Figure 1. Severe stripe rust observed on an early planted winter wheat field in Horse Heaven Hills on Nov. 9, 2010. Photo courtesy of Nathan Clemens.

Stripe rust: the good, bad and ugly

By Xianming Chen

The level of stripe rust severity has varied considerably since 2010, with the disease incidence greater in 2010 and 2011 than it was in 2012 and 2013. The difference between years has many causes.

In 2010, wheat stripe rust was a national problem with the widest distribution, the greatest use of fungicides and the highest estimated yield loss (95.7 million bushels) in recorded history. In the PNW, the potential yield loss on susceptible cultivars was determined to be more than 60 percent. In Washington alone, growers spent about $27 million on fungicide applications, but that likely saved 13.7 million bushels of grain, worth more than $96 million. The major factor causing the epidemic was a long period of cool and wet weather in the spring and early summer both east of the Rocky Mountains and in the West.

In 2011, the nationwide stripe rust epidemic was not as severe as 2010, causing a yield loss of about 35.25 million bushels. The low level was mainly due to widespread drought conditions in states east of the Rocky Mountains. The stripe rust epidemic in the PNW, however, was arguably the most severe since 1981.

The potential yield loss was assayed at more than 90 percent on susceptible winter wheat varieties and about 45 percent on susceptible spring wheat varieties. Fungicide application cost growers more than $30 million, which saved more than 20 million bushels, worth more than $136 million in Washington.

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The PNW's severe epidemic in 2011 can be attributed to several factors:

- 2010's delayed wheat crops due to cool and moist weather conditions provided a huge amount of viable rust spores in the fall;
- The heavy spore load and unusually high precipitation levels in September and October 2010;
- High survival of stripe rust due to a relatively mild winter, especially snow cover during cold spells;
- The unusually early start and widespread stripe rust development throughout the state's winter wheat fields; and
- The abnormally long rust season which caused devastating damage on susceptible and moderately susceptible varieties. Even moderately resistant varieties had significant yield losses.

The 2012 and 2013 stripe rust outbreaks were less severe than those of 2010 and 2011, but still significant. In 2012, stripe rust caused a 57.5 percent yield loss on susceptible winter wheat varieties and a 35.9 percent loss on susceptible spring wheat varieties. In 2013, yield losses of susceptible varieties were 34.2 percent for winter wheat and 20.1 percent for spring wheat. Commercially grown winter wheat varieties would have had a yield loss of 16 percent in 2012 and 10 percent in 2013 without fungicide use. Spring wheat varieties would have had an average yield loss of 27 percent in 2012 and 6 percent in 2013 without fungicides. These figures are all higher than the average over the last decade, 2002-2013, except for spring wheat in 2013.

During the 12-year period, stripe rust on susceptible checks caused average yield losses of 43.71 percent on winter wheat and 32.80 percent on spring wheat. Of commercially grown varieties, that translates to an 8.47 percent loss on winter wheat and a 12.74 percent loss on spring if fungicides had not been used.

From 2002 to 2013, extremely severe epidemics (more than 60 percent yield loss on susceptible checks) occurred two times (2010 and 2011), severe epidemics (40 to 60 percent loss) occurred three times (2005, 2007 and 2012), moderate epidemics (20 to 40 percent) occurred seven times (2001, 2002, 2003, 2004, 2006, 2008 and 2013), and low epidemics (less than 20 percent) occurred one time (2009).

Variations in epidemic levels were mainly caused by weather conditions and variety changes. In 2012, the disease started about one week later than normal, but still developed to a severe level due to relatively favorable weather in the late spring and summer. In contrast, rust started earlier than normal in 2013, but the hot and dry weather conditions in the late spring and summer stopped its development.

It has been great to see highly resistant varieties becoming more dominant across the state. For example, Norwest 553 became the No. 1 hard red winter wheat variety in 2013, while Bruehl still ranks No. 1 for club wheat and Cara, another club, has gained acreage.

For spring wheat, highly susceptible varieties such as Hank and WBP 926 have disappeared while the highly resistant variety, Expresso, became the No. 1 hard red spring variety and Diva became the No. 2 soft white spring variety. The increased acreage of resistant varieties contributed to the low rust level in 2013, especially in the spring wheat crop.

