

Quality Factors of the 1972 Durum Crop

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The overall quality of the 1972 North Dakota durum wheat crop is considered very good. In the major quality characteristics (test weight, protein content, vitreous kernels, and spaghetti color) the crop is similar to the average durum wheat produced in North Dakota in recent years. The crop is low in moisture, high in protein and essentially free of sprout damage. As in the past four years, Leeds durum continues to be the predominant wheat variety. Leeds has large kernels, high protein and produces bright yellow colored pasta products.

The United States Department of Agriculture estimates that the 1972 North Dakota Durum Crop will be 64 million bushels (1.7 million metric tons) out of a total of 73 million bushels of durum wheat produced in the United States. For North Dakota the crop represents a decrease of 18 million bushels below last year's durum crop. The average yield for the crop was 28.5 bushels per acre with a total of 2.2 million acres of durum harvested this year. An anticipated 87 per cent of the crop will grade U. S. No. 2 Hard Amber Durum or better. Tests show that the crop has good milling and pasta processing qualities.

SAMPLES AND METHODS

During the 1972 harvest, samples were collected by cooperating elevators from all of the counties producing substantial amounts of durum wheat, with at least two elevators in each county participating. The number of samples collected during an eight-week period reflected the anticipated crop production of each county. Elevator operators were

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requested to collect a sample from each truck load of durum wheat delivered to the elevator. Twice a week, the samples were thoroughly mixed and a three-pound aliquot was taken, placed in a moisture proof plastic bag, and mailed to the Department of Cereal Chemistry and Technology at North Dakota State University, Fargo, North Dakota, for grading and quality evaluation. These samples were uncleaned and reflected the condition of the grain delivered to the elevators.

Determinations were made on the individual samples for test weight, dockage, moisture, and protein in the Cereal Chemistry and Technology Laboratory. Randomly selected aliquots from one-fourth of the samples were submitted to the federally licensed Grain Inspection Department for an official U. S. grade.

To determine the milling, spaghetti processing and other quality data on this year's crop, measured aliquots of each sample were composited by counties. Samples were milled and processed into spaghetti with continuous laboratory procedures which are comparable to commercial practices.

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 (average of 1.6 per cent) and indicates that the harvesting operation is efficient in separating the wheat from the straw and chaff. Test weight data averages 61.7 pounds per bushel with a range from a low of 55.2 pounds per bushel to a high of 63.5 pounds per bushel. In grade, the crop is variable among the counties and ranges from a low of U. S. No. 4 Amber Durum for Cass County to a high of U. S. No. 1 **Heavy** Hard Amber Durum for 10 major durum producing counties. Theoretically, the average grade for the state is high, U. S. No. 1 Hard Amber Durum.

Table 1. Durum Wheat Survey — 1972 Crop: Grading Information (County Averages).

