

Evaluation of Pacific Northwest spring wheat cultivars to fungicide application for control of stripe rust in 2020.

This study was conducted in a field near Pullman, WA to evaluate the control of stripe rust with fungicide applications on major spring wheat cultivars grown in the U.S. Pacific Northwest and assess yield loss caused by the disease. Spring wheat genotype 'Avocet S' (AvS) was used as a susceptible check, and 23 cultivars were selected based on their high acreage planted in the state of Washington in 2019. The 24 entries were arranged in a randomized split block design based on fungicide application, with four replications. They were seeded in rows spaced 14-in. apart at 60 lb/A (99% germination rate) with a drill planter on 27 Apr 20. The plots were 4.5-ft in width and 14.4 to 16.6-ft in length. Ammonium nitrogen fertilizer was applied at 100 lb/A at the time of planting and again on 2 Jun at the same rate when plants were at early jointing stage (Feekes 4). Herbicides (Huskie 15.0 fl oz/A + Axial XL 16.4 fl oz/A + M-90 10.4 fl oz/A) were applied on 4 Jun when wheat plants were at the early jointing stage (Feekes 4). On 18 Jun when most plants were at the middle jointing stage (Feekes 6) and stripe rust was 1-2% severity in the susceptible check plots, Quilt Xcel 2.2SE was sprayed at the rate of 14.0 fl oz/A mixed with 0.25% v/v M-90 in 16-gallon water/A. A 601C backpack sprayer was used with a CO₂-pressurized spray boom at 18 psi having three operating ¼ in. nozzles spaced 19-in. apart. Disease severity (percentage of stripe rust infected foliage per whole plot) was assessed from each plot on 17 Jun at the middle jointing stage (Feekes 6), 1 Jul at the heading stage (Feekes 10.2), 15 Jul at the late flowering stage (Feekes 10.54), and 22 Jul at the milk stage (Feekes 11.1) or 1 day before and 13, 27, and 34 days after the fungicide application. Plots were harvested on 27 Aug when kernels had 13 to 15% kernel moisture and test weight of kernels was measured. Area under the disease progress curve (AUDPC) was calculated for each plot using the four sets of severity data. Relative AUDPC (rAUDPC) was calculated as percent of the non-treated susceptible check. rAUDPC, test weight, and yield data were subjected to analysis of variance, and the effect of fungicide application on rAUDPC, test weight, and yield was determined in comparison with non-sprayed plots for each cultivar by Fisher's protected LSD test.

Stripe rust was observed on AvS plants in the nursery at the late tillering stage (Feekes 3) and reached 100% severity at the late flowering stage (Feekes 10.54) in the non-sprayed susceptible check plots. The application of Quilt Xcel at 14 fl oz/A reduced rAUDPC by 97.1% in the susceptible check (AvS) plots. The fungicide application also significantly reduced rAUDPC of thirteen commercial cultivars (WB-1035CL+, Kelse, Whit, Solano, Diva, Louise, Net CL+, Chet, Alum, Ryan, Glee, SY Selway, and SY Gunsight), and the reduction ranged from 4.7 to 86.7%. The fungicide application significantly protected grain test weight of the susceptible check (AvS) by 7.9 lb/bu and ten commercial cultivars (WB-1035CL+, Kelse, Whit, Solano, Diva, Louise, Tekoa, Net CL+, Alum, and Glee) by 1.1 to 7.8 lb/bu. The fungicide application made significant yield differences for the susceptible check (93.9 bu/A more in the sprayed plots) and fifteen commercial cultivars (WB-1035CL+, Kelse, Whit, Solano, Diva, Louise, Tekoa, Net CL+, Chet, Alum, Ryan, Melba, Glee, AP Renegade, and SY Selway) with 8.4 to 62.8 bu/A more grain in the sprayed plots. The remaining eight commercial cultivars (Seahawk, SY Gunsight, Espresso, WB9668, WB9662, WB6121, WB7202CLP, and JD) showed no significant yield differences between the no-spray and spray treatments. These data indicated that stripe rust caused yield loss of 93.9 bu/A (83.8%) on the susceptible check and 11.9 bu/A (10.7%) yield loss on average across the commercially grown cultivars under the severe disease pressure in the experimental field.

