

### **Evaluation of Pacific Northwest spring wheat cultivars to fungicide application for control of stripe rust in 2017.**

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 their yield loss caused by the disease. Spring wheat genotype 'Avocet S' (AvS) was used as a susceptible check, and 23 spring wheat cultivars were selected based on their acreage planted in the state of Washington in 2016 or new releases. 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 15 May. The plots were 4.5 ft in width and 14.4 to 16.6 ft in length. Urea (46N-0P-0K) was applied at 100 lb/A planting. Herbicides (Huskie 15.0 fl oz/A + Axial XL 16.4 fl oz/A + Starane Flex 13.5 fl oz/A + M-90 10.4 fl oz/A) were applied on 14 Jun when wheat plants were at the tillering stage (Feekes 3-4). Fungicide, 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 on 19 Jun when most plants were at the jointing stage (Feekes 3-4) and the susceptible check had no stripe rust. A 601C backpack sprayer was used with a CO<sub>2</sub>-pressurized spray boom at 18 psi having three operating ¼ in. nozzles spaced 19-in. apart. Disease severity (percentage of diseased foliage per whole plot) was assessed from each plot on 19 Jun at Feekes 3-4, 5 Jul at Feekes 10.1, 19 Jul at Feekes 11.1, and 3 Aug at Feekes 11.3 or at 0, 16, 30, and 45 days after the fungicide application. Plots were harvested on 28 Aug when kernels had 3 to 5% 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 control. 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 first observed on AvS in late Jun when plants were at the early tillering stage (Feekes 5). The disease reached 90-100% severity in the non-sprayed susceptible check plots on 19 Jul at Feekes 11.1, 30 days after the fungicide application. The applications of Quilt Xcel 2.2SE at 14 fl oz/A controlled 83% of the stripe rust based on the susceptible check AvS. The fungicide application significantly reduced the rAUDPC for 17 cultivars in addition to the susceptible check, while the remaining 6 cultivars did not have significant stripe rust. The fungicide application significantly protected grain test weight of the susceptible check (AvS) and four commercially grown cultivars (WB-1035CL+, Kelse, Espresso, and Whit). The fungicide application significantly protected the grain yields of the susceptible check and five cultivars (WB6341, WB-1035CL+, Solano, Babe, and Alpowa), and the significantly protected yields ranged from 13.4 to 41.4 bu/A (18.9-92.8%) over their non-sprayed yields, whereas the yields of the remaining 18 cultivars (JD, Melba, Kelse, SY 605CL, Buck Pronto, Alum, WB Hartline, SY Steelhead, Dayn, Espresso, Seahawk, Louise, Whit, Chet, Glee, WB6121, WB9518, and Diva) were not significantly different between the sprayed and non-sprayed treatments, indicating that these cultivars have adequate levels of resistance against stripe rust under the severe level of epidemic. These data also indicated that stripe rust caused yield loss of 41.4 bu/A (48.1%) on the susceptible check and 6.2 bu/A (7.4%) on average across the commercially grown cultivars. Under the severe stripe rust epidemic in 2017, about 22% of the spring wheat cultivars needed application of effective fungicide, such as Quilt Xcel, to protect yield.