Although stripe rust is mainly controlled by growing resistant varieties and applying fungicides when needed, cultural practices can play a significant role in disease management. For instance, planting wheat early is not indicated, especially in years of high precipitation, because big plants act as nets for rust spores in the air.

During the last two years, I gladly noted that most wheat fields in the Horse Heaven Hills area were planted later than in the past, likely contributing to the low rust level. On Nov. 11, 2013, my team didn't find any stripe rust in the Horse Heaven Hills or the Connell or Ritzville areas. On Nov. 14, however, we received a report of heavy stripe rust in a field of Eltan planted at the end of July (Fig. 2).

Figure 2. Severe stripe rust observed on November 15 in a field of winter wheat variety Eltan planted at the end of July 2013. Photo courtesy of Nathan Clemens.

Early planting of winter wheat produces huge amounts of rust spores for infecting wheat crops in additional fields before winter, and rust mycelia within the leaves can continue to infect as long as the leaves survive. If early planting is necessary, then selecting resistant varieties with effective, all-stage resistance is key.

Genetic resistance is the most reliable approach to controlling stripe rust, and several effective, all-stage resistance genes have been identified in recent years. We have also developed more than 70 new stripe rust germplasm lines mostly with different resistance genes and provided this genetic stocks to breeding programs.

For breeding programs, it is still better to develop varieties with levels of high temperature adult plant resistance (HTAP) or combine HTAP resistance with effective all-stage resistance in individual varieties. To keep tracking which all-stage resistance genes are effective and which ones are not, we continue to monitor

Table 1. The number of years in test and mean and standard deviation (SD) of grown acreage in Washington, relative area under the disease progress curve (rAUDPC), relative yield loss (rYL), significance of fungicide application (SFA) and rating by rYL for winter wheat varieties tested in 2002 to 2013.

