



COLORADO STATE UNIVERSITY

Agricultural Experiment Station

College of Agricultural Sciences - Department of Soil & Crop Sciences -
Extension

2026



2025 WINTER WHEAT VARIETY PERFORMANCE TRIALS

Making Better Decisions



CROPS TESTING
PROGRAM

Table of Contents

Authors.....	3
2025 Wheat Trial Location Management and Characteristics.....	7
Summary of 2025 Dryland Winter Wheat Variety Performance Results.....	8
Summary of 2025 Dryland Winter Wheat Variety Results- Northeast Region.....	9
Summary of 2025 Dryland Winter Wheat Variety Results- Southeast Region.....	10
Summary of 2-Yr (2024-2025) Dryland Winter Wheat Variety Performance Results.....	11
Summary of 3-Yr (2023-2025) Dryland Winter Wheat Variety Performance Results.....	12
Summary of 2025 Collaborative On-Farm Test (COFT) Winter Wheat Variety Performance Results.....	13
Spring 2026 CSU Dryland Winter Wheat Decision Tree.....	14
Summary of 2025 Irrigated Winter Wheat Variety Performance Results.....	15
Summary of 2-year (2024-2025) Irrigated Winter Wheat Variety Performance Results...	16
Summary of 3-Year (2023-2025) Irrigated Winter Wheat Variety Performance Results...	17
Spring 2026 CSU Irrigated Winter Wheat Decision Tree.....	18
Small Grain Forage Trial Results.....	19
Description of Winter Wheat Varieties in Eastern Colorado Dryland and Irrigated Trials (2025-2026).....	21
Seed Storage, Certified Seed, and Plant Variety Protection: Best Practices for Farmers...	28
Wheat Quality Evaluations from the 2025 Dryland and Irrigated Variety Trials.....	31
Millions Still at Stake: Wheat Stem Sawfly Remains a Persistent Challenge in Colorado Wheat Economy.....	39
Colorado Wheat Stem Sawfly Survey.....	42
Does Stem Solidness Influence Residue Decomposition in Winter Wheat?.....	44
Survey of Aphid and Mite Populations in Colorado Wheat.....	49
What's the Deal with the 'Yellowing Disease'?.....	53
Weather-Variable Nitrogen Management in Winter Wheat: Optimizing Grain Yield and Protein Concentration in Sem-Arid Systems.....	55
Colorado Wheat Update.....	59
Acknowledgments.....	61

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Additional Resources

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

Colorado State University Wheat Breeding Program: www.agsci.colostate.edu/wheat/

Wheat Variety Performance Database: www.wheattrials.com

Colorado Wheat Administrative Committee (CWAC), Colorado Association of Wheat Growers (CAWG), and Colorado Wheat Research Foundation (CWRF): www.coloradowheat.org

Overview of 2024-2025 Eastern Colorado Winter Wheat Trials

Sally Jones-Diamond

Colorado State University researchers strive to provide current, reliable, and unbiased wheat variety information to Colorado producers. Support of our research keeps public variety testing thriving in Colorado. Our work 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 that enter varieties, and farmers who donate their resources and time to host the replicated wheat variety trials.

The eastern Colorado winter wheat trials are conducted under a broad range of environmental conditions to best determine the expected performance of varieties. We have a regional uniform variety testing program, meaning the dryland varieties entered in our northeast region are tested across seven test locations in Northeast Colorado, and varieties entered in the southeast region are tested across six test locations in Southeast Colorado. All irrigated varieties are tested in three irrigated trials spread across Northeast Colorado. In the dryland trials, 52 varieties were tested, including experimental lines across the two regions of the 13 total trial locations. The three irrigated trials had 28 varieties. 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, Armor by WinField United, WestBred Bayer, Limagrain Cereal Seeds, and Frenchman Valley Coop. There were entries from the Colorado State University marketing organization PlainsGold, the Kansas State University marketing organization Kansas Wheat Alliance, the University of Nebraska-Lincoln marketing organization NU Horizon Genetics, and Montana State University.

All dryland and irrigated trials were planted in a randomized complete block design with three replicates. Plot sizes were approximately 150 ft² (except the Fort Collins irrigated trial, which was 80 ft²). All varieties were planted at 700,000 seeds per acre for dryland trials and 2 million seeds per acre for irrigated trials. Individual location management data is listed in the 2025 Wheat Trial Management and Characteristics table in this report. Grain yield and protein were corrected to 12% moisture content. Variety trial grain weight, test weight, and grain moisture content information were obtained from a HarvestMaster H2 GrainGage™ weigh system on a Zurn 150 plot combine. Protein content was obtained using a FOSS Infratec™ NOVA grain analyzer. Data were analyzed using a spatial mixed model applied within each location, with location included as a random effect in the overall analysis in the multi-location results tables.

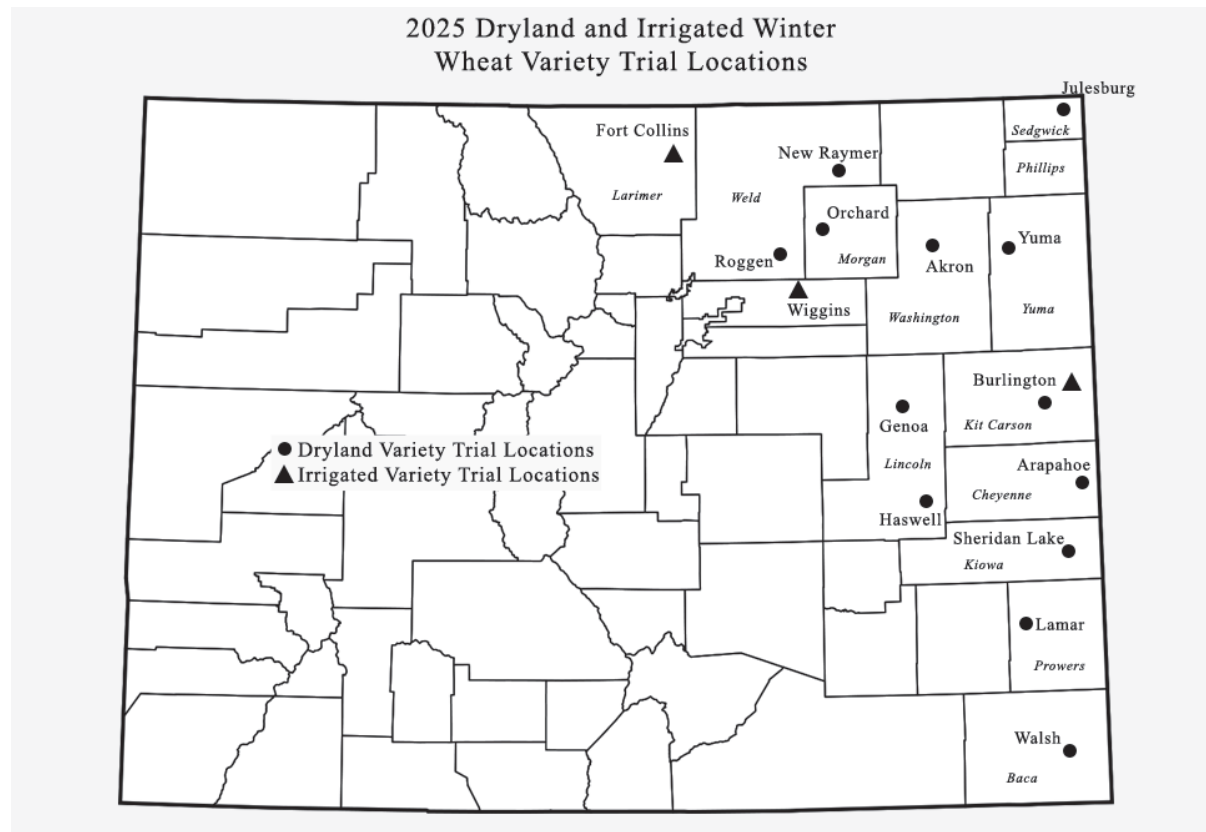
General Growing Conditions Affecting the 2025 Colorado Wheat Crop

Wheat planting conditions in the fall of 2024 were drier than average for the region. While conditions were mostly normal in Northeast Colorado, from Kit Carson County south, it was abnormally dry to severe drought conditions. Fall stand establishment in Southeast Colorado was poor to average in most areas due to dry planting conditions. The abnormally dry to drought conditions encompassed all of eastern Colorado by the first week of November. A significant snowstorm the week of November 4th brought much needed moisture to most of the region. By early December, drought conditions had largely disappeared, except in north-central

Colorado, which experienced persistent drought conditions into June. By mid-March, extreme southeast Colorado was in a moderate drought again, which persisted until mid-June. East-Central Colorado received timely and frequent rainfall throughout the spring, lasting until mid-June. Northeast Colorado experienced abnormally dry to moderate drought conditions from May to early July. Isolated hail events either destroyed or severely damaged wheat fields for several producers.

Triticum mosaic virus (TriMV), a mite-vectored disease, was widespread across the eastern part of the state and severely affected yield in some fields with susceptible varieties. There were few co-infections of TriMV with WSMV based on field samples and rarely was WSMV the only virus in fields showing symptomology. Stripe rust disease was not an issue until June, when frequent precipitation and high humidity favored the disease along the I-70 corridor. Some growers sprayed fungicides if the crop was not yet in the grain-fill period. Brown wheat mites were observed at low levels in southeast Colorado in the early spring. Cutworms were widespread in southeast Colorado at varying levels of infestation. Wheat Stem Sawfly (WSS) is widespread across many northeastern Colorado counties and continues to spread south and east.

Harvest occurred about 2 weeks earlier than normal in Colorado this year. Wheat yields were mostly higher than expected, test weight was generally around 60 lb/bu, and protein ranged from 10-12% on average.



2025 Wheat Trial Management and Characteristics

Dryland Locations

Irrigated Locations

Location	Akron	Arapahoe	Burlington	Genoa	Haswell	Julesburg	Lamar	New Raymer	Orchard	Reggen	Sheridan Lake	Walsh	Yuma	Burlington	Fort Collins	Wiggins	
Average Yield (bu/acre)	44	-	63	45	-	57	75	51	28	-	66	67	83	84	94	137	
GPS Coordinates (Lat/Long)	40.1499108, -103.1371728	38.903798, -102.31431	39.2851853, -102.279391	39.380358, -103.47343	38.6386854, -102.33952	40.5836209, -102.33952	38.012272, -102.62205	40.553532, -103.89849	40.5110819, -104.071168	40.06925124, -104.2814146	38.5385583, -102.469833	37.434262330, -102.31464905	40.18668, -102.65383	39.410895, -102.15287	40.65285, -104.9995	39.997682, -104.104908	
County	Washington	Cheyenne	Kit Carson	Lincoln	Lincoln	Segevick	Prowers	Weld	Morgan	Weld	Kiowa	Baca	Yuma	Kit Carson	Larimer	Adams	
Soil Type	Weld silt loam	Wiley complex	Kuma-Keith silt loams	Weld silt loam	Wild silt loam	Keith-Kuma silt loams	Manvel silt loam	Olney fine sandy loam	Briggsdale fine sandy loam	Weld loam	Wiley loam	Wiley loam	Haxtum sandy loam	Kuma-Keith silt loams	Fort Collins loam	Truckton sandy loam	
Soil Organic Matter	1.3%	1.4%	1.7%	1.9%	1.7%	1.3%	0.9%	-	0.8%	1.5%	1.0%	1.8%	1.6%	1.7%	0.8%	0.8%	
Soil pH	6.3	7.8	7.2	6.3	7.7	5.7	8.0	-	5.1	7.4	7.6	8.2	6.9	6.6	-	7.8	
Soil Nutrients at Planting Based on Soil Test (N-P lb/acre)	132 lb N 48 lb P	38 lb N 10 lb P	84 lb N 36 lb P	152 lb N 70 lb P	50 lb N 38 lb P	240 lb N 84 lb P	122 lb N 16 lb P	-	196 lb N 220 lb P	58 lb N 16 lb P	31 lb N in top 8" 21 lb P	46 lb N 14 lb P	89 lb N 96 lb P	19 lb N 52 lb P	-	118 lb N 50 lb P	
Fertilizer applied at Planting	4.7 lb N 15.9 lb P	4.7 lb N 15.9 lb P	2.9 lb N 9.9 lb P	7.6 lb N 25.7 lb P	14 lb N 48 lb P	5.6 lb N 19 lb P	5.8 lb N 20 lb P	7.6 lb N 25.7 lb P	15 lb N 53 lb P	4.7 lb N 16 lb P	5.6 lb N 19 lb P	7.6 lb N 25.7 lb P	5.0 lb N 17 lb P	3.5 lb N 11.9 lb P	7.6 lb N 25.7 lb P	5.3 lb N 18 lb P	
Fertilizer applied In-Season (lb nutrient/acre)	None	23.8 lb N 4.4 lb S	20 lb N 3.6 lb S	55 lb N	55 lb N	20 lb N, 5 lb S, 25 lb Zn	30.1 lb N, 5.4 lb S	-	Manure application pre-plant	6.2 lb N, 0.7 lb K, 0.7 lb S	30 lb N, 1.5 lb S	-	-	-	-	-	
Tillage	No-Till	Sweep Tillage	Tilled	No-Till	No-Till	No-Till	No-Till	No-Till	No-Till	No-Till	Sweep Tillage	No-Till	No-Till	Tilled	Tilled	Tilled	
Previous Crop	Proso Millet to Fallow	Corn to Fallow	Corn to Fallow	Grain Sorghum to Fallow	Grain Sorghum to Fallow	Corn to Fallow	Wheat to Fallow	Proso Millet to Fallow	Proso Millet to Fallow	Wheat to Fallow	Grain Sorghum to Fallow	Grain Sorghum	Millet to Fallow	Corn	Dry Beans	Black-Eyed Peas	
Planting Depth	1.5"	1.5"	1.5"	1.5"	1.25"	1"	1.5"	1.5"	1.25"	1.25"	1.5"	1"	1.25"	1.25"	1"	1.25"	
Planter Type	Disc drill	Disc drill	Disc drill with shanks down	Disc drill	Disc drill	Disc drill	Disc drill	Disc drill	Disc drill	Disc drill	Disc drill	Disc drill	Disc drill	Disc drill	Disc drill	Disc drill	
Planting Date	9/26/2024	9/24/2024	10/4/2024	9/23/2024	9/23/2024	9/25/2024	9/24/2024	9/20/2024	9/27/2024	9/27/2024	9/24/2024	9/27/2024	9/25/2024	10/11/2024	9/25/2024	10/8/2024	
Harvest Date	7/2/2025	N/A	7/9/2025	7/20/2025	N/A	7/15/2025	6/26/2025	7/14/2025	7/18/2025	N/A	6/26/2025	6/26/2025	7/3/2025	7/11/2025	7/21/2025	7/21/2025	
Biotic Stress	Yellowing disease and wheat stem sawfly	N/A	Triticum and wheat streak mosaic virus	Wheat stem sawfly	N/A	N/A	None	Wheat stem sawfly	Wheat stem sawfly	Wheat stem sawfly	Brown wheat mite	Yellowing disease and cutworm	Wheat stem sawfly	Wheat stem sawfly	None	Wheat stem sawfly	
Abiotic Stress	Freeze and hail	Drought	None	Drought	Drought	Drought during emergence	None	Drought during emergence	Drought during emergence and late season hail	Hail	Drought during emergence	None	None	None	None	None	
Total Rainfall: January 1 to Harvest	7.91"	N/A	9.48"	10.17"	N/A	11.81"	7.23"	10.05"	10.21"	N/A	8.25"	6.52"	9.89"	9.4"	7.89"	10.36"	
Growing Degree-Days (Jan 1 - Harvest, 32°F base)	3,163	N/A	3,613	3,851	N/A	3,756	3,555	3,752	3,707	N/A	3,481	3,561	3,263	3,955	3,987	4,125	
General Comments	Planted into moisture. Fall emergence and stands were excellent. Good growth in the spring, but in April Triticum mosaic virus symptoms were apparent and pressure was heavy.	Lost to poor emergence and drought.	Fall emergence and stands were excellent. Good growth in the spring, but in April Triticum mosaic virus symptoms were apparent and pressure was heavy.	Fall emergence and stands were excellent. Good growth in the spring, but in April Triticum mosaic virus symptoms were apparent and pressure was heavy.	Lost to drought.	Fall emergence and stands were poor. Spring emerged plants helped trial get to final stand of ~75%. Well-timed moisture in the spring and early summer allowed for plant tillering and increased plant density. Sawfly pressure was good yield.	Planted into mixed moisture. Fall emergence and stands were excellent. Good growth in the spring, but in April Triticum mosaic virus symptoms were apparent and pressure was heavy.	Fall emergence and stands were poor. Spring emerged plants helped trial get to final stand of ~75%. Well-timed moisture in the spring and early summer allowed for plant tillering and increased plant density. Sawfly pressure was moderate. May.	Fall emergence and stands were below average with areas of poor emergence. Spring emergence helped final stand. Wheat stem sawfly pressure was moderate. Moderate damage from late season hail.	Fall emergence and stands were below average with areas of poor emergence. Spring emergence helped final stand. Wheat stem sawfly pressure was moderate. Moderate damage from late season hail.	Lost to late season hail.	Planted into mixed moisture. Fall emergence was below average and stands were spotty. Good growth in the spring and some spring emergence noted. Low level of wheat mite noted in April. Heavy yellowing disease pressure received in spring.	Fall emergence and stands were below average. Good moisture through most of fall and winter. Good growth in the spring. Good growth in the spring and some spring emergence noted. Wheat stem sawfly pressure in the later planning date. Wheat stem sawfly present but did not lodge plots.	Planned into mixed moisture. Fall emergence and stands were below average. Good moisture through most of fall and winter. Good growth in the spring and some spring emergence noted. Wheat stem sawfly pressure in the later planning date. Wheat stem sawfly present but did not lodge plots.	Field had water applied immediately after planting. Tral irrigated as needed. Excellent fall emergence and starting in late May due to irrigation equipment applied in late spring. Wheat stem sawfly present at moderate levels but lodging was due to high yield environment.	Good fall emergence as needed. Excellent fall emergence and starting in late May due to irrigation equipment applied in late spring. Wheat stem sawfly present at moderate levels but lodging was due to high yield environment.	Water applied immediately after planting. Excellent fall emergence and starting in late May due to irrigation equipment applied in late spring. Wheat stem sawfly present at moderate levels but lodging was due to high yield environment.

Dashes denote missing information. N/A means not applicable.

Summary of 2025 Dryland Winter Wheat Variety Performance Results

Brand/Source	Market Class	Variety ^a	2025 Multi-Location Average						Wheat Stem Sawfly ^e	2025 Individual Trial Yield ^b								
			Yield ^b	Test		Heading ^d	Sawfly	New Sheridan										
				Yield	Weight			Protein ^c		bu/ac	percent of average	lb/bu	percent	days from	rating (1-9) ^e	Akron	Burlington	Genoa
PlainsGold	HRW	Whistler	67.2	114%	58.0	12.8	1	4	57	72	47	79	65	56	36	76	80	92
PlainsGold	HRW	Breck	64.0	109%	60.0	13.7	-1	4	48	71	51	83	60	58	33	68	77	88
PlainsGold	HRW	Avery	62.6	107%	58.3	12.6	0	4	49	73	46	77	54	62	29	72	73	88
PlainsGold	HRW	Outlaw	61.4	105%	57.0	12.8	-2	3	46	64	47	86	59	58	18	68	69	95
PlainsGold	HRW	Gabriel	61.3	104%	59.0	13.2	1	4	52	71	40	73	65	52	28	67	73	80
PlainsGold	HRW	Byrd	61.1	104%	57.9	12.8	-1	3	50	68	47	76	60	60	23	63	73	88
PlainsGold	HRW	Langin	60.8	104%	57.6	12.7	-2	3	47	66	42	85	61	56	18	67	71	91
AgriPro	HRW	AP Sunbird	60.6	103%	58.7	13.1	0	4	48	70	50	80	56	51	24	68	65	88
PlainsGold	HRW	Monarch	60.4	103%	57.9	12.5	1	3	47	67	41	78	60	53	25	66	68	90
PlainsGold	HRW	Crescent AX	60.3	103%	58.0	12.8	-1	4	48	72	48	75	57	54	24	62	68	91
PlainsGold	HRW	Telluride	60.1	102%	58.0	12.9	0	4	42	73	44	76	54	53	20	67	77	90
Armor	HRW	AR Iron Eagle 22AX	60.1	102%	59.2	12.8	0	3	48	65	48	74	59	54	23	68	65	88
PlainsGold	HRW	Hoyt SF	59.3	101%	58.7	12.9	0	2	46	65	47	69	58	53	26	67	70	88
Kansas Wheat Alliance	HRW	KS Territory	59.3	101%	58.0	13.3	0	4	53	66	47	71	59	40	23	68	70	82
PlainsGold	HRW	Windom SF	59.0	100%	59.0	13.5	-1	1	42	53	51	75	56	52	38	67	61	82
PlainsGold	HRW	Canvas	58.8	100%	59.0	13.0	0	4	46	65	43	72	57	54	29	66	68	84
PlainsGold	HRW	Snowmass 2.0	58.7	100%	57.7	13.0	-1	4	47	66	42	76	55	48	22	68	65	90
PlainsGold	HRW	Byrd CL Plus	58.6	100%	58.1	13.0	1	4	46	64	47	68	62	51	24	63	64	88
PlainsGold	HRW	Sheridan	58.6	100%	57.7	13.0	1	4	41	61	44	72	62	49	25	68	68	83
CROPLAN	HRW	CP7017AX	58.3	99%	59.2	13.1	0	3	49	66	46	75	52	55	23	66	67	86
PlainsGold	HRW	Kivari AX	57.6	98%	56.7	12.5	0	4	37	57	43	79	54	55	36	68	60	86
Kansas Wheat Alliance	HRW	KS Bill Snyder	57.3	98%	58.0	13.3	0	3	42	65	47	68	61	48	20	61	69	83
PlainsGold	HRW	Guardian	56.8	97%	58.7	13.6	0	4	50	59	38	75	53	51	24	65	69	84
PlainsGold	HRW	Broad AX	56.2	96%	55.8	14.1	3	3	43	51	40	72	57	43	37	64	64	78
PlainsGold	HRW	Amplify SF	55.5	95%	58.1	13.3	0	2	39	51	51	65	57	51	33	62	62	81
PlainsGold	HRW	Fortify SF	55.4	94%	57.6	13.3	-1	2	43	64	43	66	55	49	26	61	58	81
Croplan	HRW	CP7869	53.3	91%	57.5	13.4	-2	4	35	47	45	71	53	47	31	63	57	79
Armor	HRW	AR Turret 25	52.8	90%	57.4	13.6	-1	4	35	51	43	70	52	47	23	63	62	79
Croplan	HRW	CP7909	48.5	83%	56.7	13.7	-1	3	25	43	44	74	52	47	19	65	46	72
Experimentals																		
Colorado State University exp.	HRW	CO19410R	63.6	108%	59.2	12.9	0	4	51	77	46	83	55	53	27	68	74	88
Colorado State University exp.	HRW	CO22SF047RA	63.6	108%	58.5	12.6	-1	1	49	66	52	81	66	63	32	68	73	88
Colorado State University exp.	HRW	CO20D036R	63.1	107%	58.0	12.8	-3	3	50	70	55	81	61	56	21	68	69	92
Colorado State University exp.	HRW	CO20022RC	61.8	105%	59.4	12.8	1	5	49	72	45	71	62	55	30	68	72	85
Colorado State University exp.	HRW	CO21D1790R	61.3	104%	58.6	12.5	-1	3	44	65	49	82	68	49	19	69	69	88
Colorado State University exp.	HRW	CO22SF003R	60.2	103%	57.3	13.0	0	2	45	57	42	85	57	50	43	66	61	86
Colorado State University exp.	HRW	CO20D108R	60.0	102%	57.3	12.6	1	4	46	69	35	78	54	60	26	67	73	90
Colorado State University exp.	HRW	CO21SF226R	59.0	100%	59.4	13.1	1	1	44	58	48	69	64	52	32	67	63	82
Colorado State University exp.	HRW	CO21SFD0950R	58.7	100%	55.5	12.9	3	1	48	55	41	80	52	44	42	66	65	80
Colorado State University exp.	HRW	CO18042RA	54.6	93%	56.9	13.2	0	3	39	57	41	79	53	44	22	57	58	85
Colorado State University exp.	HRW	CO20SFD019R	54.4	93%	57.3	13.3	-2	2	40	60	51	70	55	48	14	57	62	83
Colorado State University exp.	HRW	CO21SF263RA	51.1	87%	54.8	14.3	4	3	38	47	40	66	47	48	34	58	56	73
Colorado State University exp.	HRW	CO22SF039M	50.7	86%	57.6	14.6	3	1	37	52	35	59	50	51	41	58	57	73
Average			58.7	100%	57.9	13.1	0	3	45	63	45	75	58	52	27	66	67	85
fLSD (0.30)			2.4		0.6				2	3	4	3	4	4	3	2	4	3
fLSD (0.05)			4.5		1.1				4	5	7	5	8	8	6	4	7	5
Coefficient of Variation (CV)			10.3		1.4				6	5	9	3	8	7	11	3	4	4

^aVarieties grouped according to released varieties or experimentals, and then ranked from highest to lowest yield across nine Colorado trials in 2025.

