



Virginia Cooperative Extension

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Specialty Small Grains in 2020

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Introduction

The following tables present results from specialty wheat and barley varietal tests conducted in Virginia in 2018-2020. The tests provide information to assist Virginia Cooperative Extension Service agents in formulating cultivar recommendations for small grain producers and to companies developing cultivars and/or marketing seed within the state. Yield data are given for individual locations and across locations and years, where available. Performance of a given variety often varies widely over locations and years which makes multiple location-year averages a more reliable indication of expected performance than data from a single year or location. When available, those data are preferred. Details about management practices for barley and wheat are listed for each experiment location.

The Season

Early fall, 2019 was unseasonably warm and dry in most of the Commonwealth, delaying planting in some areas. Rain in mid to late October mitigated the dry conditions but also slowed planting. By October 25, 58% of intended acres were planted, increasing to 71% by November 3 which was more than a 20% increase over 2018-19. In December over 90% of the state reported adequate moisture and 69 and 62% of wheat and barley were reported to be in good condition. January and February were relatively warm and wet resulting in muddy fields. Reports held that 78% of wheat was in good or excellent condition. March brought more rain and cooler than normal temperatures with 80% of wheat acres in good or excellent condition. By mid-April, wheat condition continued to be very good with 3% of the crop headed, compared with 11% on this date last year. Cooler weather continued through the month with only 13% of the crop headed by April 20. There were also areas that experienced frost. On May 6, 51% of the wheat crop had headed, compared with the 5-year average of 55%. Over 80% of the crop continued to be rated good or excellent. Frost damage and moisture stress caused the percentage of the wheat crop rated good to decline to 66% by mid-May. A late frost event on the weekend of May 9 caused significant damage in some fields, resulting in near total loss, though this was not widespread. By May 20, 91% of wheat had headed and 2% of barley was harvested. Wheat harvest began in early June with 11% of the crop harvested by June 10. Some areas experienced rain but harvest increased to 20% of acres by June 17. By July 1, 91% of barley and 73% of wheat acres were harvested, 7% greater than the 5-year average. Farmers are expected to harvest 11.0 million bushels of winter wheat during 2020 according to the Virginia field office of USDA's National Agricultural Statistics Service. The expected crop for 2020 would be up 69% from the previous year. The forecast was based on crop conditions as of June 1 and decreased 6% from the May forecast. Growers expect a yield of 61.0 bushels per acre, down 1.0 bushel from 2019 and down 4.0 bushels from May. Farmers seeded 260,000 acres last fall with 180,000 acres to be harvested for grain. Acres for other uses totaled 80,000 acres and will be used as cover crop for tobacco or cut as silage or hay.

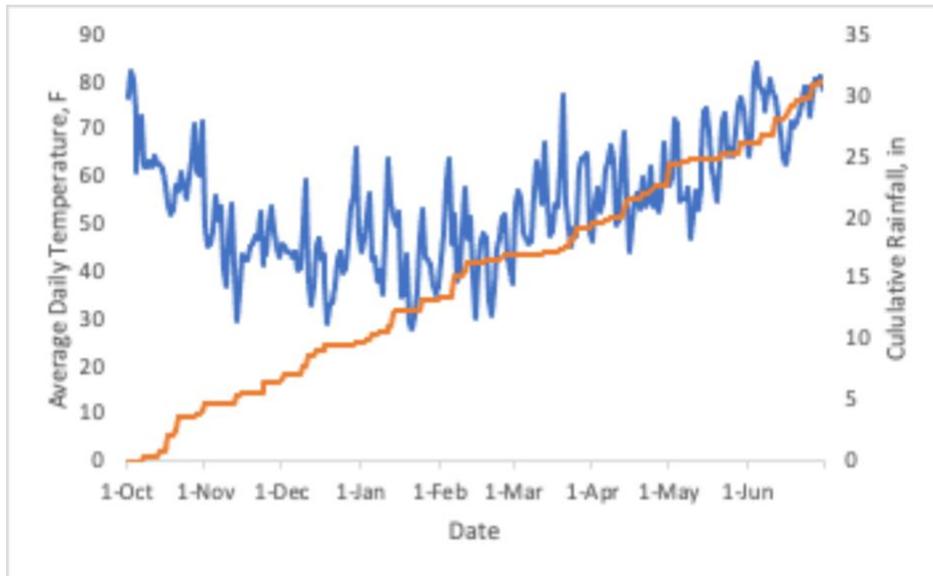


Figure 1. 2019-2020 daily average temperature and cumulative growing season precipitation for Virginia.

Wheat Management Practices

(All rates are given on a per acre basis.)

Blacksburg - Planted October 18, 2019. Pre-plant fertilizer was 30-50-70-10(S)-2(B). Site was sprayed with 1 oz. Harmony Extra SG® and fertilized with 25 units N on March 15, 2020. Site was fertilized with 40 units N + .25 lb. Boron + 1 qt Manni-Plex® on April 6, 2020. Harvest occurred July 2, 2020.

Blackstone - Planted October 24, 2019. Pre-plant fertilizer was 500 lb. 6-6-18 on October 21, 2019. Site received 60 lb. N using UAN + 0.5 oz. Harmony Extra XP® January 23, 2020. Site received 60 lb. N using UAN on March 2, 2020. Site received 4 oz Mustang® Maxx on March 27, 2020. Harvest occurred June 9, 2020.

Warsaw - Planted November 9, 2019. Lime was applied at 1 ton September 18, 2019. Pre-plant fertilizer was 40-100-60-8 applied November 6, 2019. Site was fertilized using 12-0-0-1.5 at 25 lb. on December 20, 2019 and again on January 31, 2020. Harmony Extra SG® was applied at .5 oz. with surfactant at 1.5 qt. /100 gallons of water + 1.5 qt. Quelex® on February 23, 2020. Finesse was applied at .4 oz on March 1, 2020. Site was fertilized using 24-0-0-3 at 60 lb. on March 14, 2020. Site was treated with 1 qt. Boron March 31, 2020. Harvest occurred June 27, 2020.

Painter - Planted October 30, 2019. Pre-plant fertilizer was 60 lb. N on October 29, 2019. Application of .75 oz. Harmony Extra SG® + 60 lb. N using 30% UAN April 5, 2020. Harvest occurred June 22-23, 2020.

Barley Management Practices

(All rates are given on a per acre basis.)

Blacksburg - Planted October 15, 2019. Pre-plant fertilizer was 30-50-70-10(S)-2(B). Site was sprayed with 1 oz. Harmony Extra SG® and fertilized with 25 units N on March 15, 2020. Site was fertilized with 20 units N + .25 lb. Boron + 1 qt Manni-Plex® for small grain April 6, 2020. Harvest occurred June 25, 2020.

Blackstone - Planted October 24, 2019. Pre-plant fertilizer was 500 lb. 6-6-18 on October 21, 2019. Site received 60 lb. N using UAN + 0.5 oz. Harmony Extra XP® January 23, 2020. Site received 60 lb. N using UAN on March 2, 2020. Site received 4 oz. Mustang® Maxx on March 27, 2020. Harvest occurred June 3, 2020.

Warsaw - Planted November 5-6, 2019. Lime was applied at 1 ton September 18, 2019. Pre-plant fertilizer was 35-80-80-10 applied November 4, 2019. Site was fertilized using 12-0-0-1.5 at 25 lb. on December 21, 2019 and again on January 30, 2020. Rates of 0.5 oz Harmony Extra SG® + .75 oz. Quelex® with surfactant at 1.5 qt. /100 gal. water were applied on February 23, 2020. Finesse was applied at 0.4 oz on March 12, 2020. Site was fertilized using 24-0-0-3 at 40 lb. on March 14, 2020. Site was treated with 1 qt. Boron on March 31, 2020. Harvest occurred June 6, 2020.

Section 1: Hard Red Winter Wheat Varieties in Virginia

Agronomic Performance

This study has been conducted in Blacksburg, Warsaw, and Painter, Virginia for several years. An additional test site, Blackstone, Virginia, has been added since 2019. Three replications were planted in Blacksburg, Warsaw, and Blackstone. Two replications were planted in Painter.

The over-location agronomic performance data for the 2020 harvest season is presented in Table 1 and test results from individual locations in 2020 are presented in Tables 4 - 7. The two-year (2019 and 2020) and three-year (2018, 2019, and 2020) average test results are presented in Table 2 and Table 3, respectively. Fusarium head blight (scab) nursery test results in Mt. Holly, VA are presented in Table 8.

Based on the average performance of four locations (Table 1), the grain yields of 15 hard red winter (HRW) wheat experimental lines and 3 soft wheat checks (Shirley, Hilliard, and Liberty 5658) are significantly higher than the test average (90.8 bushels/a) and Vision 45 (91.5 bushels/a). Of the 15 high-yielding HRW wheat experimental lines, 5 lines (VA18HRW-96, VA18HRW-57, VA18HRW-58, VA18HRW-51, and 15VDH-HRW19-018) have overall quality comparable to Vision 45 basing on 2019 Mennel quality test results (table is not presented here). According to the 2019 and 2020 two-year summary (Table 2), the grain yield of two soft wheat checks (Shirley and Hilliard) and nine HRW wheat experimental lines were significantly higher than the test mean (81.7 bushels/a). Of the nine high-yielding HRW lines, three lines (14VDH-HRW02-029, 15VDH-HRW19-018, and 14VDH-HRW19-019) have the acceptable quality to Mennel Milling (table is not presented here). Based on the three-year average performance (2018, 2019 and 2020), the grain yield of two HRW lines (5210 and DH12HRW50-11) and two soft wheat checks (Shirley and Hilliard) were significantly higher than the test average (76.7 bushels/a). But the quality of the two HRW lines is not comparable to Vision 45. Most of our experimental lines also have good resistance to leaf rust and powdery mildew.

Grain, Milling and Baking Quality

Every year, grain samples from the Warsaw test location were sent to the USDA Hard Winter Wheat Quality Lab in Manhattan, KS for grain, flour, and milling and baking quality analyses. The seeds from the Blacksburg test location were sent for quality testing in 2019. Due to the wet weather before harvest, the protein contents were lower than in previous years, so the baking tests were not performed in 2019. Parts of the milling quality results from 2017, 2018 and 2019 are presented in Table 9. The two quality check varieties are Jagger and Karl 92. The flour yield check variety is Soissons. Generally speaking, the quality of the HRW wheats grown in Virginia is similar to our quality checks, but not comparable to hard red spring wheat grown in the Northern Plains or hard red winter wheat grown in the Great Plains due to rain and other environmental conditions in the Mid-Atlantic region.

Table 1. Summary of performance of entries in the Virginia Tech Hard Red Winter Wheat Test over locations, 2020 harvest.

