2023

U.S. DURUM WHEAT

REGIONAL QUALITY REPORT

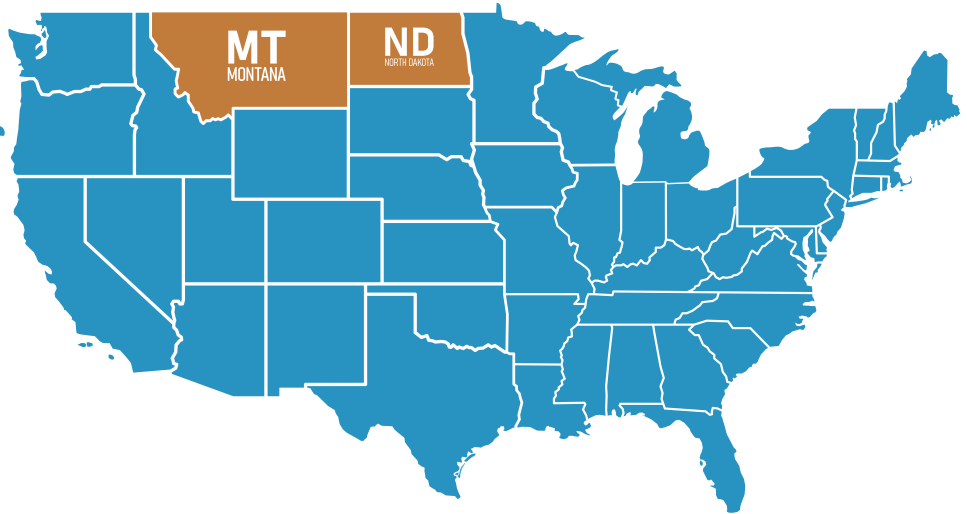# U.S. DURUM *Wheat*

MONTANA | NORTH DAKOTA

MAKING PREMIUM PASTA

Durum is the hardest of all wheats. Its density, combined with its high protein content and gluten strength, make durum the wheat of choice for producing premium pasta and couscous products. Pasta made from durum is firm with consistent cooking quality. Durum kernels are amber colored and larger than those of other wheat classes. Also unique to durum is its yellow endosperm, which gives pasta its golden hue and the best color for couscous.

When durum is milled, the endosperm is ground into a granular product called semolina. A mixture of water and semolina forms a stiff dough. Pasta dough is then forced through dies, or metal discs with holes, to create hundreds of different shapes.

Durum production is geographically concentrated to the Northern Plains because it demands a special agronomic environment. In most years, the states of North Dakota and Montana produce 80 percent of the U.S. durum crop.

AVERAGE SHARE OF U.S. HRS EXPORTS BY PORT (2019-2022)

PNW 5%

LAKES 54%

GULF 41%
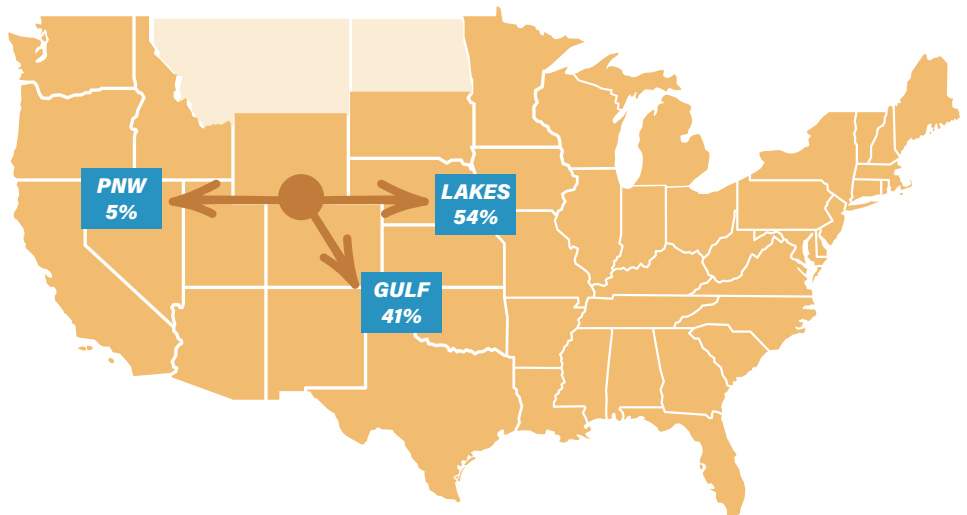
OVERVIEW

THE 2023 NORTHERN DURUM production was 6% higher than last year at 52.9 million bushels, (1.44 MMT). While acres increased by 7%, yields were quite variable due to weather and growing conditions and trended lower overall. Moisture was mostly adequate at planting time, but conditions early in the growing season turned hot and dry, stressing the crop and limiting yield potential. Increased moisture conditions at harvest impacted quality characteristics in some of the crop. Variable is the key word to describe the crop in terms of both yield and quality. Overall this year's crop shows high grading and kernel characteristics with lower vitreous kernel counts. Protein is higher and the crop shows increased gluten strength with end-use characteristics similar to an average crop.

The crop **GRADES** an average of U.S. No. 1 Hard Amber Durum (HAD), with about half of the crop reaching that top grade, compared to 73% last year. This year's crop shows increased variability in grades with a larger than normal portion falling in some lower grade categories. Test weight averaged 61.3 lbs./bu. (79.8 kg/hl), similar to last year, but it should be noted there were areas of lower test weights. Damage was slightly higher than last year, but lower than the five-year average due to minimal disease pressure. Vitreous kernel counts are skewed lower this year with about a fourth of the samples falling below 75% vitreous kernel content. The crop average is 79% compared to 84% for a five year average, however, nearly half the crop has vitreous kernel levels of 90% or higher. Moisture of the crop is slightly higher at 11.5% due to some wet conditions at harvest.

PROTEIN in this year's durum crop averages 14.2%, up nearly half a point from last year and right in line with the 5-year average. There is a balanced distribution of protein in 2023, but there are parts of the region where protein levels are unusually low due to very high yields. Over 80% of this year's durum crop had protein above 13 percent. Thousand kernel weight is slightly higher than last year at 40.9 grams. Distributions show 60% of the crop above 40 grams TKW, and just 16% below 37 grams.

FALLING NUMBER values are strong, averaging 394 seconds and indicating a sound crop. A small portion, about 5%, of the samples fall below 300 seconds. DON is once again almost non-existent in the Northern Durum crop due to limited disease pressure.

