Title: Northcentral Montana Off-Station Spring Durum Variety Performance Evaluations

Principal Investigator: Peggy Lamb, Research Scientist, Havre

Project Personnel: Mike Giroux, Breeder/Geneticist, Durum, Bozeman
Andy Hogg, Research Associate, Durum, Bozeman
Kyla McNamara, Research Associate, Havre
Eleri Haney, Research Associate, Havre
Jesse Fulbright, Liberty County Extension
Marko Manoukian, Phillips County Extension
Julianne Snedigar, Blaine County Extension

Cooperators: Max Cederberg, Landowner, Turner
Pete Lumsden & John Flansaas, Landowners, Loring
Kurt Kammerzell, Landowner, Chester

Objectives:

Diverse cropping environments exist within the five-county area most closely served by Northern Agricultural Research Center. Winter wheat, spring wheat, barley, durum and oat production together in the five counties (Blaine, Chouteau, Hill, Liberty and Phillips), represents just over 28 percent of the 2015-2019 statewide cereal production totals (42 percent for winter wheat and 27 percent for spring wheat). Producers are keenly interested in variety performance data generated under local conditions. It is our objective, within budget and other resource limitations, to evaluate small grain variety performance, over time, under conditions representative of specific areas of northern Montana, yet differing from that of the Research Center. Growers are provided reliable, unbiased, up-to-date information to make comparisons among improved durum varieties. This report provides producers in northcentral Montana the information necessary to select varieties best suited for their specific area and growing conditions.

Methods:

Standard off-station durum variety performance trials were conducted on chemical fallow or minimal tillage during 2020 in three northern Montana counties.

Dryland Spring Durum Trials:

1. Cederberg Farm, Blaine County — S13-T36N-R25E
2. Flansaas/Lumsden Farm, Phillips County — S24-T35N-R29E
3. McKeever Farms, Chouteau County — S28-T27N-R10E

All three durum trials consisted of 15 entries and were seeded in replicated, 3-row, 22-foot plots on a 12-inch row spacing, utilizing a self-propelled cone seeder with Atom Jet paired row openers. All rows of each plot 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 Classic' plot combine, funded in part by Montana Wheat and Barley Committee, was used to harvest each 3-row plot. Seed was cleaned prior to measuring plot weight. Protein, test weight and moisture content were determined 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 sawfly. Pickup guards coupled with an extremely slow ground speed and 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 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:

Durum seed yields at Turner averaged just over 43 bu/ac (Table 1). 'Alzada' was the highest yielding entry at over 45 bu/ac. 'Carpio', 'CDC Fortitude', 'Grenora', 'Joppa', 'Lustre', 'Mountrail', 'ND-Grano' and 'ND-Riveland' along with one Montana State University breeding lines produced seed yields equal to that of Alzada. Test weights averaged just over 58 lb/bu, while protein averaged 15.7 percent and sawfly cutting was minimal. Plant height, yield, test weight, protein, falling number and sawfly data for the 2020 Turner 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 (2011-2020) for durum seed yield and test weight at Turner are summarized in Table 2, while nine-year comparable averages for protein content and wheat stem sawfly cutting are summarized in Table 3.

Loring spring durum yields averaged 46 bu/ac (Table 4). ND-Grano was the highest yielding entry at over 52 bu/ac with ND-Riveland and two Montana State University breeding lines yielding the same, statistically. 'CDC Dynamic' and 'CDC Fortitude' produced the highest protein at 16.1 and 15.9 percent, respectively. Sawfly cutting was nearly nonexistent in the durum trial at Loring. Plant height, yield, moisture, test weight, protein, falling number and sawfly cutting data, for the 2020 Loring dryland spring durum trial, are summarized in Table 4. Nine-year comparable averages for spring durum seed yield and test weight at Loring are summarized in Table 5, while nine-year comparable averages for protein content and wheat stem sawfly cutting are summarized in Table 6.

Durum seed yields at Chester averaged just over 47 bu/ac, while test weights averaged under 56 lb/bu (Table 7). Alzada was the highest yielding entry at over 52 bu/ac. Grenora, Joppa and Mountrail along with one Montana State University breeding line all produced seed yields statistically equal to that of Alzada. Sawfly cutting in the small plot scenario was minimal in 2020, averaging less than one percent. Plant height, yield, test weight, protein, falling number and sawfly cutting data for the 2020 Chester dryland spring durum trial are summarized in Table 7. Seven-year comparable averages for spring durum seed yield and test weight at Chester are summarized in Table 8, while seven-year comparable averages for protein content and sawfly cutting are summarized in Table 9.

