K-STATE Research and Extension

Department of Agronomy

MF3312

Wheat Variety Date of First Hollow Stem, Fall Forage Yield, and Grain Yield for 2019-20

To be successful in dual-purpose systems, wheat varieties often require traits that are sometimes overlooked in grain-only systems. These traits include fall forage yield potential, date of first hollow stem, recovery potential from grazing, resistance to viral diseases more commonly transmitted under early sowing, high-temperature germination sensitivity, long coleoptile, and tolerance to low soil pH and aluminum toxicity. This publication evaluates fall forage yield, date of first hollow stem, plant height, 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 and nitrogen rates, and fall temperature and precipitation.

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

Varieties with a shorter vernalization requirement might reach first hollow stem up to 20 to 30 days earlier than varieties with a longer vernalization requirement, depending on environmental conditions. An early occurrence of first hollow stem reduces the grazing window into early spring. Date of first hollow stem depends on temperature and day length.

Grain yield following grazing is another important variety-specific trait in dual-purpose systems. Varieties that mostly 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 were sown in three neighboring trials in the South Central Experiment Field near Hutchinson, Kansas. Two trials were sown to simulate dual-purpose management, characterized by early sowing date, increased nitrogen rate, and higher seeding rate; while a third trial was sown to the same varieties under grain-only management (Table 1). 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 pre-plant to supplement forage production (Table 2). Trials were not sprayed with foliar fungicides; thus, the high inci-

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

Trial	Seeding rate	Sowing date	Forage harvest	Simulated grazing	Grain harvest
	--- lbs/acre ---	---------- date ----------			
Dual-purpose — First hollow stem	120	9/18/2019	12/20/2019	—	—
Dual-purpose — Grain harvest	120	9/18/2019	—	3/2/2020	6/30/2020
			—	3/11/2020	
			—	3/18/2020	
				3/26/2020	
Grain-only	60	10/10/2019	—	—	6/30/2020

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

Soil depth	O.M.	pH	NO_3-N	P	K	Ca	Mg	Na	SO_4-S	CEC
inches	%	---------- ppm ----------								meq/100g
0 - 6	1.9	6.0	60.4	55.7	235	1,997	164	13	18.3	18.2
6 - 24	1.8	7.2	33.6	38.1	194	3,556	206	10	20.0	20.0

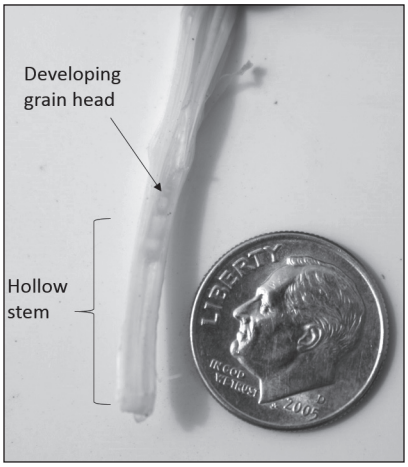

Figure 1. *Wheat plant at the first hollow stem stage. First hollow stem occurs when there is approximately 1.5 centimeters (9/16 inch or roughly the diameter of a dime) below the developing wheat head.*

dence of leaf and stripe rust during the 2019-20 season needs to be considered when evaluating the results.

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% of the measured stems had passed 1.5 centimeters (9/16 inch) of hollow stem below the developing wheat head (Figure 1).

Simulated grazing occurred in a neighboring dual-purpose trial during the fall and spring seasons (Table 1). Plots were mowed to about 1.5 inch height every time regrowth achieved about 2 inches. Simulated grazing was stopped at first hollow stem. Plant height was measured and lodging scores varied from 1 (upright) to 9 (flat). Grain was harvested and grain yield was corrected for 13% moisture content.

