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Wheat rusts in the United States in 2007.

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Wheat stem rust (*Puccinia graminis f. sp. tritici*). The first reports of wheat stem rust in 2007 were in soft red wheat winter varietal plots in south central Louisiana at Crowley and in southwest Louisiana at Jeanerette on 23 April. Stem rust was severe in some plots, but the distribution of infections was not uniform throughout the nursery. Hot, dry weather accelerated the crop to maturity in these plots.

On 23 April, traces of stem rust were found in two wheat plots in southern Texas at Castroville. On 8 May, a hot spot of wheat stem rust was found in a SRWW plot in central Texas at McGregor. On 10 May, stem rust severities ranged from 5–75% with 50% of the plants infected on the susceptible cultivar Winmaster in plots at Castroville and Uvalde in southern Texas.

On 23 May, low levels of wheat stem rust were found in the susceptible McNair 701 plot at Stillwater, in north-central Oklahoma.

In the spring of 2007, stem rust was found in susceptible plots of soft and red winter wheat in the southern U.S., but stem rust was not found in any commercial fields.

The next reports of wheat stem rust in 2007 were in late June when an infection site was observed in a plot of the susceptible winter wheat cultivar McNair 701 at the Rosemount experiment station in Minnesota and low levels were found on susceptible lines in spreader rows at Brookings, South Dakota. In early July, low levels of stem rust were found in plots of the susceptible spring wheat cultivar Baart at Waseca and Lamberton, Minnesota. During the second week in July, low levels of stem rust were found in a Baart plot at the west central experiment station at Morris, Minnesota.

In mid-July, trace levels of stem rust were observed in a plot of Radiant winter wheat at Lisbon, North Dakota. Moderate levels of stem rust were observed on a triticale line on July 23 at the Fargo, ND Experiment Station. In late July, trace levels of stem rust were found in the susceptible spring wheat cultivars Baart and Max at the Carrington and Langdon experiment stations in North Dakota. In summary, during the month of July, trace levels of wheat stem rust were found in susceptible winter wheat and spring wheat plots from southeastern Minnesota to east-central South Dakota and onto northeastern North Dakota. Stem rust was not observed on any current wheat cultivars in research plots or in commercial fields in this area.

In mid-July, stem rust was found in winter wheat breeding plots near Pullman, Washington.

In late July, stem rust was not observed in Manitoba and eastern Saskatchewan, Canada, commercial wheat fields, but was found on the susceptible line Little Club at Indianhead, Saskatchewan.

The wheat stem rust observation maps are available on the CDL website (http://www.ars.usda.gov/SP2UserFiles/ad_hoc/36400500Cerealrustbulletins/2007wsr.pdf).

Table 1. Races of *Puccinia graminis* f. sp. *tritici* identified from wheat in 2006. Pgt race code after Roelfs and Martens (Phytopathology 78:526-533).

Race	Collections	State
QFCS	36	LA, TX, MN, SD, ND
RCRS	1	SD

Virulence of wheat stem rust. From collections made from the above locations (including samples from the Triticales) race QFCS was identified as the predominant race (Table 1). This is a common race that has been found in the U.S. the past several years. This race is relatively avirulent; the majority of the U.S. cultivars are resistant to QFCS. Race RCRS was found in a collection from Brookings, South Dakota. Viable isolates were not recovered from samples collected in Oklahoma and Washington.

Stem rust on barberry (alternate host for stem rust). On 22 May, aecial development was light on susceptible barberry (*Berberis vulgaris*) bushes growing in southeastern Minnesota. In early June, no aecial development was found on susceptible barberry bushes growing in south central Wisconsin. Infections on the common barberry from southeast Minnesota were *P. graminis f. sp. secalis*. *Puccinia graminis f. sp. tritici* and *P. graminis f. sp. avenae* were not isolated from barberry samples.

Wheat leaf rust (*Puccinia triticina*). Southern Plains – Texas. In early February, low levels of leaf rust were reported in central Texas wheat plots and by late February, high levels of rust were found in the plots. In mid-March, low amounts of leaf rust were found on lower wheat leaves in the irrigated nursery at Castroville, Texas. Moisture was limited from late January to mid-March in much of the state of Texas. In plots at College Station, leaf rust was at low levels except for high severities in Jagelene (*Lr24* resistance). By the second week of April, susceptible cultivars such as Jagalene and Jagger (*Lr17* resistance) in nurseries at Castroville and College Station, Texas, had 80% leaf rust severities on lower leaves. On highly resistant cultivars such as Fannin and Endurance, no infections were found. Low to moderate levels of rust were reported in Texas fields. In early June, high severity (100%) levels of leaf rust were reported in irrigated nursery plots of susceptible winter wheat cultivars at Bushland, Texas (Fig. 1). At the same time leaf rust was not present in the dryland nurseries.

Oklahoma. In early February, traces of leaf rust were found on susceptible varieties in the plots at Stillwater, Oklahoma. In late February, leaf rust was light in southwest Oklahoma fields. By mid-March leaf rust still was light in plots and fields in Oklahoma. In mid-April, severe levels of leaf rust had been reported on susceptible cultivars in north-central Oklahoma plots. And by late April, high severity levels of leaf rust had been reported on susceptible cultivars in north-central Oklahoma plots. During the first two weeks in May, high levels of leaf rust were observed in central Oklahoma on susceptible cultivars. In late May, high severity (80%) levels of