Summary:

Cropping environments for 2020 started out with very good soil moisture recharge. The spring growing season was cooler and drier than average with many crops showing drought stress during early June. Timely rainfall was spotty during the mid- to latter part of June and into early July having significant impact on localized yields. Both Turner and Loring received near average rainfall for June, resulting in average spring crop yields. The Chester area started out with excellent soil moisture, and timely spring precipitation resulted in a very good stand, however July was fairly dry and durum seed production was limited. The Turner and Chester sites were seeded into chemical fallow. The Loring location was seeded into chemical fallow ground that had been minimally tilled to eliminate potential weed issues.

This work has been strongly supported by producers near each of the off-station locations, and by the Northern Agricultural Research Center Advisory Council. With budget and other resources allowing, it is planned to continue off-station cereal variety investigations in the five-county area. The Loring location is entering its twenty-sixth year, and the cooperator and area producer interest and support has been outstanding. The Turner location is only 32 miles from the Loring site, but growing conditions are quite different. Cooperator and producer support in the Big Flat area has been outstanding through the years with 2020 marking 37 years at the present Turner site. The Chester location was reestablished in 2014 following a prolonged absence of uniform off-station spring cereal testing in Liberty County.

Recognition:

This research would not have been possible without the assistance of the following seasonal employees:
Peyton Brown, Jonathan Erickson, Daisen Fox, Faith Gasvoda, Isabella Lawless, Tracey Reed, Erin Taylor and Ivy Thomas.

TABLE 1. Dryland Fallow Spring Durum Cultivar Evaluation Nursery Grown Off-Station at the Max Cederberg Farm, Turner. Northern Agricultural Research Center. Havre, Montana. 2020. (Exp# 20-9851-DUR)

ID	SOURCE	PLNT HT Inches	1/ YIELD Bu/Ac	TEST WT Lbs/Bu	2/ PROTEIN %	3/ FN Seconds	4/ SAWFLY %
Alzada	WestBred	25.0	**45.6**	57.5	15.1	**552**	**0.3**
Carpio	NDSU	27.5	**44.1**	57.7	15.3	462	0.7
CDC-Dynamic	CDC	28.9	40.6	57.7	**16.8**	393	**0.0**
CDC-Fortitude	CDC	26.8	**44.6**	58.1	**16.5**	469	**0.0**
CDC-Vivid	CDC	26.5	38.7	57.8	**16.7**	448	0.7
Divide	NDSU	**29.7**	40.4	**58.6**	15.6	453	0.7
Grenora	NDSU	28.5	**44.8**	**58.6**	15.2	493	0.7
Joppa	NDSU	**29.4**	**44.2**	**58.7**	15.2	456	**0.3**
Lustre (++)	MSU	28.7	**43.0**	57.0	16.4	436	1.0
Mountrail	NDSU	28.6	**43.9**	58.1	15.1	451	0.7
ND-Grano	NDSU	25.9	**44.4**	**58.7**	15.6	484	1.0
ND-Riveland	NDSU	**30.2**	**45.3**	58.1	16.0	500	0.7
Tioga	NDSU	**31.0**	40.8	**58.2**	15.5	462	**0.3**
MTD16001	MSU	29.1	42.6	57.3	15.4	427	**0.0**
MTD16002	MSU	**30.1**	**45.4**	**58.7**	15.4	477	**0.0**
EXPERIMENTAL MEANS		28.4	43.2	58.1	15.7	464.2	0.5
LSD (0.05)		1.7	2.9	0.6	0.4	21.7	0.7
C.V.%		3.5	4.1	0.6	1.6	2.8	95.8
P-VALUE (Varieties)		<.0001	0.0003	<.0001	<.0001	<.0001	0.0794

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 highest value within a column.

Bold indicates varieties with values equal to highest variety within a column based on Fisher's protected LSD (p=0.05).

Management Information (20-9851-DUR)

Seeding Date:	May 5, 2020
Harvest Date:	August 21, 2020
Fertility:	100-20-10-10 side banded
System:	no till
Herbicide:	Bromac (16oz/ac), Affinity (0.4oz/ac), Discover (12.8oz/ac)
Insecticide:	none
Previous Crop:	Chemical Fallow - Durum
Precipitation:	5.45" 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 Max Cederberg Farm, Turner. Northern Agricultural Research Center. Havre, Montana. 2011-2020. (Exp# 9851-DUR)

