In addition to RWA, we also are aggressively pursuing wheat stem sawfly (WSS) resistance as a breeding objective. With one month of salary support from our program, Terri Randolph (Frank Peairs' team) coordinated solid stem evaluations of segregating populations at Fort Collins. We also have generated a group of 300 DHs from crosses with Byrd and Antero and the solid-stemmed Montana cultivar Bearpaw. We have completed DNA marker analysis for WSS-associated markers in these DHs and are hopeful that some of the DHs will be advanced to yield trials in 2016. In 2014, we added a field site near New Raymer for evaluation of wheat WSS response, and we believe that we have some form of non solid-stem resistance in our germplasm. One DH line (CO11D1397, pedigree: CO050337-2/Byrd) showed very good yield at New Raymer and other locations, low WSS damage, and low larvae counts in the stubble after harvest. This line is in the 2015 UVPT and IVPT and is under Breeder seed increase for potential Foundation seed production and release in 2016.

Personnel updates. CSU wheat breeder Scott Haley completed a six-month sabbatical leave in Europe from December 2013 to May 2014. The focus of the sabbatical was to learn new ideas and new techniques at the interface of crop genomics and wheat breeding. In December 2014, Ph.D. student Sue Latshaw accepted a position in wheat breeding with Bayer CropScience in Lincoln, NE, and will work to complete her Ph.D. in spring 2015. In November 2014, Ph.D. student Jessica Cooper successfully completed her degree program, focusing on genomic selection for end-use quality traits (including preharvest sprouting tolerance), and accepted a position in canola breeding with Cargill in Fort Collins. Our Ph.D. student Craig Beil completed his first year in our program in summer 2014 conducting research to leverage next-generation sequencing technologies (i.e., genotyping by sequencing) to more efficiently exploit winter wheat germplasm from the CIMMYT–ICARDA International Winter Wheat Improvement Program based in Turkey. Craig is currently spending three months with CIMMYT in Mexico (February to May 2015) participating in their international training program. Craig is only the 5th U.S. trainee to participate in this program since the 1960s. In autumn 2014, Ben Conway joined our program (co-advised by Pat Byrne) to work on a Ph.D. focusing on research to improve genomic selection models in wheat using climatological and other covariates. Ben joined us following completion of an M.S. degree in wheat breeding at the University of Maryland.

KANSAS

KANSAS STATE UNIVERSITY
Environmental Physics Group, Department of Agronomy, 2004 Throckmorton Plant Sciences Center, Manhattan, KS 66506-5501, USA.

Chemical properties of soil with winter cover crops.

Oliver W. Freeman and M.B. Kirkham.

In Kansas, winter cover crops have a new interest with the development of summer crops for biofuel. When a crop is harvested for bioenergy, the residue is removed leaving the soil prone to erosion during the winter fallow period. Winter cover crops may allow maximum biomass harvest by protecting the soil from wind and water erosion. Therefore, the objective of the research reported by Freeman (2014) was to determine the effect of two winter cover crops on the growth of two biofuel crops, corn (*Zea mays* L.) and forage sorghum (*Sorghum bicolor* (L.) Moench) in a corn–forage sorghum rotation. The two rotations, established in 2009, were continuous forage sorghum and corn–forage sorghum. In the corn–forage sorghum rotation, the 2009 plots with corn grew forage sorghum in 2010 and corn in 2011; the 2009 plots with forage sorghum grew corn in 2010 and forage sorghum in 2011. The two cover crops were a legume, Austrian winter pea (*Pisum sativum* var. *arvense* Poir.), and winter wheat. Control plots were fallowed. The experiment was done for two years in Manhattan and Tribune, KS, with harvests of the winter cover crops in the springs of 2011 and 2012. Two levels of nitrogen were added to the soil: 0 and 101 kg/ha N. The main results for both locations were 1) nitrogen increased yield of both corn and sorghum. 2) growth of the winter cover crops did not decrease the yield of the summer crops. and 3) winter wheat produced more biomass than Austrian winter pea. The Austrian pea winter killed in the second year of the study at Manhattan, KS. The results showed that winter wheat is a better winter cover crop than Austrian winter pea, because of its ability to grow well during the off-season of the bioenergy crops and to provide soil cover during winter.

In the study of Freeman (2014), soil data were not reported, although soil was sampled. Here we report the soil data for Manhattan, KS. Soil samples were taken in the autumn of 2010 after harvest of the forage sorghum and corn and at the time of the planting of the cover crops. Soil was sampled again in the spring of 2011 after the cover crops were harvested and before the corn and sorghum were planted. The soil was analyzed for four chemical characteristics (pH, organic matter, nitrogen, and carbon) using standard methods practiced in the Soil Testing Laboratory of Kansas State University, Manhattan, KS.

Table 1. Properties of a silt loam soil at Manhattan, KS, before two winter cover crops were planted in the autumn of 2010 and after their harvest in the spring of 2011. The two cover crops were winter wheat and Austrian winter pea. Plots also were fallowed during the winter. The summer crops were forage sorghum and corn, and they were grown in two rotations established in 2009: continuous forage sorghum and corn-forage sorghum. In the corn–forage sorghum rotation, the 2009 plots with corn grew forage sorghum in 2010 and corn in 2011; the 2009 plots with forage sorghum grew corn in 2010 and forage sorghum in 2012. Half the plots were fertilized with 101 kg/ha nitrogen and half the plots received no fertilizer nitrogen. The values are the means and standard deviations of four replications.

	0 kg/ha nitrogen			101 kg/ha nitrogen		
	Winter cover crop			Winter cover crop		
Soil property	Wheat	Pea	Fallow	Wheat	Pea	Fallow
At cover crop planting in autumn 2010 in the forage sorghum–forage sorghum rotation						
pH	6.03±0.19	6.08±0.29	6.10±0.23	6.33±0.19	6.00±0.37	6.13±0.39
Organic matter, %	1.48±0.05	1.33±0.26	1.25±0.41	1.55±0.13	1.30±0.37	1.33±0.15
Nitrogen, %	0.10±0.01	0.09±0.02	0.08±0.02	0.10±0.02	0.09±0.02	0.09±-0.02
Carbon, %	0.95±0.16	0.79±0.14	0.72±0.16	0.94±0.17	0.78±0.16	0.80±0.12
At cover crop planting in fall 2010 in corn-forage sorghum rotation after sorghum harvest						
pH	6.08±0.38	5.85±0.36	6.20±0.28	6.10±0.26	6.08±0.39	6.00±0.35
Organic matter, %	1.03±0.49	1.03±0.28	1.10±0.29	1.05±0.47	1.03±2.38	1.05±0.27
Nitrogen, %	0.08±0.03	0.08±0.03	0.09±0.02	0.08±0.03	0.07±0.02	0.08±0.02
Carbon, %	0.66±0.23	0.62±0.16	0.65±0.12	0.62±0.21	0.57±0.14	0.62±0.13
At cover crop planting in autumn 2010 in corn–forage sorghum rotation after corn harvest						
pH	5.83±0.16	6.08±0.28	6.00±0.25	6.10±0.08	6.10±0.29	6.08±0.31
Organic matter, %	1.15±0.35	1.08±0.33	1.13±0.43	1.05±0.19	1.20±0.55	1.00±0.39
Nitrogen, %	0.08±0.02	0.09±0.03	0.09±0.01	0.09±0.02	0.09±0.02	0.08±0.02
Carbon, %	0.66±0.28	0.65±0.21	0.71±0.18	0.71±0.70	0.68±0.22	0.64±0.19
After cover crop harvest in spring 2011 in forage sorghum–forage sorghum rotation						
pH	6.08±0.30	5.85±0.49	6.13±0.34	5.95±0.45	5.90±0.35	6.18±0.15
Organic matter, %	1.38±0.25	1.15±0.21	1.40±0.24	1.23±0.15	0.98±0.49	1.30±0.27
Nitrogen, %	0.08±0.01	0.07±0.01	0.08±0.01	0.07±0.01	0.06±0.01	0.07±0.01
Carbon, %	0.93±0.14	0.81±0.11	0.91±0.05	0.82±0.10	0.71±0.18	0.88±0.10
After cover crop harvest in spring 2011 in corn–forage sorghum rotation before sorghum planting						
pH	6.15±0.17	5.88±0.10	5.98±0.17	6.25±0.13	5.88±0.36	6.08±0.30
Organic matter, %	0.95±0.48	0.93±0.22	1.15±0.31	0.93±0.49	0.98±0.26	1.03±0.46
Nitrogen, %	0.06±0.03	0.06±0.02	0.07±0.02	0.06±0.03	0.06±0.02	0.06±0.02
Carbon, %	0.72±0.28	0.65±0.15	0.74±0.27	0.71±0.28	0.67±0.19	0.70±0.24
After cover crop harvest in spring 2011 in corn–forage sorghum rotation before corn planting						
pH	6.05±0.24	6.15±0.35	6.84±0.29	6.03±0.38	6.05±0.24	6.15±0.10
Organic matter, %	0.83±0.26	0.90±0.34	0.88±0.21	0.78±0.28	0.88±0.34	0.91±0.26
Nitrogen, %	0.09±0.02	0.09±0.03	0.09±0.02	0.09±0.02	0.09±0.02	0.08±0.02
Carbon, %	0.65±0.22	0.66±0.25	0.59±0.18	0.60±0.14	0.62±0.18	0.62±0.21

The soil data provided information about the change in soil properties after a winter season with the cover crops (Table 1, p. 69). The pH, organic matter, nitrogen, and carbon were not changed by the presence of either of the cover crops. Values before planting of the cover crops were similar to those after their harvest. Nitrogen in the soil was not increased by the presence of the peas. The results showed that there is no advantage of increased nitrogen in the soil, if winter pea is a cover crop. They reinforced the fact that the winter cover crop in Manhattan, KS, should be wheat.

