

### Evaluation of foliar fungicide treatments for control of stripe rust on spring wheat in 2017.

The study was conducted in a field with Palouse silt loam soil near Pullman, WA. Stripe rust susceptible 'Avocet S' spring wheat was seeded in rows spaced 14-in. apart at 60 lb/A (99% germination rate) with a drill planter on 11 May. Urea fertilizer (46-0-0) was applied at the rate of 100 lb/A at the time of planting. A mixture of herbicides (Huskie, 15 fl oz/A; Axial XL, 16.4 fl oz/A; Starane Flex, 13.5 fl oz/A; and M-90, 10.4 fl oz/A) was applied to the entire field to control weeds on 14 Jun when wheat plants were at the early jointing stage (Feekes 5). Before the first fungicide application, the field was divided into individual plots of 4.5 ft (4 rows) in width and 15.6 to 17.0 ft in length by eliminating plants between plots by spraying herbicide (Glystar, 88.7 ml/gal plus M-90 0.25% v/v) on 18 Jun. Fungicides were applied in 16 gal water/A on different dates and stages depending upon the treatment. The first fungicide application timing at the early jointing stage (Feekes 5) was made on 19 Jun when stripe rust was 0 to 5% severity in some plots. The second application timing at the boot stage (Feekes 10) was conducted on 30 Jun when stripe rust in the non-treated plots was 5 to 10% severity. A 601C backpack sprayer was used with a CO<sub>2</sub>-pressurized spray boom at 18 psi having three operating 0.25-in. nozzles spaced 19-in. apart. A randomized complete block design was used with four replications. Disease severity (percentage of diseased foliage per whole plot) was assessed from each plot on 19 Jun, 29 Jun, 13 Jul, 27 Jul (data not presented), and 3 Aug or 4 days before and 6, 20, 34, and 41 days after the first fungicide application timing, respectively. Plots were harvested on 30 Aug when kernels had 3 to 5% kernel moisture and test weight of kernels was measured. Area under disease progress curve (AUDPC) was calculated for each plot using the five sets of severity data. Relative AUDPC (rAUDPC) was calculated as percent of the non-treated check. Rust severity, rAUDPC, test weight, and yield data were subjected to analysis of variance and means were separated by Fisher's protected LSD test.

Stripe rust started developing in the plots in early Jun when plants were at the early jointing stage (Feekes 4) and reached 100% severity in late Jul at the milk stage in the non-treated check plots (data not presented). The rAUDPC values of all treatments, ranging from 5.5 to 57.7%, were significantly less than the non-treated check (100%). Twelve treatments, which all had applications at both Feekes 5 and 10 provided the best control, except the treatments with F9654-1 5.54 fl oz/A applied at Feekes 5 followed by Topguard EQ 7.0 fl oz/A applied at Feekes 10 and F9654-1 3.0 fl oz/A applied at Feekes 5 followed by Topguard 14.0 fl oz/A applied at Feekes 10. Ten treatments had significantly greater test weight than the non-treated check. All treatments significantly increased yield compared with the non-treated check, and the increases ranged from 10.6 bu/A (26%) by the treatment of Tilt 2.0 fl oz/A applied at Feekes 5 to 32.8 bu/A (80%) by the treatment of F9654-1 5.54 fl oz/A applied at Feekes 5 followed by Topguard EQ 7.0 fl oz/A applied at Feekes 10. Yields of seven treatments were not significantly different from the greatest yield, and those treatments included six treatments with both the Feekes 5 and 10 applications and only one treatment (Quilt Xcel 14.0 fl oz/A) applied at Feekes 10.

