



MONTANA
STATE UNIVERSITY

College of
AGRICULTURE &
MONTANA AGRICULTURAL
EXPERIMENT STATION

PROJECT TITLE:

2016 STATEWIDE DURUM VARIETY TRIALS

PRINCIPAL INVESTIGATORS:

Michael Giroux, MSU Bozeman, MT

Email: mgiroux@montana.edu

Phone: (406) 994-7877

Andy Hogg, MSU Bozeman, MT

Email: ahogg@montana.edu

Phone: (406) 994-1876

CONTRIBUTORS:

- Dave Wichman, Pat Carr, and Shabeg Briar, MSU-CARC, Moccasin, MT
- Chengci Chen, MSU-EARC, Sidney, MT
- Peggy Lamb, MSU-NARC, Havre, MT
- Gadi Reddy, Roger Nkoa Ondoua, and John Miller MSU-WTARC, Conrad, MT
- Craig Cook, Northern Seed LLC., Bozeman, MT
- Gautam Pradhan and Austin Link, NDSU-WREC, Williston, ND
- Linda Dykes, USDA-ARS, Fargo, ND

OBJECTIVE:

To test advanced durum lines for agronomic and quality traits relative to currently grown varieties under Montana growing conditions.

METHODS:

Six advanced experimental durum lines and nine elite durum varieties were tested at five Montana State University Agricultural Experiment Centers, two locations maintained by Northern Seed, LLC, and the North Dakota State University Williston Research Extension Center (Table 1). Rainfed experiments were grown in Havre, MT (MSU-NARC), Sidney, MT (MSU-EARC), Conrad, MT (MSU-WTARC and Northern Seed, LLC), Moccasin, MT (MSU-CARC), and Williston, ND (NDSU-WREC). Irrigated trials were grown in Bozeman, MT (MSU-Post Agronomy Farm), Churchill, MT (Northern Seed, LLC) and Sidney, MT (MSU-EARC). There were three replicates of each line/variety grown at each location, all seed was treated with CruiserMaxx Vibrance for Cereals (Syngenta) (5 fl oz/100 lb), and Mountrail was considered the check variety. The individual research centers/cooperators provided agronomic data and grain sub-samples from the three replicates per line per location were bulked and submitted to Linda Dykes (USDA-ARS, Fargo, ND) for analysis of seed traits, milling and semolina quality, and mixing strength. Overall statewide agronomic performance can be found in Table 2 with agronomic performance separated by irrigation environment (irrigated or rainfed) presented in Tables 3 and 4. Agronomic data for each individual location is in Tables 5-13 with overall quality data summarized in Tables 14 and 15 and individual location quality data in Tables 16-21.

AGRONOMIC RESULTS SUMMARY:

Across all nine locations, encompassing both irrigated and rainfed trials, there was no statistical significant differences for all traits based on ANOVA. However, numerically the highest yielding line was MT112219 (67.0 bu/ac) which also had the highest test weight (60.2 lb/bu). Mountrail had the lowest yield (58.0 bu/ac) and test weight (55.5 lb/bu) (Table 2). MT112219 and MT101717 were the shortest lines (27.2 and 27.9 in, respectively) and had the lowest grain protein (both 13.8 %), while Tioga had the highest protein (15.1 %) and was the tallest (32.7 in) (Table 2).

Under irrigated conditions at three locations there were no significant differences observed for any measured trait, however MT112219 numerically was the second highest

yielding line (99.3 bu/ac) behind Carpio (101.9 bu/ac), had the highest test weight (61.3 lb/bu), and was the shortest (31.3 in) (Table 3). Under irrigation, MT112434 ranked the lowest for yield (86.6 bu/ac) and test weight (59.4 lb/bu) but the highest for protein (14.2 %), while MT101717 ranked the lowest for protein (12.7 %) (Table 3).

Under rainfed conditions no significant differences were observed between lines tested for heading date, yield, test weight, or protein content (Table 4), however MT112219 ranked the highest for yield (50.8 bu/ac) and test weight (59.6 lb/bu) but the lowest for protein (14.1 %). In 2015, MT112219 was also the top yielding line under rainfed conditions. MT112219 was the shortest line (25.2 in) and was significantly shorter than the check Mountrail (29.3 in). The lowest yielding line under rainfed conditions in 2016 was Mountrail (41.1 bu/ac) which also had the lowest test weight (53.3 lb/bu). Tioga was the tallest cultivar (30.7 in) with the highest protein (15.5 %) under rainfed conditions (Table 4).

Supplemental information for off-station variety trials grown in the north central and eastern part of Montana can be found at the end of this report (pgs. 25-39). All the off-station trials in north central Montana were conducted and data summarized by Peggy Lamb (MSU-NARC) and all the off-station trials in eastern Montana were conducted and data summarized by Dr. Chengci Chen (MSU-EARC).

QUALITY RESULTS SUMMARY:

Grain quality results supplied by the USDA-ARS showed no significant difference for test weight, individual kernel weight, grain hardness, or grain protein based off ANOVA (Table 14). Significant differences did exist for percent large kernels, percent small kernels, and kernel diameter (Table 14). Overall, MT101717 and MT112219 again had the largest test weights (61.2 and 60.9 lb/bu, respectively) while Mountrail had the lowest test weight (58.7 bu/ac), though not significantly. MT101717 had the smallest individual kernel weight (37.3 mg) which resulted in it having the largest percent of small kernels (13.8%) along with Mountrail (13.8 %). Alzada had the largest individual kernel weight (44.2 mg) and kernel diameter (3.0 mm) which equated to it having the greatest percent of large kernels (77.0 %) and lowest percent of small kernels (5.1 %). MT101717 and MT112219 had the lowest grain protein (13.8 % and 14.0 % respectively) while line MT112434 had the highest grain protein content (14.9%), although not significantly.

After milling, no significant differences were detected for semolina milling yield, semolina brightness (L*), whole grain ash, semolina protein, or falling number (Table 15). Significant differences did exist for semolina yellow color (b*), mixograph pattern, and semolina ash (Table 15). MT112219 had the highest milling yield (63.7%) with its semolina having the lowest protein content (12.6%) and lowest brightness score (83.5) along with Alzada (83.5). MT101717 had the lowest whole grain (1.4 %) and semolina ash content (0.57%) and the second lowest semolina protein (12.7 %). Grenora had the lowest milling yield (61.7%), while Mountrail had the brightest (84.5) semolina and highest semolina protein (13.7%), though not significantly. Mountrail had significantly the least yellow semolina (24.9) while Joppa had the most yellow semolina (30.3). All MT lines except MT101694 had significantly more yellow (27.2-28.7) semolina than Mountrail. Mountrail had significantly the lowest mixograph pattern score reflecting weak gluten with a score of 3.0 while Alzada had the highest mixograph pattern score of 6.9. Mixograph pattern scores for all the experimental MT lines except MT101694 were significantly higher than Mountrail. Quality data for individual locations can be found in Tables 16-21.

Table 1. 2016 site information for testing sites across Montana and North Dakota.

Location	Bozeman	Churchill	Conrad	CARC	WREC-ND
Latitude	45° 41'	45° 46'	48°06'	47° 03'	48° 08'
Longitude	111° 00'	111° 19'	112°02'	109° 57'	103° 44'
Planting Date	4/20/2016	5/2/2016	NA	4/4/2016	5/2/2016
Harvest Date	8/17/2016	9/5/2016	NA	8/11/2016	8/5/2016
Crop Year Precipitation	14.3 in.	NA	10.3 in.	12.1 in.	NA
Growing Season Precipitation	4.3 in.	NA	5.2 in.	8.7 in.	8.2 in.
Irrigation	4 in.	NA	-	-	-
Herbicide	Axial (12 oz/ac); Husky (15 oz/ac)	NA	NA	Glyphosate pre-emergence and in crop application of Bromoxynil+MCPA	Brox-M/Discover NG @ 1.5 pt/ac and 16 oz/ac (6-6-16)
Soil Fertility	6" 6-22-297 NPK	NA	NA	6" 7-28-359 NPK	6" 2-17-266 NPK
Fertilizer applied	46-0-0 NPK Tilled-in	NA	NA	10-15-10-5 NPKS w/seed + 60 N top dress.	67-18-5 NPS (lb/ac)
Previous Crop	Fallow wheat	NA	NA	Chemical fallow barley	Safflower

Table 1 cont. 2016 site information for testing sites across Montana and North Dakota.

3	NARC	EARC	EARC (I)	WTARC
Latitude	48° 29'	47° 46'	47° 46'	48° 18'
Longitude	109° 48'	104° 14'	104° 14'	111° 55'
Planting Date	5/4/2016	4/12/2016	4/22/2016	5/3/2016
Harvest Date	8/15/2016	8/4/2016	8/16/2016	NA
Crop Year Precipitation	18.5 in.	14.5 in.	14.5 in.	16.9 in
Growing season Precipitation	9.3 in.	9.7 in.	9.7 in.	5.2 in.
Irrigation	-	-	NA	-
Herbicide	Brox-M, 24 oz/ac	Full Deck; Discover	Full Deck; Discover	Prowl 3 pts/ac; RT3 20 oz/ac
Soil Fertility	NA	143 lb N/ac	78 lb N/ac	NA
Fertilizer applied	125-20-10-10 NPKS	None	200 lb/ac 46-0-0 N	NA
Previous Crop	Chemical fallow barley	Fallow	Safflower	Chemical fallow barley

Table 2. Agronomic means from 2016 intrastate durum trials all locations (n=9) and conditions.

Line/Variety	Heading (Julian)¹	Flowering (Julian)²	Plant Height (in)	Yield (bu/ac)³	Test Weight (lb/bu)	Protein (%)³
Alkabo	174.7	188.8	32.1	59.7	57.9	14.7
Alzada	<u>172.6</u>	188.0	28.4	62.7	58.2	14.8
Carpio	<u>176.3</u>	188.8	32.3	65.7	59.0	14.8
Divide	174.8	188.4	32.2	64.5	57.8	14.7
Grenora	174.5	188.0	30.8	63.7	57.1	14.8
Joppa	175.8	188.1	31.9	61.5	57.5	14.6
Mountrail	175.3	187.7	31.4	<u>58.0</u>	<u>55.5</u>	14.9
Silver	172.8	<u>187.3</u>	29.5	62.1	57.6	14.6
Tioga	175.2	187.3	<u>32.7</u>	61.2	58.4	<u>15.1</u>
MT101694	174.5	189.3	31.2	61.8	58.8	14.4
MT101717	173.5	188.8	27.9	65.4	60.0	13.8
MT112219	172.7	<u>189.8</u>	<u>27.2</u>	<u>67.0</u>	<u>60.2</u>	<u>13.8</u>
MT112434	174.4	189.7	31.3	59.9	58.1	14.9
MT112444	173.3	188.4	30.9	63.1	57.8	14.5
MT112463	173.1	188.2	28.6	62.6	57.5	14.3
Grand Mean	174.2	188.4	30.6	62.6	58.1	14.6
CV (%)	3.0	3.6	15.4	41.6	9.3	15.2
LSD (0.05)	7.1	13.8	4.3	25.5	5.2	2.1
P-value	NS	NS	NS	NS	NS	NS

¹Data for five locations

²Data for two locations

³Reported on a 12% moisture basis

NS = No significant difference based on ANOVA $p < 0.05$

Underline = Highest and lowest values

Table 3. Agronomic means from 2016 intrastate durum trials conducted under irrigated conditions (n=3).