2/ VARIETY or SELECTION		No. of YEARS TESTED 3/	1/ YIELD (Bushels Per Acre) 2016	2017	2018	2019	2020	AVE. for YEARS TESTED 3/	% of CHECK YIELD 4/	**9-YR COMP. AVE. YIELD 5/**	TEST WEIGHT (Pounds Per Bushel) 2016	2017	2018	2019	2020	AVE. for YEARS TESTED 3/	% of CHECK TEST WT 4/	**9-YR COMP. AVE. TEST WT 5/**
D03028	CARPIO (+)	7	43.1	16.9	38.6	39.4	44.1	38.8	104.1	**35.9**	59.8	59.0	60.8	59.0	57.7	60.2	100.1	**60.3**
D00095	TIOGA (+)	9	43.7	17.7	40.8	39.5	40.8	35.2	102.2	**35.2**	60.3	61.3	62.0	59.2	58.2	61.2	101.5	**61.2**
CDC Fortitude	CDC FORTITUDE (P+)	4		17.5	39.0	39.7	44.6	35.2	101.6	**35.0**		59.3	61.1	58.5	58.1	59.3	99.8	**60.2**
D97780	GRENORA (+)	9	36.8	17.0	39.2	41.3	44.8	34.5	100.1	**34.5**	58.3	59.4	61.1	59.2	58.6	60.5	100.3	**60.5**
D901313	MOUNTRAIL (+)	9	41.7	15.5	35.2	44.1	43.9	34.4	100.0	**34.4**	59.3	59.7	60.6	59.1	58.1	60.3	100.0	**60.3**
CDC Dynamic	CDC DYNAMIC (P+)	4		20.0	38.1	38.6	40.6	34.3	98.9	**34.1**		59.8	60.0	58.7	57.7	59.1	99.5	**60.0**
D9715-11	DIVIDE (+)	9	49.7	15.3	34.4	40.7	40.4	33.8	98.1	**33.8**	60.1	60.6	61.4	59.8	58.6	61.0	101.3	**61.0**
D04581	JOPPA (+)	6	31.0	19.2	39.3	38.9	44.2	33.8	96.0	**33.1**	59.4	60.0	61.8	59.9	58.7	60.4	101.3	**61.1**
MTD16005	LUSTRE (++)	3			37.6	36.2	43.0	38.9	94.8	**32.7**			60.3	58.4	57.0	58.6	98.8	**59.6**
CDC Vivid	CDC VIVID (P+)	4		16.6	38.2	36.4	38.7	32.5	93.7	**32.3**		60.5	60.7	59.2	57.8	59.6	100.3	**60.5**
YU894-75	ALZADA (P+)	8	39.3	13.7	33.0	31.4	45.6	31.8	91.1	**31.4**	58.9	60.8	61.1	59.8	57.5	60.5	100.5	**60.5**
MEANS (For Entries Listed)			40.8	16.9	37.6	38.7	42.8			**33.8**	59.5	60.0	61.0	59.2	58.0			**60.5**
6/ Growing Season Precipitation (in.)			8.6	2.3	4.0	3.0	5.5	6.9										
Soil PAW (in.) to SD @ Planting			6.1	n/a	n/a	6.3	n/a	7.4										
Total Plant Available Water (in.)			14.7	n/a	n/a	9.3	n/a	16.4										
Soil NO3 (lbs.) to SD at Planting			85	n/a	n/a	n/a	n/a	46										
SD (Sampling Depth in Inches)			48	n/a	n/a	19	n/a	44										
Fertilizer Applied		(# N)	125	100	100	100	100	97										
		(# P2O5)	20	20	20	20	20	24										
		(# K2O)	10	10	10	10	10	13										
		(# S)	10	0	10	10	10	4										

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 selecton decisions.

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

3/ Only the most recent 5 years are shown, but summary calculations include all years noted. No harvest in 2014 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 maturity.

TABLE 3. Nine-Year Protein and Sawfly Summary on Selected Entries from Dryland Fallow Spring Durum Variety Nurseries Grown Off-Station at the Max Cederberg Farm, Turner. Northern Agricultural Research Center. Havre, Montana. 2011-2020. (Exp# 9851-DUR)

