2021

U.S. DURUM WHEAT

Regional Quality Report

U.S. DURUM Wheat

MONTANA | NORTH DAKOTA

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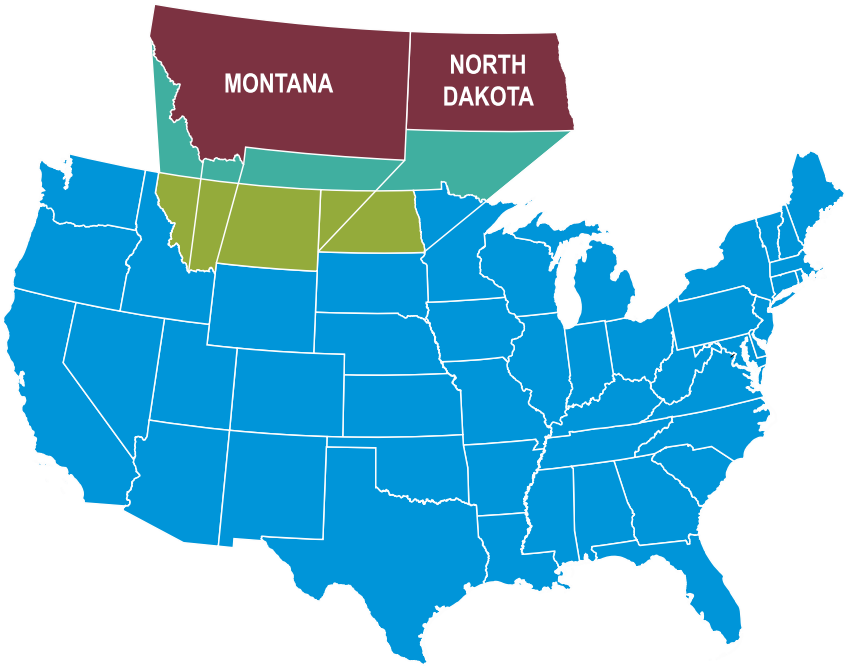
MAKING PREMIUM PASTA

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.



OVERVIEW

The **2021 DURUM CROP** produced in North Dakota and Montana is substantially smaller this year due to significant drought issues. Planted acreage in the region was down marginally, about three percent, but production was cut by more than 50% due to extreme drought conditions throughout the growing season that affected plant populations and led to well below average yields. The dry conditions during the growing season limited disease pressure. Most of the harvest was completed under dry conditions, allowing for excellent grading and kernel characteristics, however, a small portion did receive untimely rains at harvest which affected some quality factors, but did not have a significant impact on overall quality.

PRODUCTION DATA

	2021	2020	2016-20 AVERAGE
MILLION BUSHELS			
Montana	10.2	26.7	23.1
North Dakota	19.7	35.3	38.1
U.S. Total	**37.3**	**68.8**	**70.8**
MILLION METRIC TONS			
Montana	0.28	0.73	0.63
North Dakota	0.54	0.96	1.04
U.S. Total	**1.02**	**1.87**	**1.93**

Source: USDA 2021 Small Grains Summary

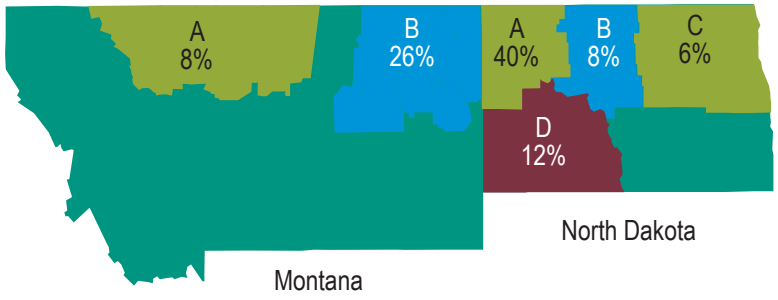
The average **GRADE** of the survey samples is U.S. No. 1 Hard Amber Durum. This year 74% of the samples grades a No. 1 or No. 2 Hard Amber Durum, with a larger percentage than last year in the No. 2 grade due to slightly lower test weights. Nineteen percent of the samples are a No. 3 grade or lower, slightly higher than last year. Average test weight is 60.5 lb./bu. (78.8 kg/hl), below last year and the five-year average, a result of drought pressure. Over half of the samples had a test weight of 60 lb./bu or higher, the minimum needed for a No. 1 grade. Damage was quite low at 0.1% due to minimal disease pressure, but shrunken and broken kernels were higher at 1.0%. Overall total defects were lower than average at 1.2%. For the second year, kernel moisture was lower than average due to a mostly dry harvest period.

The average **VITREOUS KERNEL** content (HVAC) is 86%, very similar to last year and the five-year average and a product of the dry growing and harvest conditions. Nearly two-thirds of the samples had HVAC of 90% or higher, but there is a portion of the crop that saw lower HVAC levels due to rain at harvest. Protein content is nearly two percentage points higher than last year at 15.5%. Almost 90% of the crop has a minimum protein of 14%.

The average **THOUSAND KERNEL WEIGHT** (TKW) is 41.2 grams, a drop from last year's high value of 46.7 and slightly below the five-year average of 42.1. The drop in TKW is not surprising given the dry conditions during kernel fill. Falling number values are high, with the average for the region being 428 seconds. Almost all of the crop had a falling number value above 300 seconds and 73% was 400 seconds or higher. DON is nearly non-existent in this year's crop due to very minimal disease pressure.

MILLING for the 2021 survey samples was performed on a Quadromat Junior mill, the same as 2019 and 2020, limiting direct comparisons to the Buhler laboratory mill used prior to those years. The semolina extraction values should be used for yearly comparison only as commercial mills will see much higher extraction values. Semolina extraction for this crop is 54.6%, indicating a reduction in extraction from last year. Ash is slightly higher at 0.65%, mirroring the higher kernel ash in this year's crop. Speck count is lower than both last year and the five-year average. Semolina protein is 14.2%, much higher than last year due to higher kernel protein. Gluten index values are 81%, higher than

APPROXIMATE SHARE OF REGIONAL PRODUCTION



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both 2020 and the five-year average, in part due to variety impacts.

SEMOLINA color shows similar to the 2020 crop, with b values (yellow color) and L values (brightness) just slightly lower. Mixing properties reveal a stronger crop than last year and the five-year average with a mixogram classification of 6.7. Cooked spaghetti evaluations show color similar to the five-year average (color score of 8.3 on a scale of 1-12) and higher cooked weight and firmness. Cooking loss is higher than last year.

BUYERS will find the 2021 durum crop to be of high quality, especially for grading and kernel characteristics. Although lower than previous years, test weights are stronger than expected, and damage is low. There is no shortage of protein in this year's crop and falling number values indicate a sound crop. Lower thousand kernel weights and a reduction in the percentage of large sized kernels will likely reduce milling yields. Dough properties look to be strong as well as cooked pasta characteristics. The main issues buyers will face is lower supply levels. Customers should also continue to be diligent in contract specifications given that a small portion of the crop did see some rainfall at harvest.

