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Wheat Variety Date of First Hollow Stem and Grain Yield 2018

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To be successful in dual-purpose systems, wheat varieties often require traits that are overlooked in grain-only systems. These traits include fall forage yield potential, date of first hollow stem, potential for recovery from grazing, resistance to viral diseases common under early planting, high-temperature germination sensitivity, coleoptile length, and tolerance to low soil pH and aluminum toxicity. This publication evaluates the fall forage yield, date of first hollow stem, and grain yield of current varieties in dual-purpose versus grain-only systems.

Fall forage yield potential is an important trait in dual-purpose systems because it sets the potential beef production from wheat grazing in the fall, winter, and early spring. Approximately 100 pounds of beef can be produced for every 1,000 pounds of wheat forage produced in an acre. Forage production is dependent on variety selection, planting date, seeding rate, and especially on fall precipitation and temperature.

Date of first hollow stem is an important trait in dual-purpose systems. Terminating grazing at the right time is essential to maintaining the crop's grain yield potential. Grazing past first hollow stem can decrease wheat grain yields by as much as 1 to 5 percent per day.

Depending on environmental conditions, varieties with a shorter vernalization requirement might reach first hollow stem up to 30 days earlier than varieties with a longer vernalization requirement. An early occurrence of first hollow stem reduces the grazing window into early spring. In photoperiod-sensitive varieties, date of first hollow stem is dependent on temperature and day length.

Grain yield following grazing is another important variety-specific trait in dual-purpose systems. Varieties that predominately rely on fall-formed tillers to produce grain yield generally show a greater yield penalty from grazing than varieties with a good spring tiller potential.

Description of site and methods

Twenty eight commonly grown winter wheat varieties or breeding lines were planted in three neighboring trials at the South Central Experiment Field near Hutchinson, Kansas. Two trials were sown to simulate dual-purpose management, characterized by early planting date and higher seeding rate, while a third trial was planted with the same varieties under grain-only management (Table 1). A randomized complete block design with four replications was used at the three trials. All plots received 50 pounds per acre of 18-46-00 in furrow at planting, and nitrogen fertilization was performed for a 65 bushels per acre yield goal. Dual-purpose plots received an additional 110 pounds of nitrogen per acre to supplement forage production and harvest (Table 2).

One of the two dual-purpose trials was used for destructive measurements to assess first hollow stem. Forage yield is usually measured in this trial, but there was no measurable forage production during the fall of

Table 1. *Planting rate, dates of sowing, forage harvest, simulated grazing, and grain harvest for three trials evaluating 28 wheat varieties under dual-purpose versus grain-only management.*

Trial	Planting rate	Planting date	Simulated grazing	Grain harvest
	---- lbs/acre ----	---------- date ----------		
Dual-purpose — First hollow stem	120	09/20/2017	—	—
Dual-purpose — Grain harvest	120	09/20/2017	03/05/2017	06/15/2018
Grain-only	60	10/19/2017	—	06/15/2018

Table 2. *Initial soil fertility on the study site collected at sowing.*

pH (0-6 in)	pH (6-24 in)	NO_3-N (0-24 in)	P (0-6 in)	K (0-6 in)	Ca (0-6 in)	Mg (0-6 in)	Na (0-6 in)	SO_4-S (0-24 in)	Cl (0-6 in)	CEC (0-6 in)
		---------- ppm ----------								meq/100 g
5.5	5.9	2.8	53.7	225	1,339	240	5.8	5.3	6.9	19.3

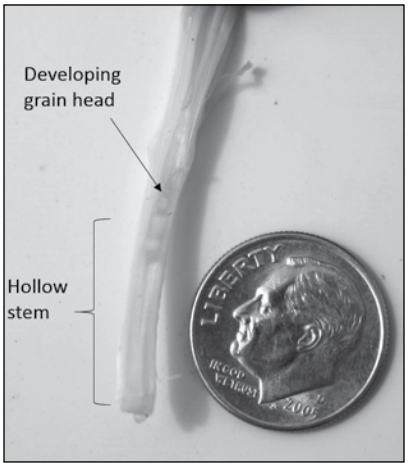

Figure 1. *Wheat plant at the first hollow stem stage. First hollow stem occurs when there is approximately 1.5 centimeters (9/16 inch or roughly the diameter of a dime) below the developing wheat head.*

