



**On-Farm Cereal Variety and Advanced Breeding Line
Testing across Montana for Environment Specific
Cultivar Recommendations:**



Durum Wheat Off-Station Variety Performance, Loring, MT

Principal Investigator:

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Objectives:

Commercially available durum varieties and advanced breeding lines were evaluated for agronomic performance and fit at on-farm locations across the state of Montana. Sites chosen for the research considered the environment, growing conditions and soil types, and represent the major land areas for producers in those regions served by Northern Agricultural Research Center. The Phillips County location near Loring completed its 28th year of spring cereal variety testing collaborations in 2023.

Methods:

The uniform off-station durum variety performance trial was seeded into chemical fallow ground during 2023. The trial consisted of 12 entries seeded in replicated, three-row, 22-foot plots on a 12-inch row spacing, utilizing a self-propelled cone seeder with Atom Jet paired row openers. All plots were trimmed to a harvest length of approximately 17 feet with a three-point rototiller. Plant height was measured from the soil surface to the top of the head, excluding awns, and percent sawfly cutting was visually estimated for each plot immediately prior to harvest. A 'Wintersteiger' small plot combine, funded in part by the Montana Wheat and Barley Committee, was used to harvest each three-row plot. Prior to measuring plot weight for yield determination, seed was either cleaned or weighed in-dirt as per protocols. Protein, test weight and moisture content were determined on a clean sample using a Foss Infratec 1241 near infrared analyzer. Falling number was determined using a Perten FN1700 according to the FGIS Directive 9180.38. Other variables specific to each individual trial are listed with the current year data tables.

Please note that research trial seed yield results recorded under wheat stem sawfly pressure are likely much higher than a producer should expect. Small plot variety trials are managed to assess maximum yield potential and are harvested in such a way that all stems and heads are picked up by the combine, regardless of lodging or cutting due to wheat stem sawfly. Pickup guards coupled with an extremely slow ground speed and an exceptionally low cutting height help researchers collect all heads in order to

assess seed yield potential. If you are a producer in a wheat stem sawfly environment, although hollow stemmed varieties may be high yielding in research trials in your area, we strongly recommend against growing those hollow stemmed varieties. Please be aware that if you seed hollow stemmed varieties with wheat stem sawfly present, you are only creating a breeding ground for future generations of sawfly in your area and not helping combat the pest population.

Results:

This report contains both single-year and long-term data summaries limited to the most recent ten years. It should be noted that the 2023 data table in this report represents varietal performance for a single crop year at a single location, therefore cannot be considered representative of performance expected when differing conditions due to location, year and management are imposed. By itself, 2023 data shall not constitute in any form a recommendation for or against any variety or breeding line included.

Durum seed yields at Loring averaged just over 44 bu/ac (Table 1). Montana State University breeding line 'MTD19011' produced the highest seed yield at over 48 bu/ac. 'Alzada', 'Mountrail', 'MT Raska', 'ND Grano', 'ND Riveland' and breeding line 'MTD18148' all produced seed yields statistically equal to that of MTD19011. Test weights of all durum entries for this site averaged just over 58 lb/bu with MT Raska producing the highest test weight at 60.6 lb/bu. Wheat stem sawfly infestation averaged over nine percent cutting in the durum trial at Loring. Yield, test weight, protein, falling number, plant height and sawfly cutting data for the 2023 Loring dryland durum trial are summarized in Table 1.

Comparable averages are calculated using a standard check variety when not all entries are present in a specific trial for all years. Variety means are adjusted by multiplying the actual check mean by the ratio of the individual variety mean compared to the check mean for the same years as tested. All varieties are then directly comparable to each other when in the same nursery. A minimum of three years of data is necessary to be included in the comparable average calculation. Nine-year comparable averages (2014-2023) for durum seed yield and test weight at Loring are summarized in Table 2, while nine-year comparable averages for protein content and wheat stem sawfly cutting are summarized in Table 3. Based on the comparable average calculations, MT Raska, ND Grano, 'Carpio' and 'MT Blackbeard' are the highest yielding varieties at Loring.

Summary:

Following snow cover that persisted into early April, the Loring site continued to receive timely rain events throughout the growing season. This precipitation coupled minimal grasshopper damage and a lack of extreme temperatures during flowering and head fill contributed to the highest spring wheat trial seed yields near Loring since 2020.

