U.S. DURUM WHEAT 14

REGIONAL QUALITY REPORT

U.S. DURUM WHEAT

MONTANA • NORTH DAKOTA

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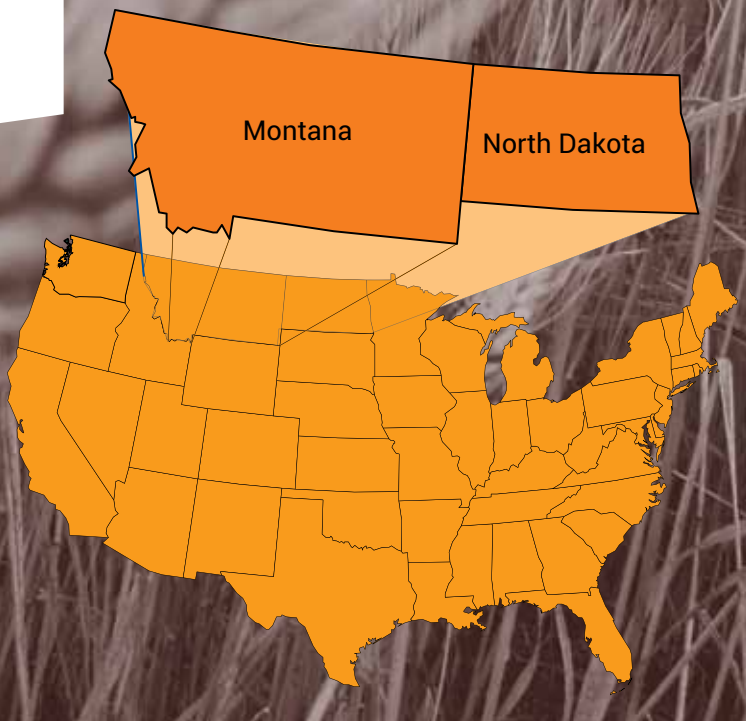


MAKING PREMIUM PASTA

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. The states of North Dakota and Montana in most years jointly produce 80 percent of the U.S. durum crop.

U.S. DURUM WHEAT

MONTANA • NORTH DAKOTA

PRODUCTION DATA	2014	2013	2009-13 AVERAGE
MILLION BUSHELS			
Montana	13.8	15.2	15.2
North Dakota	30.8	29.5	43.7
U.S. Total	57.1	58.0	80.2
MILLION METRIC TON			
Montana	0.38	0.41	0.41
North Dakota	0.84	0.80	1.20
U.S. Total	1.55	1.58	2.18

Source: USDA 2014 Small Grains Summary

2014 OVERVIEW

The 2014 durum crop produced in North Dakota and Montana is similar in production to 2013 but reflects more quality impact from a challenging production and harvest season. The crop averages a #2 Amber Durum (AD), down from a #1 Hard Amber Durum (HAD) in 2013 and the 5-yr average, with a greater than normal variance in quality across the crop. Functional performance on the crop is very similar to 2013 in spite of the impacts on physical kernel and non-grade factors.

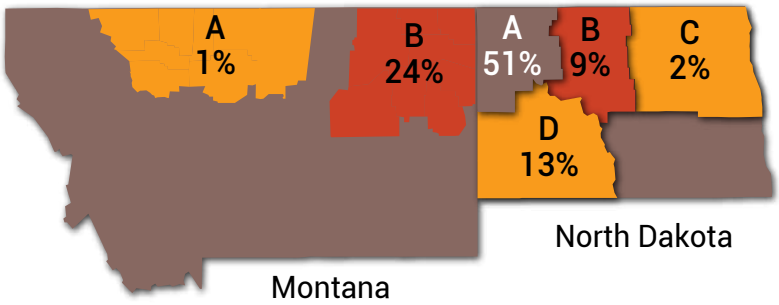
A large portion of the crop is of #2 grade or better, but due to untimely rains during harvest a greater than normal share of the crop fell below the 75% vitreous kernel level for HAD. Only 50% of the crop remained in the #2 HAD or better grade and subclass, compared to 82% in 2013, with a much larger percentage falling into the Durum subclass (<60% vitreous kernels). The average test weight is 59 lbs/bu (76.8 kg/hl), down from both last year and the 5-yr average. Distribution of test weight shows 28% of the crop above 60 lb/bu (78.1 kg/hl) compared to 83% in 2013. Average damaged kernels are 0.8%, up from 0.2% in 2013 and slightly higher than the 5-yr average, reflective of higher Fusarium and wheat midge pressures in parts of the region. Due to the Fusarium pressures, average DON values on the crop are 2.10 ppm, up from 1.02 ppm in 2013 and only 0.69 ppm for the 5-yr average. Some portions of the crop are reporting significantly higher levels of DON, but those segments will be pushed into feed channels.

The 2014 crop is showing higher average protein levels, at 13.2% (12% moisture basis), compared to 2013, but slightly below the 5-yr average. A relatively cool growing season and high yields in areas kept protein levels below average, and along with the untimely harvest rains led to lower vitreous kernel levels. The crop average is 74%, down from 85% in 2013 and the 5-yr average. Distributions show a more extreme range in vitreous levels in 2014. Although two-thirds of the crop is above the HAD threshold of 75% vitreous kernels, only 24% of the crop is above 90% vitreous, compared to 65% last year. About 15% of the crop is below 60% vitreous in 2014, compared to just 3% in 2013.

The crop average falling number value is 276 seconds, lower than the 2013 and 5-yr average level of 370 seconds. One-half of the crop reports falling number values between 200 and 300 seconds, with one-third of the crop remaining above 300 seconds.

Milling performance on the crop, based on a Buhler Laboratory Mill, indicates an overall yield of 70.4%, similar to 2013, with slightly lower semolina extraction of 64.5%, compared to 65.2%. Ash levels are slightly higher than 2013 and the 5-yr average but speck counts are similar. Wet gluten values are lower at 32.8%, compared to 34.8% in 2013 and 35.5% for the 5-yr avg. The gluten index fell to 45.1%,

Approximate Share of Regional Production by Crop Reporting Area



compared to the mid to upper 50's for 2013 and the 5-yr average.

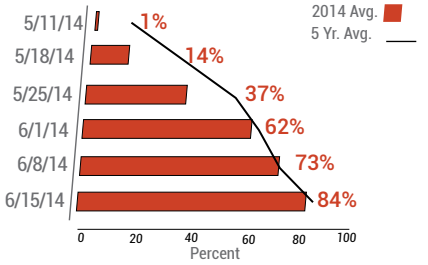
Semolina mixing properties are similar to the 2013 crop and the 5-yr average. Color scores on the semolina and cooked spaghetti are similar to the 2013 crop, with the exception of a slight decrease in the a-value for semolina color. Cooking qualities are showing improved cooked weight and cooked firmness compared to 2013 although cooked firmness is slightly below the 5-yr average.

Buyers will find wide values in the market for the 2014 durum crop produced in the northern U.S., due to the challenges from adverse weather. Variability in key parameters, such as vitreous kernels, falling number, protein and DON will require buyers to carefully evaluate the importance of each factor for their end-use needs. Premium contract specifications will command premium prices, but good value can be obtained from large portions of the crop with diligent contracts specifications and communication with sellers.

SEASONAL CONDITIONS

A challenging planting season was experienced for most areas in the region due to a longer, colder winter and excess soil moisture in the spring, leading to lower than expected final durum plantings. Initial planting was delayed until mid-May, about one month later than normal for some areas. Periods of rain hampered progress in May with planting held to forty percent complete by the end of May, well behind the five-year average of three-fourths. In some areas, planting was not complete until the last half of June.

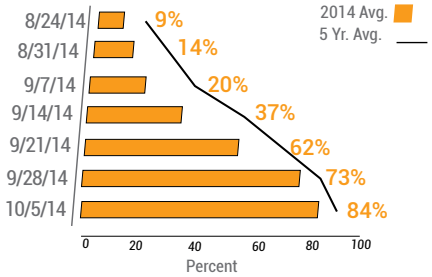
DURUM PLANTING PROGRESS



Emergence of the crop remained slower than normal in many areas with some emergence pushed into late June. Growing season conditions were favorable early with ample moisture and cooler than average temperatures, boosting plant growth and yield potential. Excessive moisture heightened disease pressures on the crop and relatively high humidities throughout the growing season led to a broader impact than normal. Crop maturity remained behind normal for much of the growing season. In the latter part of the growing season, warmer temperatures helped to accelerate crop maturity.

Harvest began in mid-August, about two weeks later than normal and remained sluggish into mid-September due to periods of above average rain and delayed crop maturity. Completion reached thirty percent by mid-September, but accelerated to eighty percent by the end of September, benefitting from a period of well above average temperatures and dry conditions in late September. Still, harvest was not completed across the region until mid-October.

DURUM 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 a 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 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.

