



**MONTANA**  
STATE UNIVERSITY

College of  
AGRICULTURE &  
MONTANA AGRICULTURAL  
EXPERIMENT STATION

**PROJECT TITLE:**

2019 STATEWIDE DURUM VARIETY TRIALS

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- Dr. Linda Dykes, USDA-ARS, Fargo, ND

**OBJECTIVE:**

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

**METHODS:**

In 2019, ten experimental durum lines developed at MSU and fourteen elite durum varieties were tested at six Montana Agricultural Experiment Stations and six off-station locations. Experimental lines developed at MSU carry genetic markers associated with reduced cadmium accumulation and/or a licensed gene that increases pasta firmness (Table 1). Durum varieties tested include releases from North Dakota State University, University of Saskatchewan-Canadian Crop Development Center, and Westbred (Table 1). Dryland experiments were grown on-station in Bozeman, MT (MSU-Post Agronomy Farm), Havre, MT (MSU-NARC), Sidney, MT (MSU-EARC), Conrad, MT (MSU-WTARC), Huntley, MT (MSU-SARC), and Moccasin, MT (MSU-CARC). Irrigated trials were grown on-station in Bozeman, MT (MSU-Post Agronomy Farm) and Sidney, MT (MSU-EARC). At the Bozeman locations two additional MSU experimental lines, MT112219 and MTD16003, were grown to maintain experimental design. There were three off-station experiments planted in Eastern Montana by EARC staff and three off-station experiments planted in North Central Montana by NARC staff. The trial at SARC this year was destroyed before harvest by hail and the Wibaux off-station site in Eastern Montana was sprayed out by the cooperator. There were three replicates of each line/variety grown at each location in either a randomized complete block design or an alpha-lattice design to determine statistical differences. Seed was treated with CruiserMaxx Vibrance for Cereals® (Syngenta) (5 fl oz/100 lb). MAES research cooperators provided agronomic data such as plant height, heading date, pest pressure, grain protein content, grain test weight, and grain yield. On-station grain sub-samples from the three replicates per line per location were bulked and submitted to Dr. Linda Dykes (USDA-ARS, Fargo, ND) for analysis of seed traits, milling and semolina quality, and mixing strength.

Overall statewide agronomic performance from 2019 can be found in Table 1. Statewide yield and protein evaluation over three years (2017-19) are presented in Table 2. Statewide agronomic performance for 2019 separated by environment (irrigated or dryland) is presented in Tables 3 and 4. Agronomic data for each individual location is found in Tables 5-12 with overall quality data summarized in Tables 13 and 14. Individual location quality data can be found in Tables 15-28. Agronomic data for off-station variety trails grown in the North Central and North Eastern Montana can be found in Tables 29-33. Fusarium head blight evaluations conducted by Dr. Crutcher at EARC are found in Table 34.

**Table 1. Agronomic means from 2019 intrastate durum trials all locations (n=7) and conditions.**

Cultivar	Source <sup>1</sup>	Yield bu/ac <sup>2</sup>	Test weight lb/bu	Protein % <sup>3</sup>	Plant height inch	Heading date	
						Julian	Calendar
Mountrail	NDSU	<b>79.4*</b>	60.5	14.3	37.8	186.0	Jul 5
Divide	NDSU	77.0	60.5	14.2	37.9	186.0	Jul 5
Alkabo	NDSU	<b>80.5*</b>	61.2	14.0	37.0	185.4	Jul 4
Grenora	NDSU	<b>81.3*</b>	60.5	14.3	34.9	185.4	Jul 4
Tioga	NDSU	77.2	60.5	14.8	38.9	186.1	Jul 5
Carpio	NDSU	75.3	60.6	14.1	37.4	187.5	Jul 7
Joppa	NDSU	77.1	60.8	14.3	38.7	185.1	Jul 4
ND-Riveland <sup>+</sup>	NDSU	77.8	60.3	14.6	38.7	186.7	Jul 6
ND-Grano <sup>+</sup>	NDSU	<b>81.3*</b>	61.2	14.4	37.0	187.7	Jul 7
Alzada	WestBred	71.0	60.3	14.3	29.6	182.4	Jul 1
CDC-Dynamic <sup>+</sup>	CDC	<b>79.9*</b>	60.7	14.9	37.8	188.0	Jul 7
CDC-Fortitude <sup>+</sup>	CDC	76.3	60.5	14.8	35.0	186.5	Jul 6
CDC-Precision <sup>+</sup>	CDC	<b>80.9*</b>	60.7	14.8	37.0	185.5	Jul 5
CDC-Vivid <sup>+</sup>	CDC	<b>82.6*</b>	61.1	14.9	37.4	186.5	Jul 6
MTD16001 <sup>\</sup>	MSU	<b>79.8*</b>	59.6	13.6	37.5	186.8	Jul 6
MTD16002 <sup>+ \</sup>	MSU	77.2	60.0	14.3	39.6	187.9	Jul 7
MTD16004 <sup>\</sup>	MSU	<b>79.5*</b>	61.4	14.0	36.8	185.8	Jul 5
MTD16005 <sup>+ \</sup>	MSU	<b>84.2**</b>	60.2	14.4	38.3	187.0	Jul 6
MTD16006 <sup>+</sup>	MSU	77.3	60.7	14.2	38.6	185.9	Jul 5
MTD16007 <sup>+</sup>	MSU	<b>79.6*</b>	61.1	14.4	37.4	186.1	Jul 5
MTD16008 <sup>+ \</sup>	MSU	<b>79.5*</b>	59.2	14.4	37.5	185.4	Jul 4
MTD16009	MSU	72.4	57.0	15.0	38.0	186.7	Jul 6
MTD16010 <sup>\</sup>	MSU	75.5	61.1	14.7	38.7	186.4	Jul 5
MTD16011 <sup>+ \</sup>	MSU	<b>79.0*</b>	60.1	14.1	38.0	187.0	Jul 6
Average	-	78.4	60.4	14.4	37.3	186.3	-
LSD (0.05)	-	5.4	0.6	0.4	1.2	0.7	-
Prob > F	-	<0.001	<0.001	<0.001	<0.001	<0.001	-
CV (%)	-	6.5	1.0	2.8	3.0	0.3	-

<sup>+</sup>Low cadmium accumulation gene.

<sup>\</sup>Pasta firmness gene.

<sup>1</sup>NDSU-North Dakota State University, CDC-University of Saskatchewan Crop Development Center, MSU-Montana State University.

<sup>2</sup>Grain yield reported on a 13% moisture basis.

<sup>3</sup>Grain protein reported on a 12% moisture basis.

\*\* Indicates highest yielding cultivar within a column.

\* Indicates cultivars yielding equal to the highest yielding entry based on Fisher's Protected LSD at the 0.05 probability level.

**Table 2. Yield and protein evaluation for statewide durum testing 23 location-years.**

Cultivar	-----Yield (bu/ac) <sup>1</sup> -----				-----Protein (%) <sup>2</sup> -----			
	3 year	2017	2018	2019	3 Year	2017	2018	2019
Mountrail	73.3	64.0	77.3	<b>79.3*</b>	14.5	14.5	14.5	14.5
Divide	72.7	<b>66.5*</b>	75.2	76.9	14.6	14.8	14.6	14.4
Alkabo	73.6	64.7	75.9	<b>81.3*</b>	14.2	14.2	14.2	14.1
Grenora	<b>74.8*</b>	<b>66.4*</b>	77.5	<b>81.4*</b>	14.4	14.4	14.4	14.5
Tioga	72.1	65.4	74.1	77.5	14.9	15.0	14.9	15.0
Carpio	72.9	<b>67.0*</b>	76.8	75.2	14.4	14.6	14.4	14.3
Joppa	71.2	63.9	73.6	76.7	14.3	14.3	14.3	14.4
Alzada	66	60.4	67.7	70.4	14.6	14.6	14.6	14.5
CDC-Dynamic	73.1	62.8	78.0	<b>79.3*</b>	15.6	16.1	15.5	15.1
CDC-Fortitude	71.9	62.1	78.2	76.0	15.2	15.5	15.0	14.9
CDC-Precision	<b>73.8*</b>	64.3	77.0	<b>80.9*</b>	15.2	15.4	15.1	15.0
CDC-Vivid	73.2	62.1	76.1	<b>82.6*</b>	15.4	15.4	15.4	15.1
MTD16001	<b>76.4**</b>	<b>66.6*</b>	<b>83.0**</b>	<b>80.0*</b>	14.0	14.4	13.8	13.7
MTD16002	73.1	<b>66.3*</b>	76.0	77.5	14.6	14.7	14.5	14.6
MTD16004	<b>75.9*</b>	<b>68.8*</b>	<b>80.1*</b>	<b>79.3*</b>	14.3	14.4	14.3	14.1
MTD16005	<b>74.8*</b>	65.4	76.0	<b>84.3**</b>	14.6	14.7	14.6	14.6
MTD16006	73.5	<b>66.5*</b>	77.6	76.9	14.5	14.6	14.5	14.5
MTD16007	<b>74.9*</b>	<b>69.1*</b>	77.0	<b>79.0*</b>	14.7	14.7	14.6	14.6
MTD16008	71.7	63.0	73.5	<b>79.7*</b>	14.7	14.5	15.0	14.6
MTD16009	69.1	61.9	73.3	72.6	15.4	15.5	15.4	15.2
MTD16010	71.6	64.9	74.8	75.7	14.9	15.0	14.9	14.9
MTD16011	72.9	<b>66.4*</b>	73.3	<b>79.8*</b>	14.6	14.9	14.6	14.3
Average	72.8	64.9	76.0	78.3	14.7	14.8	14.7	14.6
LSD (0.05)	2.7	3.3	4.7	5.3	0.3	0.4	0.4	0.5
Prob > F	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
CV (%)	6.3	5.2	6.2	6.4	2.9	3.0	2.8	2.8

<sup>1</sup>Grain yield reported on a 13% moisture basis.

<sup>2</sup>Grain protein reported on a 12% moisture basis.

\*\* Indicates highest yielding cultivar within a column.

\* Indicates cultivars yielding equal to the highest yielding entry based on Fisher's Protected LSD at the 0.05 probability level.

**Table 3. Agronomic means from 2019 irrigated intrastate durum trials (n=2).**

<b>Cultivar</b>	<b>Yield bu/ac<sup>1</sup></b>	<b>Test weight lb/bu</b>	<b>Protein %<sup>2</sup></b>	<b>Plant height inch</b>	<b>Heading date Julian</b>
Mountrail	<b>118.8*</b>	60.6	15.3	42.5	189.3
Divide	111.9	60.6	15.4	42.5	189.9
Alkabo	<b>119.8*</b>	61.1	14.6	41.2	188.6
Grenora	<b>116.8*</b>	60.1	15.0	39.2	188.6
Tioga	<b>115.3*</b>	60.3	15.3	43.5	189.3
Carpio	<b>115.6*</b>	61.2	15.1	42.6	190.9
Joppa	<b>113.8*</b>	61.1	14.9	42.4	188.6
ND-Riveland	<b>118.7*</b>	60.9	15.1	43.4	189.8
ND-Grano	<b>124.6**</b>	61.6	15.1	42.4	190.9
Alzada	97.9	59.3	14.8	30.9	185.1
CDC-Dynamic	<b>115.2*</b>	60.8	16.0	42.5	191.0
CDC-Fortitude	110.2	60.1	15.7	38.6	189.7
CDC-Precision	<b>120.9*</b>	60.3	15.6	41.0	189.0
CDC-Vivid	<b>116.7*</b>	60.9	15.7	40.6	189.9
MTD16001	<b>117.0*</b>	59.4	14.6	41.3	190.9
MTD16002	107.0	60.0	15.4	44.1	191.1
MTD16004	<b>115.7*</b>	60.6	14.7	41.2	188.7
MTD16005	<b>119.2*</b>	60.2	15.5	42.4	190.7
MTD16006	110.2	60.3	15.3	42.5	189.2
MTD16007	<b>114.0*</b>	60.7	15.2	41.0	190.4
MTD16008	<b>121.5*</b>	59.3	15.1	42.0	188.6
MTD16009	113.4	57.8	15.9	43.3	190.7
MTD16010	111.5	61.4	15.4	43.7	189.6
MTD16011	<b>115.1*</b>	60.0	15.0	43.0	190.3
Average	115.1	60.3	15.3	41.6	189.6
LSD (0.05)	11.06	1.4	0.7	2.1	1.0
Prob > F	0.045	0.004	0.012	<0.001	<0.001
CV (%)	4.6	1.1	2.1	2.4	0.3

<sup>1</sup>Grain yield reported on a 13% moisture basis.

<sup>2</sup>Grain protein reported on a 12% moisture basis.

\*\* Indicates highest yielding cultivar within a column.

\* Indicates cultivars yielding equal to the highest yielding entry based on Fisher's Protected LSD at the 0.05 probability level.

