

Section 5: Wheat Scab Research

One of the primary research objectives of the Virginia Tech wheat breeding program is to identify and develop cultivars possessing resistance to Fusarium Head Blight (FHB) or scab. Each year all wheat entries in Virginia's Official State Variety Trials are evaluated for FHB resistance in an inoculated, irrigated nursery at the Blacksburg test site. The data from 2015 was insignificant, so data from 2016 is being combined with data from 2014 to provide a two-year data set of FHB incidence, FHB severity and FHB Index (incidence x severity / 100.) Tables 31 and 32 are included in this bulletin to aid producers in selection of cultivars on the basis of FHB resistance. Cultivars possessing complete resistance or immunity to FHB have not been identified and resistance levels in currently available cultivars vary from moderately resistant to highly susceptible.

A major goal of the breeding program is to identify and incorporate unique and complementary types of FHB resistance into cultivars to enhance the overall level of resistance. Genes controlling FHB resistance have been identified on more than six chromosomes in wheat and some of these genes are complementary in nature and effect different disease resistance components such as FHB incidence, severity, and DON toxin content. Incorporating such multiple resistance genes having additive effects on FHB resistance into cultivars will enhance the overall level of resistance. Because the individual resistance genes are located on different wheat chromosomes and each gene confers only partial resistance to FHB, identifying wheat lines having multiple resistance genes is difficult using traditional breeding techniques. To overcome this limitation, our program is currently identifying and using DNA markers located close to these resistance genes on the same chromosome as "tags" for selecting wheat lines possessing different combinations of these complementary resistance genes.

Entries were inoculated two times by spreading scabby corn seeds in plots at the booting stage and a week later, and by spraying a *Fusarium graminearum* spore suspension directly onto spikes at the 50% flowering stage. Among 133 lines and varieties tested in 2016, the FHB index varied from 5.3 to 62.3 with FHB incidence ranging from 37.5% to 100% and FHB severity ranging from 9.3% to 65.6% (Table 31). Seventy-two lines or varieties had FHB index values lower than the mean (<21.2) and expressed moderate resistant to FHB in 2016. Based on two year mean data for 2014 and 2016 (Table 32), twenty-six lines or varieties had FHB index values lower than the test mean (<17.0).

Table 31. Summary of reaction of entries in the Virginia Tech State Wheat Test to Fusarium head blight (scab) and glume blotch resistance, 2016 harvest.

Line	FHB Incidence ¹ (%)	FHB Severity ² (%)	FHB Index ³ (0-100)
USG 3197	37.5	14.6	5.3
Pioneer Brand 25R32	62.5	9.3	5.8
Dyna-Gro 9600	55.0	10.8	5.9
VA13W-177	52.5	12.3	6.4
VA13W-38	55.0	14.4	7.8
USG 3316	70.0	11.3	7.9
Dyna-Gro 9772	65.0	12.4	8.0
MBX 15-E-229	67.5	12.0	8.2
MAS 67	72.5	12.3	8.9
MAS 35	80.0	11.9	9.5
AgriMAXX Exp 1675	87.5	10.9	9.5
MAS 32	80.0	12.1	9.6
MAS 61	65.0	15.2	9.9
Progeny 243	65.0	15.2	10.0
ARW1516	70.0	14.5	10.2
AgriMAXX 454	77.5	13.2	10.3
Massey	72.5	14.8	10.8
15MW315	85.0	12.6	10.8
MBX 16-B-203	80.0	13.5	10.8
VA13W-174	77.5	14.2	11.0
MAS 7	72.5	15.3	11.2
SY 547	77.5	14.4	11.2
Dyna-Gro 9642	77.5	14.3	11.3
L11541	85.0	13.2	11.3
SS EXP 8550	80.0	14.4	11.5
MD272-8-4-14-6	85.0	13.8	11.7
MAS 42S	85.0	13.6	11.7
AR21513	82.5	14.3	11.8
NC09-20986	85.0	13.8	11.8
PGX 15-10	77.5	15.3	11.8
SS 8340	57.5	21.2	12.2
USG 3404	82.5	15.1	12.4
Featherstone 73	77.5	15.9	12.4
Dyna-Gro 9692	85.0	14.9	12.6
AgriMAXX Exp 1558	65.0	20.5	13.0
SS 8530	60.0	20.4	13.0
VA12W-72	90.0	15.3	13.7
VA12W-101	77.5	18.2	13.9
L11420	67.5	21.7	14.1
MAS 66	67.5	21.8	14.6
MBX 14-S-210	72.5	20.7	15.0

Table 31. Summary of reaction of entries in the Virginia Tech State Wheat Test to Fusarium head blight (scab) and glume blotch resistance, 2016 harvest.