	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	0.5	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 classes [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

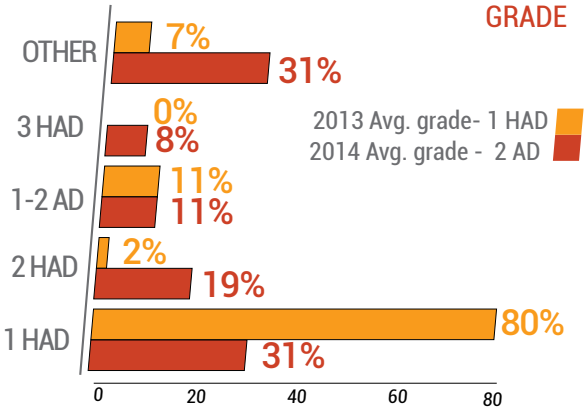
c. is heating or of distinctly low quality.

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.

WHEAT GRADING DATA

STATE AND CROP REPORTING AREA	TEST WEIGHT LBS/BU	TEST WEIGHT KG/HL	DAMAGE %	FOREIGN MATERIAL %	SHRUNKEN/ BROKEN KERNELS %	TOTAL DEFECTS %	CONTRASTING CLASSES %	U.S. GRADE	VITREOUS KERNELS %
MONTANA									
Area A	59.3	77.2	0.1	0.0	0.7	0.8	0.0	2 HAD	96
Area B	59.6	77.6	0.0	0.0	0.8	0.8	0.0	2 AD	63
State Avg. 2014	59.6	77.6	0.1	0.0	0.8	0.8	0.0	2 AD	67
State Avg. 2013	61.1	79.6	0.2	0.0	1.0	1.2	0.3	1 HAD	86
NORTH DAKOTA									
Area A	58.3	76.0	1.3	0.0	1.0	2.3	0.0	2 HAD	75
Area B	59.3	77.2	0.6	0.0	1.0	1.6	0.0	2 HAD	77
Area C	60.2	78.4	0.4	0.0	0.9	1.3	0.0	1 HAD	82
Area D	59.4	77.4	0.9	0.0	0.8	1.7	0.0	2 HAD	81
State Avg. 2014	58.7	76.5	1.1	0.0	0.9	2.0	0.0	2 HAD	77
State Avg. 2013	60.5	78.7	0.2	0.0	0.8	1.0	0.2	1 HAD	84
TWO-STATE REGION AVG									
Avg. 2014	59.0	76.8	0.8	0.0	0.9	1.6	0.0	2 AD	74
Avg. 2013	60.7	79.0	0.2	0.0	0.8	1.0	0.2	1 HAD	85
Five-Year Avg	60.5	78.8	0.5	0.0	1.0	1.5	0.2	1 HAD	85

REGIONAL DISTRIBUTION



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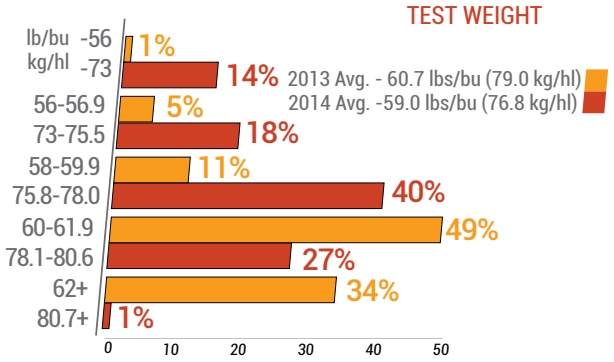
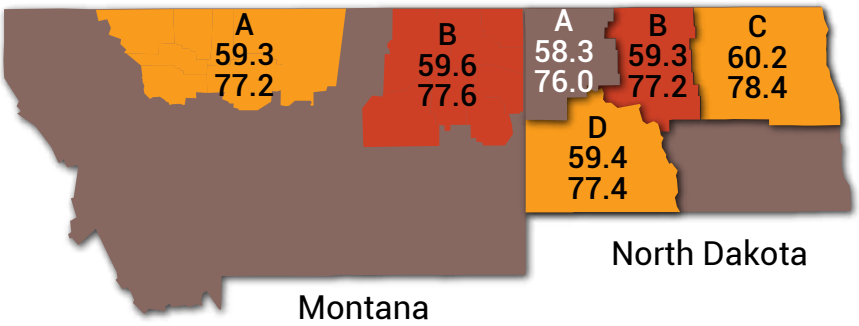


AVERAGE TEST WEIGHT BY AREA lbs/bu kg/hl



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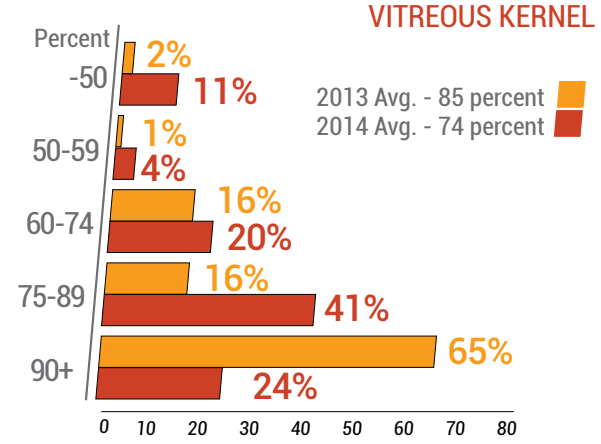
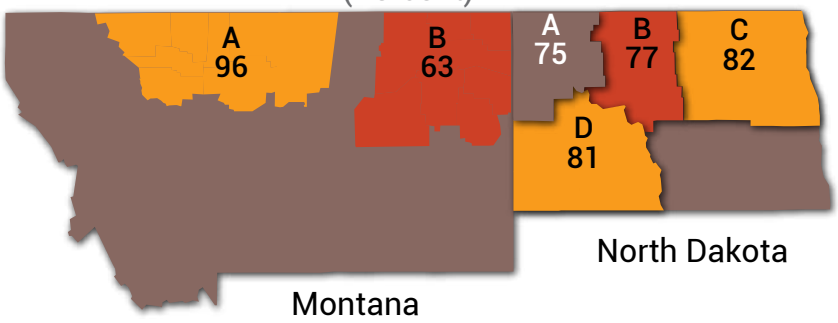


AVERAGE VITREOUS KERNEL BY AREA

(Percent)



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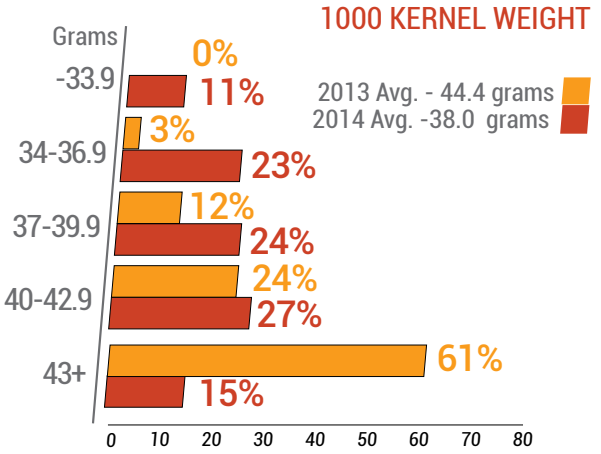
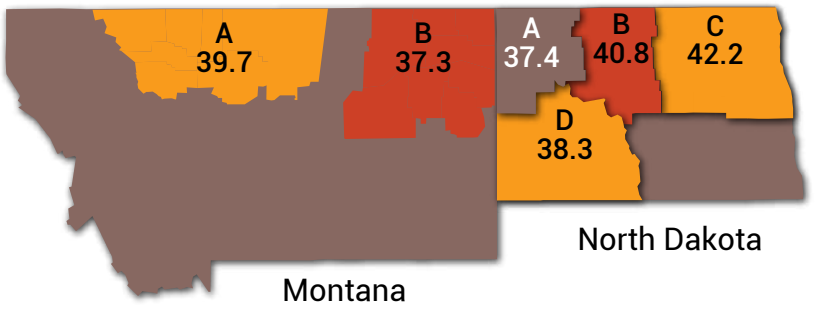


AVERAGE 1000 KERNEL WEIGHT BY AREA

(Grams)