2/ VARIETY or SELECTION		No. of YEARS TESTED 3/	1/ PROTEIN % (Adjusted to 13% grain moisture) 2016	2017	2018	2019	2020	AVE. for YEARS TESTED 3/	% of CHECK PROTEIN 4/	**9-YR COMP. AVE. PROTEIN 5/**	SAWFLY RATING (% of cut and lodged stems) 2016	2017	2018	2019	2020	AVE. for YEARS TESTED 3/	% of CHECK SAWFLY 4/	**9-YR COMP. AVE. SAWFLY 5/**
CDC Dynamic	CDC DYNAMIC (P+)	4		17.6	17.6	16.3	16.8	17.1	109.3	**16.0**		0.0	0.3	0.0	0.0	0.1	20.0	**1.4**
D9715-11	DIVIDE (+)	9	14.6	16.4	16.4	15.0	15.6	14.9	102.2	**14.9**	0.0	0.7	0.7	0.0	0.7	3.6	51.3	**3.6**
YU894-75	ALZADA (P+)	8	13.8	16.1	16.1	14.5	15.1	14.7	100.5	**14.7**	0.0	0.3	0.3	0.3	0.3	4.4	55.5	**3.9**
CDC Fortitude	CDC FORTITUDE (P+)	4		17.3	16.9	16.3	16.5	16.8	107.5	**15.7**		0.0	0.7	0.3	0.0	0.3	60.0	**4.2**
D00095	TIOGA (+)	9	15.0	15.9	16.0	15.4	15.5	14.8	101.1	**14.8**	0.0	0.7	0.7	1.0	0.3	6.1	85.9	**6.1**
D03028	CARPIO (+)	7	14.5	16.3	15.6	14.9	15.3	15.0	98.7	**14.4**	0.0	0.0	0.7	0.3	0.7	0.8	100.0	**7.1**
D901313	MOUNTRAIL (+)	9	14.0	16.2	16.0	15.1	15.1	14.6	100.0	**14.6**	0.0	0.3	0.7	0.0	0.7	7.1	100.0	**7.1**
MTD16005	LUSTRE (++)	3			16.6	15.7	16.4	16.2	105.3	**15.4**			0.3	0.0	1.0	0.4	100.1	**7.1**
D97780	GRENORA (+)	9	14.7	15.9	16.0	14.9	15.2	14.7	100.3	**14.7**	0.0	0.0	0.0	0.3	0.7	7.2	101.6	**7.2**
D04581	JOPPA (+)	6	14.3	16.2	16.2	15.2	15.2	15.2	100.7	**14.7**	0.0	0.3	0.7	0.7	0.3	0.3	119.9	**8.5**
CDC Vivid	CDC VIVID (P+)	4		16.9	16.6	15.8	16.7	16.5	105.6	**15.4**		0.7	1.0	0.3	0.7	0.7	159.9	**11.3**
MEANS (For Entries Listed)			14.4	16.5	16.4	15.4	15.8			**15.0**	0.0	0.3	0.5	0.3	0.5			**6.1**
6/ Growing Season Precipitation (in.)			8.6	2.3	4.0	3.0	5.5	6.9										
Soil PAW (in.) to SD @ Planting			6.1	n/a	n/a	6.3	n/a	7.4										
Total Plant Available Water (in.)			14.7	n/a	n/a	9.3	n/a	16.4										
Soil NO3 (lbs.) to SD at Planting			85	n/a	n/a	n/a	n/a	46										
SD (Sampling Depth in Inches)			48	n/a	n/a	19	n/a	44										
Fertilizer Applied		(# N)	125	100	100	100	100	97										
		(# P2O5)	20	20	20	20	20	24										
		(# K2O)	10	10	10	10	10	13										
		(# S)	10	0	10	10	10	4										

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 selecton decisions.

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

3/ Only the most recent 5 years are shown, but summary calculations include all years noted. No harvest in 2014 due to hail.

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 maturity.

TABLE 4. Dryland Fallow Spring Durum Cultivar Evaluation Nursery Grown Off-Station at the Flansaas-Lumsden Farm, Loring. Northern Agricultural Research Center. Havre, Montana. 2020. (Exp# 20-9855-DUR)

ID	SOURCE	PLNT HT Inches	1/ YIELD Bu/Ac	TEST WT Lbs/Bu	2/ PROTEIN %	3/ FN Seconds	4/ SAWFLY %
Alzada	WestBred	22.6	38.8	60.3	15.2	**520**	**0.7**
Carpio	NDSU	24.6	48.3	60.4	14.4	415	**0.7**
CDC-Dynamic	CDC	27.1	44.3	59.4	**16.1**	407	**0.3**
CDC-Fortitude	CDC	23.9	41.6	59.6	**15.9**	446	**0.0**
CDC-Vivid	CDC	**28.8**	45.8	60.0	15.2	446	**0.3**
Divide	NDSU	**29.0**	41.0	60.0	15.4	386	**0.3**
Grenora	NDSU	26.0	43.2	60.5	15.0	417	**0.7**
Joppa	NDSU	**29.5**	46.8	**61.2**	14.2	423	**0.7**
Lustre (++)	MSU	27.7	42.6	59.2	15.3	455	**0.3**
Mountrail	NDSU	26.0	46.3	60.4	15.1	418	1.0
ND-Grano	NDSU	26.2	**52.5**	**61.2**	14.6	458	**0.3**
ND-Riveland	NDSU	**29.0**	**52.3**	60.5	14.3	448	**0.7**
Tioga	NDSU	**30.2**	46.7	**61.1**	14.7	398	**0.7**
MTD16001	MSU	**28.6**	**48.8**	59.8	14.0	422	**0.3**
MTD16002	MSU	27.0	**52.0**	60.7	14.1	478	**0.7**
EXPERIMENTAL MEANS		27.1	46.1	60.3	14.9	435.7	0.5
LSD (0.05)		1.8	4.0	0.4	0.5	25.7	0.8
C.V.%		3.9	5.1	0.4	1.8	3.5	93.2
P-VALUE (Varieties)		<.0001	<.0001	<.0001	<.0001	<.0001	0.7

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 highest value within a column.

