K-STATE Research and Extension

Dual-Purpose Wheat Variety Performance 2024

Wheat Rx Series

To be successful in dual-purpose systems, wheat varieties often require traits that are sometimes overlooked in grain-only systems. These include fall forage yield, date of first hollow stem, recovery potential from grazing, resistance to viral diseases more commonly transmitted when the crop is planted early, no high-temperature germination sensitivity, long coleoptile, and a greater tolerance to low soil pH and aluminum toxicity. This publication, evaluates fall forage yield, date of first hollow stem, plant height, grain yield, and test weight of current varieties in a dual-purpose system versus a grain-only system.

Fall forage yield 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 per acre can be produced for every 1,000 pounds of wheat forage produced per acre. Forage production is dependent on variety selection, planting date, seeding and nitrogen rates, and fall temperature and precipitation.

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

Depending on environmental conditions, varieties with a shorter vernalization requirement might reach first hollow stem 15 to 20 days earlier than varieties with a longer vernalization requirement. An earlier occurrence of first hollow stem reduces the grazing window into early spring. Date of first hollow stem is dependent on temperature and day length.

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

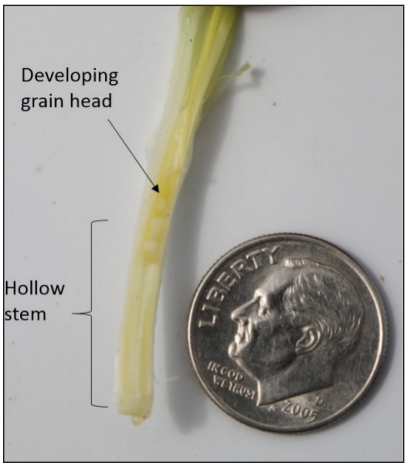

Figure 1. *Wheat plant at the first hollow stem stage. First hollow stem occurs when there is approximately 1.5 centimeters (9/16 inch or roughly the diameter of a dime) below the developing wheat head.*

Description of site and methods

Sixteen commonly grown winter wheat varieties as well as pre-release lines 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 using 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 100 pounds of nitrogen per acre pre-plant to supplement forage production (Table 2). All trials were sprayed with foliar fungicides at heading (April 26, 2024).

One of the two dual-purpose trials was used for destructive measurements to assess forage yield and date of first hollow stem. Forage yield was measured by hand clipping plants approximately ½ inch above the soil surface at two 1-meter 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 six times during the winter and early spring by splitting 10 primary stems collected from each plot one or two times per week. First hollow stem sampling was terminated when 100% of the measured stems had passed 1.5 centimeters of hollow stem below the developing wheat head (Figure 1).

Simulated grazing occurred in the dual-purpose trial during the spring (Table 1). Plots were grazed to about 1.5 inch height using a commercial grass mower every time regrowth achieved about 2 inches, which happened five times during the 2024 season. Simulated grazing was stopped at the average first hollow stem date of the varieties evaluated. Plant height was measured in five plants in each plot. Grain harvest was performed with a small plot combine and grain yield was corrected for 13% moisture content.

Kansas Wheat Rx is a prescription for economical and sustainable production of high-quality winter wheat in Kansas.

Wheat Rx is partnership between Kansas Wheat and K-State Research and Extension to disseminate the latest research recommendations for high-yielding and high-quality wheat to Kansas wheat farmers.

KANSAS WHEAT Rx

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Table 1. *Seeding rate, dates of sowing, forage harvest, simulated grazing, and grain harvest for three trials evaluating 16 winter wheat varieties under dual-purpose or grain-only management.*

Trial	Seeding rate	Sowing	Forage harvest	Simulate grazing	Grain harvest
	-- pounds per acre --	---------- date ----------			
Dual Purpose - First Hollow Stem	120	9/25/2023	11/30/2023		
Dual Purpose - Grain Haverst	120	9/25/2023		2/26/2024	6/12/2024
				3/4/2024	
				3/11/2024	
				3/18/2024	
				3/25/2024	
Grain Only	75	10/17/2023			6/12/2024

Table 2. *Initial soil fertility and soil texture on the study site collected at sowing. Abbreviations: O.M., organic matter; NO_3-N, nitrate nitrogen; NH4-N, ammonium nitrogen; CEC, cation exchange capacity.*

Soil depth	O.M.	pH	NO_3-N	NH_4-N	P	K	S	Ca	Mg	CEC	Sand	Silt	Clay
inches	%		---------- ppm ----------							Meq/100g	------- % -------		
0-6	2.1	6.6	1.9	3.1	34	510.4	3.1	2,732.8	507	23	17	50	33
6-24	1.9	7	1.7	3.6	38.6	469.3	4.1	3,312.6	583.1	22.8	17	47	36

Weather conditions

The fall of 2023 had 4.4 inches of precipitation at the station where the plots were located, resulting in above-average forage production by late November (Table 3). Still, below-average temperatures resulted in modest forage production in December (Table 3). The winter and early spring were warm and had decent precipitation, with about 1.9 inches of cumulative precipitation between January 1 and March 30. A total of 4.6 inches of precipitation accumulated between April 1 and harvest (Figure 2), portraying a relatively dry spring.