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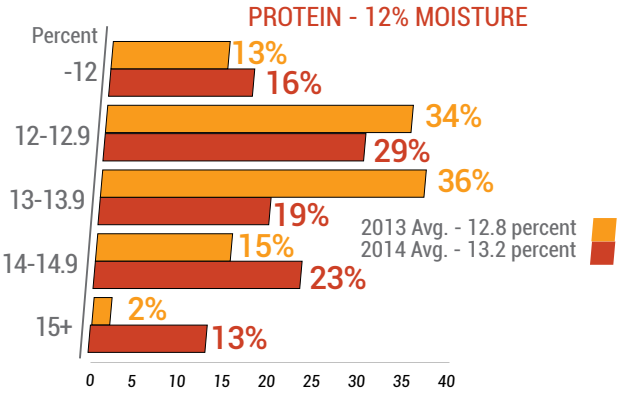
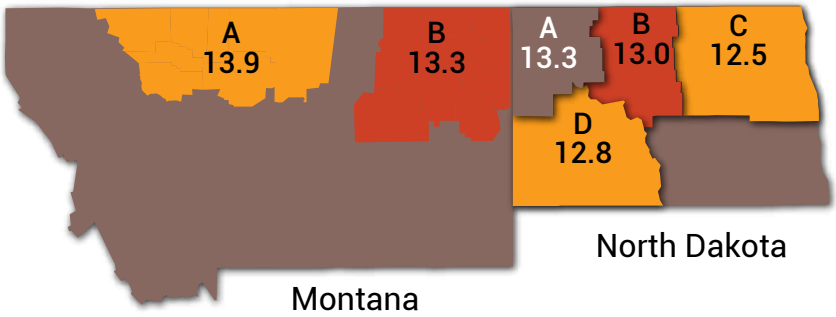


AVERAGE PROTEIN BY AREA

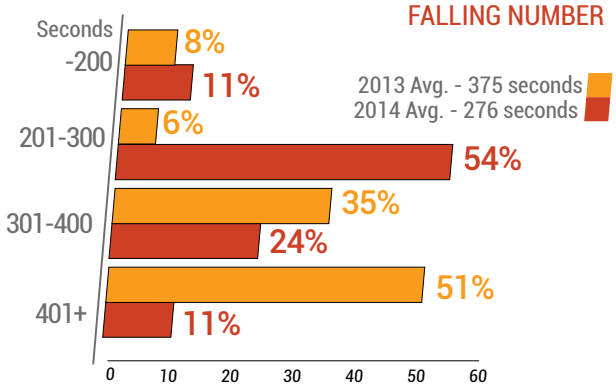
12% Moisture Basis-Percent



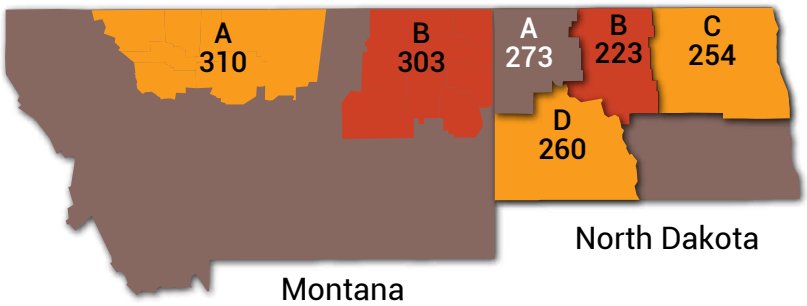
OTHER KERNEL QUALITY DATA

STATE AND CROP REPORTING AREA	Dockage %	Moisture %	1000 Kernel Weight G	Kernel Dist. Medium %	Kernel Dist. Large %	Protein (12% moisture) %	Protein (0% moisture) %	DON (ppm)	Wheat Ash %	Falling Number (sec)	Zeleny Sed (cc)
MONTANA											
Area A	0.9	11.3	39.7	37	60	13.9	15.8	<0.25	1.58	310	80
Area B	0.6	12.2	37.3	57	40	13.3	15.1	<0.25	1.52	303	63
State Avg. 2014	0.6	12.1	37.6	54	43	13.4	15.2	<0.25	1.53	304	65
State Avg. 2013	0.9	12.0	43.0	43	54	12.6	14.4	<0.25	1.58	430	48
NORTH DAKOTA											
Area A	0.8	12.7	37.4	41	57	13.3	15.1	3.5	1.70	273	58
Area B	0.4	12.2	40.8	50	46	13.0	14.8	3.0	1.70	223	62
Area C	0.9	12.7	42.2	25	74	12.5	14.2	1.0	1.63	254	51
Area D	1.0	11.9	38.3	42	56	12.8	14.5	1.8	1.67	260	58
State Avg. 2014	0.8	12.5	38.2	42	56	13.1	14.9	3.1	1.69	264	58
State Avg. 2013	0.9	12.2	45.0	35	62	12.9	14.7	1.38	1.56	349	45
TWO STATE REGION											
Avg. 2014	0.7	12.4	38.0	46	52	13.2	15.0	2.10	1.64	276	60
Avg. 2013	0.9	12.1	44.4	37	59	12.8	14.6	1.02	1.57	375	46
Five-Year Avg	1.1	11.5	40.1	44	51	13.6	15.5	0.69	1.57	378	46

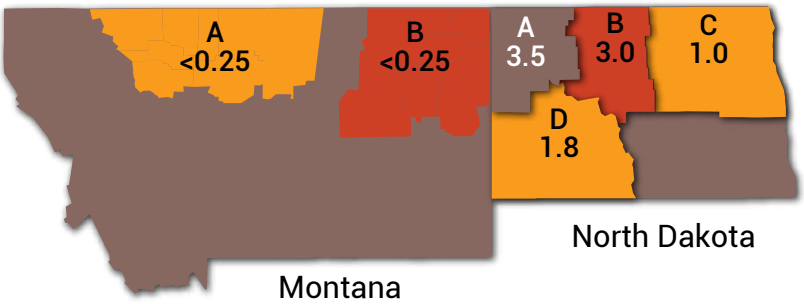
REGIONAL DISTRIBUTION



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.

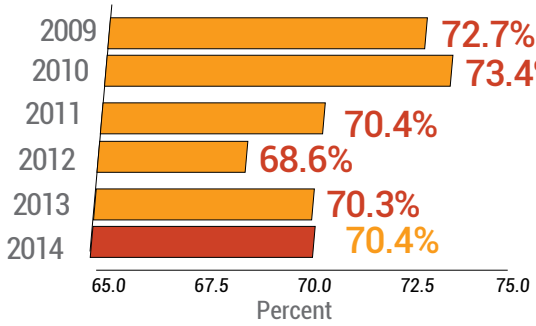
SPECKS appear in semolina when small particles of bran or other material escape the cleaning and purifying process. Millers can control speck count by selecting durum that is free of disease and foreign material, thoroughly cleaning the durum, properly tempering and conditioning the wheat before milling,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

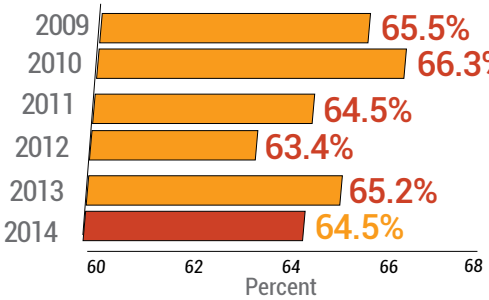
REGIONAL AVERAGE

TOTAL EXTRACTION



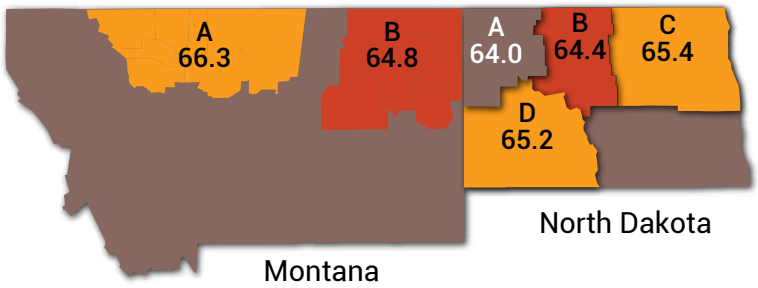
REGIONAL AVERAGE

SEMOLINA EXTRACTION



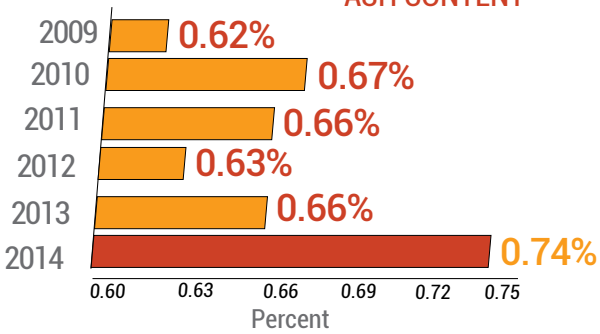
AVERAGE SEMOLINA EXTRACTION BY AREA

(Percent)