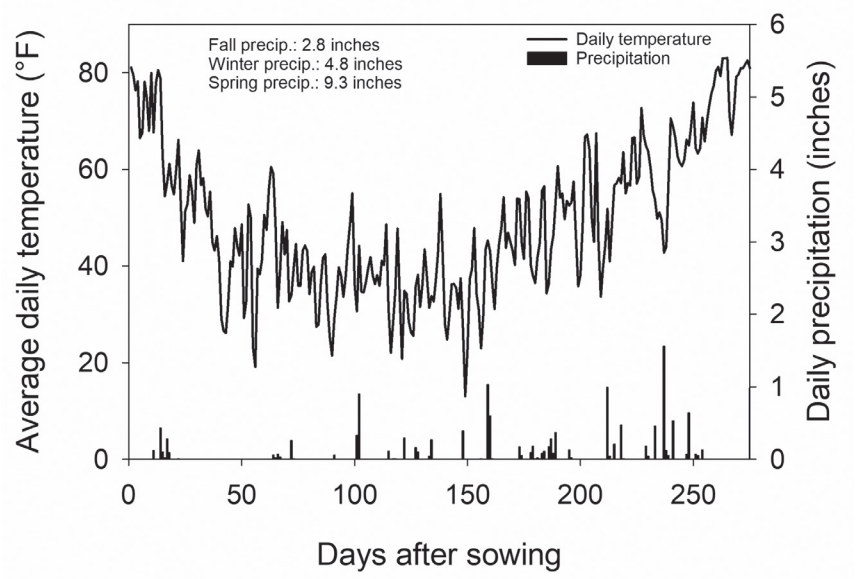

Figure 2. *Observed weather during the 2019-20 growing season in the South Central Experiment Field near Hutchinson, Kansas. Weather data are average daily temperature and cumulative daily precipitation from September 18, 2019 to June 30, 2020.*

Weather conditions

The fall of 2019 had 2.8 inches of precipitation, which did not fall significantly until about 14 days after the sowing of the dual-purpose trial (Figure 2), resulting in suboptimal stand establishment. Winter and early spring were relatively warm and moist, with 4.8 inches cumulative precipitation between January 1 and March 30, allowing for tiller production during this time. Temperatures remained below average and precipitation above average through the end of the growing season, totaling another 9.3 inches accumulated between April 1 and June 30 (Figure 2).

Fall forage yield

Fall forage production averaged 1,002 pounds per acre, which is about half of that produced in 2018-19. The range was from 438 to 1,888 pounds per acre (Table 3). The greatest forage producer was the variety Gallagher, which was statistically similar to the forage production attained by the varieties Paradise, Rock Star, Smith's Gold, WB4269, WB4303, and WB4792. The limited forage production during the 2019-20 growing season as compared to previous years was led by lack of precipitation following the sowing of the dual-purpose trials, which resulted in poor, uneven, and late emergence.

First hollow stem

First hollow stem is reported in day of year format. Day of the year 80 is equivalent to March 21. Average occurrence of first hollow stem was day 76, which is about ten days earlier than the 2017-18 and 2018-19 growing seasons, and about 10 days later than the 2015-16 and 2016-17 seasons. The range in first hollow stem was narrow, from day of year 71 to 78. This was due to a somewhat constant transition to warm temperatures and moisture availability. The earliest varieties to reach first hollow stem were Long Branch and WB4792, and latest varieties were AM Eastwood, Bob Dole, Smith's Gold, and WB4269 (Table 3). All studied varieties reached first hollow stem within a seven-day interval.

Grain yield and lodging in grain-only or dual-purpose systems

Average grain yield in the grain-only trial was 66.4 bushels per acre, whereas the dual-purpose trial aver-

Table 3. *Fall dry forage yield, date of first hollow stem, and plant height under grain-only (GO) and dual-purpose (DP) systems in Hutchinson, KS, during the 2019-20 production year. Values pertaining to the highest group are highlighted in bold.*

Variety	Source	Fall forage dry matter (12/20/19)	First hollow stem	Plant height		
				GO	DP	diff.
		--- lbs/acre ---	Day of year	----- in -----		
AM Cartwright	AgriMaxx	1,163	77	34.9	34.0	0.9
AM Eastwood	AgriMaxx	475	78	33.3	30.3	3.0
AP EverRock	Agripro	906	77	32.7	29.8	2.9
Bentley	OGI	884	77	38.2	36.5	1.7
Bob Dole	Agripro	751	78	39.1	**37.6**	1.6
Doublestop CL Plus	OGI	1,095	76	**40.3**	36.6	3.8
Gallagher	OGI	**1,888**	75	34.6	31.8	2.8
Green Hammer	OGI	1,144	75	37.4	35.9	1.5
Guardian	PlainsGold	849	77	36.0	33.5	2.5
KS Dallas	KWA	805	75	34.4	33.4	1.0
KS Silverado	KWA	538	75	34.0	33.0	1.0
KS Western Star	KWA	809	74	38.4	33.2	5.2
LCS Valiant	Limagrain	540	77	34.6	33.5	1.1
Long Branch	Dyna-Gro	683	71	36.8	34.0	2.8
Paradise	Polansky	**1,385**	75	33.6	34.3	-0.8
Rock Star	Polansky	**1,618**	77	35.0	33.6	1.4
Showdown	OGI	634	74	37.6	36.6	1.0
Smith's Gold	OGI	**1,357**	78	35.6	33.6	2.0
SY Achieve CL2	Agripro	438	74	35.0	33.0	2.0
SY Wolverine	Agripro	745	75	32.8	30.8	2.0
TAM205	AGSECO	1,015	75	36.5	33.3	3.2
WB4269	WestBred	**1,523**	78	32.1	30.9	1.2
WB4303	WestBred	**1,765**	76	33.4	30.8	2.6
WB4595	WestBred	725	75	34.6	34.5	0.1
WB4699	WestBred	1,146	77	32.6	31.6	1.0
WB4792	WestBred	**1,294**	73	36.1	34.8	1.2
Whistler	PlainsGold	884	74	**41.6**	**38.6**	3.0
Zenda	KWA	983	75	35.9	34.3	1.7
Average		1,002	76	36	34	2
Min.		438	71	32	30	-1
Max.		1,888	78	42	39	5
HSD*		595		1.5	1.3	