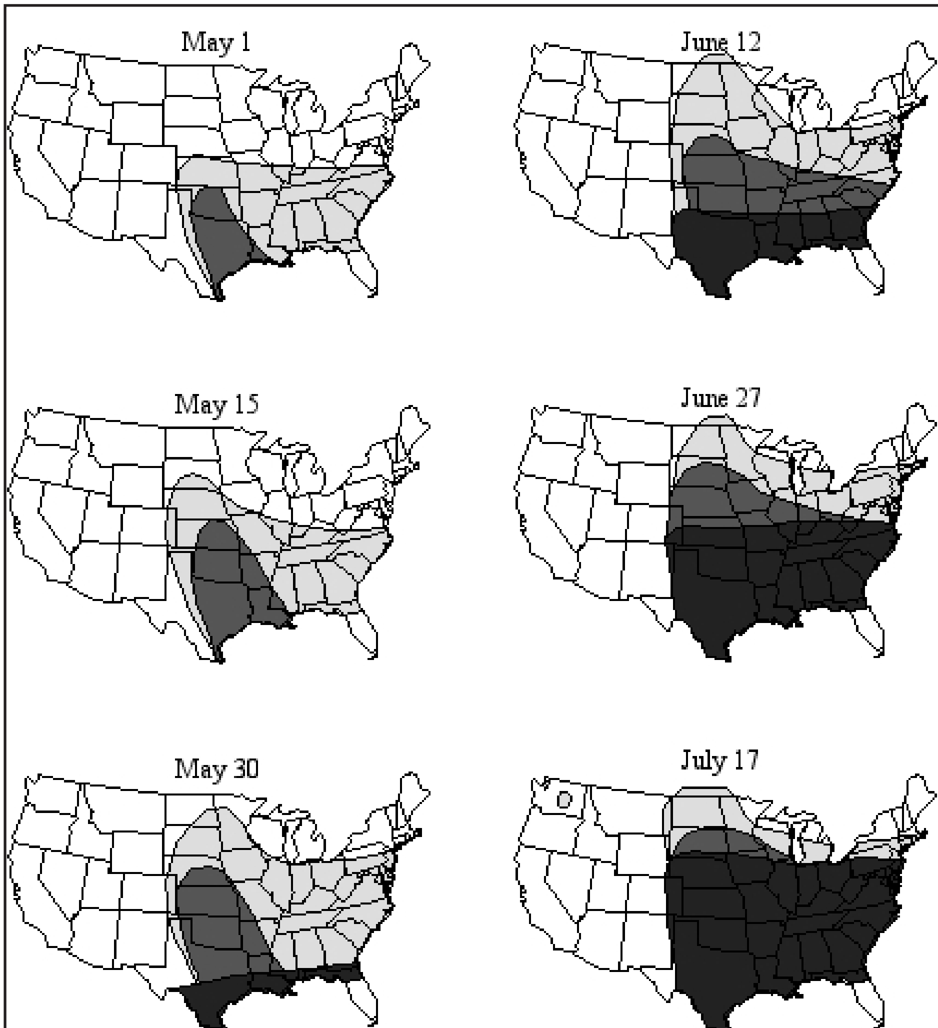

Fig. 1. Leaf rust severities in wheat fields in 2007.

wheat leaf rust were found in fields throughout the state of Oklahoma (Fig. 1, p. 183). With adequate moisture for rust development, leaf rust increased throughout Oklahoma and Texas and provided inoculum for the northern wheat growing areas.

Central Plains – Kansas, Nebraska, Colorado. In mid-March, traces of leaf rust were found in Manhattan, Kansas plots. The leaf rust appeared to have over wintered, because it was limited to the lower leaves. In early April, low levels of rust were found in the lower and middle canopy of susceptible wheat in plots at Manhattan. In mid-April, 5% severities were reported on the lower leaves of Jagger and Jagalene in south-central Kansas. Leaf rust was scattered and at high levels in locations where moisture was sufficient for rust infections.

During the first two weeks of May, wheat leaf rust was found in plots and fields from southeastern Colorado to south-central Nebraska. High levels of leaf rust were observed from central Oklahoma to central Kansas on susceptible varieties. With adequate moisture for rust development, leaf rust increased throughout this area.

In late May, high severity (80%) levels of wheat leaf rust were found in fields throughout Kansas and Nebraska. Many fields were sprayed for rust control and some fields of susceptible cultivars were almost a total loss due to leaf rust. Commonly grown cultivars such as Jagalene and Jagger were susceptible.

During the first week in June in northwestern Kansas, high severity levels of leaf rust were found in susceptible cultivars of hard red and white winter wheat. By the first week in June, high levels of wheat leaf rust were found in south-central and southeastern Nebraska winter wheat fields.

In 2007, the overall estimated loss due to leaf rust in Kansas was 13.9 % (roughly 50 million bushels) (Table 4, p. 190), which is well above the 20-year average of 3.8%. The 13.9% loss was the highest for leaf rust or any disease in Kansas since 1976 when disease loss estimates were initiated. Yield losses were estimated from fungicide plot data, cultivar surveys, cultivar disease ratings and disease surveys.

Northern Plains – Minnesota, South Dakota, North Dakota, Montana. During the first two weeks of May, wheat leaf rust was found in plots and fields in south-central South Dakota. On 23 May, traces of wheat leaf rust were found on susceptible winter wheat cultivars in the Rosemount, Minnesota, nursery and on 25 May, low levels of leaf rust were found on winter wheat in southeastern North Dakota fields. On 1 June, traces of wheat leaf rust were found on susceptible spring wheat cultivars in the St. Paul, Minnesota, nursery. In early June, leaf rust was increasing in southern South Dakota winter wheat fields and plots.

During the third week in June, plots of susceptible winter wheat cultivars such as Jagalene, in east-central Minnesota, east-central South Dakota and southwestern Nebraska had 60% rust severities, whereas resistant cultivars had only trace levels of infection on the flag leaves. Throughout this area fungicide usage on winter wheat was very common this year with many fields receiving multiple applications. By late June, spring wheat had leaf rust severities of trace to 5% on lower leaves in southern Minnesota and South Dakota fields (Fig. 1, p. 183). Susceptible spring wheat cultivars in southern Minnesota plots had 20% rust severities with most infections on the lower leaves.

This year there was more leaf rust than normal in the upper Midwest on both spring and winter wheat. Increased amounts of rust inoculum than in previous years arrived from the winter wheat region because of ideal conditions for infection in the Southern Plains, which increased the rust severities on the winter wheat. Regular rainfall in May and June in many areas of the northern Great Plains further increased rust development. Over 50% of the wheat fields in the spring wheat region were treated with fungicide, which prevented losses due to leaf rust and FHB (Table 4, p. 190).