2017 due to the extremely dry and cold conditions. First hollow stem was measured during the winter and early spring by splitting 10 primary stems collected from each plot on a weekly basis during the spring. First hollow stem sampling was terminated when 100 percent of the measured stems had passed 1.5 centimeters (9/16 inch) of hollow stem below the developing wheat head (Figure 1). This trial was not harvested for grain yield due to the excessive amount of destructive measurements.

The other two trials, one managed as grain-only and another as dual-purpose, were harvested for grain yield to compare how commercial varieties recovered from simulated grazing. Simulated grazing occurred in the dual-purpose trial during the spring (Table 1). To represent grazing, plots were mowed to about 1.5 inches every time regrowth reached about 2 inches until first hollow stem.

Weather conditions

Fall 2017 was dry (3.3 inches rainfall) and cool (48 degrees Fahrenheit, Figure 2). Combined, these conditions severely restricted fall forage development. Winter and early spring had about 2.4 inches of cumulative precipitation between January 1 and March 30, and temperatures also were below normal, averaging 36.9 degrees Fahrenheit. Cool conditions extended until late April, delaying wheat development. The dry fall and spring were followed by warm and dry May and June, with a total of 5.3 inches of precipitation and 74 degrees Fahrenheit average temperature.

First hollow stem

First hollow stem is reported in day of year format. Day of the year 60 is equivalent to March 1. Average occurrence of first hollow stem was day 85, which is 12 days later than the values measured during the 2016-17 growing season, and 15 days later than the average measured during the 2015-16 growing season (Table 3). The earliest varieties (1863, AM Eastwood, Gallagher, LCS Pistol, Lonerider, Spirit Rider, Stardust, SY Achieve CL 2, and SY Benefit) reached first hollow stem on day 81, which was 15 days earlier than the latest variety Oakley CL, which reached first hollow stem on day 96 (Table 3). Varieties that reached first hollow stem intermediately were Iba, Ruby Lee, Smith's Gold, Paradise, Bob Dole, SY Rugged, Joe, Larry, Tatanka, and Zenda, as well as the lines OK12716, NE10478-1, LCH13-22, LCH14-55, and LCH14-89. Later varieties included LCS Chrome, Bentley, and Doublestop CL Plus.

All varieties reached first hollow stem within a 15-day interval, which is a longer interval than the 9 days measured during 2015-16 and similar to the interval measured in 2016-17. Despite a similar interval, first hollow stem was reached considerably later in 2017-18 than in the previous two growing seasons. Reports of first hollow stem from Oklahoma have shown that early varieties may reach first hollow stem as much as 30 days earlier than later varieties, depending on environmental conditions. Our report may also differ from results obtained in Oklahoma due to the interaction of varieties with day length.

Grain yield and test weight in grain-only or dual-purpose systems

Average grain yield in the grain-only trial was 72 bushels per acre, whereas the dual-purpose trial averaged 43.2 bushels per acre (Table 4). This substantial