MILLING for the 2023 survey samples was performed on a Quadromat Junior mill, similar to the last four years. Semolina extraction is showing slightly lower than last year at 52.0%, but commercial mills are likely to see much higher extraction values. Larger kernel size and strong thousand kernel weights are positive attributes for milling but the lower vitreous kernel levels may impact semolina yields. Adjustments may need to be made due to variability in the crop. Ash is similar to last year at 0.63% with speck counts similar to last year. Semolina protein is 12.4%, higher than last year due to higher kernel protein. Gluten index is much higher at 91 percent.

SEMOLINA color shows a bit of a decline in the b value (yellow color), but it is quite similar to the average. Mixing properties reveal a crop that performs very similar to last year's crop. Dry spaghetti evaluations show color similar to the average. This year's crop shows higher cooking loss and lower cooked firmness.

The 2023 crop boasts many positive attributes including higher protein, strong grades, low damage, sound kernels, and good test weights and kernel size. However, buyers should be aware of variance in all quality parameters, especially vitreous kernel content, and adjust contract specifications as needed. The performance of the crop is similar to the five-year average and buyers should find value in this year's crop.

2023 PRODUCTION DATA			
	2023	**2022**	**2018-22 AVERAGE**
MILLION BUSHELS			
Montana	20.9	18.9	20.1
North Dakota	32.0	31.2	30.9
U.S. Total	59.3	64.0	**59.8**
MILLION METRIC TON			
Montana	0.57	0.51	0.55
North Dakota	0.85	0.85	0.84
U.S. Total	1.61	1.74	**1.63**

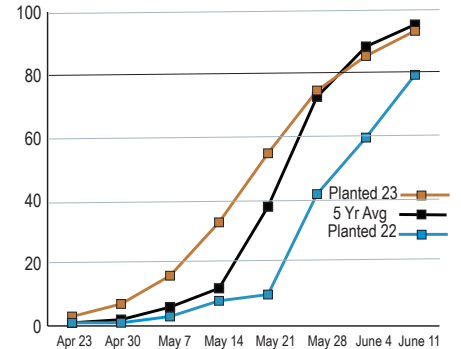*Source: USDA 2023 Small Grains Summary*

SEASONAL CONDITIONS - 2023

PLANTING of the 2023 U.S. northern durum crop began in late April, near normal. Initial progress was slow due to cool soil temperatures but the pace accelerated in mid-May and remained steady through early June. Planting was completed by early June in most areas.

EMERGENCE of the crop was hampered in areas due to overly dry soil conditions, but most areas had good initial crop growth. The growing season was quite variable across the region, ranging from well above average precipitation in southern growing areas, to well below normal precipitation in areas further north and west. Yield potential was reduced early in the growing season in the driest areas, and all areas were impacted by early season heat. Yield potential was tempered in much of the region due to below normal seasonal precipitation, although the latter half of the growing season brought cooler temperatures, and more frequent precipitation, which stabilized crop conditions, and benefitted kernel fill. Disease pressures were minimal to non-existent.

HARVEST began in early August, slightly behind normal, due to slow crop ripening. Progress remained slower than normal through much of August due to periods of rain and heavy morning dews. In late August and early September, harvest progress accelerated, due to advanced crop maturity and more favorable conditions, with more than 80 percent harvested by mid-September. The last portion of the harvest stretched out into early October, later than normal.
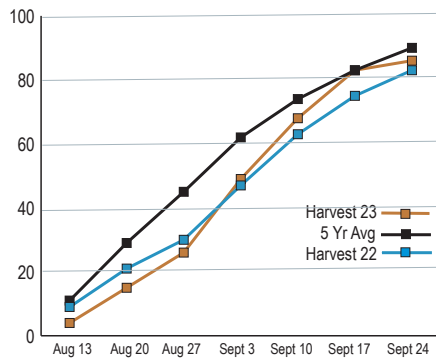
PRODUCTION is estimated at 52.9 million bushels (1.4 MMT), up 4% from last year, due to higher planted area and similar yields.

ND PLANTING PROGRESS

Percent

- Planted 23
- 5 Yr Avg
- Planted 22

Apr 23 Apr 30 May 7 May 14 May 21 May 28 June 4 June 11

ND HARVEST PROGRESS

Percent

- Harvest 23
- 5 Yr Avg
- Harvest 22

Aug 13 Aug 20 Aug 27 Sept 3 Sept 10 Sept 17 Sept 24

APPROXIMATE SHARE OF REGIONAL PRODUCTION

Montana:
- A 7%
- B 33%

North Dakota:
- A 35%
- B 9%
- C 5%
- D 11%

WHEAT CHARACTERISTICS

WHEAT GRADES as defined by the Federal Grain Inspection Service (FGIS) of the USDA Grain Inspection, Packers and Stockyards Administration (GIPSA), reflect the general quality and condition of a representative sample. U.S. grades are based on test weight and include limits on damaged kernels, foreign material, shrunken and broken kernels, and wheat of contrasting classes. Each determination is made on the basis of the grain when free from dockage and shrunken and broken kernels.

SUBCLASS is as separate marketing factor based on the number of kernels that are dark, hard and vitreous. For durum wheat, the subclasses are:

- *Hard Amber Durum (HAD)* – at least 75 percent or more hard, vitreous kernels;
- *Amber Durum (AD)* – between 60 and 74 percent hard, vitreous kernels;
- *Durum (D)* – less than 60 percent hard, vitreous kernels.
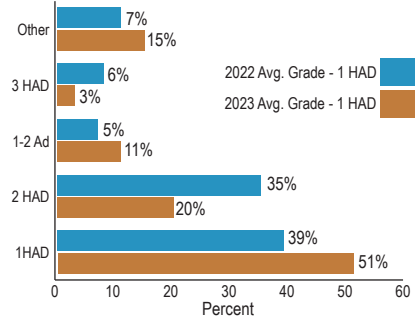
PRODUCTION DATA