Line/Variety	Flowering (Julian)	Plant Height (in)	Yield (bu/ac) ¹	Test Weight (lb/bu)	Protein (%) ¹
Alkabo	<u>185.2</u>	36.8	88.6	60.9	13.2
Alzada	<u>183.0</u>	32.2	93.4	60.3	13.9
Carpio	184.7	36.9	<u>101.9</u>	60.6	13.7
Divide	184.7	36.4	95.7	60.3	14.0
Grenora	184.0	36.3	97.9	59.8	13.5
Joppa	184.7	36.7	91.5	60.7	13.4
Mountrail	184.5	35.6	91.8	59.9	13.5
Silver	183.5	35.1	97.1	59.8	13.6
Tioga	183.5	36.7	94.4	60.4	14.1
MT101694	185.0	35.8	88.5	59.9	13.4
MT101717	184.2	33.4	95.9	61.3	<u>12.7</u>
MT112219	183.2	<u>31.3</u>	99.3	<u>61.3</u>	13.2
MT112434	184.5	36.8	<u>86.6</u>	<u>59.4</u>	<u>14.2</u>
MT112444	183.7	<u>37.4</u>	95.7	59.7	13.4
MT112463	183.3	32.8	95.1	60.7	13.1
Grand Mean	184.1	35.4	94.2	60.3	13.5
CV (%)	1.8	8.0	15.4	3.0	9.3
LSD (0.05)	9.4	4.3	28.2	3.5	2.4
P-value	NS	NS	NS	NS	NS

¹Reported on a 12% moisture basis

NS = No significant difference based on ANOVA $p < 0.05$

Underline = Highest and lowest values

Table 4. Agronomic means from 2016 intrastate durum trials conducted under rainfed conditions (n=6).

Line/Variety	Heading (Julian) ¹	Plant Height (in)	Yield (bu/ac) ²	Test Weight (lb/bu)	Protein (%) ²
Alkabo	175.9	29.8	45.2	56.4	15.4
Alzada	<u>173.5</u>	26.5	47.3	57.2	15.3
Carpio	<u>177.4</u>	30.0	47.6	58.2	15.4
Divide	175.8	30.2	48.9	56.5	15.1
Grenora	175.6	28.0	46.6	55.7	15.5
Joppa	176.7	29.5	46.5	55.8	15.3
Mountrail	176.3	29.3	<u>41.1</u>	<u>53.3</u>	15.5
Silver	173.7	26.7	44.6	56.5	15.2
Tioga	176.2	<u>30.7</u>	44.5	57.4	<u>15.5</u>
MT101694	175.6	28.9	48.5	58.2	14.9
MT101717	174.4	25.2	50.1	59.3	14.4
MT112219	173.6	<u>25.2</u>	<u>50.8</u>	<u>59.6</u>	<u>14.1</u>
MT112434	175.3	28.5	46.6	57.5	15.3
MT112444	174.1	27.6	46.8	56.9	15.1
MT112463	174.1	26.4	46.3	56.0	14.9
Grand Mean	175.2	28.2	46.8	57.0	15.1
CV (%)	3.0	12.2	26.5	10.9	15.9
LSD (0.05)	8.5	3.7	15.3	7.6	3.0
P-value	NS	0.038	NS	NS	NS

¹Data for four locations

²Reported on a 12% moisture basis

NS = No significant difference based on ANOVA $p < 0.05$

Underline = Highest and lowest values

Table 5. Agronomic means from 2016 irrigated intrastate durum trial conducted by Giroux/Hogg at the Post Agronomy Farm in Bozeman, MT.

Line/variety	Flowering (Julian)	Plant Height (in)	Yield (bu/ac)¹	Test Weight (lb/bu)	Protein (%)¹
Alkabo	182.0	36.0	89.7	61.5	14.3
Alzada	<u>179.3</u>	29.0	<u>84.9</u>	61.2	14.3
Carpio	<u>182.3</u>	36.2	<u>103.1</u>	<u>59.4</u>	14.5
Divide	181.7	36.2	92.5	60.5	15.0
Grenora	180.7	33.5	88.8	60.5	14.8
Joppa	182.3	35.8	90.4	60.8	14.3
Mountrail	181.7	35.7	86.2	60.4	14.7
Silver	180.7	32.5	90.3	60.8	14.6
Tioga	181.7	<u>37.8</u>	94.3	60.5	<u>15.1</u>
MT101694	182.0	37.5	86.0	61.2	13.9
MT101717	181.0	28.3	86.6	62.5	<u>13.7</u>
MT112219	179.3	<u>27.8</u>	91.0	63.0	13.8
MT112434	181.3	34.2	84.5	60.9	14.4
MT112444	180.0	36.7	98.3	60.1	14.1
MT112463	179.7	29.5	95.6	<u>63.1</u>	13.9
Mean	181.0	33.8	90.8	61.1	14.4
CV (%)	0.6	10.5	7.5	1.8	3.2
LSD (0.05)	1.0	1.9	9.0	0.7	0.3
P-value	<0.001	<0.001	0.008	<0.001	<0.001

¹Reported on a 12% moisture basis

NS = No significant difference based on ANOVA $p < 0.05$

Underline = Highest and lowest values

Table 6. Agronomic means from 2016 rainfed intrastate durum trial conducted by Northern Seed, LLC in Conrad, MT.

Line/variety	Plant Height (in)	Yield (bu/ac)¹	Test Weight (lb/bu)	Protein (%)¹
Alkabo	32.5	43.6	58.5	12.6
Alzada	31.0	52.6	58.6	12.8
Carpio	32.5	40.2	57.9	12.9
Divide	<u>33.5</u>	47.8	58.3	12.2
Grenora	31.5	49.5	59.0	13.0
Joppa	31.0	<u>40.2</u>	58.3	13.2
Mountrail	31.5	43.2	57.2	13.4
Silver	30.0	43.0	58.2	12.0
Tioga	32.0	41.9	58.7	13.3
MT101694	31.0	41.0	57.9	13.2
MT101717	28.5	46.4	60.1	12.9
MT112219	<u>28.0</u>	<u>53.4</u>	<u>60.2</u>	<u>11.2</u>
MT112434	31.5	48.4	59.2	12.7
MT112444	31.5	42.6	<u>56.2</u>	<u>13.7</u>
MT112463	31.0	51.2	57.8	12.8
Mean	31.1	45.7	58.4	12.9
CV	6.1	14.0	2.0	5.0
LSD (0.05)	3.7	9.6	1.4	0.8
P-value	NS	NS	<0.001	0.002

¹Reported on a 12% moisture basis

NS = No significant difference based on ANOVA $p < 0.05$

Underline = Highest and lowest values

Table 7. Agronomic means from 2016 irrigated intrastate durum trial conducted by Northern Seed, LLC in Churchill, MT.

Line/variety	Flowering (Julian)	Plant Height (in)	Yield (bu/ac)¹	Test Weight (lb/bu)	Protein (%)¹
Alkabo	<u>188.3</u>	37.5	99.0	58.3	11.6
Alzada	186.7	35.5	123.9	59.0	12.0
Carpio	187.0	36.0	<u>125.4</u>	<u>59.5</u>	12.4
Divide	187.7	34.0	116.6	58.8	12.1
Grenora	187.3	<u>38.5</u>	112.5	57.6	12.1
Joppa	187.0	36.5	97.9	59.1	12.0
Mountrail	187.3	<u>34.0</u>	101.0	<u>56.6</u>	11.7
Silver	<u>186.3</u>	37.5	117.6	57.7	11.6
Tioga	185.3	35.0	113.8	58.9	12.7
MT101694	188.0	36.0	<u>94.5</u>	57.3	12.1
MT101717	187.3	38.0	105.9	58.1	<u>11.0</u>
MT112219	187.0	35.0	114.2	58.6	11.9
MT112434	187.7	37.0	99.9	57.3	<u>13.1</u>
MT112444	187.3	37.5	119.3	58.0	11.5
MT112463	187.0	37.0	115.5	58.1	11.2
Grand Mean	187.2	36.3	110.5	58.2	11.9
CV (%)	0.6	8.1	11.8	1.8	5.9
LSD (0.05)	1.7	7.6	17.6	1.3	0.9
P-value	NS	NS	0.011	0.006	0.011

¹Reported on a 12% moisture basis

NS = No significant difference based on ANOVA $p < 0.05$

Underline = Highest and lowest values

Table 8: Agronomic means from 2016 rainfed intrastate durum trial at Eastern Agricultural Research Center in Sidney, MT.

Line/Variety	Heading (Julian)	Plant Height (in)	Yield (bu/ac) ¹	Test weight (lb/bu) ¹	Protein (%) ¹
Alkabo	168.0	33.3	<u>79.2</u>	64.5	11.8
Alzada	165.0	26.8	66.9	63.5	12.1
Carpio	<u>169.3</u>	32.4	71.6	64.5	11.8
Divide	168.7	33.5	75.7	64.2	<u>12.4</u>
Grenora	168.3	30.7	74.9	63.7	11.8
Joppa	169.0	33.6	73.5	64.3	11.6
Mountrail	168.7	33.3	68.2	64.4	11.6
Silver	167.0	29.1	65.8	63.7	12.3
Tioga	169.3	<u>34.9</u>	<u>61.3</u>	63.9	11.9
MT 1011694	167.3	30.2	69.6	64.4	12.0
MT101717	166.0	26.2	77.2	<u>66.4</u>	<u>11.4</u>
MT112219	<u>165.0</u>	<u>25.5</u>	70.4	65.3	11.5
MT112434	167.0	30.1	72.5	63.4	11.7
MT112444	166.0	31.1	68.9	<u>63.0</u>	11.8
MT112463	165.3	27.0	69.5	63.4	11.7
Grand Mean	167.3	30.5	70.9	64.2	11.8
CV (%)	0.3	2.0	9.8	0.4	3.7
LSD (0.05)	0.9	2.6	12.1	0.4	0.8
P-value	<0.001	<0.001	NS	<0.001	NS

¹Reported on a 12% moisture basis

NS = No significant difference based on ANOVA $p < 0.05$

Underline = Highest and lowest values

Table 9: Agronomic means from 2016 irrigated intrastate durum trial at Eastern Agricultural Research Center in Sidney, MT.

Line/Variety	Heading (Julian)	Plant Height (in)	Yield (bu/ac) ¹	Test Weight (lb/bu) ¹	Protein (%) ¹	Lodging (%)
Alkabo	170.0	36.9	77.1	62.9	13.8	<u>0</u>
Alzada	169.0	32.2	71.5	60.7	<u>15.6</u>	87
Carpio	172.0	38.6	77.1	63.0	14.3	17
Divide	171.0	39.0	78.0	61.6	14.8	47
Grenora	170.3	36.9	92.5	61.5	13.5	33
Joppa	<u>172.3</u>	37.7	86.3	62.3	13.8	0
Mountrail	171.3	37.3	88.2	62.7	14.1	40
Silver	169.3	35.4	83.3	61.0	14.5	13
Tioga	171.3	37.3	75.2	61.8	14.7	23
MT 1011694	170.0	34.0	85.2	61.3	14.1	60
MT101717	169.7	33.9	<u>95.1</u>	<u>63.2</u>	<u>13.5</u>	0
MT112219	<u>169.0</u>	<u>31.1</u>	92.7	62.2	13.9	3
MT112434	170.7	<u>39.1</u>	75.4	<u>60.1</u>	15.0	47
MT112444	170.0	37.9	<u>69.6</u>	61.0	14.7	67
MT112463	169.0	32.0	74.1	61.0	14.4	<u>90</u>
Grand Mean	170.3	35.9	81.4	61.7	14.3	35.1
CV (%)	0.49	1.2	7.52	1.2	1.3	49.1
LSD (0.05)	1.0	1.8	8.9	1.2	0.3	29
P-value	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

¹Reported on a 12% moisture basis

NS = No significant difference based on ANOVA $p < 0.05$

Underline = Highest and lowest values

Table 10. Agronomic means from 2016 rainfed intrastate durum trial at Central Agricultural Research Center in Moccasin, MT.

Line/Variety	Heading (Julian)	Plant Height (in)	Yield (bu/ac) ¹	Test Weight (lb/bu)
Alkabo	177.7	32.7	34.7	60.9
Alzada	175.3	28.9	43.2	61.7
Carpio	<u>178.0</u>	31.4	37.3	<u>59.9</u>
Divide	175.7	32.7	39.9	60.7
Grenora	177.7	28.8	<u>33.7</u>	60.6
Joppa	178.0	30.7	36.8	60.6
Mountrail	177.7	30.6	36.2	60.6
Silver	<u>173.3</u>	27.7	38.4	61.1
Tioga	177.7	<u>33.2</u>	37.4	61.2
MT101694	178.0	31.4	34.1	61.3
MT101717	177.3	25.6	35.9	61.7
MT112219	175.7	27.6	<u>43.2</u>	<u>61.8</u>
MT112434	175.0	28.0	38.2	61.2
MT112444	175.3	<u>27.1</u>	40.3	60.8
MT112463	175.7	29.5	41.7	61.4
Grand Mean	176.5	29.7	38.1	61.0
CV (%)	0.9	9.2	12.3	1.4
LSD (0.05)	1.6	3.1	7.2	1.4
P-value	<0.001	<0.001	NS	NS

¹Reported on a 12% moisture basis

NS = No significant difference based on ANOVA $p < 0.05$

Underline = Highest and lowest values

Table 11. Agronomic means from 2016 rainfed intrastate durum trial at Western Triangle Agricultural Research Center in Conrad, MT.