^bYield adjusted to 12% moisture content. Variety yield and test weight values in the top least significant difference (LSD) yield group are in bold. Multi-location yield and test weight values for each variety are least squares means across the nine sites and not arithmetic averages.

^cProtein adjusted to 12% moisture content and averaged across nine trials in 2025.

^dVarieties with positive values headed later than the trial averages and varieties with negative values headed earlier than average. Based on two trials.

^eWheat Stem Sawfly cutting score: 1 equals no cutting and 9 is severe cutting. Scores are based on four trials.

^fFarmers 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 2025 Dryland Winter Wheat Variety Performance Results- Northeast Region

Brand/Source	Market Class	Variety ^a	2025 Multi-Location Average						2025 Individual Trial Yield ^b					
			Yield ^b	Yield	Test Weight	Protein ^c	Heading ^d	Wheat Stem Sawfly	Akron	Genoa	Julesburg	New Raymer	Orchard	Yuma
			bu/ac	percent of average	lb/bu	percent	days from average	rating (1-9) ^e	bu/ac					
PlainsGold	HRW	Whistler	59.0	115%	57.5	12.8	1	4	57	47	65	56	36	92
PlainsGold	HWW	Breck	56.3	110%	59.5	13.6	-1	4	48	51	60	58	33	88
PlainsGold	HRW	Avery	54.9	107%	57.9	12.9	0	4	49	46	54	62	29	88
PlainsGold	HRW	Byrd	54.6	106%	57.0	13.1	-1	3	50	47	60	60	23	88
PlainsGold	HWW	Windom SF	54.5	106%	58.5	13.8	-1	1	42	51	56	52	38	82
PlainsGold	HRW	Outlaw	54.4	106%	56.3	13.1	-2	3	46	47	59	58	18	95
PlainsGold	HRW	Crescent AX	53.9	105%	57.2	13.0	-1	4	48	48	57	54	24	91
PlainsGold	HRW	Hoyt SF	53.8	105%	58.3	13.2	0	2	46	47	58	53	26	88
Armor	HRW	AR Iron Eagle 22AX	53.7	105%	58.2	13.1	0	3	48	48	59	54	23	88
PlainsGold	HRW	Byrd CL Plus	53.4	104%	57.8	13.5	1	4	46	47	62	51	24	88
AgriPro	HRW	AP Sunbird	53.3	104%	58.1	13.7	0	4	48	50	56	51	24	88
PlainsGold	HWW	Monarch	53.2	104%	57.1	12.8	1	3	47	41	60	53	25	90
PlainsGold	HRW	Gabriel	52.9	103%	57.9	13.6	1	4	52	40	65	52	28	80
PlainsGold	HRW	Langin	52.9	103%	57.0	13.2	-2	3	47	42	61	56	18	91
AgriPro	HRW	AP Solid	52.7	103%	57.6	13.6	3	1	49	46	58	47	37	78
AgriPro	HRW	AP Bigfoot	52.7	103%	57.1	13.9	0	5	49	43	64	54	26	80
CROPLAN	HRW	CP7017AX	52.1	102%	58.2	13.5	0	3	49	46	52	55	23	86
PlainsGold	HRW	Canvas	52.1	102%	58.7	13.4	0	4	46	43	57	54	29	84
PlainsGold	HRW	Amplify SF	52.1	102%	58.0	13.6	0	2	39	51	57	51	33	81
PlainsGold	HRW	Kivari AX	51.4	100%	56.7	12.4	0	4	37	43	54	55	36	86
Kansas Wheat Alliance	HRW	KS Territory	51.1	100%	56.9	14.0	0	4	53	47	59	40	23	82
PlainsGold	HWW	Telluride	51.0	99%	57.1	13.0	0	4	42	44	54	53	20	90
PlainsGold	HRW	Sheridan	50.9	99%	57.0	13.1	1	4	41	44	62	49	25	83
PlainsGold	HWW	Snowmass 2.0	50.9	99%	57.4	13.4	-1	4	47	42	55	48	22	90
PlainsGold	HRW	Guardian	50.4	98%	58.3	14.0	0	4	50	38	53	51	24	84
PlainsGold	HRW	Fortify SF	50.2	98%	57.1	13.5	-1	2	43	43	55	49	26	81
Kansas Wheat Alliance	HRW	KS Homesteader CL+	50.1	98%	58.5	14.4	0	4	53	43	56	43	30	75
PlainsGold	HRW	Broad AX	50.1	98%	55.8	14.4	3	3	43	40	57	43	37	78
Kansas Wheat Alliance	HRW	KS Bill Snyder	49.8	97%	57.3	13.8	0	3	42	47	61	48	20	83
Frenchman Valley Coop	HWW	Valley	49.6	97%	56.2	13.5	0	4	42	40	48	58	29	81
Croplan	HRW	CP7869	48.8	95%	57.1	13.7	-2	4	35	45	53	47	31	79
WestBred	HRW	WB4444	47.8	93%	55.8	14.6	1	1	39	46	52	42	35	71
Armor	HRW	AR Turret 25	46.1	90%	56.9	13.9	-1	4	35	43	52	47	23	79
NU Horizon Genetics	HRW	NHH19668	45.8	89%	56.9	13.9	-1	5	38	42	49	45	19	82
WestBred	HRW	WB4733CLP	44.7	87%	55.6	14.8	2	1	38	39	50	35	37	67
Croplan	HRW	CP7909	43.4	85%	55.7	14.0	-1	3	25	44	52	47	19	72
Montana State University	HRW	MT WarCat	37.3	73%	54.0	15.1	7	2	22	31	47	30	26	64
Experimentals														
Colorado State University exp.	HRW	CO22SF047RA	58.6	114%	57.7	13.0	-1	1	49	52	66	63	32	88
Colorado State University exp.	HRW	CO20D036R	56.0	109%	57.2	13.2	-3	3	50	55	61	56	21	92
Colorado State University exp.	HRW	CO21SF226R	54.1	105%	59.2	13.6	1	1	44	48	64	52	32	82
Colorado State University exp.	HRW	CO19410R	54.0	105%	58.6	13.3	0	4	51	46	55	53	27	88
Colorado State University exp.	HRW	CO20022RC	53.9	105%	59.0	13.1	1	5	49	45	62	55	30	85
Colorado State University exp.	HRW	CO22SF003R	53.9	105%	56.7	13.3	0	2	45	42	57	50	43	86
Colorado State University exp.	HRW	CO21D1790R	52.9	103%	58.4	12.8	-1	3	44	49	68	49	19	88
Colorado State University exp.	HRW	CO20D108R	51.7	101%	56.4	13.3	1	4	46	35	54	60	26	90
Colorado State University exp.	HRW	CO21SFD0950R	51.4	100%	55.4	13.3	3	1	48	41	52	44	42	80
Colorado State University exp.	HWW	CO22SF008WC	51.4	100%	55.9	13.4	2	3	44	44	59	53	29	81
Colorado State University exp.	HRW	CO20SFD019R	49.1	96%	56.5	13.5	-2	2	40	51	55	48	14	83
Colorado State University exp.	HRW	CO22SF039M	47.6	93%	57.4	15.2	3	1	37	35	50	51	41	73
Colorado State University exp.	HRW	CO18042RA	47.6	93%	56.0	13.7	0	3	39	41	53	44	22	85
Colorado State University exp.	HRW	CO21SF263RA	46.4	91%	54.9	14.7	4	3	38	40	47	48	34	73
Colorado State University exp.	HRW	CO22SFD101R	45.2	88%	56.8	13.8	3	2	36	40	46	40	27	76
Average			51.3	100%	57.2	13.6	0	3	44	45	57	51	28	83
^f LSD (0.30)			3.0		0.8									
^f LSD (0.05)			5.8		1.6									
Coefficient of Variation (CV)			15.1		1.9									

^aVarieties grouped according to released varieties or experimentals, and then ranked from highest to lowest yield across six northeast Colorado region trials in 2025.

^bYield adjusted to 12% moisture content. Variety yield and test weight values in the top least significant difference (LSD) yield group are in bold. Multi-location yield and test weight values for each variety are least squares means across the six sites and not arithmetic averages.

^cProtein adjusted to 12% moisture content and averaged across six trials in 2025.

^dVarieties with positive values headed later than the trial averages and varieties with negative values headed earlier than average. Based on two trials.

^eWheat Stem Sawfly cutting score: 1 equals no cutting and 9 is severe cutting. Scores are based on four trials.

^fFarmers 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 2025 Dryland Winter Wheat Variety Performance Results- Southeast Region

Brand/Source	Market Class	Variety ^a	2025 Multi-Location Average				2025 Individual Trial Yield ^b			
			Yield ^b	Yield	Test		Burlington	Sheridan		
					Weight ^b	Protein ^c		Lamar	Lake	Walsh
		bu/ac	percent of average	lb/bu	percent	bu/ac				
PlainsGold	HRW	Whistler	76.9	114%	59.0	12.8	71.6	78.9	75.8	79.6
PlainsGold	HWW	Breck	74.3	110%	60.5	13.9	70.8	83.1	68.4	76.8
PlainsGold	HRW	Avery	73.9	110%	58.8	12.2	72.9	76.7	72.0	73.5
PlainsGold	HWW	Telluride	73.1	109%	59.4	12.7	72.6	76.1	66.7	76.9
PlainsGold	HRW	Langin	72.1	107%	58.3	12.1	65.8	84.6	66.7	71.1
PlainsGold	HRW	Outlaw	71.3	106%	57.9	12.4	63.9	85.6	68.0	69.5
PlainsGold	HRW	Gabriel	70.5	105%	60.5	12.6	71.1	72.5	67.3	73.4
AgriPro	HRW	AP Sunbird	70.3	104%	59.9	12.4	69.7	79.6	67.8	65.5
PlainsGold	HRW	Byrd	70.2	104%	58.9	12.5	67.6	75.9	63.5	72.6
PlainsGold	HWW	Monarch	70.1	104%	59.1	12.2	67.4	77.8	66.3	68.4
PlainsGold	HWW	Snowmass 2.0	69.0	102%	58.4	12.6	65.7	76.2	68.2	64.9
PlainsGold	HRW	Crescent AX	68.8	102%	59.0	12.6	72.0	74.9	61.5	68.2
Armor	HRW	AR Iron Eagle 22AX	68.4	102%	60.3	12.3	65.3	73.6	68.3	65.0
Kansas Wheat Alliance	HRW	KS Territory	68.2	101%	59.2	12.4	65.8	71.4	67.9	69.6
Croplan	HRW	CP7017AX	67.8	101%	60.4	12.5	66.2	74.6	65.5	67.4
PlainsGold	HRW	Canvas	67.7	101%	59.5	12.5	65.4	72.1	65.6	68.5
PlainsGold	HRW	Sheridan	67.6	100%	58.8	12.8	60.9	72.5	68.3	68.5
PlainsGold	HRW	Hoyt SF	67.2	100%	59.2	12.4	65.0	68.5	66.9	70.2
PlainsGold	HRW	Guardian	67.0	100%	59.4	13.1	59.0	75.1	65.5	69.2
PlainsGold	HRW	Kivari AX	66.2	98%	57.2	12.5	56.9	79.1	68.2	59.6
Kansas Wheat Alliance	HRW	KS Bill Snyder	65.7	98%	59.0	12.5	65.4	67.6	61.4	68.7
PlainsGold	HRW	Byrd CL Plus	65.0	97%	58.7	12.4	63.7	67.7	62.7	63.6
PlainsGold	HWW	Windom SF	64.1	95%	59.9	13.0	53.1	75.5	66.6	60.6
PlainsGold	HRW	Broad AX	62.7	93%	56.4	13.7	51.1	71.6	63.9	64.0
PlainsGold	HRW	Fortify SF	62.6	93%	58.4	13.0	64.0	66.0	60.8	58.1
Armor	HRW	AR Turret 25	61.5	91%	58.0	13.1	51.0	69.7	63.2	62.2
PlainsGold	HRW	Amplify SF	59.8	89%	58.7	12.8	51.0	64.5	61.8	61.6
Croplan	HRW	CP7869	59.3	88%	57.9	13.0	47.1	70.9	62.6	57.3
Croplan	HRW	CP7909	57.0	85%	57.7	13.2	43.0	73.6	64.9	46.4
Experimentals										
Colorado State University exp.	HRW	CO19410R	75.8	113%	60.0	12.4	77.3	82.8	67.5	74.2
Colorado State University exp.	HRW	CO20D108R	72.3	107%	58.7	11.7	69.4	77.6	67.1	73.3
Colorado State University exp.	HRW	CO20D036R	71.9	107%	58.8	12.3	69.7	80.6	68.0	69.0
Colorado State University exp.	HRW	CO22SF047RA	71.7	106%	59.6	12.0	65.7	81.2	67.6	73.2
Colorado State University exp.	HRW	CO21D1790R	71.0	105%	58.9	12.0	64.6	81.9	69.1	69.0
Colorado State University exp.	HRW	CO20022RC	70.7	105%	60.2	12.5	72.0	70.5	67.9	71.7
Colorado State University exp.	HRW	CO22SF003R	67.1	100%	58.4	12.6	56.8	84.6	65.8	60.6
Colorado State University exp.	HRW	CO21SFD0950R	66.4	99%	56.4	12.4	55.3	79.9	66.1	65.4
Colorado State University exp.	HRW	CO21SF226R	64.8	96%	59.7	12.6	58.5	69.3	67.4	63.3
Colorado State University exp.	HRW	CO18042RA	62.3	93%	58.1	12.6	56.8	79.1	57.1	58.3
Colorado State University exp.	HRW	CO20SFD019R	62.1	92%	58.7	12.9	59.9	70.0	57.1	61.9
Colorado State University exp.	HRW	CO21SF263RA	56.7	84%	55.2	13.7	47.0	65.6	58.1	56.1
Colorado State University exp.	HRW	CO22SF039M	56.2	83%	58.5	13.7	51.5	58.6	57.8	56.8
Average			67.3	100%	58.8	12.7	62.5	74.5	65.5	66.5
^d LSD (0.30)			3.4		0.6		2.7	2.5	2.3	3.5
^d LSD (0.05)			6.4		1.2		5.1	4.7	4.3	6.6
Coefficient of Variation (CV)			5.0		1.6		4.6	2.8	3.4	4.2

^aVarieties grouped according to released varieties or experimentals, and then ranked from highest to lowest yield across four southeast Colorado trials in 2025.

^bYield adjusted to 12% moisture content. Variety yield and test weight values in the top least significant difference (LSD) yield group are in bold. Multi-location yield and test weight values for each variety are least squares means across the four sites and not arithmetic averages.

^cProtein adjusted to 12% moisture content and averaged across four trials in 2025.

^dFarmers 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-Yr (2024-2025) Dryland Winter Wheat Variety Performance Results

Brand/Source	Market		2-Year Average ^a					
	Class ^b	Variety ^c	Yield		Test Weight		Protein	
			bu/ac	% trial average	lb/bu	% trial average	percent	% trial average
PlainsGold	HRW	Whistler	63.6	111%	58.3	100%	12.3	99%
PlainsGold	HWW	Breck	61.1	106%	59.8	102%	12.7	102%
Colorado State University exp.	HRW	CO19410R	60.8	106%	59.5	102%	12.4	100%
PlainsGold	HRW	Avery	60.7	106%	58.4	100%	11.9	96%
PlainsGold	HRW	Outlaw	60.2	105%	57.4	98%	11.9	96%
PlainsGold	HWW	Telluride	59.3	103%	58.5	100%	12.1	98%
PlainsGold	HRW	Byrd	59.2	103%	58.3	100%	12.2	99%
AgriPro	HRW	AP Sunbird	59.2	103%	59.4	102%	12.3	99%
PlainsGold	HWW	Monarch	59.2	103%	58.6	100%	11.9	96%
PlainsGold	HRW	Langin	58.7	102%	57.9	99%	12.0	97%
PlainsGold	HRW	Crescent AX	58.6	102%	58.3	100%	12.1	98%
Colorado State University exp.	HRW	CO20022RC	58.5	102%	59.4	102%	12.3	99%
Colorado State University exp.	HRW	CO20D108R	58.4	102%	58.2	100%	12.0	97%
CROPLAN	HRW	CP7017AX	58.2	101%	59.3	102%	12.4	100%
PlainsGold	HRW	Hoyt SF	57.8	101%	59.3	101%	12.1	98%
PlainsGold	HRW	Canvas	57.7	101%	59.1	101%	12.5	101%
PlainsGold	HRW	Kivari AX	57.7	101%	57.3	98%	11.9	96%
PlainsGold	HRW	Sheridan	57.6	100%	58.5	100%	12.5	101%
PlainsGold	HRW	Gabriel	57.2	100%	59.2	101%	12.7	102%
PlainsGold	HWW	Snowmass 2.0	57.1	99%	58.4	100%	12.2	99%
PlainsGold	HRW	Byrd CL Plus	56.0	98%	58.4	100%	12.1	98%
PlainsGold	HWW	Windom SF	55.6	97%	58.1	99%	12.8	103%
PlainsGold	HRW	Guardian	55.2	96%	59.3	101%	12.9	104%
Colorado State University exp.	HRW	CO18042RA	54.5	95%	57.6	99%	12.3	99%
PlainsGold	HRW	Amplify SF	54.1	94%	58.7	101%	12.7	102%
PlainsGold	HRW	Fortify SF	53.4	93%	58.2	100%	12.6	102%
Colorado State University exp.	HRW	CO20SFD019R	52.8	92%	58.2	100%	12.7	103%
PlainsGold	HRW	Broad AX	52.7	92%	56.6	97%	13.2	107%
Colorado State University exp.	HRW	CO21SF263RA	48.7	85%	56.0	96%	13.4	108%
Average			57.4	100%	58.4	100%	12.4	100%

^aThe 2-year average yield, test weight, and protein are based on 16 trials (six 2024 and ten 2025 trials).

^bMarket class: HRW=hard red winter wheat; **HWW**=hard white winter wheat.

^cVarieties ranked from highest to lowest average 2-year yield.

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Summary of 3-Yr (2023-2025) Dryland Winter Wheat Variety Performance Results

Brand/Source	Market Class ^b	Variety ^c	3-Year Average ^a					
			Yield		Test Weight		Protein	
			bu/ac	% trial average	lb/bu	% trial average	percent	% trial average
Colorado State University exp.	HRW	CO19410R	66.6	106%	58.7	101%	11.9	101%
PlainsGold	HRW	Whistler	66.4	106%	57.3	99%	11.6	98%
PlainsGold	HWW	Monarch	65.9	105%	58.1	100%	11.5	97%
PlainsGold	HRW	Outlaw	65.1	104%	56.8	98%	11.6	98%
PlainsGold	HWW	Telluride	64.5	103%	58.0	100%	11.6	98%
PlainsGold	HRW	Avery	64.3	103%	57.6	99%	11.3	96%
CROPLAN	HRW	CP7017AX	63.8	102%	58.9	102%	11.9	101%
Colorado State University exp.	HRW	CO20D108R	63.7	102%	57.7	100%	11.6	98%
PlainsGold	HWW	Breck	63.5	102%	59.1	102%	12.0	102%
PlainsGold	HRW	Sheridan	63.2	101%	58.3	101%	12.1	102%
PlainsGold	HWW	Snowmass 2.0	63.1	101%	57.8	100%	11.7	99%
PlainsGold	HRW	Byrd	63.0	101%	58.0	100%	11.6	99%
PlainsGold	HRW	Crescent AX	63.0	101%	58.2	101%	11.7	99%
PlainsGold	HRW	Kivari AX	61.9	99%	56.5	98%	11.4	97%
PlainsGold	HRW	Canvas	61.7	99%	58.2	100%	12.1	102%
PlainsGold	HRW	Langin	61.7	99%	57.2	99%	11.7	99%
PlainsGold	HRW	Gabriel	61.1	98%	58.2	101%	12.1	103%
PlainsGold	HRW	Byrd CL Plus	60.7	97%	57.7	100%	11.7	99%
PlainsGold	HRW	Amplify SF	59.9	96%	58.1	100%	12.3	104%
PlainsGold	HRW	Guardian	59.9	96%	58.8	102%	12.3	104%
Colorado State University exp.	HRW	CO18042RA	59.8	96%	57.3	99%	11.7	99%
PlainsGold	HWW	Windom SF	59.1	94%	57.5	99%	12.1	103%
PlainsGold	HRW	Fortify SF	57.4	92%	57.6	99%	12.0	102%
Average			62.6	100%	57.9	100%	11.8	100%

^aThe 3-year average yield and test weight are based on 26 trials (ten 2025, six 2024, and ten 2023 trials). Protein is based on 23 trials (ten 2025, six 2024, and seven 2023 trials).

^bMarket class: HRW=hard red winter wheat; **HWW**=hard white winter wheat.

^cVarieties ranked from highest to lowest average 3-year yield.

