

# U.S. DURUM WHEAT

MONTANA | NORTH DAKOTA



## 2012 REGIONAL QUALITY REPORT

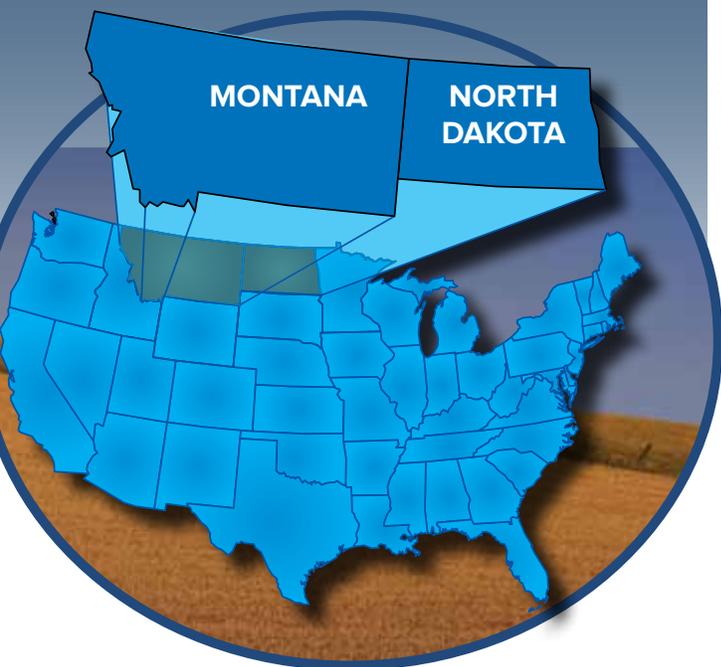
# U.S. DURUM WHEAT

MONTANA | NORTH DAKOTA

## 2012 REGIONAL QUALITY REPORT

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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. Farmers in California and Arizona grow the remainder.

#### 2012 OVERVIEW

Planted acreage in North Dakota and Montana was up by nearly 60 percent after wet conditions dropped acreage to a record low in 2011. Total acreage was still slightly below average. Yields were similar to or higher than last year's levels due to the early planting season and adequate subsoil moisture. Final yields were not as high as expected early on in the growing season due to hot, dry conditions that prevailed during July and August. The increased acreage and larger yields equated to Northern durum production that was nearly double the size of last year's crop.

The 2012 crop grades #1 Hard Amber Durum (HAD), with over 50 percent of the crop reaching the top grade. Average test weight is slightly higher than last year and the five year average at 60.6 pounds per bushel (78.9 kg/hl) and vitreous kernel content is marginally higher at 89 percent. Eighty-three percent of the crop is above the HAD minimum of 75% vitreous kernels, while sixty-three percent is above the desired 90% vitreousness. Thousand kernel weights are slightly higher than last year, but below the five-year average at 36.9 grams. Average protein is 14.6%, one point higher than 2011 and half a point higher than the five-year average. Ninety-five percent of

the crop is above the typical minimum industry demand of 13 percent.

Damage levels are similar to last year at 0.5% due to some areas experiencing disease pressures during flowering and elevating DON levels in those areas. While DON levels are higher than average, the average in most regions is below last year's levels. Total defects are 1.8% with higher than average levels of shrunken and broken kernels. Falling number values are significantly higher with the average at 412 seconds, indicating a very sound crop. Only one percent of the crop fell below a 300 second falling number.

Milling performance, based on the Buhler Laboratory Mill, indicates total and semolina extraction levels lower than last year and the five-year average. Total extraction is 68.6% and semolina extraction is 63.4% compared to the five-year average of 70.6% and 64.2% respectively. Average semolina ash of 0.63% is lower than both last year and the five-year average.

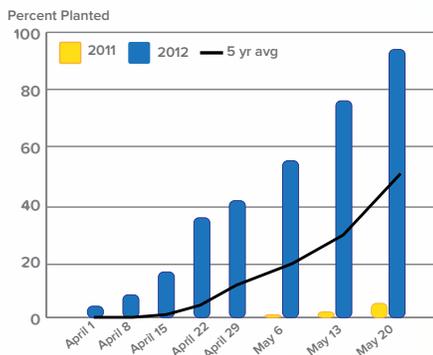
Semolina mixing properties are stronger than last year and the gluten index continues to increase each year. Gluten index is 60.6 percent, up significantly from the five year average of 51.8 percent. The high vitreous kernel counts and sound crop resulted in lower speck counts (23 per 10 sq in versus 31 in 2011) and better pasta color compared to last year. The average pasta color score is 9.5 (scale 1-12) compared to 9.0 for the five-year average. Cooking loss is nearly a percentage point lower than 2011 at 5.3 percent with similar cooked firmness values.

Buyers will enjoy a durum crop that is high grading and good in overall quality. Especially notable are improvements in semolina and processing characteristics such as higher gluten indexes, improved pasta color and lower cooking loss. It should be noted that there is a portion of the crop that falls into lower grade classes with lower vitreous kernel counts and pockets of production areas with higher DON levels. However with a larger crop this year and with specific contract specifications, buyers will be able to source the quality they need.

PRODUCTION DATA	2011	2012	2007-2011 AVERAGE
<b>MILLION BUSHEL</b>			
Montana	10.8	14.4	13.5
North Dakota	18.2	42.6	46.3
Regional Total	29.0	57.0	59.8
U.S. Total	50.5	82.0	84.5
<b>MILLION METRIC TON</b>			
Montana	0.29	0.39	1.26
North Dakota	0.50	1.16	0.37
Regional Total	0.79	1.55	1.63
U.S. Total	1.37	2.23	2.30

## SEASONAL CONDITIONS

### NORTH DAKOTA DURUM PLANTING PROGRESS



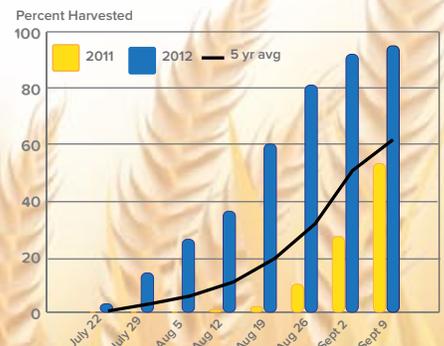
**PLANTING** of the durum crop began earlier than normal in April and progressed well ahead of both last year and the five-year average pace. Cooperative weather conditions allowed planting to finish by the end of May with very few interruptions.

**GROWING** conditions were mostly favorable during the first part of the season with adequate moisture for crop development. Conditions turned hot and dry in July and August, but subsoil moisture was mostly sufficient to finish the crop and maintain yields. Overall, disease pressure was lower

than last year and minimized by dry conditions, but untimely rain showers in some areas did have some impact on quality.

**HARVEST** began ahead of average in late July due to the early planting and hot, dry conditions that pushed crop development. Harvest was finished very quickly as there were few weather related interruptions. Most of the durum was harvested by mid-September.

### NORTH DAKOTA DURUM HARVEST PROGRESS



# U.S. DURUM WHEAT

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## WHEAT CHARACTERISTICS

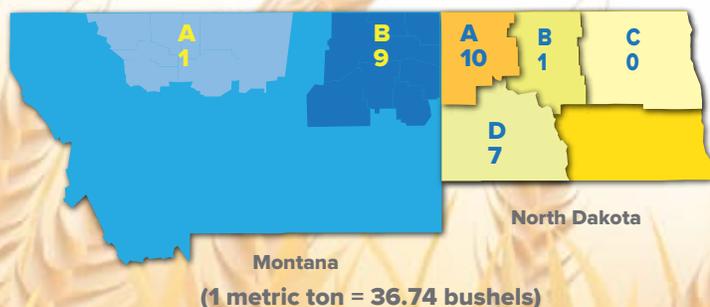
**WHEAT GRADES** as defined by the Federal Grain Inspection Service (FGIS) of the USDA Grain Inspection, Packers and Stockyards Administration (GIPSA), reflect the general quality and condition of a representative sample. U.S. grades are based on test weight and include limits on damaged kernels, foreign 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.

