K-STATE Research and Extension

Department of Agronomy

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Wheat Variety Date of First Hollow Stem, Fall Forage Yield, and Grain Yield 2017

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 commonly grown winter wheat varieties 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).

Table 1. *Planting rate, dates of sowing, forage harvest, simulated grazing, and grain harvest for three trials evaluating 20 wheat varieties under dual-purpose versus grain-only management.*

Trial	Planting rate	Planting date	Forage harvest	Simulated grazing	Grain harvest
	---- lbs/acre ----	---------- date ----------			
Dual purpose — First hollow stem	120	09/23/2016	12/14/2016	-	-
Dual purpose — Grain harvest	120	09/23/2016	- - -	02/10/2017 02/28/2017 03/05/2017	06/16/2017
Grain only	60	10/13/2016	-	-	06/16/2017

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 (0-6 in)	Cl (0-6 in)	CEC (0-6 in)
		---------- ppm ----------								meq/100 g
7.8	7	17.2	63.3	201.3	2,172	180.6	12.8	7.8	4.8	12.9

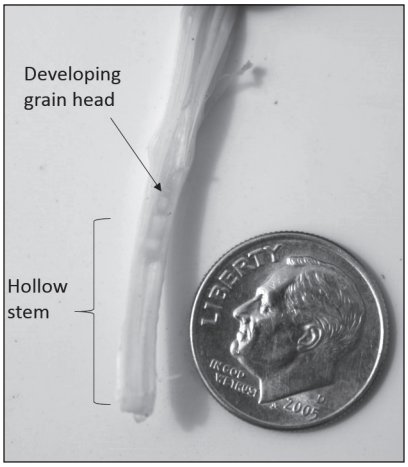

Figure 1. *Wheat plant at the first hollow stem stage. First hollow stem occurs when there is approximately 1.5 centimeters (9/16 inch or roughly the diameter of a dime) below the developing wheat head.*

One of the two dual-purpose trials was used for destructive measurements to assess forage yield and first hollow stem. Forage yield was measured by hand clipping plants approximately ½ inch above the soil surface at two 1-meter (3.3 feet) by 1-row samples within each plot. Samples were then placed in a forced-air dryer for approximately 7 days and weighed. 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 different commercial varieties recovered from simulated grazing. Simulated grazing occurred in the dual-purpose trial during the fall and 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

The warm fall of 2016 favored fall forage development, although only 1.9 inches of precipitation were measured at the station neighboring the plots. Fall forage production of most varieties were above 1,350 pounds per acre. Winter and early spring were dry, with only 2.4 inches cumulative precipitation between January 1 and March 15. Grain yields following the dry early spring were favored by cool and moist weather during late April and May, with a total of 15 inches of precipitation and 62 degrees Fahrenheit average temperature.

Fall forage yield

Average fall forage yield across all varieties was 1,804 pounds per acre, ranging from 1,350 to 2,177 pounds per acre (Table 3). While fall forage yield may have been restricted across all varieties by the relatively low rainfall during the fall, average forage production was still greater than that measured during the 2015-16 growing season, which averaged 1,554 pounds per acre. The greatest forage producer was the variety Zenda, and statistically similar forage production was attained by the varieties Bob Dole, DoubleStop CL Plus, Gallagher, Iba, Larry, OK12716, SY Flint, SY Grit, SY Llano, and Tatanka. Varieties such as Smith's Gold, AG Icon, 1863, KanMark, and others, produced significantly less forage than the ones mentioned above (Table 3).

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 73, which is three days later than the values measured during the 2015-16 growing season. The earliest variety (SY Llano) reached first hollow stem on day 65 and latest variety (Bentley) on day 80 (Table 3). Varieties that reached first hollow stem earlier were 1863, Everest, Iba, Larry, Lonerider, Ruby Lee, Smith's Gold, Stardust, SY Grit, and Zenda, and later varieties included Ag Icon, Bentley, DoubleStop CL Plus, OK12716, and Tatanka.

