Southeast Kansas Wheat Variety Test Results - 2020

G.F. Sassenrath, L. Mengarelli, J. Lingenfelser, and X. Lin

Summary
This is a summary of the winter wheat production conditions in southeast Kansas in 2019-20, and the results of the variety testing for winter wheat.

Introduction
Crop production is dependent on many factors including cultivar selection, environmental conditions, soil, and management practices. This report summarizes the environmental conditions during the 2019-20 growing season in comparison to previous years and the historical averages. Fifteen hard-red and ten soft wheat varieties were tested at Parsons.

Experimental Procedures
The Kansas State University Crop Performance Tests were conducted in replicated research fields throughout the state. This report summarizes winter wheat production for Parsons, Kansas. Wheat varieties were tested in Parsons silt loam soil at the Southeast Research and Extension Center in Parsons. All crop variety trials are managed with conventional tillage. Individual variety results are available at the K-State Crop Performance Test webpage (http://www.agronomy.k-state.edu/services/crop-performance-tests/).

Wheat was drilled in 7" rows at 1.2 million seed/acre (approx. 90 lb/acre) in conventional tillage with an Almaco plot drill on Oct. 23, 2019 in Parsons and harvested June 18, 2020. Plots were 7' wide by 27.5' long. Fertilizer was applied before planting at a rate of 50-46-30 lb/acre N-P-K (dry), with an additional 60-46-30 lb/acre N-P-K (dry) applied on Feb. 7, 2020 for both hard-red and soft-red cultivars. No fungicide or herbicides were used in wheat.

Weather information was downloaded from the Kansas Mesonet site (http://mesonet.k-state.edu/weather/historical/). Historical data from the Parsons and Columbus stations were used in preparing these reports. Climatic conditions are reported on a water year (WY) basis that begins October 1 and ends September 30 of the next year. For example, the period from Oct. 1, 2019 – Sept. 30, 2020 is written as WY20. Cumulative rainfall was calculated during the winter wheat growing season from Oct. 1 – June 30. Average air temperature was calculated as a 5-day running average to reduce daily variability. Minimum soil temperature at the 2" level was calculated during the winter wheat growing season, and the 10-year average calculated.

Results and Discussion
Rainfall
Rainfall during the 2019-20 water year was near record highs (Figure 1). Initial rainfall in the fall was very close to average. Beginning in early January, regular high rainfall events increased the cumulative rainfall to well above average. During April, the cumulative rainfall exceeded that received during the previous WY19. On May 15, 2020, Parsons received 4.7" of rain in one 24-hr period. After a very wet spring, however, the rain stopped; Parsons received only 1.18" of rain in all of June. This coincided perfectly with wheat harvest. Wet conditions during wheat flowering contribute to fungal disease, in particular Fusarium head blight or scab (De Wolf et al., 2003). There was heavy infestation of scab in some cultivars and wheat fields. The dry conditions at wheat maturity allowed timely harvesting, resulting in little dockage due to scab in 2020.

Temperature
Temperatures in 2020 were slightly warmer than average, especially during the winter months of December and January (Figure 2A). Daily air temperature is reported as a 5-day average to reduce daily spikes and make comparison across years easier. After periods of low temperatures in the late fall, temperatures increased during the winter and remained mild for most of WY20. Below-freezing low air temperatures were received on April 17 and 18, and a low temperature of 36.5 on May 9, but were not low enough or long enough to cause damage in the Parsons area.

Minimum soil temperature at the 2" level was very near normal, and did not fall below freezing (Figure 2B). This is common, as soil temperatures at 2" depth only fell below freezing in 4 of the last 10 previous years. In comparison, 2018 had freezing soil temperatures (Figure 2B). The low temperatures in late spring also reduced soil temperatures in WY20.

Crop Production
Winter wheat was planted on 6.9 million acres throughout Kansas. In the variety trials, heading notes were taken on individual varieties. Heading is defined as the date when 50% of the plot had heads emerged. Heading in the hard-red varieties began April 25, 2020, and was complete by April 30. Heading in the soft-red varieties occurred between April 28 and May 1, 2020.

