2022

U.S. DURUM WHEAT

Regional Quality Report

U.S. DURUM Wheat

MONTANA | NORTH DAKOTA

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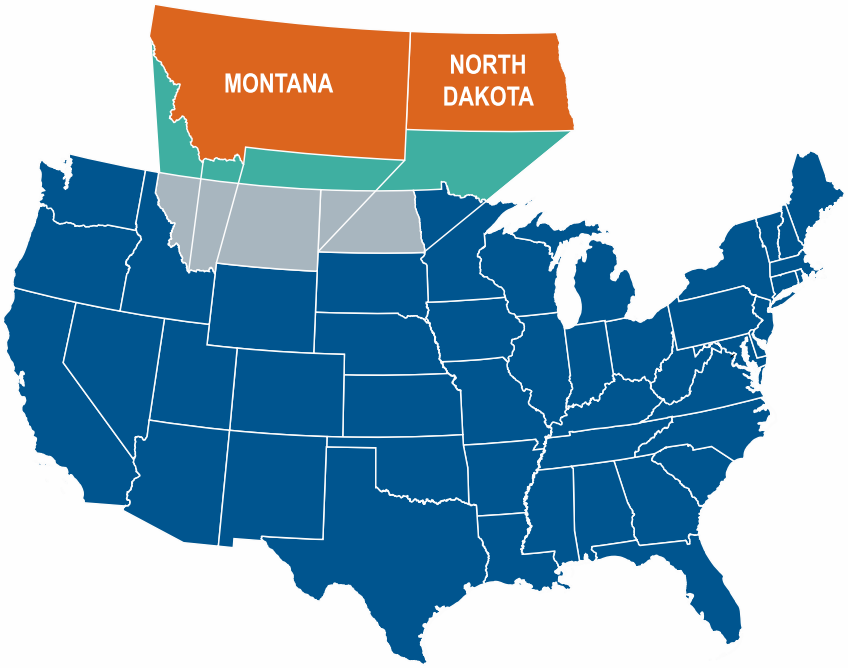
MAKING PREMIUM PASTA

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 2022 U.S. NORTHERN DURUM CROP, produced in North Dakota and Montana, is nearly 70% larger in production compared to 2021, and boasts excellent grade and kernel attributes, and high color scores for semolina and pasta. Production was boosted by ample growing season moisture and favorable temperatures for a large part of the region leading to above average yields, in spite of an extremely late, and delayed planting season. Some dramatic differences did exist in available growing season moisture across the region, creating a wider distribution for some factors, and subpar yields in areas.

PRODUCTION DATA

	2022	2021	2017-21 AVERAGE
MILLION BUSHELS			
Montana	18.9	9.9	18.8
North Dakota	31.2	19.7	30.4
U.S. Total	**64.0**	**37.6**	**57.7**
MILLION METRIC TONS			
Montana	0.51	0.27	0.51
North Dakota	0.85	0.54	0.83
U.S. Total	**1.74**	**1.02**	**1.57**

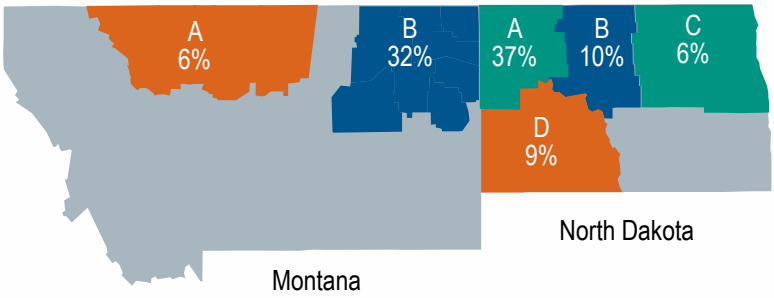
Source: USDA 2022 Small Grains Summary

The crop GRADES an average of U.S. No. 1 Hard Amber Durum (HAD), with nearly three-fourths of the crop grading No. 1 HAD, up from just 39% in 2021. High test weights, little to no damaged kernels, and high vitreous kernel counts led to the high grading parameters on the crop, the result of minimal disease pressures during the growing season, and a mostly dry harvest period. Average test weight is 61.8 lb./bu. (80.4 kg/hl), above last year, and slightly higher than the five-year average. Eighty-five percent of the samples analyzed had a test weight of 60 lb/bu (78.1 kg/hl) or higher. Damage was quite low at 0.1%, well below the five-year average, but shrunken and broken kernels were similar to the five-year average at 1.0%, with a couple regions showing slightly higher levels due to moisture stress during kernel fill. Average crop moisture was just 11 percent.

The average VITREOUS KERNEL content (HVAC) is 92%, higher than 2021 and the five-year average, with more than two-thirds of the samples showing greater than 90% vitreous kernel levels. Less of the overall crop is showing vitreous counts lower than 74%, when compared to last year, but there are pockets in the region where vitreous levels were reduced due to low protein levels. Average crop protein is 13.7%, nearly two percentage points lower than last year's drought impacted crop, and 0.7% lower than the five-year average. The lower crop average protein was the result of well above-average yields in parts of the region, which offset higher protein levels in other areas which endured more heat and moisture stress during the growing season. While distributions show a lower skew to protein levels in the 2022 crop, still nearly 70 percent of the samples are above the trade standard of 13% protein.

The average THOUSAND KERNEL WEIGHT (TKW) is 40.4 grams, slightly lower than last year, and about 2 grams below the five-year average. A wider than normal spread in TKW exists across the region, as well as kernel size. Falling number values are high, with the average being 433 seconds, with 99 percent of the crop above 300 seconds. For a second consecutive year, DON is nearly non-existent in all production regions.

APPROXIMATE SHARE OF REGIONAL PRODUCTION



MILLING for the 2022 survey samples was performed on a Quadromat Junior mill, similar to the last three years. Semolina extraction is showing slightly lower than last year at 53.9%, but commercial mills are likely to see much higher extraction values. Some adjustment for smaller kernel size and lighter TKW in portions of the crop may be required. Ash is similar to last year at 0.64%,

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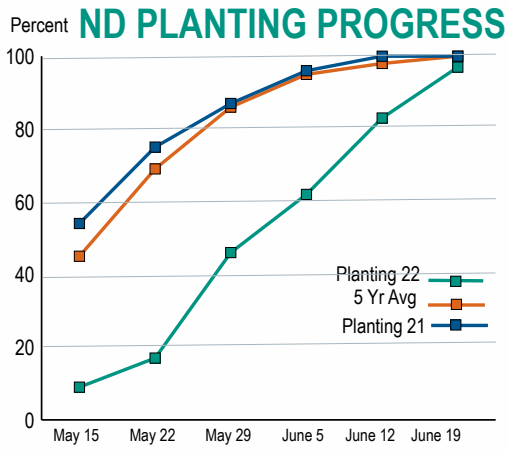
with speck counts higher than last year but similar to the five-year average. Semolina protein is 12%, well below recent years due to lower kernel protein. Similarly, gluten index values and wet gluten are both lower.