	Variety	No. years in test	Grown acreage (%)[a]		rAUDPC (%)[b]		rYL (%)[c]		SFA[d]		Rating by rYL[e]	
			Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Fungicide application is needed	AP Legacy	2	0.67	0.09	71.32	4.71	94.22	22.95	1.00	0.00	3.50	2.12
	Hatton	3	0.70	0.33	96.85	2.97	102.93	16.80	1.00	0.00	4.00	1.73
	PS 279[f]	12	0.00	0.00	100.00	0.00	100.00	0.00	1.00	0.00	3.42	1.38
	Moreland	2	0.00	0.00	93.92	5.94	91.66	8.14	1.00	0.00	3.50	2.12
	Gaines	1	0.00	-[g]	106.25	-	93.55	-	1.00	-	3.00	-
	Wanser	2	0.08	0.11	72.63	35.93	50.65	14.07	1.00	0.00	3.00	1.41
	ORCF-103	4	4.93	3.33	40.34	17.04	42.65	18.93	1.00	0.00	2.25	0.50
	Basin	1	0.08	-	42.96	-	64.24	-	1.00	-	2.00	-
	Gary	1	0.00	-	45.58	-	29.24	-	1.00	-	2.00	-
	Hubbard	1	0.00	-	12.48	-	20.13	-	1.00	-	2.00	-
	Lewjain	1	0.78	-	22.22	-	41.39	-	1.00	-	2.00	-
	Paha	1	0.00	-	23.13	-	48.39	-	1.00	-	2.00	-
	Declo	4	2.57	2.46	41.67	38.38	43.02	38.35	0.80	0.45	1.80	0.84
App. may/may not needed depending upon stripe rust situation	Eddy	6	0.96	0.79	41.59	30.22	31.59	23.83	0.67	0.52	1.83	0.75
	Tubbs 06	7	1.01	0.99	37.37	32.36	33.57	26.30	0.57	0.53	1.71	0.76
	WPB 470	3	1.34	0.64	54.05	13.94	38.74	1.95	1.00	0.00	1.67	0.58
	Xerpha	7	3.98	4.51	37.39	28.34	27.64	20.01	0.43	0.53	1.57	0.79
	Buchanan	4	1.94	0.83	55.90	29.50	26.95	29.41	0.50	0.58	1.50	0.58
	CDC Falcon	2	0.03	0.05	27.93	39.40	13.13	30.90	0.50	0.71	1.50	0.71
	Nugaines	2	0.00	0.00	35.47	2.87	42.60	5.51	1.00	0.00	1.50	0.71
	Bauermeister	9	1.44	1.89	19.37	17.01	28.01	13.50	0.50	0.53	1.40	0.70
	ORCF-102	9	6.61	6.30	14.87	22.31	14.94	18.92	0.33	0.50	1.33	0.71
	Finch	4	1.06	0.74	0.31	0.63	10.39	17.19	0.25	0.50	1.33	0.58
	Lambert	6	2.28	1.04	20.99	31.77	13.30	33.61	0.67	0.52	1.33	0.82
	Paladin	6	0.93	0.50	30.19	30.27	27.95	7.56	0.67	0.52	1.33	0.52
	Rely	3	0.93	1.04	17.86	13.00	21.61	7.09	0.33	0.58	1.33	0.58
	Finley	7	1.99	1.21	30.13	25.32	20.44	22.54	0.43	0.53	1.29	0.49
	Edwin	4	1.18	1.25	13.84	12.15	8.02	12.93	0.00	0.00	1.25	0.50
	Masami	10	1.07	1.04	12.73	14.50	16.32	14.21	0.30	0.48	1.20	0.42
	Eltan	11	21.45	7.75	15.61	13.09	23.22	17.38	0.27	0.47	1.27	0.65
	MDM	5	0.92	2.06	6.49	5.97	5.98	22.03	0.00	0.00	1.20	0.45
	WPB 528	6	6.84	3.97	11.49	8.97	12.71	8.39	0.33	0.52	1.17	0.41
	Tubbs	7	3.46	3.11	14.69	28.19	8.38	17.99	0.43	0.53	1.14	0.38
	Stephens	10	3.50	1.78	12.94	17.19	10.79	13.45	0.20	0.42	1.10	0.32
Fungicide application is generally not needed	Albion	1	1.07	-	3.30	-	15.12	-	0.00	-	1.00	-
	AP700CL	5	4.88	3.32	6.02	4.85	3.52	15.09	0.40	0.55	1.00	0.00
	Boundary	7	0.49	0.55	20.36	16.62	13.01	20.38	0.00	0.00	1.00	0.00
	Bruehl	10	5.48	2.50	1.90	2.82	3.87	16.79	0.00	0.00	1.00	0.00
	Brundage 96	8	2.04	0.80	10.46	8.27	18.23	7.59	0.38	0.52	1.00	0.00
	Cara	4	1.00	0.81	2.69	2.08	2.31	18.64	0.00	0.00	1.00	0.00
	Cashup	8	1.77	1.29	11.85	15.05	13.90	12.59	0.38	0.52	1.00	0.00
	Chuckar	11	0.93	0.65	1.78	2.77	9.87	9.28	0.27	0.47	1.00	0.00
	Coda	4	0.87	0.87	2.29	1.58	-1.94	14.25	0.25	0.50	1.00	0.00
	Concept	1	0.00	-	3.42	-	-2.35	-	0.00	-	1.00	-
	Daws	1	0.09	-	0.07	-	-26.74	-	0.00	-	1.00	-
	Estica	1	0.14	-	0.36	-	0.00	-	0.00	-	1.00	-
	F1182M1-10	1	0.00	-	0.00	-	-3.45	-	0.00	-	1.00	-
	Farnum	6	1.71	1.49	4.74	3.16	3.42	15.14	0.00	0.00	1.00	0.00
	Foote	1	0.00	-	0.25	-	18.02	-	0.00	-	1.00	-
	Hill 81	1	0.77	-	0.00	-	-9.68	-	0.00	-	1.00	-
	Hiller	1	0.26	-	0.00	-	16.13	-	0.00	-	1.00	-
	Madsen	11	11.09	7.74	1.67	2.64	7.12	6.15	0.09	0.30	1.00	0.00
	Malcolm	1	0.67	-	0.00	-	32.26	-	0.00	-	1.00	-
	MJ-4	2	0.27	0.11	3.11	2.94	-11.68	18.43	0.50	0.71	1.00	0.00
	MJ-9	2	0.00	0.00	0.17	0.01	-3.60	10.94	0.00	0.00	1.00	0.00
	Mohler	3	0.78	0.62	0.30	0.31	3.80	13.51	0.00	0.00	1.00	0.00
	Moro	2	0.49	0.32	27.43	37.02	11.39	2.42	0.00	0.00	1.00	0.00
	Norwest 553	2	2.21	2.64	5.72	0.58	4.34	7.58	0.00	0.00	1.00	0.00
	ORCF 101	5	3.32	1.11	3.43	4.05	13.55	3.42	0.20	0.45	1.00	0.00
	Rjames	1	0.00	-	0.32	-	9.73	-	0.00	-	1.00	-
	Rod	7	4.02	2.76	11.18	15.12	9.63	15.94	0.29	0.49	1.00	0.00
	Rohde	1	0.15	-	0.00	-	6.45	-	0.00	-	1.00	-
	Semper	1	0.41	-	0.00	-	25.29	-	0.00	-	1.00	-
	Simom	1	0.00	-	0.17	-	-8.32	-	0.00	-	1.00	-
	Skiles	2	0.74	0.46	3.37	1.32	17.71	14.49	0.00	0.00	1.00	0.00
	SPN/PS279	1	0.00	-	0.00	-	25.81	-	0.00	-	1.00	-
	Symphony	1	0.44	-	2.35	-	15.41	-	0.00	-	1.00	-
	Temple	1	0.00	-	1.25	-	-6.45	-	0.00	-	1.00	-
	Tres	1	0.00	-	11.25	-	45.16	-	0.00	-	1.00	-
	Trifecta Mix	1	3.40	-	6.85	-	23.65	-	0.00	-	1.00	-
	Weatherford	1	0.33	-	0.00	-	-3.23	-	0.00	-	1.00	-
	Weston	1	0.59	-	1.25	-	-6.45	-	0.00	-	1.00	-
	Wetstone	2	1.11	1.57	12.51	1.12	16.72	5.44	0.00	0.00	1.00	0.00