	U.S. GRADES				
GRADING FACTORS	**1**	**2**	**3**	**4**	**5**
DURUM - MINIMUM TEST WEIGHTS					
Pounds per bushel	60.0	58.0	56.0	54.1	51.0
Kilograms per hectoliter	78.2	75.6	73.0	70.4	66.5
MAXIMUM PERCENT LIMITS OF:					
Damaged kernels					
Heat (part of total)	0.2	0.2	0.0	1.0	3.0
Total	2.0	4.0	7.0	10.0	15.0
Foreign material	0.4	0.7	1.3	3.0	5.0
Shrunken/broken kernels	3.0	5.0	8.0	12.0	20.0
Total	3.0	5.0	8.0	12.0	20.0
Wheat of other class[2]					
Contracting classes	1.0	2.0	3.0	10.0	20.0
Total[1]	3.0	5.0	10.0	10.0	10.0
Stones	0.1	0.1	0.1	0.1	0.1
MAXIMUM COUNT LIMITS OF:					
Other material					
Animal filth	1	1	1	1	1
Castor beans	1	1	1	1	1
Crotalaria seeds	2	2	2	2	2
Glass	0	0	0	0	0
Stones	3	3	3	3	3
Unknown foreign material	3	3	3	3	3
Total[4]	4	4	4	4	4
Insect-damaged kernels	31	31	31	31	31

U.S. sample grade is wheat that:
a. Does not meet the requirements for U.S. Nos. 1, 2, 3, 4 or 5; or
b. Has a musty, sour or commercially objectionable foreign odor (except smut or garlic odor); or
c. Is heating or of distinctly low quality.
1. Includes damaged kernels (total), foreign material and shrunken and broken kernels.
2. Unclassed wheat of any grade may contain not more than 10.0 percent of wheat of other classes.
3. Includes contrasting classes.
4. Includes any combination of animal filth, castor beans, crotalaria seeds, glass, stones or unknown foreign substance.

WHEAT GRADING DATA

STATE AND CROP REPORTING AREA	TEST WEIGHT		DAMAGE %	SHRUNKEN/BROKEN KERNELS %	TOTAL DEFECTS %	CONTRASTING CLASSES %	U.S. GRADE SUBCLASS	VITREOUS KERNELS %
	LBS/BU	KG/HL						
MONTANA								
Area A	59.9	78.0	0.2	0.6	0.9	0.0	2 HAD	95
Area B	60.8	79.2	0.6	0.7	1.3	0.7	1 HAD	79
State Avg. 2023	60.6	79.0	0.5	0.7	1.2	0.6	1 HAD	82
State Avg. 2022	60.4	78.6	0.0	1.2	1.2	0.4	1 HAD	96
NORTH DAKOTA								
Area A	61.7	80.3	0.2	0.7	1.0	0.0	1 HAD	77
Area B	62.1	80.9	0.4	0.4	0.8	0.0	1 HAD	84
Area C	61.3	79.8	0.2	0.6	0.8	0.0	1 HAD	78
Area D	61.5	80.1	0.6	0.6	1.2	0.0	1 HAD	75
State Avg. 2023	61.7	80.3	0.3	0.6	1.0	0.0	1 HAD	78
State Avg. 2022	62.6	81.5	0.2	0.8	1.0	0.1	1 HAD	89
TWO-STATE AVERAGE								
Avg. 2023	61.3	79.8	0.4	0.6	1.0	0.2	1 HAD	79
Avg. 2022	61.8	80.4	0.1	1.0	1.1	0.2	1 HAD	92
Five-Year Avg	61.4	79.9	0.7	0.8	1.5	0.4	1 HAD	84

GRADE – Regional Distribution

2022 Avg. Grade - 1 HAD
2023 Avg. Grade - 1 HAD

	2022	2023
Other	7%	15%
3 HAD	6%	3%
1-2 Ad	5%	11%
2 HAD	35%	20%
1HAD	39%	51%

Percent

TEST WEIGHT – Regional Distribution

2022 Avg. – 61.8 lbs/bu (80.4 kg/hl)
2023 Avg. – 61.3 lbs/bu (79.8 kg/hl)

lb/bu – kg/hl	2022	2023
-56 / -73	2%	0%
56-57.9 / 73-75.5	5%	3%
58-59.9 / 75.6-78.0	8%	18%
60-61.9 / 78.1-80.6	36%	47%
62+ / 80.7+	49%	32%

Percent
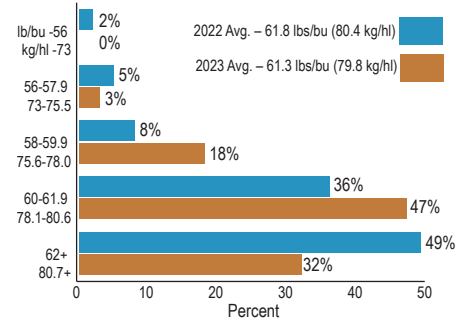
AVERAGE TEST WEIGHT BY AREA

lbs/bu
kg/hl

Montana
- A: 59.9 / 78.0
- B: 60.8 / 79.2

North Dakota
- A: 61.7 / 80.3
- B: 62.1 / 80.9
- C: 61.3 / 79.8
- D: 61.5 / 80.1

VITREOUS KERNEL

Regional Distribution

Percent

2022 Avg. - 92 percent
2023 Avg. - 79 percent

Percent	
- 49	2% / 11%
50-59	1% / 2%
60-74	5% / 11%
75-89	23% / 26%
90+	69% / 50%

Percent
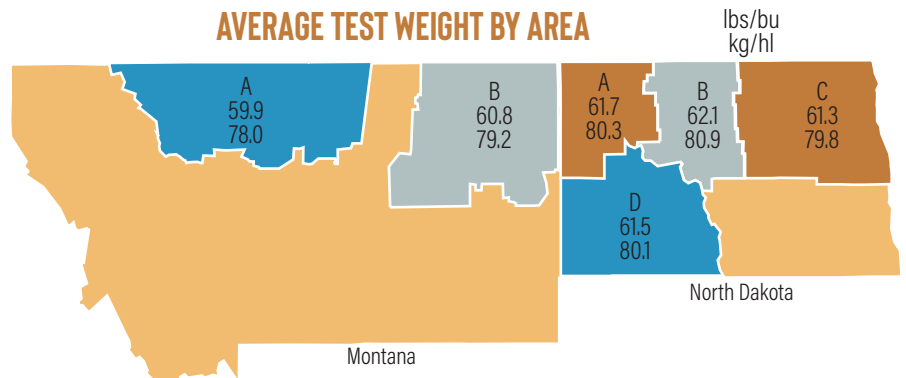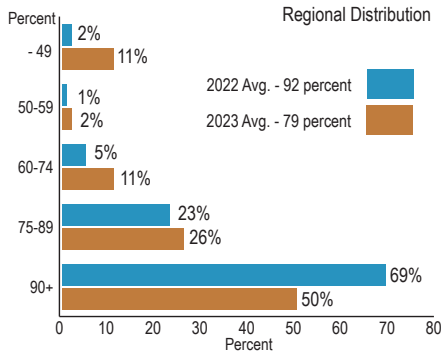
AVERAGE VITREOUS KERNEL BY AREA