Yields in all varieties were very good this year (Figures 3A, 4 and Table 1). The highest yield in the hard-red wheat varieties was measured in WB4401 at 108.8 bu/acre. This is well above the 12-year average yield of 53.1 bu/acre in the variety trials, and the 12-year average yield of 40.7 bu/acre across the state of Kansas.

Cultivars varied in their susceptibility to disease. High rainfall around flowering and heading increases disease pressure (De Wolf et al., 2003). Fungal disease ratings were measured in all varieties as the percent infection and the extent of infection, with 0 being no damage and 10 being highest infection rate. Fusarium head blight (FHB) and stripe rust were both present in the variety trials, and show differences across the varieties (Figure 4 B and C). Stripe rust showed greater infection rates than FHB. Varieties with higher yields tended to have better resistance to the fungal diseases.

Yields in soft-red varieties were higher than the hard-red varieties, as has been observed previously (Figures 3B, 5, and Table 2). No information on state-wide yields for soft-red wheat is available, as soft-red wheat production occurs primarily in the southeast region of the state, so hard-red wheat variety yields are given for the KS state average. Soft-red yield of 102.4 bu/acre across all varieties in 2020 was much higher than the 11-year average of 64 bu/ac for soft-red wheats in the variety trials. The yields were similar to those harvested in soft-red wheat in 2012 in the variety trials. The highest yield of 113.9 bu/acre was measured in AgriMaxx 503, but several other varieties had yields over 100 bu/acre (Table 2).

One advantage of soft-red wheat is their greater resistance to disease. This was observed in the FHB and stripe rust disease ratings (Figure 5B and C). As with the hard-red varieties, those varieties that had greater resistance to diseases tended to have higher yields.

Conclusions

Wheat did exceptionally well this year. The planting conditions in the fall and relatively mild winter led to good plant stands. Notable, many plots were thinner than expected. However, ideal dry conditions

during harvest made optimal and timely harvest possible. The high probability of rainfall around May 31 in Parsons often confounds wheat harvest, making fields inaccessible and increasing disease damage.

Different varieties are entered in the variety testing each year. Therefore, it is important to compare variety performance across different growing seasons to get an understanding of how a variety responds under different growing conditions. For ease of comparison, variety testing results from the previous 5 years are provided for hard-red (Table 1) and soft-red (Table 2) varieties at Parsons. Note no data is available from 2019 due to poor plant stand.

No herbicides or fungicides are normally used in the variety trials to provide an equal comparison based only on genetics. However, timely application of fungicide has been shown to be especially important in high rainfall areas such as southeast Kansas in order to control fungal diseases (De Wolf et al., 2003). Application of appropriate fungicides around flowering are especially important to control FHB (Onofre and De Wolf, 2020).

Acknowledgment
This work is supported by the U.S. Department of Agriculture National Institute of Food and Agriculture, Hatch project 1003478. This data is part of the 2020 Winter Wheat Performance Tests, SRP 1158.

References
De Wolf, E. D., Madden, L. V., & Lipps, P. E. (2003). Risk assessment models for wheat Fusarium head blight epidemics based on within-season weather data. Phytopathology, 93(4), 428-435.

Onofre, K.A., De Wolf, E.D. 2020. Foliar fungicide efficacy ratings for wheat disease management 2020. KSU Ag Exp Station and Coop Ext Serv. EP130. https://bookstore.ksre.ksu.edu/pubs/EP130.pdf