SEASONAL CONDITIONS

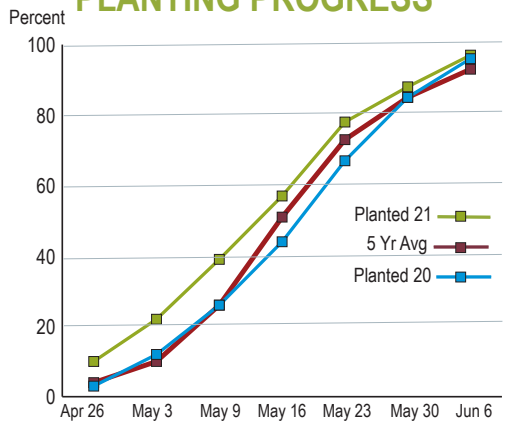
PLANTING of the 2021 Northern Durum crop began earlier than normal in mid-April due to drier than normal soil conditions. Many producers had not received measurable precipitation since the previous summer and lower than normal snowfall over the winter months exacerbated the issue. Much of the durum was planted in severe to extreme drought conditions. At times planting was delayed due to cool conditions, and in some areas, producers waited for moisture. Planting continued at a faster than normal pace, with most producers finishing planting by the end of May.

THE GROWING SEASON was challenging for producers. The early planted crop was affected by cool, dry conditions that delayed emergence and produced uneven stands in fields. Temperatures became warmer than normal in mid-June and the continued hot, dry conditions impacted emergence, early plant growth, and reduced yield potential.

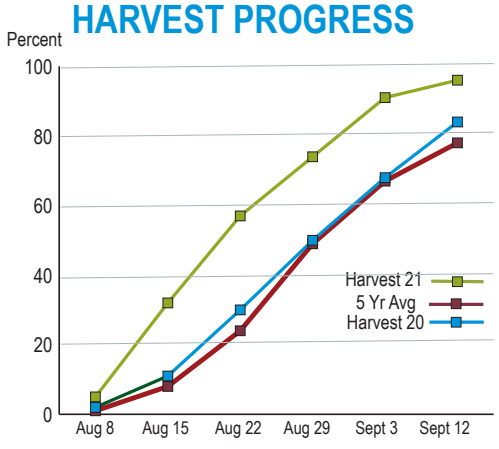
While some precipitation fell during the growing season, it was extremely variable and never consistent. Crop condition ratings declined throughout the growing season and were well below average, however, disease pressure was minimal due to dry conditions. Crop development was pushed ahead of average by the weather conditions with some of the crop heading out at very short heights. Overall, durum conditions and yield potential were quite variable and highly dependent on rainfall events.

HARVEST began in early August, earlier than normal due to crop development being pushed by the hot, dry conditions. In the driest areas, a share of the crop was abandoned or used for feed due to extremely low yields. Rains did delay progress in the latter portion of the harvest in northern areas, causing some isolated quality impacts, but the majority of the crop was harvested under dry conditions which secured a high quality crop overall.

PLANTING PROGRESS



HARVEST PROGRESS



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 weight percentage of kernels with a complete, hard and vitreous endosperm, the portion that makes semolina. For durum wheat, the subclasses are:

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

GRADING FACTORS	U.S. GRADES 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.	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[1]	3.0	5.0	8.0	12.0	20.0
Wheat of other class[2]					
Contrasting classes	1.0	2.0	3.0	10.0	10.0
Total[3]	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.

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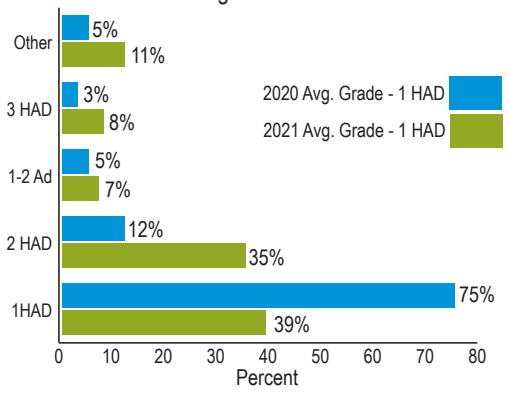
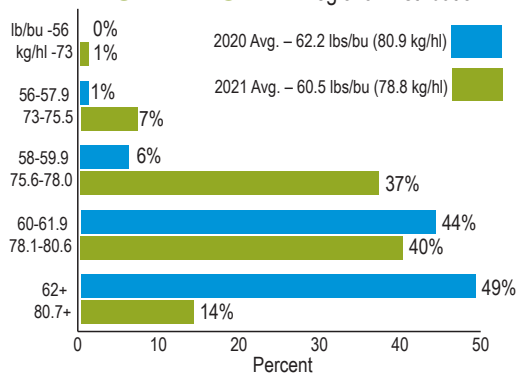
WHEAT GRADING DATA

STATE AND CROP REPORTING AREA	TEST WEIGHT LBS/BU	TEST WEIGHT KG/HL	DAMAGE %	SHRUNKEN/ BROKEN KERNELS %	TOTAL DEFECTS %	CONTRASTING CLASSES %	U.S. GRADE	VITREOUS KERNELS %
MONTANA								
Area A	59.9	78.0	0.0	0.6	0.6	0.3	2 HAD	90
Area B	59.6	77.6	0.0	1.1	1.2	2.0	2 HAD	94
State Avg 2021	59.6	77.7	0.0	1.0	1.1	1.7	2 HAD	93
State Avg 2020	62.0	80.7	0.6	0.5	1.2	0.5	1 HAD	90
NORTH DAKOTA								
Area A	60.9	79.3	0.0	0.9	1.0	0.3	1 HAD	79
Area B	61.7	80.3	0.4	0.5	1.0	0.6	1 HAD	83
Area C	61.2	79.7	1.1	0.5	1.6	0.0	1 HAD	83
Area D	60.7	79.1	0.2	1.6	1.8	1.0	1 HAD	94
State Avg 2021	61.0	79.4	0.2	0.9	1.2	0.5	1 HAD	83
State Avg 2020	62.3	81.1	1.2	0.6	1.8	0.4	1 HAD	86
TWO-STATE AVERAGE								
Avg 2021	60.5	78.8	0.1	1.0	1.2	0.9	1 HAD	86
Avg 2020	62.2	80.9	0.9	0.6	1.5	0.4	1 HAD	88
Five-Year Avg	61.2	79.7	0.7	0.8	1.6	0.3	1 HAD	84