SEMOLINA color shows a notable improvement in the b value (yellow color) at 31.2, with similar brightness to the five-year average. Mixing properties reveal a slightly weaker crop, due in part to the lower protein content. Cooked spaghetti evaluations show improved color, with less cooking loss, but slightly lower cooked weight and firmness.

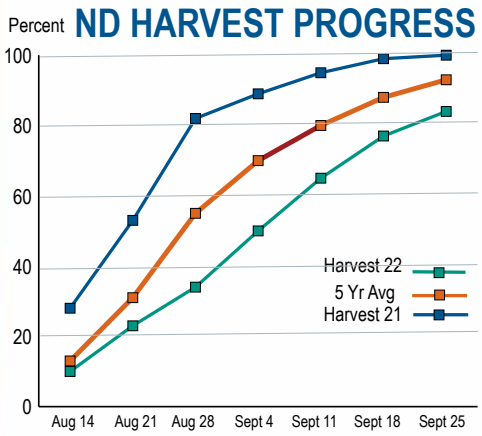
The 2022 crop will certainly meet the needs of **BUYERS,** not just with the larger production,but also with the excellent kernel, semolina and pasta qualities it shows. Protein levels may be a marketing challenge in portions of the crop, and in areas kernel size and weights are lower than typical, but on a crop average both factors are manageable. The high vitreous levels, low moisture, high test weights, little to no damage, sound kernel characteristics, and high color scores will provide tremendous value to buyers.

SEASONAL CONDITIONS

PLANTING of the Northern Durum crop began later than normal in mid-May. In contrast to the drought afflicted 2021 season, a large part of the region struggled with cold, wet conditions due to late season snowstorms and early May rains. Planting didn't finish until the third week of June in North Dakota, with some fields remaining to wet to plant. Planting pace was closer to normal across Montana as soils were drier.



The first part of the **GROWING SEASON** brought warmer, drier conditions. The ample moisture before and during planting helped sustain crop development during the drier periods, but portions of the crop in Montana were stressed. Timely precipitation fell in July for a good portion of the growing region, promoting strong yield potential in northwest North Dakota and portions of Montana. However, other portions of Montana remained short on precipitation and yields were lower in those areas. Given the late planting season, crop development was behind average throughout the growing season. Crop condition ratings were high due to improved moisture conditions, strong yield potential and limited disease pressure.



HARVEST began later than normal with the earlier planted crop seeing harvest in early August, while harvest on the later planted crop didn't begin until mid to late August. Once harvest got started, it continued with very few interruptions as rainfall was limited during most of August and September. Harvest continued into mid-October, with some rain interruptions on the later harvest. There were very few weather related quality issues on this year's crop.

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.

	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.	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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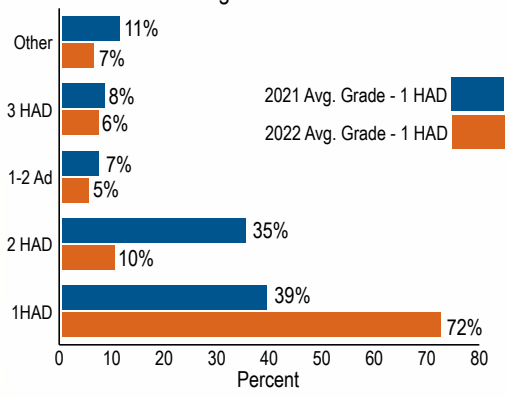
WHEAT GRADING DATA

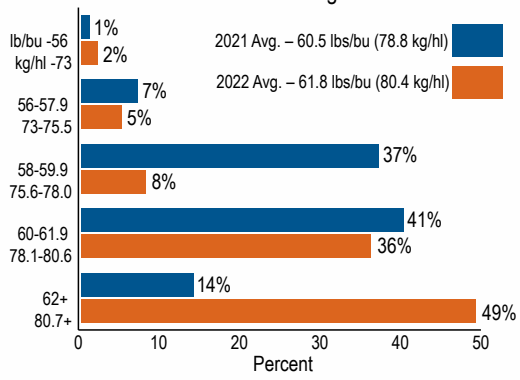
STATE AND CROP REPORTING AREA	TEST WEIGHT LBS/BU	TEST WEIGHT KG/HL	DAMAGE %	SHRUNKEN/ BROKEN KERNELS %	TOTAL DEFECTS %	CONTRASTING CLASSES %	U.S. GRADE	VITREOUS KERNELS %
MONTANA								
Area A	59.8	77.9	0.1	0.8	0.9	0.4	2 HAD	94
Area B	60.5	78.8	0.0	1.3	1.3	0.4	1 HAD	97
State Avg 2022	60.4	78.6	0.0	1.2	1.2	0.4	1 HAD	96
State Avg 2021	59.6	77.7	0.0	1.0	1.1	1.7	2 HAD	93
NORTH DAKOTA								
Area A	62.9	81.9	0.0	0.8	0.8	0.1	1 HAD	90
Area B	62.1	80.9	0.2	1.0	1.2	0.1	1 HAD	87
Area C	62.7	81.6	0.4	0.4	0.9	0.0	1 HAD	84
Area D	61.9	80.6	0.7	0.8	1.5	0.1	1 HAD	87
State Avg 2022	62.6	81.5	0.2	0.8	1.0	0.1	1 HAD	89
State Avg 2021	61.0	79.4	0.2	0.9	1.2	0.5	1 HAD	83
TWO-STATE AVERAGE								
Avg 2022	61.8	80.4	0.1	1.0	1.1	0.2	1 HAD	92
Avg 2021	60.5	78.8	0.1	1.0	1.2	0.9	1 HAD	86
Five-Year Avg	61.1	79.5	0.7	0.9	1.6	0.3	1 HAD	83

*Total defects includes foreign matter (FM), which is not displayed in the table.

