

Technical Report TR23-4

# Agricultural



Experiment Station

College of Agricultural Sciences

Department of Soil & Crop Sciences

Extension

# Making Better Decisions



## 2023 Colorado Winter Wheat Variety Performance Trials



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### **Additional Resources**

Colorado State University Crop Variety Testing Program: [www.csucrops.com](http://www.csucrops.com) and on Twitter with the handle [@CSUCrops](https://twitter.com/CSUCrops)

Colorado State University Wheat Breeding Program: [www.agsci.colostate.edu/wheat/](http://www.agsci.colostate.edu/wheat/)

Wheat Variety Performance Database: [www.wheattrials.com](http://www.wheattrials.com)

Colorado Wheat Administrative Committee (CWAC), Colorado Association of Wheat Growers (CAWG), and Colorado Wheat Research Foundation (CWRP): [www.coloradowheat.org](http://www.coloradowheat.org)

# Overview of 2022-2023 Eastern Colorado Winter Wheat Trials

Sally Jones-Diamond

Colorado State University researchers provide current, reliable, and unbiased wheat variety information to Colorado producers. Support of our research keeps public variety testing thriving in Colorado. Our work in Colorado is possible due to the support and cooperation of the entire Colorado wheat industry, the Colorado Wheat Administrative Committee, the Colorado Wheat Research Foundation, seed companies who enter varieties, and Colorado farmers who donate their resources and time to host wheat variety trials.

The Eastern Colorado winter wheat trials are conducted under a broad range of environmental conditions to best determine expected performance of new varieties. We have a regional uniform variety testing program, meaning that dryland varieties entered in our northeast region are tested across our seven test locations in northeast Colorado, and varieties entered in our southeast region are tested across our six test locations in southeast Colorado. All irrigated varieties are tested in all three irrigated trials across northeast Colorado. In the dryland trials, there were 46 varieties tested, including experimental lines across the two regions of the 13 total dryland trial locations. The three irrigated trials had 23 varieties each. The variety trials included a combination of public and private varieties and experimental lines. Seed companies with entries in the variety trials included AgriPro Syngenta, CROPLAN by WinField United, Limagrain Cereal Seeds, and Meridian Seeds. There were entries from the Colorado marketing organization PlainsGold, the Kansas Wheat Alliance, the University of Nebraska-Lincoln, and Crop Research Foundation of Wyoming.

All dryland and irrigated trials were planted in a randomized complete block design with three replicates. Plot sizes were approximately 150 ft<sup>2</sup> (except the Fort Collins irrigated trial, which was 80 ft<sup>2</sup>). All varieties were planted at 700,000 seeds per acre for dryland trials and 1.2 million seeds per acre for irrigated trials. Plot sizes for the Collaborative On-Farm Tests ranged from 0.20 to 1.5 acres per variety in side-by-side strips with seeding rates conforming to the seeding rate used by the collaborating farmer. Yield was corrected to 12% moisture. Variety trial plot weight, test weight, and grain moisture content information were obtained from a HarvestMaster H2 GrainGage™ weigh system on a plot combine. Protein content was corrected to 12% moisture and obtained using a FOSS Infratec™ NOVA grain analyzer.

## **General Conditions Affecting the 2022 Colorado Wheat Crop**

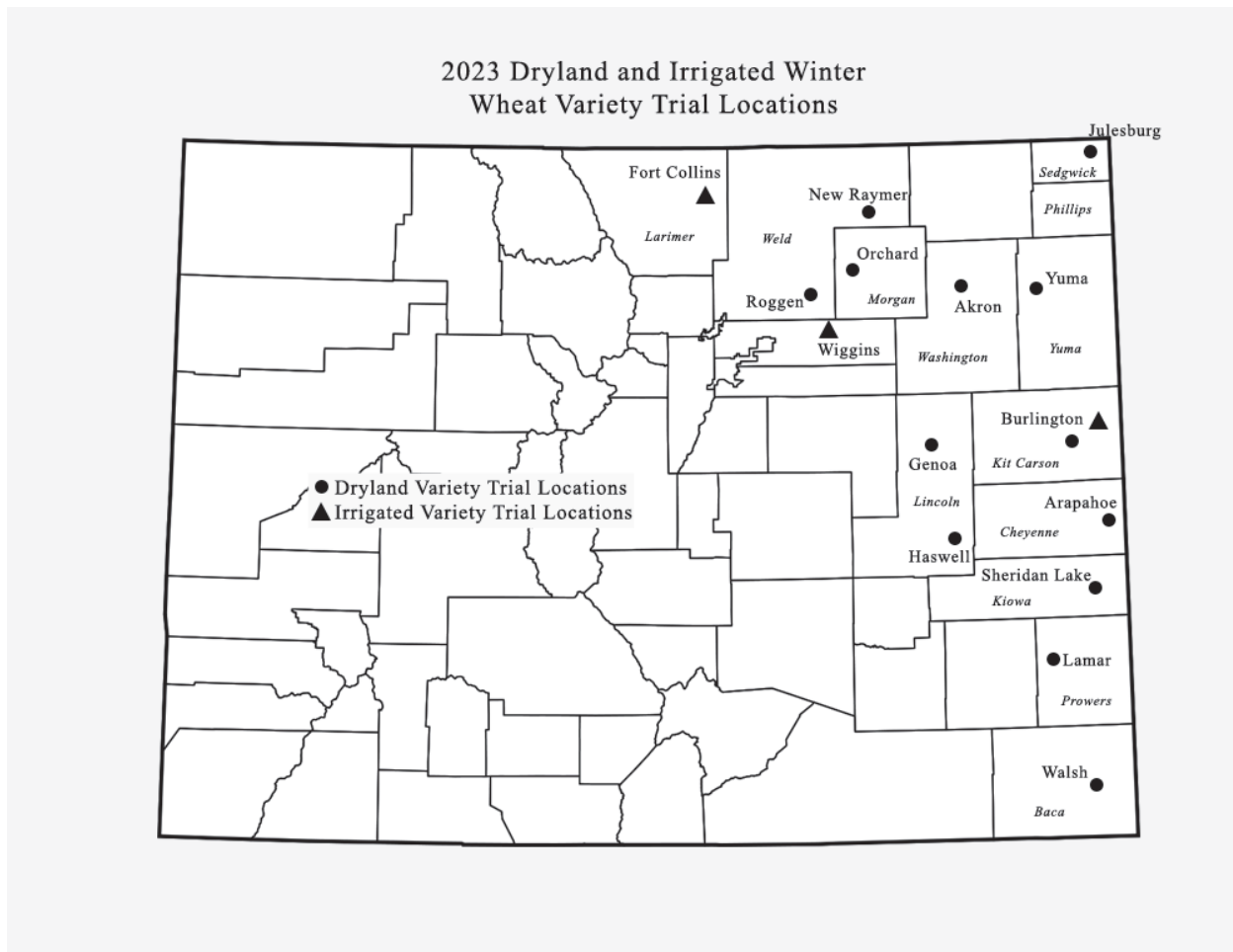
Sally Jones-Diamond and Ron Meyer

Fall 2022 was drier than normal in east-central and northeast Colorado. Rainfall received in September allowed for most wheat to be planted into adequate moisture. However, soil moisture conditions quickly deteriorated throughout eastern Colorado, especially in Sedgwick and Phillips counties in the northeast. Temperatures in the fall were above average and precipitation was well below normal. Most of northeast Colorado was experiencing moderate to exceptional drought conditions during the planting season and through the fall. Baca County in southeast Colorado moved from abnormally dry conditions at planting into extreme drought conditions by mid-November. Winter precipitation helped improve drought conditions for most of eastern

Colorado. Frequent and heavy rains from the spring through harvest pulled the region out of the drought. With the rain came isolated hail events which destroyed or severely damaged wheat fields for a number of producers.

Stripe rust disease was not an issue until June and July when frequent precipitation and high humidity favored the spread of the disease. Many growers sprayed fungicides if the crop was not yet in the grain-fill period. Brown wheat mite infestations ranged from low levels in east-central Colorado to high levels in southeast Colorado that required chemical control. Wheat Stem Sawfly (WSS) was widespread across many northeast Colorado counties, albeit at lower numbers than previous seasons. Some producers swathed their wheat to avoid lodging and decrease harvest losses. Some wheat in east-central and northeast Colorado showed lodging due to high moisture and wind (which usually shows up first) combined with wheat stem sawfly cutting.

Wheat yields in northeast Colorado were above average while yields south of I-70 were recorded at below normal levels. Some wheat fields south of I-70 were abandoned due to the early drought conditions which resulted in poor stands.



## 2023 Wheat Trial Management and Characteristics

Location	Dryland Locations										Irrigated Locations					
	Akron	Arapahoe	Burlington	Genoa	Haswell	Julesburg	Lamar	New Raymer	Orchard	Roggen	Sheridan Lake	Walsh	Yuma	Burlington	Fort Collins	Wiggins
Average Yield (bu/acre)	88	-	91	54	15	66	-	57	56	77	37	48	63	77	117	97
GPS Coordinates (Lat/Long)	40.151038, -103.141808	38.911339, -102.31567	39.31518, -102.258	39.359785, -103.510437	38.632886, -103.265932	40.83667, -102.373352	38.012394, -102.62329	40.57115, -103.8973	40.481426, -104.07898	40.07075, -104.28144	38.53187, -102.43544	37.43116, -102.31043	40.186218, -102.65899	39.4107331, -102.15088	40.652947, -104.9992	39.9953, -104.10392
County	Washington	Cheyenne	Kit Carson	Lincoln	Lincoln	Sedgewick	Weld	Weld	Morgan	Weld	Kiowa	Baca	Yuma	Kit Carson	Fort Collins	Adams
Soil Type	Rago silt loam	Wiley complex	Kuma and Keith silt loams	Weld silt loam	Bacil silt loam	Rago and Kuma silt loams	Manvel silt loam	Olney fine sandy loam	Planner sandy loam	Weld loam	Wiley loam	Wiley loam	Planner loam	Norka silt loam	Fort Collins loam	Truckton sandy loam
Soil Organic Matter	1.6%	1.9%	2.0%	1.8%	1.9%	1.8%	1.6%	-	1.6%	1.5%	1.4%	-	1.4%	2.1%	-	1.1%
Soil pH	6.2	8	7.8	7.7	7.4	7.3	7.6	-	7.1	7.4	7.6	-	7.2	8.1	-	7.8
Soil Nutrients at planting (N-P-K lb/acre)	134 - 38	129 - 6	125 - 28	121 - 20	89 - 14	46 - 20	75 - 22	-	82 - 60	111 - 24	87 - 12	-	76 - 34	108 - 10	-	64 - 14
Applied Fertilizer in Season* (N-P-K lb/acre)	70 - 0 - 0	-	12 - 41.5 - 0	-	-	6 - 22 - 0	-	-	8.7 - 30 - 0	16 - 55.5 - 0	-	-	14 - 47.5 - 0	5 - 16 - 0	-	54 - 30 - 0
Tillage	No-Till	No-Till	Tilled	Tilled	Sweep Plow 1x	No-Till	No-Till	No-Till	No-Till	No-Till	Tilled	No-Till	No-Till	Tilled	Tilled	Tilled
Previous Crop	Proso Millet	Sunflower	Corn	Sunflower	Corn	Corn	Fallow	Corn	Proso Millet	Fallow	Corn	Fallow	Fallow	Corn	Dry Bean	Dry Bean
Planting Date	9/29/2022	9/26/2022	9/26/2022	9/20/2022	9/5/2022	9/27/2022	9/5/2022	9/26/2022	9/27/2022	9/15/2022	9/5/2022	9/21/2022	9/19/2022	10/17/2022	9/29/2022	10/18/2022
Harvest Date	8/5/2023	-	7/13/2023	7/27/2023	7/17/2023	7/26/2023	-	7/31/2023	7/29/2023	7/19/2023	7/14/2023	7/17/2023	7/17/2023	7/27/2023	8/9/2023	7/28/2023
Biotic Stress	Wheat Stem Sawfly Stripe Rust	-	Wheat Stem Sawfly	Wheat Stem Sawfly	-	Wheat Stem Sawfly Stripe Rust	-	Wheat Stem Sawfly	Wheat Stem Sawfly	Wheat Stem Sawfly	-	Stripe Rust	Wheat Stem Sawfly	Wheat Stem Sawfly	-	Wheat Stem Sawfly
Abiotic Stress	-	Drought	-	Hail	Drought and Hail	-	Hail	Drought and Hail	-	-	Winter Kill	Hail	Hail	-	-	-
Total Rain: January 1 to Harvest	19.2"	-	13.2"	18"	12.3"	15"	-	18.7"	19.1"	19.1"	14.5"	11.1"	15.4"	17.9"	17.1"	20.5"
GDD (Jan 1 - Harvest, 32°F base)	4,014	-	3,367	3,611	3,671	3,770	-	3,795	3,749	3,490	3,719	4,274	3,338	3,908	4,115	3,847
General Comments	Planted about 2" deep into excellent moisture. Emergence and stands, although field was dry in mid-October. Wheat stem sawfly was present at moderate levels, but lodging was due to high yield. Stripe rust was observed at low levels, but lodging was due to late in the season - trial was not sprayed.	Trial lost due to severe drought and poor stands. Excellent fall emergence. Trial had lush spring growth. Wheat stem sawfly was present at low levels, but lodging was due to high yield.	Planted about 2" deep into filled corn residue. Excellent fall emergence. Trial had lush spring growth. Wheat stem sawfly was present at low levels, but lodging was due to high yield.	Planted 2" deep into good moisture and sunflower residue. Dry conditions in fall, emergence and stands were above average. Wheat stem sawfly present but minimal lodging was observed at harvest. Minor hail damage received in July.	Planted 2" deep into excellent moisture and corn residue. Fall emergence was very good and stands were above average. Wheat stem sawfly present but minimal lodging was observed at harvest. Minor hail damage received in early July.	Planted 1.5" deep into good moisture and heavy corn residue. Very dry conditions in fall, emergence and stands were average with some areas of spotty emergence. Wheat stem sawfly present but minimal lodging was observed at harvest.	Trial lost due to severe hail damage in June.	Planted about 1.5" deep into good moisture. Very good fall emergence, although field was dry in mid-October. Wheat stem sawfly was present at low levels. Trial had minor hail damage in mid-July.	Planted about 2" deep into good moisture and millet residue. Very good fall emergence, although field was dry in mid-October. Trial had lush spring growth. Wheat stem sawfly was present at low levels, but lodging was due to high yield.	Planted about 2" deep into good moisture and wheat residue. Very good fall emergence. Trial had lush spring growth. Wheat stem sawfly was present at low levels, but lodging was due to high yield.	Planted 1.5" deep into excellent moisture and corn residue. Fall emergence was very good. Trial showed minor damage from two small hail events in June and a high wind event in early July. There was moderate to heavy stripe rust pressure in late June, but lodging was due to late in the season - trial was not sprayed.	Planted 2" deep into moisture. Fall emergence was acceptable and good fall growth. Trial received minor damage from two small hail events in June and a high wind event in early July. There was moderate to heavy stripe rust pressure in late June, but lodging was due to late in the season - trial was not sprayed.	Planted 1.5" deep into heavy residue. Fall emergence and growth was good. Trial showed winterkill in some varieties in early spring and slow green-up due to residue. Wheat stem sawfly present but minimal lodging was observed. Minor hail damage in July.	Planted about 1.5" deep into fall emergence and very late to green-up in the spring due to late planting date. Trial irrigated late to green-up in the spring due to late planting date. Wheat stem sawfly was present at low levels, but lodging was due to high yield.	Planted about 1.5" deep into moisture. Good fall emergence and very late to green-up in the spring due to late planting date. Trial irrigated late to green-up in the spring due to late planting date. Wheat stem sawfly was present at low levels, but lodging was due to high yield.	Planted about 1.5" deep into moisture. Field had one inch of water applied immediately after planting. Good fall emergence and very late to green-up in the spring due to late planting date. Trial irrigated late to green-up in the spring due to late planting date. Wheat stem sawfly was present at low levels, but lodging was due to high yield.