Line	Yield (Bu/a)	Test Weight (Lb/bu)	Heading Date (Julian)	Height (In)	Lodging (0-9)	Powdery Mildew (0-9)	Leaf Rust (0-9)	Leaf Blotch (0-9)
	(4)	(4)	(2)	(2)	(2)	(3)	(2)	(1)
Shirley (SRW Check)	104.7	58.6	118.5	34.5	0.2	0.0	0.2	1.3
Hilliard (SRW Check)	103.9	59.5	114.0	38.2	0.2	0.3	0.0	1.3
VA18HRW-96	103.9	59.9	121.3	37.8	0.3	0.2	0.2	4.7
VA18HRW-57	102.5	59.8	124.3	38.8	0.7	2.2	0.0	4.0
15VDH-HRW16-110	102.0	58.7	123.2	34.7	0.3	0.0	0.0	5.3
VA18HRW-58	101.9	61.1	123.3	38.3	0.7	0.5	0.2	4.0
DH15HRW-65-142	101.6	59.9	121.3	37.4	2.8	0.5	0.0	3.3
NVIR17-8	101.5	59.3	119.7	33.2	0.0	0.7	0.2	3.3
5210 (EXP21)	100.8	58.3	120.8	33.5	0.2	0.2	0.3	2.0
Liberty 5658	100.2	60.1	115.5	38.2	0.2	0.8	0.0	2.3
VA18HRW-51	99.1	60.7	124.0	39.7	1.0	0.3	0.5	4.0
MAS1417-010-6-4	98.2	57.5	118.3	34.2	0.2	2.7	1.8	4.7
VA18HRW-47	97.6	59.8	123.5	38.7	1.8	1.0	0.7	3.7
MAS1417-148-3-1	97.5	59.1	119.3	38.7	0.8	0.0	0.5	4.7
DH15HRW-68-106	97.3	57.6	113.7	35.2	0.8	0.7	2.2	3.3
NVIR17-1	97.2	59.7	117.5	37.3	0.8	1.8	0.3	3.3
15VDH-HRW18-163	96.5	60.2	122.3	37.7	1.3	0.3	0.5	5.3
15VDH-HRW19-018	96.4	60.8	121.2	40.3	2.8	0.7	0.2	3.0
MAS1417-006-6-4	95.7	59.4	118.2	34.5	0.3	0.3	0.3	4.7
VA18HRW-45	95.7	59.3	124.0	39.7	0.2	0.0	0.0	3.7
14VDH-HRW02-029	95.4	60.1	119.7	36.0	0.7	0.5	0.3	2.7
VA18HRW-98	95.2	59.3	118.0	37.3	1.3	1.7	1.0	4.7
16VDH-HRW13-090	95.1	59.0	121.7	40.2	1.2	0.0	1.2	4.7
VA17HRW-33	94.5	57.1	122.3	39.0	1.3	1.3	0.3	2.7
DH15HRW-69-55	94.4	60.0	119.3	35.8	1.2	0.0	0.8	3.3
14VDH-HRW01-019	94.2	59.8	120.8	39.8	2.2	1.5	0.2	3.0

VA09HRW-43	94.1	57.4	-	116.2	-	35.3		1.7		0.2		0.7		2.0	
VA18HRW-61	94.1	60.4	+	122.2	+	40.0	+	2.0	+	1.2		0.0		4.0	
DH12HRW50-11	93.9	58.7	-	117.5		32.2	-	0.3		0.3		0.2		2.3	
15VDH-HRW15-199	93.8	59.7		119.2		32.5	-	0.3		0.0		0.2		5.3	+
14VDH-HRW02-105	93.5	60.5	+	119.7	+	36.2		1.7		1.0		0.5		2.7	
DH15HRW-65-70	93.5	59.6		124.0	+	37.2		0.0		1.2		0.2		3.0	
DH12HRW46-8	93.4	59.2		116.2	-	32.2	-	0.0		0.0		0.2		2.3	
15VDH-HRW15-062	93.1	59.4		120.5	+	34.3	-	0.8		0.3		0.2		3.0	
15VDH-HRW15-081	92.4	57.3	-	122.8	+	34.7	-	0.8		0.3		2.3	+	3.0	
VA18HRW-100	92.2	59.1		121.7	+	38.8	+	0.5		1.5		0.5		4.7	
DH16HRW-72-134	91.9	59.7		116.5	-	36.7		0.3		1.3		0.3		6.0	+
VA17HRW-8	91.7	58.0	-	117.7		39.0	+	1.5		0.7		0.0		2.3	
Vision 45	91.5	60.4	+	123.3	+	41.8	+	0.2		0.7		0.0		2.0	
VA18HRW-95	90.9	60.0	+	119.7	+	35.5		0.2		0.0		0.3		4.3	
DH15HRW-69-50	90.4	59.8		116.5	-	33.8	-	0.5		0.3		0.2		3.3	
VA17HRW-43	90.2	59.6		118.8		37.5		0.3		0.2		0.2		2.7	
DH13HRW09-81WS	89.9	59.3		114.7	-	35.8		0.8		0.0		0.2		2.3	
ARS14W0947	89.3	58.7	-	119.0		40.3	+	2.0	+	0.0		0.3		2.0	
VA18HRW-15	89.3	58.4	-	113.5	-	37.5		0.5		0.0		0.0		3.7	
DH16HRW-72-25	89.2	59.9	+	114.0	-	36.5		0.0		1.5		0.7		5.7	+
Vision 50	88.9	59.1		116.8		34.5	-	1.0		2.7	+	0.2		2.0	
VA18HRW-9	88.8	56.4	-	120.3	+	37.5		1.2		1.7		0.7		3.7	
VA13MAS14-1992-3-3	88.3	57.6	-	114.5	-	34.5	-	0.2		0.0		0.0		2.7	
VA15HRW-86	87.9	60.0	+	114.2	-	34.5	-	0.0		0.8		0.0		2.3	
VA18HRW-66	87.9	59.8		117.2		37.7		1.0		0.5		0.8		4.0	
DH13HRW07-30	87.7	59.6		119.3		36.7		0.0		0.5		0.7		2.3	
VA18HRW-28	87.5	59.2		113.5	-	39.5	+	2.8	+	0.3		0.8		3.7	
VA13MAS14-1992-3-4	87.3	57.4	-	114.2	-	35.8		0.2		0.2		0.2		2.7	
VA17HRW-92	87.2	59.5		115.2	-	36.2		1.0		0.7		0.2		2.7	
VA14HRW-25	87.2	59.1		113.2	-	38.8	+	1.0		1.8	+	0.0		2.3	
VA18HRW-35	86.7	57.2	-	116.3	-	38.5	+	0.3		2.5	+	0.0		3.7	
16VDH-HRW14-008	86.7	58.9		118.0		30.2	-	0.0		0.0		0.0		5.0	+

Soissons	86.3		58.5	-	120.8	+	35.2	-	0.2		1.2		3.2	+	1.3	-
DH16HRW-72-148	86.2		60.8	+	118.0		37.7		0.5		0.7		1.5	+	6.0	+
VA16HRW-36	86.1		60.7	+	115.7	-	35.5		1.8		0.2		0.2		2.3	
VA18HRW-68	85.7		59.8		119.8	+	39.7	+	2.2	+	0.0		0.3		4.3	
VA18HRW-16	85.7		59.5		120.7	+	39.3	+	0.2		0.0		1.3	+	3.7	
VA16HRW-22	85.7		60.4	+	117.5		38.5	+	1.0		1.2		0.0		2.3	
VA18HRW-7	85.5		59.2		115.0	-	37.5		0.3		1.0		0.3		3.7	
DH13HRW08-192	85.5		61.2	+	117.2		35.5		1.2		0.3		0.0		2.3	
VA18HRW-4	85.4		59.1		115.5	-	37.5		0.3		0.3		1.5	+	3.3	
DH16HRW-68-22	85.1	-	59.3		117.7		38.0		0.7		0.8		0.8		5.3	+
DH12HRW46-40	84.8	-	58.8		113.3	-	34.2	-	0.0		0.0		0.5		2.3	
VA18HRW-67	84.5	-	59.5		118.8		38.3	+	1.3		0.2		0.3		4.3	
VA13MAS14-2047-4-2	82.9	-	59.0		112.2	-	34.2	-	0.3		0.0		1.0		2.7	
Vision 30	82.8	-	59.1		114.0	-	36.2		0.8		0.0		3.2	+	2.0	
DH13HRW09-143	82.4	-	60.3	+	120.2	+	37.5		0.5		0.2		0.0		2.3	
VA18HRW-3	82.1	-	60.9	+	118.3		37.2		0.3		0.3		1.0		3.3	
DH16HRW-70-127	79.9	-	58.7	-	112.7	-	38.3	+	0.5		2.3	+	0.3		5.3	+
Everest	78.7	-	59.6		110.2	-	36.0		0.3		1.2		0.0		2.0	
Jagger	78.0	-	59.6		111.7	-	36.7		1.3		5.2	+	1.5	+	1.7	-
VA17HRW-9	73.8	-	58.4	-	114.0	-	36.8		0.2		1.3		0.0		2.3	
Karl 92	72.9	-	59.0		112.3	-	35.5		1.0		3.5	+	2.5	+	1.3	-
KS120729M~3	71.1	-	59.5		114.2	-	36.5		0.0		4.2	+	0.0		6.7	+
Average (n=80)	90.8		59.3		118.0		36.8		0.8		0.8		0.5		3.3	
LSD (0.05)	5.6		0.6		1.3		1.5		1.2		0.9		0.7		1.5	
C.V.	7.3		1.2		1.0		3.7		135.6		102.1		117.6		28.6	

Note: The number in parentheses below column headings indicates the number of locations on which data are based. Released cultivars are shown in bold print.

Note: Varieties are ordered by descending yield averages. A plus or minus sign indicates a performance significantly above or below the test average.

Note: The 0-9 ratings indicate a genotype's response to disease or lodging where 0 = highly resistant and 9 = highly susceptible.

Table 2. Two-year summary of performance of entries in the Virginia Tech Hard Red Winter Wheat Test over location, 2019 and 2020 harvests.

Line	Yield (Bu/a)		Test Weight (Lb/bu)		Heading Date (Julian)		Height (In)		Lodging (0-9)		Powdery Mildew (0-9)		Leaf Rust (0-9)		Leaf Blotch (0-9)
	(8)		(8)		(4)		(4)		(5)		(2)		(4)		(2)
Hilliard (SRW Check)	92.4	+	58.2		115.6	-	36.1	+	0.1		0.3		0.5		1.0
Shirley (SRW Check)	90.3	+	57.6	-	118.4		33.0	-	0.1		0.0		0.6		1.0
DH15HRW-65-142	89.5	+	58.5		121.1	+	34.7		2.4	+	0.5		0.4		1.0
5210 (EXP21)	89.5	+	57.0	-	120.6	+	31.7	-	0.1		0.2		0.5		1.2
14VDH-HRW02-029	89.2	+	59.4	+	119.0	+	33.5		0.3		0.5		0.5		1.0
NVIR17-8	88.3	+	57.8	-	119.3	+	31.3	-	0.0		0.7		0.3		1.0
DH15HRW-68-106	86.9	+	56.9	-	115.3	-	34.3		0.5		0.7		1.9	+	1.0
NVIR17-1	86.6	+	58.7	+	117.1		34.5		0.5		1.8	+	0.3		1.0
15VDH-HRW19-018	86.4	+	59.5	+	121.3	+	37.7	+	1.3		0.7		0.6		1.0
14VDH-HRW01-019	85.8	+	58.9	+	119.9	+	37.7	+	1.3		1.5		0.2		1.0
14VDH-HRW02-105	85.6	+	59.5	+	119.4	+	33.4		0.8		1.0		0.7		1.2
DH15HRW-65-70	84.8		58.0		122.4	+	35.2		0.1		1.2		0.3		1.0
VA09HRW-43	84.8		56.7	-	117.0		34.2		1.2		0.2		0.6		1.0
VA17HRW-33	84.4		55.9	-	121.4	+	37.0	+	0.6		1.3		0.5		1.5
15VDH-HRW15-081	84.1		56.4	-	122.2	+	33.3	-	0.4		0.3		1.5	+	1.0
DH12HRW50-11	83.7		57.6	-	117.7		31.9	-	0.3		0.3		0.5		1.0
15VDH-HRW15-062	83.7		58.3		120.3	+	32.3	-	0.9		0.3		0.4		1.2
DH12HRW46-8	83.5		57.8		116.8	-	30.0	-	0.1		0.0		0.4		1.0
VA17HRW-8	82.4		57.0	-	118.0		36.8	+	1.1		0.7		0.4		1.0
VA14HRW-25	82.3		58.7	+	115.0	-	37.0	+	0.9		1.8	+	0.3		1.0
VA16HRW-22	81.6		59.6	+	117.8		36.6	+	1.0		1.2		0.2		1.0
DH13HRW07-30	81.2		58.3		118.8	+	35.4	+	0.1		0.5		0.8		1.0
DH13HRW09-81WS	81.2		57.3	-	115.8	-	33.3	-	0.4		0.0		0.5		1.0
ARS14W0947	81.2		58.3		119.1	+	37.4	+	1.6	+	0.0		0.4		1.3
VA13MAS14-1992-3-3	81.1		56.8	-	116.1	-	33.2	-	0.5		0.0		0.0		1.2