GRADE – Regional Distribution

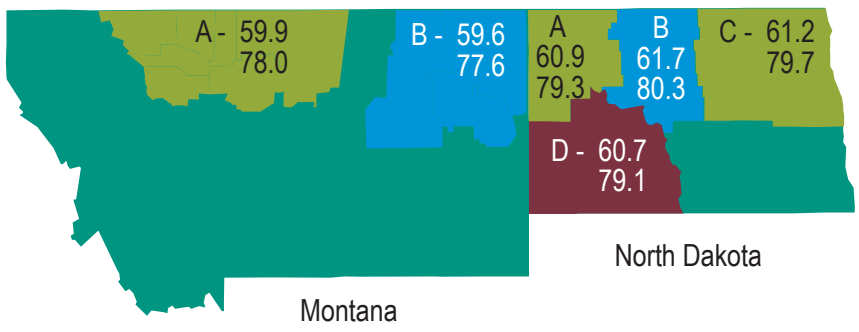


TEST WEIGHT – Regional Distribution

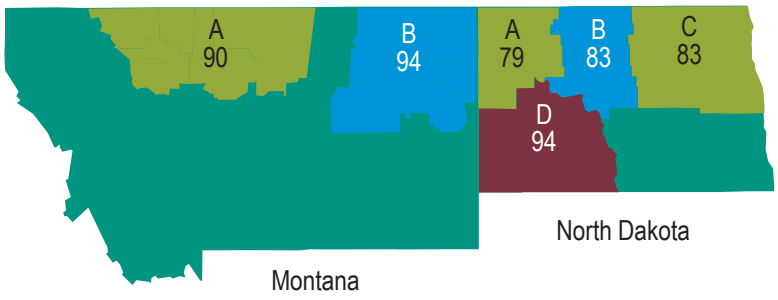


AVERAGE TEST WEIGHT BY AREA

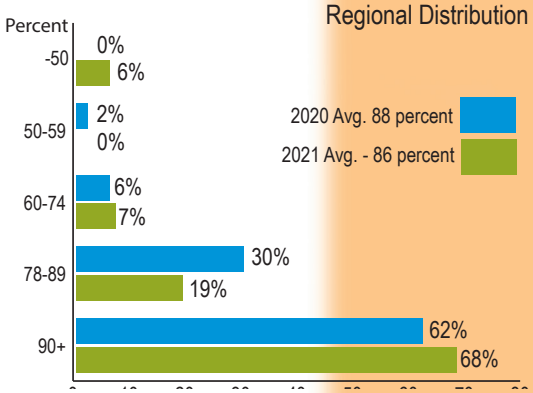
lbs/bu
kg/hl



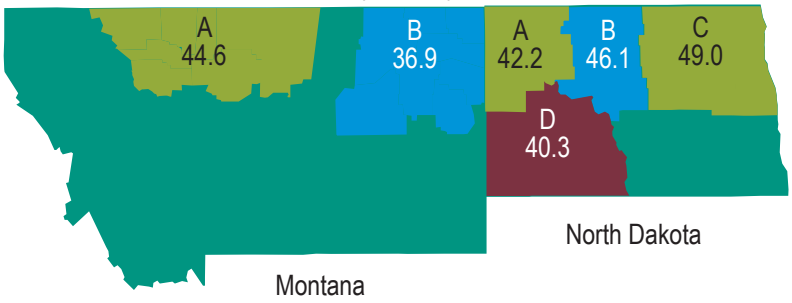
AVERAGE VITREOUS KERNEL BY AREA
(Percent)



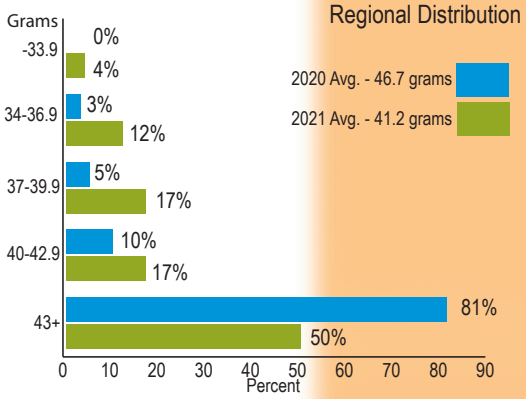
VITREOUS KERNEL
Regional Distribution



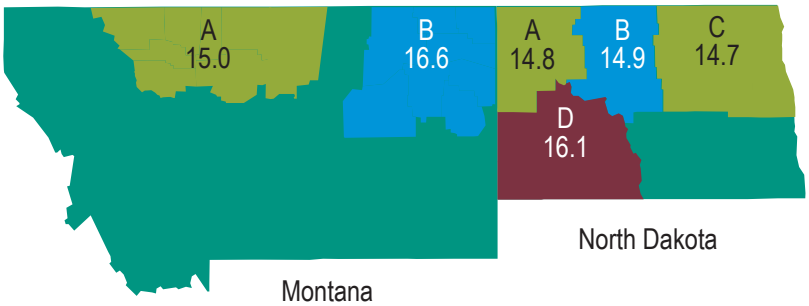
AVERAGE 1000 KERNEL WEIGHT BY AREA
(Grams)



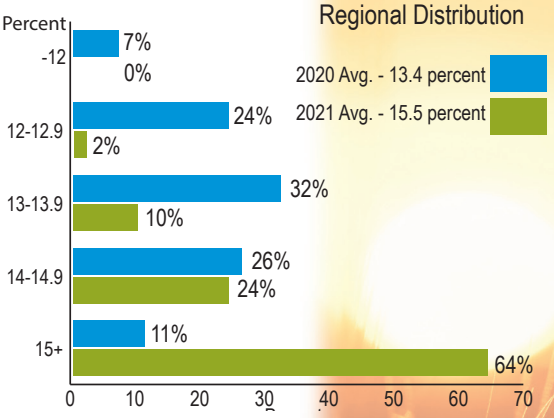
1000 KERNEL WEIGHT
Regional Distribution



AVERAGE PROTEIN BY AREA
12% Moisture Basis - Percent



PROTEIN - 12% MOISTURE
Regional Distribution



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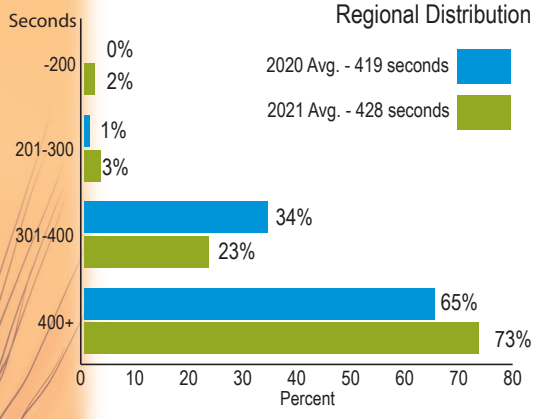
OTHER KERNEL QUALITY DATA

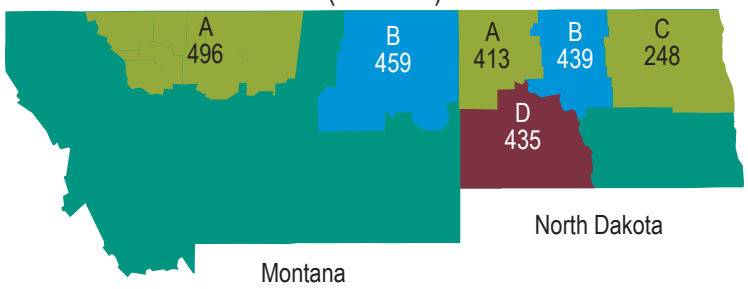
STATE AND CROP REPORTING AREA	DOCKAGE %	MOISTURE %	1000 KERNEL WEIGHT G	KERNEL DIST. MED/LGE %	PROTEIN 12%/0% MOISTURE BASIS %	DON (PPM)	WHEAT ASH %	FALLING NUMBER (SEC)	MICRO SED (CC)
MONTANA									
Area A	0.7	10.6	44.6	49/48	15.0/17.0	0.0	1.50	496	91
Area B	0.3	10.5	36.9	73/19	16.6/18.9	0.0	1.78	459	80
State Avg 2021	0.4	10.5	38.1	69/23	16.4/18.6	< 0.1	1.74	464	82
State Avg 2020	0.8	9.8	46.7	40/58	13.4/15.3	0.1	1.58	441	60
NORTH DAKOTA									
Area A	0.6	11.1	42.2	55/41	14.8/16.8	0.0	1.71	413	79
Area B	0.5	11.7	46.1	42/55	14.9/16.9	0.0	1.63	439	76
Area C	0.5	12.1	49.0	33/66	14.7/16.7	0.0	1.60	248	73
Area D	0.5	9.9	40.3	67/26	16.1/18.3	0.0	1.58	435	75
State Avg 2021	0.6	11.0	42.9	54/42	15.1/17.1	< 0.1	1.67	409	77
State Avg 2020	0.8	11.4	46.8	40/58	13.4/15.3	0.3	1.57	402	64
TWO-STATE AVERAGE									
Avg 2021	0.5	10.9	41.2	59/36	15.5/17.6	< 0.1	1.69	428	79
Avg 2020	0.8	10.7	46.7	40/58	13.4/15.3	0.2	1.57	419	62
Five-Year Avg	0.8	11.4	42.1	44/53	13.9/15.8	0.4	1.54	398	65

FALLING NUMBER



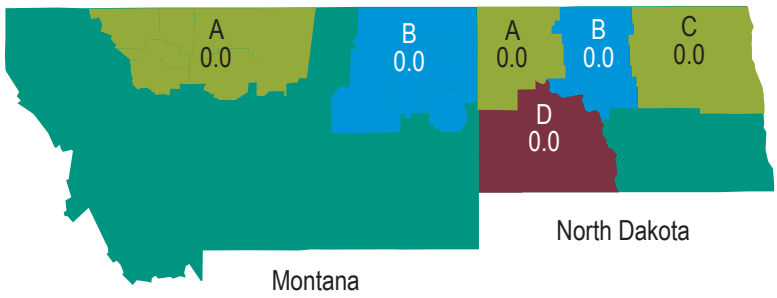
AVERAGE FALLING NUMBER BY AREA

(Seconds)



AVERAGE DON BY AREA

(PPM)



MILLING CHARACTERISTICS

TOTAL EXTRACTION represents the portion of the kernel that can be milled into flour and semolina.