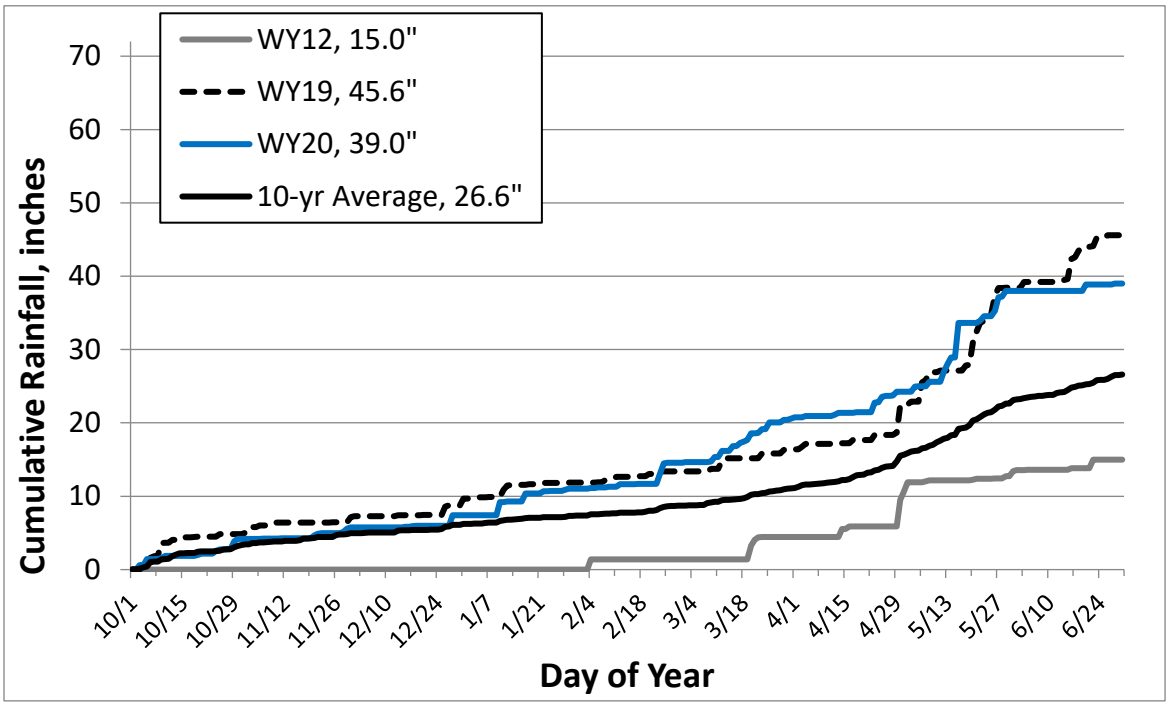

Figure 1. Cumulative rainfall during the water year from October 1 through June 30. Ten-year average included for comparison. Rainfall total in inches for this time period given after each year in legend.