**Table 4. Agronomic means from 2019 dryland intrastate durum trials (n=5).**

<b>Cultivar</b>	<b>Yield bu/ac<sup>1</sup></b>	<b>Test weight lb/bu</b>	<b>Protein %<sup>2</sup></b>	<b>Plant height inch</b>	<b>Heading date Julian</b>
Mountrail	63.7	60.4	13.9	35.9	184.4
Divide	63.0	60.5	13.7	36.0	184.0
Alkabo	<b>64.8*</b>	61.3	13.8	35.3	183.9
Grenora	<b>67.1*</b>	60.7	14.0	33.2	183.9
Tioga	61.9	60.6	14.6	37.0	184.5
Carpio	59.2	60.4	13.7	35.3	185.8
Joppa	62.3	60.7	14.0	37.2	183.4
ND-Riveland	61.4	60.1	14.4	36.9	185.2
ND-Grano	64.0	61.1	14.1	34.8	186.1
Alzada	60.2	60.8	14.1	29.1	181.0
CDC-Dynamic	<b>65.8*</b>	60.7	14.4	35.9	186.5
CDC-Fortitude	62.7	60.7	14.4	33.6	184.8
CDC-Precision	<b>64.9*</b>	60.9	14.4	35.4	183.7
CDC-Vivid	<b>68.9*</b>	61.2	14.6	36.2	184.8
MTD16001	<b>64.9*</b>	59.6	13.3	36.0	184.7
MTD16002	<b>65.3*</b>	60.0	13.9	37.8	186.4
MTD16004	<b>65.1*</b>	61.7	13.7	35.1	184.4
MTD16005	<b>70.3**</b>	60.2	13.9	36.7	185.2
MTD16006	64.1	60.8	13.8	37.0	184.3
MTD16007	<b>65.8*</b>	61.3	14.0	35.9	184.0
MTD16008	62.6	59.2	14.1	35.7	183.9
MTD16009	56.0	56.7	14.6	35.8	184.8
MTD16010	61.1	61.0	14.4	36.6	184.8
MTD16011	<b>64.6*</b>	60.1	13.7	36.0	185.4
Average	63.7	60.4	14.1	35.6	184.6
LSD (0.05)	5.8	0.7	0.5	1.3	0.9
Prob > F	0.005	<0.001	<0.001	<0.001	<0.001
CV (%)	7.2	1.0	3.0	3.0	0.3

<sup>1</sup>Grain yield reported on a 13% moisture basis.<sup>2</sup>Grain protein reported on a 12% moisture basis.

\*\* Indicates highest yielding cultivar within a column.

\* Indicates cultivars yielding equal to the highest yielding entry based on Fisher's Protected LSD at the 0.05 probability level.

**Table 5. Agronomic means from 2019 irrigated intrastate durum trial conducted by Giroux/Hogg at the Post Agronomy Farm in Bozeman, MT.**

Cultivar	Yield bu/ac <sup>1</sup>	Test weight lb/bu	Protein % <sup>2</sup>	Stand % <sup>3</sup>	Plant height inch	Leaf spot 1-5 <sup>4</sup>	Heading date Julian	Maturity date Julian
Mountrail	<b>144.3*</b>	60.2	14.3	83.6	46.5	0.4	194.8	234.7
Divide	138.7	59.9	14.5	85.2	47.6	0.0	195.0	235.4
Alkabo	<b>148.7*</b>	61.0	13.5	83.4	45.3	0.0	193.8	236.1
Grenora	<b>146.8*</b>	59.8	14.1	88.7	43.6	0.0	194.2	236.3
Tioga	<b>144.7*</b>	60.0	14.1	81.9	47.7	0.0	195.3	235.3
Carpio	135.5	60.5	14.2	78.5	46.5	0.0	196.1	235.5
Joppa	<b>145.4*</b>	60.9	13.9	83.5	46.7	0.6	193.5	235.6
ND-Riveland	<b>141.8*</b>	59.9	14.6	76.6	46.9	0.0	195.3	236.2
ND-Grano	<b>152.4**</b>	60.9	14.4	78.3	46.6	0.0	196.1	236.3
Alzada	124.4	58.3	14.0	85.5	32.4	4.3	190.1	232.6
CDC-Dynamic	136.6	59.5	15.3	87.5	46.3	0.0	196.2	235.4
CDC-Fortitude	130.6	59.9	15.0	89.9	42.6	3.3	195.4	237.1
CDC-Precision	<b>149.7*</b>	59.7	15.1	86.1	45.2	1.3	195.2	236.6
CDC-Vivid	139.5	60.0	14.9	83.7	45.0	2.7	195.4	235.2
MT112219	130.7	59.9	13.2	82.9	30.9	1.3	190.0	236.1
MTD16001	<b>151.1*</b>	58.5	13.5	83.8	45.6	0.0	195.7	236.0
MTD16002	132.8	59.4	14.4	89.6	47.7	1.9	196.1	236.4
MTD16003	<b>143.4*</b>	60.2	12.7	91.7	42.8	0.0	193.4	235.3
MTD16004	<b>147.0*</b>	60.9	13.9	79.1	43.9	4.1	194.1	235.9
MTD16005	<b>147.3*</b>	59.3	14.7	89.4	46.7	2.1	195.6	235.5
MTD16006	136.1	60.7	14.3	83.4	45.9	0.0	194.1	235.1
MTD16007	139.1	60.3	14.4	86.3	44.2	4.8	195.5	235.3
MTD16008	<b>146.9*</b>	58.6	14.4	82.2	46.2	0.2	193.8	235.5
MTD16009	134.5	56.4	15.7	88.1	46.9	0.0	196.0	235.0
MTD16010	137.5	61.4	14.4	83.8	48.3	0.5	194.5	236.5
MTD16011	136.8	59.1	14.5	87.9	46.7	1.8	195.9	234.3
Average	140.4	59.8	14.2	84.5	44.0	0.7	194.7	235.7
LSD (0.05)	12.4	0.7	0.5	1.0	1.4	0.4	0.8	1.9
Prob > F	0.002	<0.001	<0.001	0.003	<0.001	<0.001	<0.001	0.014
CV (%)	4.8	0.7	2.2	4.8	1.8	90.6	0.2	0.4
Lattice RE (%) <sup>5</sup>	123.5	127.6	103.6	119.9	107.0	102.4	139.4	172.4

<sup>1</sup>Grain yield reported on a 13% moisture basis.

<sup>2</sup>Grain protein reported on a 12% moisture basis.

<sup>3</sup>Percent stand 2 weeks after planting.

<sup>4</sup>Leaf spot disease assessed using a severity scale of 0-5, with 0 have no visible leaf spot symptoms and 5 having 100% of upper leaves having symptoms.

<sup>5</sup>Adjusted means provided for Lattice RE% values equal to or greater than 100%.

\*\* Indicates highest yielding cultivar within a column.

\* Indicates cultivars yielding equal to the highest yielding entry based on Fisher's Protected LSD at the 0.05 probability level.

**Table 6. Agronomic means from 2019 dryland intrastate durum trial conducted by Giroux/Hogg at the Post Agronomy Farm in Bozeman, MT.**

Cultivar	Yield bu/ac <sup>1</sup>	Test weight lb/bu	Protein % <sup>2</sup>	Stand % <sup>3</sup>	Plant height inch	Leaf spot 1-5 <sup>4</sup>	Heading date Julian	Maturity date Julian
Mountrail	<b>101.2*</b>	63.1	14.7	83.6	43.4	0.0	194.8	232.8
Divide	<b>100.2*</b>	63.4	15.1	84.9	44.0	0.0	194.2	233.7
Alkabo	<b>102.9*</b>	63.9	14.3	87.7	42.4	0.0	193.1	233.1
Grenora	<b>102.5*</b>	63.2	14.8	88.5	40.5	0.0	194.3	233.3
Tioga	<b>97.6*</b>	63.2	14.9	88.3	45.5	0.0	194.6	234.2
Carpio	96.4	62.9	14.4	84.5	43.7	0.3	195.4	234.2
Joppa	<b>102.3*</b>	63.2	14.4	88.6	44.1	0.0	193.2	233.5
ND-Riveland	95.0	61.9	15.0	81.6	44.3	0.0	195.6	235.4
ND-Grano	<b>103.9*</b>	63.0	14.8	83.4	42.1	0.0	196.0	233.7
Alzada	81.3	62.5	14.9	87.9	32.3	4.0	189.9	231.6
CDC-Dynamic	<b>100.9*</b>	62.6	15.5	89.8	43.7	0.0	196.6	232.4
CDC-Fortitude	94.7	62.3	15.7	88.7	41.4	3.0	195.1	233.7
CDC-Precision	<b>98.3*</b>	62.6	15.5	84.9	42.9	0.7	194.2	234.9
CDC-Vivid	<b>97.3*</b>	62.4	15.8	87.0	42.9	1.0	194.0	233.1
MT112219	91.1	63.8	14.2	85.0	30.1	4.0	189.3	232.7
MTD16001	<b>104.2*</b>	62.1	14.2	85.6	43.6	0.0	195.0	233.7
MTD16002	<b>98.4*</b>	62.2	14.9	89.6	45.3	1.7	196.7	234.2
MTD16003	<b>101.7*</b>	63.6	13.3	88.2	41.0	0.0	193.0	232.3
MTD16004	<b>105.3**</b>	64.4	14.5	86.0	42.1	4.0	193.0	232.5
MTD16005	<b>103.7*</b>	62.6	15.0	89.3	43.9	1.7	194.8	233.4
MTD16006	<b>104.3*</b>	63.2	14.6	85.1	45.3	0.7	193.6	234.2
MTD16007	<b>101.2*</b>	63.9	15.0	87.2	44.2	4.0	194.6	233.3
MTD16008	<b>97.9*</b>	61.4	15.3	84.8	42.9	1.3	194.0	233.5
MTD16009	89.9	59.9	16.2	83.7	43.3	0.3	195.2	233.3
MTD16010	94.4	63.9	14.8	86.8	45.1	0.3	194.6	233.7
MTD16011	<b>97.4*</b>	62.7	15.2	86.8	43.4	2.0	195.5	231.9
Average	98.3	62.9	14.8	86.2	41.8	1.1	194.3	233.5
LSD (0.05)	8.0	0.6	0.3	0.5	1.1	0.9	1.1	1.2
Prob > F	<0.001	<0.001	<0.001	0.020	<0.001	<0.001	<0.001	<0.001
CV (%)	4.4	0.5	1.4	3.5	1.3	50.6	0.3	0.3
Lattice RE (%) <sup>5</sup>	130.4	113.7	100.4	108.3	169.0	100.0	109.8	342.2

<sup>1</sup>Grain yield reported on a 13% moisture basis.

<sup>2</sup>Grain protein reported on a 12% moisture basis.

<sup>3</sup>Percent stand 2 weeks after planting.

<sup>4</sup>Leaf spot disease assessed using a severity scale of 0-5, with 0 have no visible leaf spot symptoms and 5 having 100% of upper leaves having symptoms.

<sup>5</sup>Adjusted means provided for Lattice RE% values equal to or greater than 100%.

\*\* Indicates highest yielding cultivar within a column.

\* Indicates cultivars yielding equal to the highest yielding entry based on Fisher's Protected LSD at the 0.05 probability level.



**Table 7. Agronomic means from 2019 dryland intrastate durum trial conducted at Southern Agricultural Research Center Huntley, MT. Plots were destroyed by hail on August 11<sup>th</sup> before harvest.**

<b>Cultivar</b>	<b>Plant height</b>	<b>Lodging<sup>1</sup></b>	<b>Heading Date</b>	
	<b>inch</b>	<b>%</b>	<b>Julian</b>	<b>Calendar</b>
Mountrail	48.7	46.7	178.7	Jun 28
Divide	48.8	24.4	178.7	Jun 28
Alkabo	47.9	32.2	178.0	Jun 27
Grenora	44.0	4.4	178.7	Jun 28
Tioga	49.2	35.6	178.7	Jun 28
Carpio	48.5	7.8	180.7	Jun 30
Joppa	49.0	68.9	178.0	Jun 27
ND-Riveland	49.0	64.4	179.7	Jun 29
ND-Grano	47.8	26.7	179.0	Jun 28
Alzada	35.5	57.8	175.0	Jun 24
CDC-Dynamic	46.4	24.4	179.7	Jun 29
CDC-Fortitude	46.1	23.3	179.0	Jun 28
CDC-Precision	46.1	37.8	178.0	Jun 27
CDC-Vivid	47.2	61.1	178.7	Jun 28
MTD16001	47.9	18.9	178.3	Jun 27
MTD16002	49.0	80.0	180.3	Jun 29
MTD16004	46.7	14.4	178.7	Jun 28
MTD16005	47.0	62.2	180.0	Jun 29
MTD16006	51.0	36.7	178.3	Jun 27
MTD16007	45.8	43.3	179.3	Jun 28
MTD16008	48.6	33.3	178.3	Jun 27
MTD16009	49.0	65.5	179.7	Jun 29
MTD16010	49.9	41.1	179.3	Jun 28
MTD16011	48.2	65.5	180.3	Jun 29
Average	47.4	41.1	178.9	Jun 28
LSD (0.05)	1.7	12.5	1.0	-
Prob > F	<0.0001	0.004	<0.0001	-
CV (%)	2.2	1.3	0.3	-
Lattice RE(%) <sup>2</sup>	100.0	154.1	100.0	-

<sup>1</sup>Estimated to the nearest 10 percent prior to harvest. Lodging estimates transformed by natural logarithm prior to analysis. Displayed means and PLSD are convert back to percent lodging.

<sup>2</sup>Adjusted means provided for Lattice RE% values equal to or greater than 100%.