[a]The percentages of acreage were calculated based on planted acreage against the total winter wheat acreage in Washington. Cultivars or breeding lines with a zero acreage were grown on less than 1,000 acres, seed not available for commercial fields or never released. Most cultivars grown in Washington were also grown in Idaho and Oregon and some not grown in Washington were grown in Idaho and Oregon.

their reactions in fields and use a newly established set of single-gene lines to differentiate races of the pathogen.

Fungicide application is recommended only when needed. **Highly resistant varieties do not need fungicide application.** Commercially grown varieties and newly developed breeding lines have been characterized into three categories:

- At least one fungicide application may be needed;
- Fungicide application may or may not be needed; and
- Fungicide application is generally not needed based on their resistance/susceptibility to stripe rust and response to fungicide application (See Tables 1 and 2).

I do not recommend fungicide application for other controversial arguments, such as "fungicides have plant vigor effects" or "increased yield." Our experimental data over 12 years does not support such questionable "beneficial" effects.

To decide when to apply fungicides, the following time- or growth-points need to be considered. As mentioned above, stripe rust infection in the fall can be effectively reduced by not planting too early. Seed treatment can be an approach, but currently labeled fungicides and recently tested new chemicals for controlling soil-borne

[b]Relative area under the disease progress curve (rAUDPC) values were calculated as the percentages of the susceptible check's AUDPC in each year.
[c]Relative yield loss (rYL) values in percentage were calculated as the percentages of the susceptible check's yield loss in each year.
[d]Significance of fungicide application (SFA) was determined by the least significant difference (LSD) values for each year experiment, 0 = insignificant and 1 = significant.
[e]In each experiment, a cultivar was rated by its rYL against the experiment rYL LSD, 1 for rYLs less than 1 x the rYL LSD value; 2 for rYLs from equal to the rYL LSD value to less than 2 x the rYL LSD values; 3 for equal to 2 X but less than 3 X the YL LSD value; and so on. For cultivars with a rating equal to or greater than 1, fungicide application is generally recommended.
[f]PS 279 was used as the susceptible check in all years except Walladay was used in 2002.
[g]-Not applicable as there was only one year's data.