Bold indicates varieties with values equal to highest variety within a column based on Fisher's protected LSD (p=0.05).

Management Information (20-9855-DUR)	
Seeding Date:	May 5, 2020
Harvest Date:	August 26, 2020
Fertility:	100-20-10-10 side banded
System:	minimum till
Herbicide:	Wild Card Extra (21 oz/ac)
Insecticide:	none
Previous Crop:	Chemical Fallow - Spring Wheat
Precipitation:	n/a

TABLE 5. 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. 2011-2020. (Exp# 9855-DUR)

2/ VARIETY or SELECTION		No. of YEARS TESTED 3/	1/ YIELD (Bushels Per Acre) 2016	2017 4/	2018	2019	2020	AVE. for YEARS TESTED 3/	% of CHECK YIELD 5/	**9-YR COMP. AVE. YIELD 6/**	TEST WEIGHT (Pounds Per Bushel) 2016	2017 4/	2018	2019	2020	AVE. for YEARS TESTED 3/	% of CHECK TEST WT 5/	**9-YR COMP. AVE. TEST WT 6/**
D03028	CARPIO (+)	7	47.6		31.7	47.2	48.3	43.7	103.8	**40.1**	61.0		61.2	58.4	60.4	60.1	100.8	**60.2**
D00095	TIOGA (+)	9	41.3		32.4	48.7	46.7	39.3	101.8	**39.3**	60.9		61.7	58.7	61.1	60.5	101.2	**60.5**
CDC Vivid	CDC VIVID (P+)	3			32.8	54.9	45.8	44.5	100.2	**38.7**			61.5	59.3	60.0	60.3	100.5	**60.0**
D901313	MOUNTRAIL (+)	9	38.6		35.6	51.4	46.3	38.6	100.0	**38.6**	59.3		60.6	59.0	60.4	59.7	100.0	**59.7**
YU894-75	ALZADA (P+)	8	39.4		31.3	48.2	38.8	38.0	99.8	**38.6**	59.3		61.3	59.3	60.3	59.9	100.5	**60.0**
D9715-11	DIVIDE (+)	9	42.2		32.7	55.4	41.0	38.3	99.0	**38.3**	59.9		61.1	58.3	60.0	60.2	100.8	**60.2**
D97780	GRENORA (+)	9	36.5		29.9	50.2	43.2	37.3	96.5	**37.3**	59.3		61.2	58.1	60.5	59.7	99.9	**59.7**
D04581	JOPPA (++)	6	37.6		27.1	47.3	46.8	40.2	96.5	**37.3**	60.1		61.9	59.4	61.2	60.1	101.2	**60.5**
CDC Fortitude	CDC FORTITUDE (P+)	3			35.2	50.0	41.6	42.3	95.1	**36.8**			60.8	58.4	59.6	59.6	99.4	**59.4**
CDC Dynamic	CDC DYNAMIC (P+)	3			23.3	51.1	44.3	39.6	89.0	**34.4**			60.4	58.1	59.4	59.3	98.9	**59.1**
MTD16005	LUSTRE (++)	3			32.0	51.0	42.6	41.8	94.2	**36.4**			60.4	58.4	59.2	59.3	98.9	**59.1**
MEANS (For Entries Listed)			40.4		31.3	50.5	44.1			**37.8**	60.0		61.1	58.7	60.2			**59.8**
7/ Growing Season Precipitation (in.)			7.2	n/a	n/a	8.8	n/a	8.0										
Soil PAW (in.) to SD @ Planting			3.7	n/a	n/a	6.21	8.9	7.6										
Total Plant Available Water (in.)			10.9	n/a	n/a	15.0	n/a	15.2										
Soil NO3 (lbs.) to SD at Planting			25	n/a	n/a	n/a	23.0	39										
SD (Sampling Depth in Inches)			24	n/a	n/a	33.0	48.0	43										
Fertilizer Applied	(# N)		125	125	100	100	100	99										
	(# P_2O_5)		20	20	20	20	20	24										
	(# K_2O)		10	10	10	10	10	13										
	(# S)		10	10	10	10	10	5										

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 selecton 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.

4/ No Harvest in 2017 due to hail.

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

6/ 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.

7/ Seeding to 14 days prior to harvest maturity.