During the last week in June, high levels of leaf rust were found in spring wheat plots at Lamberton in southwest Minnesota. Leaf rust was found at high severity levels on cultivars Knudson and Ada that had been previously rated as resistant to moderately resistant. In mid- July, trace to 80% leaf rust severities were observed on flag leaves of spring wheat cultivars in fields and plots from south-central Minnesota (Fig. 1, p. 183) to east central South Dakota and east central North Dakota. Hot dry weather combined with severe leaf rust infections killed the flag leaves of spring wheat.

During the fourth week in July, wheat leaf rust was widespread and at high severity levels on susceptible and moderately resistant spring wheat cultivars in research plots in North Dakota and northwestern Minnesota. The cultivars

Knudson and Briggs with *Lr16* and *Lr34* had low to moderate levels of leaf rust infection, a significant increase from previous years. Cultivars postulated to have *Lr21* (RB07, Glenn, Steele, Faller, and Howard) were highly resistant. In western North Dakota and eastern Montana high temperatures and leaf rust defoliated leaves in susceptible wheat lines in research plots. No leaf rust was observed on durum wheat cultivars. In fields throughout North Dakota trace to moderate levels of leaf rust were observed in a small number of fields due to highly resistant cultivars and common use of fungicide sprays. Many fields that had been sprayed had no rust infections.

In early July, low levels of leaf rust were found in spring wheat plots at Sidney in northeastern Montana.

Louisiana. In late February, leaf rust was found on susceptible cultivars in statewide variety trails in southwest Louisiana. During the second week in April, plots in southern Louisiana had high levels of leaf rust, whereas levels were light in fields. Many of these southern areas provided rust inoculum for areas further north.

Arkansas. In early April, leaf rust was light throughout Arkansas. In mid-April, freezing temperatures slowed further leaf rust development.

Southeast - Mississippi, Georgia, Alabama, South Carolina. In late April, plots of susceptible wheat cultivars in southern Alabama and southwestern Georgia had leaf rust severities up to 20% on lower leaves. Leaf rust was either absent or at trace levels in commercial fields in Georgia and Alabama. Dry conditions in March and April slowed rust development throughout much of the southeastern U.S. SRWW area.

Mid-Atlantic – North Carolina, Virginia. Trace amounts of leaf rust were found in plots in the Coastal Plain area of North Carolina in early April (Fig. 1, p. 183). In the last week in April, 10% leaf rust severities were observed on lower leaves of wheat in southeastern and eastern North Carolina plots.

In late April, high levels of leaf rust were found on the lower leaves of susceptible lines in a nursery at Warsaw, Virginia. The rust was found on the closest leaves to the ground level, indicating that leaf rust may have over wintered at this location. During the first two weeks in May, light levels of leaf rust were found in plots and fields in the coastal plains of Virginia.

In late May, wheat leaf rust was increasing in fields and plots in the coastal plains of Virginia. High leaf rust severity levels were observed in nurseries in northeastern South Carolina and eastern Virginia.

This year wheat leaf rust development was greater than normal in the Mid-Atlantic states and losses occurred in a few areas (Table 4, p. 190).

New York. In mid-June, low levels of wheat leaf rust were found in plots in Cayuga County, New York.

Midwest. In early June, wheat leaf rust was found in fields from northeastern Missouri to southern Illinois at 60% severity on flag leaves. There were yield losses to leaf rust in the soft red winter cultivars in this area. In early June, trace levels of leaf rust were found on flag leaves in wheat fields from northwestern Ohio, northwestern Indiana, to south-central Wisconsin. In plots in west-central and northeastern Indiana, 20% severities were found on lower leaves. In early June, leaf rust was found on several breeding lines in a nursery at Wooster, in north-central Ohio. In early July, low levels of leaf rust were found in winter wheat fields in eastern Wisconsin. Lack of moisture limited rust development in some locations in the northern SRWW area.

Western U.S. In mid-May, no leaf rust was detected in nurseries throughout the San Joaquin Valley in California. In the Pacific Northwest, wheat leaf rust was found at low levels in northwestern Washington and in irrigated fields in central Washington.

Canada. In early June, light levels of wheat leaf rust were found in winter wheat cultivars at the University of Manitoba, Canada, and other locations in southern Manitoba and on susceptible spring wheat cultivars at Homewood, Manitoba. On 23 and 24 July, wheat fields were surveyed in Manitoba and eastern Saskatchewan. Leaf rust was widespread and severe in Manitoba fields that were not sprayed with fungicide. Severities of 80% were observed on the flag leaves in some fields, although the average level of infection was approximately 20%. Highest severities in Saskatchewan were near the Manitoba border and declined to trace levels near Regina.

Wheat leaf rust virulence. In 2007, 52 races of wheat leaf rust were found in the U.S. (Table 2, pp. 186-187). Races with virulence to *Lr24* increased in frequency throughout all wheat growing regions of the U.S. (Table 3, p. 188). Virulence to *Lr24* was highest throughout the Great Plains region, where a number of winter wheat cultivars have *Lr24*. Virulence to *Lr9* and *Lr41* was high throughout the Great Plains region. Virulence to *Lr26* occurred in all regions of the U.S., and was highest in the eastern region. Virulence to *Lr16* was highest in the spring wheat region of Minnesota and North and South Dakota, where a number of the spring wheats have this gene. Virulence to *Lr17* was found equally in all regions of the U.S. Virulence to *Lr18* occurred in the southeast and northeast, where a number of SRWWs have this

Table 2. Races of *Puccinia triticina* in the U.S. in 2007 determined by virulence to 20 near-isogenic lines of Thatcher wheat with leaf rust-resistance genes. Differentials used were 1a, 2c, 3, 9, 16, 24, 26, 3ka, 11, 17, 30, B, 10, 14a, 18, 21, 28, 41, 42. An * indicates less than 0.6 %. SE includes the states of LA, AR, MS, AL, GA, FL, TN, SC and NC; NE includes states of VA, WV, MD, PA, DE, NJ, NY, MA, CT, RI, VT, NH, and ME; and OH Valley includes states of MO, IL, KY, OH, IN, MI and WI.