GRADE – Regional Distribution

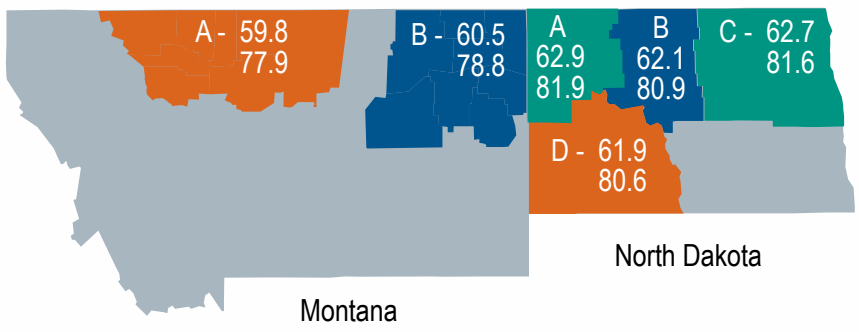


TEST WEIGHT – Regional Distribution



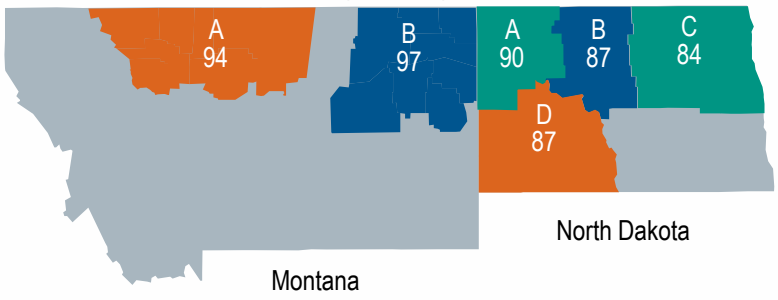
AVERAGE TEST WEIGHT BY AREA

lbs/bu
kg/hl



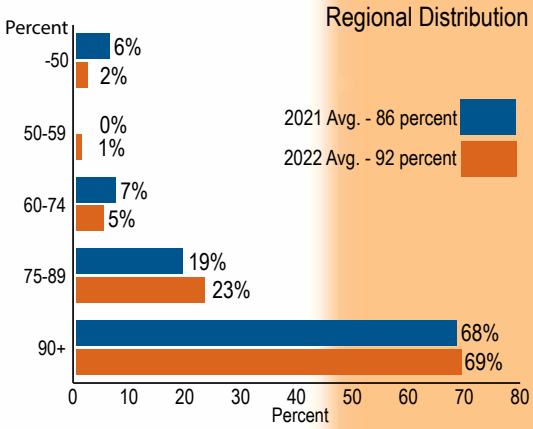
AVERAGE VITREOUS KERNEL BY AREA

(Percent)



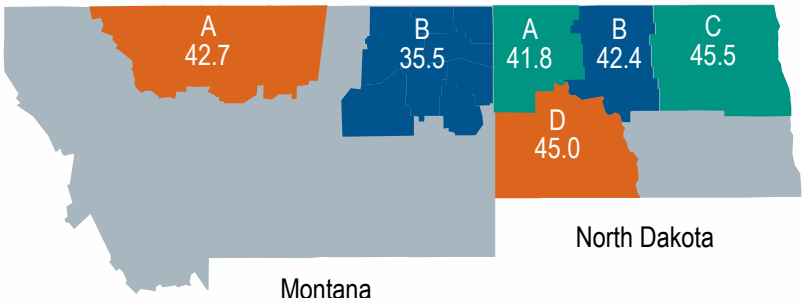
VITREOUS KERNEL

Regional Distribution



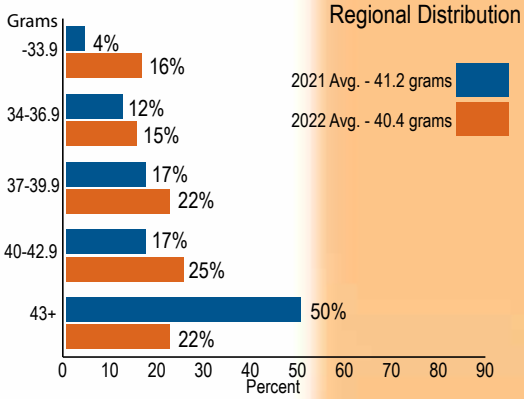
AVERAGE 1000 KERNEL WEIGHT BY AREA

(Grams)



