

Winter Wheat Variety Performance Bulletin

2024



Winter Wheat Breeding Program

Department of Plant Sciences and Plant Pathology

<https://plantsciences.montana.edu/crops/index.html>

Table of Content

Content	Pg. No.
Introduction	3
Variety testing methods	3-5
2024 Winter wheat overview	5
Variety Selection	5
Information on cropping history, seeding date, fertilizer applications, and harvest date at each location	6
Public and private hard winter wheat varieties and experimental lines in the 2024 intrastate test	7-9
Performance of varieties at different locations	
Arthur H. Post Agronomy Farm, Bozeman (Location 1)	10
Western Triangle Agricultural Research Center, Conrad (Location 2)	11
Nutrien Agri Solutions, Fort Benton (Location 3)	12
Northern Agricultural Research Center, Havre (Location 4)	13
Southern Agriculture Research Center, Huntley (Location 5)	14
Northwestern Agricultural Research Center, Kalispell (Location 6)	15
Central Agricultural Research Center, Moccasin (Location 7)	16
Eastern Agricultural Research Center, Sideny (Location: 8)	17
Research Extension Center, Williston-North Dakota (Location: 9)	18
Performance cross locations, disease reaction and stem sawfly scores in cropping season 2024	19
Stem solidness (SS) and number of infested stems (IS) as identified in selected intrastate entries at primary stem sawfly areas	20
Weather data of cropping season 2024	21-22
Acknowledgements	23

2024 MONTANA WINTER WHEAT VARIETY PERFORMANCE REPORT

Arpit Gaur^{1,2}, Ronald Proctor^{1,2}, Ronald Ramsfield^{1,2}, Andrew Lehnerz^{1,2}, Duncan Pantos², Ricardo Javier Leiton Cubillo², Chengci, Chen³, Calla Kowatch-Carlson³, David Larson³, Dale Clark⁵, Deanna Nash², Jessica A. Torrión³, Doug Holen², Joseph Jenson, Jed Eberly³, Jennifer Hammontree³, Justin Jacobs⁴, Kent McVay³, Peggy Lamb³, Qasim Khan³, Trevor Schafer⁵, Wyatt Medina³, and Suchismita Mondal^{1,2}

¹Winter Wheat Breeding Program, Montana State University

²Dept. of Plant Sciences and Plant Pathology, Montana State University

³Montana Agricultural Experiment Station (MAES), Montana State University

⁴Williston Research and Extension Center, Montana State University

⁵Nutrien Ag Solutions, Bozeman, Montana.

Introduction

Intrastate trials are conducted by the Montana Agriculture Experiment Stations (MAES) across the agro-climatic zones to evaluate the performance of new developed hard red winter varieties and breeding lines in comparison to released and widely grown varieties in Montana. The data presented is provided by the research personal of MAES, NDSU and private entities. Data from some locations are not available due to winterkill and other unavoidable circumstances.

Variety testing methods

1. Locations, experimental design and seeding method

Intrastate trial winter wheat trial was evaluated at eight locations in Montana and one location in North Dakota. Figure 1 shows the test locations which include, Conrad, Ft. Benton and Havre (North Central District), Moccasin (Central District), Huntley (Southern District), Sidney and Williston, ND (Northeast District), Kalispell (Northwest District) and Bozeman (Southwest District).

The trial consists of 49 entries with 3 replicates and arranged in a 7x7 lattices or a randomized complete block design at each location. Plot size varies by location, from 35 ft² at Conrad to 60 ft² at Havre. Row number also varies; Bozeman and Havre are 3-row, Conrad, Huntley, Ft. Benton, and Sidney are 4-row, Moccasin (5-row), Kalispell (7-row), and Williston (8-row). Row spacing at all locations was on 1 ft. centres, except at Williston and Kalispell (6" centers). All plots were seeded at 1 million seeds/acre, except at Kalispell (1.25 million) and Williston (1.17 million seeds/acre). Information on cropping history, seeding date, fertilizer applications, and harvest date is available for most testing locations in Table 1.

All seed, for each nursery, was treated with CruiserMaxx Vibrance Cereals® seed treatment and Gaucho® insecticide seed treatment, at recommended rates, before seeding.

2. Entries in Intrastate trial 2024

A total of 49 hard red winter wheat varieties and experimental breeding lines were evaluated in 2024 as part of the Intrastate trial. Of these, 21 were from private industries and 28 from public institutions (Table 2). Two of the private entries and sixteen of the public entries were experimental lines.

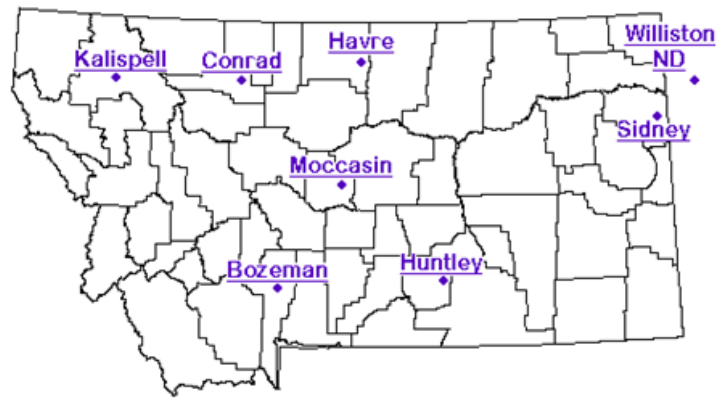


Figure 1. Locations of interstate trials for hard winter wheat performance tests in 2024

3. Data Collection

I. Days to heading Date (DTH)

Heading date was recorded when 50% of the heads in a plot are extended above the flag-leaf collar. DTH was calculated as the number of days between 1st January, 2024 and heading date.

II. Days to maturity (DTM)

Heading date is recorded when 50% of the heads in a plot are extended above the flag-leaf collar. Heading dates are recorded both in ordinal date (number of days from January 1) and the actual calendar date.

III. Plant height (PH)

Plant height was observed in inches as a length of a plant from ground to head (excluding awns). Data was collected 20 days after heading.

IV. Hail damage (HaD)

Hail damage was observed in Bozeman as an estimated percentage of grain loss per plot. For this purpose, Suchismita Mondal and Arpit Gaur conducted an independent survey. The grain loss per plot was scored on a scale of 0 (no loss) to 100 (complete loss). The mean both surveys was used for analysis.

V. Lodging

Percentage of plot fallen on the ground was noted for lodging on the score of 0 (erect) to 100 (completely on ground).

VI. Yield (GY)

All rows of each plot are trimmed and measured prior to harvesting with an experimental plot combine. Grain yields are reported in bushels per acre based on a 60-pound standard bushel weight. In addition to yields obtained in 2024, data is provided for two (2023-2024), three (2022-2024), four (2021-2024), and five (2020-2024) year averages for hard wheat entries tested during previous cropping seasons.

VII. Test Weight (TW)

Test weights (pounds per bushel) were obtained for each plot by using a DICKEY-john® Grain Analysis Computer (GAC) at some locations. Other locations use a Seedburo® test weight apparatus. In this case, a sample is dropped through a funnel at a given height into a quart brass bucket, excess grain is removed by a flat stick then weighed on a gram scale, and grams per quart are converted into pounds per bushels.

VIII. Grain Protein

Grain protein is sampled from a composite of all 3 replicated plots at each location. It is reported as a percentage by NIR (near-infrared reflectance) using an Infratec® whole grain analyzer. Samples are adjusted to a 12% moisture basis.

IX. Wheat Stem Sawfly

Wheat stem sawfly (WSS) is a persistent and economic problem for wheat growers in Montana. Host plant resistance in the form of stem solidness has been effective in reducing sawfly losses in both spring and winter wheat. Current MSU/MAES solid-stemmed winter wheat varieties include Judee, (released in 2011), Bearpaw (2011), Warhorse (2013), Loma (2016), Bobcat (2019) StandClear CLP (2020), and MT WarCat (2022). Sawfly cutting percentage was noted at Ft Benton location where sawfly pressure was present.

X. Disease Reactions

Yellow rust severity (YR) was scored as percentage on a scale of 0 (resistant) to 100 (highly susceptible).

4. Statistical analyses and interpretation

The data collected at each winter wheat location was analyzed as a three-replication lattice or randomized complete block design. Least significant difference at the 0.05 probability level (LSD, $p = 0.05$) and coefficients of variation (CV) were calculated from analysis of variance at each location. The LSD is used to compare the performance of two specific varieties at a time. If the difference between two varieties exceeds the LSD, this is interpreted as a true difference because a difference between two varieties this large will only occur 5% of the time due to chance.

5. 2024 Winter wheat overview

The USDA Agricultural Statistics Service reported statewide winter wheat yields at 50 bushels per acre (bu/ac) nearly equal to season 2023. This year, a total of 91.5-million-bushel winter wheat was harvested from 1.8 million acres, which is near 6.8% higher than winter wheat season-2023 (total production = 85.68 million bu) compared to 1.80 million acres harvested in 2022.

6. Variety Selection

Performance summary for the hard red winter wheat varieties and experimental lines are presented in tables 3 through 13 from trials conducted at each experiment station sites and statewide. Across year performance of a variety or experimental line is presented for those that have been evaluated for two, three or four years. Variety selection should be based on yield stability at a particular location or within a particular district over a period of years. It is also important to consider other traits such as winter hardiness, heading data, test weight, protein, plant height, stem-solidness and disease resistance in the process of selection.

Table 1: Information on cropping history, seeding date, fertilizer applications, and harvest date at each interstate testing site

Location	Conditions	District	Field Cropping History		Fertilizer Application* (lb/ac)				Dates		Notes	
					N		P ₂ O ₅	K ₂ O				S
			2022	2023	Fall '23	Spring '24				Seeding		Harvest
Arthur H. Post Agronomy Farm	Dry land	Bozeman	Barley	Fallow	210					10/15/2023	08/14/2024	
Western Triangle Agricultural Research Center	Dry land	Conrad										
Nutrien Agri Solutions	Dry land	Fort Benton										
Northern Agricultural Research Center	Dry land	Havre	Feed Barley	Chem fallow	44	46	9	4	4	10/09/2023	07/22/2024	
Southern Agriculture Research Center	Dry land	Huntley										
Northwestern Agricultural Research Center	Dry land/High rainfall	Kalispell		Canola	125		45	70		09/29/2023	08/29/2024	Herbicides: Axial Bold, Cleansweep
Central Agricultural Research Center	Dry land	Moccasin		Pulse	20	50		20	10	10/08/2023	08/22/2024	Additional fertilizer @120 lbs/acre
Eastern Agricultural Research Center	Dry land	Sidney		Peas	42	46	21			10/10/2023	07/30/2024	
Research Extension Center	Dry land	Williston, ND										

* = Fall nitrogen (N), phosphorus (P₂O₅), and potassium (K₂O) were preplant applied and incorporated.