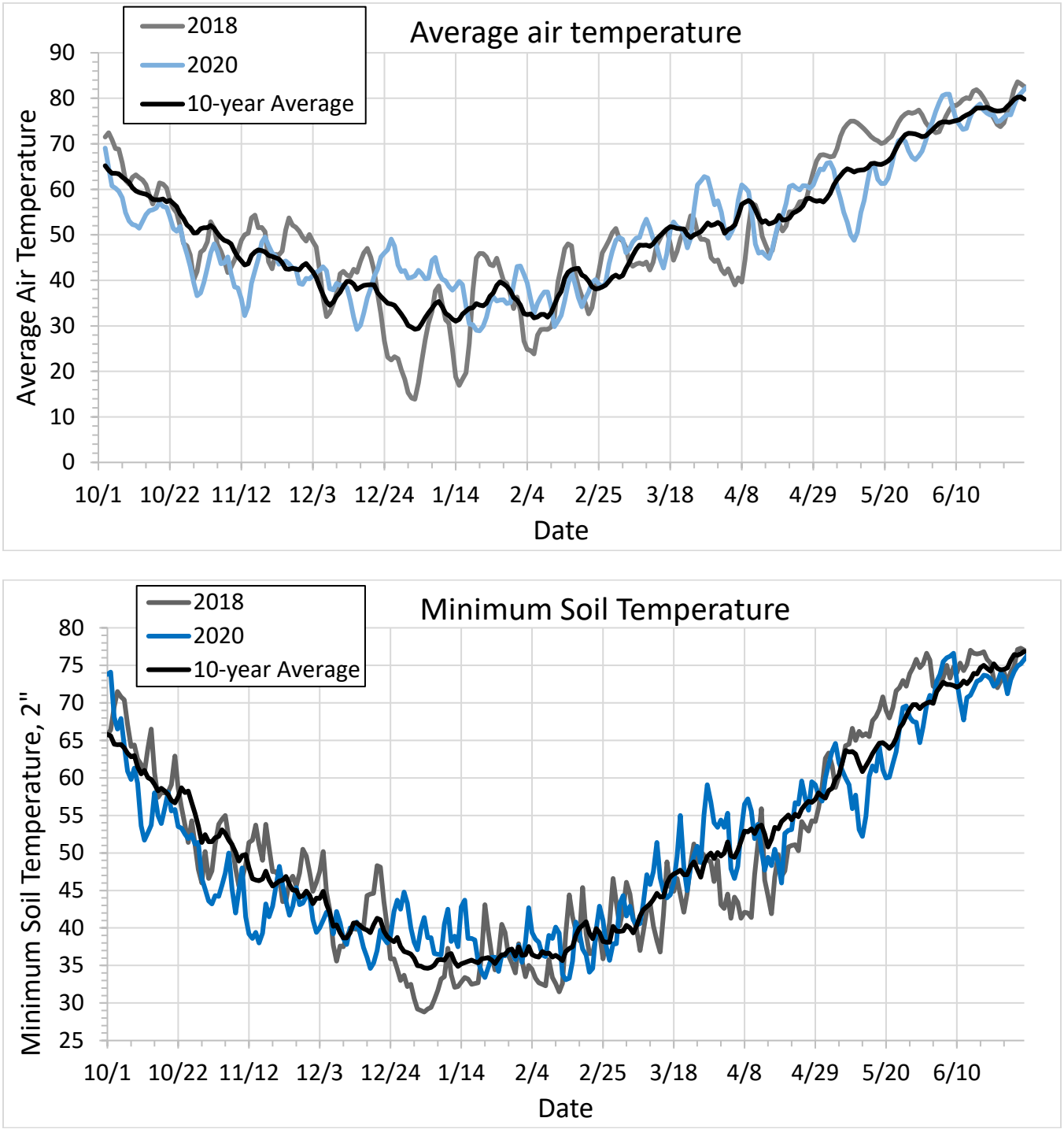

Figure 2. Temperature patterns and extremes the winter wheat growing season.