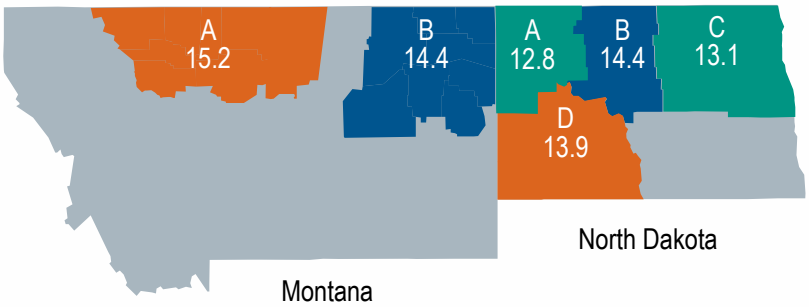
1000 KERNEL WEIGHT

Regional Distribution



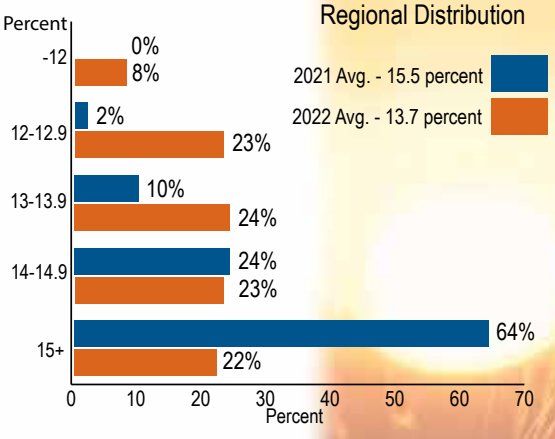
AVERAGE PROTEIN BY AREA

12% Moisture Basis - Percent



PROTEIN - 12% MOISTURE

Regional Distribution



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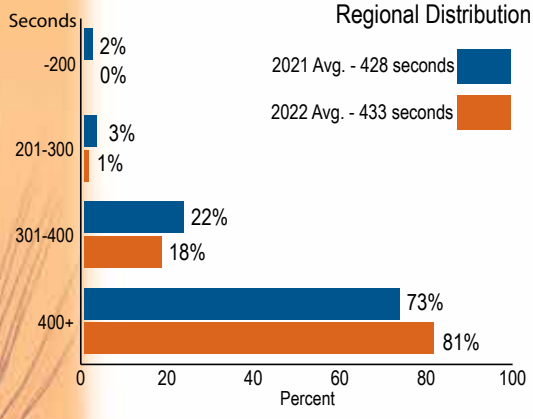
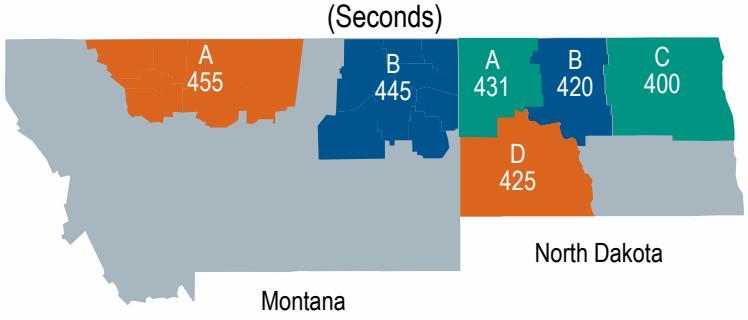
OTHER KERNEL QUALITY DATA

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	1.4	9.3	42.7	46/49	15.2/17.3	0.0	1.69	455	75
Area B	1.5	10.3	35.5	69/23	14.4/16.4	0.0	1.69	445	61
State Avg 2022	1.5	10.1	36.7	65/27	14.5/16.5	0.0	1.69	447	63
State Avg 2021	0.4	10.5	38.1	69/23	16.4/18.6	<0.1	1.74	464	82
NORTH DAKOTA									
Area A	0.8	11.5	41.8	42/55	12.8/14.5	<0.1	1.60	431	60
Area B	0.7	11.6	42.4	48/48	14.4/16.4	<0.1	1.58	420	60
Area C	0.7	12.0	45.5	41/57	13.1/14.9	<0.1	1.64	400	59
Area D	1.4	11.0	45.0	49/48	13.9/15.8	0.0	1.67	425	62
State Avg 2022	0.9	11.5	42.7	44/53	13.2/15.0	<0.1	1.61	425	60
State Avg 2021	0.6	11.0	42.9	54/42	15.1/17.1	<0.1	1.67	409	77
TWO-STATE AVERAGE									
Avg 2022	1.1	11.0	40.4	52/43	13.7/15.6	<0.1	1.64	433	61
Avg 2021	0.5	10.9	41.2	59/36	15.5/17.6	<0.1	1.69	428	79
Five-Year Avg	0.9	11.3	42.3	47/49	14.4/16.3	0.2	1.55	399	70

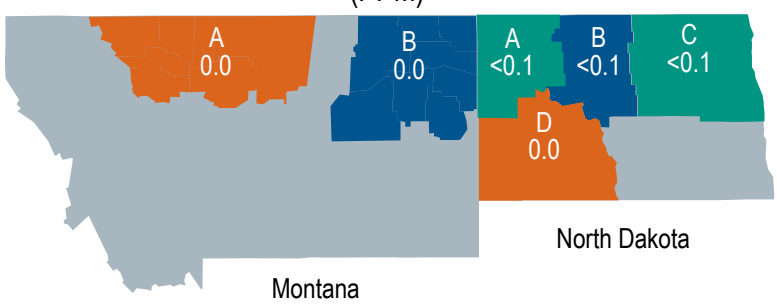
FALLING NUMBER



AVERAGE FALLING NUMBER BY AREA



AVERAGE DON BY AREA



MILLING CHARACTERISTICS

SEMOLINA extraction is the portion milled into semolina only.

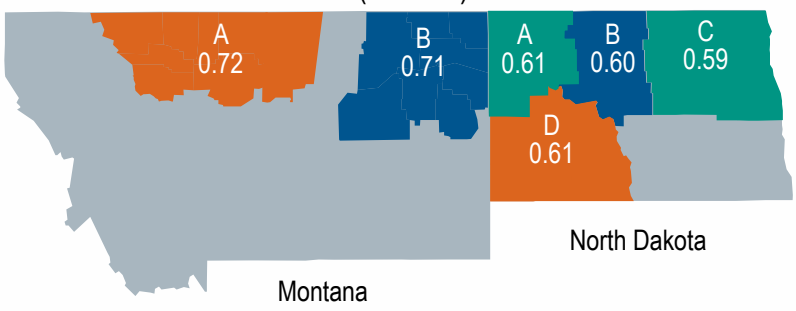
ASH CONTENT in the endosperm of durum is inherently higher than in the endosperm of other hard wheats, but can still be used as a relative measure of bran or mineral content in the flour and semolina.

SPECKS appear in semolina when small particles of bran or other material escape the cleaning and purifying process. Millers can control 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.

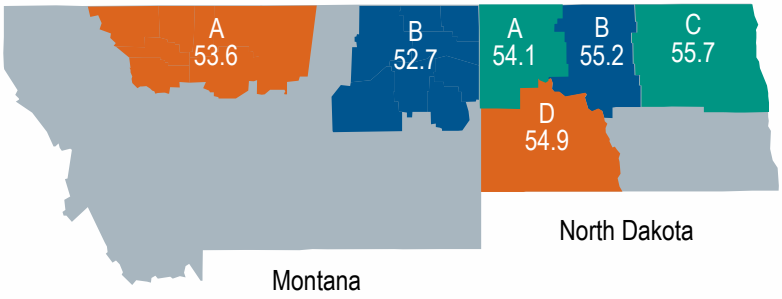
AVERAGE ASH CONTENT BY AREA

(Percent)



AVERAGE SEMOLINA EXTRACTION BY AREA

(Percent)



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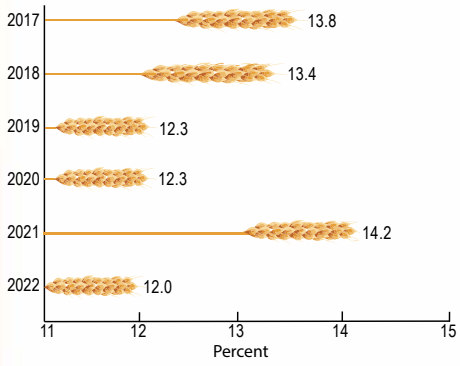
SEMOLINA QUALITY DATA