**Table 8. Agronomic means from 2019 irrigated intrastate durum trial conducted at Eastern Agricultural Research Center Sidney, MT.**

<b>Cultivar</b>	<b>Yield bu/ac<sup>1</sup></b>	<b>Test weight lb/bu</b>	<b>Moisture %</b>	<b>Protein %<sup>2</sup></b>	<b>Plant height inch</b>	<b>Heading date Julian</b>
Mountrail	<b>93.3*</b>	60.9	10.2	16.3	38.6	183.7
Divide	85.1	61.2	10.3	16.4	37.4	184.7
Alkabo	<b>91.0*</b>	61.1	10.3	15.8	37.1	183.3
Grenora	<b>86.9*</b>	60.4	10.3	16.0	34.9	183.0
Tioga	85.9	60.6	10.2	16.5	39.4	183.3
Carpio	<b>95.7*</b>	61.8	10.5	16.1	38.8	185.7
Joppa	82.3	61.2	10.3	16.0	38.1	183.7
ND-Riveland	<b>95.7*</b>	61.9	10.4	15.6	40.0	184.3
ND-Grano	<b>96.8**</b>	62.3	10.6	15.9	38.2	185.7
Alzada	71.4	60.2	10.5	15.6	29.5	180.0
CDC-Dynamic	<b>93.9*</b>	62.0	10.2	16.8	38.7	185.7
CDC-Fortitude	<b>89.9*</b>	60.3	10.3	16.4	34.6	184.0
CDC-Precision	<b>92.2*</b>	60.8	10.1	16.2	36.9	182.7
CDC-Vivid	<b>93.9*</b>	61.8	10.3	16.5	36.2	184.3
MTD16001	82.9	60.2	10.2	15.7	37.1	186.0
MTD16002	81.3	60.5	10.1	16.5	40.6	186.0
MTD16004	84.4	60.2	10.3	15.6	38.5	183.3
MTD16005	<b>91.1*</b>	61.0	10.1	16.3	38.2	185.7
MTD16006	84.4	59.8	10.3	16.3	39.2	184.3
MTD16007	<b>88.9*</b>	61.1	10.4	16.1	37.9	185.3
MTD16008	<b>96.2*</b>	60.0	10.4	15.9	37.8	183.3
MTD16009	<b>92.3*</b>	59.2	10.3	16.1	39.8	185.3
MTD16010	85.5	61.3	10.3	16.4	39.1	184.7
MTD16011	<b>93.4*</b>	60.8	10.2	15.6	39.4	184.7
Average	88.9	60.9	10.3	16.1	37.8	184.3
LSD (0.05)	10.5	0.6	0.3	0.8	1.5	1.2
Prob > F	0.004	<0.001	0.032	0.132	<0.001	<0.001
CV (%)	7.1	0.6	1.5	3.1	2.4	0.4
Lattice RE (%) <sup>3</sup>	100.0	100.0	102.7	100.0	100.0	100.0

<sup>1</sup>Grain yield reported on a 13% moisture basis.

<sup>2</sup>Grain protein reported on a 12% moisture basis.

<sup>3</sup>Adjusted means provided for Lattice RE% values equal to or greater than 100%.

\*\* Indicates highest yielding cultivar within a column.

\* Indicates cultivars yielding equal to the highest yielding entry based on Fisher's Protected LSD at the 0.05 probability level.

**Table 9. Agronomic means from 2019 dryland intrastate durum trial conducted at Eastern Agricultural Research Center Sidney, MT.**

<b>Cultivar</b>	<b>Yield bu/ac<sup>1</sup></b>	<b>Test weight lb/bu</b>	<b>Moisture %</b>	<b>Protein %<sup>2</sup></b>	<b>Plant height inch</b>	<b>Heading Date Julian</b>
Mountrail	81.5	64.0	10.4	11.7	33.1	177.3
Divide	81.3	63.9	10.5	11.1	33.9	177.0
Alkabo	92.6	63.9	10.4	12.8	34.5	177.0
Grenora	85.5	63.0	10.4	13.1	32.3	176.7
Tioga	79.7	63.7	10.5	14.0	32.2	178.0
Carpio	68.8	64.6	10.6	12.0	31.4	179.3
Joppa	74.4	64.0	10.5	12.4	33.5	176.0
ND-Riveland	74.3	63.9	10.4	12.8	34.4	178.3
ND-Grano	85.7	65.1	10.6	12.8	33.1	178.3
Alzada	71.8	62.9	10.4	13.4	27.7	175.0
CDC-Dynamic	83.0	63.9	10.5	12.1	34.5	179.7
CDC-Fortitude	84.3	64.2	10.4	12.0	30.1	177.3
CDC-Precision	80.5	63.9	10.3	13.1	33.2	177.0
CDC-Vivid	94.9	64.5	10.5	13.6	35.3	178.0
MTD16001	69.2	63.0	10.4	10.9	33.7	177.7
MTD16002	89.5	63.8	10.4	13.0	36.4	179.3
MTD16004	78.9	64.5	10.2	12.6	33.3	178.3
MTD16005	93.8	63.7	10.3	12.5	34.3	178.0
MTD16006	78.7	63.9	10.6	12.7	34.0	177.3
MTD16007	81.5	64.1	10.4	12.6	33.6	177.3
MTD16008	82.5	62.8	10.4	12.4	34.0	176.7
MTD16009	76.6	61.5	10.4	12.4	33.1	177.7
MTD16010	75.7	64.7	10.5	13.1	34.8	178.3
MTD16011	86.7	63.5	10.5	12.4	32.5	178.3
Average	81.3	63.8	10.4	12.6	33.3	177.7
LSD (0.05)	16.6	0.5	0.2	1.3	3.0	1.5
Prob > F	0.120	<0.001	0.029	0.010	0.001	<0.001
CV (%)	12.4	0.5	1.1	6.4	5.4	0.5

<sup>1</sup>Grain yield reported on a 13% moisture basis.

<sup>2</sup>Grain protein reported on a 12% moisture basis.

**Table 10. Agronomic means from 2019 dryland intrastate durum trial at Central Agricultural Research Center in Moccasin, MT.**

<b>Cultivar</b>	<b>Yield bu/ac<sup>1</sup></b>	<b>Test weight lb/bu</b>	<b>Moisture %</b>	<b>Protein %<sup>2</sup></b>	<b>Plant height inch</b>	<b>Heading date Julian</b>
Mountrail	44.0	58.3	8.3	13.2	36.6	187.7
Divide	51.4	57.7	8.5	13.1	37.3	187.0
Alkabo	43.3	59.1	8.4	13.2	35.3	188.7
Grenora	46.8	57.5	8.3	13.1	33.4	187.3
Tioga	44.1	57.8	8.1	13.3	39.1	188.3
Carpio	42.6	57.9	8.4	12.9	36.3	190.0
Joppa	47.8	58.4	8.2	13.3	39.3	187.0
ND-Riveland	47.6	57.9	8.1	13.7	38.6	188.7
ND-Grano	43.5	58.4	8.3	13.3	36.0	191.0
Alzada	47.7	58.5	8.5	12.9	29.3	184.3
CDC-Dynamic	45.3	58.3	8.6	13.6	35.7	190.7
CDC-Fortitude	45.6	58.5	8.5	13.8	35.4	189.0
CDC-Precision	45.7	58.8	8.6	13.2	36.3	186.7
CDC-Vivid	46.1	58.8	8.4	13.5	35.7	189.3
MTD16001	49.4	56.2	8.3	13.4	38.0	188.3
MTD16002	43.6	57.9	8.5	12.9	38.3	190.0
MTD16004	42.6	59.2	8.8	13.4	36.3	188.3
MTD16005	49.0	56.7	8.4	13.1	38.0	190.0
MTD16006	43.6	58.1	8.6	12.7	37.7	188.3
MTD16007	44.6	58.2	8.4	13.2	36.0	186.3
MTD16008	43.4	56.6	8.3	13.4	36.8	187.7
MTD16009	39.3	53.4	7.7	14.0	36.0	188.3
MTD16010	43.7	58.5	8.8	13.5	36.6	188.3
MTD16011	45.2	56.7	8.4	12.9	37.0	188.3
Average	45.2	57.8	8.4	13.3	36.5	188.3
LSD (0.05)	8.2	0.9	0.4	0.8	1.8	2.0
Prob > F	0.645	<0.001	0.015	0.169	<0.001	<0.001
CV (%)	10.1	0.8	3.0	3.1	2.8	0.6
Lattice RE (%) <sup>3</sup>	112.3	111.9	100.0	144.4	100.7	100.0

<sup>1</sup>Grain yield reported on a 13% moisture basis.

<sup>2</sup> Grain yield reported on a 12% moisture basis.

<sup>3</sup>Adjusted means provided for Lattice RE% values equal to or greater than 100%.

**Table 11. Agronomic means from 2019 dryland intrastate durum trial at Northern Agricultural Research Center in Havre, MT.**

<b>Cultivar</b>	<b>Yield bu/ac<sup>1</sup></b>	<b>Test weight lb/bu</b>	<b>Moisture %</b>	<b>Protein %<sup>2</sup></b>	<b>Plant height inch</b>	<b>Heading date Julian</b>	<b>Sawfly damage %<sup>3</sup></b>	<b>Falling number sec<sup>4</sup></b>
Mountrail	45.2	58.4	11.2	14.2	31.2	178.0	0.5	491.7
Divide	44.7	58.1	11.4	13.9	31.2	178.0	0.3	501.6
Alkabo	47.7	58.9	11.9	13.7	31.2	176.8	0.8	509.4
Grenora	49.2	58.4	11.7	14.0	29.8	177.2	0.8	555.8
Tioga	47.2	59.0	11.7	14.1	34.3	177.2	0.6	529.2
Carpio	47.7	58.3	12.1	13.7	32.8	178.6	0.3	526.4
Joppa	42.6	58.1	11.7	14.3	34.3	177.4	0.6	505.3
ND-Riveland	44.3	57.5	11.5	14.4	32.0	178.3	0.5	532.5
ND-Grano	46.9	59.2	11.9	14.2	30.3	179.0	0.8	544.3
Alzada	49.5	58.8	11.4	14.2	26.3	175.0	0.3	600.6
CDC-Dynamic	<b>53.1*</b>	59.2	11.5	14.7	32.8	178.9	0.6	502.8
CDC-Fortitude	50.6	58.7	11.8	14.4	30.5	178.0	0.6	554.9
CDC-Precision	48.9	58.6	11.5	14.4	29.5	177.0	0.3	597.6
CDC-Vivid	<b>54.6**</b>	59.6	11.0	14.1	31.3	177.8	0.5	521.1
MTD16001	<b>52.2*</b>	57.9	11.4	13.0	30.5	177.9	0.3	499.7
MTD16002	43.0	57.3	11.1	13.6	33.1	179.6	0.3	535.7
MTD16004	48.8	59.6	11.3	13.5	30.3	178.1	0.5	466.0
MTD16005	<b>50.7*</b>	58.4	11.6	13.7	32.0	178.0	0.3	507.7
MTD16006	49.8	58.5	11.3	13.8	32.4	178.1	0.3	485.8
MTD16007	50.7	59.6	11.1	13.5	31.8	177.9	0.1	505.7
MTD16008	47.3	57.1	11.2	14.0	31.7	177.1	0.5	499.4
MTD16009	42.6	54.0	11.0	14.4	32.5	177.9	0.5	492.6
MTD16010	45.0	57.7	11.5	14.6	32.5	178.0	0.3	531.9
MTD16011	49.4	58.3	11.1	13.1	32.4	179.6	0.5	533.8
Average	48.0	58.3	11.5	14.0	31.5	177.9	0.5	522.1
LSD (0.05)	3.8	0.6	0.5	0.4	2.4	1.4	0.3	25.8
Prob > F	<0.001	<0.001	0.007	<0.001	<0.001	<0.001	0.004	<0.001
CV (%)	4.4	0.6	2.8	1.5	4.6	0.4	37.0	3.0
Lattice RE(%) <sup>5</sup>	109.6	183.5	100.6	316.5	100.0	103.0	100.0	100.0

<sup>1</sup>Grain yield reported on a 13% moisture basis.

<sup>2</sup>Grain protein reported on a 12% moisture basis.

<sup>3</sup>Sawfly damage reported on percent cut stems.

<sup>4</sup>Falling number reported on a 14% moisture basis.

<sup>5</sup>Adjusted means provided for Lattice RE% values equal to or greater than 100%.

\*\* Indicates highest yielding cultivar within a column.

\* Indicates cultivars yielding equal to the highest yielding entry based on Fisher's Protected LSD at the 0.05 probability level.

**Table 12. Agronomic means from 2019 dryland intrastate durum trial at Western Triangle Agricultural Research Center in Conrad, MT.**

<b>Cultivar</b>	<b>Yield bu/ac<sup>1</sup></b>	<b>Test weight lb/bu</b>	<b>Moisture %</b>	<b>Protein %<sup>2</sup></b>	<b>Sawfly damage %<sup>3</sup></b>	<b>Plant height inch</b>
Mountrail	46.6	58.4	10.7	15.8	9.3	35.3
Divide	37.3	59.4	10.9	15.4	6.5	33.8
Alkabo	37.4	60.7	11.0	14.8	6.7	33.0
Grenora	51.4	61.2	11.1	15.1	5.0	30.0
Tioga	41.1	59.4	10.9	16.6	9.3	34.0
Carpio	40.6	58.5	10.9	15.3	3.9	32.2
Joppa	44.6	60.0	11.0	15.6	8.7	35.0
ND-Riveland	45.7	59.4	10.9	16.0	9.3	35.0
ND-Grano	40.1	59.8	10.8	15.2	10.0	32.5
Alzada	50.6	61.1	11.0	15.0	6.5	29.7
CDC-Dynamic	46.8	59.6	10.9	16.3	6.5	33.0
CDC-Fortitude	38.4	59.9	10.8	16.3	6.5	30.7
CDC-Precision	51.3	60.4	10.8	15.9	7.5	35.0
CDC-Vivid	51.8	60.6	11.0	15.9	7.5	35.7
MTD16001	49.7	59.0	10.8	14.8	6.5	34.2
MTD16002	51.8	58.6	10.9	15.1	9.3	36.0
MTD16004	49.7	60.8	10.8	14.6	6.5	33.5
MTD16005	54.1	59.4	10.8	15.4	9.3	35.3
MTD16006	44.3	60.4	10.9	15.1	7.5	35.7
MTD16007	50.9	60.6	10.8	15.8	7.5	33.8
MTD16008	42.1	58.0	10.7	15.6	10.0	33.2
MTD16009	31.6	54.9	10.6	16.2	9.3	34.3
MTD16010	46.7	60.3	10.8	15.8	9.3	34.2
MTD16011	44.2	59.5	10.8	15.0	9.3	34.7
Average	45.4	59.6	10.8	15.5	8.2	33.7
LSD (0.05)	14.4	1.8	0.2	0.7	2.8	3.0
Prob > F	0.200	<0.001	<0.001	<0.001	0.147	0.002
CV (%)	19.3	1.9	1.1	2.8	29.6	5.4

<sup>1</sup>Grain yield reported on a 13% moisture basis.

<sup>2</sup>Grain protein reported on a 12% moisture basis.

<sup>3</sup>Sawfly damage reported on percent cut stems.