DH15HRW-69-55	80.9	58.5		119.1	+	34.5		0.9	0.0		0.7	1.0	
Vision 50	80.9	57.3	-	119.3	+	34.4		0.7	2.7	+	0.4	1.2	
Vision 45	80.8	59.1	+	122.6	+	40.2	+	0.2	0.7		0.3	1.0	
DH12HRW46-40	80.4	58.0		114.7	-	32.9	-	0.0	0.0		0.4	1.0	
VA17HRW-43	80.4	58.6		119.0	+	34.3		0.2	0.2		0.2	1.0	
DH13HRW08-192	80.0	60.1	+	117.9		34.1		0.8	0.3		0.4	1.0	
DH15HRW-69-50	80.0	58.9	+	117.0		31.9	-	0.6	0.3		0.3	1.0	
VA15HRW-86	79.5	59.3	+	115.5	-	32.3	-	0.1	0.8		0.3	1.0	
VA17HRW-92	79.2	58.4		116.2	-	34.1		0.7	0.7		0.5	1.0	
VA16HRW-36	78.1	59.7	+	116.3	-	33.9		1.3	0.2		0.4	1.0	
VA13MAS14-1992-3-4	78.1	57.0	-	115.4	-	34.2		0.1	0.2		0.2	1.2	
Soissons	76.8	57.1	-	120.7	+	32.7	-	0.1	1.2		2.9	+	1.0
Vision 30	76.6	58.4		115.3	-	34.6		1.2	0.0		2.7	+	1.0
VA13MAS14-2047-4-2	76.4	58.6		114.4	-	32.7	-	0.4	0.0		0.8	1.0	
DH13HRW09-143	75.4	58.9	+	120.1	+	34.4		0.5	0.2		0.4	1.0	
Everest	72.1	59.4	+	112.3	-	34.3		0.5	1.2		0.3	1.0	
Jagger	70.5	58.9	+	113.1	-	34.1		0.9	5.2	+	1.1	1.0	
VA17HRW-9	70.0	57.8		115.4	-	34.7		0.4	1.3		0.2	1.0	
Karl 92	67.3	58.6		114.3	-	33.8		1.1	3.5	+	1.5	+	1.2
Average (n=44)	81.7	58.2		117.8		34.3		0.6	0.8		0.6	1.0	
LSD (0.05)	3.9	0.4		0.9		1.0		0.8	0.9		0.6	0.2	
C.V.	8.1	1.3		1.0		3.6		165.3	102.1		124.0	19.6	

Note: The number in parentheses below column headings indicates the number of location-years on which data are based.

Note: Released cultivars are shown in bold print.

Note: Varieties are ordered by descending yield averages.

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

Note: The 0-9 ratings indicate a genotype's response to disease or lodging where 0 = highly resistant and 9 = highly susceptible.

Table 3. Three-year summary of performance of entries in the Virginia Tech Hard Red Winter Wheat Test over locations, 2018-2020 harvests.

Line	Yield (Bu/a)		Test Weight (Lb/bu)		Heading Date (Julian)		Height (In)		Lodging (0-9)		Powdery Mildew (0-9)		Leaf Rust (0-9)		Leaf Blotch (0-9)	
	(4)		(4)		(2)		(2)		(2)		(2)		(2)		(1)	
Shirley (SRW Check)	90.0	+	57.1	-	120.8	+	32.8	-	0.2	-	0.1	-	0.6		1.0	
Hilliard (SRW Check)	88.0	+	57.8		118.6	-	35.9	+	0.4	-	1.0		0.5		1.0	
5210 (EXP21)	83.9	+	56.5	-	123.4	+	32.2	-	0.4	-	0.4	-	0.5		1.2	
DH12HRW50-11	80.4	+	56.9	-	120.1		32.5	-	1.2		0.6	-	0.5		1.0	
DH13HRW09-81WS	79.9		57.4		118.4	-	33.2	-	0.4	-	0.0	-	0.5		1.0	
VA14HRW-25	79.7		58.4	+	118.4	-	35.9	+	2.4	+	2.7	+	0.3		1.0	
DH13HRW07-30	79.6		58.1		121.2	+	35.2	+	0.1	-	1.5		0.8		1.0	
DH12HRW46-8	79.2		57.0	-	119.3		30.4	-	0.1	-	0.1	-	0.4		1.0	
VA09HRW-43	78.9		55.7	-	119.4		33.9		2.0	+	0.7	-	0.6		1.0	
DH12HRW46-40	78.2		57.5		117.2	-	33.1	-	0.8		0.1	-	0.4		1.0	
DH13HRW08-192	78.1		59.9	+	121.0	+	33.8		1.6		0.6	-	0.4		1.0	
Vision 45	77.8		58.3	+	124.5	+	39.8	+	1.4		1.1		0.3		1.0	
VA15HRW-86	77.0		58.9	+	118.8	-	32.1	-	0.6		2.1	+	0.3		1.0	
VA16HRW-22	76.5		59.0	+	120.8	+	36.0	+	2.1	+	1.7		0.2		1.0	
ARS14W0947	76.1		57.5		121.3	+	36.9	+	3.0	+	0.2	-	0.4		1.3	+
Vision 50	76.0		56.5	-	122.0	+	34.5		1.2		1.9	+	0.4		1.2	
VA16HRW-36	75.9		59.4	+	119.2		33.6		1.6		1.3		0.4		1.0	
DH13HRW09-143	74.6		58.6	+	122.3	+	34.3		0.6		0.1	-	0.4		1.0	
Soissons	71.6	-	56.2	-	123.2	+	33.1	-	0.4	-	1.8		2.9	+	1.0	
Vision 30	71.3	-	57.5		118.1	-	34.2		2.8	+	0.4	-	2.7	+	1.0	
Everest	68.6	-	59.0	+	115.5	-	34.2		1.8		2.3	+	0.3		1.0	
Karl 92	62.0	-	57.9		117.1	-	33.8		2.3	+	4.8	+	1.5	+	1.2	
Jagger	61.9	-	57.7		116.2	-	33.7		1.5		6.2	+	1.1		1.0	
Average (n=23)	76.7		57.8		119.9		34.1		1.2		1.4		0.7		1.0	
LSD (0.05)	3.4		0.5		0.7		0.8		0.7		0.5		0.7		0.2	
C.V.	8.8		1.6		0.9		3.4		97.6		46.2		125.3		16.7	

Note: The number in parentheses below column headings indicates the number of location-years on which data are based. Released cultivars are shown in bold print.

Note: Varieties are ordered by descending yield averages. A plus or minus sign indicates a performance significantly above or below the test average.
 Note: The 0-9 ratings indicate a genotype's response to disease or lodging where 0 = highly resistant and 9 = highly susceptible.

Table 4. Summary of performance of entries in the Virginia Tech Hard Red Winter Wheat Test at Blacksburg, 2020 harvest.

Line	Yield (Bu/a)		Test Weight (Lb/bu)		Heading Date (Julian)		Height (In)		Lodging (0-9)		Leaf Blotch (0-9)	
15VDH-HRW16-110	97.4	+	59.3		129.3	+	31.3	-	0.0		5.3	+
VA18HRW-96	95.9	+	61.3	+	125.7		36.3		0.0		4.7	
NVIR17-8	94.8	+	60.8	+	126.3		30.7	-	0.0		3.3	
5210 (EXP21)	90.8	+	59.6		127.0		30.7	-	0.0		2.0	
VA18HRW-45	90.3	+	62.0	+	129.3	+	37.3	+	0.0		3.7	
DH15HRW-65-142	89.5	+	59.7		126.3		34.0		4.0	+	3.3	
VA18HRW-58	88.8	+	61.8	+	128.6	+	35.7		1.0		4.0	
DH12HRW50-11	87.9	+	58.5	-	124.3		29.3	-	0.0		2.3	
NVIR17-1	87.3	+	58.3	-	122.7	-	32.3		0.7		3.3	
16VDH-HRW13-090	87.0	+	60.4	+	127.0		36.7	+	2.0		4.7	
VA18HRW-51	86.6	+	61.7	+	130.7	+	38.0	+	1.0		4.0	
MAS1417-148-3-1	86.4	+	60.1	+	126.0		36.3		0.7		4.7	
DH15HRW-68-106	86.3	+	57.7	-	120.7	-	31.7		0.3		3.3	
VA18HRW-57	86.1	+	59.6		130.7	+	36.0		1.0		4.0	
MAS1417-010-6-4	85.9	+	58.6		125.3		31.0	-	0.0		4.7	
Liberty 5658	85.9	+	60.7	+	121.7	-	36.5	+	0.0		2.3	
DH15HRW-69-55	85.6	+	60.2	+	126.0		33.3		0.7		3.3	
DH13HRW07-30	84.4	+	59.4		125.7		34.0		0.0		2.3	
Shirley (SRW Check)	84.3	+	58.9		123.0		31.7		0.0		1.3	-
VA18HRW-47	84.0	+	60.9	+	129.3	+	36.0		2.7		3.7	
VA18HRW-98	83.2	+	60.9	+	123.7		35.0		0.7		4.7	
DH15HRW-65-70	82.7		60.0	+	129.0	+	35.0		0.0		3.0	
DH12HRW46-8	81.7		58.8		123.0		28.7	-	0.0		2.3	
15VDH-HRW15-062	81.6		60.9	+	126.7		33.7		1.0		3.0	
VA17HRW-8	81.4		57.7	-	125.3		36.0		2.7		2.3	
14VDH-HRW02-029	81.2		61.0	+	125.7		32.3		0.7		2.7	

15VDH-HRW19-018	81.0	61.3	+	127.7	+	37.3	+	5.0	+	3.0
VA09HRW-43	80.3	58.3	-	123.0		32.0		1.0		2.0
14VDH-HRW01-019	80.3	61.3	+	127.0		36.7	+	3.3	+	3.0
MAS1417-006-6-4	79.9	60.3	+	124.0		32.7		0.0		4.7
14VDH-HRW02-105	79.2	61.4	+	126.0		33.3		2.7		2.7
VA18HRW-15	78.8	57.9	-	121.0	-	34.3		0.0		3.7
VA18HRW-16	78.5	59.6		127.3	+	36.7	+	0.0		3.7
15VDH-HRW15-199	77.6	60.4	+	126.3		29.0	-	0.0		5.3
VA18HRW-100	77.5	59.7		127.0		35.3		0.3		4.7
15VDH-HRW18-163	77.4	60.7	+	128.2	+	34.3		2.0		5.3
VA17HRW-92	77.2	60.0	+	123.7		33.3		1.7		2.7
VA18HRW-68	76.2	60.5	+	126.7		37.3	+	1.7		4.3
VA18HRW-61	76.0	60.9	+	127.7	+	36.7	+	2.3		4.0
VA18HRW-95	75.7	60.6	+	125.7		31.7		0.0		4.3
15VDH-HRW15-081	75.7	58.2	-	129.7	+	32.3		1.3		3.0
VA18HRW-66	75.5	59.8		123.3		35.7		0.7		4.0
Vision 50	75.4	59.4		124.7		31.0	-	0.0		2.0
DH15HRW-69-50	74.7	59.8		123.0		31.0	-	0.0		3.3
VA18HRW-7	74.6	57.3	-	122.3	-	35.0		0.0		3.7
Soissons	74.6	58.9		126.7		32.7		0.0		1.3
ARS14W0947	74.5	55.8	-	123.7		37.7	+	2.7		2.0
VA17HRW-33	74.1	57.2	-	127.7	+	35.7		2.0		2.7
Jagger	73.5	60.1	+	120.7	-	33.3		1.7		1.7
Vision 45	73.4	59.9	+	127.3	+	39.3	+	0.0		2.0
VA14HRW-25	73.2	56.9	-	122.0	-	36.7	+	1.0		2.3
VA17HRW-43	73.0	60.5	+	126.0		34.3		0.0		2.7
VA18HRW-67	72.9	59.4		125.3		35.3		2.3		4.3
VA13MAS14-1992-3-3	71.3	55.5	-	122.7	-	32.3		0.0		2.7
16VDH-HRW14-008	71.1	58.1	-	125.7		26.3	-	0.0		5.0
DH13HRW08-192	70.8	61.1	+	124.7		31.3	-	1.3		2.3
DH16HRW-70-127	70.6	55.9	-	121.0	-	35.3		0.0		5.3
VA16HRW-36	70.5	59.8		125.0		32.0		3.3	+	2.3
VA18HRW-35	70.5	53.6	-	125.3		35.7		0.3		3.7

