Luckily, Tanner made the decision to apply fungicide to his crop. His wheat yielded between 30 and 50 bu/acre with test weights of 59 to 62 pounds/bu, in contrast to producers who did not spray and ended the harvest season with yields ranging from 15 to 20 bu/acre with test weights of 46 to 55 pounds/bu.

In its June report, the USDA–NASS upped their forecast to 314.5 x 10^6 bushels in production; a 28% increase from the last year's drought-plagued crop. By 12 August, the USDA–NASS increased that projection, forecasting Kansas wheat production at 334 x 10^6 bushels, up 36% from last year's crop. Yield is forecast at 38 bu/acre, 10 bushels above 2014.

As planting season approaches, Kansas wheat farmers are being encouraged to select wheat cultivars with high resistance to fungal diseases as well as to apply fungicides to seed before drilling wheat this season. According to Jeff Vogel, the Plant Protection and Weed Control program manager for the Kansas Department of Agriculture, "Research has shown that the use of certified seed combined with fungicide seed treatments, is highly effective in preventing the spread of disease." He noted that producers and seedsmen should follow proper protocols to ensure that a thorough and even application of fungicide is made to the seed to ensure a high level of product effectiveness.

After years of drought conditions, farmers can reasonably expect more of that moisture to continue, thanks to the official El Niño pattern declared in April, according to Knapp, who also said if the El Niño pattern persists, most of Kansas will continue to receive more moisture throughout the rest of summer and into the winter, which would be good news for the 2016 Kansas wheat crop.

MINNESOTA

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Wheat rusts in the United States in 2014.

Small grain development and spring fieldwork in the Great Plains and to the east was generally delayed due to the unusually cool late winter and early spring weather. Ongoing drought conditions in many areas of the central and southern Plains were a significant constraint to small grain production and greatly limited development of rust diseases. Drought and freeze damage in early spring in the southern U.S. may have delayed rust development and spread in the spring. Significant rainfall occurred in many areas to the east in mid-June to early July. The widespread rain hampered winter wheat harvest in the South and limited fieldwork in other areas. In the Pacific Northwest, small grain development was somewhat ahead of the 10-year averages. Hot, dry weather dominated California and the Pacific Northwest areas.

Wheat stem rust (caused by *Puccinia graminis* f. sp. *tritici*). Wheat stem rust was not widespread or severe in the U.S. in 2014. It only was reported in nursery locations this season in Texas, Louisiana, Arkansas, Nebraska, Kansas, South Dakota, Minnesota, and Wisconsin. Wheat stem rust was first reported on 7 April at Weslaco in extreme southern Texas. Race QFCSC was the most commonly identified wheat stem rust race in 2014 and in recent years.

Rio Grande Valley, Texas. Wheat stem rust was found in sentinel plots of Morocco, Panola, Siouxland, and Line E at Weslaco in extreme southern Texas on 7 April 7. Severities ranged from <1% on Siouxland (stem rust pustules were found only on leaves) to 5% on Morocco with incidences from 10% on Siouxland to 90% on Morocco. Line E and Morocco were fully headed, whereas Panola and Siouxland did not completely vernalize. In previous years, barley, emmer, and triticale were used more commonly in windbreaks for watermelon, currently more sorghum or sorghum–Sudangrass is used. This was the first report of wheat stem rust in the U.S. in 2014.

Arkansas. Stem rust was found in late-maturing plots at Kibler and Fayetteville in northwestern Arkansas in early June, but was not reported elsewhere in the state in 2014. Generally, rust (leaf, stripe, and stem) was found at lower levels than any of the last 26 years.

Nebraska. Stem rust was found on two lines (at hard dough stage) in a wheat nursery at Lincoln in southeastern Nebraska on 13 June. Wheat stem rust was not reported in commercial fields in the state in 2014.

Kansas. Wheat stem rust at 100% incidence and approaching 30% severity was found in plots near Manhattan in northeastern Kansas in late June. Based on the samples, stem rust appears to have been in the plots for some time. Wheat stem rust was not reported in commercial fields in the state in 2014 and did not impact yields.

Wisconsin. On 26 June, stem rust was found on five plants in a single plot at Arlington in south-central Wisconsin. Stem rust was not found in any other plots at the location. Stem rust was not found at any other site in the state in 2014.

South Dakota. Trace levels of wheat stem rust were found in plots of the cultivar Rubidoux in Brookings County in eastern South Dakota in the second week of July.

Minnesota. On 10 July, trace to moderate levels of wheat stem rust were found in plots of the susceptible spring wheat cultivar Baart at Lamberton in southwestern Minnesota.

North Dakota. Wheat stem rust was found at trace levels on the susceptible spring cultivar Baart in plots at Langdon in the northeastern part of the state in early August.

Wheat stem rust map. Please visit: http://www.ars.usda.gov/Main/docs.htm?docid=9757.

Wheat Leaf Rust (caused by *Puccinia triticina*). Leaf rust was at very low levels in the central Great Plains in 2014 due to drought and very dry conditions. As a result, wheat leaf rust inoculum for areas north and east was very limited. The cool spring delayed leaf rust development in many areas. In the Southeast and mid-Atlantic areas, wheat leaf rust was more widespread but generally at low levels, with the exception of higher severities noted on the cultivar Shirley at some locations. By late June, leaf rust had appeared at low levels in South Dakota, Minnesota, Wisconsin, and Michigan. The number and frequency of virulence phenotypes and number and frequency of isolates virulent to the 20 wheat lines with single resistance genes for leaf rust resistance, respectively, is reported (Tables 1 (pages 86-87) and Table 2 (p. 87)). An estimated national winter wheat loss of 0.1%, a trace spring wheat loss, and a 0% durum wheat loss were due leaf rust in 2014 (see Tables 3 (page 88) and 4 (page 89)).