GRADING FACTORS	U.S. Grades				
	1	2	3	4	5
<b>DURUM - MINIMUM TEST WEIGHTS</b>					
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
<b>MAXIMUM PERCENT LIMITS OF:</b>					
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 <sup>1</sup>	3.0	5.0	8.0	12.0	20.0
Wheat of other classes <sup>2</sup>					
Contrasting classes	1.0	2.0	3.0	10.0	10.0
Total <sup>3</sup>	3.0	5.0	10.0	10.0	10.0
Stones	0.1	0.1	0.1	0.1	0.1
<b>MAXIMUM COUNT LIMITS OF:</b>					
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 <sup>4</sup>	4	4	4	4	4
Insect-damaged kernels in 100 grams	31	31	31	31	31

### Crop Reporting Areas & 2011 Durum Wheat Production in Million Bushels



U.S. Sample grade is wheat that:

- Does not meet the requirements for U.S. Nos. 1, 2, 3, 4, or 5; or
- Has a musty, sour, or commercially objectionable foreign odor (except smut or garlic odor); or
- is heating or of distinctly low quality.

- Includes damaged kernels (total), foreign material, and shrunken and broken kernels.
- Unclassed wheat of any grade may contain not more than 10.0 percent of wheat of other classes.
- Includes contrasting classes.
- Includes any combination of animal filth, castor beans, crotalaria seeds, glass, stones, or unknown foreign substance.

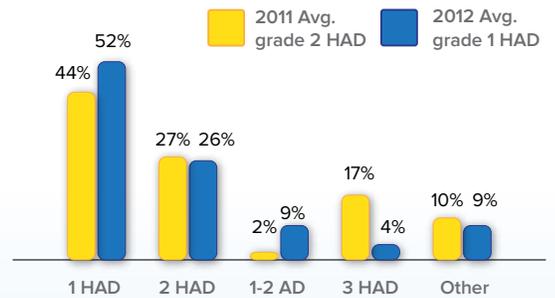
# WHEAT GRADING DATA

## OVERALL GRADE

The average grade for the region is 1 HAD. This grade represents average test weight of 60.6 pounds per bushel (78.9 kg/hl), total defects of 1.8 percent and vitreous kernel content of 89 percent.

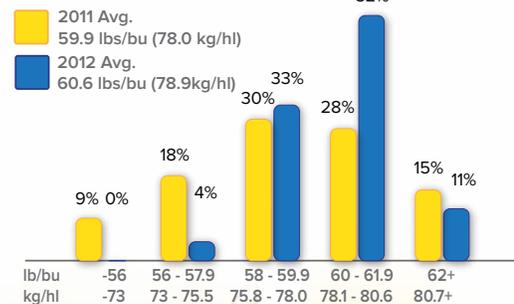
Seventy-eight percent of the 2012 samples grade 2 HAD or better.

## REGIONAL GRADE DISTRIBUTION



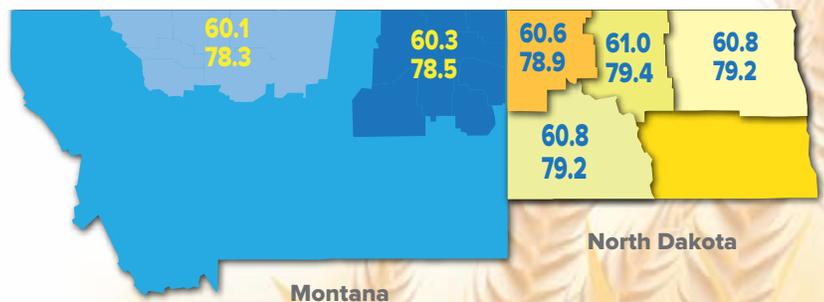
STATE AND CROP REPORTING AREA	TEST WEIGHT LBS/BU	TEST WEIGHT KG/HL	DAMAGE %	FOREIGN MATERIAL %	SHRUNKEN/BROKEN KERNELS %	TOTAL DEFECTS %	CONTRASTING CLASSES %	U.S. GRADE	VITREOUS KERNELS %
<b>MONTANA</b>									
Area A	60.1	78.3	0.0	0.1	1.5	1.6	0.0	1 HAD	99
Area B	60.3	78.5	0.0	0.0	1.2	1.2	0.0	1 HAD	91
State Avg. 2012	60.3	78.5	0.0	0.0	1.2	1.3	0.0	1 HAD	92
State Avg. 2011	61.4	80.0	0.2	0.0	0.8	1.0	0.0	1 HAD	89
<b>NORTH DAKOTA</b>									
Area A	60.6	78.9	0.8	0.0	1.2	2.0	0.0	1 HAD	89
Area B	61.0	79.4	1.0	0.1	1.7	2.8	0.0	1 HAD	92
Area C	60.8	79.2	0.2	0.0	1.1	1.3	0.0	1 HAD	89
Area D	60.8	79.2	0.1	0.0	1.2	1.3	0.0	1 HAD	82
State Avg. 2012	60.7	79.1	0.7	0.0	1.3	2.0	0.0	1 HAD	88
State Avg. 2011	58.9	76.8	0.6	0.0	1.7	2.3	0.0	2 HAD	88
<b>TWO-STATE REGION</b>									
Avg. 2012	60.6	78.9	0.5	0.0	1.3	1.8	0.0	1 HAD	89
Avg. 2011	59.9	78.0	0.4	0.0	1.4	1.8	0.0	2 HAD	88
Five-Year Avg.	60.3	78.5	0.5	0.0	1.1	1.6	0.2	1 HAD	86

## REGIONAL TEST WEIGHT DISTRIBUTION



Sixty-three percent of the 2012 samples have a test weight of 60 lb/bu (78.1 kg/hl) or greater.

## TEST WEIGHT BY AREA

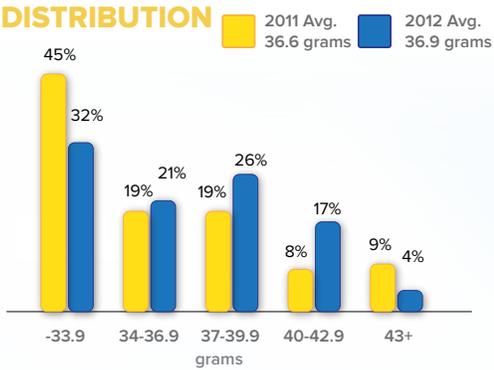


pounds per bushel - top  
kilograms per hectoliter - bottom

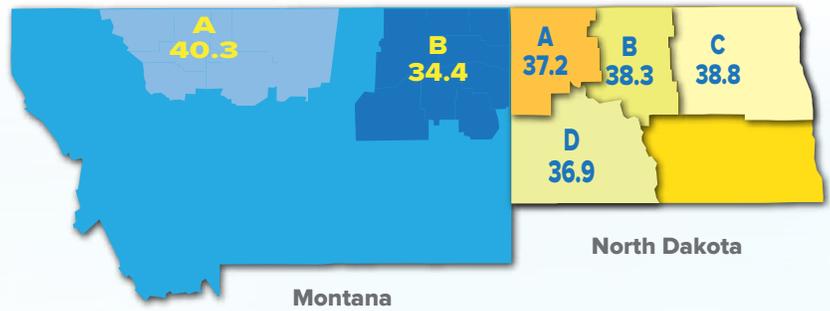
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## REGIONAL 1000 KERNEL WEIGHT DISTRIBUTION

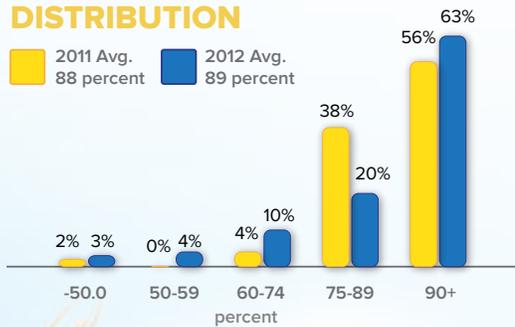


## 1000 KERNEL WEIGHT BY AREA (grams)

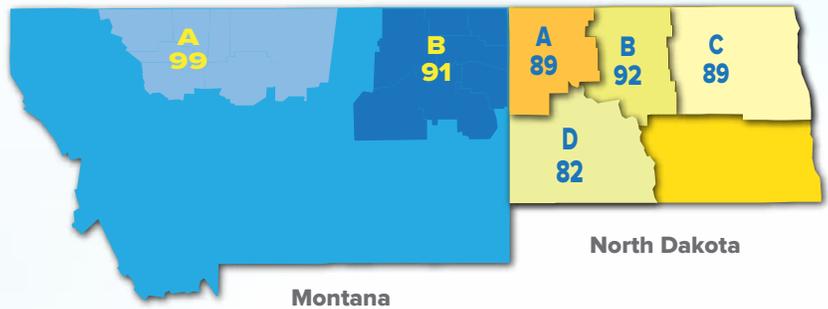


Forty-seven percent of the 2012 samples have a thousand kernel weight of 37 grams or more.

