

Durum Wheat 101: An Overview

Everything you ever wanted to know about the crop, but were afraid to ask

“If today you said, ‘I want a durum wheat variety with high yield and protein, and a certain color, gluten strength, test weight, and disease resistance,’ and assuming I have the genes I need, I’d tell

Northern U.S. Wheat



Sally Sologuk

you to come back in 10 years,” says Dr. Elias Elias (701-231-8159), professor in the department of plant sciences at North Dakota State University (NDSU).

Elias, project leader for the only public breeding program in the

United States, says it takes that long to develop a durum wheat variety from start to release.

NDSU established the first U.S. durum breeding program in 1929. Since then, NDSU has released more than 30 northern durum cultivars.

Durum wheat’s density, high-protein content, and gluten strength makes it an ideal wheat for premium pasta products, couscous, and durum breads.

Hard Amber Durum (HAD) wheat—durum wheat with 75% or more of hard and vitreous kernels of amber color—is in greatest demand by millers.

Domestic durum production occurs mainly in six states: North Dakota, South Dakota, Montana, Minnesota, California, and Arizona.

Historically, North Dakota is the largest durum producer in the United States. The U.S. Department of Agriculture’s (USDA) September 2004 small grains summary shows that 79% of the nation’s estimated 90.5-million-bushel durum crop is produced in North Dakota and Montana.

2004 Crop Update

The 2004 U.S. durum crop is slightly smaller than 2003, with an average quality grade of No. 1 HAD, according to Jim Peterson, North Dakota Wheat Commission.

Most crop areas benefited from an unusually cool summer, with above-average

precipitation, allowing per-acre yields to reach the second-highest level on record and helping to compensate for the decrease in planted acres.

Based on the first two-thirds of the harvest, the average quality grade on the 2004 northern durum crop is equal to last year for No. 1 HAD and above the five-year-average grade of No. 2 HAD.

As expected, the average value of most specific quality factors is lower than the exceptional 2003 crop, and there is a wider-than-normal distribution for many factors.

New Variety Development

How does a breeder develop a new cultivar?

“We might start with a variety that has good yield but poor quality, or we might take one that has good quality but poor yield,” Elias says. “We cross these and select the progenies that combine the traits of both parents, which in this case are high yield and quality.

“We evaluate the progenies for several years for the traits of interest, until they become inbred lines. Then, we start evaluating the lines in yield trials at several North Dakota locations. Finally, we reach a stage where we have 30 that are very good in yield and quality. We plant these in loca-

tions in North Dakota, South Dakota, Montana, Minnesota and Canada. They are tested for at least three years, and the results must be good all three years,” he said.

At this point, the team summarizes the data and presents it to a committee representing a cross-section of the ▶

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Popular Northern Durum Wheat Varieties

VARIETY	QUALITY FACTORS ¹									
	TEST WEIGHT LB/BU	TEST WEIGHT KG/HL	LARGE KERNELS %	FALLING NUMBER SEC.	WHEAT ² PROTEIN %	SEMOLINA EXTRACTION (%)	MIXOGRAM SCORE (1-8)	PASTA COLOR (1-12)	COOKED FIRMNESS G CM	OVERALL ⁵ QUALITY RATING
Belzer	58.6	76.3	63	394	14.7	61.5	7	9.0	6.8	good
Ben	60.5	78.8	66	387	14.9	62.9	6	9.0	6.7	excellent
Dilse	60.0	78.2	53	383	15.6	62.8	7	9.3	7.5	excellent
Lebsock	60.9	79.3	60	405	14.3	62.8	6	9.2	6.4	good
Maier	59.9	78.0	55	397	15.1	62.6	7	9.4	7.2	excellent
Monroe	59.1	77.0	66	377	14.6	62.2	6	9.2	6.6	good
Mountrail	59.8	77.9	50	407	14.3	61.9	5	9.0	6.2	average
Munich	59.2	77.1	49	386	14.7	62.3	5	9.5	6.5	good
Pierce ³	60.7	79.1	52	390	14.5	61.4	7	9.4	6.7	good
Plaza	59.2	77.1	46	410	14.4	62.1	6	9.1	6.2	average
Renville	59.9	78.0	47	391	14.7	63.1	6	9.3	6.8	good
Rugby	59.9	78.0	55	374	14.8	62.9	3	9.0	5.4	poor ⁴

