

Control of stripe rust of winter wheat with various foliar fungicides, 2015.

The study was conducted in a field with Palouse silt loam soil near Pullman, WA. Stripe rust susceptible 'PS 279' winter wheat was seeded in rows spaced 14-in. apart at 60 lb/A (99% germination rate) with a drill planter on 16 Oct 2014. Nitrogen fertilizer (46-0-0) was applied at the rate of 100 lb/A at the time of planting and also applied at the rate of 100 lb/A on 1 May when plants were between Feekes 4 and 5. Before the first fungicide application, the field was divided into individual plots of 4.5 ft (4 rows) in width and 16.0 to 17.1 ft in length by eliminating plants between plots by spraying herbicide (Allecto, 24 fl oz/A mixed with surfactant M-90, 14 fl oz/A) on 4 May. Herbicides (Huskie, 15 fl oz/A, Axial XL, 16.4 fl oz/A, and M-90, 10.4 fl oz/A) were applied to the entire field to control weeds on 8 May when wheat plants were at the early jointing stage (Feekes 5). 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 6 May when stripe rust was 0 to 1% severity in the field. The second application was done at the boot stage (Feekes 10) on 20 May when stripe rust in the plots without first fungicide application reached 1 to 5% severity. A 601C backpack sprayer was used with a CO₂-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 6 May (data not presented), 20 May, 15 Jun, 22 Jun, and 30 Jun or 0, 14, 40, 47, and 55 days after the first fungicide application timing, respectively. Plots were harvested on 4 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 control. 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 from natural infection started developing in the plots in early May when plants were at the early jointing stage (Feekes 5) and reached 80% and 100% severity at the flowering and milk stages, respectively in the non-treated check plots. All fungicide treatments significantly reduced rust severity compared to the non-treated at the flowering, milk, and dough stages, except the treatments of Tilt 2.0 fl oz/A and Tilt 4.0 fl oz/A applied at Feekes 5 recorded at the milk and/or dough stages. The rAUDPC values of all treatments were significantly less than the non-treated. All treatments provided similar control of stripe rust except Tilt 2.0 fl oz/A and Tilt 4.0 fl oz/A applied at Feekes 5 and Quadris 8.0 fl oz/A applied at Feekes 10. All treatments significantly increased test weight compared to the non-treated. The treatments of HM 0812 10.5 fl oz/A applied at Feekes 10, Tilt 2.0 fl oz/A applied at Feekes 5 followed by Quilt Xcel 10.5 fl oz/A applied at Feekes 10, Tilt 4.0 fl oz/A applied at Feekes 5 followed by Quilt Xcel 10.5 fl oz/A applied at Feekes 10, and Tilt 4.0 fl oz/A applied at Feekes 10 produced the greatest test weight. Except the treatments of Tilt 2.0 fl oz/A and Tilt 4.0 fl oz/A applied at Feekes 5, all treatments significantly increased yield compared with the non-treated, and the significant increases ranged from 20.7% following the application of A15457K 4.0 fl oz/A + Quilt Xcel 10.5 fl oz/A at Feekes 5 followed by A15457K 4.0 fl oz/A + Quilt Xcel 10.5 fl oz/A at Feekes 10 to 34.3% by the treatment of HM 0812 14.0 fl oz/A applied at Feekes 10. Except these two treatments, the yields of the other treatments with significant yield increases compared to the non-treated were not significantly different from these two treatments and also were not significantly different from each other.