VA18HRW-35	70.5		53.6	-	125.3		35.7		0.3		3.7	
DH16HRW-72-148	69.7	-	61.3	+	126.3		34.7		0.0		6.0	+
DH16HRW-68-22	69.4	-	59.0		123.7		35.3		0.3		5.3	+
VA18HRW-9	69.2	-	54.2	-	127.0		35.3		1.3		3.7	
VA15HRW-86	69.1	-	58.7		122.7	-	32.7		0.0		2.3	
VA18HRW-4	69.1	-	57.0	-	122.7	-	35.3		0.0		3.3	
VA13MAS14-1992-3-4	68.9	-	55.3	-	123.0		33.3		0.0		2.7	
VA13MAS14-2047-4-2	68.7	-	57.8	-	121.7	-	32.0		0.0		2.7	
VA18HRW-28	68.7	-	58.0	-	122.3	-	36.3		3.0	+	3.7	
Vision 30	66.6	-	57.5	-	123.3		32.3		0.7		2.0	
DH13HRW09-81WS	66.0	-	56.7	-	121.0	-	32.3		1.0		2.3	
DH16HRW-72-134	65.5	-	58.9		123.3		34.0		0.0		6.0	+
DH16HRW-72-25	64.5	-	60.1	+	122.3	-	33.3		0.0		5.7	+
Karl 92	63.7	-	57.6	-	119.7	-	33.3		0.7		1.3	-
DH12HRW46-40	63.1	-	58.1	-	122.3	-	31.3	-	0.0		2.3	
KS120729M~3	61.9	-	59.7		122.0	-	33.7		0.0		6.7	+
DH13HRW09-143	61.6	-	60.2	+	126.7		35.0		0.0		2.3	
VA18HRW-3	58.2	-	59.2		125.7		34.3		0.0		3.3	
VA16HRW-22	57.4	-	60.5	+	124.3		35.7		1.0		2.3	
VA17HRW-9	56.7	-	56.7	-	122.3	-	34.3		0.0		2.3	
Everest	52.9	-	58.0	-	119.0	-	34.0		0.0		2.0	
Average (n=80)	76.4		59.2		124.9		34.0		0.8		3.3	
LSD (0.05)	6.7		0.7		2.2		2.5		2.1		1.5	
C.V.	5.4		0.7		1.1		4.5		167.3		28.6	

Note: Released cultivars are shown in bold print.

Note: Varieties are ordered by descending yield averages.

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

Note: The 0-9 ratings indicate a genotype's response to disease or lodging where 0 = highly resistant and 9 = highly susceptible.

Table 5. Summary of performance of entries in the Virginia Tech Hard Red Winter Wheat Test at Warsaw, 2020 harvest.

Line	Yield (Bu/a)	Test Weight (Lb/bu)	Heading Date (Julian)	Height (In)	Lodging (0-9)	Powdery Mildew (0-9)	Leaf Rust (0-9)
Hilliard (SRW Check)	122.3 +	59.2	106.0 -	41.0	0.3	0.0	0.0
NVIR17-8	115.2 +	57.8 -	113.0 +	35.7 -	0.0	0.7	0.0
5210 (EXP21)	114.9 +	57.4 -	114.7 +	36.3 -	0.3	0.0	0.3
Shirley (SRW Check)	114.6 +	57.7 -	114.0 +	37.3 -	0.3	0.0	0.0
VA09HRW-43	113.8 +	56.6 -	109.3 -	38.7	2.3 +	0.3	0.0
DH16HRW-72-134	113.6 +	59.2	109.7	39.3	0.7	1.7	0.3
VA18HRW-57	113.1 +	59.3 +	118.0 +	41.7 +	0.3	2.0 +	0.0
VA18HRW-98	112.7 +	58.0 -	112.3	39.7	2.0 +	2.0 +	0.0
DH15HRW-65-142	112.6 +	58.5	116.3 +	39.7	1.7	0.0	0.0
15VDH-HRW16-110	111.8	58.6	117.0 +	38.0	0.7	0.0	0.0
DH15HRW-69-50	111.7	59.2	110.0	36.7 -	1.0	0.0	0.0
DH16HRW-72-25	110.4	59.2	105.7 -	39.7	0.0	1.3	0.0
Liberty 5658	109.9	58.9	109.3 -	39.3	0.3	1.0	0.0
VA18HRW-58	109.8	60.2 +	118.0 +	41.0	0.3	0.3	0.0
VA18HRW-96	109.5	59.0	117.0 +	39.3	0.7	0.0	0.0
MAS1417-010-6-4	109.1	56.5 -	111.3	37.3 -	0.3	3.0 +	0.0
MAS1417-148-3-1	109.0	57.6 -	112.7	41.0	1.0	0.0	0.0
MAS1417-006-6-4	108.9	57.5 -	112.3	36.3 -	0.7	0.0	0.0
Vision 45	107.9	59.4 +	119.3 +	44.3 +	0.3	0.7	0.0
DH15HRW-68-106	107.2	57.0 -	106.7 -	38.7	1.3	0.7	0.0
VA16HRW-22	107.1	59.9 +	110.7	41.3	1.0	1.3	0.0
VA18HRW-28	106.8	59.3 +	104.7 -	42.7 +	2.7 +	0.0	0.0
16VDH-HRW14-008	106.5	58.7	110.3	34.0 -	0.0	0.0	0.0
VA18HRW-61	106.4	59.7 +	116.7 +	43.3 +	1.7	1.0	0.0
14VDH-HRW02-105	106.1	59.6 +	113.3 +	39.0	0.7	1.0	0.0
15VDH-HRW15-199	106.0	59.3	112.0	36.0 -	0.7	0.0	0.0
DH12HRW50-11	105.8	58.2	110.7	35.0 -	0.7	0.0	0.0
DH13HRW09-81WS	105.5	59.3 +	108.3 -	39.3	0.7	0.0	0.3

14VDH-HRW02-029	105.5	59.0		113.7	+	39.7		0.7		0.0		0.0	
VA17HRW-33	105.2	56.4	-	117.0	+	42.3	+	0.7		1.0		0.3	
14VDH-HRW01-019	105.1	58.6		114.7	+	43.0	+	1.0		1.0		0.3	
VA18HRW-47	105.0	59.1		117.7	+	41.3		1.0		1.3		0.0	
DH16HRW-72-148	104.9	59.8	+	109.7		40.7		1.0		1.0		0.0	
VA18HRW-9	104.8	56.0	-	113.7	+	39.7		1.0		1.7		0.0	
DH12HRW46-8	104.5	58.1	-	109.3	-	35.7	-	0.0		0.0		0.0	
15VDH-HRW19-018	104.3	59.9	+	114.7	+	43.3	+	0.7		0.3		0.0	
VA17HRW-43	104.2	59.0		111.7		40.7		0.7		0.0		0.0	
15VDH-HRW15-081	103.8	57.1	-	116.0	+	37.0	-	0.3		0.3		0.0	
16VDH-HRW13-090	103.8	57.7	-	116.3	+	43.7	+	0.3		0.0		0.0	
Vision 50	103.2	58.8		109.0	-	38.0		2.0	+	2.3	+	0.0	
VA18HRW-66	103.2	58.4		111.0		39.7		1.3		0.0		0.0	
VA17HRW-8	102.9	57.6	-	110.0		42.0	+	0.3		0.7		0.0	
VA15HRW-86	102.6	60.0	+	105.7	-	36.3	-	0.0		1.0		0.0	
VA18HRW-15	102.4	58.0	-	106.0	-	40.7		1.0		0.0		0.0	
DH15HRW-65-70	102.2	57.9	-	119.0	+	39.3		0.0		1.0		0.0	
DH16HRW-68-22	101.9	58.8		111.7		40.7		1.0		1.0		0.0	
Vision 30	101.8	59.0		104.7	-	40.0		1.0		0.0		1.3	+
15VDH-HRW15-062	101.6	58.5		114.3	+	35.0	-	0.7		0.0		0.0	
VA18HRW-3	101.4	60.3	+	111.0		40.0		0.7		0.0		0.0	
DH15HRW-69-55	101.1	58.8		112.7		38.3		1.7		0.0		0.0	
NVIR17-1	101.0	58.8		112.3		42.3	+	1.0		2.3	+	0.0	
VA18HRW-45	100.9	59.1		118.7	+	42.0	+	0.3		0.0		0.0	
VA14HRW-25	100.7	59.9	+	104.3	-	41.0		1.0		2.0	+	0.0	
Soissons	100.7	57.9	-	115.0	+	37.7	-	0.3		2.0	+	1.7	+
VA18HRW-51	100.4	60.3	+	117.3	+	41.3		1.0		0.0		0.0	
VA18HRW-95	100.3	59.2		113.7	+	39.3		0.3		0.0		0.0	
VA18HRW-100	99.8	57.7	-	116.3	+	42.3	+	0.7		1.7		0.0	
15VDH-HRW18-163	99.2	59.7	+	116.3	+	41.0		0.7		0.7		0.0	
VA18HRW-67	99.1	58.8		112.3		41.3		0.3		0.0		0.0	
VA18HRW-35	98.6	57.7	-	107.3	-	41.3		0.3		2.3	+	0.0	
DH12HRW46-40	98.5	58.1	-	104.3	-	37.0	-	0.0		0.0		0.0	

VA16HRW-36	98.3	59.8	+	106.3	-	39.0	0.3	0.3	0.0
VA13MAS14-2047-4-2	97.7	59.0		102.7	-	36.3	-	0.7	0.0
VA13MAS14-1992-3-4	97.4	58.1		105.3	-	38.3		0.3	0.3
DH13HRW07-30	97.2	58.3		113.0	+	39.3		0.0	0.7
VA13MAS14-1992-3-3	96.7	57.5	-	106.3	-	36.7	-	0.3	0.0
ARS14W0947	95.7	59.3		114.3	+	43.0	+	1.3	0.0
VA18HRW-16	95.3	58.2		114.0	+	42.0	+	0.3	0.0
VA17HRW-92	95.3	58.0	-	106.7	-	39.0		0.3	0.7
VA18HRW-4	92.6	58.7		108.3	-	39.7		0.7	0.3
DH13HRW09-143	92.0	59.4	+	113.7	+	40.0		1.0	0.0
DH16HRW-70-127	91.7	59.2		104.3	-	41.3		1.0	2.0
VA18HRW-7	91.3	58.7		107.7	-	40.0		0.7	1.0
VA18HRW-68	91.0	59.1		113.0	+	42.0	+	2.7	0.0
VA17HRW-9	90.9	57.9	-	105.7	-	39.3		0.3	1.0
Everest	88.4	59.7	+	101.3	-	38.0		0.7	1.7
DH13HRW08-192	88.2	60.5	+	109.7		39.7		1.0	0.0
Karl 92	86.7	59.1		105.0	-	37.7	-	1.3	3.3
Jagger	85.6	59.8	+	102.7	-	40.0		1.0	4.7
KS120729M~3	80.2	59.8	+	106.3	-	39.3		0.0	3.3
Average (n=80)	102.7	58.7		111.2		39.6		0.7	0.8
LSD (0.05)	9.4	0.6		1.6		1.9		1.0	1.0
C.V.	5.7	0.6		0.9		2.9		86.2	85.9

Note: Released cultivars are shown in bold print.

Note: Varieties are ordered by descending yield averages.

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

Note: The 0-9 ratings indicate a genotype's response to disease or lodging where 0 = highly resistant and 9 = highly susceptible.

Table 6. Summary of performance of entries in the Virginia Tech Hard Red Winter Wheat Test at Blackstone, 2020 harvest.