REGIONAL AVERAGE

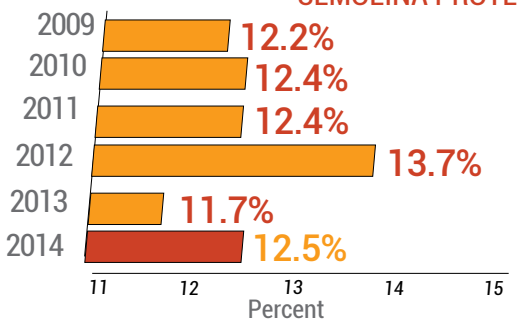
ASH CONTENT



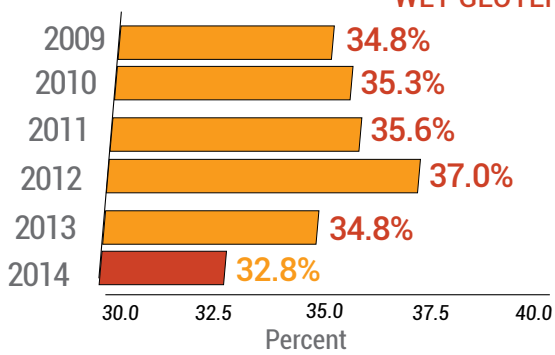
SEMOLINA QUALITY DATA

STATE AND CROP REPORTING AREA	TOTAL EXTRACTION %	SEMOLINA EXTRACTION %	ASH %	SPECKS NO/10 SQ IN %	PROTEIN (14% MOISTURE) %	WET GLUTEN %	GLUTEN INDEX %	MIXOGRAM CLASSIFICATION SCALE 1-8
MONTANA								
Area A	70.5	66.3	0.75	20	13.2	33.0	86.4	8.0
Area B	70.3	64.8	0.70	23	12.7	33.6	47.7	6.0
State Avg. 2014	70.3	65.0	0.71	23	12.8	33.5	52.7	6.3
State Avg. 2013	70.6	65.7	0.64	22	11.6	33.5	60.1	6.2
NORTH DAKOTA								
Area A	70.1	64.0	0.76	28	12.6	33.3	43.0	5.0
Area B	71.1	64.4	0.75	27	12.2	31.2	42.3	5.0
Area C	71.2	65.4	0.74	27	11.6	30.5	28.6	5.0
Area D	71.0	65.2	0.73	27	12.0	31.0	39.6	6.0
State Avg. 2014	70.4	64.3	0.75	28	12.4	32.5	41.7	5.2
State Avg. 2013	70.2	65.0	0.66	27	11.8	35.3	52.8	5.1
TWO-STATE REGION								
Avg. 2014	70.4	64.5	0.74	26	12.5	32.8	45.1	5.5
Avg. 2013	70.3	65.2	0.66	26	11.7	34.8	55.1	5.5
Five-Year Avg	71.1	65.0	0.65	29	12.5	35.5	57.1	5.5

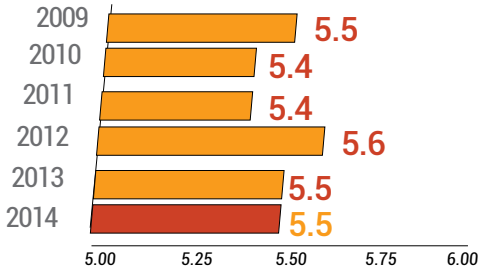
REGIONAL AVERAGE
SEMOLINA PROTEIN



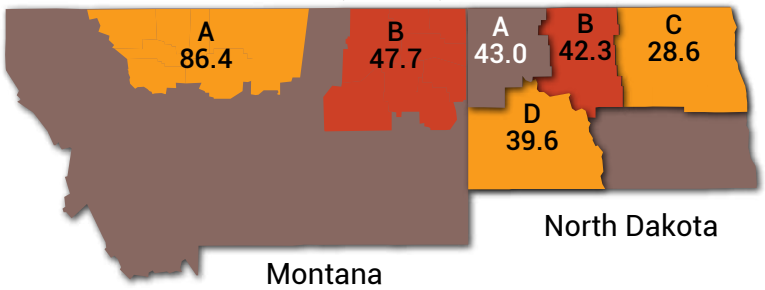
REGIONAL AVERAGE
WET GLUTEN



REGIONAL AVERAGE
MIXOGRAM CLASSIFICATION (Scale 1 to 8)



AVERAGE GLUTEN INDEX BY AREA
(Percent)



PASTA CHARACTERISTICS

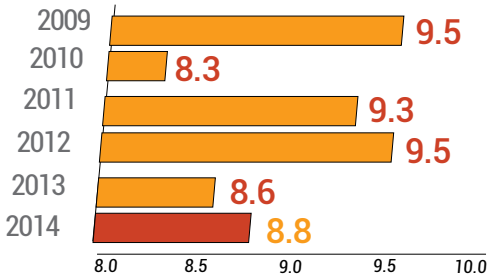
DRY PASTA PROCESSORS want a finished product that is visually appealing, elastic and strong enough to resist breakage during cutting, packaging, handling and shipping, able to withstand the rigors of cooking, and satisfying to the consumer palate.

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.

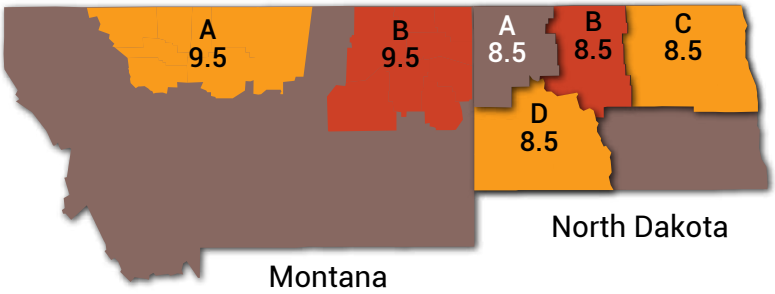
REGIONAL AVERAGE

COLOR SCORE (Scale 1 to 12)



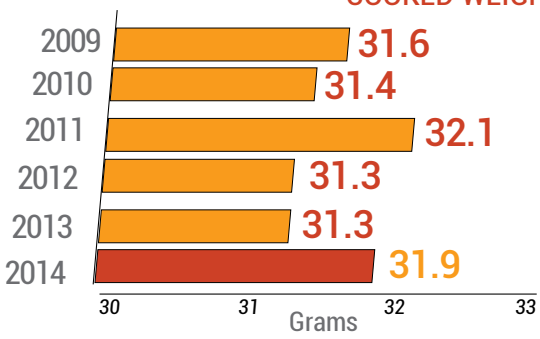
AVERAGE COLOR SCORE BY AREA

(Scale of 1- 12)



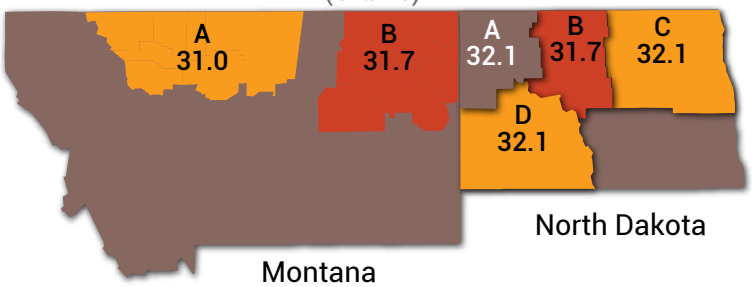
REGIONAL AVERAGE

COOKED WEIGHT



AVERAGE COOKED WEIGHT BY AREA

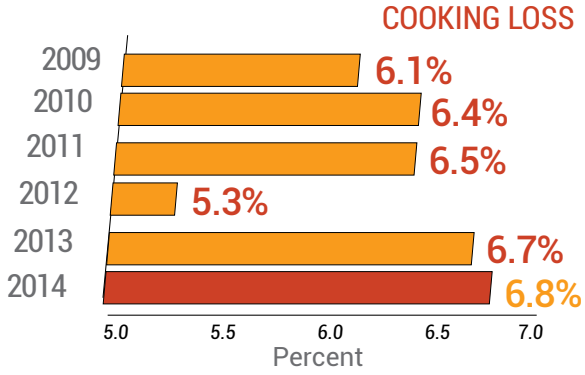
(Grams)



SEMOLINA AND SPAGHETTI DATA

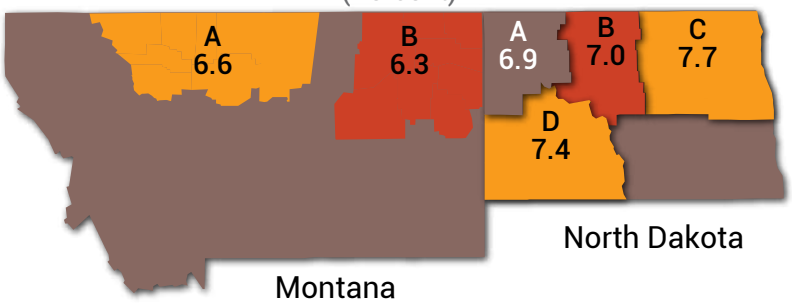
STATE AND CROP REPORTING AREA	SEMOLINA COLOR L (black-white)	SEMOLINA COLOR a (red-green)	SEMOLINA COLOR b (yellow-blue)	SPAGHETTI COLOR SCORE (1-12)	SPAGHETTI COOKED WEIGHT G	SPAGHETTI COOKING LOSS %	SPAGHETTI COOKED FIRMNESS G CM
MONTANA							
Area A	83.9	-3.97	31.7	9.5	31.0	6.6	4.8
Area B	85.2	-4.03	27.4	9.5	31.7	6.3	4.2
State Avg. 2014	85.0	-4.03	28.7	9.5	31.6	6.3	4.2
State Avg. 2013	85.6	-3.29	28.1	9.1	31.2	6.5	4.0
NORTH DAKOTA							
Area A	85.2	-4.03	27.7	8.5	32.1	6.9	4.3
Area B	84.3	-3.76	28.1	8.5	31.7	7.0	4.5
Area C	84.2	-3.52	25.7	8.5	32.1	7.7	3.9
Area D	84.3	-3.83	27.9	8.5	32.1	7.4	4.0
State Avg. 2014	84.9	-3.94	27.7	8.5	32.0	7.0	4.2
State Avg. 2013	84.1	-3.19	27.5	8.4	31.4	6.7	4.0
TWO-STATE REGION							
Avg. 2014	84.9	-3.97	27.9	8.8	31.9	6.8	4.2
Avg. 2013	84.6	-3.23	27.7	8.6	31.3	6.7	4.0
Five-Year Avg	84.6	-2.85	28.3	9.0	31.5	6.2	4.8

