

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. In 2017, all wheat entries in Virginia's Official State Variety Trials were evaluated for FHB resistance in an inoculated, irrigated nursery at the Virginia Crop Improvement Association (VCIA) test site in Mt. Holly, VA. Data from this test for the current crop year and two-year average for FHB incidence, FHB severity and FHB Index (incidence x severity / 100) are included in this bulletin (Table 32) 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.

In 2017, entries were inoculated by spreading scabby corn kernels (50g/4-rows) in plots at the booting stage. Among 139 lines and varieties tested in 2017, the FHB index varied from 2.8 to 51.6 with FHB incidence ranging from 25% to 75% and FHB severity ranging from 5.9% to 70.1% (Table 31). Seventy-eight lines and varieties had FHB index values lower than the mean (<15.3) and expressed moderate resistant to FHB in 2017. Based on two year mean data for 2016 and 2017 (Table 32), eight lines and 26 varieties had FHB index values lower than the test mean (<15.9).

Table 31. Summary of reaction of entries in the Virginia Tech State Wheat Test to Fusarium head blight (scab) and glume blotch resistance, 2017 harvest.

Line	FHB Incidence ¹ (%)	FHB Severity ² (%)	FHB Index ³ (0-100)	Flowering Date (Julian)	Rank FHB Index
USG 3228	37.5	- 7.3	- 2.8	107.3	1
MBX 17-P-275	42.5	- 6.9	- 2.9	107.0	2
VA13W-38	25.0	- 11.1	- 3.0	103.3	3
AgriMAXX 464	32.5	- 9.9	- 3.4	107.0	4
MAS #67	45.0	- 7.9	- 3.5	106.5	5
AgriMAXX 463	47.5	- 7.2	- 3.5	106.5	6
USG 3549	45.0	- 8.1	- 3.6	108.3	7
15MDX2	40.0	- 9.4	- 4.0	104.0	8
#Bullet	51.3	- 8.8	- 4.6	108.8	9
Dyna-Gro 9600	47.5	- 11.2	- 4.7	106.5	10
AgriMAXX 473	52.5	- 8.9	- 4.8	108.0	11
PGX 14-5	37.5	- 12.0	- 4.8	107.0	12
Dyna-Gro 9750	53.8	- 8.9	- 4.8	106.8	13
Dyna-Gro 9772	27.5	- 17.0	- 4.8	106.5	14
CROPLAN 8530	46.3	- 10.7	- 4.9	107.0	15
USG 3197	45.0	- 10.6	- 4.9	107.5	16
VA13W-174	50.0	- 10.4	- 5.2	104.3	17
MAX116	51.3	- 10.1	- 5.2	108.0	18
VA12W-68	42.5	- 12.3	- 5.3	103.3	19
SY 007	45.0	- 12.9	- 5.6	107.5	20
Southern Harvest 4400	73.8	+ 7.3	- 5.6	96.0	21
15MDX4	57.5	- 9.7	- 5.6	107.5	22
MAX316	58.8	- 9.7	- 5.6	110.8	23
Dyna-Gro 9862	43.8	- 13.4	- 5.7	111.0	24
MAS #61	37.5	- 14.7	- 5.8	107.5	25
USG 3536	55.0	- 10.9	- 5.9	110.0	26
VA12W-72	37.5	- 16.3	- 6.2	104.0	27
VA09MAS2-131-6-2-4	47.5	- 12.9	- 6.3	104.8	28
Armor Mayhem	60.0	- 10.5	- 6.3	109.3	29
MAX516	47.5	- 13.8	- 6.5	105.5	30
CROPLAN 8550	57.5	- 11.4	- 6.6	110.5	31
Southern Harvest 4300	43.8	- 14.8	- 6.6	108.8	32
Dyna-Gro 9701	57.5	- 11.7	- 6.7	108.0	33
DH11SRW065-26	43.8	- 16.3	- 7.1	105.5	34
VA14FHB-28	55.0	- 13.0	- 7.3	99.3	35
Progeny 243	38.8	- 17.3	- 7.5	108.0	36
Massey	45.0	- 18.3	- 7.7	106.5	37
PGX 16-3	62.5	- 12.2	- 7.7	108.3	38
DH11SRW061-16	43.8	- 18.3	- 8.0	103.0	39
Pioneer XW15C	48.8	- 16.2	- 8.0	108.0	40
SY 547	50.0	- 16.0	- 8.0	107.5	41

Table 31. Summary of reaction of entries in the Virginia Tech State Wheat Test to Fusarium head blight (scab) and glume blotch resistance, 2017 harvest.