NA = No Application

- = Data not available

Table 2: Public and private hard winter wheat varieties and experimental lines in the 2024 intrastate test

Variety	Experimental Designation	Origin	Release Year	Pedigree (PVP)	Entity
AAC Coldfront		Alberta/ SECAN		na	Private
AAC Vortex		Alberta/ SECAN		na	Private
AAC Wildfire	W512	Alberta/ SECAN	2015	((Norstar*5/PGR16635, AMN4LV) /6/ (RWA53, PI294994/3/ 13C//Norwin/ Blizzard/4/2* AC Readymade /5/ Norstar*5/PGR16635// 2*Redwin/3/ AC Readymade) /7/ (A7257W-71-2-1/ A77695W, ID337-R1)// CDC Kestrel, L99-1236) /8/ AC Bellatrix PVP# 202000008	Private
ACC Goldrush		Alberta/ SECAN		na	Private
Amplify SF		Alberta/ SECAN		na	Private
AP Bigfoot		Syngenta	2021	single cross [TAM112 x CO04393] PVP# 202200427	Private
AP Solid	NP13005004#49	Syngenta	2021	single cross [Judee x SY Wolf] PVP# 202200433	Private
AP24AX					
Bobcat	MTS1588	Montana	2019	selection from a composite of 2 crosses: 07X291, ((SMN82164/ SMN82140//Rocky/Tiber, MT9659)/3/S87-101/4/Pronghorn, MT0598)/5/(98X366E29-1, Heyne/Rampart/(MT9513, BigSky sib)) and 07X295, (((Lew/Tiber//Redwin ,MTS92021)/3/Judith/Arapahoe, MTS0023)/4/Pryor/ Genou, 01X258C1)/5/MT0598, PVP# 202000177	Public
Brawl CL Plus	CO06052	Colorado: Plainsgold/ Colorado Research Foundation	2011	Teal 11A/Above// (CO99314, TX91V4931/ Halt) PVP# 201200434	Public
	CO21SF191RA			na	Public
	CO21SF263RA			na	Public
	CP 7266			na	Public
	CP 7869			na	Public
	CP15CW3388#011			na	Public
CS Bridger CLP		Circle S Seeds		PVP# 202400210	Public
Flathead	MT1564	Montana	2019	selection from a composite of 2 crosses: 07X76, Yellowstone*2/5/ (PI640431, BC4F4 line derived from WA007900*5/4/WA007900// Yr5/6*Avocet3/ WA007900//Yr15/ 6*Avocet) and 07X77, Yellowstone/PI640431/4/(Yellowstone(340,233), Yellowstone*5/3/ (Yellowstone sib, MT9982)/(MTS0222, Rampart*2/Judith)), PVP# 202000202	Public
FourOsix	MT1465	Montana	2018	selection from a composite of 5 crosses: 06X272, Yellowstone/ (MT0684, a composite - see pedigree); 06X276, Yellowstone/ (MT06102, , a composite - see pedigree); 06X278, Yellowstone/7/ (MT06110,	Public

Variety	Experimental Designation	Origin	Release Year	Pedigree (PVP)	Entity
				(Arapahoe/3/Brule//Hiplains/ Newton, SD93528)/6/ (MT9409, Tiber/5/ (TAM W-103/Froid/4/Yogo//Turkey Red/ Oro/3/Centurk, MT8030)); 06X282, Yellowstone/3/(MT06123, '2174'/(MT9440, BigSky sib)/BigSky); and 06X285, Yellowstone/7/ (98X168E1, (Nuwest/4/ (MT88001, Sawmont/Tendoy /3/Yogo// Norin 10/Brevor) /5/(MT7863, Froid/Winoka/ Centurk), MTS9720)/6/(PI 191303, Alba = Belgian variety)/Elkhorn) PVP# 201900053	
Judee	MTS0713	Montana	2011	(Vanguard/Norstar//Judith dwf, 93X312E14)/3/ NuHorizon, PVP# 201200161	Public
Keldin	ACS55017	Peter Franck: Seed-Link Inc.; Ontario,Canada, Westbred LLC	2011	Barenburg 235/Carlisle//TRX-A16-3-2 PVP# 201300462	Private
LCS Julep	LCH13D-47-1675	Limagrain LLC	2020	The hard red winter wheat (HRW) line LCS Julep is from the cross T153/LCS Mint. The pedigree of T153 is T136//T81/KS93U206. The pedigree of LCS Mint is Overlay/C0980829. PVP# 202000267	Private
LCS Radar		Limagrain LLC			Private
LCS Steel AX	LCS 18-7071 AX	Limagrain LLC	2021	The hard red winter wheat (HRW) line LCS Steel AX is from the cross LCS Chrome/ACC?-38. The pedigree of LCS Chrome is HV9W03-696R-2/KS020617-9. The pedigree of ACC?-38 is (AF28/Byrd//AF26/Byrd)//2*Byrd. PVP# 202100229	Private
Loma	MTS1224	Montana	2016	Yellowstone/5//((Lew/Tiber//Redwin, MTS92045)/3/2*Erhardt, MTS0112)/4/(MTS0125, selection from a composite of 4 crosses) PVP# 201700021	Public
Milestone	ACS14132-412	Dr. Peter Franck, Germany; Nutrien	2020	PVP# 202100493	Private
MS Maverick		Meridian Seeds	2021	PVP# 007700108	Private
MS Sundown	MS 1022	Meridian Seeds	2022	The hard red winter wheat (HRW) line MS Sundown is from the cross T163/PSB13NEDH-11-26. The pedigree of T163 is KS93WGRC27/T81. The pedigree of PSB 13NEDH-11-26 is NE06469/Pronghom. PVP# 202200357	Private
MT WarCat	MTS18149	MSU	2022	Loma*2/AAC Gateway PVP# 20240018	Public
	MT2019	MSU		MT10114/MT10128//MTW1251	Public Elite
	MT2270	MSU		MT1747*2/Flathead	Public Elite
	MTAX22120	MSU		Crescent AX/FourOsix	Public Elite
	MTCS20151	MSU		Loma//(Bobcat sib, MTS1589)/StandClear CLP	Public Elite
	MTCS20156	MSU		Bobcat//(Bobcat sib, MTS1589)/StandClear CLP	Public Elite
	MTS1908	MSU		selection from a composite of 2 crosses: 11X1, (Judee sib, MTS0819) /10/ (Yellowstone loppo plant seln, MT08189) /8/ (Yellowstone loppo plant seln, MT08188) /7/ (MT0419-1, Erhardt /5/ (KS92H21-4, (Plainsman IV / Cheney // Odessa / 2*Eagle /3/ Pawnee / DURM, KS82H238-1) /4/ HF5761 / TAM 105 //Bounty 203) /6/ Pronghorn)), 08X350-A6 /9/ Warhorse and 11X2, Spur // 08X350-A6 / Warhorse	Public Elite
	MTS21103	MSU		Bobcat//LCS Jet/MTS1703	Public Elite

Variety	Experimental Designation	Origin	Release Year	Pedigree (PVP)	Entity
	MTS22100	MSU		MT1090/WB-Quake//Spur	Public Elite
	MTS22104	MSU		Bobcat/(CO15SFD092, Fortify SF sib)	Public Elite
	MTS2286	MSU		MT1090/WB-Quake//Spur	Public Elite
	MTV2164	MSU		MT1265*2/Joe	Public Elite
ND Allison				na	Public
Northern	MT0978	Montana	2015	selection from a composite of 2 crosses: 00X248, (Yellowstone sib, MT9982)/4/((MT8709, Erhardt sib)/NuWest//Erhardt, MTW0072)/3/ (NW97S151, KSSB0192-3/NE89529) and 00X249, (Judith/(PI262605, Karagach, RWA resis.)/3/(S86-740, Norstar/Plainsman V //Ulianovka) ,MTW0047)/4/MTW0072/NW97S151, PVP#201600092	Public
Ramsay	NAS-7653	Nutrien	2021	na	Private
StandClear CLP	MTCS1601	Montana/ Loveland Products Inc; Loveland, CO	2020	((L'Govskaya 167/Rampart/6/(MT9409, Tiber/5/ (MT8030, TAM W-103/Froid /4/Yogo//Turkey Red /Oro/3/Centurk)) ,MTS0531) /13/ (MTS0532, same pedigree as MTS0531) /12/ (Morgan/5/ (88X24D247-?, (Wasatch/Yogo//Rescue/3/Tendoy, Sel. 251, MT88006)/4/Judith)), 96X17E69) /9/((Tiber/5/(MT8030, TAM W-103/Froid /4/Yogo//Turkey Red /Oro/3/Centurk), MT9409)*2/6/IMI Fidel, MTCL0309)/7/CDC Teal 11A/8/(MTW01143, Promontory/5/ (MT91366, NuWest/ Lovrin 24 /4/((Rego/ Cheyenne, Sel. 39-18-7)//Winalta, MT7431)/3/NuWest)) /10/(MTCL0510, Rampart*3/Fidel/6/ (MTS9720, Nuwest/4/(MT88001, Sawmont/Tendoy /3/Yogo//Norin 10/Brevor)/5/(MT7863, Froid/Winoka/Centurk))) /11/ (MTS0531, see above) PVP# 202000183	Private
SY Clearstone 2CL	MTCL1077	Syngenta, Montana	2012	Yellowstone*4/3/MTCL01158/CDC Teal 11A//Jagalene PVP# 202000183	Private
SY Wolverine		Syngenta, Montana			Private
Warhorse	MTS0808	MSU	2013	selection from a composite of 3 crosses: 00X182, ((Froid/Winoka/7/ ((Sinvalocho/Wichita// Hope/Cheyenne /3/Wichita/4/Seu Seun 27, TX55-391-56-D8)/5/Westmont, MT6928)/6/ Trader, MT85200)/8/ Redwin, MT9908)/9/ Nuplains/6/(MTS9862, (NuWest/ Lovrin 24 /4/((Rego/Cheyenne, Sel. 39-18-7)// Winalta, MT7431)/3/(MT7115, Yogo/T. polonicum-70-5), MT91366)/5/ (MTS92137, Lew/Tiber//Redwin)); 00X183, Nuplains/MTS9862/4/ (MTW0047, Judith/(PI262605, Karagach, RWA resis.)/3/(S86-740, Norstar/ Plainsman V //Ulianovka)); and 00X184, Nuplains/MTS9862/5/(MTS0028, Vanguard/4/(Lew/Tiber//Redwin, MTSF1570)/3/ Norstar), PVP# 201400131	Public
WestBred	WB4510 CLP	Westbred	2021	na	Private Elite
WestBred2	WB4619	Westbred	2021	na	Private Elite
Yellowstone	MT00159	Montana	2005	F ₂ composite of Promontory/Judith and Judith-dwarf/Promontory, PVP# 200600284	Public

na: information not available

Table 3: Arthur H. Post Agronomy Farm, Bozeman (Location 1)