Line	Yield (Bu/a)		Test Weight (Lb/bu)		Powdery Mildew (0-9)		Leaf Rust (0-9)	
VA18HRW-45	120.8	+	58.4	-	0.0		0.0	
Shirley (SRW Check)	118.3	+	60.4		0.0		0.3	
Liberty 5658	117.6	+	62.1	+	0.7		0.0	
VA18HRW-51	116.2	+	61.7		0.7		1.0	
15VDH-HRW18-163	113.9	+	61.1		0.0		1.0	
DH15HRW-68-106	112.5		58.2	-	0.7		4.3	+
VA18HRW-58	111.4		63.5	+	0.7		0.3	
Hilliard (SRW Check)	110.6		61.0		0.7		0.0	
VA18HRW-47	110.2		60.4		0.7		1.3	
VA18HRW-96	109.5		61.6		0.3		0.3	
VA17HRW-33	109.1		58.3	-	1.7		0.3	
14VDH-HRW02-029	108.5		61.2		1.0		0.7	
DH15HRW-65-142	108.0		61.8		1.0		0.0	
VA18HRW-57	107.6		62.0	+	2.3		0.0	
VA18HRW-61	107.3		61.7		1.3		0.0	
14VDH-HRW01-019	106.9		60.7		2.0		0.0	
VA15HRW-86	106.5		62.2	+	0.7		0.0	
15VDH-HRW19-018	106.0		62.2	+	1.0		0.3	
16VDH-HRW13-090	106.0		59.9		0.0		2.3	+
MAS1417-006-6-4	105.8		60.3		0.7		0.7	
VA18HRW-95	105.6		61.8		0.0		0.7	
DH12HRW46-8	105.5		61.7		0.0		0.3	
NVIR17-1	105.4		62.2	+	1.3		0.7	
5210 (EXP21)	105.2		58.5	-	0.3		0.3	
DH13HRW08-192	105.0		62.8	+	0.7		0.0	
DH15HRW-69-55	104.6		61.3		0.0		1.7	
VA18HRW-98	104.1		61.0		1.3		2.0	
15VDH-HRW15-199	103.7		61.3		0.0		0.3	
VA17HRW-43	103.7		59.7	-	0.3		0.3	
MAS1417-148-3-1	103.6		60.6		0.0		1.0	
VA18HRW-15	103.5		59.5	-	0.0		0.0	
DH13HRW09-81WS	103.3		61.4		0.0		0.0	
DH16HRW-72-134	102.9		61.9		1.0		0.3	
DH16HRW-72-25	102.8		61.6		1.7		1.3	
NVIR17-8	102.5		60.6		0.7		0.3	
VA18HRW-4	102.4		62.0		0.3		2.3	+
DH15HRW-69-50	102.3		61.2		0.7		0.3	

DH12HRW50-11	102.2		60.4		0.7		0.3	
VA14HRW-25	102.1		62.1	+	1.7		0.0	
VA17HRW-8	102.0		59.7	-	0.7		0.0	
15VDH-HRW15-081	101.7		57.4	-	0.3		4.7	+
VA16HRW-36	101.3		62.8	+	0.0		0.3	
Everest	101.0		61.7		0.7		0.0	
MAS1417-010-6-4	100.9		57.3	-	2.3		3.7	+
15VDH-HRW16-110	100.5		59.5	-	0.0		0.0	
VA13MAS14-1992-3-3	100.4		59.6	-	0.0		0.0	
VA09HRW-43	100.2		58.0	-	0.0		1.3	
VA17HRW-92	100.0		60.3		0.7		0.3	
VA18HRW-35	99.1		59.7		2.7	+	0.0	
Vision 45	99.0		62.9	+	0.7		0.0	
DH12HRW46-40	99.0		60.4		0.0		1.0	
ARS14W0947	98.8		61.4		0.0		0.7	
15VDH-HRW15-062	98.8		59.6	-	0.7		0.3	
14VDH-HRW02-105	98.2		61.8		1.0		1.0	
VA16HRW-22	98.2		62.4	+	1.0		0.0	
VA18HRW-16	97.6		62.0		0.0		2.7	+
VA18HRW-7	96.8		62.3	+	1.0		0.7	
Vision 50	96.7		60.2		3.0	+	0.3	
VA18HRW-100	96.3		61.2		1.3		1.0	
VA18HRW-66	95.8		61.2		1.0		1.7	
VA18HRW-3	95.7		63.8	+	0.7		2.0	
VA13MAS14-1992-3-4	95.6		59.3	-	0.0		0.0	
DH13HRW07-30	95.3		62.2	+	0.3		1.3	
Vision 30	95.0		60.5		0.0		5.0	+
Soissons	94.8		58.8	-	0.3		4.7	+
VA18HRW-28	94.4		62.1	+	0.7		1.7	
DH16HRW-68-22	93.5		60.6		0.7		1.7	
VA18HRW-9	93.4		58.8	-	1.7		1.3	
16VDH-HRW14-008	93.1		60.1		0.0		0.0	
DH16HRW-72-148	92.6		62.5	+	0.3		3.0	+
DH15HRW-65-70	92.6		61.4		1.3		0.3	
DH13HRW09-143	91.8		62.3	+	0.3		0.0	
VA13MAS14-2047-4-2	91.4		61.3		0.0		2.0	
VA18HRW-68	91.3		61.1		0.0		0.7	
DH16HRW-70-127	90.2		61.0		2.7	+	0.7	
VA18HRW-67	89.3		61.0		0.3		0.7	
VA17HRW-9	83.7	-	60.4		1.7		0.0	
Jagger	81.1	-	60.1		5.7	+	2.0	
Karl 92	80.6	-	60.4		3.7	+	4.3	+
KS120729M~3	76.3	-	59.6	-	5.0	+	0.0	

Average (n=80)	101.0	60.9	0.9	1.0
LSD (0.05)	12.8	1.1	1.6	1.3
C.V.	7.8	1.1	112.4	86.6

Note: Released cultivars are shown in bold print.

Note: Varieties are ordered by descending yield averages.

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

Note: The 0-9 ratings indicate a genotype's response to disease or lodging where 0 = highly resistant and 9 = highly susceptible.

Table 7. Summary of performance of entries in the Virginia Tech Hard Red Winter Wheat Test at Painter, 2020 harvest.

Line	Yield (Bu/a)		Test Weight (Lb/bu)		Powdery Mildew (0-9)
VA18HRW-57	103.2	+	57.5		2.0
Hilliard (SRW Check)	100.8	+	57.1		0.0
Shirley (SRW Check)	100.3	+	56.7		0.0
VA18HRW-96	99.4	+	56.8		1.0
DH15HRW-65-70	97.9	+	58.8		1.0
MAS1417-010-6-4	96.6		57.8		5.0
VA18HRW-100	96.5		57.0		3.0
15VDH-HRW16-110	96.3		56.8		1.0
VA18HRW-58	95.5		57.8		1.0
15VDH-HRW18-163	95.0		58.7		0.0
NVIR17-1	94.2		59.4		4.0
DH15HRW-65-142	93.5		59.3		1.0
15VDH-HRW19-018	93.3		59.2		2.0
VA18HRW-51	90.6		58.5		0.0
NVIR17-8	89.3		57.6		1.0
15VDH-HRW15-062	89.2		58.1		4.0
14VDH-HRW02-105	88.8		58.9		4.0
VA18HRW-47	88.2		58.4		4.0
5210 (EXP21)	87.9		57.4		0.0
ARS14W0947	87.7		58.2		0.0
MAS1417-148-3-1	87.7		57.5		0.0
VA13MAS14-1992-3-4	87.6		56.8		0.0
VA18HRW-9	87.1		56.8		0.0
15VDH-HRW15-081	86.6		56.2		0.0
DH13HRW09-143	85.3		59.1		1.0
15VDH-HRW15-199	85.1		56.9		0.0
MAS1417-006-6-4	84.5		59.4		2.0
VA18HRW-68	83.5		58.1		0.0
VA13MAS14-1992-3-3	83.3		57.7		1.0
Vision 45	83.0		59.0		0.0
VA18HRW-61	82.9		58.6		0.0

DH16HRW-72-134	82.6	58.6	0.0
DH13HRW09-81WS	82.1	59.7	0.0
14VDH-HRW02-029	81.9	58.9	0.0
Liberty 5658	81.2	58.3	1.0
14VDH-HRW01-019	79.9	58.2	1.0
VA17HRW-33	79.9	55.3	- 0.0
16VDH-HRW13-090	78.2	57.4	0.0
VA18HRW-95	77.4	57.5	0.0
VA16HRW-22	77.2	58.3	0.0
VA18HRW-28	76.7	56.8	0.0
DH15HRW-68-106	76.4	57.6	1.0
VA09HRW-43	76.1	56.1	1.0
VA18HRW-7	76.0	58.2	3.0
DH12HRW46-8	76.0	57.8	0.0
Vision 50	75.9	57.9	1.0
DH12HRW46-40	75.4	58.5	0.0
VA17HRW-8	75.0	56.3	1.0
VA17HRW-43	74.9	58.8	0.0
VA18HRW-35	74.6	58.3	3.0
DH13HRW08-192	74.0	60.1	0.0
DH16HRW-72-25	74.0	58.3	1.0
VA18HRW-4	73.7	58.8	0.0
DH16HRW-72-148	73.5	59.0	0.0
VA18HRW-98	73.4	56.3	2.0
DH12HRW50-11	72.6	57.3	0.0
VA18HRW-67	72.6	58.3	1.0
VA18HRW-66	71.9	59.6	0.0
VA17HRW-92	71.1	59.7	3.0
DH16HRW-68-22	71.0	58.7	1.0
16VDH-HRW14-008	70.7	58.5	0.0
DH15HRW-69-55	70.5	58.8	0.0
Soissons	69.6	58.2	0.0
Everest	69.1	58.6	1.0
VA13MAS14-2047-4-2	69.1	57.2	1.0
Jagger	68.6	57.8	7.0
VA18HRW-3	68.6	59.8	0.0
VA16HRW-36	68.5	60.2	0.0
DH13HRW07-30	67.3	58.0	2.0
VA15HRW-86	66.3	58.8	0.0
VA14HRW-25	65.8	56.8	0.0
VA18HRW-16	64.1	57.7	0.0
VA18HRW-15	64.1	57.9	1.0
DH15HRW-69-50	63.9	58.4	0.0

KS120729M~3	63.7		58.8		6.0
DH16HRW-70-127	60.8	+	58.7		3.0
Vision 30	60.4	+	59.7		0.0
VA17HRW-9	59.0	+	58.8		4.0
VA18HRW-45	58.3	+	57.1		0.0
Karl 92	54.4	+	58.7		4.0
Average (n=80)	79.1		58.1		1.1
LSD (0.05)	18.3		2.7		---
C.V.	11.5		2.3		---

Note: Released cultivars are shown in bold print.

Note: Varieties are ordered by descending yield averages.

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

Note: The 0-9 ratings indicate a genotype's response to disease or lodging where 0 = highly resistant and 9 = highly susceptible.

Table 8. Summary of reaction of entries in the Virginia Hard Red Winter Wheat test to Fusarium head blight (scab), 2020 harvest.

Line	Flowering Date (Julian)		FHB Incidence ^a (%)	FHB Severity ^b (%)	FHB Index ^c (0-100)
VA18HRW-68	119.0		5.0	15.5	0.8
DH12HRW50-11	119.0		5.0	17.0	0.9
14VDH-HRW02-105	121.0		7.5	21.5	1.5
VA16HRW-22	119.0		7.5	23.0	1.7
VA18HRW-7	119.0		7.5	21.0	1.7
VA18HRW-3	119.0		7.5	20.0	1.7
VA14HRW-25	114.5	-	7.5	22.5	1.9
Jagger	115.5		7.5	26.5	2.1
VA18HRW-4	116.0		7.5	30.5	2.3
VA17HRW-33	123.5		10.0	25.0	2.5
Everest	114.5	-	10.0	25.0	2.5
DH15HRW-68-106	116.0		10.0	26.0	2.6
ARS14W0947	124.0		10.0	27.5	2.8
KS120729M~3	116.0		10.0	31.0	3.1
MAS1417-148-3-1	123.5		15.0	20.5	3.3
VA17HRW-8	118.5		10.0	34.0	3.4
DH12HRW46-40	115.5		10.0	36.0	3.6
NVIR17-1	123.0		15.0	27.5	3.7
VA18HRW-28	117.0		10.0	38.5	3.9
DH16HRW-70-127	117.0		10.0	39.5	4.0
DH15HRW-69-50	120.5		12.5	31.5	4.1
VA13MAS14-2047-4-2	116.0		15.0	28.5	4.1
VA18HRW-98	124.0		15.0	27.5	4.1
DH12HRW46-8	118.5		10.0	41.5	4.2

NVIR17-8	122.5	45.0	48.0	22.2		
VA18HRW-47	124.0	50.0	45.0	22.8		
VA18HRW-51	124.5	50.0	46.5	23.3		
15VDH-HRW15-062	124.0	60.0	42.5	25.5		
15VDH-HRW19-018	123.5	55.0	47.5	28.0		
DH15HRW-69-55	123.0	65.0	49.0	32.1		
VA18HRW-95	123.0	60.0	55.5	33.3		
15VDH-HRW18-163	122.5	80.0	+	49.0		39.1
Shirley (SRW Check)	124.0	65.0		64.5	+	42.4
15VDH-HRW16-110	124.0	70.0	+	60.5		42.4
DH15HRW-65-142	124.5	75.0	+	61.0		45.9
DH15HRW-65-70	124.0	80.0	+	57.0		46.2
VA18HRW-45	125.0	70.0	+	66.5	+	46.6
Average (n=80)	120.8	29.0		36.8		12.5
LSD (0.05)	6.2	39.9		24.5		24.1
C.V.	2.6	69.7		33.8		97.7

^a Scab Incidence (%): Based on infected spikes within 4 ft row.