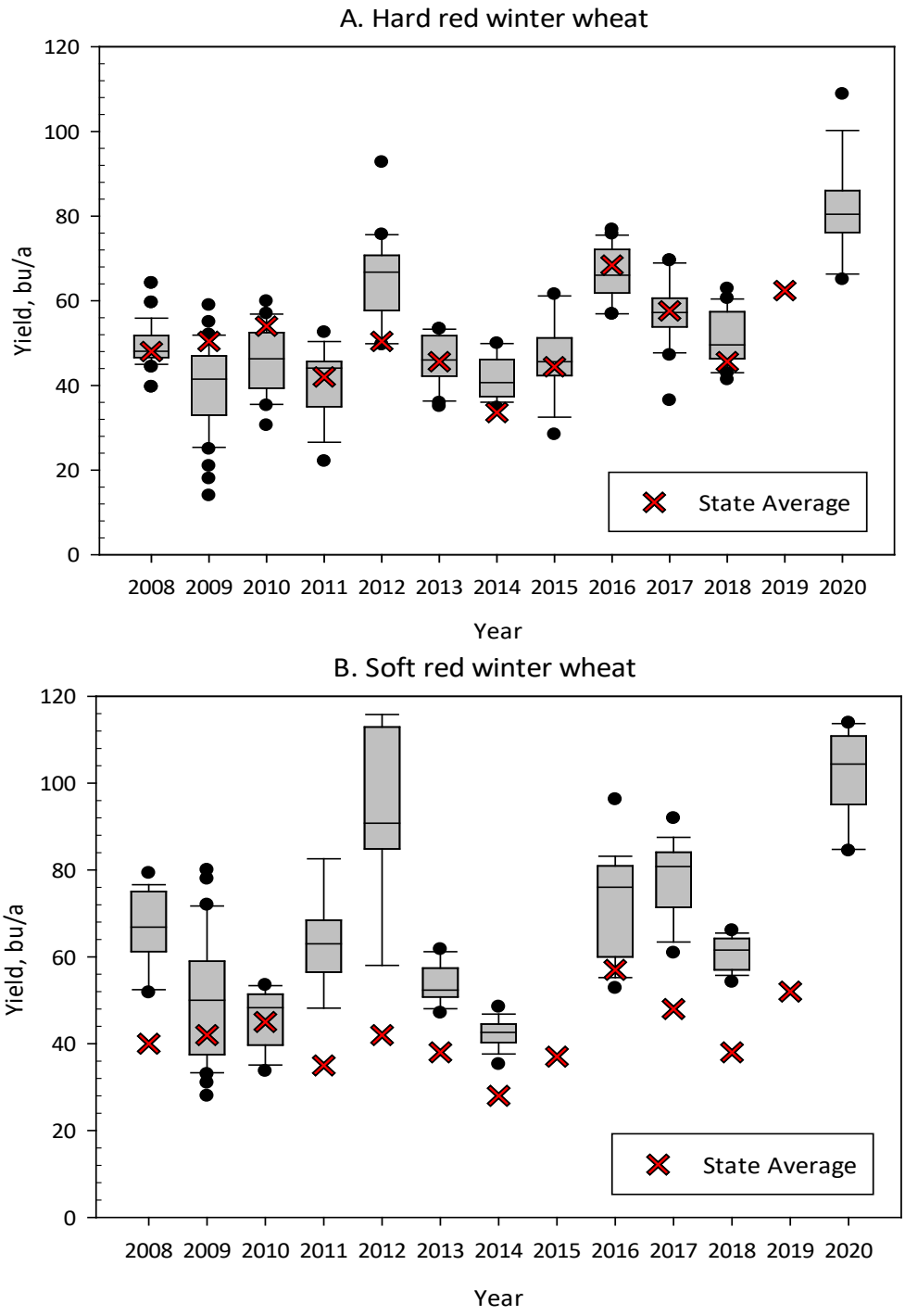

Figure 3. Winter wheat yield for (A) hard-red wheat and (B) soft-red wheat from variety trials in southeast and eastern Kansas from 2008 through 2020. In 2019, variety testing at both Ottawa and Parsons were abandoned due to flooding and poor stands. State winter wheat yields are not yet available for 2020. The line in the middle of the box plots is the median yield of all varieties. The upper and lower quartiles are given by the upper and lower edges of the boxes. The maximum and minimum values are given by the upper and lower "whiskers" extending from the box. Outliers are given as solid circles. For comparison, average reported state yields from Kansas are highlighted as a red X.

