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Fall forage production and first hollow stem date in winter wheat varieties during the 2016-2017 crop year

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Introduction

Fall forage production potential is just one consideration in deciding which wheat variety to plant. Dual-purpose wheat producers, for example, may find varietal characteristics such as grain yield after grazing and disease resistance to be more important selection criteria than an advantage in early forage production potential. Forage-only producers might place more importance on planting an awnless wheat variety or one that germinates readily in hot soil conditions. Ultimately though, fall forage production is a selection criterion that should be considered.

Fall forage production by winter wheat is determined by genetic potential, management and environmental factors. The purpose of this current report is to quantify some of the genetic differences in forage production potential and grazing duration among the most popular wheat varieties grown in Oklahoma. Management factors such as planting date, seeding rate and soil fertility are very influential and frequently are more important than variety in determining forage production. Environmental factors such as rainfall and temperature also play a heavy role in dictating how much fall forage is produced. All of these factors, along with yield potential after grazing and the individual producer's preferences, will determine which wheat variety is best suited for a particular field.

Site descriptions and methods

The objective of the fall forage variety trials is to give producers an indication of the fall forage production ability of wheat varieties commonly grown throughout the state of Oklahoma. The forage trials were conducted under the umbrella of the Oklahoma State University Small Grains Variety Performance Tests. During the 2016-2017 crop year, the forage trial was conducted at the Chickasha and Stillwater test sites. Additionally, first hollow stem measurements were collected at the Goodwell test site. Weather data for each location is provided in Figures 1 through 3.

A randomized complete block design with four replications was used at each site. Plots at Stillwater and Chickasha were sown at 120 pounds per acre in a conventionally-tilled seedbed and received 50 pounds per acre of 18-46-0 in furrow at planting. At Goodwell, plots were sown at 90 pounds per acre into a conventionally-tilled seedbed and received 5 gallons per acre of 10-34-0 in furrow at planting. Forage was measured by hand clipping two, 1-m by 1-row samples approximately ½ inch above the soil surface from the interior rows within each plot. At

Stillwater and Chickasha, two separate forage clippings were collected. After the first clipping, plots were mowed to 2.5 inches to simulate grazing. The results for each clipping is presented, and the combined total of the two clippings represents the fall forage potential. All samples were placed in a forced-air dryer after collection for approximately seven days and weighed. Fertility, planting date and clipping date information is provided in Table 1.

First hollow stem sampling began in mid-February at the Stillwater and Chickasha locations and in early March at Goodwell and continued every three to four days on a by-variety basis until first hollow stem. Plant samples were collected for each variety by digging an 8-inch (approximately) section of row and selecting ten plants randomly from this sample. The largest tiller on each plant was split longitudinally and the hollow stem below the developing grain head was measured. Varieties were considered at first hollow stem when the average of the 10-plant samples was 1.5 cm or greater.

Results

The 2016-2017 wheat fall forage production season was characterized by average to above-average temperatures and a few timely rainfall events from planting through mid-November. With adequate soil moisture present at the end of August, producers targeting fall forage were prompted to plant early and were able to achieve good stands. The temperatures and sufficient rainfall received through the beginning of the fall provided for a bumper forage crop overall. After mid-November, the crop received little moisture, and the crop quickly wicked up available soil moisture. Dry conditions overall remained through December into January. A significant and widespread rainfall event occurred in mid-January that was able to keep the wheat progressing. Temperatures throughout the winter were above normal, and the wheat broke winter dormancy almost two weeks earlier than normal. Fortunately, rains returned by the end of February and the temperatures cooled back to normal to help the grazed wheat bounce back from the grazing injury.

