



A continuous dough processing unit permits evaluation of different flours under simulated commercial conditions.

# The Quality of North Dakota's 1973 Durum Wheat Crop

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Overall quality of the 1973 North Dakota durum wheat crop is considered good. In the major quality characteristics (test weight, vitreous kernels, and spaghetti color), the crop is slightly below the average quality level of durum wheat produced in North Dakota in recent years. The crop is low in moisture and high in protein. A small amount harvested late in the season shows sprout damage. As in the past five years, Leeds durum continues to be the predominant wheat variety. The Leeds variety has large kernels, high protein, and produces bright yellow colored pasta products.

The United States Department of Agriculture estimates that the 1973 North Dakota durum crop is 76 million bushels (2.1 million metric tons) out of a total of 85 million bushels of durum wheat produced in the United States. The North Dakota durum crop represents an increase of 12 million bushels over last year's crop. The average yield is 29 bushels per acre, with a total of 2.6 million acres of durum harvested this year. It is anticipated that 66 per cent of the crop grades U. S. No. 2 Hard Amber Durum or better. Tests show that the crop has good milling and pasta processing qualities.

## QUALITY DATA FOR COMPOSITES

### Wheat Data

Table 1 shows the average dockage, test weight, moisture and grading data for the major

durum producing counties of North Dakota. Dockage in this year's crop is low (state average of 1.8 per cent) and indicates that the harvesting operation is efficient in separating the wheat from the straw and chaff. The state average for test weight is 61.1 pounds per bushel. The county average test weights range from 58.4 to 63.2 pounds per bushel.

In wheat grade, the 1973 crop is variable among the counties and ranges from a low of U. S. No. 3 Amber Durum for Cavalier county to a high of U. S. No. 1 **Heavy** Hard Amber Durum for five major durum producing counties. Theoretically, the average grade for the state is U. S. No. 2 Hard Amber Durum.

In other grading factors (shrunken and broken kernels, foreign material, damage, total defects, and wheat of contrasting classes), the 1973 durum crop is good. On the average, shrunken and broken kernels are only 1.5 per cent, foreign material is negligible (0.2 per cent). The amount of damaged kernels is 1.3 per cent. The increase in damaged kernels over last year's crop is large-

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**Table 1. Durum Wheat Survey - 1973 Crop: Grading Information (County Averages).**