Reference.

Freeman II OW. 2014. Winter cover crops in corn and forage sorghum rotations in the Great Plains. Ph.D. dissertation, Kansas State University, Manhattan. 145 pages.

Acknowledgements. We thank Dr. Scott A. Staggenborg, Director, Product Portfolio and Technology Advancement, Chromatin, Inc., Lubbock, TX, for suggesting that research be done with cover crops. We thank Kathleen M. Lowe, Assistant Scientist, Soil Testing Laboratory, Manhattan, KS, for soil analyses and reporting of the data.

Publications.

Clothier BE and Kirkham MB. 2014. Natural capital supplying valuable ecosystem services. *In:* The Soil Underfoot: Infinite Possibilities for a Finite Resource (Churchman GJ and Landa ER Eds). Taylor and Francis, Boca Raton, FL. pp. 135-149.

Kirkham MB. 2014. Principles of Soil and Plant Water Relations, Second edition. Elsevier, Academic Press, Amsterdam. xviii + 579 pages. ISBN: 978-0-12-420022-7.

Nimmo JR, Hermann PM, Kirkham MB, and Landa ER. 2014. Pollen dispersal by catapult: Experiments of Lyman J. Briggs on the flower of mountain laurel. Physics in Perspective **16:**371-389.

KANSAS STATE UNIVERSITY
Wheat Genetics Resource Center, Department of Plant Pathology, Department of Agronomy, and the USDA–ARS Hard Red Winter Wheat Genetic Research Unit, Throckmorton Plant Sciences Center, Manhattan, KS 66506-5501, USA.

Mining novel genetic diversity in Aegilops tauschii, the D-genome progenitor of hexaploid wheat.

Narinder Singh, Sunish K. Sehgal (South Dakota State University, Brookings), Duane L. Wilson, W. Jon Raupp, Bikram S. Gill, and Jesse Poland.

Wheat production is threatened by depleting resources, increasing cost of production and climate change. An estimated 60% increase in wheat production is needed by 2050 to feed the projected population of 9 billion. Hexaploid wheat, like many other crops, has undergone bottlenecks during polyploidization and domestication resulting in narrow genetic base. *Aegilops tauschii* the D-genome progenitor of bread wheat, has remained genetically diverse and is an excellent source for broadening the genetic base of wheat. With this vision, we assessed the diversity in the *Ae. tauschii* collection at the Wheat Genetics Resource Center at Kansas State University and developed PowerCore and MiniCore sets. We genotyped 551 accessions representing the world collection by genotyping-by-sequencing (GBS). More than 120K SNPs were discovered using TASSEL pipeline. SNPs with less than 50% missing data were filtered, and a random subset of 15K SNPs was selected to identify a PowerCore consisting of 144 accessions retaining most of the genetic diversity and maintaining frequency of alleles in core set similar to the entire collection. The PowerCore was optimized based on genetic distance to represent the major clusters of phylogenetic tree. A MiniCore set of 52 accessions was selected from the PowerCore set to represent all the major clusters in the phylogenetic tree. The MiniCore set of 52 accessions will be crossed to elite wheat cultivars to produce wheat–*Ae. tauschii* amphiploids. These amphiploids will be selfed and backcrossed to elite wheat lines to enhance the diversity of bread wheat.

In addition, the *Ae. tauschii* accessions were evaluated for a second year at the Rocky Ford Research Area, Manhattan, KS, for field resistance to leaf and strip rust and barley yellow dwarf virus (Table 1, pp. 72-81). The lines also were evaluated for heading date. Field data was recorded on two dates. Virus infection was rated as symptoms on visible as chlorosis, necrosis of the leaf tips and leaves, or purpling of the leaves. Hessian fly and seedling and adult-plant stripe rust reactions were scored on greenhouse-grown plants.

The Wheat Genetics Resource Center Genebank and the rapid curation of germplasm Collections using Genotyping-by-Sequencing.

W. Jon Raupp, Shuangye Wu, Narinder Singh, Jesse Poland, and Bikram Gill.

The main mission of the WGRC, collecting, conserving, and utilizing germplasm in wheat improvement for sustainable production, broadens the crop genetic base assuring future advances in breeding. The WGRC genebank contains passport and evaluation data on ~3,800 wheat species accessions and, in addition, houses ~3,400 cytogenetic stocks.

In wheat, accessions from genebanks and individuals have been widely circulated for the last century. Historically, each genebank has used their own accession identification numbers, often resulting in the loss of globally unique identifiers, cross-referenced collection information, or passport data. Thus, once an accession travels from genebank to genebank, the ability to discern duplicates is confounded. In this context, much effort is given at the WGRC to cross-reference our accessions with those of other wheat gene banks.

Recognizing the importance of identifying duplicity and cross-referencing collections, we used genotyping-by-sequencing (GBS) to ascertain the genetic diversity in our collection of 568 *Aegilops tauschii* accessions and compare it to an undocumented collection. After de novo SNP calling using the TASSEL pipeline, removing duplicate tags, and SNP filtering for missing data, 14k SNPs were mapped on wheat D genome. Using allele matching accounting for a ~1% sequencing error (>99% match), we could identify accessions with similar, yet incomplete, passport data as possible duplicates. Of 551 *Ae. tauschii* accessions assayed, 402 were unique, representing a 27% duplication. We also were able to match 118 unidentified accessions from the genebank at Punjab Agricultural University as the same accession represented the WGRC collection. We currently are using this same approach to characterize and curate our collection of over 900 tetraploid wheats.

With a rapid and cost-effective tool to study genetic diversity, giving a consistent characterization of genetic and phenotypic diversity in wheat germplasm GBS will be important in the genetic curation of accessions within and between collection(s). With such information across global collections, it becomes possible identify the truly unique accessions across all of our gene banks, enabling more targeted access to genetic diversity.

Detection of adult-plant resistance to Puccinia triticina in native wheat species; transfer and mapping in wheat.

Bhanu Kalia, Jesse Poland, and Bikram S. Gill; Robert L. Bowden and Erena Edae, USDA–ARS, Manhattan; and Ravi P. Singh, CIMMYT, Mexico.

Resistance to wheat rusts may be race-specific and subject to boom and bust cycles, or race-nonspecific or adult-plant resistance (APR), which is associated with durability. We evaluated *Aegilops tauschii*, one of the diploid ancestors of wheat, for APR to *P. triticina*. The *Ae. tauschii* populations in Caspian Iran and eastern Afghanistan commonly exhibited APR, suggesting that APR may be an important defense in nature against leaf rust. We transfered APR to leaf rust from *Ae. tauschii* (TA2474) to wheat through production of synthetic-hexaploid wheat (SHW), but expression was suppressed in the progeny. To unlock the expression of APR, a population of 261 recombinant inbred lines (RILs) was developed from a cross of SHW with the cultivar WL711. The RILs were phenotyped for maximum disease severity at Manhattan, KS, in 2013–14 and at CIMMYT, Mexico, in 2013. Genotyping-by-sequencing (GBS) detected QTL associated with APR and was contributed by both the parents. Two major QTL from WL711 were mapped on chromosome 1BL, explaining 11–24% of the phenotypic variance across environments; two additional QTL were mapped on 5AL and 6BL. SHW-derived QTL for APR were mapped on 1AL, 1BS, 2DS, 2DL, and 5DL. The results demonstrate complex genetic control and evolution of APR. The novel APR genes and their linked GBS-based ,SNP markers are potentially useful for durable control of leaf rust in wheat.

Table 1. Data from the set of *Aegilops tauschii* evaluated for disease severity in the field, Manhattan, KS, during the 2014–15 crop season, for field resistance to leaf (Lr) and stripe (Yr) rust and barley yellow dwarf virus (BYDV). Heading date also was recorded. Leaf and stripe rusts were evaluated at two dates on the Cobb scale, where a number indicating the percent of leaf area affected is followed by a letter designation, R = resistant flecks or very small pustules, MR = moderately resistant small pustules, M = moderate small to medium size pustules, MS = moderately susceptible medium to large pustules, and S = susceptible with large pustules. Rating of the leaves with BYDV symptoms was 0 = no visible signs of infection, L = low infection with 10% or less of the leaf area with visible symptoms, M = moderate infection with up to 40% of the leaf area with visible symptoms, and H = high infection with over 40% of the leaf area showing symptoms. — = no test. Seedling and adult-plant stripe rust reactions were scored in the greenhouse; the superscript indicates the number of plants scored;.seedling test is a 0 to 9 scale with 1–3 resistant, 4–6 intermediate, and 7–9 susceptible; adult-plant reaction also used the Cobb scale; 0 = immune/no infection observed. Hessian Fly scored as R = resistant or S = susceptible; segregating lines given as number of resistant plants/number of susceptible plants.