**Table 13. USDA-ARS seed quality means from all locations (n=7) for 2019 intrastate durum trial.**

<b>Cultivar</b>	<b>Test weight lb/bu</b>	<b>Large seeds %</b>	<b>Small seeds %</b>	<b>Hardness index</b>	<b>Individual seed weight mg</b>	<b>Individual seed diameter mm</b>	<b>Grain protein %<sup>1</sup></b>	<b>Grain ash %<sup>2</sup></b>	<b>Falling number sec<sup>2</sup></b>
Mountrail	60.2	53.6	10.6	73.4	43.9	2.91	14.1	1.53	424.2
Divide	60.6	69.4	6.4	72.4	45.6	2.97	13.9	1.45	417.1
Alkabo	61.4	70.4	6.3	73.4	45.7	2.99	13.8	1.50	391.9
Grenora	60.8	71.9	5.4	77.7	45.9	3.02	14.0	1.55	426.8
Tioga	60.8	74.4	5.6	71.8	48.0	3.08	14.3	1.51	394.4
Carpio	60.6	70.9	7.4	74.5	45.0	2.99	14.0	1.51	426.9
Joppa	61.1	67.6	7.9	76.1	45.5	2.96	13.9	1.51	405.6
ND-Riveland	60.4	71.3	6.6	73.8	46.5	2.97	14.2	1.57	452.2
ND-Grano	61.4	61.1	9.3	77.5	43.7	2.92	14.1	1.51	442.7
Alzada	60.2	84.9	3.4	74.7	48.8	3.18	14.2	1.57	445.5
CDC-Dynamic	60.6	60.0	8.6	81.6	41.3	2.90	14.6	1.57	429.0
CDC-Fortitude	60.5	67.9	7.9	81.8	41.2	2.95	14.5	1.58	425.6
CDC-Precision	60.8	68.4	6.1	82.4	41.8	2.91	14.4	1.59	459.4
CDC-Vivid	61.1	70.4	6.7	77.6	43.7	2.94	14.9	1.54	423.1
MTD16001	59.6	59.4	9.6	77.2	43.4	2.91	13.3	1.48	440.0
MTD16002	59.8	47.6	12.3	81.3	39.4	2.81	14.2	1.48	466.4
MTD16004	61.3	74.4	5.0	78.9	43.9	3.01	13.7	1.48	431.9
MTD16005	60.1	59.7	7.6	74.8	44.7	2.93	13.9	1.44	455.3
MTD16006	60.8	76.1	4.4	74.1	47.5	3.04	13.9	1.50	421.0
MTD16007	61.1	65.7	6.7	77.9	43.4	2.96	13.8	1.47	420.6
MTD16008	59.4	74.3	5.1	73.9	46.7	3.01	14.1	1.50	442.5
MTD16009	56.9	55.1	9.6	74.7	40.6	2.84	15.2	1.55	415.0
MTD16010	61.3	56.1	10.1	83.0	40.7	2.89	14.4	1.50	454.2
MTD16011	60.1	56.7	7.7	76.8	44.1	2.90	13.8	1.45	435.9
Average	60.5	66.1	7.3	76.7	44.2	2.96	14.1	1.51	431.1
LSD (0.05)	0.7	7.0	2.4	2.5	1.7	0.06	0.5	0.05	31.8
Prob > F	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
CV (%)	1.1	10.1	30.7	3.1	3.6	1.7	3.3	3.0	7.0

<sup>1</sup>Reported on a 12% moisture basis

<sup>2</sup>Reported on a 14% moisture basis

**Table 14. USDA-ARS semolina quality means from all locations (n=7) for 2019 intrastate durum trial.**

<b>Cultivar</b>	<b>Bran %</b>	<b>Shorts %</b>	<b>Semolina %</b>	<b>Semolina protein %<sup>1</sup></b>	<b>Semolina ash %<sup>1</sup></b>	<b>L<sup>2</sup></b>	<b>b*<sup>2</sup></b>	<b>a*<sup>2</sup></b>	<b>Mixograph pattern</b>
Mountrail	26.6	11.1	62.3	13.2	0.64	85.5	25.9	-2.78	3.4
Divide	26.4	11.1	62.5	12.5	0.60	85.5	27.9	-3.03	5.3
Alkabo	26.4	11.6	62.0	12.6	0.58	85.6	29.5	-3.22	4.7
Grenora	27.4	11.9	60.8	12.9	0.62	85.6	29.0	-3.22	5.1
Tioga	26.5	11.3	62.2	13.1	0.61	85.2	29.5	-3.14	5.7
Carpio	26.9	11.7	61.5	12.7	0.64	85.2	31.2	-3.51	7.1
Joppa	26.8	11.5	61.7	12.8	0.62	85.4	29.5	-3.14	6.0
ND-Riveland	29.0	12.3	58.7	12.9	0.63	85.5	30.3	-3.38	6.4
ND-Grano	26.8	11.2	62.0	12.8	0.60	85.3	31.0	-3.44	5.1
Alzada	25.1	13.1	61.8	13.0	0.67	84.6	30.7	-3.01	6.4
CDC-Dynamic	27.3	11.2	61.6	13.3	0.63	85.0	32.4	-3.29	5.3
CDC-Fortitude	28.4	11.8	59.8	13.2	0.65	85.1	32.1	-3.35	5.9
CDC-Precision	28.8	11.6	59.6	13.2	0.67	84.8	32.6	-3.35	6.1
CDC-Vivid	26.4	12.0	61.6	13.4	0.66	84.7	32.4	-3.26	6.0
MTD16001	26.6	11.1	62.2	12.1	0.59	85.6	28.4	-3.08	5.0
MTD16002	28.1	11.8	60.1	13.0	0.61	85.3	27.8	-3.00	4.4
MTD16004	27.2	11.5	61.3	12.4	0.63	85.1	25.4	-2.54	4.7
MTD16005	26.2	11.5	62.3	12.8	0.61	85.1	29.1	-2.96	5.1
MTD16006	26.8	11.5	61.7	12.7	0.61	85.6	25.5	-2.71	5.0
MTD16007	27.6	11.3	61.2	12.6	0.63	85.9	22.4	-2.37	5.0
MTD16008	26.4	11.6	62.0	12.8	0.63	84.2	27.0	-2.24	4.6
MTD16009	29.0	11.3	59.6	13.9	0.65	84.8	26.3	-2.55	4.9
MTD16010	27.0	11.5	61.5	13.2	0.60	85.4	26.7	-2.78	5.3
MTD16011	26.2	11.4	62.4	12.5	0.61	85.3	29.7	-3.01	5.3
Average	27.1	11.6	61.4	12.9	0.62	85.2	28.8	-3.01	5.3
LSD (0.05)	0.9	0.5	1.1	0.5	0.03	0.3	0.8	0.1	0.6
Prob > F	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
CV (%)	3.1	3.9	1.7	3.4	4.0	0.3	2.5	-4.0	10.0

<sup>1</sup>Reported on a 14% moisture basis

<sup>2</sup>Semolina color- L= whiteness, b\*= yellowness, a\*=redness



**Table 15. USDA-ARS seed quality means for Bozeman dryland for 2019 intrastate durum trial.**

<b>Cultivar</b>	<b>Test weight lb/bu</b>	<b>Large seeds %</b>	<b>Small seeds %</b>	<b>Hardness index</b>	<b>Individual seed weight mg</b>	<b>Individual seed diameter mm</b>	<b>Grain protein %<sup>1</sup></b>	<b>Grain ash %<sup>2</sup></b>	<b>Falling number sec<sup>2</sup></b>
Mountrail	62.6	59.0	8.0	74.8	43.5	2.90	14.4	1.42	416.1
Divide	63.5	77.0	5.0	71.2	46.1	3.00	15.2	1.41	431.8
Alkabo	64.5	78.0	4.0	71.6	46.6	3.02	14.3	1.42	422.0
Grenora	63.8	79.0	4.0	78.1	45.9	3.01	14.6	1.48	440.7
Tioga	63.8	83.0	4.0	74.1	50.7	3.17	14.6	1.48	383.2
Carpio	62.7	79.0	4.0	75.8	47.5	3.06	14.5	1.47	427.4
Joppa	63.9	80.0	4.0	78.5	47.4	3.03	14.3	1.47	389.1
ND-Riveland	62.2	82.0	4.0	74.6	47.8	3.02	14.5	1.51	441.1
ND-Grano	63.4	78.0	5.0	82.0	45.5	2.99	14.6	1.42	419.5
Alzada	62.1	90.0	2.0	79.1	51.3	3.25	14.8	1.60	453.9
CDC-Dynamic	62.7	67.0	6.0	84.9	42.2	2.90	15.7	1.47	413.6
CDC-Fortitude	62.6	78.0	6.0	81.9	43.2	3.01	15.5	1.51	429.3
CDC-Precision	63.3	76.0	4.0	84.5	44.6	2.99	15.2	1.52	456.8
CDC-Vivid	62.9	80.0	4.0	79.6	45.7	2.98	15.8	1.46	427.4
MTD16001	62.3	72.0	6.0	86.4	43.7	2.93	14.2	1.47	413.6
MTD16002	62.0	57.0	6.0	86.9	41.4	2.87	15.0	1.47	426.4
MTD16004	64.3	80.0	4.0	82.6	44.3	3.01	14.6	1.44	427.4
MTD16005	62.6	63.0	5.0	78.9	44.7	2.92	14.8	1.41	432.3
MTD16006	63.4	83.0	4.0	74.8	49.5	3.10	14.4	1.46	387.1
MTD16007	63.8	66.0	5.0	82.1	43.6	2.96	14.9	1.47	392.0
MTD16008	61.4	79.0	3.0	71.4	44.6	3.00	15.0	1.48	412.6
MTD16009	60.2	67.0	4.0	78.3	42.9	2.89	16.1	1.58	403.8
MTD16010	63.9	62.0	7.0	85.7	41.3	2.92	15.0	1.52	456.7
MTD16011	62.5	60.0	6.0	81.8	46.4	2.93	15.7	1.44	422.4
Average	62.9	74.0	4.8	79.2	45.4	2.99	14.9	1.47	421.9

<sup>1</sup>Reported on a 12% moisture basis

<sup>2</sup>Reported on a 14% moisture basis

**Table 16. USDA-ARS semolina quality means from Bozeman dryland for 2019 intrastate durum trial.**

Mountrail	24.9	11.5	63.6	13.6	0.64	85.5	27.0	-2.93	3
Divide	24.6	12.4	63.0	13.6	0.65	85.1	29.4	-2.98	5
Alkabo	25.4	12.3	62.3	13.0	0.56	85.6	31.4	-3.44	3
Grenora	26.0	12.8	61.2	13.7	0.61	85.5	31.0	-3.28	4
Tioga	25.0	12.1	62.9	13.4	0.58	85.2	30.7	-3.22	5
Carpio	24.8	12.5	62.6	13.0	0.60	85.2	32.7	-3.59	7
Joppa	26.0	12.7	61.3	12.9	0.58	85.7	30.8	-3.43	5
ND-Riveland	28.2	13.3	58.5	13.3	0.61	85.8	31.7	-3.55	6
ND-Grano	25.9	12.7	61.5	13.3	0.55	85.2	32.1	-3.52	4
Alzada	25.4	14.4	60.2	13.7	0.67	84.7	32.0	-3.22	6
CDC-Dynamic	26.5	12.3	61.3	14.1	0.62	84.9	33.9	-3.35	5
CDC-Fortitude	27.6	13.1	59.4	14.1	0.64	85.2	32.8	-3.44	5
CDC-Precision	28.1	12.8	59.1	13.9	0.67	84.8	33.4	-3.39	6
CDC-Vivid	26.0	13.4	60.6	14.5	0.67	84.6	33.8	-3.30	6
MTD16001	26.3	12.7	61.1	12.9	0.58	85.3	30.3	-3.19	4
MTD16002	27.7	13.8	58.6	13.7	0.61	85.3	29.8	-3.21	4
MTD16004	26.0	12.9	61.1	13.4	0.65	84.8	27.0	-2.64	4
MTD16005	26.0	12.7	61.4	13.8	0.59	84.9	30.7	-3.05	4
MTD16006	26.4	12.8	60.8	13.3	0.58	85.6	27.0	-2.84	4
MTD16007	27.0	12.5	60.6	13.3	0.63	85.7	24.8	-2.59	4
MTD16008	25.9	13.1	61.0	13.9	0.66	84.0	28.4	-2.21	4
MTD16009	28.4	11.8	59.8	15.1	0.68	84.6	27.2	-2.55	4
MTD16010	26.0	13.0	60.9	13.7	0.60	85.2	29.2	-2.99	4
MTD16011	26.3	13.2	60.4	14.5	0.63	85.0	31.4	-3.10	4
Average	26.3	12.8	61.0	13.7	0.62	85.1	30.4	-3.13	4.6

<sup>1</sup>Reported on a 14% moisture basis

<sup>2</sup>Semolina color- L= whiteness, b\*= yellowness, a\*=redness

**Table 17. USDA-ARS seed quality means for Bozeman irrigated for 2019 intrastate durum trial.**

<b>Cultivar</b>	<b>Test weight lb/bu</b>	<b>Large seeds %</b>	<b>Small seeds %</b>	<b>Hardness index</b>	<b>Individual seed weight mg</b>	<b>Individual seed diameter mm</b>	<b>Grain protein %<sup>1</sup></b>	<b>Grain ash %<sup>2</sup></b>	<b>Falling number sec<sup>2</sup></b>
Mountrail	60.9	61.0	9.0	67.1	42.8	2.95	14.2	1.41	372.4
Divide	61.0	84.0	3.0	65.4	45.8	3.10	13.7	1.32	360.7
Alkabo	62.1	83.0	4.0	64.4	46.8	3.10	12.9	1.37	269.6
Grenora	61.2	86.0	2.0	69.2	45.7	3.13	13.5	1.45	313.7
Tioga	61.3	82.0	3.0	66.4	45.6	3.12	13.4	1.46	281.4
Carpio	61.4	77.0	5.0	67.0	42.9	3.01	13.5	1.47	359.7
Joppa	61.9	80.0	4.0	67.7	45.4	3.06	13.1	1.40	334.2
ND-Riveland	60.6	82.0	3.0	64.4	44.9	3.02	13.5	1.47	411.6
ND-Grano	62.2	67.0	6.0	69.6	42.5	2.93	13.9	1.37	383.2
Alzada	59.0	83.0	3.0	65.1	44.3	3.13	13.3	1.49	247.1
CDC-Dynamic	60.6	66.0	6.0	75.2	39.5	2.88	14.4	1.52	395.9
CDC-Fortitude	61.0	76.0	5.0	74.5	39.8	2.93	14.6	1.51	339.1
CDC-Precision	61.1	79.0	3.0	73.6	42.5	3.01	13.8	1.52	377.3
CDC-Vivid	61.2	79.0	4.0	68.6	43.6	3.01	14.7	1.52	374.4
MTD16001	59.9	78.0	4.0	64.5	45.2	3.08	12.9	1.44	352.8
MTD16002	60.5	69.0	4.0	75.1	39.2	2.89	13.8	1.40	359.7
MTD16004	62.1	83.0	3.0	68.0	43.5	3.11	13.4	1.37	348.9
MTD16005	60.2	70.0	4.0	67.6	45.0	3.02	13.6	1.32	369.5
MTD16006	61.4	81.0	3.0	65.5	46.6	3.08	13.7	1.42	379.3
MTD16007	61.3	71.0	5.0	69.9	41.9	2.98	13.6	1.41	355.8
MTD16008	60.1	81.0	3.0	68.0	45.8	3.08	13.4	1.45	382.9
MTD16009	57.3	68.0	5.0	72.6	40.0	2.94	15.9	1.49	300.0
MTD16010	62.8	62.0	8.0	74.5	40.0	2.93	13.7	1.44	376.1
MTD16011	60.1	64.0	5.0	67.4	42.5	2.91	13.6	1.35	381.0
Average	60.9	75.5	4.3	68.8	43.4	3.02	13.8	1.43	351.1

<sup>1</sup>Reported on a 12% moisture basis.

