

#	NAME	MEAN	Avg	AF	KY	MO	VA
1	PIONEER 2545	32.7	32.8	39	23.1	36.3	32.3
2	ERNIE	13.9 l	12.4	12	12.1	13.1	18.3
3	FREEDOM	12.2 l	11.6	8	12.2	14.7	13.9
4	IL97-6755	9.8 l	11.3	12	18.0	3.8	5.3
5	PATTERSON	44.7 h	44.0	39	38.5	54.4	47.0
6	TRUMAN	8.2 l	8.6	7	15.1	3.7	7.1
7	97397J1-4-1-4-7	10.3 l	11.4	9	18.7	6.4	7.0
8	981238A1-1-44-1	22.6 l	24.7	34	26.8	13.3	16.2
9	981312A1-6-2-2	17.6 l	15.9	11	22.5	14.3	22.6
10	981517A1-1-5-2	10.8 l	11.6	11	14.8	8.9	8.6
11	992128A2-4-1	24.9	23.7	22	31.1	18.1	28.3
12	VAN98W-342	25.1	30.2	43	27.3	20.2	10.0
13	VA03W-630	49.2 h	46.7	55	46.2	39.0	56.7
14	VA03W-633	26.8	32.7	17	42.6	38.6	9.1
15	VA03W-644	15.2 l	17.6	13	34.1	5.8	7.9
16	VA03W-674	34.2	39.1	22	40.9	54.5	19.4
17	IL96-24851-1	9.9 l	9.6	8	15.7	5.1	10.8
18	IL99-27048	19.1 l	22.6	15	31.1	21.7	8.5
19	IL00-8061	18.1 l	17.6	8	30.4	14.4	19.4
20	IL00-1665	23.3 l	27.5	16	41.8	24.6	10.6
21	IL99-20756	11.9 l	12.6	11	24.0	2.8	9.7
22	KY97C-0151-1	32.3	32.2	19	33.7	43.8	32.8
23	KY96C-0895-1	27.9	28.9	20	25.6	41.0	24.9
24	KS00HW175-4	22.6 l	22.4	23	33.7	10.5	23.4
25	KS950409-P-4	18.8 l	21.9	18	23.3	24.4	9.4
26	MD27-37	25.0	25.6	12	47.2	17.7	22.9
27	MO010925	29.5	29.2	21	51.2	15.4	30.3
28	MO010789	37.5 h	42.7	66	29.1	33.1	21.8
29	MO010574	19.4 l	19.9	14	36.1	9.5	18.0
30	MO010719	14.5 l	16.4	12	19.1	18.2	8.8
31	MO011130	32.6	34.6	20	35.7	48.1	26.7
32	NY88046-8138	31.9	27.7	19	32.9	31.3	44.4
33	Caledonia Resel-T	32.6	29.2	12	41.1	34.6	42.7
34	NY91028-9073	23.7 l	13.5	10		17.0	39.0
35	NY91028SP-9245W	35.6 h	23.1	24	26.5	18.9	73.1
36	NY89025-9111W	35.4 h	29.6	9	35.3	44.5	52.9
37	OH743	24.1 l	23.7	25	31.1	15.0	25.2
38	OH751	25.1	24.8	16	36.6	21.7	26.3
39	OH776	35.1 h	34.4	24	35.3	43.8	37.3
40	OH788	50.1 h	54.7	59	57.4	47.8	36.1
41	OH790	43.7 h	43.1	31	48.3	50.0	45.5
42	X00-1051	18.0 l	18.5	7	39.7	8.7	16.4
43	X00-1058	12.0 l	10.8	8	15.1	9.4	15.5
44	Y00-3044	30.0	24.4	20	18.3	34.9	46.8
45	E2057	22.4 l	13.1	10	20.5	8.9	50.2
46	E2038	13.4 l	9.7	10		9.3	15.8
47	E2048	26.7	27.0	14		39.9	21.3
48	E2037	23.0 l	22.7	8	41.1	19.0	23.9
49	E0009	27.8	17.4	14	19.9	18.3	59.1
50	RCATL33	51.0 h	48.9	26	69.7	51.0	57.1
51	RCATL10	31.2	17.8	18	23.6	11.9	71.3
52	RCATL24	33.9	30.7	12	32.2	47.8	43.6
53	RCATL12	26.1	24.7	22	19.9	32.1	30.6
54	RCAT L2	23.6 l	21.7	11	36.4	17.8	29.2
55	WESLEY	34.2	27.4	21	27.4	33.9	54.3
56	NE98466	31.0	21.9	14	31.0	20.8	58.3
	AVERAGE	25.8		19.3	31.0	24.4	28.6
	MINIMUM	8.2		7.0	12.1	2.8	5.3
	MAXIMUM	51.0		66.0	69.7	54.5	73.1
	CV%	45.5		46.1			
	LSD (0.05)	16.6		18	21.3		