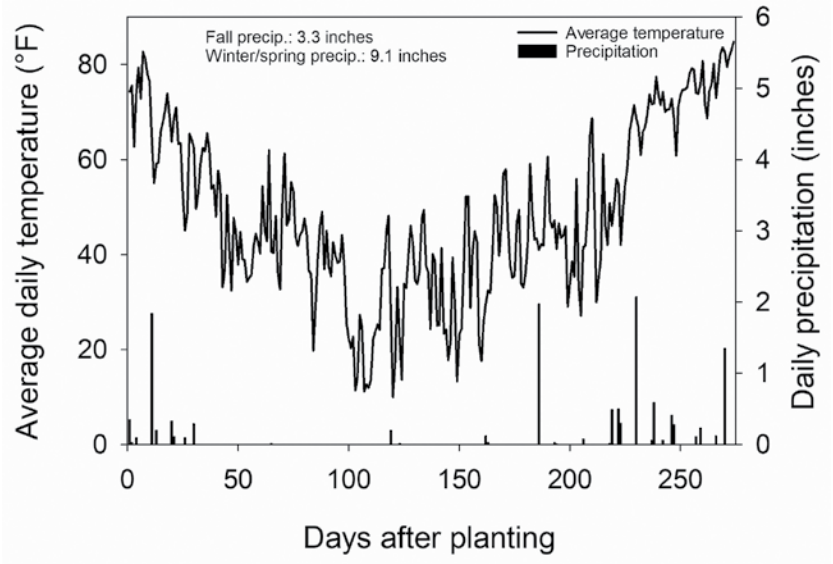

Figure 2. *Observed weather during the 2017-18 growing season in the South Central Experiment Field near Hutchinson, Kansas. Weather data are average daily temperature and cumulative daily precipitation from September 15, 2017, until June 15, 2018.*

difference in grain yield between trials was likely due to early sowing of the dual-purpose trial, coupled with extremely dry conditions and simulated grazing. Varieties that yielded statistically better than the others include Bentley, Joe, Larry, LCS Pistol, Oakley CL, Paradise, Ruby Lee, and Tatanka in the grain-only trial. In the dual-purpose trial, varieties in the top yielding group were Bentley, Iba, Joe, Larry, LCS Chrome, and Paradise. The effects of early sowing and simulated grazing decreased wheat yields anywhere between 16.1 and 42.4 bushels per acre, depending on variety (Table 4). Average test weight was also decreased by the dual-purpose system, from an average 57.3 pounds per bushel in the grain-only trial to 52.8 pounds per bushel in the dual-purpose trial (Table 4). There were significant differences in test weight among varieties, with Joe having consistently greater test weight than the remaining varieties (Table 4).

Table 3. *Date of first hollow stem during the 2015-16, 2016-17, and 2017-18 growing seasons for 28 selected varieties in Hutchinson, Kansas.*

		First hollow stem		
Variety	**Source**	**2015-16**	**2016-17**	**2017-18**
		---------- Day of year ----------		
1863	Wildcat Genetics	69	68	81
AM Eastwood	AgriMAXX		-	81
Bentley	OGI	72	80	92
Bob Dole	Syngenta		74	86
Doublestop CL Plus	OGI	73	78	92
Gallagher	OGI	69	68	81
Iba	OGI	-	71	86
Joe	Wildcat Genetics	-	-	86
Larry	Wildcat Genetics	-	71	86
LCH13-22	Limagrain	-	-	86
LCH14-55	Limagrain	-	-	86
LCH14-89	Limagrain	-	-	86
LCS Chrome	Limagrain	74	-	92
LCS Pistol	Limagrain	69	-	81
Lonerider	OGI	-	71	81
NE10478-1	Husker Genetics	-	-	86
Oakley CL	Wildcat Genetics	-	-	96
OK12716	OGI	-	78	86
Paradise	Polansky	-	-	86
Ruby Lee	OGI	-	71	86
Smith's Gold	OGI	-	71	86
Spirit Rider	OGI	-	-	81
Stardust	OGI	-	71	81
SY Achieve CL2	Syngenta	-	-	81
SY Benefit	Syngenta	-	-	81
SY Rugged	Syngenta	-	-	86
Tatanka	Wildcat Genetics	-	78	86
Zenda	Wildcat Genetics	-	71	86
Mean		70	73	85
Minimum		65	65	81
Maximum		74	80	96

Table 4. *Grain yield and test weight in grain-only (GO) and dual-purpose (DP) systems in Hutchinson, Kansas, during the 2017-18 production year.*