Line	FHB Incidence ¹ (%)	FHB Severity ² (%)	FHB Index ³ (0-100)
PGX 15-12	67.5	22.2	15.0
Jamestown	75.0	19.8	15.3
USG 3523	80.0	19.0	15.7
L11410	75.0	21.0	16.0
MAS 6	82.5	19.6	16.1
MAS 23	85.0	18.9	16.2
USG 3251	80.0	20.4	16.4
VA11W-108PA	75.0	22.0	16.5
SY 007	70.0	24.5	16.8
Hilliard	77.5	22.0	17.1
Progeny 870	77.5	21.9	17.2
AgriMAXX 415	70.0	25.1	17.6
VA13FHB-26	80.0	22.3	17.6
NC8170-4-3	80.0	22.4	17.7
Southern Harvest 4400	77.5	24.1	18.0
VA13FHB-5	80.0	22.6	18.1
USG 3201	75.0	24.8	18.1
SY Viper	77.5	22.0	18.2
PGX 15-16	77.5	23.6	18.4
VA14FHB-28	77.5	23.4	18.6
Pioneer XW13W	87.5	21.2	18.8
Oakes	77.5	24.4	19.2
Southern Harvest 4300	82.5	23.9	19.2
VA11W-313	80.0	24.5	19.4
VA14FHB-14	77.5	25.3	19.8
VA08MAS1-188-6-4-1	82.5	24.0	20.0
VA13W-124	82.5	25.0	20.0
AgriMAXX 462	85.0	23.6	20.2
L11437	72.5	28.3	20.3
Dyna-Gro 9522	85.0	24.0	20.4
Pioneer Brand 26R10	87.5	23.9	20.7
Inferno	82.5	25.6	21.2
MAS 50	82.5	26.0	21.3
VA12W-31	92.5	23.0	21.3
VA11W-106	85.0	24.6	21.4
Dyna-Gro 9552	92.5	23.4	21.5
USG 3612	92.5	23.4	21.6
VA09MAS6-122-7-1	80.0	27.2	21.9
VA12W-68	87.5	25.1	22.0
SY Harrison	80.0	28.3	22.0
AgriMAXX 444	82.5	27.7	22.1

Table 31. Summary of reaction of entries in the Virginia Tech State Wheat Test to Fusarium head blight (scab) and glume blotch resistance, 2016 harvest.

Line	FHB Incidence ¹ (%)	FHB Severity ² (%)	FHB Index ³ (0-100)		
VA12W-22	90.0	24.9	22.5		
Progeny 357	90.0	25.1	22.6		
VA12FHB-8	82.5	27.4	22.6		
VA14W-6	90.0	24.9	22.7		
VA12W-248	80.0	28.5	22.8		
VA11W-279	90.0	25.5	22.9		
VA07MAS4-7463-6-2-2-2	80.0	29.0	23.1		
VA07MAS3-7304-3-1-2-3	87.5	26.1	23.2		
DH11SRW070-28	87.5	26.8	23.5		
SS 8360	90.0	26.6	23.7		
AgriMAXX 446	87.5	27.2	23.8		
Pioneer Brand 26R53	77.5	30.6	23.9		
MBX 16-A-206	87.5	26.9	24.0		
MAS 46	85.0	28.4	24.1		
VA10W-96	77.5	30.9	24.2		
Pioneer Brand 26R59	87.5	27.6	24.2		
Featherstone VA258	95.0	26.0	24.7		
MBX 11-V-258	97.5	25.4	24.9		
VA07MAS4-7417-1-3-3	82.5	30.5	25.4		
AR01040-4-1	90.0	29.0	25.9		
VA07MAS4-7416-5-4-2	82.5	32.1	26.3		
Pioneer Brand 26R20	90.0	30.0	26.9		
LCS 3677	82.5	34.0	26.9		
Pioneer Brand 26R41	95.0	28.6	27.0		
MBX 14-K-297	87.5	30.9	27.0		
VA07MAS14-9260-8-2-2	100.0	27.1	27.1	+	
Dyna-Gro 9223	87.5	31.1	27.2		
Shirley	97.5	29.4	28.6		
USG 3895	92.5	31.0	28.7		
GA-03564-12E6	87.5	33.5	29.3		
AgriMAXX Exp 1674	90.0	32.6	29.5		
VA09MAS7-61-2-1	75.0	39.6	30.2	+	
NC11-22289	70.0	43.0	30.3	+	
DH11SRW070-14	92.5	34.0	31.8		+
VA10W-119	92.5	35.8	33.2		+
SS 8513	90.0	37.2	33.8	+	+
VA07MAS4-7463-6-2-2-4	92.5	36.6	33.8	+	+
MAS 65	95.0	37.4	35.3	+	+
VA09MAS1-12-8-4	90.0	40.2	36.2	+	+
TN1102	92.5	41.4	38.2	+	+
VA14W-59	87.5	44.7	39.1	+	+

Table 31. Summary of reaction of entries in the Virginia Tech State Wheat Test to Fusarium head blight (scab) and glume blotch resistance, 2016 harvest.