This work has been strongly supported by producers in the Loring-White Water area, and by the Northern Agricultural Research Center Advisory Board. With budget and other resources allowing, it is planned to continue off-station winter wheat variety and breeding line investigations in this area. The Phillips County location near Loring has been used for various spring cereal variety trials since 1996.

Recognition:

This research would not have been possible without the assistance of the following seasonal employees: Clara Haslem, Brady Kueffler, Cleta Lamb, Teresa Miller, and Nevaeh Phillips.

TABLE 1. Dryland Fallow Spring Durum Cultivar Evaluation Nursery Grown Off-Station at the Flansaas-Lumsden Farm, Loring. Northern Agricultural Research Center. Havre, Montana. 2023. (Exp# 23-9855-DUR)

ID	ORIGIN or PEDIGREE	1/	TEST WT	2/	3/	PLNT HT	4/
		YIELD		PROTEIN	FN		SAWFLY
		bu/ac	lb/bu	%	seconds	inches	%
Alzada	Westbred, 2004	46.6	57.4	14.4	511	25.2	8.3
Carpio	NDSU, 2012	43.0	57.5	15.2	437	30.2	10.0
Divide	NDSU, 2005	39.5	58.8	15.0	435	30.6	5.3
Joppa	NDSU, 2013	43.7	59.0	14.9	446	29.7	13.3
Lustre	Montana, 2020	37.5	56.8	15.5	457	29.8	6.7
Mountrail	NDSU, 1998	45.5	57.3	14.9	434	31.4	11.7
MT Blackbeard	Montana, 2022	42.8	58.2	15.3	493	30.9	5.0
MT Raska	Montana, 2022	48.2	60.6	14.7	490	24.5	3.7
ND Grano	NDSU, 2017	46.4	59.1	15.4	466	29.4	13.3
ND Riveland	NDSU, 2017	45.3	58.1	15.1	483	34.2	13.3
MTD18148	Montana	46.4	58.6	14.4	539	22.9	6.7
MTD19011	Montana	48.4	58.0	15.2	539	30.2	13.3
EXPERIMENTAL MEANS		44.5	58.3	15.0	477.3	29.1	9.2
LSD (0.05)		4.0	1.0	0.4	28.4	2.0	NS
C.V.%		5.3	1.0	1.6	3.5	4.2	43.3
P-VALUE (Varieties)		0.0002	<.0001	<.0001	<.0001	<.0001	0.0936

1/ Volumetric yields are based on plot weights adjusted to uniform 13 percent grain moisture and 60 lbs/bu as the standard test weight for durum.

2/ Protein values are adjusted to 13 percent grain moisture.

3/ FN is the falling number value reported in seconds adjusted to 14 percent flour moisture.

4/ Sawfly rating is reported as the percentage of cut stems.

Bold indicates the highest or lowest value within a column (whichever is most desirable for the specific characteristic).

Bold indicates values equal to the underlined value within a column based on Fisher's protected LSD (P=0.05).

NS for non-significant replaces the LSD when the probability value (P-Value) exceeds 0.05.

Management Information (23-9855-DUR)

Seeding Date:	May 3, 2023
Harvest Date:	August 15, 2023
Fertility:	46-9-5-5 side banded
System:	Minimum Till
Herbicide:	none
Insecticide:	none
Previous Crop:	Chemical Fallow - Spring Wheat
Precipitation:	5.39" seeding to harvest maturity

TABLE 2. Nine-Year Yield and Test Weight Summary on Selected Entries from Dryland Fallow Spring Durum Variety Nurseries Grown Off-Station at the Flansaas-Lumsden Farm, Loring. Northern Agricultural Research Center. Havre, Montana. 2014-2023. (Exp# 9855-DUR)