REGIONAL AVERAGE

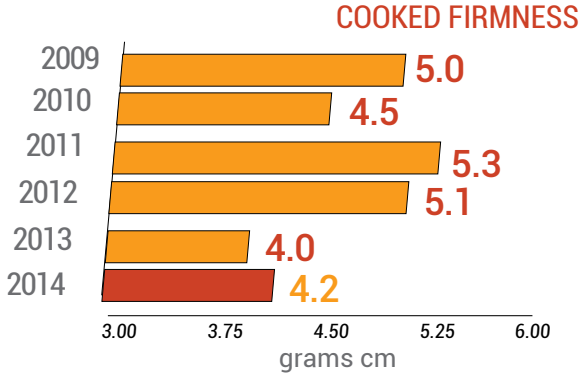


AVERAGE COOKING LOSS BY AREA

(Percent)

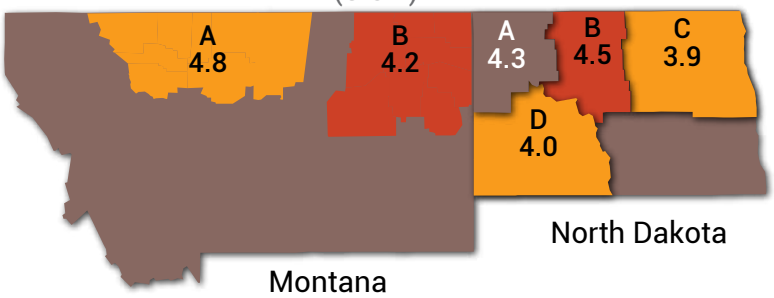


REGIONAL AVERAGE



AVERAGE COOKED FIRMNESS BY AREA

(G CM)



AVERAGE QUALITY FACTORS

	2014	2013	2012	2011	2010	2009	Five-Year Average
GRADING AND WHEAT DATA							
Test Weight (lbs/bu)	59.0	60.7	60.6	59.9	60.0	61.4	60.5
Test Weight (kg/hl)	76.8	79.0	78.9	78.0	78.1	80.0	78.8
Total Defects (%)	1.6	1.0	1.8	1.8	2.0	1.1	1.5
Vitreous Kernels (%)	74	85	89	88	82	83	85
Grade	2 AD	1 HAD	1 HAD	2 HAD	1 HAD	1 HAD	1 HAD
OTHER WHEAT DATA							
Dockage (%)	0.7	0.9	0.9	1.4	0.9	1.4	1.1
Protein: 12% moisture	13.2	12.8	14.6	13.6	13.4	13.5	13.6
1000 Kernel Weight (gm)	38.0	44.1	36.9	36.6	40.3	42.4	40.1
Moisture (%)	12.4	12.1	10.5	11.6	11.5	11.8	11.5
DON	2.10	1.02	0.97	0.96	0.32	0.16	0.69
Ash (%)	1.64	1.57	1.57	1.71	1.56	1.72	1.57
Falling Number (sec)	276	375	412	372	335	398	378
Sedimentation (cc)	60	46	49	43	43	50	46
SEMOLINA DATA							
Total Extraction (%)	70.4	70.3	68.6	70.4	73.4	72.7	71.1
Semolina Extraction (%)	64.5	65.2	63.4	64.5	66.3	65.5	65.0
Ash (%)	0.74	0.66	0.63	0.66	0.67	0.62	0.65
Wet Gluten (%)	32.8	34.8	37.0	35.6	35.3	34.8	35.5
Specks (no/10 sq in)	26	26	23	31	41	25	29
Protein (%)	12.5	11.7	13.7	12.4	12.4	12.2	12.5
Gluten Index (%)	45.1	55..1	60.6	55.5	55.2	58.9	57.1
Mixograph Classification	5.5	5.5	5.6	5.4	5.4	5.5	5.5
Color: L (black-white)	84.9	84.6	85.0	84.6	84.2	84.7	84.6
a (red-green)	-3.97	-3.23	-2.82	-2.74	-2.67	-2.80	-2.85
b (yellow-blue)	27.9	27.7	29.8	29.7	25.9	28.4	28.3
SPAGHETTI PROCESSING DATA							
Color Score (scale of 1-12)	8.8	8.6	9.5	9.3	8.3	9.5	9.0
L (black-white)	53.5	56.4	55.5	55.2	55.2	56.4	55.4
b (yellow-blue)	26.6	27.4	27.5	27.3	26.9	27.4	26.9
Cooked Weight (gm)	31.9	31.3	31.3	32.1	31.4	31.6	31.5
Cooking Loss (%)	6.8	6.7	5.3	6.4	6.4	6.1	6.2
Cooked Firmness (g cm)	4.2	4.0	5.1	5.3	4.5	5.0	4.8

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.

EXPORT CARGO SAMPLING

SAMPLE COUNT	2013 (2)	2012 (6)
GRADING AND WHEAT DATA		
Test Weight (lbs/bu)	60.9	60.5
Test Weight (kg/hl)	79.3	78.9
Damaged Kernels (%)	1.9	1.2
Foreign Material (%)	0.3	0.1
Shrunken & Broken (%)	1.3	1.8
Total Defects (%)	3.5	3.1
Vitreous Kernels (%)	74	81
Grade	2 AD	2 HAD
OTHER WHEAT DATA		
Dockage (%)	0.5	0.5
Moisture (%)	12.7	10.9
Protein: 12% moisture (%)	13.6	14.3
Protein: Dry (%)	15.4	16.3
Ash: 14% moisture (%)	1.61	1.62
Ash: Dry (%)	1.87	1.88
1000 Kernel Weight (gm)	39.2	36.4
Kernel Size (%) lg/md/sm	36/60/5	37/57/6
Falling Number (sec)	458	451
DON (ppm)	n/a	0.7
SEMOLINA DATA		
Total Extraction (%)	69.7	68.8
Semolina Extraction (%)	62.6	62.8
Ash: 14% moisture (%)	0.57	0.68
Ash: Dry (%)	0.67	0.79
Gluten Index	58	56
Specks (no/10 sq in)	25	25
Protein: 14% moisture (%)	12.4	13.1
Protein: Dry (%)	14.4	15.2
Mixograph Classification (scale of 1-8)	6.0	5.7
Color: L (black-white)	85.1	84.9
a (red-green)	-3.19	-2.79
b (yellow-blue)	27.0	27.6
SPAGHETTI PROCESSING DATA		
Color Score (scale of 1-12)	8.3	8.9
Cooked Weight (gm)	31.9	32.6
Cooking Loss (%)	7.3	5.8
Cooked Firmness (g cm)	4.6	4.6

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.

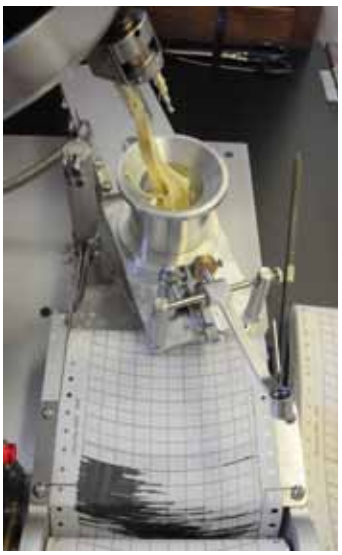
Data contained in previous sections of this report are derived from the testing of samples gathered during harvest from origination points throughout the northern U.S. durum growing region. The results provide and assessment of the overall quality of the crop produced in a given year.

U.S. Wheat Associates, the export market development arm for American wheat growers, furthers this information by commissioning an export cargo sampling program. That data is shown in the table to the left. The program provides an accurate representation of the supplies moving through the grain marketing and transportation system and actually reaching export points. Results show the quality levels at which U.S. wheat is realistically traded and are useful to customers in developing reasonable purchase specifications.