Average fall forage production at Stillwater was 2,790 pounds per acre (Table 2), which was 160 pounds per acre less than in 2015 but approximately 90 pounds per acre more than in 2014. The range in forage yield across the varieties was 2,070 to 3,440 pounds per acre. Six triticale varieties were also included in the trial, and the average fall forage production for those was 3,190 pounds per acre (Table 3). Wheat fall forage production at the

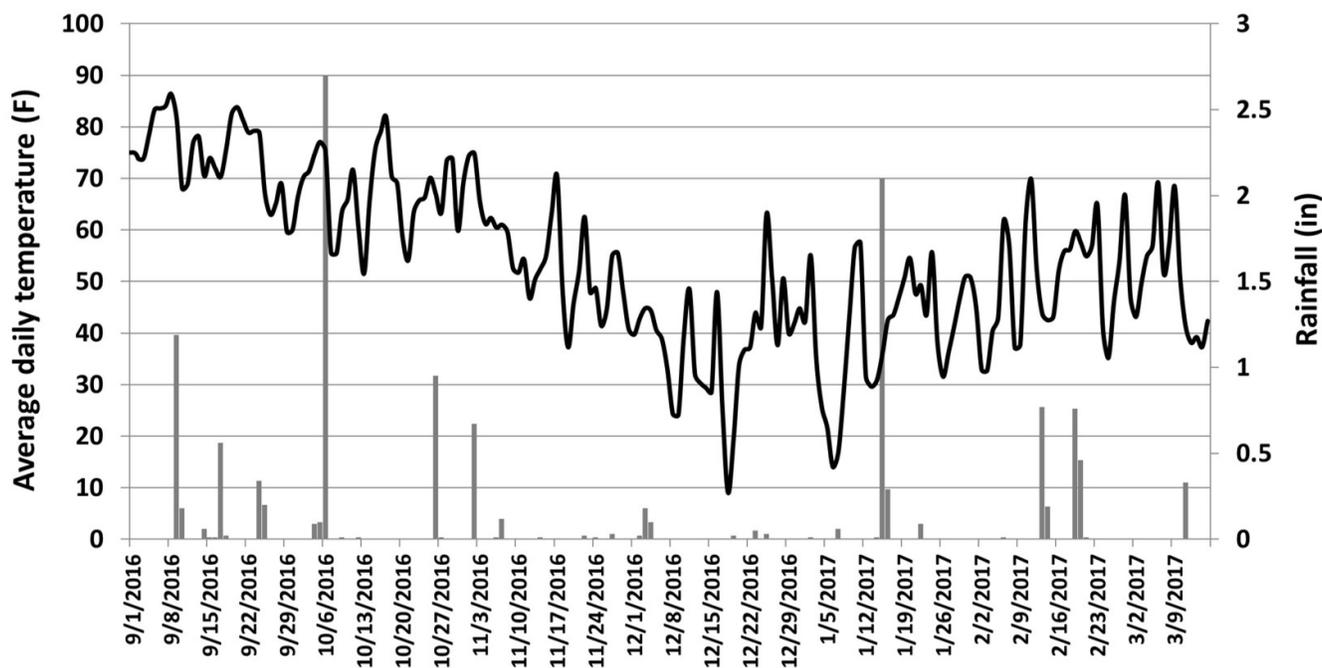


Figure 1. Average daily temperature (line graph) and rainfall (bar chart) from September 1, 2016 to March 15, 2017 at Stillwater, OK. Weather data courtesy Oklahoma Mesonet.

Table 1. Location information.

	Planting date	Sampling dates		pH	N	P	K
Chickasha	9/15/16	11/16/16	12/14/16	7.3	139	169	313
Goodwell	10/6/16	-	-	7.8	112	17	1185
Stillwater	9/13/16	11/14/16	12/16/16	5.7	17	63	273

Chickasha location was much higher than Stillwater where the average was 3,920 pounds per acre with a range of 3,110 to 4,760 pounds per acre (Table 4). While fall forage measurements were not collected at Chickasha in 2015, the 2016 average was 400 pounds per acre more than the average in 2014 and 340 pounds per acre more than in 2013. The average fall forage production for the six triticale varieties at this location was 3,610 pounds per acre (Table 5).