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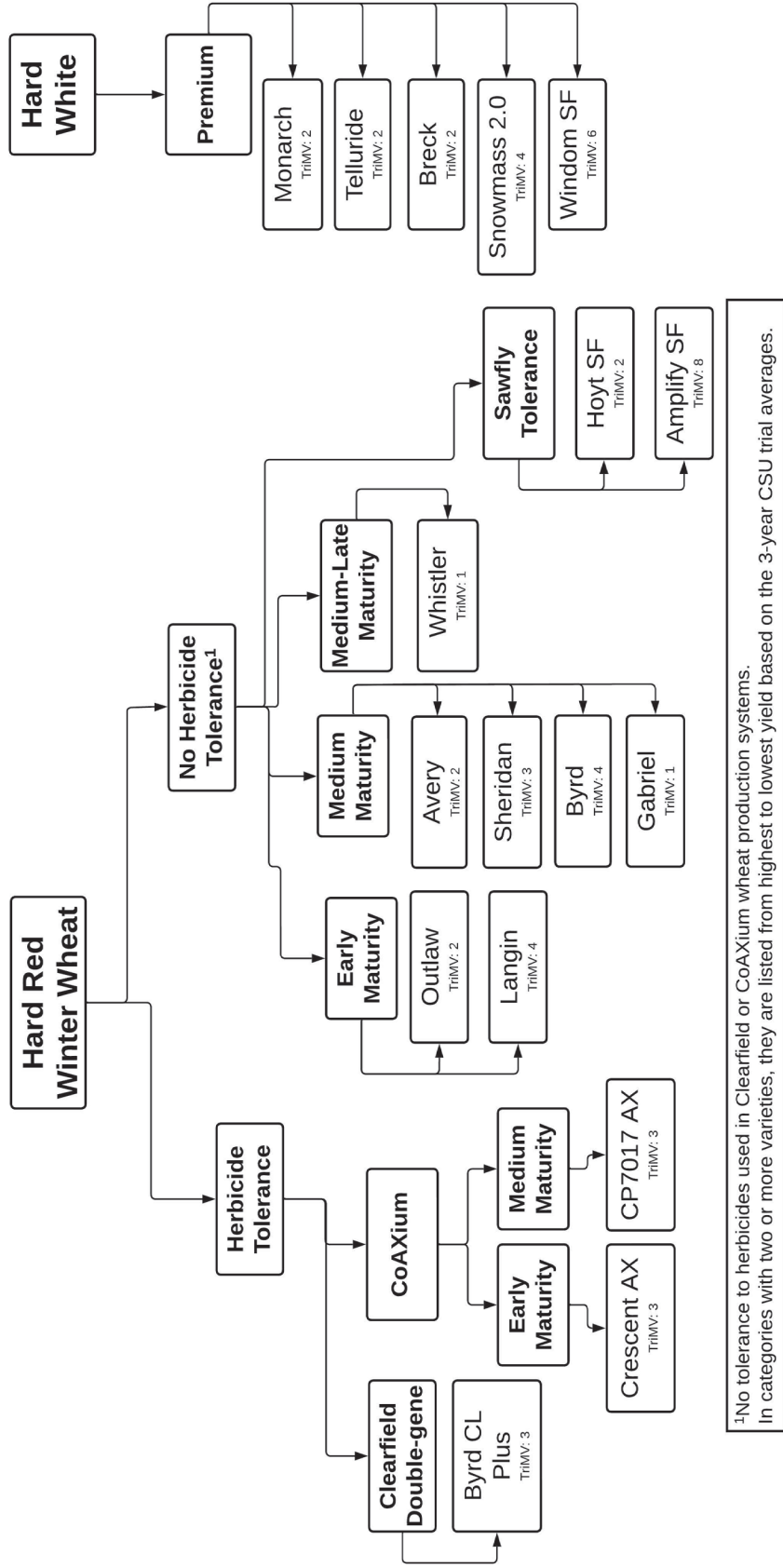
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Summary of 2025 Collaborative On-Farm Test (COFT) Winter Wheat Variety Performance Results

2025 Varieties (ranked left to right by highest yield)

Nearest Town/County	Whistler			Sheridan			Kivari AX			Amplify SF			AP Solid			COFT Average		
	Yield ^a bu/ac	Weight lb/bu	Protein percent	Yield ^a bu/ac	Weight lb/bu	Protein percent	Yield ^a bu/ac	Weight lb/bu	Protein percent	Yield ^a bu/ac	Weight lb/bu	Protein percent	Yield ^a bu/ac	Weight lb/bu	Protein percent	Yield ^a bu/ac	Weight lb/bu	Protein percent
Arriba/Lincoln	60	57	13	51	59	13	60	58	12	68	58	13	53	56	13	59	58	13
Bennett/Adams	39	61	11	37	62	11	47	61	10	48	63	10	37	61	11	42	62	10
Bethune/Kit Carson	43	57	13	43	60	13	41	58	12	38	59	13	40	62	13	41	59	13
Burlington/Kit Carson	56	59	10	61	58	11	47	56	10	48	58	12	45	58	12	51	58	11
Cheyenne Wells/Cheyenne	60	57	13	46	57	14	34	54	13	36	56	13	42	56	15	44	56	14
Eads/Kiowa	15	57	9	19	58	9	20	58	8	15	58	9	15	60	10	17	58	9
Julesburg/Sedgwick	72	59	11	62	59	13	70	58	11	56	59	13	60	60	12	64	59	12
Lamar S/Prowers	65	60	8	54	61	8	56	60	8	47	61	9	48	62	9	54	61	9
Lamar SW/Bent	33	57	13	19	55	15	21	56	15	22	56	15	19	55	16	23	56	15
Platner/Washington	37	57	16	35	57	15	27	56	15	17	56	18	26	56	17	28	56	16
Prospect Valley/Adams	29	57	12	29	58	11	32	59	10	28	59	11	27	60	11	29	58	11
Severance/Weld (Irrigated)	82	61	16	80	-	-	80	59	16	58	60	17	46	61	17	69	60	17
Vilas/Baca	48	60	11	43	60	13	42	60	12	37	60	13	39	60	13	42	60	12
Walsh/Baca	44	55	15	43	57	13	32	56	13	38	57	14	42	57	15	40	56	14
Yuma/Yuma	45	60	10	46	62	10	54	58	9	52	59	10	51	58	10	50	60	10
Average	48.6	58.2	12.0	44.5	58.8	12.1	44.0	57.7	11.6	40.6	58.4	12.6	39.4	58.7	13.0	43.4	58.4	12.3
Yield Significance ^b	A			B			B			C			C			C		

Spring 2026 CSU Dryland Wheat Decision Tree



Summary of 2025 Irrigated Winter Wheat Variety Performance Results

Brand/Source	Market Class	Variety ^a	2025 Multi-Location Average						2025 Individual Trial Yield ^b		
			Yield ^b	Test		Lodging	Heading ^d	Burlington	Fort		
				Yield	Weight				Protein ^c	Collins	Wiggins
			bu/ac	percent of average	lb/bu	percent	score (1-9) ^c	days from average		bu/ac	
PlainsGold	HWW	Telluride	115.6	110%	58.3	13.6	3	0	96	98	153
Limagrain	HRW	LCS Atomic AX	113.4	108%	59.5	14.1	3	-4	99	93	149
PlainsGold	HRW	Canvas	111.4	106%	60.3	13.6	4	0	91	97	146
Colorado State University exp.	HRW	CO20022RC	110.9	106%	60.5	13.9	7	0	93	94	146
PlainsGold	HRW	Sheridan	110.4	105%	59.2	13.4	3	1	87	102	142
PlainsGold	HWW	Monarch	109.4	104%	59.4	13.0	2	1	89	98	142
PlainsGold	HRW	Crescent AX	108.4	104%	59.5	14.5	7	-1	90	94	141
PlainsGold	HWW	Snowmass 2.0	108.1	103%	59.1	13.9	1	0	90	94	140
AgriPro	HRW	AP Sunbird	108.0	103%	59.5	14.0	4	-1	100	82	142
PlainsGold	HRW	Breck	107.0	102%	60.0	14.7	5	0	86	91	143
Limagrain	HRW	LCS Steel AX	105.8	101%	58.9	14.0	4	3	70	114	133
Armor	HRW	AR Iron Eagle 22AX	105.1	100%	59.6	13.7	6	-2	94	92	130
PlainsGold	HRW	Hoyt SF	105.0	100%	58.7	13.5	6	1	89	97	129
PlainsGold	HRW	Byrd CL Plus	104.9	100%	58.2	13.7	7	0	85	95	135
Limagrain	HRW	LCS Helix AX	104.9	100%	58.8	13.6	5	-2	94	79	142
PlainsGold	HRW	Guardian	104.8	100%	59.7	14.5	5	1	83	107	124
PlainsGold	HRW	Amplify SF	104.1	99%	59.5	13.8	5	1	77	100	136
Colorado State University exp.	HWW	CO22SF008WC	103.7	99%	58.1	13.7	8	0	83	96	133
PlainsGold	HRW	Kivari AX	102.7	98%	57.8	13.1	9	0	77	103	128
University of Nebraska-Lincoln exp.	HRW	NE18435	102.4	98%	59.5	13.7	4	-1	79	89	140
Armor	HRW	AR Turret 25	101.6	97%	58.3	13.7	6	-2	76	89	140
Limagrain	HRW	LCS Radar	101.6	97%	58.8	14.5	2	-3	88	78	139
PlainsGold	HWW	Windom SF	100.8	96%	59.8	13.9	9	-1	83	85	134
Limagrain	HRW	LCS Mojo	100.6	96%	58.5	13.7	1	0	75	83	143
Croplan	HRW	CP7909	97.8	93%	58.4	13.8	1	-4	65	88	140
Croplan	HRW	CP7869	97.5	93%	58.6	13.8	3	-3	74	85	134
PlainsGold	HRW	Broad AX	97.5	93%	56.4	14.9	4	3	63	103	127
Colorado State University exp.	HRW	CO21SF263RA	87.6	84%	55.5	15.2	7	4	61	98	103
Average			104.7	100%	58.9	13.9	5	0	84	94	137

^aVarieties ranked from highest to lowest yield across three irrigated trials in 2025.

^bYield adjusted to 12% moisture content. Multi-location yield and test weight values for each variety are arithmetic averages from across the three sites and could not be statistically analyzed due to the wide variation among sites.

^cProtein adjusted to 12% moisture content and averaged across three trials in 2025.

^dVarieties with positive values headed later than the trial averages and varieties with negative values headed earlier than average. Based on one trial.

^eLodging score: 1 equals no lodging and 9 is severe lodging. Scores from one trial in 2025.

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Summary of 2-year (2024-2025) Irrigated Winter Wheat Variety Performance Results

Brand/Source	Market Class ^b	Variety ^c	2-Year Average ^a						
			Yield		Test Weight		Protein	Height	Lodging
			bu/ac	% trial average	lb/bu	% trial average	percent	in	score (1-9) ^d
PlainsGold	HWW	Telluride	118.4	105%	59.1	99%	13.1	33	2
Colorado State University exp.	HRW	CO20022RC	117.5	104%	61.0	102%	13.3	33	3
PlainsGold	HRW	Canvas	116.8	103%	60.6	102%	13.3	31	2
PlainsGold	HRW	Sheridan	116.3	103%	60.0	101%	13.1	33	2
PlainsGold	HWW	Monarch	115.9	103%	59.7	100%	12.8	32	1
PlainsGold	HRW	Crescent AX	115.7	103%	59.6	100%	13.6	33	7
PlainsGold	HRW	Hoyt SF	114.7	102%	60.1	101%	12.9	31	2
PlainsGold	HWW	Breck	113.6	101%	60.6	102%	14.2	32	3
Limagrain	HRW	LCS Atomic AX	113.0	100%	60.0	101%	13.6	31	2
PlainsGold	HWW	Snowmass 2.0	112.2	99%	59.4	100%	13.4	31	1
PlainsGold	HRW	Byrd CL Plus	111.9	99%	59.1	99%	13.4	35	4
PlainsGold	HRW	Kivari AX	111.2	99%	58.1	97%	12.7	32	7
PlainsGold	HRW	Amplify SF	111.0	98%	59.9	101%	13.4	34	2
PlainsGold	HWW	Windom SF	110.5	98%	59.5	100%	13.4	30	3
PlainsGold	HRW	Guardian	110.3	98%	60.1	101%	14.0	33	2
Limagrain	HRW	LCS Steel AX	109.7	97%	59.1	99%	13.6	35	2
Limagrain	HRW	LCS Radar	108.2	96%	59.1	99%	14.2	31	1
PlainsGold	HRW	Broad AX	105.0	93%	57.0	96%	14.5	33	3
Average			112.9	100%	59.6	100%	13.5	32	3

^aThe 2-year average yield, test weight, and protein are based on six trials (three 2025 and three 2024). Plant heights are based on five trials (two 2025 and three 2024). Lodging is based on four trials (one 2025 and three 2024).

^bMarket class: HRW=hard red winter wheat; **HWW**=hard white winter wheat.

^cVarieties ranked from highest to lowest average 2-year yield.

^dLodging score: 1 equals no lodging and 9 is severe lodging.

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Summary of 3-Year (2023-2025) Irrigated Winter Wheat Variety Performance Results

Brand/Source	Market Class ^b	Variety ^c	3-Year Average ^a						
			Yield	Yield	Test Weight	Test Weight	Protein	Height	Lodging
			bu/ac	% trial average	lb/bu	% trial average	percent	in	score (1-9) ^d
PlainsGold	HRW	Sheridan	113.2	105%	59.6	101%	12.8	33	2
PlainsGold	HWW	Monarch	112.7	104%	59.2	101%	12.4	31	1
PlainsGold	HWW	Telluride	112.0	103%	58.3	99%	12.8	32	2
PlainsGold	HRW	Canvas	110.5	102%	59.5	101%	13.0	31	2
PlainsGold	HRW	Crescent AX	110.2	102%	59.4	101%	13.2	33	7
PlainsGold	HRW	Amplify SF	108.5	100%	59.3	101%	13.2	34	3
PlainsGold	HRW	Byrd CL Plus	108.4	100%	58.4	99%	13.0	35	4
PlainsGold	HRW	Guardian	107.5	99%	59.5	101%	13.6	33	3
PlainsGold	HWW	Snowmass 2.0	107.1	99%	58.4	99%	13.1	31	2
PlainsGold	HWW	Breck	106.3	98%	59.5	101%	13.7	32	3
Limagrain	HRW	LCS Atomic AX	106.3	98%	59.5	101%	13.2	32	3
Limagrain	HRW	LCS Steel AX	105.6	98%	58.8	100%	13.3	33	2
PlainsGold	HWW	Windom SF	104.5	96%	58.4	99%	13.1	31	3
PlainsGold	HRW	Kivari AX	103.4	95%	57.3	97%	12.2	32	7
Average			108.3	100%	58.9	100%	13.0	32	3

^aThe 3-year average yield and test weight are based on nine trials (three each year). Protein is based on eight trials (three 2025 and 2024, and two 2023). Plant heights and lodging are based on seven trials (two 2025, three 2024, and two 2023).

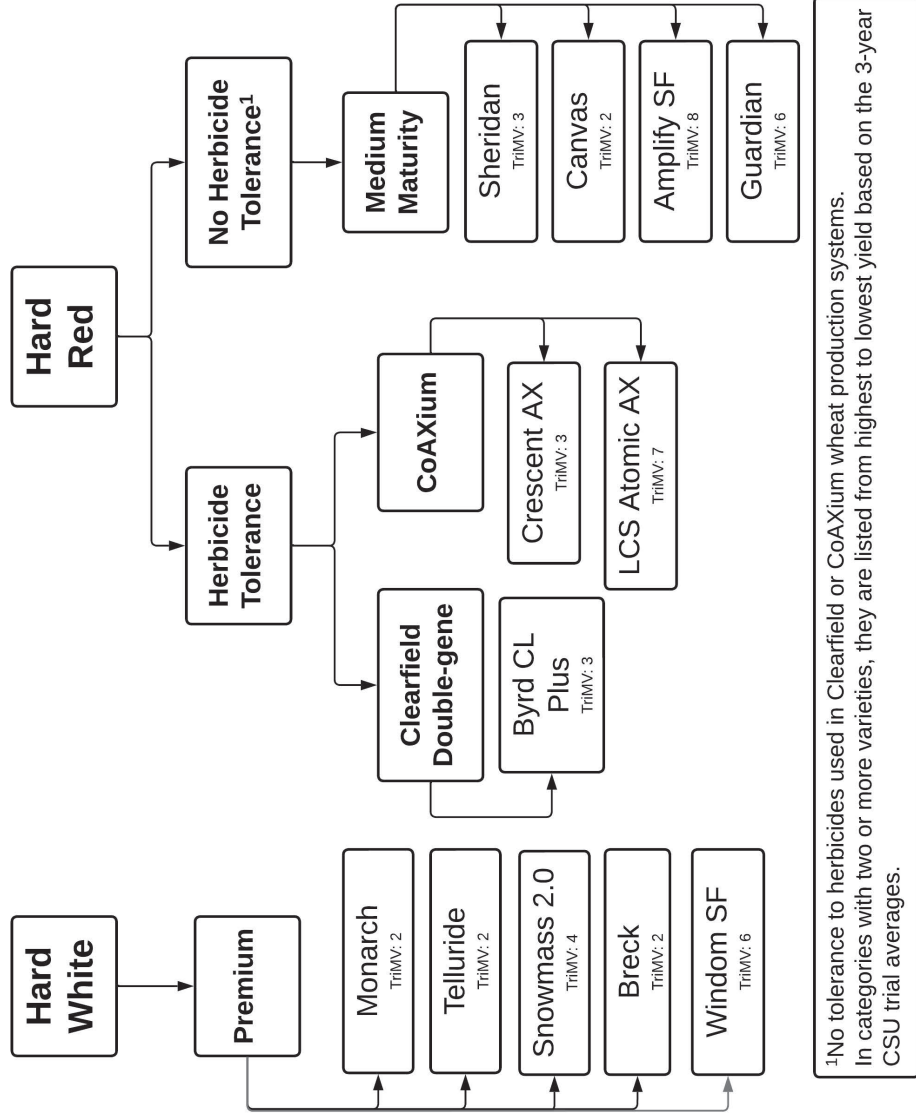
^bMarket class: HRW=hard red winter wheat; **HWW**=hard white winter wheat.

^cVarieties ranked from highest to lowest average 3-year yield.

^dLodging score: 1 equals no lodging and 9 is severe lodging.

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Spring 2026 CSU Irrigated Wheat Decision Tree



2025 Small Grain Forage Trial Results

Sally Jones-Diamond, Jason Webb, Kat Caswell, and Ron Meyer

The 2024-2025 growing season was the fourth year 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.

Testing Methods:

Entries were planted in small plots (6' by 30') at three dryland locations: Akron, Burlington, and Orchard. Each site had a minimum of eight entries, up to ten. The eight core varieties tested at all sites were Ray, Willow Creek, MTF1435, MT Cash, OK Corral, Big Country, Whistler, and Amplify SF. Amplify SF and Whistler are traditional, non-forage wheat varieties that were included. Akron had two additional entries, KWS Aviator and KWS Progas, which are hybrid rye.

Forage sub-samples were cut from the center of the plots as each variety reached the early heading stage (Akron) or at a single date (Orchard and Burlington) to determine forage yield and quality. If the entries were harvested on one date, the growth stage of each plot was reported. Forage wet and dry weights were obtained and used to calculate dry matter yield. Hay quality information was based on NIR analyses done by Dairyland Laboratories in Acadia, WI. The remainder of the plots were harvested for grain (yield area adjusted to account for forage sampling), and grain test weight 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 entries within a location.

2025 Dryland Winter Forage Variety Performance Trials at Akron, Burlington, and Orchard

Akron

Brand/Source	Variety	Forage Species ^b	Forage Harvest			Grain Harvest				Forage Quality ^a								
			Dry Matter Yield ton/ac	Moisture % at harvest	Harvest Date ^c	Test			Plant Height in	Dry				NEL Mcal/cwt	NEG lb/ton			
						Yield lb/ac	Weight lb/bu	Protein percent		RFQ	CP	Matter	aNDFom percent			NDFD30	TDN	
Montana State Univ.	MTF1435	W	5.7	66	29-May	2730	50.5	15	40	114	12.6	93.6	55	59	59	61	34	2578
KWS Cereals	PROGAS	H. Rye	5.3	68	12-May	5097	49.8	11	48	115	14.2	94.1	57	60	60	62	36	2655
PlainsGold	Ray	W	5.3	62	29-May	3312	51.3	14	34	130	13.0	93.7	52	62	62	64	37	2791
PlainsGold	Whistler	W	5.3	66	21-May	4508	55.0	13	36	136	12.8	93.9	49	61	62	64	38	2848
PlainsGold	Amplify SF	W	5.2	66	21-May	3059	54.0	13	33	138	13.9	93.3	49	62	63	65	39	2871
KWS Cereals	AVIATOR	H. Rye	5.0	69	12-May	4768	49.9	9	51	112	13.3	93.5	58	59	59	61	34	2592
Oklahoma Genetics, Inc	Big Country	W	5.0	64	21-May	2790	54.8	14	31	159	12.6	94.4	48	66	64	66	40	3085
Montana State Univ.	MT Cash	W	4.7	65	29-May	2763	54.2	15	43	124	13.2	93.4	53	60	61	63	36	2744
Oklahoma Genetics, Inc	OK Corral	W	4.3	64	21-May	3884	52.5	12	28	141	12.5	93.5	48	61	63	65	38	2893
Montana State Univ.	Willow Creek	W	4.2	62	2-Jun	1621	53.9	-	40	127	13.7	93.8	52	60	61	62	36	2736
Average			5.0	65	22-May	3453	52.6	13	39	130	13.2	94	52	61	62	63	37	2779
LSD (0.30) ^d			0.40			175	0.9											
LSD (0.05) ^d			0.70			345	1.7											
Coefficient of Variation (CV)			6.6			4.8	1.1											

Burlington

Brand/Source	Variety	Forage Species ^b	Forage Harvest			Grain Harvest				Forage Quality ^a								
			Dry Matter Yield ton/ac	Moisture % at harvest	Harvest Growth Stage ^c	Test			Plant Height in	Dry				NEL Mcal/cwt	NEG lb/ton			
						Yield bu/ac	Weight lb/bu	Protein percent		RFQ	CP	Matter	aNDFom percent			NDFD30	TDN	
Montana State Univ.	MTF1435	W	5.9	53	Soft Dough	45.2	47.9	17	34	144	11.1	90.3	49	47	63	65	38	2969
PlainsGold	Whistler	W	5.8	52	Soft Dough	71.4	54.3	15	32	141	10.1	88.4	48	52	63	65	38	2977
PlainsGold	Ray	W	5.2	55	Milk	51.1	46.6	16	32	139	10.2	90.0	52	55	61	63	35	2905
Oklahoma Genetics, Inc	Big Country	W	5.2	52	Soft Dough	47.4	53.8	16	31	150	12.7	90.1	46	50	63	65	39	3025
Montana State Univ.	MT Cash	W	5.2	54	Soft Dough	41.5	53.3	17	42	131	10.5	89.4	52	44	62	63	36	2768
PlainsGold	Amplify SF	W	4.8	50	Soft Dough	48.7	54.3	15	28	154	11.6	90.8	46	49	65	67	41	3111
Oklahoma Genetics, Inc	OK Corral	W	4.5	50	Soft Dough	64.9	52.5	15	26	143	11.2	90.4	48	49	63	65	38	2930
Montana State Univ.	Willow Creek	W	4.1	54	Milk	20.9	47.4	-	39	111	11.2	89.7	58	50	55	56	27	2359
Average			5.1	52		48.9	51.3	16	33	139	11.1	90	50	50	62	63	36	2881
LSD (0.30) ^d			0.4			2.3	0.9											
LSD (0.05) ^d			0.9			4.6	1.9											
Coefficient of Variation (CV)			6.7			5.0	1.2											

Orchard

Brand/Source	Variety	Forage Species ^b	Forage Harvest			Grain Harvest				Forage Quality ^a								
			Dry Matter Yield ton/ac	Moisture % at harvest	Harvest Growth Stage ^c	Test			Plant Height in	Dry				NEL Mcal/cwt	NEG lb/ton			
						Yield bu/ac	Weight lb/bu	Protein percent		RFQ	CP	Matter	aNDFom percent			NDFD30	TDN	
Oklahoma Genetics, Inc	OK Corral	W	1.7	70	10.5	33.0	56.2	14	30	184	15.7	89.2	49	69	65	67	43	3393
PlainsGold	Whistler	W	1.6	72	10.4	39.7	59.2	14	27	191	14.7	88.1	48	70	65	67	42	3327
PlainsGold	Ray	W	1.5	72	10.2	29.0	55.5	16	34	180	16.5	89.4	48	70	66	68	44	3369
Montana State Univ.	MTF1435	W	1.3	73	10.3	21.5	54.2	15	32	178	17.5	88.2	50	72	64	65	41	3322
Oklahoma Genetics, Inc	Big Country	W	1.3	71	10.5	16.8	52.9	16	28	198	15.6	90.1	47	70	66	68	44	3493
PlainsGold	Amplify SF	W	1.2	72	10.5	31.7	58.5	14	28	167	13.6	89.9	50	61	65	67	41	3185
Montana State Univ.	MT Cash	W	1.2	74	10.1	25.5	55.5	17	38	170	16.9	89.4	48	68	64	66	42	3241
Montana State Univ.	Willow Creek	W	0.9	74	9	24.6	54.1	16	35	154	20.6	88.1	45	64	63	65	42	3068
Average			1.3	72	10.2	27.7	55.8	15	31	178	16.4	89	48	68	65	67	42	3300
LSD (0.30) ^d			0.2			2.8	1.0											
LSD (0.05) ^d			0.5			5.5	1.9											
Coefficient of Variation (CV)			13.7			9.7	1.6											

^aAll forage quality analyses results are dry basis values. CP=crude protein; RFQ=relative feed quality; aNDFom=ash free neutral detergent fiber; NDFD30=neutral detergent fiber digestibility at 30 hours; TDN=total digestible nutrients using OARDC; NEL=net energy for lactation using OARDC; NEG=net energy gain using OARDC; and Milk/ton=predicted amount of milk produced per ton of dry matter calculated using MILK2013.

^bForage Species: H. Rye=Hybrid Rye and W=Wheat

^cThe harvest dates at Akron were targeted for the early heading growth stage of each entry. The harvest growth stages at Burlington and Orchard were the stage of each entry on the single harvest date of June 16. The Feekes scale rates the flag leaf fully emerged as stage 9, and boot to early heading as stages as 10.1 (boot) through 10.5 (head fully emerged).

^dIf 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 9 (Burlington), July 10 (Akron), and July 17 (Orchard).