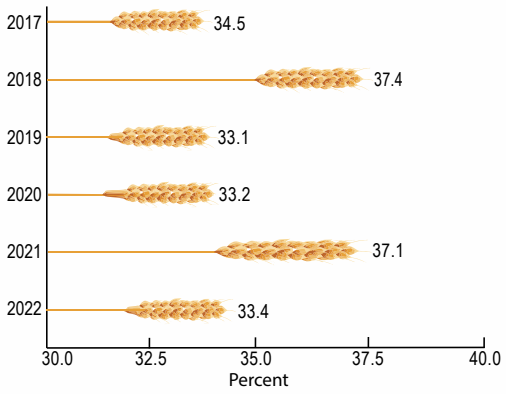
STATE AND CROP REPORTING AREA	SEMOLINA EXTRACTION[1] %	ASH[1] %	SPECKS NO/10 SQ IN[1] %	PROTEIN (14% MOISTURE) %	WET GLUTEN %	GLUTEN INDEX %	GLUTOPEAK PEAK TIME SEC	GLUTOPEAK MAX TORQUE BE
MONTANA								
Area A	53.6	0.72	20	13.5	38.3	88	255	46
Area B	52.7	0.71	23	12.7	35.0	69	161	46
State Avg 2022	52.9	0.71	22	12.8	35.6	72	177	46
State Avg 2021	53.0	0.68	20	15.0	38.9	80	156	50
NORTH DAKOTA								
Area A	54.1	0.61	30	11.1	31.4	69	166	41
Area B	55.2	0.60	27	12.3	34.2	72	194	43
Area C	55.7	0.59	33	11.5	32.6	80	218	39
Area D	54.9	0.61	30	11.9	32.6	75	206	40
State Avg 2022	54.5	0.60	30	11.4	32.1	71	181	41
State Avg 2021	55.5	0.64	21	13.7	36.1	82	169	46
TWO-STATE AVERAGE								
Avg 2022	53.9	0.64	27	12.0	33.4	72	180	43
Avg 2021	54.6	0.65	21	14.2	37.1	81	165	47
Five-Year Avg	n/a	0.66	28	13.2	34.5	73	165	42

1. The 2019 - 2022 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 PROTEIN – Regional Average

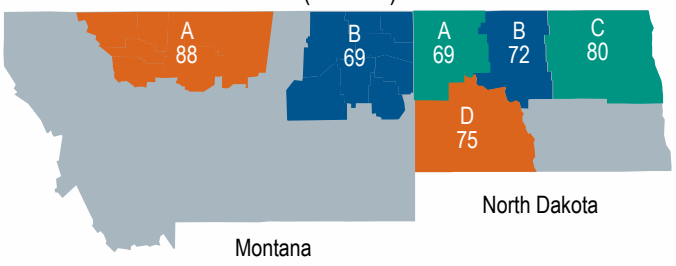


WET GLUTEN – Regional Average



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	82.9	-2.3	33.3	8.5	30.1	6.9	4.8
Area B	82.8	-2.2	31.2	8.5	29.7	6.5	4.9
State Avg 2022	82.8	-2.2	31.5	8.5	29.8	6.6	4.9
State Avg 2021	83.0	-2.2	30.6	8.1	32.2	7.8	5.0
NORTH DAKOTA							
Area A	83.7	-2.8	31.3	8.5	29.6	6.8	4.3
Area B	83.6	-2.5	30.1	8.5	29.3	6.7	4.4
Area C	83.4	-2.7	30.1	8.5	30.2	7.1	4.0
Area D	83.6	-2.7	31.2	8.5	29.7	7.1	4.5
State Avg 2022	83.7	-2.7	31.0	8.5	29.6	6.9	4.3
State Avg 2021	83.5	-2.4	30.1	8.4	32.5	8.1	4.7
TWO-STATE AVERAGE							
Avg 2022	83.3	-2.5	31.2	8.5	29.7	6.7	4.5
Avg 2021	83.3	-2.3	30.2	8.3	32.4	8.0	4.8
Five-Year Avg	83.4	-2.4	29.8	8.3	31.4	6.8	4.3

PASTA CHARACTERISTICS

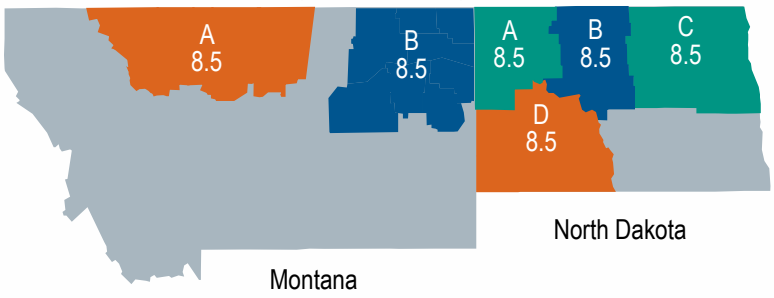
DRY PASTA PROCESSORS want a finished product that is visually appealing, elastic and strong enough to resist breakage during cutting, packaging, handling and shipping, able to withstand the rigors of cooking, and satisfying to the consumer palate.

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

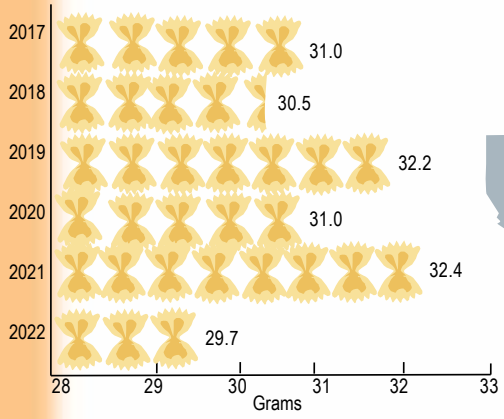
(Scale of 1-12)