Line/Variety	Flowering (Julian)	Plant Height (in)	Yield (bu/ac) ¹	Test Weight (lb/bu)
Alkabo	196.0	26.3	46.9	43.7
Alzada	198.0	23.0	42.3	50.1
Carpio	197.0	27.7	52.8	54.4
Divide	196.0	27.0	47.5	43.8
Grenora	196.0	24.0	46.4	40.9
Joppa	195.0	25.7	57.6	42.5
Mountrail	<u>194.0</u>	26.3	<u>32.3</u>	28.9*
Silver	195.0	24.7	45.3	44.6
Tioga	195.0	<u>27.7</u>	52.1	45.9
MT101694	198.0	25.0	<u>60.5</u>	49.9
MT101717	198.0	22.0	54.2	51.0
MT112219	<u>203.0</u>	<u>21.7</u>	44.3	<u>54.5</u>
MT112434	200.0	26.3	40.7	49.3
MT112444	198.0	24.7	45.5	51.6
MT112463	198.0	22.7	40.8	44.7
Grand Mean	197.1	25.0	46.5	47.3
CV (%)	1.1	2.1	21.9	15.3
LSD (0.05)	0.0	1.7	14.6	11.3
P-value	<0.001	<0.001	0.033	0.05

¹Reported on a 12% moisture basis

NS = No significant difference based on ANOVA $p < 0.05$

Underline = Highest and lowest values

*Only one of the three reps was harvested for Mountrail.

Table 12. Agronomic means from 2016 rainfed intrastate durum trial at Northern Agricultural Research Center in Havre, MT.

Line/Variety	Heading (Julian)	Plant Height (in)	Yield (bu/ac)¹	Test Weight (lb/bu)	Protein (%)¹
Alkabo	182.0	29.9	<u>29.5</u>	54.9	17.4
Alzada	180.0	25.9	36.4	54.5	17.5
Carpio	<u>184.0</u>	30.4	41.3	56.3	17.4
Divide	183.0	30.1	39.7	56.5	17.6
Grenora	181.3	29.3	36.2	54.5	17.3
Joppa	183.3	30.5	31.5	<u>53.7</u>	<u>17.8</u>
Mountrail	182.7	29.4	30.1	54.3	17.7
Silver	181.0	27.9	35.6	55.5	17.4
Tioga	183.0	<u>33.0</u>	35.9	54.9	17.4
MT101694	180.7	30.1	44.9	58.3	15.6
MT101717	180.0	26.4	47.4	<u>59.9</u>	<u>14.5</u>
MT112219	<u>180.0</u>	<u>25.6</u>	<u>47.7</u>	58.4	15.7
MT112434	180.7	28.1	41.2	55.9	17.2
MT112444	180.3	27.9	41.3	55.7	16.6
MT112463	181.0	26.3	35.0	54.8	16.5
Grand Mean	181.5	28.7	38.2	55.9	16.9
CV (%)	0.4	4.0	5.4	1.1	2.2
LSD (0.05)	1.3	1.9	3.4	1.0	0.6
P-value	<0.001	<0.001	<0.001	<0.001	<0.001

¹Reported on a 13% moisture basis

NS = No significant difference based on ANOVA $p < 0.05$

Underline = Highest and lowest values

Table 13. Agronomic means from 2016 rainfed intrastate durum trial at NDSU-WREC Williston, ND.

Line/Variety	Heading (Julian)	Plant Height (in)	Yield (bu/ac) ¹	Test Weight (lb/bu)	Protein (%) ²
Alkabo	176.0	23.9	37.6	56.1	18.9
Alzada	173.7	23.5	42.4	54.9	18.1
Carpio	178.3	25.9	42.6	56.0	18.4
Divide	175.7	24.3	42.9	55.6	18.1
Grenora	175.0	23.6	38.7	55.5	18.4
Joppa	176.3	25.7	39.3	55.6	18.8
Mountrail	176.3	24.4	<u>36.9</u>	54.2	18.2
Silver	173.3	<u>21.1</u>	39.5	56.0	18.2
Tioga	174.7	23.6	38.5	<u>59.7</u>	18.0
MT101694	176.3	25.9	40.6	57.3	18.0
MT101717	174.3	22.3	39.6	56.9	17.8
MT112219	<u>173.7</u>	22.7	<u>45.8</u>	57.6	<u>16.8</u>
MT112434	<u>178.7</u>	<u>27.2</u>	38.4	55.9	<u>19.2</u>
MT112444	174.7	23.5	42.1	53.9	17.8
MT112463	174.3	22.0	39.7	<u>53.6</u>	17.9
Grand Mean	175.4	24.0	40.3	55.9	18.2
CV (%)	1.1	6.9	11.8	2.4	5.4
LSD (0.05)	0.9	2.8	NS	2.3	NS

¹Reported on a 13.5% moisture basis

²Reported on a 12% moisture basis

NS = No significant difference based on ANOVA $p < 0.05$

Underline = Highest and lowest values

Table 14. USDA-ARS seed quality means from all locations for 2016 intrastate durum trial.

Line/Variety	Test Weight (lb/bu) ¹	Kernel Weight (mg)	Large Kernels (%)	Small Kernels (%)	Kernel diameter (mm)	Hardness	Protein (%) ¹
Alkabo	59.4	40.5	57.0	10.8	2.8	74.7	14.6
Alzada	59.2	<u>44.2</u>	<u>77.0</u>	<u>5.1</u>	<u>3.0</u>	76.4	14.8
Carpio	59.9	40.8	64.8	8.1	2.8	77.3	14.7
Divide	59.5	39.9	59.3	9.2	2.8	75.4	14.8
Grenora	58.9	40.0	56.9	9.0	2.8	79.1	14.6
Joppa	59.3	38.8	<u>45.7</u>	12.8	<u>2.7</u>	79.3	14.5
Mountrail	<u>58.7</u>	39.3	45.9	13.8	2.8	74.8	14.5
Silver	59.4	39.2	55.9	9.7	2.8	76.1	14.6
Tioga	59.5	42.6	67.1	7.4	2.9	74.4	14.8
MT101694	60.1	38.1	51.4	12.1	2.8	80.7	14.2
MT101717	<u>61.2</u>	<u>37.3</u>	47.0	<u>13.8</u>	2.8	<u>82.6</u>	<u>13.8</u>
MT112219	60.9	40.5	58.1	9.6	2.9	77.6	14.0
MT112434	59.3	41.6	64.1	8.3	2.9	<u>73.8</u>	<u>14.9</u>
MT112444	58.8	39.5	60.2	9.2	2.9	75.3	14.4
MT112463	58.8	38.0	64.1	9.4	2.9	76.0	14.3
Grand Mean	59.5	40.0	58.3	9.9	2.8	76.9	14.5
CV (%)	3.1	10.9	34.5	45.8	5.7	8.9	12.4
LSD (0.05)	1.7	3.9	18.1	3.8	0.2	6.3	1.7
P-value	NS	NS	0.048	<0.001	0.031	NS	NS

¹Reported on a 12% moisture basis

NS = No significant difference based on ANOVA $p < 0.05$

Underline = Highest and lowest values

Table 15. USDA-ARS semolina quality means from all locations for 2016 intrastate durum trial.

Line/Variety	Milling Yield (%)	Brightness (L*)	Yellowness (b*)	Mixograph pattern	Whole grain ash (%) ¹	Falling Number (sec)	Semolina protein (%) ²	Semolina ash (%) ¹
Alkabo	62.8	84.2	28.8	4.4	1.5	422.6	13.5	0.6
Alzada	62.5	<u>83.5</u>	30.2	<u>6.9</u>	1.5	<u>443.7</u>	13.6	0.7
Carpio	63.1	84.1	30.3	6.8	1.5	426.3	13.6	0.6
Divide	62.9	84.5	27.0	4.7	1.5	429.9	13.5	0.6
Grenora	<u>61.7</u>	84.4	28.5	4.8	1.5	430.3	13.5	0.6
Joppa	62.5	84.0	<u>30.3</u>	6.4	1.5	422.3	13.3	0.6
Mountrail	62.4	<u>84.5</u>	<u>24.9</u>	<u>3.0</u>	1.5	420.3	<u>13.7</u>	0.6
Silver	62.9	83.9	26.5	5.4	1.5	416.6	13.5	0.6
Tioga	63.7	84.2	28.7	5.6	1.5	418.1	13.6	0.6
MT101694	61.7	83.7	26.5	4.0	1.4	<u>412.4</u>	13.2	0.6
MT101717	61.8	83.7	28.7	4.8	<u>1.4</u>	440.7	12.7	<u>0.6</u>
MT112219	<u>63.7</u>	83.5	27.2	5.4	1.5	422.3	<u>12.6</u>	0.7
MT112434	62.5	83.9	28.1	5.9	1.5	437.8	13.7	0.6
MT112444	61.9	83.6	28.7	6.1	1.5	442.6	13.3	0.7
MT112463	62.0	83.6	28.3	6.7	<u>1.6</u>	435.9	12.9	<u>0.7</u>
Grand Mean	62.5	84.0	28.2	5.4	1.5	428.1	13.4	0.6
CV (%)	3.5	1.1	8.1	35.1	11.1	7.5	15.5	10.5
LSD (0.05)	2.1	0.9	1.7	1.5	0.2	30.3	2.0	0.1
P-value	NS	NS	<0.001	<0.001	NS	NS	NS	0.002

¹Reported on a 14% moisture basis

²Reported on a 12% moisture basis

NS = No significant difference based on ANOVA $p < 0.05$

Underline = Highest and lowest values

Table 16. Seed quality traits for irrigated locations in Bozeman, Churchill, and Sidney, MT.

Location	Line/Variety	Test weight (lb/bu)	Large kernels (%)	Small kernels (%)	Hardness	Ind. kernel weight (mg)	Ind. kernel diameter (mm)	Grain protein (12% mb)
Bozeman	Mountrail	60.9	71	7	70.7	44.4	2.9	14.6
Bozeman	Divide	60.8	77	7	71.2	43.5	2.9	15.0
Bozeman	Alkabo	61.5	78	6	70.9	45.8	3.0	14.5
Bozeman	Grenora	60.4	77	6	72.7	44.7	3.0	14.8
Bozeman	Tioga	60.9	82	5	70.8	48.2	3.1	15.2
Bozeman	Carpio	60.2	80	6	73.3	43.7	3.0	14.4
Bozeman	Joppa	61.6	71	6	80.1	42.8	2.9	14.8
Bozeman	Silver	61.9	80	6	71.8	45.4	3.0	14.9
Bozeman	Alzada	62.2	87	4	72.7	50.0	3.2	14.6
Bozeman	MT101717	62.3	73	7	79.8	41.7	2.9	13.9
Bozeman	MT101694	61.2	74	7	79.2	42.7	2.9	14.0
Bozeman	MT112434	61.3	78	7	73.6	44.6	3.0	14.8
Bozeman	MT112444	61.1	83	5	74.5	45.4	3.1	14.4
Bozeman	MT112463	62.9	87	4	76.5	46.5	3.2	14.4
Bozeman	MT112219	63.1	79	7	75.0	46.3	3.1	14.1
Churchill	Mountrail	59.2	76	9	61.5	43.4	3.0	11.5
Churchill	Divide	60.2	90	2	60.0	47.0	3.1	12.1
Churchill	Alkabo	59.5	82	6	56.4	46.0	3.0	11.6
Churchill	Grenora	59.5	85	4	67.1	44.5	3.0	11.9
Churchill	Tioga	60.6	90	3	58.8	49.3	3.2	12.3
Churchill	Carpio	61.7	91	2	65.7	48.2	3.2	12.6
Churchill	Joppa	60.7	71	8	70.5	43.0	2.9	12.1
Churchill	Silver	59.9	80	6	63.8	42.6	2.9	11.8
Churchill	Alzada	60.1	91	2	65.7	50.0	3.2	12.3
Churchill	MT101717	59.9	56	16	76.5	36.4	2.7	11.1
Churchill	MT101694	59.2	62	14	72.9	37.7	2.7	11.9
Churchill	MT112434	59.4	87	4	62.1	47.7	3.1	12.9
Churchill	MT112444	60.1	88	4	63.3	44.6	3.1	11.8
Churchill	MT112463	59.9	78	7	62.1	41.8	3.0	11.3
Churchill	MT112219	60.2	81	5	63.6	44.0	3.0	11.7
Sidney	Mountrail	60.0	75	8	76.9	47.4	3.0	13.8
Sidney	Divide	59.2	78	5	77.3	42.6	2.9	14.8
Sidney	Alkabo	60.2	82	5	74.2	46.8	3.0	14.1
Sidney	Grenora	59.0	80	5	81.7	44.5	3.0	13.7
Sidney	Tioga	59.7	87	4	73.4	48.5	3.1	14.3
Sidney	Carpio	60.5	82	4	83.5	44.0	3.0	14.4
Sidney	Joppa	59.9	75	7	83.6	44.0	2.9	14.0
Sidney	Silver	59.0	71	8	75.0	41.9	2.9	14.3
Sidney	Alzada	58.6	84	4	71.3	46.6	3.1	15.3
Sidney	MT101717	60.9	64	10	81.6	40.8	2.9	14.0
Sidney	MT101694	59.0	65	10	80.2	40.3	2.9	14.0
Sidney	MT112434	58.6	80	5	70.4	46.4	3.1	15.2
Sidney	MT112444	59.1	75	7	78.0	41.5	3.0	14.4
Sidney	MT112463	58.8	74	8	73.9	41.2	3.0	14.2
Sidney	MT112219	60.2	78	6	69.3	45.9	3.1	14.2