[†] Indicates a mean that is not different from the lowest (l) or highest (h) mean in the column based on LSD_(0.05)

Table 14. Heading date in Julian days

#	NAME	MEAN	IL	KY	MD	MI	MO	OH	OO	OR	VA
1	PIONEER 2545	141	133	131	124	151	139	145	170	147	132
2	ERNIE	139 l	131	129	124	147	136	142	166	144	132
3	FREEDOM	142	134	133	125	153	139	143	173	149	132
4	IL97-6755	140	132	131	126	150	139	142	170	145	130
5	PATTERSON	140	131	132	127	148	139	141	169	145	128
6	TRUMAN	145		141	127	157	143	144	176	149	135
7	97397J1-4-1-4-7	139 l	131	129	124	149	139	141	169	145	129
8	981238A1-1-44-1	139 l	131	131	123	147	138	145	166	142	129
9	981312A1-6-2-2	142	134	134	124	153	139	147	172	147	133
10	981517A1-1-5-2	142	130	131	125	150	139	141	172	155	131
11	992128A2-4-1	139 l	131	129	124	148	137	141	169	143	127
12	VAN98W-342	141	132	129	126	150	137	144	172	146	130
13	VA03W-630	143	131	131	126	152	139	145	174	154	132
14	VA03W-633	141	132	132	124	151	139	142	174	147	130
15	VA03W-644	140	132	130	125	149	137	144	172	142	130
16	VA03W-674	139 l	131	130	124	148	137	142	171	143	128
17	IL96-24851-1	142	135	135	127	151	139	145	168	147	132
18	IL99-27048	138 l	130	129	123	147	134	141	169	143	129
19	IL00-8061	141	132	132	127	150	139	143	168	145	130
20	IL00-1665	141	133	133	125	152	138	144	169	147	132
21	IL99-20756	138 l	130	129	127	147	133	140	166	141	127
22	KY97C-0151-1	141	133	132	125	150	139	144	171	145	131
23	KY96C-0895-1	144	133	133	128	152	139	145	172	158	132
24	KS00HW175-4	143	135	135	127	152	140	145	170	149	132
25	KS950409-P-4	142	134	133	126	151	139	145	167	148	131
26	MD27-37	139 l	131	129	126	147	133	142	170	143	127
27	MO010925	142	133	135	125	154	140	145	171	149	131
28	MO010789	143	135	135	124	156	139	145	170	150	132
29	MO010574	142	133	132	127	152	139	145	170	151	132
30	MO010719	141	133	132	123	151	138	143	172	146	130
31	MO011130	142	133	132	128	152	139	145	171	149	132
32	NY88046-8138	147 h		142	125	158	145	149	175	153	137
33	Caledonia Resel-T	147 h		142	125	158	145	150	175	154	137
34	NY91028-9073	148 h		144	125	161	145	150	177	154	137
35	NY91028SP-9245W	148 h		144	127	161	145	150	177	154	137
36	NY89025-9111W	148 h		144	127	160	143	150	175	154	137
37	OH743	143	135	133	124	152	139	146	173	149	132
38	OH751	142	134	133	125	152	139	146	170	148	132
39	OH776	141	133	131	124	150	138	144	169	146	132
40	OH788	140	131	129	123	150	138	142	169	144	130
41	OH790	141	132	131	125	151	139	142	171	147	132
42	X00-1051	142	135	135	123	155	139	144	170	148	133
43	X00-1058	144		136	126	155	141	146	173	148	135
44	Y00-3044	145		140	128	157	144	146	174	148	135
45	E2057	146 h		141	124	158	144	150	174	150	136
46	E2038	147 h		140	125	159	144	150	175	153	136
47	E2048	146 h		140	125	158	144	149	175	153	136
48	E2037	147 h		140	127	160	145	149	176	152	137
49	E0009	148 h		144	124	160	145	150	177	154	136
50	RCATL33	140	132	131	127	149	138	142	169	146	130
51	RCATL10	145		140	125	156	144	149	173	151	135
52	RCATL24	147 h		143	124	160	144	149	174	154	137
53	RCATL12	144	135	133	126	154	141	146	173	151	134
54	RCAT L2	140	131	129	125	150	139	141	168	153	129
55	WESLEY	143		136	127	152	141	147	169	148	132
56	NE98466	142	134	134	126	153	139	144	169	147	131
	AVERAGE	143	133	134	125	153	140	145	171	148	132
	MINIMUM	138	130	129	123	147	133	140	166	141	127
	MAXIMUM	148	135	144	128	161	145	150	177	158	137
	CV%	1.3		69	2	2	1	33	1	2	9
	LSD (0.05)	1.8		2	3	2	2	3	2	4	2