Spring wheat cultivar ^z	rAUDPC (%) ^y			Test weight (lb/bu) ^x			Yield (bu/A) ^x		
	No spray	Spray ^w	Reduction ^v	No spray	Spray ^w	Protected ^v	No spray	Spray ^w	Protected ^v
AvS	100.0	2.9	97.1* ^u	52.7	60.6	7.9* ^u	18.1	112.0	93.9* ^u
WB-1035CL+	90.5	3.8	86.7*	52.8	60.6	7.8*	46.0	108.8	62.8*
Kelse	53.5	4.5	49.0*	56.5	60.9	4.4*	72.4	108.1	35.7*
Whit	46.2	4.6	41.6*	57.5	60.0	2.5*	90.5	117.3	26.8*
Solano	43.3	5.6	37.7*	57.6	59.5	1.9*	86.4	111.4	25.0*
Diva	16.4	3.0	13.4*	58.7	59.8	1.1*	81.5	99.3	17.8*
Louise	25.8	3.4	22.4*	57.3	58.6	1.3*	78.9	93.3	14.4*
Tekoa	5.6	2.8	2.8	59.7	61.1	1.4*	103.9	122.6	18.7*
Net CL+	19.8	3.6	16.2*	60.3	61.5	1.2*	93.6	109.9	16.3*
Chet	16.5	3.4	13.1*	61.5	62.2	0.7	87.1	102.1	15.0*
Alum	18.0	3.8	14.2*	59.6	60.8	1.2*	92.0	105.7	13.7*
Ryan	12.9	3.4	9.5*	59.1	60.1	1.0	114.4	127.3	12.9*
Melba	4.9	2.3	2.6	60.8	61.0	0.2	102.1	112.9	10.8*
Glee	22.1	4.3	17.8*	59.4	60.6	1.2*	103.7	113.8	10.1*
AP Renegade	10.4	3.0	7.4	59.0	59.6	0.6	104.1	113.8	9.7*
SY Selway	18.8	4.1	14.7*	59.2	60.0	0.8	104.4	112.8	8.4*
Seahawk	2.6	2.6	0.0	60.0	60.2	0.2	109.4	115.4	6.0
SY Gunsight	7.0	2.3	4.7*	59.9	60.7	0.8	109.0	114.3	5.3
Espresso	4.8	2.6	2.2	60.4	60.7	0.3	103.3	107.6	4.3
WB9668	2.8	3.3	-0.5	61.2	61.5	0.3	110.5	113.8	3.3
WB9662	3.1	2.4	0.7	60.3	60.2	-0.1	103.8	106.7	2.9
WB6121	3.2	2.8	0.4	61.2	61.9	0.7	112.9	115.8	2.9
WB7202CLP	3.3	2.8	0.5	60.7	61.2	0.5	118.5	121.3	2.8
JD	3.6	2.6	1.0	61.6	61.0	-0.6	91.1	89.4	-1.7
Mean (excl. AvS)	15.7	3.3	12.3*	59.6	60.6	1.0	98.8	110.7	11.9*
R^2			1.0			0.9			1.0
CV			20.5			1.4			4.7
<i>P</i> -value			<0.0001			<0.0001			<0.0001
LSD ($P \leq 0.05$)			3.7			1.1			6.6

^z Wheat genotype Avocet S (AvS) was used as a susceptible check, and the remaining 23 cultivars were selected based on their high planted acreage in the State of Washington in 2019, which were also major cultivars planted in Idaho and Oregon.

^y AUDPC is area under disease progress curve, $=\sum[\text{rust severity (i)} + \text{rust severity (i+1)}]/2 \times \text{days}$, calculated using severity data recorded four times at Feekes 6 (17 Jun), Feekes 10.2 (1 Jul), Feekes 10.54 (15 Jul), and Feekes 11.1 (22 Jul). Stripe rust severity was recorded as percentage of whole plot leaf area with stripe rust infection. Relative AUDPC (rAUDPC) was calculated for each treatment as the percent of the AUDPC (as 100%) of the susceptible check without fungicide application.

^x Test weight (lb/bu) and yield (bu/A) based on 13 to 15% kernel moisture.

^w Fungicide, Quilt Xcel 2.2 SE, was sprayed at the rate of 14.0 fl oz/A mixed with surfactant M-90 0.25% v/v on 18 Jun when the plants were at the jointing stage (Feekes 6) and stripe rust severity was 1-2% in the susceptible check (AvS) plots.

^v The reduction value of rAUDPC (%) was calculated by subtracting the mean of the sprayed plots from the mean of the non-sprayed plots for each cultivar, and the protected or increased value of test weight (lb/bu) or yield (bu/A) was calculated by subtracting the mean of non-sprayed plots from the mean of the sprayed plots for each cultivar.

^u The “*” indicates that the value is significant at $P = 0.05$ as determined by Fischer’s Protected LSD test.