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Description of Winter Wheat Varieties in Eastern Colorado Dryland and Irrigated Trials (2025-2026)

Name/Class/Pedigree	Origin	HD	HT	SS	COL	YR	LR	SR	WSMV ^{**}	TriMV ^{**}	WSS ⁺	TW	PRO ⁺⁺	MILL	BAKE	Comments
Amplify SF	2021	6	7	4	7	6	3	2	8	8	1	3	3	3	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. CSO sunsets harvest 2026.
Hard red winter Bearpaw/Antero//Antero																
AP Bigfoot	AgriPro 2022	4	5	3	2	6	2	2	4	2	7	3	4	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 Solid	AgriPro 2021	7	3	3	5	8	6	5	5	2	1	2	2	3	5	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																
AP Sunbird	AgriPro 2023	3	4	4	5	7	2	5	3	2	9	2	2	2	4	AgriPro release (2024). First entered in CSU variety trials in 2023. Early to medium early variety with moderately strong WSMV resistance. Very good milling and baking qualities.
Hard red winter Undisclosed																
AR Iron Eagle 22AX	Armor Seed 2023	4	3	4	2	4	--	--	5	3	6	5	7	--	--	Armor Seed release (2023). First entered in CSU variety trials in 2025. Dual-purpose variety for grain or grazing. Good straw strength and test weight.
Hard red winter Undisclosed																
AR Turret 25	Armor Seed 2023	4	5	5	3	3	3	3	9	9	9	5	4	--	--	Armor Seed release (2023). First entered in CSU variety trials in 2025. Medium maturity. Moderately resistant to stripe rust. Very good test weight and protein.
Hard red winter Undisclosed																
Avery	CSU 2015	5	7	5	6	6	8	8	1	2	7	5	6	3	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																
Bernd	KS-USDA 2025	5	4	3	--	4	3	1	1	1	--	4	3	3	6	USDA-ARS release and co-developed with CSU. First entered into the CSU variety trials in 2026. Excellent WSMV and TriMV resistance (Wsm7) with wheat curl mite resistance. Very good straw strength. Commercial release pending.
Hard red winter Wsm1-Overley/Fuller//CO050270/3/CO050337-2 F2/4/Byrd																
Breakthrough	OK 2020	5	3	5	2	6	6	3	2	2	--	2	4	2	3	OSU release (2020). Good resistance to WSMV based on Wsm7 and stem rust. Very good test weight and milling quality, and above-average protein.
Hard red winter Wsm1-Overley/Fuller//CO050270/3/CO050337-8																

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), yellowing disease (YD), 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. A priority is given to data collected in Colorado. Regional data or developer input is utilized when Colorado specific data is unavailable.

* 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 and TriMV 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. Lines susceptible to TriMV have been shown to contain high levels of *Triticum mosaic virus*.

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++ 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 (2025-2026)

Name/Class/Pedigree	Origin	HD	HT	SS	COL	YR	LR	SR	WSMV ^{**}	TriMV ^{**}	WSS [†]	TW	PRO ^{††}	MILL	BAKE	Comments
Breck	CSU 2017	5	5	5	8	8	5	2	4	2	7	2	2	2	4	CSU release (2017), marketed by PlainsGold in CWRP-Arden 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	CSU 2025	7	6	5	7	3	--	--	6	2	3	8	2	4	9	CSU release (2025), first entered into the CSU trials in 2024. Semi-solid stem (13 out of 25) for partial resistance to wheat stem sawfly. CoAXium wheat for winter annual grassy weed control. Certified seed only.
Broad AX	CSU 2011	4	6	5	5	8	7	8	4	4	7	4	5	3	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 <i>Cmca4</i> for moderate resistance to WSMV and has tolerance to TriMV.
Hard red winter TAM 112/CO970547-7	CSU 2018	5	8	5	5	5	5	8	4	3	5	5	6	4	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. Tolerant to TriMV. Certified seed only.
Canvas	CSU 2018	5	4	2	6	4	6	2	2	2	6	3	4	2	3	CSU release (2018), marketed by PlainsGold. Hard red winter, medium maturing, medium-short, good straw strength. Good stripe and stem rust resistance. Carries <i>Cmca4</i> for moderate resistance to WSMV and has tolerance to TriMV. Good test weight and milling and baking quality.
Hard red winter Denali/Antero//Byrd	CSU 2025	5	4	5	5	4	8	2	1	2	6	2	5	3	2	CSU release (2025), first entered into the CSU trials in 2023. Carries <i>Cmca4</i> for moderate resistance to WSMV and has tolerance to TriMV. Moderate susceptibility to stripe rust and good resistance to stem rust. Good milling and baking quality. Potential release in 2026.
CO19410R	CSU EXP	5	5	4	6	5	--	--	2	2	8	3	7	1	4	CSU experimental line, first entered in the CSU trials in 2024. Two-gene Clearfield. Carries <i>Cmca4</i> for wheat curl mite resistance and has tolerance to TriMV. Potential release in 2026.
Hard red winter CO14079RC/CO12D075	CSU EXP	1	3	3	5	3	--	--	6	4	5	3	3	5	4	CSU wheat breeding line. Very early maturity. Carries <i>Cmca4</i> for wheat curl mite resistance and has tolerance to TriMV.
CO20D036R	CSU EXP	6	5	3	7	4	5	1	1	1	5	5	7	3	3	CSU experimental line, first entered into the CSU trials in 2023. Carries <i>Cmca4</i> for moderate resistance to WSMV and has tolerance to TriMV. Moderate resistance to stripe rust and good resistance to stem rust. Good milling and excellent baking quality. Potential release in 2025.
Hard red winter CO13D1320/Valley//Canvas	CSU EXP	6	5	3	7	4	5	1	1	1	5	5	7	3	3	CSU experimental line, first entered into the CSU trials in 2023. Carries <i>Cmca4</i> for moderate resistance to WSMV and has tolerance to TriMV. Moderate resistance to stripe rust and good resistance to stem rust. Good milling and excellent baking quality. Potential release in 2025.

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), yellowing disease (YD), 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. A priority is given to data collected in Colorado. Regional data or developer input is utilized when Colorado specific data is unavailable.

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** WSMV and TriMV 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. Lines susceptible to TriMV have been shown to contain high levels of *Triticum mosaic virus*.

† 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. See comments for solidness rating.

†† 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 (2025-2026)

Name/Class/Pedigree	Origin	HD	HT	SS	COL	YR	LR	SR	WSMV	TriMV	WSS	TW	PRO	MILL	BAKE	Comments
CO21D1790R Hard red winter	CSU EXP	4	2	3	7	3	--	--	2	3	4	3	6	5	1	CSU wheat breeding line. Carries <i>Cmca4</i> for wheat curl mite resistance and has tolerance to TriMV. <i>Bx70e</i> for strong mixing and high-end baking quality.
CO21SF226R Hard red winter	CSU EXP	5	6	9	9	9	--	--	6	5	1	1	3	4	7	CSU breeding line with semi-solid stem (19/25) for partial resistance to wheat stem sawfly.
CO15SFD088/CO15SFD067//CO16SF075																
CP7017AX Hard red winter Undisclosed	Croplan 2020	4	2	6	2	5	4	1	3	3	7	3	6	3	7	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 soilborne mosaic virus. Certified seed only.
CP7462 Hard red winter Undisclosed	Croplan 2022	3	5	1	--	2	5	3	6	--	--	5	--	--	--	CROPLAN by WinField United release (2022). First entered in CSU variety trials in 2026. Medium early maturity, excellent straw strength, and average test weight and protein.
CP7599CLP Hard red winter Undisclosed	Croplan 2025	5	5	3	--	5	5	6	3	--	--	2	--	--	--	CROPLAN by WinField United release (2025). First entered in CSU variety trials in 2026. Medium maturity, good resistance to WSMV, and very good test weight.
CP7869 Hard red winter Undisclosed	Croplan 2017	4	4	4	4	2	1	1	8	8	8	5	5	2	6	CROPLAN by WinField United release (2017). First entered into CSU trials in 2020. High yield potential, strong straw, good test weight. Good resistance to leaf, stem, and stripe rusts.
CP7909 Hard red winter Undisclosed	Croplan 2018	4	4	5	4	7	5	5	8	8	6	5	6	3	6	CROPLAN by WinField United release (2018). First entered into CSU trials in 2020. Excellent yields and higher protein potential with very good winterhardness, broad adaptation, and excellent soilborne mosaic resistance.
Crescent AX Hard red winter (AF28/Byrd)//(AF10/2*Byrd)	CSU 2018	3	7	8	4	6	6	--	2	3	7	3	6	3	2	CSU release (2018), marketed by PlainsGold. CoAXium wheat for winter annual grassy weed control. <i>AeEah1er</i> and much improved yield and test weight relative to incline AX. Intermediate reaction to stripe rust. Carries <i>Cmca4</i> for moderate resistance to WSMV and has tolerance to TriMV. Certified seed only.
Fortify SF Hard red winter Byrd/Bearpaw//Byrd	CSU 2019	4	6	6	5	6	7	4	3	2	2	3	5	3	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.

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), yellowing disease (YD), 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. A priority is given to data collected in Colorado. Regional data or developer input is utilized when Colorado specific data is unavailable.

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Name/Class/Pedigree	Origin	HD	HT	SS	COL	YR	LR	SR	WSMV**	TriMV**	WSS**	TW	PRO**	MILL	BAKE	Comments	
Gabriel	CSU 2024	6	4	3	7	4	5	1	1	1	1	5	3	4	3	4	CSU release (2024), marketed by PlainsGold. First entered into the CSU trials in 2023. Similar performance as Canvas. Resistant to the wheat curl mite and carries <i>Wsm3</i> , with broad resistance against the mosaic virus complex. Moderate resistance to stripe rust and stem rust. Good milling and baking quality. Acid soil tolerant. Certified seed only.
Hard red winter Canvas/X170868/Canvas																	
Guardian	CSU 2019	6	7	6	7	4	4	2	4	6	7	2	2	3	3	3	CSU release (2019), marketed by PlainsGold. Medium height, medium maturity. Good resistance to WSMV due to combination of resistance to wheat curl mite and the virus itself via <i>Wsm2</i> . 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																	
Hoyt SF	CSU 2025	6	4	4	2	5	--	--	4	2	2	3	7	2	2	8	CSU release (2025) marketed by PlainsGold. First entered into the CSU trials in 2024. Semi-solid stem (15 out of 25) for partial resistance to wheat stem sawfly. Certified seed only.
Hard red winter CO16SFD020/CO16SF029																	
Kivari AX	CSU 2020	5	6	8	6	7	8	5	6	6	5	6	8	3	3	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.
Hard red winter (AF28/Byrd)/(AF10/2*Byrd)																	
KS Bill Snyder	KS-Hays 2023	5	3	1	4	4	2	3	2	2	6	5	6	--	--	--	KSU release (2023), marketed by Kansas Wheat Alliance. Medium maturity with moderate stripe rust resistance. Average test weight. Certified seed only (CSO) variety.
Hard red winter KS11HW15-4-1/KS060476-M-6																	
KS Homesteader CL+	KS-Hays 2024	6	5	4	--	2	7	4	2	4	7	4	4	--	--	--	KSU release (2023), marketed by Kansas Wheat Alliance. Two-gene Clearfield wheat. Medium-late maturity. Resistant to stripe rust and has higher temperature resistance to WSMV. Certified seed only (CSO) variety.
Hard red winter KS14-50809/Brawl CL Plus																	
KS Territory	KS-Hays 2022	5	4	3	3	2	4	4	3	2	7	5	4	5	7	7	KSU release (2022), marketed by the Kansas Wheat Alliance. First entered in the CSU trial in 2023. Medium maturity, excellent straw strength, and resistant to WSMV and Triticum mosaic virus (TriMV).
Hard red winter KS11HW15/TX10A001006																	
KS Tradition	KS-Hays 2025	8	7	4	5	2	2	2	3	--	--	5	--	--	--	--	KSU release (2025), marketed by Kansas Wheat Alliance. Late maturity, resistant to leaf stem and stripe rust, and moderately resistant to BYDV and tolerant to WSMV. Average test weight and protein.
Hard red winter Joel/KS14-50809/Bentley																	
Langin	CSU 2016	2	3	8	3	2	6	8	4	4	7	5	6	4	3	3	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), yellowing disease (YD), 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. A priority is given to data collected in Colorado. Regional data or developer input is utilized when Colorado specific data is unavailable.

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Description of Winter Wheat Varieties in Eastern Colorado Dryland and Irrigated Trials (2025-2026)

Name/Class/Pedigree	Origin	HD	HT	SS	COL	YR	LR	SR	WSMV*	TriMV**	WSS†	TW	PRO**	MILL	BAKE	Comments
LCS Atomic AX Hard red winter Undisclosed	Limagrain 2019	3	4	4	5	3	2	9	--	7	7	6	5	4	5	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 Caballero AX Hard red winter Undisclosed	Limagrain 2025	8	8	1	--	8	8	--	1	--	--	3	--	--	--	Limagrain release (2025). Late maturity and excellent straw strength. Susceptible to stripe and leaf rust, but resistant to WSMV. Very good test weight.
LCS Helix AX Hard red winter Undisclosed	Limagrain 2019	4	4	4	6	5	4	2	--	8	3	8	4	4	4	Limagrain release (2018), first entered in CSU Variety Trials in 2020. CoAXium wheat for winter annual grassy weed control. Broad adaptation, good resistance to stem rust and Fusarium head blight. Certified seed only.
LCS High Noon Hard red winter Undisclosed	Limagrain 2016	5	7	1	--	1	1	--	5	--	--	4	--	--	--	Limagrain release (2016). Medium maturity dual-purpose wheat. Resistant to stripe and leaf rust, but susceptible to WSMV. Good test weight and protein.
LCS Mojo Hard red winter Undisclosed	Limagrain 2023	5	7	4	2	9	--	--	2	--	4	4	5	5	5	Limagrain release (2023). Medium maturity with good straw strength. Strong resistance to WSMV. Good test weight and protein.
LCS Radar Hard red winter Undisclosed	Limagrain 2024	2	4	4	3	1	2	5	3	2	8	4	3	3	4	Limagrain release (2024). First entered into the CSU trials in 2024. Broadly adapted across the Great Plains, very good to excellent stripe and leaf rust resistance.
LCS Steel AX Hard red winter LCH13KSDH-20-87/ACC 7-38	Limagrain 2021	4	4	3	4	5	2	8	--	7	5	4	3	3	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.
Milestone Hard red winter Danby/Winterhawk/CIMMYT-06-3040	Dyna-Gro 2020	6	4	2	--	3	--	--	--	--	--	8	--	--	--	Dyna-Gro release (2020). Medium maturity with excellent straw strength. First entered in CSU variety trials in 2026. Below average test weight but tolerant to stripe rust.
Monarch Hard white winter CO07W722-F5/Snowmass/CO07W722-F5	CSU 2018	6	3	3	6	4	5	2	5	2	5	4	7	4	4	CSU release (2018), marketed by PlainsGold. Hard white winter with excellent straw strength and very high irrigated yield potential. Tolerant to TriMV. Good stripe rust resistance. Quality more similar to Breck, but very low PPO. Certified seed only.

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), yellowing disease (YD), 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. A priority is given to data collected in Colorado. Regional data or developer input is utilized when Colorado specific data is unavailable.

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Description of Winter Wheat Varieties in Eastern Colorado Dryland and Irrigated Trials (2025-2026)

Name/Class/Pedigree	Origin	HD	HT	SS	COL	YR	LR	SR	WSMV ^{**}	TriMV ^{**}	WSS ⁺	TW	PRO ⁺⁺	MILL	BAKE	Comments
MT WarCat Hard red winter Loma/AAC Gateway/Loma	MT 2022	8	4	--	--	1	6	4	--	8	1	5	2	3	1	Montana State University release (2022). Late maturity. Semi-solid stem for resistance to WSS. Excellent resistance to stripe rust. Average test weight and above-average protein. Certified seed only (CSO) variety.
NHH19668 Hard red winter OK09915C/NH11565	UNL EXP	3	2	5	5	--	--	--	--	3	7	3	4	3	8	University of Nebraska experimental line. First entered into the CSU trials in 2024.
Outlaw Hard red winter CO12D1777/Langin	CSU 2024	2	2	4	2	2	7	2	3	2	7	5	5	4	3	CSU release (2024), first entered into the CSU trials in 2023. Performed at 115% of the trial mean for yield in southeastern Colorado in 2023. Resistant to the wheat curl mite which vectors the mosaic virus complex. Good resistance to stripe rust and stem rust. Good milling and baking quality. Acid soil tolerant.
Ramsay Hard red winter Undisclosed	Dyna-Gro 2021	6	5	2	--	3	--	--	--	--	--	5	--	--	--	Dyna-Gro release (2021). Medium maturity with excellent straw strength. First entered in CSU variety trials in 2026. Average test weight and protein content.
Sheridan Hard red winter CO12D906/CO11D1353/Monarch	CSU 2023	5	6	4	8	3	5	1	5	3	7	3	4	3	3	CSU release (2023). Medium maturity and height and moderate straw strength. Very long coleoptile. Good resistance to stripe rust, stem rust and moderate for leaf rust. Excellent grain protein deviation. Tolerant to TriMV. Good milling and baking quality.
Showdown Hard red winter W99-194/OK02518W	OK 2018	6	7	5	4	4	5	6	8	6	--	6	--	--	--	Oklahoma Genetics, Inc. release (2018). Medium maturity with medium-tall plant height. Susceptible to WSMV. Average test weight and protein.
Snowmass 2.0 Hard white winter CO07W722-F5/Snowmass/Brawl CL Plus	CSU 2018	3	4	4	5	6	5	1	4	4	5	5	4	3	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.
Telluride Hard white winter CO12D906/CO07W722-F5	CSU 2023	4	4	2	4	8	6	1	4	2	7	4	4	3	3	CSU release (2023). Hard white winter wheat. Mid to early maturity and slightly short stature. Excellent straw strength and overall yield performance in irrigated and dryland environments. Excellent grain protein deviation. Very good milling and baking quality. Certified seed only.
Valley Hard white winter CO07W722-F5/Antero/Snowmass	CSU 2022	5	7	4	3	3	6	4	4	2	6	5	4	4	2	CSU release (2018), marketed by Frenchman Valley Coop in CWRP-Arden 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. Certified seed only.

Column Key - heading date (HD), plant height (HT), straw strength (SS), coleoptile length (COL), stripe rust resistance (SR), leaf rust resistance (LR), stem rust resistance (SR), wheat streak mosaic virus tolerance (WSMV), yellowing disease (YD), 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 poor, very susceptible, very late, or very tall/long. A priority is given to data collected in Colorado. Regional data or developer input is utilized when Colorado specific data is unavailable.

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WB4444 Hard red winter Undisclosed	Westbred 2022	5	5	2	--	4	6	4	8	4	2	6	3	4	4	WestBred release (2022), Medium maturity. Solid solid stem for resistance to WSS. Excellent protein and good stripe rust resistance. Certified seed only (CSO) variety.
WB4733CLP Hard red winter Undisclosed	Westbred 2022	7	2	3	6	2	3	6	6	7	1	7	4	--	--	WestBred release (2022), Two-gene Clearfield wheat. Medium-late maturity. Very good to excellent resistance to leaf and stripe rusts. Certified seed only (CSO) variety.
Whistler Hard red winter CO08W218/Snowmass//Byrd	CSU 2018	7	9	9	7	5	6	1	2	1	6	6	5	4	3	CSU release (2018), marketed by PlainsGold. Hard red winter, later maturing, tall, marginal straw strength. Good stripe and stem rust resistance. Overall very good virus tolerance. Carries <i>Cmrc4</i> for moderate resistance to WSMV and has tolerance to TriMV. Very good milling and baking quality.
Windom SF Hard white winter Warhorse/Breck//CO12D1028	CSU 2022	4	2	4	7	6	8	1	5	6	1	3	4	3	2	CSU release (2021), marketed by PlainsGold in CWRF-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. <i>Wsm2</i> for resistance to WSMV. Good test weight, long coleoptile, tolerance to lower pH. Certified seed only.

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), yellowing disease (YD), 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. A priority is given to data collected in Colorado. Regional data or developer input is utilized when Colorado specific data is unavailable.

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Seed Storage, Certified Seed, and Plant Variety Protection: Best Practices for Farmers

Laura Pottorff

Seed Storage and Inventory Management

Seed held in inventory from one growing season to the next can still be sold and used if its viability (germination potential) and vigor (overall health and resilience) remain acceptable. One key reason for storing seeds is to preserve desired genetic stocks for years following low production seasons, which are often influenced by environmental factors.

Seed deterioration is inevitable, but proper storage can delay the loss of viability and vigor. Common factors contributing to seed deterioration include age, temperature, humidity and physical damage of seeds.

To minimize deterioration and preserve seed quality, follow these guidelines:

- **Cool, Dry, and Dark Environment:** Store seeds at temperatures between 32°F and 50°F (0°C to 10°C), maintain low relative humidity, and keep seeds away from light to prevent aging.
- **Airtight Containers:** Use sealed containers or resealable plastic bags to prevent moisture and air exchange. Ensure seeds are thoroughly dried before storage.
- **Regular Monitoring:** Inspect stored seeds periodically for signs of mold, moisture, or deterioration.
- **Isolation from Contaminants:** Store seeds away from chemicals, fertilizers, and other contaminants.
- **Record Keeping:** Maintain detailed records of storage practices, including dates and conditions, to track seed viability.
- **Periodic Germination Testing:** Retest germination rates regularly to comply with state (Colorado – 13-month expiration) and federal (6-month expiration) seed labeling laws. Discard or repurpose seeds with poor viability.
- **FIFO Inventory Management:** Use a “first in, first out” system to sell older inventory first, ensuring seed quality and legal compliance with labeling laws.

Certified Seed: It Pays to Plant the Best

Certified seed offers numerous advantages over common or bin-run seed, including higher yields, improved crop quality, reduced risk of crop failure, lower input costs, and reduced weed competition. While certified seed may involve a higher initial investment, its superior quality, genetic purity, and disease resistance make it a reliable choice for maximizing crop performance and profitability.

Certified Seed Longevity

Although certified seed does not inherently have a longer storage life than common or bin-run seed, its superior handling and storage practices help retain viability and vigor for longer periods. Proper storage conditions—cool temperatures, low humidity, darkness, and airtight containers—are essential for preserving seed quality over time.

Saving Seed of PVP-Protected Varieties

Many certified seed varieties come with restrictions on saving or selling seed. The Plant Variety Protection Act (PVP) protects the intellectual property rights of plant breeders, ensuring their investment in research and development is safeguarded. This protection benefits farmers by facilitating ongoing innovation in plant breeding.

Types of Protection for Certified Seed:

- **PVP¹:**
 - Varieties must be sold by name, and farmer-saved seed sales are prohibited.
 - Seed conditioners may be held liable for cleaning protected seed that are illegally sold.
 - Farmers may save grain for their own planting but cannot sell it.
- **PVP Title V Option²:**
 - Seed may only be sold as a certified class if elected by the owner.
 - Sales of non-certified seed are illegal under Title V of the Federal Seed Act.
- **Single Use Seed Agreements (Certified Seed Only)³:**
 - Growers agree to use seed solely for planting and producing a single crop.
 - Saving or selling grain for future planting is prohibited.

To help discern which certified varieties can be saved and which varieties need to be purchased each year, refer to the table on the following page.

Table 1. PVP Status of selected varieties. *Any omissions of varieties or miscategorizations were unintentional, categorizations are based on communication with variety owners. June 2026

PVP¹ – Unauthorized propagation is prohibited. Grain may be saved for planting by the grower only. Seed must be sold by variety name. Sale of farmer-saved seed is prohibited.			
WB4418		WB4483	
PVP + Title V option² – Unauthorized propagation is prohibited. Grain may be saved for planting by the grower only. Sale of farmer-saved seed is prohibited. Seed must be sold by variety name. Seed may only be sold as a class of Certified Seed.			
Antero	AP BigFoot	AP Everrock	AP Roadrunner
AP Solid	Avery	Breck	Byrd
Canvas	Fortify SF	Guardian	KS Dallas
KS Hamilton	KS Providence	Langin	LCS Julep
LCS Mint	LCS Radar	Monarch	NuGrain
Outlaw	Ray	Sheridan	SY Assure
SY Legend	SY Ovation	SY Wolverine	Whistler
	Telluride		
Single Use³ – All the provisions of PVP and Title V apply. In addition, seed of these wheat varieties must be purchased every year due to stewardship agreements or exclusive contracts.			
Amplify SF	AP18 AX	Brawl CL+	Byrd CL+
Crescent AX	Gabriel	Hoyt SF	Kivari AX
KS Bill Snyder	KS Homesteader CL+	KS Territory	LCS Atomic AX
LCS Helix AX	NE Prism CLP	Settler CL	Snowmass
Snowmass 2.0	SY Sunrise	WB4347	WB4422
WB4444	WB4595	WB4733CLP	Windom SF

Wheat Quality Evaluations from the 2025 CSU Dryland and Irrigated Variety Trials

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Introduction

End-use quality maintenance and improvement is an important objective of virtually all wheat breeding programs. Grain milling and product manufacturing industries have grown increasingly advanced in both domestic and international markets. While wheat producers are not always rewarded for improvements in functional quality, ongoing technological developments are enhancing the grain trade's ability to identify and source high-quality wheat while appropriately discounting lower-quality varieties.