First hollow stem data are reported in 'day of year' (day) format for the wheat varieties in Table 6 and the triticale varieties in Table 7. To provide reference, keep in mind that March 1 is day 60. Given the warmer than normal temperatures during the first part of 2017, the wheat crop broke from winter dormancy early, and the beginning of stem elongation advanced quickly. The average first hollow stem date at Stillwater was day 51 (February 20). This was nine days earlier than in 2016 and 14 days earlier than in 2015. At Stillwater, there was only nine days difference between the earliest and latest varieties, compared to 15 days difference in 2016 and 14 days difference in 2015. Although there was a nine-day range among the varieties, approximately 80 percent of the varieties reached first hollow stem within four days of each other. The average first hollow stem date for the Chickasha location was 61 (March 2). It is important to remember though that these measurements were collected from plots under simulated grazing, and grazing delays the onset of first hollow stem. There was 12 days difference between the earliest and latest varieties, but 83 percent of the varieties examined at this location reached

first hollow stem between days 59 to 62. At the Goodwell location, the average first hollow stem date was 73 (March 14) with a range of 11 days. Similar to Stillwater and Chickasha, a majority of the varieties reached this growth stage within a few days of each other. Sixty percent of the varieties reached first hollow stem between days 70 to 74 at that location. For the six triticale varieties, the average first hollow stem date was 49 (February 18) at Stillwater and 61 (March 2) at Chickasha.

Acknowledgments

The authors want to thank the Oklahoma Wheat Commission and the Oklahoma Wheat Research Foundation for providing partial funding for this research.

Seed Sources and Abbreviations

AGSECO = AGSECO Inc.
 KWA = Kansas Wheat Alliance
 LCS = Limagrain Cereal Seeds
 NRTH = Northern Seed, LLC
 OGI = Oklahoma Genetics Inc.
 OSU = Oklahoma State University
 PlainsGold = PlainsGold Seeds
 Syngenta = Syngenta Seeds
 Watley = Watley Seeds
 WestBred = Monsanto Co./WestBred Wheat

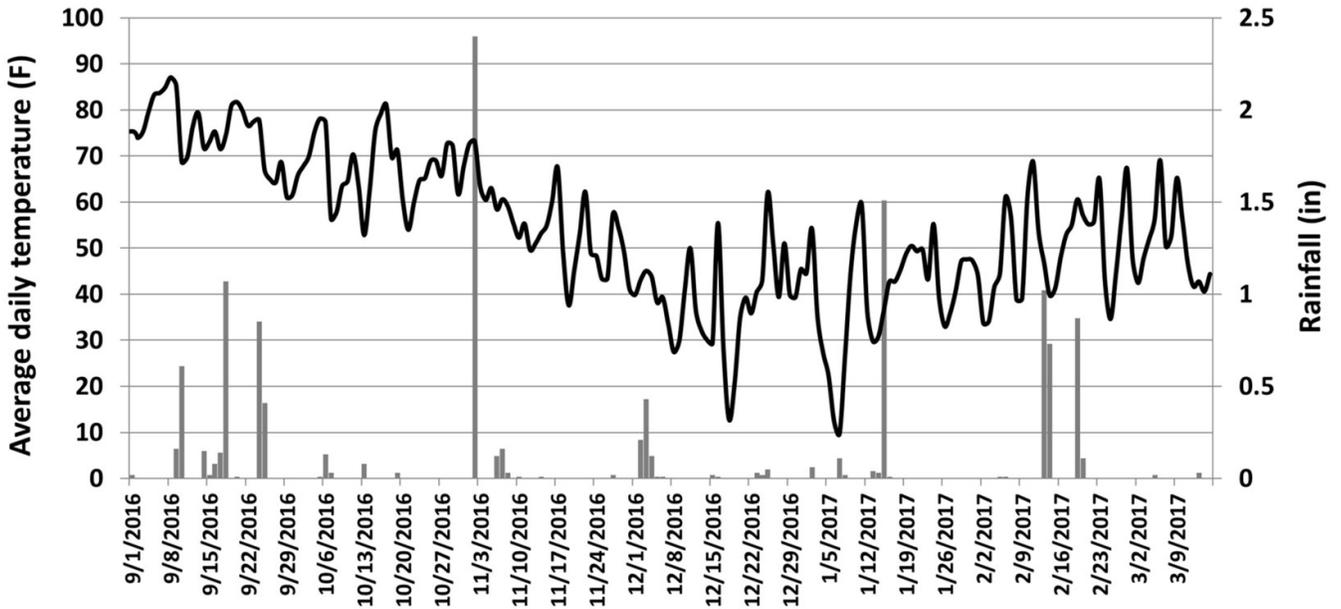


Figure 2. Average daily temperature (line graph) and rainfall (bar chart) from September 1, 2016 to March 15, 2017 at Chickasha, OK. Weather data courtesy Oklahoma Mesonet.