Percent

Montana: A 95, B 79

North Dakota: A 77, B 84, C 78, D 75

1000 KERNEL WEIGHT

Regional Distribution

Grams

2022 Avg. - 40.4 grams
2023 Avg. - 40.9 grams

Grams	
- 33.9	16% / 6%
34-36.9	15% / 10%
37-39.9	22% / 24%
40-42.9	25% / 27%
43+	22% / 33%

Percent

PROTEIN - 12% MOISTURE

Regional Distribution

Percent

2022 Avg. - 13.7 percent
2023 Avg. - 14.2 percent

Percent	
-12	8% / 2%
12-12.9	23% / 16%
13-13.9	24% / 28%
14-14.9	23% / 26%
15+	22% / 28%

Percent

AVERAGE PROTEIN BY AREA

12% Moisture Basis - Percent

Montana: A 14.0, B 14.6

North Dakota: A 14.2, B 14.1, C 13.5, D 13.5
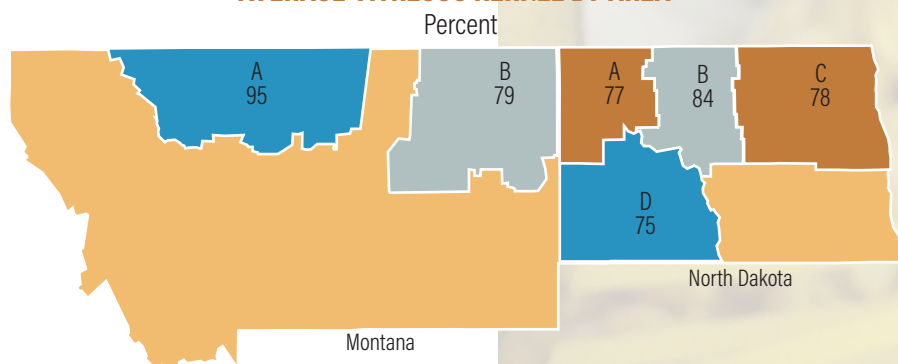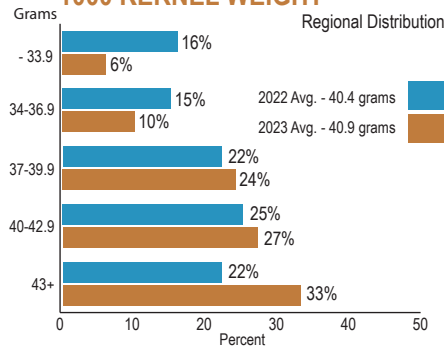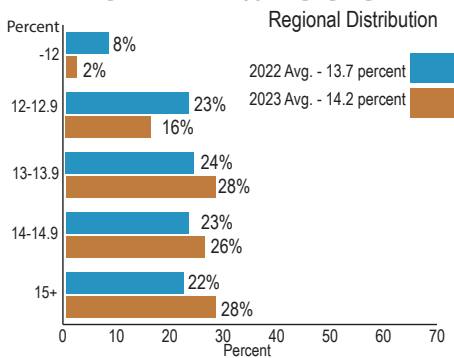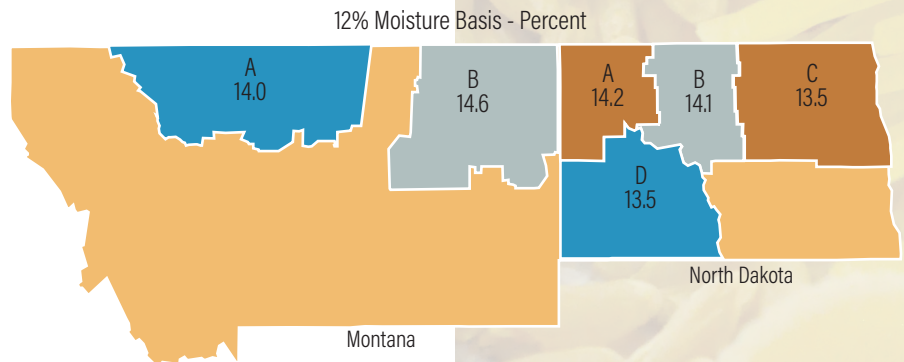
OTHER KERNEL QUALITY DATA

STATE AND CROP REPORTING AREA	DOCKAGE %	MOISTURE %	1000 KERNEL WEIGHT G	KERNEL DIST. MED/LGE %	PROTEIN 12%/0% MOISTURE BASIS %	DON (PPM)	WHEAT ASH%	FALLING NUMBER (SEC)	MICRO SED (CC)
MONTANA									
Area A	0.4	10.0	38.6	40/58	14.0/15.9	0.0	1.38	454	101
Area B	0.8	11.0	38.3	53/45	14.6/16.6	0.0	1.34	380	75
State Avg. 2023	0.7	10.8	38.4	51/48	14.5/16.5	0.0	1.35	392	79
State Avg. 2022	1.5	10.1	36.7	65/27	14.5/16.5	0.0	1.69	447	63
NORTH DAKOTA									
Area A	1.8	11.9	42.4	36/61	14.2/16.1	0.0	1.51	398	82
Area B	0.9	12.3	46.1	33/66	14.1/16.0	0.0	1.37	377	87
Area C	0.6	12.4	46.7	29/70	13.5/15.3	0.0	1.51	384	78
Area D	0.7	11.2	36.8	42/56	13.5/15.3	0.0	1.42	414	85
State Avg. 2023	1.4	11.9	42.6	36/62	14.0/15.9	0.0	1.48	395	83
State Avg. 2022	0.9	11.5	42.7	44/53	13.2/15.0	0.1	1.61	425	60
REGION AVERAGE									
Avg. 2023	1.1	11.5	40.9	42/56	14.2/16.1	0.0	1.43	394	81
Avg. 2022	1.1	11.0	40.4	52/43	13.7/15.6	0.0	1.64	433	61
Five-Year Avg	0.9	11.2	42.8	46/50	14.2/16.1	0.2	1.59	410	65