Table 17. Seed quality traits for rainfed locations in Conrad (1-Northern Seed LLC, 2-WTARC) and Havre, MT.

Location	Line/Variety	Test weight (lb/bu)	Large kernels (%)	Small kernels (%)	Hardness	Ind. kernel weight (mg)	Ind. kernel diameter (mm)	Grain protein (12% mb)
Conrad-1	Mountrail	58.3	30	17	77.9	36.9	2.6	13.0
Conrad-1	Divide	58.4	46	15	78.1	36.8	2.6	14.0
Conrad-1	Alkabo	59.0	46	12	80.5	37.5	2.7	12.9
Conrad-1	Grenora	59.1	47	10	81.5	38.5	2.8	13.2
Conrad-1	Tioga	58.7	63	7	77.6	40.3	2.8	13.4
Conrad-1	Carpio	57.8	48	12	76.9	35.5	2.6	13.7
Conrad-1	Joppa	58.7	22	18	81.7	35.7	2.6	13.1
Conrad-1	Silver	59.0	45	10	78.9	38.4	2.8	13.1
Conrad-1	Alzada	59.0	79	4	81.8	43.2	3.0	13.8
Conrad-1	MT101717	60.1	26	22	85.5	33.9	2.6	12.7
Conrad-1	MT101694	59.1	25	22	82.4	33.8	2.6	13.5
Conrad-1	MT112434	59.4	57	9	77.4	39.3	2.7	13.6
Conrad-1	MT112444	56.8	45	13	77.1	35.8	2.7	13.5
Conrad-1	MT112463	57.4	59	11	80.6	36.5	2.8	12.9
Conrad-1	MT112219	60.3	44	12	83.5	36.3	2.7	12.9
Conrad-2	Mountrail	54.7	41	14	69.7	37.2	2.7	18.0
Conrad-2	Divide	57.6	66	8	69.5	38.6	2.8	16.2
Conrad-2	Alkabo	56.2	56	12	73.0	38.3	2.7	16.7
Conrad-2	Grenora	54.9	60	10	74.0	37.8	2.8	17.6
Conrad-2	Tioga	56.1	76	5	68.5	42.2	2.9	17.6
Conrad-2	Carpio	59.2	80	4	72.2	46.6	3.0	17.0
Conrad-2	Joppa	55.7	46	14	70.1	36.6	2.6	16.3
Conrad-2	Silver	56.7	66	8	74.3	39.8	2.9	16.8
Conrad-2	Alzada	57.0	81	5	73.8	43.6	3.0	17.3
Conrad-2	MT101717	60.7	72	6	79.2	41.4	2.9	15.1
Conrad-2	MT101694	58.2	64	9	74.9	40.8	2.9	15.4
Conrad-2	MT112434	56.2	73	6	67.4	42.4	2.9	17.3
Conrad-2	MT112444	57.0	74	6	71.8	41.2	2.9	16.9
Conrad-2	MT112463	55.3	66	10	73.1	35.6	2.8	16.4
Conrad-2	MT112219	59.0	69	6	75.8	41.8	2.9	16.0
Havre	Mountrail	55.5	24	23	75.2	32.6	2.6	17.3
Havre	Divide	58.4	41	14	75.8	35.9	2.7	17.0
Havre	Alkabo	56.5	33	18	72.2	35.3	2.6	17.0
Havre	Grenora	55.8	38	14	77.6	34.9	2.6	16.9
Havre	Tioga	56.3	51	11	70.0	37.4	2.7	17.0
Havre	Carpio	58.0	42	16	78.4	34.0	2.6	17.2
Havre	Joppa	55.8	23	21	75.0	33.4	2.6	17.3
Havre	Silver	57.5	39	12	75.0	34.1	2.6	16.9
Havre	Alzada	56.2	56	9	74.9	35.9	2.8	17.2
Havre	MT101717	61.3	36	16	82.3	34.5	2.7	14.3
Havre	MT101694	59.7	48	10	79.4	36.5	2.8	15.6
Havre	MT112434	57.1	44	13	71.5	34.7	2.7	17.0
Havre	MT112444	57.4	42	13	75.0	34.5	2.7	15.8
Havre	MT112463	57.0	48	13	74.0	32.6	2.7	16.7
Havre	MT112219	60.1	43	14	78.2	36.8	2.7	15.7

Table 18. Seed quality traits for rainfed locations in Moccasin, MT, Sidney, MT, and Williston, ND.

Location	Line/Variety	Test weight (lb/bu)	Large kernels (%)	Small kernels (%)	Hardness	Ind. kernel weight (mg)	Ind. kernel diameter (mm)	Grain protein (12% mb)
Moccasin	Mountrail	60.1	25	15	83.0	37.9	2.7	14.5
Moccasin	Divide	60.3	42	12	84.8	38.3	2.7	14.3
Moccasin	Alkabo	60.2	35	16	85.9	37.4	2.7	15.2
Moccasin	Grenora	60.6	37	10	88.1	38.6	2.7	14.8
Moccasin	Tioga	60.9	50	11	84.8	39.1	2.7	14.8
Moccasin	Carpio	59.8	49	9	80.7	37.2	2.6	14.7
Moccasin	Joppa	60.6	27	15	86.8	39.0	2.7	13.9
Moccasin	Silver	60.6	45	11	86.1	36.4	2.7	14.3
Moccasin	Alzada	61.0	82	3	89.7	46.1	3.0	14.0
Moccasin	MT101717	61.4	25	16	88.7	35.6	2.7	14.7
Moccasin	MT101694	61.2	39	11	87.3	38.5	2.7	14.9
Moccasin	MT112434	61.3	59	8	84.1	41.3	2.9	13.7
Moccasin	MT112444	60.2	40	13	85.3	38.1	2.7	13.8
Moccasin	MT112463	60.7	59	10	85.6	37.0	2.8	14.0
Moccasin	MT112219	61.6	41	11	91.8	37.6	2.7	13.7
Sidney	Mountrail	61.4	57	10	79.4	39.2	2.8	11.7
Sidney	Divide	61.5	61	10	79.7	38.6	2.8	12.9
Sidney	Alkabo	61.6	64	9	82.8	39.6	2.8	12.2
Sidney	Grenora	61.2	60	9	85.3	41.2	2.9	12.3
Sidney	Tioga	61.3	68	7	79.3	43.4	2.9	12.6
Sidney	Carpio	61.8	71	8	82.2	41.3	2.9	11.9
Sidney	Joppa	61.4	50	12	85.1	38.6	2.8	12.1
Sidney	Silver	60.9	55	10	77.1	39.9	2.8	12.7
Sidney	Alzada	60.6	76	7	79.4	44.4	3.0	12.5
Sidney	MT101717	63.5	50	14	85.1	37.8	2.8	12.1
Sidney	MT101694	62.4	50	13	82.9	38.2	2.7	12.6
Sidney	MT112434	60.8	65	9	76.1	41.4	2.9	12.2
Sidney	MT112444	60.1	63	9	76.1	39.7	2.9	12.4
Sidney	MT112463	60.8	66	10	80.3	37.4	2.8	12.3
Sidney	MT112219	62.5	59	11	80.4	38.1	2.8	12.4
Williston, ND	Mountrail	57.8	14	21	78.7	34.3	2.6	16.4
Williston, ND	Divide	59.2	33	10	82.6	37.9	2.7	16.5
Williston, ND	Alkabo	59.7	37	13	76.7	37.3	2.7	17.4
Williston, ND	Grenora	59.1	28	13	83.9	35.6	2.7	16.7
Williston, ND	Tioga	60.9	37	14	86.7	35.1	2.7	15.7
Williston, ND	Carpio	59.7	40	12	83.2	36.8	2.7	16.8
Williston, ND	Joppa	59.0	26	14	81.1	36.0	2.7	17.2
Williston, ND	Silver	59.0	22	16	83.1	34.5	2.7	16.7
Williston, ND	Alzada	58.2	57	8	78.1	38.2	2.8	16.3
Williston, ND	MT101717	60.2	21	17	84.6	33.8	2.7	16.2
Williston, ND	MT101694	60.6	36	13	87.4	34.5	2.7	16.1
Williston, ND	MT112434	59.4	34	14	81.4	36.6	2.7	17.4
Williston, ND	MT112444	57.2	32	13	76.9	34.7	2.7	16.0
Williston, ND	MT112463	56.6	40	12	78.3	33.8	2.7	16.4
Williston, ND	MT112219	60.8	29	14	80.7	37.2	2.7	15.6

Table 19. Semolina quality traits for irrigated locations in Bozeman, Churchill, and Sidney, MT.

