

### Control of stripe rust of spring wheat with various foliar fungicides, 2014.

The study was conducted in a field with Palouse silt loam near Pullman, WA. Nitrogen fertilizer (46-0-0) was applied at 100 lb/A at the time of cultivation on 6 May 2014. Stripe rust susceptible 'Lemhi' spring wheat was seeded in rows spaced 14-in. apart at 80 lb/A (99% germination rate) with a drill planter on 6 May. Herbicides (Huskie, 15 fl oz/A, Axial, 12 fl oz/A, and M-90, 14 fl oz/A) were applied on 22 May when wheat plants were at the tillering stage (Feekes 2). The field was inoculated with a mixture of urediniospores of locally predominant races PSTv-14 and PSTv-37 of *Puccinia striiformis* f. sp. *tritici* on 27 May when plants were at the tillering stage (Feekes 2). Before the first fungicide application, the field was divided into individual plots of 4.5 ft (4 rows) in width and 15.5 to 17.1 ft in length by eliminating plants between plots with a rototiller. 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 3 to 5% severity in the field. The second application was done at the boot stage (Feekes 10) on 30 Jun when stripe rust in the plots without first fungicide application reached 15 to 20% severity. 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. 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 18 Jun, 1 Jul, 14 Jul, 21 Jul, and 6 Aug (data not presented) or one day before and 12, 25, 32, and 48 days after the first fungicide application timing, respectively. Plots were harvested on 29 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 five sets of severity data. Relative AUDPC (rAUDPC) was calculated as percent of the nontreated 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.

The first fungicide was applied at Feekes 5 as stripe rust began to develop (3 to 5% severity) and the second application as the disease reached 15 to 25% severity (Feekes 10) in the plots without the first application. Stripe rust reached 100% severity in the nontreated check plots approximately 55 days after inoculation or 32 days after the first application. Stripe rust developed slowly as the weather was hot and dry in Jun and Jul. All fungicide treatments significantly reduced rust severity compared to the nontreated at the flowering stage (Feekes 10.5). The rAUDPC values of all treatments were significantly less than the nontreated. Among all treatments, the treatment of Tilt 2.0 fl oz/A at Feekes 5 followed by Quilt Xcel 10.5 fl oz/A at Feekes 10 provided the best disease control, but four other treatments (Tilt 2.0 fl oz/A at Feekes 5 followed by Quilt Xcel 10.5 fl oz/A + A15457 4.1 fl oz/A at Feekes 10; A15457 2.74 fl oz/A + Tilt 2.72 fl oz/A + Quadris 4.1 fl oz/A at Feekes 5 followed by Quilt Xcel 10.5 fl oz/A at Feekes 10; Aproach 3.0 fl oz/A at Feekes 5 followed by Aproach 6.8 fl oz/A at Feekes 10; and Aproach 3.0 fl oz/A + Tilt 4.0 fl oz/A at Feekes 5 followed by Aproach 6.0 fl oz/A + Tilt 4.0 fl oz/A at Feekes 10) had similar control. None of the treatments significantly increased or decreased test weight compared with the nontreated. Except Viathon 32 fl oz/A and CHA-073 14 fl oz/A at Feekes 10, all treatments significantly increased the yield compared with the nontreated. The significant yield increases ranged from 28.4% (by the treatment of Equation 4.0 fl oz/A at Feekes 10) to 161.1% (by the treatment of A15457 2.74 fl oz/A + Tilt 2.72 fl oz/A + Quadris 4.1 fl oz/A at Feekes 5 followed by QuiltXcel 10.5 fl oz/A at Feekes 10). The yields of four other treatments (Tilt 2.0 fl oz/A at Feekes 5 followed by Quilt Xcel 10.5 fl oz/A at Feekes 10; Tilt 2.0 fl oz/A at Feekes 5 followed by Quilt Xcel 10.5 fl oz/A + A15457 4.1 fl oz/A at Feekes 10; Aproach 3.0 fl oz/A at Feekes 5 followed by Aproach 6.8 fl oz/A at Feekes 10; and Aproach 3.0 fl oz/A + Tilt 4.0 fl oz/A at Feekes 5 followed by Aproach 6.0 fl oz/A + Tilt 4.0 fl oz/A at Feekes 10) were similar to the greatest.