FALLING NUMBER
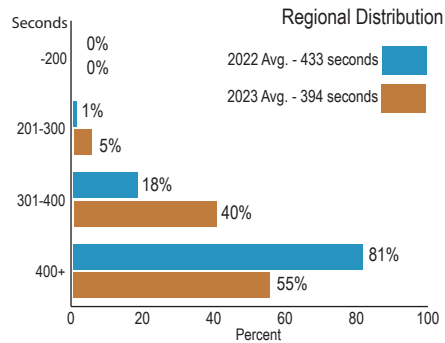
AVERAGE FALLING NUMBER BY AREA
(Seconds)
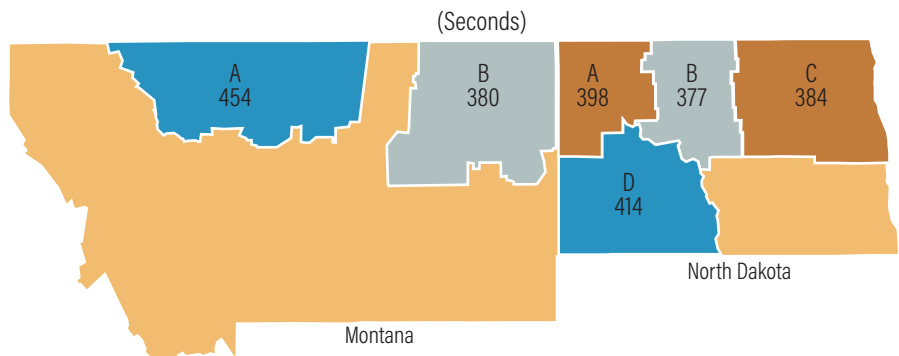
MILLING CHARACTERISTICS

▮ **SEMOLINA** extraction is the portion milled into semolina only.

▮ **ASH CONTENT** in the endosperm of durum is inherently higher than in the endosperm of other hard wheats, but can still be used as a relative measure of bran or mineral content in the flour and semolina.

▮ **SPECKS** appear in semolina when small particles of bran or other material escape the cleaning and purifying process. Millers can control spec count by selecting durum that is free of disease and foreign material, thoroughly cleaning the durum, properly tempering and conditioning the wheat before milling, and by using purifiers to remove small bran particles from the semolina.

▮ **PROTEIN CONTENT** in semolina has a high correlation with gluten content and, in turn, mechanical strength and cooking quality. Wet gluten is a quantitative measure of the gluten forming proteins in semolina that are primarily responsible for its mechanical strength and pasta quality.

SEMOLINA QUALITY DATA

STATE AND CROP REPORTING AREA	SEMOLINA EXTRACTION[1] %	ASH[1] %	SPECKS NO/10 SQ IN[1] %	PROTEIN (14% MOISTURE) %	WET GLUTEN %	GLUTEN INDEX %	GLUTOPEAK PEAK TIME SEC	MAX TORQUE BE
MONTANA								
Area A	49.9	0.63	21	12.6	31.1	97	162	41
Area B	50.1	0.56	25	13.0	34.8	86	176	42
State Avg. 2023	50.1	0.67	24	12.9	34.1	88	174	41
State Avg. 2022	52.9	0.71	22	12.8	35.6	72	177	46
NORTH DAKOTA								
Area A	54.1	0.54	30	12.3	31.5	91	181	39
Area B	52.3	0.48	25	12.1	30.7	93	199	40
Area C	53.1	0.47	28	11.6	28.8	95	203	46
Area D	51.7	0.56	25	11.7	29.0	96	162	45
State Avg. 2023	53.4	0.61	28	12.1	30.7	93	183	41
State Avg. 2022	54.5	0.60	30	11.4	32.1	71	181	41
REGION AVERAGE								
Avg. 2023	52.0	0.63	27	12.4	32.1	91	179	41
Avg. 2022	53.9	0.64	27	12.0	33.4	72	180	43
Five-Year Avg	58.8	0.65	28	12.8	34.8	70	167	42

1. Samples were milled on a Quad Junior Mill. As a result, no total extraction data is available, and comparison for semolina extraction and ash values is limited in reference to samples milled on larger scale mills.

SEMOLINA & SPAGHETTI DATA

STATE AND CROP REPORTING AREA	SEMOLINA COLOR L (BLACK-WHITE)	SEMOLINA COLOR A (GREEN-RED)	SEMOLINA COLOR B (BLUE-YELLOW)	SPAGHETTI COLOR L (BLACK-WHITE)	SPAGHETTI COLOR A (GREEN-RED)	SPAGHETTI COLOR B (BLUE-YELLOW)	SPAGHETTI COOKED WEIGHT G	SPAGHETTI COOKING LOSS %	SPAGHETTI COOKED FIRMNESS G CM
MONTANA									
Area A	82.8	-2.2	33.5	53.0	3.7	27.3	32.4	7.3	3.9
Area B	83.4	-2.5	29.9	52.8	2.8	25.5	31.6	7.3	4.1
State Avg. 2023	83.3	-2.5	30.6	52.9	2.9	25.8	31.8	7.3	4.1
State Avg. 2022	82.8	-2.2	31.5	53.3	3.4	25.8	29.8	6.6	4.9
NORTH DAKOTA									
Area A	83.2	-2.6	29.6	53.9	3.0	25.1	31.2	7.3	4.0
Area B	83.5	-2.6	29.6	54.1	2.7	25.6	31.7	7.6	3.6
Area C	83.7	-2.7	28.7	52.3	2.8	24.7	32.7	7.7	3.0
Area D	83.8	-2.7	30.9	53.2	2.8	26.1	32.0	7.3	3.8
State Avg. 2023	83.4	-2.6	29.7	53.7	2.9	25.3	31.6	7.4	3.8
State Avg. 2022	83.7	-2.7	31.0	54.2	3.0	26.0	29.6	6.9	4.3
REGION AVERAGE									
Avg. 2023	83.4	-2.5	30.1	53.3	2.9	25.5	31.6	7.3	3.9
Avg. 2022	83.4	-2.5	31.2	53.8	3.2	25.9	29.7	6.7	4.5
Five-Year Avg	83.4	-2.4	30.2	53.2	3.3	25.5	31.2	6.9	4.2

DRY PASTA PROCESSORS want a finished product that is visually appealing, elastic and strong enough to resist breakage during cutting, packaging, handling and shipping, able to withstand the rigors of cooking, and satisfying to the consumer palate.