ID / accession number	Country of origin	Leaf rust		Stripe rust				BYDV		Hessian fly	Heading date
		27 May	8 June	27 May	8 June	Seedling	Adult	27 May	8 June		
Triumph 64	Check	50MS	—	30MS	—		—	H	—		27 May
Newton	Check	30M	—	15MS	—		—	H	—		21 May
Fuller	Check	70S	—	25MS	—		—	H	—		8 May
Everest	Check	20M	—	10MS	—		—	H	—		8 May
Kingbird	Check	—	—	—	—		5R ^{5}	—	—		—
Morocco	Check	—	—	—	—	8 ^{10}	70S ^{5}	—	—		—
Karl 92	Check									S	
Carol	Check									S	
Caldwell	Check									S	
WGRC1 (*H13*)	Check									R	
		20MR	20MR	30MS	30MS			L	L		13 May
TA1585	Turkey	10MR	25MR	30M	30M	5 ^{6}	20MS ^{3}	M	M	S	14 May
		5MR	25MR	20M	20M			M	M		15 May
		5R	10R	30MS	30MS			M	M		26 May
TA1586	Turkey	10R	15MR	20M	20M	5 ^{6}	40MS ^{3}	M	M	S	27 May
		5MR	20MR	20MR	20MR			M	M		18 May
		70S	70S	30MS	30MS			H	H		27 May
TA1592	Turkey	60MS	—	30MS	—	5 ^{6}	40MS ^{3}	H	H	S	16 May
		60MS	—	30MS	—			H	H		17 May
		WINTER KILLED									
TA1604	Afghanistan	70S	—	20MS	—	4 ^{5}	60MS ^{3}	H	H	S	16 May
		WINTER KILLED									
		10MR	10MR	5R	5MR			L	M		14 May
TA1606	Afghanistan	1R	30MR	5R	5MR	4 ^{2}	5R ^{2}	M	H	S	13 May
		WINTER KILLED									
		10MS	10MS	30M	40MS			H	H		15 May
TA1620	Afghanistan	30M	35M	30M	30MS	5 ^{6}	20M ^{2}	H	H	S	12 May
		30MS	—	40MS	—			M	H		12 May
		50MS	50MS	10M	20MS			M	H		29 May
TA1621	Georgia	50MS	50MS	20M	20MS	5 ^{4}	5R ^{5}	M	M	S	28 May
		30MS	30MS	20MS	20MS			H	H		1-Jun
		10M	30M	40MS	40MS			H	H		12 May
TA1629	Afghanistan	20MS	—	40MS	—	3 ^{5}	50S ^{3}	H	H	S	10 May
		20M	30M	10MR	15M			H	H		13 May
		25MS	—	30MS	—			H	H		11 May
TA1631	Afghanistan	30MS	—	40MS	—	4 ^{6}	50S ^{3}	H	H	S	9 May
		25MS	—	30MS	—			H	H		10 May
		20MR	20MR	25R	25MR			L	L		24 May
TA1642	Iran	15R	25MR	5R	10MR	3 ^{6}	1R ^{3}	L	M	R	16 May
		5MR	20MR	1R	5MR			L	M		16 May

Table 1. Data from the set of *Aegilops tauschii* evaluated for disease severity in the field, Manhattan, KS, during the 2014–15 crop season, for field resistance to leaf (Lr) and stripe (Yr) rust and barley yellow dwarf virus (BYDV). Heading date also was recorded. Leaf and stripe rusts were evaluated at two dates on the Cobb scale, where a number indicating the percent of leaf area affected is followed by a letter designation, R = resistant flecks or very small pustules, MR = moderately resistant small pustules, M = moderate small to medium size pustules, MS = moderately susceptible medium to large pustules, and S = susceptible with large pustules. Rating of the leaves with BYDV symptoms was 0 = no visible signs of infection, L = low infection with 10% or less of the leaf area with visible symptoms, M = moderate infection with up to 40% of the leaf area with visible symptoms, and H = high infection with over 40% of the leaf area showing symptoms. — = no test. Seedling and adult-plant stripe rust reactions were scored in the greenhouse; the superscript indicates the number of plants scored;.seedling test is a 0 to 9 scale with 1–3 resistant, 4–6 intermediate, and 7–9 susceptible; adult-plant reaction also used the Cobb scale; 0 = immune/no infection observed. Hessian Fly scored as R = resistant or S = susceptible; segregating lines given as number of resistant plants/number of susceptible plants.

ID / accession number	Country of origin	Leaf rust		Stripe rust				BYDV		Hessian fly	Heading date
		27 May	8 June	27 May	8 June	Seedling	Adult	27 May	8 June		
		10R	15MR	20MR	20MR			L	L		14 May
TA1644	Iran	10R	25MR	5R	15MR	3 [6]	1R [3]	M	M	R	13 May
		10MR	30MR	5MR	20MR			M	M		12 May
		15MR	20MR	25MR	25MR			L	M		22 May
TA1645	Iran	10MR	—	5MR	—	3 [6]	15R [3]	M	H	R	16 May
		10M	15M	1R	20MR			L	H		15 May
		WINTER KILLED									
TA1655	Afghanistan	20MS	—	40MS	—	5 [5]	70S [3]	H	H	S	11 May
		WINTER KILLED									
		20M	—	20MS	—			H	H		22 May
TA1657	Afghanistan	30MS	—	40MS	—	3 [5]	30M [3]	H	H	S	10 May
		40M	—	25MS	—			H	H		10 May
		20R	30MS	10R	10MR			L	L		14 May
TA1662	Azerbaijan	15M	30M	10MR	20M	2 [4]	5R [3]	M	M	S	28 May
		WINTER KILLED									
		20R	20MR	15R	15MR			L	L		22 May
TA1664	Azerbaijan	10MR	25M	15MR	15MR	3 [6]	5MR [3]	L	M	R	15 May
		1R	20M	5R	20MS			H	H		14 May
		WINTER KILLED									
TA1667	Azerbaijan	10M	25M	5MR	15R	3 [6]	20MS [3]	M	H	R	30 May
		30M	30M	20MR	20M			M	M		18 May
		30R	30M	30MR	30MR			M	M		24 May
TA1668	Azerbaijan	10MR	30MS	5R	20MR	3 [6]	10MR [3]	M	M	R	16 May
		30M	30M	5MR	25M			M	M		22 May
		1R	—	5R	—			M	H		22 May
TA1670	Azerbaijan	1R	5R	5R	5R	4 [5]	20MR [3]	L	L	R	16 May
		1R	20MR	5R	10MR			L	M		16 May
		20M	40MS	10MR	20MS			M	M		26 May
TA1679	Azerbaijan	40MS	50MS	20MR	20M	6 [6]	10M [3]	L	M	S	30 May
		50MS	50MS	20M	20M			M	M		1-Jun
		30M	30M	10MR	15MR			L	L		28 May
TA1680	Azerbaijan	15MR	25MR	10MR	10MR	3 [2]	20MR [2]	M	M	R	28 May
		10M	30M	5MR	20MR			L	M		30 May
		40MS	40MS	10MR	10MR			M	M		27 May
TA1681	Azerbaijan	30M	30M	5R	25M	4 [6]	10MR [3]	H	H	S	22 May
		40MS	50MS	5MR	20MR			H	H		17 May
		20M	10MR	5MR	10MR			M	M		15 May
TA1690	Afghanistan	20M	20M	5MR	25M	4 [6]	10R [2]	M	H	R	16 May
		30MS	30MS	10MR	25M			L	M		17 May
		20MR	20MR	10R	10MR			L	L		13 May
TA1691	Unknown	1R	20MR	5R	5MR	4 [5]	20MR [3]	L	M	4/7	15 May
		10MR	20MR	1R	5MR			L	M		15 May
		60S	—	50MS	—			H	H		12 May
TA1697	Unknown	20M	—	60MS	—	4 [5]	25MS [3]	H	H	S	12 May
		20M	—	40MS	—			H	H		13 May

Table 1. Data from the set of *Aegilops tauschii* evaluated for disease severity in the field, Manhattan, KS, during the 2014–15 crop season, for field resistance to leaf (Lr) and stripe (Yr) rust and barley yellow dwarf virus (BYDV). Heading date also was recorded. Leaf and stripe rusts were evaluated at two dates on the Cobb scale, where a number indicating the percent of leaf area affected is followed by a letter designation, R = resistant flecks or very small pustules, MR = moderately resistant small pustules, M = moderate small to medium size pustules, MS = moderately susceptible medium to large pustules, and S = susceptible with large pustules. Rating of the leaves with BYDV symptoms was 0 = no visible signs of infection, L = low infection with 10% or less of the leaf area with visible symptoms, M = moderate infection with up to 40% of the leaf area with visible symptoms, and H = high infection with over 40% of the leaf area showing symptoms. — = no test. Seedling and adult-plant stripe rust reactions were scored in the greenhouse; the superscript indicates the number of plants scored;.seedling test is a 0 to 9 scale with 1–3 resistant, 4–6 intermediate, and 7–9 susceptible; adult-plant reaction also used the Cobb scale; 0 = immune/no infection observed. Hessian Fly scored as R = resistant or S = susceptible; segregating lines given as number of resistant plants/number of susceptible plants.