The Federal Grain Inspection service oversees the program whereby all export inspection agencies at all ports collect every tenth sub lot sample from every vessel of U.S. wheat shipped during three two-month time periods annually.

The durum wheat samples are sent for analysis to the Durum Wheat Quality and Pasta Processing Laboratory in the North Dakota State University Plant Science Department. The samples represented here are based on samples collected from the fall of 2012 through the summer of 2013 for crop year 2012. For crop year 2013, samples tested were collected from the fall of 2013 through the spring of 2014. Grade data in the table is the actual official grade on individual sublots.

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, Hiroshi Ando, food technologists and Elena de la Pena and Yu Liu, graduate assistants 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 late August when approximately 10 percent of the regional durum crop had been harvested and continued until early October. A total of 185 samples were collected during harvest from Montana (49) and North Dakota (136).

Collected samples fell slightly short of the pre-harvest target due to the extended harvest season, and survey data presented does not reflect 100% of the harvest.

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, Fargo, 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 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 (Combustion Method), expressed on dry basis and 12 percent moisture basis.

ASH • American Association of Cereal Chemists Method 08-01, 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 56-81B, 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, 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, approved October 1999; determined with the glutomatic instrument as an indication of gluten strength.

SEMOLINA

EXTRACTION • AACC Method 26-41 (modified for the Buhler Mill). Expressed on a total product basis.

ASH • AACC Method 08-01, approved April 1961, revised October 1999; expressed on a 14 percent moisture basis.

PROTEIN • AACC Method 46-30 (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 54-40A 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, 1983), using a Minolta Color Difference Meter (Model CR 310, 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.

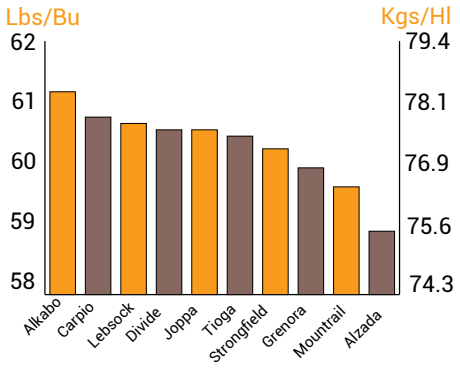
COOKED WEIGHT • AACC Method 66-50 with some modifications: 10 g of dry spaghetti were placed in 300 ml boiling distilled water and cooked for 12 min. The cooked and drained spaghetti sample was weighed and the results were reported in grams.

COOKING LOSS • AACC Method 66-50. Solids lost to the cooking water. After drying the residue was weighed and reported as percentage of the original dry sample.

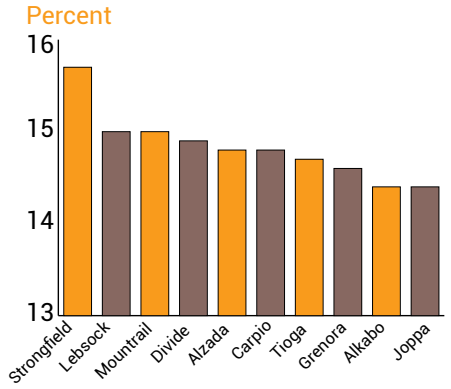
FIRMNESS • AACC Method 66-50 with a Plexiglas tooth attached to a Texture Analyzer (Model TA-XT2, Texture Technology Corp., Scarsdale, New York).

VARIETAL INFORMATION

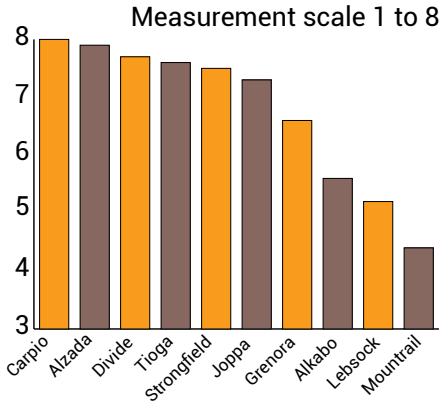
TEST WEIGHT



KERNEL PROTEIN



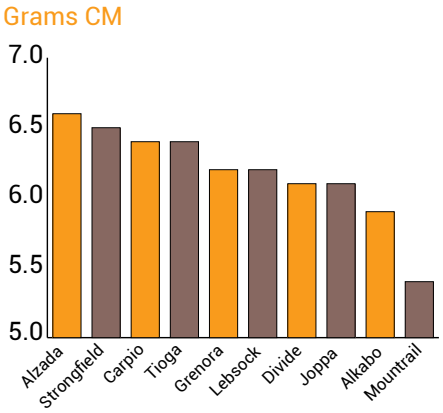
MIXOGRAPH



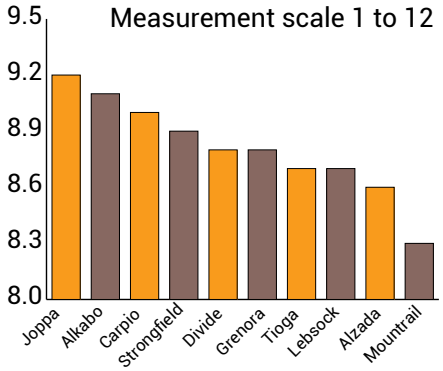
Quality products begin with quality ingredients. In the case of wheat, quality begins with the varieties planted. Within the durum class of wheat, there are different varieties available—all with relatively uniform characteristics. The public plant breeding program at North Dakota State University in Fargo develops and releases most of the durum varieties grown in the northern region, although some private firms also have durum breeding programs. Before any durum variety is released to the public, breeders are encouraged to show that it meets or exceed current standards for the class. Prospective releases are evaluated for milling and pasta characteristics as well as for yield, protein content, test weight, resistance to diseases and insects, and straw strength.

Environment influences the quality of varieties across growing areas and planting years. For this reason, wheat breeders use "check" or reference varieties to evaluate quality in experimental varieties. They test and analyze quality data from multiple years and growing locations before a variety is released.

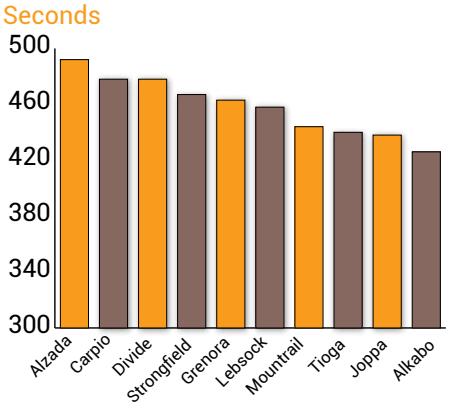
COOKED FIRMNESS



PASTA COLOR



FALLING NUMBER



Source: Yield trials 2011-13 crop years across multiple North Dakota locations.

VARIETAL INFORMATION

MAJOR VARIETIES PRODUCED IN REGION • AGRONOMIC FACTORS								
			Agronomic Description		Reaction to Disease[2]		Average Yield	
Variety	Agent or Origin[1]	Year Released	Straw Strength	Leaf Rust	Foliar Disease	Head (Scab)	Western, North Dakota[4] BU/Acre	MT/Hect
Alkabo	ND	2005	v. strong	R	M	M	52.6	3.54
Alzada	WB	2004	medium	R	S	S	45.2	3.04
Carpio	ND	2012	medium	R	M	M	54.8	3.68
Divide	ND	2005	medium	R	M	M	52.3	3.52
Grenora	ND	2005	medium	R	M	M	53.4	3.59
Joppa	ND	2013	medium	R	M	M	57.0	3.83
Lebsock	ND	1999	strong	R	M	M	52.0	3.49
Mountrail	ND	1998	medium	R	M	M	52.8	3.55
Strongfield	CAN	2004	medium	R	MS	MS	51.8	3.48
Tioga	ND	2010	medium	R	M	M	54.1	3.63

GROWN AND TESTED ACROSS NORTH DAKOTA • QUALITY & END-USE FACTORS									
	Quality Factors[4]								
Variety	Test Weight LB/BU	Test Wheat KG/HL	Wheat Protein %	Wheat Falling # Seconds	Mixogram Score (scale 1-12)	Pasta Color (Scale 1-12)	Gluten Index %	Cooked Firmness G CM	Overall Pasta Quality Rating [5]
Alkabo	61.2	79.7	14.4	426	5.6	9.1	53	5.9	average
Alzada	59.0	76.9	14.8	492	7.9	8.6	91	6.6	good
Carpio	60.8	79.2	14.8	478	8.0	9.0	92	6.4	excellent
Divide	60.6	78.9	14.9	478	7.7	8.8	80	6.1	good
Grenora	60.0	78.2	14.6	463	6.6	8.8	66	6.2	good
Joppa	60.6	78.9	14.4	438	7.3	9.2	85	6.1	good
Lebsock	60.7	79.1	15.0	458	5.2	8.7	47	6.2	average
Mountrail	59.7	77.8	15.0	444	4.4	8.3	33	5.4	fair
Strongfield	60.3	78.5	15.7	467	7.5	8.9	69	6.5	good
Tioga	60.5	78.8	14.7	440	7.6	8.8	81	6.4	good

Source: 2014 North Dakota Durum Wheat Variety Performance Descriptions

1. ND–North Dakota State University, WB–Westbred and CAN-Canada.

2. Reaction to Disease: resistant (R), moderately resistant (MR), intermediate (M), moderately susceptible (MS), susceptible (S), very susceptible (VS).