Texas. Wheat leaf rust was slowly developing in plots at Castroville in early March and, by late March, it was uniformly distributed in the lower canopy and mid-canopy of winter wheat spreader rows in nurseries at Castroville and Wharton, respectively. Warm temperatures and rains created conditions favorable for rust spread. In the second week of April, wheat leaf rust was moving into the flag leaves of susceptible wheat in irrigated plots at Castroville. At Beeville, where there were both winter and spring wheat plots, leaf rust increased on TAM 112 (*Lr39/Lr41*) and in the spreader rows. Leaf rust developed on TAM 112 and in the spreader rows at College Station.

In a survey of north-central Texas in late March and early April, no rust was found in commercial fields, and rust had not been seen by consultants and extension agents in the areas. Typically, wheat leaf rust is found by this time in north-central Texas. Low levels of leaf rust were reported 30 miles south of Dallas. Some cultivars with leaf rust were Greer (*Lr39/Lr41, Lr34,* and *Lr37*), WB Cedar (*Lr14a* and *Lr37*) and Coronado (*Lr1, Lr10,* and *Lr14a*). Most of the wheat was fully headed.

Ten of the 11 lines in plots at Weslaco in extreme southern Texas had wheat leaf rust the second week of April; Panola (*Lr11*) was the lone exception. Severities were 3–40% with incidences from 20–90%. TAM 112 (*Lr39/Lr41*) was rated at 15S, whereas Jagalene (*Lr24*) was 60S on the flag leaves.

A rust survey covering the southern half of Texas to Baton Rogue in southeastern Louisiana was conducted between 30 April and 5 May. Winter wheat fields along a west to east transect extending from Uvalde, TX, to Baton Rouge, LA, varied from milk to soft-dough stage. Of the 11 fields sampled, leaf rust was found in all but one. Most of leaf rust

Table 1. Number and frequency (%) of virulence phenotypes of *Puccinia triticina* in the United States in 2014 identified by virulence to 20 lines of wheat with single genes for leaf rust resistance. Lines tested were Thatcher lines with genes *Lr1*, *Lr2a*, *Lr2c*, *Lr3*, *Lr9*, *Lr16*, *Lr24*, *Lr26*, *Lr3ka*, *Lr11*, *Lr17*, *Lr30*, *LrB*, *Lr10*, *Lr14a*, *Lr18*, *Lr21*, *Lr28*, *Lr39*, and *Lr42*.