† Indicates a mean that is not different from the lowest (l) or highest (h) mean in the column based on LSD_(0.05)

Table 15. Plant height in inches

#	NAME	MEAN	KY	MO	OR	VA
1	PIONEER 2545	33	35	33	35	30
2	ERNIE	30 l	30	29	33	29
3	FREEDOM	35	35	34	39	31
4	IL97-6755	38	38	36	43	36
5	PATTERSON	35	35	35	36	33
6	TRUMAN	35	36	35	39	32
7	97397J1-4-1-4-7	32	34	31	34	29
8	981238A1-1-44-1	32	32	33	36	29
9	981312A1-6-2-2	31 l	30	32	33	28
10	981517A1-1-5-2	32	30	32	35	30
11	992128A2-4-1	32	33	33	33	29
12	VAN98W-342	29 l	30	29	30	27
13	VA03W-630	32	32	32	36	30
14	VA03W-633	30 l	30	31	32	27
15	VA03W-644	30 l	31	29	31	28
16	VA03W-674	30 l	32	29	33	27
17	IL96-24851-1	32	33	33	32	30
18	IL99-27048	34	35	34	35	31
19	IL00-8061	36	36	36	38	35
20	IL00-1665	33	34	32	36	30
21	IL99-20756	34	35	33	37	31
22	KY97C-0151-1	35	36	35	37	32
23	KY96C-0895-1	37	37	36	40	34
24	KS00HW175-4	35	35	36	37	33
25	KS950409-P-4	34	33	35	37	33
26	MD27-37	32	32	32	36	29
27	MO010925	35	32	35	39	33
28	MO010789	37	37	35	42	35
29	MO010574	37	39	36	38	34
30	MO010719	40	39	38	43	39
31	MO011130	38	37	36	43	36
32	NY88046-8138	36	37	34	40	32
33	Caledonia Resel-T	36	37	35	39	32
34	NY91028-9073	35	34	34	40	32
35	NY91028SP-9245W	35	37	33	38	33
36	NY89025-9111W	37	39	36	40	34
37	OH743	36	37	35	40	33
38	OH751	35	36	35	38	32
39	OH776	34	34	35	35	31
40	OH788	34	35	33	38	31
41	OH790	34	35	33	38	32
42	X00-1051	33	33	33	34	30
43	X00-1058	33	34	32	34	30
44	Y00-3044	33	33	34	35	31
45	E2057	32	31	32	34	29
46	E2038	34	33	35	37	31
47	E2048	38	37	37	41	36
48	E2037	35	36	35	39	32
49	E0009	38	39	37	42	35
50	RCATL33	41 h	40	40	46	39
51	RCATL10	39	39	39	43	36
52	RCATL24	42 h	40	41	46	40
53	RCATL12	40	38	38	46	38
54	RCAT L2	40	38	40	44	37
55	WESLEY	33	31	35	35	30
56	NE98466	37	37	39	39	34
	AVERAGE	35	35	34	38	32
	MINIMUM	29	30	29	30	27
	MAXIMUM	42	40	41	46	40
	CV	3.5	4	4	3	5
	LSD (0.05)	1.7	3	2	2	2

† Indicates a mean that is not different from the lowest (l) or highest (h) mean in the column based on LSD_(0.05)

Table 17. Pearson correlation among genotype means averaged over all locations. Correlations >0.6 are in bold while correlations between 0.3 and -0.3 are in small font and shown with less numerical precision.