^b Scab Severity (%): Based on infected spikelets in 10 spikes showing disease symptoms.

^c FHB Index=(Incidence x Severity)/100; it is an overall indicator of scab resistance/susceptibility level.

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

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

Table 9. Flour quality of entries in the Virginia Tech Hard Red Winter Wheat Test, 2017, 2018, and 2019 harvests.

Line	Flour Yield			Flour Ash @14% Moisture			Flour Protein @14% Moisture			Flour Water Absorption		
	2019	2018	2017	2019	2018	2017	2019	2018	2017	2019	2018	2017
5210 (EXP21)	70.6	67.1	71.9	0.4	0.5	0.5	8.3	11.2	7.6	56.9	61.6	57.2
Everest	64.9	67.6	68.3	0.4	0.4	0.5	9.1	10.6	9.1	57.7	62.6	59.2
Jagger	65.9	63.6	67.3	0.4	0.5	0.5	9.0	11.9	9.5	57.9	64.7	61.0
Karl 92	66.2	67.5	68.0	0.4	0.4	0.4	9.2	11.4	9.7	58.4	61.9	61.2
Soissons	71.4	69.9	72.9	0.4	0.4	0.4	8.9	11.8	8.3	57.9	61.7	59.7
Vision 30	67.7	66.1	67.7	0.4	0.4	0.4	9.3	11.9	9.0	58.5	62.8	61.3
Vision 45	71.0	69.1	71.2	0.4	0.4	0.4	8.9	11.0	9.1	57.7	61.3	59.5
Vision 50	73.8	69.9	74.0	0.4	0.4	0.4	8.3	11.1	7.9	57.2	61.5	58.6
14VDH-HRW01-019	70.1	---	---	0.4	---	---	8.3	---	---	55.8	---	---
14VDH-HRW02-029	71.0	---	---	0.4	---	---	8.5	---	---	56.5	---	---
14VDH-HRW02-105	69.8	---	---	0.4	---	---	8.1	---	---	55.4	---	---
15VDH-HRW15-062	70.1	---	---	0.4	---	---	9.3	---	---	58.1	---	---
15VDH-HRW15-081	72.2	---	---	0.4	---	---	8.2	---	---	55.8	---	---
15VDH-HRW19-018	71.3	---	---	0.4	---	---	9.1	---	---	57.6	---	---
ARS14W0947	62.3	---	---	0.4	---	---	8.1	---	---	55.5	---	---
DH12HRW46-40	66.5	64.9	64.4	0.5	0.4	0.4	9.6	10.6	9.8	59.2	60.6	62.7
DH12HRW46-8	68.8	64.7	67.0	0.4	0.5	0.5	8.3	11.7	8.3	56.5	62.5	59.8
DH12HRW50-11	68.5	70.0	69.1	0.4	0.4	0.3	8.9	12.0	8.9	57.4	63.0	60.4
DH13HRW07-30	67.2	67.3	---	0.5	0.4	---	9.8	11.1	---	59.0	61.4	---
DH13HRW08-192	65.0	66.0	---	0.5	0.4	---	8.9	10.8	---	57.5	60.9	---
DH13HRW09-143	70.3	69.5	---	0.4	0.4	---	9.0	11.1	---	57.5	61.5	---
DH13HRW09-81WS	67.1	71.1	---	0.4	0.4	---	8.8	10.3	---	57.1	60.1	---
DH15HRW-65-142	69.2	---	---	0.4	---	---	8.3	---	---	56.1	---	---
DH15HRW-65-70	67.2	---	---	0.4	---	---	9.1	---	---	57.8	---	---
DH15HRW-68-106	67.0	---	---	0.4	---	---	7.8	---	---	55.2	---	---
DH15HRW-69-50	67.9	---	---	0.4	---	---	8.6	---	---	56.4	---	---

DH15HRW-69-55	68.9	---	---	0.4	---	---	9.3	---	---	58.1	---	---
NVIR17-1	68.0	---	---	0.4	---	---	8.4	---	---	56.2	---	---
NVIR17-8	69.3	---	---	0.4	---	---	8.6	---	---	56.4	---	---
VA09HRW-43	67.8	65.1	70.1	0.4	0.4	0.4	8.1	10.8	7.8	55.9	62.4	58.1
VA13MAS14-1992-3-3	69.2	---	---	0.4	---	---	8.8	---	---	57.4	---	---
VA13MAS14-1992-3-4	67.7	---	---	0.4	---	---	8.3	---	---	56.4	---	---
VA13MAS14-2047-4-2	68.9	---	---	0.4	---	---	10.1	---	---	59.2	---	---
VA14HRW-25	65.1	65.6	67.3	0.4	0.4	0.4	8.7	11.7	9.3	57.1	64.4	61.8
VA15HRW-86	69.8	71.0	72.6	0.4	0.4	0.4	8.9	12.3	9.3	57.3	63.4	58.7
VA16HRW-22	70.4	69.3	---	0.4	0.5	---	8.7	11.9	---	57.0	62.7	---
VA16HRW-36	71.0	71.8	---	0.4	0.4	---	9.1	12.1	---	58.5	63.2	---
VA17HRW-33	70.9	---	---	0.4	---	---	9.5	---	---	59.1	---	---
VA17HRW-43	74.0	---	---	0.4	---	---	9.2	---	---	58.6	---	---
VA17HRW-8	70.7	---	---	0.4	---	---	8.8	---	---	57.3	---	---
VA17HRW-9	66.0	---	---	0.4	---	---	9.6	---	---	58.7	---	---
VA17HRW-92	70.9	---	---	0.4	---	---	9.3	---	---	58.8	---	---
Average	68.8	67.9	69.4	0.4	0.4	0.4	8.8	11.4	8.8	57.3	62.2	59.9
Maximum	74.0	71.8	74.0	0.5	0.5	0.5	10.1	12.3	9.8	59.2	64.7	62.7
Minimum	62.3	63.6	64.4	0.4	0.4	0.3	7.8	10.3	7.6	55.2	60.1	57.2

Note: Cultivars are sorted alphabetically; released lines are in bold print; Jagger is the quality standard check variety.

Section 2: Malting Quality of Soft Red Winter Wheats in 2020

Table 10. Malting quality of selected soft winter wheats at Blacksburg, Virginia, harvested in 2020.

Description	Fine Extract	Color	Soluble Protein	Total Protein	S/T	FAN	Diastatic Power	Alpha Amylase	Filtration Time	Clarity
	% (DB)	°ASBC	%	%	%	mg/L	°L	D.U.		
SY Viper	83.8	2.01	4.59	11.0	41.7	103	106	32.9	normal	clear
SY 547	85.1	3.06	4.97	10.3	48.3	119	130	41.2	normal	clear
Shirley	85.2	1.75	4.46	10.8	41.3	90	111	24.2	normal	slightly hazy
Featherstone 125	84.4	1.84	4.12	10.4	39.6	101	87	31.6	normal	slightly hazy
Pioneer 26R45	87.1	1.71	5.24	9.7	54.0	143	172	45.0	normal	slightly hazy
Pioneer 26R59	86.5	1.70	5.26	10.3	51.1	134	115	40.9	normal	hazy
CROPLANCP 9606	87.0	3.16	5.15	9.8	52.6	136	107	36.1	normal	clear
AgriMaxx 473	84.4	3.31	5.68	11.3	50.3	168	124	48.8	normal	clear
USG 3316	86.7	2.45	4.96	9.5	52.2	151	124	61.5	normal	clear
USG 3329	84.7	2.97	4.79	10.6	45.2	139	128	53.3	normal	clear
USG 3458	85.7	2.32	5.13	10.3	49.8	131	189	37.3	normal	clear
Dyna-Grow 9772	84.1	2.65	5.55	10.4	53.4	166	111	48.4	normal	clear
Dyna-Grow 9941	84.2	2.97	4.89	10.8	45.3	140	117	43.9	normal	hazy
MAS#86	85.8	3.15	4.90	9.1	53.8	140	101	45.1	normal	hazy
MAS#316	84.9	2.78	5.16	10.8	47.8	149	133	55.9	normal	clear

STEERING: 10 h wet (18 h air) 8 h wet (12 h air) 2 h wet @ 16°C

GERMINATION: 96 Hours @ 15°C

KILNING: 6 hrs @ 55°C, 6 hrs @ 65°C, 6 hrs @ 72°C, 4 hrs @ 85°C

Section 3: Malt Barley Varieties in Virginia

As interest continues to grow in locally produced ingredients from the craft brewing industry in the mid-Atlantic and eastern U.S., finding malted barley is not easy for those located in the region. Therefore, demands for the production of high-quality winter barley for the malt, brewing and distilling industries have generated new interest in barley.

Malt barley tests were planted in seven-inch rows at Blackstone and in six-inch rows at Warsaw and Blacksburg; at 44 seeds per square foot.

Agronomic performance data for entries in the Eastern Malt Barley Trial conducted at locations in Blacksburg, Blackstone and Warsaw, VA in 2020 are presented in Table 11. One six rowed Virginia winter malt barley doubled-haploid (DH) experimental line VA17M-13DH1720LX ranked 1st in average grain yield (122 bu/ac) and was 10 bushel per acre higher than the cultivar Thoroughbred, 3 bushel per acre higher than the two rowed malt barley cultivar Flavia (119 bu/ac), 22 bushel per acre higher than Violetta, 7 to 13 bu/ac higher than the American Malting Barley Association (AMBA) winter malt barley check cultivars Wintmalt and Endeavor (115 bu/ac, and 109 bu/ac) respectively, 10 bushels per acre more than Calypso (112 bu/ac), and 25 bushels per acre higher than the overall test average. The two-row winter malt barley cultivar Flavia ranked 2nd in grain yield (119 Bu/ac) that was 6 bushel per acre higher than Thoroughbred and 4 to 22 bushel per acre higher than the two row winter check cultivars Wintmalt (115 bu/ac), Calypso (112 bu/ac), Endeavor (109 bu /ac) and Violetta (97 bu/ac). The two-row recently released Virginia malt barley cultivar Avalon (tested as VA16M-81 2R) had average grain yield that was 6 bushel per acre higher than Violetta, but lower than the check cultivars Flavia, Wintmalt, Calypso and Endeavor. Results for these new malt barley lines are encouraging and indicate that significant progress is being made by the breeding program in developing barley cultivars with high yield and improved disease resistance.

Summary of malt quality performance of entries in the 2019 Eastern Malt Barley Trials (EMBT) at locations in Blacksburg, Blackstone and Warsaw, VA conducted by Hartwick College, Center for Craft Food and Beverage, Oneonta, NY are presented in Table 17. Malting quality data among malt barley indicates that the Virginia malt barley cultivar Avalon released in 2020 meets or exceeds the desired AMBA target ranges for all of the important malting characteristics including protein (9.0 %), plump kernels >6/64” (97 %), germination energy 8mL (90 %), malt extract (83 %), beta-glucan (42 ppm), soluble /total protein (48 %), diastatic power (148 °ASBC), alpha-amylase (72 D.U.), and FAN (187 ppm). Malt extract for Avalon is 2% higher than Violetta (82 %), beta-glucan content of Avalon is 39 ppm lower than Violetta (81 ppm). Malt quality values for the check varieties (Violetta, Flavia, Calypso and Wintmalt) changed to varying degrees that were either lower or higher than the upper or lower limits for all-malt specifications. Our breeding program plans to continue to build on the data collected on these varieties and evaluate and select superior malt barley lines each year from the EMBT and the WMBT, to determine which lines are best suited to provide the yields and quality sought by craft maltsters and brewers in the eastern U.S.