Counties	Dockage	Test		Moisture	Grade	Shrunken and Broken		F.M.	Damage	Total Contrasting Defects	
		Weight				Vitreous	and			Broken	Defects
	%	lbs./bu.	%		U.S.	%	%	%	%	%	%
Barnes	2.6	59.4	13.2	2	HAD	77	1.7	1.1	1.0	3.8	0.4
Benson	3.1	62.5	12.1	1	Hv HAD	84	0.9	0.5	0.9	2.3	0.1
Bottineau	1.2	61.9	12.0	1	HAD	82	1.2	0.3	0.7	2.2	0.0
Burke	0.9	61.9	12.3	1	HAD	86	1.1	0.4	0.9	2.4	0.0
Cass	2.5	55.2	12.3	4	AD	70	2.5	0.5	1.2	4.2	0.0
Cavalier	1.3	61.6	13.1	1	HAD	82	1.2	0.3	0.7	2.2	0.0
Dickey	0.4	60.8	11.3	1	HAD	83	1.9	0.4	0.4	2.7	0.3
Divide	0.5	62.8	13.0	1	Hv HAD	85	0.7	0.3	0.3	1.3	0.0
Eddy	2.5	61.9	12.0	1	HAD	82	1.7	0.4	0.8	2.9	0.0
Foster	1.7	62.3	10.5	2	Hv HAD	83	1.5	0.8	0.8	3.1	0.2
Grand Forks	1.1	61.1	12.4	2	HAD	82	1.6	0.2	1.4	3.2	0.0
Griggs	1.2	62.7	12.5	1	Hv HAD	89	1.4	0.4	0.4	2.2	0.0
LaMoure	0.7	61.1	12.0	1	HAD	80	1.1	0.4	0.5	2.0	0.1
McHenry	1.5	63.1	11.8	1	Hv HAD	81	1.6	0.1	0.6	2.3	0.1
McLean	0.6	63.4	12.2	1	Hv HAD	88	1.0	0.2	0.5	1.7	0.1
Mountrail	1.4	61.5	13.2	1	HAD	88	0.9	0.3	0.8	2.0	0.0
Nelson	1.8	61.9	12.7	1	HAD	88	1.4	0.3	0.6	2.3	0.1
Pierce	0.3	63.0	11.1	1	Hv HAD	91	0.5	0.3	0.6	1.4	0.1
Ramsey	1.3	61.2	12.7	1	HAD	87	0.9	0.3	0.7	1.7	0.0
Renville	2.4	60.4	13.9	1	HAD	85	1.7	0.3	0.5	2.5	0.0
Rolette	1.0	62.1	12.1	1	Hv HAD	84	1.1	0.4	0.7	2.2	0.0
Stutsman	1.6	62.4	10.7	1	Hv HAD	87	1.1	0.4	0.7	2.2	0.0
Towner	1.9	62.6	12.4	2	Hv HAD	83	0.9	0.7	1.0	2.6	0.1
Trail	0.5	61.4	11.7	1	HAD	79	1.6	0.4	0.8	2.7	0.4
Walsh	1.2	62.0	12.0	1	Hv HAD	82	1.6	0.2	0.4	2.2	0.1
Ward	1.0	63.5	12.1	1	Hv HAD	87	1.0	0.2	0.6	1.8	0.0
Wells	6.4	62.0	11.2	2	Hv HAD	86	2.0	0.6	0.5	3.1	0.3
Williams	1.1	63.3	11.7	1	HAD	96	1.0	0.2	0.5	1.7	0.6
Average	1.6	61.7	12.2	1	HAD	84	1.3	0.4	0.7	2.4	0.1

In other grading factors (shrunken and broken kernels, foreign material, damage, total defects, and wheat of contrasting classes) the 1972 durum crop is very good. On the average, shrunken and broken kernels are low (1.3 per cent), foreign material is negligible (0.4 per cent) and damaged kernels is only 0.7 per cent. Since total defects is the sum of shrunken and broken, foreign material and damaged kernels, it may be used as a general index of wheat condition. In total defects, the crop ranges

from a low of 1.3 per cent to a high of 4.2 per cent with an average of 2.4 per cent for the state. This indicates that the crop does not have an excess of kernel damage. Wheat of contrasting classes is negligible (only 0.1 per cent) and well within the maximum limits set for the top grades of durum wheat. For additional information, Table 2 lists the Official United States Grades and Grade Requirements for Durum Wheat.

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

Grade	Maximum Limits Of							
	Defects				Wheat of Other Classes ¹			
	Minimum Test Weight Per Bushel	Heat Damaged Kernels	Damaged Kernels (total)	Foreign Material	Shrunken and Broken Kernels	Defects (total)	Contrasting Classes	Wheat of other Classes (total)
pounds	per cent	per cent	per cent	per cent	per cent	per cent	per cent	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, an 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.