U.S. DURUM WHEAT

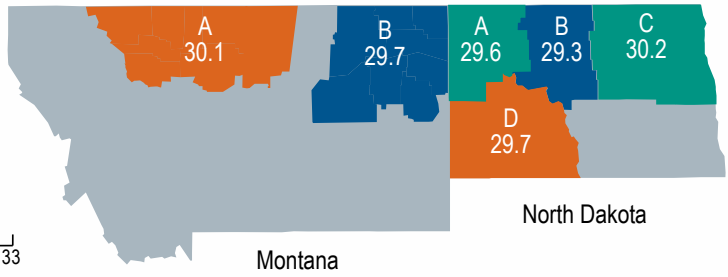
MONTANA | NORTH DAKOTA

COOKED WEIGHT – Regional Average

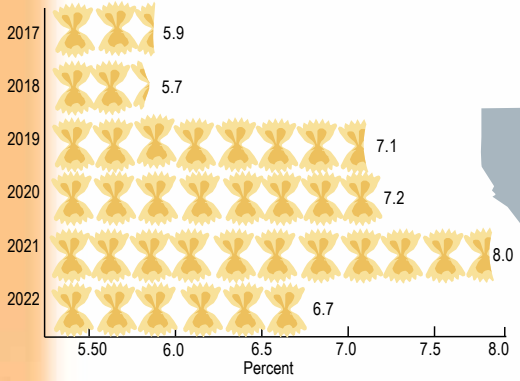


AVERAGE COOKED WEIGHT BY AREA

(Grams)

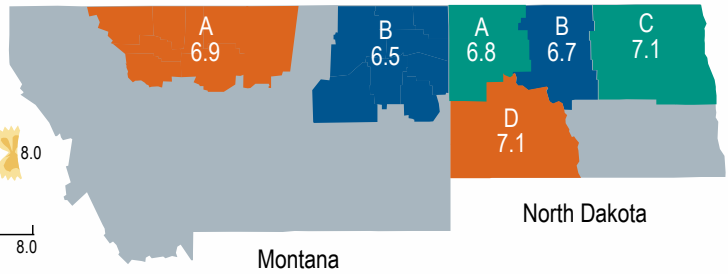


COOKING LOSS – Regional Average

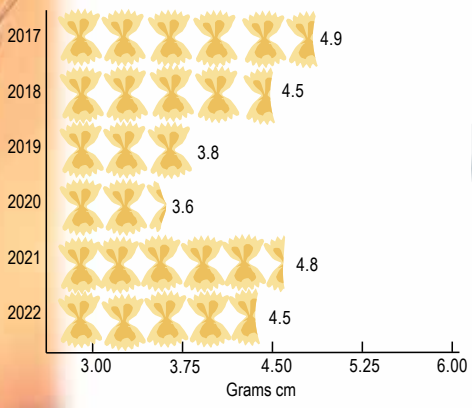


AVERAGE COOKING LOSS BY AREA

(Percent)

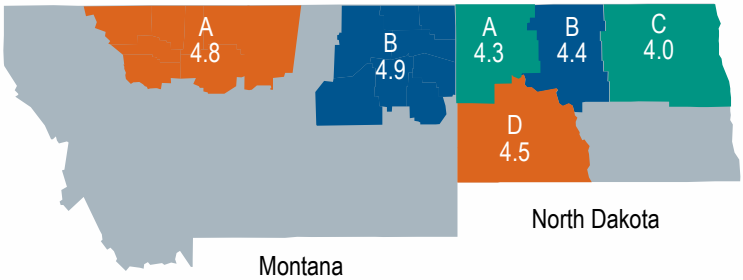


COOKED FIRMNESS – Regional Average



AVERAGE COOKED FIRMNESS BY AREA

(G CM)



RECENT QUALITY TRENDS

	2022	2021	2020	2019	2018	2017	FIVE-YEAR AVERAGE
GRADING AND WHEAT DATA							
Test Weight (lbs/bu)	61.8	60.5	62.2	61.1	61.4	60.9	61.1
Test Weight (kg/hl)	80.4	78.8	80.9	79.6	79.9	79.4	79.5
Total Defects (%)	1.1	1.2	1.5	3.0	1.0	1.2	1.6
Vitreous Kernels (%)	92	86	88	64	90	88	83
Grades	1 HAD	1 HAD	1 HAD	2 AD	1 HAD	1 HAD	1 HAD
OTHER WHEAT DATA							
Dockage (%)	1.1	0.5	0.8	1.3	0.7	1.1	0.9
Protein: 12% moisture	13.7	15.5	13.4	13.9	14.5	14.5	14.4
1000 Kernel Weight (gm)	40.4	41.2	46.7	44.2	41.2	38.4	42.3
Moisture (%)	11.0	10.9	10.7	12.2	11.2	11.3	11.3
DON	<0.1	<0.1	0.6	0.2	<0.1	1.0	0.2
Ash (%)	1.64	1.69	1.57	1.51	1.54	1.46	1.55
Falling Number (sec)	433	428	419	345	425	380	399
Sedimentation (cc)	61	79	62	61	61	87	70
SEMOLINA DATA							
**Semolina Extraction (%)	53.9	54.6	58.5	57.5	69.3	68.5	n/a
Ash (%)	0.64	0.65	0.64	0.60	0.73	0.69	0.66
Wet Gluten (%)	33.4	37.1	33.2	33.1	37.4	34.5	34.5
Specks (no/10 sq in)	27	21	30	31	29	26	28
Protein (%)	12.0	14.2	12.3	12.3	13.4	13.8	13.2
Gluten Index (%)	72	81	74	67	57	86	73
Glutopeak							
Peak Time (sec)	180	165	160	190	140	168	165
Max Torque (be)	43	47	36	40	42	43	42
*Color: L (black-white)	83.3	83.3	83.7	82.9	83.6	83.3	83.4
*a (green-red)	-2.5	-2.3	-2.4	-2.4	-2.5	-2.3	-2.4
*b (blue-yellow)	31.2	30.2	30.4	29.3	29.9	29.4	29.8
SPAGHETTI PROCESSING DATA							
Color Score (scale of 1-12)	8.5	8.3	8.5	7.8	8.3	9.0	8.5
L (black-white)	53.8	53.1	54.4	51.8	52.8	54.4	53.3
b (blue-yellow)	25.9	25.1	26.5	24.2	25.6	27.1	25.7
Cooked Weight (gm)	29.7	32.4	31.0	32.2	30.5	31.0	31.4
Cooking Loss (%)	6.7	8.0	7.2	7.1	5.7	5.9	6.8
Cooked Firmness (g cm)	4.5	4.8	3.6	3.8	4.5	4.9	4.3

* 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 & 2017 samples were milled on a Buhler laboratory mill.