## REGIONAL VITREOUS KERNEL DISTRIBUTION

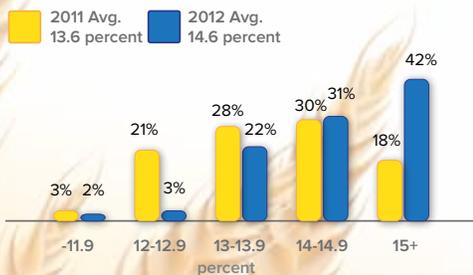


## AVERAGE VITREOUS KERNELS BY AREA (percent)

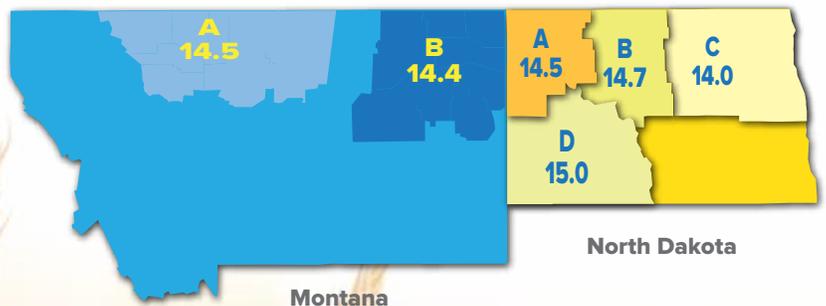


Eighty-three percent of the 2012 samples have 75 percent or greater vitreous kernels.

## REGIONAL PROTEIN DISTRIBUTION



## PROTEIN BY AREA - 12% moisture basis (percent)

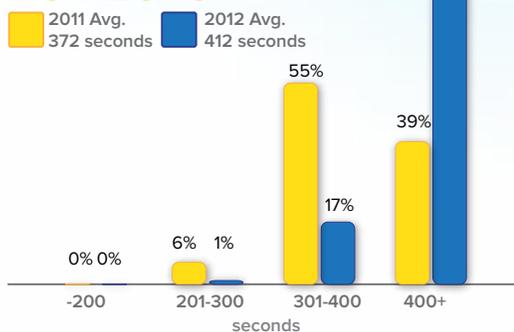


Ninety-five percent of the 2012 samples have a protein content of 13.0 percent or greater.

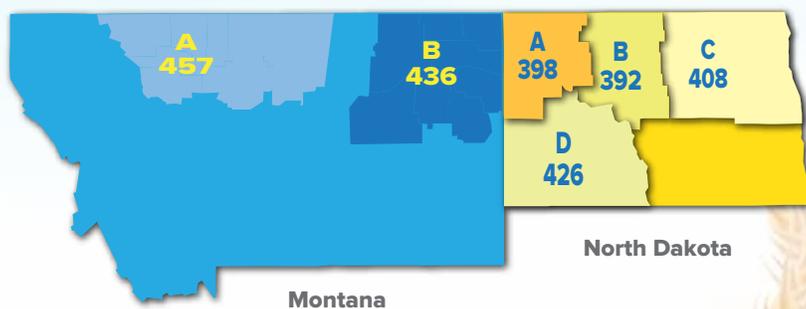
# OTHER KERNEL QUALITY DATA

STATE AND CROP REPORTING AREA	DOCKAGE %	MOISTURE %	1000 KERNEL WEIGHT G	KERNEL DIST MEDIUM %	KERNEL DIST LARGE %	PROTEIN (0 % MOISTURE) %	PROTEIN (12 % MOISTURE) %	DON (PPM)	WHEAT ASH %	FALLING NUMBER (SEC)	SED (CC)
<b>MONTANA</b>											
Area A	0.9	9.4	40.3	47	48	16.5	14.5	<0.25	1.84	457	67
Area B	1.2	10.2	34.4	19	74	16.4	14.4	<0.25	1.59	436	54
State Avg. 2012	1.2	10.1	35.2	23	70	16.4	14.4	<0.25	1.63	439	56
State Avg. 2011	1.3	11.1	40.0	57	39	14.6	12.8	<0.25	1.62	392	45
<b>NORTH DAKOTA</b>											
Area A	0.9	10.4	37.2	29	63	16.5	14.5	1.61	1.59	398	48
Area B	0.9	11.2	38.3	34	59	16.7	14.7	1.66	1.49	392	46
Area C	1.3	11.4	38.8	46	50	15.9	14.0	1.66	1.52	408	45
Area D	0.6	10.4	36.9	29	65	17.0	15.0	<0.25	1.53	426	47
State Avg. 2012	0.9	10.6	37.4	31	62	16.6	14.6	1.30	1.55	403	47
State Avg. 2011	1.5	11.9	34.6	56	34	16.1	14.1	1.56	1.76	360	42
<b>TWO-STATE REGION</b>											
Avg. 2012	0.9	10.5	36.9	29	64	16.6	14.6	0.97	1.57	412	49
Avg. 2011	1.4	11.6	36.6	57	36	15.5	13.6	0.96	1.71	372	43
Five-Year Avg.	1.3	11.7	37.6	55	39	16.0	14.1	0.36	1.57	359	47

## REGIONAL FALLING NUMBER DISTRIBUTION

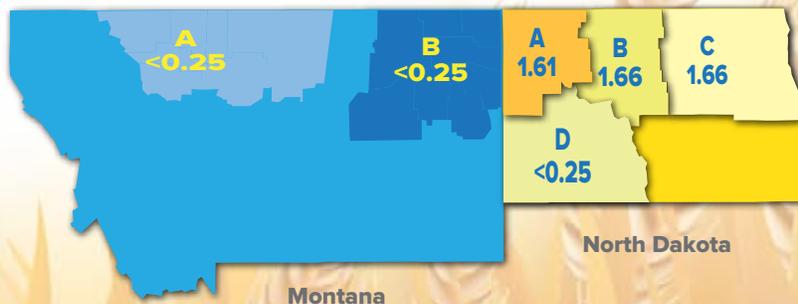


## FALLING NUMBER BY AREA (seconds)



Ninety-nine percent of the 2012 samples have a falling number of 300 seconds or better.

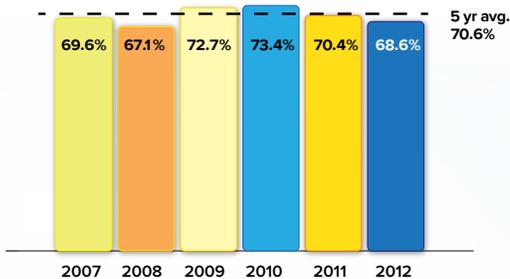
## DON BY AREA (PPM)



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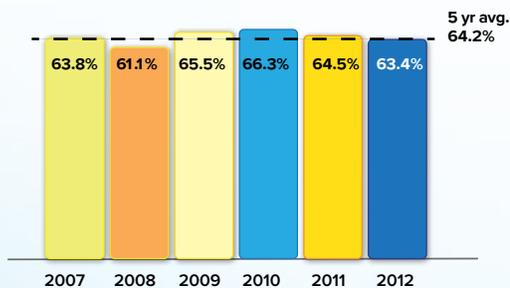
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## REGIONAL AVERAGE TOTAL EXTRACTION



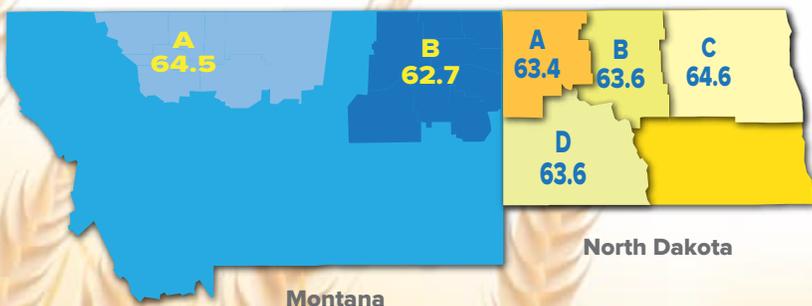
The regional average is 68.6 percent, lower than last year and the five-year average.