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

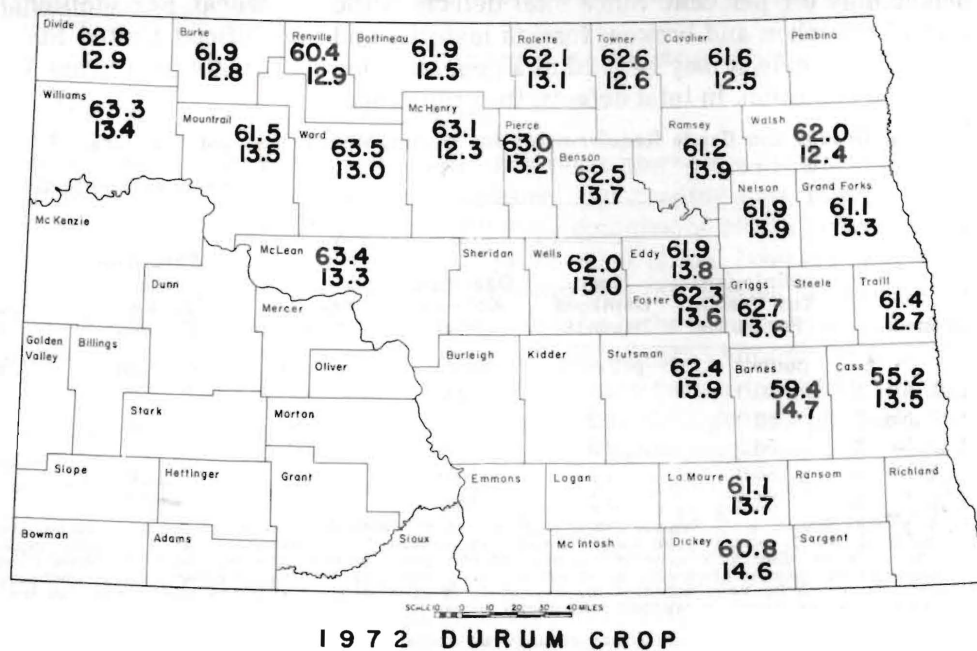
Other wheat quality data for evaluating the 1972 durum crop are shown in Table 3. Data for hectoliter weight, 1000 kernel weight, kernel size distribution, mineral content, and wheat protein content are included in the table. Hectoliter weight of the crop is high and ranges from 71.1 to 81.8

with an average of 79.8 kilograms per hectoliter for the durum producing counties. Moreover, the thousand kernel weight is very high and averages 36.9 grams. In appearance, the kernels lack the luster seen in the 1971 crop and there is evidence of slightly more black point than last year.

Table 3. Durum Wheat Survey — 1972 Crop: Wheat Data (County Averages).

County	Hectoliter Weight kg.	1000 Kernel Weight g.	Kernel Distribution			Protein %	Mineral Content (ash) %
			Large %	Medium %	Small %		
Barnes	76.5	35.6	30	62	8	14.7	1.59
Benson	80.5	38.0	41	53	6	13.7	1.53
Bottineau	79.7	33.4	20	71	9	12.5	1.70
Burke	79.6	35.0	28	62	10	12.8	1.80
Cass	71.1	26.1	9	71	20	13.5	1.92
Cavalier	79.3	39.4	36	55	9	12.5	1.63
Dickey	78.3	33.3	15	73	12	14.6	1.60
Divide	80.9	38.5	34	59	7	12.9	1.66
Eddy	79.7	37.9	33	59	8	13.8	1.58
Foster	80.1	40.2	33	62	5	13.6	1.57
Grand Forks	78.7	41.3	42	51	7	13.3	1.61
Griggs	80.7	38.0	39	58	10	13.6	1.49
LaMoure	78.7	35.1	16	75	9	13.7	1.61
McHenry	81.2	37.0	26	67	7	12.3	1.55
McLean	81.6	38.2	35	59	6	13.3	1.57
Mountrail	79.2	37.6	29	63	8	13.5	1.63
Nelson	79.6	39.1	39	55	6	13.9	1.47
Pierce	81.0	38.0	31	64	5	13.2	1.72
Ramsey	78.7	40.7	38	55	7	13.9	1.58
Renville	77.7	35.7	15	74	11	12.9	1.78
Rolette	80.0	36.4	28	64	8	13.1	1.56
Stutsman	80.4	37.6	28	66	6	13.9	1.56
Towner	80.6	38.9	28	65	7	12.6	1.63
Trail	79.0	34.1	25	67	8	12.7	1.76
Walsh	79.8	35.7	26	66	8	12.4	1.40
Ward	81.8	37.2	28	65	7	13.0	1.64
Wells	79.8	38.5	30	64	6	13.0	1.55
Williams	81.4	36.6	19	74	7	13.4	1.60
Average	79.8	36.9	29	63	8	13.3	1.62

Fig. 1. The test weight and average protein content for wheat from the major durum producing counties of North Dakota. In each county, the upper number indicates the test weight; the lower shows the protein content.



Another means of measuring kernel size is to test for kernel distribution. In the test, wheat is separated into three sizes (large, medium, and small) according to kernel diameter. For best milling yields, the wheat should have a minimum of small kernels and a uniform kernel size. The average data show the kernel distribution of the crop to be 29 per cent large, 63 per cent medium, and 8 per cent small kernels.

The average protein content of the crop is 13.3 per cent which is higher by 0.7 per cent over last year's crop. The map in Figure 1 shows the average test weights and protein contents for the major durum producing counties.