Breeding for wheat end-use quality is relatively complex in comparison to many other breeding objectives. Quality is a function of variety interacting with climate and agronomic practices and Colorado's harsh and variable climatic conditions often negatively impact quality. Quality assessment involves evaluating multiple traits influenced by many underlying genetic factors. Most experimental quality tests only approximate average quality needs of product manufacturers and do not exactly match specific requirements of different wheat product types and processes. For hard winter wheat, high grain protein content is an important criterion for baking quality, but may be indicative of varieties with lower yield if yield differences at a given location are not taken into account (through "grain protein deviation"). Finally, wheat quality testing must accommodate the reality of large sample numbers and small sample sizes that are typical of all wheat breeding programs. Despite these challenges, standard testing methodologies have been developed that are consistent, repeatable, and can be done on large numbers of relatively small samples. These analyses provide reliable assessments of functional quality characteristics for a broad array of potential product types and processes.

Our objective with providing quality data and summaries for entries in the CSU Dryland and Irrigated Variety Trials is to characterize the quality of public and private trial entries that are currently or have the potential to be marketed in Colorado. We hope that the data and resulting ratings will be included among the criteria by which wheat producers choose their varieties. At the very least, we encourage producers to carefully consider avoiding varieties that have lower wheat quality when other agronomically acceptable varieties with better quality are available.

Testing Methodology

In 2025, grain samples were collected from each of the dryland (UVPT) and irrigated (IVPT) variety trial locations. Preliminary small-scale quality analyses were carried out to determine suitability of each location for full-scale analyses, with the selection criteria including grain protein content not too far below or above 11.5%, sound grain free of visual defects, and good discrimination among samples at a given location for experimental dough mixing properties (using the Mixograph). In this process of sample selection, the following locations were retained for full scale testing:

UVPT – Burlington and Walsh (South); Julesburg and New Raymer (North)

IVPT – Burlington, Fort Collins

Using standard protocols, analyses were done in the CSU Wheat Quality Laboratory on samples from the remaining locations. These tests, reported in the attached tables, include the following:

Milling-Related Traits

- Test weight: obtained by standard methodology on a cleaned sample of the harvested grain.
- Grain protein and protein recovery: obtained using near-infrared reflectance spectroscopy (NIRs) with a Foss NIRS™ DA1650 Feed and Forage analyzer. Grain protein is reported on a

standard 12% moisture basis. High grain protein content is associated with higher water absorption of flours and higher loaf volumes in the bakery. Protein recovery represents the numerical difference between grain and flour protein content and a value closer to zero is most desirable by the milling industry.

- Single kernel characterization system (SKCS): the Perten SKCS 4100 provides data on kernel weight and hardness of a grain sample. From 100-300 kernels are analyzed to provide an average value and a measure of variability for each trait. Millers prefer a uniform sample with heavier (>30 grams per 1,000 kernels, or <15,133 seeds per pound) kernels for improved milling performance. Hardness should be representative of the hard winter wheat class (60-80 hardness units).
- Flour yield: obtained using a modified Brabender Quadrumat Milling System. Flour yield represents the percentage of straight grade flour obtained from milling a grain sample (approximately one pound). In general, millers prefer high flour extraction values. Due to variation among different milling systems, valid comparison of values from different mills and establishment of a single target value is not possible.

Baking-Related Traits

- Mixograph mixing time and tolerance: obtained using a National Manufacturing Computerized Mixograph. The Mixograph measures the resistance of dough during the mixing process. Bakers generally prefer flours with moderate mixing time requirements (between 3 and 6 minutes) and good tolerance to breakdown of the dough with over-mixing (subjective score >3). Some varieties with exceptionally long mixing times (i.e., Snowmass) may not compare favorably with other varieties in conventional evaluations but have unique characteristics that merit handling in an identity-preserved program such as with the CWRP Ardent Mills Ultragrain® Premium Program.
- Pup loaf bake test: using a 100-gram straight-dough test, data on bake water absorption, mixing time, loaf volume, and crumb characteristics are obtained. In general, bakers prefer higher water absorption (> 62%), high loaf volume (> 850 cubic centimeters), and higher crumb grain and crumb color scores (score > 3). The crumb grain and color scores are subjective assessments of the color and size, shape, and structure of the small holes in a slice of bread.

Composite Scores

Because none of the traits measured can be used alone to represent overall milling or baking quality, development of a composite score has proven useful as a means to differentiate and characterize overall quality of different samples. The development of a composite score also has the advantage of accounting for differences in environmental conditions from year to year and utilizing all of the data generated on the samples collected at each trial location.

Composite scores are generated through a two-step process. First, each trait is ranked from high to low (or "very good" to "very poor") at individual locations and a score from 1=very good to 9=very bad is assigned to each variety for each trait depending on the optimal orientation of the trait. Second, these individual-trait scores are used to generate a composite score that weights the trait scores by the relative importance of that trait to overall milling or baking quality. The weights that we have used are similar to those developed by the USDA-ARS Hard Winter Wheat Quality Laboratory for the Wheat Quality Council evaluations. These weights are as follows:

Milling – test weight 30%, grain protein content 10%, protein recovery 10%, kernel weight 20%, grain hardness 10%, flour yield 20% (100% total)

Baking – bake absorption 20%, Mixograph mixing time 20%, Mixograph tolerance 20%, loaf volume 20%, crumb color 10%, crumb grain 10% (100% total)

Wheat Milling and Baking Quality Data - 2025 UVPT Burlington

* **Bold** indicates superior value, underlined indicates inferior value.

Entry	Test Weight	Grain Protein	SKCS Weight	SKCS Hardness	Flour Yield	Flour Protein	Bake Absorption	Mixograph Mix Time	Mixograph Tolerance	Loaf Volume	Crumb Color	Crumb Grain	Milling Score	Baking Score
Amplify SF	53.9	13.6	22.4	60.2	69.3	-0.7	65.1	3.65	3	1100	4	4	6	4
AP Sunbird	56.6	13.5	27.9	56.4	71.9	-0.6	65.3	5.84	5	1020	3	4	1	3
AR Iron Eagle	56.5	13.6	26.1	55.4	72.2	-0.8	63.4	3.19	2	890	3	3	2	7
AR Turret 25	54.9	13.9	28.9	49.2	70.3	0.3	64.2	2.73	0	955	4	3	2	7
Avery	55.1	13.7	25.1	54.6	70.0	-0.6	65.2	4.59	4	1200	4	4	5	2
Breck	57.3	14.0	24.8	62.0	71.0	-0.5	66.4	4.07	4	1125	4	4	1	3
Broad AX	50.5	14.6	22.0	66.5	65.5	0.3	65.2	2.37	1	770	2	2	8	9
Byrd	54.7	13.5	23.0	55.4	71.1	-0.6	65.2	5.61	5	1080	3	4	5	3
Byrd CL Plus	53.9	13.5	26.1	53.1	68.5	-0.2	65.2	4.02	3	965	3	3	5	5
Canvas	56.4	14.1	22.8	62.1	71.9	0.0	66.4	5.41	5	985	3	3	2	3
CO19410R	55.8	13.8	24.3	63.5	69.7	-0.3	68.3	5.29	5	1010	4	4	4	2
CO20022RC	56.4	13.8	22.5	66.6	71.6	-0.1	66.3	4.79	5	990	4	4	2	3
CO20D036R	54.5	13.3	26.5	71.3	68.3	-0.6	68.2	5.71	5	1060	5	4	4	1
CO20D108R	54.2	13.3	22.6	58.3	70.3	-0.5	65.3	6.80	5	1040	5	5	6	2
CO21D1790R	56.2	13.3	24.8	62.8	68.7	-0.9	68.3	?	6	1115	5	4	5	1
CO21SF226R	56.7	13.9	25.2	56.3	70.3	-1.0	64.1	3.66	2	1115	5	5	3	4
CO21SFD0950R	53.8	14.5	25.0	63.3	69.6	-0.4	65.3	3.63	1	1025	2	3	4	6
CO22SF039M	54.9	14.6	24.4	63.6	67.7	-0.6	68.2	4.68	4	1120	4	3	4	2
CO22SF047RA	53.5	13.8	24.2	56.3	70.0	-0.9	65.2	5.55	5	1020	4	4	7	3
CP7017AX	55.4	14.3	25.3	57.8	70.2	-0.4	63.3	2.80	2	785	2	2	4	9
CP7909	54.3	13.9	23.8	52.7	67.6	-0.1	65.3	2.50	0	900	2	1	6	9
Crescent AX	53.8	13.7	27.3	53.1	69.8	-0.3	63.1	6.11	5	1070	3	4	5	3
Fortify SF	54.4	13.5	21.7	52.3	69.6	-0.2	61.1	3.04	0	980	3	3	6	9
Gabriel	57.1	13.6	25.7	57.6	71.4	-0.2	65.4	4.98	4	995	1	4	4	4
Guardian	55.3	14.6	26.2	63.6	68.8	-0.4	68.1	6.20	5	1055	4	4	3	2
Hoyt SF	53.6	13.8	23.6	51.5	68.5	-0.3	62.4	2.85	1	950	2	3	7	8
Kivari AX	54.2	13.7	25.0	52.4	70.8	-0.4	67.2	4.56	4	1000	3	3	5	4
KS Bill Snyder	56.5	13.5	28.7	57.2	68.2	-0.4	66.4	4.62	4	1040	3	3	3	4
KS Territory	55.3	13.6	26.8	64.3	68.6	-0.3	64.3	3.79	2	980	4	4	4	6
Langin	54.5	13.3	25.4	54.3	69.3	-0.7	65.1	5.62	5	1030	4	4	5	3
Monarch	54.4	13.9	25.1	62.5	68.3	-0.4	66.2	4.55	4	1065	3	4	5	3
Outlaw	53.6	13.2	24.3	53.9	69.2	-0.4	64.3	5.24	4	1115	3	4	6	3
Sheridan	55.7	13.9	23.2	63.9	68.9	-0.7	68.1	4.69	5	980	4	4	5	2
Snowmass 2.0	54.6	14.0	27.8	64.8	68.7	-0.1	70.4	7.28	5	1085	5	5	3	1
Telluride	55.1	13.6	27.0	54.6	70.2	0.1	69.3	5.75	5	960	4	4	3	1
Whistler	54.7	14.0	25.3	62.2	68.0	-0.4	67.3	5.59	5	1105	4	4	5	2
Windom SF	57.0	14.9	26.7	62.7	68.6	-0.6	71.2	4.87	4	1090	3	4	2	2
Average	55.0	13.8	25.1	58.9	69.5	-0.4	65.9	4.82	3.6	1021	3.4	3.6		
Minimum	50.5	13.2	21.7	49.2	65.5	-1.0	61.1	2.37	0	770	1	1		
Maximum	57.3	14.9	28.9	71.3	72.2	0.3	71.2	?	6	1200	5	5		

Wheat Milling and Baking Quality Data - 2025 UVPT Walsh

* **Bold** indicates superior value, underlined indicates inferior value.

Entry	Test Weight	Grain Protein	SKCS Weight	SKCS Hardness	Flour Yield	Protein Recovery	Bake Absorption	Mixograph Mix Time	Mixograph Tolerance	Loaf Volume	Crumb Color	Crumb Grain	Milling Score	Baking Score
Amplify SF	57.3	13.9	29.0	51.0	71.4	-1.3	63.1	4.02	2	970	3	4	4	6
AP Sunbird	59.3	13.5	34.6	49.1	72.1	-1.9	63.8	6.00	5	1045	3	4	2	3
AR Iron Eagle	59.0	13.1	29.4	54.3	71.7	-2.0	63.3	3.49	3	845	2	3	5	6
AR Turret 25	55.2	14.2	31.9	44.7	70.7	-0.6	63.3	2.91	0	905	3	1	6	8
Avery	57.7	13.8	28.5	46.4	69.7	-1.3	66.0	5.25	5	1150	4	3	6	2
Breck	59.1	14.2	29.2	57.0	71.3	-1.2	67.1	4.19	3	1015	5	3	2	4
Broad AX	55.9	14.5	28.0	61.1	69.4	-1.6	62.1	2.28	0	770	3	2	7	9
Byrd	57.3	13.4	28.0	52.3	72.0	-1.6	63.0	6.22	5	1095	4	4	5	2
Byrd CL Plus	57.5	13.9	30.6	50.5	70.6	-1.8	64.2	4.10	4	995	3	2	5	5
Canvas	58.9	13.3	27.8	57.5	73.0	-1.5	63.2	6.09	4	915	4	5	3	4
CO19410R	58.8	13.4	28.2	53.6	72.4	-1.4	65.0	6.24	5	980	5	4	4	2
CO20022RC	59.7	13.5	27.3	59.4	72.9	-1.6	65.6	4.80	4	960	4	3	2	3
CO20D036R	57.2	13.2	30.5	62.7	68.7	-1.7	66.8	6.25	5	1045	4	4	6	1
CO20D108R	58.3	12.3	27.8	58.1	72.6	-1.8	61.1	6.09	3	975	5	5	5	5
CO21D1790R	58.1	13.0	29.8	62.1	70.8	-1.4	65.2	12.08	6	990	5	4	4	1
CO21SF226R	59.0	13.7	30.4	51.8	71.6	-1.5	62.8	3.76	2	925	3	3	4	6
CO21SFD0950R	58.2	13.2	31.4	60.0	72.5	-1.6	62.3	3.86	1	875	4	3	3	7
CO22SF039M	57.8	14.5	26.3	62.6	69.4	-1.5	64.1	4.51	3	985	3	4	5	4
CO22SF047RA	58.1	12.7	29.0	52.5	71.3	-1.5	62.7	6.14	5	890	4	4	5	4
CP7017AX	58.8	13.5	28.7	52.9	72.0	-1.7	62.8	3.32	3	775	2	2	4	7
CP7869	57.1	14.0	33.4	44.0	70.8	-1.2	63.0	2.83	1	900	3	2	4	7
CP7909	54.7	13.9	26.9	48.9	69.2	-0.6	64.2	2.88	1	825	3	1	8	8
Crescent AX	58.8	13.5	33.5	46.3	72.3	-1.4	65.2	5.64	5	1080	4	5	3	2
Fortify SF	56.4	13.4	27.4	40.8	72.3	-1.4	60.9	3.17	1	1000	5	5	6	7
Gabriel	59.8	13.3	28.2	53.6	73.6	-1.6	62.5	5.41	4	1005	1	5	2	4
Guardian	58.6	13.5	29.2	57.2	71.0	-1.5	64.5	5.50	4	1005	4	4	4	3
Hoyt SF	57.2	13.5	26.5	55.3	70.8	-1.3	63.3	3.01	1	1030	4	3	6	6
Kivari AX	57.2	13.4	30.0	51.9	73.3	-1.3	64.1	5.33	5	1070	4	5	4	2
KS Bill Snyder	58.2	13.7	33.8	52.9	70.5	-1.5	67.0	4.64	4	1005	3	3	4	3
KS Territory	59.1	13.3	35.0	58.1	70.0	-1.9	64.2	3.77	3	970	4	4	3	4
Langin	57.0	13.6	29.2	51.1	70.9	-1.7	65.9	7.39	5	1065	4	3	5	1
Monarch	57.5	12.3	29.3	55.9	70.8	-1.5	62.9	5.65	4	880	3	3	5	5
Outlaw	56.8	13.3	27.4	54.1	71.4	-1.7	64.3	6.00	5	1105	4	4	6	2
Sheridan	57.5	13.4	26.1	55.4	71.0	-1.8	63.6	5.53	5	975	4	4	6	3
Snowmass 2.0	57.0	13.3	34.0	61.5	70.1	-1.4	68.2	9.23	5	945	5	4	4	1
Telluride	58.0	12.3	32.7	47.9	71.8	-1.2	64.0	6.32	5	910	5	5	4	2
Whistler	57.8	13.1	30.5	58.2	71.0	-1.6	66.1	5.77	5	1025	3	4	4	2
Windom SF	59.4	14.1	32.4	60.8	69.3	-1.6	71.2	7.65	5	1115	4	4	3	1
Average	57.9	13.5	29.8	54.0	71.2	-1.5	64.3	5.19	3.6	974	3.7	3.6		
Minimum	54.7	12.3	26.1	40.8	68.7	-2.0	60.9	2.28	0	770	1	1		
Maximum	59.8	14.5	35.0	62.7	73.6	-0.6	71.2	12.08	6	1150	5	5		

Wheat Milling and Baking Quality Data - 2025 UVPT Julesburg

* **Bold** indicates superior value, underlined indicates inferior value.

Entry	Test Weight	Grain Protein	SKCS Weight	SKCS Hardness	Flour Yield	Flour Protein	Bake Absorption	Mixograph Mix Time	Mixograph Tolerance	Loaf Volume	Crumb Color	Crumb Grain	Milling Score	Baking Score
Amplify SF	56.2	13.8	27.1	54.5	71.6	-1.1	62.2	3.20	1	950	2	2	4	7
AP Bigfoot	56.0	<u>12.8</u>	26.2	<u>50.8</u>	69.8	-0.8	<u>61.2</u>	4.59	<u>2</u>	940	4	3	5	6
AP Solid	57.4	13.7	28.4	61.6	70.4	-1.0	64.2	4.04	3	945	4	4	3	5
AP Sunbird	56.5	13.0	28.5	54.5	71.3	-0.8	65.1	4.04	4	1000	4	4	3	3
AR Iron Eagle	56.9	14.1	27.1	53.3	70.4	-1.2	<u>62.1</u>	3.27	<u>2</u>	840	2	2	4	8
AR Turret 25	57.9	14.1	33.3	49.1	70.9	-0.6	63.3	2.92	1	860	3	3	1	8
Avery	56.3	13.5	26.8	54.7	70.1	-1.3	65.1	5.20	4	1080	4	3	5	3
Breck	58.4	13.8	26.7	58.7	71.4	-1.1	66.2	4.43	4	1015	5	4	2	3
Byrd	56.1	13.9	26.9	52.0	71.7	-1.1	65.1	5.45	5	1115	5	4	4	2
Byrd CL Plus	56.1	13.0	30.4	47.7	69.7	-1.3	63.2	3.61	3	870	3	3	4	7
Canvas	56.9	13.7	24.7	61.9	71.9	<u>-1.4</u>	67.2	4.79	5	975	4	4	4	3
CO19410R	56.4	13.8	24.2	59.2	70.1	-0.8	68.0	5.65	5	1010	4	5	5	2
CO20022RC	58.1	13.4	26.1	61.2	72.2	-1.0	66.1	4.29	4	970	3	4	2	4
CO20D108R	54.5	13.3	23.8	60.9	70.6	-0.8	63.1	10.80	6	1080	5	6	7	1
CO21D1790R	57.3	13.3	28.3	63.3	69.9	-1.6	70.1	11.93	6	1080	4	5	4	1
CP7017AX	56.3	13.7	27.1	54.5	70.5	-1.2	64.2	2.95	3	845	2	2	5	7
CP7869	55.3	14.3	30.3	51.8	70.4	-0.5	64.0	3.15	1	955	3	3	3	6
CP7909	55.7	13.4	27.4	48.2	69.0	-0.4	64.1	2.88	3	850	2	1	5	8
Crescent AX	56.5	13.4	29.2	48.5	71.4	-1.1	65.0	5.73	5	1080	5	3	3	2
Fortify SF	53.9	13.7	22.6	51.3	70.3	-1.4	63.0	3.35	2	1055	4	3	8	6
Gabriel	56.0	13.7	24.4	57.5	71.8	-1.0	65.2	4.92	5	985	1	4	4	4
Guardian	55.2	14.7	26.7	56.3	69.4	-0.7	70.0	5.19	5	1125	4	4	4	1
Hoyt SF	56.4	13.2	25.6	54.3	70.4	-1.1	62.2	3.55	3	955	3	4	5	5
Kivari AX	56.2	12.5	30.0	49.2	72.7	-1.1	63.9	4.60	5	1015	5	4	3	3
KS Bill Snyder	57.8	14.1	29.2	62.0	69.2	-1.0	68.3	4.59	4	935	3	3	2	4
KS Homesteader	57.1	14.9	28.7	73.1	69.5	-1.0	69.1	5.42	5	1115	4	3	2	2
KS Territory	55.7	14.3	29.1	63.4	69.4	-1.2	66.0	3.98	3	920	2	2	4	5
Langin	56.4	13.1	29.0	53.1	71.4	-0.9	67.2	4.75	5	1030	4	3	4	3
Monarch	54.2	12.9	24.2	69.1	68.4	-1.0	65.9	5.04	5	940	4	4	7	3
MT WarCat	51.7	15.1	25.3	57.4	70.4	-0.7	68.7	5.52	5	1025	2	3	6	3
NHH19668	55.4	14.3	26.5	57.6	69.6	-0.8	65.0	2.73	1	965	3	2	4	7
Outlaw	53.9	<u>13.1</u>	25.4	48.0	69.3	-0.8	66.1	5.18	5	1030	4	4	8	3
Sheridan	56.9	13.4	26.3	58.2	69.8	-1.2	63.9	4.64	4	970	5	5	4	3
Snowmass 2.0	55.4	14.2	28.2	62.2	69.4	-0.5	72.1	7.76	6	1110	5	5	3	1
Telluride	55.9	13.7	27.7	45.9	69.1	-0.8	68.2	6.43	5	1025	4	4	5	2
Valley	54.6	14.2	27.4	66.4	67.4	-1.4	69.2	7.21	6	1150	5	4	7	1
WB4444	54.8	14.5	25.0	72.2	68.5	-0.5	66.0	4.31	4	1125	4	3	5	3
WB4733CLP	54.1	15.1	26.3	63.4	70.4	-0.5	68.1	4.75	4	1010	2	2	4	4
Whistler	55.4	13.1	26.2	61.3	69.2	-1.1	68.2	5.40	5	1050	4	4	5	2
Windom SF	58.5	14.2	27.3	58.4	70.1	<u>-1.4</u>	66.2	5.87	5	1045	5	6	3	1
Average	56.0	13.7	27.1	57.2	70.2	-1.0	65.8	4.95	4.0	1001	3.6	3.5		
Minimum	51.7	12.5	22.6	45.9	67.4	-1.6	61.2	2.73	1	840	1	1		
Maximum	58.5	15.1	33.3	73.1	72.7	-0.4	72.1	11.93	6	1150	5	6		

Wheat Milling and Baking Quality Data - 2025 UVPT New Raymer

* **Bold** indicates superior value, underlined indicates inferior value.