2/ VARIETY or SELECTION	3/ No. of YEARS TESTED	1/ YIELD (Bushels Per Acre)					TEST WEIGHT (Pounds Per Bushel)										
		2019	2020	2021	2022	2023	3/ AVE. for YEARS TESTED	4/ % of CHECK YIELD	5/ 9-YR COMP. AVE. YIELD	2019	2020	2021	2022	2023	3/ AVE. for YEARS TESTED	4/ % of CHECK TEST WT	5/ 9-YR COMP. AVE. TEST WT
MTD18313 MT RASKA (++)	3			28.1	25.0	48.2	33.8	103.3	39.9			62.0	60.6	60.6	61.1	105.2	62.0
NDSU ND-GRANO (+)	5	51.3	52.5	27.3	20.5	46.4	39.6	101.2	39.1	58.9	61.2	59.8	59.5	59.1	59.7	101.7	59.9
D03028 CARPIO (+)	9	47.2	48.3	27.0	22.9	43.0	39.0	100.9	39.0	58.4	60.4	58.7	59.1	57.5	59.3	100.7	59.3
MTD18348 MT BLACKBEARD (++)	3			29.3	26.1	42.8	32.7	100.2	38.7			59.1	59.6	58.2	59.0	101.6	59.9
D901313 MOUNTRAIL (+)	9	51.4	46.3	26.6	26.0	45.5	38.7	100.0	38.7	59.0	60.4	58.4	58.4	57.3	58.9	100.0	58.9
NDSU ND-RIVELAND (+)	5	50.1	52.3	24.8	22.8	45.3	39.1	99.8	38.6	58.5	60.5	59.1	59.3	58.1	59.1	100.7	59.4
D00095 TIOGA (+)	8	48.7	46.7	25.5	22.7		37.5	99.2	38.3	58.7	61.1	59.6	60.0		59.9	101.2	59.7
YU894-75 ALZADA (P+)	7	48.2	38.8		25.8	46.6	38.8	97.6	37.7	59.3	60.3		59.1	57.4	59.1	100.4	59.2
D9715-11 DIVIDE (+)	9	55.4	41.0	22.9	22.8	39.5	37.2	96.3	37.2	58.3	60.0	59.6	59.2	58.8	59.5	100.9	59.5
CDC Vivid CDC VIVID (P+)	5	54.9	45.8	23.9	21.0		35.7	96.0	37.1	59.3	60.0	59.5	59.1		59.9	100.9	59.5
D04581 JOPPA (+)	9	47.3	46.8	24.7	22.7	43.7	36.9	95.5	36.9	59.4	61.2	59.9	59.8	59.0	59.9	101.7	59.9
D97780 GRE Nora (+)	8	50.2	43.2	26.3	21.6		35.9	94.9	36.7	58.1	60.5	58.9	59.2		59.3	100.2	59.0
MTD16005 LUSTRE (+)	6	51.0	42.6	24.1	21.6	37.5	34.8	90.2	34.9	58.4	59.2	58.0	57.6	56.8	58.4	99.0	58.3
MEANS (For Entries Listed)		50.5	45.9	25.9	23.2	43.9			37.9	58.8	60.4	59.4	59.3	58.3			59.6
6/ Growing Season Precipitation (in.)		8.78	n/a	5.79	2.62	5.39	6.33										
Soil PAW (in.) to SD @ Planting		6.21	8.90	8.63	7.37	2.94	6.86										
Total Plant Available Water (in.)		15.00	n/a	14.40	10.00	8.30	12.89										
Soil NO3 (lbs.) to SD at Planting		n/a	23	36	62	87	48										
SD (Sampling Depth in Inches)		33	48	48	44	42	42										
Fertilizer Applied	(# N)	100	100	100	46	46	94										
	(# P ₂ O ₅)	20	20	20	9	9	18										
	(# K ₂ O)	10	10	10	5	5	9										
	(# S)	10	10	10	5	5	7										

Check variety is Mountrail.

1/ See MCES Bulletin 1093 or the Plant Sciences & Plant Pathology website at <http://plantsciences.montana.edu/> for evaluation of other important variety performance characteristics to include protein, quality, disease resistance, etc. before making cultivar selection decisions.

2/ P = Private Variety, + = Protected Variety, ++ = PVP Title 5 Pending.

3/ Only the most recent 5 years shown, but summary calculations include all years noted. No harvest in 2017 due to hail.

4/ Percent of Mountrail yield or test weight for the same data years as those in which a given entry was tested.

5/ 9-Yr Comparable Average = (x/y) * z where x = average yield or test weight of a given entry for years tested, y = average yield or test weight for Mountrail for the same years, and z = 9-Yr average yield or test weight for the check variety Mountrail.

6/ Seeding to 14 days prior to harvest.