## REGIONAL AVERAGE SEMOLINA EXTRACTION

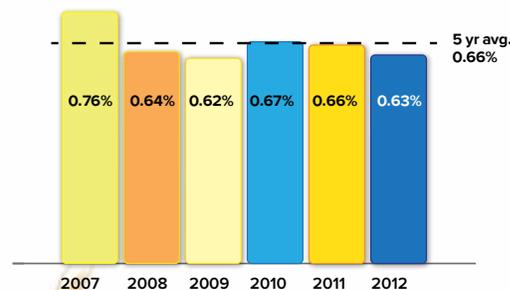


The regional average is 63.4 percent, lower than last year and the five-year average.

## SEMOLINA EXTRACTION BY AREA (percent)



## REGIONAL AVERAGE ASH CONTENT



The 2012 crop produced semolina with an average ash content of 0.63 percent, lower than last year and the five-year average.

## 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.

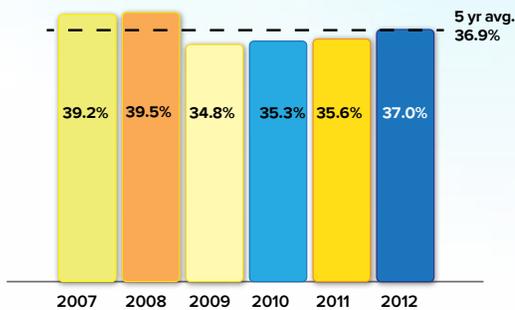
**PROTEIN CONTENT** in semolina has a high correlation with gluten content and, in turn, mechanical strength and cooking quality. Wet gluten is a quantitative measure of the gluten forming proteins in semolina that are primarily responsible for its mechanical strength and pasta quality.

**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.

# SEMOLINA QUALITY DATA

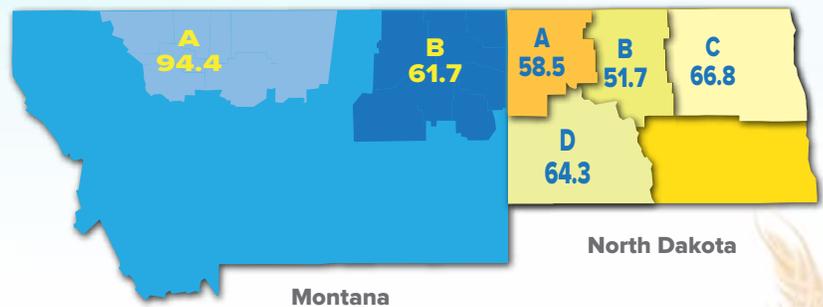
STATE AND CROP REPORTING AREA	TOTAL EXTRACTION %	SEMOLINA EXTRACTION %	ASH %	SPECKS NO/10 SQ IN %	PROTEIN (14 % MOISTURE) %	WET GLUTEN %	GLUTEN INDEX %	MIXOGRAM CLASSIFICATION SCALE 1-8
<b>MONTANA</b>								
Area A	68.9	64.5	0.72	20	13.6	34.4	94.4	8.0
Area B	67.7	62.7	0.65	17	13.6	36.0	61.7	6.0
State Avg. 2012	67.9	62.9	0.66	17	13.6	35.7	66.3	6.3
State Avg. 2011	71.6	65.5	0.61	26	11.8	33.8	55.9	5.4
<b>NORTH DAKOTA</b>								
Area A	68.7	63.4	0.61	27	13.7	37.7	58.5	5.0
Area B	69.2	63.6	0.63	23	13.4	36.9	51.7	5.0
Area C	70.4	64.6	0.67	23	12.8	34.4	66.8	5.5
Area D	69.0	63.6	0.66	20	14.0	37.7	64.3	6.5
State Avg. 2012	68.9	63.5	0.63	25	13.7	37.4	58.6	5.3
State Avg. 2011	69.7	63.8	0.70	34	12.8	36.7	55.2	5.3
<b>TWO-STATE REGION</b>								
Avg. 2012	68.6	63.4	0.63	23	13.7	37.0	60.6	5.6
Avg. 2011	70.4	64.5	0.66	31	12.4	35.6	55.5	5.4
Five-Year Avg.	70.6	64.2	0.66	29	13.0	36.9	51.8	5.4

## REGIONAL AVERAGE WET GLUTEN

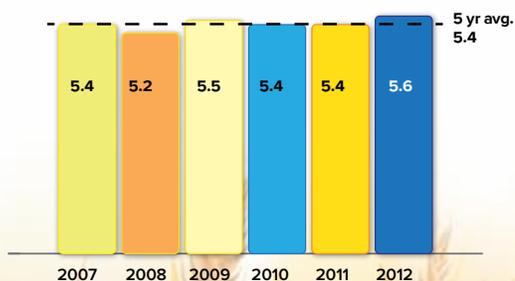


Average wet gluten content for the 2012 crop is 37.0 percent, similar to the five-year average.

## GLUTEN INDEX BY AREA (percent)

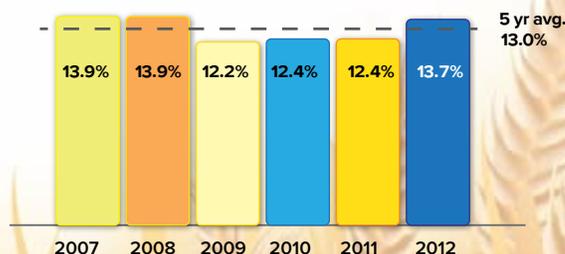


## REGIONAL AVERAGE MIXOGRAM CLASSIFICATION (scale of 1 to 8)



The average mixogram score is 5.6 (scale 1-8).

## REGIONAL AVERAGE SEMOLINA PROTEIN CONTENT



The 2012 average semolina protein content is 13.7 percent, higher than last year and the five-year average.

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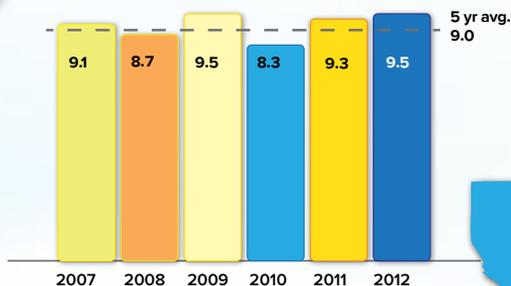
## PASTA CHARACTERISTICS

**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.

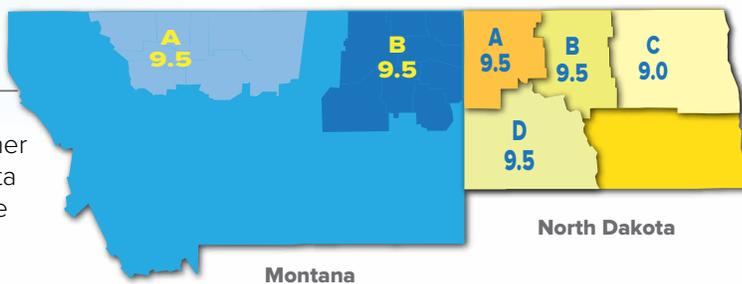
Most consumers prefer pasta that is “al dente,” meaning it has some firmness to the bite. Good quality pasta that is cooked according to package directions should not be sticky or mushy when eaten.

**REGIONAL AVERAGE COLOR SCORE (scale of 1-12)**

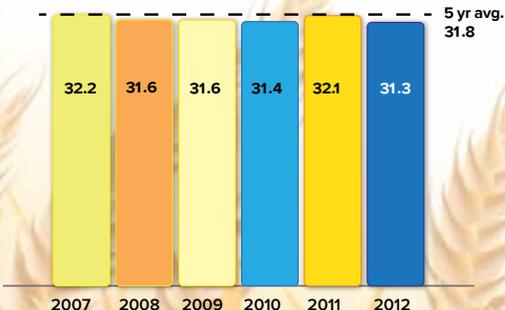


The 2012 average color score is 9.5, higher than 2011 and the five year average. Pasta samples with scores of 8.0 or higher have good color.