	SEV	INC	IND	GH	KR	PSS	ISK	DON	HD	HGT
SEV	1	0.901	0.953	0.487	0.371	0.435	0.897	-0.02	-0.321	-0.329
INC	0.901	1	0.904	0.403	0.395	0.470	0.864	0.10	-0.25	-0.380
IND	0.953	0.904	1	0.511	0.340	0.328	0.830	-0.09	-0.452	-0.30
GH	0.487	0.403	0.511	1	0.412	0.432	0.506	0.294	0.08	0.23
KR	0.371	0.395	0.340	0.412	1	0.524	0.592	0.299	0.13	-0.02
PSS	0.435	0.470	0.328	0.432	0.524	1	0.684	0.688	0.556	0.10
ISK	0.897	0.864	0.830	0.506	0.592	0.684	1	0.21	-0.07	-0.22
DON	-0.02	0.10	-0.09	0.29	0.30	0.688	0.21	1	0.762	0.186
HD	-0.321	-0.25	-0.452	0.077	0.13	0.556	-0.07	0.762	1	0.331
HGT	-0.329	-0.380	-0.30	0.23	-0.02	0.10	-0.22	0.19	0.331	1

Table 14. Additional FHB data from MO, plus reaction to Stripe Rust (SR), Leaf Rust (LR), Barley Yellow Dwarf Virus (BYDV), Stagonospora nodorum (SN,) a complex of leaf diseases (CLD), plus seed weight.