All studied varieties reached first hollow stem within a 15-day interval, which is a longer interval than the 9 days measured during 2015-16. Previous reports

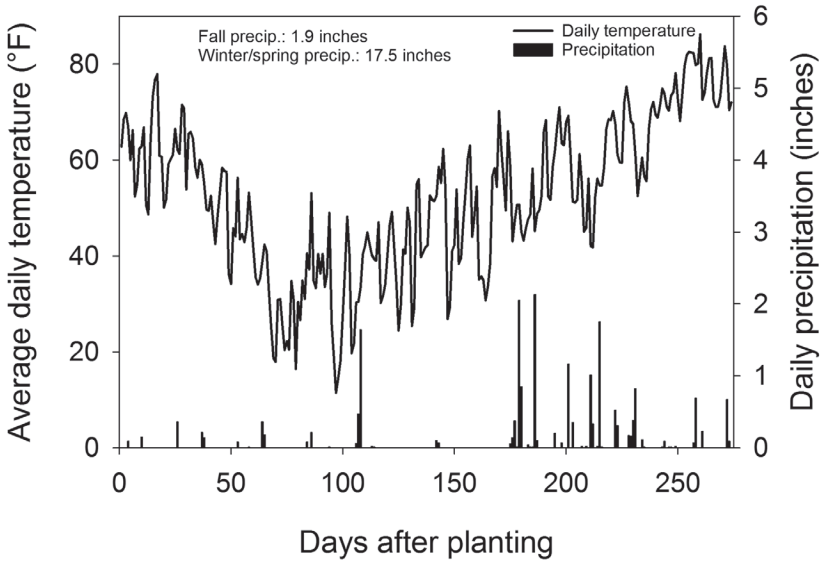

Figure 2. *Observed weather during the 2016–17 growing season in the South Central Experiment Field near Hutchinson, Kansas. Weather data are average daily temperature and cumulative daily precipitation from October 1, 2016, until June 30, 2017.*

of first hollow stem from Oklahoma have shown early varieties may reach first hollow stem as much as 30 days earlier than later varieties, depending on environmental conditions. This report may differ from results obtained in Oklahoma due to the interaction of varieties with photoperiod.

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

Average grain yield in the grain-only trial was 88.8 bushels per acre, whereas the dual-purpose trial averaged 85.8 bushels per acre (Table 4). Varieties that yielded statistically better than the others include Bob Dole and Lonerider in the grain-only trial, and the same varieties in the dual-purpose trial in addition to DoubleStop CL Plus, Gallagher, Larry, OK12716, Smith's Gold, Tatanka, and Zenda. The effects of simulated grazing increased and decreased wheat yields by as much as 7.9 and 14.6 bushels per acre, depending on variety (Table 4). Average test weight also seemed to be increased by removing early-season forage, as average test weight increased from 58.6 pounds per bushel in the grain-only trial to 59.8 pounds to bushel in the dual-purpose trial (Table 4). There was significant difference in test weight between varieties. DoubleStop CL Plus, Iba, and Zenda had greater test weight than other varieties at both the grain-only and dual-purpose trials. Everest and SY Llano were also in the top group when not grazed, while Bob Dole, Gallagher, and KanMark were in the top group when grazed.

Table 3. *Fall forage yield, date of first hollow stem, plant height, and lodging under grain-only (GO) and dual-purpose (DP) systems in Hutchinson, Kansas, during the 2016-17 production year. Height: 1 = short; 9 = tall. Lodging: 1 = excellent straw strength; 9 = poor straw strength.*