\* 8 and 28 lb/ac of N and P were applied at planting as starter by Crops Testing  
Dashes denote missing information, N/A means not applicable

## Summary of 2023 Dryland Winter Wheat Variety Performance Results

Brand/Source	Market Class	Variety <sup>a</sup>	2023 Multi-Location Average					2023 Individual Trial Yield <sup>b</sup>									
			Yield <sup>b</sup>	Yield	Test		Heading <sup>d</sup>	Akron	Burlington	Genoa	Julesburg	New			Sheridan		
					Weight	Protein <sup>c</sup>						Raymer	Orchard	Roggen	Lake	Walsh	Yuma
			bu/ac	percent of average	lb/bu	percent	days from average	bu/ac									
PlainsGold	<b>HWW</b>	Monarch	<b>76.3</b>	<b>111%</b>	57	10.5	0	<b>101.5</b>	<b>103.0</b>	60.5	70.5	81.0	97.5	83.5	43.5	54.5	<b>71.0</b>
PlainsGold	<b>HWW</b>	Snowmass 2.0	72.5	105%	57	10.7	-1	96.0	101.5	54.0	69.5	71.0	<b>103.0</b>	81.5	35.5	53.0	62.0
CROPLAN	HRW	CP7017AX	72.4	105%	58	10.6	0	93.0	97.0	53.0	<b>72.0</b>	81.5	96.0	77.5	41.0	51.0	65.5
Frenchman Valley Coop	<b>HWW</b>	Valley	72.0	104%	57	11.0	0	<b>99.0</b>	<b>103.0</b>	44.5	<b>73.0</b>	75.0	92.0	81.0	38.0	46.0	67.0
PlainsGold	HRW	Crescent AX	70.2	102%	58	11.0	-1	90.5	99.5	60.0	63.0	77.5	97.5	76.0	31.0	46.0	59.0
PlainsGold	HRW	Whistler	69.7	101%	56	10.2	1	76.0	75.0	62.0	68.0	<b>90.0</b>	89.0	81.0	<b>48.5</b>	53.5	67.0
PlainsGold	HRW	Amplify SF	69.6	101%	57	11.3	0	88.0	85.5	58.5	68.0	80.0	89.0	78.0	36.0	45.0	64.0
PlainsGold	HRW	Avery	69.6	101%	56	10.0	1	86.5	91.0	53.5	63.5	81.5	95.0	79.0	32.0	54.5	64.5
PlainsGold	<b>HWW</b>	Sunshine	69.2	101%	57	11.0	-1	<b>97.5</b>	91.0	58.5	66.0	80.5	87.0	75.0	31.0	49.0	62.5
PlainsGold	HRW	Byrd	69.2	100%	57	10.3	0	84.5	90.5	56.0	67.5	78.0	93.5	79.0	33.5	47.0	61.5
Meridian Seeds	HRW	MS Maverick	68.1	99%	57	11.2	0	<b>98.5</b>	81.0	55.0	68.0	76.0	89.0	73.0	36.5	53.5	60.0
PlainsGold	HRW	Byrd CL Plus	68.1	99%	56	10.5	0	89.0	91.0	56.5	67.0	77.0	92.5	78.0	34.5	37.0	61.5
PlainsGold	HRW	Kivari AX	67.9	99%	55	10.2	0	85.5	75.0	56.0	66.5	81.0	85.5	81.5	37.5	52.0	65.0
PlainsGold	HRW	Canvas	67.7	98%	57	11.1	0	76.0	87.5	46.0	69.5	83.5	86.5	77.0	40.0	55.0	60.0
PlainsGold	<b>HWW</b>	Breck	67.4	98%	58	10.6	0	82.5	77.0	53.5	61.5	74.0	91.5	73.0	38.5	<b>60.5</b>	63.0
PlainsGold	HRW	Guardian	66.7	97%	58	11.0	0	76.5	85.5	53.0	60.0	79.5	94.0	80.0	36.0	50.5	57.5
PlainsGold	HRW	Langin	66.6	97%	56	10.9	-2	77.0	88.5	62.0	60.5	71.0	94.5	83.0	31.5	36.0	61.0
PlainsGold	HRW	Brawl CL Plus	66.4	96%	57	11.6	-1	96.0	95.0	50.5	59.0	71.5	90.5	70.0	32.0	45.5	57.0
Limagrain	HRW	LCS Steel AX	66.1	96%	58	11.0	-2	84.0	<b>107.0</b>	56.5	59.0	65.5	88.0	74.0	33.0	45.0	58.0
PlainsGold	HRW	Hatcher	65.5	95%	56	10.6	0	78.0	84.5	55.5	59.0	74.0	83.0	74.5	37.5	51.5	58.5
PlainsGold	<b>HWW</b>	Windom SF	64.3	93%	57	10.6	-1	84.0	64.5	52.5	68.5	<b>87.5</b>	72.5	68.0	40.0	47.5	61.5
PlainsGold	HRW	Fortify SF	63.2	92%	57	10.5	0	73.5	74.5	47.5	61.0	76.0	96.0	74.0	32.0	34.5	67.5
Limagrain	HRW	LCS Atomic AX	59.7	87%	57	11.0	-1	80.0	100.0	48.0	65.0	57.5	84.5	75.5	21.5	10.5	56.0
PlainsGold	HRW	Ray	54.2	79%	52	11.7	6	58.5	60.5	41.5	46.0	68.0	77.5	66.0	33.5	42.0	52.5
<b>Experimentals</b>																	
Colo. State University exp.	HRW	CO19410R	<b>75.6</b>	<b>110%</b>	58	10.9	1	<b>98.0</b>	100.0	<b>69.0</b>	66.5	85.5	95.0	78.5	40.0	54.0	<b>71.5</b>
Colo. State University exp.	HRW	CO19393R	<b>73.5</b>	<b>107%</b>	57	10.8	0	92.0	101.0	58.5	67.0	83.0	95.0	<b>87.5</b>	43.0	45.0	63.5
Colo. State University exp.	HRW	CO20D108R	73.0	106%	57	10.8	1	86.5	99.0	53.0	66.5	82.0	90.5	82.0	39.5	56.5	67.0
Colo. State University exp.	<b>HWW</b>	CO18D007W	73.0	106%	57	10.4	0	<b>97.0</b>	93.0	53.5	67.0	70.0	<b>102.0</b>	82.0	40.5	54.0	68.5
Colo. State University exp.	HRW	CO19D087R	72.3	105%	56	10.9	-1	86.5	<b>107.0</b>	56.5	70.0	76.5	96.0	82.5	40.5	54.0	58.5
Colo. State University exp.	HRW	CO19D304R	71.9	104%	56	10.6	1	84.0	92.5	54.5	68.0	<b>90.0</b>	91.5	79.5	<b>45.5</b>	<b>58.0</b>	64.5
Colo. State University exp.	HRW	CO18D297R	71.9	104%	58	11.1	0	94.5	98.0	62.0	67.5	67.0	<b>100.0</b>	78.5	41.0	48.0	64.5
Colo. State University exp.	<b>HWW</b>	CO19S129W	71.7	104%	57	10.6	0	96.5	<b>103.0</b>	49.5	69.5	82.5	88.0	74.5	38.5	47.0	65.0
Colo. State University exp.	<b>HWW</b>	CO19S135W	70.6	103%	57	10.6	-1	96.5	<b>103.5</b>	53.5	70.5	77.0	94.0	82.0	31.5	39.5	66.5
Colo. State University exp.	<b>HWW</b>	CO19S085W	70.3	102%	57	11.4	0	90.0	94.0	55.5	65.5	78.5	95.0	79.5	38.0	49.0	61.0
Colo. State University exp.	HRW	CO18042RA	68.3	99%	57	10.5	1	88.5	96.0	61.0	62.5	74.5	84.5	78.5	35.0	42.0	59.5
Colo. State University exp.	HRW	CO19S053R	68.2	99%	57	10.5	0	77.5	84.5	57.0	64.0	<b>87.0</b>	92.0	77.5	37.0	49.5	63.5
Colo. State University exp.	HRW	CO18035RA	68.1	99%	56	11.1	-2	91.5	85.0	56.5	63.0	79.0	88.5	80.5	35.0	43.5	63.0
Colo. State University exp.	HRW	CO200037R	66.8	97%	57	11.0	1	83.5	90.5	50.5	64.5	76.0	87.0	72.0	36.0	52.5	60.5
		<b>Average</b>	<b>68.9</b>	<b>100%</b>	57	10.8	0	<b>87.0</b>	<b>91.0</b>	<b>55.0</b>	<b>65.5</b>	<b>77.5</b>	<b>91.0</b>	<b>77.5</b>	<b>36.5</b>	<b>47.5</b>	<b>62.5</b>
		<sup>e</sup> LSD (0.30)	2.8					5.0	5.0	5.0	2.0	3.0	4.0	3.0	3.5	3.0	2.0
		<sup>e</sup> LSD (0.05)	5.3					9.5	9.0	9.5	4.5	6.0	7.0	5.0	7.0	5.5	4.5

<sup>a</sup>Varieties grouped according to released varieties or experimentals, and then ranked from highest to lowest yield across ten trials in 2023. Varieties not entered at all ten locations were not included to provide fair comparisons. Varieties entered in a single testing region (southeast or northeast Colorado) appear in the associated 2023 Colorado regional summary table.

<sup>b</sup>Yield adjusted to 12% moisture content. Variety yield values in the top least significant difference (LSD) yield group across the locations and within each location are in bold. Multi-location yield values for each variety are least squares means and not arithmetic averages.

<sup>c</sup>Protein adjusted to 12% moisture content and averaged across seven trials in 2023.

<sup>d</sup>Varieties with positive values headed later than the trial averages and varieties with negative values headed earlier than average. Based on three trials in 2023.