Location	Line/Variety	Whole grain ash (%)	Falling Number (%)	Milling yield (%)	Semolina Protein (12% mb)	Semolina ash (%)	Brightness (L*)	Yellowness (b*)	Mixograph pattern
Bozeman	Mountrail	1.4	420	65.0	13.7	0.59	85.2	24.8	2
Bozeman	Divide	1.4	401	64.8	13.7	0.55	84.1	28.8	3
Bozeman	Alkabo	1.4	421	64.6	13.4	0.54	84.3	30.3	3
Bozeman	Grenora	1.5	450	63.8	13.7	0.52	84.4	29.7	3
Bozeman	Tioga	1.5	392	65.4	13.9	0.56	83.8	30.2	4
Bozeman	Carpio	1.3	371	63.8	13.4	0.62	83.9	31.5	6
Bozeman	Joppa	1.4	423	64.4	13.3	0.55	84.3	31.2	5
Bozeman	Silver	1.5	404	64.3	13.4	0.54	84.0	26.3	3
Bozeman	Alzada	1.5	450	64.4	13.3	0.61	83.3	30.7	6
Bozeman	MT101717	1.4	450	63.2	13.1	0.53	83.3	30.3	3
Bozeman	MT101694	1.4	418	63.8	13.0	0.53	83.8	27.1	3
Bozeman	MT112434	1.6	400	64.8	13.4	0.57	83.5	28.6	4
Bozeman	MT112444	1.4	433	64.3	12.9	0.57	83.7	29.6	5
Bozeman	MT112463	1.5	450	65.1	12.9	0.58	83.6	28.4	6
Bozeman	MT112219	1.5	450	64.9	12.8	0.61	83.5	27.4	4
Churchill	Mountrail	1.6	350	65.1	9.8	0.60	85.8	22.1	1
Churchill	Divide	1.5	385	67.0	10.3	0.59	85.7	24.2	2
Churchill	Alkabo	1.5	333	66.0	9.8	0.54	86.0	24.8	1
Churchill	Grenora	1.6	375	65.2	10.3	0.54	86.7	24.7	2
Churchill	Tioga	1.6	348	66.2	10.8	0.60	86.2	26.2	2
Churchill	Carpio	1.5	394	66.4	10.6	0.62	86.3	28.3	4
Churchill	Joppa	1.6	376	66.4	10.5	0.59	86.2	28.0	4
Churchill	Silver	1.6	338	66.2	10.1	0.59	86.6	23.9	2
Churchill	Alzada	1.6	417	66.3	10.7	0.64	85.2	27.0	3
Churchill	MT101717	1.6	415	62.8	9.6	0.60	85.9	25.4	3
Churchill	MT101694	1.6	356	63.0	10.7	0.62	85.4	24.9	2
Churchill	MT112434	1.6	405	65.0	11.5	0.62	85.8	25.5	2
Churchill	MT112444	1.6	401	65.4	10.4	0.64	86.1	26.5	3
Churchill	MT112463	1.6	401	64.7	9.6	0.68	86.2	25.2	4
Churchill	MT112219	1.5	370	67.4	10.0	0.67	85.4	24.4	1
Sidney	Mountrail	1.7	364	66.0	13.0	0.62	84.5	23.8	2
Sidney	Divide	1.7	450	64.3	13.2	0.62	83.9	27.5	4
Sidney	Alkabo	1.7	431	66.4	12.8	0.61	84.2	28.6	4
Sidney	Grenora	1.7	437	65.4	12.4	0.65	83.6	27.4	4
Sidney	Tioga	1.8	450	66.0	13.2	0.66	83.8	28.2	6
Sidney	Carpio	1.7	450	64.8	12.9	0.69	83.7	30.0	7
Sidney	Joppa	1.8	405	65.0	12.4	0.68	83.6	29.6	7
Sidney	Silver	1.8	406	64.4	13.2	0.62	83.3	26.5	6
Sidney	Alzada	1.8	426	63.9	14.2	0.73	82.2	28.1	7
Sidney	MT101717	1.7	450	61.5	12.6	0.62	83.2	27.4	6
Sidney	MT101694	1.7	371	61.5	13.0	0.65	82.1	24.9	4
Sidney	MT112434	1.9	450	63.7	13.6	0.68	83.6	26.9	7
Sidney	MT112444	1.8	450	63.5	13.5	0.75	83.3	28.1	7
Sidney	MT112463	1.9	450	62.8	13.1	0.75	82.7	26.7	7
Sidney	MT112219	1.7	353	64.9	12.6	0.69	82.6	25.6	6

Table 20. Semolina quality traits for rainfed locations in Conrad (1-Northern Seed LLC, 2-WTARC) and Havre, MT.

Location	Line/Variety	Whole grain ash (%)	Falling Number (%)	Milling yield (%)	Semolina Protein (12% mb)	Semolina ash (%)	Brightness (L*)	Yellowness (b*)	Mixograph pattern
Conrad-1	Mountrail	1.4	449	62.3	11.8	0.63	84.8	27.1	5
Conrad-1	Divide	1.3	450	62.7	12.6	0.62	84.1	29.6	6
Conrad-1	Alkabo	1.3	442	62.3	11.5	0.63	84.7	29.7	6
Conrad-1	Grenora	1.3	450	61.1	11.6	0.62	85.0	29.6	6
Conrad-1	Tioga	1.4	450	62.9	11.6	0.59	84.6	30.4	6
Conrad-1	Carpio	1.4	447	60.7	12.4	0.63	83.7	31.1	7
Conrad-1	Joppa	1.3	450	61.1	11.6	0.57	83.8	32.1	7
Conrad-1	Silver	1.4	450	61.6	11.7	0.60	84.0	27.8	6
Conrad-1	Alzada	1.4	450	61.5	12.3	0.63	83.5	31.9	8
Conrad-1	MT101717	1.3	450	59.8	11.5	0.58	83.2	29.9	4
Conrad-1	MT101694	1.4	441	60.1	12.4	0.61	83.7	28.6	4
Conrad-1	MT112434	1.4	450	61.7	12.0	0.64	84.2	29.4	6
Conrad-1	MT112444	1.3	450	60.7	12.1	0.67	83.3	29.7	7
Conrad-1	MT112463	1.3	450	60.9	11.3	0.67	84.0	29.3	7
Conrad-1	MT112219	1.4	450	63.0	11.8	0.66	83.2	28.5	6
Conrad-2	Mountrail	1.6	400	58.0	17.4	0.70	83.4	24.6	4
Conrad-2	Divide	1.7	412	58.8	15.7	0.56	85.8	18.1	6
Conrad-2	Alkabo	1.7	401	59.0	15.9	0.64	83.4	28.5	5
Conrad-2	Grenora	1.7	363	57.8	16.5	0.69	83.5	27.4	8
Conrad-2	Tioga	1.8	341	61.9	16.8	0.69	82.9	26.6	8
Conrad-2	Carpio	1.7	405	62.2	16.1	0.69	83.4	28.3	8
Conrad-2	Joppa	1.7	385	59.0	15.4	0.69	82.5	29.2	8
Conrad-2	Silver	1.8	355	61.4	16.2	0.70	82.9	25.9	7
Conrad-2	Alzada	1.7	450	60.8	16.4	0.70	83.1	29.4	8
Conrad-2	MT101717	1.6	401	61.5	14.5	0.61	83.4	27.6	7
Conrad-2	MT101694	1.6	365	61.1	14.8	0.67	83.1	25.9	6
Conrad-2	MT112434	1.7	435	61.8	16.4	0.79	82.6	27.4	8
Conrad-2	MT112444	1.8	449	60.4	16.2	0.75	83.1	28.1	8
Conrad-2	MT112463	1.8	372	59.4	15.8	0.83	82.5	28.1	8
Conrad-2	MT112219	1.7	398	62.9	15.0	0.72	83.0	25.5	8
Havre	Mountrail	1.7	450	58.3	16.9	0.75	84.2	25.7	4
Havre	Divide	1.5	450	61.8	16.4	0.67	83.9	27.9	6
Havre	Alkabo	1.6	450	59.8	16.3	0.67	84.1	30.4	7
Havre	Grenora	1.6	450	58.9	16.2	0.72	84.3	29.8	6
Havre	Tioga	1.6	450	61.3	16.4	0.64	84.5	30.2	8
Havre	Carpio	1.6	450	59.2	16.6	0.72	84.4	30.2	8
Havre	Joppa	1.6	450	59.5	16.9	0.69	83.4	31.6	8
Havre	Silver	1.6	450	61.2	16.3	0.61	83.5	27.3	7
Havre	Alzada	1.7	450	59.3	16.4	0.73	82.6	31.1	8
Havre	MT101717	1.3	450	62.1	13.6	0.53	84.0	30.5	5
Havre	MT101694	1.3	450	61.7	14.6	0.52	84.2	27.3	5
Havre	MT112434	1.6	450	60.4	16.2	0.64	83.4	28.9	8
Havre	MT112444	1.5	450	60.6	15.2	0.66	83.0	29.3	8
Havre	MT112463	1.6	450	60.2	15.3	0.71	83.3	29.3	8
Havre	MT112219	1.5	450	62.3	14.5	0.66	83.0	28.5	6

Table 21. Semolina quality traits for rainfed locations in Moccasin, MT, Sidney, MT, and Williston, ND.

Location	Line/Variety	Whole grain ash (%)	Falling Number (%)	Milling yield (%)	Semolina Protein (12% mb)	Semolina ash (%)	Brightness (L*)	Yellowness (b*)	Mixograph pattern
Moccasin	Mountrail	1.3	450	60.7	13.4	0.57	84.3	28.3	3
Moccasin	Divide	1.2	421	62.2	13.0	0.56	84.4	30.4	4
Moccasin	Alkabo	1.3	425	60.1	13.6	0.60	83.9	29.5	4
Moccasin	Grenora	1.4	448	59.9	13.5	0.61	84.1	30.4	4
Moccasin	Tioga	1.3	432	62.7	13.8	0.58	84.1	31.6	5
Moccasin	Carpio	1.4	420	61.7	13.5	0.55	84.4	31.9	7
Moccasin	Joppa	1.3	412	61.8	12.6	0.55	84.4	32.8	6
Moccasin	Silver	1.3	446	61.0	12.9	0.58	83.2	28.0	6
Moccasin	Alzada	1.3	450	61.5	12.6	0.58	83.9	32.3	7
Moccasin	MT101717	1.3	450	61.4	13.6	0.54	83.5	30.4	5
Moccasin	MT101694	1.3	411	60.0	13.9	0.58	84.1	26.3	4
Moccasin	MT112434	1.2	450	60.3	12.3	0.57	84.0	31.2	7
Moccasin	MT112444	1.3	450	60.1	13.0	0.60	83.7	29.5	5
Moccasin	MT112463	1.3	450	61.7	12.1	0.64	83.5	30.5	7
Moccasin	MT112219	1.3	430	61.0	12.0	0.59	83.6	30.0	7
Sidney	Mountrail	1.4	450	65.0	10.9	0.58	84.7	24.0	2
Sidney	Divide	1.3	450	63.6	11.5	0.56	84.4	27.7	4
Sidney	Alkabo	1.4	450	64.5	11.1	0.56	84.1	29.4	4
Sidney	Grenora	1.4	450	62.1	11.0	0.57	84.1	29.1	4
Sidney	Tioga	1.4	450	64.2	11.1	0.50	84.2	28.7	6
Sidney	Carpio	1.3	450	67.5	10.9	0.55	83.4	30.8	6
Sidney	Joppa	1.3	450	64.2	10.7	0.50	84.7	29.5	6
Sidney	Silver	1.4	450	63.5	11.5	0.53	84.6	26.6	5
Sidney	Alzada	1.3	450	64.3	11.3	0.57	83.6	30.4	7
Sidney	MT101717	1.3	450	63.3	11.0	0.53	83.5	29.3	4
Sidney	MT101694	1.3	450	62.7	11.3	0.53	83.5	27.2	3
Sidney	MT112434	1.4	450	63.8	11.0	0.63	84.0	28.1	5
Sidney	MT112444	1.4	450	62.9	11.0	0.58	83.6	29.7	5
Sidney	MT112463	1.5	450	63.1	11.0	0.61	83.7	28.8	6
Sidney	MT112219	1.3	450	64.6	10.8	0.57	83.6	27.7	4
Williston, ND	Mountrail	1.4	450	61.4	16.2	0.65	83.4	24.0	4
Williston, ND	Divide	1.5	450	60.6	15.6	0.65	83.7	28.6	7
Williston, ND	Alkabo	1.5	450	62.2	16.7	0.62	83.3	27.8	6
Williston, ND	Grenora	1.5	450	61.0	16.0	0.62	83.8	28.0	6
Williston, ND	Tioga	1.4	450	62.8	14.9	0.62	83.5	26.6	5
Williston, ND	Carpio	1.5	450	62.0	16.0	0.75	83.6	30.2	8
Williston, ND	Joppa	1.6	450	61.3	16.3	0.68	83.5	28.6	7
Williston, ND	Silver	1.5	450	62.0	15.9	0.61	83.2	26.5	7
Williston, ND	Alzada	1.6	450	60.6	15.4	0.68	83.6	30.9	8
Williston, ND	MT101717	1.4	450	60.8	15.3	0.58	83.6	27.8	6
Williston, ND	MT101694	1.5	450	61.0	15.5	0.61	83.8	26.1	5
Williston, ND	MT112434	1.5	450	61.3	16.5	0.64	83.8	27.1	6
Williston, ND	MT112444	1.6	450	59.5	15.3	0.72	82.9	28.0	7
Williston, ND	MT112463	1.7	450	60.1	15.3	0.80	82.5	28.3	7
Williston, ND	MT112219	1.5	450	62.8	14.3	0.69	83.1	26.9	7

**2016 Supplemental Off-station Durum Variety Trials Conducted by
Montana State University Agricultural Experiment Stations**

North East Montana Off-Station Spring Durum Variety Performance Evaluations Pages 26-28
Research conducted by: Chengci Chen and EARC staff

North Central Montana Off-Station Spring Durum Variety Performance Evaluations Pages 29-40
In Blaine, Philips, and Liberty Counties.
Research conducted by: Peggy F. Lamb and NARC staff