Treatment, rate/A	Growth stage ^y (Feekes)	Stripe rust severity (%) ^z					Relative AUDPC ^x	Test weight ^w (lb/bu)	Yield ^w (bu/A)
		20 May Boot	15 Jun Flowering	22 Jun Milk	30 Jun Dough				
Non-treated	---	2.0 ab ^v	80.0 a	100.0 a	100.0 a	100.0 a	51.4 d	74.7 g	
Tilt 3.6EC, 2.0 fl oz ^s	5	1.0 bc	28.8 b	72.5 b	100.5 a	57.7 c	54.6 c	81.1 cd	
Tilt 3.6EC, 4.0 fl oz ^s	5	1.0 bc	27.5 b	95.0 a	100.0 a	63.7 b	54.6 bc	80.1 d	
A15457K 100EC, 4.0 fl oz + Quilt Xcel 2.2SE, 10.5 fl oz fb ^t A15457K 100EC, 4.0 fl oz + Quilt Xcel 2.2SE, 10.5 fl oz ^u	5 fb ^t 10	1.3 abc	1.3 ef	3.5 c	3.5 c	3.4 e	57.0 abc	90.1 bc	
A15457K 100EC, 3.0 fl oz + Quilt Xcel 2.2SE, 7.5 fl oz fb A15457K 100EC, 4.0 fl oz + Quilt Xcel 2.2SE, 10.5 fl oz ^u	5 fb 10	1.0 bc	1.0 f	5.0 c	5.0 bc	3.8 de	56.0 abc	98.9 ab	
Tilt 3.6EC, 2.0 fl oz fb A15457K 100EC, 4.0 fl oz + Quilt Xcel 2.2SE, 10.5 fl oz ^u	5 fb 10	1.0 bc	2.0 def	3.5 c	3.5 c	3.7 de	56.4 abc	96.1 ab	
Tilt 3.6EC, 2.0 fl oz fb Quilt Xcel 2.2SE, 10.5 fl oz ^s	5 fb 10	1.0 bc	1.0 f	2.8 c	4.3 bc	3.0 e	57.5 a	93.5 ab	
Tilt 3.6EC, 4.0 fl oz fb Quilt Xcel 2.2SE, 10.5 fl oz ^s	5 fb 10	1.0 bc	1.0 f	4.3 c	5.0 bc	3.6 de	57.6 a	95.0 ab	
A15457K 100EC, 4.0 fl oz + Quilt Xcel 2.2SE, 10.5 fl oz ^u	10	1.0 bc	1.5 def	4.3 c	4.3 bc	3.7 de	57.3 abc	99.6 ab	
A15457K 100EC, 4.0 fl oz + Quilt Xcel 2.2SE, 10.5 fl oz ^s	10	1.0 bc	1.0 f	4.3 c	5.0 bc	3.6 de	56.5 abc	93.3 ab	
Approach Prima 2.34SC, 3.4 fl oz ^s	10	1.0 bc	1.3 ef	4.3 c	5.0 bc	3.7 de	57.4 ab	96.7 ab	
Approach Prima 2.34SC, 6.8 fl oz ^s	10	1.0 bc	1.5 def	5.0 c	5.0 bc	4.3 de	55.9 abc	92.7 ab	
Caramba 90SL, 5.0 fl oz ^u	10	0.8 c	3.5 d	2.8 c	3.5 c	4.3 de	57.3 abc	94.7 ab	
HM-0812 1.66SC, 10.5 fl oz	10	1.0 bc	1.3 ef	3.5 c	5.0 bc	3.5 e	57.7 a	92.1 ab	
HM-0812 1.66SC, 14.0 fl oz	10	1.0 bc	2.0 def	5.8 c	5.5 bc	4.7 de	55.6 abc	100.3 a	
HM 1456, 10.5 fl oz	10	2.3 a	2.0 def	4.3 c	4.3 bc	5.1 de	56.1 abc	97.4 ab	
HM 1456, 14.0 fl oz	10	1.5 abc	1.3 ef	4.3 c	4.3 bc	4.0 de	57.4 abc	94.1 ab	
Quadris 2.08SC, 8.0 fl oz	10	1.3 abc	6.3 c	6.3 c	6.3 b	8.0 d	56.1 abc	97.3 ab	
Quilt Xcel 2.2SE, 10.5 fl oz ^s	10	1.0 bc	1.0 f	5.5 c	6.3 b	4.1 de	56.4 abc	97.1 ab	
Tilt 3.6EC, 4.0 fl oz ^s	10	1.3 abc	3.3 de	6.3 c	5.0 bc	5.8 de	57.5 a	93.1 ab	
CV	---	61.58	17.17	56.22	7.57	21.25	3.55	7.62	
<i>p</i> -value	---	0.43	<0.0001	<0.0001	<0.0001	<0.0001	<0.009	<0.0001	
LSD (<i>P</i> ≤ 0.05)	---	1.01	2.04	13.63	2.04	4.41	2.83	10.01	

^z Stripe rust severity was recorded as percentage of whole plot leaf area with disease.

^y The first application at Feekes 5 was done on 6 May when wheat plants were at the early jointing stage and the second application at Feekes 10 was done on 20 May when wheat plants were at the boot stage.

^x 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.

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

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

^u Non-ionic (NIS) 90% SL 0.25% v/v tank mixed with the fungicide.

^t fb, followed by.

^s Crop oil concentrate (COC) SL 1% v/v mixed with the fungicide.