**COLOR SCORE BY AREA (scale of 1-12)**

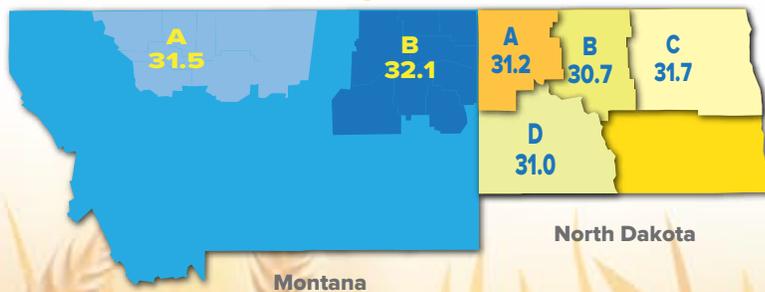


**REGIONAL AVERAGE COOKED WEIGHT (grams)**



The 2012 average cooked weight is 31.3 grams, lower than last year and the five-year average.

**COOKED WEIGHT BY AREA (grams)**

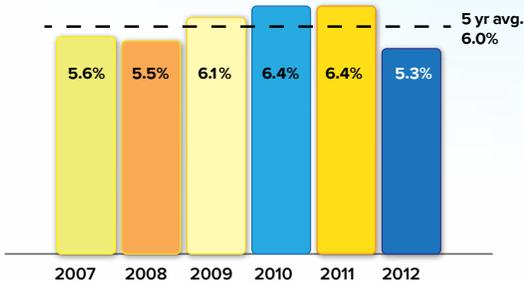


# SEMOLINA AND SPAGHETTI QUALITY DATA

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
<b>MONTANA</b>							
Area A	84.5	-2.75	31.8	9.5	31.5	5.4	5.7
Area B	85.5	-2.93	28.6	9.5	32.1	5.2	5.0
State Avg. 2012	85.3	-2.90	29.0	9.5	32.0	5.2	5.1
State Avg. 2011	84.6	-2.71	29.9	9.6	32.2	6.4	5.2
<b>NORTH DAKOTA</b>							
Area A	84.6	-2.77	30.3	9.5	31.2	5.4	5.0
Area B	85.2	-2.84	29.6	9.5	30.7	5.2	4.9
Area C	84.9	-2.83	29.9	9.0	31.7	5.4	4.6
Area D	85.5	-2.81	29.9	9.5	31.0	5.4	5.5
State Avg. 2012	84.9	-2.79	30.1	9.5	31.1	5.4	5.1
State Avg. 2011	84.5	-2.75	29.6	9.1	32.1	6.4	5.3
<b>TWO-STATE REGION</b>							
Avg. 2012	85.0	-2.82	29.8	9.5	31.3	5.3	5.1
Avg. 2011	84.6	-2.74	29.7	9.3	32.1	6.4	5.3
Five-Year Avg.	84.7	-2.80	27.2	9.0	31.8	6.0	5.2

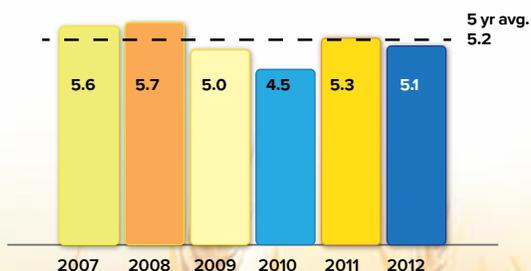
Semolina color performed on CIE color scale. Granulation size is approximately 40 percent above 425 microns and 12 percent below 180 microns.

## REGIONAL AVERAGE COOKING LOSS



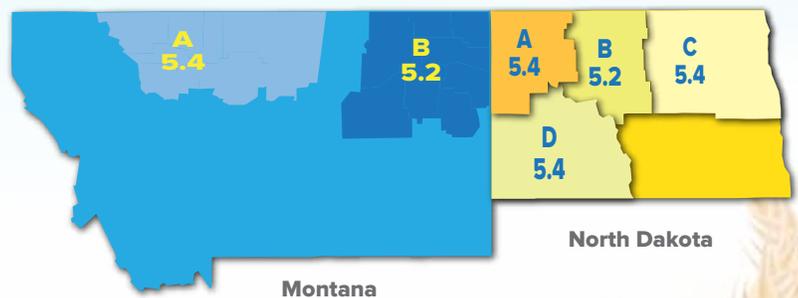
The 2012 average cooking loss is 5.3 percent, lower than last year and the five-year average.

## REGIONAL AVERAGE COOKED FIRMNESS (g cm)

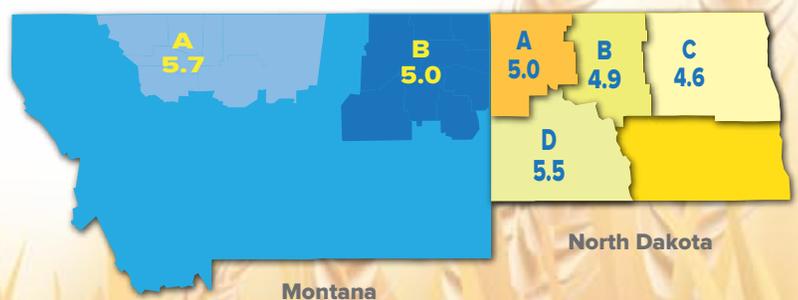


The 2012 average cooked firmness is 5.1 grams, similar to last year and the five-year average.

## COOKING LOSS BY AREA (percent)



## COOKED FIRMNESS BY AREA (g cm)



# U.S. DURUM WHEAT

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## AVERAGE QUALITY FACTORS FOR THE REGIONAL DURUM WHEAT CROP OVER RECENT YEARS

	2007	2008	2009	2010	2011	Five-Year Average	2012
<b>GRADING AND WHEAT DATA</b>							
Test Weight (lbs/bu)	59.9	60.2	61.4	60.0	59.9	60.3	60.6
Test Weight (kg/hl)	78.0	78.4	80.0	78.1	78.0	78.5	78.9
Total Defects (%)	1.8	1.6	1.1	2.0	1.8	1.6	1.8
Vitreous Kernels (%)	95	83	83	82	88	86	89
Grade	2 HAD	1 HAD	1 HAD	1 HAD	2 HAD	1 HAD	1 HAD
<b>OTHER WHEAT DATA</b>							
Dockage (%)	1.6	1.1	1.4	0.9	1.4	1.3	0.9
Protein: 12% moisture	15.1	14.8	13.5	13.4	13.6	14.1	14.6
1000 Kernel Weight (gm)	33.8	35.0	42.4	40.3	36.6	37.6	36.9
Moisture (%)	11.8	11.7	11.8	11.5	11.6	11.7	10.5
DON	0.30	0.01	0.16	0.32	0.96	0.35	0.97
Ash (%)	1.67	1.50	1.42	1.56	1.71	1.57	1.57
Falling Number (sec)	367	322	398	335	372	359	412
Sedimentation (cc)	52	49	50	43	43	47	49
<b>SEMOLINA DATA</b>							
Total Extraction (%)	69.6	67.1	72.7	73.4	70.4	70.6	68.6
Semolina Extraction (%)	63.8	61.1	65.5	66.3	64.5	64.2	63.4
Ash (%)	0.76	0.64	0.62	0.67	0.66	0.66	0.63
Wet Gluten (%)	39.2	39.5	34.8	35.3	35.6	36.9	37.0
Specks (no/10 sq in)	23	22	25	41	31	29	23
Protein (%)	13.9	13.9	12.2	12.4	12.4	13.0	13.7
Gluten Index (%)	48.0	41.4	58.9	55.2	55.5	51.8	60.6
Mixograph Classification	5.4	5.2	5.5	5.4	5.4	5.4	5.6
Color: L (black-white)	85.0	84.9	84.7	84.2	84.6	84.7	85.0
a (red-green)	-2.87	-2.94	-2.80	-2.67	-2.74	-2.80	-2.82
b (yellow-blue)	26.1	25.9	28.4	25.9	29.7	27.2	29.8
<b>SPAGHETTI PROCESSING DATA</b>							
Color Score (scale of 1-12)	9.1	8.7	9.5	8.3	9.3	9.0	9.5
L (black-white)	n/a	55.0	56.4	55.2	55.2	55.5	55.5
b (yellow-blue)	n/a	27.0	27.4	26.9	27.3	27.2	27.5
Cooked Weight (gm)	32.2	31.6	31.6	31.4	32.1	31.8	31.3
Cooking Loss (%)	5.6	5.5	6.1	6.4	6.4	6.0	5.3
Cooked Firmness (g cm)	5.6	5.7	5.0	4.5	5.3	5.2	5.1