Genotype	DTH	DTM	PH	Lodging	Protein	TW	HaD	GY					
								2024	2024 [‡] (adj.)	2023-2024	2022-24	2021-24	2020-24
AAC Coldfront	173	217	38.0	0	12.4	63.0	7	101.4	108.9	119.0	--	--	--
AAC Vortex	174	216	37.8	0	12.9	62.2	28	76.6	98.7	--	--	--	--
AAC Wildfire	177	219	40.6	0	13.4	61.4	28	89.3	113.8	104.4	102.7	91.3	91.9
ACC Goldrush	176	215	40.6	0	14.1	59.0	20	87.2	102.7	--	--	--	--
Amplify SF	167	206	36.6	0	13.0	61.7	22	75.2	92.5	102.2	--	--	--
AP Bigfoot	169	208	33.5	0	13.0	60.6	10	71.1	77.6	100.4	109.9	--	--
AP Solid	172	215	33.5	0	12.8	62.9	8	72.7	78.3	104.9	109.1	98.0	--
AP24AX	172	215	37.0	0	12.1	58.9	25	72.9	90.8	--	--	--	--
Bobcat	174	214	31.9	0	12.7	62.3	18	88.1	103.7	104.3	107.2	94.3	93.6
Brawl CL Plus	165	212	35.8	0	12.9	62.8	30	90.6	117.2	104.1	111.2	100.6	95.2
CO21SF191RA	173	212	39.4	0	12.8	61.3	13	89.1	100.1	--	--	--	--
CO21SF263RA	173	212	38.0	0	13.2	60.8	15	84.1	96.6	--	--	--	--
CP 7266	169	211	35.8	0	12.1	61.1	75	59.6	104.6	--	--	--	--
CP 7869	165	211	33.1	0	12.7	61.5	10	91.4	100.5	--	--	102.6	--
CP15CW3388#011	167	214	35.0	0	11.6	61.7	23	95.0	116.5	--	--	--	--
CS Bridger CLP	171	216	33.9	0	12.5	62.5	23	108.7	132.8	125.6	124.8	110.7	--
Flathead	166	208	38.0	0	12.9	61.6	45	64.8	94.3	97.8	109.4	99.6	95.7
FourOsix	174	217	36.0	0	13.4	61.2	35	101.0	133.0	118.7	115.9	102.2	102.6
Judee	174	214	39.0	0	13.1	63.0	33	100.0	132.7	115.6	112.9	98.2	97.0
Keldin	169	213	35.0	0	12.8	61.1	40	67.6	94.6	112.4	120.7	108.1	106.4
LCS Julep	166	215	35.0	0	12.7	63.8	35	78.4	106.3	--	117.1	108.4	--
LCS Radar	167	206	33.7	0	13.5	59.3	15	62.0	71.9	--	--	--	--
LCS Steel AX	170	215	36.2	0	12.2	60.6	40	82.3	114.6	110.7	115.1	102.8	100.9
Loma	176	219	36.6	65	12.5	60.7	7	110.4	118.7	124.7	124.0	109.4	106.8
Milestone	170	213	32.5	0	13.4	56.8	10	99.8	109.5	123.7	133.0	116.3	--
MS Maverick	171	208	35.0	0	13.2	61.2	18	72.3	85.3	110.6	116.1	--	--
MS Sundown	167	210	36.6	0	12.5	62.1	20	82.3	98.8	108.7	--	--	--
MT WarCat	176	217	35.2	0	12.7	61.4	30	87.9	115.2	112.8	113.4	100.3	98.8
MT2019	174	214	35.0	0	12.5	61.2	25	83.8	104.9	112.5	115.1	--	--
MT2270	173	214	37.4	0	12.5	63.2	50	95.2	143.2	--	--	--	--
MTAX22120	169	213	34.5	0	12.3	59.7	30	77.4	100.6	--	--	--	--
MTCS20151	176	219	36.6	80	12.6	62.0	7	117.9	126.4	127.5	--	--	--
MTCS20156	176	217	35.6	0	13.2	62.5	15	108.8	125.1	114.4	112.3	--	--
MTS1908	177	217	36.6	0	12.9	60.8	25	110.7	138.1	125.8	122.1	107.1	--
MTS21103	174	215	33.7	0	12.7	61.3	23	104.8	128.6	--	--	--	--
MTS22100	173	214	33.9	0	13.5	61.3	30	83.1	107.8	--	--	--	--
MTS22104	175	215	38.0	0	12.3	61.3	25	108.6	132.9	--	--	--	--
MTS2286	176	217	36.0	0	12.3	60.8	23	113.2	138.9	--	--	--	--
MTV2164	173	215	38.8	0	12.8	60.0	40	85.8	119.6	116.6	--	--	--
ND Allison	175	217	41.3	0	12.8	61.8	25	80.1	100.2	--	--	--	--
Northern	176	216	40.4	0	13.8	60.2	18	102.3	120.0	122.2	119.8	106.4	105.1
Ramsay	--	--	--	--	13.5	--	--	--	109.0	--	--	--	--
StandClear CLP	174	215	36.2	0	13.5	63.3	15	111.8	128.7	125.6	122.1	106.4	103.0
SY Clearstone 2CL	175	215	40.9	0	13.3	59.6	30	86.5	112.0	103.7	106.9	94.5	94.0
SY Wolverine	--	--	--	--	12.9	--	--	--	109.0	--	--	--	--
Warhorse	175	214	39.4	0	14.0	61.2	40	71.3	100.2	100.2	102.0	89.7	86.5
WestBred	--	--	--	--	13.7	--	--	--	113.9	--	--	--	--
WestBred2	173	215	36.0	0	12.4	60.3	55	80.0	123.6	--	--	--	--
Yellowstone	174	215	40.0	0	13.0	61.0	45	86.6	125.9	112.4	116.3	104.1	101.8
Grand Mean	<i>172</i>	<i>214</i>	<i>36.5</i>	<i>3.2</i>	<i>12.9</i>	<i>61.2</i>	<i>26.1</i>	<i>88.5</i>	<i>110.6</i>	<i>105.4</i>	<i>106.1</i>	<i>93.5</i>	<i>92.5</i>
LSD	<i>2</i>	<i>4</i>	<i>3.0</i>	<i>16.8</i>	--	<i>2.30</i>	<i>23.6</i>	<i>20.0</i>	<i>30.1</i>	<i>31.6</i>	<i>26.7</i>	<i>22.0</i>	<i>22.2</i>
CV	<i>0.7</i>	<i>0.8</i>	<i>4.0</i>	<i>264.1</i>	--	<i>1.86</i>	<i>44.9</i>	<i>11.2</i>	<i>13.5</i>	<i>7.3</i>	<i>7.0</i>	<i>7.1</i>	<i>6.8</i>
Genotype significance	***	***	***	***	--	***	***	***	***	NS	NS	***	**
GenxEnv significance	--	--	--	--	--	--	--	--	--	***	***	***	***

Bold: highest value reported for the respective trait; ‘--’: No observation; Significance levels: p≤0.001***, p≤0.01**, p≤0.05*, NS: non-significant

[‡]Hail damage adjusted data just for information purpose. Variety extension or recommendation is not suggested using adjusted Yield data

Table 4: Western Triangle Agricultural Research Center, Conrad (Location 2)

Genotype	DTH	DTM	PH	SFC	Protein	TW	GY				
							2024	2023-2024	2022-24	2021-24	2020-24
AAC Coldfront	--	--	24.7	4	13.0	59.2	33.6	--	--	--	--
AAC Vortex	--	--	24.3	3	13.7	19.2	29.7	--	--	--	--
AAC Wildfire	--	--	24.3	4	13.1	58.3	35.3	--	--	42.3	65.3
ACC Goldrush	--	--	24.3	4	14.7	19.5	31.6	--	--	--	--
Amplify SF	--	--	24.0	3	13.3	40.2	34.2	--	--	--	--
AP Bigfoot	--	--	22.7	5	13.2	39.6	34.0	--	--	--	--
AP Solid	--	--	23.3	3	13.8	40.6	34.5	--	--	43.8	--
AP24AX	--	--	23.7	3	12.7	59.0	35.1	--	--	--	--
Bobcat	--	--	23.7	1	14.0	59.3	37.5	--	--	46.4	66.7
Brawl CL Plus	--	--	22.0	3	13.9	40.6	31.6	--	--	40.1	52.6
CO21SF191RA	--	--	24.3	3	14.0	58.0	34.0	--	--	--	--
CO21SF263RA	--	--	25.7	3	14.0	56.2	33.2	--	--	--	--
CP 7266	--	--	22.7	3	13.2	58.0	33.0	--	--	--	--
CP 7869	--	--	22.0	3	13.3	58.4	34.8	--	--	40.2	--
CP15CW3388#011	--	--	20.7	3	13.1	40.7	33.0	--	--	--	--
CS Bridger CLP	--	--	22.0	2	14.5	39.8	32.1	--	--	43.2	--
Flathead	--	--	22.3	3	13.7	59.6	34.1	--	--	48.4	65.9
FourOsix	--	--	24.7	4	14.0	58.5	34.6	--	--	50.7	70.5
Judee	--	--	24.0	3	15.4	39.4	31.1	--	--	42.7	59.4
Keldin	--	--	24.3	4	13.1	59.1	34.5	--	--	43.2	57.8
LCS Julep	--	--	21.3	2	14.5	40.6	31.2	--	--	49.1	--
LCS Radar	--	--	21.0	4	14.3	0.0	23.3	--	--	--	--
LCS Steel AX	--	--	23.3	5	12.6	59.5	33.7	--	--	39.1	54.8
Loma	--	--	23.7	4	14.9	19.4	31.2	--	--	51.6	68.7
Milestone	--	--	23.3	4	13.7	57.7	32.6	--	--	42.5	--
MS Maverick	--	--	23.3	5	13.8	19.7	29.5	--	--	--	--
MS Sundown	--	--	22.3	3	13.7	39.7	30.8	--	--	--	--
MT WarCat	--	--	22.3	2	15.4	39.6	33.6	--	--	47.7	67.1
MT2019	--	--	21.3	3	14.0	39.8	33.7	--	--	--	--
MT2270	--	--	22.3	3	12.9	38.5	30.4	--	--	--	--
MTAX22120	--	--	23.3	3	12.7	59.5	38.0	--	--	--	--
MTCS20151	--	--	25.3	2	14.7	58.7	39.1	--	--	--	--
MTCS20156	--	--	23.7	2	14.5	59.5	37.4	--	--	--	--
MTS1908	--	--	26.3	1	13.6	59.2	36.0	--	--	42.5	--
MTS21103	--	--	23.3	2	13.5	56.7	36.9	--	--	--	--
MTS22100	--	--	22.3	2	13.5	19.8	31.9	--	--	--	--
MTS22104	--	--	24.0	3	13.0	60.7	37.1	--	--	--	--
MTS2286	--	--	25.0	3	14.0	39.3	35.3	--	--	--	--
MTV2164	--	--	26.3	3	14.0	59.3	35.8	--	--	--	--
ND Allison	--	--	25.7	3	12.3	59.5	34.9	--	--	--	--
Northern	--	--	23.7	3	14.5	39.2	31.3	--	--	44.1	68.8
Ramsay	--	--	24.0	3	13.1	59.1	35.4	--	--	45.1	--
StandClear CLP	--	--	23.7	3	14.1	60.0	34.9	--	--	44.3	66.2
SY Clearstone 2CL	--	--	25.3	5	13.9	57.5	32.0	--	--	42.6	59.9
SY Wolverine	--	--	23.0	3	14.1	58.8	33.8	--	--	37.7	51.2
Warhorse	--	--	23.7	2	13.8	58.3	33.5	--	--	41.8	61.0
WestBred	--	--	24.3	3	14.2	58.9	35.8	--	--	--	--
WestBred2	--	--	23.0	3	12.2	38.6	34.5	--	--	--	--
Yellowstone	--	--	25.3	3	14.1	58.4	35.4	--	--	51.3	63.3
Grand Mean	--	--	23.6	3	13.8	47.7	33.7	--	--	44.4	62.4
LSD	--	--	1.6	1	0.4	35.5	3.6	--	--	15.6	18.3
CV	--	--	4.2	19.9	2.0	45.9	6.6	--	--	17.4	13.1
Genotype significance	--	--	***	***	***	NS	***	--	--	NS	NS
GenxEnv significance	--	--	--	--	--	--	--	--	--	*	***

