Quality Factors of the 1968 Durum Crop

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The 1968 North Dakota durum wheat crop is estimated by the USDA to be about 82 million bushels (2.4 million metric tons), the largest on record for production of this specialty crop. The 1968 yield is almost 50 per cent larger than last year and the 5-year average. An average yield of 28.0 bushels per acre is estimated. This is 4.0 bushels above a year ago but a little below the 5-year average.

In general the 1968 North Dakota durum wheat crop is of fair to good quality, and is somewhat similar to that produced in 1966. It is, however, below the excellent quality of the durum wheat crop produced last year. All of the major factors examined are lower than the 1967 crop, with the exception of weight per 1000 kernels. This increase in kernel weight can be attributed to the new variety Leeds which was grown extensively in North Dakota for the first time. The color of the spaghetti is bright, but the score is a little lower than that produced last year.

In an attempt to avoid some duplication which existed last year, the general format was changed for the 1968 North Dakota wheat quality survey. A cooperative effort was initiated which involved to varying degrees the North Dakota Department of Agriculture, the U.S. Department of Agriculture (Consumer and Marketing Service, Grain Division), the North Dakota Wheat Commission, the Cooperative Extension Service and the Experiment Station at North Dakota State University. These changes involved primarily the procedure imposed for the selection of samples.

Samples and Methods

During the 1968 harvest, samples were collected and submitted 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 8-week period reflected the anticipated crop production of each county. The elevator operators were requested to collect and place in suitable containers a sample from each truck load of durum wheat delivered to the elevator. Twice a week the samples were thoroughly mixed and a 2½ pound aliquot was taken, placed in a moisture proof plastic bag and transmitted to the Department of Cereal Chemistry and Technology at North Dakota State University, Fargo, N. Dak., for a complete grade and quality evaluation. These samples were uncleaned and reflected the condition of the grain delivered to the elevator.

Determinations were made on the individual samples for test weight, dockage, moisture and protein in the Cereal Chemistry and Technology laboratory. Aliquots were taken and transmitted to the federally licensed Grain Inspection Department, located on the campus, for a complete official grade. These data were transmitted on a weekly basis to the North Dakota Department of Agriculture, Bismarck, N. Dak. Weekly reports publicized, as early as possible, some preliminary information on the general condition of the crop.

To determine the milling, spaghetti processing and other quality tests on this year's crop, measured aliquots of each sample were composited by counties. Unfortunately, for certain counties a limited number of samples precluded preparation of an adequately sized composite for complete quality evaluation.

QUALITY DATA ON COMPOSITES

Wheat Tests

Table 1 lists by county the averages for dockage, grades and the various grading factors as

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Table 1. Durum Wheat Survey — 1968 Crop: Grading Information (County Averages).

Counties	Dockage	Test Weight	Moisture	Grade	Vitreous Kernels	Shrunken and Broken	F.M.	Damage	Total Defects	Contrasting Classes
	%	lbs/bu	%		%	%	%	%	%	%
Adams	0.7	60.6	12.7	2 HAD	82	3.4	0.3	0.6	4.3	0.1
Barnes	0.8	61.0	13.3	2 HAD	79	1.2	0.3	2.6	4.1	0.1
Benson	1.4	58.3	13.3	3 AD	74	1.9	0.3	3.6	5.8	0.1
Bottineau	1.0	59.6	13.5	4 AD	73	1.0	0.3	7.2	8.5	0.1
Cass	1.2	62.6	11.7	1 Hv AD	71	1.8	0.3	0.4	2.5	0.0
Cavalier	1.2	57.6	13.6	3 HAD*	75	1.4	0.3	4.4	6.1	0.0
Divide	0.8	59.7	14.0	3 HAD*	83	0.7	0.2	6.6	7.5	0.1
Grand Forks	1.0	59.5	13.3	3 HAD	77	1.3	0.3	4.0	5.6	0.1
Griggs	0.2	60.0	12.0	4 AD	68	1.2	0.2	9.4	10.8	0.1
Kidder	1.8	61.6	12.7	1 AD	70	2.4	0.3	0.3	3.0	0.1
Logan	0.8	62.2	13.8	1 Hv HAD*	80	1.2	0.5	0.4	2.1	0.1
McLean	1.2	58.8	13.8	3 HAD*	84	2.0	0.2	3.0	5.2	0.0
Mountrail	1.0	59.3	13.3	3 HAD	80	1.7	0.3	3.6	5.6	0.1
Nelson	0.8	58.6	13.8	3 AD*	64	1.6	0.2	4.3	6.1	0.1
Pembina	1.2	57.9	13.8	SG AD*	63	1.0	0.3	16.2	17.5	0.0
Pierce	1.0	58.6	12.6	5 AD	65	1.3	0.3	14.9	16.5	0.1
Ramsey	0.9	59.7	13.2	2 HAD	77	1.3	0.3	3.4	5.0	0.0
Renville	2.2	60.0	13.2	2 HAD	86	1.4	0.4	2.6	4.4	0.1
Richland	0.5	61.4	11.5	2 AD	71	2.3	0.2	0.7	3.2	0.0
Rolette	1.9	58.4	14.7	2 HAD*	85	1.3	0.2	3.0	4.5	0.1
Steele	0.9	60.5	13.0	2 AD	66	1.4	0.2	2.8	4.4	0.1
Stutsman	1.2	60.4	13.0	2 HAD	75	2.2	0.3	1.4	3.9	0.1
Towner	0.8	59.7	13.8	2 HAD*	81	1.0	0.3	3.6	4.9	0.1
Traill	0.5	60.3	13.1	3 D	59	1.6	0.3	3.5	5.4	0.0
Walsh	1.4	57.9	12.9	SG D	44	1.2	0.4	19.7	21.3	0.1
Ward	1.2	60.2	13.1	2 HAD	83	1.7	0.2	3.0	4.9	0.1
Wells	0.9	60.2	13.3	3 AD	70	1.6	0.3	3.6	5.5	0.0
Williams	0.6	60.5	13.4	3 HAD	86	1.3	0.2	3.9	5.4	0.1
Average	1.0	59.5	13.2	3 AD	74	1.6	0.3	4.7	6.6	0.1