Semolina Data

To characterize the quality of the 1972 durum crop, the composite samples of wheat from each county were milled and purified into semolina. Table 4 shows data for milling yield, bran specks, protein, wet gluten, and mineral contents, and fall-

Table 4. Durum Wheat Survey — 1972 Crop: Semolina Data (County Averages).

County	Semolina Yield	Mineral Content (ash)	Bran Specks	Protein	Wet Gluten	Falling No.
Barnes	54.7	0.67	24	13.6	42.1	472
Benson	56.7	0.61	25	12.3	37.6	430
Bottineau	56.1	0.64	23	12.0	37.8	427
Burke	55.0	0.63	23	12.1	39.3	422
Cass	49.0	0.80	37	12.2	36.5	465
Cavalier	53.3	0.60	23	11.7	35.1	435
Dickey	53.9	0.62	13	13.5	41.6	468
Divide	55.8	0.62	20	11.9	35.9	405
Eddy	55.4	0.62	24	12.2	36.1	441
Foster	56.4	0.62	15	12.8	38.4	443
Grand Forks	55.2	0.61	25	12.2	40.5	373
Griggs	55.6	0.58	18	12.3	41.0	403
LaMoure	54.9	0.61	22	13.1	39.8	461
McHenry	55.2	0.60	18	11.3	35.3	449
McLean	55.3	0.60	17	12.1	34.6	439
Mountrail	54.4	0.62	23	12.3	37.7	445
Nelson	55.1	0.60	20	12.7	39.8	408
Pierce	56.5	0.60	27	12.2	35.5	451
Ramsey	54.7	0.61	23	13.0	38.4	453
Renville	54.3	0.66	23	12.2	36.5	430
Rolette	56.3	0.59	23	12.1	35.8	425
Stutsman	55.1	0.62	27	12.9	38.9	419
Towner	56.4	0.64	25	11.2	34.4	440
Traill	55.4	0.71	30	12.1	37.5	407
Walsh	54.0	0.59	15	11.8	36.4	443
Ward	54.0	0.60	17	12.0	36.0	420
Wells	55.2	0.60	20	12.3	35.2	446
Williams	55.2	0.58	15	12.5	37.5	426
Average	55.0	0.62	22	12.3	37.5	434

ing number values for the samples. The average semolina milling yield of the crop was 55.0 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 purification, averaged 22 per 10 square inches of semolina surface. Compared with last year, the 1972 crop has a higher milling yield but contains more specks in the semolina.

The 1972 semolina was high in gluten content and contained an average of 37.5 per cent wet gluten. Semolina protein content averaged 12.3 per cent. Falling number, a test for detecting sprout damage, showed that the 1972 durum samples were essentially free of sprouting. Finally, the semolina mineral content of the crop averaged 0.62 per cent which is an acceptable value for good quality durum semolina.

Spaghetti Processing Data

To evaluate the semolina, a semi-commercial scale 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 data in Table 5 show that the samples have a deep yellow color with color scores ranging from 9.5 to 11.0 with a state average color score of 10.4, which is slightly lower than last year's average. Also shown in Table 5 are spaghetti cooking data for the crop. Cooked weight averages 36.7 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 (6.8 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. Table 5 shows firmness values which are determined by shearing cooked spaghetti with a laboratory instrument (Instron). The average shear value is 4.67 g. cm. which shows that the 1972 crop has better spaghetti firmness than last year's crop. In general, the spaghetti from the 1972 durum crop is

Table 5. Durum Wheat Survey — 1972 Crop: Spaghetti Processing Data (County Averages).

County	Color	Cooked Weight	Cooking Loss	Firmness
		g.	%	g. cm.
Barnes	10.5	37.3	7.0	5.03
Benson	10.5	36.0	7.0	4.94
Bottineau	10.5	36.3	6.0	4.60
Burke	10.0	36.4	6.0	4.79
Cass	9.5	38.3	8.0	3.75
Cavalier	10.5	37.0	8.0	4.20
Dickey	10.5	35.7	7.0	5.17
Divide	10.5	36.8	7.0	4.42
Eddy	10.5	37.2	8.0	4.31
Foster	11.0	36.4	7.0	4.22
Grand Forks	9.5	36.2	9.0	4.11
Griggs	10.0	36.3	6.0	4.82
LaMoure	10.5	37.2	7.0	4.30
McHenry	11.0	37.2	6.0	4.44
McLean	10.5	37.5	7.0	4.46
Mountrail	10.5	36.1	7.0	4.87
Nelson	10.5	32.4	5.0	5.80
Pierce	10.5	40.5	6.0	4.36
Ramsey	10.5	35.9	6.0	5.63
Renville	10.5	36.5	6.0	4.49
Rolette	10.0	36.6	7.0	4.94
Stutsman	10.5	35.6	6.0	5.65
Towner	11.0	37.9	6.0	4.68
Traill	10.0	35.7	8.0	4.67
Walsh	10.5	37.6	7.0	4.19
Ward	10.5	36.4	6.0	4.42
Wells	10.5	37.8	7.0	4.05
Williams	10.5	35.5	7.0	5.56
Average	10.4	36.7	6.8	4.67