Bold: highest value reported for the respective trait; ‘--’: No observation; Significance levels: p≤0.001***, p≤0.01**, p≤0.05*, NS: non-significant

Table 5: Nutrien Agri Solutions, Fort Benton (Location 3)

Genotype	DTH	DTM	PH	SFC	TW	Protein	GY				
							2024	2023-2024	2022-24	2021-24	2020-24
AAC Coldfront	--	--	31.0	4	63.6	11.6	53.9	64.3	--	--	--
AAC Vortex	--	--	31.5	6	62.7	11.5	46.6	--	--	--	--
AAC Wildfire	--	--	31.5	5	62.0	11.0	49.9	54.7	43.5	40.2	46.1
ACC Goldrush	--	--	33.0	5	62.6	12.6	47.1	--	--	--	--
Amplify SF	--	--	32.0	2	64.5	11.3	56.9	67.3	--	--	--
AP Bigfoot	--	--	29.5	8	64.4	11.2	50.8	51.0	41.0	--	--
AP Solid	--	--	28.5	2	65.3	11.7	59.7	55.8	46.9	46.6	--
AP24AX	--	--	31.5	6	62.1	11.5	58.7	--	--	--	--
Bobcat	--	--	29.0	2	63.4	12.2	62.4	62.1	51.0	47.2	49.7
Brawl CL Plus	--	--	31.0	4	63.9	12.5	49.5	50.6	40.7	43.5	45.3
CO21SF191RA	--	--	31.5	4	62.8	12.1	55.1	--	--	--	--
CO21SF263RA	--	--	32.5	5	62.2	12.6	54.3	--	--	--	--
CP 7266	--	--	29.5	4	63.1	11.9	47.9	--	--	--	--
CP 7869	--	--	28.5	7	62.6	12.1	51.2	--	--	44.0	--
CP15CW3388#011	--	--	28.5	6	64.6	11.2	57.3	--	--	--	--
CS Bridger CLP	--	--	28.5	6	62.9	12.2	49.7	43.5	37.3	38.6	--
Flathead	--	--	31.5	4	63.5	12.1	56.1	52.8	43.1	44.9	47.4
FourOsix	--	--	30.5	5	63.1	11.7	55.6	51.3	43.5	42.7	46.1
Judee	--	--	29.5	2	64.0	12.3	50.4	54.5	45.8	42.5	46.4
Keldin	--	--	30.0	4	62.2	11.3	58.9	68.6	54.6	54.8	56.3
LCS Julep	--	--	29.0	5	64.4	11.5	51.1	--	43.8	44.6	--
LCS Radar	--	--	28.5	8	63.3	12.8	38.8	--	--	--	--
LCS Steel AX	--	--	32.5	7	63.3	10.7	50.8	57.8	48.7	46.8	50.2
Loma	--	--	31.0	3	62.1	13.0	52.9	56.1	45.8	44.8	48.3
Milestone	--	--	28.5	6	61.4	11.4	55.1	52.3	42.6	45.1	--
MS Maverick	--	--	28.0	8	62.8	11.6	44.2	52.3	45.4	--	--
MS Sundown	--	--	30.0	6	64.2	11.3	50.8	48.1	--	--	--
MT WarCat	--	--	28.5	2	62.1	13.3	49.7	59.3	48.9	47.7	52.4
MT2019	--	--	27.5	7	62.8	11.2	57.0	47.0	40.9	--	--
MT2270	--	--	28.5	4	65.0	10.8	56.8	--	--	--	--
MTAX22120	--	--	29.0	5	62.7	10.8	56.0	--	--	--	--
MTCS20151	--	--	31.0	2	63.1	12.5	60.3	66.7	--	--	--
MTCS20156	--	--	30.0	2	63.7	12.4	59.1	60.5	50.4	--	--
MTS1908	--	--	31.5	2	62.0	12.5	56.5	67.5	54.3	53.2	--
MTS21103	--	--	28.0	2	62.3	11.7	59.8	--	--	--	--
MTS22100	--	--	25.5	2	63.9	10.9	54.7	--	--	--	--
MTS22104	--	--	29.5	3	63.9	11.8	57.1	--	--	--	--
MTS2286	--	--	30.0	2	62.9	11.7	59.4	--	--	--	--
MTV2164	--	--	32.5	7	62.4	11.4	56.9	54.0	--	--	--
ND Allison	--	--	32.0	3	63.1	10.6	49.0	--	--	--	--
Northern	--	--	32.5	4	62.3	12.4	50.0	57.3	47.0	44.5	50.2
Ramsay	--	--	31.5	4	62.9	10.5	61.6	55.2	46.2	48.4	--
StandClear CLP	--	--	29.0	2	63.7	12.2	56.8	57.3	48.2	46.5	49.7
SY Clearstone 2CL	--	--	33.5	6	61.4	12.1	51.0	45.4	38.2	37.2	42.3
SY Wolverine	--	--	26.5	7	63.6	12.3	51.0	54.3	44.3	44.2	46.2
Warhorse	--	--	30.5	1	63.3	12.3	56.4	64.3	50.3	46.3	49.8
WestBred	--	--	28.5	3	62.4	13.2	50.2	--	--	--	--
WestBred2	--	--	30.0	7	62.2	10.7	53.6	--	--	--	--
Yellowstone	--	--	31.0	7	61.9	12.0	45.2	42.0	36.7	37.7	42.2
Grand Mean	--	--	30.1	4	63.1	11.8	53.5	55.8	45.4	44.9	48.0
LSD	--	--	2.1	2	0.9	1.0	8.8	21.5	18.0	16.5	17.1
CV	--	--	3.6	18.2	0.8	4.9	10.1	18.8	19.2	18.9	16.5
Genotype significance	--	--	***	***	***	***	***	**	*	**	*
GenxEnv significance	--	--	--	--	--	--	--	**	**	**	**

Bold: highest value reported for the respective trait; ‘--’: No observation; Significance levels: p≤0.001***, p≤0.01**, p≤0.05*, NS: non-significant

Table 6: Northern Agricultural Research Center, Havre (Location 4)

Genotype	DTH	DTM	PH	Protein	TW	GY				
						2024	2023-2024	2022-24	2021-24	2020-24
AAC Coldfront	163	--	30.3	13.8	61.7	85.7	58.1	--	--	--
AAC Vortex	165	--	29.3	14.3	61.1	72.9	--	--	--	--
AAC Wildfire	168	--	28.9	14.4	57.9	78.8	55.3	52.8	44.2	45.8
ACC Goldrush	164	--	32.0	15.0	61.0	79.7	--	--	--	--
Amplify SF	159	--	31.7	13.0	61.9	88.9	60.4	--	--	--
AP Bigfoot	158	--	30.9	13.3	63.1	91.0	59.9	57.9	--	--
AP Solid	162	--	29.8	13.7	62.8	93.1	60.4	60.3	52.7	--
AP24AX	161	--	31.8	13.7	58.9	89.0	--	--	--	--
Bobcat	164	--	28.9	14.0	60.5	82.5	58.9	61.1	52.3	53.6
Brawl CL Plus	157	--	31.7	14.3	62.2	85.7	57.9	57.9	50.8	50.2
CO21SF191RA	162	--	30.3	14.4	59.3	85.2	--	--	--	--
CO21SF263RA	164	--	32.8	14.2	59.6	83.2	--	--	--	--
CP 7266	161	--	30.6	12.3	62.4	85.7	--	--	--	--
CP 7869	159	--	28.6	14.2	61.0	81.3	--	--	51.7	--
CPI5CW3388#011	157	--	29.2	12.4	62.4	92.0	--	--	--	--
CS Bridger CLP	161	--	29.7	14.7	60.4	85.1	60.7	60.1	53.1	--
Flathead	160	--	30.9	13.7	61.6	87.4	60.3	59.1	53.3	52.4
FourOsix	163	--	30.6	13.9	61.3	90.3	60.5	60.0	51.2	51.7
Judee	164	--	30.0	14.7	60.3	74.6	53.3	52.4	43.9	45.3
Keldin	164	--	30.4	13.0	61.0	98.3	68.2	66.0	56.7	57.1
LCS Julep	158	--	29.7	13.8	63.6	90.0	--	60.7	53.0	--
LCS Radar	158	--	28.5	13.8	63.3	81.0	--	--	--	--
LCS Steel AX	162	--	31.4	13.1	61.1	87.4	62.2	62.3	53.2	53.2
Loma	167	--	29.8	13.9	59.5	79.9	57.3	56.0	47.9	48.5
Milestone	162	--	30.3	13.9	59.1	99.2	65.1	64.9	54.9	--
MS Maverick	161	--	29.8	13.3	61.5	87.6	60.6	60.8	--	--
MS Sundown	157	--	31.3	12.4	63.1	87.3	62.2	--	--	--
MT WarCat	167	--	27.7	13.4	60.5	75.2	53.4	54.7	47.4	49.4
MT2019	163	--	28.7	13.7	59.5	86.0	59.3	59.2	--	--
MT2270	163	--	30.2	13.4	61.3	88.0	--	--	--	--
MTAX22120	159	--	30.3	13.5	60.1	91.0	--	--	--	--
MTCS20151	166	--	31.0	13.7	61.0	82.2	58.9	--	--	--
MTCS20156	166	--	29.9	15.2	59.8	75.3	55.2	61.1	--	--
MTS1908	167	--	29.2	13.5	58.7	81.6	60.4	60.5	50.4	--
MTS21103	164	--	29.4	13.9	59.1	84.2	--	--	--	--
MTS22100	162	--	28.5	13.1	62.0	85.6	--	--	--	--
MTS22104	165	--	31.3	13.2	60.1	88.3	--	--	--	--
MTS2286	166	--	28.1	14.7	59.6	77.5	--	--	--	--
MTV2164	162	--	33.8	13.3	59.5	90.3	65.1	--	--	--
ND Allison	164	--	32.0	13.0	61.3	84.5	--	--	--	--
Northern	165	--	30.9	14.4	59.5	91.6	62.2	60.8	51.2	51.1
Ramsay	164	--	30.3	14.1	59.7	94.9	62.7	63.9	54.3	--
StandClear CLP	164	--	32.1	14.9	59.9	77.6	55.3	56.0	47.7	48.8
SY Clearstone 2CL	164	--	33.6	13.8	59.7	92.7	61.7	59.7	49.4	50.5
SY Wolverine	158	--	27.9	13.5	62.8	82.0	55.2	55.1	48.5	48.5
Warhorse	165	--	29.3	14.4	60.3	73.5	50.0	51.3	43.2	45.3
WestBred	165	--	30.2	14.8	59.3	80.3	--	--	--	--
WestBred2	163	--	31.3	13.8	58.4	85.4	--	--	--	--
Yellowstone	164	--	32.6	14.1	59.1	90.2	63.2	63.1	54.3	54.2
Grand Mean	163	--	30.4	13.8	60.7	85.3	59.5	59.1	50.7	50.4
LSD	1	--	2.3	1.1	1.1	8.7	13.4	11.0	10.9	12.2
CV	0.4	--	4.6	4.8	1.1	6.3	8.3	8.3	8.8	8.7
Genotype significance	***	--	***	***	***	***	NS	NS	NS	NS
GenxEnv significance	--	--	--	--	--	--	***	***	***	***