Fall forage yield

Fall forage production of the varieties evaluated ranged from 871 to 1,969 pounds of dry matter per acre, averaging 1,457 pounds of dry matter per acre (Table 3). There were significant statistical differences among the varieties, with 11 varieties falling into the highest forage yielding group (range within the highest yielding group: 1,370 to 1,969 pounds of dry matter per acre).

First hollow stem

First hollow stem is reported in day of year format. For reference, day of the year 80 is equivalent to March 21. Average occurrence of first hollow stem was day 76 (Table 3), ranging from day of year 72 for early varieties to day of year 83 for late varieties. These dates represent a normal release from winter dormancy; for reference, about 15 days before the dormancy release measured in 2022-23. The earliest varieties to reach first hollow stem were AP24 AX and AR Iron Eagle 22AX. The latest variety to achieve first hollow stem was KS Providence. All studied varieties reached first hollow stem within a 11-day interval. Previous 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. Kansas results may differ from Oklahoma results due to

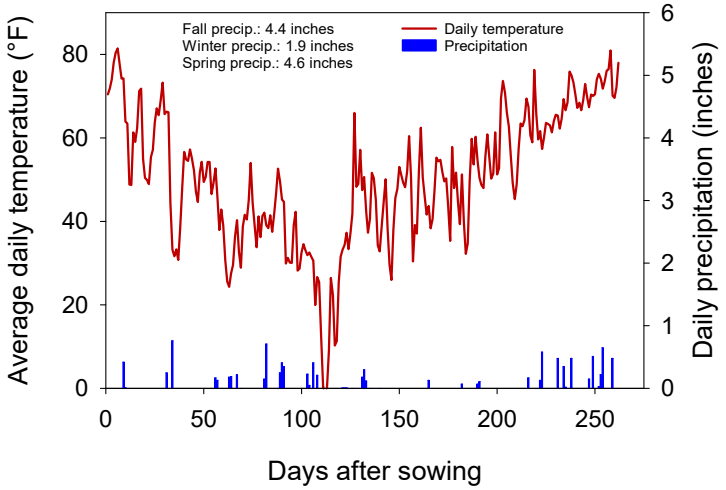

Figure 2. *Observed weather during the 2023-24 growing season in the South Central Experiment Field near Hutchinson, Kansas. Weather data are average daily temperature and cumulative daily precipitation from September 25, 2023 until June 12, 2024.*

Table 3. *Fall dry matter forage yield, date of first hollow stem, and plant height under grain-only (GO) and dual-purpose (DP) systems in Hutchinson, KS, during the 2023-24 production year. Shaded values refer to the highest testing group. Values pertaining to the highest group are highlighted in bold.*

Variety	Source	Fall forage yield	First hollow stem	Plant height		
				GO	DP	diff.
		--- pounds per acre ---	Day of year	----- inches -----		
AP Prolific	AgriPro	**1,492**	77	**25.0**	19.8	-5.2
AP Roadrunner	AgriPro	1,246	75	24.1	**22.8**	-1.4
AP Sunbird	AgriPro	**1,370**	77	**26.0**	20.9	-5.1
AP24 AX	AgriPro	**1,646**	72	23.6	20.6	-3.1
AR Iron Eagle 22AX	Armor	**1,473**	72	24.7	22.2	-2.5
CP 7017AX	Croplan	**1,606**	75	24.3	**23.0**	-1.3
CP 7266AX	Croplan	**1,649**	75	**25.3**	**23.5**	-1.7
CP 7869	Croplan	871	79	24.3	**24.3**	0.0
CP 7909	Croplan	**1,665**	75	**24.9**	21.2	-3.7
Golden Hawk	Polansky	875	77	24.4	**23.6**	-0.8
Guardian	Plains Gold	**1,510**	75	**25.1**	**23.6**	-1.5
Kivari AX	Plains Gold	1,082	75	23.8	**23.5**	-0.2
KS Ahearn	KWA	**1,740**	79	**24.8**	21.3	-3.4
KS Providence	KWA	**1,958**	83	24.7	21.0	-3.7
LCH16AC403-158	Limagrain	**1,969**	75	**26.9**	**24.7**	-2.2
WB4347	WestBred	1,154	77	**26.3**	21.0	-5.3
Average		1,457	76	24.9	22.3	-2.6
Minimum		871	72	23.6	19.8	-5.3
Maximum		1,969	83	26.9	24.7	0.0

cooler winter temperatures holding crop development across varieties, and its interaction with photoperiod as day lengths were already long when temperatures were warm enough to allow for crop development.