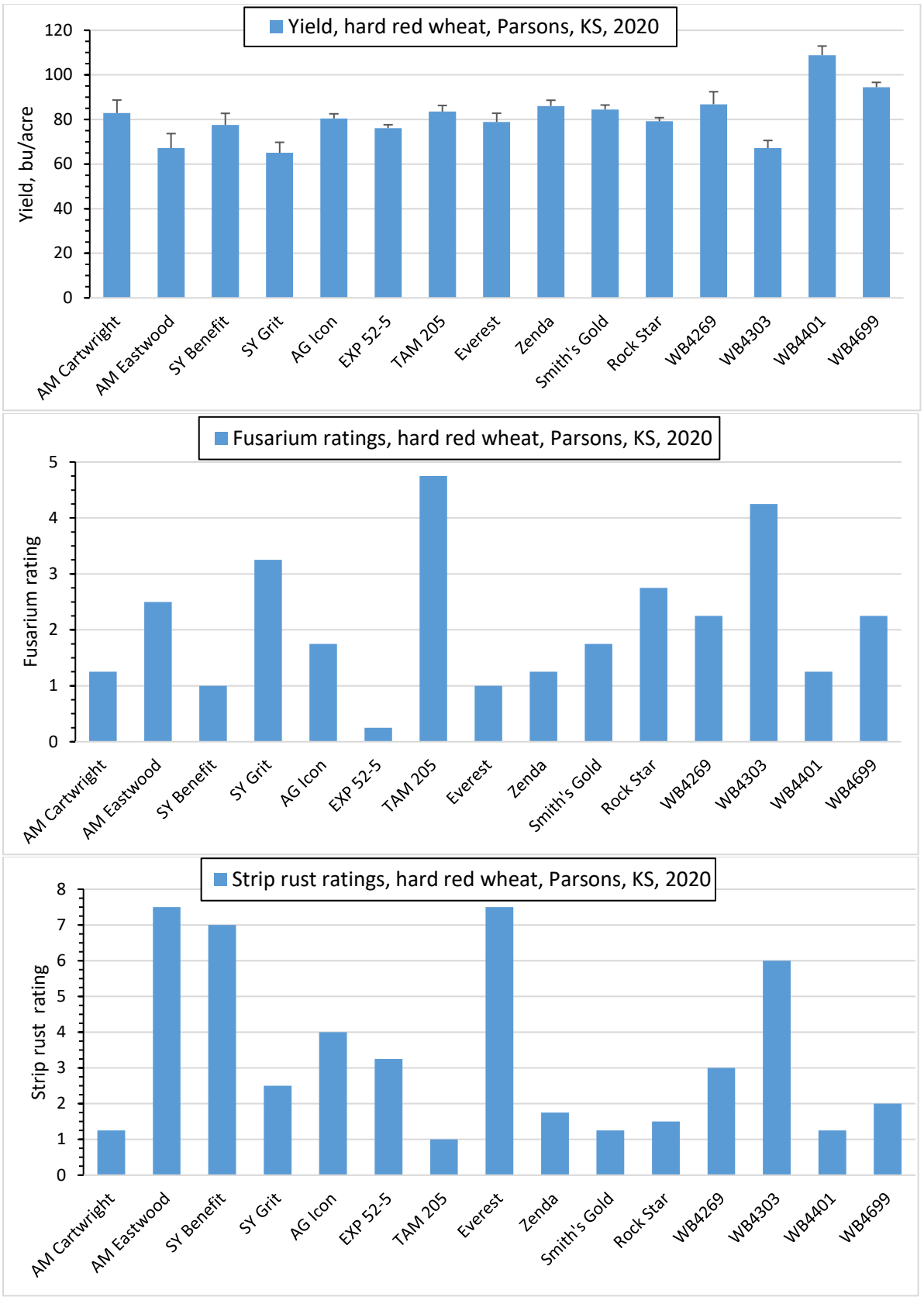

Figure 4. Summary of hard-red wheat variety trials, Parsons, KS, 2020. A. Yield. B. Fusarium ratings. C. Strip rust ratings.