* *HSD — Tukey's honest significant difference, or the minimum difference required between two varieties to be statistically different.*

aged 51.3 bushels per acre (Table 4). Varieties that yielded statistically better than counterparts included Rock Star, WB4269, and WB4699 in the grain-only trial and AM Cartwright, Bentley, DoubleStop CL Plus, Guardian, Rock Star, Showdown, WB4269, and WB4699 in the dual-purpose trial (Table 4).

The yield penalty from simulated grazing averaged 15 bushels per acre and ranged from fewer than 6 bushels per acre for Bentley, TAM 205, and Whistler, to more than 24 bushels per acre (a four-fold difference) for SY Achieve CL2 and SY Wolverine.

These results demonstrate that the recovery from grazing is variety-specific and should be considered when selecting a wheat variety for dual-purpose systems. Wheat varieties also showed varying levels of lodging in the grain only trial, with rates ranging from 1 to 9, in a scale in which 1 means completely erect and 9 means completely flat on the ground.

Table 4. *Grain yield in grain-only (GO) and dual-purpose (DP) systems in Hutchinson, KS, during the 2019-20 production year. Shaded values refer to the highest testing group. Values pertaining to the highest group are highlighted in bold.*

		Grain yield			Lodging*
Variety	**Source**	**GO**	**DP**	**diff.**	**1-9**
			---------- bu/a ----------		
AM Cartwright	AgriMaxx	73.9	59.0	14.9	2
AM Eastwood	AgriMaxx	58.7	42.6	16.1	1
AP EverRock	Agripro	66.1	45.8	20.3	3
Bentley	OGI	67.7	61.9	5.8	1
Bob Dole	Agripro	61.7	47.1	14.6	6
Doublestop CL Plus	OGI	74.3	60.1	14.2	2
Gallagher	OGI	55.8	42.4	13.4	4
Green Hammer	OGI	66.3	51.3	15.1	1
Guardian	PlainsGold	67.1	60.0	7.0	4
KS Dallas	KWA	66.8	51.7	15.1	5
KS Silverado	KWA	70.4	52.3	18.1	1
KS Western Star	KWA	62.9	48.8	14.1	1
LCS Valiant	Limagrain	62.0	51.9	10.1	1
Long Branch	Dyna-Gro	61.4	53.0	8.5	7
Paradise	Polansky	66.0	49.5	16.5	1
Rock Star	Polansky	75.8	59.6	16.2	3
Showdown	OGI	67.8	56.8	11.1	4
Smith's Gold	OGI	70.0	52.3	17.8	5
SY Achieve CL2	Agripro	70.3	44.1	26.2	4
SY Wolverine	Agripro	64.7	40.0	24.7	1
TAM205	AGSECO	55.3	50.6	4.7	6
WB4269	WestBred	81.5	61.0	20.5	2
WB4303	WestBred	55.7	35.2	20.5	1
WB4595	WestBred	65.3	47.4	17.9	1
WB4699	WestBred	77.1	60.2	17.0	1
WB4792	WestBred	67.0	47.9	19.2	2
Whistler	PlainsGold	56.8	52.5	4.3	5
Zenda	KWA	70.4	52.7	17.7	1
Average		66.4	51.3	15.0	3
Min.		55.3	35.2	4.3	1
Max.		81.5	61.9	26.2	7
HSD**		5.8	5.2		

** 1 = completely erect, 9 = completely flat on the ground.*

*** HSD — Tukey's honest significant difference, or the minimum difference required between two varieties to be statistically different.*

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MF3312 | August 2020