Line	FHB Incidence ¹ (%)	FHB Severity ² (%)	FHB Index ³ (0-100)	Flowering Date (Julian)	Rank FHB Index
VA15W-101	57.5	14.3	8.2	105.0 -	42
MAS #35	50.0	17.2	8.2	108.8 +	43
Pioneer Brand 26R36	57.5	13.8	8.2	109.0 +	44
VA09MAS6-122-7-1	47.5	17.5	8.5	103.0 -	45
L11541	61.3	13.5	8.5	108.0	46
Armor ARW1575	56.3	15.1	8.6	108.5 +	47
MBX 16-B-203	53.8	16.1	8.7	107.5	48
MAS #42	48.8	18.4	9.1	109.3 +	49
USG 3316	55.0	17.3	9.3	108.3 +	50
15MW133	55.0	17.3	9.8	108.5 +	51
VA11W-313	50.0	19.2	10.0	101.0 -	52
MAX216	52.5	18.3	10.0	107.5	53
Dyna-Gro 9692	56.3	18.6	10.1	110.0 +	54
USG 3404	51.3	20.6	10.2	111.5 +	55
VA09MAS6-122-7-1-4	47.5	22.1	10.3	103.5 -	56
Dyna-Gro 9522	48.8	20.7	10.4	110.8 +	57
AgriMAXX 444	47.5	23.9	11.4	111.0 +	58
#Turbo	51.3	22.2	11.4	105.5 -	59
SY 100	66.3	17.6	11.6	107.0	60
MAS #7	60.0	19.7	11.7	111.0 +	61
VA12FHB-8	45.0	25.5	12.1	101.0 -	62
CROPLAN SRW 9415	60.0	19.4	12.2	110.5 +	63
MBX 14-S-210	48.8	23.6	12.4	110.5 +	64
15MDX17	50.0	23.5	12.4	105.5 -	65
GA051207-14E53	57.5	22.3	12.8	106.0	66
VA14W-32	42.5	28.2	13.2	100.5 -	67
VA11W-279	55.0	24.2	13.4	101.3 -	68
Armor ARW1611	65.0	20.6	13.4	108.0	69
#BOSS	47.5	28.5	13.4	106.5	70
Progeny 357	56.3	23.8	13.6	111.5 +	71
DH12SRW056-058	53.8	24.7	13.8	108.0	72
Dyna-Gro 9223	63.8	22.2	14.1	109.0 +	73
VA15W-94	57.5	24.8	14.3	106.0	74
VA09MAS3-34-2-1	57.5	26.3	14.9	106.0	75
VA07MAS3-7304-3-1-2-3	66.3	21.9	14.9	98.5 -	76
NC13-23443	57.5	27.6	15.1	107.0	77
VA14FHB-29	50.0	30.4	15.4	106.3	78
AgriMAXX 415	58.8	25.6	15.5	108.3 +	79
VA12W-248	46.3	35.1	15.9	105.5 -	80
Pioneer Brand 26R53	51.3	31.0	16.0	108.0	81
WX16722	70.0 +	22.9	16.0	108.0	82

Table 31. Summary of reaction of entries in the Virginia Tech State Wheat Test to Fusarium head blight (scab) and glume blotch resistance, 2017 harvest.