Treatment; rate [fl oz/A]	Growth stage <sup>y</sup> (Feekes)	Stripe rust severity (%) <sup>x</sup>				Relative AUDPC <sup>x</sup>	Test weight <sup>w</sup> (lb/bu)	Yield <sup>w</sup> (bu/A)
		18 Jun Jointing	1 Jul Boot	14 Jul Flowering	21 Jul Milk			
Nontreated	---	2.0 b <sup>y</sup>	16.3 a	65.0 a	100.0 a	100.0 a	54.9 a	18.4 j
A15457 100 EC; 2.74 oz + Tilt 3.6 EC; 4.0 oz <sup>u</sup>	10	2.0 a	11.3 abc	17.5 c	18.8 cd	25.5 bcd	56.4 a	33.8 b
A15457 100 EC; 4.1 oz + Tilt 3.6 EC; 4.0 oz + Quadris 250 SC; 6.0 oz <sup>t</sup>	10	2.8 a	12.5 abc	21.3 bc	23.8 bcd	31.4 bcd	55.4 a	29.0 b-f
A15457 100 EC; 2.74 oz + Tilt 3.6 EC; 2.72 oz + Quadris 250 SC; 4.1 oz fb Quilt Xcel 2.2 SE; 10.5 oz <sup>u</sup>	5 fb 10	2.0 b	1.0 d	2.0 d	2.0 e	4.2 e	55.0 a	48.0 a
Approach 2.08 SC; 3.0 oz fb Approach 2.08 SC; 6.8 oz <sup>s</sup>	5 fb 10	2.8 ab	1.0 d	2.0 d	2.0 e	4.4 e	55.1 a	43.3 a
Approach 2.08 SC; 3.0 oz + Tilt 3.6 EC; 4.0 oz fb Approach 2.08 SC; 6.0 oz + Tilt 3.6 EC; 4.0 oz <sup>s</sup>	5 fb 10	2.0 b	1.0 d	1.3 d	2.0 e	3.6 e	55.4 a	43.3 a
Approach Prima 2.34 SC; 6.8 oz <sup>s</sup>	10	2.8 ab	9.3 c	21.3 bc	21.3 bcd	27.5 bcd	55.4 a	24.6 f-i
CHA-073 2.2 SC; 7.0 oz	10	2.8 a	12.5 abc	18.8 bc	18.8 cd	26.7 bcd	55.8 a	28.3 c-g
CHA-073 2.2 SC; 10.5 oz	10	2.0 b	12.5 abc	21.3 bc	22.5 bcd	29.6 bcd	56.0 a	30.6 b-e
CHA-073 2.2 SC; 14.0 oz	10	2.8 ab	12.5 abc	21.3 bc	20.0 bcd	28.4 bcd	55.6 a	23.1 hij
Equation 2.08 SC; 4.0 oz	10	2.0 b	10.0 bc	28.8 b	28.8 b	36.5 b	54.8 a	23.6 ghi
Equation 2.08 SC; 8.0 oz	10	2.0 b	11.3 abc	23.8 bc	23.8 bcd	30.5 bcd	55.0 a	27.8 c-h
Equation 2.08 SC; 16.0 oz	10	2.0 b	12.5 abc	21.3 bc	25.0 bc	32.1 bcd	56.0 a	29.9 b-e
HM 0812; 10.5 oz	10	2.0 b	10.0 bc	15.0 c	15.0 d	22.2 d	55.7 a	30.9 bcd
HM 0812; 14.0 oz	10	3.5 a	12.5 abc	17.5 c	21.3 bcd	28.5 bcd	55.7 a	25.6 e-i
Quadris 2.08 SC; 8.0 oz	10	2.0 b	11.3 abc	23.8 bc	23.8 bcd	31.9 bcd	55.6 a	28.5 c-g
Quilt Xcel 2.2 SC; 10.5 oz	10	2.8 ab	15.0 ab	21.3 bc	23.8 bcd	31.8 bcd	55.9 a	23.7 ghi
Quilt Xcel 2.2 SE; 10.5 oz <sup>u</sup>	10	2.0 ab	12.5 abc	21.3 bc	22.5 bcd	29.3 bcd	55.7 a	32.5 bc
Quilt Xcel 2.2 SE; 10.5 oz + A15457 100 EC; 4.1 oz <sup>u</sup>	10	2.0 b	11.3 abc	16.3 c	18.8 cd	25.1 cd	55.8 a	28.8 c-h
Tilt 3.6 EC; 4.0 oz	10	2.0 b	15.0 ab	25.0 bc	25.0 bc	33.8 bc	55.6 a	26.4 d-i
Tilt 3.6 EC; 2.0 oz fb <sup>t</sup> Quilt Xcel 2.2 SE; 10.5 oz <sup>u</sup>	5 fb <sup>t</sup> 10	2.0 b	1.0 d	1.3 d	1.0 e	2.9 e	55.7 a	43.6 a
Tilt 3.6 EC; 2.0 oz fb Quilt Xcel 2.2 SE; 10.5 oz + A15457 100 EC; 4.1 <sup>u</sup>	5 fb 10	2.0 b	1.0 d	1.3 d	1.3 e	3.3 e	55.4 a	43.9 a
Viathon 5.1 SC; 32 oz <sup>f</sup>	10	2.0 b	15.0 ab	23.8 bc	28.8 b	35.6 bc	55.2 a	22.5 ij
R <sup>2</sup>	---	0.25	0.69	0.79	0.92	0.89	0.13	0.87
CV	---	37.46	38.51	41.19	30.68	28.91	2.09	11.70
p-value	---	0.44	<0.0001	<0.0001	<0.0001	<0.0001	0.98	0.0001
LSD ( $P \leq 0.05$ )	---	1.19	5.39	10.90	9.21	11.08	1.63	5.09

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

<sup>z</sup> The first application at Feekes 5 was done on 13 May when wheat plants were at the early jointing stage and the second application at Feekes 8 was done on 30 May when wheat plants were at the late jointing 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 (lb/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> Crop oil concentrate (COC) SL 1% v/v mixed with the fungicide.

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

<sup>s</sup> Non-ionic (NIS) 90% SL 25% v/v tank mixed with the fungicide.