2016 Off-station durum trials conducted by Chengci Chen and MSU-Eastern Agricultural Research Center staff.

Table 1. Dryland Durum Evaluation - EARC Daniels County, MT

Entry	Height cm	Grain YLD bu/ac	Protein %	TW lb/bu
Mountrail	85	45.9	10.3	60.4
Divide	89	52.7	10.3	62.6
Alkabo	87	43.5	9.6	61.7
Grenora	85	45.7	10.9	61.5
Tioga	82	38.9	10.0	61.6
Carpio	88	56.5	10.0	62.7
Joppa	80	43.1	11.3	60.9
Alzada	84	42.9	11.2	61.4
Silver	65	24.0	12.8	58.9
Strongfield	90	44.2	11.0	61.9
AVG	84	43.7	10.7	61.4
CV	14.5	19.4	6.8	1.5
LSD (0.05)	19	12.7	1.3	1.5

Table 2. Dryland Durum Evaluation - EARC Roosevelt County, MT

Entry	Height cm	Grain YLD bu/ac	Protein %	TW lb/bu
Mountrail	98	40.1	15.4	60.8
Divide	106	45.5	16.3	62.0
Alkabo	98	38.9	14.3	63.6
Grenora	101	45.6	14.9	61.1
Tioga	105	46.8	16.0	61.8
Carpio	99	50.2	15.5	62.6
Joppa	101	48.6	15.1	61.4
Alzada	81	42.7	14.9	60.8
Silver	81	42.0	15.2	60.3
Strongfield	103	36.6	16.8	61.8
AVG	97	43.7	15.4	61.6
CV	4.5	12.2	1.9	1.3
LSD (0.05)	7	8.5	0.5	1.3

Table 3. Dryland Durum Evaluation – EARC Sheridan County, MT

Entry	Height cm	Grain YLD bu/ac	Protein %	TW lb/bu
Mountrail	74	40.1	13.6	60.9
Divide	74	38.8	14.1	62.0
Alkabo	72	35.5	13.0	61.6
Grenora	73	38.4	13.0	60.9
Tioga	78	43.1	13.8	61.6
Carpio	87	38.9	13.6	61.4
Joppa	78	40.9	13.1	61.3
Alzada	73	24.4	13.8	58.9
Silver	65	18.7	14.2	58.8
Strongfield	80	37.1	15.0	61.7
AVG	75	35.6	13.7	60.9
CV	11.8	8.3	2.3	0.6
LSD (0.05)	14	4.5	0.5	0.6

Table 4. Dryland Durum Evaluation - EARC Valley County, MT

Entry	Height cm	Grain YLD bu/ac	Protein %	TW lb/bu
Mountrail	75	30.4	15.4	62.5
Divide	75	33.9	16.0	63.6
Alkabo	73	24.9	14.3	63.5
Grenora	68	32.4	14.9	62.7
Tioga	84	37.5	15.2	64.0
Carpio	85	41.2	15.7	63.2
Joppa	76	34.1	14.8	63.7
Alzada	66	29.0	15.7	63.3
Silver	62	27.9	16.2	60.9
Strongfield	74	32.0	16.3	64.0
AVG	74	32.3	15.5	63.1
CV	6.7	11.5	2.1	0.8
LSD (0.05)	8	6.0	0.5	0.9

Table 5. Dryland Durum Evaluation - EARC Wibaux County, MT

Entry	Height cm	Grain YLD bu/ac	Protein %	TW lb/bu
Mountrail	74	46.6	12.8	64.3
Divide	71	41.0	12.2	65.1
Alkabo	68	43.4	12.7	65.5
Grenora	68	44.4	13.1	64.5
Tioga	76	36.9	14.4	63.6
Carpio	77	43.9	13.4	64.6
Joppa	65	29.6	12.7	64.6
Alzada	63	29.9	13.9	64.4
Silver	61	39.2	13.8	63.6
Strongfield	79	43.0	12.8	65.1
AVG	70	39.8	13.2	64.5
CV	6.4	22.3	5.8	1.1
LSD (0.05)	7	15.2	1.3	1.2

Table 6. Re-crop Durum Variety Yield Evaluation EARC, Sidney, MT

Entry	Height cm	Heading Date DAP	Yield bu/ac	Protein %	TW lb/bu
Mountrail	71	169	59.8	13.5	63.7
Divide	74	169	56.4	12.8	63.5
Alkabo	70	167	57.3	15.1	63.5
Grenora	73	167	60.2	13.4	62.7
Tioga	72	168	55.0	14.7	63.6
Carpio	71	169	63.9	13.4	63.0
Joppa	72	169	57.6	12.8	63.5
Alzada	66	166	59.8	12.8	63.6
Silver	60	166	52.9	13.5	63.2
Strongfield	73	169	62.0	15.3	63.7
AVG	70	168	58.5	13.7	63.4
CV (%)	5.7	0.6	5.8	8.7	0.7
LSD (0.05)	6.4	1.6	5.6	2.0	0.7

Location: EARC dryland farm
 Soil type: Williams Clay Loam
 Previous crop: Pea and Safflower
 Residual soil N: 100 lb N/ac
 Planted: April 12, 2016
 Harvested: August 3, 2016

Applied fertilizer: No fertilizer
 Herbicide: Full Deck; Axial
 Precipitation April – August 2016: 9.74 in
 Ave (65 yr) precipitation April – August: 9.67 in
 Precipitation September 2015 – August 2016: 14.55 in
 Ave (65 yr) precipitation September – August: 14.09 in

Title: North Central Montana Off-Station Spring Durum Variety Performance Evaluations

Principal Investigator: Peggy F. Lamb, Research Scientist, Havre

Project Personnel: Mike Giroux, Breeder/Geneticist, Durum, Bozeman

Angela E. Sebelius, Research Associate, Havre
Andy Hogg, Research Associate, Durum, Bozeman
Ben Hauptman, Blaine County Extension
Marko Manoukian, Phillips County Extension
Jesse Fulbright, Liberty 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 27 percent of the 2011-2015 statewide cereal production totals (43 percent for winter wheat and 23 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 in north central Montana are provided reliable, unbiased, up-to-date information to make comparisons among improved durum varieties. This report provides producers in north central 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 in 2016 in three northern Montana counties.

Dryland Spring Durum Trials:

- | | |
|---|------------|
| 1. Cederberg Farm, Blaine County | 13-36N-25E |
| 2. Flansaas/Lumsden Farm, Phillips County | 24-35N-29E |
| 3. Kammerzell Farm, Liberty County | 13-31N-05E |

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 17 feet with a three-point rototiller. Plant height was measured and percent sawfly cutting was 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.

Results:

Please note that research trial 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.

Cropping environments in 2016 started out below average to marginal with warmer early spring temperatures and lower than normal precipitation across north central Montana followed by heavy rainfall resulting in delayed spring seeding in many areas. Higher than normal rainfall was experienced at Turner and Loring resulting in good to excellent durum yields for growers who were able to seed their crops in a timely manner. The Chester area went into the fall and started out early spring dryer than normal, however, spring rains were frequent. Timely precipitation encouraged growth for good yield potential, however, stripe rust was prevalent in the cereal trials, limiting yield and quality of the spring wheat and durum.

At Havre, annual growing season precipitation (9/1/15 through 8/31/16) was 18.86 inches, 6.84 inches higher than the average for all years since 1916. April 1 through July 31 precipitation was 12.24 inches or 177 percent of the 101-year average. Heat units expressed as "Growing Degree Days" (GDD, base 50) from May through July totaled 1201, or 93 percent of the average for the last 66 years (1951-2016). The last spring frost was on May 14 and the first fall frost of 2016 was on September 13, resulting in 122 frost-free days. The minimum winter temperature was -15 degrees F on December 26, 2015. Overall, the 2015-2016 average crop year temperatures mirrored the long-term average. The April through July growing season saw an average daily temperature of 57.6 degrees F, similar to historical temperatures. July and August average temperatures were one degree F lower than long-term averages with the high for 2016 recorded on July 23 at 96 degrees F. There were 13 days with temperatures 90 degrees F or above, with no days over 100 degrees F.

Following a summer of timely rainfall, the durum trial yields at Turner averaged nearly 39 bu/ac (Table 1). 'Divide' was the highest yielding entry at nearly 50 bu/ac. No other entry in the trial produced a yield statistically equal to that of Divide. Test weight of all entries averaged 59 lb/bu, while protein averaged 14 percent. Sawfly cutting was nonexistent in the durum trial at Turner. Stand percent, plant height, yield, test weight, moisture, protein, falling number and sawfly data for the 2016 Turner dryland durum trial are summarized in Table 1.

Comparable averages are calculated using a standard long-term 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 comparable average calculation. Nine-year comparable averages (2007-2016) for durum seed yield and test weight at Turner are summarized in Table 2, while nine-year comparable averages for sawfly cutting are summarized in Table 3.

Loring spring durum yields averaged nearly 39 bu/ac (Table 4). 'Carpio' was the highest yielding entry at over 47 bu/ac and only one experimental line yielded the same, statistically. MSU release 'Silver' and NDSU release 'Tioga' produced the highest protein at 16 and 15.6 percent, respectively. Sawfly cutting was nonexistent in the durum trial at Loring. Stand percent, plant height, yield, moisture, test weight, protein, falling number and sawfly cutting data, for the 2016 Loring dryland spring durum trial, are summarized in Table 4. Six-year comparable averages for spring durum seed yield and test weight at Loring are summarized in Table 5, while six-year comparable averages for sawfly cutting are summarized in Table 6.

In 2014, an off-station spring durum trial was established near Chester. The lack of timely rainfall events coupled with extreme stripe rust disease pressure resulted in spring durum yields averaging just over 26 bu/ac (Table 7). 'MT112219' was the highest yielding entry at nearly 33 bu/ac, with no other entry producing a seed yield statistically equal. Sawfly cutting in the small plot scenario was minimal in 2016. Stand percent, plant height, yield, test weight, moisture, protein, falling number and sawfly cutting data for the 2016 Chester dryland spring durum trial are summarized in Table 7. Three-year comparable averages for spring durum seed yield and test weight at Chester are summarized in Table 8, while three-year comparable averages for sawfly cutting are summarized in Table 9.

Summary:

This work has been strongly supported by producers near each of the locations, and by the Northern Agricultural Research Center Advisory Council, so it was decided to conduct the research with no funding source identified in 2016. The Loring location is entering its twenty-second 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 have been outstanding through the years with 2016 marking 33 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.

Funding Summary:

Alternative funding sources were used to conduct off-station durum trials during 2016, as there was no grant support.

Grant Submission Plans:

It is planned to submit this project for funding consideration to the Montana Wheat and Barley Committee for calendar year 2017.

Recognition:

This research would not have been possible without the assistance of the following summertime hourly employees: Kasee Clark, Kyla McNamara, Nicole Parsons and John Perodin.

TABLE 1. Dryland Fallow Spring Durum Cultivar Evaluation Nursery Grown Off-Station at the Leon Cederberg Farm, Turner. Northern Agricultural Research Center. Havre, Montana. 2016. (Exp# 16-9851-DUR)

ID	PEDIGREE/SELECTION	STAND %	PLNT HT Inches	1/ YIELD Bu/Ac	TEST WT Lbs/Bu	MOISTURE %	2/ PROTEIN %	3/ FN seconds	4/ SAWFLY %
Alkabo	NDSU	89.7	31.2	36.3	60.2	9.8	13.4	332	0.0
Alzada	NDSU	98.4	25.7	39.3	58.9	9.8	13.8	366	0.0
Carpio	NDSU	84.4	29.8	43.1	59.8	10.3	14.5	344	0.0
Divide	NDSU	94.6	32.6	49.7	60.1	10.1	14.6	347	0.0
Grenora	NDSU	88.7	29.4	36.8	58.3	9.9	14.7	340	0.0
Joppa	NDSU	84.6	29.6	31.0	59.4	9.9	14.3	336	0.0
Mountrail	NDSU	91.3	29.1	41.7	59.3	9.7	14.0	345	0.0
Silver	MSU	97.1	25.4	38.2	58.4	9.7	15.0	346	0.0
Tioga	NDSU	92.0	31.4	43.7	60.3	9.9	15.0	341	0.0
MT101717	CC4	92.6	25.8	41.3	60.5	9.8	13.7	369	0.0
MT101694	CC4	91.0	30.3	33.1	59.9	9.9	13.9	324	0.0
MT112434	Alzada x Cimmyt 5	93.1	22.1	32.6	56.4	9.6	14.4	362	0.0
MT112444	Alzada x Cimmyt 5	97.1	24.6	37.0	57.4	9.6	13.5	367	0.0
MT112463	Alzada x Cimmyt 8	92.0	25.6	33.5	56.4	9.6	14.0	349	0.0
MT112219	MT06541 x Syrian 7	79.6	24.8	44.7	61.6	10.0	13.4	351	0.0
EXPERIMENTAL MEANS		91.1	27.8	38.8	59.1	9.8	14.1	348.0	0.0
LSD (0.05)		12.5	2.7	4.7	1.3	0.2	0.6	6.7	-
C.V.%		8.2	5.8	7.3	1.3	1.5	2.7	1.1	-
P-VALUE (Varieties)		0.1984	<.0001	<.0001	<.0001	0.0002	<.0001	<.0001	-

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.