Entry	Test Weight	Grain Protein	SKCS Weight	SKCS Hardness	Flour Yield	Flour Protein	Bake Absorption	Mixograph Mix Time	Mixograph Tolerance	Loaf Volume	Crumb Color	Crumb Grain	Milling Score	Baking Score
Amplify SF	58.2	14.2	27.7	44.1	70.8	-0.9	63.3	2.79	1	1010	4	5	4	6
AP Bigfoot	56.4	14.1	26.2	49.2	68.8	0.2	61.2	4.12	0	945	2	3	6	8
AP Solid	59.6	14.2	30.1	54.2	70.2	-0.6	64.2	3.53	2	955	4	4	2	5
AP Sunbird	58.1	14.4	31.8	47.9	71.4	-0.6	67.0	4.13	3	1075	4	3	2	3
AR Iron Eagle	57.8	13.6	27.7	49.7	71.1	-1.1	63.2	2.66	2	800	2	2	5	9
AR Turret 25	57.3	14.1	30.0	47.3	71.0	-0.2	64.3	2.29	0	930	3	3	4	8
Avery	58.2	13.9	27.4	50.2	71.0	-0.9	64.9	3.94	4	1055	4	4	4	3
Breck	58.8	14.2	28.9	48.6	71.6	-0.3	67.4	3.78	3	1100	6	4	2	2
Byrd	56.7	14.2	25.9	44.2	72.1	-0.6	64.0	4.78	4	1100	4	4	4	3
Byrd CL Plus	57.3	14.0	29.3	46.4	69.6	-0.3	65.2	3.81	2	965	3	3	5	5
Canvas	58.6	14.0	24.9	51.5	73.2	-0.6	65.2	4.61	4	1010	3	4	3	4
CO19410R	57.6	13.6	25.9	48.0	69.6	-0.5	67.8	5.30	5	1015	5	5	6	1
CO20022RC	59.2	13.6	25.5	53.8	72.3	-0.5	64.3	4.77	4	1025	6	4	3	3
CO20D108R	56.8	13.9	23.2	57.2	71.7	-0.6	65.1	6.67	4	1070	5	4	6	2
CO21D1790R	57.7	13.6	27.8	53.1	69.2	-0.6	67.2	9.53	6	1125	4	3	5	1
CO21SF226R	59.5	14.0	28.5	46.9	71.7	-1.2	61.0	3.04	1	945	3	3	3	8
CP7017AX	57.3	13.1	27.5	48.9	70.8	-0.5	63.4	2.86	2	825	2	2	5	8
CP7869	56.4	14.0	30.2	45.0	70.6	0.0	64.0	2.32	0	950	3	3	4	8
CP7909	54.9	14.0	24.7	49.3	67.7	0.4	65.2	2.27	0	795	2	2	8	9
Crescent AX	56.3	13.7	30.9	41.8	70.1	-0.4	64.9	5.01	5	1060	4	4	5	2
Fortify SF	57.4	14.2	24.2	43.9	71.8	-0.3	62.0	3.18	1	990	3	3	5	7
Gabriel	59.1	14.1	28.4	49.0	71.9	-0.8	65.9	3.53	3	1025	1	5	3	5
Guardian	58.3	14.7	27.1	54.1	71.0	-1.0	67.6	3.96	3	1110	5	4	3	2
Hoyt SF	58.6	13.6	28.8	45.4	70.6	-1.0	62.3	2.63	0	940	4	4	4	8
Kivari AX	57.7	13.5	30.2	43.0	72.9	-0.8	65.0	3.64	2	1035	4	3	3	5
KS Bill Snyder	57.5	13.7	29.2	49.6	68.5	-0.2	66.2	4.36	4	980	4	3	5	4
KS Homesteader	59.5	14.5	30.4	65.2	69.3	-0.3	68.2	5.63	5	1105	5	4	1	1
KS Territory	55.7	14.0	26.5	57.3	69.0	-0.2	64.1	2.95	1	890	2	1	7	8
Langin	55.4	14.0	27.1	44.8	70.1	-0.4	65.8	4.24	4	1005	3	3	7	4
Monarch	56.0	13.6	27.5	49.8	69.3	-0.8	63.2	4.31	3	990	4	4	6	5
MT WarCat	58.2	15.1	28.8	55.1	73.0	-1.0	67.1	5.41	5	1205	4	3	2	1
NHH19668	56.9	14.1	28.1	49.7	71.2	-0.1	64.8	2.44	0	910	2	2	4	8
Outlaw	55.1	13.2	25.7	44.1	69.8	-0.2	65.9	4.42	4	1030	4	3	9	4
Sheridan	57.4	13.8	28.6	52.2	69.3	-0.7	67.0	4.01	3	1035	4	4	5	4
Snowmass 2.0	57.1	14.1	31.2	50.1	70.4	-0.5	68.1	7.05	5	1080	5	5	3	1
Telluride	57.8	13.7	29.0	45.0	70.7	-0.1	66.3	5.48	5	1070	4	4	4	2
Valley	56.7	13.8	24.4	56.4	69.5	-0.6	67.0	3.21	5	1095	6	5	6	1
WB4444	57.9	14.5	25.3	66.8	68.6	-0.4	65.2	3.20	2	1100	5	4	5	4
WB4733CLP	57.4	14.6	26.4	53.9	71.0	0.4	66.4	3.20	1	995	2	1	3	6
Whistler	57.3	13.8	28.0	52.3	68.5	-0.7	66.3	4.34	4	1065	5	5	6	2
Wisdom SF	58.9	14.7	29.1	54.6	70.0	-0.6	68.3	5.42	5	1065	5	4	2	1
Average	57.5	14.0	27.8	50.2	70.5	-0.5	65.3	4.18	2.9	1012	3.8	3.5		
Minimum	54.9	13.1	23.2	41.8	67.7	-1.2	61.0	2.27	0	795	1	1		
Maximum	59.6	15.1	31.8	66.8	73.2	0.4	68.3	9.53	6	1205	6	5		

Wheat Milling and Baking Quality Data - 2025 IVPT Burlington

* **Bold** indicates superior value, underlined indicates inferior value.

Entry	Test Weight	Grain Protein	SKCS Weight	SKCS Hardness	Flour Yield	Flour Protein	Recovery	Absorption	Bake	Mixograph Mix Time	Mixograph Tolerance	Loaf Volume	Crumb Color	Crumb Grain	Milling Score	Baking Score
Amplify SF	55.9	14.1	26.0	54.2	68.1	-1.1		61.7	2.79	0	975	3	2	5	8	
AP Sunbird	57.4	13.8	28.9	54.3	71.0	-1.1		63.8	5.17	4	1175	4	4	2	2	
AR Iron Eagle	55.6	13.7	26.0	52.3	70.6	-1.2		62.1	3.00	2	815	2	2	5	9	
Breck	56.1	14.9	24.5	60.3	69.5	-0.7		68.9	3.55	3	1150	5	3	4	2	
Broad AX	54.4	14.9	24.9	65.4	67.4	-1.0		65.8	2.92	2	930	3	2	5	6	
Byrd CL Plus	53.4	14.0	26.7	50.8	68.1	-1.1		64.8	4.18	3	920	3	3	7	5	
Canvas	57.3	14.1	24.5	59.4	71.1	-1.1		64.0	5.46	4	1105	4	3	3	3	
CO20022RC	55.2	14.2	23.0	64.6	69.3	-0.7		64.9	5.17	4	1025	4	3	5	3	
CP7869	55.0	13.7	27.4	54.4	69.7	-1.0		63.6	3.73	2	1010	4	3	5	5	
CP7909	55.2	13.6	26.4	49.0	67.8	-0.7		62.0	2.97	0	855	2	1	5	9	
Crescent AX	56.1	13.8	27.5	46.9	68.6	-1.0		64.7	4.78	4	1105	4	3	5	3	
Guardian	56.4	14.9	26.0	59.2	68.3	-0.9		65.6	5.19	5	1150	5	5	3	1	
Hoyt SF	54.7	13.7	23.7	59.1	68.5	-1.2		60.9	3.39	1	1085	4	3	6	7	
Kivari AX	54.5	13.6	27.6	50.7	69.8	-1.0		63.9	3.62	3	1000	3	3	6	5	
LCS Atomic AX	57.1	13.9	30.0	53.0	69.4	-1.6		64.0	4.16	2	935	3	2	2	6	
LCS Helix AX	56.1	13.7	25.8	58.6	66.5	-1.6		60.8	4.15	4	1045	4	4	5	5	
LCS Mojo	55.3	14.2	27.1	55.6	68.1	-1.1		62.8	3.00	1	970	4	4	4	6	
LCS Radar	56.0	14.3	26.9	58.9	69.5	-0.8		63.9	3.43	3	1035	4	3	4	5	
LCS Steel AX	55.6	15.0	27.2	58.2	67.0	-1.6		64.7	4.65	4	965	3	4	4	4	
Monarch	54.4	13.7	24.7	62.7	67.1	-1.0		66.8	4.43	4	1000	5	4	6	2	
NE18435	55.4	13.8	27.0	58.7	68.4	-0.7		62.0	2.60	1	830	3	2	4	9	
Sheridan	55.7	14.1	22.9	58.7	67.5	-1.5		65.9	5.18	4	1040	5	4	6	2	
Snowmass 2.0	55.6	14.6	26.3	64.6	68.5	-1.5		67.0	7.49	5	1035	5	5	4	1	
Telluride	54.4	14.1	25.2	55.4	69.1	-0.6		69.7	5.15	5	1055	4	4	5	1	
Windom SF	58.2	14.9	27.9	63.0	68.0	-1.5		67.2	4.58	3	1145	4	4	1	2	

Average	55.6	14.1	26.2	57.1	68.7	-1.1		64.5	4.19	2.9	1014	3.8	3.2		
Minimum	53.4	13.6	22.9	46.9	66.5	-1.6		60.8	2.60	0	815	2	1		
Maximum	58.2	15.0	30.0	65.4	71.1	-0.6		69.7	7.49	5	1175	5	5		

Wheat Milling and Baking Quality Data - 2025 IVPT Fort Collins

* **Bold** indicates superior value, underlined indicates inferior value.

Entry	Test Weight	Grain Protein	SKCS Weight	SKCS Hardness	Flour Yield	Flour Protein	Bake Absorption	Mixograph Mix Time	Mixograph Tolerance	Loaf Volume	Crumb Color	Crumb Grain	Milling Score	Baking Score
Amplify SF	61.5	14.4	33.4	55.2	69.8	-2.0	61.5	2.37	0	925	4	4	4	6
AP Sunbird	60.3	15.4	35.7	<u>51.4</u>	71.3	-1.2	64.4	2.83	0	975	4	4	3	5
AR Iron Eagle	61.1	14.6	33.6	<u>52.6</u>	71.2	-1.9	59.4	2.04	0	710	1	2	4	9
AR Turret 25	59.1	14.1	36.7	44.6	69.8	-1.2	61.5	1.66	0	775	2	1	5	9
Breck	62.1	15.0	32.3	<u>58.6</u>	69.0	-1.4	65.9	2.51	0	1050	4	2	3	5
Broad AX	60.1	15.2	33.4	61.8	70.1	-1.7	61.4	1.71	0	745	2	2	4	9
Byrd CL Plus	61.2	14.0	35.9	50.9	70.8	-1.9	61.4	2.65	1	890	2	2	4	7
Canvas	62.1	14.3	30.7	55.8	72.2	-1.6	64.5	3.19	3	1025	5	4	2	2
CO20022RC	62.1	14.5	32.0	57.8	71.5	-1.8	64.4	3.05	2	1050	4	4	3	3
CP7869	58.7	14.5	34.2	45.3	69.5	-1.1	61.1	1.74	0	765	2	1	6	9
CP7909	<u>57.9</u>	13.7	29.4	46.3	68.8	-0.8	62.5	1.96	0	810	3	2	9	7
Crescent AX	61.6	14.0	36.9	50.8	70.7	-1.8	61.5	2.33	1	820	3	4	3	6
Guardian	62.1	14.2	32.1	61.3	71.0	-1.5	62.1	2.80	1	910	4	4	3	5
Hoyt SF	60.8	14.3	31.3	53.6	70.3	-1.6	60.3	1.88	0	900	4	3	5	7
Kivari AX	61.1	14.2	32.4	53.0	72.2	-1.6	62.9	3.89	2	1100	4	5	4	2
LCS Atomic AX	61.2	15.5	37.0	52.7	70.3	-1.8	63.8	2.56	1	895	3	3	3	6
LCS Helix AX	59.4	14.9	36.6	49.8	67.6	-0.8	65.7	1.89	0	895	3	1	5	6
LCS Mojo	59.6	14.0	30.9	57.1	69.4	-1.6	59.3	2.17	0	875	3	3	6	8
LCS Radar	59.4	15.2	36.0	54.2	68.9	-1.0	64.5	1.91	0	840	3	3	4	7
LCS Steel AX	61.1	13.9	34.1	60.7	69.9	-1.6	63.9	3.60	3	1050	4	4	4	2
Monarch	60.7	13.4	32.9	60.4	67.4	-1.8	62.6	3.84	2	950	5	3	6	4
NE18435	60.2	14.4	30.4	51.9	71.6	-1.3	60.3	1.65	0	720	2	1	4	9
Sheridan	60.2	14.2	29.2	59.3	68.9	-1.6	65.2	4.00	3	1015	5	4	6	1
Snowmass 2.0	60.5	14.7	35.6	61.8	69.4	-1.6	68.3	4.84	4	1080	5	5	4	1
Telluride	61.3	13.9	36.0	52.4	70.3	-1.8	62.2	3.19	1	965	4	3	4	5
Windom SF	61.2	14.9	34.8	64.6	67.2	-1.8	63.1	2.64	1	900	3	3	4	6
Average	60.6	14.4	33.6	54.8	70.0	-1.5	62.8	2.65	1.0	909	3.4	3.0		
Minimum	57.9	13.4	29.2	44.6	67.2	-2.0	59.3	1.65	0	710	1	1		
Maximum	62.5	15.5	37.0	64.6	72.2	-0.8	68.3	4.84	4	1100	5	5		

Millions Still at Stake:

Wheat Stem Sawfly Remains a Persistent Challenge in Colorado Wheat Economy

Sabina Regmi, Rebecca Hill, Dawn Thilmany, Rebecca Wasserman-Olin, Adam Osterholzer, and Punya Nachappa

Wheat stem sawfly (WSS) has been a persistent challenge for wheat production in Colorado. In recent years, concerns around sawfly have intensified, with increasing reports of infestation and growing recognition of its economic consequences. At the same time, Colorado State University’s public wheat breeding program has responded by developing and releasing sawfly-resistant (solid-stem and semi-solid stem) varieties, providing producers with an important management tool. Given these developments, this was an appropriate time to revisit and provide an update on statewide estimates of crop losses and the subsequent economic impact of WSS in Colorado.

We conducted a survey of 53 wheat producers during the 2025 CSU Wheat Field Days. In the survey, we asked producers about sawfly infestation on their farms, whether they perceive sawfly as a threat, and which varietal and non-varietal practices they use to prevent and manage sawfly. In total, surveyed producers represented roughly 320,000 acres of cropland, including about 149,000 acres of wheat. The average wheat yield reported for 2024 was 43.1 bushels per acre, with yields ranging from 12 to 70 bushels. Notably, WSS remains widespread among surveyed producers with 71% of respondents reporting experiencing WSS infestation. In addition, about 9 out of 10 producers perceived sawfly as a threat to wheat production in Colorado. Producers commonly associate WSS with the potential for major yield loss, higher management costs, lodging issues affecting their ability to harvest, lack of effective control options, and risk of long-term infestation build-ups. These threats reinforce the continued importance of WSS in production decisions.

Using the 2025 survey data, new estimates of the economic impact of WSS were calculated and are reported in Table 1 below. These estimates combine producer-reported yield losses with data from the CSU Wheat Entomology annual sawfly survey and USDA NASS data on wheat acreage and prices. Results indicate that WSS continues to generate substantial losses across Colorado’s wheat sector, with an annual average economic impact of about \$78.6 million over 2022–2024, including both direct and indirect effects. Since impacts were highest in 2023 and somewhat lower in 2022 and 2024, the overall pattern suggests year-to-year variation rather than a clear upward trend.

Table 1. Estimated Economic Impact of Wheat Stem Sawfly in Colorado (2022–2024)

Year	Direct Losses (\$)	Indirect Losses (\$)	Induced Losses (\$)	Total Output Impact (\$)
2022	34,023,831	26,349,238	11,529,283	71,902,351
2023	43,376,200	33,592,038	14,698,417	91,666,656
2024	34,242,763	26,518,787	11,603,470	72,365,020
Average	37,214,265	28,820,021	12,610,390	78,644,676

Note: The estimated economic impacts are reported in 2025 dollars.

Beyond direct yield losses, these estimates also reflect impacts across the broader economy. Direct effects capture the immediate value of lost wheat production. Indirect effects arise from linkages with agricultural supply chain businesses and services connected to the sector. For example, when less wheat moves through the economy, activity declines for input suppliers, transportation, and grain handlers.

Induced effects reflect lower household spending as producer income declines. In 2023, more than half of the total impact came from indirect and induced effects, showing that these linkages make up a large share of the overall impact. This suggests that focusing only on direct production losses would underestimate the total economic impact of sawfly infestation.

To provide a consistent comparison, earlier estimates from Wasserman-Olin et al. (2023) were recalculated and expressed in 2025 dollars, resulting in an estimated average annual impact of \$77.6 million, which is very similar to the updated estimates reported in Table 1. Given continued concern among producers and reports of increasing infestation, one might expect losses to increase over time. However, results suggest that while WSS remains widespread, the overall magnitude of losses has held steady. One possible explanation is the increased adoption of sawfly-resistant wheat varieties developed by CSU’s breeding program mitigating this production risk. Rather than increasing yields beyond baseline levels, these varieties appear to function as a form of loss prevention, helping producers avoid larger yield reductions while under infestation. In this sense, adoption may be maintaining productivity in the presence of sawfly pressure, even if it does not eliminate losses entirely.

Survey results provide additional insight into how producers are adapting to sawfly pressure through varietal choices. Out of 53 respondents, about 62% reported adopting solid-stem or semi-solid stem wheat varieties, while roughly one-third had not adopted these varieties. Most producers began adopting these varieties within the past five years, indicating a relatively recent shift in management practices. The primary motivation for adoption was prior reported yield loss due to sawfly infestation, along with CSU Extension recommendations.

Table 2. Producers Reported Reasons for Adoption and Non-Adoption of WSS-Resistant Varieties

Adoption Status	Reason	Percent of Producers
Adopters (N = 31)		
	Prior yield loss from sawfly	87%
	CSU Extension recommendation	23%
	Other reasons	16%
	Peer/neighbor experience	3%
Non-adopters (N = 20)		
	Not enough sawfly pressure	50%
	Concern about lower yield	25%
	Market or price concerns	10%
	Seed not easily available	10%
	Not aware of varieties	5%
	Not recommended by trusted sources	5%

Among non-adopters, the most common reasons for non- adoption were perceived limited sawfly pressure, suggesting that adoption decisions are closely tied to local infestation conditions. Some producers may also continue to prefer conventional varieties where they expect higher yields in low-infestation environments. Overall, these results indicate that adoption is not uniform across the state but is instead driven by producer experience, perceived risk, and expected effectiveness. In addition to varietal choices, producers use several non-varietal practices to manage WSS, including crop rotation,

avoiding previously infested fields, swathing, increasing wheat block size, planting less wheat, and other field management strategies.

Overall, WSS continues to impose significant economic costs on Colorado's wheat sector. One possible explanation is that adoption of resistant varieties may be stabilizing losses, even as infestation remains widespread. These findings point to an important next question for future research: what is the economic contribution of CSU's public wheat breeding program through the development and adoption of wheat stem sawfly-resistant varieties? This analysis will provide a clearer understanding of the value of these resistant varieties in reducing losses and supporting the long-term resilience of Colorado's wheat sector. Results are expected to be shared in a future bulletin.

Acknowledgements

We would like to thank the Colorado wheat farmers who participated in the survey and generously shared their time and insights. We also appreciate the entire team behind the CSU Wheat Field Days for making this study possible by connecting us with producers across the state. This work was supported by funding from the Colorado Wheat Research Foundation.

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Colorado Wheat Stem Sawfly Survey

Adam Osterholzer and Punya Nachappa

Background

The wheat stem sawfly (*Cephus cinctus*) has become an increasingly significant pest in Eastern Colorado wheat production. It was initially detected in 2010 at New Raymer. Adult sawflies emerge from wheat stubble in the spring, coinciding with the jointing stage of wheat development. Females lay eggs inside wheat stems over a 4–6-week flight. Once the eggs hatch, the larvae feed on the internal pith, compromising plant integrity. As the plant matures, larvae move toward the crown, construct a pupation chamber, and sever the stem. This causes lodging before harvest.

Survey Overview

To assess the geographic spread and severity of WSS infestations, a statewide survey has been conducted annually since 2013. Survey sites are selected based on wheat acreage per county, proximity to the previous year’s wheat stubble, and a minimum distance of 10 miles from other survey sites. At each site, 100 wheat tillers are dissected to determine the presence of WSS larvae. Infestation levels are classified as follows:

- **Low:** <10% of tillers infested
- **Medium:** 10%–50% of tillers infested
- **High:** >50% of tillers infested

Infestation Trends

From 2013 through 2025, survey data indicated a steady increase in the proportion of infested sites, including a notable rise in locations with medium and high infestation levels (**Table 1**). In 2024, there was a significant rebound in infestation from the prior year. 2025 had a similar overall level of infestation, with a notable southward spread beyond I-70 (**Figure 1**).

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Not Infested	56	50	32	81	42	46	41	33	44	34	17	16	8
<10%	20	30	48	11	36	26	29	41	33	15	25	17	14
10-50%	13	15	16	4	13	12	22	20	20	24	19	19	27
>50%	5	5	3	3	5	12	14	11	3	21	4	17	11
Total Sites	94	100	99	99	96	96	106	106	100	94	65	69	60

Table 1: Number of wheat fields in each WSS infestation category from 2013 to 2025.

Additional results from previous years can be found at www.csuwheatentomology.com.

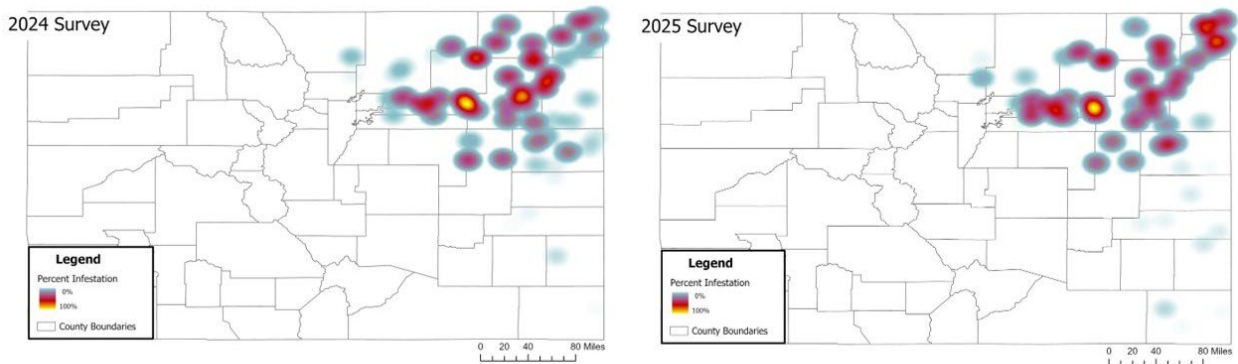


Figure 1: State-wide WSS infestation in 2024 and 2025. Note the WSS expansion south of the I-70 corridor.

First report of entomopathogenic fungi (EPF)-infecting sawfly larvae in wheat

We found a natural infestation of entomopathogenic (insect-infecting) fungi on WSS larvae in New Raymer in 2022. A notable finding in 2025 was the presence of the EPF across the state (**Figure 2**). The larvae were found dead and infected within the stems, thereby preventing stem cutting. We have begun characterizing the EPF and evaluating their potential as biocontrol agents.

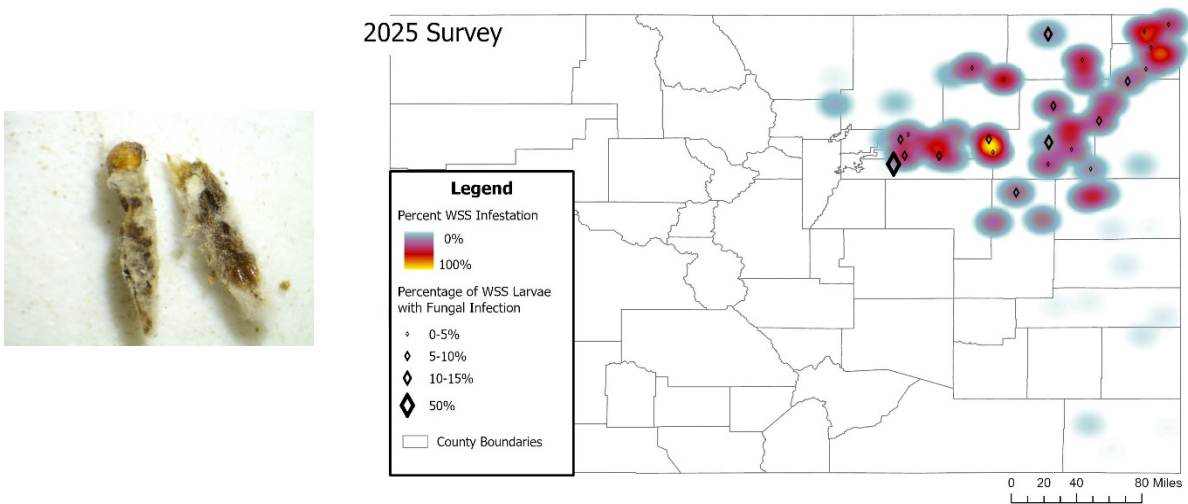


Figure 2: Wheat stem sawfly larvae found to be naturally infested with entomopathogenic fungi (Photo by Grace Miner). 2025 EPF-infected sawfly infestation overlaid on the WSS state-wide survey.