TABLE 3. Nine-Year Protein and Sawfly Summary on Selected Entries from Dryland Fallow Spring Durum Variety Nurseries Grown Off-Station at the Flansaas-Lumsden Farm, Loring. Northern Agricultural Research Center. Havre, Montana. 2014-2023. (Exp# 9855-DUR)

2/ VARIETY or SELECTION	3/ No. of YEARS TESTED	1/ PROTEIN % (Adjusted to 13% Grain Moisture)					SAWFLY RATING (% of Cut and Lodged Stems)										
		2019	2020	2021	2022	2023	3/ AVE. YEARS TESTED	4/ % CHECK PROTEIN	5/ 9-YR COMP. AVE. PROTEIN	2019	2020	2021	2022	2023	3/ AVE. YEARS TESTED	4/ % CHECK SAWFLY	5/ 9-YR COMP. AVE. SAWFLY
MTD18313 MT RASKA (++)	3			15.8	14.0	14.7	14.9	98.7	14.7			3.7	0.7	3.7	2.7	45.3	1.0
MTD18348 MT BLACKBEARD (++)	3			15.5	13.6	15.3	14.8	98.4	14.6			2.3	1.0	5.0	2.8	47.2	1.0
YU894-75 ALZADA (P+)	7	13.4	15.2		13.8	14.4	14.6	98.9	14.7	0.0	0.7		1.0	8.3	1.6	65.4	1.4
D03028 CARPIO (+)	9	14.3	14.4	15.5	14.1	15.2	14.7	98.7	14.7	0.0	0.7	1.0	5.0	10.0	1.9	88.1	1.9
D9715-11 DIVIDE (+)	9	14.0	15.4	16.0	14.1	15.0	15.0	101.0	15.0	0.0	0.3	8.3	3.7	5.3	2.0	93.2	2.0
NDSU ND-RIVELAND (+)	5	14.2	14.3	16.0	13.8	15.1	14.7	99.3	14.8	0.0	0.7	1.0	3.7	13.3	3.7	100.0	2.2
D901313 MOUNTRAIL (+)	9	13.6	15.1	16.2	14.1	14.9	14.9	100.0	14.9	0.0	1.0	2.3	3.7	11.7	2.2	100.0	2.2
NDSU ND-GRANO (+)	5	13.8	14.6	16.3	14.3	15.4	14.9	100.8	15.0	0.0	0.3	2.3	5.3	13.3	4.3	114.3	2.5
D04581 JOPPA (+)	9	13.9	14.2	15.9	13.9	14.9	14.8	99.3	14.8	0.0	0.7	2.3	8.3	13.3	2.9	130.5	2.9
CDC Vivid CDC VIVID (P+)	5	14.1	15.2	16.9	14.5		15.3	102.6	15.3	0.0	0.3	8.3	1.0		2.1	140.9	3.1
D97780 GRENORA (+)	8	14.1	15.0	15.6	13.9		14.8	99.7	14.8	0.0	0.7	8.3	3.7		1.7	170.8	3.7
MTD16005 LUSTRE (+)	6	14.0	15.3	16.3	14.8	15.5	15.4	103.2	15.3	0.0	0.3	3.7	5.0	6.7	2.7	181.8	4.0
D00095 TIOGA (+)	8	14.4	14.7	16.1	14.4		15.3	102.9	15.3	0.0	0.7	2.3	10.0		2.1	212.5	4.6
MEANS (For Entries Listed)		14.0	14.8	16.0	14.1	15.0			14.9	0.0	0.6	3.8	4.0	9.1			2.5
6/ Growing Season Precipitation (in.)		8.78	n/a	5.79	2.62	5.39	6.33										
Soil PAW (in.) to SD @ Planting		6.21	8.90	8.63	7.37	2.94	6.86										
Total Plant Available Water (in.)		15.00	n/a	14.40	10.00	8.30	12.89										
Soil NO3 (lbs.) to SD at Planting		n/a	23	36	62	87	48										
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	(# P ₂ O ₅)	20	20	20	9	9	18										
	(# K ₂ O)	10	10	10	5	5	9										
	(# S)	10	10	10	5	5	7										

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2/ P = Private Variety, + = Protected Variety, ++ = PVP Title 5 Pending.

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4/ Percent of Mountrail protein or sawfly rating for the same data years as those in which a given entry was tested.

5/ 9-Yr Comparable Average = (x/y) * z where x = average protein or sawfly rating of a given entry for years tested, y = average protein or sawfly rating for Mountrail for the same years, and z = 9-Yr average protein or sawfly rating for the check variety Mountrail.

6/ Seeding to 14 days prior to harvest.