TABLE 6. 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. 2011-2020. (Exp# 9855-DUR)

2/ VARIETY or SELECTION		No. of YEARS TESTED 3/	1/ PROTEIN % (Adjusted to 13% grain moisture) 2016	2017 4/	2018	2019	2020	AVE. for YEARS TESTED 3/	% of CHECK PROTEIN 5/	**9-YR COMP. AVE. PROTEIN 6/**	SAWFLY RATING (% of cut and lodged stems) 2016	2017 4/	2018	2019	2020	AVE. for YEARS TESTED 3/	% of CHECK SAWFLY 5/	**9-YR COMP. AVE. SAWFLY 6/**
CDC Fortitude	CDC FORTITUDE (P+)	3			16.7	14.5	15.9	15.7	106.5	**15.5**			0.3	0.0	0.0	0.1	25.0	**1.1**
D03028	CARPIO (+)	7	14.8		15.0	14.3	14.4	14.7	98.5	**14.3**	0.0		0.3	0.0	0.7	0.5	40.7	**1.8**
YU894-75	ALZADA (P+)	8	15.3		15.6	13.4	15.2	14.5	99.6	**14.5**	0.0		0.3	0.0	0.7	2.3	44.3	**2.0**
MTD16005	LUSTRE (++)	3			16.3	14.0	15.3	15.2	103.1	**15.0**			0.3	0.0	0.3	0.2	50.1	**2.3**
D9715-11	DIVIDE (+)	9	15.4		15.7	14.0	15.4	14.8	101.8	**14.8**	0.0		0.0	0.0	0.3	2.6	56.5	**2.6**
CDC Dynamic	CDC DYNAMIC (P+)	3			17.5	14.9	16.1	16.2	109.6	**15.9**			0.7	0.0	0.3	0.3	75.1	**3.4**
CDC Vivid	CDC VIVID (P+)	3			15.9	14.1	15.2	15.1	102.1	**14.8**			0.7	0.0	0.3	0.3	75.1	**3.4**
D04581	JOPPA (+)	6	14.4		16.3	13.9	14.2	14.7	99.4	**14.5**	0.0		0.3	0.0	0.7	0.3	83.4	**3.8**
D97780	GRENORA (+)	9	15.3		15.9	14.1	15.0	14.7	101.0	**14.7**	0.0		0.7	0.0	0.7	4.1	90.2	**4.1**
D901313	MOUNTRAIL (+)	9	15.1		15.6	13.6	15.1	14.5	100.0	**14.5**	0.0		0.3	0.0	1.0	4.5	100.0	**4.5**
D00095	TIOGA (+)	9	15.6		16.2	14.4	14.7	15.1	103.7	**15.1**	0.0		2.0	0.0	0.7	5.3	118.0	**5.3**
MEANS (For Entries Listed)			15.1		16.1	14.1	15.1			**14.9**	0.0		0.5	0.0	0.5			**3.1**

7/ Growing Season Precipitation (in.)		7.2	n/a	n/a	8.8	n/a	8.0
Soil PAW (in.) to SD @ Planting		3.7	n/a	n/a	6.21	8.9	7.6
Total Plant Available Water (in.)		10.9	n/a	n/a	15.0	n/a	15.2
Soil NO3 (lbs.) to SD at Planting		25	n/a	n/a	n/a	23.0	39
SD (Sampling Depth in Inches)		24	n/a	n/a	33.0	48.0	43
Fertilizer Applied	(# N)	125	125	100	100	100	99
	(# P_2O_5)	20	20	20	20	20	24
	(# K_2O)	10	10	10	10	10	13
	(# S)	10	10	10	10	10	5

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 selecton 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.

4/ No Harvest in 2017 due to hail.

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

6/ 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.

7/ Seeding to 14 days prior to harvest maturity.

TABLE 7. Dryland Fallow Spring Durum Cultivar Evaluation Nursery Grown Off-Station at the Kammerzell Farm, Chester. Northern Agricultural Research Center. Havre, Montana. 2020. (Exp# 20-9853-DUR)

ENTRY	SOURCE	PLNT HT Inches	1/ YIELD Bu/Ac	TEST WT Lbs/Bu	2/ PROTEIN %	3/ FN Seconds	4/ SAWFLY %
Alzada	WestBred	31.1	**52.3**	55.8	16.9	**527**	1.0
Carpio	NDSU	37.5	42.5	53.9	17.9	400	**0.3**
CDC-Dynamic	CDC	37.4	46.7	54.7	**19.5**	361	**0.7**
CDC-Fortitude	CDC	36.0	47.8	55.3	**18.9**	440	**0.0**
CDC-Vivid	CDC	37.2	44.1	55.3	**19.2**	402	**0.3**
Divide	NDSU	**38.6**	45.4	**56.4**	17.3	438	**0.7**
Grenora	NDSU	35.7	**50.7**	**56.7**	17.1	**510**	2.0
Joppa	NDSU	**39.2**	**48.5**	**56.7**	17.1	430	1.0
Lustre (++)	MSU	**38.6**	47.5	54.6	18.0	429	0.7
Mountrail	NDSU	**38.7**	**51.2**	55.3	18.0	457	**0.7**
ND-Grano	NDSU	36.4	45.6	55.7	**18.9**	419	1.0
ND-Riveland	NDSU	**38.1**	47.0	**56.1**	17.8	459	1.0
Tioga	NDSU	**38.4**	46.3	**56.4**	18.3	494	1.0
MTD16001	MSU	**38.1**	**47.9**	54.9	17.4	444	**0.0**
MTD16002	MSU	**39.3**	44.1	54.3	17.3	453	0.7
EXPERIMENTAL MEANS		37.3	47.2	55.5	18.0	444.2	0.7
LSD (0.05)		1.7	4.4	0.8	0.7	29.9	1.3
C.V.%		2.7	5.6	0.9	2.4	4.0	106.0
P-VALUE (Varieties)		<.0001	0.0046	<.0001	<.0001	<.0001	0.3304

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 highest value within a column.