<sup>e</sup>Farmers selecting a variety based on yield should use the LSD (.30) to protect themselves from false negative conclusions (concluding varieties are the same when they are actually different). Companies or researchers may use the LSD (.05) to avoid false positive conclusions (concluding varieties are different when they are actually the same).

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## Summary of 2023 Dryland Winter Wheat Variety Performance Results - Northeast Region

Brand/Source	Market Class	Variety <sup>a</sup>	2023 Multi-Location Average				2023 Individual Trial Yield <sup>b</sup>								
			Yield <sup>b</sup> bu/ac	Yield percent of average	Test		Akron	Genoa	Julesburg	New			Orchard	Roggen	Yuma
					Weight lb/bu	Protein <sup>c</sup> percent				Heading <sup>d</sup> days from average	Raymer	Orchard			
PlainsGold	HWW	Monarch	<b>79.8</b>	109%	57	10.4	0	<b>101.5</b>	60.5	70.5	81.0	97.5	83.5	<b>71.0</b>	
Crop Research Foundation of WY	HRW	Steamboat	<b>77.0</b>	105%	59	10.5	1	95.0	63.5	<b>73.0</b>	77.5	91.5	80.0	67.5	
AgriPro	HRW	AP Solid	76.1	104%	57	11.0	1	90.0	59.5	64.0	75.5	98.0	74.0	68.5	
CROPLAN	HRW	CP7017AX	76.1	104%	58	10.6	0	93.0	53.0	<b>72.0</b>	81.5	96.0	77.5	65.5	
PlainsGold	HWW	Snowmass 2.0	76.0	104%	57	10.6	-1	96.0	54.0	69.5	71.0	<b>103.0</b>	81.5	62.0	
Frenchman Valley Coop	HWW	Valley	75.4	103%	58	10.9	0	<b>99.0</b>	44.5	<b>73.0</b>	75.0	92.0	81.0	67.0	
PlainsGold	HRW	Amplify SF	75.2	103%	58	11.3	0	88.0	58.5	68.0	80.0	89.0	78.0	64.0	
PlainsGold	HRW	Crescent AX	74.7	102%	58	10.9	-1	90.5	60.0	63.0	77.5	97.5	76.0	59.0	
PlainsGold	HRW	Whistler	74.3	102%	56	10.0	1	76.0	62.0	68.0	<b>90.0</b>	89.0	81.0	67.0	
PlainsGold	HWW	Sunshine	74.2	102%	57	11.0	-1	<b>97.5</b>	58.5	66.0	80.5	87.0	75.0	62.5	
PlainsGold	HRW	Avery	74.1	101%	57	9.8	1	86.5	53.5	63.5	81.5	95.0	79.0	64.5	
Kansas Wheat Alliance	HRW	KS Territory	74.1	101%	57	11.3	1	93.5	54.0	64.0	82.5	90.0	74.5	64.5	
PlainsGold	HRW	Byrd	74.0	101%	58	10.2	0	84.5	56.0	67.5	78.0	93.5	79.0	61.5	
PlainsGold	HRW	Byrd CL Plus	74.0	101%	57	10.5	0	89.0	56.5	67.0	77.0	92.5	78.0	61.5	
PlainsGold	HRW	Kivari AX	73.4	101%	55	10.2	0	85.5	56.0	66.5	81.0	85.5	81.5	65.0	
Meridian Seeds	HRW	MS Maverick	72.9	100%	58	11.0	0	<b>98.5</b>	55.0	68.0	76.0	89.0	73.0	60.0	
AgriPro	HRW	AP Bigfoot	72.6	99%	58	10.7	-1	<b>97.5</b>	44.0	68.0	72.5	88.0	74.5	68.0	
PlainsGold	HRW	Langin	72.6	99%	56	10.9	-2	77.0	62.0	60.5	71.0	94.5	83.0	61.0	
PlainsGold	HWW	Breck	71.0	97%	59	10.5	0	82.5	53.5	61.5	74.0	91.5	73.0	63.0	
PlainsGold	HRW	Canvas	70.6	97%	57	11.1	0	76.0	46.0	69.5	83.5	86.5	77.0	60.0	
PlainsGold	HRW	Guardian	70.6	97%	58	10.8	0	76.5	53.0	60.0	79.5	94.0	80.0	57.5	
PlainsGold	HRW	Fortify SF	70.3	96%	57	10.5	0	73.5	47.5	61.0	76.0	96.0	74.0	67.5	
PlainsGold	HWW	Windom SF	70.1	96%	56	10.6	-1	84.0	52.5	68.5	<b>87.5</b>	72.5	68.0	61.5	
PlainsGold	HRW	Brawl CL Plus	69.8	95%	58	11.6	-1	96.0	50.5	59.0	71.5	90.5	70.0	57.0	
PlainsGold	HRW	Hatcher	68.8	94%	56	10.4	0	78.0	55.5	59.0	74.0	83.0	74.5	58.5	
Limagrain	HRW	LCS Steel AX	67.9	93%	58	10.9	-2	84.0	56.5	59.0	65.5	88.0	74.0	58.0	
Limagrain	HRW	LCS Atomic AX	66.2	91%	57	10.9	-1	80.0	48.0	65.0	57.5	84.5	75.5	56.0	
PlainsGold	HRW	Ray	58.0	79%	51	11.8	6	58.5	41.5	46.0	68.0	77.5	66.0	52.5	
<b>Experimentals</b>															
Colorado State University exp.	HRW	CO19410R	<b>79.9</b>	109%	58	10.9	1	<b>98.0</b>	<b>69.0</b>	66.5	85.5	95.0	78.5	<b>71.5</b>	
Colorado State University exp.	HRW	CO19393R	77.7	106%	57	10.8	0	92.0	58.5	67.0	83.0	95.0	<b>87.5</b>	63.5	
Colorado State University exp.	HWW	CO18D007W	<b>77.3</b>	106%	58	10.3	0	<b>97.0</b>	53.5	67.0	70.0	<b>102.0</b>	82.0	68.5	
Colorado State University exp.	HWW	CO19S135W	76.2	104%	57	10.5	-1	96.5	53.5	70.5	77.0	94.0	82.0	66.5	
Colorado State University exp.	HRW	CO20D108R	76.1	104%	57	10.7	1	86.5	53.0	66.5	82.0	90.5	82.0	67.0	
Colorado State University exp.	HRW	CO18D297R	75.7	104%	58	11.1	0	94.5	62.0	67.5	67.0	<b>100.0</b>	78.5	64.5	
Colorado State University exp.	HWW	CO19S129W	75.1	103%	57	10.5	0	96.5	49.5	69.5	82.5	88.0	74.5	65.0	
Colorado State University exp.	HWW	CO19S085W	74.3	102%	57	11.5	0	90.0	55.5	65.5	78.5	95.0	79.5	61.0	
Colorado State University exp.	HRW	CO19D304R	74.3	102%	56	10.5	1	84.0	54.5	68.0	<b>90.0</b>	91.5	79.5	64.5	
Colorado State University exp.	HRW	CO19D087R	74.3	102%	56	10.8	-1	86.5	56.5	70.0	76.5	96.0	82.5	58.5	
Colorado State University exp.	HRW	CO18035RA	73.9	101%	56	11.1	-2	91.5	56.5	63.0	79.0	88.5	80.5	63.0	
University of Nebraska-Lincoln exp.	HWW	PSB13NEDH-14-83W	72.9	100%	58	10.3	0	<b>101.5</b>	52.5	69.5	67.0	92.0	74.5	63.0	
Colorado State University exp.	HRW	CO19S053R	72.9	100%	57	10.5	0	77.5	57.0	64.0	<b>87.0</b>	92.0	77.5	63.5	
Colorado State University exp.	HRW	CO18042RA	72.1	99%	57	10.3	1	88.5	61.0	62.5	74.5	84.5	78.5	59.5	
Colorado State University exp.	HRW	CO200037R	69.7	95%	57	10.9	1	83.5	50.5	64.5	76.0	87.0	72.0	60.5	
University of Nebraska-Lincoln exp.	HRW	NHH17450	61.8	85%	57	11.8	0	85.5	37.5	60.0	60.5	84.0	66.5	45.0	
<b>Average</b>			<b>73.1</b>	<b>100%</b>	<b>57</b>	<b>10.7</b>	<b>0</b>	<b>88.0</b>	<b>54.5</b>	<b>65.5</b>	<b>77.0</b>	<b>91.0</b>	<b>77.0</b>	<b>62.5</b>	
LSD (0.30)			3.0					5.0	5.0	2.0	3.0	4.0	3.0	2.0	
LSD (0.05)			5.6					9.5	9.5	4.5	6.0	7.0	5.0	4.5	

<sup>a</sup>Varieties grouped according to released varieties or experimentals, and then ranked from highest to lowest yield across seven northeast Colorado region trials in 2023.

<sup>b</sup>Yield adjusted to 12% moisture content. Variety yield values in the top least significant difference (LSD) yield group across the locations and within each location are in bold. Multi-location yield values for each variety are least squares means and not arithmetic averages.

<sup>c</sup>Protein adjusted to 12% moisture content and averaged across seven trials in 2023.

<sup>d</sup>Varieties with positive values headed later than the trial averages and varieties with negative values headed earlier than average. Based on three trials.

<sup>e</sup>Farmers selecting a variety based on yield should use the LSD (.30) to protect themselves from false negative conclusions (concluding varieties are the same when they are actually different). Companies or researchers may use the LSD (.05) to avoid false positive conclusions (concluding varieties are different when they are actually the same).

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## Summary of 2023 Dryland Winter Wheat Variety Performance Results - Southeast Region

Brand/Source	Market Class	Variety <sup>a</sup>	2023 Multi-Location Average				2023 Individual Trial Yield <sup>b</sup>		
			Yield <sup>b</sup>	Yield	Test		Burlington	Sheridan Lake	Walsh
					Weight	Protein <sup>c</sup>			
			bu/ac	percent of average	lb/bu	percent			
PlainsGold	<b>HWW</b>	Monarch	67.0	114%	57	11.1	<b>103.0</b>	43.5	54.5
Kansas Wheat Alliance	<b>HWW</b>	KS Big Bow	64.0	109%	57	11.4	99.5	40.5	52.0
PlainsGold	<b>HWW</b>	Snowmass 2.0	63.4	108%	56	11.5	101.5	35.5	53.0
CROPLAN	HRW	CP7017AX	63.1	108%	58	11.0	97.0	41.0	51.0
Frenchman Valley Coop	<b>HWW</b>	Valley	62.3	106%	57	11.2	<b>103.0</b>	38.0	46.0
Limagrain	HRW	LCS Steel AX	61.7	105%	58	11.9	<b>107.0</b>	33.0	45.0
PlainsGold	HRW	Canvas	60.9	104%	57	11.2	87.5	40.0	55.0
PlainsGold	HRW	Avery	59.1	101%	56	10.9	91.0	32.0	54.5
PlainsGold	HRW	Whistler	59.0	101%	55	11.3	75.0	<b>48.5</b>	53.5
PlainsGold	HRW	Crescent AX	58.7	100%	57	11.3	99.5	31.0	46.0
PlainsGold	<b>HWW</b>	Breck	58.6	100%	57	11.4	77.0	38.5	<b>60.5</b>
PlainsGold	HRW	Hatcher	57.9	99%	56	11.4	84.5	37.5	51.5
PlainsGold	HRW	Brawl CL Plus	57.4	98%	57	12.0	95.0	32.0	45.5
PlainsGold	HRW	Guardian	57.4	98%	57	11.8	85.5	36.0	50.5
PlainsGold	HRW	Byrd	57.1	97%	57	11.0	90.5	33.5	47.0
Meridian Seeds	HRW	MS Maverick	57.1	97%	55	12.6	81.0	36.5	53.5
PlainsGold	<b>HWW</b>	Sunshine	57.0	97%	56	11.5	91.0	31.0	49.0
PlainsGold	HRW	Amplify SF	55.5	95%	56	11.5	85.5	36.0	45.0
PlainsGold	HRW	Kivari AX	54.7	93%	55	10.1	75.0	37.5	52.0
PlainsGold	HRW	Byrd CL Plus	54.1	92%	56	11.1	91.0	34.5	37.0
PlainsGold	HRW	Langin	51.9	89%	56	10.8	88.5	31.5	36.0
PlainsGold	<b>HWW</b>	Windom SF	50.7	86%	57	11.2	64.5	40.0	47.5
PlainsGold	HRW	Fortify SF	46.9	80%	56	10.6	74.5	32.0	34.5
PlainsGold	HRW	Ray	45.2	77%	53	11.1	60.5	33.5	42.0
Limagrain	HRW	LCS Atomic AX	44.0	75%	56	11.6	100.0	21.5	10.5
<b>Experimentals</b>									
Colorado State University exp.	HRW	CO19D087R	67.1	115%	55	11.3	<b>107.0</b>	40.5	54.0
Colorado State University exp.	HRW	CO19D304R	65.2	111%	56	10.8	92.5	<b>45.5</b>	<b>58.0</b>
Colorado State University exp.	HRW	CO20D108R	65.0	111%	57	11.2	99.0	39.5	56.5
Colorado State University exp.	HRW	CO19410R	64.7	110%	57	11.2	100.0	40.0	54.0
Colorado State University exp.	HRW	CO19393R	63.1	108%	56	11.3	101.0	43.0	45.0
Colorado State University exp.	<b>HWW</b>	CO19S129W	63.0	107%	57	11.4	<b>103.0</b>	38.5	47.0
Colorado State University exp.	<b>HWW</b>	CO18D007W	62.5	107%	56	10.6	93.0	40.5	54.0
Colorado State University exp.	HRW	CO18D297R	62.4	106%	58	11.4	98.0	41.0	48.0
Colorado State University exp.	<b>HWW</b>	CO19S085W	60.3	103%	56	11.3	94.0	38.0	49.0
Colorado State University exp.	HRW	CO200037R	59.6	102%	57	11.3	90.5	36.0	52.5
Colorado State University exp.	<b>HWW</b>	CO19S135W	58.1	99%	56	11.8	<b>103.5</b>	31.5	39.5
Colorado State University exp.	HRW	CO18042RA	57.7	98%	56	11.2	96.0	35.0	42.0
Colorado State University exp.	HRW	CO19S053R	57.1	98%	57	10.9	84.5	37.0	49.5
Colorado State University exp.	HRW	CO18035RA	54.6	93%	56	11.0	85.0	35.0	43.5
<b>Average</b>			<b>58.6</b>	<b>100%</b>	<b>56</b>	<b>11.3</b>	<b>91.0</b>	<b>37.0</b>	<b>48.0</b>
			<sup>d</sup> LSD (0.30)				5.0	3.5	3.0
			<sup>d</sup> LSD (0.05)				9.0	7.0	5.5