Yellow color in semolina and pasta is a traditional, rather than functional, mark of quality. In the early days of the pasta industry, before sophisticated testing evolved, consumers assumed that a yellow pasta was made from durum wheat, which is known to make pasta with superior cooking quality compared to that made from other hard wheats.

Most consumers prefer pasta that is "al dente," meaning it has some firmness to the bite. Good quality pasta that is cooked according to package directions should not be sticky or mushy when eaten.

AVERAGE COOKED FIRMNESS BY AREA (G CM)

Montana — A 3.9, B 4.1
North Dakota — A 4.0, B 3.6, C 3.0, D 3.8
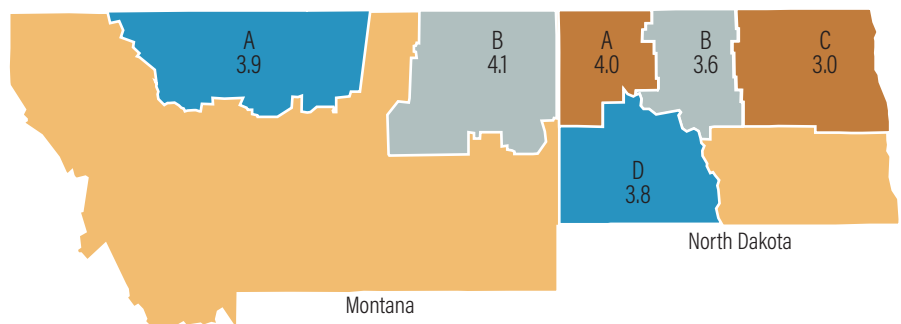
RECENT QUALITY TRENDS

CROP YEAR	2023	2022	2021	2020	2019	2018	FIVE-YEAR AVERAGE
GRADING AND WHEAT DATA							
Test Weight (lbs/bu)	61.3	61.8	60.5	62.2	61.1	61.4	61.4
Test Weight (kg/hl)	79.8	80.4	78.8	80.9	79.6	79.9	79.9
Total Defects (%)	1.0	1.1	1.2	1.5	3.0	1.0	1.5
Vitreous Kernels (%)	79	92	86	88	64	90	84
Grades	1 HAD	1 HAD	1 HAD	1 HAD	2 AD	1 HAD	1 HAD
OTHER WHEAT DATA							
Dockage (%)	1.1	1.1	0.5	0.8	1.3	0.7	0.9
Protein: 12% moisture	14.2	13.7	15.5	13.4	13.9	14.5	14.2
1000 Kernel Weight (gm)	40.9	40.4	41.2	46.7	44.2	41.2	42.8
Moisture (%)	11.5	11.0	10.9	10.7	12.2	11.2	11.2
DON	0.0	0.0	<0.1	0.6	0.2	<0.1	0.2
Ash (%)	1.43	1.64	1.69	1.57	1.51	1.54	1.59
Falling Number (sec)	394	433	428	419	345	425	410
Sedimentation (cc)	81	61	79	62	61	61	65
Semolina Data							
**Semolina Extraction (%)*	52.0	53.9	54.6	58.5	57.5	69.3	58.8
Ash (%)	0.63	0.64	0.65	0.64	0.60	0.73	0.65
Wet Gluten (%)	32.1	33.4	37.1	33.2	33.1	37.4	34.8
Gluten Index	91	72	81	74	67	57	70
Specks (no/10 sq in)	27	27	21	30	31	29	28
Protein (%)	12.4	12.0	14.2	12.3	12.3	13.4	12.8
Color: L (Black-white)	83.4	83.3	83.3	83.7	82.9	83.6	83.4
a (green-red)	-2.5	-2.5	-2.3	-2.4	-2.4	-2.5	-2.4
b (blue-yellow)	30.1	31.2	30.2	30.4	29.3	29.9	30.2
Glutopeak							
Peak Time (sec)	179	180	165	160	190	140	167
Max Torque (be)	41	43	47	36	40	42	42
SPAGHETTI PROCESSING DATA							
Color: L (black-white)	53.3	53.8	53.1	54.4	51.8	52.8	53.2
a (green-red)	2.9	3.2	2.9	3.0	3.3	4.2	3.3
b (blue-yellow)	25.5	25.9	25.1	26.5	24.2	25.6	25.5
Cooked Weight (gm)	31.6	29.7	32.4	31.0	32.2	30.5	31.2
Cooking Loss (%)	7.3	6.7	8.0	7.2	7.1	5.7	6.9
Cooked Firmness (g cm)	3.9	4.5	4.8	3.6	3.8	4.5	4.2

* Semolina color performed on CIE color scale. Granulation size is approximately 40 percent above 425 microns and 12 percent below 180 microns. Spaghetti color is performed on Hunter color scale.

** 2018 samples were milled on a Buhler laboratory mill.

U.S. DURUM *Wheat* REGIONAL QUALITY REPORT

MAJOR VARIETIES PRODUCED IN REGION

AGRONOMIC FACTORS

VARIETY	AGRONOMIC DESCRIPTION		STRAW STRENGTH (1-9)	PLANT HEIGHT INCHES	FOLIAR DIEASE[2] (1-9)	AVERAGE YIELD[3]	
	AGENT OR ORIGIN[1]	YEAR RELEASED				BU/ACRE	MT/HECT
Alkabo	ND	2005	2	37	5	45.1	3.03
Divide	ND	2005	5	39	5	42.8	2.87
Joppa	ND	2013	5	38	5	45.1	3.03
ND Grano*	ND	2017	5	37	8	49.3	3.31
ND Riveland*	ND	2017	4	38	5	50.2	3.37
ND Stanley*	ND	2021	4	37	5	50.0	3.37

GROWN AND TESTED ACROSS NORTH DAKOTA

QUALITY AND END-USE FACTORS[4]

VARIETY	TEST WEIGHT LB/BU	TEST WEIGHT KG/HL	WHEAT PROTEIN %	WHEAT FALLING # SECONDS	SEMOLINA COLOR L (BLACK-WHITE)	SEMOLINA COLOR B (BLUE-YELLOW)	GLUTEN INDEX%	COOKED FIRMNESS G CM	OVERALL PASTA QUALITY RATING[5]
Alkabo	61.3	79.8	14.3	416	83.4	28.8	49	3.9	good
Divide	61.0	79.4	14.5	498	83.3	27.6	75	3.9	good
Joppa	61.4	80.0	14.3	491	83.2	30.4	82	4.0	good
ND Grano*	61.5	80.1	14.8	491	83.5	29.7	66	4.0	good
ND Riveland*	61.0	79.4	14.7	501	83.3	29.4	81	4.0	good
ND Stanley*	61.9	80.6	14.9	498	83.5	28.8	73	3.9	good

* Low Cadmium

Source: 2022 North Dakota Durum Wheat Variety Performance Descriptions

1. ND - North Dakota State University.

2. Foliar Disease includes tan spot and septoria: 1 to 9 scale, with 1 = resistant and 9 very susceptible

3. Yield trials 3 yr average - 2020-22 crop years grown at Carrington, Hettinger, Langdon, Minot and Williston, North Dakota.