<sup>2</sup>Reported on a 14% moisture basis

**Table 18. USDA-ARS semolina quality means from Bozeman irrigated for 2019 intrastate durum trial.**

<b>Cultivar</b>	<b>Bran %</b>	<b>Shorts %</b>	<b>Semolina %</b>	<b>Semolina protein %<sup>1</sup></b>	<b>Semolina ash %<sup>1</sup></b>	<b>L<sup>2</sup></b>	<b>b*<sup>2</sup></b>	<b>a*<sup>2</sup></b>	<b>Mixograph pattern</b>
Mountrail	28.0	9.5	62.5	13.2	0.55	86.1	25.8	-2.95	3
Divide	26.2	9.4	64.4	12.3	0.53	86.2	28.5	-3.34	4
Alkabo	26.3	10.2	63.6	11.5	0.51	86.4	29.2	-3.47	4
Grenora	27.0	11.0	62.0	12.1	0.56	86.3	28.9	-3.42	5
Tioga	26.6	9.8	63.6	12.0	0.56	86.2	29.8	-3.50	6
Carpio	25.4	9.8	64.8	12.2	0.62	86.1	31.5	-3.69	7
Joppa	26.1	10.0	63.9	11.7	0.57	86.7	28.8	-3.45	5
ND-Riveland	28.1	10.8	61.2	12.4	0.57	86.3	30.0	-3.59	6
ND-Grano	26.4	9.8	63.7	12.6	0.56	86.0	31.8	-3.69	5
Alzada	25.5	11.7	62.8	12.5	0.65	85.4	31.4	-3.27	6
CDC-Dynamic	27.0	9.9	63.1	13.3	0.62	85.7	33.7	-3.56	5
CDC-Fortitude	27.2	10.6	62.3	13.1	0.63	85.6	31.9	-3.48	5
CDC-Precision	28.5	9.9	61.6	12.9	0.61	85.6	32.3	-3.55	6
CDC-Vivid	25.6	10.2	64.1	13.0	0.64	85.7	32.7	-3.52	6
MTD16001	25.5	9.4	65.1	11.3	0.53	86.6	28.6	-3.39	4
MTD16002	26.9	10.6	62.5	12.7	0.54	86.0	28.3	-3.20	3
MTD16004	26.6	9.2	64.2	11.7	0.54	86.4	24.8	-2.81	3
MTD16005	25.5	10.3	64.2	12.8	0.54	85.9	29.1	-3.16	4
MTD16006	25.9	9.4	64.6	12.3	0.52	86.3	26.8	-3.05	4
MTD16007	27.2	9.2	63.6	12.2	0.55	86.6	22.6	-2.61	4
MTD16008	26.3	9.9	63.8	12.4	0.54	84.8	27.4	-2.49	3
MTD16009	28.6	10.0	61.4	14.4	0.58	85.5	27.0	-2.83	3
MTD16010	26.2	9.3	64.4	12.4	0.56	86.4	27.5	-3.14	4
MTD16011	25.7	10.0	64.3	12.3	0.54	86.1	29.8	-3.28	4
Average	26.6	10.0	63.4	12.5	0.57	86.0	29.1	-3.27	4.5

<sup>1</sup>Reported on a 14% moisture basis

<sup>2</sup>Semolina color- L= whiteness, b\*= yellowness, a\*=redness

**Table 19. USDA-ARS seed quality means from WTARC for 2019 intrastate durum trial.**

<b>Cultivar</b>	<b>Test weight lb/bu</b>	<b>Large seeds %</b>	<b>Small seeds %</b>	<b>Hardness index</b>	<b>Individual seed weight mg</b>	<b>Individual seed diameter mm</b>	<b>Grain protein %<sup>1</sup></b>	<b>Grain ash %<sup>2</sup></b>	<b>Falling number sec<sup>2</sup></b>
Mountrail	58.2	43.0	13.0	81.9	41.7	2.76	16.1	1.46	450.4
Divide	59.0	66.0	7.0	83.3	44.4	2.80	15.5	1.26	407.0
Alkabo	60.6	66.0	7.0	85.7	44.2	2.85	14.9	1.31	425.3
Grenora	61.4	76.0	4.0	90.7	47.4	2.99	14.9	1.36	435.9
Tioga	59.7	68.0	7.0	83.0	45.9	2.89	16.4	1.32	412.8
Carpio	58.4	71.0	8.0	82.8	42.5	2.75	15.5	1.29	456.1
Joppa	60.3	62.0	11.0	86.1	44.5	2.84	15.5	1.29	426.3
ND-Riveland	59.5	64.0	8.0	82.7	44.0	2.76	15.5	1.36	491.8
ND-Grano	59.6	50.0	10.0	84.0	40.4	2.71	15.5	1.27	412.8
Alzada	61.0	90.0	2.0	87.5	52.2	3.18	15.3	1.24	480.2
CDC-Dynamic	60.3	62.0	8.0	89.5	42.2	2.85	16.5	1.30	414.7
CDC-Fortitude	60.3	64.0	8.0	91.5	40.0	2.82	16.4	1.25	444.6
CDC-Precision	60.6	61.0	7.0	91.6	41.4	2.82	15.6	1.32	489.9
CDC-Vivid	60.7	72.0	6.0	86.4	44.5	2.83	16.3	1.29	414.7
MTD16001	59.5	52.0	10.0	86.1	43.0	2.79	15.0	1.18	466.7
MTD16002	59.1	29.0	16.0	87.6	37.4	2.60	15.0	1.26	528.4
MTD16004	61.0	77.0	5.0	88.7	44.8	2.95	14.6	1.17	422.8
MTD16005	59.8	51.0	10.0	84.4	42.6	2.76	15.3	1.20	487.3
MTD16006	61.0	75.0	3.0	86.9	45.5	2.87	14.8	1.19	452.7
MTD16007	60.8	70.0	6.0	86.1	43.4	2.90	15.2	1.16	412.2
MTD16008	58.4	77.0	4.0	79.4	46.5	2.87	15.4	1.21	391.1
MTD16009	55.1	39.0	16.0	77.6	37.3	2.63	16.7	1.24	444.0
MTD16010	61.0	61.0	7.0	92.8	41.0	2.81	15.8	1.18	492.5
MTD16011	59.8	60.0	8.0	87.2	43.8	2.79	14.9	1.17	429.0
Average	59.8	62.8	8.0	86.0	43.4	2.83	15.5	1.26	445.4

<sup>1</sup>Reported on a 12% moisture basis

<sup>2</sup>Reported on a 14% moisture basis

**Table 20. USDA-ARS semolina quality means from WTARC for 2019 intrastate durum trial.**

<b>Cultivar</b>	<b>Bran %</b>	<b>Shorts %</b>	<b>Semolina %</b>	<b>Semolina protein %<sup>1</sup></b>	<b>Semolina ash %<sup>1</sup></b>	<b>L<sup>2</sup></b>	<b>b*<sup>2</sup></b>	<b>a*<sup>2</sup></b>	<b>Mixograph pattern</b>
Mountrail	29.2	10.3	60.5	15.0	0.64	85.5	27.2	-2.73	4
Divide	29.0	11.2	59.8	13.9	0.55	85.3	30.1	-2.98	6
Alkabo	28.2	10.9	61.0	13.4	0.53	85.7	31.1	-3.12	6
Grenora	28.1	11.2	60.7	13.7	0.53	86.2	29.5	-3.33	6
Tioga	29.4	11.2	59.4	15.2	0.59	85.4	31.7	-3.18	7
Carpio	28.9	11.6	59.5	14.0	0.58	85.0	33.0	-3.45	8
Joppa	28.3	10.9	60.8	14.3	0.59	85.5	31.8	-3.17	8
ND-Riveland	30.5	11.6	57.8	14.4	0.58	85.5	32.1	-3.39	7
ND-Grano	28.0	10.4	61.5	13.7	0.57	85.7	33.1	-3.54	6
Alzada	25.4	13.2	61.4	13.7	0.55	84.7	32.0	-2.83	8
CDC-Dynamic	28.6	11.1	60.4	14.7	0.52	84.9	33.2	-3.16	6
CDC-Fortitude	29.6	11.9	58.5	14.9	0.54	84.8	35.0	-3.30	7
CDC-Precision	30.1	11.2	58.6	14.4	0.60	84.6	35.4	-3.29	7
CDC-Vivid	26.8	12.3	61.0	14.4	0.59	84.5	34.3	-3.27	7
MTD16001	26.3	11.0	62.8	13.4	0.54	85.1	30.7	-3.05	6
MTD16002	28.8	11.1	60.0	13.7	0.57	84.8	30.1	-2.98	5
MTD16004	28.0	11.5	60.5	13.3	0.55	85.0	26.1	-2.43	5
MTD16005	26.5	11.7	61.7	13.9	0.60	84.6	31.8	-2.81	6
MTD16006	27.3	10.9	61.8	13.7	0.58	85.3	27.3	-2.65	6
MTD16007	27.9	11.0	61.1	14.2	0.56	85.5	24.5	-2.39	6
MTD16008	27.1	11.0	61.9	13.9	0.56	83.9	28.0	-2.05	5
MTD16009	29.3	11.6	59.1	15.4	0.60	84.2	28.5	-2.37	6
MTD16010	26.3	10.6	63.0	14.5	0.52	85.4	27.5	-2.58	6
MTD16011	26.4	11.4	62.2	13.5	0.52	84.8	32.3	-2.80	6
Average	28.1	11.3	60.6	14.1	0.57	85.1	30.7	-2.95	6.3

<sup>1</sup>Reported on a 14% moisture basis

<sup>2</sup>Semolina color- L= whiteness, b\*= yellowness, a\*=redness

**Table 21. USDA-ARS seed quality means from NARC for 2019 intrastate durum trial.**

<b>Cultivar</b>	<b>Test weight lb/bu</b>	<b>Large seeds %</b>	<b>Small seeds %</b>	<b>Hardness index</b>	<b>Individual seed weight mg</b>	<b>Individual seed diameter mm</b>	<b>Grain protein %<sup>1</sup></b>	<b>Grain ash %<sup>2</sup></b>	<b>Falling number sec<sup>2</sup></b>
Mountrail	59.4	37.0	12.0	78.8	40.4	2.75	14.0	1.54	490.6
Divide	59.4	57.0	7.0	76.7	43.1	2.81	13.1	1.44	480.0
Alkabo	60.2	61.0	7.0	80.3	44.2	2.89	13.5	1.52	488.0
Grenora	59.7	56.0	7.0	84.5	43.6	2.90	14.0	1.53	526.3
Tioga	60.2	73.0	4.0	75.6	46.9	2.99	13.8	1.44	491.9
Carpio	59.6	63.0	9.0	79.1	43.6	2.86	13.9	1.45	477.5
Joppa	59.8	57.0	8.0	79.8	42.9	2.81	14.3	1.49	515.7
ND-Riveland	59.0	62.0	7.0	79.1	44.6	2.88	14.7	1.54	511.9
ND-Grano	60.6	54.0	9.0	81.6	41.7	2.83	14.2	1.49	533.2
Alzada	59.5	88.0	2.0	77.4	50.2	3.11	14.3	1.56	603.8
CDC-Dynamic	59.7	47.0	10.0	85.3	38.5	2.73	14.3	1.58	493.1
CDC-Fortitude	59.5	61.0	8.0	85.9	40.0	2.84	14.2	1.59	516.0
CDC-Precision	59.3	58.0	7.0	87.5	38.9	2.73	15.4	1.57	522.7
CDC-Vivid	60.5	60.0	9.0	82.1	41.8	2.79	14.3	1.48	497.0
MTD16001	58.6	39.0	13.0	81.8	38.6	2.71	12.5	1.43	511.3
MTD16002	57.8	14.0	24.0	81.4	34.7	2.55	13.1	1.48	545.6
MTD16004	61.1	74.0	4.0	83.5	44.0	2.93	13.5	1.41	521.2
MTD16005	59.5	53.0	8.0	78.9	44.9	2.87	13.3	1.38	504.7
MTD16006	59.9	78.0	4.0	77.3	48.7	2.97	13.9	1.49	497.9
MTD16007	60.6	63.0	6.0	82.9	42.4	2.86	13.4	1.40	506.6
MTD16008	57.8	70.0	6.0	75.6	46.2	2.89	14.2	1.41	509.5
MTD16009	54.5	33.0	13.0	73.4	37.0	2.64	14.4	1.53	466.8
MTD16010	59.0	37.0	14.0	86.3	36.3	2.67	14.5	1.45	522.4
MTD16011	59.2	41.0	10.0	80.0	42.2	2.78	13.1	1.40	490.4
Average	59.3	55.7	8.7	80.6	42.3	2.82	13.9	1.48	509.3