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.

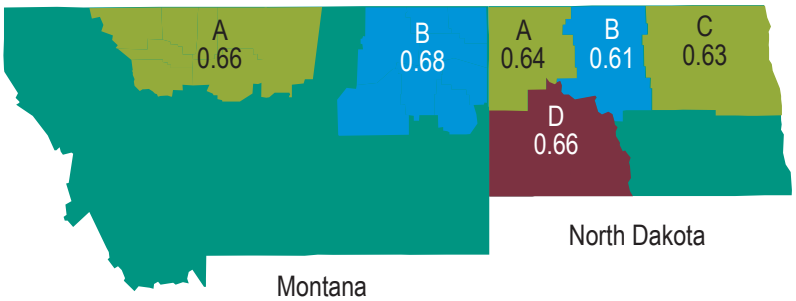
SPECKS appear in semolina when small particles of bran or other material escape the cleaning and purifying process. Millers can control speck count by selecting durum that is free of disease and foreign material, thoroughly cleaning the durum, properly tempering and conditioning the wheat before milling,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

MIXOGRAM curves reveal important information about the dough quality of semolina and ultimately about the potential cooked firmness of pasta. Mixograms are rated on a scale of 1 to 8, with the higher values indicating stronger mixing characteristics.

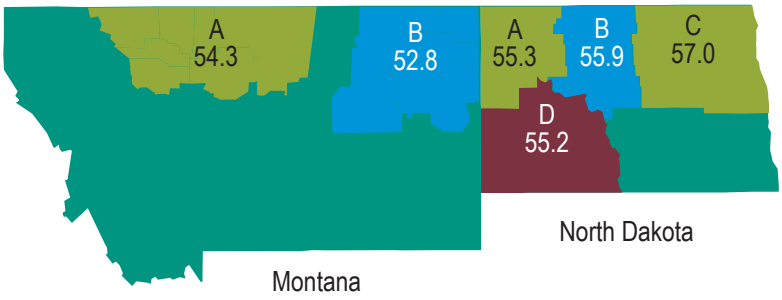
AVERAGE ASH CONTENT BY AREA

(Percent)



AVERAGE SEMOLINA EXTRACTION BY AREA

(Percent)



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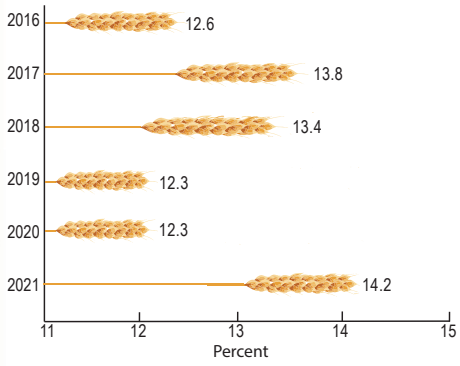
SEMOLINA QUALITY DATA

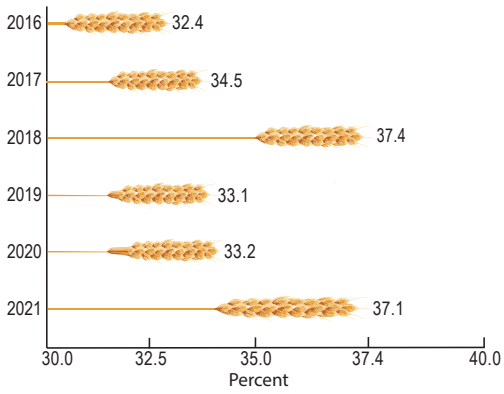
STATE AND CROP REPORTING AREA	TOTAL EXTRACTION[1] %	SEMOLINA EXTRACTION[1] %	ASH[1] %	SPECKS NO/10 SQ IN[1] %	PROTEIN (14% MOISTURE) %	WET GLUTEN %	GLUTEN INDEX %	MIXOGRAM CLASSIFICATION SCALE 1-8
MONTANA								
Area A	n/a	54.3	0.66	17	13.7	35.6	93	8.0
Area B	n/a	52.8	0.68	20	15.2	39.5	78	7.0
State Avg 2021	n/a	53.0	0.68	20	15.0	38.9	80	7.2
State Avg 2020	n/a	58.2	0.67	28	12.3	32.9	74	6.1
NORTH DAKOTA								
Area A	n/a	55.3	0.64	20	13.5	35.1	84	7.0
Area B	n/a	55.9	0.61	25	13.6	36.3	79	6.0
Area C	n/a	57.0	0.63	23	13.3	35.7	81	6.0
Area D	n/a	55.2	0.66	22	14.7	39.7	75	5.0
State Avg 2021	n/a	55.5	0.64	21	13.7	36.1	82	6.4
State Avg 2020	n/a	58.5	0.62	32	12.3	33.4	75	6.0
TWO-STATE AVERAGE								
Avg 2021	n/a	54.6	0.65	21	14.2	37.1	81	6.7
Avg 2020	n/a	58.5	0.64	30	12.3	33.2	74	6.0
Five-Year Avg	n/a	n/a	0.67	29	12.8	33.6	69	5.7

1. The 2019 - 2021 samples were milled on a Quad Junior Mill. Prior years were milled on a Buhler Lab Mill. As a result, no total extraction data is available, and comparison for semolina extraction and ash values is limited in reference to 5 year average values.

SEMOLINA PROTEIN – Regional Average

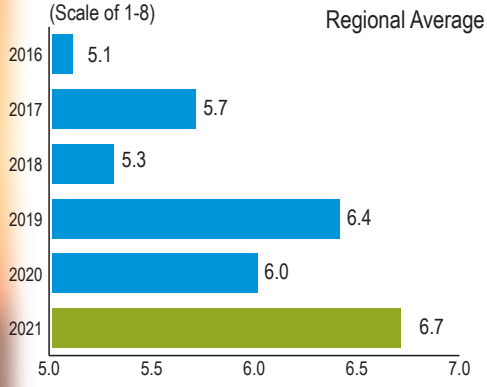


WET GLUTEN – Regional Average



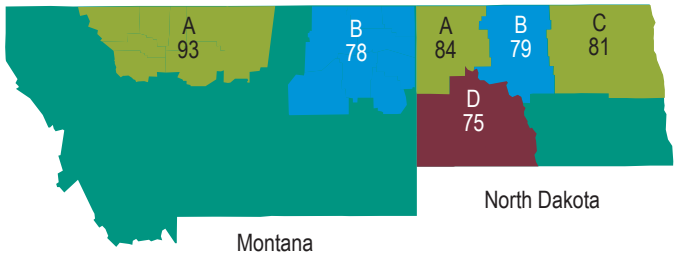
MIXOGRAM CLASSIFICATION

(Scale of 1-8) Regional Average



AVERAGE GLUTEN INDEX BY AREA

(Percent)