		Grain yield						Test weight		
Variety	**Source**	**GO**	**DP**	**diff.**	**2-yr GO**	**2-yr DP**	**2-yr diff.**	**GO**	**DP**	**diff.**
		bu / a						lbs / bu		
1863	Wildcat Genetics	61.5	37.5	-24.0	69.8	66.1	-3.7	58.1	53.2	-4.9
AM Eastwood	AgriMAXX	61.3	36.1	-25.1	-	-	-	55.1	51.4	-3.7
Bentley	OGI	77.0	53.0	-24.0	64.3	66.9	2.7	58.2	55.7	-2.6
Bob Dole	Syngenta	75.0	37.9	-37.1	81.9	71.8	-10.1	55.5	49.8	-5.7
Doublestop CL Plus	OGI	70.9	41.9	-29.0	77.1	71.3	-5.8	59.4	53.5	-5.9
Gallagher	OGI	65.8	36.2	-29.6	75.4	70.7	-4.7	55.8	51.4	-4.4
Iba	OGI	72.2	48.9	-23.3	71.8	68.6	-3.1	58.5	54.2	-4.4
Joe	Wildcat Genetics	83.3	57.5	-25.8	-	-	-	61.4	58.6	-2.9
Larry	Wildcat Genetics	78.6	49.9	-28.7	71.6	72.4	0.8	58.8	53.6	-5.3
LCH13-22	Limagrain	74.0	42.9	-31.1	-	-	-	59.8	55.0	-4.8
LCH14-55	Limagrain	71.9	45.8	-26.1	-	-	-	54.5	51.8	-2.7
LCH14-89	Limagrain	73.0	40.0	-33.0	-	-	-	58.0	52.8	-5.2
LCS Chrome	Limagrain	70.4	54.3	-16.1	-	-	-	59.0	53.0	-6.0
LCS Pistol	Limagrain	77.4	42.4	-35.0	-	-	-	55.1	49.5	-5.6
Lonerider	OGI	68.9	39.3	-29.7	-	-	-	53.7	49.5	-4.2
NE10478-1	Husker Genetics	61.4	33.0	-28.4	-	-	-	52.7	47.6	-5.2
Oakley CL	Wildcat Genetics	79.0	44.0	-35.0	-	-	-	58.8	53.6	-5.2
OK12716	OGI	74.4	44.5	-29.8	-	-	-	55.0	49.5	-5.5
Paradise	Polansky	79.0	52.1	-26.9	-	-	-	58.1	54.7	-3.4
Ruby Lee	OGI	78.6	36.2	-42.4	71.1	62.2	-8.9	59.9	52.9	-7.1
Smith's Gold	OGI	69.9	43.1	-26.8	76.3	71.8	-4.5	55.5	51.5	-4.0
Spirit Rider	OGI	68.7	42.2	-26.5	-	-	-	58.7	53.4	-5.3
Stardust	OGI	72.6	43.7	-28.9	70.7	69.0	-1.6	57.6	54.8	-2.8
SY Achieve CL2	Syngenta	61.5	43.2	-18.3	-	-	-	57.2	54.6	-2.6
SY Benefit	Syngenta	68.1	41.0	-27.2	-	-	-	56.8	53.1	-3.7
SY Rugged	Syngenta	68.8	40.9	-27.9	-	-	-	56.6	52.6	-4.0
Tatanka	Wildcat Genetics	86.2	47.0	-39.1	74.0	75.1	1.1	58.7	54.6	-4.1
Zenda	Wildcat Genetics	67.5	36.0	-31.6	76.6	75.1	-1.5	58.6	54.0	-4.6
Mean		72.0	43.2	-28.8				57.3	52.8	-4.5
Minimum		61.3	33.0	-42.4				52.7	47.6	-7.1
Maximum		86.2	57.5	-16.1				61.4	58.6	-2.6
LSD (0.05)		9.2	8.6					1	1.6	

**LSD — Least significant difference, or the minimum difference required between two varieties to be statistically different. Shading indicates varieties with the highest grain yield. Shaded varieties do not differ statistically.*

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