Table 11. Summary of performance of entries in the Virginia Tech Eastern Malting Barley Test over locations, 2020 harvest.

Line	Yield (Bu/a)		Test Weight (Lb/bu)		Heading Date (Julian)		Height (In)		Lodging (0-9) ^a		Net Blotch (0-9) ^a	
	(3)		(3)		(2)		(2)		(1)		(2)	
VA17M-13DH1720 (LX)	121.5	+	48.2		114.2		34.8		4.0		2.2	
Flavia	118.7	+	49.4		115.2	+	30.2	-	0.3	-	1.7	-
VA17M-14DH1476 (LX)	116.9	+	47.9		112.2		36.0		3.7		2.3	
VA17M-14DH1801 (LX)	115.3	+	47.9		107.8	-	33.3		2.3		2.3	
VA17M-14DH1840	115.0	+	50.1		112.2		33.5		2.0		1.2	-
Wintmalt	115.0	+	49.7		116.5	+	32.3		0.7	-	2.0	
Thoroughbred	112.9	+	51.3	+	110.3		37.8	+	2.0		3.5	
12W587-n-28	112.9	+	51.2	+	118.8	+	33.3		1.7		3.0	
Hirondella	111.8	+	47.6		114.3	+	33.5		2.3		1.7	-
Calypso	111.6	+	47.9		115.8	+	35.5		2.7		2.2	
Endeavor	108.9	+	50.7	+	107.2	-	35.8		0.7	-	2.8	
ARS15B12	108.1		50.6	+	109.8	-	35.5		0.3	-	1.3	-
VA17M-14DH1815 (LX)	104.8		49.7		108.2	-	37.3	+	1.0		1.3	-
12W589-n-07	102.9		47.0	-	114.7	+	34.0		3.3		4.0	
VA16M-14DH1312 (2R)	102.9		50.4	+	108.2	-	33.2		0.0	-	0.8	-
Avalon (VA16M-81 (2R))	102.1		51.7	+	114.5	+	36.2		1.7		2.2	
12W587-n-23	100.2		49.9		117.8	+	33.3		2.0		3.2	
12W595-n-16	100.1		48.6		114.3	+	34.8		4.0		5.0	+
Violetta	97.4		49.2		109.8	-	29.8	-	1.3		2.0	
VA16M-84 (2R)	95.4		52.4	+	114.5	+	39.7	+	0.7	-	1.8	-
VA18M-75 LA	93.9		50.8	+	106.7	-	33.7		1.0		0.5	-
VA17M-14DH1836	93.8		50.7	+	104.3	-	31.2	-	2.0		2.7	
12W595-n-74	93.4		47.9		114.7	+	34.3		6.0	+	6.0	+
12W595-n-02	93.4		48.2		115.0	+	32.2		4.7	+	4.2	
12W595-n-96	93.2		47.2	-	114.3	+	34.8		5.7	+	5.2	+
VA16M-82 (2R)	93.0		52.3	+	109.8	-	41.3	+	2.3		2.0	
12W595-n-83	92.7		46.1	-	114.5	+	32.7		5.0	+	6.0	+
VA17M-189 (2R)	92.4		49.8		106.7	-	37.3	+	3.0		1.7	-
12W595-n-71	90.4		45.5	-	114.3	+	33.7		7.0	+	4.2	
12W595-n-05	89.9		46.8	-	114.7	+	33.0		6.0	+	5.7	+
VA17M-15DH0272	89.7		52.4	+	110.8		35.2		2.0		1.0	-
12W595-n-04	89.5		46.9	-	115.2	+	33.2		4.7	+	5.2	+
12W595-n-66	86.6		46.8	-	114.5	+	33.2		6.7	+	5.3	+

ARS15B19	85.3	-	49.2	108.3	-	40.3	+	0.0	-	1.2	-
VA17M-128 (2R)	84.7	-	49.1	109.0	-	37.7	+	4.7	+	4.2	
VA17M-187 (2R)	82.0	-	49.8	107.5	-	38.2	+	1.3		1.5	-
VA16M-115 (2R)	81.9	-	50.1	105.8	-	31.8		1.3		2.8	
12W586-n-28	80.8	-	44.9	116.2	+	28.3	-	2.3		5.5	+
12W586-n-50	80.5	-	46.9	115.2	+	28.2	-	1.7		5.3	+
12W586-n-56	80.0	-	45.9	115.5	+	27.8	-	3.3		6.0	+
12W581-n-13	79.2	-	45.0	112.0		32.0		5.0	+	7.0	+
12W581-n-42	55.6	-	43.7	113.7		28.7	-	4.7	+	7.5	+
Average (n=42)	97.1		48.8	112.3		34.0		2.8		3.3	
LSD (0.05)	11.1		1.4	2.0		2.5		1.8		1.3	
C.V.	12.1		3.0	1.1		6.4		40.8		36.2	

Note: The number in parentheses below column headings indicates the number of locations on which data are based.

Note: Released cultivars are shown in bold print. Varieties are ordered by descending yield averages.

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

^a The 0-9 ratings indicate a genotype's response to disease or lodging where 0 = highly resistant and 9 = highly susceptible.

Table 12. Two-year summary of performance of entries in the Virginia Tech Eastern Malting Barley Test over locations, 2019 and 2020 harvests.

Line	Yield (Bu/a)	Test Weight (Lb/bu)	Heading Date (Julian)	Height (In)	Lodging (0-9) ^a				
	(6)	(6)	(4)	(4)	(4)				
Thoroughbred	109.6	+	48.5	111.0	-	32.6	+	1.3	
Wintmalt	103.6		47.2	118.1	+	28.2	-	0.9	
Flavia	102.4		47.5	116.5	+	25.8	-	0.9	
ARS15B12	101.5		49.4	110.7	-	31.1		0.9	
Hirondella	100.0		45.4	115.5	+	29.7		1.5	
Calypso	98.9		46.0	116.6	+	30.8		1.8	
Violetta	96.6		47.9	111.3	-	26.5	-	1.3	
Avalon (VA16M-81 (2R))	96.4		49.9	114.4	+	31.6		1.5	
VA16M-82 (2R)	95.1		50.7	111.2	-	37.2	+	1.6	
VA16M-14DH1312 (2R)	94.0		49.7	111.2	-	29.1	-	0.5	
VA16M-84 (2R)	90.6		51.3	114.8	+	34.8	+	1.1	
VA16M-115 (2R)	84.4	-	50.0	109.8	-	29.0	-	1.0	
ARS15B19	82.7	-	48.2	110.2	-	35.9	+	0.2	-
Average (n=13)	101.8		47.4	114.2		29.2		1.2	
C.V.	11.0		2.7	1.0		5.7		99.0	
LSD (0.05)	7.1		0.9	0.9		1.4		0.9	

Note: The number in parentheses below column headings indicates the number of location-years on which data are based.

Note: Released cultivars are shown in bold print. Varieties are ordered by descending yield averages.

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

^a The 0-9 ratings indicate a genotype's response to disease or lodging where 0 = highly resistant and 9 = highly susceptible.

Table 13. Three-year summary of performance of entries in the Virginia Tech Eastern Malting Barley Test over locations, 2018, 2019 and 2020 harvests.

Line	Yield (Bu/a)		Test Weight (Lb/bu)		Heading Date (Julian)		Height (In)		Lodging (0-9) ^a	
	(9)		(9)		(6)		(6)		(6)	
Flavia	99.0	+	46.0	-	118.9	+	26.6	-	0.9	
Thoroughbred	98.9	+	46.3	-	114.1	-	32.8		2.4	+
Hirondella	97.7		44.1	-	117.8	+	31.1		1.5	
ARS15B12	97.2		48.2		113.7	-	33.1		0.9	
Calypso	97.0		45.0	-	118.9	+	31.7		1.5	
Violetta	94.3		46.8		114.4	-	27.9	-	1.1	
Avalon (VA16M-81 (2R))	92.9		48.6	+	116.9	+	32.6		1.3	
VA16M-84 (2R)	91.2		50.6	+	116.7	+	35.6	+	0.9	
VA16M-14DH1312 (2R)	90.4		48.4		114.2	-	30.4	-	0.5	-
VA16M-82 (2R)	89.2		50.3	+	114.2	-	37.1	+	2.1	+
ARS15B19	83.7	-	47.4		113.5	-	37.3	+	0.2	-
VA16M-115 (2R)	83.4	-	49.4	+	113.1	-	31.0	-	1.6	
Average (n=12)	97.3		46.1		116.3		30.5		1.4	
C.V.	10.7		3.5		0.8		5.6		88.1	
LSD (0.05)	5.4		0.9		0.6		1.2		0.7	

Note: The number in parentheses below column headings indicates the number of location-years on which data are based.

Note: Released cultivars are shown in bold print.

Note: Varieties are ordered by descending yield averages.

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

^aThe 0-9 ratings indicate a genotype's response to disease or lodging where 0 = highly resistant and 9 = highly susceptible.

Table 14. Summary of performance of entries in the Virginia Tech Eastern Malting Barley Test at Blacksburg, VA, 2020 harvest.

Line	Yield (Bu/a)		Test Weight (Lb/bu)		Heading Date (Julian)		Height (In)		Net Blotch (0-9) ^a	
VA17M-13DH1720 (LX)	109.9	+	47.1		119.0	+	34.3		2.7	
Wintmalt	104.9	+	48.0		121.0	+	30.3	-	1.7	
Flavia	103.9	+	47.8		118.3	+	28.3	-	2.3	
Calypso	103.4	+	47.0		119.3	+	33.3		2.7	
12W587-n-28	102.2	+	50.2	+	123.7	+	32.0		4.0	
12W587-n-23	101.4	+	49.5	+	123.0	+	33.0		3.3	
Hirondella	99.7	+	45.9	-	118.3	+	32.3		2.3	
Thoroughbred	99.4	+	50.1	+	114.7		37.3	+	5.3	
12W589-n-07	95.6		45.9	-	117.7		33.0		4.3	
VA17M-14DH1801 (LX)	94.6		47.1		111.7	-	33.0		3.3	
12W595-n-96	94.1		46.4		117.7		32.0		4.7	
VA17M-14DH1476 (LX)	93.7		44.4	-	116.0		34.7		3.7	
12W595-n-04	92.6		46.3		118.3	+	31.7		3.3	
ARS15B12	90.4		50.2	+	114.0	-	36.0	+	1.7	
12W595-n-16	90.0		47.3		116.7		32.0		4.0	
12W595-n-71	88.5		44.0	-	118.3	+	32.3		5.0	
12W595-n-02	87.7		46.8		118.0		30.7		4.7	
12W595-n-66	86.2		45.7	-	117.0		31.7		5.3	
VA17M-14DH1815 (LX)	85.7		47.9		111.7	-	37.3	+	2.7	
Violetta	83.5		49.0		112.7	-	29.3	-	2.7	
VA17M-14DH1840	83.4		48.8		114.7		31.0		2.0	
Endeavor	82.5		50.4	+	112.3	-	36.0	+	3.7	
Avalon (VA16M-81 (2R))	82.0		51.1	+	119.7	+	34.7		3.3	
12W595-n-05	81.7		46.0	-	118.3	+	31.0		5.3	
12W595-n-83	80.9		45.8	-	117.7		30.0	-	5.3	
12W595-n-74	78.7		46.6		118.3	+	31.3		6.3	+
VA17M-15DH0272	78.2		51.9	+	114.3		35.7		2.0	
VA17M-189 (2R)	75.0		50.2	+	112.0	-	38.0	+	3.3	
12W586-n-56	74.7		45.2	-	119.3	+	29.3	-	5.3	
VA16M-82 (2R)	74.3		52.4	+	114.7		40.3	+	3.0	
VA16M-14DH1312 (2R)	74.0		46.5		111.3	-	33.3		1.7	
VA16M-84 (2R)	72.9		52.9	+	119.3	+	39.0	+	2.7	
VA17M-128 (2R)	71.3		49.4	+	113.3	-	37.3	+	6.0	+
12W586-n-28	70.8		41.8	-	120.3	+	29.0	-	7.0	+
12W586-n-50	70.4		44.2	-	119.0	+	28.7	-	4.7	
VA18M-75 LA	68.4		51.0	+	111.7	-	35.3		1.0	-

ARS15B19	67.0	-	49.1		112.3	-	40.3	+	1.7	
VA17M-187 (2R)	61.5	-	48.7		112.3	-	38.7	+	2.3	
12W581-n-42	57.3	-	39.7	-	117.3		30.0	-	7.3	+
12W581-n-13	56.2	-	42.4	-	116.7		29.7	-	6.7	+
VA17M-14DH1836	53.1	-	49.7	+	106.7	-	29.7	-	4.3	
VA16M-115 (2R)	51.4	-	48.3		109.7	-	34.7		4.0	
Average (n=42)	82.7		47.6		116.2		33.3		3.8	
LSD (0.05)	14.4		1.5		2.1		2.7		2.2	
C.V.	10.7		2.0		1.1		5.0		35.5	

Note: Released cultivars are shown in bold print.