3. Three year average data 2011-13 from six locations across North Dakota, however in 2011 data from Carrington, Dickinson and Minot was not available.

4. Based on NDSU Durum Quality Lab testing of samples grown at multiple North Dakota locations during 2011-13.

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 five durum varieties planted in North Dakota in 2014 remained the same as 2013 and included Divide, Alkabo, Mountrail, Tioga and Lebsock. On a combined basis they account for more than eighty percent of the planted acres.

DIVIDE is the top variety planted in North Dakota, accounting for 37 percent of the acreage, up slightly from 33 percent in 2013. It has been the leading variety in North Dakota for six consecutive years and dominates the share of acres in each of the four primary durum producing districts in the state. In 2014 Divide also advanced to the leading variety in Montana with slightly more than one-third of the acres. A 2005 release from North Dakota State University, Divide has grown in popularity with producers for its high yield potential and very good disease resistance package. It is rated as good for end-use quality, especially for gluten strength and overall cooking qualities.

ALKABO remained the second most popular variety in North Dakota with 16 percent of durum plantings, but fell slightly from its peak acreage share of 19 percent in 2013. It is most popular in the northwest and southwest districts in North Dakota. Alkabo is the sixth most popular variety in Montana in 2014 with a 4 percent share of the acres. It is a 2005 NDSU release noted for high yield potential with improved straw strength when compared to other popular varieties. Alkabo possesses good end-use quality traits, especially for pasta color.

TIOGA is the fourth most popular variety planted in North Dakota in 2014 with roughly 10 percent of the acres, similar to its share in 2013. It ranks seventh for acreage share in Montana with 4 percent. Tioga was released in 2010 for its combination of enhanced yield potential and very balanced end-use quality traits. It is most popular in the west central district of North Dakota.

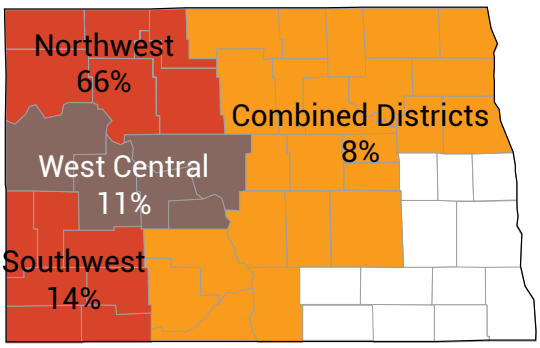
LEBSOCK retained fifth place in North Dakota planted area with slightly more than 7 percent of the acres but continues to slip in its share of acres compared to recent years. It advanced to third place in Montana in 2014 with a 6 percent share of planted area, up from just 1 percent in 2013. Lebsock is a 1999 NDSU release and has been long-time popular variety with producers for its dependable agronomics, strong straw and proven performance for higher test weights. It is rated as average for end-use quality.

NORTH DAKOTA VARIETIES SHARE OF PLANTED ACRES[3]

Variety	2014%[1]	2013%[1]
Divide	37.0	33.4
Alkabo	16.2	19.0
Mountrail	12.9	12.7
Tioga	9.7	10.7
Lebsock	7.5	10.3
Grenora	3.4	2.3
Ben	1.6	1.5
Monroe	1.0	1.0
Dilse	1.0	1.5
DG Star	0.8	0.9
Other[2]	8.9	6.7

1. Percentage may not add to 100 due to rounding.
2. Includes varieties with less than 1% of acreage in 2014 and unknown varieties.
3. 1,000 acres (1 acre = 0.405 hectares)
   2014 - 840,000 acres
   2013 - 800,000 acres

NORTH DAKOTA 2014 SHARE OF PLANTED ACRES BY NASS DISTRICTS

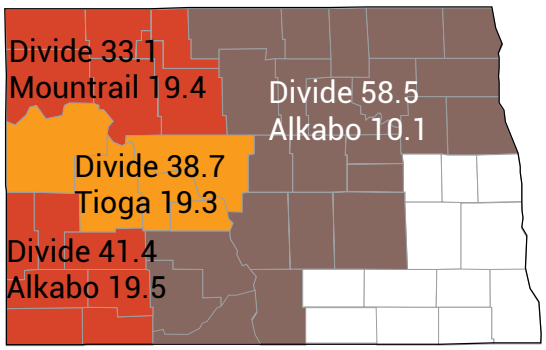


NORTH DAKOTA VARIETIES SHARE OF 2014 PLANTED ACRES BY CROP DISTRICT

Variety	North West	West Central	South West	Combined Districts[1]	Total State
			percentage (%)[2]		
Divide	33.1	38.7	41.4	58.5	37.0
Alkabo	17.7	7.3	19.5	10.1	16.2
Mountrail	19.4	0.0	0.0	0.0	12.9
Tioga	7.7	19.3	12.0	8.9	9.7
Lebsock	6.1	16.5	5.9	9.2	7.5
Grenora	3.7	0.0	3.8	5.2	3.4
Ben	0.3	0.0	9.8	0.0	1.6
Monroe	1.5	0.0	0.0	0.0	1.0
Dilse	0.0	0.0	4.4	4.1	1.0
DG Star	0.3	5.2	0.0	0.0	0.8
Other[3]	10.2	13.1	3.2	4.1	8.9
			1,000 acres (1 acre = 0.4 hectares)		
Total Acres[3]	578	95	126	71	870[4]

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 2014 and unknown varieties.
4. September 30, 2014 small grain estimates was 840,000 acres.

NORTH DAKOTA 2014 TOP TWO VARIETIES BY DISTRICT (% OF ACRES)



MONTANA

The top five durum varieties planted across Montana in 2014 included Divide, Mountrail, Lebsock, Alzada and Strongfield, combining for slightly more than eighty percent of the total durum acres.

MOUNTRAIL is the second leading variety in Montana with 28 percent of the acres, up from 23 percent in 2013. It is most popular in the north east part of the state where it is showing a resurgence in acre share. In North Dakota, Mountrail is the third most popular variety with 13 percent of the acres, a share that has been steady for the past five years. Released by NDSU in 1998 it quickly became a dominant variety for its elite yield potential and proven agronomic traits for producers despite its lower disease resistance. Mountrail is rated as fair for end-use quality.

ALZADA is the fourth most popular variety in Montana with a 6 percent share of acres, down marginally from 9 percent in 2013. All of its acres are outside of the north east district in the state due to its susceptibility to disease. Alzada is a 2004 release from Westbred (Monsanto) with uniquely strong gluten qualities and typically has very high pasta color scores.

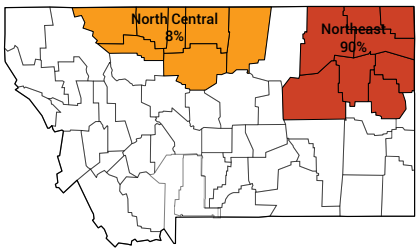
STRONGFIELD ranks fifth for acreage share in Montana in 2014 with roughly 6 percent, but down from third position and nearly 11 percent of the acres in 2013. It is a 2004 release from Ag Canada developed for low grain cadmium uptake and higher kernel protein content. Strongfield is rated as good for end-use quality.