Bold: highest value reported for the respective trait; ‘--’: No observation; Significance levels: p<0.001***, p<0.01**, p<0.05*, NS: non-significant

Table 7: Southern Agriculture Research Center, Huntley (Location 5)

Genotype	DTH	DTM	PH	Protein	TW	GY				
						2024	2023-2024	2022-24	2021-24	2020-24
AAC Coldfront	159	--	36.6	62.3	12.6	24.9	70.7	--	--	--
AAC Vortex	161	--	37.9	60.5	12.7	22.7	--	--	--	--
AAC Wildfire	163	--	37.7	58.2	13.2	23.5	69.9	58.8	55.6	59.3
ACC Goldrush	160	--	38.6	58.4	13.4	22.7	--	--	--	--
Amplify SF	157	--	39.5	57.6	11.9	31.0	71.2	--	--	--
AP Bigfoot	157	--	36.7	62.5	11.7	30.6	76.4	67.6	--	--
AP Solid	158	--	35.0	61.8	12.6	28.8	74.9	68.7	65.9	--
AP24AX	158	--	36.2	59.2	11.4	25.5	--	--	--	--
Bobcat	159	--	33.1	60.0	12.9	21.0	46.8	47.1	50.0	55.8
Brawl CL Plus	156	--	36.7	60.7	12.8	28.9	54.2	52.1	53.7	59.0
CO21SF191RA	158	--	37.3	57.0	13.0	26.3	--	--	--	--
CO21SF263RA	160	--	37.1	57.2	12.7	24.4	--	--	--	--
CP 7266	157	--	38.1	61.8	11.4	29.1	--	--	--	--
CP 7869	155	--	35.3	54.2	12.9	26.7	--	--	53.1	--
CP15CW3388#011	156	--	35.3	61.9	11.6	32.8	--	--	--	--
CS Bridger CLP	156	--	34.4	59.1	12.6	31.0	55.5	53.4	56.1	--
Flathead	157	--	39.0	55.9	12.4	25.2	54.1	50.4	51.5	57.1
FourOsix	159	--	37.1	60.1	13.1	23.8	47.6	45.4	49.6	56.4
Judee	160	--	35.4	59.1	13.4	21.0	67.9	60.1	58.5	63.0
Keldin	158	--	37.9	60.4	12.2	29.8	79.3	66.6	65.7	71.1
LCS Julep	157	--	35.8	61.5	12.6	26.2	--	56.7	56.7	--
LCS Radar	155	--	37.0	61.0	12.7	30.1	--	--	--	--
LCS Steel AX	158	--	37.4	57.0	11.1	27.2	79.7	69.0	64.9	67.9
Loma	161	--	37.1	59.2	12.8	26.7	58.3	55.1	57.1	61.5
Milestone	159	--	35.3	57.4	12.4	27.7	80.2	72.1	66.8	--
MS Maverick	157	--	37.5	60.7	12.4	31.2	83.1	70.8	--	--
MS Sundown	155	--	38.3	63.1	11.9	29.0	63.0	--	--	--
MT WarCat	162	--	34.9	59.6	12.6	27.2	66.0	59.6	58.8	61.6
MT2019	160	--	34.4	52.5	11.8	25.4	62.7	58.6	--	--
MT2270	159	--	36.1	61.6	11.5	30.0	--	--	--	--
MTAX22120	159	--	35.6	60.4	12.0	26.2	--	--	--	--
MTCS20151	161	--	37.1	60.6	13.3	26.1	56.4	--	--	--
MTCS20156	161	--	34.1	60.4	13.5	24.1	47.1	45.9	--	--
MTS1908	163	--	39.0	55.2	13.2	26.2	61.3	55.6	56.0	--
MTS21103	160	--	36.6	56.8	12.9	26.9	--	--	--	--
MTS22100	158	--	33.5	59.5	12.9	25.3	--	--	--	--
MTS22104	160	--	37.5	59.6	12.8	25.3	--	--	--	--
MTS2286	161	--	35.7	58.5	12.7	26.8	--	--	--	--
MTV2164	159	--	40.0	59.9	12.0	28.8	60.6	--	--	--
ND Allison	161	--	40.3	60.2	12.0	27.5	--	--	--	--
Northern	161	--	37.4	59.4	13.3	26.1	67.7	60.9	59.3	64.5
Ramsay	159	--	37.8	58.7	13.0	28.8	76.6	64.8	64.6	--
StandClear CLP	159	--	37.4	61.4	13.2	27.5	55.5	52.2	53.7	60.3
SY Clearstone 2CL	160	--	42.0	58.6	12.5	25.9	50.3	44.9	49.5	57.5
SY Wolverine	157	--	34.0	62.5	12.4	30.1	74.8	67.0	64.6	68.6
Warhorse	160	--	36.9	58.9	14.2	24.2	62.6	56.4	55.3	59.9
WestBred	161	--	37.3	57.5	13.4	22.6	--	--	--	--
WestBred2	160	--	37.7	58.2	12.4	26.1	--	--	--	--
Yellowstone	160	--	40.4	59.4	12.6	29.0	52.8	48.3	50.9	58.0
Grand Mean	159	--	36.9	59.3	12.6	26.8	64.2	58.0	57.3	61.3
LSD	2	--	2.1	4.8	0.8	4.6	35.7	27.4	24.3	23.2
CV	0.8	--	3.6	5.0	4.0	10.5	9.6	9.2	9.9	9.3
Genotype significance	***	--	***	*	***	***	NS	NS	NS	NS
GenxEnv significance	--	--	--	--	--	--	***	***	***	***

Bold: highest value reported for the respective trait; ‘--’: No observation; Significance levels: p≤0.001***, p≤0.01**, p≤0.05*, NS: non-significant

Table 8: Northwestern Agricultural Research Center, Kalispell (Location 6)

Genotype	DTH	DTM	PH	YR	Protein	TW	GY				
							2024	2023-2024	2022-24	2021-24	2020-24
AAC Coldfront	162	210	39.2	037	11.0	64.2	177.4	166.2	--	--	--
AAC Vortex	162	208	37.0	013	10.8	62.1	180.2	--	--	--	--
AAC Wildfire	165	208	44.5	050	10.4	63.2	168.9	149.3	144.8	141.0	144.2
ACC Goldrush	164	204	41.8	040	10.6	62.8	156.7	--	--	--	--
Amplify SF	158	203	41.6	050	10.6	63.0	176.1	152.7	--	--	--
AP Bigfoot	158	201	37.3	027	10.8	61.9	180.8	162.8	155.5	--	--
AP Solid	161	208	38.6	040	10.8	63.2	150.9	135.0	132.6	124.8	--
AP24AX	161	209	40.5	030	10.9	62.9	197.4	--	--	--	--
Bobcat	163	205	36.1	013	10.7	63.8	184.0	164.2	154.2	147.2	145.7
Brawl CL Plus	156	204	39.2	040	10.5	63.0	167.9	141.0	131.6	125.9	127.8
CO21SF191RA	161	206	39.8	037	10.7	63.4	189.6	--	--	--	--
CO21SF263RA	161	204	37.1	040	10.6	64.2	180.8	--	--	--	--
CP 7266	157	205	39.3	000	10.7	62.2	159.2	--	--	--	--
CP 7869	155	203	32.7	027	10.6	63.1	175.6	--	--	137.5	--
CPI5CW3388#011	155	204	36.2	060	10.7	60.4	152.8	--	--	--	--
CS Bridger CLP	161	207	37.8	023	10.5	62.1	188.6	166.0	151.1	141.3	--
Flathead	157	204	40.4	000	10.9	63.2	193.1	174.5	159.8	153.2	154.5
FourOsix	163	208	37.6	020	10.8	63.2	191.9	172.8	157.3	152.2	150.5
Judee	161	206	39.0	000	10.9	63.4	168.8	163.3	148.1	135.6	137.7
Keldin	160	204	35.8	013	10.8	63.3	182.7	170.1	162.5	155.5	157.9
LCS Julep	157	205	34.6	043	10.8	63.4	173.4	--	145.4	139.2	--
LCS Radar	156	202	37.8	010	10.4	63.0	173.0	--	--	--	--
LCS Steel AX	162	208	41.1	050	10.7	61.3	175.4	147.7	142.0	132.8	136.3
Loma	164	207	37.4	017	11.0	63.6	185.1	171.6	155.2	151.2	153.5
Milestone	160	206	36.6	010	10.6	61.5	128.4	127.7	133.3	134.8	--
MS Maverick	159	203	39.9	007	10.9	64.6	200.9	169.9	155.6	--	--
MS Sundown	156	203	41.5	027	10.8	63.0	182.2	159.7	--	--	--
MT WarCat	164	209	37.2	033	10.8	63.7	189.4	169.6	154.0	150.4	149.6
MT2019	162	206	37.7	000	10.8	63.7	197.4	180.7	164.7	--	--
MT2270	160	206	37.7	000	10.8	63.7	191.3	--	--	--	--
MTAX22120	159	207	38.9	013	10.7	62.5	183.7	--	--	--	--
MTCS20151	163	206	39.2	013	10.6	63.0	167.2	160.1	--	--	--
MTCS20156	162	205	36.4	030	10.8	63.8	170.1	155.8	153.4	--	--
MTS1908	166	210	42.4	000	10.5	63.6	147.4	142.9	137.1	137.9	--
MTS21103	162	208	36.3	000	10.8	61.9	197.5	--	--	--	--
MTS22100	159	203	35.2	053	10.5	60.9	153.0	--	--	--	--
MTS22104	162	206	38.6	047	10.7	63.0	180.5	--	--	--	--
MTS2286	164	209	72.7	033	10.7	63.1	176.7	--	--	--	--
MTV2164	161	205	43.2	000	10.9	62.6	207.9	179.1	--	--	--
ND Allison	161	206	43.0	067	10.6	62.2	164.4	--	--	--	--
Northern	163	209	41.2	000	11.0	63.7	137.3	149.1	142.6	139.0	144.0
Ramsay	161	205	38.1	013	10.8	62.9	200.9	180.2	164.9	158.4	--
StandClear CLP	161	203	40.2	000	10.7	64.3	179.0	163.2	151.4	141.4	143.0
SY Clearstone 2CL	162	206	42.8	023	10.9	63.6	189.3	175.4	165.1	157.3	158.3
SY Wolverine	157	202	35.2	030	10.8	62.0	164.7	140.3	141.0	132.6	137.5
Warhorse	162	205	35.7	010	10.5	63.2	159.4	143.5	138.4	130.7	132.2
WestBred	163	208	40.5	040	10.8	61.6	167.8	--	--	--	--
WestBred2	161	205	39.3	053	10.5	62.1	162.2	--	--	--	--
Yellowstone	163	208	43.2	017	10.9	63.6	188.9	168.5	154.4	151.3	153.4
Grand Mean	161	206	39.5	024	10.7	62.9	175.9	160.1	149.9	142.2	145.4
LSD	2	4	15.0	022	0.41	1.84	46.2	33.7	32.4	30.0	28.4
CV	0.7	1.1	23.4	62.5	2.32	1.78	16.2	14.5	14.0	13.4	12.1
Genotype significance	***	***	NS	***	NS	*	NS	***	*	***	***
GenxEnv significance	--	--	--	--	--	--	--	NS	NS	*	**