<sup>1</sup>Reported on a 12% moisture basis

<sup>2</sup>Reported on a 14% moisture basis

**Table 22. USDA-ARS semolina quality means from NARC for 2019 intrastate durum trial.**

<b>Cultivar</b>	<b>Bran %</b>	<b>Shorts %</b>	<b>Semolina %</b>	<b>Semolina protein %<sup>1</sup></b>	<b>Semolina ash %<sup>1</sup></b>	<b>L<sup>2</sup></b>	<b>b*<sup>2</sup></b>	<b>a*<sup>2</sup></b>	<b>Mixograph pattern</b>
Mountrail	28.2	11.8	59.9	13.2	0.66	85.5	27.2	-2.77	3
Divide	27.8	11.9	60.3	12.4	0.61	85.7	28.1	-2.86	5
Alkabo	28.4	12.5	59.1	12.8	0.59	85.7	29.7	-2.96	5
Grenora	29.5	13.7	56.8	12.8	0.64	85.5	29.8	-2.93	5
Tioga	26.6	12.1	61.3	12.7	0.58	85.1	30.2	-2.86	6
Carpio	27.3	12.5	60.2	12.9	0.63	85.3	31.7	-3.39	7
Joppa	27.1	11.9	61.0	13.1	0.63	85.3	30.2	-2.86	6
ND-Riveland	30.2	13.5	56.3	13.4	0.63	85.5	31.5	-3.21	6
ND-Grano	27.9	11.9	60.2	12.9	0.59	85.3	31.8	-3.31	5
Alzada	24.8	13.8	61.4	13.2	0.67	84.8	32.0	-2.90	6
CDC-Dynamic	27.9	11.9	60.2	13.2	0.64	85.0	33.2	-3.15	5
CDC-Fortitude	29.5	12.1	58.4	13.2	0.68	85.0	33.1	-3.19	5
CDC-Precision	29.9	12.5	57.6	13.7	0.67	85.1	33.0	-3.16	6
CDC-Vivid	27.3	13.0	59.7	13.1	0.65	84.4	33.2	-2.97	6
MTD16001	27.3	11.9	60.8	11.7	0.59	85.4	29.0	-2.90	5
MTD16002	29.4	12.1	58.6	12.4	0.62	85.3	25.6	-2.41	5
MTD16004	27.2	11.7	61.1	12.3	0.62	84.9	29.8	-2.81	5
MTD16005	26.5	12.2	61.3	12.5	0.60	85.4	29.6	-2.88	5
MTD16006	27.1	11.5	61.4	12.5	0.60	86.2	25.8	-2.69	5
MTD16007	27.7	12.0	60.3	12.2	0.63	86.5	22.2	-2.35	5
MTD16008	26.5	12.4	61.1	12.8	0.66	84.3	28.0	-2.23	5
MTD16009	30.4	11.9	57.8	13.7	0.68	84.7	27.2	-2.40	6
MTD16010	28.2	12.3	59.5	13.6	0.63	85.2	27.2	-2.61	6
MTD16011	27.0	12.2	60.8	11.8	0.61	85.2	30.3	-2.80	6
Average	27.9	12.3	59.8	12.8	0.63	85.3	29.6	-2.86	5.4

<sup>1</sup>Reported on a 14% moisture basis

<sup>2</sup>Semolina color- L= whiteness, b\*= yellowness, a\*=redness



**Table 23. USDA-ARS seed quality means from CARC for 2019 intrastate durum trial.**

<b>Cultivar</b>	<b>Test weight lb/bu</b>	<b>Large seeds %</b>	<b>Small seeds %</b>	<b>Hardness index</b>	<b>Individual seed weight mg</b>	<b>Individual seed diameter mm</b>	<b>Grain protein %<sup>1</sup></b>	<b>Grain ash %<sup>2</sup></b>	<b>Falling number sec<sup>2</sup></b>
Mountrail	58.7	9.0	22.0	75.5	36.1	2.61	13.3	1.66	561.2
Divide	58.5	32.0	14.0	70.1	35.7	2.68	12.4	1.61	474.0
Alkabo	60.0	35.0	12.0	73.8	37.3	2.68	13.2	1.64	500.1
Grenora	58.2	32.0	15.0	75.2	35.7	2.65	12.7	1.73	549.6
Tioga	58.4	39.0	14.0	71.7	36.3	2.68	12.7	1.64	508.2
Carpio	58.6	29.0	19.0	72.1	34.4	2.62	12.4	1.63	499.5
Joppa	58.7	22.0	20.0	77.3	34.4	2.57	13.0	1.66	504.7
ND-Riveland	58.9	42.0	15.0	73.9	36.4	2.59	13.3	1.69	527.9
ND-Grano	59.2	12.0	25.0	78.3	33.4	2.54	12.7	1.75	541.4
Alzada	59.0	65.0	7.0	71.4	39.1	2.86	12.3	1.68	553.0
CDC-Dynamic	58.4	14.0	20.0	82.2	34.0	2.61	13.1	1.75	496.0
CDC-Fortitude	58.6	26.0	19.0	83.2	32.6	2.61	13.6	1.76	518.2
CDC-Precision	59.4	30.0	16.0	81.2	33.4	2.57	12.7	1.74	592.4
CDC-Vivid	59.0	32.0	15.0	77.2	34.4	2.58	13.6	1.71	480.0
MTD16001	56.5	13.0	24.0	74.9	33.3	2.54	12.3	1.69	538.9
MTD16002	58.0	7.0	24.0	80.0	32.6	2.56	13.8	1.64	556.1
MTD16004	59.4	32.0	11.0	76.8	34.9	2.66	12.3	1.70	569.6
MTD16005	57.1	19.0	15.0	72.3	35.9	2.65	12.2	1.70	521.6
MTD16006	58.6	39.0	10.0	75.8	36.2	2.67	12.3	1.75	508.1
MTD16007	59.0	22.0	18.0	76.0	34.7	2.60	12.3	1.71	504.3
MTD16008	57.3	38.0	12.0	74.9	37.0	2.68	13.3	1.74	578.2
MTD16009	53.4	15.0	20.0	74.4	32.3	2.54	14.2	1.80	495.7
MTD16010	59.3	13.0	23.0	78.9	33.2	2.60	12.5	1.71	557.3
MTD16011	57.5	16.0	15.0	71.1	36.6	2.67	12.1	1.67	518.0
Average	58.3	26.4	16.9	75.7	35.0	2.63	12.8	1.70	527.2

<sup>1</sup>Reported on a 12% moisture basis

<sup>2</sup>Reported on a 14% moisture basis

**Table 24. USDA-ARS semolina quality means from CARC for 2019 intrastate durum trial.**

<b>Cultivar</b>	<b>Bran %</b>	<b>Shorts %</b>	<b>Semolina %</b>	<b>Semolina protein %<sup>1</sup></b>	<b>Semolina ash %<sup>1</sup></b>	<b>L<sup>2</sup></b>	<b>b*<sup>2</sup></b>	<b>a*<sup>2</sup></b>	<b>Mixograph pattern</b>
Mountrail	26.8	11.8	61.4	12.5	0.75	86.1	28.4	-3.32	5
Divide	26.8	10.7	62.5	11.2	0.69	86.3	28.3	-3.38	6
Alkabo	26.8	11.7	61.6	11.7	0.69	86.1	30.9	-3.51	6
Grenora	30.8	11.2	58.0	11.7	0.73	86.0	30.2	-3.57	6
Tioga	30.6	10.9	58.6	11.4	0.70	85.9	30.7	-3.53	6
Carpio	31.6	10.9	57.5	11.2	0.74	85.8	31.1	-3.65	7
Joppa	30.1	11.2	58.7	12.0	0.75	85.6	31.1	-3.37	7
ND-Riveland	31.6	11.9	56.6	12.0	0.75	85.5	31.5	-3.48	7
ND-Grano	30.7	10.8	58.4	11.7	0.76	85.6	31.8	-3.67	6
Alzada	27.0	12.3	60.7	11.2	0.75	85.8	31.9	-3.53	7
CDC-Dynamic	31.0	11.7	57.3	11.9	0.79	85.2	32.4	-3.37	5
CDC-Fortitude	32.2	12.0	55.7	12.0	0.77	85.8	32.5	-3.61	6
CDC-Precision	31.2	11.4	57.4	11.7	0.80	85.1	34.3	-3.62	6
CDC-Vivid	30.1	11.5	58.4	11.9	0.79	85.2	33.1	-3.57	5
MTD16001	31.4	10.9	57.7	11.5	0.71	86.0	29.5	-3.37	5
MTD16002	31.8	11.8	56.4	12.1	0.72	86.0	28.5	-3.34	5
MTD16004	30.4	11.8	57.8	11.4	0.80	85.9	25.4	-2.83	5
MTD16005	30.2	11.1	58.7	11.4	0.73	86.0	29.0	-3.25	6
MTD16006	30.4	11.4	58.2	11.1	0.77	86.4	26.3	-3.08	6
MTD16007	30.9	11.0	58.1	11.3	0.79	86.5	23.8	-2.77	6
MTD16008	29.5	12.2	58.3	12.1	0.75	84.7	27.7	-2.54	6
MTD16009	33.2	11.8	55.0	13.0	0.76	85.4	26.3	-2.76	6
MTD16010	31.0	10.8	58.1	11.8	0.69	86.2	27.3	-3.16	6
MTD16011	29.5	10.9	59.6	11.1	0.73	86.2	29.2	-3.32	6
Average	30.2	11.4	58.4	11.7	0.75	85.8	29.6	-3.32	5.9

<sup>1</sup>Reported on a 14% moisture basis

<sup>2</sup>Semolina color- L= whiteness, b\*= yellowness, a\*=redness

**Table 25. USDA-ARS seed quality means from EARC dryland for 2019 intrastate durum trial.**

<b>Cultivar</b>	<b>Test weight lb/bu</b>	<b>Large seeds %</b>	<b>Small seeds %</b>	<b>Hardness index</b>	<b>Individual seed weight mg</b>	<b>Individual seed diameter mm</b>	<b>Grain protein %<sup>1</sup></b>	<b>Grain ash %<sup>2</sup></b>	<b>Falling number sec<sup>2</sup></b>
Mountrail	62.5	83.0	5.0	66.6	50.5	3.16	11.3	1.55	443.3
Divide	62.5	83.0	4.0	70.6	50.9	3.16	11.3	1.46	460.5
Alkabo	62.3	82.0	6.0	68.2	49.7	3.15	12.7	1.48	430.8
Grenora	61.6	86.0	3.0	74.9	49.8	3.19	13.1	1.58	473.0
Tioga	62.4	87.0	3.0	68.7	53.7	3.30	13.7	1.50	459.6
Carpio	63.1	86.0	4.0	73.7	49.9	3.24	12.5	1.53	445.2
Joppa	62.6	86.0	4.0	74.1	50.2	3.16	11.9	1.53	423.2
ND-Riveland	62.2	82.0	4.0	72.9	52.2	3.21	12.5	1.58	483.5
ND-Grano	63.3	81.0	5.0	74.3	48.4	3.16	12.5	1.48	504.0
Alzada	61.6	88.0	5.0	69.6	51.7	3.30	13.8	1.61	520.2
CDC-Dynamic	62.2	77.0	6.0	79.0	43.4	3.08	12.0	1.60	477.2
CDC-Fortitude	62.5	83.0	5.0	80.5	44.3	3.12	11.8	1.61	492.5
CDC-Precision	62.2	86.0	3.0	80.0	45.5	3.11	12.8	1.59	509.7
CDC-Vivid	62.6	83.0	5.0	77.9	45.6	3.09	13.5	1.54	473.3
MTD16001	61.6	80.0	5.0	72.4	47.5	3.08	11.2	1.44	503.0
MTD16002	62.2	77.0	6.0	79.6	43.9	3.05	12.7	1.42	484.8
MTD16004	62.8	88.0	4.0	74.7	48.7	3.19	12.4	1.46	477.6
MTD16005	62.4	78.0	6.0	72.6	47.2	3.06	12.2	1.44	509.0
MTD16006	62.5	87.0	4.0	71.8	52.2	3.23	12.5	1.46	485.8
MTD16007	62.6	81.0	4.0	72.8	47.3	3.12	12.1	1.44	479.2
MTD16008	61.4	87.0	4.0	72.8	53.0	3.22	12.6	1.48	483.9
MTD16009	59.9	83.0	4.0	71.8	46.4	3.08	12.4	1.45	423.9
MTD16010	63.4	77.0	6.0	80.8	45.6	3.10	13.3	1.49	510.6
MTD16011	62.2	74.0	5.0	75.5	47.1	3.05	12.2	1.44	487.7
Average	62.3	82.7	4.6	74.0	48.5	3.15	12.5	1.51	476.7