Source: 2003 North Dakota Durum Wheat Variety Performance Descriptions

1 Source: NDSU Cereal Science Department. Five-year average data from field plot trials (1998-02).

2 Wheat protein content is expressed on a 12% moisture basis.

3 2000-02 data from Minot, Williston, Dickinson, Hettinger locations in ND.

4 Desired for certain pastas, such as bow-ties, but not for long goods.

5 Based on protein content, kernel attributes, and milling and spaghetti processing performance.

Note: Figures reflect semolina extraction on a laboratory mill, which results in lower extraction than expected from a commercial durum mill. Expect at least five to seven percentage points increase from lab mill to a commercial durum semolina mill.

North Dakota durum industry. The committee votes, and if a line gets more than 50% of the vote, the line is released as a variety.

"If the vote is less than 50%, the variety goes down, and all your work for the last 10 years goes down with it," explains Elias.

"In 2004, farmers planted three varieties—Ben, Lebsock, and Mountrail—on about 70% of North Dakota acreage. Millers and pasta manufacturers are always looking for the very high-quality durum with good yields, so we also need varieties like Maier, Pierce, and Dilse," Elias said.

Quality Characteristics

Durum millers are concerned with how much semolina or flour they will get from a variety, said Brian Sorenson, Northern Crops Institute (NCI) Technical Director and NDSU Extension Crop Quality Specialist.

"For instance, Ben is known for plump kernels, and many millers like it because it is easier to mill and results in higher semolina extraction rates," Sorenson said.

Typically, millers must look at test weight and percentage of large kernels together, because together they give you a better indication of what your milling yield will be, he said.

"All the varieties that are listed have the potential for producing sound grain that is fairly resistant to sprouting. Falling number is an indicator of pre-harvest

sprout damage. When developing new varieties, breeders target high falling number values of over 350 seconds," he said.

A few quality tests for semolina are unique to durum. Sorenson noted that color and speck count are important factors in determining semolina quality. Good quality pasta requires semolina that is bright yellow and maintains that color during processing.

"Speck count is an important indicator of visual quality for semolina, which relates to the number of specks or particles of contaminants. You have to keep in mind that overall quality ratings are a combination of all of this data," he said.

Many millers and pasta manufacturers will evaluate gluten quality through tests such as wet gluten, mixograph, alveograph, and glutograph, he said. Gluten strength is important for both bread production and pasta processing, but you are looking for a slightly different gluten quality in durum.

Durum Milling Training

Northern Crops Institute (NCI) in Fargo, ND, became the leader in durum milling training in the early 1990s, when NCI built a pilot-scale durum mill, the only facility in the United States dedicated specifically to training durum millers. The pilot-scale mill, which grinds up to 300 pounds of durum wheat per hour, is also a

research laboratory for studying durum and semolina milling techniques.

"NDSU was fortunate recently to receive a Buhler, Inc. mill from Nestle Co. of Switzerland," said NCI Director Dr. Pat Berglund. "We accepted the donation in order to bring our milling education and services to a higher level."

NDSU received the mill equipment, because of a contact Elias made in France in 1996, which led to a visit to Nestle in Switzerland. Consequently, Nestle and Elias initiated a research collaboration that included a student exchange.

Ann Heinze did her master's course work at NDSU, then her research in Switzerland at Nestle, using North Dakota durum wheat. When Nestle discontinued its durum work, they donated the Buhler mill to NDSU.

"This generous donation from Nestle gives us a world-class durum mill to enhance our training program," Berglund said. "We look forward to offering longer training programs for durum millers and providing internships for milling students from NDSU and other universities."

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