Race	Virulence combination (ineffective *Lr* genes)	SE		NE		OH Valley		TX OK–NM		KS–NE IA–CO		MN SD–ND MT–WY		WA		U.S. Total	
		#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
BBBDB	14a	2	2.2	0	0	0	0	0	0	0	0	4	1.2	0	0	6	0.7
CCPSB	3,26,3ka,17,30,B,10,14a	0	0	2	2.9	0	0	0	0	0	0	0	0	0	0	2	0.2
LCDSB	1,26,17,B,10,14a	2	2.2	0	0	0	0	0	0	0	0	0	0	0	0	2	0.2
MBDSB	1,3,17,B,10,14a	0	0	0	0	0	0	2	1	1	0.8	0	0	0	0	3	0.3
MBDTG	1,3,17,B,10,14a,18,28	0	0	2	2.9	0	0	0	0	0	0	0	0	0	0	2	0.2
MBGJG	1,3,11,10,14a,28	0	0	0	0	1	2.3	0	0	0	0	0	0	1	100	5	0.6
MBPSB	1,3,3ka,17,30,B,10,14a	0	0	0	0	0	0	0	0	0	0	6	1.8	0	0	6	0.7
MBRJG	1,3,3ka,11,30,10,14a,28	1	1.1	0	0	0	0	0	0	0	0	0	0	0	0	1	0.1
MBTSB	1,3,3ka,11,17,30,B,10,14a	2	2.2	0	0	0	0	0	0	0	0	0	0	0	0	2	0.2
MCDSB	1,3,26,17,B,10,14a	6	6.5	11	15.7	1	2.3	5	2.5	1	0.8	2	0.6	0	0	26	3.1
MCGJG	1,3,26,11,10,14a,28	4	4.3	0	0	0	0	0	0	0	0	0	0	0	0	4	0.5
MCRKG	1,3,26,3ka,11,30,10,14a,18,28	4	4.3	1	1.4	0	0	0	0	0	0	0	0	0	0	5	0.6
MCTSB	1,3,26,3ka,11,17,30,B,10,14a	0	0	3	4.3	0	0	0	0	0	0	0	0	0	0	3	0.3
MDGJG	1,3,24,11,10,14a,28	0	0	2	2.9	0	0	0	0	0	0	0	0	0	0	2	0.2
MDPSC	1,3,24,3ka,17,30,B,10,14a,42	0	0	0	0	1	2.3	0	0	2	1.6	1	0.3	0	0	4	0.5
MDSPC	1,3,24,3ka,11,17,B,14a,18,42	0	0	0	0	0	0	2	1	0	0	0	0	0	0	2	0.2
MFBJG	1,3,24,26,10,14a,28	5	5.4	0	0	0	0	0	0	0	0	0	0	0	0	5	0.6
MFGJH	1,3,24,26,11,10,14a,28,42	6	6.5	26	37.1	0	0	0	0	0	0	0	0	0	0	32	3.7
MFPSC	1,3,24,26,3ka,17,30,B,10,14a,42	15	16.1	7	10	8	18.2	28	14.2	18	14.4	45	13.4	0	0	121	13.9
MGBJG	1,3,16,10,14a,28	0	0	0	0	0	0	0	0	0	0	3	0.9	0	0	3	0.3
MJDSC	1,3,16,24,17,B,10,14a,42	0	0	0	0	0	0	2	1	2	1.6	0	0	0	0	4	0.5
MLDSD	1,3,9,17,B,10,14a,41	0	0	0	0	0	0	34	17.3	14	11.2	58	17.3	0	0	106	12.2
NBBFG	1,2c,14a,18,28	0	0	5	7.1	0	0	0	0	0	0	0	0	0	0	5	0.6
NBBKG	1,2c,10,14a,18,28	0	0	6	8.6	0	0	0	0	0	0	0	0	0	0	6	0.7
PBBGG	1,2c,3,10,28	0	0	0	0	0	0	0	0	2	1.6	0	0	0	0	2	0.2
PBDGG	1,2c,3,17,10,28	0	0	0	0	0	0	0	0	1	0.8	0	0	0	0	1	0.1
PCDSG	1,2c,3,26,17,B,10,14a,28	2	2.2	0	0	0	0	0	0	0	0	2	0.6	0	0	4	0.5
SBDGG	1,2a,2c,17,10,28	0	0	0	0	0	0	0	0	0	0	2	0.6	0	0	2	0.2
SBDSB	1,2a,2c,17,B,10,14a	0	0	0	0	0	0	0	0	0	0	1	0.3	0	0	1	0.1

gene. Virulence to *Lr21* was not found in any region. Virulence to *Lr41* was found in all regions except the southeast and Ohio Valley, California, and Washington. Virulence to *Lr42* was found in all regions except California and Washington.

In the Southeast, the most common race, MFPSC (16.1%), had virulence to *Lr17*, *Lr24*, and *Lr26* (Table 3, p. 188). In the Northeast, the most common race, MFGJH (37.1%) had virulence to *Lr11*, *Lr24*, and *Lr26*. In the Midwest, TDBGH (22.7%) had virulence to *Lr2a*, *Lr24*, and *Lr42*. This also was the most common race identified in the U.S. In

Table 2 (continued). Races of *Puccinia triticina* in the U.S. in 2007 determined by virulence to 20 near-isogenic lines of Thatcher wheat with leaf rust-resistance genes. Differentials used were 1a, 2c, 3, 9, 16, 24, 26, 3ka, 11, 17, 30, B, 10, 14a, 18, 21, 28, 41, 42. An * indicates less than 0.6 %. SE includes the states of LA, AR, MS, AL, GA, FL, TN, SC and NC; NE includes states of VA, WV, MD, PA, DE, NJ, NY, MA, CT, RI, VT, NH, and ME; and OH Valley includes states of MO, IL, KY, OH, IN, MI and WI.