Table 2. The number of years in test and mean and standard deviation (SD) of grown acreage in Washington, relative area under the disease progress curve (rAUDPC), relative yield loss (rYL), significance of fungicide application (SFA), and rating by rYL for spring wheat varieties tested from 2002 to 2013

		No. of years	Grown acreage (%)[a]		rAUDPC (%)[b]		rYL (%)[c]		SFA[d]		Rating by rYL[e]	
	Variety	in test	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Fungicide application is needed	Lemhi[f]	11	0.00	0.00	100.00	0.00	100.00	0.00	0.83	0.39	3.00	1.28
	Eden	1	0.00	-	63.72	-	49.67	-	1.00	-	3.00	-
	Penawawa	3	0.80	0.65	66.90	16.00	58.07	6.45	1.00	0.00	2.67	0.58
	Zak	5	5.71	5.86	83.39	21.95	66.05	17.45	1.00	0.00	2.60	0.89
	Jubilee	2	0.00	0.00	86.09	3.89	72.11	4.55	1.00	0.00	2.50	0.71
	Calowa	3	0.03	0.05	65.72	27.52	42.89	8.82	1.00	0.00	2.00	1.00
	Challis	2	0.72	1.01	67.50	2.57	50.51	8.58	1.00	0.00	2.00	0.00
	Edwall	2	1.71	0.85	89.73	6.28	55.53	9.46	1.00	0.00	2.00	0.00
	Macon	2	0.17	0.23	71.97	3.58	45.75	10.72	1.00	0.00	2.00	0.00
	WA7952	1	0.00	-	23.99	-	37.62	-	1.00	-	2.00	-
	Winsome	2	0.00	0.00	68.53	5.41	44.24	12.86	1.00	0.00	2.00	0.00
Application may or may not needed	Nick	8	10.04	3.22	46.74	40.25	49.43	31.92	0.63	0.52	1.50	0.53
	Express	4	3.28	3.24	13.75	12.74	30.26	28.45	0.25	0.50	1.50	0.58
	Alpowa	12	18.72	17.43	31.31	22.40	36.71	28.10	0.58	0.51	1.50	0.52
	Hank	10	5.31	3.80	38.42	45.46	45.58	45.67	0.50	0.53	1.40	0.52
	Lolo	3	0.13	0.22	1.62	2.10	21.35	7.47	0.67	0.58	1.33	0.58
	Scarlet	6	6.37	2.85	52.49	16.10	23.94	15.58	0.83	0.41	1.33	0.52
	Tara 2002	7	2.82	2.50	26.49	42.60	23.14	34.53	0.29	0.49	1.29	0.49
	Babe	5	2.65	5.20	42.31	27.42	41.76	31.42	0.40	0.55	1.20	0.45
	JD	6	0.77	0.97	4.84	4.04	14.74	14.99	0.00	0.00	1.17	0.41
	Kelse	6	4.49	8.00	23.94	19.52	81.37	119.95	0.67	0.52	1.17	0.41
	Whit	6	2.51	4.34	29.34	28.66	12.50	41.46	0.17	0.41	1.17	0.41
	Jefferson	7	5.66	2.44	25.18	24.65	27.78	21.66	0.71	0.49	1.14	0.38
	WPB 926	7	7.19	3.93	16.83	28.72	3.76	67.63	0.63	0.52	1.13	0.35
Fungicide application is generally not needed	Alturas	3	0.00	0.00	22.17	29.72	24.77	31.53	0.00	0.00	1.00	0.00
	Blanca Grande	4	3.13	2.07	1.03	1.49	-7.13	12.04	0.00	0.00	1.00	0.00
	Buck Pronto	1	2.70	-[g]	1.38	-	16.68	-	1.00	-	1.00	-
	Cabernet	2	2.15	3.04	18.12	2.77	31.35	2.12	0.00	0.00	1.00	0.00
	Dayn	2	0.00	0.00	5.56	3.36	15.64	20.29	0.00	0.00	1.00	0.00
	Diva	4	8.19	16.37	17.59	7.98	29.38	9.24	0.25	0.50	1.00	0.00
	Glee (WA8074)	3	0.54	0.94	24.51	8.63	4.12	1.81	0.00	0.00	1.00	0.00
	Hollis	7	3.51	2.00	23.37	24.46	10.08	21.22	0.29	0.49	1.00	0.00
	ID0377s	1	3.06	-	0.00	-	14.68	-	0.00	-	1.00	-
	Jedd	1	0.00	-	0.93	-	4.75	-	0.00	-	1.00	-
	Jerome	2	0.00	0.00	6.10	8.63	8.99	1.66	0.00	0.00	1.00	0.00
	Louise	10	20.74	15.24	10.74	14.67	14.06	17.12	0.00	0.00	1.00	0.00
	Otis	4	0.00	0.00	6.09	5.89	27.76	20.78	0.50	0.58	1.00	0.00
	Scarlet 09	1	0.00	-	0.00	-	2.02	-	0.00	-	1.00	-
	Solano	1	2.59	-	30.57	-	12.42	-	0.00	-	1.00	-
	Summit	1	0.00	-	0.12	-	13.28	-	1.00	-	1.00	-
	UI Pettit	1	0.00	-	68.98	-	33.56	-	0.00	-	1.00	-
	Waikea	1	0.00	-	0.00	-	14.96	-	0.00	-	1.00	-
	Wakanz	1	3.36	-	2.05	-	14.08	-	0.00	-	1.00	-
	Wawawai	1	0.81	-	66.79	-	13.48	-	0.00	-	1.00	-
	WA7931	1	0.00	-	0.42	-	13.28	-	0.00	-	1.00	-
	WA7961	1	0.00	-	30.18	-	13.48	-	0.00	-	1.00	-
	WA7964	1	0.00	-	0.12	-	4.62	-	0.00	-	1.00	-
	WA8016	1	0.00	-	0.00	-	-16.67	-	0.00	-	1.00	-
	WA8026	1	0.00	-	0.00	-	-24.00	-	1.00	-	1.00	-
	WA8027	1	0.00	-	0.00	-	83.15	-	0.00	-	1.00	-
	WA8124	3	0.00	0.00	20.74	3.06	18.71	5.96	0.00	0.00	1.00	0.00