Pheno-type	Virulences	AR, GA, LA, NC, TN, VA		NY		IL, IN, WI		TX		KS		MN, ND, SD		Total	
		#	%	#	%	#	%	#	%	#	%	#	%	#	%
MBDSB	1,3,17,B,10,14a	0	0	0	0	0	0	1	1.2	0	0	0	0	1	0.3
MBDSD	1,3,17,B,10,14a,39	0	0	0	0	0	0	16	19.5	0	0	4	3.5	20	5.3
MBPNB	1,3,3ka,17,30,B,14a	0	0	0	0	1	3.1	0	0	0	0	0	0	1	0.3
MBPSB	1,3,3ka,17,30,B,10,14a	0	0	0	0	0	0	0	0	3	33.3	3	2.6	6	1.6
MBPSD	1,3,3ka,17,30,B,10,14a,39	0	0	0	0	0	0	2	2.4	0	0	0	0	2	0.5
MBPTB	1,3,3ka,17,30,B,10,14a,18	0	0	0	0	0	0	0	0	1	11.1	0	0	1	0.3
MBTNB	1,3,3ka,11,17,30,B,14a	36	28.1	4	28.6	17	53.1	0	0	1	11.1	16	13.9	74	19.5
MCDSB	1,3,26,17,B,10,14a	0	0	0	0	0	0	3	3.7	0	0	0	0	3	0.8
MCDSD	1,3,26,17,B,10,14a,39	0	0	0	0	0	0	8	9.8	0	0	0	0	8	2.1
MCPSB	1,3,26,3ka,17,30,B,10,14a	0	0	0	0	0	0	0	0	0	0	1	0.9	1	0.3
MCPSD	1,3,26,3ka,17,30,B,10,14a,39	0	0	0	0	0	0	0	0	0	0	1	0.9	1	0.3
MCTNB	1,3,26,3ka,11,17,30,B,14a	11	8.6	4	28.6	6	18.8	0	0	0	0	2	1.7	23	6.1
MDDSB	1,3,24,17,B,10,14a	0	0	0	0	0	0	0	0	0	0	1	0.9	1	0.3
MDTSB	1,3,24,3ka,11,17,30,B,10,14a	0	0	0	0	0	0	0	0	0	0	1	0.9	1	0.3
MFDSB	1,3,24,26,17,B,10,14a	0	0	0	0	0	0	0	0	3	33.3	1	0.9	4	1.1
MFNQB	1,3,24,26,3ka,17,B,10	0	0	0	0	0	0	0	0	0	0	1	0.9	1	0.3
MFNSB	1,3,24,26,3ka,17,B,10,14a	0	0	0	0	0	0	2	2.4	0	0	1	0.9	3	0.8
MFPSB	1,3,24,26,3ka,17,30,B,10,14a	4	3.1	0	0	0	0	1	1.2	0	0	2	1.7	7	1.8
MFTSB	1,3,24,26,3ka,11,17,30,B,10,14a	0	0	0	0	0	0	0	0	0	0	1	0.9	1	0.3
MLDSD	1,3,9,17,B,10,14a,39	0	0	0	0	0	0	5	6.1	0	0	5	4.3	10	2.6
MLPSD	1,3,9,3ka,17,30,B,10,14a,39	0	0	0	0	0	0	7	8.5	1	11.1	5	4.3	13	3.4
MMDSD	1,3,9,26,17,B,10,14a,39	0	0	0	0	0	0	1	1.2	0	0	1	0.9	2	0.5
MMPSD	1,3,9,26,3ka,17,30,B,10,14a,39	2	1.6	0	0	0	0	7	8.5	0	0	0	0	9	2.4
PBDGJ	1,2c,3,17,10,28,39	3	2.3	0	0	0	0	0	0	0	0	1	0.9	4	1.1
PBDQJ	1,2c,3,17,B,10,28,39	0	0	0	0	0	0	2	2.4	0	0	0	0	2	0.5
PBDSJ	1,2c,3,17,B,10,14a,28,39	0	0	0	0	0	0	1	1.2	0	0	0	0	1	0.3
PLDDJ	1,2c,3,9,17,14a,28,39	0	0	0	0	0	0	1	1.2	0	0	0	0	1	0.3
PNDGJ	1,2c,3,9,24,17,10,28,39	0	0	0	0	0	0	0	0	0	0	1	0.9	1	0.3
TBBGJ	1,2a,2c,3,10,28,39	0	0	0	0	0	0	6	7.3	0	0	0	0	6	1.6
TBBGS	1,2a,2c,3,10,21,28,39	1	0.8	0	0	0	0	1	1.2	0	0	42	36.5	44	11.6
TBHTB	1,2a,2c,3,11,30,B,10,14a,18	0	0	1	7.1	0	0	0	0	0	0	0	0	1	0.3
TBJGS	1,2a,2c,3,11,17,10,21,28,39	0	0	0	0	0	0	0	0	0	0	1	0.9	1	0.3
TBJSB	1,2a,2c,3,11,17,B,10,14a	1	0.8	0	0	0	0	0	0	0	0	0	0	1	0.3
TBRJG	1,2a,2c,3,3ka,11,30,10,14a,28	1	0.8	0	0	0	0	0	0	0	0	0	0	1	0.3
TBRKG	1,2a,2c,3,3ka,11,30,10,14a,18,28	11	8.6	0	0	0	0	0	0	0	0	0	0	11	2.9
TBTNB	1,2a,2c,3,3ka,11,17,30,B,14a	3	2.3	0	0	0	0	0	0	0	0	0	0	3	0.8
TBTSB	1,2a,2c,3,3ka,11,17,30,B,10,14a	0	0	2	14.3	0	0	0	0	0	0	0	0	2	0.5
TCJSB	1,2a,2c,3,26,11,17,B,10,14a	3	2.3	0	0	0	0	0	0	0	0	0	0	3	0.8
TCLJG	1,2a,2c,3,26,3ka,10,14a,28	0	0	0	0	0	0	1	1.2	0	0	0	0	1	0.3
TCRKG	1,2a,2c,3,26,3ka,11,30,10,14a,18,28	43	33.6	0	0	0	0	0	0	0	0	0	0	43	11.3
TCSQB	1,2a,2c,3,26,3ka,11,17,B,10	1	0.8	0	0	0	0	0	0	0	0	0	0	1	0.3
TCTNB	1,2a,2c,3,26,3ka,11,17,30,B,14a	1	0.8	0	0	0	0	0	0	0	0	0	0	1	0.3
TCTQB	1,2a,2c,3,26,3ka,11,17,30,B,10	1	0.8	0	0	0	0	0	0	0	0	0	0	1	0.3
TCTSB	1,2a,2c,3,26,3ka,11,17,30,B,10,14a	0	0	1	7.1	0	0	0	0	0	0	3	2.6	4	1.1
TDBGJ	1,2a,2c,3,24,10,28,39	0	0	0	0	0	0	0	0	0	0	1	0.9	1	0.3
TDBGQ	1,2a,2c,3,24,10,21,28	1	0.8	0	0	0	0	0	0	0	0	0	0	1	0.3
TDBJQ	1,2a,2c,3,24,10,14a,21,28	0	0	0	0	0	0	0	0	0	0	1	0.9	1	0.3
TDCHG	1,2a,2c,3,24,30,10,18,28	1	0.8	0	0	0	0	0	0	0	0	0	0	1	0.3
TLBGJ	1,2a,2c,3,9,10,28,39	0	0	0	0	0	0	1	1.2	0	0	0	0	1	0.3

Table 1. Number and frequency (%) of virulence phenotypes of *Puccinia triticina* in the United States in 2014 identified by virulence to 20 lines of wheat with single genes for leaf rust resistance. Lines tested were Thatcher lines with genes *Lr1*, *Lr2a*, *Lr2c*, *Lr3*, *Lr9*, *Lr16*, *Lr24*, *Lr26*, *Lr3ka*, *Lr11*, *Lr17*, *Lr30*, *LrB*, *Lr10*, *Lr14a*, *Lr18*, *Lr21*, *Lr28*, *Lr39*, and *Lr42*.