Acknowledgements

We want to acknowledge the Colorado wheat growers, the Colorado Wheat Administrative Committee, which supported this project, and the numerous undergraduate students who helped process thousands of wheat stems!

Does Stem Solidness Influence Residue Decomposition in Winter Wheat?

Nick Skaric and Steve Fonte

Wheat stem sawfly (*Cephus cinctus Norton*) management in Colorado has increasingly shifted toward semi-solid and solid-stemmed wheat varieties. As adoption of these varieties has grown, questions have emerged about how the solid stem trait could affect soil cover and other agronomic factors beyond sawfly resistance. Stem solidness comes with a change in the overall composition of wheat residues that could influence wheat residue decomposition processes and persistence following wheat harvest, with potential implications for soil water conservation, erosion control, weed management, and long-term productivity.

To examine the impact of solidness and associated residue quality characteristics of decomposition processes, we conducted a laboratory incubation study. We tested eight varieties of winter wheat, spanning a gradient of stem solidness, from hollow to solid. We also evaluated residue decomposition rates in the field using a litterbag study of the same varieties, and monitored residue cover from wheat variety test plots in Akron, Colorado. In addition to solidness, we measured residue quality by evaluating total nitrogen (N), carbon (C), lignin, hemicellulose, and cellulose (Table 1). The incubation study tracked CO₂ respiration from decomposing residues over 134 days, while the litterbag study lasted 229 days (August 2025 to April 2026). Residue cover was also monitored between September 2025 and April 2026 for three varieties representing hollow, semi-solid, and solid stem varieties.

While variety was an important predictor of decomposition rates, there was no clear impact of solidness on decomposition rates for either the incubation or litterbag study (Figure 1). Instead, the chemical quality of residues appeared to be a more important determinant of mass loss. For example, total N and C:N ratio were both important determinants of decomposition rates, with faster residue decay occurring in varieties with high total N concentration and lower C:N ratios (Figure 2). Additionally, higher fiber content (lignin, hemicellulose, and cellulose) was associated with slower decomposition rates. Residue quality data for the eight varieties helps explain the observed patterns of mass loss. For example, Fortify SF had the highest fiber content and lowest N, consistent with the slow decomposition rates observed across both studies.

While not statistically significant, residue cover observations suggest that stem-solidness may support soil cover, such that the most solid variety maintained higher residue cover across the seasons compared relative to the plots with semi-solid and hollow varieties, though the difference was subtle (Figure 3).

Taken together, these results suggest that stem solidness is not a strong driver of residue decomposition or cover persistence. Instead, varietal differences in decomposition appear to be governed primarily by residue parameters including fiber content and N availability, rather than by the structural characteristics that define solid stem trait expression. Future research should examine how climate, soil properties, and nutrient management and water availability interact with stem solidness expression to shape decomposition dynamics, including the potential role of water-soluble carbohydrates, which accumulate in stem internodes prior to grain filling and may accelerate early-phase decomposition given their readily mineralizable nature (Scofield et al., 2000).

Table 1. Residue quality parameters for eight winter wheat varieties used in litterbag and lab incubation studies. Note: aNDF represents the sum of hemicellulose, cellulose and lignin, while ADF is the sum of lignin and cellulose.

Variety	Solidness Rating	Commercial Solidness	Total N (%)	C:N Ratio	Hemicellulose (%)	Cellulose (%)	Lignin (%)	aNDF (%)	ADF (%)	L:N Ratio
Byrd CL Plus	5	5	0.49	92	26.6	37.4	12.7	76.7	50.1	25.83
Canvas	5	5	0.61	73	25.0	10.4	36.4	71.9	46.8	59.75
AP Solid	7	16	0.74	62	23.1	21.2	19.8	64.0	40.9	26.68
WB4444	9	14	0.56	81	29.2	29.3	16.4	73.2	47.5	29.36
Fortify SF	10	12	0.40	110	27.5	29.3	20.8	77.5	50.0	51.83
Amplify SF	12	17	0.48	94	25.7	34.0	13.5	73.2	47.5	28.41
Windom SF	12	15	0.57	78	25.0	4.7	43.2	72.8	47.8	75.5
WB4733	19	19	0.57	78	21.9	28.5	15.5	65.9	44.0	27.24

Residue quality metrics were measured at the variety level from bulk samples; values are not replicated within variety.

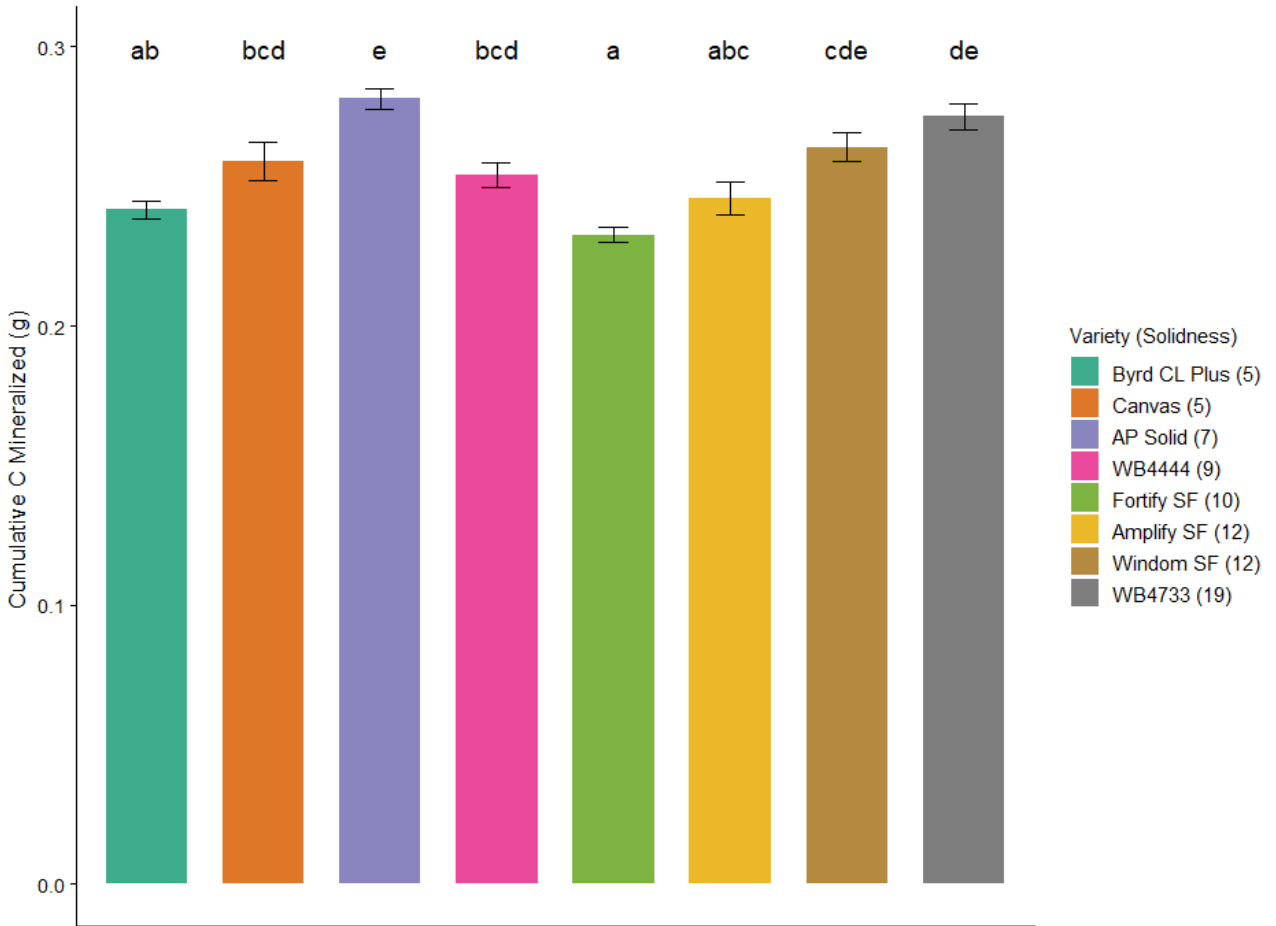


Figure 1. Average cumulative carbon mineralized on final date of sampling for eight winter wheat varieties. Significant differences among varieties were detected, but decomposition did not follow a consistent pattern with increasing solidness. The variety with the greatest cumulative C mineralized (AP Solid) and the least (Fortify SF) were both semi-solid. Letters indicate Tukey-adjusted pairwise differences ($\alpha = 0.05$).

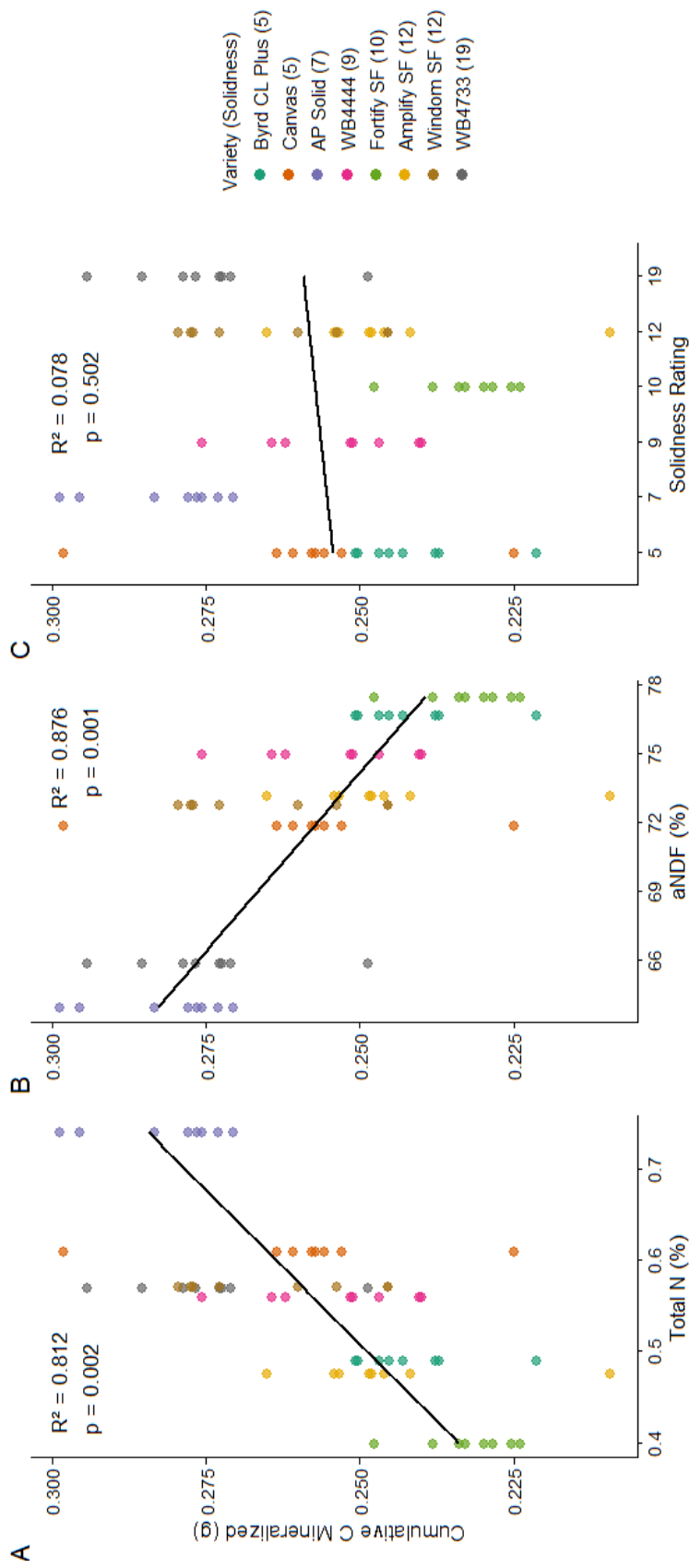


Figure 2. Relationship between residue quality metrics and cumulative carbon mineralized across eight winter wheat varieties during a laboratory incubation. Total N (A), aNDF (B), and solidness rating (C) were evaluated as predictors of cumulative C mineralized. Points represent individual jar replicates; lines represent linear regression fits.

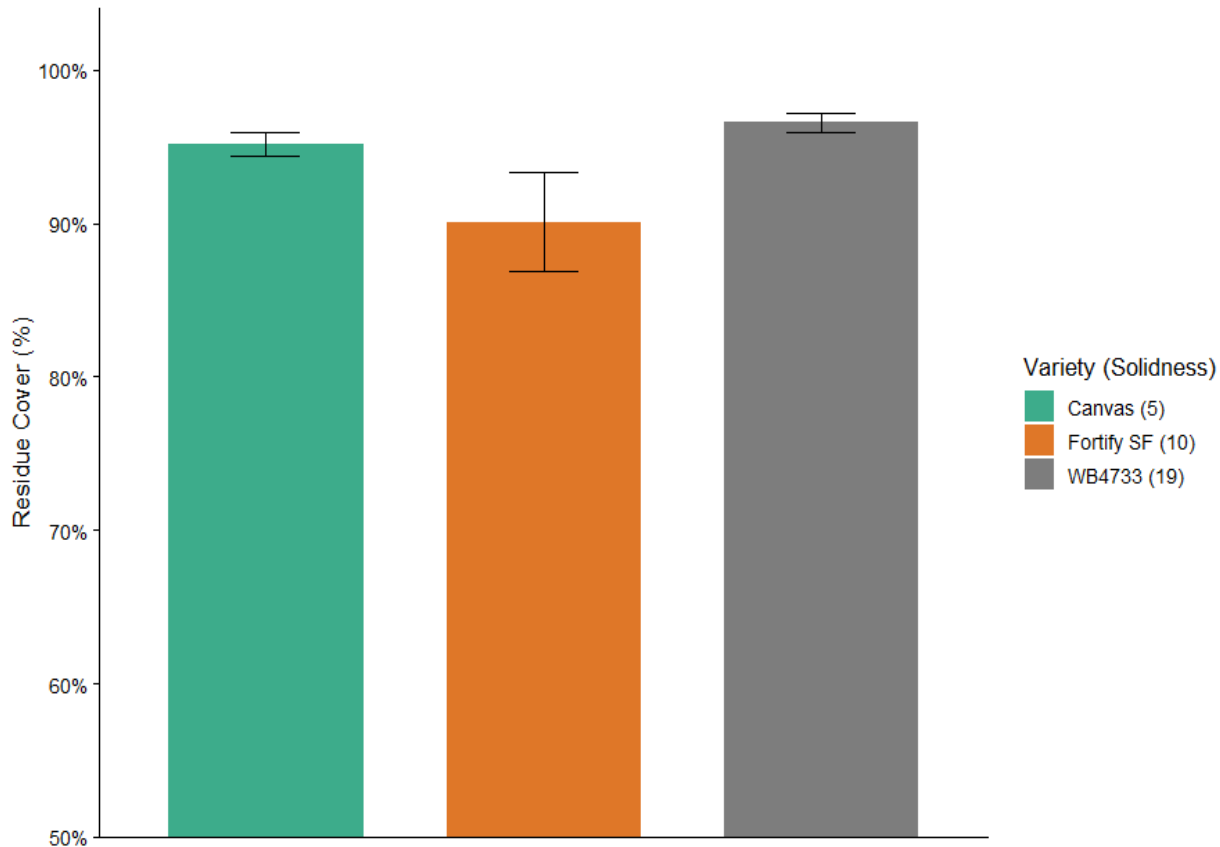


Figure 3. Mean residue cover (%) across five sampling dates (September 2025 – April 2026) for three winter wheat varieties differing in stem solidness. Bars represent plot-level means \pm 1 SE averaged across all dates and replicates ($n = 3$ plots per variety). All varieties maintained high residue cover ($>80\%$) throughout the season. No significant differences among varieties were detected ($F(2,6) = 3.046$, $p = 0.150$), though Fortify SF (solidness 10) showed numerically lower cover than Canvas (solidness 5) and WB4733 (solidness 19).

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Survey of Aphid and Mite Populations in Colorado Wheat

Adam Osterholzer and Punya Nachappa

Background

While the wheat stem sawfly remains the predominant insect pest of wheat in Colorado, aphids and mites have also caused widespread damage in recent years. High populations of these pests were observed during the 2025 growing season, and infestations have intensified further in 2026, with many growers reporting outbreaks that have reached or exceeded economic thresholds and requiring insecticide applications.

To better understand the extent and severity of these infestations, our program is conducting surveys across multiple wheat-growing locations in Colorado and actively monitoring pest outbreaks throughout the season. Findings and management updates will be shared through our bi-weekly newsletter in collaboration with the Colorado Wheat- <https://coloradowheat.org/2026-wheat-entomology-newsletter/>

Survey Overview

Since April 1st, our program has been using pan traps for weekly aphid sampling at Fort Collins, New Raymer, Akron, and Burlington (**Figure 1**). Additionally, we're collecting leaves in a 5-point transect at each location to monitor for mites. All samples are stored in ethanol and brought back to CSU, where we determine the species present and their respective abundances.



Figure 1: Our aphid sampling setup of 3 pan traps per location. Wheat leaves are also collected in a nearby transect to monitor for mites.

Infestation Trends

We have observed several pest species and mapped their distribution (**Figure 2**). Wheat curl mites and Russian wheat aphids are particularly widespread, with them being present from Fort Collins all the way to the state border. While we don't have full counts yet, we continue to see increased species diversity and abundance.

CO Pest Survey, Updated 5-5-26

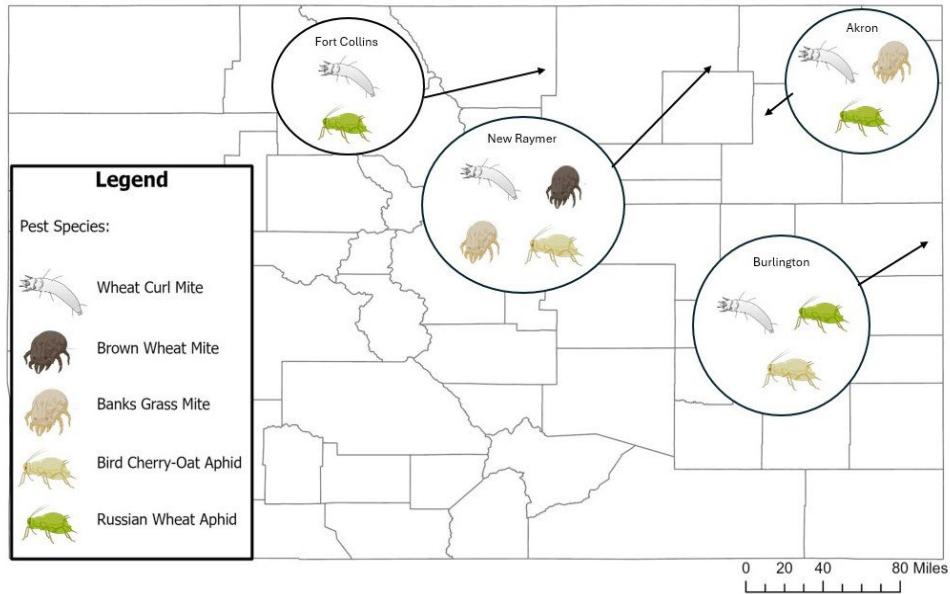


Figure 2: Map depicting wheat pest species observed in CO (as of May 5th, 2026).

Species of Interest

Wheat curl mite (*Aceria tosichella*): These mites are vectors for harmful plant viruses, including wheat streak mosaic virus (WSMV) and Triticum mosaic virus (TriMV). They are too small to be observed with the naked eye and are usually noticed when viral symptoms appear in the wheat crop (**Figure 3**). They often reside in volunteer wheat, so applying herbicides to last year's stubble is an important control measure for these pests. Utilizing resistant wheat varieties can further mitigate damage done to crops.



Figure 3: Wheat curl mites observed in our samples from New Raymer, CO.

Brown wheat mite (*Petrobia latens*): These mites have distinctly long forelimbs and cause tissue damage to wheat (stippling patterns on the leaves and leaf tips drying out). Although visible to the naked eye, they still require magnification to view in detail (**Figure 4**). They thrive during drought years, since heavy rainfall can drastically reduce population sizes. Insecticides are a common control measure for this pest, and destroying volunteer wheat can also help keep populations in check.



Figure 4: Adult brown wheat mite observed in our samples from New Raymer, CO.

Banks grass mite (*Oligonychus pratensis*): This mite causes stippling damage to leaves, discoloration, and can lead to tissues drying out. High infestations often arise during drought conditions. They overwinter in the soil substrate and are best observed under magnification (**Figure 5**). Pyrethroids are the most commonly used pesticides against this pest.



Figure 5: Banks grass mite adult specimen (photo by Texas A&M extension).

Bird cherry-oat aphid (*Rhopalosiphum padi*): The insect is 1/16 inch long, olive-green colored with a red-orange patch surrounding the base of the body (**Figure 6**). It is a known vector of barley yellow dwarf virus (BYDV), which causes leaf discoloration and diminished plant growth. Bird cherry-oat aphid infestations often coincide with outbreaks of other aphid species.



Figure 6: Bird cherry-oat aphid (photo by Ashley Raffa).

Russian wheat aphid (*Diruaphis noxia*): This aphid is about 1/16 inch long, lime green in color, and “spindle shaped” (**Figure 7**). It is a historically troublesome pest of Colorado wheat crops. Leaves infested by Russian wheat aphids have long white, purple, or yellowish streaks. The grain heads often have a “fishhook” appearance, resulting from awns becoming trapped in curled leaves.



Figure 7: Russian wheat aphid (left) and “fishhook” wheat head (right). Photos by Ashley Raffa.

What's the Deal with the 'Yellowing Disease'?

Nichole Barber and Dr. Robyn Roberts

There has been an uptick of disease that causes a striking 'yellowness' to wheat. You may have heard it referred to as 'yellowing disease.' So, what is it? It could be one of two things:

1. *Triticum* mosaic virus

Triticum mosaic virus (TriMV) is a virus that has been in Colorado for about 15 years, but only recently became a concern. It is closely related to wheat streak mosaic virus (WSMV), but it is a different virus that is controlled by different resistance genes.

TriMV is not only becoming more prevalent, but the disease it causes is more severe than previously observed. Some have called this 'yellowing disease' since the disease can become so severe that the plants almost turn completely yellow. However, this is a severe case of TriMV, not something new. If you have TriMV, the entire field will have symptoms in a fairly uniform manner.

There is no spray or chemical that can be applied to control or cure the virus. The best strategies we have to control it are 1) virus resistant varieties, and 2) controlling volunteer wheat. For disease resistance, see the information in this booklet for information on available varieties. Controlling volunteers between harvest and planting interrupts the 'green bridge' to prevent the viral vector, the wheat curl mite, from surviving harvest and overwintering in volunteers. Corn and other grassy weeds also host the mites, so be sure these are addressed as well.

—OR—

2. Another pathogen?

Over the past five years, we have observed a new disease symptom that is associated with TriMV, but TriMV does not seem to be the only component of the system. These plants appear quite yellow and appear in patches in a field. Usually, we will see one or a few plants that are stunted and yellow, and the neighboring plants are asymptomatic. The yellow plants are all infected with TriMV, but the symptoms do not match what we have previously seen for TriMV. We are calling this possible new pathogen/disease 'yellowing disease.' We are currently investigating what else may be causing these plants to get sick. If you see this in your fields, Dr. Robyn Roberts (robyn.roberts@colostate.edu) would like to know!