considered good in overall quality. Compared with last year's durum, the 1972 crop is slightly down in color but superior in spaghetti cooking quality.

Grade and Market Quality

Figure 2 depicts the distribution of the crop within the main wheat grades (U. S. Official). For the most part, the 1972 crop can be divided into

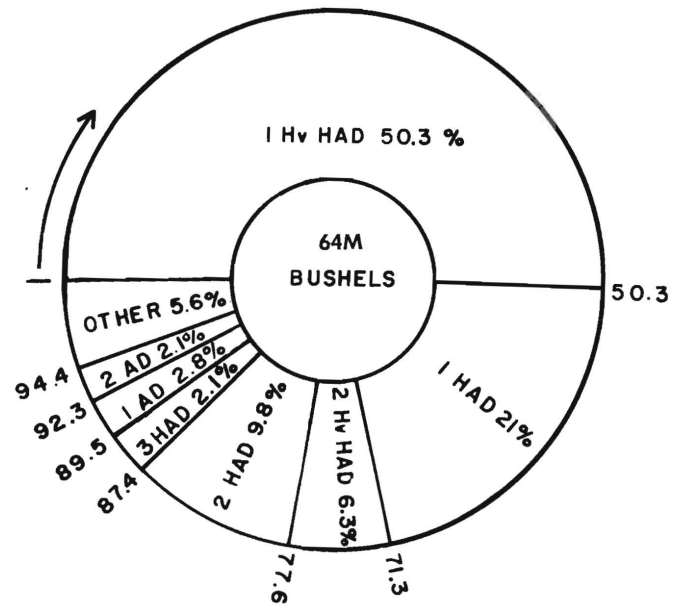


Fig. 2. Diagram showing the durum wheat grade distribution of the 1972 crop:

three major grades. Approximately 50 per cent of the wheat falls in the top grade, U. S. No. 1 **Heavy** Hard Amber Durum (U. S. No. 1 HvHAD). Another 12 per cent is U. S. No. 1 Hard Amber Durum (U. S. No. 1 HAD) and 9 per cent is in the grade

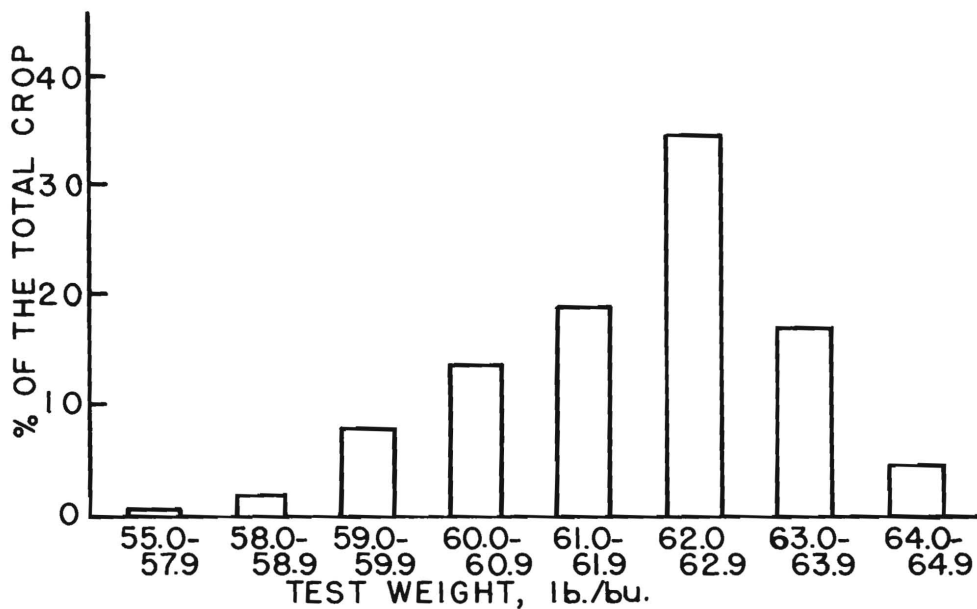


Fig. 3. Histogram showing the test weight distribution of the 1972 durum crop.