Bold: highest value reported for the respective trait; ‘--’: No observation; Significance levels: p<0.001***, p<0.01**, p<0.05*, NS: non-significant

Table 9: Central Agricultural Research Center, Moccasin (Location 7)

Genotype	DTH	DTM	PH	Protein	TW	GY				
						2024	2023-2024	2022-24	2021-24	2020-24
AAC Coldfront	163	--	26.7	--	--	31.3	--	--	--	--
AAC Vortex	165	--	28.3	--	--	31.5	--	--	--	--
AAC Wildfire	165	--	26.7	--	--	29.8	--	37.2	34.3	40.6
ACC Goldrush	165	--	28.0	--	--	34.8	--	--	--	--
Amplify SF	161	--	27.0	--	--	36.3	--	--	--	--
AP Bigfoot	161	--	25.3	--	--	39.5	--	43.0	--	--
AP Solid	163	--	26.7	--	--	40.7	--	48.9	43.9	--
AP24AX	162	--	28.0	--	--	37.1	--	--	--	--
Bobcat	164	--	27.0	--	--	35.4	--	39.8	37.4	41.8
Brawl CL Plus	159	--	27.0	--	--	34.1	--	39.0	38.3	40.0
CO21SF191RA	162	--	30.3	--	--	38.5	--	--	--	--
CO21SF263RA	163	--	29.7	--	--	43.6	--	--	--	--
CP 7266	161	--	26.7	--	--	32.8	--	--	--	--
CP 7869	160	--	24.3	--	--	27.0	--	--	28.7	--
CP15CW3388#011	160	--	24.0	--	--	35.8	--	--	--	--
CS Bridger CLP	161	--	25.0	--	--	32.4	--	38.7	37.4	--
Flathead	161	--	26.3	--	--	39.0	--	44.6	41.5	42.8
FourOsix	164	--	26.7	--	--	37.7	--	41.8	38.2	44.2
Judee	162	--	28.0	--	--	40.4	--	41.1	38.6	43.0
Keldin	164	--	26.3	--	--	30.8	--	40.2	38.6	44.1
LCS Julep	160	--	25.3	--	--	31.2	--	35.1	34.6	--
LCS Radar	158	--	25.0	--	--	27.6	--	--	--	--
LCS Steel AX	162	--	27.0	--	--	39.9	--	44.5	38.8	45.4
Loma	164	--	25.0	--	--	33.6	--	39.3	37.9	43.3
Milestone	162	--	26.7	--	--	40.8	--	41.0	37.7	--
MS Maverick	160	--	25.7	--	--	29.0	--	32.2	--	--
MS Sundown	160	--	26.0	--	--	35.3	--	--	--	--
MT WarCat	165	--	24.0	--	--	34.4	--	38.0	36.1	42.2
MT2019	164	--	25.7	--	--	39.5	--	47.3	--	--
MT2270	161	--	26.7	--	--	43.7	--	--	--	--
MTAX22120	161	--	25.3	--	--	36.2	--	--	--	--
MTCS20151	167	--	27.3	--	--	35.7	--	--	--	--
MTCS20156	166	--	27.0	--	--	31.5	--	37.4	--	--
MTS1908	165	--	28.0	--	--	41.4	--	39.7	36.3	--
MTS21103	162	--	26.0	--	--	40.4	--	--	--	--
MTS22100	162	--	24.7	--	--	34.8	--	--	--	--
MTS22104	165	--	29.3	--	--	50.2	--	--	--	--
MTS2286	164	--	27.3	--	--	40.8	--	--	--	--
MTV2164	163	--	29.7	--	--	33.8	--	--	--	--
ND Allison	165	--	26.0	--	--	38.2	--	--	--	--
Northern	163	--	28.0	--	--	35.7	--	36.2	36.7	42.5
Ramsay	163	--	27.3	--	--	36.7	--	41.6	38.7	--
StandClear CLP	163	--	26.7	--	--	35.2	--	38.0	35.5	40.4
SY Clearstone 2CL	165	--	29.7	--	--	35.4	--	43.8	40.9	45.1
SY Wolverine	161	--	25.3	--	--	36.2	--	40.4	39.5	41.5
Warhorse	163	--	27.0	--	--	39.9	--	42.4	39.7	42.6
WestBred1	164	--	27.7	--	--	41.2	--	--	--	--
WestBred2	163	--	25.7	--	--	24.7	--	--	--	--
Yellowstone	164	--	29.0	--	--	38.8	--	44.6	41.3	45.3
Grand Mean	163	--	26.8	--	--	36.1	--	40.6	37.8	42.8
LSD	2	--	1.7	--	--	10.0	--	10.1	11.0	12.4
CV	0.61	--	3.96	--	--	16.18	--	16.69	16.46	13.83
Genotype significance	***	--	***	--	--	***	--	***	*	NS
GenxEnv significance	--	--	--	--	--	--	--	NS	**	***

Bold: highest value reported for the respective trait; ‘--’: No observation; Significance levels: p≤0.001***, p≤0.01**, p≤0.05*, NS: non-significant

Table 10: Eastern Agricultural Research Center, Sideny (Location: 8)

Genotype	DTH	DTM	PH	YR	Protein	TW	GY				
							2024	2023-2024	2022-24	2021-24	2020-24
AAC Coldfront	162	--	28.9	50	11.1	66.5	94.4	98.3	--	--	--
AAC Vortex	163	--	28.3	10	12.1	66.2	90.5	--	--	--	--
AAC Wildfire	165	--	30.2	3	11.3	65.2	98.0	98.9	85.8	44.2	73.3
ACC Goldrush	165	--	33.2	50	11.8	65.7	85.2	--	--	--	--
Amplify SF	158	--	28.5	87	9.9	65.3	91.3	90.7	--	--	--
AP Bigfoot	158	--	28.0	100	9.8	66.2	92.9	90.9	79.7	--	--
AP Solid	159	--	28.5	93	10.8	65.3	79.5	84.5	76.8	52.7	--
AP24AX	160	--	31.4	23	10.3	64.3	104.0	--	--	--	--
Bobcat	161	--	26.0	0	11.4	65.7	96.9	94.3	85.9	52.3	72.5
Brawl CL Plus	157	--	28.5	100	11.3	65.7	85.5	83.8	75.3	50.8	61.0
CO21SF191RA	163	--	29.5	13	11.6	65.0	92.3	--	--	--	--
CO21SF263RA	163	--	32.2	3	11.9	64.4	94.8	--	--	--	--
CP 7266	159	--	28.3	0	10.0	66.7	98.8	--	--	--	--
CP 7869	158	--	25.6	0	10.7	65.5	97.9	--	--	51.7	--
CP15CW3388#011	158	--	28.1	100	9.4	63.9	87.4	--	--	--	--
CS Bridger CLP	160	--	29.0	0	11.2	65.7	105.7	104.7	92.2	53.1	--
Flathead	158	--	30.7	0	10.9	66.0	105.8	98.5	86.5	53.3	72.8
FourOsix	160	--	29.0	0	11.2	65.9	104.9	100.6	88.7	51.2	73.7
Judee	161	--	28.7	0	12.0	65.5	86.2	86.4	76.6	43.9	60.3
Keldin	163	--	29.1	20	10.0	65.2	104.0	102.4	87.0	56.7	72.9
LCS Julep	158	--	28.7	100	10.6	66.5	91.0	--	80.4	53.0	--
LCS Radar	158	--	27.6	3	11.0	66.6	90.4	--	--	--	--
LCS Steel AX	161	--	30.8	50	9.8	64.6	100.8	101.6	87.6	53.2	72.8
Loma	163	--	29.7	0	10.9	65.0	98.2	98.3	86.5	47.9	73.5
Milestone	161	--	27.8	33	10.0	63.6	99.9	95.9	82.1	54.9	--
MS Maverick	160	--	29.0	80	10.7	66.0	103.1	102.0	87.1	--	--
MS Sundown	157	--	31.2	93	10.4	66.5	94.6	96.4	--	--	--
MT WarCat	166	--	27.6	0	11.5	65.8	96.4	95.5	86.0	47.4	74.9
MT2019	162	--	27.8	0	10.6	64.8	105.9	104.9	95.4	--	--
MT2270	161	--	30.1	3	9.7	67.3	111.2	--	--	--	--
MTAX22120	158	--	29.1	13	10.3	64.4	103.2	--	--	--	--
MTCS20151	165	--	30.3	17	11.2	66.3	101.0	100.1	--	--	--
MTCS20156	163	--	28.3	0	11.3	66.9	93.8	91.3	80.8	--	--
MTS1908	166	--	31.2	2	11.0	66.0	105.8	100.5	87.9	50.4	--
MTS21103	163	--	28.1	0	11.5	64.6	105.1	--	--	--	--
MTS22100	161	--	27.7	83	11.0	63.9	81.5	--	--	--	--
MTS22104	163	--	30.4	53	9.9	65.2	96.4	--	--	--	--
MTS2286	163	--	28.2	43	10.9	64.6	92.1	--	--	--	--
MTV2164	161	--	33.6	0	10.5	64.7	104.1	103.0	--	--	--
ND Allison	163	--	31.2	57	10.3	65.9	89.8	--	--	--	--
Northern	162	--	31.4	0	11.2	65.4	110.2	105.5	90.6	51.2	76.2
Ramsay	162	--	29.7	33	11.0	64.3	102.0	100.6	85.5	54.3	--
StandClear CLP	162	--	31.5	0	11.6	66.7	101.2	99.0	87.7	47.7	72.3
SY Clearstone 2CL	162	--	31.9	7	11.2	64.2	106.8	96.5	85.5	49.4	72.7
SY Wolverine	158	--	27.7	100	10.1	64.6	75.0	85.2	74.4	48.5	60.0
Warhorse	163	--	28.3	0	11.8	65.4	89.8	89.6	80.8	43.2	67.4
WestBred1	165	--	29.9	3	11.0	64.7	90.5	--	--	--	--
WestBred2	162	--	29.5	73	10.7	62.3	87.4	--	--	--	--
Yellowstone	161	--	31.1	0	11.7	64.5	106.3	103.7	91.2	54.3	79.2
Grand Mean	161	--	29.4	31	10.9	65.3	96.6	96.7	84.8	50.7	71.0
LSD	1	--	2.1	22	0.8	0.8	8.0	13.1	12.3	10.9	13.5
CV	0.6	--	4.5	43.7	4.7	0.8	5.1	5.4	7.0	8.8	8.5
Genotype significance	***	--	***	***	***	***	***	***	***	NS	***
GenxEnv significance	--	--	--	--	--	--	--	***	***	***	***