*tough

Table 2. Grades and Grade Requirements for Durum Wheat (Effective March 5, 1965).

Grade	Minimum Test Weight Per Bushel	Maximum limits of: Defects: Heat Damaged Kernels	Damaged Kernels (total)	Foreign Material	Shrunken and Broken Kernels	Defects (total)	Wheat of Other Classes: Contrasting Classes	Wheat of other Classes (total)
	pounds	percent	percent	percent	percent	percent	percent	percent
1	60.0	0.1	2.0	0.5	3.0	3.0	1.0	3.0
2	58.0	0.2	4.0	1.0	5.0	5.0	2.0	5.0
3	56.0	0.5	7.0	2.0	8.0	8.0	3.0	10.0
4	54.0	1.0	10.0	3.0	12.0	12.0	10.0	10.0
5	51.0	3.0	15.0	5.0	20.0	20.0	10.0	10.0

Sample Grade: Sample grade shall be wheat which does not meet the requirements for any of the grades from No. 1 to No. 5, inclusive; or which contains stones; or which is musty, or 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.

well as the overall state average. Table 2 lists the Official Grades and Grade Requirements for Durum Wheat produced in the United States.

The test weight of this year's crop as shown in Table 1 ranged from 57.6 to 62.6 with an average of 59.5 pounds per bushel. The moisture content was somewhat higher than last year and resulted in a number of the county averages grading "Tough". The state average, however, was 13.2 per cent. Percentage of vitreous kernels ranged from 63 to 86 with an average of 74. This was down about 10 per cent from last year and is primarily attributed to the rains at harvest time.

Shrunken and broken kernels averaged 1.6 per cent which is considerably below the permissable limit for the two highest grades. Foreign material (FM) was quite low, showing an average

of 0.3 per cent with a range of 0.2 to 0.5 per cent. Damaged kernels were considerably higher than a year ago with a state average of 4.7 per cent and a range of 0.3 to 19.7 per cent. Total defects, which is the sum of shrunken and broken kernels, foreign material and damaged kernels, were on the average much higher than a year ago. The range was from 2.1 per cent in Logan county to 21.3 per cent in Walsh county with a state average of 6.6 per cent. Wheats of contrasting classes were of a negligible amount. The grades ranged from I Heavy Hard Amber Durum to Sample Grade Durum. The average test weight for each county sampled is presented in Fig. 1.

of the wheat passed through this sieve. The second set of data was obtained from an European sieve with openings 30 per cent wider and twice as long as the U.S. sieve. In this test an average of 4.5 per cent of the kernels passed through the sieve. Kernel distribution, which is another determination for kernel size, separates the wheat into three sizes, large, medium and small according to their cross sectional area. Desirable durum wheat should have a preponderance of uniform sized kernels with a relatively small amount of the small size. The averages for the state as shown in Table 2 for the large, medium and small sized kernels were 24, 72 and 4 per cent, respectively. The average protein content