ID / accession number	Country of origin	Leaf rust		Stripe rust				BYDV		Hessian fly	Heading date
		27 May	8 June	27 May	8 June	Seedling	Adult	27 May	8 June		
TA1698	Russian Federation	50MS	—	20MS	—	5 [4]	10M [3]	H	H	4/14	11 May
		40MS	—	20MS	—			H	H		10 May
		60MS	—	20MS	—			H	H		11 May
TA1704	Tajikistan	60S	—	30MS	—	5 [5]	20MS [3]	H	H	S	12 May
		30MS	—	30MS	—			H	H		12 May
		WINTER KILLED									
TA1707	Unknown	20MR	20M	10R	10MR	4 [1]	30R [2]	M	M	5/6	12 May
		WINTER KILLED									
		WINTER KILLED									
TA1708	Unknown	40MS	—	40MS	—	4 [6]	40MS [3]	H	H	S	10 May
		30MS	—	40MS	—			H	H		10 May
		40MS	—	25MS	—			H	H		10 May
TA1713	Turkey	5R	10M	1R	5MR	4 [6]	20MS [3]	M	M	R	22 May
		30M	30M	15MR	20M			M	M		31 May
		25M	40MS	15MR	20M			M	M		31 May
TA2370	Unknown	5MR	20MR	30M	40MS	8 [6]	60MS [3]	H	H	S	14 May
		5R	30MR	5R	15MR			H	H		13 May
		10MR	20MR	40M	50M			H	H		12 May
TA2377	Iran	50MS	—	40MS	—	6 [6]	35MS [3]	H	H	S	11 May
		40MS	—	50MS	—			H	H		12 May
		40MS	—	40MS	—			H	H		13 May
TA2384	Pakistan	WINTER KILLED				6 [6]	40MS [3]			S	
		WINTER KILLED									
		WINTER KILLED									
TA2387	Afghanistan	5MR	—	50MS	—	4 [6]	20MS [3]	H	H	3/14	10 May
		20MS	—	60MS	—			H	H		10 May
		25MS	—	30MS	—			H	H		10 May
TA2388	Afghanistan	30MS	—	50MS	—	7 [4]	50MS [3]	H	H	S	10 May
		20MS	—	40MS	—			H	H		11 May
		20MR	30MR	10MR	20MR			M	H		10 May
TA2395	Afghanistan	10MS	—	60MS	—	7 [5]	60S [3]	H	H	S	14 May
		40MS	—	50S	—			H	H		12 May
		40MS	—	50MS	—			H	H		12 May
TA2369	Afghanistan	1R	15MR	1R	10MR	3 [6]	15MR [3]	L	L	R	2-Jun
		5R	20MR	10R	10MR			L	M		1-Jun
		1R	25MR	5R	15MR			L	M		1-Jun
TA2401	Afghanistan	35MS	—	1R	—	3 [2]	30M [2]	H	H	S	13 May
		40MS	—	5MR	—			H	H		15 May
		30MS	—	20MS	—			H	H		14 May
TA2407	Afghanistan	40MS	—	5R	—	7 [3]	20M [1]	H	H	S	10 May
		20MS	—	40MS	—			H	H		10 May
		25MS	—	10MS	—			H	H		13 May
TA2412	Afghanistan	40MS	—	30MS	—	4 [5]	15MR [3]	H	H	S	10 May
		40MS	—	10M	—			H	H		9 May
		40MS	—	10M	—			H	H		10 May

Table 1. Data from the set of *Aegilops tauschii* evaluated for disease severity in the field, Manhattan, KS, during the 2014–15 crop season, for field resistance to leaf (Lr) and stripe (Yr) rust and barley yellow dwarf virus (BYDV). Heading date also was recorded. Leaf and stripe rusts were evaluated at two dates on the Cobb scale, where a number indicating the percent of leaf area affected is followed by a letter designation, R = resistant flecks or very small pustules, MR = moderately resistant small pustules, M = moderate small to medium size pustules, MS = moderately susceptible medium to large pustules, and S = susceptible with large pustules. Rating of the leaves with BYDV symptoms was 0 = no visible signs of infection, L = low infection with 10% or less of the leaf area with visible symptoms, M = moderate infection with up to 40% of the leaf area with visible symptoms, and H = high infection with over 40% of the leaf area showing symptoms. — = no test. Seedling and adult-plant stripe rust reactions were scored in the greenhouse; the superscript indicates the number of plants scored;.seedling test is a 0 to 9 scale with 1–3 resistant, 4–6 intermediate, and 7–9 susceptible; adult-plant reaction also used the Cobb scale; 0 = immune/no infection observed. Hessian Fly scored as R = resistant or S = susceptible; segregating lines given as number of resistant plants/number of susceptible plants.

ID / accession number	Country of origin	Leaf rust		Stripe rust				BYDV		Hessian fly	Heading date
		27 May	8 June	27 May	8 June	Seedling	Adult	27 May	8 June		
		50MS	—	30MS	—			H	H		10 May
TA2413	Afghanistan	70S	—	25MS	—	5^{5}	30MR^{3}	H	H	S	10 May
		WINTER KILLED									
		10M	—	50MS	—			H	H		9 May
TA2420	Afghanistan	40MS	—	40MS	—	5^{6}	60MS^{3}	H	H	S	9 May
		WINTER KILLED									
		30M	—	25MS	—			H	H		10 May
TA2424	Afghanistan	30MS	—	25MS	—	5^{6}	40MS^{2}	H	H	S	9 May
		WINTER KILLED									
		20M	—	10MS	—			H	H		9 May
TA2433	Afghanistan	15MR	—	5R	—	4^{6}	70MS^{3}	H	H	S	11 May
		5MR	—	20M	—			H	H		11 May
TA2434		WINTER KILLED									
	Afghanistan	25MS	—	40MS	—	8^{6}	20M^{2}	H	H	S	9 May
		50MS	—	40MS	—			H	H		9 May
		10MS	—	40MS	—			H	H		9 May
TA2437	Afghanistan	30MS	—	50MS	—	7^{6}	60S^{3}	H	H	S	9 May
		25MS	—	60S	—			H	H		9 May
		WINTER KILLED									
TA2442	Afghanistan	30M	—	20MS	—	3^{5}	15M^{2}	H	H	S	10 May
		WINTER KILLED									
		20MS	30MS	15MR	15MR			H	H		13 May
TA2448	Iran	30M	30M	10MR	15M	4^{3}	0	H	H	S	13 May
		10M	30M	5R	20M			M	H		14 May
		WINTER KILLED									
TA2450	Iran	10R	20MR	5MR	5MR	4^{6}	1R^{3}	L	M	S	16 May
		1R	20MR	5R	5R			L	L		18 May
		15R	15MR	20M	20M			L	L		14 May
TA2455	Iran	5R	25MR	1R	20MR	4^{6}	1R^{3}	M	H	8/6	15 May
		5R	20MR	1R	10MR			L	M		23 May
		10R	10R	5R	5R			H	H		14 May
TA2457	Iran	5R	30MR	5R	15MR	5^{6}	1R^{3}	M	H	R	15 May
		1R	10MR	5R	15MR			M	M		22 May
		10MR	—	5R	—			M	H		14 May
TA2458	Iran	WINTER KILLED				4^{5}	20MS^{3}			S	
		1R	20MR	1R	15MR			L	H		21 May
		15MR	15MR	5R	5R			M	M		15 May
TA2459	Iran	25MR	30M	15MR	15MR	4^{6}	20MR^{3}	M	H	S	22 May
		5MR	25MR	5MR	10MR			M	H		16 May
		5MR	25M	5R	15MR			L	M		15 May
TA2460	Iran	10MR	15M	1R	5MR	2^{2}	—	L	M	2/10	17 May
		10MR	20M	1R	5MR			L			17 May
		25MS	30MS	5R	15MR			M	M		28 May
TA2461	Iran	30MS	40MS	15M	25M	4^{6}	20MR^{3}	M	M	S	28 May
		20MS	50MS	15M	15MS			M	M		22 May

Table 1. Data from the set of *Aegilops tauschii* evaluated for disease severity in the field, Manhattan, KS, during the 2014–15 crop season, for field resistance to leaf (Lr) and stripe (Yr) rust and barley yellow dwarf virus (BYDV). Heading date also was recorded. Leaf and stripe rusts were evaluated at two dates on the Cobb scale, where a number indicating the percent of leaf area affected is followed by a letter designation, R = resistant flecks or very small pustules, MR = moderately resistant small pustules, M = moderate small to medium size pustules, MS = moderately susceptible medium to large pustules, and S = susceptible with large pustules. Rating of the leaves with BYDV symptoms was 0 = no visible signs of infection, L = low infection with 10% or less of the leaf area with visible symptoms, M = moderate infection with up to 40% of the leaf area with visible symptoms, and H = high infection with over 40% of the leaf area showing symptoms. — = no test. Seedling and adult-plant stripe rust reactions were scored in the greenhouse; the superscript indicates the number of plants scored;.seedling test is a 0 to 9 scale with 1–3 resistant, 4–6 intermediate, and 7–9 susceptible; adult-plant reaction also used the Cobb scale; 0 = immune/no infection observed. Hessian Fly scored as R = resistant or S = susceptible; segregating lines given as number of resistant plants/number of susceptible plants.