<sup>a</sup>Varieties grouped according to released varieties or experimentals, and then ranked from highest to lowest yield across three southeast Colorado region trials in 2023.

<sup>b</sup>Yield adjusted to 12% moisture content. Variety yield values in the top least significant difference (LSD) yield group within each location are in bold. Multi-location yield values for each variety are arithmetic averages from across the three sites and could not be statistically analyzed due to the wide variation among locations.

<sup>c</sup>Protein adjusted to 12% moisture content and from Burlington trial in 2023.

<sup>d</sup>Farmers selecting a variety based on yield should use the LSD (.30) to protect themselves from false negative conclusions (concluding varieties are the same when they are actually different). Companies or researchers may use the LSD (.05) to avoid false positive conclusions (concluding varieties are different when they are actually the same).

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## Summary of 2-Year (2022-2023) Dryland Winter Wheat Variety Performance Results

Variety <sup>b</sup>	Brand/Source	Market Class <sup>c</sup>	2-Year Average <sup>a</sup>					
			Yield bu/ac	Yield % trial average	Test Weight lb/bu	Test Weight % trial average	Plant Height in	Protein percent
Monarch	PlainsGold	<b>HWW</b>	67.0	111%	58	101%	26	11.4
CO18D007W	Colo. State University exp.	<b>HWW</b>	63.6	106%	58	101%	27	11.4
CO18D297R	Colo. State University exp.	HRW	63.2	105%	58	102%	29	12.0
CP7017AX	CROPLAN	HRW	63.2	105%	59	102%	26	11.5
Valley	Frenchman Valley Coop	<b>HWW</b>	62.9	105%	58	101%	28	11.8
Whistler	PlainsGold	HRW	62.5	104%	56	98%	30	11.2
Snowmass 2.0	PlainsGold	<b>HWW</b>	62.4	104%	57	100%	26	11.5
Avery	PlainsGold	HRW	62.2	103%	57	99%	29	10.9
Crescent AX	PlainsGold	HRW	61.6	102%	58	102%	28	11.9
Byrd	PlainsGold	HRW	61.0	101%	58	101%	28	11.1
CO18035RA	Colo. State University exp.	HRW	61.0	101%	57	100%	26	11.6
Kivari AX	PlainsGold	HRW	60.9	101%	56	98%	27	11.1
Amplify SF	PlainsGold	HRW	60.7	101%	58	101%	29	12.1
MS Maverick	Meridian Seeds	HRW	60.3	100%	57	100%	27	12.0
CO18042RA	Colo. State University exp.	HRW	60.2	100%	57	100%	28	11.4
Canvas	PlainsGold	HRW	60.2	100%	58	100%	27	11.9
Sunshine	PlainsGold	<b>HWW</b>	60.0	100%	57	100%	26	12.1
Byrd CL Plus	PlainsGold	HRW	59.8	99%	57	99%	30	11.5
Breck	PlainsGold	<b>HWW</b>	59.4	99%	59	102%	28	11.7
Guardian	PlainsGold	HRW	59.1	98%	58	102%	27	11.8
Langin	PlainsGold	HRW	58.6	97%	57	99%	27	11.8
Brawl CL Plus	PlainsGold	HRW	57.7	96%	58	101%	27	12.4
Hatcher	PlainsGold	HRW	57.3	95%	57	99%	26	11.4
Windom SF	PlainsGold	<b>HWW</b>	56.4	94%	57	99%	26	11.8
Fortify SF	PlainsGold	HRW	55.5	92%	57	100%	28	11.5
Ray	PlainsGold	HRW	47.1	78%	52	91%	32	12.9
<b>Average</b>			<b>60.1</b>	<b>100%</b>	<b>57</b>	<b>100%</b>	<b>28</b>	<b>11.7</b>

<sup>a</sup>The 2-year average yield and test weight are based on 13 trials (ten 2023 and three 2022 trials). Plant heights and protein are based on 10 trials (seven 2023 and three 2022 trials).

<sup>b</sup>Varieties ranked from highest to lowest average 2-year yield.

<sup>c</sup>Market class: HRW=hard red winter wheat; **HWW**=hard white winter wheat.

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## Summary of 3-Year (2021-2023) Dryland Winter Wheat Variety Performance Results

Variety <sup>b</sup>	Brand/Source	Market Class <sup>c</sup>	3-Year Average <sup>a</sup>					
			Yield		Test Weight		Plant	
			bu/ac	% trial average	lb/bu	% trial average	Height in	Protein percent
Monarch	PlainsGold	<b>HWW</b>	62.7	107%	57	100%	28	11.6
Snowmass 2.0	PlainsGold	<b>HWW</b>	61.2	104%	57	100%	28	12.2
CO18D007W	Colo. State University exp.	<b>HWW</b>	61.1	104%	57	100%	29	12.3
CO18D297R	Colo. State University exp.	HRW	60.6	103%	58	102%	31	12.5
CP7017AX	CROPLAN	HRW	60.0	102%	57	101%	29	12.1
Crescent AX	PlainsGold	HRW	59.4	101%	57	101%	31	12.5
Avery	PlainsGold	HRW	59.3	101%	56	99%	31	11.8
Byrd	PlainsGold	HRW	59.3	101%	57	101%	31	11.8
Langin	PlainsGold	HRW	59.1	101%	56	99%	29	12.3
Kivari AX	PlainsGold	HRW	58.7	100%	55	97%	30	11.8
Canvas	PlainsGold	HRW	58.6	100%	57	99%	30	12.4
Whistler	PlainsGold	HRW	58.5	100%	55	98%	32	11.9
Amplify SF	PlainsGold	HRW	58.2	100%	57	101%	32	12.3
Byrd CL Plus	PlainsGold	HRW	57.2	98%	56	99%	32	12.3
Breck	PlainsGold	<b>HWW</b>	57.1	98%	58	102%	31	12.5
Brawl CL Plus	PlainsGold	HRW	56.0	96%	58	101%	31	12.8
Guardian	PlainsGold	HRW	55.5	95%	57	101%	31	12.6
Fortify SF	PlainsGold	HRW	55.1	94%	57	101%	31	12.0
Hatcher	PlainsGold	HRW	54.7	93%	56	98%	30	11.9
<b>Average</b>			<b>58.5</b>	<b>100%</b>	<b>57</b>	<b>100%</b>	<b>30</b>	<b>12.2</b>

<sup>a</sup>The 3-year average yield and test weight are based on 22 trials (ten 2023, three 2022, and nine 2021). Plant heights are based on 18 trials (seven 2023, three 2022, and eight 2021). Protein based on 16 trials (seven 2023, three 2022, and six 2021).

<sup>b</sup>Varieties ranked according to average 3-year yield.

<sup>c</sup>Market class: HRW=hard red winter wheat; **HWW**=hard white winter wheat.

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## 2023 Collaborative On-Farm Test (COFT) Variety Performance Results

Sally Jones-Diamond, Ron Meyer, Kat Caswell, and Michaela Mattes

The COFT program is in its 27th year and the majority of Colorado's winter wheat acreage is planted to varieties that have been tested in the program. On-farm testing leads to more rapid replacement of old inferior varieties and wider and faster adoption of improved varieties. It also brings Colorado State University wheat results to rural communities. The varieties tested in COFT this year fit different farmer needs and producers are encouraged to study the tables in the Description of Winter Wheat Varieties in Eastern Colorado and the Dryland Decision Tree for more information.

In the fall of 2022, twenty-six eastern Colorado wheat producers received seed for five varieties of wheat and planted them in side-by-side strips under the same conditions as the wheat in the rest of the field. Ten viable harvest results were obtained due to drought conditions and hail that occurred during the growing season. The objective of our on-farm testing program is to compare the performance of wheat varieties of interest for Colorado farmers under their field conditions. Each of the five varieties tested has potential advantages for farmers and should be chosen on a case-by-case basis depending on the specific farm needs.

The same five varieties were included in all tests. Amplify SF, Fortify SF, Kivari AX, and Whistler are hard red winter wheat varieties and Windom SF is a hard white winter wheat variety. Three semi-solid stemmed varieties were included in the test to help combat the wheat stem sawfly (WSS): Amplify SF, Fortify SF, and Windom SF. One CoAXium<sup>®</sup> variety was also included for grass weed control, Kivari AX. Additionally, it is important to note that all varieties tested in the COFT this year except Whistler are Certified Seed Only (CSO), which means saving back harvested seed is illegal.

Amplify SF is a CSU release (2021), marketed by PlainsGold. Amplify SF has a semi-solid stem, is medium maturity, and has good standability under severe WSS pressure with an average yield.

Fortify SF is a CSU release (2019). Fortify SF was the first Colorado-bred semi-solid wheat to combat the wheat stem sawfly. It has a medium-early maturity, carries wheat curl mite resistance, but has a below-average yield in our three-year trial average.

Windom SF is a CSU release (2022) and a non-premium variety with medium maturity. It is a hard white wheat with a semi-solid stem and a below-average yield in our two-year trial average.

Kivari AX is a CSU release (2020) marketed by PlainsGold. Higher yielding and slightly later maturing than Crescent AX, it shows intermediate reaction to stripe rust and carries wheat curl mite resistance. The CoAXium<sup>®</sup> Wheat Production System is based on the Aggressor<sup>®</sup> herbicide, a different class of compounds from Beyond<sup>®</sup>, and provides excellent control of winter annual grasses. It has an average yield in our three-year trial average.

Whistler is a CSU release (2018), marketed by PlainsGold. It is later maturing, tall, has marginal straw strength, good stripe and stem rust resistance, and carries wheat curl mite resistance from the Byrd parent. It has an average yield in the three-year trial average.

# Summary of 2023 Collaborative On-Farm Test (COFT) Winter Wheat Variety Performance Results



COLORADO STATE UNIVERSITY  
EXTENSION

## Summary of 2023 Collaborative On-Farm Test (COFT) Winter Wheat Variety Performance Results



2023 Varieties (ranked left to right by highest yield)

County/Nearest Town	Amplify SF			Windom SF			Kivari AX			Whistler			Fortify SF			COFT Average		
	Yield <sup>a</sup> bu/ac	Weight lb/bu	Protein percent	Yield <sup>a</sup> bu/ac	Weight lb/bu	Protein percent	Yield <sup>a</sup> bu/ac	Weight lb/bu	Protein percent	Yield <sup>a</sup> bu/ac	Weight lb/bu	Protein percent	Yield <sup>a</sup> bu/ac	Weight lb/bu	Protein percent	Yield <sup>a</sup> bu/ac	Weight lb/bu	Protein percent
Adams/Byers	83	58	10	73	59	9	86	57	9	80	58	10	74	58	9	79	58	10
Adams/Prospect Valley	64	60	9	53	60	8	52	59	9	47	60	9	51	58	9	53	59	9
Baca/Walsh	30	59	13	35	61	13	32	58	13	35	59	13	30	60	13	32	59	13
Kiowa/Eads	24	59	9	19	60	10	19	56	8	25	58	9	19	57	9	21	58	9
Kit Carson/Bethune	26	57	12	26	59	12	24	55	11	20	56	11	25	58	11	24	57	11
Logan/Leroy	105	61	12	101	62	12	92	60	11	94	61	11	87	60	12	96	61	11
Sedgwick/Julesburg	44	56	12	34	53	13	36	54	11	37	55	12	33	57	12	37	55	12
Sedgwick/Julesburg S	40	56	12	41	54	12	38	51	11	30	51	12	43	57	11	38	54	12
Washington/Otis	64	58	12	57	58	12	53	55	10	60	57	12	51	55	10	57	56	11
Yuma/Yuma	19	56	9	19	59	9	18	57	9	19	57	9	18	59	9	19	57	9
<b>Average</b>	<b>50</b>	<b>58</b>	<b>11</b>	<b>46</b>	<b>58</b>	<b>11</b>	<b>45</b>	<b>56</b>	<b>10</b>	<b>45</b>	<b>57</b>	<b>11</b>	<b>43</b>	<b>58</b>	<b>11</b>	<b>46</b>	<b>58</b>	<b>11</b>

Yield Significance<sup>b</sup>

A

B

B, C

LSD ( $p < 0.30$ ) for yield = 1.9 bu/ac, for test weight = 0.6 lb/bu, and for protein = 0.2 percent

<sup>a</sup>All yield and protein data are corrected to 12% moisture.