Line	FHB Incidence ¹ (%)		FHB Severity ² (%)		FHB Index ³ (0-100)	
VA07MAS3-7304-3-2-4-3	100.0	+	39.5	+	39.5	+
PGX 15-14	95.0		42.4	+	40.4	+
SS 8415	97.5		43.3	+	42.2	+
VA10W-21BSR124	80.0		53.8	+	42.8	+
VA14W-29	92.5		49.8	+	46.2	+
GA061349-13LE29	97.5		49.7	+	48.6	+
GA051102-13LE43	95.0		54.1	+	50.9	+
ARGA04510-11LE24	100.0	+	53.7	+	53.7	+
GA061349-13LE31	95.0		60.1	+	57.1	+
GA-04434-12LE28	95.0		65.6	+	62.3	+
Average	81.5		25.2		21.2	
LSD (0.05)	17.1		11.0		10.1	
C.V.	10.6		22.0		24.0	

Released cultivars are shown in bold print.

Varieties are ordered by ascending index averages.

A plus or minus sign indicates a performance significantly above or below the average.

Entries were planted in 2-row plots, 4 ft in length at Blacksburg, VA and were inoculated at 50% and 100% heading stages with *Fusarium graminearum* spore suspension (50,000 spores/ml).

¹Scab Incidence (%): Percentage of infected spikes among 10 randomly selected spikes.

²Scab Severity (%): Percentage of infected spikelets among 10 infected spikes.

³Scab Index = Incidence X Severity/100; it is an overall indicator of scab resistance/susceptibility level.

Table 32. Two-year average summary of reaction of entries in the Virginia Tech State Wheat Tests to Fusarium head blight (scab) and glume blotch resistance, 2014 and 2016 harvests.

Line	FHB Incidence ¹ (%)	FHB Severity ² (%)	FHB Index ³ (0-100)
MAS 32	66.3	11.9	- 8.1
Massey	53.8	15.7	8.3
MAS 35	61.3	15.1	8.7
Pioneer Brand 25R32	60.0	15.2	8.9
MBX 14-S-210	51.3	20.0	9.7
Jamestown	57.5	15.9	9.8
SS 8340	42.5	- 28.9	10.4
USG 3201	50.0	18.4	10.6
VA11W-313	52.8	16.8	10.9
VA12W-72	60.0	25.1	11.0
Progeny 870	58.0	17.4	11.1
SY 007	50.0	21.9	11.2
Hilliard	57.5	18.6	11.4
USG 3523	61.3	17.1	11.8
AgriMAXX 415	51.3	21.2	12.0
MAS 6	61.3	22.1	13.0
USG 3612	63.8	18.1	13.1
MAS 7	50.0	35.6	13.4
Featherstone 73	61.3	25.6	14.2
AgriMAXX 446	62.5	19.5	14.2
SS 8360	58.8	21.5	14.4
VA11W-106	61.3	22.1	14.8
USG 3404	67.5	24.2	14.9
Pioneer Brand 26R53	50.0	28.7	15.1
VA10W-96	57.5	24.0	15.4
MAS 23	71.3	22.7	16.2
Pioneer Brand 26R10	66.3	28.1	17.8
AgriMAXX 444	56.3	37.3	17.9
USG 3251	63.8	31.2	18.0
VA11W-279	68.8	29.5	18.9
MBX 14-K-297	70.0	25.8	19.3
SS 8513	58.8	28.9	19.6
Dyna-Gro 9223	66.3	30.3	20.5
AgriMAXX 462	75.0	27.3	21.9
VA10W-119	68.8	28.2	22.0
Progeny 357	83.8	+ 32.4	26.7
MBX 11-V-258	87.5	+ 35.2	29.8 +
Pioneer Brand 26R20	75.0	45.2 +	31.6 +
Featherstone VA258	87.5	+ 41.4 +	36.6 +
Shirley	92.5	+ 43.8 +	41.1 +

Table 32. Two-year average summary of reaction of entries in the Virginia Tech State Wheat Tests to Fusarium head blight (scab) and glume blotch resistance, 2014 and 2016 harvests.

Line	FHB Incidence ¹ (%)	FHB Severity ² (%)		FHB Index ³ (0-100)	
SS 8415	77.5	60.0	+	43.2	+
Average	63.3	26.0		17.0	
LSD (0.05)	17.0	13.9		11.6	
C.V.	19.0	37.9		48.6	

Released cultivars are shown in bold print.

Varieties are ordered by ascending index averages.

A plus or minus sign indicates a performance significantly above or below the average.

Entries were planted in 2-row plots, 4 ft in length at Blacksburg, VA and were inoculated at 50% and 100% heading stages with *Fusarium graminearum* spore suspension (50,000 spores/ml).

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