Pheno-type	Virulences	AR, GA, LA, NC, TN, VA		NY		IL, IN, WI		TX		KS		MN, ND, SD		Total	
		#	%	#	%	#	%	#	%	#	%	#	%	#	%
TNBGJ	1,2a,2c,3,9,24,10,28,39	0	0	0	0	4	12.5	12	14.6	0	0	3	2.6	19	5
TNBJJ	1,2a,2c,3,9,24,10,14a,28,39	0	0	0	0	0	0	3	3.7	0	0	8	7	11	2.9
TNRJJ	1,2a,2c,3,9,24,3ka,11,30,10,14a,28,39	4	3.1	0	0	0	0	0	0	0	0	0	0	4	1.1
TPBGJ	1,2a,2c,3,9,24,26,10,28,39	0	0	0	0	0	0	1	1.2	0	0	0	0	1	0.3
TPBJJ	1,2a,2c,3,9,24,26,10,14a,28,39	0	0	0	0	2	6.3	0	0	0	0	1	0.9	3	0.8
Total		128	1	4		32		82		9		115		380	

Table 2. Number and frequency (%) of isolates of *Puccinia triticina* in the United States in 2014 virulent to 20 lines of wheat with single resistance genes for leaf rust resistance.

Resistance gene	AR, GA, LA, NC, TN, VA		NY		IL, IN, WI		TX		KS		MN, ND, SD		Total	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%
Lr1	128	100.0	14	100.0	32	100.0	82	100.0	9	100.0	115	100.0	380	100.0
Lr2a	72	56.3	6	42.9	8	25.0	25	30.5	0	0.0	67	58.3	178	46.8
Lr2c	75	58.6	6	42.9	8	25.0	29	35.4	0	0.0	69	60.0	187	49.2
Lr3	128	100.0	14	100.0	32	100.0	82	100.0	9	100.0	115	100.0	380	100.0
Lr9	6	4.7	0	0.0	6	18.8	38	46.3	1	11.1	24	20.9	75	19.7
Lr16	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Lr24	10	7.8	2	14.3	8	25.0	19	23.2	3	33.3	30	26.1	72	18.9
Lr26	66	51.6	7	50.0	10	31.3	24	29.3	3	33.3	22	19.1	132	34.7
Lr3ka	118	92.2	13	92.9	26	81.3	20	24.4	6	66.7	44	38.3	227	59.7
Lr11	116	90.6	14	100.0	25	78.1	0	0.0	1	11.1	31	27.0	187	49.2
Lr17	66	51.6	13	92.9	26	81.3	57	69.5	9	100.0	59	51.3	230	60.5
Lr30	118	92.2	14	100.0	26	81.3	17	20.7	6	66.7	42	36.5	223	58.7
LrB	63	49.2	14	100.0	26	81.3	56	68.3	9	100.0	56	48.7	224	58.9
Lr10	77	60.2	6	42.9	8	25.0	81	98.8	8	88.9	97	84.3	277	72.9
Lr14a	120	93.8	14	100.0	28	87.5	59	72.0	9	100.0	65	56.5	295	77.6
Lr18	55	43.0	1	7.1	0	0.0	0	0.0	1	11.1	0	0.0	57	15.0
Lr21	2	1.6	0	0.0	0	0.0	1	1.2	0	0.0	44	38.3	47	12.4
Lr28	65	50.8	0	0.0	6	18.8	29	35.4	0	0.0	59	51.3	159	41.8
Lr39	10	7.8	0	0.0	6	18.8	74	90.2	1	11.1	74	64.3	165	43.4
Lr42	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Total	123		14		32		82		9		115		380	

samples had low severities (10–20%) and were taken from the edges of otherwise disease-free fields. However, samples obtained from Zavala and Bastrop counties in Texas had a high disease severity (50–80%) and prevalence (100%).

Louisiana. Wheat leaf rust was present at low incidence and severity in an early planted Baton Rouge nursery on 18 March. Due to the cool winter and spring wheat leaf rust occurred late in the season and at lower levels than is typical in Louisiana. Leaf rust in plots developed in grain-illing stages and did reach higher levels in late April and early May as the plants approached physiological maturity, but yield impact was minor.

Mississippi. Trace levels of wheat leaf rust were reported in Greenwood in the eastern Delta region in late April. As in Louisiana and Alabama, a very cool spring likely significantly delayed wheat leaf rust development.

Alabama. Leaf rust was found at trace levels in the state in 2014. The very cool spring likely impacted rust development.

Oklahoma. Other than the low levels of leaf rust found in one irrigated wheat field in central Oklahoma in early May and a single leaf rust pustule observed in late March, rust was not reported in the state in 2014. Drought conditions in the state, coupled with high temperatures and wind, were not conducive for wheat or rust development. Seventy-eight percent of the winter wheat crop was rated poor to very poor. Many fields were not harvested, however, irrigated fields in the panhandle had better yield potential and a few dryland fields appeared to have some yield potential.

Kansas. Persistent drought and high temperatures were not conducive for wheat or rust development in the state this season. Other than low levels of wheat leaf rust observed in plots in northeastern Kansas in late May, wheat leaf rust was not reported in the state. Winter wheat production in the state was forecasted to be down 26% from last year's crop and the lowest in 25 years. Yield was estimated at 28 bu/acre; 10 bushels below last year and the lowest since 1995.

Table 3. Estimated losses in winter wheat due to rust in 2014 (T = trace, less than 1% loss statewide; — no state estimates available; and * = preliminary 2014 Kansas wheat disease loss estimate).