| Counties    | Dockage % | Test Weight lbs/bu | Moisture % | Grade U.S. | Vitreous Kernels % | Shrunken and Broken % | F.M. % | Damage % | Total Defects % | Contrasting Classes % |
|-------------|-----------|--------------------|------------|------------|--------------------|-----------------------|--------|----------|-----------------|-----------------------|
| Barnes      | 0.5       | 59.2               | 11.7       | 2 HAD      | 76                 | 1.3                   | 0.1    | 1.0      | 2.4             | 0.1                   |
| Benson      | 1.6       | 61.6               | 12.6       | 1 HAD      | 83                 | 1.5                   | 0.1    | 0.7      | 2.3             | 0.0                   |
| Bottineau   | 2.0       | 61.1               | 13.0       | 2 AD       | 68                 | 2.0                   | 0.1    | 2.0      | 4.1             | 0.1                   |
| Burke       | 1.6       | 61.5               | 12.5       | 1 AD       | 67                 | 2.0                   | 0.2    | 0.7      | 2.9             | 0.2                   |
| Cass        | 1.4       | 60.3               | 12.7       | 1 HAD      | 80                 | 1.2                   | 0.1    | 0.7      | 2.0             | 0.0                   |
| Cavalier    | 3.7       | 58.7               | 12.7       | 3 AD       | 64                 | 1.6                   | 0.1    | 6.0      | 7.7             | 0.0                   |
| Dickey      | 3.1       | 61.3               | 11.3       | 1 HAD      | 79                 | 2.5                   | 0.1    | 0.4      | 3.0             | 0.1                   |
| Divide      | 0.8       | 63.2               | 11.9       | 1 Hv HAD   | 80                 | 1.0                   | 0.1    | 0.7      | 1.8             | 0.1                   |
| Eddy        | 1.5       | 61.3               | 11.5       | 2 AD       | 71                 | 2.0                   | 0.1    | 1.3      | 3.4             | 0.1                   |
| Foster      | 0.7       | 61.0               | 12.5       | 1 HAD      | 93                 | 1.9                   | 0.0    | 0.7      | 2.6             | 0.5                   |
| Grand Forks | 1.6       | 60.0               | 12.7       | 4 HAD      | 75                 | 2.2                   | 0.1    | 6.0      | 8.3             | 0.3                   |
| Griggs      | 2.3       | 60.3               | 11.8       | 2 HAD      | 79                 | 2.2                   | 0.1    | 1.0      | 3.3             | 0.0                   |
| LaMoure     | 2.7       | 60.3               | 11.6       | 1 HAD      | 88                 | 1.9                   | 0.1    | 0.7      | 2.7             | 0.1                   |
| McHenry     | 0.5       | 62.1               | 11.1       | 2 Hv HAD   | 90                 | 2.0                   | 0.2    | 1.0      | 3.2             | 0.1                   |
| McLean      | 1.0       | 63.0               | 11.4       | 1 Hv HAD   | 92                 | 0.7                   | 0.2    | 0.7      | 1.6             | 0.0                   |
| Mountrail   | 1.2       | 62.7               | 12.2       | 1 Hv HAD   | 78                 | 1.2                   | 0.2    | 0.8      | 2.2             | 0.0                   |
| Nelson      | 1.7       | 60.2               | 12.8       | 2 HAD      | 84                 | 1.3                   | 0.4    | 1.4      | 3.1             | 0.0                   |
| Pierce      | 0.1       | 62.5               | 13.0       | 1 Hv HAD   | 88                 | 0.6                   | 0.3    | 1.8      | 2.7             | 0.3                   |
| Ramsey      | 2.4       | 61.0               | 12.3       | 2 HAD      | 78                 | 1.7                   | 0.4    | 1.4      | 3.5             | 0.0                   |
| Renville    | 1.1       | 61.9               | 12.7       | 1 HAD      | 84                 | 1.0                   | 0.4    | 0.8      | 2.2             | 0.4                   |
| Rolette     | 1.9       | 60.9               | 12.9       | 2 HAD      | 76                 | 1.3                   | 0.4    | 2.0      | 3.7             | 0.3                   |
| Stutsman    | 1.0       | 60.5               | 11.7       | 1 AD       | 72                 | 1.1                   | 0.2    | 0.5      | 1.8             | 0.0                   |
| Towner      | 2.3       | 61.4               | 13.0       | 2 HAD      | 80                 | 1.1                   | 0.6    | 0.9      | 2.6             | 0.8                   |
| Traill      | 0.9       | 60.8               | 11.6       | 1 HAD      | 82                 | 1.1                   | 0.3    | 0.8      | 2.2             | 0.0                   |
| Walsh       | 3.5       | 58.4               | 12.7       | 2 AD       | 72                 | 2.3                   | 0.7    | 1.5      | 4.5             | 0.0                   |
| Ward        | 2.6       | 62.4               | 11.2       | 2 Hv HAD   | 85                 | 1.6                   | 0.4    | 1.2      | 3.2             | 0.6                   |
| Wells       | 1.5       | 61.4               | 11.9       | 1 HAD      | 82                 | 0.2                   | 0.5    | 0.6      | 1.3             | 0.8                   |
| Williams    | 0.9       | 62.7               | 10.6       | 1 Hv HAD   | 89                 | 2.0                   | 0.4    | 0.3      | 2.7             | 0.4                   |
| Average     | 1.8       | 61.1               | 12.2       | 2 HAD      | 80                 | 1.5                   | 0.2    | 1.3      | 3.1             | 0.2                   |

ly due to sprouting. Wheat of contrasting classes in the crop is a low of 0.2 per cent. The crop has an average vitreous kernel content of 80 per cent and has a similar wheat appearance to last year's crop.

Hectoliter weight of the crop is high and ranges from 75.2 to 81.3 for the individual counties, with an average of 78.6 kilograms per hectoliter for the state. The average thousand-kernel weight is 40.9 grams, which indicates that the crop has larger kernels than last year. However, kernel appearance is variable and many samples have excellent kernel appearance while others show signs of weathering on the kernel bran coat.

The protein content of the crop is exceptionally high and averages 14.0 per cent for the state. This is 0.7 per cent higher than the 1972 crop and 1.4 per cent higher than the 1971 crop.

#### Semolina Data

To characterize the quality of the 1973 durum crop, composite samples of wheat from each

county were milled and purified into semolina. The average semolina milling yield of the crop is 53.8 per cent as determined with a Buhler laboratory mill. In commercial practice, the yield of semolina is expected to be higher than the reported laboratory values. Speck count, which is a measure of the number of bran or black particles remaining after semolina purification, averages 24 per ten square inches of semolina surface. Compared with last year, the 1973 crop has a slightly lower milling yield and shows more specks in the semolina.