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 SCORE (1-12)	SPAGHETTI COOKED WEIGHT G	SPAGHETTI COOKING LOSS %	SPAGHETTI COOKED FIRMNESS G CM
MONTANA							
Area A	82.7	-2.1	32.9	8.5	32.2	8.2	4.8
Area B	83.1	-2.2	30.2	8.0	32.2	7.7	5.1
State Avg 2021	83.0	-2.2	30.6	8.1	32.2	7.8	5.0
State Avg 2020	83.6	-2.3	30.6	8.6	30.9	7.1	3.6
NORTH DAKOTA							
Area A	83.5	-2.4	30.2	8.5	32.8	8.1	4.8
Area B	83.6	-2.4	29.3	8.5	32.3	8.4	4.8
Area C	83.6	-2.5	28.7	8.0	32.1	8.1	4.7
Area D	83.3	-2.4	30.5	8.0	32.1	7.8	4.5
State Avg 2021	83.5	-2.4	30.1	8.4	32.5	8.1	4.7
State Avg 2020	83.8	-2.6	30.2	8.5	31.1	7.2	3.6
TWO-STATE AVERAGE							
Avg 2021	83.3	-2.3	30.2	8.3	32.4	8.0	4.8
Avg 2020	83.7	-2.4	30.4	8.5	31.0	7.2	3.6
Five-Year Avg	83.6	-2.5	29.9	8.4	31.1	6.4	4.2

PASTA CHARACTERISTICS

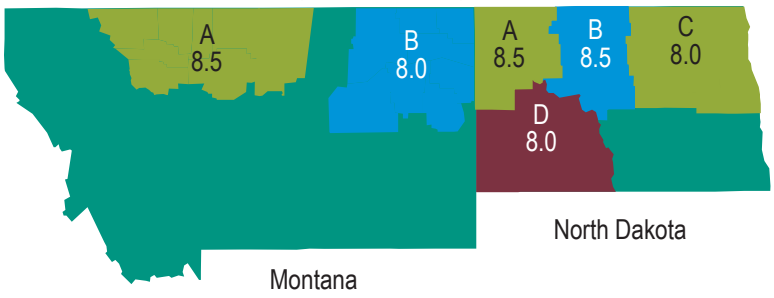
DRY PASTA PROCESSORS want a finished product that is visually appealing, elastic and strong enough to resist breakage during cutting, packaging, handling and shipping, able to withstand the rigors of cooking, and satisfying to the consumer palate.

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 COLOR SCORE BY AREA

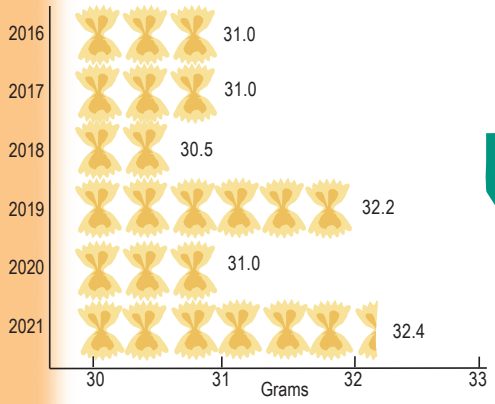
(Scale of 1-12)



U.S. DURUM WHEAT

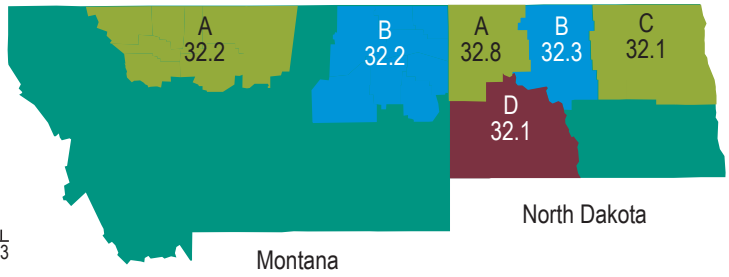
MONTANA | NORTH DAKOTA

COOKED WEIGHT – Regional Average

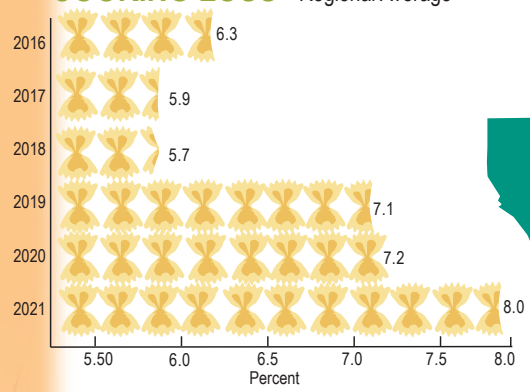


AVERAGE COOKED WEIGHT BY AREA

(Grams)

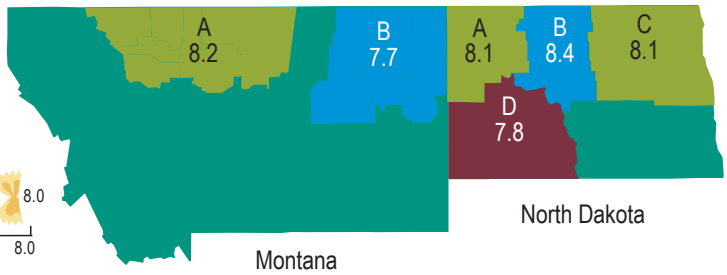


COOKING LOSS – Regional Average

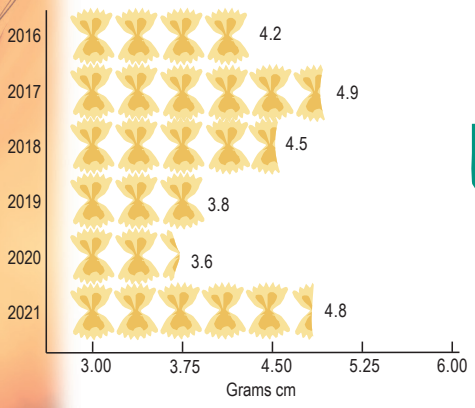


AVERAGE COOKING LOSS BY AREA

(Percent)

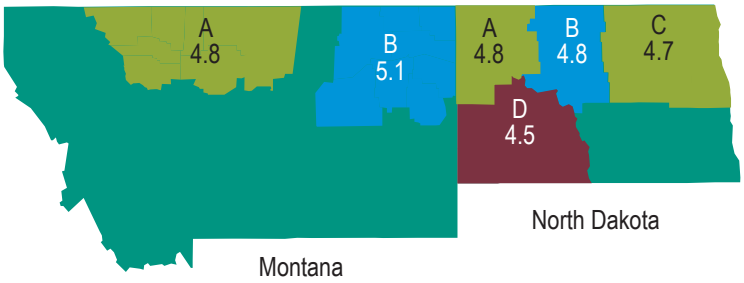


COOKED FIRMNESS – Regional Average



AVERAGE COOKED FIRMNESS BY AREA

(G CM)