Race	Virulence combination (ineffective *Lr* genes)	SE		NE		OH Valley		TX OK–NM		KS–NE IA–CO		MN SD–ND MT–WY		WA		U.S. Total	
		#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
SBJDG	1,2a,2c,11,17,14a,28	0	0	0	0	0	0	0	0	1	0.8	0	0	0	0	1	0.1
TBBJG	1,2a,2c,3,10,14a,28	6	6.5	0	0	0	0	0	0	0	0	1	0.3	0	0	7	0.8
TBRKG	1,2a,2c,3,3ka,11,30,10,14a,18,28	2	2.2	0	0	0	0	0	0	0	0	0	0	0	0	2	0.2
TCBJG	1,2a,2c,3,26,10,14a,28	0	0	0	0	0	0	0	0	2	1.6	0	0	0	0	2	0.2
TCDSB	1,2a,2c,3,26,17,B,10,14a	0	0	0	0	2	4.5	0	0	0	0	1	0.3	0	0	3	0.3
TCMJG	1,2a,2c,3,26,3ka,30,10,14a,28	5	5.4	0	0	0	0	0	0	0	0	0	0	0	0	5	0.6
TCRJG	1,2a,2c,3,26,3ka,11,30,10,14a,28	0	0	0	0	2	4.5	0	0	0	0	0	0	0	0	2	0.2
TCRKG	1,2a,2c,3,26,3ka,11,30,10,14a,18,28	8	8.6	0	0	0	0	0	0	1	0.8	1	0.3	0	0	10	1.2
TCSJG	1,2a,2c,3,26,3ka,11,17,10,14a,28	0	0	1	1.4	0	0	0	0	0	0	0	0	0	0	1	0.1
TDBBG	1,2a,2c,3,24,28	0	0	0	0	2	4.5	0	0	0	0	0	0	0	0	2	0.2
TDBGG	1,2a,2c,3,24,10,28	4	4.3	2	2.9	2	4.5	10	5.1	2	1.6	21	6.3	0	0	41	4.7
TDBGH	1,2a,2c,3,24,10,28,42	0	0	0	0	10	22.7	16	8.1	43	34.4	88	26.3	0	0	157	18.1
TDBJG	1,2a,2c,3,24,10,14a,28	6	6.5	0	0	6	13.6	57	28.9	6	4.8	18	5.4	0	0	93	10.7
TDBJH	1,2a,2c,3,24,10,14a,28,42	4	4.3	0	0	7	15.9	14	7.1	6	4.8	11	3.3	0	0	42	4.8
TDDGH	1,2a,2c,3,24,17,10,28,42	0	0	0	0	0	0	0	0	2	1.6	6	1.8	0	0	8	0.9
TFBGH	1,2a,2c,3,24,26,10,28,42	0	0	0	0	0	0	4	2	7	5.6	5	1.5	0	0	16	1.8
TFBJG	1,2a,2c,3,24,26,10,14a,28	8	8.6	0	0	0	0	12	6.1	4	3.2	6	1.8	0	0	30	3.5
TGBJG	1,2a,2c,3,16,10,14a,28	1	1.1	0	0	0	0	6	3	0	0	0	0	0	0	7	0.8
TJBGH	1,2a,2c,3,16,24,10,28,42	0	0	0	0	1	2.3	2	1	3	2.4	30	9	0	0	36	4.1
TJBJG	1,2a,2c,3,16,24,10,14a,28	0	0	0	0	1	2.3	2	1	5	4	22	6.6	0	0	30	3.5
TLBJG	1,2a,2c,3,9,10,14a,28	0	0	0	0	0	0	0	0	2	1.6	0	0	0	0	2	0.2
TLGJG	1,2a,2c,3,9,11,10,14a,28	0	0	0	0	0	0	1	0.5	0	0	0	0	0	0	1	0.1
TNRJK	1,2a,2c,3,9,24,3ka,11,30,10, 14a,28, 41,42	0	0	2	2.9	0	0	0	0	0	0	1	0.3	0	0	3	0.3
TOTAL		93		70		44		197		125		355		4		868	

Table 3. Virulence frequencies (%) of *Puccinia triticina* in the U.S. in 2007 to 20 differential lines of Thatcher wheat with leaf rust-resistance genes. SE includes the states of LA, AR, MS, AL, GA, FL, TN, SC and NC; NE includes states of VA, WV, MD, PA, DE, NJ, NY, MA, CT, RI, VT, NH, and ME; and OH Valley includes states of MO, IL, KY, OH, IN, MI and WI.

Resistance gene	SE		NE		OH Valley		TX OK–NM		KS–NE IA–CO		MN ND–SD MT–WY		WA		U.S. Total	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
Lr1	91	97.8	68	97.1	44	100.0	197	100.0	125	100.0	331	98.8	4	100.0	860	99.1
Lr2a	44	47.3	5	7.1	33	75.0	124	62.9	84	67.2	214	63.9	0	0.0	504	58.1
Lr2c	46	49.5	16	22.9	33	75.0	124	62.9	87	69.6	216	64.5	0	0.0	522	60.1
Lr3	89	95.7	59	84.3	44	100.0	197	100.0	124	99.2	328	97.9	4	100.0	845	97.4
Lr9	0	0.0	2	2.9	0	0.0	35	17.8	16	12.8	59	17.6	0	0.0	112	12.9
Lr16	1	1.1	0	0.0	2	4.5	12	6.1	10	8.0	55	16.4	0	0.0	80	9.2
Lr24	48	51.6	39	55.7	38	86.4	149	75.6	100	80.0	254	75.8	0	0.0	628	72.4
Lr26	65	69.9	51	72.9	13	29.5	49	24.9	33	26.4	62	18.5	0	0.0	273	31.5
Lr3ka	37	39.8	16	22.9	11	25.0	30	15.2	21	16.8	54	16.1	0	0.0	169	19.5
Lr11	27	29.0	35	50.0	3	6.8	3	1.5	2	1.6	2	0.6	4	100.0	76	8.8
Lr17	27	29.0	26	37.1	12	27.3	73	37.1	42	33.6	124	37.0	0	0.0	304	35.0
Lr30	37	39.8	15	21.4	11	25.0	28	14.2	21	16.8	54	16.1	0	0.0	166	19.1
LrB	27	29.0	25	35.7	12	27.3	73	37.1	38	30.4	116	34.6	0	0.0	291	33.5
Lr10	91	97.8	65	92.9	42	95.5	195	99.0	124	99.2	331	98.8	4	100.0	852	98.2
Lr14a	89	95.7	68	97.1	29	65.9	165	83.8	65	52.0	183	54.6	4	100.0	603	69.5
Lr18	14	15.1	14	20.0	0	0.0	2	1.0	1	0.8	1	0.3	0	0.0	32	3.7
Lr21	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Lr28	66	71.0	47	67.1	32	72.7	124	62.9	87	69.6	217	64.8	4	100.0	577	66.5
Lr41	0	0.0	2	2.9	0	0.0	34	17.3	14	11.2	59	17.6	0	0.0	109	12.6
Lr42	25	26.9	35	50.0	27	61.4	68	34.5	83	66.4	187	55.8	0	0.0	425	49.0
Total	93		70		44		197		125		335		4		868	