4. Based on NDSU Durum Quality Lab testing of 2017-21 samples grown at Carrington, Casselton, Dickinson, Hettinger, Langdon, Minot and Williston, North Dakota. Does not include samples from 2018 Williston, and 2020 Hettinger, ND

5. Based on kernel attributes, milling and semolina processing, pasta color and spaghetti cooking performance. Ratings can be excellent, good, average, fair and poor.

NORTH DAKOTA

The top four durum varieties planted in North Dakota in 2023 are ND Riveland, Joppa, Divide and AAC Cabri, accounting for nearly 80 percent of the acres. In Montana, the top four varieties are Alzada, Divide, ND Riveland, and AC Brigade, accounting for slightly more than 60 percent of the acres.

ND RIVELAND continues to dominate North Dakota acres with nearly 53 percent of the acres, up from 39 percent in 2022. It is the third most popular in Montana with a 15 percent share of the acres, up slightly from a year ago. Released from NDSU in 2017, ND Riveland is a variety with elite yield potential and strong agronomic characteristics. It also has low cadmium (cd) uptake traits, and possesses very good end-use quality characteristics.

JOPPA accounts for 12.5 percent of the acres in North Dakota, and 6.4 percent of the acres in Montana, ranking it second and sixth, respectively. It saw slight declines in its share of acres in both states, but had held the top spot in North Dakota from 2017-2021. Released from NDSU in 2013, Joppa is popular with producers for its high-end yield potential and positive agronomic characteristics. It has very good end-use quality traits with especially high pasta color scores and a high gluten index value.

AAC CABRI accounts for 5.1 percent of the acreage in North Dakota in 2023, up from 1 percent in 2022, ranking it fourth this year. It is a 2014 release developed in Canada. AAC Cabri is solid stemmed with excellent wheat stem sawfly tolerance, and has high test weight, good gluten strength and low cadmium (cd) uptake traits.

MONTANA

ALZADA remains the top variety in Montana in 2023 with 18.5 percent of the acres, down slightly from a year ago. It is the dominant variety produced in the North Central region where it is primarily grown under contracted production. Alzada is a 2004 release from Westbred. It has competitive yields, excellent straw strength, and good sawfly tolerance. Alzada has uniquely strong gluten properties and excellent color scores.

DIVIDE is the second most popular variety in Montana with a 16.8 percent acreage share, and ranks third in North Dakota with 7.4 percent of the acres. Divide was released in 2005 from NDSU, and remains popular with producers for its high yield potential and higher relative ratings for disease tolerance. Divide is rated good for end-use quality.

AC BRIGADE holds the fourth position in Montana with 10.4 percent of the acres. It was developed in Canada and has strong straw, high gluten strength and good resistance to Fusarium head blight.

NORTH DAKOTA VARIETY SHARE OF 2023 PLANTED ACRES BY CROP DISTRICT

VARIETY	NORTH WEST	WEST CENTRAL	SOUTH WEST	COMBINED DISTRICTS	TOTAL STATE
PERCENTAGE (%)[2]					
ND Riveland	60.9	77.3	38.1	26.4	52.7
Joppa	1.9	6.2	53.4	16.8	12.5
Divide	6.7	0.0	0.0	18.7	7.4
AAC Cabri	8.7	0.0	0.0	0.0	5.1
VT Peak	4.1	0.0	0.0	2.8	2.9
TCG Webster	0.0	0.0	0.0	11.7	2.2
Carpio	1.8	10.5	0.0	0.6	2.1
Other[2]	15.9	6.0	8.5	23.0	15.1

1. Data from North Central, Northeast, Central, East Central, South Central and Southeast districts are combined to avoid disclosure of individual operations.
2. Percentages may not add to 100 due to rounding.
3. Includes varieties with less than 1% acreage and unknown varieties.
4. September 30, 2023 small grain estimate 905,000 acres.

NORTH DAKOTA VARIETY SHARE OF PLANTED ACRES[3]

VARIETY	2023%	2022%
ND Riveland	52.7	38.9
Joppa	12.5	15.2
Divide	7.4	9.8
AAC Cabri	5.1	1.0
VT Peak	2.9	2.9
Other[2]	19.4	32.2

1. Percentage may not add to 100 due to rounding.
2. Includes varieties with less than 1% of acreage and unknown varieties.
3. 1,000 acres (1 acre = 0.405 hectares)
   2023 – 905,000 acres
   2022 – 790,000 acres

MONTANA VARIETY SHARE OF PLANTED ACRES[3]

VARIETY	2023%	2022%
Alzada	18.5	20.4
Divide	16.8	11.8
ND Riveland	15.3	12.6
AC Brigade	10.4	0.0
AC Transcend	8.5	10.4
Other[2]	30.5	44.8

1. Percentage may not add to 100 due to rounding.
2. Includes varieties with less than 1% of acreage and unknown varieties.
3. 1,000 acres (1 acre = 0.405 hectares)
   2023 – 705,000 acres
   2022 – 710,000 acres

LABORATORY ANALYSIS

All quality data contained in this report is the result of testing and analysis conducted by or under the supervision of Dr. Frank Manthey, Wheat Quality Specialist and assisted by Delgersaikhan Shinezorigt, Food Technologist Specialist, and James Perleberg, chemist of the Durum Wheat Quality and Pasta Processing Laboratory in the Department of Plant Science at North Dakota State University, Fargo, North Dakota, USA.

COLLECTION - The North Dakota and Montana state offices of the National Agricultural Statistics Service obtained durum wheat samples during harvest directly from growers, farm bins and local elevators. These samples reflect the condition of the grain at the point of origin. Collection began in mid August and continued through the end of September. A total of 225 samples were collected from Montana (82) and North Dakota (143).