Bold: highest value reported for the respective trait; ‘--’: No observation; Significance levels: p<0.001***, p<0.01**, p<0.05*, NS: non-significant

Table 11: Research Extension Center, Williston-North Dakota (Location: 9)

Genotype	DTH	DTM	PH	Protein	TW	GY				
						2024	2023-2024	2022-24	2021-24	2020-24
AAC Coldfront										
AAC Vortex										
AAC Wildfire										
ACC Goldrush										
Amplify SF										
AP Bigfoot										
AP Solid										
AP24AX										
Bobcat										
Brawl CL Plus										
CO21SF191RA										
CO21SF263RA										
CP 7266										
CP 7869										
CP15CW3388#011										
CS Bridger CLP										
Flathead										
FourOsix										
Judee										
Keldin										
LCS Julep										
LCS Radar										
LCS Steel AX										
Loma										
Milestone										
MS Maverick										
MS Sundown										
MT WarCat										
MT2019										
MT2270										
MTAX22120										
MTCS20151										
MTCS20156										
MTS1908										
MTS21103										
MTS22100										
MTS22104										
MTS2286										
MTV2164										
ND Allison										
Northern										
Ramsay										
StandClear CLP										
SY Clearstone 2CL										
SY Wolverine										
Warhorse										
WestBred1										
WestBred2										
Yellowstone										
<i>Grand Mean</i>										
<i>LSD</i>										
<i>CV</i>										
<i>Genotype significance</i>										
<i>GenxEnv significance</i>										

Insufficient Results

Bold: highest value reported for the respective trait; ‘—’: No observation

Table 12: Performance cross locations, disease reaction and stem sawfly scores in cropping season 2024

Genotype	DTH	DTM	PH	SFC ^S	TW	Protein	GY	YR
AAC Coldfront	164	214	31.8	3.8	63.0	12.2	74.9	43
AAC Vortex	165	212	31.7	4.2	56.0	12.5	69.0	12
AAC Wildfire	167	213	32.9	4.1	60.9	12.3	71.6	27
ACC Goldrush	166	209	33.8	4.3	55.3	13.0	68.0	45
Amplify SF	160	205	32.6	2.6	59.1	11.7	74.1	68
AP Bigfoot	160	205	30.5	6.2	59.8	11.6	74.3	63
AP Solid	162	212	30.6	2.4	60.2	12.2	70.3	67
AP24AX	162	212	32.5	4.5	60.9	11.7	78.1	27
Bobcat	164	209	29.5	1.5	62.2	12.5	76.0	7
Brawl CL Plus	158	208	31.5	3.3	59.7	12.6	71.6	70
CO21SF191RA	163	209	32.7	3.5	61.0	12.7	76.3	25
CO21SF263RA	164	208	33.1	3.7	60.7	12.6	75.0	22
CP 7266	161	208	31.4	3.3	62.3	11.6	69.0	0
CP 7869	159	207	28.7	5.4	60.9	12.3	73.1	13
CP15CW3388#011	159	208	29.6	4.4	59.4	11.4	73.0	80
CS Bridger CLP	162	211	30.1	4.1	58.9	12.6	78.7	12
Flathead	160	206	32.3	3.3	61.7	12.3	76.5	0
FourOsix	164	212	31.5	4.1	62.0	12.5	79.9	10
Judee	164	210	31.6	2.4	59.1	13.1	70.9	0
Keldin	163	208	31.1	3.8	61.8	11.7	76.5	17
LCS Julep	160	210	29.9	3.5	60.5	12.3	71.8	72
LCS Radar	159	204	29.9	6.1	53.0	12.4	66.3	7
LCS Steel AX	163	211	32.5	5.7	61.1	11.3	74.8	50
Loma	166	213	31.2	3.4	55.5	12.8	76.8	8
Milestone	162	209	30.2	4.7	59.8	12.0	72.5	22
MS Maverick	161	206	31.1	6.4	56.4	12.1	75.2	43
MS Sundown	158	206	32.2	4.5	60.2	11.7	74.2	60
MT WarCat	167	213	29.6	1.8	58.9	12.8	74.3	17
MT2019	164	210	29.8	4.8	57.7	12.0	78.9	0
MT2270	163	210	31.1	3.1	60.0	11.5	80.8	2
MTAX22120	161	210	30.8	3.6	61.5	11.7	77.0	13
MTCS20151	166	212	32.2	2.0	62.1	12.7	77.9	15
MTCS20156	166	211	30.6	1.8	62.4	12.9	74.4	15
MTS1908	167	213	33.1	1.7	60.8	12.4	75.0	1
MTS21103	164	212	30.3	1.9	60.4	12.4	81.7	0
MTS22100	162	208	29.0	2.2	55.6	12.0	68.7	68
MTS22104	165	210	32.4	2.9	62.0	11.9	80.0	50
MTS2286	166	213	35.7	2.5	58.3	12.4	77.0	38
MTV2164	163	210	34.8	4.7	61.3	12.0	80.7	0
ND Allison	165	211	33.8	2.8	62.1	11.5	71.2	62
Northern	165	212	33.0	3.3	58.5	12.8	72.5	0
Ramsay	164	209	31.9	3.4	61.5	12.1	82.0	23
StandClear CLP	164	209	32.2	2.5	62.8	12.8	77.4	0
SY Clearstone 2CL	165	210	34.9	5.3	60.8	12.4	77.6	15
SY Wolverine	160	206	29.3	4.9	62.6	12.2	69.5	65
Warhorse	165	210	31.2	1.3	61.6	12.8	68.6	5
WestBred1	165	212	32.0	2.6	60.9	12.9	71.7	37
WestBred2	164	210	31.6	4.7	57.4	11.7	69.3	63
Yellowstone	164	211	34.1	4.9	61.4	12.6	77.7	8
Grand Mean	163	210	31.6	3.6	60.0	12.3	74.5	29
LSD	1	3	2.2	2.2	6.42	0.51	8.3	45
CV	0.6	1.0	11.5	18.3	14.54	3.97	15.6	50.5
Genotype significance	***	***	***	***	NS	***	***	***
GenxEnv significance	***	NS	NS	***	***	***	***	***
Env significance	***	*	***	*	***	***	***	NS

Bold: highest value reported for the respective trait; ‘—’: No observation; Significance levels: p≤0.001***, p≤0.01**, p≤0.05*, NS: non-significant; ^SScore based on Ft. Benton Location

Table 13: Stem solidness (SS) and number of infested stems (IS) as identified in selected intrastate entries at primary stem sawfly areas in 2024

Variety	Conrad		Fort Benton		Havre		Pooled	
	IS	SS	IS	SS	IS	SS	IS	SS
Amplify SF	0.0	4.0	5.5	2.5	1.0	3.6	2.2	3.4
AP Solid	0.0	3.8	5.5	2.6	1.0	2.6	2.2	3.0
Bobcat	2.5	3.0	1.0	4.6	0.0	4.7	1.2	4.1
CO21SF191RA	8.0	2.6	5.5	2.1	0.5	2.0	4.7	2.3
CO21SF263RA	1.5	2.6	7.0	1.8	0.5	1.8	3.0	2.1
Judee	4.0	4.2	6.5	2.3	0.5	2.7	3.7	3.1
LCS Steel AX	9.5	1.9	4.0	1.3	0.0	1.1	4.5	1.4
Loma	8.0	4.2	5.5	3.0	2.0	2.9	5.2	3.3
MT WarCat	0.0	4.2	4.5	2.4	5.0	3.3	3.2	3.3
MTCL19151	5.0	2.3	6.5	1.2	0.0	1.0	3.8	1.5
MTCS20151	0.0	5.0	4.5	3.7	0.5	4.2	1.7	4.3
MTCS20156	0.0	4.7	5.0	3.5	0.5	4.5	1.8	4.3
MTS1908	1.0	4.6	3.0	4.2	0.5	4.9	1.5	4.6
MTS21103	0.0	4.7	5.0	3.2	0.5	3.2	1.8	3.7
MTS22100	5.0	3.9	4.0	4.2	0.0	3.9	3.0	4.0
MTS22104	0.0	4.3	8.5	2.2	0.0	3.0	2.8	3.2
MTS2286	9.0	4.4	6.5	2.6	1.0	3.9	5.5	3.6
MTV2164	10.0	1.4	8.5	1.0	0.0	1.0	6.2	1.1
StandClear CLP	0.5	4.3	5.0	2.2	0.5	3.5	2.0	3.4
Warhorse	1.5	4.5	6.0	3.3	0.5	3.8	2.7	3.9
WestBred1	0.5	4.7	5.5	2.5	0.5	3.3	2.2	3.5
Yellowstone	3.0	1.8	7.0	1.1	2.0	1.0	4.0	1.3
Grand Mean	3.1	3.7	5.5	2.6	0.8	3.0	3.1	3.1
LSD	5.8	1.5	2.4	0.9	1.3	0.6	3.9	0.8
CV	89.5	19.9	21.5	16.5	78.0	9.6	57.4	16.7
Genotype significance	***	***	***	***	***	***	NS	NS
GenxEnv significance							***	***

Table 14: Average monthly weather data of interstate testing sites during winter wheat cropping season 2023-24[#]