Texas and Oklahoma, the most common race TDBJG (28.9%) had virulence to *Lr2a* and *Lr24*. In Kansas and Nebraska, the most common race TDBGH (34.4%) had virulence to *Lr2a, Lr24*, and *Lr42*. In Minnesota, South Dakota, and North Dakota, TDBGH (26.3%)was the most common race, which also was the most common race in the U.S.

Wheat stripe rust (*Puccinia striiformis* f. sp. *tritici*). Southern Plains. In early February, wheat stripe rust was found at low severities in plots at College Station and McGregor in central Texas. Dry conditions were not favorable for rust development in February and early March. By late March, stripe rust development in Texas was equal to last year. In mid-April, only low levels of stripe rust were found in plots in southern, central, and north-central Texas. In late April, in north-central Texas fields, trace levels of active sporulating stripe rust infections were found and, at the same locations, leaf rust was increasing rapidly in the fields and plots (Fig. 2, p. 189). During the first two weeks of May, traces of wheat stripe rust were reported in north central Oklahoma plots. Most of these infections were found on the F-1 or flag leaves. In late May, severe levels of stripe rust were reported in irrigated plots in the Oklahoma panhandle (Fig. 2, p. 189). However, little stripe rust was found in dryland plots and fields. In comparison, leaf rust was heavy in both irrigated and dryland plots in the same area. In early June, high severity (100%) levels of stripe rust were observed in irrigated nursery plots of susceptible winter wheat cultivars at Bushland, Texas. No stripe rust was found in the dryland nurseries. The southern plains infection sites provided a reduced amount of inoculum for the northern regions of the U.S.

Central Plains. During the first two weeks of May, traces of wheat stripe rust were reported in southeastern Colorado plots, east central Nebraska plots, central and north central Kansas plots and fields. Most of these infections were found on the F-1 or flag leaves. In late May, stripe rust was present at many Kansas locations but appeared to be a heavier in western Kansas. Leaf rust was the predominant disease in western Kansas and many growers in this area responded to the disease threat with timely fungicide applications. Stripe rust was found at many locations in central Kansas, but the disease appeared to be held in check by the widespread use of resistant cultivars. In early June, in an irrigated nursery in northwestern Kansas, 70% stripe rust severities were observed in susceptible cultivars. Low levels were found on previously resistant cultivars. In 2007, the overall estimated loss due to wheat stripe rust in Kansas was 0.2%, which is below the 20-year average of 1.31% (Table 4).

In early June, stripe rust was found in wheat plots in southern Nebraska and in northeastern Colorado fields.

By the third week in June, light levels of stripe rust (1-10% severities) were found in winter wheat in northwestern Nebraska fields and southwestern South Dakota plots (Fig. 2). In the roadside ditch near one of the fields, 40% severities were observed on jointed goatgrass *Ae. cylindrica*.

Northern Plains. By late June, hot and dry conditions brought stripe rust infections to almost a complete remission in the Great Plains states. In late July, no stripe rust was detected in spring wheat in northwest Minnesota or northern North Dakota.

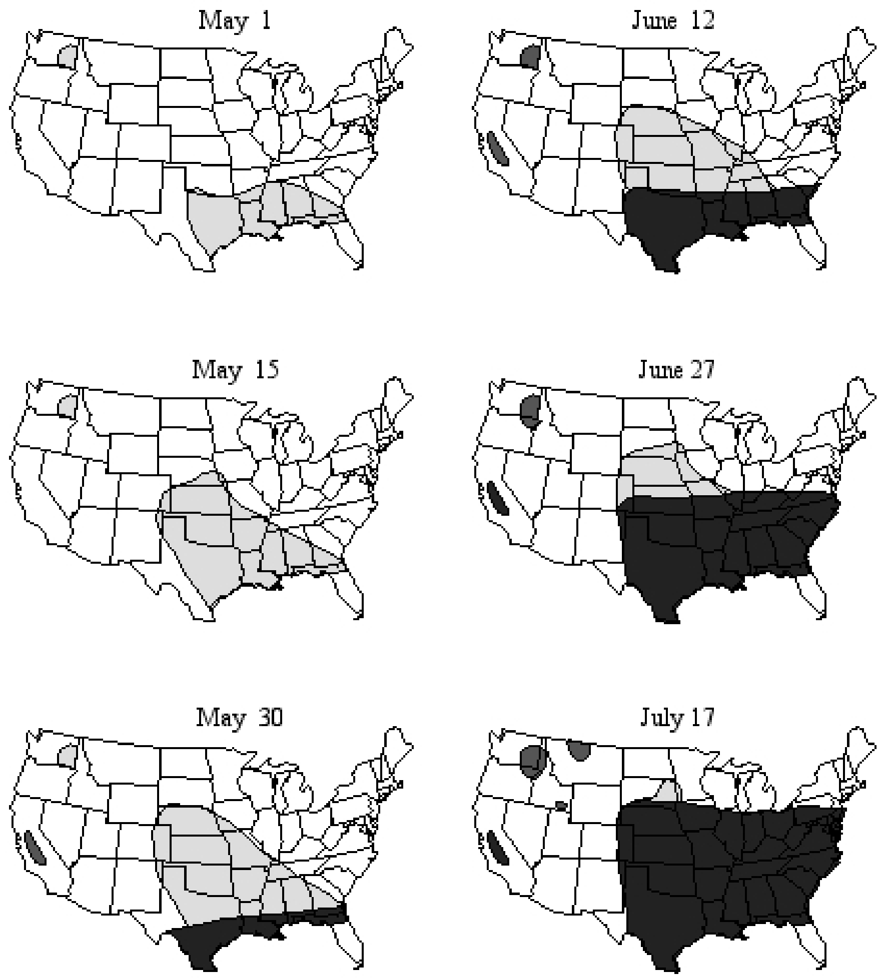

Fig. 2. Stripe rust severities in wheat fields in 2007.