RECENT QUALITY TRENDS

	2021	2020	2019	2018	2017	2016	FIVE-YEAR AVERAGE
GRADING AND WHEAT DATA							
Test Weight (lbs/bu)	60.5	62.2	61.1	61.4	60.9	61.2	61.2
Test Weight (kg/hl)	78.8	80.9	79.6	79.9	79.4	79.7	79.7
Total Defects (%)	1.2	1.5	3.0	1.0	1.2	1.2	1.6
Vitreous Kernels (%)	86	88	64	90	88	90	84
Grades	1 HAD	1 HAD	2 AD	1 HAD	1 HAD	1 HAD	1 HAD
OTHER WHEAT DATA							
Dockage (%)	0.5	0.8	1.3	0.7	1.1	0.2	0.8
Protein: 12% moisture	15.5	13.4	13.9	14.5	14.5	13.4	13.9
1000 Kernel Weight (gm)	41.2	46.7	44.2	41.2	38.4	40.0	42.1
Moisture (%)	10.9	10.7	12.2	11.2	11.3	11.4	11.4
DON		0.6	0.2	<0.5	1.0		
Ash (%)	1.69	1.57	1.51	1.54	1.46	1.61	1.54
Falling Number (sec)	428	419	345	425	380	423	398
Sedimentation (cc)	79	62	61	61	87	54	65
SEMOLINA DATA							
Total Extraction (%)	n/a	n/a	n/a	74.0	72.2	73.6	n/a
Semolina Extraction (%)	54.6	58.5	57.5	69.3	68.5	67.9	n/a
Ash (%)	0.65	0.64	0.60	0.73	0.69	0.71	0.67
Wet Gluten (%)	37.1	33.2	33.1	37.4	34.5	32.4	33.6
Specks (no/10 sq in)	21	30	31	29	26	30	29
Protein (%)	14.2	12.3	12.3	13.4	13.8	12.6	12.8
Gluten Index (%)	81	74	67	57	86	61	69
Mixograph Classification	6.7	6.0	6.4	5.3	5.7	5.1	5.7
*Color: L (black-white)	83.3	83.7	82.9	83.6	83.3	84.3	83.6
*a (green-red)	-2.3	-2.4	-2.4	-2.5	-2.3	-2.8	-2.5
*b (blue-yellow)	30.2	30.4	29.3	29.9	29.4	30.3	29.9
SPAGHETTI PROCESSING DATA							
Color Score (scale of 1-12)	8.3	8.5	7.8	8.3	9.0	8.5	8.4
L (black-white)	53.1	54.4	51.8	52.8	54.4	53.5	53.4
b (blue-yellow)	25.1	26.5	24.2	25.6	27.1	26.4	26.0
Cooked Weight (gm)	32.4	31.0	32.2	30.5	31.0	31.0	31.1
Cooking Loss (%)	8.0	7.2	7.1	5.7	5.9	6.3	6.4
Cooked Firmness (g cm)	4.8	3.6	3.8	4.5	4.9	4.2	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.

U.S. DURUM WHEAT

MONTANA | NORTH DAKOTA

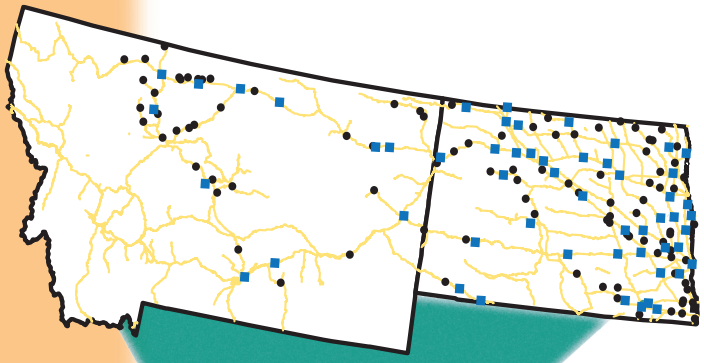
HANDLING & TRANSPORTATION

The durum wheat growing region in the Northern Plains has a vast network of country elevators to facilitate efficient and precise movement to domestic and export markets. On average, nearly 80 percent of the region's wheat moves to markets by rail. Duluth is the only export market easily serviced by trucks. Shipments to the Pacific Northwest and Gulf export markets are almost entirely by rail, with some barge movement to the Gulf. The dominant railroad is the Burlington Northern Santa Fe, followed by the Canadian Pacific.

A growing number of elevators in the region are investing to ship 100-110 car units in "shuttle" trains. Each rail car holds approximately 3,500 bushels (95 metric tons) of wheat. Shuttle-equipped facilities receive the lowest rates, sharing volume and transaction efficiencies with the railroad.

The diverse rail shipping capacities and widespread network of elevators are strengths buyers can capitalize on, especially as their demand heightens for more precise quality specifications and consistency between shipments. Buyers are encouraged to explore origin-specific shipments to optimize quality and value.

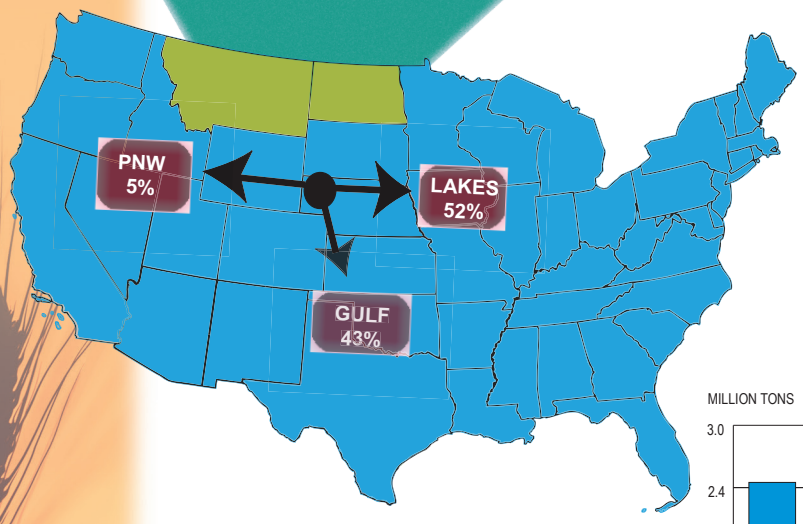
The rail and elevator network in the U.S. northern grown durum region is well suited for meeting the increasing quality demands of both domestic and international customers.



● Track for 50 to 99 rail cars
■ Track for 100 or more cars

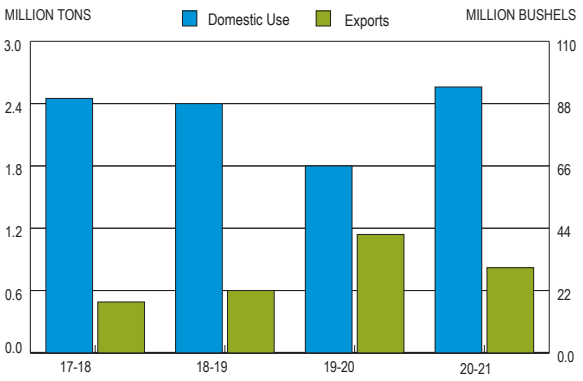
Source: Upper Great Plains Transportation Institute

Grain Handling and Transportation Facilities in the Two-State Region



AVERAGE SHARE OF U.S. DURUM EXPORTS BY PORT (2017-2020)

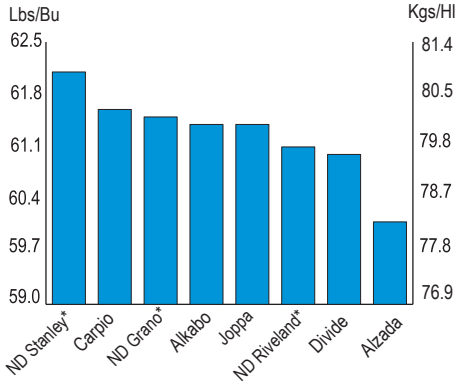
2017-20 U.S. DURUM DOMESTIC USE AND EXPORTS