#	NAME	FIELD SPREAD	GH SPREAD	GH RACHIS	SR	CLD	LR	BYDV	SN	SEED WEIGHT
		# spikelets	# spikelets	0-1	%	%	0-9	0-9	0-9	GMS/100
1	PIONEER 2545	5.8	6.1	1.00	88.5	60.0	6.0	6.3	3.0	2.6
2	ERNIE	5.7	1.5	0.38	94.8	92.3	6.3	4.3	2.0	3.3
3	FREEDOM	4.7	2.5	0.63	86.5	80.8	5.3	7.0	2.0	2.6
4	IL97-6755	1.7	0.5	0.13	22.5	35.0	7.3	5.0	4.3	3.1
5	PATTERSON	3.4	8.2	0.88	89.8	91.0	6.0	5.3	2.3	2.5
6	TRUMAN	1.8	0.8	0.38	4.8	26.3	4.7	2.7	2.3	2.8
7	97397J1-4-1-4-7	3.4	0.7	0.88	41.3	55.0	1.3	6.0	2.3	3.1
8	981238A1-1-44-1	3.2	1.5	0.88	31.3	55.0	5.3	4.7	3.7	3.2
9	981312A1-6-2-2	3.4	2.5	0.63	22.5	53.8	4.7	6.7	2.7	2.3
10	981517A1-1-5-2	3.4	1.3	0.38	9.8	55.0	1.3	5.7	4.7	3.2
11	992128A2-4-1	6.3	2.4	0.86	50.0	50.0	5.0	5.0	1.3	2.0
12	VAN98W-342	5.9	2.5	0.71	96.8	96.8	2.3	5.7	3.3	2.9
13	VA03W-630	5.8	4.8	0.71	57.0	95.5	3.3	4.3	1.3	3.0
14	VA03W-633	4.0	5.7	0.88	70.8	72.5	6.7	6.0	1.7	2.3
15	VA03W-644	4.3	0.8	0.25	20.5	95.5	7.0	6.0	3.0	2.4
16	VA03W-674	4.6	6.9	0.86	69.5	95.5	6.7	3.7	1.7	3.3
17	IL96-24851-1	3.1	0.9	0.38	50.0	53.8	5.7	4.3	1.7	2.6
18	IL99-27048	5.4	3.3	0.88	24.8	50.0	1.0	5.3	1.3	2.4
19	IL00-8061	2.6	2.0	0.50	21.5	30.0	2.7	6.0	1.7	2.9
20	IL00-1665	3.9	3.8	0.63	27.5	30.0	5.7	6.0	2.3	2.8
21	IL99-20756	7.5	0.4	0.25	28.5	50.0	5.0	5.7	3.0	3.2
22	KY97C-0151-1	3.7	5.9	0.75	5.8	60.0	5.3	5.0	1.3	2.8
23	KY96C-0895-1	4.6	6.9	1.00	71.5	72.5	5.7	4.0	2.7	3.2
24	KS00HW175-4	5.5	1.4	0.50	14.0	72.5	1.0	5.7	5.7	2.6
25	KS950409-P-4	5.4	3.7	0.88	9.8	60.0	1.3	7.3	4.0	3.1
26	MD27-37	9.6	2.1	1.00	18.5	92.3	7.7	6.3	3.0	2.4
27	MO010925	4.1	2.4	0.71	61.5	83.3	2.7	6.3	5.7	3.0
28	MO010789	4.1	4.5	0.88	50.0	45.0	2.0	3.3	2.0	3.0
29	MO010574	3.8	1.2	0.63	65.8	60.0	6.0	3.0	2.3	3.2
30	MO010719	3.1	2.4	1.00	3.3	35.0	3.3	4.0	7.7	3.2
31	MO011130	5.2	8.0	1.00	70.8	87.0	2.7	5.0	2.3	3.1
32	NY88046-8138	2.7	6.5	0.88	72.8	69.0	6.3	5.0	1.3	2.4
33	Caledonia Resel-T	4.2	7.6	1.00	53.8	26.3	6.7	3.3	1.0	2.1
34	NY91028-9073	3.2	3.6	0.75	12.3	18.8	3.0	4.3	1.3	3.0
35	NY91028SP-9245W	2.8	3.6	0.88	13.5	18.8	1.3	3.3	1.3	2.6
36	NY89025-9111W	2.6	8.0	0.88	3.3	18.8	5.7	5.7	1.3	2.5
37	OH743	4.5	2.1	0.43	7.8	50.0	5.0	5.0	4.0	2.9
38	OH751	4.5	3.4	0.63	90.3	94.3	2.3	4.0	1.0	2.8
39	OH776	3.9	6.1	1.00	72.0	60.0	4.7	5.3	2.3	2.7
40	OH788	4.4	6.1	0.83	70.8	55.0	3.0	4.3	6.3	2.7
41	OH790	5.1	7.6	1.00	75.8	67.5	1.3	6.0	5.3	2.5
42	X00-1051	3.9	1.8	0.75	7.8	40.0	3.3	3.0	1.7	2.8
43	X00-1058	4.5	2.0	0.50	9.8	30.0	4.3	2.3	2.3	2.6
44	Y00-3044	3.2	6.3	0.88	7.8	30.0	2.7	4.7	1.3	2.6
45	E2057	2.6	2.1	0.57	46.3	55.0	4.0	5.3	1.0	3.1
46	E2038	2.8	1.8	0.63	50.0	55.0	5.3	7.3	1.7	3.1
47	E2048	3.0	8.9	1.00	5.3	26.3	1.3	6.7	2.3	2.4
48	E2037	2.7	3.5	1.00	4.5	22.5	4.7	5.7	1.3	2.3
49	E0009	2.5	3.0	0.40	2.8	15.0	8.3	2.7	4.7	2.5
50	RCATL33	2.1	6.3	1.00	41.3	65.0	4.7	7.3	6.7	3.6
51	RCATL10	3.3	5.7	0.86	40.0	35.0	5.0	6.3	2.3	2.9
52	RCATL24	2.2	8.3	1.00	15.5	35.0	5.3	6.0	2.0	3.0
53	RCATL12	5.2	5.2	0.86	31.3	45.0	1.3	6.3	2.3	2.5
54	RCAT L2	4.3	1.8	1.00	40.0	73.8	5.3	6.3	5.7	3.2
55	WESLEY	6.6	5.8	1.00	3.3	65.0	4.0	7.3	4.7	3.1
56	NE98466	4.5	2.9	0.88	34.3	73.8	2.7	5.7	5.0	2.6
AVERAGE		4.1	3.9	0.7	39.1	56.0	4.3	5.2	2.8	2.8
# LOCATIONS		1 MO	1 MO	1 MO	1 AR	1 AR	1 VA	1VA	1VA	1 MD

CLD=% leaf area diseased at soft dough. Primarily septoria leaf blotch, stripe rust and leaf rust in this order

Rachis - 0-1 - where no rachis involvement = 0 and disease has spread to the rachis = 1