Wheat cultivar <sup>z</sup>	rAUDPC (%) <sup>y</sup>			Test weight (lb/bu) <sup>x</sup>			Yield (bu/A) <sup>x</sup>		
	No spray	Spray <sup>w</sup>	Reduction <sup>v</sup>	No spray	Spray <sup>w</sup>	Protected <sup>v</sup>	No spray	Spray <sup>w</sup>	Protected <sup>v</sup>
AvS	100.0	17.2	82.8* <sup>u</sup>	57.1	61.1	4.0* <sup>u</sup>	44.6	86.0	41.4* <sup>u</sup>
WB6341	27.6	3.2	24.4*	60.1	61.7	1.6	75.2	96.2	21.0*
WB-1035CL+	76.5	4.2	72.3*	56.6	59.1	2.5*	53.2	67.3	14.1*
Solano	19.5	3.3	16.2*	58.8	59.6	0.8	80.0	99.4	19.4*
Babe	54.7	5.9	48.8*	59.6	60.4	0.8	63.2	78.5	15.3*
Alpowa	41.6	7.8	33.8*	59.0	59.8	0.8	70.9	84.3	13.4*
JD	2.9	1.9	1.0	61.3	61.3	0.0	63.2	72.9	9.7
Melba	3.1	1.5	1.6	60.7	62.1	1.4	66.3	75.6	9.3
Kelse	23.1	3.6	19.5*	57.8	61.3	3.5*	82.3	92.5	10.2
SY605CL	37.3	2.5	34.8*	60.0	61.1	1.1	63.4	71.2	7.8
Buck Pronto	16.8	3.6	13.2*	60.9	61.5	0.6	79.3	88.8	9.5
Alum	10.7	1.5	9.2*	61.4	61.4	0.0	84.7	94.7	10.0
WB Hartline	6.7	2.8	3.9*	61.3	61.7	0.4	79.0	86.4	7.4
SY Steelhead	11.3	2.5	8.8*	62.7	62.8	0.1	67.1	72.0	4.9
Dayn	2.5	1.5	1.0	61.2	61.9	0.7	91.3	96.4	5.1
Espresso	15.7	3.3	12.4*	55.5	57.9	2.4*	77.0	80.7	3.7
Seahawk	1.5	1.5	0.0	60.0	58.9	-1.1	91.6	93.7	2.1
Louise	6.3	2.8	3.5	57.9	58.3	0.4	72.6	73.9	1.3
Whit	40.9	4.0	36.9*	57.9	60.0	2.1*	90.1	89.9	-0.2
Chet	9.0	1.9	7.1*	62.2	62.8	0.6	98.3	94.7	-3.6
Glee	13.0	2.9	10.1*	60.9	61.1	0.2	80.1	77.2	-2.9
WB6121	4.0	2.8	1.2	61.8	61.8	0.0	89.1	85.0	-4.1
WB9518	2.5	1.9	0.6	60.7	59.7	-1.0	82.1	77.5	-4.6
Diva	9.1	3.3	5.8*	58.9	60.0	1.1	80.0	74.2	-5.8
Mean (excl. AvS)	19.0	3.1	15.9*	59.9	60.7	0.8	77.4	83.6	6.2
R <sup>2</sup>	1.0			0.6			0.8		
CV	20.5			2.5			9.9		
P-value	<0.0001			<0.0001			<0.0001		
LSD (P ≤ 0.05)	3.7			2.1			11.1		

<sup>z</sup> Wheat genotype 'Avocet S' (AvS) was used as a susceptible check, and the remaining 23 cultivars were selected based on their planted acreage in the State of Washington in 2016, which were also major cultivars planted in Idaho and Oregon.

<sup>y</sup> 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 3-4 (19 Jun), Feekes 10.1 (5 Jul), Feekes 11.1 (19 Jul), and Feekes 11.3 (3 Aug). Stripe rust severity was recorded as percentage of whole plot leaf area with disease. Relative AUDPC (rAUDPC) was calculated for each treatment as the percent of the AUDPC (as 100%) of the susceptible check without fungicide application.

<sup>x</sup> Test weight (lb/bu) and yield (bu/A) based on 3 to 5% kernel moisture.

<sup>w</sup> Fungicide, Quilt Xcel 2.2SE, was sprayed at the rate of 14.0 fl oz/A mixed with surfactant M90 at 0.25% v/v on 19 Jun when most cultivars were at the early jointing stage (Feekes 3-4) and susceptible check AvS plants had no stripe rust.

<sup>v</sup> 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 as the benefits of the fungicide application.

<sup>u</sup> The '\*' indicates that the value is significant at  $P = 0.05$  as determined by LSD test.