U.S. DURUM WHEAT

MONTANA | NORTH DAKOTA

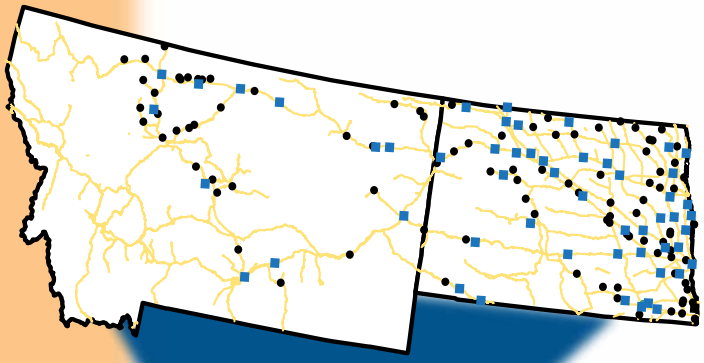
HANDLING & TRANSPORTATION

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.



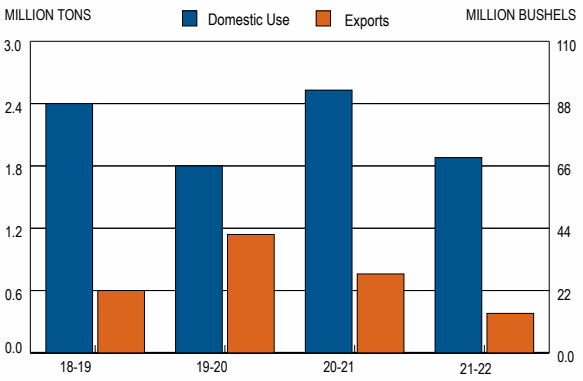
- Track for 50 to 99 rail cars
- Track for 100 or more cars

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 (2018-2021)

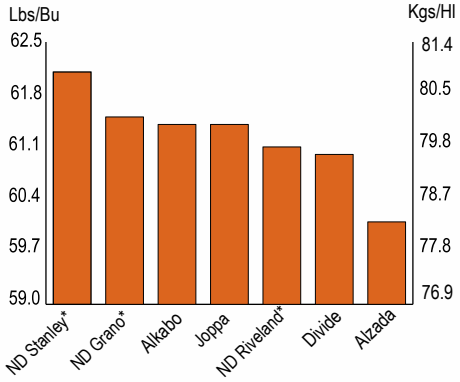
2018-21 U.S. DURUM DOMESTIC USE AND EXPORTS



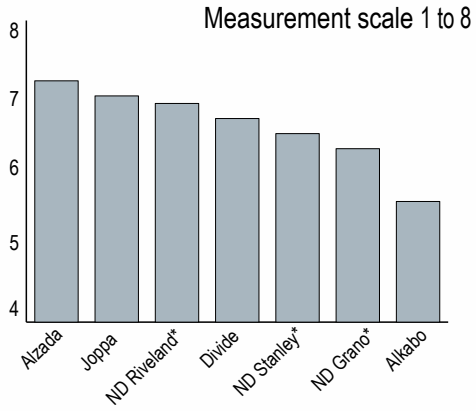
Marketing Year (June - May)

VARIETAL INFORMATION

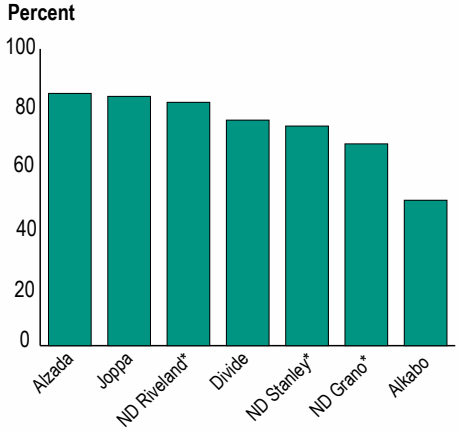
TEST WEIGHT



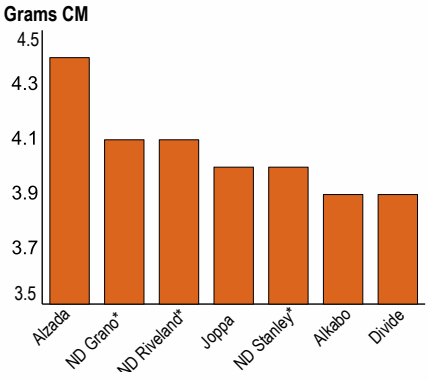
MIXOGRAPH



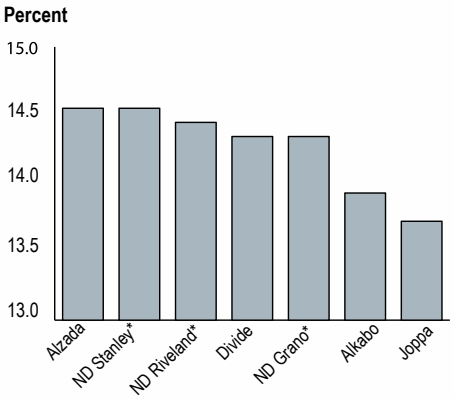
GLUTEN INDEX



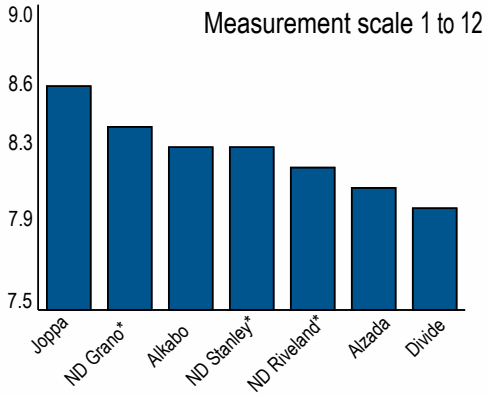
COOKED FIRMNESS



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
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	3.60

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
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 2022 are ND Riveland, Joppa, Divide and Alkabo, the same as last year, and account for nearly three-fourths of the acres. In Montana, the top four varieties in 2022 are Alzada, ND Riveland, Divide and Transcend, accounting for slightly more than one-half of the acres.

ND RIVELAND accelerated into the top spot in North Dakota with 38.9 percent of the acres, up from 22.6 percent in 2021. It moved into second position in Montana with 12.6 percent of the acres, down just slightly in share from last year. Released from 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.

JOPPA accounts for 15.2 percent of the acres in North Dakota, and 8.7 percent of the acres in Montana, ranking it second and fifth, respectively. It saw declines in its share of acres in both states, and fell from the top position in North Dakota, a spot it had held for five straight years. 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.