State	1,000 acres harvested	Yields in bushels per acre	Production in 1,000 of bushels	Losses due to: Stem rust %		Leaf rust %		Stripe rust %	
				%	1,000 bu	%	1,000 bu	%	1,000 bu
AL	225	69.0	15,525	0	0	0.0	0	0.0	0
AZ	7	100.0	700	—	—	—	—	—	—
AR	395	63.0	24,885	0	0	0.0	0	0.0	0
CA	180	80.0	14,400	0	0	0.0	0	1.0	145
CO	2,350	38.0	89,300	0	0	0.0	0	T	T
DE	75	72.0	5,400	0	0	0.0	0	0.0	0
FL	10	39.0	390	—	—	—	—	—	—
GA	230	49.0	11,270	0	0	T	T	T	T
ID	730	80.0	58,400	0	0	0.0	0	3.0	1,806
IL	670	67.0	44,890	0	0	T	T	T	T
IN	335	76.0	25,460	T	T	1	257	1.0	257
IA	15	49.0	735	—	—	—	—	—	—
KS*	8,800	28.0	246,400	T	T	T	T	0.0	0
KY	510	71.0	36,210	0	0	T	T	0.0	0
LA	150	62.0	9,300	0	0	1.0	94	T	T
MD	250	70.0	17,500	—	—	—	—	—	—
MI	485	74.0	35,890	0	0	2.0	732	0.0	0
MN	32	49.0	1,568	0	0	0.0	0	0.0	0
MS	215	58.0	12,470	0	0	T	T	2.0	254
MO	740	58.0	42,920	0	0	T	T	T	T
MT	2,240	41.0	91,840	0	0	0.0	0	T	T
NE	1,450	49.0	71,050	0	0	T	T	0.0	0
NV	9	110.0	990	—	—	—	—	—	—
NJ	25	53.0	1,325	—	—	—	—	—	—
NM	105	28.0	2,940	—	—	—	—	—	—
NY	95	63.0	5,985	T	T	T	T	T	T
NC	770	58.0	44,660	0	0	1.0	451	0.0	0
ND	555	49.0	27,195	0	0	0.0	0	0.0	0
OH	545	74.0	40,330	0	0	T	T	0.0	0
OK	2,800	17.0	47,600	0	0	0.0	0	0.0	0
OR	740	55.0	40,700	0	0	T	T	T	T
PA	150	65.0	9,750	—	—	—	—	—	—
SC	220	52.0	11,440	—	—	—	—	—	—
SD	1,080	55.0	59,400	T	T	T	T	T	T
TN	475	66.0	31,350	0	0	T	T	T	T
TX	2,250	30.0	67,500	—	—	—	—	—	—
UT	109	50.0	5,450	—	—	—	—	—	—
VA	260	68.0	17,680	0	0	T	T	0.0	0
WA	1,640	52.0	85,280	0	0	0.0	0	T	T
WV	7	64.0	448	—	—	—	—	—	—
WI	250	65.0	16,250	T	T	1.0	164	T	T
WY	125	38.0	4,750	—	—	—	—	—	—
U.S. % loss				T		0.1		0.2	
U.S. total	32,304	42.6	1,377,526		T		1,699		2,463

Table 4. Estimated losses in spring and durum wheat due to rust in 2013 (T = trace, — = no state estimate available, N/A = data not available, * U.S. total does not includestates for which loss or production data is not available).

State	1,000 acres harvested	Yields in bushels per acre	Production in 1,000 of bushels	Losses due to:					
				Stem rust		Leaf rust		Stripe rust	
				%	1,000 bu	%	1,000 bu	%	1,000 bu
SPRING WHEAT									
CA	NA	NA	NA	0	0	0.0	0	0.0	0
CO	8	64.0	512	—	—	—	—	—	—
ID	455	76.0	34,580	0	0	0.0	0	6.0	2,207
MN	1,180	55.0	64,900	0	0	0.0	0	0.0	0
MT	2,990	36.0	107,640	0	0	0.0	0	T	T
NV	1	60.0	60	—	—	—	—	—	—
NY	NA	NA	NA	T	T	T	T	T	T
ND	6,190	47.5	294,025	0	0	1.0	2,940	0.0	0
OR	78	48.0	3,744	0	0	T	T	T	T
SD	1,280	56.0	71,680	T	T	T	T	T	T
UT	8	54.0	432	—	—	—	—	—	—
WA	610	38.0	23,180	0	0	0.0	0	T	T
U.S. % loss				T		0.5		0.4	
U.S. total *	12,800	46.9	600,753		T		2,940		2,207
DURUM WHEAT									
State	1,000 acres harvested	Yields in bushels per acre	Production in 1,000 of bushels	Losses due to:					
				Stem rust		Leaf rust		Stripe rust	
				%	1,000 bu	%	1,000 bu	%	1,000 bu
AZ	72	111.0	7,992	—	—	—	—	—	—
CA	35	105.0	3,675	0	0	0	0	0	0
ID	11	67.0	737	0	0	0	0	3	23
MT	430	32.0	13,760	0	0	0	0	0	0
ND	820	37.5	30,750	0	0	0	0	0	0
SD	4	45.0	180	—	—	—	—	—	—
U.S. % loss				0		0		0.04	
U.S. total *	1,372	41.6	57,094		0.0		0.0		23

Nebraska. In late May, a few pustules of wheat leaf rust were observed in Nuckolls County and also in Clay County in south-central Nebraska. These were the first confirmed reports of wheat leaf rust in the state in 2014. Only two pustules of leaf rust were found in a survey of fields in south-central and southeastern areas of the state on 4 June. The fields surveyed were virtually disease free. A majority of the fields in the south-central area were severely drought stressed. The wheat was at soft to hard dough stage. On June 10, wheat leaf rust, at trace to low incidence with severities up to 30% on flag leaves, was found in plots at Lincoln in southeastern Nebraska. No rusts were observed in a survey of southwestern Nebraska and the southern and northern Panhandle during 17–19 June. Most fields were stressed due to a lack of moisture. Wheat ranged from milk to hard dough.