Variety	Source	Fall dry forage yield	First hollow stem	Plant height		Lodging	
				GO	DP	GO	DP
		lbs/acre	day of year				
1863	KWA	1,671	68	7.2	6.7	6.5	6.3
AG Icon	AGSECO	1,562	78	7.3	7.0	2.1	2.0
Bentley	OGI	1,724	80	8.0	8.7	8.0	6.0
Bob Dole	Agripro	1,831	74	8.5	7.7	2.4	3.1
Doublestop CL Plus	OGI	1,845	78	8.7	8.5	2.2	1.7
Everest	KWA	1,729	71	4.7	6.3	4.1	7.3
Gallagher	OGI	1,777	68	5.5	4.5	4.1	5.0
Iba	OGI	1,898	71	6.7	6.5	8.3	7.3
KanMark	KWA	1,694	74	3.9	4.7	3.5	5.2
Larry	KWA	1,826	71	6.5	5.5	4.8	3.4
Lonerider	OGI	1,781	71	4.9	4.0	2.5	1.0
OK12716	OGI	1,747	78	7.7	7.5	1.9	2.5
Ruby Lee	OGI	1,718	71	8.5	6.7	6.0	4.5
Smith's Gold	OGI	1,350	71	6.7	5.5	4.5	4.4
Stardust	OGI	1,672	71	7.2	6.2	5.7	4.3
SY Flint	Agripro	1,972	74	5.4	6.0	5.4	7.3
SY Grit	Agripro	2,059	68	5.5	4.5	3.5	2.2
SY Llano	Agripro	1,993	65	3.6	2.7	2.6	2.2
Tatanka	KWA	2,054	78	6.2	7.0	7.0	7.0
Zenda	KWA	2,177	71	7.7	8.5	4.0	2.7
Mean		1,804	73	7	6	4	4
Minimum		1,350	65	4	3	2	1
Maximum		2,177	80	9	9	8	7
LSD (0.05)		430		1.6	1.3	2.5	1.3

**LSD — Least significant difference, or the minimum difference required between two varieties to be statistically different. Shading indicates varieties with the highest forage yield, tallest plant height, or better straw strength. Shaded varieties in the same column do not differ statistically.*

Table 4. *Grain yield and test weight in grain-only (GO) and dual-purpose (DP) systems in Hutchinson, Kansas, during the 2016-17 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	KWA	81.5	78.9	-2.6	79.7	78.2	-1.5	58.5	60.2	1.7
AG Icon	AGSECO	87.3	87.3	0.0	-	-	-	58.4	60.2	1.8
Bentley	OGI	70.3	78.2	7.9	76.3	81.4	5.1	55.6	56.9	1.3
Bob Dole	Agripro	108.3	93.7	-14.6	-	-	-	58.9	60.8	1.9
Doublestop CL Plus	OGI	94.8	89.0	-5.8	84.9	78.8	-6.1	60.9	61.5	0.6
Everest	KWA	89.8	76.7	-13.0	83.8	74.6	-9.2	60.6	60.1	-0.4
Gallagher	OGI	95.0	90.0	-5.0	89.6	81.9	-7.7	58.8	61.1	2.2
Iba	OGI	85.0	83.1	-1.9	-	-	-	59.4	61.8	2.4
KanMark	KWA	87.5	76.4	-11.1	85.2	79.0	-6.1	58.4	60.7	2.2
Larry	KWA	84.3	91.2	7.0	-	-	-	59.1	59.9	0.8
Lonerider	OGI	100.8	93.8	-7.0	-	-	-	55.9	56.9	1.1
OK12716	OGI	94.0	95.5	1.5	-	-	-	57.6	58.6	0.9
Ruby Lee	OGI	82.3	71.5	-10.7	79.3	71.4	-7.9	56.7	56.6	-0.1
Smith's Gold	OGI	97.0	92.1	-4.9	-	-	-	59	60.1	1.0
Stardust	OGI	82.3	76.9	-5.4	-	-	-	59.2	58.9	-0.3
SY Flint	Agripro	83.8	83.3	-0.5	79.7	78.7	-0.9	58.7	60.4	1.7
SY Grit	Agripro	83.3	81.4	-1.9	-	-	-	57.4	58.4	1.0
SY Llano	Agripro	84.8	86.0	1.2	-	-	-	60.8	60.5	-0.3
Tatanka	KWA	89.3	95.6	6.3	-	-	-	59.2	60.3	1.1
Zenda	KWA	94.5	96.1	1.6	-	-	-	59.5	61.2	1.7
Mean		88.8	85.8	-2.9				58.6	59.8	1.1
Minimum		70.3	71.5	-14.6				55.6	56.6	-0.4
Maximum		108.3	96.1	7.9				60.9	61.8	2.4
LSD (0.05)*		7.5	7.1					1.5	1.1	

**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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