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	2010 (31)	2011 (10)
<b>GRADING AND WHEAT DATA</b>		
Test Weight (lbs/bu)	60.3	59.9
Test Weight (kg/hl)	78.6	78.1
Damaged Kernels (%)	3.4	2.6
Foreign Material (%)	0.2	0.1
Shrunken & Broken (%)	1.3	1.5
Total Defects (%)	5.3	4.2
Vitreous Kernels (%)	65	68
Grade	3 AD	2 AD
<b>OTHER WHEAT DATA</b>		
Dockage (%)	0.63	0.76
Moisture (%)	12.2	12.6
Protein: 12% moisture (%)	13.3	13.8
Protein: Dry (%)	15.1	15.6
Ash: 14% moisture (%)	1.54	1.64
Ash: Dry (%)	1.79	1.91
1000 Kernel Weight (gm)	39	39
Kernel Size (%) lg/md/sm	50/46/4	48/48/5
Falling Number (sec)	274	311
DON (ppm)	0.4	0.7
<b>SEMOLINA DATA</b>		
Total Extraction (%)	71.2	69.8
Semolina Extraction (%)	64.6	64.7
Ash: 14% moisture (%)	0.69	0.69
Ash: Dry (%)	0.80	0.80
Gluten Index	57	58
Specks (no/10 sq in)	33	23
Protein: 14% moisture (%)	12.2	12.4
Protein: Dry (%)	14.1	14.4
Mixograph Classification (scale of 1-8)	6.2	6.2
Color: L (black-white)	84.8	84.7
a (red-green)	-2.64	-2.51
b (yellow-blue)	26.5	26.6
<b>SPAGHETTI PROCESSING DATA</b>		
Color Score (scale of 1-12)	8.3	8.2
Cooked Weight (gm)	31.8	32.1
Cooking Loss (%)	6.4	5.9
Cooked Firmness (g cm)	4.7	4.7

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

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 2010 through the summer of 2011 for crop year 2010. For crop year 2011, samples tested were collected from the fall of 2011 through the spring of 2012. Grade data in the table is the actual official grade on individual sublots.

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## 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, Claudia Carter and Hiroshi Ando, food technologists 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 July when approximately 10 percent of North Dakota's durum crop had been harvested and continued until early September. A total of 221 samples were collected during harvest from Montana (58) and North Dakota (163).

**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

# U.S. DURUM WHEAT

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them to reference mixograms. A scale of 1 to 8 is employed, higher values indicate strong mixing characteristics (see reference mixogram chart).

## SPAGHETTI

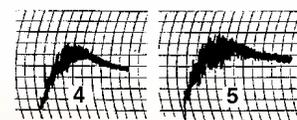
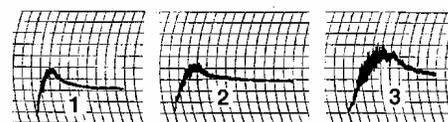
**PROCESSING** • Pasta was made using the laboratory procedure described by Walsh, Ebeling, and Dick, Cereal Sci. Today: 16(11) 385, 1971. A 1-Kg semolina was mixed with the appropriate amount of water that gave a dough consistency of 32 percent total water absorption. The other processing conditions 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).

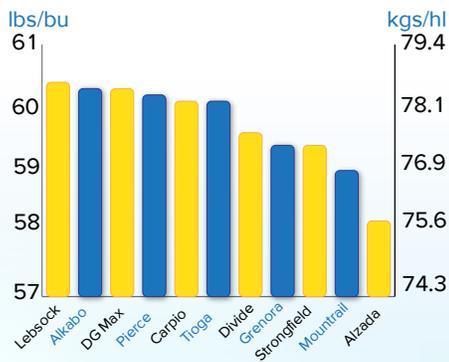


## REFERENCE MIXOGRAMS FOR DURUM WHEAT

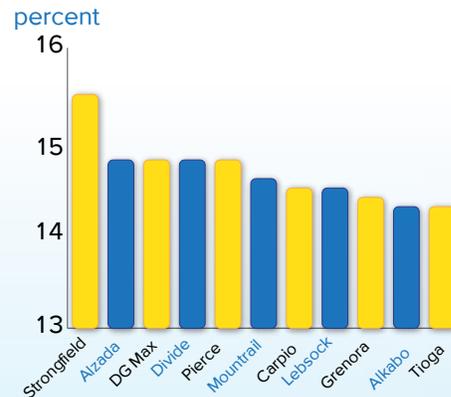
# VARIETAL INFORMATION

## QUALITY COMPARISON OF LEADING VARIETIES

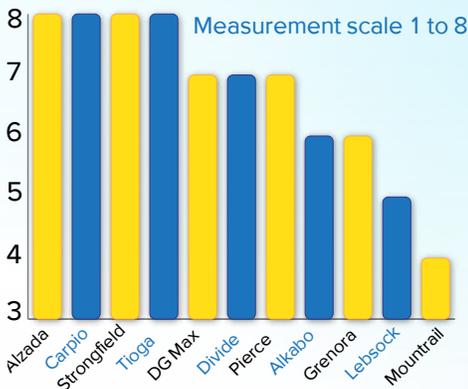
### TEST WEIGHT



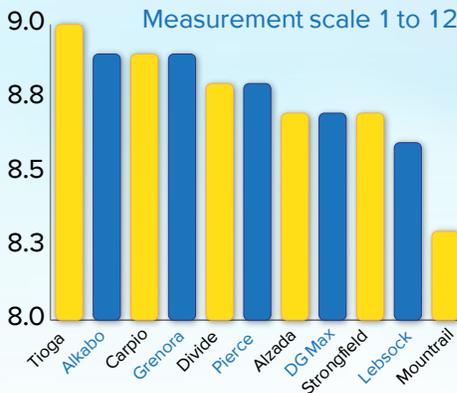
### KERNEL PROTEIN



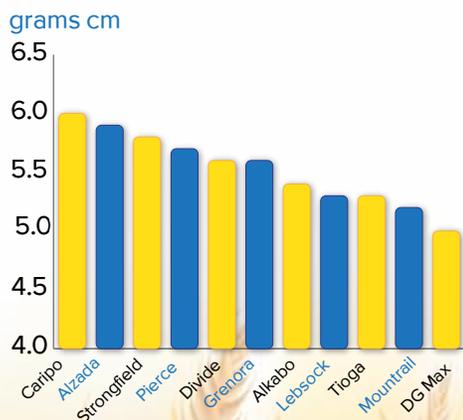
### MIXOGRAPH



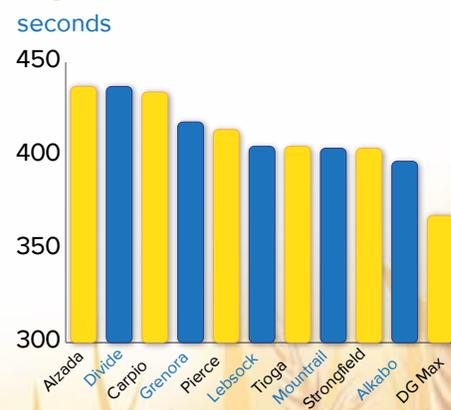
### PASTA COLOR



### COOKED FIRMNESS



### WHEAT FALLING NUMBER



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, it must meet 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.

Source: Advanced Yield Trials 2007-2011 crop years across multiple North Dakota locations.