U. S. No. 2 **Heavy** Hard Amber Durum (U. S. No. 2 HvHAD). Of the total crop, approximately 32 million bushels of durum will fall into the top grade (U. S. No. 1 HvHAD). To be in this grade, the wheat must contain a minimum of 75 per cent vitreous kernels, have a test weight of at least 62 pounds per bushel and be within the maximum limits for defects shown in Table 2.

Quality Comparisons of the 1972 Crop with Other Year's Durum Crops

Table 6 shows some of the pertinent average quality data for the 1967, 1968, 1969, 1970, 1971, the averages for 5 years, and 1972 durum wheat crops. Compared with the five-year averages, the 1972 durum wheat crop is similar in test weight, hectoliter weight, vitreous kernel content and protein content. The 1972 crop shows the highest average thousand kernel weight (36.9 g.) of the durum crops harvested over the previous five years. Falling number and visual inspection indicate that

Table 6. Durum Wheat Survey: Comparison of Average Quality Factors for North Dakota, 1967, 1968, 1969, 1970, 1971, and 1972 Crops.

(Milling and Analytical Data)							
Crop Year	Test Weight	Hectoliter Weight	1000 Kernel Weight	Vit. Kernels	Wheat Protein	Falling Number	Sprout Damage
	lbs/bu	kg.	g.	%	%	Units	%
1967	61.3	78.9	31.1	85	13.5	431	0.0
1968	59.5	76.6	32.0	74	13.3	260	3.5
1969	62.3	80.2	34.7	89	13.3	471	0.0
1970	61.3	78.9	36.7	80	13.9	451	0.0
1971	62.4	80.3	35.2	81	12.6	469	0.0
1972	61.7	79.8	36.9	84	13.3	434	0.0
5 Yr. Ave.	61.4	79.0	33.9	82	13.3	416	0.7
(Semolina and Spaghetti Data)							
Crop Year	Semolina Yield	Semolina Protein	Mineral Content (ash)	Bran Specks	Spaghetti Color		
1967	54.8	12.6	0.61	14	9.8		
1968	51.5	12.4	0.62	21	9.3		
1969	55.8	12.3	0.63	15	10.9		
1970	53.0	13.0	0.66	22	10.2		
1971	53.5	11.8	0.61	17	10.8		
1972	55.0	12.3	0.62	22	10.4		
5 Yr. Ave.	53.7	12.4	0.63	18	10.2		

there is no detectable sprout damage in the crop. Semolina milling yield of the crop was up somewhat

over the five-year average. Although the spaghetti color of the crop is down from last year, it still is slightly better than the five-year average color score.

WEATHER AND HARVEST

To acquaint the readers with seeding, growing, and harvesting conditions which influenced the 1972 durum crop, the following resumé is presented.

Wet weather during May and early June hampered the planting so the crop was seeded somewhat later than usual. By May 30 only 67 per cent of the crop had been seeded. By June 13, seeding was essentially completed throughout the state. Through June and July, the weather was dry and moisture shortages were reported in half of the counties in early July. Scattered showers in mid and late July helped the crop develop. By the end of July, it was evident that an abundant durum harvest would occur. As the harvest began in August, it was apparent that the quality would be good. Harvesting was somewhat slower than usual and by September 5, only 50 per cent of the crop was in the bin. Scattered showers and cool weather continued to hamper combining operations. As of October 10, 92 per cent of the crop was harvested. Fortunately, little heavy rain occurred until late October and the crop was harvested with essentially no sprout damage.

SUMMARY

In 1972, the farmers of North Dakota produced an estimated 64 million bushels (about 1.7 million metric tons) of durum wheat. The wheat is low in moisture, high in vitreous kernels, high protein and very good in overall quality. More than 87 per cent of the crop should grade U. S. No. 2 Hard Amber Durum or better. The crop is low in damaged kernels, contains little dockage, and is similar in test weight to the average North Dakota durum crop.