ID / accession number	Country of origin	Leaf rust		Stripe rust				BYDV		Hessian fly	Heading date
		27 May	8 June	27 May	8 June	Seedling	Adult	27 May	8 June		
		30MR	30M	10MR	20MR			M	H		15 May
TA2464	Iran	10MR	30MR	5MR	20M	5^{5}	15MR^{3}	M	H	S	17 May
		—	—	—	—			—	—		15 May
		WINTER KILLED									
TA2468	Iran	1MR	15MR	5MR	10MR	5^{5}	5R^{3}	L	L	R	2-Jun
		—	—	—	—			—	—		16 May
		WINTER KILLED									
TA2469	Iran	20MR	30MR	5R	20MR	4^{6}	15R^{3}	M	H	R	15 May
		5R	30MR	1R	20MR			L	M		12 May
		20M	30MS	5R	15M			M	M		14 May
TA2471	Iran	15MR	15M	5R	20M	5^{6}	10R^{3}	L	M	S	15 May
		5M	40M	5R	15MS			L	M		16 May
		WINTER KILLED									
TA2472	Iran	WINTER KILLED				4^{6}	10R^{3}			R	
		1R	20MR	1R	5MR			L	L		18 May
		30MR	30MR	5MR	10MR			M	M		15 May
TA2474	Iran	20MR	20MR	10MR	15MR	3^{6}	40R^{3}	M	H	R	14 May
		5M	30M	1R	15MR			M	H		14 May
		20M	25M	10MR	15MR			M	H		13 May
TA2479	Iran	20M	30MS	10M	15MS	2^{6}	5R^{3}	M	H	S	15 May
		10MS	25MS	1R	15MR			M	H		16 May
		15MR	30MR	10R	25MR			H	H		15 May
TA2482	Iran	5R	20MR	30M	30MS	4^{6}	60MS^{3}	H	H	S	16 May
		5MR	—	25MS	—			H	H		16 May
		15MS	30MS	10R	25MS			M	M		30 May
TA2484	Iran	30MS	30MS	20MS	25MS	4^{5}	0	M	M	S	1-Jun
		30M	30M	1R	20M			L	M		17 May
		40MS	—	20M	—			H	H		12 May
TA2488	Iran	20S	—	20MS	—	4^{5}	30S^{3}	H	H	S	14 May
		70S	—	20MS	—			H	H		18 May
		50S	—	15MS	—			M	H		15 May
TA2491	Iran	40MS	—	20MS	—	4^{6}	20M^{3}	H	H	S	15 May
		60MS	—	20MS	—			M	H		16 May
		30MR	30MR	20MR	20MR			M	M		15 May
TA2496	Iran	10MR	20M	5MR	15MR	3^{3}	1R^{3}	M	H	S	15 May
		5MR	30MR	5MR	20MR			L	M		16 May
		40MS	—	40MS	—			H	H		27 May
TA2502	Turkey	60MS	—	30MS	—	3^{3}	50MS^{3}	H	H	S	17 May
		40MS	—	30MS	—			H	H		17 May
		50MS	—	40MS	—			M	H		29 May
TA2510	Turkey	70MS	—	30MS	—	6^{6}	40MS^{3}	H	H	S	24 May
		30M	30M	20M	30M			H	H		18 May
		60S	—	30MS	—			H	H		26 May
TA2512	Iran	50MS	50MS	5R	30MS	4^{6}	30MS	M	H	S	17 May
		50MS	—	40MS	—			H	H		25 May

Table 1. Data from the set of *Aegilops tauschii* evaluated for disease severity in the field, Manhattan, KS, during the 2014–15 crop season, for field resistance to leaf (Lr) and stripe (Yr) rust and barley yellow dwarf virus (BYDV). Heading date also was recorded. Leaf and stripe rusts were evaluated at two dates on the Cobb scale, where a number indicating the percent of leaf area affected is followed by a letter designation, R = resistant flecks or very small pustules, MR = moderately resistant small pustules, M = moderate small to medium size pustules, MS = moderately susceptible medium to large pustules, and S = susceptible with large pustules. Rating of the leaves with BYDV symptoms was 0 = no visible signs of infection, L = low infection with 10% or less of the leaf area with visible symptoms, M = moderate infection with up to 40% of the leaf area with visible symptoms, and H = high infection with over 40% of the leaf area showing symptoms. — = no test. Seedling and adult-plant stripe rust reactions were scored in the greenhouse; the superscript indicates the number of plants scored;.seedling test is a 0 to 9 scale with 1–3 resistant, 4–6 intermediate, and 7–9 susceptible; adult-plant reaction also used the Cobb scale; 0 = immune/no infection observed. Hessian Fly scored as R = resistant or S = susceptible; segregating lines given as number of resistant plants/number of susceptible plants.

ID / accession number	Country of origin	Leaf rust		Stripe rust				BYDV		Hessian fly	Heading date
		27 May	8 June	27 May	8 June	Seedling	Adult	27 May	8 June		
		10MR	30M	5MR	25M			H	H		15 May
TA2516	Iran	60MS	—	10MR	—	5^{6}	20MS ^{3}	H	H	S	16 May
		40MS	—	10MR	—			H	H		17 May
		70S	—	25M	—			H	H		15 May
TA2521	Iran	50MS	—	40MS	—	5^{6}	50MS ^{3}	H	H	S	14 May
		30MS	—	40MS	—			H	H		16 May
		20M	20M	10MR	15M			M	H		15 May
TA2525	Iran	20M	30M	15M	25M	4^{6}	10R ^{3}	M	H	S	15 May
		10MS	30MS	1MR	25M			M	M		16 May
		WINTER KILLED									
TA2530	Iran	5MR	20MR	1R	15MR	4^{3}	5R ^{3}	L	M	S	14 May
		10MR	30MR	5MR	20MR			M	H		12 May
		40MS	—	40MS	—			M	H		13 May
TA2536	Afghanistan	40MS	—	20M	—	4^{3}	50S ^{3}	H	H	S	13 May
		25MS	—	30MS	—			H	H		11 May
		40MS	—	20MS	—			H	H		14 May
TA2538	Afghanistan	20M	25MS	20MS	30MS	4^{5}	30MS ^{3}	M	H	—	12 May
		40MS	—	40MS	—			M	H		12 May
		20MR	20M	15MR	20M			M	H		16 May
TA2539	Afghanistan	40MS	40MS	20MS	20MS	4^{6}	30MS ^{3}	H	H	—	16 May
		20MS	—	40MS	—			M	H		15 May
		60MS	—	40MS	—			H	H		14 May
TA2540	Afghanistan	60MS	—	30MS	—	3^{5}	40MS ^{3}	H	H	S	15 May
		60MS	—	30MS	—			M	H		14 May
		30MS	30MS	20MR	20MR			M	H		16 May
TA2544	Afghanistan	10M	30M	15MS	25MS	4^{5}	50MS ^{3}	M	H	S	15 May
		10MR	30MS	20M	25MS			M	H		16 May
		30M	—	40MS	—			H	H		12 May
TA2556	Afghanistan	60MS	—	30MS	—	4^{5}	70MS ^{3}	M	H	S	14 May
		70S	—	20MS	—			H	H		15 May
		5R	20MR	15MR	15MR			M	L		29 May
TA2561	Azerbaijan	10R	30MR	5R	25MR	4^{5}	30M ^{3}	M	M	R	31 May
		WINTER KILLED									
		30MS	60S	15MR	20MS			M	L		30 May
TA2564	Azerbaijan	15MS	40MS	5R	15M	4^{6}	10MR ^{3}	M	M	S	30 May
		20MS	25MS	15MS	20MS			L	L		22 May
		20MR	20M	5MR	15M			M	L		30 May
TA2565	Azerbaijan	5R	25MR	5MR	10MR	4^{5}	0	L	L	R	1-Jun
		WINTER KILLED									
		10MR	—	60MS	—			H	H		15 May
TA2569	Armenia	5R	30MR	20M	30M	5^{6}	50MS ^{3}	H	H	S	15 May
		1R	25MR	5R	20M			H	H		18 May
		60MS	—	25MS	—			H	H		16 May
TA2575	Armenia	40MS	—	30MS	—	4^{4}	30MS ^{3}	H	H	S	16 May
		70MS	—	20MS	—			H	H		17 May

Table 1. Data from the set of *Aegilops tauschii* evaluated for disease severity in the field, Manhattan, KS, during the 2014–15 crop season, for field resistance to leaf (Lr) and stripe (Yr) rust and barley yellow dwarf virus (BYDV). Heading date also was recorded. Leaf and stripe rusts were evaluated at two dates on the Cobb scale, where a number indicating the percent of leaf area affected is followed by a letter designation, R = resistant flecks or very small pustules, MR = moderately resistant small pustules, M = moderate small to medium size pustules, MS = moderately susceptible medium to large pustules, and S = susceptible with large pustules. Rating of the leaves with BYDV symptoms was 0 = no visible signs of infection, L = low infection with 10% or less of the leaf area with visible symptoms, M = moderate infection with up to 40% of the leaf area with visible symptoms, and H = high infection with over 40% of the leaf area showing symptoms. — = no test. Seedling and adult-plant stripe rust reactions were scored in the greenhouse; the superscript indicates the number of plants scored;.seedling test is a 0 to 9 scale with 1–3 resistant, 4–6 intermediate, and 7–9 susceptible; adult-plant reaction also used the Cobb scale; 0 = immune/no infection observed. Hessian Fly scored as R = resistant or S = susceptible; segregating lines given as number of resistant plants/number of susceptible plants.