Station	Name	Month	Year	T _{min}	T _{max}	T _{avg}	PRCP	SNOW	SNWD	Note
USC00241044	Bozeman	October	2023	32.9	57.5	45.2	0.0	0.2	0.8	
USC00241044	Bozeman	November	2023	25.6	48.8	37.2	0.0	0.0	0.0	
USC00241044	Bozeman	December	2023	20.0	42.3	31.1	0.0	0.2	1.0	
USC00241044	Bozeman	January	2024	9.4	33.5	21.5	0.0	0.5	6.7	
USC00241044	Bozeman	February	2024	21.1	40.4	30.8	0.1	0.6	5.8	
USC00241044	Bozeman	March	2024	23.7	48.2	36.0	0.0	0.5	2.1	Hail on 03/21/2024
USC00241044	Bozeman	April	2024	32.3	59.9	46.1	0.1	0.4	0.0	
USC00241044	Bozeman	May	2024	36.7	61.6	49.2	0.1	0.6	0.4	
USC00241044	Bozeman	June	2024	47.7	76.6	62.2	0.1	0.0	0.0	
USC00241044	Bozeman	July	2024	54.1	85.8	70.0	0.1	0.0	0.0	Hail on 08/08/2024
USC00241044	Bozeman	August	2024	50.9	83.2	67.1	0.1	0.0	0.0	
USC00241044	Bozeman	September	2024	45.9	79.8	62.9	0.1	0.0	0.0	Hail on 09/04/2024
USC00241974	Conrad	October	2023	31.6	56.1	43.9	0.0	0.1	0.7	
USC00241974	Conrad	November	2023	24.6	47.8	36.2	0.0	0.0	0.0	
USC00241974	Conrad	December	2023	20.8	46.9	33.9	0.0	0.0	0.0	
USC00241974	Conrad	January	2024	5.6	30.7	18.1	0.0	0.3	1.9	
USC00241974	Conrad	February	2024	16.9	35.8	26.3	0.1	0.4	3.3	
USC00241974	Conrad	March	2024	19.0	43.0	31.0	0.0	0.2	0.5	
USC00241974	Conrad	April	2024	31.5	58.7	45.1	0.0	0.1	0.0	
USC00241974	Conrad	May	2024	38.0	63.9	51.0	0.1	0.0	0.0	
USC00241974	Conrad	June	2024	44.4	73.8	59.1	0.0	0.0	0.0	
USC00241974	Conrad	July	2024	54.5	87.0	70.8	0.0	0.0	0.0	
USC00241974	Conrad	August	2024	51.0	80.8	65.9	0.1	0.0	0.0	
USC00241974	Conrad	September	2024	46.7	76.1	61.4	0.0	0.0	0.0	
USC00243113	Fort Benton	October	2023	31.8	57.8	44.8	0.1	0.2	1.0	
USC00243113	Fort Benton	November	2023	24.2	53.2	38.7	0.0	0.0	0.0	
USC00243113	Fort Benton	December	2023	20.2	49.1	34.7	0.0	0.0	0.0	
USC00243113	Fort Benton	January	2024	3.1	30.6	16.9	0.0	0.5	3.3	
USC00243113	Fort Benton	February	2024	16.9	39.1	28.0	0.0	0.3	2.5	
USC00243113	Fort Benton	March	2024	19.4	44.5	32.0	0.0	0.3	1.0	
USC00243113	Fort Benton	April	2024	32.4	59.8	46.1	0.0	0.0	0.0	
USC00243113	Fort Benton	May	2024	39.7	65.0	52.4	0.1	0.0	0.0	
USC00243113	Fort Benton	June	2024	47.5	76.2	61.9	0.1	0.0	0.0	
USC00243113	Fort Benton	July	2024	55.1	88.5	71.8	0.0	0.0	0.0	
USC00243113	Fort Benton	August	2024	54.3	86.1	70.2	0.1	0.0	0.0	
USC00243113	Fort Benton	September	2024	46.6	80.6	63.6	0.1	0.0	0.0	
USC00244345	Huntley	October	2023	32.2	58.8	45.5	0.0	0.1	0.5	
USC00244345	Huntley	November	2023	23.5	53.3	38.4	0.0	0.0	0.0	
USC00244345	Huntley	December	2023	21.0	47.6	34.3	0.0	0.0	0.0	
USC00244345	Huntley	January	2024	2.6	32.7	17.7	0.0	0.1	0.5	
USC00244345	Huntley	February	2024	19.5	44.2	31.8	0.0	0.2	0.7	
USC00244345	Huntley	March	2024	22.4	48.5	35.5	0.0	0.1	0.2	
USC00244345	Huntley	April	2024	31.5	62.7	47.1	0.1	0.0	0.0	
USC00244345	Huntley	May	2024	39.6	66.0	52.8	0.1	0.0	0.0	
USC00244345	Huntley	June	2024	47.4	80.1	63.8	0.0	0.0	0.0	
USC00244345	Huntley	July	2024	54.6	90.6	72.6	0.0	0.0	0.0	
USC00244345	Huntley	August	2024	53.4	85.9	69.6	0.0	0.0	0.0	
USC00244345	Huntley	September	2024	46.2	82.1	64.2	0.1	0.0	0.0	
USC00244558	Kalispell	October	2023	30.7	55.5	43.1	0.0	0.0	0.1	
USC00244558	Kalispell	November	2023	23.1	40.0	31.5	0.1	0.0	0.0	
USC00244558	Kalispell	December	2023	24.1	34.7	29.4	0.0	0.2	0.3	
USC00244558	Kalispell	January	2024	13.5	27.2	20.3	0.1	0.7	6.9	
USC00244558	Kalispell	February	2024	22.1	36.1	29.1	0.0	0.3	6.3	
USC00244558	Kalispell	March	2024	24.6	47.2	35.9	0.0	0.1	0.2	
USC00244558	Kalispell	April	2024	32.0	57.0	44.5	0.0	0.0	0.0	
USC00244558	Kalispell	May	2024	37.7	64.2	51.0	0.1	0.0	0.0	
USC00244558	Kalispell	June	2024	43.6	73.2	58.4	0.1	0.0	0.0	
USC00244558	Kalispell	July	2024	50.9	88.0	69.5	0.0	0.0	0.0	
USC00244558	Kalispell	August	2024	50.5	81.1	65.8	0.1	0.0	0.0	
USC00244558	Kalispell	September	2024	44.4	76.8	60.6	0.0	0.0	0.0	
USC00329430	Williston	October	2023	35.8	55.4	45.6	0.1	0.2	1.1	
USC00329430	Williston	November	2023	23.9	42.3	33.1	0.0	0.0	0.4	
USC00329430	Williston	December	2023	21.3	38.4	29.9	0.0	0.1	0.5	
USC00329430	Williston	January	2024	6.5	22.1	14.3	0.0	0.1	0.8	
USC00329430	Williston	February	2024	20.2	38.8	29.5	0.0	0.1	0.2	
USC00329430	Williston	March	2024	16.7	37.0	26.8	0.0	0.4	1.5	

USC00329430	Williston	April	2024	35.9	63.0	49.5	0.0	0.0	0.0	
USC00329430	Williston	May	2024	44.0	68.3	56.2	0.1	0.0	0.0	
USC00329430	Williston	June	2024	51.1	74.7	62.9	0.1	0.0	0.0	
USC00329430	Williston	July	2024	60.8	87.1	73.9	0.1	0.0	0.0	
USC00329430	Williston	August	2024	58.0	83.2	70.6	0.0	0.0	0.0	
USC00329430	Williston	September	2024	51.9	82.9	67.4	0.0	0.0	0.0	
USW00094012	Havre	October	2023	31.1	54.5	42.8	0.0	0.2	0.8	
USW00094012	Havre	November	2023	25.3	47.8	36.5	0.0	0.0	0.1	
USW00094012	Havre	December	2023	20.4	44.9	32.6	0.0	0.0	0.0	
USW00094012	Havre	January	2024	0.9	23.4	12.2	0.0	0.4	3.4	
USW00094012	Havre	February	2024	14.4	34.2	24.3	0.0	0.3	2.9	
USW00094012	Havre	March	2024	18.3	39.7	29.0	0.0	0.4	1.1	
USW00094012	Havre	April	2024	32.8	59.6	46.2	0.0	0.0	0.0	
USW00094012	Havre	May	2024	41.1	64.5	52.8	0.1	0.0	0.0	
USW00094012	Havre	June	2024	46.7	74.9	60.8	0.0	0.0	0.0	
USW00094012	Havre	July	2024	56.5	89.7	73.1	0.0	0.0	0.0	
USW00094012	Havre	August	2024	55.0	85.0	70.0	0.0	0.0	0.0	
USW00094012	Havre	September	2024	47.8	79.2	63.5	0.1	0.0	0.0	

T_{MIN}: Average minimum temperature (F); T_{MAX}: Average maximum temperature (F); T_{AVG}: Average temperature (F); PRCP: Average precipitation (in); SNOW: Average snowfall (in); SNWD: Average snow depth (in)

#Data has been sourced from national weather service (NWS) provided by National Oceanic and Atmospheric Administration of the United States of America

Acknowledgements

Publication reviewed and/or data supplied by the following Montana and North Dakota research staff

Plant Sciences and Plant Pathology Department, Montana State University, Bozeman, MT

Dr. Suchismita Mondal

Assistant Professor & Winter wheat breeder
Winter Wheat Breeding Program

Mr. Ronald Proctor

Research Associate (till July 2024)
Winter Wheat Breeding Program

Mr. Andrew Lehnerz

Research Associate (Part time), Winter Wheat Breeding Program

Mr. Ricardo Javier Leiton Cubillo

Graduate student, Winter Wheat Breeding Program

Mr. Doug Holen

Manager, Montana Foundation Seed Program

Mr. Clayton Edwards

Research Associate, Montana Foundation Seed Program

Mr. Ron Ramsfield

Research Associate
Winter Wheat Breeding Program

Dr. Arpit Gaur

Postdoctoral Research Fellow
Winter Wheat Breeding Program

Mr. Duncan Pantos

Graduate student, Winter Wheat Breeding Program

Mr. Dave Gettel

Farm Operations Manager, Arthur H. Post Research Farm

Ms. Brandee Johnston

Crop Variety Promotions and Education Specialist, Montana
Foundation Seed

Ms. Deanna Nash

Cereal Quality Laboratory Manager

Central Agricultural Research Center (CARC), Moccasin, MT

Dr. Jed Eberly

Assistant Professor

Ms. Jennifer Hammontree

Research/Lab Manager

Eastern Agricultural Research Center (EARC), Sidney, MT

Dr. Chengci Chen

Superintendent and Associate Professor of Agronomy

Ms. Calla Kowatch-Carlson

Research Assistant

Northern Agricultural Research Center (NARC), Havre, MT

Ms. Peggy Lamb

Research Scientist and Agronomist

Northwestern Agricultural Research Center (NWARC), Kalispell, MT

Dr. Joeseeph Jenson

Assistant Professor - Cropping Systems Agronomist

Dr. Jessica Torrión

Superintendent and Assistant Professor of Crop Physiology

Mr. David Larson

Research Associate

Southern Agricultural Research Center (SARC), Huntley, MT

Dr. Kent McVay Kephart

Superintendent and Professor of Agronomy

Dr. Qasim Khan

Research Scientist

Williston Research and Extension Center, North Dakota State University, Williston, ND

Dr. Justin Jacobs

Research Agronomist

Nutrien Ag Solutions (Loveland Products, Inc), Bozeman, MT

Dr. Dale Clark

Sr. Breeder and Project Manager

Mr. Trevor Schafer

Research Manager

This publication is available on the web at:

<https://plantsciences.montana.edu/crops/index.html>