The wheat has good milling properties and milling yield is up over last year. However, the semolina shows a slightly higher speck count and there is more black point in the crop than last year. When processed, the semolina has normal extrusion characteristics and produces very good quality spaghetti. Spaghetti color is similar to the five-year average but slightly below the color of last year's crop. Leeds durum continues to be the predominant wheat variety of the crop. In the major quality characteristics the 1972 crop is similar to the five-year average for North Dakota and slightly below the quality of the 1971 crop.

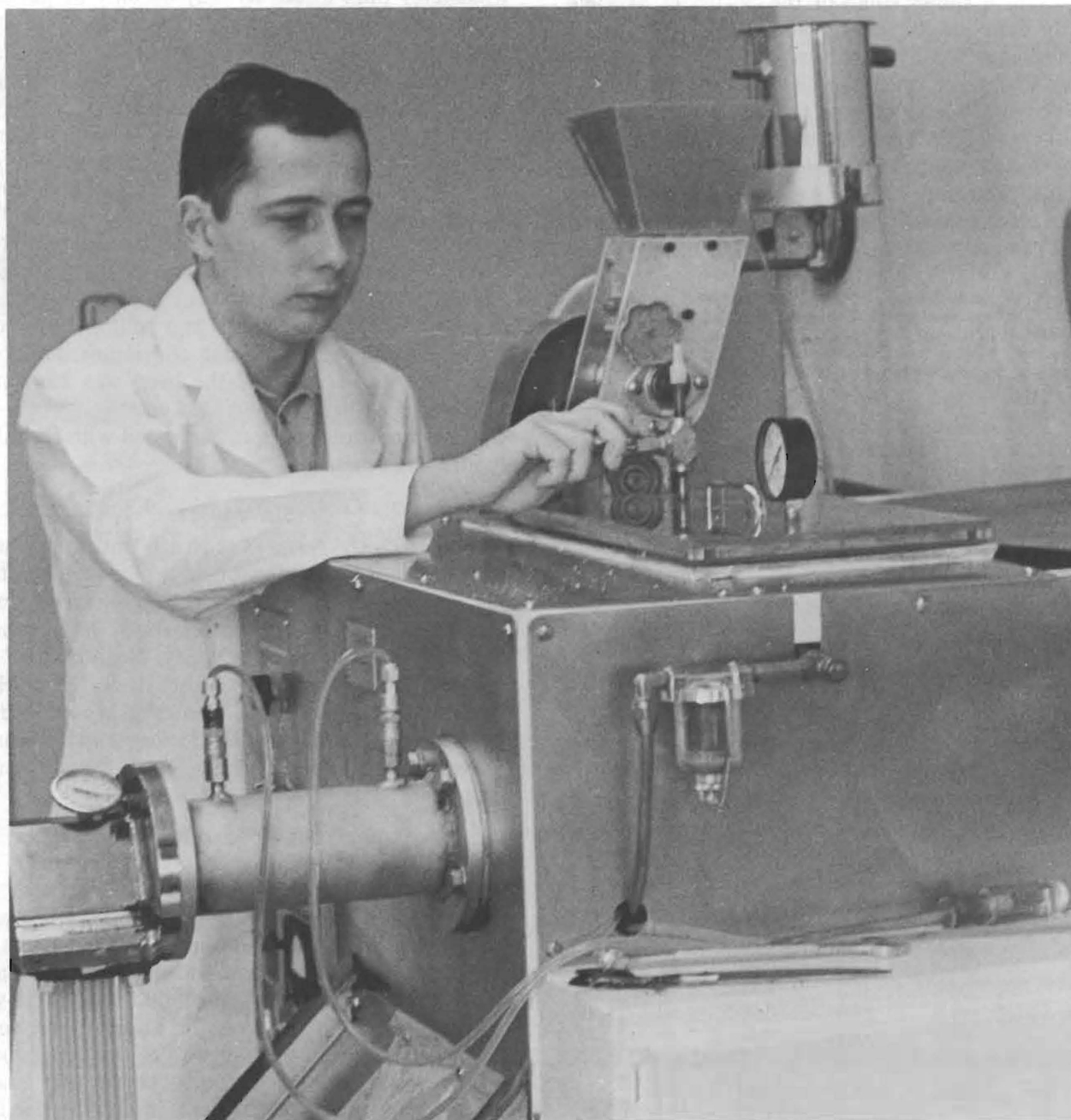
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Spaghetti samples are processed using semi-commercial scale equipment.