Bold indicates varieties with values equal to highest variety within a column based on Fisher's protected LSD (p=0.05).

Management Information (20-9853-DUR)	
Seeding Date:	May 4, 2020
Harvest Date:	August 27, 2020
Fertility:	100-20-10 side banded
System:	no till
Herbicide:	none
Insecticide:	none
Previous Crop:	Chemical Fallow - Spring Wheat
Precipitation:	n/a

TABLE 8. Seven-Year Yield and Test Weight Summary on Selected Entries from Dryland Fallow Spring Durum Variety Nurseries Grown Off-Station at the Kammerzell Farm, Chester. Northern Agricultural Research Center. Havre, Montana. 2014-2020. (Exp# 9853-DUR)

2/ VARIETY or SELECTION		No. of YEARS TESTED	1/ YIELD (Bushels Per Acre) 2016	2017	2018	2019	2020	AVE. for YEARS TESTED	% of CHECK YIELD 3/	**7-YR COMP. AVE. YIELD 4/**	TEST WEIGHT (Pounds Per Bushel) 2016	2017	2018	2019	2020	AVE. for YEARS TESTED	% of CHECK TEST WT 3/	**7-YR COMP. AVE. TEST WT 4/**
YU894-75	ALZADA (P+)	6	28.3	31.9	33.9	60.7	52.3	40.5	108.1	**38.1**	50.2	57.7	54.4	58.8	55.8	55.1	100.1	**55.3**
D901313	MOUNTRAIL (+)	7	24.0	33.9	30.0	53.6	51.2	35.2	100.0	**35.2**	51.3	56.6	55.0	57.7	55.3	55.2	100.0	**55.2**
D97780	GRENORA (+)	7	25.4	33.1	29.6	57.1	50.7	35.0	99.3	**35.0**	50.6	57.0	56.0	58.3	56.7	55.8	101.0	**55.8**
D00095	TIOGA (+)	7	27.4	30.7	30.9	54.3	46.3	34.9	99.0	**34.9**	52.0	59.5	57.2	57.7	56.4	56.5	102.3	**56.5**
CDC Fortitude	CDC FORTITUDE (P+)	4		31.3	29.6	53.2	47.8	40.5	95.9	**33.8**		57.1	55.8	56.9	55.3	56.3	100.2	**55.3**
D9715-11	DIVIDE (+)	7	24.9	29.9	28.4	52.0	45.4	33.5	95.1	**33.5**	51.6	58.7	57.8	58.4	56.4	56.4	102.0	**56.4**
D04581	JOPPA (+)	7	24.4	29.9	24.7	51.0	48.5	33.5	95.1	**33.5**	51.3	58.2	56.4	58.4	56.7	56.0	101.5	**56.0**
CDC Dynamic	CDC DYNAMIC (P+)	4		28.1	27.3	54.0	46.7	39.0	92.5	**32.6**		57.1	55.9	56.8	54.7	56.1	99.9	**55.2**
MTD16005	LUSTRE (++)	3			25.2	51.3	47.5	41.4	92.0	**32.4**			55.5	56.6	54.6	55.6	99.2	**54.8**
D03028	CARPIO (+)	7	24.6	26.6	27.0	48.3	42.5	31.9	90.4	**31.9**	52.8	56.9	55.3	57.1	53.9	55.4	100.2	**55.4**
CDC Vivid	CDC VIVID (P+)	4		26.1	31.0	49.8	44.1	37.8	89.5	**31.6**		57.6	56.8	57.0	55.3	56.7	100.9	**55.7**
MEANS (For Entries Listed)			25.5	30.2	28.9	53.2	47.6			**33.9**	51.4	57.7	56.0	57.6	55.5			**55.6**
5/ Growing Season Precipitation (in.)			8.3	2.8	n/a	n/a	n/a	5.3										
Soil PAW (in.) to SD @ Planting			n/a	n/a	n/a	n/a	n/a	11.7										
Total Plant Available Water (in.)			n/a	n/a	n/a	n/a	n/a	14.8										
Soil NO3 (lbs.) to SD at Planting			n/a	n/a	n/a	n/a	n/a	254										
SD (Sampling Depth in Inches)			48	n/a	n/a	n/a	n/a	48										
Fertilizer Applied		(# N)	125	100	100	100	100	104										
		(# P_2O_5)	20	20	20	20	20	20										
		(# K_2O)	10	10	10	10	10	10										
		(# S)	10	0	0	0	10	3										

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 selecton decisions.