<sup>b</sup>Yield significance: varieties with different letters have yields that are significantly different from one another.



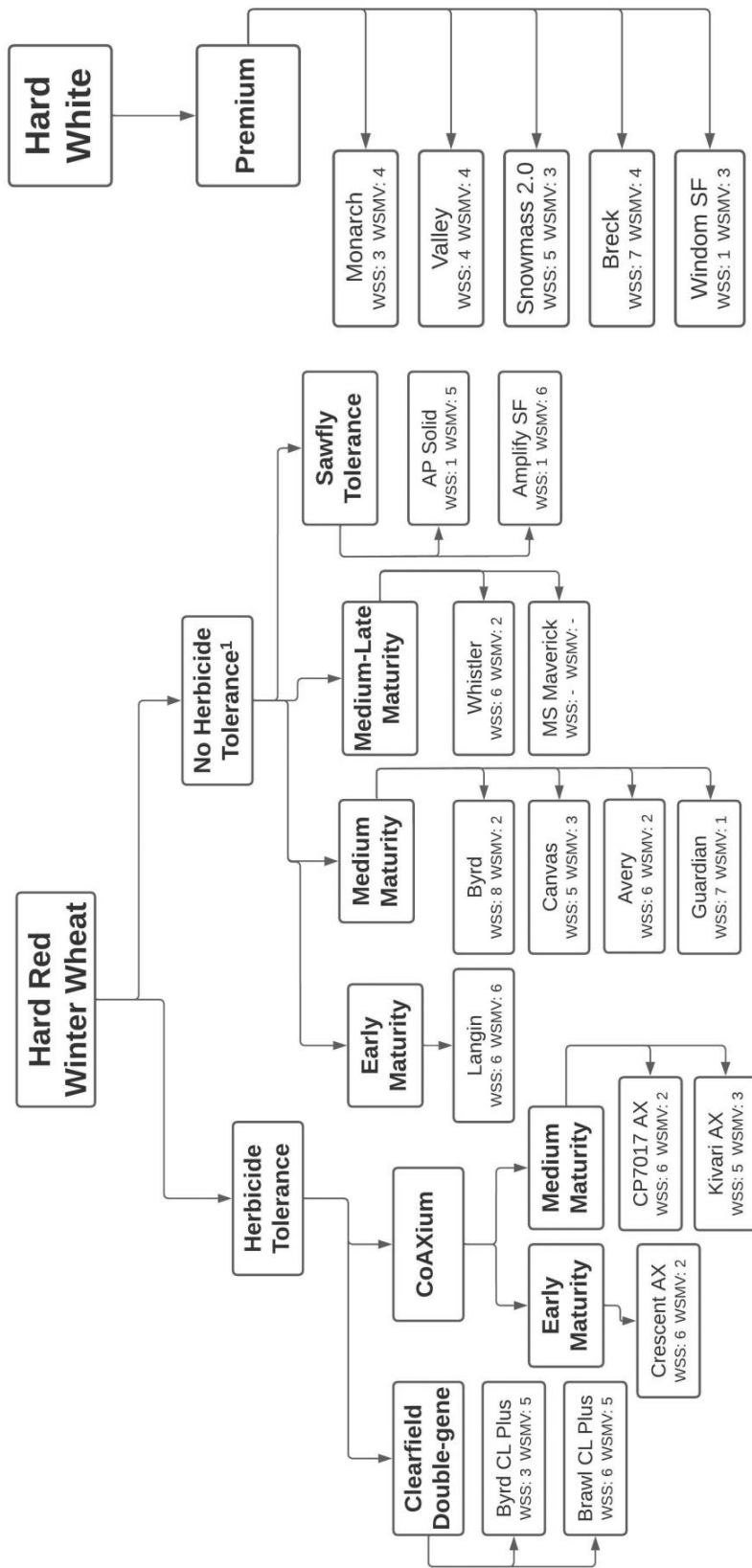
## Summary of 2023 Collaborative On-Farm Test (COFT) Winter Wheat Variety Results (10 tests included)

Variety	Yield <sup>a</sup>	Test Weight	Protein <sup>a</sup>
	bu/ac	lb/bu	percent
Amplify SF	<b>49.9</b>	58.0	11.1
Windom SF	45.6	58.5	11.0
Kivari AX	45.1	56.2	10.1
Whistler	44.5	57.1	10.7
Fortify SF	43.1	57.9	10.5
<b>Average</b>	<b>45.7</b>	<b>57.5</b>	<b>10.7</b>
	LSD <sub>(0.30)</sub> 1.9	0.6	0.2
	Coefficient of Variation (CV) 9.1%	2.1%	3.3%

<sup>a</sup>Yield and protein corrected to 12% moisture.

# CSU Fall 2023 Dryland Winter Wheat Decision Tree

Sally Jones-Diamond



WSS=wheat stem sawfly and WSMV=wheat streak mosaic virus. Rating scale is 1=resistant and 9=susceptible. WSS ratings are based on field evaluation of tolerance to wheat stem sawfly cutting in Colorado. Values do not represent the level of stem solidness expression.  
 ¹No tolerance to herbicides used in Clearfield or CoAXium wheat production systems.  
 Varieties in each section are listed from highest to lowest yield based on multi-year trial averages.





## Summary of 2023 Irrigated Winter Wheat Variety Performance Results

Brand/Source	Market Class	Variety <sup>a</sup>	2023 Multi-Location Average						2023 Individual Trial Yield <sup>b</sup>		
			Yield <sup>b</sup>	Yield	Test Weight	Protein <sup>c</sup>	Lodging	Heading <sup>d</sup>	Burlington	Fort Collins	Wiggins
			bu/ac	percent of average	lb/bu	percent	score (1-9) <sup>e</sup>	days from average	bu/ac		
Colorado State University exp.	HRW	CO18D297R	<b>107.4</b>	<b>111%</b>	59	12.2	3	1	<b>84.5</b>	<b>127.5</b>	<b>109.0</b>
PlainsGold	<b>HWW</b>	Monarch	<b>106.0</b>	<b>110%</b>	58	11.3	1	1	<b>84.5</b>	<b>128.5</b>	<b>105.5</b>
PlainsGold	HRW	Amplify SF	<b>103.5</b>	<b>107%</b>	58	12.4	4	2	80.0	<b>128.0</b>	103.0
PlainsGold	HRW	Guardian	<b>102.3</b>	<b>106%</b>	58	12.6	3	2	82.5	122.0	101.5
Frenchman Valley Coop	<b>HWW</b>	Valley	<b>102.2</b>	<b>106%</b>	59	11.8	3	1	80.5	<b>127.0</b>	98.5
PlainsGold	HRW	Byrd CL Plus	<b>101.1</b>	<b>104%</b>	57	11.6	5	2	82.5	118.5	103.0
CROPLAN	HRW	CP7017AX	<b>100.6</b>	<b>104%</b>	58	11.7	3	0	79.0	116.0	<b>108.0</b>
Colorado State University exp.	<b>HWW</b>	CO18D007W	<b>99.8</b>	<b>103%</b>	57	11.9	2	-1	74.0	<b>127.5</b>	96.5
Colorado State University exp.	HRW	CO19D304R	<b>99.4</b>	<b>103%</b>	57	11.9	7	2	81.5	<b>124.5</b>	93.0
PlainsGold	HRW	Crescent AX	<b>99.0</b>	<b>102%</b>	59	12.1	6	-2	<b>84.0</b>	113.5	100.5
Colorado State University exp.	HRW	CO18035RA	<b>98.3</b>	<b>102%</b>	57	11.7	6	-2	82.5	116.5	97.0
Limagrain	HRW	LCS Steel AX	<b>98.2</b>	<b>101%</b>	58	12.5	3	-3	<b>83.5</b>	110.5	98.5
PlainsGold	<b>HWW</b>	Snowmass 2.0	<b>97.6</b>	<b>101%</b>	56	12.1	4	-1	77.0	122.0	92.0
PlainsGold	HRW	Canvas	<b>97.6</b>	<b>101%</b>	57	12.2	2	0	69.0	122.5	102.0
AgriPro	HRW	SY Wolverine	<b>96.1</b>	<b>99%</b>	56	12.5	1	0	75.5	121.5	91.0
CROPLAN	HRW	CP7266AX	<b>93.3</b>	<b>96%</b>	58	12.1	7	0	<b>90.0</b>	95.0	96.5
Limagrain	HRW	LCS Atomic AX	<b>93.1</b>	<b>96%</b>	58	12.0	5	0	<b>85.0</b>	97.5	96.5
PlainsGold	<b>HWW</b>	Windom SF	<b>92.0</b>	<b>95%</b>	56	12.2	3	-1	73.0	111.0	93.5
PlainsGold	<b>HWW</b>	Breck	<b>92.0</b>	<b>95%</b>	57	12.1	1	0	62.0	122.5	91.0
Colorado State University exp.	HRW	CO18042RA	<b>91.2</b>	<b>94%</b>	58	12.0	6	0	68.0	114.5	90.5
PlainsGold	HRW	Kivari AX	<b>88.5</b>	<b>91%</b>	56	11.0	8	0	70.0	110.5	82.5
PlainsGold	HRW	Brawl CL Plus	<b>87.7</b>	<b>91%</b>	58	13.3	2	-1	70.5	103.0	89.0
PlainsGold	HRW	Ray	<b>79.3</b>	<b>82%</b>	50	12.4	3	9	46.5	111.0	81.0
<b>Average</b>			<b>96.8</b>	<b>100%</b>	57	<b>12.0</b>	<b>4</b>	<b>0</b>	<b>77.0</b>	<b>117.0</b>	<b>96.5</b>
†LSD (0.30)			6.1						7.0	4.0	5.0
‡LSD (0.05)			11.7						13.0	7.5	9.5

<sup>a</sup>Varieties ranked from highest to lowest yield across three irrigated trials in 2023.

<sup>b</sup>Yield adjusted to 12% moisture content. Variety yield values in the top least significant difference (LSD) yield group across the locations and within each location are in bold. Multi-location yield values for each variety are least squares means and not arithmetic averages.

<sup>c</sup>Protein adjusted to 12% moisture content and averaged across two trials in 2023.

<sup>d</sup>Varieties with positive values headed later than the trial averages and varieties with negative values headed earlier than average. Based on one trial.

<sup>e</sup>Lodging score: 1 equals no lodging and 9 is severe lodging. Scores from three trials in 2023.

<sup>f</sup>Farmers selecting a variety based on yield should use the LSD (.30) to protect themselves from false negative conclusions (concluding varieties are the same when they are actually different). Companies or researchers may use the LSD (.05) to avoid false positive conclusions (concluding varieties are different when they are actually the same).