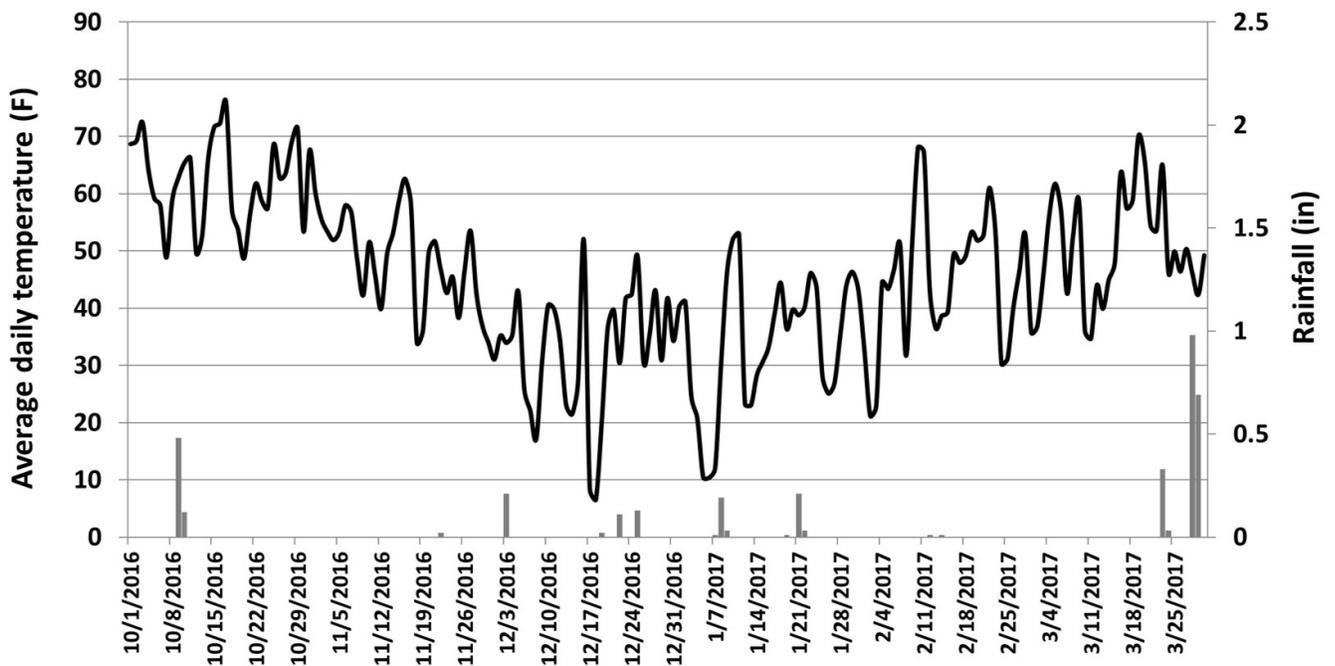


Figure 3. Average daily temperature (line graph) and rainfall (bar chart) from October 1, 2016 to March 30, 2017 at Goodwell, OK. This location also received 3.25" of supplemental irrigation from mid-October through early-March. Weather data courtesy Oklahoma Mesonet.

Table 2. Fall forage production by winter wheat varieties at Stillwater, OK during the 2016-2017 production year.