<sup>1</sup>Reported on a 12% moisture basis

<sup>2</sup>Reported on a 14% moisture basis

**Table 26. USDA-ARS semolina quality means from EARC dryland for 2019 intrastate durum trial.**

<b>Cultivar</b>	<b>Bran %</b>	<b>Shorts %</b>	<b>Semolina %</b>	<b>Semolina protein %<sup>1</sup></b>	<b>Semolina ash %<sup>1</sup></b>	<b>L<sup>2</sup></b>	<b>b*<sup>2</sup></b>	<b>a*<sup>2</sup></b>	<b>Mixograph pattern</b>
Mountrail	24.6	11.0	64.3	10.6	0.56	86.2	23.2	-2.76	3
Divide	25.7	10.8	63.5	9.9	0.55	86.2	26.5	-3.18	5
Alkabo	24.6	11.6	63.8	11.7	0.54	85.5	28.4	-3.26	4
Grenora	25.3	11.6	63.0	12.0	0.60	85.7	27.9	-3.29	5
Tioga	23.7	11.7	64.6	12.8	0.60	85.2	27.8	-3.09	5
Carpio	25.1	12.2	62.7	11.2	0.60	85.4	30.6	-3.69	7
Joppa	24.6	12.1	63.3	11.2	0.57	85.5	27.4	-3.06	5
ND-Riveland	27.1	13.2	59.7	11.5	0.59	85.4	28.8	-3.37	6
ND-Grano	24.3	11.3	64.4	11.5	0.54	85.3	29.3	-3.41	5
Alzada	24.2	12.8	63.0	12.5	0.64	84.3	29.5	-3.01	6
CDC-Dynamic	25.4	10.4	64.2	11.0	0.57	85.4	31.6	-3.42	5
CDC-Fortitude	27.0	11.6	61.4	10.8	0.59	85.4	30.9	-3.51	6
CDC-Precision	27.0	11.6	61.4	11.5	0.61	84.9	31.0	-3.47	5
CDC-Vivid	25.0	12.2	62.8	12.1	0.63	84.7	30.8	-3.21	5
MTD16001	25.0	10.7	64.3	10.0	0.54	86.1	25.9	-3.06	5
MTD16002	25.6	11.8	62.6	11.8	0.56	85.4	27.3	-3.08	4
MTD16004	25.2	10.8	64.0	11.3	0.58	85.0	23.3	-2.36	5
MTD16005	24.0	10.8	65.2	11.2	0.57	85.1	28.0	-2.97	5
MTD16006	24.4	11.6	64.0	11.6	0.58	85.0	23.7	-2.51	5
MTD16007	25.7	10.9	63.4	11.0	0.58	85.8	19.5	-2.12	5
MTD16008	25.0	11.3	63.6	11.0	0.59	84.5	25.6	-2.31	4
MTD16009	27.1	10.9	61.9	11.3	0.59	85.3	24.2	-2.58	4
MTD16010	25.4	11.9	62.7	12.0	0.55	85.3	25.3	-2.73	5
MTD16011	24.3	11.0	64.6	11.1	0.59	85.2	28.8	-3.01	5
Average	25.2	11.5	63.3	11.4	0.58	85.3	27.3	-3.02	5.0

<sup>1</sup>Reported on a 14% moisture basis

<sup>2</sup>Semolina color- L= whiteness, b\*= yellowness, a\*=redness

**Table 27. USDA-ARS seed quality means from EARC irrigated for 2019 intrastate durum trial.**

<b>Cultivar</b>	<b>Test weight lb/bu</b>	<b>Large seeds %</b>	<b>Small seeds %</b>	<b>Hardness index</b>	<b>Individual seed weight mg</b>	<b>Individual seed diameter mm</b>	<b>Grain protein %<sup>1</sup></b>	<b>Grain ash %<sup>2</sup></b>	<b>Falling number sec<sup>2</sup></b>
Mountrail	59.1	83.0	5.0	69.1	52.5	3.26	15.3	1.67	235.3
Divide	60.3	87.0	5.0	69.7	53.1	3.28	15.8	1.66	305.8
Alkabo	60.1	88.0	4.0	69.6	51.3	3.22	15.2	1.74	207.7
Grenora	59.5	88.0	3.0	71.6	53.3	3.31	15.1	1.72	248.6
Tioga	59.7	89.0	4.0	63.0	57.1	3.42	15.7	1.76	223.9
Carpio	60.5	91.0	3.0	71.3	54.4	3.37	15.4	1.76	322.9
Joppa	60.2	86.0	4.0	69.1	53.5	3.27	15.3	1.73	245.8
ND-Riveland	60.6	85.0	5.0	69.3	55.3	3.31	15.0	1.83	297.2
ND-Grano	61.4	86.0	5.0	72.7	54.3	3.30	15.5	1.80	305.2
Alzada	59.4	90.0	3.0	72.6	53.3	3.40	15.4	1.82	260.3
CDC-Dynamic	60.5	87.0	4.0	74.8	49.4	3.22	16.1	1.74	312.8
CDC-Fortitude	59.1	87.0	4.0	75.3	48.5	3.28	15.6	1.83	239.4
CDC-Precision	59.5	89.0	3.0	78.2	46.4	3.15	15.6	1.84	267.0
CDC-Vivid	60.6	87.0	4.0	71.2	50.5	3.26	16.2	1.79	294.7
MTD16001	59.1	82.0	5.0	74.3	52.1	3.22	14.9	1.69	293.7
MTD16002	59.2	80.0	6.0	78.4	46.8	3.14	15.7	1.66	363.4
MTD16004	58.7	87.0	4.0	77.6	47.0	3.24	15.0	1.78	255.9
MTD16005	59.4	84.0	5.0	69.2	52.5	3.24	15.7	1.62	362.9
MTD16006	59.0	90.0	3.0	66.9	54.1	3.33	15.9	1.74	235.8
MTD16007	59.8	87.0	3.0	75.8	50.7	3.29	15.3	1.72	294.1
MTD16008	59.2	88.0	4.0	75.3	53.9	3.30	14.9	1.70	339.0
MTD16009	57.9	81.0	5.0	75.1	48.2	3.17	16.3	1.78	370.5
MTD16010	60.1	81.0	6.0	82.4	47.4	3.17	16.1	1.73	263.5
MTD16011	59.4	82.0	5.0	74.6	50.1	3.14	15.1	1.68	322.7
Average	59.7	86.0	4.3	72.8	51.5	3.26	15.5	1.74	286.2

<sup>1</sup>Reported on a 12% moisture basis

<sup>2</sup>Reported on a 14% moisture basis

**Table 28. USDA-ARS semolina quality means from EARC irrigated for 2019 intrastate durum trial.**

<b>Cultivar</b>	<b>Bran %</b>	<b>Shorts %</b>	<b>Semolina %</b>	<b>Semolina protein %<sup>1</sup></b>	<b>Semolina ash %<sup>1</sup></b>	<b>L<sup>2</sup></b>	<b>b*<sup>2</sup></b>	<b>a*<sup>2</sup></b>	<b>Mixograph pattern</b>
Mountrail	24.7	11.6	63.7	14.4	0.67	83.7	22.4	-2.02	3
Divide	24.9	11.3	63.8	14.3	0.63	84.1	24.6	-2.49	6
Alkabo	25.0	12.1	62.9	13.9	0.63	83.9	26.2	-2.81	5
Grenora	24.9	11.5	63.6	14.2	0.65	84.2	25.4	-2.73	5
Tioga	23.6	11.5	64.9	14.5	0.64	83.6	25.5	-2.61	5
Carpio	24.9	12.2	62.9	14.2	0.68	83.9	27.6	-3.09	7
Joppa	25.2	12.1	62.8	14.1	0.64	83.7	26.3	-2.64	6
ND-Riveland	27.1	12.1	60.8	13.5	0.67	84.3	26.8	-3.07	7
ND-Grano	24.4	11.5	64.0	14.2	0.66	83.9	27.1	-2.96	5
Alzada	23.7	13.6	62.8	14.0	0.74	82.8	26.2	-2.29	6
CDC-Dynamic	24.4	11.1	64.5	14.8	0.63	84.0	29.2	-3.01	6
CDC-Fortitude	25.7	11.1	63.2	14.4	0.69	83.9	28.6	-2.90	7
CDC-Precision	26.5	11.7	61.8	14.0	0.72	83.6	28.5	-2.96	7
CDC-Vivid	24.1	11.2	64.7	14.7	0.67	84.0	28.7	-2.96	7
MTD16001	24.8	11.3	63.9	13.7	0.61	84.6	24.6	-2.60	6
MTD16002	26.3	11.4	62.3	14.5	0.61	84.6	25.2	-2.77	5
MTD16004	27.4	12.3	60.3	13.5	0.69	83.5	21.6	-1.89	6
MTD16005	24.6	11.4	64.0	14.2	0.62	84.0	25.7	-2.60	6
MTD16006	26.0	12.8	61.2	14.1	0.65	84.0	21.8	-2.14	5
MTD16007	26.6	12.3	61.1	13.8	0.64	84.6	19.2	-1.77	5
MTD16008	24.4	11.2	64.4	13.8	0.63	83.2	24.3	-1.85	5
MTD16009	26.3	11.1	62.6	14.6	0.64	84.3	23.5	-2.33	5
MTD16010	25.9	12.5	61.6	14.5	0.62	84.2	23.2	-2.28	6
MTD16011	24.0	11.2	64.9	13.4	0.63	84.5	26.1	-2.74	6
Average	25.2	11.8	63.0	14.1	0.65	84.0	25.3	-2.56	5.7

<sup>1</sup>Reported on a 14% moisture basis

<sup>2</sup>Semolina color- L= whiteness, b\*= yellowness, a\*=redness

**Table 29. Agronomic means from 2019 dryland off-station durum trial Roosevelt Co., MT.**

<b>Cultivar</b>	<b>Yield bu/ac<sup>1</sup></b>	<b>Test Weight lb/bu</b>	<b>Moisture %</b>	<b>Protein %<sup>2</sup></b>	<b>Plant Height inch</b>	<b>Lodging %</b>
Mountrail	<b>83.0*</b>	63.4	10.5	13.0	31.9	54.2
Divide	76.9	63.1	10.4	13.9	31.2	2.3
Alkabo	75.2	63.7	10.5	12.7	32.7	4.3
Grenora	70.2	62.1	10.3	12.1	28.9	12.8
Tioga	<b>81.1*</b>	63.4	10.7	13.0	36.7	0.0
Carpio	<b>87.8**</b>	63.8	10.8	13.3	35.0	6.3
Joppa	79.6	64.0	10.6	12.9	33.2	66.2
ND-Riveland	<b>87.6*</b>	63.0	10.5	13.4	35.7	0.0
ND-Grano	<b>81.2*</b>	64.1	10.8	13.1	34.5	2.9
Alzada	56.0	61.1	10.4	13.0	24.7	100.0
CDC-Dynamic	<b>87.2*</b>	62.7	10.7	13.8	34.0	0.0
CDC-Fortitude	78.7	61.7	10.8	13.7	30.2	0.0
CDC-Precision	<b>83.4*</b>	62.9	10.7	13.8	33.0	3.3
CDC-Vivid	<b>87.5*</b>	63.0	10.6	14.0	35.0	2.5
MTD16001	79.5	61.2	10.4	13.0	32.8	52.6
MTD16002	<b>84.2*</b>	63.0	10.4	13.5	34.9	4.4
MTD16004	76.7	63.9	10.5	13.2	31.4	5.4
MTD16005	76.1	62.1	10.5	13.6	33.4	26.0
MTD16006	67.4	63.3	10.6	13.3	33.7	39.1
MTD16007	73.4	63.1	10.6	13.2	32.2	27.5
MTD16008	79.9	61.4	10.3	14.1	32.5	15.7
MTD16009	75.5	58.4	10.3	14.8	32.3	5.2
MTD16010	78.7	63.7	10.5	13.5	34.1	31.5
MTD16011	74.1	61.7	10.4	13.8	32.1	14.5
Average	78.4	62.7	10.5	13.4	32.8	19.6
LSD (0.05)	7.4	0.8	0.3	0.6	2.4	32.2
Prob > F	<0.001	<0.001	0.018	<0.001	<0.001	<0.001
CV (%)	5.0	0.7	1.6	2.3	3.9	93.7
Lattice RE % <sup>3</sup>	187.3	136.9	102.0	111.3	129.7	104.0

<sup>1</sup>Grain yield reported on a 13% moisture basis.

<sup>2</sup>Grain protein reported on a 12% moisture basis.

<sup>3</sup>Adjusted means provided for Lattice RE% values equal to or greater than 100%.

\*\* Indicates highest yielding cultivar within a column.

\* Indicates cultivars yielding equal to the highest yielding entry based on Fisher's Protected LSD at the 0.05 probability level.

**Table 30. Agronomic means from 2019 dryland off-station durum trial Sheridan, MT.**

<b>Cultivar</b>	<b>Yield bu/ac<sup>1</sup></b>	<b>Test Weight lb/bu</b>	<b>Moisture %</b>	<b>Protein %<sup>2</sup></b>	<b>Plant Height inch</b>
Mountrail	59.9	62.1	10.3	14.0	34.9
Divide	57.6	62.3	10.4	14.1	34.4
Alkabo	<b>65.5*</b>	63.2	10.5	13.4	37.4
Grenora	58.2	61.5	10.1	14.6	33.2
Tioga	<b>65.1*</b>	62.9	10.7	14.2	38.8
Carpio	<b>65.9*</b>	63.2	10.7	13.0	36.1
Joppa	<b>62.3*</b>	62.7	10.4	13.4	37.3
ND-Riveland	<b>61.9*</b>	63.0	10.4	13.3	36.2
ND-Grano	<b>62.9*</b>	63.1	10.5	13.7	36.6
Alzada	38.3	60.3	10.2	13.1	26.4
CDC-Dynamic	<b>66.3*</b>	62.7	10.6	15.3	37.7
CDC-Fortitude	<b>64.7*</b>	62.0	10.8	14.6	36.1
CDC-Precision	<b>66.8*</b>	62.7	10.5	15.1	35.6
CDC-Vivid	<b>68.6**</b>	62.9	10.8	14.7	37.9
MTD16001	52.4	61.0	10.4	13.8	33.0
MTD16002	<b>67.5*</b>	62.6	10.7	14.0	38.1
MTD16004	<b>60.9*</b>	63.3	10.2	13.7	31.4
MTD16005	<b>63.3*</b>	62.1	10.3	14.1	35.3
MTD16006	51.5	62.3	10.7	12.8	36.5
MTD16007	<b>64.0*</b>	63.4	10.6	14.0	34.5
MTD16008	<b>65.7*</b>	61.6	10.4	14.4	37.7
MTD16009	49.8	58.5	10.2	15.1	33.6
MTD16010	51.0	63.0	10.5	13.8	33.7
MTD16011	60.0	62.4	10.4	14.1	36.7
Average	60.4	62.3	10.5	14.0	35.4
LSD (0.05)	8.0	0.9	0.5	0.5	2.7
Prob > F	<0.001	<0.001	0.3	<0.001	<0.001
CV (%)	7.7	0.8	2.9	2.2	4.5

<sup>1</sup>Reported on a 13% moisture basis

<sup>2</sup>Reported on a 12% moisture basis

\*\* Indicates highest yielding cultivar within a column.