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## Summary of 2-Year (2022-2023) Irrigated Winter Wheat Variety Performance Results



Variety <sup>b</sup>	Brand/Source	Market Class <sup>c</sup>	2-Year Average <sup>a</sup>					
			Yield		Test Weight		Plant	
			bu/ac	% trial average	lb/bu	% trial average	in	percent
CO18D297R	Colorado State University exp.	HRW	96.6	110%	60	102%	28	13.2
Monarch	PlainsGold	<b>HWW</b>	93.5	107%	59	101%	28	12.5
CO18D007W	Colorado State University exp.	<b>HWW</b>	92.9	106%	59	101%	28	13.2
CP7017AX	CROPLAN	HRW	91.0	104%	60	102%	26	13.2
Valley	Frenchman Valley Coop	<b>HWW</b>	90.8	104%	59	101%	31	13.3
Crescent AX	PlainsGold	HRW	90.0	103%	60	102%	29	13.2
CO18035RA	Colorado State University exp.	HRW	89.9	103%	59	100%	28	13.1
Canvas	PlainsGold	HRW	89.7	102%	59	101%	29	13.5
Byrd CL Plus	PlainsGold	HRW	89.3	102%	59	100%	32	13.1
Guardian	PlainsGold	HRW	88.3	101%	60	102%	30	13.9
Windom SF	PlainsGold	<b>HWW</b>	86.4	99%	59	99%	27	13.3
Breck	PlainsGold	<b>HWW</b>	86.4	99%	60	101%	27	13.7
CO18042RA	Colorado State University exp.	HRW	85.5	98%	59	100%	30	13.4
Kivari AX	PlainsGold	HRW	84.1	96%	58	99%	31	12.3
CP7266AX	CROPLAN	HRW	83.0	95%	59	101%	29	13.5
Snowmass 2.0	PlainsGold	<b>HWW</b>	82.1	94%	59	99%	29	13.7
Brawl CL Plus	PlainsGold	HRW	81.1	93%	60	101%	29	14.5
Ray	PlainsGold	HRW	76.3	87%	52	88%	35	13.9
<b>Average</b>			<b>87.6</b>	<b>100%</b>	<b>59</b>	<b>100%</b>	<b>29</b>	<b>13.4</b>

<sup>a</sup>The 2-year average yield and test weight are based on six trials (three 2023 and three 2022). Plant heights and protein are based on five trials (two 2023 and three 2022).

<sup>b</sup>Varieties ranked from highest to lowest average 2-year yield.

<sup>c</sup>Market class: HRW=hard red winter wheat; **HWW**=hard white winter wheat.

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*Contact Sally Jones-Diamond (sally.jones@colostate.edu)*



## Summary of 3-Year (2021-2023) Irrigated Winter Wheat Variety Performance Results



Variety <sup>b</sup>	Brand/Source	Market Class <sup>c</sup>	3-Year Average <sup>a</sup>					
			Yield		Test Weight		Plant	
			bu/ac	% trial average	lb/bu	% trial average	in	percent
CO18D007W	Colorado State University exp.	<b>HWW</b>	95.7	107%	59	100%	30	13.2
CO18D297R	Colorado State University exp.	HRW	94.8	106%	59	100%	30	13.2
Monarch	PlainsGold	<b>HWW</b>	93.8	105%	59	100%	30	12.4
CP7017AX	CROPLAN	HRW	91.1	102%	60	101%	28	13.4
Canvas	PlainsGold	HRW	90.4	101%	59	100%	30	12.9
Crescent AX	PlainsGold	HRW	90.1	101%	60	101%	32	13.1
Breck	PlainsGold	<b>HWW</b>	87.1	97%	60	101%	29	13.5
Snowmass 2.0	PlainsGold	<b>HWW</b>	87.0	97%	59	99%	31	13.0
Brawl CL Plus	PlainsGold	HRW	85.7	96%	60	101%	31	14.3
Guardian	PlainsGold	HRW	85.1	95%	60	101%	32	13.6
Kivari AX	PlainsGold	HRW	82.9	93%	58	98%	32	12.5
<b>Average</b>			<b>89.4</b>	<b>100%</b>	<b>59</b>	<b>100%</b>	<b>30</b>	<b>13.2</b>

<sup>a</sup>The 3-year average yield and test weight are based on nine trials (three each year). Plant heights and protein are based on seven trials (two 2023, three 2022, and three 2021).

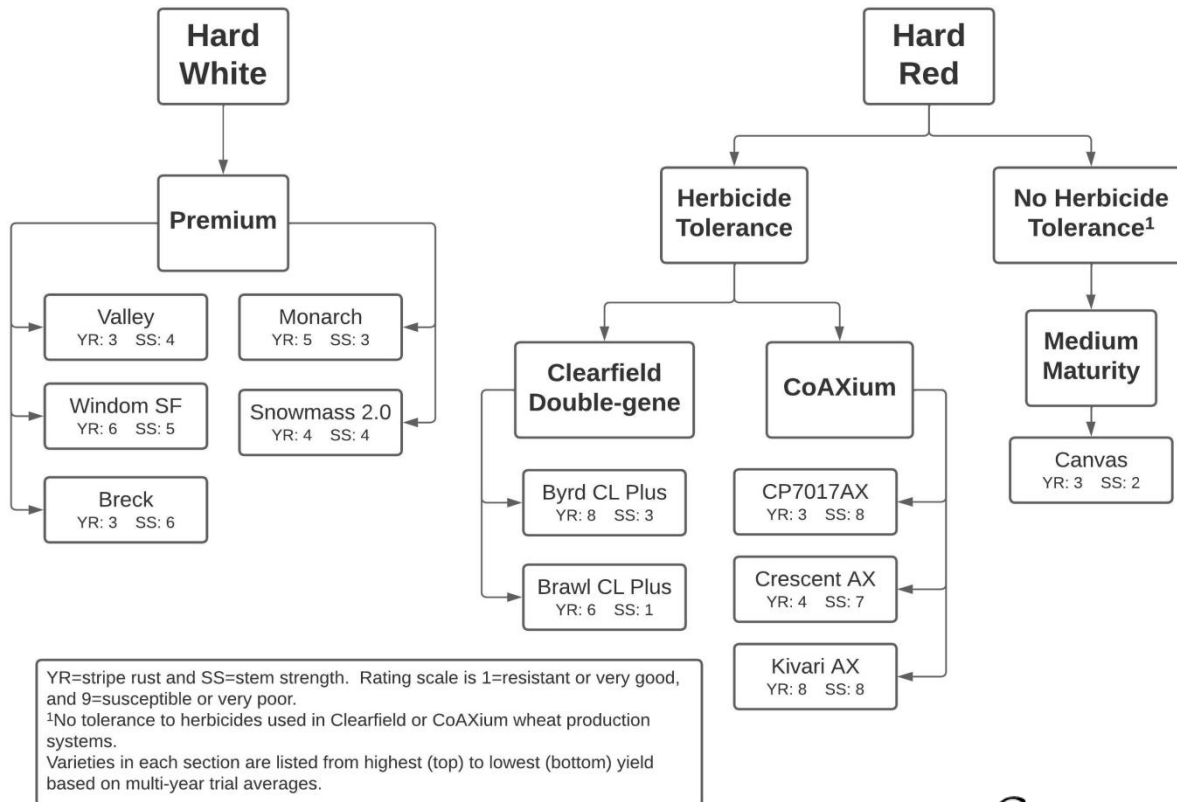
<sup>b</sup>Varieties ranked from highest to lowest average 2-year yield.

<sup>c</sup>Market class: HRW=hard red winter wheat; **HWW**=hard white winter wheat.

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Contact Sally Jones-Diamond (sally.jones@colostate.edu)*

# CSU Fall 2023 Irrigated Winter Wheat Decision Tree

Sally Jones-Diamond



## Important Variety Selection Considerations

Sally Jones-Diamond

It is not possible to accurately predict which variety will perform best in each field every year. However, there are some selection guidelines to improve the ability to select superior varieties. The variety performance summary tables and decision trees in this report provide useful information to farmers for improving variety selections. Guidelines are below.

- Focus on multi-year and location yield summary results when selecting a variety. Use results from the three-year variety performance trials or the collaborative on-farm tests. Comparing results across years and locations is a better predictor of how a variety will perform on your farm than looking at single year or location data. You can also use the wheat variety database, which is an excellent resource found at [www.wheattrials.com](http://www.wheattrials.com).
- Plant more than one variety on your farm to spread your risk of crop failure due to drought, disease, herbicide, pest, or other issues.
- Pay attention to ratings for maturity, disease tolerance, insect resistance, and end-use quality characteristics that are relevant to you. Refer to the Description of Winter Wheat Varieties in Eastern Colorado Dryland and Irrigated Trials (2022-2023) for variety-specific information.
- Control volunteer wheat and weeds to avoid loss of valuable soil moisture and to avoid creating a green bridge. A green bridge is an area where the presence of weeds or volunteer wheat allows for unimpeded disease spread. Green bridges can lead to serious virus disease infections vectored by the wheat curl mite (wheat streak mosaic virus, High Plains wheat mosaic virus, and Triticum mosaic virus) or vectored by aphids (barley yellow dwarf virus and cereal yellow dwarf virus).
- Be aware of current ratings for stripe rust resistance and pay attention to the potential of new races of stripe rust to develop. If variety susceptibility, market prices, expected yield, and fungicide and application costs warrant an application, consult the North Central Regional Committee on Management of Small Grain Diseases (NCERA-184) fungicide efficacy chart.
- Plant treated seed for protection against seed-borne diseases. Information on seed treatments is available from Kansas State University at: [tinyurl.com/jgeznu](http://tinyurl.com/jgeznu)
- Soil sample to determine optimum fertilizer application rates. Sampling should be done prior to planting. Soil samples can be sent to the CSU Soil, Water, and Plant Testing Laboratory. For more information, visit: [www.agsci.colostate.edu/soiltestinglab/](http://www.agsci.colostate.edu/soiltestinglab/)
- Plant in seeds per acre and not in pounds per acre. Different varieties and seed lots can vary widely in seed size. Reassess and adjust your seeding rate as necessary when changing varieties, switching seed lots, and as planting season progresses.

## Description of Winter Wheat Varieties in Eastern Colorado Dryland and Irrigated Trials (2022-2023)

Name/Class/Pedigree	Origin	HD	HT	SS	COL	YR	LR	SR	WSMV**	TWWS*	PRO**	MILL	BAKE	Comments	
Amplify SF	CSU 2021	6	7	4	6	4	3	2	6	4	1	5	4	6	CSU release (2021), marketed by PlainsGold. Medium height, medium maturity. Carries the semi-solid stem trait (17 out of 25 rating) for partial resistance to the wheat stem sawfly. Certified seed only.
Hard red winter Bearpaw/Antero//Antero															
AP Bigfoot	AgriPro 2022	3	4	3	3	4	2	2	4	1	--	--	4	6	AgriPro release (2021). First entered in CSU variety trials in 2022. Early to med-early variety with very good test weight and WSMV tolerance.
Hard red winter Undisclosed															
AP Roadrunner	AgriPro 2020	6	4	4	1	2	3	8	4	7	7	4	3	3	AgriPro release (2020). First entered in CSU variety trials in 2020. Medium-late variety with good winter hardiness and resistance to WSMV. Good leaf and stripe rust resistance.
Hard red winter Undisclosed															
AP Solid	AgriPro 2021	8	2	2	4	6	6	5	5	2	1	3	1	4	AgriPro release (2021). First entered in CSU variety trials in 2020. Medium-late semi-solid stem variety for use in managing wheat stem sawfly. Very good test weight and straw strength.
Hard red winter Undisclosed															
Avery	CSU 2015	6	7	8	5	8	8	8	2	5	6	6	4	3	CSU release (2015), marketed by PlainsGold. Doubled haploid-derived line, similar to Byrd with higher yield potential, larger kernels and slightly improved quality. Carries wheat curl mite resistance from TAM 112 parent. Susceptible to stripe rust.
Hard red winter TAM 112/Byrd															
Brawl/CL Plus	CSU 2011	2	7	1	7	6	6	7	5	4	6	1	3	3	CSU release (2011), marketed by PlainsGold. Two-gene Clearfield wheat. Excellent test weight, straw strength, milling and baking quality. Early maturity, medium height, long coleoptile. Intermediate reaction to both stripe rust and leaf rust. Certified seed only.
Hard red winter Teal 11A/Above//CO9314															
Breck	CSU 2017	5	7	6	7	3	5	2	4	2	7	2	2	3	CSU release (2017), marketed by PlainsGold in CWRP-Ardent Mills UltraGrain Premium Program. Good stripe rust resistance, sprouting tolerance, straw strength, grain protein deviation, and quality. Very high test weight, lower polyphenol oxidase (PPO) activity for improved whole grain bread and noodle quality. Certified seed only.
Hard white winter Denali/HV9W07-482W//Antero															
Byrd	CSU 2011	4	6	6	4	8	7	8	2	5	8	5	4	3	CSU release (2011), marketed by PlainsGold. Excellent drought tolerance (from TAM 112) and quality. Average test weight and straw strength. Moderately susceptible to stripe rust. Carries wheat curl mite resistance from TAM 112 parent.
Hard red winter TAM 112//CO970547-7															
Byrd CL Plus	CSU 2018	5	8	3	4	8	5	8	5	5	3	6	5	5	CSU release (2018), marketed by PlainsGold. Two-gene Clearfield wheat in Byrd background. Highly similar to Byrd with exception of tolerance to Beyond herbicide. Has shown some non solid-stem based tolerance to wheat stem sawfly. Certified seed only.
Hard red winter CO06072/4*Byrd															

**Column Key** - heading date (HD), plant height (HT), straw strength (SS), coleoptile length (COL), stripe rust resistance (YR), leaf rust resistance (LR), stem rust resistance (SR), wheat streak mosaic virus tolerance (WSMV), wheat stem sawfly tolerance (WSS), test weight (TW), protein (PRO), milling (MILL) and baking quality (BAKE). Rating scale: 1 - very good, very resistant, very early, or very short to 9 - very poor, very susceptible, very late, or very tall/long.