ANALYSIS - Half of the total wheat samples collected were analyzed for grad and other physical kernel characteristics. The data obtained from the analyses was used to generate frequency distributions as a percentage of the harvested crop. Distribution results may differ from the data presented in the various tables, because the latter are derived from production adjusted averages, rather than simple averages. All samples received in the laboratory were sub-sampled to obtain one composite sample for each of the four areas in North Dakota and one composite each of two areas for Montana. These were analyzed for grade and physical characteristics as well as milling performance and spaghetti processing qualities. Again, all state and regional averages have been adjusted to reflect production as opposed to simple averaging.

METHODS, TERMS AND SYMBOLS - WHEAT

SAMPLE COLLECTION - Each sample contained approximately 2 to 3 pounds of wheat, stored in securely closed, moisture proof plastic bags.

MOISTURE - Official USDA procedure using Motomco Moisture Meter.

GRADE - Official United States Standards for Grain, as determined by a licensed grain inspector. North Dakota Grain Inspection service, Devils Lake, ND, provided grades for composite wheat samples representing each crop reporting area.

VITREOUS KERNELS - Approximate percentage of kernels having vitreous endosperm, based on weights.

DOCKAGE - Official USDA procedure. All matter other than wheat which can be removed readily from a test portion of the original sample by use of an approved device (Carter Dockage Tester).

TEST WEIGHT - American Association of Cereal Chemists Method 55-10.01 approved April 1961, revised October 1999. Measured as pounds per bushel (lb/bu), kilograms per hectoliter (kg/hl) = (lbs/bu X 1.292) + 0.630. Approved Methods of the

American Association of Cereal Chemists, Cereal Laboratory Methods (10th edition), St. Paul, MN (2000)

THOUSAND KERNEL WEIGHT - Based on 10 gram sample of cleaned wheat (free of foreign material and broken kernels) counted by electronic seed counter.

KERNEL SIZE DISTRIBUTION - Determinations made according to the procedure described in Cereal Science Today 5:(3), 71 (1960). Kernels remaining over a Tyler No. 7 (2.92 mm opening) are classified as "large;" kernels passing through the top sieve but remaining on a Tyler No. 9 (2.24 mm opening) are classified as "medium" size kernels. Kernels passing through the second sieve are classed as "small." Size is reported as percentage of large, medium, and small kernels.

PROTEIN - American Association of Cereal Chemists (AACC) Method: 46-30.01 (Combustion Method), expressed on dry basis and 12 percent moisture basis.

ASH - American Association of Cereal Chemists Method 08-01.01, approved April 1961, revised Oc-

tober 1999; expressed on a 14 percent moisture basis.

DON - Analysis was done on ground wheat using a gas chromatograph with an electron capture detector as described in J. Assoc. Official Anal. Chem 79,472 (1996)

FALLING NUMBER - American Association of Cereal Chemists Method 56-81.03, approved November 1972, revised September 1999; unites of seconds (14 percent moisture basis).

MICRO SEDIMENTATION - Determined as described by Dick, J.W. and Quick, J.S. Cereal Chem. 60(4):315-318. 1983.

WET GLUTEN - American Association of Cereal Chemists Method 38-12.01, approved October 1999; expressed on a 14 percent moisture basis determined with the glutomatic instrument.

GLUTEN INDEX -American Association of Cereal Chemists Method 38-12-02, approved October 1999; determined with the glutomatic instrument as an indication of gluten strength.

SEMOLINA

EXTRACTION - Durum tempered to 15.5% moisture and milled on a Brabender Quadrumat Jr mill configured to mill semolina.

ASH - AACC Method 08-01.01, approved April 1961, revised October 1999; expressed on a 14 percent moisture basis.

PROTEIN - AACC Method 46-30.01 (combustion method), approved September 1995, revised October 1999, N x 5.7, expressed on a 14 percent moisture basis.

SPECKS - The number of specks in semolina was determined on a flat surface under a constant light source, and counting the visible specks (brown and black particles) in three different one-inch square areas. The average of the three readings was converted to the number of specks per 10 square inches.

GLUTOPEAK - Glutopeak is a shear-based device that measures the aggregation behavior of gluten. Flour and solvent are mixed at a constant speed with a rotating paddle, resulting in the separation of gluten and aggregation. The gluten aggregate mass exerts a resistance force on the paddle, and creates a torque curve. The curve records the complexity of aggregation and gluten breakdown, measured as Peak Maximum Time (PMT, in seconds), and the Maximum Torque (MT, in Brabender equivalents (BE)).

NDSU laboratory procedure: The semolina sample (8.5 g, 14% mb) was placed in 9.5 g solution of 0.5mol L-1 CaCl2. e temperature at 350C. The mixing paddle was set to rotate at 2,750 rpm and the test was run for 5 min at 35C.

SPAGHETTI

PROCESSING - Pasta was made using the laboratory procedure described by Walsh, Ebeling, and Dick, Cereal Sci. Today: 16(11) 385, 1971. A 1-Kg semolina was mixed with the appropriate amount of water that gave a dough consistency of 32 percent total water absorption. The other processing conditions used were: Water temperature, 40 C, extruder shaft speed, 25 rpm and vacuum, 18 in. HG; the dough was pressed through an 84-strand teflon-coated spaghetti die with 0.157 cm openings. The extruded spaghetti samples were dried at high temperature for 12 hrs, using maximum temperature and relative humidity of 73 C and 83 percent, respectively.

COLOR - Color scores were determined by light reflectance (AACC Method 14-22.01, 1983), using a Minolta Color Difference Meter (Model CR 410, Minolta Camera Co., Japan). The scores were generated according to the new color map designed by Debbouz (Pasta J. vol 6, No 6, 1994). A spaghetti sample with a score of 8.0 or higher is considered to have good color.

COOKED WEIGHT - 10 g of dry spaghetti were placed in 300 ml boiling distilled water and cooked for 12 min. The cooked and drained spaghetti sample was weighed and the results were reported in grams.

COOKING LOSS - AACC Method 66-50.01. Solids lost to the cooking water. After drying the residue was weighed and reported as percentage of the original dry sample.

FIRMNESS - AACC Method 66-50.01 with a Plexiglass tooth attached to a Texture Analyzer (Model TA-XT2, Texture Technology Corp., Scarsdale, New York).

2023

U.S. DURUM WHEAT

REGIONAL QUALITY REPORT