Note: Varieties are ordered by descending yield averages.

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

^a The 0-9 ratings indicate a genotype's response to disease or lodging where 0 = highly resistant and 9 = highly susceptible.

Table 15. Summary of performance of entries in the Virginia Tech Eastern Malting Barley Test in Warsaw, VA, 2020 harvest.

Line	Yield (Bu/a)		Test Weight (Lb/bu)		Heading Date (Julian)		Height (In)		Lodging (0-9) ^a	
VA17M-14DH1840	153.8	+	50.7		109.7		36.0		2.0	
Flavia	150.9	+	50.1		112.0	+	32.0		0.3	-
VA17M-13DH1720 (LX)	149.9	+	50.0		109.3		35.3		4.0	
VA17M-14DH1801 (LX)	146.5		49.6		104.0	-	33.7		2.3	
Calypso	145.7		49.8		112.3	+	37.7		2.7	
12W587-n-28	145.1		52.0		114.0	+	34.7		1.7	
Wintmalt	142.8		51.4		112.0	+	34.3		0.7	-
VA17M-14DH1836	139.3		52.3	+	102.0	-	32.7		2.0	
Endeavor	138.0		51.4		102.0	-	35.7		0.7	-
VA17M-14DH1476 (LX)	136.8		50.8		108.3		37.3		3.7	
VA16M-14DH1312 (2R)	135.1		52.5	+	105.0	-	33.0		0.0	-
12W595-n-16	133.2		50.8		112.0	+	37.7		4.0	
Thoroughbred	132.3		51.3		106.0	-	38.3		2.0	
12W589-n-07	132.0		49.2		111.7	+	35.0		3.3	
Hirondella	130.0		48.7		110.3		34.7		2.3	
ARS15B12	129.7		50.8		105.7	-	35.0		0.3	-
VA17M-14DH1815 (LX)	129.1		50.6		104.7	-	37.3		1.0	
12W595-n-96	128.5		48.2		111.0	+	37.7		5.7	+
Violetta	128.1		50.7		107.0		30.3	-	1.3	
12W595-n-83	128.1		48.3		111.3	+	35.3		5.0	+
12W595-n-71	127.3		47.7	-	110.3		35.0		7.0	+
12W595-n-74	124.4		49.3		111.0	+	37.3		6.0	+
12W595-n-02	124.2		49.7		112.0	+	33.7		4.7	+

12W595-n-05	123.1	48.5		111.0	+	35.0	6.0	+	
Avalon (VA16M-81 (2R))	123.0	50.3		109.3		37.7	1.7		
VA18M-75 LA	122.4	51.0		101.7	-	32.0	1.0		
VA16M-82 (2R)	120.0	52.3	+	105.0	-	42.3	+	2.3	
12W595-n-04	119.6	48.2		112.0	+	34.7	4.7	+	
12W581-n-13	118.7	48.3		107.3		34.3	5.0	+	
12W595-n-66	116.2	48.5		112.0	+	34.7	6.7	+	
VA16M-115 (2R)	115.6	52.2	+	102.0	-	29.0	-	1.3	
VA17M-189 (2R)	114.1	51.8		101.3	-	36.7	3.0		
VA16M-84 (2R)	113.5	52.1	+	109.7		40.3	+	0.7	
VA17M-128 (2R)	112.3	51.0		104.7	-	38.0	4.7	+	
12W587-n-23	111.4	50.8		112.7	+	33.7	2.0		
VA17M-15DH0272	110.5	52.5	+	107.3		34.7	2.0		
ARS15B19	106.6	49.7		104.3	-	40.3	+	0.0	
12W586-n-28	105.7	46.6	-	112.0	+	27.7	-	2.3	
VA17M-187 (2R)	102.0	50.2		102.7	-	37.7	1.3		
12W586-n-50	101.3	47.9	-	111.3	+	27.7	-	1.7	
12W586-n-56	96.4	-	46.6	-	111.7	+	26.3	-	3.3
12W581-n-42	72.0	-	46.6	-	110.0		27.3	-	4.7
Average (n=42)	124.6	50.0		108.4		34.8	2.8		
LSD (0.05)	25.1	2.1		2.0		4.2	1.8		
C.V.	12.4	2.5		1.1		7.4	40.8		

Note: Released cultivars are shown in bold print.

Note: Varieties are ordered by descending yield averages.

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

^aThe 0-9 ratings indicate a genotype's response to disease or lodging where 0 = highly resistant and 9 = highly susceptible.

Table 16. Summary of performance of entries in the Virginia Tech Eastern Malting Barley Test at Blackstone, VA, 2020 harvest.

Line	Yield (Bu/a)		Test Weight (Lb/bu)		Net Blotch (0-9) ^a	
VA17M-14DH1476 (LX)	121.9	+	48.3		1.0	-
VA17M-14DH1840	108.0	+	50.9		0.3	-
Thoroughbred	106.9	+	52.5	+	1.7	
Endeavor	106.1	+	50.3		2.0	
Hirondella	105.7	+	48.2		1.0	-
VA17M-14DH1801 (LX)	104.7	+	47.0		1.3	
ARS15B12	104.3	+	50.9		1.0	-
Avalon (VA16M-81 (2R))	101.3	+	53.8	+	1.0	-

VA16M-84 (2R)	99.9	+	52.3	+	1.0	-
VA17M-14DH1815 (LX)	99.7	+	50.6		0.0	-
VA16M-14DH1312 (2R)	99.4	+	52.1	+	0.0	-
Wintmalt	97.2		49.8		2.3	
VA17M-13DH1720 (LX)	96.5		47.6		1.7	
Flavia	92.6		50.4		1.0	-
12W587-n-28	91.3		51.3		2.0	
VA18M-75 LA	90.9		50.6		0.0	-
VA17M-14DH1836	89.0		50.2		1.0	-
12W587-n-23	87.9		49.2		3.0	
VA17M-189 (2R)	86.0		47.5		0.0	-
Calypso	85.8		46.8		1.7	
VA17M-187 (2R)	82.6		50.8		0.7	-
12W589-n-07	81.0		45.8		3.7	
VA16M-82 (2R)	80.6		52.2	+	1.0	-
VA17M-15DH0272	80.3		52.7	+	0.0	-
VA16M-115 (2R)	78.6		49.7		1.7	
12W595-n-74	77.1		47.8		5.7	+
12W595-n-16	77.0		47.7		6.0	+
ARS15B19	76.2		48.8		0.7	-
Violetta	72.0		47.9		1.3	
VA17M-128 (2R)	70.7		46.9		2.3	
12W595-n-83	69.1		44.2	-	6.7	+
12W595-n-02	68.2		48.1		3.7	
12W595-n-05	64.7	-	45.8		6.0	+
12W586-n-50	64.5	-	49.4		6.0	+
12W586-n-56	63.4	-	45.9		6.7	+
12W586-n-28	58.5	-	46.3		4.0	
12W595-n-66	57.4	-	46.3		5.3	+
12W595-n-96	57.1	-	47.1		5.7	+
12W595-n-04	56.3	-	46.2		7.0	+
12W595-n-71	55.5	-	44.6	-	3.3	
12W581-n-13	54.2	-	44.2	-	7.3	+
12W581-n-42	37.4	-	44.9	-	7.7	+
Average (n=42)	82.7		48.6		2.7	
LSD (0.05)	16.6		3.4		1.6	
C.V.	11.4		4.2		36.1	

Note: Released cultivars are shown in bold print.

Note: Varieties are ordered by descending yield averages.

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

^a The 0-9 ratings indicate a genotype's response to disease or lodging where 0 = highly resistant and 9 = highly susceptible.

Table 17. Malting quality of entries in the Eastern Malting Barley Trial at Blacksburg, VA, 2019 harvest.

Variety or Selection	Kernel Weight (Lb/bu)	on 6/64" (%)	Germination Energy 8mL (%)	Malt Extract (%)	Barley Protein (%)	S/T (%)	Diastatic Power (°L)	Alpha-Amylase (20 DU)	Beta-glucan (mg/L)	FAN (mg/L)
Avalon (VA16M-81 (2R))	56.5	97.1	90	83.2	9.0	48.0	148	71.7	42	187
Calypso	52.8	96.7	67	83.1	8.5	47.9	136	52.8	61	168
KWS Joy	52.1	97.7	82	83.7	8.5	47.8	110	57.7	106	174
KWS Scala	53.7	97.1	89	85.1	8.6	53.1	138	70.3	42	200
SU-Mateo	54.5	94.4	82	82.3	8.6	49.5	114	58.5	102	172
Violetta	54.9	96.5	68	82.2	9.4	49.8	156	67.6	81	191
12W581-47	55.4	91.2	91	80.0	9.5	50.1	87	70.6	290	222
12W587-66	52.4	84.2	52	83.1	9.9	53.0	165	101.4	73	232
12W587-78	52.4	85.6	76	81.5	8.7	53.4	90	98.8	140	229
12W590-063	54.2	95.1	83	81.2	10.5	49.2	137	105.7	140	238
12W592-18	54.2	92.8	73	82.0	9.4	45.4	142	75.8	93	175
12W592-41	54.6	95.3	79	80.4	9.9	45.5	152	87.2	105	187
12W599-49	51.4	67.0	82	80.2	9.0	52.6	156	93.9	72	205
ARS14B12	56.3	95.0	93	81.7	10.2	45.9	101	55.1	137	192
ARS14B14	57.5	96.8	95	86.6	9.9	52.0	98	48.7	149	221
ARS14B15	57.3	96.5	93	80.6	9.9	46.3	99	48.9	159	192
ARS15B12	55.5	96.6	70	80.7	9.5	46.8	97	62.9	278	195
ARS15B19	55.2	98.4	81	81.4	10.4	47.3	103	63.0	326	226
ARS15B24	52.2	77.9	59	80.3	9.6	49.0	100	88.6	291	216
ARS15B32	55.4	98.7	78	82.0	10.4	48.4	96	70.7	328	229
ARS16B16	57.3	97.9	77	80.4	10.9	40.3	105	62.4	526	178
ARS16B24	57.8	98.4	65	80.9	10.8	41.6	105	61.1	509	182
VA16M-14DH1272 (2R)	56.3	94.2	82	81.0	10.0	40.8	105	64.2	460	160
VA16M-14DH1285	53.8	87.9	88	81.9	10.2	53.8	163	94.7	228	258
VA16M-14DH1294 (2R)	54.9	97.7	81	82.6	10.1	54.2	112	70.3	222	259
VA16M-14DH1310	57.0	88.2	91	80.4	10.1	40.7	134	53.4	353	160
VA16M-14DH1312 (2R)	56.3	94.8	83	82.2	9.6	56.3	112	87.3	77	263

VA16M-82 (2R)	56.9	98.1	98	82.4	10.1	41.0	120	56.3	165	173
VA16M-83 (2R)	56.9	98.1	86	82.7	9.7	43.0	124	58.2	216	169
VA16M-84 (2R)	56.8	98.1	87	82.8	10.1	43.3	129	61.0	182	179
Mean	55.3	92.7	81	81.6	9.9	47.5	118.0	72.5	230	206
Minimum	51.4	67.0	52	80.0	8.5	40.3	87	48.7	42	160
Maximum	57.8	98.7	98	86.6	10.9	56.3	165	105.7	526	263

Note: Cultivars are arranged alphabetically and released cultivars are shown in bold print.

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