Line	FHB Incidence ¹ (%)	FHB Severity ² (%)	FHB Index ³ (0-100)	Flowering Date (Julian)	Rank FHB Index
MAS #6	55.0	28.9	16.2	107.3	83
GAJT 141-14E45	46.3	34.4	16.4	105.5 -	84
USG 3895	58.8	28.9	16.7	107.0	85
AgriMAXX 446	55.0	29.3	16.8	109.8 +	86
Oakes	65.0	26.2	17.1	108.0	87
Pioneer Brand 26R10	53.8	32.8	17.7	109.5 +	88
Featherstone 73	58.8	30.6	18.1	109.0 +	89
Hilliard	50.0	35.7	18.2	107.0	90
CROPLAN SRW 9606	65.0	28.4	18.5	108.3 +	91
DH12SRW057-006	60.0	31.5	18.7	107.5	92
TN1501	67.5	28.2	18.8	106.5	93
USG 3458	63.8	29.6	19.1	108.3 +	94
SH EXP 1706	58.8	33.1	19.1	108.5 +	95
AgriMAXX 474	71.3 +	27.6	19.8	109.0 +	96
DH11SRW070-14	63.8	30.4	20.3	104.5 -	97
L11538	52.5	38.8	20.3	107.5	98
MBX 17-M-245	70.0 +	29.6	20.5	108.0	99
Pioneer Brand 26R59	60.0	34.8	20.5	107.5	100
15MDX1	63.8	31.5	20.5	107.3	101
VA09MAS8-34-5-2	61.3	34.0	21.4	107.5	102
VA09MAS2-131-6-2	61.3	33.0	21.4	105.5 -	103
VA15W-63	71.3 +	30.0	21.4	107.5	104
VA07MAS3-7304-3-2-4-2	68.8 +	31.5	21.8	100.5 -	105
SY Harrison	55.0	40.5 +	22.2	107.5	106
VA09MAS1-12-8-4	53.8	39.1	22.3	106.5	107
NC13-23449	56.3	40.8 +	22.4	108.0	108
DH11SRW069-70	50.0	45.7 +	23.0	110.0 +	109
TX EL2	55.0	41.2 +	23.2	107.0	110
VA09MAS1-12-5-1-1	60.0	39.1	23.3	109.5 +	111
VA09MAS1-12-5-1-3	62.5	37.5	23.4	109.0 +	112
#Warrior	70.0 +	33.7	23.8	107.5	113
VA11W-108PA	52.5	47.1 +	24.4	107.0	114
VA07MAS1-7047-1-1-4-2	53.8	40.0 +	26.4 +	105.5 -	115
VA14W-28	63.8	41.8 +	26.7 +	107.5	116
Featherstone VA258	62.5	43.7 +	26.9 +	107.0	117
VA14FHB-22	63.8	43.0 +	27.0 +	108.0	118
Armor ARW1514	66.3	41.8 +	27.3 +	108.0	119
NC13-20332	71.3 +	39.2	27.9 +	107.5	120
Progeny 16-4	56.3	50.1 +	28.1 +	105.5 -	121
SH 7200	63.8	44.8 +	28.6 +	106.0	122
NC13-21213	63.8	43.5 +	28.7 +	107.5	123

Table 31. Summary of reaction of entries in the Virginia Tech State Wheat Test to Fusarium head blight (scab) and glume blotch resistance, 2017 harvest.

Line	FHB Incidence ¹ (%)	FHB Severity ² (%)	FHB Index ³ (0-100)	Flowering Date (Julian)	Rank FHB Index
Armor ARW1610	68.8 +	40.6 +	29.1 +	109.5 +	124
SY Viper	51.3	57.0 +	29.2 +	106.8	125
VA09MAS1-12-5-1	62.5	46.9 +	29.3 +	107.5	126
TN1604	75.0 +	40.2 +	30.1 +	108.0	127
VA12W-31	73.8 +	41.1 +	30.2 +	107.5	128
VA09MAS6-122-7-1-1	67.5	45.9 +	31.4 +	106.0	129
CROPLAN 8415	66.3	44.8 +	31.5 +	107.0	130
Pioneer Brand 26R41	61.3	51.6 +	31.8 +	109.0 +	131
Shirley	61.3	52.8 +	32.0 +	107.5	132
L11550	66.3	49.1 +	32.8 +	108.0	133
VA08MAS1-188-6-4-1	68.8 +	52.8 +	36.1 +	106.0	134
DH11SRW065-23	65.0	56.2 +	36.3 +	109.0 +	135
GA07353-14E19	65.0	56.8 +	36.6 +	106.3	136
Progeny 16-1	66.3	57.4 +	38.6 +	107.5	137
VA14W-29	73.8 +	70.1 +	51.6 +	107.5	138
Average	55.3	26.1	15.3	106.9	
LSD (0.05)	13.4	13.6	9.5	1.2	
C.V.	17.4	37.5	44.7	0.8	

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 Mt. Holly, VA and were inoculated at booting stage with scabby corn kernels (50g/4-rows).

¹Scab Incidence (%): Percentage of infected spikes among 20 randomly selected spikes.

²Scab Severity (%): Percentage of infected spikelets among 20 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), 2016 and 2017 harvests.