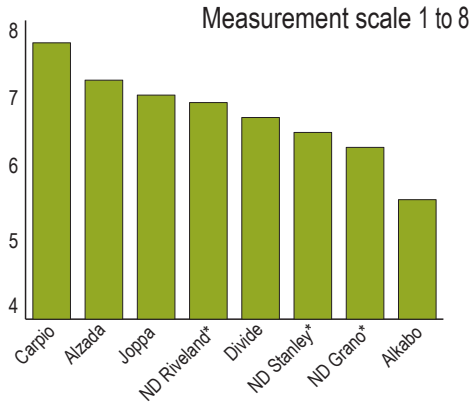
Marketing Year (June - May)

VARIETAL INFORMATION

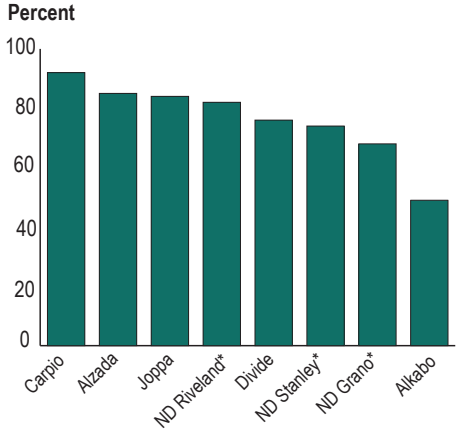
TEST WEIGHT



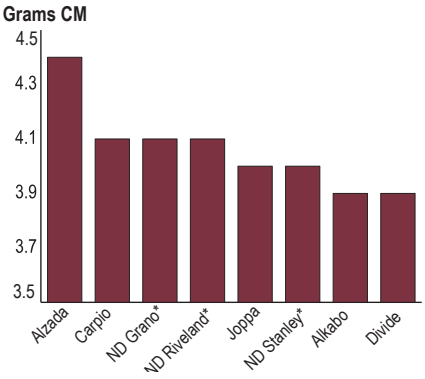
MIXOGRAPH



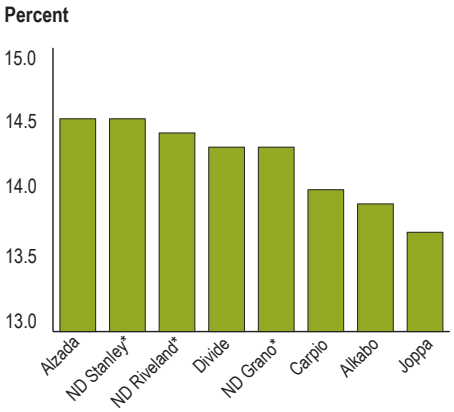
GLUTEN INDEX



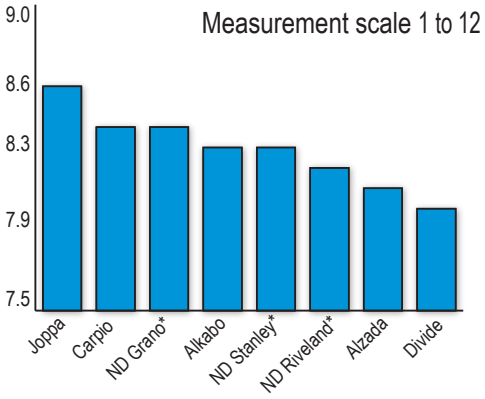
COOKED FIRMNESS



KERNEL PROTEIN



PASTA COLOR



THESE TABLES illustrate the quality evaluation of some of the most popular varieties (cultivars), for key kernel and end-use parameters during the 2016-2020 growing seasons. A commitment to extensive end-use quality testing of new cultivars during the development stages is a major priority for producers in the region. The goal is to develop and release cultivars that excel in numerous kernel, milling and end-product parameters, across a broad environment.

* Low Cadmium Varieties

U.S. DURUM WHEAT

MONTANA | NORTH DAKOTA

MAJOR VARIETIES PRODUCED IN REGION • AGRONOMIC FACTORS

	AGRONOMIC DESCRIPTION					AVERAGE YIELD[3]	
VARIETY	AGENT or ORIGIN[1]	YEAR RELEASED	STRAW STRENGTH (1-9)	PLANT HEIGHT INCHES	FOLIAR DISEASE[2] (1-9)	BU/PER ACRE	MT/PER HECTARE
Alkabo	ND	2005	2	30	5	50.3	3.38
Alzada	WB	2004	6	26	8	40.6	2.73
Carpio	ND	2012	5	31	5	51.8	3.48
Divide	ND	2005	5	31	5	50.8	3.42
Joppa	ND	2013	5	31	5	52.5	3.53
ND Grano*	ND	2017	5	31	7	52.2	3.51
ND Riveland*	ND	2017	4	32	5	53.4	3.59
ND Stanley*	ND	2021	4	30	4	53.6	3.6

GROWN AND TESTED ACROSS NORTH DAKOTA • QUALITY & END-USE FACTORS

	QUALITY FACTORS[4]								
VARIETY	TEST WEIGHT LB/BU	TEST WEIGHT KG/HL	WHEAT PROTEIN %	WHEAT FALLING # SECONDS	MIXOGRAM SCORE (SCALE 1-8)	PASTA COLOR (SCALE 1-12)	GLUTEN INDEX %	COOKED FIRMNESS G CM	OVERALL PASTA QUALITY RATING[5]
Alkabo	61.4	79.9	13.9	401	5.6	8.3	49	3.9	good
Alzada	60.1	78.3	14.5	499	7.2	8.1	85	4.4	good
Carpio	61.6	80.2	14.0	471	7.7	8.4	92	4.1	good
Divide	61.0	79.4	14.3	460	6.7	8.0	76	3.9	good
Joppa	61.4	79.9	13.7	445	7.0	8.6	84	4.0	good
ND Grano*	61.5	80.1	14.3	458	6.3	8.4	68	4.1	good
ND Riveland*	61.1	79.6	14.4	453	6.9	8.2	82	4.1	good
ND Stanley*	62.1	80.8	14.5	470	6.5	8.3	74	4.0	good

* Low Cadmium

Source: 2021 North Dakota Durum Wheat Variety Performance Descriptions

1. ND – North Dakota State University, and WB – Westbred.
2. Foliar Disease includes tan spot and septoria: 1 to 9 scale, with 1 = resistant and 9 very susceptible.
3. Yield trials 2016-20 crop years grown at Carrington, Dickinson, Hettinger, Langdon, Minot and Williston, North Dakota.
4. Based on NDSU Durum Quality Lab testing of 2016-20 samples grown at Carrington, Casselton, Dickinson, Hettinger, Langdon, Minot and Williston, North Dakota. Does not include samples from 2016 Langdon and Carrington, 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 AND MONTANA

THE TOP four durum varieties planted in North Dakota in 2021 are Joppa, ND Riveland, Divide and Alkabo, accounting for nearly two-thirds of the acres. In Montana, the top four varieties in 2021 are Divide, Alzada, ND Riveland, and Joppa, accounting for nearly sixty percent of the acres.

JOPPA accounts for 26.5 percent of the acres in North Dakota, and 12.3 percent of the acres in Montana. It has been the leading variety in North Dakota for five straight years, and ranks third in Montana. Released by 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.

ND RIVELAND advanced into second position in North Dakota with nearly 23 percent of the acres, double the level from 2020. It ranks third in Montana with 13.4 percent of the acres, also up sharply from 2020. Released by NDSU in 2017, it is a variety with elite yield potential and very good agronomic characteristics. ND Riveland is a variety with low cadmium (cd) uptake traits, and possesses very good end-use quality characteristics.

ALKABO accounts for 6.1 percent of the acreage in North Dakota in 2021, steady with it's 2020 acreage share. It is a 2005 release from NDSU, and is noted for exceptionally strong straw, and is rated good for end-use quality with high scores for color.