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## VARIETAL INFORMATION

### GROWN & TESTED IN NORTH DAKOTA • AGRONOMIC FACTORS

VARIETY	AGENT <sup>1</sup> OR ORIGIN	YEAR RELEASED	AGRONOMIC DESCRIPTION			REACTION TO DISEASE <sup>2</sup>			AVERAGE YIELD	
			STRAW STRENGTH	LEAF RUST	FOLIAR DISEASE	HEAD SCAB	BU/ ACRE	MT/ HECT		
Alkabo	ND	2005	v.strong	R	M	M	56.7	3.81		
Alzada	WB	2004	medium	R	S	S	43.6	2.93		
Carpio	ND	2012	medium	R	M	M	57.6	3.87		
DG Max	DGP	2008	medium	MR	M	MR	54.3	3.65		
Divide	ND	2005	medium	R	M	M	55.5	3.73		
Grenora	ND	2005	medium	R	M	M	57.7	3.88		
Lebsock	ND	1999	strong	R	M	M	56.7	3.81		
Mountrail	ND	1998	medium	R	M	M	56.1	3.77		
Pierce	ND	2001	medium	R	MS	MS	55.0	3.7		
Strongfield	CAN	2004	medium	R	MS	MS	52.3	3.51		
Tioga	ND	2010	medium	R	M	M	56.9	3.82		

Source: 2012 North Dakota Durum Wheat Variety Performance Descriptions

1. ND—North Dakota State University, WB—Westbred, CAN-Canada, DGP-Dakota Growers Pasta Co.
2. Reaction to Disease: resistant (R), moderately resistant (MR), intermediate (M), moderately susceptible (MS), susceptible (S), very susceptible (VS).
3. Three year average data 2009-11 from Hettinger, Langdon and Williston, North Dakota.



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

**QUALITY FACTORS<sup>4</sup>**

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 <sup>5</sup>
Alkabo	60.3	78.5	14.3	397	6	8.9	58	5.4	good
Alzada	58.2	75.8	14.8	437	8	8.7	94	5.9	good
Carpio	60.1	78.3	14.5	434	8	8.9	93	6.0	excellent
DG Max	60.3	78.5	14.8	368	7	8.7	70	5.0	good
Divide	59.6	77.6	14.8	437	7	8.8	79	5.6	good
Grenora	59.4	77.4	14.4	418	6	8.9	71	5.6	good
Lebsock	60.4	78.7	14.5	405	5	8.6	51	5.3	average
Mountrail	59.0	76.9	14.6	404	4	8.3	29	5.2	fair
Pierce	60.2	78.4	14.8	414	7	8.8	72	5.7	excellent
Strongfield	59.4	77.4	15.5	404	8	8.7	74	5.8	good
Tioga	60.1	78.3	14.3	405	8	9.0	86	5.3	good

4. Based on NDSU Durum Quality Lab testing of samples grown at multiple North Dakota locations during 2007-2011.
5. Based on kernel attributes, milling and semolina processing, pasta color, and spaghetti cooking performance.

Quality is influenced by environment and the genetic background in a particular variety. Breeders are working towards future varieties that have enhanced color and gluten strength, all important quality factors for end-users. In addition, varieties that can maintain quality under adverse environmental stress are important to both producers and end-users.



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## NORTH DAKOTA

The top five planted durum varieties in North Dakota are Divide, Alkabo, Mountrail, Lebsock and Grenora, according to the North Dakota Agricultural Statistics Service. The top five varieties remain the same as last year and account for nearly 80 percent of the 1.4 million planted acres.



**DIVIDE** is the top planted variety for the fourth consecutive year, although the percentage of acres dropped slightly from 32.5 to 30.4 percent in 2012. It is the top planted variety in all of the districts, except the west central region. Divide is also the second most popular variety in Montana, accounting for 23 percent of the acreage, up from 12 percent in 2011. It is a 2005 release from NDSU with good agronomic traits such as high yield potential and moderate resistance to Fusarium headblight. Divide also has strong gluten strength, good color and good end-use quality traits.

**ALKABO** accounted for 15 percent of the planted acreage, surpassing Mountrail for the number two spot. Alkabo is also a top five variety in Montana. It has made steady acreage increases since its release from NDSU in 2005, as producers appreciate its high yield potential and strong straw strength. Alkabo also has good end-use quality traits and is often rated very high for pasta color.

**GRENORA's** share of planted acreage increased from 6 to 10 percent in 2012, making it the fifth most popular variety and is also a top ten variety in Montana. A 2005 NDSU release, Grenora has good yield potential, strong mixing characteristics and good overall pasta quality.

**TIOGA** is a 2010 NDSU release that has potential to make acreage gains in coming years. In 2012, the variety accounted for 3 percent of the acres. Tioga has good agronomic characteristics and shows marked improvements in dough strength and end-use quality characteristics.

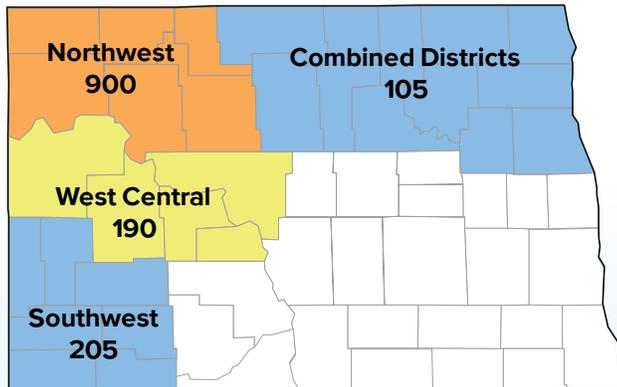
**LEB SOCK** is a 1999 NDSU release that continues to be a popular variety with producers due to good agronomic traits and this year accounts for just over 10 percent of the acreage. It has average quality traits which are being surpassed by newer released varieties.

North Dakota  
Varieties Planted Acres

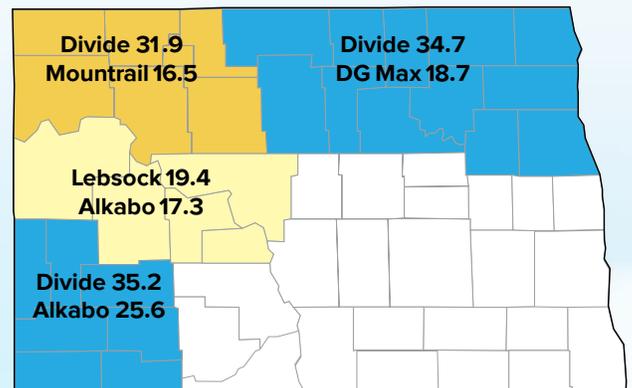
Variety	2011% <sup>1</sup>	2012% <sup>1</sup>	2012 Acres (1,000)
Divide	32.5	30.4	426.4
Alkabo	11.7	14.7	205.6
Mountrail	13.0	13.3	185.7
Lebsock	9.5	10.3	144.8
Grenora	6.2	10.2	142.8
Pierce	2.8	3.4	47.1
Tioga	2.1	2.9	41.1
DG Max	2.4	1.9	27.0
Dilse	0.6	1.3	18.2
Ben	2.9	1.3	17.5
Other <sup>2</sup>	16.3	10.3	143.8

1. Percentages may not add to 100 due to rounding.  
2. Includes varieties with less than 1% of acreage in 2012 and unknown varieties.

### North Dakota 2012 Planted Acres by NASS Districts (1,000 Acres)



### North Dakota 2012 NASS Top Two Varieties by District (% of Acres)



### North Dakota Varieties Share of 2012 Planted Acres by Crop District

Variety	North West	West Central	South West	Combined Districts <sup>1</sup>	Total State
percentage (%) <sup>2</sup>					
Divide	31.9	16.1	35.2	34.7	30.4
Alkabo	12.0	17.3	25.6	12.2	14.7
Mountrail	16.5	13.7	5.2	0.6	13.3
Lebsock	9.6	19.4	1.4	17.7	10.3
Grenora	11.9	6.6	9.6	3.0	10.2
Pierce	3.7	7.2	0.0	0.0	3.4
Tioga	1.7	4.4	7.8	1.6	2.9
DG Max	0.8	0.0	0.0	18.7	1.9
Dilse	1.5	0.0	2.2	0.0	1.3
Ben	0.1	5.1	3.3	0.0	1.3
Other <sup>3</sup>	10.2	10.3	9.9	11.6	10.3
1,000 acres (1 acre = 0.4 hectares)					
Total Acres <sup>3</sup>	900	190	205	105	1,400 <sup>4</sup>

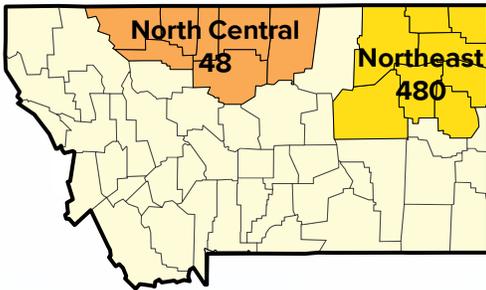
1. Data from North Central, Northeast, Central, East Central South Central and Southeast districts are combined to avoid disclosure of individual operations.
2. Percentages may not add to 100 due to rounding.
3. Includes varieties with less than 1% acreage in 2012 and unknown varieties.
4. September 28, 2012 small grain estimate was 1.3 million acres.