Very little, if any, rust inoculum was observed to the south in Kansas and Oklahoma, where drought conditions were severe. The lack of inoculum to the south, coupled with dry conditions in the state, created conditions unfavorable for rust development in the state in 2014.

Arkansas. Fresh, wheat leaf rust pustules were found on volunteer wheat at the experiment station at Marianna in the east-central part of the state on 20 March. No cereal rusts were found in plots throughout the state (Stuttgart, Marianna, Newport, Keiser, Fayetteville, and Kibler) during the second week of April. Wheat in the state ranged from Feekes 6 to Feekes 9. Traces of wheat leaf rust were observed on the cultivar Havoc at Marianna and Newport in eastern Arkansas in the fourth week of May. Hot, dry ,and windy conditions during May were not conducive for rust development.

There was less rust in Arkansas than in any of the previous 26 years. Leaf rust generally developed just prior to maturity and likely did not cause any yield loss.

Georgia. Wheat leaf rust was widespread in a very early planted (2 months earlier than normal recommendations) wheat plot in a nursery at Plains in southwestern Georgia on 2 April. Although leaf rust is usually found in this area, the severity level was high for this early in the season. Leaf rust also was found on the lower leaves of the most susceptible lines in another nursery 300 yards away. Wheat leaf rust had developed to severe levels on many lines in plots at Plains in southwestern Georgia by the third week in May. Plots of Shirley (postulated to have *Lr26* and *Lr18*) had higher levels of leaf rust than seen in previous years. Leaf rust was found in only a few commercial fields this season. The widespread use of fungicides and a long, cool spring impacted wheat leaf rust development in the state.

***South Carolina*.** Leaf rust had developed rapidly in areas of northern South Carolina by the second week of May.

North Carolina. In eastern North Carolina, leaf rust continued to increase in plots at Kinston, whereas at Ayden, leaf rust was just beginning to appear the third week of May. Conditions in early May were conducive for leaf rust development. Plots of Shirley in North Carolina also had higher levels of leaf rust severity than in past years.

In tests at the USDA– ARS Cereal Disease Laboratory, DG Shirley had a high infection type to leaf rust race TCRKG, which is virulent to *Lr18* and *Lr26*. Marker data indicated the presence of the T1B·1R translocation in DG Shirley, indicating the presence of *Lr26*. DG Shirley has been postulated to also have *Lr18* based on seedling leaf rust tests. In 2014, virulence to *Lr26* was at 51.6% and virulence to *Lr18* was at 43.0% of the southeastern population.

Wheat leaf rust was at low to moderate levels in commercial fields in the Coastal Plain and Tidewater areas and heavy in the nurseries at Kinston and Plymouth in eastern North Carolina in 2014. An estimated 1% statewide loss in winter wheat was due to leaf rust in 2014.

Virginia. A headrow in a nursery at Warsaw in eastern Virginia had low leaf rust incidence and low severity the third week of May. At Blacksburg in western Virginia low levels of wheat leaf rust were found in plots on 6 June.

Kentucky. Wheat leaf rust was widespread, but generally at low severity levels, in western Kentucky by late May. Most infections were found on the F-1 and F-2 leaves and occasionally on flag leaves. Wheat was at grain-filling stages.

Tennessee. Wheat leaf rust was found in plots at Jackson in western Tennessee in early June. Wheat in the state was generally disease free in spring 2014.

Illinois. Wheat leaf rust was found in a few plots at the Brownstown Research Farm in Fayette County in south-central Illinois on 6 June. No rust was found in surveys of Saline, Gallatin, White, Wayne, and Clay Counties in southern Illinois the week of 2 June. Wheat leaf rust at high incidence and severity was found on some cultivars in plots in Champaign County in east-central Illinois in mid-June. Rust developed too late in the season to cause yield reductions.

Michigan. Wheat leaf rust, at low severity in the lower canopy, was found in a nursery at Mason in south-central Michigan on 5 June. Wheat had finished flowering with earliest lines at milk growth stage. Wheat leaf rust was widespread across the state by mid-June. By crop maturity, flag leaf severities had reached 10% or more in fields not treated with fungicides.

New York. No cereal rusts were found on visits to fields and plots in eastern and central New York the fourth week of June.

Minnesota. A single pustule of wheat leaf rust was found in a winter wheat nursery at St. Paul in southeastern Minnesota on 18 June. By late June, the rust was found at low levels in the nursery. Heavy rains were common in Minnesota the previous weeks with many areas receiving record precipitation totals. On 10 July, wheat leaf rust was observed at trace levels in plots of spring wheat in southern Minnesota. In a plot of Marshall wheat (*Lr2a*, *Lr10* and *Lr34)*, heavy leaf rust infections were found. Plots of winter wheat had light to heavy leaf rust infections.

In early August, leaf rust was present at high severity in plots of susceptible wheat in west-central Minnesota. Plots of cultivars and breeding lines varied between trace levels of leaf rust to high severity. Cultivars with *Lr21* had higher leaf rust levels compared to most other cultivars. Most wheat fields in west-central Minnesota were close to complete maturity, however a number of fields still had green flag leaves. Leaf rust was present at low to moderate levels in wheat fields that still had green leaves. Leaf rust had not yet been found in northwestern Minnesota by 5 August.