Semolina samples in 1973 are high in gluten content and contain an average of 39.5 per cent wet gluten. The semolina protein content averaged 13.3 per cent, which is considered an adequate protein level for production of nutritious pasta products.

The falling number test is used to detect sprout damage in wheat. Falling numbers below 300 are an indication that samples contain

sprouted kernels. In this year's crop, three counties show average falling numbers below the 300 value. The sprouting appears to be localized and is associated with wheat which was harvested after late fall rains. Recent research on durum sprouting indicates that milling yield is lowered and speck counts are increased with sprouting of the wheat. At the level of sprouting observed in this year's crop, there may be a slight lowering of milling yield. However, no significant processing difficulties or problems with spaghetti appearance are anticipated.

### Spaghetti Processing Data

To evaluate the semolina, a semi-commercial scale continuous pasta processing method was used. Semolina and water were mixed under vacuum and continuously extruded through a Teflon spaghetti die. The extrusion and drying conditions were controlled precisely to follow commercial pasta processing conditions. All samples tested showed excellent extrusion properties and no cracking or checking was found in the finished dry spaghetti.

The color and appearance of the finished spaghetti is very good. The samples have a deep yellow color, with spaghetti color scores ranging from 8.5 to 11.0. The state average color score is 9.9, which is slightly lower than last year's average color score of 10.4. Cooked weight averages

37.6 grams, which is similar to last year's value and indicates that the spaghetti has a good swelling capacity when cooked. The average cooking loss (6.2 per cent) shows that the spaghetti has a good resistance to disintegration during cooking.

Of prime importance in determining the cooking quality of spaghetti is the firmness or "bite" of the cooked spaghetti. Good quality spaghetti should be firm but not "rubbery" or too soft in the cooked form. The firmness value is 5.06 g. cm., which shows that the 1973 crop has excellent spaghetti firmness, better than last year and considerably better than the year before. In general, the spaghetti from the 1973 durum crop is considered excellent in overall quality. Compared with last year's durum, the 1973 durum crop is lower in color but superior in spaghetti cooking quality.

### Grade and Market Quality

For the most part, the 1973 crop can be divided into three major grades. Approximately 33 per cent of the wheat falls in the top grade, U. S. No. 1 **Heavy** Hard Amber Durum (U. S. No. 1 HvHAD). Another 14 per cent is in the grade U. S. No. 1 Hard Amber Durum (U. S. No. 1 HAD) and 7 per cent is in the grade U. S. No. 2 **Heavy** Hard Amber Durum (U. S. No. 2 HvHAD). Of the total crop, approximately 50 million bushels of

**Table 2. Grades and Grade Requirements for Durum Wheat (Revised February, 1970).**

| Grade       | Minimum Test Weight Per Bushel pounds | Heat Damaged Kernels per cent | Damaged Kernels (Total) per cent | Defects                   |                                      | Maximum Limits Of        |                              | Wheat of Other Classes <sup>1</sup>     |  |
|-------------|---------------------------------------|-------------------------------|----------------------------------|---------------------------|--------------------------------------|--------------------------|------------------------------|---|--|
|             |                                       |                               |                                  | Foreign Material per cent | Shrunken and Broken Kernels per cent | Defects (total) per cent | Contrasting Classes per cent | Wheat of other Classes (total) per cent |  |
| U. S. No. 1 | 60.0                                  | 0.1                           | 2.0                              | 0.5                       | 3.0                                  | 3.0                      | 1.0                          | 3.0                                     |  |
| U. S. No. 2 | 58.0                                  | 0.2                           | 4.0                              | 1.0                       | 5.0                                  | 5.0                      | 2.0                          | 5.0                                     |  |
| U. S. No. 3 | 56.0                                  | 0.5                           | 7.0                              | 2.0                       | 8.0                                  | 8.0                      | 3.0                          | 10.0                                    |  |
| U. S. No. 4 | 54.0                                  | 1.0                           | 10.0                             | 3.0                       | 12.0                                 | 12.0                     | 10.0                         | 10.0                                    |  |
| U. S. No. 5 | 51.0                                  | 3.0                           | 15.0                             | 5.0                       | 20.0                                 | 20.0                     | 10.0                         | 10.0                                    |  |

**U. S. Sample Grade:** U. S. Sample grade shall be wheat which does not meet the requirements for any of the grades from U. S. No. 1 to U. S. No. 5, inclusive; or which contains more than two crotalaria seeds (*Crotalaria spp.*) in 1,000 grams of grain, or contains castor beans (*Ricinus communis*), stones, broken glass, animal filth, and unknown foreign substance(s), or a commonly recognized harmful or toxic substance(s); or which is musty, sour, or heating; or which has any commercially objectionable foreign odor except of smut or garlic; or which contains a quantity of smut so great that any one or more of the grade requirements cannot be applied accurately; or which is otherwise of distinctly low quality.