In late May, heavy wheat stripe rust was found in Bozeman, Montana plots, but was spotty throughout the rest of the state. Susceptible winter wheat varieties were more affected than spring wheat varieties. Some growers in the golden triangle of north central Montana sprayed for stripe rust control in winter wheat. Hot dry conditions throughout June prevented stripe rust from becoming a problem.

Louisiana. In late February, light levels of stripe rust were found in wheat fields and plots in southern Louisiana. One crop consultant suggested spraying for stripe rust. In early April, traces of stripe rust were found in wheat plots in Louisiana. In late April, dry and warm conditions slowed stripe rust development in plots and fields in Louisiana.

Arkansas. In early March, wheat stripe rust was reported in southeast and southwest Arkansas fields. Hot spots were seen from the road in a few fields by 13 March. Fungicides were recommended for all fields with stripe rust and several fields were sprayed. By early April, stripe rust was increasing throughout Arkansas, but freezing temperatures in mid-April affected further stripe rust development.

Southeast. In late April, dry and warm conditions slowed stripe rust development in plots and fields throughout the southeastern U.S. For example, in southern Alabama and southwestern Georgia traces of wheat stripe rust were found in a few plots. In these locations most of the stripe rust infections had occurred earlier, in mid to late winter, when temperatures were cooler.

This year there were few stripe rust inoculum sources in the southern U.S. Then as day and nighttime temperatures continued to increase, they surpassed the optimum for stripe rust development and this lead to a reduced amount of rust for the northern wheat growing regions of the U.S.

Table 4. Estimated losses in winter wheat due to rust in 2007 (T = trace).

				Losses due to					
				Stem rust		Leaf rust		Stripe rust	
State	1,000 acres harvested	Yield in bushels per acre	Production, 1,000 bushels	Percent	1,000 bushels	Percent	1,000 bushels	Percent	1,000 bushels
AL	80	43.0	3,440	0.0	0.0	T	T	0.0	0.0
AR	700	41.0	28,700	0.0	0.0	T	T	T	T
CA	240	80.0	19,200	0.0	0.0	0.0	0.0	2.0	391.8
CO	2,350	40.0	94,000	0.0	0.0	1.0	949.5	T	T
DE	55	68.0	2,740	0.0	0.0	0.0	0.0	0.0	0.0
FL	9	57.0	513	0.0	0.0	T	T	0.0	0.0
GA	230	40.0	9,200	0.0	0.0	T	T	0.0	0.0
ID	710	73.0	51,830	0.0	0.0	T	T	0.5	260.5
IL	890	57.0	50,730	0.0	0.0	0.5	254.9	T	T
IN	370	57.0	21,090	0.0	0.0	1.0	213.0	0.0	0.0
IA	28	50.0	1,400	0.0	0.0	T	T	0.0	0.0
KS	8,600	33.0	283,800	0.0	0.0	13.9	45,923.4	0.2	660.8
KY	250	49.0	12,250	0.0	0.0	0.1	12.3	0.0	0.0
LA	220	54.0	11,880	0.0	0.0	1.0	121.2	1.0	121.2
MD	170	68.0	11,560	0.0	0.0	0.0	0.0	0.0	0.0
MI	540	65.0	35,100	0.0	0.0	T	T	T	T
MN	60	48.0	2,880	0.0	0.0	3.0	89.1	0.0	0.0
MS	330	56.0	18,480	0.0	0.0	0.5	92.9	0.0	0.0
MO	880	43.0	37,840	0.0	0.0	2.0	772.2	T	T
MT	2,190	38.0	83,220	0.0	0.0	T	T	0.2	166.8
NE	1,960	43.0	84,280	0.0	0.0	7.0	6,357.3	0.2	181.6
NJ	28	51.0	1,428	0.0	0.0	0.0	0.0	0.0	0.0
NM	300	26.0	7,800	0.0	0.0	0.0	0.0	0.0	0.0
NY	85	52.0	4,420	0.0	0.0	0.5	223.2	0.0	0.0
NC	500	40.0	20,000	0.0	0.0	0.5	100.5	0.0	0.0
ND	445	50.0	22,250	0.0	0.0	5.0	1,171.1	0.0	0.0
OH	730	63.0	45,990	0.0	0.0	1.0	464.5	0.0	0.0
OK	3,500	28.0	98,000	0.0	0.0	4.0	4,126.3	1.0	1,031.6
OR	735	55.0	40,425	0.0	0.0	T	T	0.5	203.1
PA	155	58.0	8,990	0.0	0.0	1.0	90.8	0.0	0.0
SC	135	31.0	4,185	0.0	0.0	0.5	21.0	0.0	0.0
SD	1,980	48.0	95,040	0.0	0.0	4.0	3,960.0	T	T
TN	260	41.0	10,660	0.0	0.0	T	T	0.0	0.0
TX	3,800	37.0	140,600	T	T	6.7	10,608.3	4.5	7,125.0
UT	125	48.0	6,000	0.0	0.0	0.0	0.0	T	T
VA	205	64.0	13,120	0.0	0.0	T	T	0.0	0.0
WA	1,690	64.0	108,160	0.0	0.0	T	T	0.5	543.5
WV	6	58.0	348	0.0	0.0	T	T	0.0	0.0
WI	270	69.0	18,630	0.0	0.0	1.0	188.2	0.0	0.0
WY	125	26.0	3,250	0.0	0.0	T	T	0.0	0.0
Total	35,936	42.1	1,514,429		T		75,739.7		10,685.9
U.S.% Loss				4.73		0.67		0.29	
U.S. Total	35,952	42.2	1,515,989						

Table 5. Estimated losses in spring wheat due to rust in 2007 (T = trace).