Line	FHB Incidence ¹ (%)	FHB Severity ² (%)	FHB Index ³ (0-100)	Rank FHB Index
VA13W-38	35.0	12.2	4.6	1
USG 3197	42.5	11.9	5.1	2
Dyna-Gro 9600	50.0	11.1	5.1	3
MAS #67	54.2	9.4	5.3	4
Dyna-Gro 9772	40.0	15.5	5.9	5
AgriMAXX 464	43.3	13.4	6.6	6
#Bullet	60.0	11.0	7.0	7
VA13W-174	59.2	11.6	7.1	8
MAS #61	46.7	14.9	7.1	9
CROPLAN 8530	50.8	13.9	7.6	10
CROPLAN 8550	65.0	12.4	8.2	11
Progeny 243	47.5	16.6	8.3	12
MAS #35	60.0	15.4	8.7	13
VA12W-72	55.0	16.0	8.7	14
Massey	54.2	17.1	8.7	15
USG 3316	60.0	15.3	8.8	16
SY 547	59.2	15.5	9.1	17
SY 007	53.3	16.8	9.3	18
MBX 16-B-203	62.5	15.2	9.4	19
L11541	69.2	13.4	9.5	20
Southern Harvest 4400	75.0	12.9	9.7	21
MAS #42	60.8	16.8	10.0	22
Southern Harvest 4300	56.7	17.8	10.8	23
VA12W-68	57.5	16.6	10.8	24
Dyna-Gro 9692	65.8	17.4	10.9	25
USG 3404	61.7	18.8	10.9	26
VA14FHB-28	62.5	16.5	11.1	27
MAS #7	64.2	18.3	11.5	28
Pioneer Brand 26R36	67.5	16.2	11.7	29
VA09MAS6-122-7-1	58.3	20.8	12.9	30
VA11W-313	60.0	21.0	13.2	31
MBX 14-S-210	56.7	22.6	13.3	32
Dyna-Gro 9522	60.8	21.8	13.7	33
AgriMAXX 444	59.2	25.2	15.0	34
VA12FHB-8	57.5	26.1	15.6	35
MAS #6	64.2	25.8	16.1	36
Featherstone 73	65.0	25.7	16.2	37
AgriMAXX 415	62.5	25.4	16.2	38
VA11W-279	66.7	24.6	16.5	39
Progeny 357	67.5	24.2	16.6	40

Table 32. Two year average summary of reaction of entries in the Virginia Tech State Wheat Tests to Fusarium head blight (scab), 2016 and 2017 harvests.

Line	FHB Incidence ¹ (%)	FHB Severity ² (%)	FHB Index ³ (0-100)	Rank FHB Index
VA07MAS3-7304-3-1-2-3	73.3	23.3	17.7	41
Oakes	69.2	25.6	17.8	42
Hilliard	59.2	31.1	17.8	43
VA12W-248	57.5	32.9	18.2	44
Dyna-Gro 9223	71.7	25.2	18.4	45
Pioneer Brand 26R53	60.0	30.9	18.6	46
Pioneer Brand 26R10	65.0	29.8	18.7	47
AgriMAXX 446	65.8	28.6	19.1	48
USG 3895	70.0	29.6	20.7	49
Pioneer Brand 26R59	69.2	32.4	21.7	50
VA11W-108PA	60.0	38.7	+ 21.8	51
SY Harrison	63.3	36.4	+ 22.1	52
AgriMAXX 474	77.5	29.3	23.1	53
DH11SRW070-14	73.3	31.6	24.1 +	54
SY Viper	60.0	45.3	+ 25.5 +	55
Featherstone VA258	73.3	37.8	+ 26.1 +	56
VA09MAS1-12-8-4	65.8	39.4	+ 26.9 +	57
VA12W-31	80.0	35.0	27.2 +	58
L11550	72.5	40.9	+ 29.0 +	59
SH 7200	73.3	41.8	+ 30.1 +	60
Pioneer Brand 26R41	72.5	43.9	+ 30.2 +	61
VA08MAS1-188-6-4-1	73.3	43.2	+ 30.7 +	62
Shirley	73.3	45.0	+ 30.9 +	63
CROPLAN 8415	76.7	44.3	+ 35.1 +	64
VA14W-29	80.0	63.3	+ 49.8 +	65
Average	62.4	24.6	15.9	
LSD (0.05)	17.8	10.8	7.7	
C.V.	25.2	38.6	42.6	

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.

In 2016, 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).

In 2017, Entries were planted in 2-row plots, 4 ft in length at Mt. Holly, VA and were inoculated at booting stage with scabby corn kernels (50g/4-rows).

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.