**Heavy:** Heavy wheat shall be Durum Wheat of grades U. S. No. 1, U. S. No. 2 or U. S. No. 3 which has a test weight per bushel of 62 pounds or more.

**Hard Amber Durum Wheat:** The subclass Hard Amber Durum shall be Durum Wheat with 75 per cent of hard and vitreous kernels of amber color.

**Amber Durum:** The subclass Amber Durum Wheat shall be Durum Wheat with 60 per cent or more but less than 75 per cent of hard and vitreous kernels of amber color.

**Durum Wheat:** The subclass Durum Wheat shall be Durum Wheat with less than 60 per cent of hard and vitreous kernels of amber color.

<sup>1</sup> Red Durum Wheat of any grade may contain not more than 10.0 per cent of wheat of other classes.

durum will grade U. S. No. 2 Hard Amber Durum or better. To be in this grade, the wheat must contain a minimum of 75 per cent vitreous kernels, have a test weight of at least 58 pounds per bushel and be within the maximum limits for defects.

#### Quality Comparisons of the 1973 Crop With Other Years' Durum Crops

Compared with the five-year state averages, the 1973 durum wheat crop is similar in test weight, hectoliter weight, and vitreous kernel content, but higher in protein content. The 1973 crop shows a significantly higher average thousand kernel weight (40.9 g.) than the previous five years' durum crops. The falling number value and visual inspection indicate that approximately 2.6 per cent of the crop shows detectable sprouting. The semolina milling yield of the crop is equal to the five-year average for the state. In addition, the crop has the highest average semolina protein content and lowest ash content of the North Dakota durum crops harvested over the last five years. Spaghetti color of the crop is lower than last year but is still well within the acceptable range for good quality spaghetti.

#### Summary

The 1973 durum crop from North Dakota is considered good in general quality. An estimated 76 million bushels (2.1 million metric tons) were produced in 1973, most of which is of excellent quality. However, an estimated 2.6 per cent of the total crop showed sprouting. The sprouting is not considered serious enough to cause any significant difficulties in processing or reduce the quality of the finished pasta products. Buyers will need to be selective in order to consistently obtain top quality lots of durum wheat.

The wheat is low in moisture, has generally a high vitreous kernel content, and is exceptionally high in protein content. An estimated 66 per cent of the crop will grade U. S. No. 2 Hard Amber Durum or better. When compared with the 5-year state averages for durum wheat, the 1973 crop is equal in milling yield but contains slightly more bran particles in the semolina. Spaghetti of the 1973 crop is slightly lower in color than average. However, the cooking quality of spaghetti from the crop is significantly better than the average and has high cooked spaghetti firmness and low cooking loss.

# The Quality of North Dakota's 1973 Hard Red Spring Wheat

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USDA estimates place the 1973 North Dakota hard red spring wheat harvest at about 174 million bushels (4.7 million metric tons). This is the second largest hard red spring wheat crop on record for the state. It is estimated that 84 per cent of the crop should grade U. S. No. 2 Dark Northern Spring or better. Average wheat protein content for the state (expressed on a 14.0 per cent moisture basis) is 14.6 per cent, which is .6 per cent higher than last year, and more than one per cent higher than that reported for the 1971 crop. In general, the overall quality of the 1973 hard red spring crop is considered to be very good to excellent.

The overall quality of North Dakota's 1973 hard red spring wheat crop is considered to be generally very good to excellent and appears to be in certain instances similar to the crop produced in 1970. Average test weight is 59.7 pounds per bushel, which is about five-tenths of a pound

lower than last year. The moisture content is low, with an average of 11.5 per cent reported.

Average wheat protein content is 15.0 per cent expressed on an "as is" moisture basis, or when expressed on a 14.0 per cent moisture basis it becomes 14.6 per cent, which is 0.6 percentage points higher than the 1972 crop. Vitreous kernel content in this year's Northern Spring Wheat Crop is set at 84 per cent. This is one percentage

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