\* Coleoptile length ratings range from 1=very short (~50 mm or ~2 in) to 9=very long (~100 mm or ~4 in). Coleoptile lengths should be interpreted for relative variety comparisons only.

\*\* WSMV ratings are based on field evaluations in Colorado under pressure from wheat curl mite transmitted viruses. Scores may reflect both resistance to the wheat curl mite and resistance to mite-transmitted viruses.

+WSS ratings are based on field evaluation of tolerance to wheat stem sawfly cutting in Colorado. Values do not represent the level of stem solidness expression.

++ PRO ratings represent "grain protein deviation" (relative grain protein level accounting for differences in grain yield).

## Description of Winter Wheat Varieties in Eastern Colorado Dryland and Irrigated Trials (2022-2023)

Name/Class/Pedigree	Origin	HD	HT	SS	COL*	YR	LR	SR	WSMV**	TWWSS+ PRO++	MILL	BAKE	Comments		
Canvas	CSU 2018	6	3	2	6	3	6	2	3	4	5	4	3	3	CSU release (2018), marketed by PlainsGold. Hard red winter, medium maturing, medium-short, good straw strength. Good stripe and stem rust resistance and carries wheat curl mite resistance from Byrd parent. Good test weight and milling and baking quality.
Hard red winter Denali/Antero//Byrd															
CO18035RA	CSU EXP	2	5	5	4	4	7	6	4	5	6	4	3	2	CSU experimental line. Three gene CoAXium wheat for winter annual grassy weed control. Acidic soil tolerance. Wheat curl mite resistance from Byrd. Very good milling and baking quality. Potential release in 2023.
Hard red winter (AF28/Byrd//AF26/Byrd)//2*Byrd//AF10 M3/2*Byrd//((AF10 M3/2*Byrd//AF26/Byrd)//2*Byrd/ (AF28/Byrd//AF26/Byrd)//2*Byrd/Langin															
CO18042RA	CSU EXP	5	6	6	5	2	--	6	4	5	6	6	3	2	CSU experimental line. Three gene CoAXium wheat for winter annual grassy weed control. Acidic soil tolerance. Wheat curl mite resistance from Byrd and excellent stripe rust resistance. Very good milling and baking quality. Potential release in 2023.
Hard red winter (AF28/Byrd//AF26/Byrd)//2*Byrd//AF10 M3/2*Byrd//((AF10 M3/2*Byrd//AF26/Byrd)//2*Byrd/ (AF28/Byrd//AF26/Byrd)//2*Byrd/Langin															
CO18D007W	CSU EXP	4	4	1	5	4	6	1	4	5	8	2	2	3	CSU experimental line. Hard white winter wheat. Excellent straw strength and overall performance in irrigated and dryland environments. Very good milling and baking. Potential release in 2023.
Hard white winter CO12D906/CO07W722-F5															
CO18D297R	CSU EXP	5	6	6	6	2	1	5	3	8	3	2	3	3	CSU experimental line. Good overall performance and excellent resistance to stripe rust. Very good milling and baking quality. Potential release in 2023.
Hard red winter CO12D906/CO11D1353/Monarch															
CP7017AX	Croplan 2020	4	3	8	4	3	4	1	2	4	6	6	2	6	CROPLAN by WinField United release (2020). First entered into CSU trials in 2020. CoAXium wheat for winter annual grassy weed control. Strong yield potential, strong drought tolerance, tolerates acid soils and resistant to solborne mosaic virus. Certified seed only.
Hard red winter Undisclosed															
CP7266AX	Croplan EXP	5	5	1	6	2	1	5	--	5	--	6	3	5	CROPLAN by WinField United release (2021). First entered into CSU trials in 2022. CoAXium wheat for winter annual grassy weed control.
Hard red winter Undisclosed															
Crescent AX	CSU 2018	3	7	7	4	4	6	--	2	4	6	7	3	3	CSU release (2018), marketed by PlainsGold. CoAXium wheat for winter annual grassy weed control. Approximately 66% Byrd and 34% Hatcher parentage. Earlier and much improved yield and test weight relative to Incline AX. Intermediate reaction to stripe rust and carries wheat curl mite resistance from Byrd parent. Certified seed only.
Hard red winter (AF28/Byrd)//(AF10/2*Byrd)															
Fortify SF	CSU 2019	4	6	5	4	7	7	4	2	3	2	5	5	6	CSU release (2019), marketed by PlainsGold. Medium height, medium maturity. Carries wheat curl mite resistance from Byrd parent and semi-solid stem trait (13 out of 25 rating) for partial resistance to the wheat stem sawfly. Certified seed only.
Hard red winter Byrd/Bearpaw//Byrd															

**Column Key** - heading date (HD), plant height (HT), straw strength (SS), coleoptile length (COL), stripe rust resistance (YR), leaf rust resistance (LR), stem rust resistance (SR), wheat streak mosaic virus tolerance (WSMV), wheat stem sawfly tolerance (WSS), test weight (TW), protein (PRO), milling (MILL) and baking quality (BAKE). Rating scale: 1 - very good, very resistant, very early, or very short to 9 - very poor, very susceptible, very late, or very tall/long.

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\*\* WSMV ratings are based on field evaluations in Colorado under pressure from wheat curl mite transmitted viruses. Scores may reflect both resistance to the wheat curl mite and resistance to mite-transmitted viruses.

+WSS ratings are based on field evaluation of tolerance to wheat stem sawfly cutting in Colorado. Values do not represent the level of stem solidness expression.

++ PRO ratings represent "grain protein deviation" (relative grain protein level accounting for differences in grain yield).

## Description of Winter Wheat Varieties in Eastern Colorado Dryland and Irrigated Trials (2022-2023)

Name/Class/Pedigree	Origin	HD	HT	SS	COL*	YR	LR	SR	WSMV**	TW	WSS+	PRO**	MILL	BAKE	Comments
Guardian	CSU 2019	6	7	7	5	3	4	2	1	3	7	2	4	3	CSU release (2019), marketed by PlainsGold. Medium height, medium maturity. Excellent resistance to WSMV due to combination of resistance to wheat curl mite and the virus itself. Good combined resistance to all three rusts, good test weight, good milling and baking quality, high grain protein deviation. Certified seed only.
Hard red winter Antero/Snowmass/Byrd	CSU 2004	5	4	6	4	4	7	3	6	6	4	7	5	4	CSU release (2004), marketed by PlainsGold. Medium maturing semidwarf. Good test weight, moderate resistance to stripe rust, good milling and baking quality. Develops "leaf speckling" condition.
Yuma/PI 372129/TAM-2003/4*Yuma/4/KS91H184/Vista	CSU 2020	6	6	8	5	8	8	5	3	6	5	8	5	3	CSU release (2020), marketed by PlainsGold. CoAXium wheat for winter annual grassy weed control. Higher yielding and slightly later maturing than Crescent AX. Intermediate reaction to stripe rust and carries wheat curl mite resistance from Byrd parent. Certified seed only.
Kivari AX	KS-Manhattan 2022	5	5	4	3	4	--	2	2	3	--	5	4	4	KSU release (2022), marketed by the Kansas Wheat Alliance. First tested in 2023. Medium maturity and medium height. Resistant to WSMV.
Hard red winter (AF28/Byrd)/(AF10/2*Byrd)	KS050223M-2/KS11W15	5	4	7	7	4	2	1	2	4	5	4	3	3	KSU release (2019), marketed by the Kansas Wheat Alliance. First entered in CSU variety trials in 2020. Medium maturity, medium height, average straw strength, medium-long coleoptile, moderate to intermediate resistance to stripe rust, good leaf rust resistance, very good wheat streak mosaic virus resistance, good quality.
KS Dallas	KS-Hays 2019	5	4	7	7	4	2	1	2	4	5	4	3	3	KSU release (2020), marketed by the Kansas Wheat Alliance. First entered in CSU variety trials in 2020. Medium maturity, medium height, and good resistance to WSMV. Intermediate reaction to stripe rust and leaf rust.
Hard red winter KS08HW112-6/TX03A0148/Danby TR	KS-Hays 2020	5	1	5	3	5	4	3	5	3	4	5	5	5	KSU release (2020), marketed by the Kansas Wheat Alliance. First entered in CSU variety trials in 2020. Medium maturity, medium height, and good resistance to WSMV. Intermediate reaction to stripe rust and leaf rust.
KS Hamilton	KS-Hays 2019	2	2	3	5	4	2	2	3	1	6	3	3	3	KSU release (2019), marketed by the Kansas Wheat Alliance. First entered in CSU variety trials in 2020. Early maturity, medium-short, good straw strength, good to moderate resistance to stripe rust, leaf rust, and wheat streak mosaic virus. Good test weight, good milling and baking quality, good pre-harvest sprouting tolerance.
Hard red winter KS05HW122-5-2/KS05HW15-2-2/KS06HW46-3	KS-Hays 2022	5	5	1	3	4	4	4	2	5	--	5	4	4	KSU release (2022), marketed by the Kansas Wheat Alliance. First tested in the trial in 2023. Medium maturity, excellent straw strength, and resistant to WSMV and Triticum mosaic virus (TriMV).
KS Territory	CSU 2016	1	4	8	4	3	6	8	6	5	6	6	5	2	CSU release (2016), marketed by PlainsGold. Early maturing semidwarf. Good drought stress tolerance and winterhardness, stripe rust resistance, and quality. Medium coleoptile. Carries wheat curl mite resistance from Byrd parent. Very high yield potential for irrigation, but straw strength requires use of growth regulator.
Hard red winter CO050270/Byrd															

**Column Key** - heading date (HD), plant height (HT), straw strength (SS), coleoptile length (COL), stripe rust resistance (YR), leaf rust resistance (LR), stem rust resistance (SR), wheat streak mosaic virus tolerance (WSMV), wheat stem sawfly tolerance (WSS), test weight (TW), protein (PRO), milling (MILL) and baking quality (BAKE). Rating scale: 1 - very good; very resistant, very early, or very short to 9 - very poor, very susceptible, very late, or very tall/long.

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 \*\* WSMV ratings are based on field evaluations in Colorado under pressure from wheat curl mite transmitted viruses. Scores may reflect both resistance to the wheat curl mite and resistance to mite-transmitted viruses.  
 +WSS ratings are based on field evaluation of tolerance to wheat stem sawfly cutting in Colorado. Values do not represent the level of stem solidness expression.  
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Name/Class/Pedigree	Origin	HD	HT	SS	COL	YR	LR	SR	WSMV*	TWSS*	PRO**	MILL	BAKE	Comments
LCS Atomic AX Hard red winter Undisclosed	Limagrain 2019	2	5	3	3	1	2	9	--	4	8	4	2	4 Limagrain release (2019), first entered in CSU Variety Trials in 2021. CoAXium wheat for winter annual grassy weed control. Excellent straw strength and resistance to stripe rust. Certified seed only.
LCS Steel AX Hard red winter LCH13KSDH-20-87 / ACC 7-38	Limagrain 2021	9	7	1	5	8	2	8	--	3	--	3	5	5 Limagrain release (2021). First entered into the trials in 2023. CoAXium wheat for winter annual grass weed control. Broad adaptation, very good leaf rust resistance and excellent straw strength. Certified seed only.
Monarch Hard white winter CO07W722-F5/Snowmass/CO07W722-F5	CSU 2018	6	2	3	5	5	2	4	4	3	7	5	4	4 CSU release (2018), marketed by PlainsGold. Hard white winter with excellent straw strength and very high irrigated yield potential. Good stripe rust resistance. Quality more similar to Breck, but very low PPO. Certified seed only.
MS Maverick Hard red winter Undisclosed	Meridian Seeds 2022	7	5	3	5	1	1	3	--	2	--	5	3	5 Meridian Seeds Release (2021). Good overall disease package. Good grain quality
Ray Hard red winter Yellowstone*2/98X168E1	MT State 2018	9	9	7	3	2	--	8	--	6	--	4	4	4 Forage line available through the PlainsGold Brand with improved grain yield compared to other forage varieties.
Snowmass 2.0 Hard white winter CO07W722-F5/Snowmass/Brawl CL Plus	CSU 2018	3	4	4	5	4	5	1	3	5	5	4	4	1 CSU release (2018), marketed by PlainsGold in CWRP-Arden Mills Ultragrain Premium Program. Hard white wheat, quality profile very similar to Snowmass but low PPO and better grain protein deviation. Good stripe and stem rust resistance and wheat streak mosaic virus resistance. Good straw strength, good test weight. Certified seed only.
Steamboat Hard red winter TAM 114/Antero//Byrd	CSU 2020	6	9	7	6	3	3	3	2	3	5	6	3	4 CSU release (2020), marketed by Crop Research Foundation of Wyoming. Medium maturing, tall, marginal straw strength. Good resistance to all three rusts and carries resistance to the wheat curl mite from Byrd. Good test weight and milling and baking quality.
Sunshine Hard white winter KS01HW152-6/HV9W02-267W	CSU 2014	3	6	7	5	5	6	2	7	6	6	4	4	3 CSU release (2014), marketed by PlainsGold in CWRP-Arden Mills Ultragrain Premium Program. Hard white wheat. Excellent quality, good sprouting tolerance and straw strength, intermediate reaction to stripe rust. Very susceptible to mite-transmitted viruses. Certified seed only.
SY Legend CL2 Hard red winter AgriPro Exp/AP503 CL2 sib	AgriPro 2018	4	3	5	2	3	3	--	4	5	7	2	6	5 AgriPro release (2018), first entered in CSU trials in 2018. Two-gene clearfield herbicide tolerance technology. Medium early and medium tall with good test weight. Above average leaf disease package.