Plant height

Varieties and cropping systems also differed significantly in plant height (Table 3). Plant height in the grain-only system averaged 24.9 inches, ranging from 23.6 to 26.9 inches. This average was null to 5.3 inches taller than the heights measured in the dual-purpose system (22.3 inches average height). The range in plant height was narrower in the grain-only system (3.2 inches) versus the dual-purpose system (4.8 inches), with varieties ranging from 19.4 to 25.9 inches.

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

Average grain yield in the grain-only trial was 53.5 bushels per acre, whereas the dual-purpose trial averaged 28.1 bushels per acre (Table 4). Varieties that yielded statistically better their counterparts in the grain-only trial were AP Sunbird and WB4347. The yield penalty from simulated grazing averaged 13.6 bushels per acre and ranged from 6.9 to 19.7 bushels per acre. Varieties included in the highest yielding group of the dual-purpose trial were AR Iron Eagle 22AX, CP7017AX, Guardian, Golden Hawk, and WB4347. The weather conditions – characterized by enough moisture for forage production followed by drought conditions during the spring – likely worsened to effects of grazing since the larger crop likely used more water early in the season and had no moisture to recover later in the spring.

Test weight ranged from 55.1 to 62.7 pounds per bushel in the grain-only system and from 49.5 to 67.1 in the dual-purpose system (Table 4). The only variety with the highest test weight at both grain-only and dual-purpose systems was Guardian, whereas the experimental line AP Sunbird was in the highest test weight group under grain-only, and WB4347 was in the highest test group in the dual-purpose system.

Table 4. *Winter wheat grain yield and grain test weight in grain-only (GO) and dual-purpose (DP) systems in Hutchinson, KS, during the 2023-24 production year. Shaded values refer to the highest testing group. Values pertaining to the highest group are highlighted in bold.*

		Grain yield			Test weight		
Variety	**Source**	**GO**	**DP**	**diff.**	**GO**	**DP**	**diff.**
		--------- bushels per acre ----------			--------- pounds per bushel ---------		
AP Prolific	AgriPro	47.5	28.1	-19.4	57.5	53.1	-4.4
AP Roadrunner	AgriPro	53.9	36.2	-17.7	55.1	49.5	-5.6
AP Sunbird	AgriPro	**58.4**	41.8	-16.6	59.1	55.6	-3.5
AP24 AX	AgriPro	49.0	35.0	-14.1	59.6	56.7	-2.9
AR Iron Eagle 22AX	Armor	57.1	**45.2**	-11.9	60.2	58.0	-2.2
CP 7017AX	Croplan	55.7	**48.3**	-7.4	58.0	55.2	-2.8
CP 7266AX	Croplan	53.1	39.6	-13.5	60.6	56.0	-4.6
CP 7869	Croplan	47.4	38.1	-9.3	57.9	55.5	-2.4
CP 7909	Croplan	57.4	37.7	-19.7	**61.6**	56.9	-4.7
Golden Hawk	Polansky	55.8	**46.2**	-9.6	**62.7**	**61.7**	-1.1
Guardian	Plains Gold	57.2	**46.2**	-11.0	58.5	51.7	-6.7
Kivari AX	Plains Gold	48.0	39.8	-8.2	57.8	53.9	-4.0
KS Ahearn	KWA	49.6	30.0	-19.6	57.8	54.8	-3.0
KS Providence	KWA	54.7	35.5	-19.2	59.8	56.8	-3.0
LCH16AC403-158	Limagrain	48.3	34.5	-13.8	57.2	55.1	-2.1
WB4347	WestBred	**62.4**	**55.5**	-6.9	61.0	**61.1**	0.1
Average		53.5	39.8	-13.6	59.0	55.7	-3.3
Minimum		47.4	28.1	-19.7	55.1	49.5	-6.7
Maximum		62.4	55.5	-6.9	62.7	61.7	0.1

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