[a] The percentages of acreage were calculated based on planted acreage against the total spring wheat acreage in Washington state. Cultivars or breeding lines with a zero acreage were grown in less than 1000 acres, seed not available for commercial fields, or never released. Most cultivars grown in Washington were also grown in Idaho and Oregon and some not grown in Washington were grown in Idaho and Oregon.
[b] Relative area under the disease progress curve (AUDPC) values were calculated as the percentages of the susceptible check's AUDPC in each year.
[c] Relative yield loss (rYL) values were calculated as the percentages of the susceptible check's yield loss percentage in each year.
[d] Significance of fungicide application (SFA) was determined by the least significant difference (LSD) values for each year experiment, 0 = insignificant and 1 = significant.
[e] In each experiment, a cultivar was rated by its rYL against the experiment rYL LSD, 1 for rYLs less than 1 x the rYL LSD value; 2 for rYLs from equal to the rYL LSD value to less than 2 x the rYL LSD values; 3 for equal to 2 X but less than 3 X the YL LSD value; and so on. For cultivars with a rating equal to or greater than 1, fungicide application is generally recommended.
[f] Lemhi was used as the susceptible check in 2006-2012 and Fielder in 2002-2005.
[g] - not applicable as there was only one year data.

or seed-borne pathogens such as smuts and root diseases do not have significant effects on rust.

Foliar fungicides can be applied when rust is easy to find and before developing to the severe level as shown in Figures 1 and 2. At the time of herbicide application, growers should ask whether a fungicide application may or may not be used by making the following observations:

- If a resistant variety is grown, do not apply; if a susceptible or moderately susceptible variety is grown, see next.
- If active rust is observed, even at a low incidence level, apply. If not observed see next.
- If rust is reported within the region (e.g. within the eastern PNW) and infection will likely occur within a couple of weeks, apply; otherwise wait until rust is found in the field.

Mixing a fungicide with an herbicide reduces application costs and is effective if the stripe rust fungus has over-wintered. For example, this was necessary in 2011 and 2013, but not necessary in 2012. About three to four weeks after fungicide application, a second fungicide application may be considered when rust starts redeveloping. In the eastern PNW, stripe rust often starts developing at boot to heading stage, and a single application at this time usually controls stripe rust. At this point, HTAP resistance usually works unless the weather conditions are cool and wet like 2010 and 2011. To apply or not to apply fungicides will depend upon variety resistance (including HTAP resistance), the real-time rust situation in the field and the region and weather conditions in the weeks following based on forecasts.

To reduce costs, protect those applying the chemicals as well as those living nearby while reducing pressure for selection of potential chemical-resistant rust strains, it is always a good idea to curtail the unnecessary use of fungicides.

For help keeping up with stripe rust information including the disease lifecycle, pathogen races, resistance, fungicide efficacy, forecasts, updates, specific recommendations, management strategies, various nursery data, literature and research progress, please check out our website as the year progresses at striperust.wsu.edu. ■