Source	Variety	2016-2017			2-Year	3-Year
		11/14/16	12/16/16	Fall total		
-----lbs dry forage/acre-----						
Syngenta	SY Monument	1,980	1,460	3,440	3,070	2,790
PlainsGold	Langin	1,930	1,320	3,250	-	-
AGSECO	Hot Rod	2,000	1,230	3,230	-	-
KWA	Joe	1,840	1,380	3,220	3,180	-
LCS	LCS Pistol	1,870	1,340	3,210	3,380	3,140
Dyna-Gro	Long Branch	1,580	1,630	3,200	3,240	-
OGI	Doublestop CL Plus	1,860	1,300	3,160	3,110	2,990
LCS	LCS Chrome	1,910	1,250	3,160	2,890	2,670
WestBred	WB4269	1,780	1,230	3,000	-	-
WestBred	WB4303	1,890	1,050	2,940	2,930	-
OSU	Smith's Gold†	1,800	1,140	2,940	-	-
KWA	Tatanka	1,730	1,210	2,940	3,000	-
AGSECO	AG Robust	1,820	1,130	2,940	2,880	-
WestBred	WB-Cedar	1,680	1,230	2,910	2,680	2,650
Syngenta	SY Llano	1,700	1,200	2,900	2,980	3,120
PlainsGold	Avery	2,040	850	2,890	2,810	2,630
LCS	T158	1,640	1,200	2,840	3,030	3,030
KWA	Zenda	1,560	1,260	2,810	2,820	-
LCS	LCS Mint	1,690	1,120	2,800	2,740	2,780
OGI	NF 101	1,820	970	2,780	3,140	2,890
WestBred	WB4721	1,570	1,200	2,770	2,730	-
OGI	Iba	1,800	950	2,750	2,810	2,730
WestBred	WB4515	1,510	1,220	2,730	2,750	-
Syngenta	SY Grit	1,830	880	2,720	-	-
WestBred	WB4458	1,750	950	2,710	2,650	2,530
OGI	Duster	1,530	1,190	2,710	2,840	2,840
OGI	Gallagher	1,630	1,080	2,710	3,230	3,390
LCS	LCS Wizard	1,820	890	2,700	2,990	3,050
WestBred	WB-Grainfield	1,690	920	2,610	2,710	2,680
PlainsGold	Byrd	1,570	1,040	2,600	2,580	2,600
OSU	Endurance	1,510	1,050	2,560	2,720	2,700
OSU	Spirit Rider†	1,340	1,040	2,530	-	-
Syngenta	SY Flint	1,230	1,240	2,470	2,950	2,670
Watley	TAM 112	1,360	1,100	2,460	2,630	2,690
PlainsGold	Brawl CL Plus	1,620	810	2,440	2,780	2,710
KWA	Larry	1,360	1,060	2,420	2,610	-
WestBred	Winterhawk	1,600	810	2,410	2,490	2,540
Watley	TAM 204	1,500	880	2,390	2,700	2,750
AGSECO	TAM 114	1,340	1,030	2,370	2,620	2,860
OGI	Billings	1,390	940	2,330	2,570	2,640
OGI	Bentley	1,350	950	2,300	2,680	2,670
OGI	Stardust	1,130	970	2,110	-	-
OGI	Ruby Lee	1,200	870	2,070	2,920	2,890
OSU Experimentals						
	OK12716R/W	2,140	1,140	3,290	3,050	-
	OK14319	2,020	1,100	3,120	-	-
	OK12621	1,870	1,240	3,100	3,000	2,710
	OK12206-2	2,070	900	2,980	-	-
	OK11D25005	1,750	1,160	2,910	-	-
	OK13209	1,740	1,050	2,790	-	-
	OK12912C-2	1,690	980	2,670	-	-
Mean		1,680	1,100	2,790	2,870	2,800
LSD (0.05)		750	420	1,000	600	510

Shaded values are not statistically different from the highest-yielding variety within a column.

† Experimental name for the variety in the previous trial(s): Smith's Gold = OK11D25056; Spirit Rider = OK10126.

Table 3. Fall forage production by triticale varieties at Stillwater, OK during the 2016-2017 production year.