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

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

4/ 7-Yr Comparable Average = (x/y) * z where x = average yield or test weight rating for Mountrail for the same years, and z = 7-Yr average yield or test weight for the check variety Mountrail.

5/ Seeding to 14 days prior to harvest maturity.

TABLE 9. Seven-Year Protein and Sawfly Summary on Selected Entries from Dryland Fallow Spring Durum Variety Nurseries Grown Off-Station at the Kammerzell Farm, Chester. Northern Agricultural Research Center. Havre, Montana. 2014-2020. (Exp# 9853-DUR)

2/ VARIETY or SELECTION		No. of YEARS TESTED	1/ PROTEIN % (Adjusted to 13% grain moisture) 2016	2017	2018	2019	2020	AVE. for YEARS TESTED	% of CHECK PROTEIN 3/	**7-YR COMP. AVE. PROTEIN 4/**	SAWFLY RATING (% of cut and lodged stems) 2016	2017	2018	2019	2020	AVE. for YEARS TESTED	% of CHECK SAWFLY 3/	**7-YR COMP. AVE. SAWFLY 4/**
CDC Dynamic	CDC DYNAMIC (P+)	4		18.3	18.6	18.1	19.5	18.6	108.2	**19.1**		0.0	0.0	1.0	0.7	0.4	13.0	**0.6**
D9715-11	DIVIDE (+)	7	17.9	17.3	16.6	15.8	17.3	17.2	97.6	**17.2**	0.3	0.0	0.5	5.0	0.7	1.1	23.4	**1.1**
YU894-75	ALZADA (P+)	6	18.4	17.5	16.8	15.7	16.9	17.1	97.6	**17.2**	2.3	0.3	1.8	2.3	1.0	1.4	24.4	**1.2**
D03028	CARPIO (+)	7	17.9	17.6	17.4	16.6	17.9	17.6	99.6	**17.6**	0.0	0.3	0.3	6.7	0.3	1.2	25.9	**1.2**
D97780	GRENORA (+)	7	17.7	17.1	17.5	15.7	17.1	16.9	95.9	**16.9**	0.3	0.7	0.3	7.0	2.0	1.5	31.8	**1.5**
MTD16005	LUSTRE (++)	3			18.0	16.9	18.0	17.6	102.7	**18.1**			0.2	3.7	0.7	1.5	35.1	**1.7**
CDC Vivid	CDC VIVID (P+)	4		17.8	18.1	17.3	19.2	18.1	105.2	**18.6**		0.0	0.3	5.0	0.3	1.4	44.2	**2.1**
CDC Fortitude	CDC FORTITUDE (P+)	4		17.9	18.0	17.1	18.9	18.0	104.6	**18.5**		0.3	0.2	5.3	0.0	1.5	45.5	**2.2**
D04581	JOPPA (+)	7	18.2	16.8	17.1	16.1	17.1	17.3	98.1	**17.3**	1.0	0.7	0.7	13.3	1.0	2.8	57.7	**2.8**
D00095	TIOGA (+)	7	17.1	17.4	18.2	16.7	18.3	17.9	101.1	**17.9**	5.0	0.7	0.2	10.0	1.0	2.8	59.2	**2.8**
D901313	MOUNTRAIL (+)	7	18.6	17.3	17.7	15.8	18.0	17.7	100.0	**17.7**	0.7	0.0	0.5	11.7	0.7	4.8	100.0	**4.8**
MEANS (For Entries Listed)			18.0	17.5	17.6	16.5	18.0			**17.8**	1.4	0.3	0.5	6.5	0.8			**2.0**
5/ Growing Season Precipitation (in.)			8.3	2.8	n/a	n/a	n/a	5.3										
Soil PAW (in.) to SD @ Planting			n/a	n/a	n/a	n/a	n/a	11.7										
Total Plant Available Water (in.)			n/a	n/a	n/a	n/a	n/a	14.8										
Soil NO3 (lbs.) to SD at Planting			n/a	n/a	n/a	n/a	n/a	254										
SD (Sampling Depth in Inches)			48	n/a	n/a	n/a	n/a	48										
Fertilizer Applied		(# N)	125	100	100	100	100	104										
		(# P_2O_5)	20	20	20	20	20	20										
		(# K_2O)	10	10	10	10	10	10										
		(# S)	10	0	0	0	10	3										

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 selecton decisions.

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

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

4/ 7-Yr Comparable Average = (x/y) * z where x = average protein or sawfly rating for Mountrail for the same years, and z = 7-Yr average protein or sawfly rating for the check variety Mountrail.

5/ Seeding to 14 days prior to harvest maturity.