\* Indicates cultivars yielding equal to the highest yielding entry based on Fisher's Protected LSD at the 0.05 probability level.



**Table 31. Agronomic means from 2019 dryland off-station durum trial Turner, MT.**

Cultivar	Yield bu/ac <sup>1</sup>	Test weight lb/bu	Moisture %	Protein % <sup>2</sup>	Sawfly damage % <sup>3</sup>	Plant height inch	Falling number sec <sup>4</sup>
Mountrail	<b>44.1**</b>	59.1	6.5	15.1	0.0	27.2	556.9
Divide	<b>40.7*</b>	59.8	6.7	15.0	0.0	27.0	473.2
Alkabo	40.2	59.7	6.7	14.9	0.1	28.9	432.3
Grenora	<b>41.3*</b>	59.2	6.5	14.9	0.1	26.9	446.1
Tioga	39.5	59.2	6.8	15.4	1.0	30.4	386.0
Carpio	39.4	59.0	6.6	14.9	0.1	29.0	508.4
Joppa	38.9	59.9	6.6	15.2	0.5	27.8	486.6
ND-Riveland	36.9	59.5	6.5	15.3	0.1	27.0	506.1
ND-Grano	<b>42.9*</b>	59.3	6.6	15.3	1.0	28.2	523.6
Alzada	31.4	59.8	6.9	14.5	0.1	25.1	539.3
CDC-Dynamic	38.6	58.7	6.9	16.3	0.0	26.3	434.1
CDC-Fortitude	39.7	58.5	6.5	16.3	0.1	28.6	528.4
CDC-Precision	<b>43.2*</b>	59.8	6.8	16.0	0.0	28.8	545.8
CDC-Vivid	36.4	59.2	6.7	15.8	0.1	27.3	459.8
MTD16001	35.8	58.7	6.7	14.8	0.1	25.9	448.3
MTD16002	38.0	59.8	6.5	14.8	0.0	26.7	466.3
MTD16004	37.3	60.5	6.5	14.8	0.0	25.8	432.1
MTD16005	36.2	58.4	6.6	15.7	0.0	27.6	626.1
MTD16006	40.0	59.9	6.8	15.1	0.1	28.1	455.7
MTD16007	38.1	59.8	6.7	15.7	0.1	27.2	554.2
MTD16008	<b>41.2*</b>	57.4	6.5	16.5	0.0	28.5	535.6
MTD16009	38.0	55.8	6.4	16.1	0.5	25.4	423.4
MTD16010	38.3	60.1	6.6	15.0	0.0	27.2	447.4
MTD16011	<b>42.3*</b>	58.4	6.5	15.7	1.0	29.0	476.2
Average	39.1	59.2	6.6	15.4	0.1	27.5	487.2
LSD (0.05)	3.5	0.9	0.3	0.5	0.2	1.6	26.5
Prob > F	<0.001	<0.001	0.046	<0.001	0.021	<0.001	<0.001
CV (%)	5.4	0.9	2.5	1.9	130.4	3.5	3.3

<sup>1</sup>Grain yield reported on a 13% moisture basis.

<sup>2</sup>Grain protein reported on a 12% moisture basis.

<sup>3</sup>Sawfly damage reported on percent cut stems.

<sup>4</sup>Falling number reported on a 14% moisture basis.

\*\* Indicates highest yielding cultivar within a column.

\* Indicates cultivars yielding equal to the highest yielding entry based on Fisher's Protected LSD at the 0.05 probability level.

**Table 32. Agronomic means from 2019 dryland off-station durum trial Chester, MT.**

<b>Cultivar</b>	<b>Yield bu/ac<sup>1</sup></b>	<b>Test Weight lb/bu</b>	<b>Moisture %</b>	<b>Protein %<sup>2</sup></b>	<b>Sawfly damage %<sup>3</sup></b>	<b>Plant Height inch</b>	<b>Falling number sec<sup>4</sup></b>
Mountrail	53.6	57.7	9.5	15.8	10.0	38.2	478.6
Divide	52.0	58.4	9.6	15.8	5.0	38.0	460.0
Alkabo	54.9	59.0	9.7	15.7	10.0	36.0	473.2
<b>Grenora</b>	<b>57.1*</b>	58.3	9.6	15.7	8.4	33.3	493.8
Tioga	54.3	57.7	9.6	16.7	10.0	38.6	488.6
Carpio	48.3	57.1	9.6	16.6	7.5	37.0	460.8
Joppa	51.0	58.4	9.7	16.1	10.0	37.8	448.4
ND-Riveland	50.8	57.0	9.6	16.7	10.0	38.4	481.0
ND-Grano	49.8	57.3	9.5	16.4	7.5	37.2	467.4
Alzada	<b>60.7**</b>	58.8	9.5	15.7	2.1	31.5	567.9
CDC-Dynamic	54.0	56.8	9.7	18.1	1.0	37.4	425.6
CDC-Fortitude	53.2	56.9	9.6	17.1	6.1	36.1	461.7
CDC-Precision	51.1	57.6	9.5	17.2	5.0	37.2	517.8
CDC-Vivid	49.8	57.0	9.6	17.3	5.0	36.9	441.9
MTD16001	55.1	57.6	9.5	15.7	2.1	37.5	460.1
MTD16002	54.0	57.0	9.5	16.1	1.0	38.7	480.9
MTD16004	53.1	58.7	9.5	15.8	2.8	35.6	439.4
MTD16005	51.3	56.6	9.5	16.9	3.5	38.1	480.4
MTD16006	49.5	58.0	9.6	16.1	7.5	39.6	436.7
MTD16007	52.2	58.0	9.6	16.3	10.0	36.7	455.3
MTD16008	40.5	54.6	9.4	17.2	9.3	38.3	384.0
MTD16009	51.0	53.8	9.4	16.9	7.5	38.2	444.3
MTD16010	45.6	57.8	9.6	16.4	8.5	37.8	468.9
MTD16011	51.6	57.1	9.5	16.3	10.0	36.9	463.0
Average	51.9	57.4	9.6	16.4	7.4	37.1	465.8
LSD (0.05)	4.7	0.8	0.1	0.5	0.6	1.7	26.0
Prob > F	<0.001	<0.001	0.046	<0.001	0.021	<0.001	<0.001
CV (%)	5.5	0.9	0.6	2.0	4.7	2.7	3.4

<sup>1</sup>Grain yield reported on a 13% moisture basis.

<sup>2</sup>Grain protein reported on a 12% moisture basis.

<sup>3</sup>Sawfly damage reported on percent cut stems.

<sup>4</sup>Falling number reported on a 14% moisture basis.

\*\* Indicates highest yielding cultivar within a column.

\* Indicates cultivars yielding equal to the highest yielding entry based on Fisher's Protected LSD at the 0.05 probability level.

**Table 33. Agronomic means from 2019 dryland off-station durum trial Loring, MT.**

<b>Cultivar</b>	<b>Yield bu/ac<sup>1</sup></b>	<b>Test Weight lb/bu</b>	<b>Moisture %</b>	<b>Protein %<sup>2</sup></b>	<b>Plant Height inch</b>	<b>Falling number sec<sup>3</sup></b>
Mountrail	51.4	59.0	11.8	13.6	30.0	489.5
Divide	<b>55.4*</b>	58.3	12.0	14.0	31.8	480.9
Alkabo	<b>55.8*</b>	59.4	12.0	13.3	30.9	422.0
Grenora	50.2	58.1	12.0	14.1	28.0	426.2
Tioga	48.7	58.7	12.1	14.4	30.5	376.3
Carpio	47.2	58.4	12.1	14.3	30.7	464.1
Joppa	47.3	59.4	12.2	13.9	28.2	414.0
ND-Riveland	50.1	58.5	12.1	14.2	32.0	485.1
ND-Grano	51.3	58.9	11.9	13.8	31.6	485.4
Alzada	48.2	59.3	11.8	13.4	24.8	548.5
CDC-Dynamic	51.1	58.1	12.2	14.9	32.0	446.7
CDC-Fortitude	50.0	58.4	12.0	14.5	29.7	483.3
CDC-Precision	52.3	59.0	11.9	13.9	32.1	499.5
CDC-Vivid	<b>54.9*</b>	59.3	12.0	14.1	33.1	471.9
MTD16001	53.7	58.0	12.0	13.5	28.3	465.0
MTD16002	51.9	59.0	12.1	13.6	31.5	492.4
MTD16004	<b>55.8*</b>	59.4	11.9	13.4	29.7	436.5
MTD16005	51.0	58.4	12.0	14.0	30.3	490.7
MTD16006	49.7	59.5	12.1	13.7	32.2	420.8
MTD16007	<b>58.7**</b>	59.6	11.8	13.3	29.5	493.8
MTD16008	<b>56.4*</b>	57.7	11.9	13.3	32.3	441.1
MTD16009	51.3	55.3	11.5	14.4	31.4	466.6
MTD16010	<b>57.3*</b>	58.7	11.8	13.4	33.7	491.4
MTD16011	49.4	58.2	12.0	13.4	31.2	494.4
Average	52.0	58.6	12.0	13.8	30.6	466.1
LSD (0.05)	5.0	0.5	0.3	0.5	1.4	28.1
Prob > F	<0.001	<0.001	0.008	<0.001	0.021	<0.001
CV (%)	5.9	0.6	1.5	2.1	2.8	3.7

<sup>1</sup>Grain yield reported on a 13% moisture basis.

<sup>2</sup>Grain protein reported on a 12% moisture basis.

<sup>3</sup>Falling number reported on a 14% moisture basis.

\*\* Indicates highest yielding cultivar within a column.

\* Indicates cultivars yielding equal to the highest yielding entry based on Fisher's Protected LSD at the 0.05 probability level.

**Table 34: Fusarium head blight evaluation 2019 (Dr. Frankie Crutcher, EARC).**

Cultivar	Yield (bu/ac)	Severity (%) <sup>1</sup>	Incidence (%) <sup>2</sup>	Severity (%) <sup>1</sup>	Incidence (%) <sup>2</sup>	FDK (%) <sup>3</sup>	DON (ppm) <sup>4</sup>
		Jul 21	Jul 21	Jul 30	Jul 30		
Mountrail	40.2	12.2	86.7	55.3	98.3	15.0	14.6
Divide	<b>50.4*</b>	11.1	86.7	46.8	98.3	15.0	12.0
Alkabo	36.8	10.4	86.7	64.0	100.0	12.5	9.0
Grenora	41.0	13.8	93.3	47.2	100.0	15.0	12.2
Tioga	<b>49.2*</b>	15.2	95.0	49.5	98.3	22.5	11.7
Carpio	<b>52.0**</b>	9.1	71.7	43.2	100.0	20.0	13.1
Joppa	<b>45.1*</b>	10.5	86.7	45.2	96.7	15.0	13.0
ND-Riveland	<b>46.4*</b>	11.0	85.0	34.0	98.3	9.0	14.0
ND-Grano	40.0	20.8	100.0	55.2	100.0	15.0	20.6
Alzada	15.2	36.8	98.3	70.3	100.0	22.5	16.2
CDC-Dynamic	41.4	22.1	93.3	53.8	100.0	15.0	19.9
CDC-Fortitude	31.3	15.4	91.7	61.2	100.0	12.5	17.5
CDC-Precision	<b>43.8*</b>	15.0	95.0	50.3	100.0	8.0	9.7
CDC-Vivid	37.6	12.7	83.3	42.8	96.7	11.5	12.9
MTD16001	<b>49.4*</b>	12.9	90.0	42.7	98.3	17.5	13.9
MTD16002	38.3	17.3	98.3	60.0	100.0	12.5	13.4
MTD16004	36.0	17.7	100.0	64.0	100.0	15.0	14.8
MTD16005	39.5	17.7	96.7	64.3	98.3	20.0	17.7
MTD16006	34.4	18.7	98.3	68.3	100.0	17.5	21.8
MTD16007	41.3	21.7	100.0	57.3	100.0	20.0	21.4
MTD16008	29.7	19.3	96.7	64.8	100.0	35.0	16.4
MTD16009	27.9	20.8	98.3	69.8	100.0	22.5	16.3
MTD16010	33.0	19.5	93.3	57.5	98.3	17.5	16.7
MTD16011	36.1	18.1	98.3	61.6	100.0	17.5	19.5
Average	39.0	16.7	92.6	55.4	99.2	16.8	15.4
LSD (0.05)	9.9	12.9	16.9	14.9	3.2	7.4	9.9
Prob > F	<0.001	0.094	0.198	0.001	0.500	<0.001	0.417
CV (%)	12.3	37.3	8.8	13.0	1.6	21.4	31.2

\*\* Indicates highest yielding cultivar within a column.

\* Indicates cultivars yielding equal to the highest yielding entry based on Fisher's Protected LSD at the 0.05 probability level.

<sup>1</sup>Pest Severity- Average percent area of head covered by disease. Thirty heads were evaluated for each plot.

<sup>2</sup>Pest Incidence- Percent of thirty plants per plot that had visible FHB symptoms.

<sup>3</sup>Fusarium diseased kernels.

<sup>4</sup>Concentration of DON (vomitoxin) in ppm.