DIVIDE is the top variety planted in Montana with 16.9 percent of the acres, nearly double the 2020 share. It ranks third in North Dakota with nearly 10 percent of the acres, but down from it's recent highs. Divide was released in 2005 from NDSU, and remains popular with producers for its high yield potential and higher relative ratings for disease tolerance. It is rated good for end-use quality.

ALZADA is the second most popular variety in Montana with 16 percent of the acres, down from 35 percent in 2020. 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 good yield and agronomic traits with uniquely strong gluten properties and excellent cooking quality.

NORTH DAKOTA VARIETY SHARE OF 2021 PLANTED ACRES BY CROP DISTRICT

VARIETY	NORTH WEST	WEST CENTRAL	SOUTH WEST	COMBINED DISTRICTS[1]	TOTAL STATE
	PERCENTAGE (%)[2]				
Joppa	8.8	24.7	66.6	30.3	26.5
ND Riveland	20.4	12.2	8.0	28.5	20.0
Divide	13.3	18.9	0.0	6.9	11.0
Alkabo	7.4	5.2	0.0	17.3	8.6
VT Peak	8.9	11.2	4.5	0.4	6.7
Carpio	8.0	12.7	0.0	2.2	6.3
ND Grano	3.2	2.0	1.1	5.6	3.4
Other[3]	6.6	5.2	12.2	16.2	9.3

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 in 2021 and unknown varieties.
4. September 30, 2021 small grain estimate 880,000 acres.

NORTH DAKOTA VARIETY SHARE OF PLANTED ACRES[3]

VARIETY	2021%	2020%[1]
Joppa	26.5	29.3
ND Riveland	22.6	11.0
Divide	9.7	20.0
Alkabo	6.1	6.3
VT Peak	5.3	8.6
Carpio	4.9	6.7
ND Grano	3.5	2.9
Other[2]	21.4	15.2

1. Percentage may not add to 100 due to rounding.
2. Includes varieties with less than 1% of acreage in 2020 and unknown varieties.
3. 1,000 acres (1 acre = 0.405 hectares)
   2021 – 880,000 acres
   2020 – 910,000 acres

MONTANA VARIETY SHARE OF PLANTED ACRES[3]

VARIETY	2021%[1]	2020%[1]
Divide	16.9	8.8
Alzada	16.0	35.2
ND Riveland	13.4	1.0
Joppa	12.3	22.5
Transcend	10.7	5.3
Carpio	3.3	1.0
Other[2]	27.4	26.2

1. Percentage may not add to 100 due to rounding.
2. Includes varieties with less than 1% of acreage in 2020 and unknown varieties.
3. 1,000 acres (1 acre = 0.405 hectares)
   2021 – 670,000 acres
   2020 – 695,000 acres

U.S. DURUM WHEAT

MONTANA | NORTH DAKOTA

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, professor, 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 early August and continued through late September. A total of 226 samples were collected from Montana (84) and North Dakota (142). The goal for collection was 235 total samples.

ANALYSIS • Half of the total wheat samples collected were analyzed for grade 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 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, 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). Dockage may also include underdeveloped, shriveled and small pieces of wheat kernels removed in properly separating the material other than wheat and which cannot be recovered by properly rescreening or recleaning.

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 October 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; units 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.

MIXOGRAPH • Mixograph evaluation of semolina was performed according to the AACC Method 54-40.02 with some modifications: Ten grams of semolina (weighed on 14 percent moisture basis) were mixed for 8 min at constant water absorption of 5.8 ml, using a spring setting of 8. The mixograms were scored by comparing them to reference mixograms. A scale of 1 to 8 is employed, higher values indicate strong mixing characteristics (see reference mixogram chart).

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.

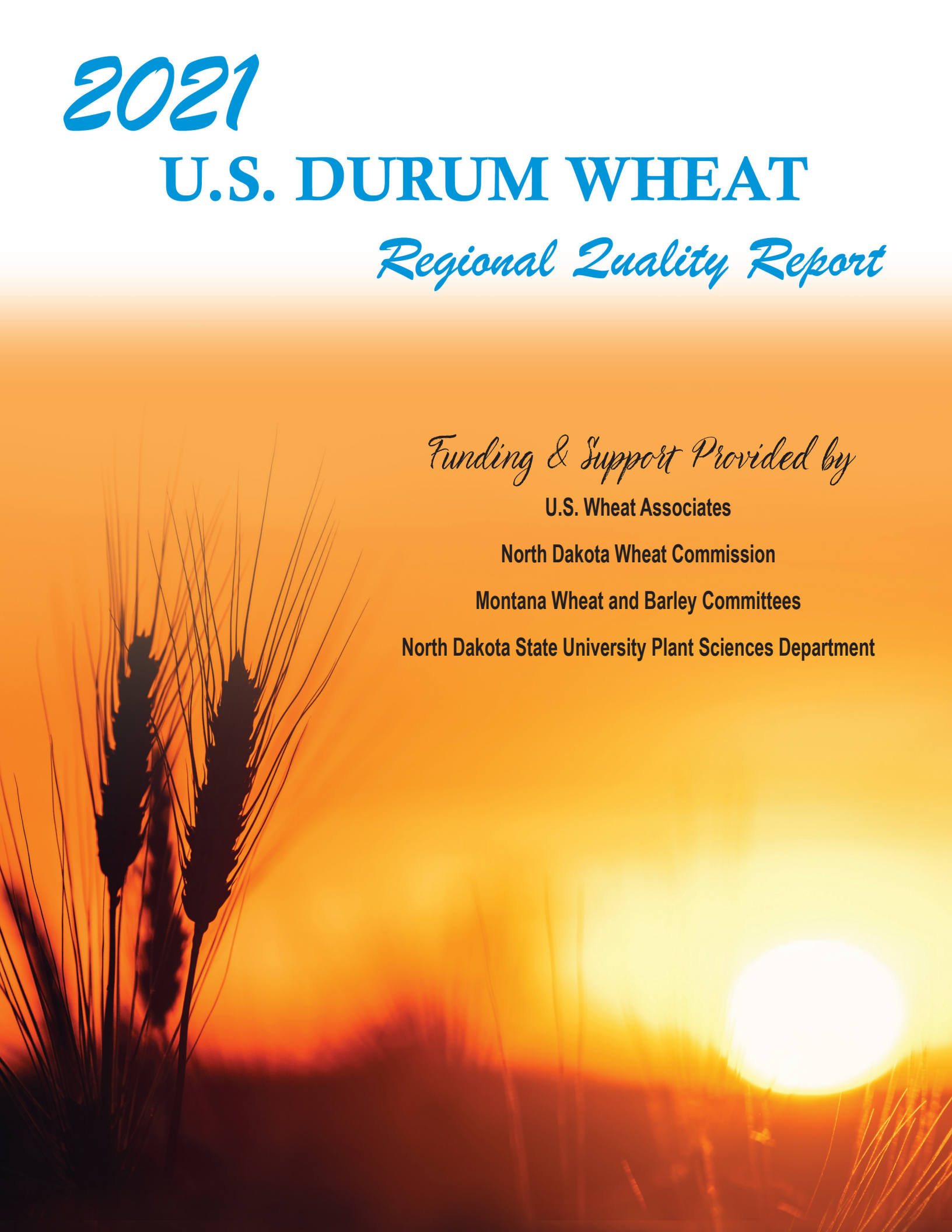
COOKING LOSS • AACC Method 66-50.01. Solids lost to the cooking water. After drying the residue was weighed and reported as percentage of the original dry sample.

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

2021

U.S. DURUM WHEAT

Regional Quality Report



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