Treatment, rate/A	Growth stage <sup>y</sup> (Feekes)	Stripe rust severity (%) <sup>z</sup>				Relative AUDPC <sup>x</sup>	Test weight <sup>w</sup> (lb/bu)	Yield <sup>w</sup> (bu/A)
		19 Jun Jointing	29 Jun Boot	13 Jul Flowering	3 Aug dough			
Non-treated	---	1.0 b <sup>v</sup>	5.0 b-e	97.5 a	100.0 a	100.0 a	61.7 c	41.1 j
Tilt 3.6EC, 2.0 fl oz <sup>t</sup>	5	1.0 b	3.0 d-g	7.5 d	97.5 a	50.2 c	62.5 a-c	51.7 i
Alto 100SL, 4.0 fl oz <sup>t</sup>	5	4.0 a	5.3 b-d	27.5 b	92.5 ab	57.7 b	63.1 a-c	60.2 h
Quilt Xcel 2.2SE, 7.0 fl oz <sup>t</sup>	5	4.3 a	1.5 g	12.5 c	87.5 bc	49.3 c	62.7 a-c	63.7 e-h
Trivapro 2.2SE, 9.0 fl oz <sup>t</sup>	5	4.0 a	1.0 g	8.8 cd	85.0 bc	46.9 cd	62.3 a-c	63.0 f-h
Trivapro 2.2SE, 9.4 fl oz <sup>t</sup>	5	4.0 a	1.0 g	8.8 cd	87.5 bc	43.5 d	62.8 a-c	63.8 e-h
Alto 100SL, 4.0 fl oz <sup>t</sup> fb <sup>u</sup> Trivapro 2.2SE, 13.7 fl oz <sup>t</sup>	5 fb <sup>u</sup> 10	3.0 ab	4.3 b-f	1.0 f	11.3 ef	6.6 hi	63.7 ab	73.4 ab
Quilt Xcel 2.2SE, 7.0 fl oz <sup>t</sup> fb Quilt Xcel 2.2SE, 14.0 fl oz <sup>t</sup>	5 fb 10	4.0 a	3.5 cd	1.0 f	12.5 d-f	7.1 hi	63.4 ab	68.7 a-f
Trivapro 2.2SE, 9.0 fl oz <sup>t</sup> fb Trivapro 2.2SE, 13.7 fl oz <sup>t</sup>	5 fb 10	4.0 a	1.5 g	1.0 f	10.0 ef	6.4 hi	63.1 a-c	73.0 a-c
Trivapro 2.2SE, 9.4 fl oz <sup>t</sup> fb Trivapro 2.2SE, 13.7 fl oz <sup>t</sup>	5 fb 10	4.0 a	1.3 g	1.0 f	11.3 ef	6.5 hi	63.8 ab	70.1 a-e
Topguard EQ, 7.0 fl oz fb Topguard EQ, 7.0 fl oz	5 fb 10	3.0 ab	1.3 g	1.0 f	12.5 d-f	7.4 g-i	63.6 ab	66.6 d-h
Topguard 1.04SC, 10.0 fl oz fb Topguard 1.04SC, 14.0 fl oz	5 fb 10	4.0 a	5.0 b-e	1.0 f	15.0 d-f	7.6 g-i	63.7 ab	65.6 e-h
Topguard EQ, 7.0 fl oz fb Topguard 1.04SC, 14.0 fl oz	5 fb 10	5.0 a	2.3 fg	1.0 f	12.5 d-f	7.2 hi	63.3 ab	69.6 a-e
F9654-1, 5.54 fl oz fb Topguard EQ, 7.0 fl oz	5 fb 10	4.0 a	3.3 d-g	2.0 ef	13.8 d-f	10.0 f-h	63.7 ab	73.9 a
F9654-1, 3.0 fl oz fb Topguard 1.04SC, 14.0 fl oz	5 fb 10	4.0 a	4.3 b-f	5.0 de	20.0 d	14.1 ef	63.9 a	66.8 c-g
F9654-1, 5.54 fl oz fb F9654-1, 5.54 fl oz	5 fb 10	3.0 ab	6.0 bc	2.0 ef	13.8 d-f	8.6 g-i	63.2 a-c	67.3 b-g
Tilt 3.6EC, 4.0 fl oz <sup>t</sup> fb Tilt 3.6EC, 4.0 fl oz <sup>t</sup>	5 fb 10	1.0 b	3.5 c-g	1.0 f	17.5 de	7.8 g-i	62.9 a-c	72.9 a-d
Approach 2.08SC, 3.0 fl oz <sup>t</sup> fb Approach 2.08SC, 6.0 fl oz <sup>t</sup>	5 fb 10	3.0 ab	2.5 e-g	1.0 f	13.8 d-f	5.5 i	63.6 ab	64.7 e-h
Approach Prima 280SC, 5.5 fl oz <sup>t</sup> fb Approach 2.08SC, 6.0 fl oz + Tilt 3.6EC, 4.0 fl oz <sup>t</sup>	5 fb 10	5.0 a	1.3 g	1.0 f	12.5 d-f	5.9 hi	62.5 a-c	66.5 d-h
Tilt 3.6EC, 4.0 fl oz <sup>t</sup>	5	3.0 ab	6.3 ab	25.0 b	92.5 ab	59.6 b	63.2 a-c	61.2 gh
Tilt 3.6EC, 4.0 fl oz <sup>t</sup>	10	3.0 ab	8.8 a	8.8 cd	16.3 d-f	14.3 e	63.2 a-c	53.4 i
Quilt Xcel 2.2SE, 14.0 fl oz <sup>t</sup>	5	5.0 a	4.3 b-f	25.0 b	82.5 c	55.8 b	63.0 a-c	64.3 e-h
Quilt Xcel 2.2SE, 14.0 fl oz <sup>t</sup>	10	3.0 ab	5.0 b-e	6.3 d	12.5 d-f	11.5 e-g	62.8 a-c	68.7 a-f
Tilt 3.6EC, 4.0 fl oz <sup>t</sup> fb Quilt Xcel 2.2SE, 14.0 fl oz <sup>t</sup>	5 fb 10	3.0 ab	6.3 ab	1.0 f	8.8 f	6.6 hi	63.4 ab	65.3 e-h
CV	---	53.6	51.6	26.8	14.2	11.9	1.8	7.0
<i>p</i> -value	---	0.1	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
LSD ( <i>P</i> ≤ 0.05)	---	2.6	2.6	3.9	7.9	4.2	1.6	6.4

<sup>z</sup> Stripe rust severity was recorded as percentage of whole plot leaf area with disease.

<sup>y</sup> The first application at Feekes 5 was done on 19 Jun when wheat plants were at the early jointing stage; and the second application at Feekes 10 was done on 30 Jun when wheat plants were at the boot stage.

<sup>x</sup> AUDPC is area under the disease progress curve, =  $\sum[\text{rust severity (i)} + \text{rust severity (i+1)}]/2 \times \text{days}$ . Relative AUDPC was calculated for each treatment as the percent of the AUDPC (as 100%) of the nontreated.

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

<sup>v</sup> Column numbers followed by the same letter are not significantly different at *P* = 0.05 as determined by LSD test.

<sup>u</sup> fb, followed by.

<sup>t</sup> Nonionic surfactant (NIS) M-90 was mixed with the fungicide at 0.25%.