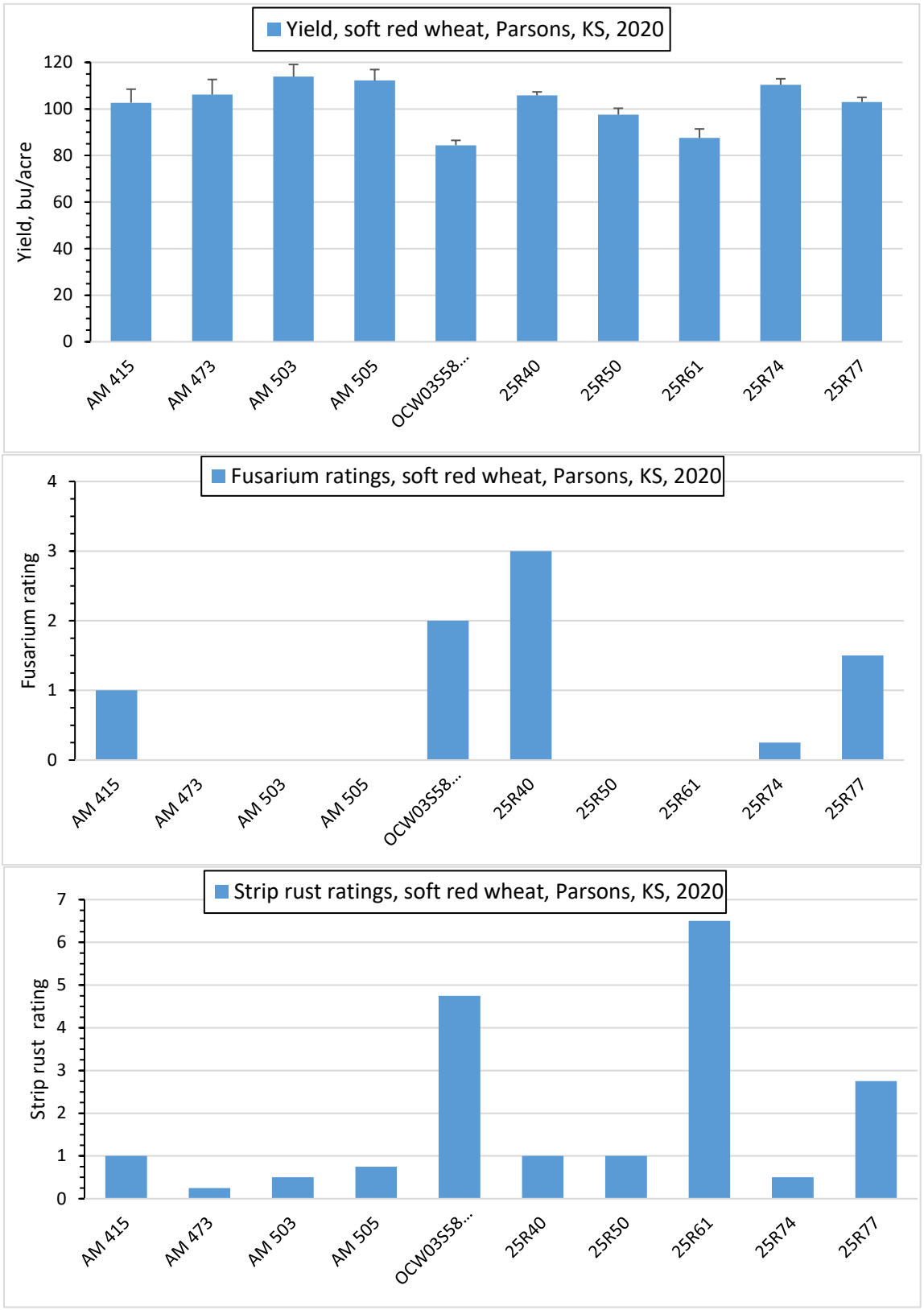

Figure 5. Summary of soft-red wheat variety trials, Parsons, KS, 2020. A. Yield. B. Fusarium ratings. C. Strip rust ratings.

Table 1. Multiyear comparison of hard-red winter wheat yields from variety trials at Parsons, KS.

Hard red wheat variety test results, Parsons, KS		Year							
Company	Variety	2016		2017		2018		2020	
		Yield	Test Weight	Yield	Test Weight	Yield	Test Weight	Yield	Test Weight
		bu/a	lb/bu	bu/a	lb/bu	bu/a	lb/bu	bu/a	lb/bu
AgriMAXX	AM Cartwright							**82.9**	60.8
AgriMAXX	AM Eastwood			47.2	55.5	**56.8**	58.5	67.2	57.9
AgriMAXX	EXP HRW					**57.9**	57.1		
Syngenta AgriPro	SY Benefit			56.9	57.7	45.2	57.4	77.5	59.5
Syngenta AgriPro	SY Grit	61.9				50.0	56.5	65.1	57.5
Syngenta AgriPro	SY Wolf					52.1	59.0		
Syngenta AgriPro	SY Llano	61.8		36.5	57.5				
Syngenta AgriPro	Bob Dole					49.0	57.4		
Syngenta AgriPro	Jackpot	66.2							
AGSECO	AG Gallant	57.0		**69.5**	57.7	45.1	58.9		
AGSECO	AG Icon					47.4	57.2	80.5	60.0
AGSECO	AG Robust	56.9		52.6	57.5	47.5	58.6		
AGSECO	EXP 52-5							76.1	56.6
AGSECO	Hot Rod	**76.8**		**69.6**	56.9	**58.1**	57.6		
AGSECO	TAM 205							**83.5**	60.2
Croplan	EXP 26-16					**60.6**	58.8		
Croplan	EXP 69-16					53.9	57.9		
Dyna-Gro	Long Branch	56.9		55.6	56.0	41.4	57.8		
KWA Wildcat Genetics	Everest	70.5		60.5	58.1	48.6	59.3	78.9	60.8
KWA Wildcat Genetics	Zenda	66.0		60.7	58.4	43.5	59.7	**86.1**	60.8
Wildcat Genetics	KanMark	66.1							
KWA Wildcat Genetics	KS061193K-2			**63.8**	57.5				
KWA Wildcat Genetics	KS080448C*102			52.4	58.4				
KWA Wildcat Genetics	KS060143K-2 "Larry"	65.4		53.7	56.8				
Limagrain	LCS Chrome	71.9		55.4	58.7	**62.9**	57.5		
OGI	Doublestop CL+	66.1							
OGI	Gallagher	**72.8**				49.6	55.3		
OGI	Iba	**74.8**							
OGI	OK09915C-1	57.1							
OGI	OK13209			54.3	56.7				
OGI	Ruby Lee	64.1		58.5	57.8	**56.9**	58.9		
OGI	Smith's Gold							**84.5**	60.1
Polansky	Rock Star							79.2	58.3
Scott Seed	TAM 304	70.0		58.5	57.0				
Scott Seed	TAM 305	**75.8**		**62.8**	57.1				
WestBred	WB4269			55.0	57.0	48.5	58.9	**86.8**	60.3
WestBred	WB4303							67.2	55.4
WestBred	WB4401							**108.8**	61.5
WestBred	WB4458	62.2							
WestBred	WB4515			60.5	58.4	**59.7**	58.4		
WestBred	WB4699							**94.5**	58.7
WestBred	WB-Cedar	66.0		57.6	58.0	42.9	59.1		
WestBred	WB-Grainfield	**73.8**							
Overall Average		66.0		57.1	57.4	51.7	58.1	81.1	59.2