Wisconsin. On 26 June, leaf rust was found in several winter wheat plots in a nursery in south-central Wisconsin. Many plots had 100% incidence with 10% flag leaf severities. Wheat was approaching dough stage. Trace levels of leaf rust were observed in fields and plots in northeastern Wisconsin the second week of July. Leaf rust severities of 20% were found on flag leaves at early dough stage in unsprayed winter wheat fields along the Lake Michigan in northeastern Wisconsin in early August. Wheat leaf rust was observed on several cultivars in wheat growing areas of Wisconsin in 2014. Flag leaf severities were 10% or less and the rust generally did not appear until late in the growing season. An estimated 1% loss statewide was due to leaf rust in winter wheat in 2014.

South Dakota. Leaf rust, at low incidence and severity, was found in a winter wheat nursery at Brookings in eastern South Dakota in late June, which was the first report of wheat leaf rust in the state in 2014. Leaf rust was still at low levels in winter wheat plots in Brookings County in eastern South Dakota the second week of July. Low levels of leaf rust were found in adjacent spring wheat plots.

North Dakota. Wheat leaf rust, at low levels with severities between 5 and 10%, was found on the lowest leaves in plots at Fargo in eastern North Dakota on 2 July. Wheat leaf rust was found in one winter wheat plot at Minot in north-central North Dakota the third week of July.

Wheat leaf rust was present at varying levels across central and eastern North Dakota during the second week of August. In central North Dakota, susceptible wheat cultivars in plots had high leaf rust severities, whereas resistant cultivars and breeding lines had low to moderate severities. In northeastern North Dakota, susceptible cultivars in plots had moderate severity and resistant cultivars generally had low levels of rust. Cultivars such as Faller, Prosper, and Barlow with *Lr21* had more leaf rust compared to other cultivars. Many wheat fields in eastern and central North Dakota were still very green the second week of August.

Wellington County, Ontario, Canada. A few pustules of wheat leaf rust were observed in variety plots in the Palmerston area in southern Ontario on 18 June. This report was the first for wheat leaf rust in the province in 2014. Winter wheat was in the grain-filling stage. The extreme winter caused significant damage to the winter wheat crop resulting in about 10% of the crop being replanted or reseeded.

The 2013 wheat leaf rust observation map can be found at: http://www.ars.usda.gov/Main/docs.htm?docid=9757.

Lr gene postulations of current soft red winter, hard red winter, and hard red spring wheat cultivars are available in a searchable database at: http://160.94.131.160/fmi/iwp/cgi?-db=Lr%20gene%20postulations&-loadframes.

Wheat stripe rust (*Puccinia striiformis* f. sp. *tritici, Pst*). Wheat stripe rust was not generally as widespread in 2014 as in 2013 or as severe as 2012. Drought conditions in the Central Plains limited rust development there. Stripe rust disease pressure generally was light in most areas of the Pacific Northwest, where dry, warm conditions were common. Nationally, an estimated 0.2% loss in winter wheat was to stripe rust (see Table 3, p. 88, and Table 4, p. 89).

South Texas. Wheat stripe rust was found in the middle of a nursery field at Castroville in South Texas on 7 March. The wheat was at Feekes stages 7–9. Conditions were conducive for further development and the rust spread throughout the irrigated field and reached 60S on flag leaves of some lines by 26 March and 70S on the susceptible cultivar Patton by 9 April. Wheat leaf rust was competing with stripe rust on the upper leaves and, with the warmer temperatures, stripe rust development stopped. The stripe rust population in the plots did not appear to have *Yr17* virulence.

Low levels of stripe rust were reported in commercial fields as far north as 30 miles south of Dallas and areas to the south in early April. In a survey of north-central Texas in late March and early April, no rusts were found in commercial fields and consultants and extension agents in the areas had no reports of rust.

Louisiana. Low levels of stripe rust (<1% severity and prevalence) were observed on GACT7, a susceptible cultivar, in plots at Alexandria in central Louisiana in late March. Stripe rust at low incidence and severity also was observed in plots at Crowley in southwestern Louisiana. Traces of stripe rust had been found around the state by early April. High stripe rust severities were found in a single family of wheat headrows in plots at Baton Rogue in early April. The stripe rust had apparently been present for some time, but had not spread beyond the one family. Generally, the nursery had very little disease pressure. Wheat maturity was about 10 days behind the 10-year average.

Mississippi. A few stripe rust infected leaves were found on volunteer plants under a rainout shelter in Stoneville in the Delta region the last week of April. Most of the stripe rust had formed telia due to the warmer temperatures. As of3 May, stripe rust had not been confirmed in commercial fields or nurseries anywhere in the state.

Arkansas. A small wheat stripe rust hot spot was found in a plot of a known susceptible cultivar at Marianna in eastern Arkansas on 30 April. This report was the first for stripe rust in the state in 2014. A few scattered reports of stripe rust in the state were made during the season, but there was no further development.

Kansas. A large stripe rust focus was found in plots of 2137 near Manhattan in northeastern Kansas in late May. The spread from the foci center suggested the stripe rust infection developed 3–6 weeks prior. Most wheat at the location was at milk stage. Stripe rust did not develop to any extent due to the warmer temperatures. Persistent drought and high temperatures in the state were not conducive for wheat or rust development in 2014.

South Dakota. Trace levels of wheat stripe rust were found in winter wheat plots at Brookings in eastern South Dakota on 10 July. This report was the first for stripe rust in the state in 2014. No significant further development was observed.

North Dakota. Stripe rust was found in a commercial field south of Minot in north-central North Dakota and also on a few leaves in one plot at Fargo in eastern North Dakota the third week of July. Wheat stripe was present at very low incidence at a trace level in various cultivars in plots at Langdon in northeastern North Dakota the second week of August. Stripe rust did not develop to significant levels in the state.