**Column Key** - heading date (HD), plant height (HT), straw strength (SS), coleoptile length (COL), stripe rust resistance (YR), leaf rust resistance (LR), stem rust resistance (SR), wheat streak mosaic virus tolerance (WSMV), wheat stem sawfly tolerance (WSS), test weight (TW), protein (PRO), milling (MILL) and baking quality (BAKE). Rating scale: 1 - very good, very resistant, very early, or very short to 9 - very poor, very susceptible, very late, or very tall/long.

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## Description of Winter Wheat Varieties in Eastern Colorado Dryland and Irrigated Trials (2022-2023)

Name/Class/Pedigree	Origin	HD	HT	SS	COL*	YR	LR	SR	WSMV**	TW	WSS+	PRO**	MILL	BAKE	Comments
SY Wolverine	Agripro 2019	4	1	2	5	4	2	2	4	5	6	2	2	6	Agripro release (2019), first entered in CSU trials in 2019. Good overall disease resistance, good straw strength. Similar to SY Wolf in reaction to wheat streak mosaic virus. Good test weight. Certified seed only.
Hard red winter Everest/Platte//SY Wolf															
Valley	CSU 2022	6	6	4	3	3	6	4	4	5	4	4	6	1	CSU release (2018) marketed by PlainsGold in CWRP-Ardent Mills Ultragrain Premium Program. White-seeded with excellent quality and good pre-harvest sprouting tolerance. Moderately resistant to stripe, leaf, and stem rust. Medium height and medium maturity.
Hard white winter CO07W722-F5/Antero//Snowmass															
Whistler	CSU 2018	7	8	9	5	3	6	1	2	6	6	5	7	3	CSU release (2018), marketed by PlainsGold. Hard red winter, later maturing, tall, marginal straw strength. Good stripe and stem rust resistance and carries wheat curl mite resistance from Byrd parent. Very good milling and baking quality.
Hard red winter CO08W218/Snowmass//Byrd															
Windom SF	CSU 2022	5	4	5	7	6	8	1	3	2	1	5	2	2	CSU release (2021), marketed by PlainsGold in CWRP-Ardent Mills Ultragrain Premium Program. White-seeded with strong mixing and baking properties. Semi-solid stem (16/25) for partial resistance to the wheat stem sawfly. Wsm2 for resistance to wheat streak mosaic virus. Very good test weight, long coleoptile, tolerance to lower pH. Certified
Hard white winter Warhorse/Breck//CO12D1028															

**Column Key** - heading date (HD), plant height (HT), straw strength (SS), coleoptile length (COL), stripe rust resistance (YR), leaf rust resistance (LR), stem rust resistance (SR), wheat streak mosaic virus tolerance (WSMV), wheat stem sawfly tolerance (WSS), test weight (TW), protein (PRO), milling (MILL) and baking quality (BAKE). Rating scale: 1 - very good, very resistant, very early, or very short to 9 - very poor, very susceptible, very late, or very tall/long.

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 +WSS ratings are based on field evaluation of tolerance to wheat stem sawfly cutting in Colorado. Values do not represent the level of stem solidness expression.  
 ++ PRO ratings represent "grain protein deviation" (relative grain protein level accounting for differences in grain yield).

## Forage Wheat Trial Results

Sally Jones-Diamond and Joe Brummer

The 2022-2023 growing season was the second season of testing winter annual forages as a potential dual-purpose crop. There is little external information available on the quality and yield of forage for dual-purpose wheats as they have not been widely grown in our region. It is critical to possess local information about wheat varieties that have favorable forage characteristics with a potential for grain production and vice versa. This season we included two traditional grain wheat varieties to determine their suitability for potential forage production.

### Testing Methods:

Eight varieties were planted in small plots (6' by 30') next to the regular wheat variety trials at three dryland locations: Akron, Burlington, and Yuma. The eight varieties were Ray, Willow Creek, MTF1435, TAM 204, OK Corral, AP Baldy, Fortify SF, and Whistler. Forage sub-samples were cut from the center of the plots in May or June as each variety reached the early heading stage to determine forage yield and quality. Forage wet and dry weights were obtained and used to calculate dry matter yield along with hay quality information based on NIR analyses done at CSU. The remainder of the plots were harvested for grain (yield area adjusted to account for forage sampling), and grain test weight and protein analyses were performed.

Yield, test weight, and dry matter yield values were statistically analyzed, and least significant differences are provided under each location table to compare varieties within a location.

### Results:

We harvested forage and grain from all three sites. Forage dry matter yield, harvest moisture, and quality, along with grain yield and quality from the three locations are shown on the next page.

Wheat varieties developed for forage often produce low grain yields, as shown by Willow Creek, which produces a lot of dry matter but very low grain yield. Grain yield has been improved in the two newer varieties out of Montana, Ray and MTF-1435, to the point they would be acceptable dual-purpose wheats. OK Corral out of the Oklahoma breeding program produced acceptable forage yields and had the highest grain yield at two of the sites. At the Yuma site, the traditional wheat varieties, Whistler and Fortify SF, produced the highest grain yields.

When comparing forage quality among varieties, you want to see higher crude protein (CP), in vitro true dry matter digestibility (IVTDMD48), digestible neutral detergent fiber (dNDF48), and relative feed value (RFV) and lower acid detergent fiber (ADF), neutral detergent fiber (aNDF), and lignin. As with many forages, as dry matter yield increases, forage quality decreases which was evident with some of the varieties evaluated in this trial. The varieties developed in Montana (Willow Creek, Ray, and MTF-1435) tended to have higher forage yields but were lower in CP and higher in fiber (ADF and NDF), especially at the Yuma site. The higher yield was related to more stem production which tends to be lower in quality. A surprising variety was Fortify SF, which is a semi-solid stemmed variety. While it did not have the forage yield like some of the other varieties, it was leafy, had a soft texture, and an overall higher forage quality. If you had to pick one variety out of the ones evaluated for dual-purpose use, OK Corral would be a good choice due to its potential grain yield, intermediate forage yield, and high forage quality.

## 2023 Dryland Winter Forage Variety Performance Trials at Akron, Burlington, and Yuma

Brand/Source	Variety	Grain Harvest			Forage Harvest		Forage Quality <sup>a</sup>							
		Yield bu/ac	Test Weight lb/bu	Protein percent	Dry Matter Yield ton/ac	Moisture % at harvest	Harvest Date	CP	ADF	aNDF	dNDF48	LIGNIN	IVTDMD48	RFV
<b>Akron</b>														
Montana State Univ.	MTF1435	56.0	47	12.7	4.4	79	7-Jun	7.0	37.8	66.4	36.4	5.4	73.9	83
PlainsGold	Ray	57.5	42	12.9	4.2	78	8-Jun	6.3	37.2	65.7	37.9	4.6	75.4	85
Watley Seed	TAM 204	77.0	49	12.9	4.2	78	28-May	9.3	31.4	59.8	37.3	4.1	80.6	101
Montana State Univ.	Willow Creek	31.5	48	13.8	3.8	80	13-Jun	6.3	40.4	67.1	36.2	5.9	71.9	80
Oklahoma Genetics, Inc	OK Corral	94.0	52	12.0	3.6	79	31-May	11.1	31.8	60.4	38.7	3.8	82.2	99
PlainsGold	Whistler	77.5	50	11.9	3.3	80	31-May	9.3	32.2	61.5	37.2	4.0	79.8	97
AgriPro	AP Baldy	71.0	52	12.3	3.2	80	31-May	10.7	33.1	60.2	35.6	4.0	79.6	98
PlainsGold	Fortify SF	76.5	52	11.1	3.1	75	28-May	9.9	31.8	59.4	36.5	3.9	81.2	101
	Average	67.5	49	12.5	3.7	79	2-Jun	8.7	34.4	62.6	37.0	4.5	78.1	93
	LSD (0.30) <sup>b</sup>	6.0	1		0.5									
	LSD (0.05) <sup>b</sup>	12.0	3		NS									
	Coefficient of Variation (CV)	10.1	3.1		13.7									
<b>Burlington</b>														
Montana State Univ.	Willow Creek	42.5	54	13.5	4.4	77	7-Jun	5.1	41.4	69.4	34.2	6.7	66.8	76
PlainsGold	Whistler	84.5	54	11.4	4.2	86	22-May	10.7	31.3	61.6	37.2	3.8	79.6	97
Montana State Univ.	MTF1435	77.0	53	11.4	4.2	78	26-May	7.2	35.7	65.3	34.5	4.6	72.7	87
PlainsGold	Ray	73.5	44	11.7	4.1	78	26-May	10.6	31.3	59.4	36.2	3.0	81.0	101
Oklahoma Genetics, Inc	OK Corral	92.0	55	11.7	3.3	85	22-May	10.5	29.2	58.2	37.2	3.3	82.4	106
AgriPro	AP Baldy	83.0	58	11.8	3.3	77	22-May	10.9	29.5	59.0	35.8	4.1	79.8	104
PlainsGold	Fortify SF	79.0	56	10.7	2.9	78	19-May	12.3	29.3	58.8	35.8	3.3	81.4	104
Watley Seed	TAM 204	91.5	55	11.9	2.8	78	19-May	11.0	30.2	59.8	35.0	3.6	79.3	102
	Average	78.0	54	11.8	3.6	80	24-May	9.8	32.2	61.4	35.7	4.0	77.9	97
	LSD (0.30) <sup>b</sup>	4.0	1		0.3									
	LSD (0.05) <sup>b</sup>	8.0	1		0.7									
	Coefficient of Variation (CV)	5.7	1.4		10.0									
<b>Yuma</b>														
Montana State Univ.	MTF1435	45.5	49	11.6	4.2	78	7-Jun	2.2	41.1	72.1	35.8	5.8	66.1	73
Montana State Univ.	Willow Creek	26.0	50	12.8	4.1	75	13-Jun	4.9	38.2	67.6	36.3	5.1	71.2	82
PlainsGold	Ray	49.5	48	11.0	3.4	78	7-Jun	3.5	38.2	66.8	37.0	4.5	73.0	83
Oklahoma Genetics, Inc	OK Corral	55.5	55	12.5	3.2	76	28-May	7.2	31.2	60.0	36.7	3.1	79.6	100
PlainsGold	Whistler	62.0	55	14.5	3.2	78	31-May	4.4	35.0	66.5	36.5	4.3	73.1	86
PlainsGold	Fortify SF	66.5	58	12.8	3.0	79	28-May	7.5	33.8	64.4	37.4	3.7	76.9	91
Watley Seed	TAM 204	54.0	52	10.9	2.8	77	28-May	7.7	31.5	61.6	36.7	3.6	77.9	98
AgriPro	AP Baldy	53.5	55	11.4	2.3	81	31-May	7.5	32.0	61.3	35.6	4.2	76.9	97
	Average	51.5	53	12.2	3.3	78	2-Jun	5.6	35.1	65.1	36.5	4.3	74.3	89
	LSD (0.30) <sup>b</sup>	4.5	1		0.4									
	LSD (0.05) <sup>b</sup>	9.0	1		0.8									
	Coefficient of Variation (CV)	9.6	1.5		12.9									

<sup>a</sup>All forage quality analyses results are dry basis values. CP=crude protein; ADF=acid detergent fiber; aNDF=neutral detergent fiber; dNDF48= digestible neutral detergent fiber at 48 hours; IVTDMD48=in vitro true dry matter digestibility at 48 hours; and RFV=relative feed value.

<sup>b</sup>If the difference between two variety yields equals or exceeds the LSD value, the difference is significant. Farmers selecting a variety based on yield should use the LSD (0.30) to protect from false negative decisions. Companies or researchers may be interested in the LSD (0.05) to avoid false positive conclusions.

Trials were harvested for grain on July 13 (Burlington), July 19 (Yuma), and August 5 (Akron).

*The data included in this table may not be republished without permission.  
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**\*\*Mention of a trademark proprietary product does not constitute endorsement by the Colorado Agricultural Experiment Station.**

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