ID / accession number	Country of origin	Leaf rust		Stripe rust				BYDV		Hessian fly	Heading date
		27 May	8 June	27 May	8 June	Seedling	Adult	27 May	8 June		
		60MS	—	10M	—			H	H		15 May
TA2581	Georgia	20M	30M	10M	15M	4^{6}	$30S^{3}$	H	H	S	14 May
		50MS	30MS	20MS	20MS			H	H		18 May
		60MS	—	40M	—			H	H		14 May
TA10069	Afghanistan	40MS	—	30MS	—	3^{6}	$40S^{3}$	H	H	S	15 May
		50MS	—	40MS	—			H	H		17 May
		60MS	—	30MS	—			H	H		24 May
TA10080	Armenia	10MS	—	50MS	—	3^{4}	$30MS^{3}$	H	H	S	15 May
		60MS	—	20MS	—			H	H		17 May
		20MR	30M	20MR	20MR			M	H		13 May
TA10087	Azerbaijan	20M	30M	10M	20M	4^{6}	$30M^{3}$	M	H	R	15 May
		10MS	—	5M	—			L	H		17 May
		20MR	20MR	5R	10MR			M	H		13 May
TA10088	Azerbaijan	5R	30MR	1R	10MR	4^{3}	$20M^{3}$	M	H	S	13 May
		5MR	30M	5MR	15MR			M	H		14 May
		20M	40MS	5R	5MR			M	M		30 May
TA10089	Azerbaijan	1R	20M	5R	5R	3^{5}	$5R^{3}$	L	L	S	2-Jun
		5MR	40MS	1R	15M			M	M		29 May
		5R	15MR	15MR	20MR			M	M		31 May
TA10090	Azerbaijan	10MR	25MR	1MR	15MR	3^{5}	$25MR^{3}$	L	L	S	31 May
		10R	5R	1R	5R			L	L		2-Jun
		30MS	35MS	15MS	20MS			M	M		29 May
TA10104	Georgia	10MR	30M	5MR	25M	2^{6}	$70S^{3}$	M	M	S	30 May
		30MS	30M	5M	20MS			M	M		1-Jun
		10R	20MR	5R	15MR			M	M		30 May
TA10105	Georgia	10MR	25MR	5MR	10MR	2^{2}	$50S^{2}$	M	M	S	22 May
		—	—	—	—			—	—		18 May
		30MS	—	40MS	—			H	H		9 May
TA10108	Tajikistan	WINTER KILLED				7^{5}	$50S^{3}$			S	
		WINTER KILLED									
		70S	—	20MS	—			M	H		14 May
TA10113	Turkmenistan	70S	—	20MS	—	7^{4}	$50S^{3}$	H	H	S	10 May
		50MS	—	20M	—			H	H		14 May
		40MS	—	40MS	—			H	H		15 May
TA10115	Turkmenistan	20MS	—	40MS	—	6^{4}	$20MS^{3}$	H	H	S	11 May
		15MS	—	40MS	—			H	H		15 May
		20M	30M	30M	30M			H	H		14 May
TA10116	Turkmenistan	10M	30M	20M	25M	3^{2}	$30M^{3}$	H	H	S	11 May
		5R	35MR	10R	20MR			H	H		14 May
		20M	20M	5MR	15MR			M	M		28 May
TA10124	Uzbekistan	15R	30MR	10R	15MR	3^{5}	$20R^{3}$	M	M	S	13 May
		5R	25MR	1R	15M			M	M		22 May
		5R	30MS	15MR	15MR			M	M		31 May
TA10130	Armenia	5R	20M	1R	5MR	4^{6}	$40MR^{3}$	L	L	R	1-Jun
		25MS	25MS	1R	15MR			L	L		2-Jun

Table 1. Data from the set of *Aegilops tauschii* evaluated for disease severity in the field, Manhattan, KS, during the 2014–15 crop season, for field resistance to leaf (Lr) and stripe (Yr) rust and barley yellow dwarf virus (BYDV). Heading date also was recorded. Leaf and stripe rusts were evaluated at two dates on the Cobb scale, where a number indicating the percent of leaf area affected is followed by a letter designation, R = resistant flecks or very small pustules, MR = moderately resistant small pustules, M = moderate small to medium size pustules, MS = moderately susceptible medium to large pustules, and S = susceptible with large pustules. Rating of the leaves with BYDV symptoms was 0 = no visible signs of infection, L = low infection with 10% or less of the leaf area with visible symptoms, M = moderate infection with up to 40% of the leaf area with visible symptoms, and H = high infection with over 40% of the leaf area showing symptoms. — = no test. Seedling and adult-plant stripe rust reactions were scored in the greenhouse; the superscript indicates the number of plants scored;.seedling test is a 0 to 9 scale with 1–3 resistant, 4–6 intermediate, and 7–9 susceptible; adult-plant reaction also used the Cobb scale; 0 = immune/no infection observed. Hessian Fly scored as R = resistant or S = susceptible; segregating lines given as number of resistant plants/number of susceptible plants.

ID / accession number	Country of origin	Leaf rust		Stripe rust				BYDV		Hessian fly	Heading date
		27 May	8 June	27 May	8 June	Seedling	Adult	27 May	8 June		
TA10132	Armenia	20MS	40MS	30MS	30MS	6 [6]	40MS [3]	M	H	S	29 May
		20MS	30MS	10MS	25MS			M	H		16 May
		30MS	25MS	10MS	15MR			L	M		22 May
TA10136	PR China	20M	30M	5MR	20MR	5 [1]	25MS [2]	M	L	S	16 May
		15MR	25MR	5R	10R			M	M		24 May
		5MR	30MR	1R	20MR			M	M		16 May
TA10140	PR China	5M	—	60S	—	6 [6]	40M [2]	H	H	S	10 May
		5M	—	15MS	—			H	H		10 May
		5MR	—	70S	—			H	H		12 May
TA10142	Syrian Arab Republic	1R	25MR	30MS	35MS	5 [6]	30M [3]	L	H	R	11 May
		1R	—	40MS	—			M	H		9 May
		1R	25M	40MS	40MS			L	H		11 May
TA10145	Syrian Arab Republic	25MS	—	30MS	—	5 [6]	60MS [3]	H	H	S	11 May
		40MS	—	20MS	—			H	H		10 May
		30MS	—	10MS	—			H	H		9 May
TA10156	Tajikistan	5MR	—	15MR	—	2 [6]	30MR [3]	H	H	S	9 May
		30MS	—	20MS	—			H	H		10 May
		15MS	—	10R	—			H	H		9 May
TA10158	Tajikistan	25MS	—	30MS	—	3 [3]	10MR [3]	H	H	S	11 May
		30MS	—	30MS	—			H	H		10 May
		30MS	—	40MS	—			H	H		12 May
TA10160	Turkmenistan	20MR	30MR	15M	15M	5 [5]	40MS [3]	H	H	S	12 May
		10M	20M	20M	30M			H	H		11 May
		10M	—	25MS	—			H	H		11 May
TA10168	Turkmenistan	20MR	25MR	15MR	15MR	6 [3]	20M [3]	H	H	S	11 May
		20M	—	15MS	—			H	H		10 May
		1R	30M	1R	20MR			M	H		13 May
TA10172	Turkmenistan	WINTER KILLED				2 [5]	50MS [2]			S	
		WINTER KILLED									
		10MR	—	30MS	—			H	H		12 May
TA10174	Turkmenistan	5MR	—	60S	—	6 [5]	50MS [2]	M	H	S	9 May
		WINTER KILLED									
		10MR	—	50MS	—			H	H		10 May
TA10176	Turkmenistan	WINTER KILLED				6 [6]	60MS [3]			S	
		20M	30MS	20M	30M			H	H		13 May
		10MS	—	30MS	—			H	H		13 May
TA10177	Turkmenistan	10MR	30MR	5M	20MR	6 [4]	40M [3]	M	H	S	11 May
		10MR	30MR	5MR	15M			M	H		11 May
		25M	20M	20M	20M			H	H		12 May
TA10185	Turkmenistan	WINTER KILLED				7 [6]	40MS [3]			S	
		WINTER KILLED									
		5M	—	1R	—			M	—		13 May
TA10187	Turkmenistan	20MR	35MR	15R	15MR	2 [4]	10R [3]	H	H	S	16 May
		WINTER KILLED									
		5MR	25MR	5MR	15MR			M	H		18 May

Table 1. Data from the set of *Aegilops tauschii* evaluated for disease severity in the field, Manhattan, KS, during the 2014–15 crop season, for field resistance to leaf (Lr) and stripe (Yr) rust and barley yellow dwarf virus (BYDV). Heading date also was recorded. Leaf and stripe rusts were evaluated at two dates on the Cobb scale, where a number indicating the percent of leaf area affected is followed by a letter designation, R = resistant flecks or very small pustules, MR = moderately resistant small pustules, M = moderate small to medium size pustules, MS = moderately susceptible medium to large pustules, and S = susceptible with large pustules. Rating of the leaves with BYDV symptoms was 0 = no visible signs of infection, L = low infection with 10% or less of the leaf area with visible symptoms, M = moderate infection with up to 40% of the leaf area with visible symptoms, and H = high infection with over 40% of the leaf area showing symptoms. — = no test. Seedling and adult-plant stripe rust reactions were scored in the greenhouse; the superscript indicates the number of plants scored;.seedling test is a 0 to 9 scale with 1–3 resistant, 4–6 intermediate, and 7–9 susceptible; adult-plant reaction also used the Cobb scale; 0 = immune/no infection observed. Hessian Fly scored as R = resistant or S = susceptible; segregating lines given as number of resistant plants/number of susceptible plants.