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 (16-9851-DUR)

Seeding Date: May 8, 2016

Harvest Date: August 22, 2016

Fertility: 125-20-10-10 side banded

System: no till

Herbicide: none

Insecticide: none

Previous Crop: Chemical Fallow - Spring Wheat

Precipitation: 8.60" 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 Leon Cederberg Farm, Turner. Northern Agricultural Research Center. Havre, Montana. 2007-2016. (Exp# 9851-DUR)

2/ VARIETY or SELECTION	No. of YEARS TESTED 4/	1/ YIELD (Bushels Per Acre)							TEST WEIGHT (Pounds Per Bushel)								
		AVE. % 9-YR					AVE. % 9-YR										
		3/	3/	3/	3/	3/	3/	3/	3/	3/	3/	3/	3/	3/			
2012	2013	2014	2015	2016	TESTED 4/	CHECK YIELD 5/	COMP. AVE. YIELD 6/	2012	2013	2014	2015	2016	TESTED 4/	CHECK YIELD 5/	COMP. AVE. YIELD 6/		
DT712 STRONGFIELD (+)	8	24.1	54.3		33.4	30.5	112.0	32.3	60.6	64.1		60.5	59.5	100.0	59.5		
D03028 CARPIO (+)	3		56.1		33.0	43.1	44.1	108.4	31.3		64.0	61.2	59.8	61.7	100.7	59.9	
Normanno NORMANNO	5	24.6	50.9				31.6	105.6	30.5	59.7	63.1			59.6	99.1	58.9	
D97780 GRENORA (+)	9	22.4	53.2		28.8	36.8	29.9	103.6	29.9	60.1	64.2		62.0	58.3	99.9	59.4	
YU894-75 ALZADA (P+)	8	19.5	47.4				39.3	28.8	29.0	60.8	63.5			58.9	99.4	100.2	59.5
D00095 TIOGA (+)	6	21.9	54.1		31.6	43.7	31.2	100.3	29.0	60.4	64.7		62.5	60.3	60.5	100.6	59.8
D901313 MOUNTRAIL (+)	9	22.6	49.5		30.8	41.7	28.9	100.0	28.9	60.1	63.5		60.9	59.3	59.4	100.0	59.4
MT03012 SILVER (+)	9	18.7	45.7		29.9	38.2	28.6	99.1	28.6	60.7	63.9		61.5	58.4	59.2	99.6	59.2
D9715-11 DIVIDE (+)	9	20.4	50.5		27.8	49.7	28.3	98.2	28.3	61.0	64.3		61.7	60.1	59.8	100.6	59.8
D96604 ALKABO (+)	9	24.3	48.9		30.5	36.3	27.8	96.4	27.8	60.9	64.9		62.3	60.2	60.4	101.6	60.4
MEANS (For Entries Listed)		22.0	51.1		30.7	41.1			29.6	60.5	64.0		61.6	59.4		59.6	

7/ Growing Season Precipitation (in.)		7.	n/a	16	n/a	8.6	8.8
Soil PAW (in.) to SD @ Planting		8.	7.8	8.	6.3	6.1	7.7
Total Plant Available Water (in.)		16	n/a	25	n/a	14.7	16.6
Soil NO3 (lbs.) to SD at Planting		15	11	65	49	85	68
SD (Sampling Depth in Inches)		48	48	48	48	48	48
Fertilizer Applied	(# N)	70	100	10	100	125	85
	(# P2O5)	40	20	20	20	20	32
	(# K2O)	25	10	10	10	10	19
	(# S)	-	-	-	-	10	10

Long-term 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/ No harvest in 2014 due to hail.

4/ Only the most recent 5 years are shown, but summary calculations include all years noted.

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.

TABLE3. Nine-Year Sawfly Summary on Selected Entries from Dryland Fallow Spring Durum Variety Nurseries Grow n Off-Station at the Leon Cederberg Farm, Turner. Northern Agricultural Research Center. Havre, Montana. 2007-2016. (Exp# 9851-DUR)

2/ VARIETY or SELECTION		No. of YEARS TESTED	1/ SAWFLY RATING (% of cut and lodged stems)									AVE. for YEARS TESTED	% of CHECK SWFLY 4/	9-YR COMP. AVE. SWFLY 5/
			2007	2008	2009	2010	2011	2012	2013	3/ 2014	2015			
Normanno	NORMANNO	5			0.7	2.3	1.0	1.0	0.7			1.1	6.2	0.9
YU894-75	ALZADA (P+)	8	6.7	2.3	8.3	8.3	15.0	16.7	2.3		0.0	7.5	47.0	6.6
DT712	STRONGFIELD (+)	8	10.0	2.3	10.0	13.3	10.0	15.0	0.3		0.0	7.6	48.0	6.8
D9715-11	DIVIDE (+)	9	13.3	3.7	5.0	18.3	16.7	13.3	0.7		0.0	7.9	55.9	7.9
MT03012	SILVER (+)	9	11.7	2.3	5.7	18.3	18.3	18.3	2.3		0.0	8.6	60.6	8.6
D00095	TIOGA (+)	6				21.7	23.3	26.7	2.0		0.0	12.3	88.0	12.4
D901313	MOUNTRAIL (+)	9	25.0	10.0	8.3	21.7	31.7	26.7	3.7		0.0	14.1	100.0	14.1
D03028	CARPIO (+)	3							3.7		0.0	1.2	100.0	14.1
D96604	ALKABO (+)	9	25.0	15.0	8.7	21.7	46.7	20.0	7.0		0.0	16.0	113.4	16.0
D97780	GRENORA (+)	9	33.3	11.7	15.0	25.0	38.3	21.7	3.7		0.0	16.5	117.1	16.5
MEANS (For Entries Listed)			17.9	6.8	7.7	16.7	22.3	17.7	2.6		0.0	0.0		10.4
6/ Growing Season Precipitation (in.)			7.0	6.6	6.0	10.3	8.3	7.5	n/a	16.4	n/a	8.6	8.8	
Soil PAW (in.) to SD @ Planting			5.8	8.1	7.8	9.0	7.9	8.9	7.8	8.9	6.3	6.1	7.7	
Total Plant Available Water (in.)			12.8	14.6	13.8	19.2	16.2	16.4	n/a	25.2	n/a	14.7	16.6	
Soil NO3 (lbs.) to SD at Planting			81	n/a	94	162	51	15	11	65	49	85	68	
SD (Sampling Depth in Inches)			48	48	48	48	48	48	48	48	48	48	48	
Fertilizer Applied														
	(# N)		70	70	70	70	70	70	100	100	100	125	85	
	(# P ₂ O ₅)		40	40	40	40	40	40	20	20	20	20	32	
	(# K ₂ O)		25	25	25	25	25	25	10	10	10	10	19	
	(# S)		-	-	-	-	-	-	-	-	-	10	10	

Long-term 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/ No harvest in 2014 due to hail.

4/ Percent of Mountrail cut 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 saw fly rating of a given entry for years tested, y = average saw fly rating for Mountrail for the same years, and z = 9-Yr average saw fly 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. 2016. (Exp# 16-9855-DUR)

ENTRY	CULTIVAR or SELECTION	STAND %	PLNT HT Inches	1/ YIELD Bu/Ac	TEST WT Lbs/Bu	MOISTURE %	PROTEIN %	2/ FN seconds	3/ SAWFLY %
Alkabo	NDSU	95.6	27.0	34.7	60.6	11.2	14.1	338	0.0
Alzada	NDSU	97.7	25.7	39.4	59.3	11.3	15.3	313	0.0
Carpio	NDSU	97.0	31.1	47.6	61.0	11.8	14.8	319	0.0
Divide	NDSU	96.7	29.0	42.2	59.9	11.3	15.4	318	0.0
Grenora	NDSU	97.7	28.2	36.5	59.3	11.2	15.3	342	0.0
Joppa	NDSU	96.3	30.8	37.6	60.1	11.6	14.4	312	0.0
Mountrail	NDSU	95.3	28.5	38.6	59.3	11.2	15.1	320	0.0
Silver	MSU	96.0	25.3	40.4	59.4	11.3	16.0	319	0.0
Tioga	NDSU	97.3	32.5	41.3	60.9	11.3	15.6	294	0.0
MT101694	CC4	96.7	29.4	36.9	59.8	11.5	14.6	284	0.0
MT101717	CC4	94.0	20.6	33.4	61.7	11.4	14.2	340	0.0
MT112219	MT06541 x Syrian 7	98.3	24.8	35.3	61.0	11.3	14.7	297	0.0
MT112434	Alzada x Cimmyt 5	99.0	22.7	30.1	58.3	11.2	14.8	348	0.0
MT112444	Alzada x Cimmyt 5	99.3	25.4	44.5	59.7	11.1	14.1	352	0.0
MT112463	Alzada x Cimmyt 8	99.0	26.4	42.2	58.6	11.1	14.0	310	0.0
EXPERIMENTAL MEANS		97.1	27.2	38.7	59.9	11.3	14.8	320.4	0.0
LSD (0.05)		3.8	2.6	5.3	0.6	0.2	0.5	17.4	-
C.V.%		2.3	5.8	8.2	0.6	0.9	2.0	3.2	-
P-VALUE (Varieties)		0.2465	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	-

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.

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 (16-9855-DUR)

Seeding Date: May 7, 2016

Harvest Date: August 24, 2016

Fertility: 125-20-10-10 side banded

System: no till

Herbicide: pending

Insecticide: pending

Previous Crop: Chemical Fallow - Spring Wheat

Precipitation: 7.23" seeding to harvest maturity

TABLE 5. Six-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, 2011-2016. (Exp# 9855-DUR)

2/ VARIETY or SELECTION	No. of YEARS TESTED	1/ YIELD (Bushels Per Acre)								TEST WEIGHT (Pounds Per Bushel)							
		2012	2013	2014	2015	2016	AVE. for YEARS TESTED	% of CHECK YIELD 3/	6-YR COMP. AVE. YIELD 4/	2012	2013	2014	2015	2016	AVE. for YEARS TESTED	% of CHECK TEST WT 3/	6-YR COMP. AVE. TEST WT 4/
D03028 CARPIO (+)	4		47.8	39.0	44.3	47.6	44.7	110.7	39.6		62.1	56.7	61.0	61.0	60.2	101.3	60.2
YU894-75 ALZADA (P+)	5	24.0	52.7	41.1		39.4	37.1	108.4	38.8	60.5	60.7	56.8		59.3	59.7	100.4	59.7
D00095 TIOGA (+)	6	26.2	46.2	37.7	44.9	41.3	37.7	105.4	37.7	60.8	61.9	56.0	61.1	60.9	60.4	101.4	60.4
D04581 JOPPA (++)	3		39.4	43.0	37.6		40.0	104.8	37.5			56.9	61.1	60.1	59.4	101.4	59.7
DT712 STRONGFIELD(+)	5	24.2	44.4	40.5	41.8		36.3	103.1	36.9	60.3	62.0	56.4	60.5		60.1	100.8	60.1
MT03012 SILVER(+)	6	25.8	45.2	38.6	39.7	40.4	36.8	102.9	36.8	60.4	61.6	56.7	60.2	59.4	59.8	100.2	59.8
D96604 ALKABO (+)	6	26.9	50.0	39.2	39.9	34.7	36.7	102.7	36.7	60.7	62.4	56.8	61.3	60.6	60.7	101.9	60.7
D9715-11 DIVIDE(+)	6	24.1	42.5	39.8	38.6	42.2	35.9	100.3	35.9	60.9	62.0	57.7	60.6	59.9	60.5	101.4	60.5
D901313 MOUNTRAIL (+)	6	24.7	44.9	34.8	43.2	38.6	35.8	100.0	35.8	59.1	61.2	56.7	60.4	59.3	59.6	100.0	59.6
D97780 GRE Nora (+)	6	25.7	43.4	39.0	40.2	36.5	35.4	98.9	35.4	59.5	60.5	56.2	60.5	59.3	59.6	99.9	59.6
MEANS (For Entries Listed)		25.2	46.3	38.9	41.8	39.8			37.1	60.3	61.6	56.7	60.7	60.0			60.0
5/ Growing Season Precipitation (in.)		n/a	9.5	5.6	8.9	7.2	7.8										
Soil PAW (in.) to SD @ Planting		8.8	8.8	8.9	8.2	3.7	7.6										
Total Plant Available Water (in.)		n/a	18.3	14.5	17.2	10.9	15.2										
Soil NO3 (lbs.) to SD at Planting		34	34	64	41	25	41										
SD (Sampling Depth in Inches)		48	48	48	48	24	44										
Fertilizer Applied																	
	(# N)	70	100	100	100	125	94										
	(# P ₂ O ₅)	40	20	20	20	20	27										
	(# K ₂ O)	25	10	10	10	10	15										
	(# S)	-	-	-	-	10	10										

Long term 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.