Source	Variety	2016-2017		Fall total
		11/14/16	12/16/16	
-----lbs dry forage/acre-----				
NRTH	TriCal Gainer 154	2,180	1,350	3,530
NRTH	TriCal 336	2,280	1,240	3,520
NRTH	TriCal 718	2,270	870	3,140
NRTH	TriCal 813	2,290	760	3,058
NRTH	TriCal 131	1,850	1,180	3,030
NRTH	TriCal 135	1,940	940	2,880
	Mean	2,140	1,060	3,190
	LSD (0.05)	NS	430	NS

Shaded values are not statistically different from the highest-yielding variety within a column.

NS = not significant

Table 4. Fall forage production by winter wheat varieties at Chickasha, OK during the 2016-2017 production year.

Source	Variety	2016-2017			2-Year†	3-Year†
		11/16/16	12/14/16	Fall total		
-----lbs dry forage/acre-----						
OGI	Duster	3,420	1,330	4,760	4,250	3,800
WestBred	WB4303	3,130	1,400	4,530	-	-
AGSECO	TAM 114	2,630	1,800	4,420	-	-
Watley	TAM 204	2,750	1,670	4,420	3,860	-
LCS	LCS Chrome	2,320	1,980	4,300	-	-
KWA	Joe	2,910	1,350	4,260	-	-
Syngenta	SY Grit	2,550	1,710	4,260	-	-
OGI	Gallagher	2,810	1,400	4,210	4,050	3,670
KWA	Tatanka	2,300	1,860	4,160	-	-
Syngenta	SY Flint	3,000	1,140	4,140	-	-
OGI	Doublestop CL Plus	2,610	1,510	4,110	3,920	3,510
KWA	Zenda	2,440	1,580	4,020	-	-
WestBred	WB-Grainfield	2,460	1,470	3,970	-	-
OGI	NF 101	2,690	1,260	3,950	3,870	-
WestBred	WB-Cedar	2,430	1,520	3,950	3,750	3,360
WestBred	WB4269	2,650	1,270	3,920	-	-
LCS	T158	2,480	1,430	3,910	-	-
OGI	Iba	2,530	1,370	3,900	3,560	3,190
OSU	Smith's Gold‡	2,340	1,560	3,900	-	-
WestBred	Winterhawk	2,410	1,480	3,890	-	-
OGI	Ruby Lee	2,670	1,180	3,860	3,300	3,010
OGI	Bentley	2,580	1,230	3,810	3,660	3,360
Dyna-Gro	Long Branch	2,040	1,750	3,780	-	-
WestBred	WB4515	2,220	1,510	3,720	-	-
AGSECO	AG Robust	2,600	1,080	3,680	-	-
OSU	Endurance	2,350	1,280	3,640	3,620	3,290
LCS	LCS Pistol	2,280	1,360	3,640	3,590	-
Syngenta	SY Llano	2,500	1,090	3,590	3,690	-
WestBred	WB4721	2,290	1,270	3,560	-	-
KWA	Larry	2,150	1,380	3,530	-	-
WestBred	WB4458	2,350	1,130	3,480	3,340	3,070
LCS	LCS Wizard	2,240	1,140	3,380	3,460	3,120
AGSECO	Hot Rod	2,050	1,170	3,220	-	-
LCS	LCS Mint	1,740	1,370	3,110	-	-
OSU Experimentals						
	OK12716R/W	2,430	1,600	4,070	-	-
	Mean	2,500	1,420	3,920	3,710	3,340
	LSD (0.05)	830	NS	1,090	670	450

Shaded values are not statistically different from the highest-yielding variety within a column.

NS = not significant

† Two-year results are the average of 2016 and 2014. Three-year results are the average of 2016, 2014, and 2013.

‡ Experimental name for the variety in the previous trial(s): Smith's Gold = OK11D25056.

Table 5. Fall forage production by triticale varieties at Chickasha, Oklahoma during the 2016-2017 production year.