ID / accession number	Country of origin	Leaf rust		Stripe rust				BYDV		Hessian fly	Heading date
		27 May	8 June	27 May	8 June	Seedling	Adult	27 May	8 June		
		5MR	—	50MS	—			H	H		13 May
TA10192	Uzbekistan	10MR	—	30MS	—	6^{5}	40S ^{3}	H	H	S	13 May
		30M	—	40MS	—			H	H		12 May
		30M	40MS	25M	30M			M	H		30 May
TA10197	Uzbekistan	30MS	40MS	20MS	20MS	3^{3}	25MS ^{3}	H	H	S	17 May
		60MS	40MS	25MS	25M			M	H		28 May
		40MR	40MS	30MR	30M			M	H		16 May
TA10210	Uzbekistan	WINTER KILLED				2^{4}	10MR ^{3}			S	
		30MR	—	10MR	—			H	H		17 May
		20M	—	40MS	—			H	H		11 May
TA10211	Uzbekistan	25MS	—	40MS	—	3^{5}	50MS ^{3}	H	H	S	9 May
		20MS	—	30MS	—			H	H		12 May
		20M	20M	5MR	15MR			M	M		29 May
TA10292	Tajikistan	20M	35M	1MR	10MR	5^{6}	20MS ^{3}	H	H	S	27 May
		10MR	30M	5MR	15MR			H	H		30 May
		WINTER KILLED									
TA10296	Tajikistan	50MS	—	20MS	—	2^{6}	15M ^{2}	H	H	S	10 May
		20MS	—	25MS	—			H	H		11 May
		WINTER KILLED									
TA10303	Tajikistan	30MS	—	40MS	—	2^{3}	50MS ^{3}	M	H	S	14 May
		20MS	—	25MS	—			H	H		12 May
		40MS	50S	30M	30M			H	H		22 May
TA10308	Tajikistan	20MS	30S	30M	30M	4^{6}	30MS ^{3}	H	H	S	16 May
		30M	30M	40MS	20MR			H	H		22 May
		30MS	40MS	20M	20M			H			16 May
TA10309	Tajikistan	30MS	30MS	25MS	25MS	1^{6}	40MS ^{3}	M	H	S	16 May
		WINTER KILLED									
		—	—	—	—			—	—		12 May
TA10316	Tajikistan	30MS	—	50MS	—	3^{6}	40M ^{3}	H	H	S	10 May
		40MS	—	30MS	—			H	H		12 May
		40MS	—	20M	—			H	H		12 May
TA10323	Tajikistan	40MS	—	10MS	—	3^{6}	15M ^{3}	M	H	S	10 May
		40MS	—	20MS	—			H	H		13 May
		60MS	—	40MS	—			H	H		11 May
TA10327	Tajikistan	30MS	—	20M	—	7^{4}	40MS ^{3}	M	H	S	13 May
		30M	30MS	10MR	20M			H	H		15 May
		50MS	—	20MS	—			H	H		10 May
TA10330	Tajikistan	60S	—	20MS	—	1^{2}	30MS ^{2}	H	H	S	9 May
		30MS	—	30MS	—			H	H		13 May
		5MR	30MR	10MR	15MR			L	M		14 May
TA10417	Unknown	10MR	25M	5R	15MR	4^{6}	10MR ^{3}	L	M	15/2	13 May
		10M	30M	5MR	20MR			M	H		18 May
		5R	20MR	20M	20MS			M	H		15 May
TA10918	Georgia	10M	35M	20M	20M	4^{6}	50MS ^{3}	H	H	S	17 May
		10MR	30MR	5R	15MR			M	H		16 May

Table 1. Data from the set of *Aegilops tauschii* evaluated for disease severity in the field, Manhattan, KS, during the 2014–15 crop season, for field resistance to leaf (Lr) and stripe (Yr) rust and barley yellow dwarf virus (BYDV). Heading date also was recorded. Leaf and stripe rusts were evaluated at two dates on the Cobb scale, where a number indicating the percent of leaf area affected is followed by a letter designation, R = resistant flecks or very small pustules, MR = moderately resistant small pustules, M = moderate small to medium size pustules, MS = moderately susceptible medium to large pustules, and S = susceptible with large pustules. Rating of the leaves with BYDV symptoms was 0 = no visible signs of infection, L = low infection with 10% or less of the leaf area with visible symptoms, M = moderate infection with up to 40% of the leaf area with visible symptoms, and H = high infection with over 40% of the leaf area showing symptoms. — = no test. Seedling and adult-plant stripe rust reactions were scored in the greenhouse; the superscript indicates the number of plants scored;.seedling test is a 0 to 9 scale with 1–3 resistant, 4–6 intermediate, and 7–9 susceptible; adult-plant reaction also used the Cobb scale; 0 = immune/no infection observed. Hessian Fly scored as R = resistant or S = susceptible; segregating lines given as number of resistant plants/number of susceptible plants.

ID / accession number	Country of origin	Leaf rust		Stripe rust				BYDV		Hessian fly	Heading date
		27 May	8 June	27 May	8 June	Seedling	Adult	27 May	8 June		
		10R	15MR	20M	20M			M	M		30 May
TA10921	Georgia	1R	20MR	20M	20M	4^{5}	60MS ^{3}	M	M	R	28 May
		5MR	20MR	1R	20MR			M	M		30 May
		10MR	10MR	15MR	15MR			H	H		16 May
TA10922	Georgia	5R	20MR	1R	5MR	6^{5}	30MS ^{3}	M	M	S	17 May
		10MR	30MR	5MR	25MR			H	H		17 May
		1R	5R	5R	5R			L	L		15 May
TA10923	Georgia	5R	20MR	1R	5R	4^{5}	5R ^{3}	L	L	4/8	22 May
		1R	15MR	1R	5R			L	L		2-Jun
		10R	10R	5R	10R			L	L		1-Jun
TA10926	Georgia	5MR	15MR	20M	30M	4^{6}	20M ^{3}	L	L	R	29 May
		20M	20MS	25M	25M			M	M		1-Jun
		10M	30M	10MR	15MR			M	M		31 May
TA10929	Georgia	10MR	25MS	1R	20MS	4^{5}	20MS ^{3}	M	M	10/3	30 May
		40MS	40MS	20MS	20MS			M	M		31 May
		30M	—	5MR	—			M	—		16 May
TA10930	Georgia	10M	20M	1R	15MR	5^{6}	30M ^{3}	L	L	R	30 May
		40MS	40MS	20MS	20MS			L	L		17 May
		WINTER KILLED									
TA10940	Azerbaijan	20MS	20MS	5R	10MR	3^{6}	20MR ^{2}	L	M	R	1-Jun
		10MR	30MS	1R	5MR			L	L		2-Jun
		10MR	35MR	15MR	15MR			M	M		15 May
TA10943	Azerbaijan	20M	30M	5MR	15MR	3^{6}	35M ^{2}	L	M	S	16 May
		10R	35MR	5R	15MR			M	H		18 May
		WINTER KILLED									
TA10944	Azerbaijan	40M	50M	20MS	20MS	3^{5}	15MR ^{3}	M	M	S	1-Jun
		5MR	30MR	1R	20MR			L	M		1-Jun
		WINTER KILLED									
TA10949	Azerbaijan	5R	10MR	1R	5MR	5^{6}	25M ^{2}	L	M	S	18 May
		5R	30MR	5R	15MR			L	M		29 May
		WINTER KILLED									
TA10952	Azerbaijan	10MS	15MS	5MR	20MS	1^{5}	20MR ^{3}	L	M	5/7	22 May
		WINTER KILLED									
		10M	—	60S	—			H	H		16 May
TA10954	Azerbaijan	10MR	25MR	30M	30M	7^{5}	40MS ^{3}	H	H	8/3	16 May
		15M	—	30MS	—			H	H		17 May
		50MS	—	40MS	—			H	H		16 May
TA10957	Azerbaijan	30MS	30MS	20MS	20MS	6^{3}	70S ^{3}	H	H	2/10	17 May
		40MS	—	30MS	—			H	H		17 May
		40MS	—	40MS	—			H	H		15 May
TA10960	Azerbaijan	60MS	—	30MS	—	6^{6}	30MS ^{3}	H	H	9/2	15 May
		40MS	—	25MS	—			H	H		14 May

Publications.