MONTANA VARIETIES SHARE OF PLANTED ACRES[3]

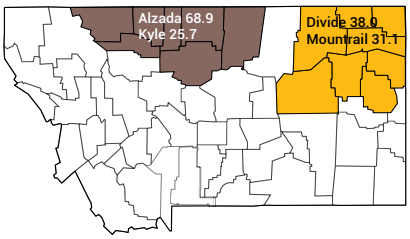
Variety	2014%[1]	2013%[1]
Divide	34.4	22.1
Mountrail	28.0	22.7
Lebsock	6.4	1.1
Alzada	6.2	9.3
Strongfield	5.8	10.8
Alkabo	4.4	4.5
Tioga	4.0	0.8
Kyle	3.4	4.5
Pierce	1.4	1.1
Grande D'Oro	1.2	0.0
Other[2]	4.8	23.1

1. Percentage may not total 100 due to rounding.
2. Includes varieties with less than 1% of acreage in 2014 and unknown varieties.
3. 1,000 acres (1 acre = 0.405 hectares)
   2014 - 440,000 planted acres
   2013 - 450,000 planted acres

MONTANA 2014 SHARE OF PLANTED ACRES BY NASS DISTRICT



MONTANA 2014 TOP TWO VARIETIES BY CROP DISTRICT (% OF ACRES)



MONTANA VARIETIES SHARE OF 2014 PLANTED ACRES BY CROP DISTRICT

Variety	North Central	North East	Other Districts[1]	Total State
	percentage (%)[2]			
Divide	0.0	38.0	9.0	34.4
Mountrail	0.0	31.1	0.0	28.0
Lebsock	0.0	7.1	0.0	6.4
Alzada	68.9	0.5	16.3	6.2
Strongfield	2.6	6.2	0.0	5.8
Alkabo	0.0	4.9	0.0	4.4
Tioga	2.3	4.2	0.0	4.0
Kyle	25.7	1.5	0.0	3.4
Pierce	0.0	1.6	0.0	1.4
Grand D'Oro	0.0	1.3	0.0	1.2
Other[3]	0.5	3.6	74.7	4.8
	1,000 acres (1 acre = 0.4 hectares)			
Total Acres[3]	35	405	10	450[4]

1. Other district varieties were combined to avoid disclosure of individual information.
2. Percentages may not add to 100 due to rounding.
3. Includes varieties with less than 1% acreage in 2014 and unknown varieties.
4. September 30, 2014 small grain estimates was 440,000 acres.

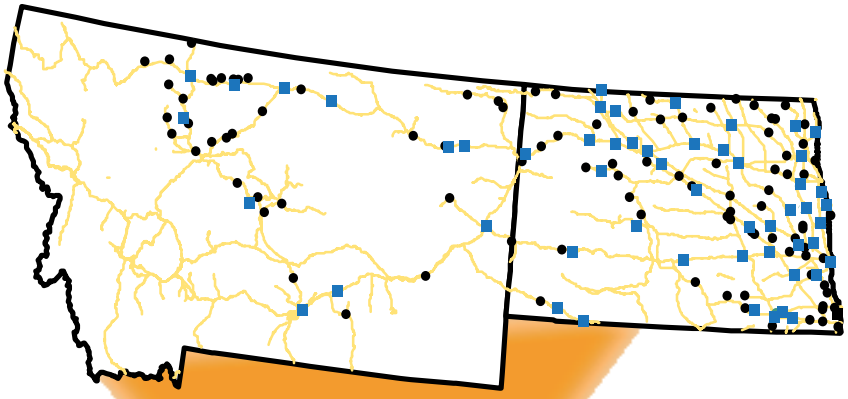
HANDLING & TRANSPORTATION

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.

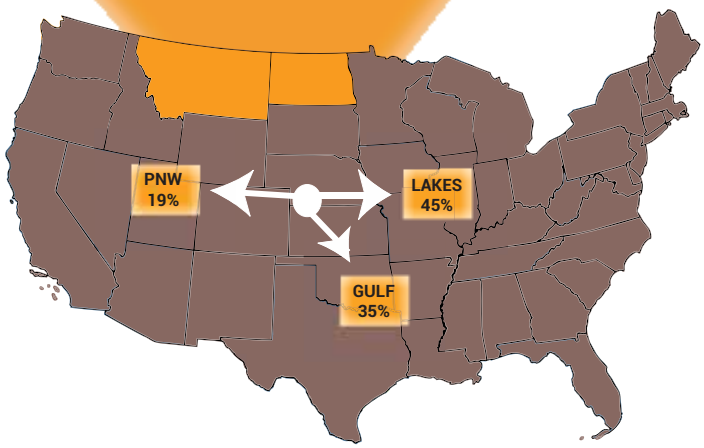
The rail and elevator network in the U.S. northern grown durum region is well suited for meeting the increasing quality demands of both domestic and international customers.



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

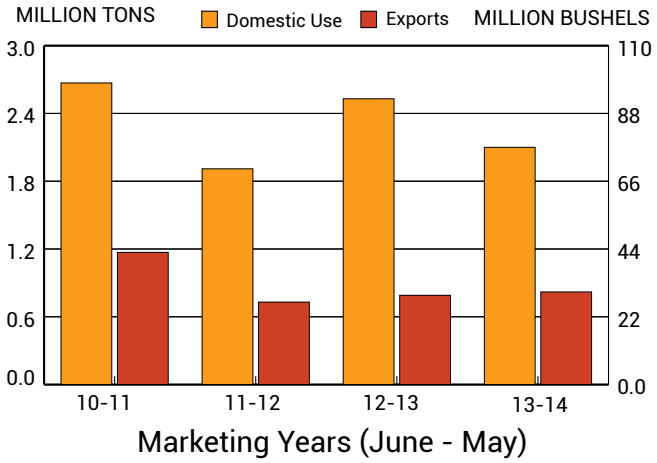
Source: Upper Great Plains Transportation Institute

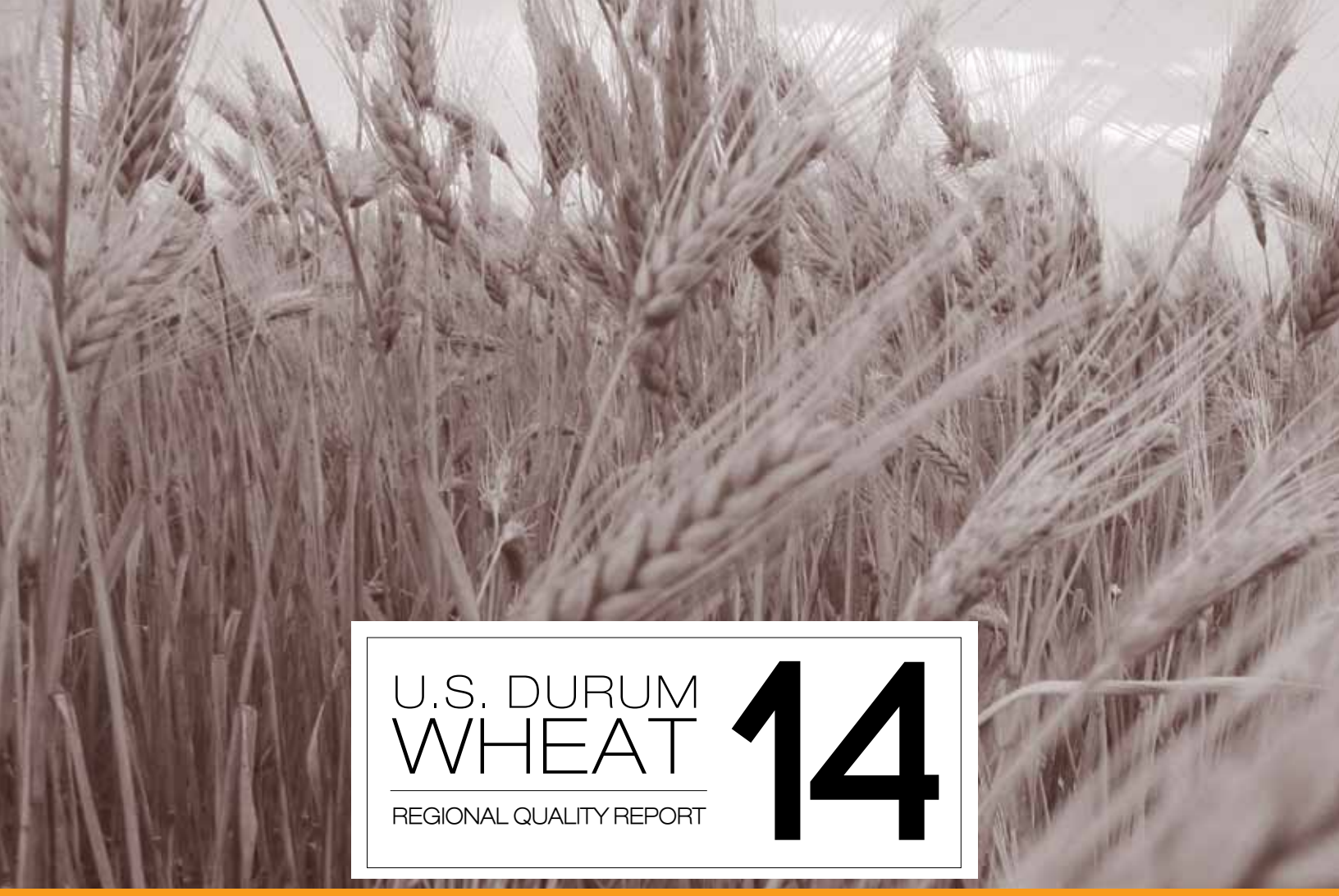
Grain Handling and Transportation Facilities in the Two-State Region



AVERAGE SHARE OF U.S. DURUM EXPORTS BY PORT (2010-2013)

2010-13 U.S. DURUM DOMESTIC USE AND EXPORTS





U.S. DURUM WHEAT 14

REGIONAL QUALITY REPORT

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North Dakota Wheat Commission

Montana Wheat and Barley Committee

North Dakota State University Plant Sciences Department