State	1,000 acres harvested	Yield in bushels per acre	Production, 1,000 bushels	Losses due to: Stem rust, Percent	Stem rust, 1,000 bushels	Leaf rust, Percent	Leaf rust, 1,000 bushels	Stripe rust, Percent	Stripe rust, 1,000 bushels
CO	19	80.0	1,520	0.0	0.0	T	T	0.0	0.0
ID	450	68.0	30,600	0.0	0.0	T	T	T	T
MN	1,650	47.0	77,550	0.0	0.0	5.0	4,081.6	0.0	0.0
MT	2,400	23.0	55,200	0.0	0.0	T	T	T	T
NV	1	100.0	100	0.0	0.0	0.0	0.0	0.0	0.0
ND	6,500	36.0	234,000	0.0	0.0	2.0	4,775.5	0.0	0.0
OR	120	53.0	6,360	0.0	0.0	0.0	0.0	0.5	31.9
SD	1,340	39.0	52,260	0.0	0.0	2.0	1,066.5	0.0	0.0
UT	7	60.0	420	0.0	0.0	0.0	0.0	T	T
WA	447	46.0	20,562	0.0	0.0	T	T	1.0	207.7
WI	8	35.0	280	0.0	0.0	1.0	2.8	0.0	0.0
WY	5	39.0	195	0.0	0.0	0.0	0.0	0.0	0.0
Total from above	12,947	37.0	479,047		0.0		9,926.0		239.6
U.S. % loss				0.0		2.03		0.05	
U.S. total	13,878	37.0	479,047						

Estimated losses in durum wheat due to rust in 2006 (T = trace).

State	1,000 acres harvested	Yield in bushels per acre	Production, 1,000 bushels	Losses due to: Stem rust, Percent	Stem rust, 1,000 bushels	Leaf rust, Percent	Leaf rust, 1,000 bushels	Stripe rust, Percent	Stripe rust, 1,000 bushels
AZ	79	100.0	7,900	0.0	0.0	0.0	0.0	0.0	0.0
CA	75	95.0	7,125	0.0	0.0	0.0	0.0	0.0	0.0
ID	15	83.0	1,245	0.0	0.0	0.0	0.0	0.0	0.0
MT	475	24.0	11,400	0.0	0.0	0.0	0.0	0.0	0.0
ND	1,460	30.0	43,800	0.0	0.0	0.0	0.0	0.0	0.0
SD	8	27.0	216	0.0	0.0	0.0	0.0	0.0	0.0
Total from above	2,112	33.9	71,686		0.0		0.0		0.0
U.S. % loss				0.0		0.0		0.0	
U.S. Total	2,112	33.9	71,686						

Midwest. In early June, foci of stripe rust were noted in plots at Saint Jacob, Illinois (near St. Louis, MO), and traces were found in plots at Owensboro in western Kentucky. These are the only two locations in the northern SRWW area where stripe rust was reported this year.

California. The growing season in California was extremely dry this year. The overall disease impact, even on susceptible varieties, was less than in 2006. However, rain showers and cool temperatures in mid-late April in the Sacramento Valley, allowed stripe rust to reach very high severity levels on susceptible cultivars not treated with fungicide. In early May, only trace levels of wheat stripe rust developed in the drier San Joaquin Valley. By mid-May, despite the very dry conditions, severe levels of rust developed in small areas of fields of susceptible varieties in the San Joaquin Valley. Because of the late development and limited spread of the disease, yield losses were minimal (Table 5, p. 191).

In mid July, stripe rust developed up to 40–100% severities on susceptible winter and spring wheat entries in the monitoring nurseries at Tule Lake, a high elevation area in northeastern California. The rust level was relatively low compared to those in the past several years.

Pacific Northwest. As usual, stripe rust reached 50% severity by the first week in April and 60% severity during the third week in April on susceptible entries in winter wheat nurseries at Mount Vernon in northwestern Washington. By the end of May in northwestern Washington, 100% stripe rust severities were observed on susceptible winter wheat entries and 40% severities on susceptible spring wheat entries.

In mid-April, early-planted HRWW fields had up to 10% stripe rust severity in south-central Washington. Timely application of fungicides prevented further development of stripe rust in this region and prevented further spread of the disease to other regions. The dry weather conditions from late April to late May and reduced rust inoculum, made rust development slow and light in the major wheat growing regions in the Pacific Northwest. In mid-May, low levels of stripe rust were found in nurseries in the Palouse region with some hot spots of severities up to 40%. In early June, stripe rust severities ranged from 10% to 40% in eastern Washington winter and spring wheat plots.

By the end of May, wheat stripe rust was reported in experimental fields in Pendleton, Oregon, and Moscow, Idaho. In mid June, wheat stripe rust developed in eastern and central Washington fields and in dryland and irrigated fields in northeastern Oregon. In mid June, stripe rust severities reached 100% on susceptible entries around Pullman and Walla Walla and 60-80% at Lind, Pendleton and Hermiston on winter wheat and 40–60% on susceptible entries at these locations on spring wheat. However, stripe rust was light in commercial wheat fields due to resistance of cultivars, low inoculum, and dry weather conditions from late April to late June.

Hot and dry weather conditions during the first two weeks of July stopped the stripe rust season in most of the Pacific Northwest. Similar to 2006, stripe rust of wheat was light in commercial fields and therefore, yield losses caused by stripe rust were low. However, stripe rust did develop to 100% severity on susceptible entries in unirrigated experimental plots of both winter and spring wheat under natural infection in Washington, and 60-80% severities in wheat nurseries in northeastern Oregon and northern Idaho.

Canada. In late July, isolated pustules of stripe rust were observed in some fields in Saskatchewan, Canada, but the severity was very low.

NEBRASKA

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Nebraska wheat crop.

In 2007, 2,050,000 acres (830,00 ha) of wheat were planted in Nebraska and 1,960,000 acres (790,000 ha) were harvested with an average yield of 43 bu/acre (2,890 kg/ha) for a total production of 84,280,000 bu (2,304,504,000 kg). The 2006 Nebraska wheat crop was estimated at 61,200,000 bu (1,667,088,000 kg), which represented a 36 bu/acre state (2,420 kg/ha) average yield on 1,700,000 harvested acres (688,500 ha). The autumn was generally conducive to good emergence