Colorado. Stripe rust, at low levels, was found in two commercial fields in Weld County in eastern Colorado in early June. Stripe rust developed to severe levels in Fort Collins along the Front Range of Colorado, but there was minimal infection in eastern Colorado in 2014.

Wisconsin. Several small stripe rust foci were found in plots at Arlington in south central Wisconsin on 27 June. Incidence and severity were at very low levels. This finding contrasts to the 2012 and 2013 seasons, when stripe rust was found at high incidence and severity in plots at this point in the season. Stripe rust was not reported in other nurseries or in commercial fields in the state in 2014.

Virginia. One small wheat stripe rust foci was found in nursery headrows at Warsaw in eastern Virginia on 3 June. Stripe rust was not reported elsewhere in the state.

Oregon. Stripe rust was found in plots near Corvallis in western Oregon in late March. Wheat stripe rust was reported on the soft white winter wheat cultivars Goetze, Kaseberg, Sy Ovation,, and Tubbs 06 in north and south areas of the Willamette Valley in early April. Stripe rust appears to have overwintered in the valley. Stripe rust disease pressure was low in the western part of the state the third week of May,.however, hot spots were observed in several fields.

In eastern Oregon, stripe rust hot spots were observed in the Hermiston and Pendelton-Ruggs nurseries, whereas trace amounts were found in the Milton–Freewater nursery in early May. Stripe rust also was found in a commercial field in Sherman County in early May. Low levels of stripe rust were observed in three commercial winter wheat fields in Umatilla County in northeastern Oregon on 22 May.

Washington and Idaho. Stripe rust was found on a solitary lower leaf of a susceptible check in a nursery at Walla Walla in southeastern Washington on 23 April. On revisiting a field in Grant County in eas-central Washington, which was heavily infected with stripe rust in November 2013, no stripe rust could be found in late April. Generally, stripe rust disease pressure was low in eastern Washington in late April.

Very low levels of stripe rust were found in three commercial fields north of Walla Walla in southeastern Washington on 22 May. No stripe rust was found in fields visited south of Walla Walla. Two stripe rust lesions were found in a commercial wheat field in Columbia County in southeastern Washington. No rust was found in commercial fields visited in Whitman, Benton, and Franklin Counties in southeastern Washington. Winter wheat ranged from Feekes 7 to 10.5, whereas spring wheat was at Feekes 2–6. Generally, stripe rust disease pressure was low in eastern Washington in late May.

As is typical, stripe rust severities up to 30% were observed on susceptible cultivars in nurseries at Mount Vernon in northwestern Washington the first week of April.

Stripe rust was found in a field of the soft white winter wheat cultivar Brundage in the Hazleton area of south central Idaho in late May. The stripe rust was mostly confined to flag leaves, and the wheat was just beginning to head. Stripe rust was readily found on Brundage in 2013, growers continue to plant the cultivar due to the high-yield potential. One pustule of stripe rust was found in a nursery near Moscow in northwestern Idaho on 21 May.

In areas of eastern and southern Idaho, stripe rust was found, but only the soft white winter wheat cultivars Brundage and WB 470 in late June and early July. Stripe rust was not found on the most susceptible spring wheat lines in the nursery at Idaho Falls nor in the spring wheat nurseries at Rupert and Aberdeen in southeastern Idaho in late June. By early July, stripe rust was found on the cultivar WB936 west of Idaho Falls. Warming temperatures limited stripe rust development.

In an early July, a survey of fields in the Palouse region of Washington and Idaho (Whitman and Spokane Counties in eastern Washington and Latah County in northwestern Idaho) found stripe rust in only one winter wheat field in Whitman County and one winter wheat field in Spokane County. One or two small hot spots (<1 foot diameter) with mixed resistant and susceptible reactions were found in the fields. Stripe rust was found in about 60% of the spring wheat fields in Whitman County and about 40% in Latah and Spokane Counties. When found in the spring wheat fields, the incidence was less than 1%. An estimated statewide loss of 3% in winter wheat was due to stripe rust in Idaho and a trace loss in Washington in 2014.

Montana. Wheat stripe rust was found on the cultivar Yellowstone in the Hardin area south central Montana in late May.

Alberta, Canada. Low to moderate levels of wheat stripe were found in commercial winter wheat fields and plots in the Beaverlodge area in west-central Alberta in early July.

Wheat stripe rust map. Please visit: http://www.ars.usda.gov/Main/docs.htm?docid=9757.

The 2014 stripe rust observation map can be found at: http://www.ars.usda.gov/SP2UserFiles/ad_hoc/36400500Cerealrustbulletins/2012wstr.pdf.

MONTANA

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2014 Spring Wheat Program.

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Approximately 3.05 x 10^6 acres (1.24 x 10^6 hectares) of hard red spring wheat were seeded in 2014. The season was excellent up until an extended period of rain near crop maturity, which caused sprouting problems in a large portion of the spring wheat crop. For spring wheat, 2.99 x 10^6 acres (1.21 x 10^6 hectares) were harvested with an average yield of 36 bu/acre (2,419 kg/ha). Total harvested production was 107.6 x 10^6 bushels (2.93 x 10^6 metric tons). Leading spring wheat cultivars in Montana were Vida, Reeder, Choteau, and Mott. Vida, Choteau, and Mott all have some resistance to the wheat stem sawfly. A new cultivar named Duclair was grown on approximately 70,000 acres (28,350 hectares) in 2014. Major agronomic objectives for the program remain excellent yield potential in the harsh Montana environments and resistance to the wheat stem sawfly. End-use quality targets for all cultivars remain excellent bread-making properties, including selection for high grain protein, strong gluten, good water absorption, and large loaf volume.