Source	Variety	2016-2017		
		11/14/16	12/16/16	Fall total
-----lbs dry forage/acre-----				
NRTH	TriCal 336	2,270	1,830	4,100
NRTH	TriCal Gainer 154	2,180	1,780	3,960
NRTH	TriCal 135	2,580	1,330	3,910
NRTH	TriCal 131	2,280	1,380	3,660
NRTH	TriCal 813	2,240	1,130	3,370
NRTH	TriCal 718	1,470	1,190	2,670
Mean		2,170	1,440	3,610
LSD (0.05)		450	NS	790

Shaded values are not statistically different from the highest-yielding variety within a column.

NS = not significant

Table 6. Occurrence of first hollow stem (day of year) for winter wheat varieties sown in 2016 and measured in 2017 at Stillwater, Chickasha, and Goodwell, OK.

Source	Variety	Stillwater	Chickasha†	Goodwell
-----day of year-----				
AGSECO	AG Robust	48	59	-
OGI	Billings	48	53	70
PlainsGold	Byrd	48	-	70
OGI	Gallagher	48	62	70
AGSECO	Hot Rod	48	59	-
KWA	Larry	48	65	74
Dyna-Gro	Long Branch	48	62	70
OGI	Ruby Lee	48	59	72
OSU	Smith's Gold‡	48	62	70
Syngenta	SY Achieve CL2	48	-	-
Syngenta	SY Benefit	48	-	-
Syngenta	SY Drifter	48	-	-
Syngenta	SY Flint	48	62	-
Syngenta	SY Llano	48	59	-
Syngenta	SY Razor	48	-	-
LCS	T158	48	62	-
AGSECO	TAM 114	48	59	70
Watley	TAM 204	48	59	68
KWA	Tatanka	48	62	76
WestBred	WB4269	48	59	-
WestBred	WB4303	48	59	-
WestBred	WB4515	48	62	-
WestBred	WB4721	48	59	-
WestBred	WB-Grainfield	48	62	76
KWA	Zenda	48	59	-
PlainsGold	Avery	52	-	74
PlainsGold	Brawl CL Plus	52	-	76
OGI	Duster	52	59	76
OSU	Endurance	52	59	74
OGI	Iba	52	62	74
KWA	Joe	52	65	79
LCS	LCS Chrome	52	65	76
LCS	LCS Pistol	52	62	-
OGI	Stardust	52	-	-
Syngenta	SY Grit	52	62	-
Syngenta	SY Rugged	52	-	-
Watley	TAM 112	52	-	70
WestBred	WB4458	52	62	-
WestBred	WB-Cedar	52	59	-
WestBred	Winterhawk	52	59	70
OGI	Bentley	55	62	76
PlainsGold	Langin	55	-	72
LCS	LCS Mint	55	65	74
LCS	LCS Wizard	55	62	-
OGI	NF 101	55	59	70
Syngenta	SY Monument	55	-	74
OGI	Doublestop CL Plus	57	62	74
OSU	Spirit Rider‡	57	-	79
OSU Experimentals				
	OK12621	48	-	-
	OK12716	48	65	74
	OK12D22002-077	48	-	-
	OK12D22004-016	48	-	-
	OK12DP22002-042	48	-	70
	OK13209	48	-	-
	OK11D25005	52	-	-
	OK12206-2	52	-	-
	OK13621	52	-	70
	OK14319	52	-	-
	OK11755W-9W	55	-	-
	OK12912C-2	55	-	-
Average		51	61	73

† Chickasha FHS results were collected from plots under simulated grazing. Grazing delays the onset of FHS.
‡ Experimental name for the variety in the previous trial(s): Smith's Gold = OK11D25056; Spirit Rider = OK10126.

Table 7. Occurrence of first hollow stem (day of year) for triticale varieties sown in 2016 and measured in 2017 at Stillwater and Chickasha.

Source	Variety	Stillwater	Chickasha†
-----day of year-----			
NRTH	TriCal 131	48	53
NRTH	TriCal 135	48	62
NRTH	TriCal 718	48	65
NRTH	TriCal 813	48	62
NRTH	TriCal 336	52	62
NRTH	TriCal Gainer 154	52	59
Average		49	61

† Chickasha FHS results were collected from plots under simulated grazing. Grazing delays the onset of FHS.

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