# U.S. DURUM WHEAT

MONTANA | NORTH DAKOTA

## Montana 2012 Planted Acres by Crop District (1,000 acres)



## Montana Varieties Share of 2012 Planted Acres by Crop District

Variety	North Central	North East	Total State
percentage (%) <sup>1</sup>			
Mountrail	0.0	29.6	26.6
Divide	0.0	25.1	23.1
Strongfield	16.2	16.2	15.9
Alzada	61.6	2.3	7.6
Alkabo	2.2	4.0	4.0
Kyle	0.0	3.6	3.2
Grenora	0.0	3.3	2.9
Lebsock	0.0	2.6	2.3
Pierce	0.0	1.6	1.4
Westhope	0.0	1.5	1.3
Other <sup>2</sup>	20.0	10.2	11.7
1,000 acres (1 acre = 0.4 hectares)			
Total Acres	48	480	540 <sup>3</sup>

1. Percentages may not add to 100 due to rounding.
2. Includes varieties with less than 1% of acreage in 2012 and unknown varieties.
3. September 28, 2012 small grain estimate was 520 thousand acres.

## MONTANA

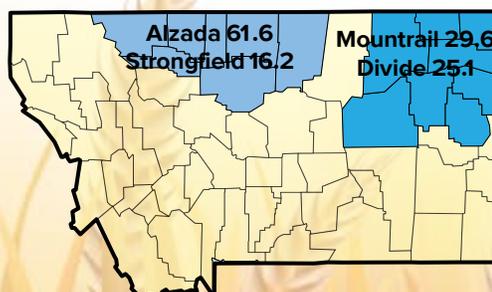
Montana Agricultural Statistics Service reports the five most popular durum varieties in 2012 are Mountrail, Divide, Strongfield, Alzada and Alkabo. The top varieties remain the same, with the exception of Alkabo, which is new to the top five. The five varieties combined account for 77 percent of the 540,000 planted acres.

**MOUNTRAIL** is the long-time top planted variety with 27 percent of the acreage, similar to last year. It is also the third most popular variety in North Dakota. A 1998 NDSU release, Mountrail is being surpassed in quality by newer varieties, but remains popular with producers as a reliable, good yielding variety.

**STRONGFIELD** dropped to the third most popular variety, being surpassed by Divide. It accounts for 16 percent of the total acreage. It is a 2004 release from Ag Canada that has low grain cadmium, good end-use quality and good disease tolerance.

**ALZADA** accounts for 8 percent of total acreage, down slightly from 9 percent last year and remains the fourth most popular variety. Alzada is a 2004 release from WestBred characterized by excellent end-use quality traits, especially semolina color and gluten strength. It is the top planted variety in the north central part of the state due to lower levels of disease tolerance.

## Montana 2012 NASS Top Two Varieties by District (% of Acres)



## Montana Varieties Planted Acres

Variety	2011 <sup>1</sup>	2012 <sup>1</sup>	2012 Acres (1,000)
Mountrail	27.6	26.6	143.4
Divide	12.1	23.1	124.9
Strongfield	14.9	15.9	85.6
Alzada	9.3	7.6	41.2
Alkabo	4.7	4.0	21.7
Kyle	5.0	3.2	17.3
Grenora	4.1	2.9	15.8
Lebsock	5.0	2.3	12.5
Pierce	2.0	1.4	7.7
Westhope	2.1	1.3	7.2
Other <sup>2</sup>	13.2	11.7	62.7

1. Percentages may not add to 100 due to rounding.
2. Includes varieties with less than 1% of acreage in 2012 and unknown varieties.

# 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.

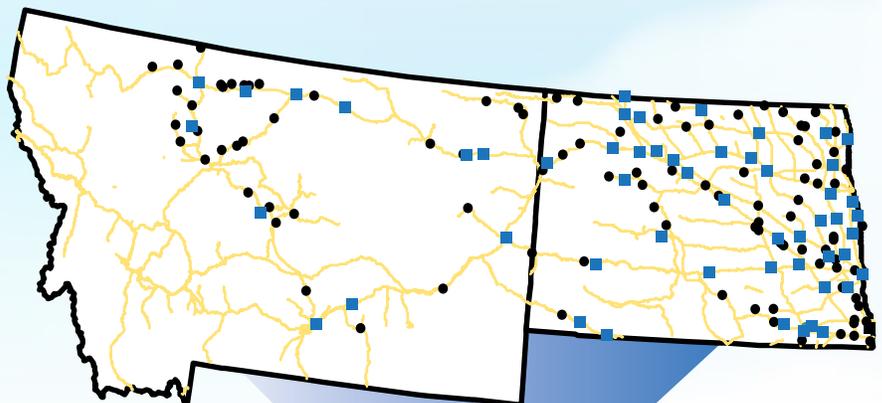
A growing number of elevators in the region are investing to ship 100 car units. Each rail car holds approximately 3,500 bushels (95 metric tons) of wheat. Some of the 100-car shippers have invested in "shuttle" capabilities. Shuttle-equipped facilities receive the lowest rates, sharing volume and transaction 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 increasingly exploring origin-specific shipments. Many international buyers now find it possible to request wheat from certain locations to optimize the quality and value of wheat they purchase.

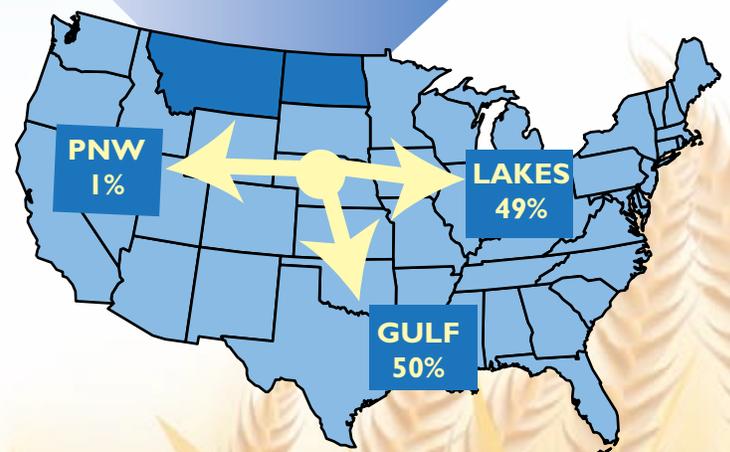
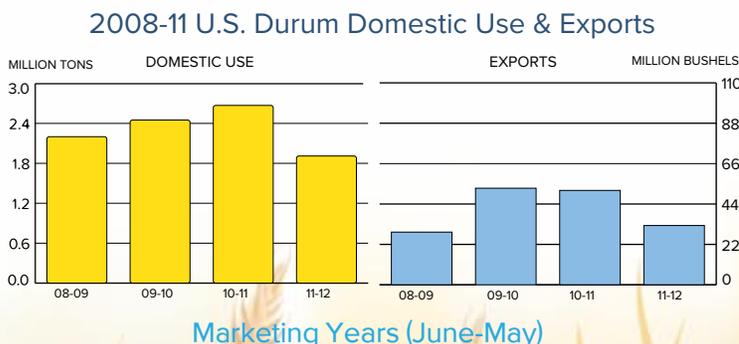
The rail and elevator network in the U.S. northern grown durum region is well suited for meeting the increasing quality demands of both domestic and international customers.

- 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 Four-State Region



Average share of U.S. Durum exports by port (2008-2011)



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