DIVIDE is the third most popular variety in both North Dakota and Montana, with a 9.8 and 11.8 percent acreage share, respectively. It has slipped from its peak in share of acres in both states. 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.

ALKABO accounts for 8.1 percent of the acreage in North Dakota in 2022, up from 6.1 percent last year, and ranking it fourth. 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.

NORTH DAKOTA VARIETY SHARE OF 2022 PLANTED ACRES BY CROP DISTRICT

VARIETY	NORTH WEST	WEST CENTRAL	SOUTH WEST	COMBINED DISTRICTS[1]	TOTAL STATE
	PERCENTAGE (%)[2]				
ND Riveland	42.9	40.0	29.1	30.7	38.9
Joppa	6.8	18.7	45.7	14.2	15.2
Divide	9.4	2.7	2.1	25.8	9.8
Alkabo	8.4	12.9	5.3	6.2	8.1
ND Grano	4.1	2.0	1.6	1.5	3.2
VT Peak	2.2	2.4	3.6	5.5	2.9
Carpio	1.8	6.1	2.1	1.6	2.3
Other[3]	24.5	15.1	10.5	14.5	19.6

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, 2022 small grain estimate 790,000 acres.

NORTH DAKOTA VARIETY SHARE OF PLANTED ACRES[3]

VARIETY	2022%[1]	2021%[1]
ND Riveland	38.9	22.6
Joppa	15.2	26.5
Divide	9.8	9.7
Alkabo	8.1	6.1
ND Grano	3.2	3.5
Other[2]	24.8	31.6

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)
   2022 – 790,000 acres
   2021 – 880,000 acres

MONTANA VARIETY SHARE OF PLANTED ACRES[3]

VARIETY	2022%[1]	2021%[1]
Alzada	20.4	16.0
ND Riveland	12.6	13.4
Divide	11.8	16.9
Transcend	10.4	10.7
Joppa	8.7	12.3
Other[2]	36.1	30.7

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)
   2022 – 710,000 acres
   2021 – 670,000 acres

ALZADA moved into the top position in Montana with a 20.4 percent acreage share, up from 16 percent in 2021. 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.

TRANSCEND holds the fourth position in Montana with 10.4 percent of the acres, steady with a year ago. Released in 2012 from Agriculture and Agri-Food Canada, it is characterized by high yield potential, protein concentration, strong straw and improved resistance to Fusarium head blight.

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 Gwendolyn Thomas, 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 234 samples were collected from Montana (78) and North Dakota (156).

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.

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 quivalents (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.

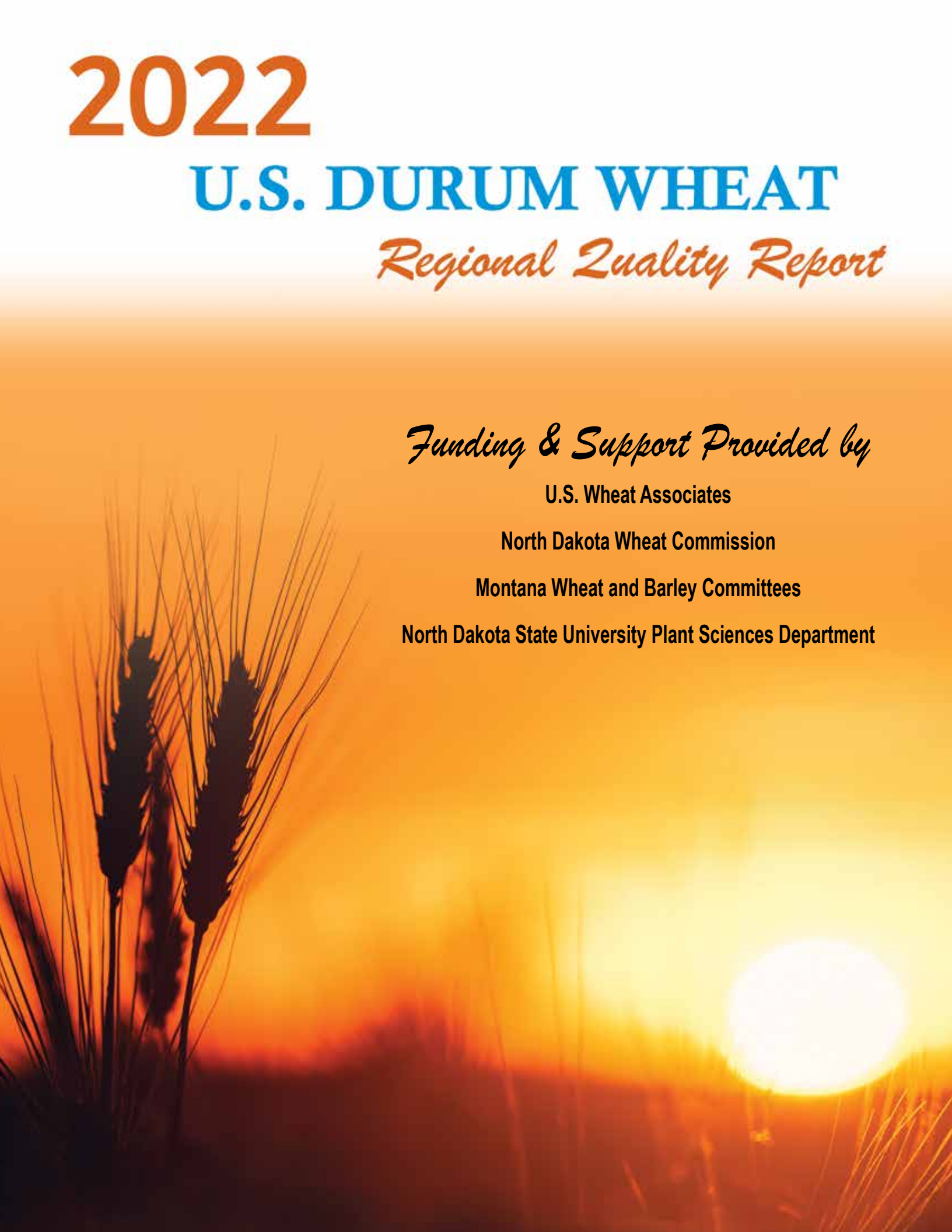
COOKING LOSS • AACC Method 66-50.01. Solids lost to the cooking water. After drying the residue was weighed and reported as percentage of the original dry sample.

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

2022

U.S. DURUM WHEAT

Regional Quality Report



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