Yields above average are highlighted in bold. Test weights were not available in 2016.

Table 1. Multiyear comparison of soft-red winter wheat yields from variety trials at Parsons, KS.

Soft red wheat variety test results, Parsons, KS		Year							
Company	Variety	2016		2017		2018		2020	
		Yield	Test Weight	Yield	Test Weight	Yield	Test Weight	Yield	Test Weight
		bu/a	lb/bu	bu/a	lb/bu	bu/a	lb/bu	bu/a	lb/bu
AgriMAXX	415	82.7	60.0	**91.9**	57.3	56.7	58.1	102.7	59.7
AgriMAXX	444	77.0	56.0	77.8	57.7	58.6	55.9		
AgriMAXX	454	56.6	54.0						
AgriMAXX	463			**81.6**	58.4	**62.5**	55.4		
AgriMAXX	473			**83.2**	57.9	**65.1**	57.5	**106.1**	59.0
AgriMAXX	475					56.4	57.3		
AgriMAXX	503							**113.9**	60.1
AgriMAXX	505							**112.2**	60.7
AgriMAXX	Exp 1663	**96.2**	57.0						
Croplan	9101	60.0	60.0						
Croplan	9201	52.8	63.0						
Croplan	9301	76.0	58.0						
Croplan	HRW 9415	72.9	65.0						
Croplan	HRW 9434	67.6	58.0						
Croplan	SRW 8550					**64.1**	56.9		
Croplan	SRW 9415					**64.7**	57.3		
Croplan	SRW 9606					55.9	55.7		
Pioneer	25R25	69.7	59.0						
DuPont Pioneer	25R40	82.5	59.0	79.5	56.8	**66.1**	56.7	**105.8**	58.1
DuPont Pioneer	25R46	56.3	54.0	70.4	57.1				
DuPont Pioneer	25R50					57.1	57.0	97.5	59.3
DuPont Pioneer	25R61			71.4	57.8	**61.6**	57.9	87.5	58.3
DuPont Pioneer	25R74			80.8	57.6	**65.4**	56.3	**110.4**	61.6
Dupont Pioneer	25R77	79.6	59.0	**84.4**	57.9	54.2	56.9	103.0	61.6
Frontier	Magnus 1069					**61.5**	55.8		
MFA	2166	63.3	57.0						
MFA	2250	80.9	60.0	60.9	56.5				
MFA	XP 2431	73.1	59.0						
MFA	2449	79.9	57.0	65.1	57.2	**63.8**	56.3		
MFA	XP 2474	83.2	61.0						
MFA	XP 2479	76.3	59.0						
MFA	XP 2538			75.8	57.6				
MFA	XP 2539			**84.6**	57.9				
MFA	XP 2542			**81.3**	57.6	**63.0**	58.6		
MFA	2622					58.3	57.8		
MFA	2633					59.7	56.7		
OGI	OCW03S580S-8WF							84.4	56.8
OGI	OK11311F	65.8	59.0						
OGI	OK11754WF	55.2	59.0						
Average		71.0	59.0	78.2	57.5	59.9	57.0	102.4	59.5

Yields above average highlighted in bold.