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

5/ 6-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 = 6-Yr average yield or test weight for the check variety Mountrail.

5/ Seeding to 14 days prior to harvest maturity.

TABLE 6. Six-Year Sawfly Summary on Selected Entries from Dryland Fallow Spring Durum Variety Nurseries Grown Off-Station at the Flansaa-Lumsden Farm, Loring, Northern Agricultural Research Center, Havre, Montana. 2011-2016. (Exp# 9855-DUR)

2/ VARIETY or SELECTION	No. of YEARS	1/ SAWFLY RATING (% of cut and lodged stems)							AVE. CHECK	% of	6-YR COMP. AVE.
		AVE.									
D03028 CARPIO (+)	4			2.3	0.3	0.0	0.0	0.7	26.1	2.1	
DT712 STRONGFIELD(+)	5	8.3	3.7	0.7	0.3	0.0		2.6	33.0	2.6	
YU894-75 ALZADA (P+)	5	10.0	5.0	1.0	1.0		0.0	3.4	34.6	2.7	
D9715-11 DIVIDE (+)	6	13.3	3.7	5.0	0.7	0.0	0.0	3.8	47.9	3.8	
MT03012 SILVER (+)	6	15.0	3.7	3.7	1.0	0.0	0.0	3.9	49.4	3.9	
D04581 JOPPA (++)	3				0.7	0.0	0.0	0.2	66.7	5.2	
D97780 GRENORA (+)	6	20.0	8.3	6.7	0.3	0.0	0.0	5.9	74.9	5.9	
D901313 MOUNTRAIL (+)	6	20.0	11.7	7.0	0.7	0.0	0.0	6.6	83.3	6.6	
D96604 ALKABO (+)	6	23.3	8.3	8.3	1.0	0.0	0.0	6.8	86.8	6.8	
D00095 TIOGA (+)	6	25.0	10.0	8.3	2.0	0.0	0.0	7.6	96.0	7.6	
MEANS (For Entries Listed)		16.9	6.8	4.8	0.8	0.0	0.0			4.7	
5/ Growing Season Precipitation (in.)		n/a	n/a	9.5	5.6	8.9	7.2	7.8			
Soil PAW (in.) to SD @ Planting		7.1	8.8	8.8	8.9	8.2	3.7	7.6			
Total Plant Available Water (in.)		n/a	n/a	18.3	14.5	17.2	10.9	15.2			
Soil NO3 (lbs.) to SD at Planting		50	34	34	64	41	25	41			
SD (Sampling Depth in Inches)		48	48	48	48	48	24	44			
Fertilizer Applied	(# N)	70	70	100	100	100	125	94			
	(# P ₂ O ₅)	40	40	20	20	20	20	27			
	(# K ₂ O)	25	25	10	10	10	10	15			
	(# S)	-	-	-	-	-	10	10			

Long term 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/ Percent of Mountrail saw fly rating for the same data years as those in which a given entry was tested.

4/ 6-Yr Comparable Average = (x/y) * z where x = average saw fly rating of a given entry for years tested, y = saw fly rating for Mountrail for the same years, and z = 6-Yr saw fly rating for the check variety Mountrail.

5/ 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. 2016. (Exp# 16-9853-DUR)

ENTRY	CULTIVAR or SELECTION	STAND %	PLNT HT Inches	1/ YIELD Bu/Ac	TEST WT Lbs/Bu	MOISTURE %	2/ PROTEIN %	3/ FN seconds	4/ SAWFLY %
Alkabo	NDSU	96.3	32.1	21.3	53.2	9.4	17.8	343	1.0
Alzada	NDSU	97.1	28.0	28.3	50.2	9.2	18.4	395	2.3
Carpio	NDSU	98.0	33.6	24.6	52.8	9.4	17.9	342	0.0
Divide	NDSU	97.0	30.4	24.9	51.6	9.4	17.9	342	0.3
Grenora	NDSU	96.7	30.8	25.4	50.6	9.4	17.7	340	0.3
Joppa	NDSU	93.7	34.0	24.4	51.3	9.3	18.2	323	1.0
Mountrail	NDSU	98.4	33.5	24.0	51.3	9.1	18.6	332	0.7
Silver	MSU	96.3	26.8	29.0	50.3	9.3	18.3	338	1.0
Tioga	NDSU	97.7	29.3	27.4	52.0	9.5	17.1	349	5.0
MT101717	CC4	96.3	26.4	28.6	53.5	9.4	16.9	361	1.0
MT101694	CC4	98.6	32.6	26.7	52.3	9.4	16.9	334	5.0
MT112434	Alzada x Cimmyt 5	97.0	33.5	29.0	52.3	9.4	18.0	342	0.0
MT112444	Alzada x Cimmyt 5	98.6	28.5	24.9	48.3	9.2	17.9	357	1.0
MT112463	Alzada x Cimmyt 8	95.1	27.4	25.4	50.1	9.1	17.7	344	1.7
MT112219	MT06541 x Syrian 7	94.9	25.9	32.7	53.9	9.3	17.0	363	0.0
EXPERIMENTAL MEANS		96.8	30.2	26.4	51.6	9.3	17.8	346.9	1.4
LSD (0.05)		3.4	2.3	3.5	1.1	0.1	0.4	13.5	1.7
C.V.%		2.1	4.5	8.0	1.2	0.7	1.2	2.3	74.7
P-VALUE (Varieties)		0.1967	<.0001	0.0001	<.0001	<.0001	<.0001	<.0001	<.0001

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.

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 (16-9853-DUR)

Seeding Date: May 5, 2016

Harvest Date: August 23, 2016

Fertility: 125-20-10-10 side banded

System: no till

Herbicide: none

Insecticide: none

Previous Crop: Chemical Fallow - Spring Wheat

Precipitation: 8.28" seeding to harvest maturity

TABLE 8. Three-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. 2014-2016. (Exp# 9853-DUR)

2/ VARIETY or SELECTION	No. of YEARS TESTED	1/ YIELD (Bushels Per Acre)							TEST WEIGHT (Pounds Per Bushel)								
		2014	2015	2016	2017	2018	AVE. for YEARS TESTED	% of CHECK YIELD 3/	3-YR COMP. AVE. YIELD 4/	2014	2015	2016	2017	2018	AVE. for YEARS TESTED	% of CHECK TEST WT 3/	3-YR COMP. AVE. TEST WT 4/
MT03012 SILVER(+)	3	33.7	24.1	29.0			29.0	111.4	29.0	53.7	56.0	50.3			53.3	98.8	53.3
D00095 TIOGA (+)	3	33.0	21.5	27.4			27.3	105.0	27.3	55.0	57.6	52.0			54.9	101.6	54.9
D04581 JOPPA (++)	3	33.4	22.7	24.4			26.8	103.2	26.8	53.4	57.9	51.3			54.2	100.4	54.2
D96604 ALKABO (+)	3	37.0	21.7	21.3			26.7	102.6	26.7	55.1	57.8	53.2			55.4	102.5	55.4
D9715-11 DIVIDE(+)	3	34.1	20.0	24.9			26.3	101.2	26.3	53.7	57.8	51.6			54.4	100.7	54.4
D03028 CARPIO(+)	3	34.6	19.4	24.6			26.2	100.7	26.2	55.0	56.6	52.8			54.8	101.4	54.8
D901313 MOUNTRAIL(+)	3	31.8	22.2	24.0			26.0	100.0	26.0	54.5	56.2	51.3			54.0	100.0	54.0
D97780 GRE Nora (+)	3	27.3	21.9	25.4			24.8	95.6	24.8	54.1	57.6	50.6			54.1	100.2	54.1
MEANS (For Entries Listed)		33.1	21.7						26.6	54.3	57.2						54.4
5/ Growing Season Precipitation (in.)		n/a	5.0	8.3			6.6										
Soil PAW (in.) to SD@ Planting		13.7	9.8	n/a			11.7										
Total Plant Available Water (in.)		n/a	14.8	n/a			14.8										
Soil NO3 (lbs.) to SD at Planting		257	251	n/a			254.0										
SD (Sampling Depth in Inches)		48	48	48			48.0										
Fertilizer Applied	(# N)	100	100	125			108.3										
	(# P ₂ O ₅)	20	20	20			20.0										
	(# K ₂ O)	10	10	10			10.0										
Check Variety is Mountrail.	(# S)	-	-	10			10.0										

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/ Percent of Mountrail saw fly rating for the same data years as those in which a given entry was tested.

4/ 3-Yr Comparable Average = (x/y) * z where x = average saw fly rating of a given entry for years tested, y = saw fly rating for Mountrail for the same years, and z = 3-Yr saw fly rating for the check variety Mountrail.

5/ Seeding to 14 days prior to harvest maturity.

TABLE 9. Three-Year 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. 2014-2016. (Exp# 9853-DUR)

2/ VARIETY or SELECTION		No. of YEARS	1/ SAWFLY RATING (% of cut and lodged stems)			AVE.		3-YR COMP. AVE.
			AVE.	%	AVE.	%		
D97780	GRENORA (+)	3	0.3	0.0	0.3	0.2	18.2	0.2
D03028	CARPIO (+)	3	1.0	0.0	0.0	0.3	27.3	0.3
D9715-11	DIVIDE (+)	3	0.7	0.7	0.3	0.6	45.5	0.6
MT03012	SILVER (+)	3	1.0	0.7	1.0	0.9	72.7	0.9
D96604	ALKABO (+)	3	2.3	0.3	1.0	1.2	100.0	1.2
D04581	JOPPA (++)	3	2.3	0.3	1.0	1.2	100.0	1.2
D00095	TIOGA (+)	3	1.0	2.0	5.0	2.7	218.2	2.7
D901313	MOUNTRAIL (+)	3	20.0	0.0	0.7	6.9	563.7	6.9
MEANS (For Entries Listed)			3.6	0.5				1.8
5/ Growing Season Precipitation (in.)			n/a	5.0	8.3	6.6		
Soil PAW (in.) to SD @ Planting			13.7	9.8	n/a	11.7		
Total Plant Available Water (in.)			n/a	14.8	n/a	14.8		
Soil NO3 (lbs.) to SD at Planting			257	251	n/a	254.0		
SD (Sampling Depth in Inches)			48	48	48	48.0		
Fertilizer Applied								
			(# N)	100	100	125	108.3	
			(# P ₂ O ₅)	20	20	20	20.0	
			(# K ₂ O)	10	10	10	10.0	
Check variety is Mountrail.			(# S)	-	-	10	10.0	

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/ Percent of Mountrail saw fly rating for the same data years as those in which a given entry was tested.

4/ 3-Yr Comparable Average = (x/y) * z where x = average saw fly rating of a given entry for years tested, y = saw fly rating for Mountrail for the same years, and z = 3-Yr saw fly rating for the check variety Mountrail.

5/ Seeding to 14 days prior to harvest maturity.