Baenziger PS, Graybosch RA, Regassa T, Klein RN, Kruger GR, Santra DK, Xu L, Rose DJ, Wegulo SN, Jin Y, Kolmer J, Hein GL, Chen M-S, Bai G, Bowden RL, and Poland J. 2014. Registration of 'NE06545' (Husker Genetics brand Freeman) hard red winter wheat. J Plant Reg 8:279-284. DOI:10.3198/jpr2014.02.0009crc.

Danilova TV, Friebe B, and Gill BS. 2014. Development of a wheat single gene FISH map for analyzing homoeologous relationship and chromosomal rearrangements within the Triticeae. Theor Appl Genet 127(3):715-730. [PDF]

Gawroski P, Ariyadasa R, Himmelbach A, Poursarebani N, Kilian B, Stein N, Steuernagel B, Hensel G, Kumlehn J, Sehgal SK, Gill BS, Gould P, Hall A, and Schnurbusch T. 2014. A distorted Circadian clock causes early flowering and temperature-dependent variation in spike development in the *Eps-3A*^{m} mutant of einkorn wheat. Genetics 196(4):1253-1261.

Gill BS, Raupp WJ, and Friebe B. 2014. Genomic perspective on the dual threats of imperiled native agro-ecosystems and climate change to world food security. J Crop Improv 28(1):88-98.

Gore MA, Fang DD, Poland J, Zhang J, Percy RG, Cantrell RG, Thyssen G, and Lipka AE. 2014 Linkage map construction and quantitative trait locus analysis of agronomic and fiber quality traits in cotton. The Plant Genome 7:1. DOI:10.3835/plantgenome2013.07.0023.

Gornicki P, Zhu H, Wang J, Challa GS, Zhang Z, Gill BS, and Li W. 2014. The chloroplast view of the evolution of hexaploid wheat. New Phytologist 204:704-714.

Huang Y-F, Poland JA, Wight CP, Jackson EW, and Tinker NA. 2014. Using genotyping-by-sequencing (GBS) for genomic discovery in cultivated oat. PLoS ONE 9(7): e102448.

IWGSC (The International Wheat Genome Sequencing Consortium). 2014. A chromosome-based draft sequence of the hexaploid bread wheat (*Triticum aestivum*) genome. Science 18 July 2014. 345 (6194):286. DOI: 10.1126/science.1251788 (11 pp).

Jamann T, Poland J, Kolkman JM, Smith LG, and Nelson RJ. 2014. Unraveling genomic complexity at a quantitative disease resistance locus in maize. Genetics 198:333-344. DOI: 10.1534/genetics.114.167486.

Kono TJY, Seth K, Poland JA, and Morrell PL. 2014. SNPMeta: SNP annotation and SNP metadata collection without a reference genome. Mol Ecol Res 14(2):419-425.

Liu H, Bayer M, Druka A, Russell JR, Hackett CA, Poland J, Ramsay L, Hedley PE, and Waugh R. 2014. An evaluation of genotyping by sequencing (GBS) to map the *Breviaristatum-e* (*ari-e*) locus in cultivated barley. BMC Genomics 15:104. DOI:10.1186/1471-2164-15-104.

Marcussen T, Sandve SR, Heier L, Spannagl M, Pfeifer M, International Wheat Genome Sequencing Consortium, Jakobsen KS, Wulff BB, Steuernagel B, Mayer KF, and Olsen OA. 2014. Ancient hybridizations among the ancestral genomes of bread wheat. Science 345:1250092.

Narayanan S, Prasad PVV, Fritz AK, Boyle DL, and Gill BS. 2015. Impact of high night-time and high daytime temperature stress on winter wheat. J Agron Crop Sci 201:206-218.

Pfeifer M, Kugler KG, Sandve SR, Zhan B, Rudi H, Hvidsten TR, International Wheat Genome Sequencing Consortium, Mayer KF, and Olsen OA. 2014. Genome interplay in the grain transcriptome of hexaploid bread wheat. Science 345:1250091.

Rife T and Poland J. 2014. Field Book: An open-source application for field data collection on Android. Crop Sci 54:1624-1627. DOI: 10.2135/cropsci2013.08.0579

Sanchez PL, Costich DE, Friebe B, Coffelt TA, Jenks MA, and Gore MA. 2014. Genome size variation in guayule and mariola: Fundamental descriptors for polyploid plant taxa. Indust Crops Prod 54:1-5.

Talukder SK, Babar MA, Vijayalakshmi K, Poland J, Prasad PV, Bowden R, and Fritz A. 2014. Mapping QTL for the traits associated with heat tolerance in wheat (*Triticum aestivum* L.). BMC Genetics 15:97.

Tinker NA, Chao S, Lazo GR, Oliver RE, Huang Y-F, Poland J, Jellen EN, Maughan PJ, Kilian A, and Jackson E. 2014. A SNP genotyping array for hexaploid oat. The Plant Genome 7:.3 DOI:10.3835/plantgenome2014.03.0010.

Tiwari VK, Wang S, Sehgal S, Vrána J, Friebe B, Kubaláková M, Chhuneja P, Doležel J, Akhunov E, Kalia B, Sabir J, and Gill BS. 2014. SNP discovery for mapping alien introgressions in wheat. BMC Genomics 15:273. [PDF]

KANSAS WHEAT
1990 Kimball Avenue, Manhattan, KS 66502, USA.

Despite drought and disease, Kansas' 2015 yields higher than average.

Marsha Boswell and Julie Debes.

In 2014, total Kansas wheat production was 246.4 x 10^6 bushels, down 26% from the 2013 crop and the lowest in 25 years (1989). Yield was 28 bu/acre, 10 bushels below 2013 and the lowest since 1995.

After the record low 2014 wheat harvest, the 2015 crop was not shaping up much better. Autumn planting started with persistent dry conditions across the state. A delayed, autumn crop harvest set planting back even further. Then, over Veterans Day weekend in November, Kansas' state climatologist Mary Knapp explained that temperatures sank into the teens, causing some of the wheat crop to enter dormancy without sufficient root development. Jim Shroyer, K-State Research and Extension crop production specialist (retired), explained in November that the cold weather affected both wheat with excessive topgrowth and wheat that showed drought-stressed symptoms.

Winter brought a roller coaster of warm and cold spells, according to Knapp, and dry soil continued to limit development in many areas. The USDA National Agricultural Statistics Service (NASS) reported on 5 January that the winter wheat condition was rated 2% very poor, 7% poor, 42% fair, 45% good, and 4% excellent.

In late April, freezing temperatures hit the state, particular in south-central Kansas. Knapp explained that although these freezes were not particularly cold, the wheat crop was flowering and particularly vulnerable. By 27 April, the condition of winter wheat condition rated 11% very poor, 20% poor, 43% fair, 24% good, and 2% excellent. Winter wheat jointed was at 78%, ahead of 54% in 2014, and the five-year average of 68%. Headed wheat was at 18%, ahead of 4% in 2014, but near the 16% average.

Then the rain started to fall. The annual Hard Winter Wheat Tour was joined by rain as it moved across the state 47 May, 2015, taking measurements and making predictions. The official tour projection for total production numbers of hard red winter wheat to be harvested in Kansas was 288.5 x 10^6 bushels.

In May, just as the grain was filling, farmers across the state saw heavy rains. Knapp attributed the rains, in part, to moisture from the Gulf of Mexico mixing with cold fronts moving across the state that "opened a fire hose pointed north." According to the Kansas Weather Data Library, Kansas received 188% more moisture than normal in May, averaging 7.73 inches statewide.

By the end of May, the U.S. Drought Monitor listed just 6% of Kansas in moderate drought and 67% of the state as drought-free. However, wet soil, Knapp explained, helped create the right climatic conditions for thunderstorms to build and stay over a small geographic area. She added that these types of weather patterns also are conducive to creating hail, which severely damaged wheat in western Kansas, particularly in Kearney, Finney, and Haskell counties.

Rain also brought disease, stripe rust, leaf rust, and Fusarium head blight. On the annual Hard Red Winter Wheat Tour, Aaron Harries, Kansas Wheat vice president for operations and research, reported seeing stripe rust "in nearly every field we visited." In addition to stripe rust, head blight, and wheat streak mosaic, wheat head smut was found in the state for the first time in decades, initially detected in a field demonstration plot in Rooks County and confirmed by laboratory result during regular and on-going disease survey work. Additional survey teams scouted for the disease, locating it in several other locations. Wheat flag smut has potential yield and trade implications, but presents no human or animal health concerns, and has no impact on grain quality.

Despite the weather and its related effects, the wheat continued to fill and the combines started to roll; later and slower than normal but with better end results than in previous years for many farmers. Kansas farmer Chris Tanner's wheat near Norton did not have a good year, damaged by spring freeze, resurrected with May rainfall, and stricken with stripe rust. "The wheat was about two days from dying of drought when we hit the wet spell," Tanner said. "Then the rust came in bad when the flag leaf was fully emerged."

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

CEREAL DISEASE LABORATORY, USDA–ARS
University of Minnesota, 1551 Lindig St., St. Paul, MN 55108, USA.
www.ars.usda.gov/mwa/cdl

J. A. Kolmer, Y. Jin, M.E. Hughes, S.W. Gale, and L.A. Wanschura.

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.