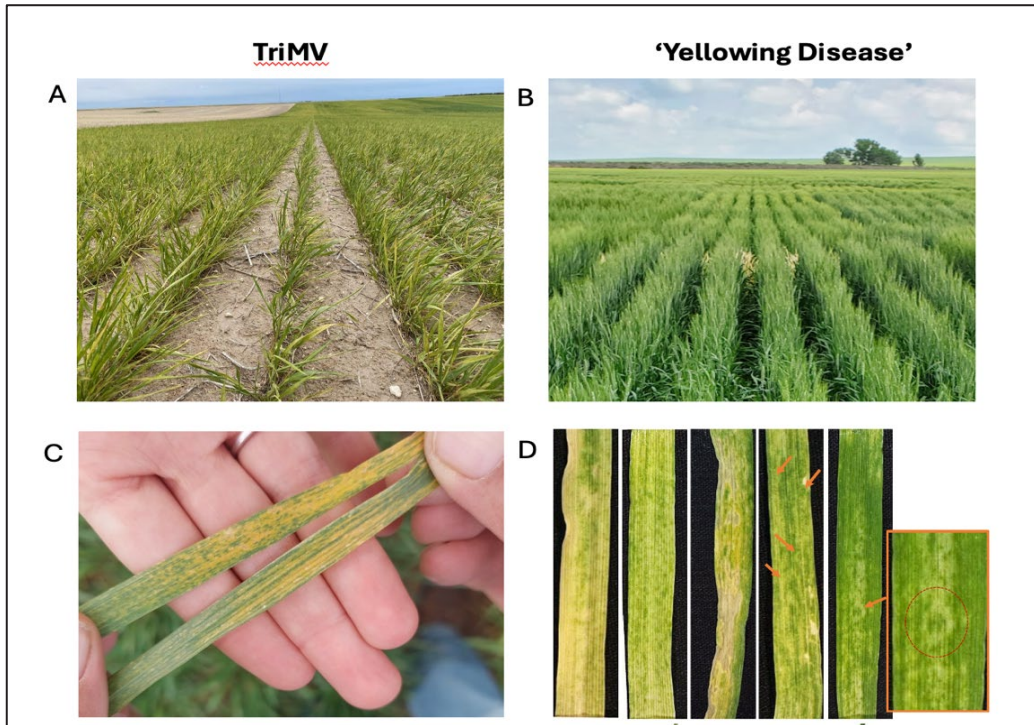


Figure 1. (A) Field infection of TriMV with uniform yellowing across the field compared to (B) 'Yellowing disease' in the field appearing in patches. (C) TriMV symptoms on individual leaves from infected field wheat showing typical yellow streaking and mosaic patterns compared to (D) Yellowing disease symptoms showing severe yellowing and ringspots (orange square).

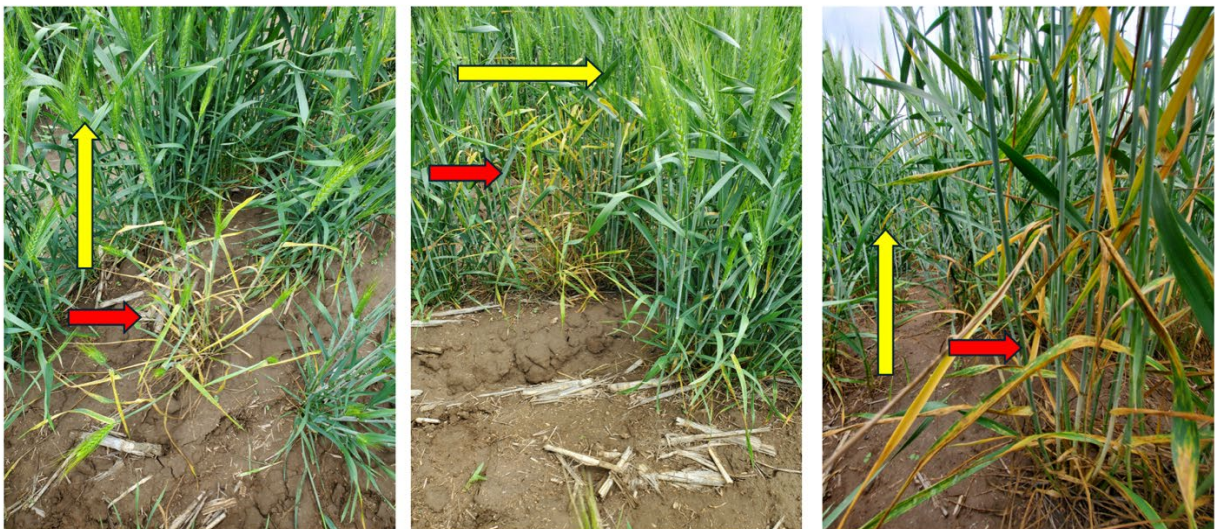


Figure 2. Yellowing disease in the field showing severe yellowing (red arrows) surrounded by asymptomatic plants (yellow arrows) of the same variety as the diseased plants.

Weather-Variable Nitrogen Management in Winter Wheat: Optimizing Grain Yield and Protein Concentration in Semi-Arid Systems

Therese Thompson, Danica Kluth, Jerry J. Johnson, Jim Ippolito, Leo Deiss

Introduction

Winter wheat production in eastern Colorado's semi-arid environments is influenced by variable weather conditions and nutrient limitations, particularly nitrogen (N). Nitrogen is the primary driver of grain yield and grain protein concentration (GPC). An inverse relationship between grain yield and GPC, in which as yield increases GPC generally declines (“the dilution effect”), poses a risk to production systems as above average precipitation years may simultaneously increase yield and reduce GPC below market thresholds resulting in price discounts despite higher yields. Utilizing N management to mitigate the dilution effect is difficult given seasonal variability. In dry years, yield benefits from additional N inputs are limited, complicating nutrient management decisions.

This study assessed the N response of three winter wheat varieties (Canvas, Langin, and Snowmass 2.0) across 14 environments in the west-central Great Plains over two growing seasons (2019-2020). The objectives of this study were to 1) determine agronomic optimal N rates to balance high yield with minimal protein dilution; 2) quantify varietal differences in N responses for grain yield and GPC; and 3) assess how soil and weather modulates wheat performance at optimum N management.

Methodology

Trials were conducted at 14 environments (site-year combinations) in eastern Colorado during 2019-2020 across eight locations (Arapahoe, Burlington, Genoa, Julesburg, Lamar, Roggen, Sheridan Lake, and Yuma) and two sites (Akron and Orchard) were excluded due to sawfly damage that compromised the study. These environments encompassed a diverse range of soil types, tillage practices (no-till, minimum-till, vertical tillage, and conventional tillage), crop rotation, and climatic conditions representative of the west-central Great Plains dryland wheat belt. Growing season precipitation ranged between 5.7-9.1 inches (2019) in the “wet year” and 1.6-6.4 inches in the “dry year” (2020). Growing degree-days (GDD) from planting to harvest ranged from 2194–2784 in 2019 and 2238–2939 in 2020. Weather data were collected from on-site automated weather stations installed at each trial location and supplemented with data from the Colorado Agricultural Meteorological Network (CoAgMET).

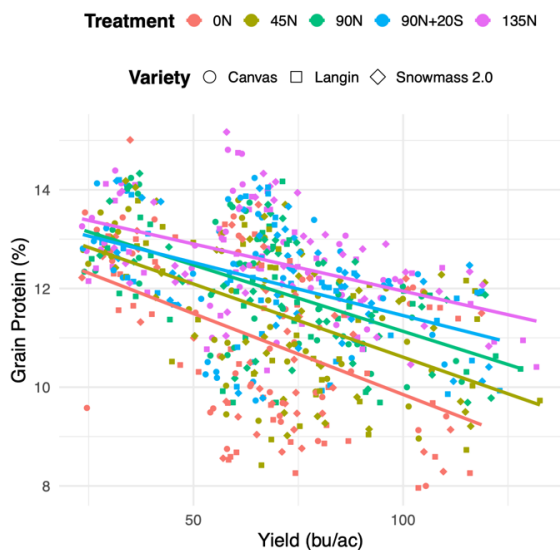
Three winter wheat varieties (Canvas, Langin, and Snowmass 2.0) were assessed and four nitrogen fertilizer rates (0, 45, 90, or 135 lbs. N acre⁻¹) were applied as urea ammonium nitrate and top-dressed in early spring. Pre-plant N applications were determined by the farmer (generally 8 lbs. N acre⁻¹ at plant as 8-28-0, and the remainder at preplant as urea applied in the fall). The agronomic optimum nitrogen rate (AONR) calculations included all N sources, including pre-plant and at-plant applications. Plots were harvested using a small plot combine equipped with a Harvest Master H2 GrainGauge to collect experimental unit grain weight, grain moisture, and grain test weight. Grain samples were collected from each plot at harvest to assess protein values.

Total available N was calculated as the sum of applied N, residual soil nitrate (NO₃⁻) from the 0–12 inch depth, and organic matter (OM) credit (estimated at 30 lbs. N acre⁻¹ per 1% soil organic matter). For each location-year-variety combination, linear and quadratic regression models were fitted to assess grain yield responses to total available N. The relationship between grain yield (bu ac⁻¹) and grain protein concentration (GPC, %) was modeled. To assess the influence of weather variability on the study, a model was used to assess the conditional distribution of wheat grain yield at AONR as a function of several key environmental and soil factors (such as rainfall and GDD), to account for year-to-year variation in yield.

Results

The concept of grain protein dilution was confirmed by the results of this study in which a negative relationship exists between grain yield and GPC. However, the intensity of this relationship was modified by N treatment; higher N application rates (90N and 135N) were associated with a lessened severity of protein dilution at higher yields. This pattern was consistent across the three varieties which all had similar responses in yield-protein tradeoff and benefit from N fertilization. Considering the economic input of additional N fertilization, the protein premium needed to cover N fertilizer cost decreases as yield increases. At low yields, the required protein premium needed to cover N fertilizer cost is larger; however, at higher yields the required premium is decreased, thus at higher yields increased N applications are more economically justified.

Protein Premium Programs



Protein Premium Needed to Cover N Fertilizer Cost

Numbers at points are protein increase vs ON line (%)
Assuming \$0.60 per lb N and wheat at \$5 bu

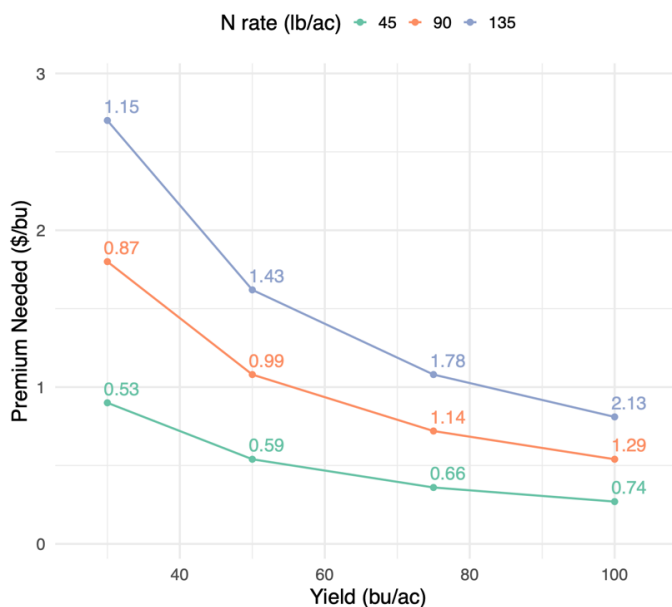


Figure 1. Grain protein response to N fertilization and protein premium required to offset nitrogen fertilizer costs across N rates and wheat varieties.

The N level that maximized grain protein concentration to the commercially desirable 12% was on average 18% higher than to maximize yield, indicating a higher N input needed to avoid

protein dilution. These findings indicate that achieving commercially acceptable GPC levels often demands more N than maximizing yield alone.

The results of this study demonstrate that nitrogen management influences grain yield and GPC, but crop responses vary depending on environmental conditions, particularly precipitation. Grain yield varied annually with values ranging from 62–126 bu ac⁻¹ in the wetter year (2019) and 26–76 bu ac⁻¹ in the drier year, reflecting 32% lower average grain yield in the drier year. In drier seasons, the benefits of additional N fertilization are limited, while favorable environmental conditions (higher rainfall and GDD) enhance response to N. However, in N limited conditions, higher rainfall and GDD intensifies risk of dilution effect resulting in price discounts. This highlights the importance of adapting N management to seasonal environmental conditions to ensure effective N application.

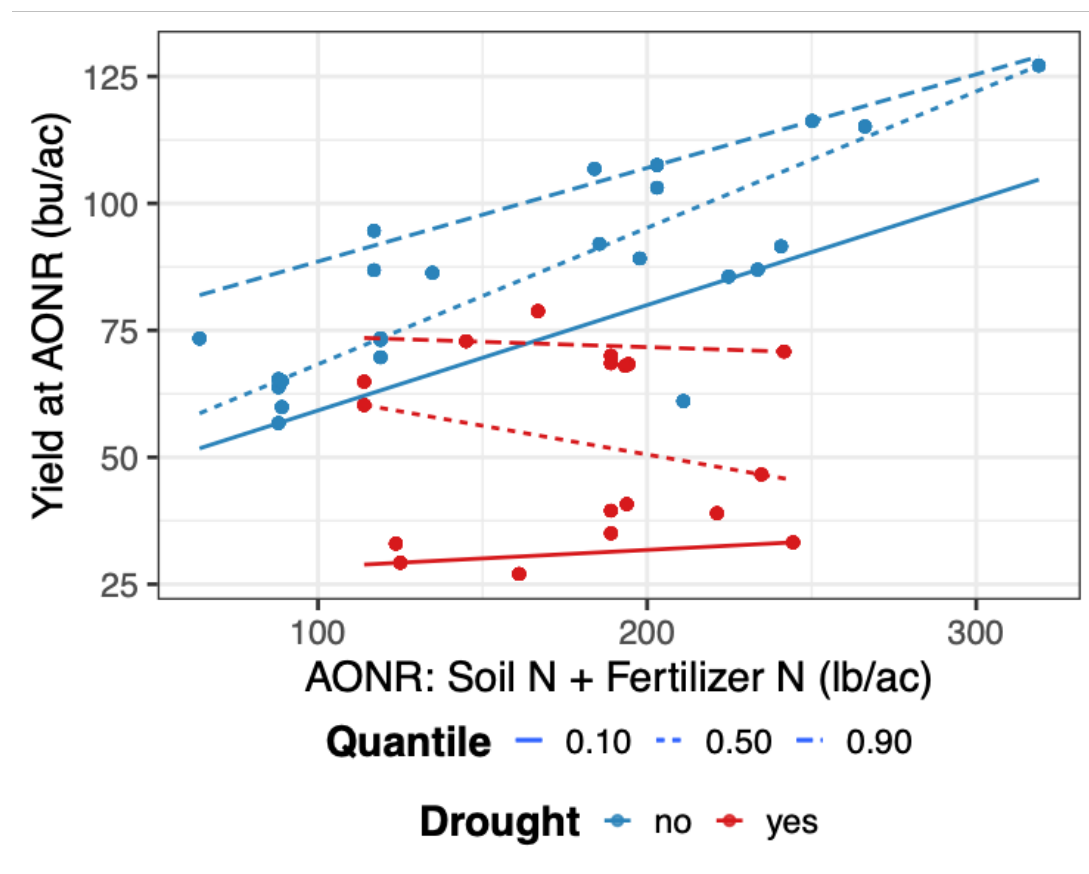


Figure 2. The relationship between total available nitrogen supply at the agronomic optimum N rate (soil N + fertilizer N, 0–12 inches depth) and grain yield at AONR under wetter (2019) and drier (2020) conditions across three winter wheat varieties (Canvas, Langin, and Snowmass 2.0) across 14 environments (site-year combinations).

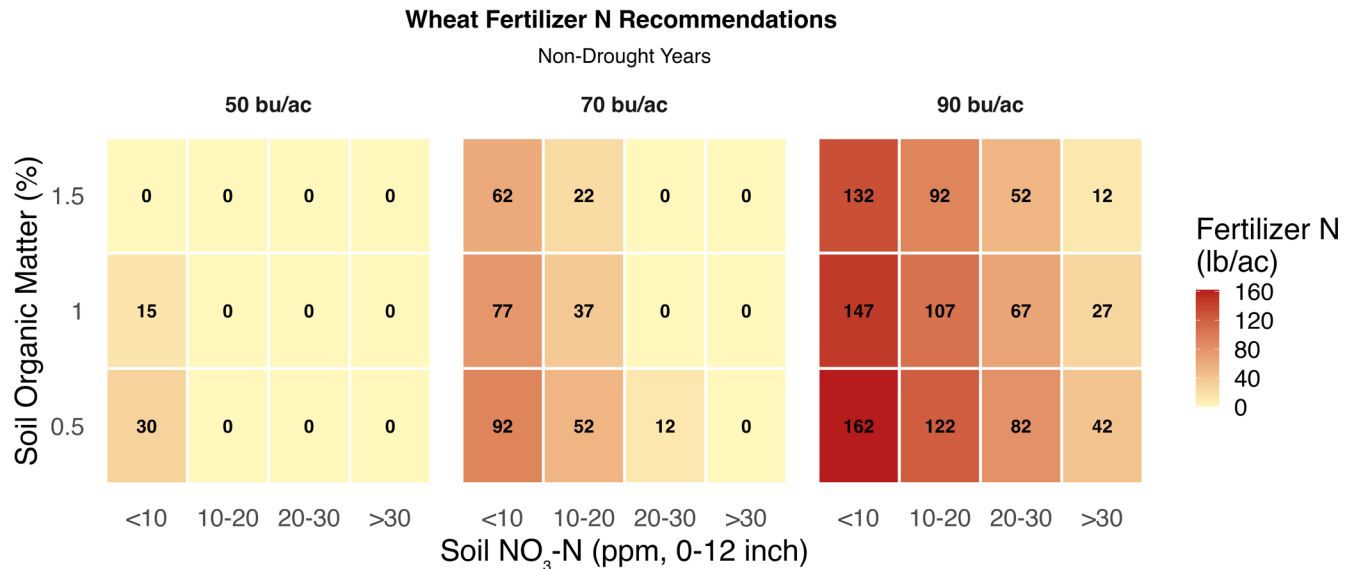


Figure 3. Fertilizer nitrogen (N) recommendations (lb ac⁻¹) for winter wheat at three yield goals (50, 70, and 90 bu ac⁻¹) as influenced by soil organic matter (SOM, %) and pre-plant soil nitrate-N concentration (ppm, 0–12 inch depth). Recommendations are derived from the median linear yield–N response $Y = 39.79 + 0.283N$ using standard N credits of 30 lb N ac⁻¹ per 1% SOM and 4 lb N ac⁻¹ per ppm NO₃-N. Results are shown for non-drought years. Zero values indicate that soil N supply is sufficient to achieve the yield goal.

Conclusion

This study demonstrates the importance of weather-adaptive nitrogen management for balancing grain yield and grain protein concentration in semi-arid winter wheat production systems of the west-central Great Plains. Results confirmed a consistent negative relationship between yield and grain protein (the dilution effect), which can be substantially mitigated by higher N rates. On average, achieving commercially desirable protein levels (~12% protein) required 18% more nitrogen than rates that maximized yield alone. Nitrogen response was strongly modulated by seasonal precipitation: additional N provided limited benefit in dry years but drove significant gains in yield and protein under favorable, wetter conditions. The three varieties evaluated (Canvas, Langin, and Snowmass 2.0) showed similar responses to N, indicating that variety selection had less influence than N rate and environment. Economically, higher yield environments lowered the protein premium needed to offset fertilizer costs, supporting more intensive N programs when conditions are productive.

These findings underscore the value of flexible, site- and season-specific N strategies that integrate soil testing, yield goals, soil organic matter, and weather outlook to optimize productivity, grain quality, and profitability while reducing risk in variable climates. This is preliminary data from 14 environments over two seasons. Further on-farm collaboration is needed to strengthen these recommendations by capturing a wider range of soil types, weather conditions, wheat varieties, and management histories.

Colorado Wheat Update

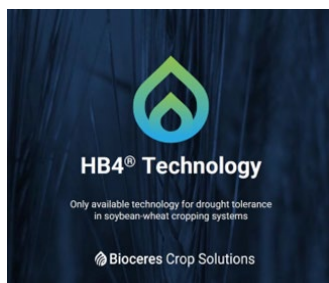
Brad Erker – Executive Director

Colorado Wheat is a strategic alliance that houses three distinct but cooperating organizations working together to serve the state’s wheat growers. The **Colorado Wheat Administrative Committee (CWAC)** collects an assessment of two cents per bushel at first point of sale, and invests those funds in research, education, and promotional activities. Board members serve on the Boards of US Wheat Associates, and the Wheat Marketing Center. The **Colorado Association of Wheat Growers (CAWG)** is funded by voluntary membership fees and sponsorships. CAWG lobbies at the state and national level on policies that affect wheat, and Board members serve on the Board of the National Association of Wheat Growers. CAWG does not utilize assessment funds for lobbying. The **Colorado Wheat Research Foundation** takes ownership of wheat varieties and traits developed at CSU and markets them in Colorado and regionally under the PlainsGold® brand.

Colorado is the only wheat state that runs these three types of organizations in tandem as much as we do. CWAC and CAWG meetings are held jointly four times per year. The CWRF Board is composed of four members from CWAC, three members from CAWG, and two members from the Colorado Seed Growers Association. This cohesiveness is reflected in the new Colorado Wheat logos which all have a similar style, and in the new website, at www.coloradowheat.org.



Colorado wheat producers planted 2.0 million acres for harvest in 2025, 100,000 acres fewer than in 2024. **Amplify SF** returned to being the top planted variety with 10.5% of the acreage (NASS survey: Winter Wheat Seedings, 2026 Crop), after being the most-planted variety in 2024. **Langin** was second-most-planted, accounting for 6.3% of the acreage. **AP Solid** was third at 5.9%. **Kivari AX**, a CoAXium® variety, came in at fourth place with 5.5% of the acreage. **Snowmass 2.0**, a Hard White Winter variety which is exclusive to use in the Ardent Mills program, tied for fourth place at 5.5%. Of varieties reported by name, 81% of the acreage was planted to varieties released by CSU and marketed by PlainsGold®. Colorado producers also reported that 51% percent of their seed planted was Certified wheat seed, and that 21% of their seed planted was treated with fungicide or insecticide.



On July 31, 2025, CWRF entered into an agreement with Bioceres and Albaugh to manage the HB4 trait. HB4 is a drought tolerance trait, sourced from the sunflower plant.

It has been put into both soybeans and wheat. The trait modulates the expression of several hundred other genes to provide drought tolerance, as well as providing a new tool for weed control in the form of tolerance to glufosinate herbicide.

In June 2022, the Food and Drug Administration approved the HB4 trait for Food and Feed consumption in the U.S. In August 2024, the United States Department of Agriculture approved the HB4 trait for cultivation in the U.S. This marks the first time in history that a GM (Genetically Modified) trait has been deregulated for wheat in the US. However, deregulation does not mean we will start growing GMO wheat here immediately. Several steps must still be taken before US wheat growers will plant, grow, or harvest GMO wheat. One of the most important of these steps is acceptance by major wheat export markets. The US Wheat Associates/National Association of Wheat Growers “Wheat Industry Principles for Biotechnology Commercialization” state that “regulatory approvals for food and feed use must be secured in major wheat export markets that will be affected where a functioning regulatory system exists. Major export markets are defined as those which represent at least five percent of export volumes.” There are seven countries currently on this list: Mexico, the Philippines, Japan, China, South Korea, Nigeria, and Taiwan.

As of this writing in May of 2025, CWRP has facilitated early breeding work with six other public wheat breeding programs to put the HB4 trait into a variety of different genetics. Public wheat breeding programs in Kansas, Oklahoma, Texas, Montana, South Dakota, and North Dakota have started the process, which is required to be done (for now) only at a secured research facility called Heartland Plant Innovations in Manhattan, Kansas. The involved states account for 70% of US planted wheat acreage, which demonstrates strong support. The trait has been shown to provide a 20% yield benefit in drought conditions in Argentina. It will be 2-3 more years before we can test the effect of the trait in our adapted varieties in the US. It will likely be 5-7 years before growers could grow this wheat commercially, and that assumes all export market approvals are in place.

For more information on any of the work being done by Colorado Wheat, stay in touch with us:

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