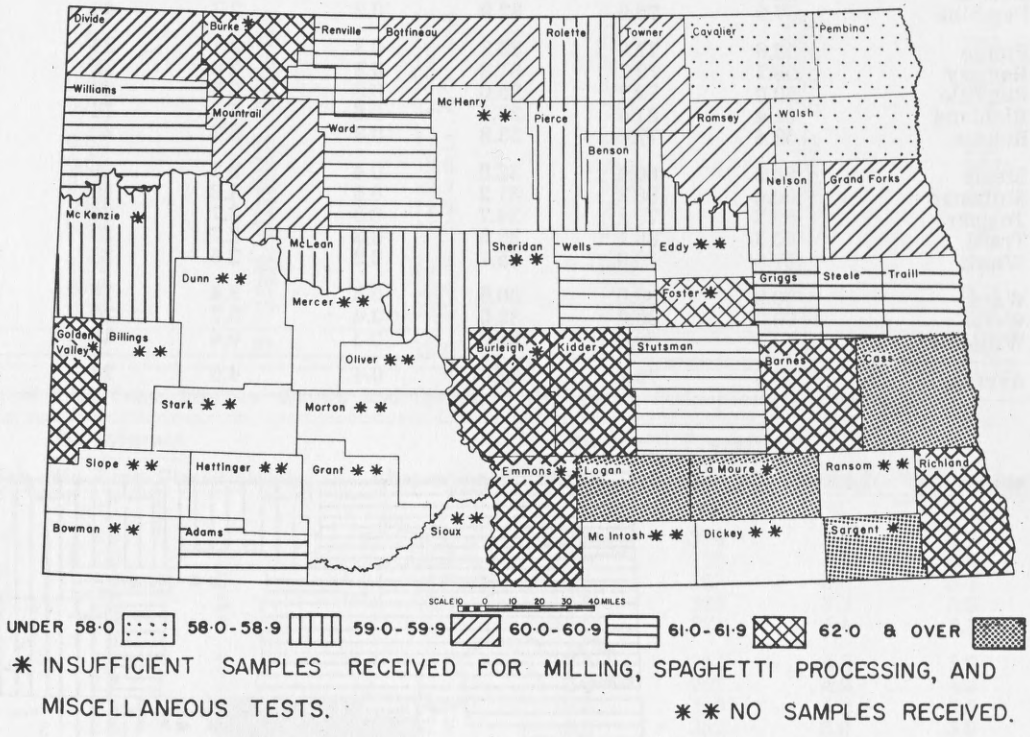

Fig. 1. The average test weight for each county in North Dakota.

Table 3 shows the wheat quality factors determined. An appendix is included in this report which lists the methods employed for the various quality factors determined. For comparative purposes the test weights are repeated in this table. The hectoliter weight of this year's crop ranged from 76.5 to 83.2 with an average of 79.1 kilograms per hectoliter. Thousand kernel weight which was somewhat higher than last year averaged 32.0 grams for the state.

Kernel size was determined by two methods. The first set of data lists results obtained by a U.S. sieve, used for the determination of shrunken and broken kernels. On the average only 0.4 per cent

for this year's crop was 13.3 per cent which compares very favorably with last year, which was 13.5 per cent. Fig. 2 shows the average protein for the various counties producing this specialty wheat.

Semolina Tests

Table 4 shows the data for the various quality determinations made on the semolina.

The average semolina yield for the state is down somewhat from last year. This is to be expected as the average test weight of this year's crop was 1.8 pounds per bushel lower. The ash content ranged from 0.55 to 0.71 with an average of 0.62 per cent, which is about the same as last year. The

Table 3. Durum Wheat Survey — 1968 Crop: Wheat Data (County Averages).

Counties	Test Weight	Hectoliter Weight	1000 Kernel Weight	Kernel Size		Kernel Distribution			Protein
				.064 x 3/8	2.10 x 20	Large	Medium	Small	
	lbs./bu.	Kg.	g.	%	%	%	%	%	%
Adams	60.6	80.5	29.2	1.2	10.2	9	82	9	13.9
Barnes	61.0	81.0	35.3	0.4	3.1	37	59	4	13.2
Benson	58.3	77.5	28.7	0.7	8.2	16	76	8	13.6
Bottineau	59.6	79.2	36.2	0.1	3.8	42	56	2	13.8
Cass	62.6	83.2	33.0	0.5	3.6	26	69	5	12.1
Cavalier	57.6	76.5	32.1	0.3	6.1	22	73	5	12.8
Divide	59.7	79.3	31.9	0.2	3.5	29	69	2	14.6
Grand Forks	59.5	79.1	34.4	0.4	3.9	25	71	4	12.6
Griggs	60.0	79.7	31.7	0.2	2.3	32	66	2	13.3
Kidder	61.6	81.8	30.8	0.4	4.1	24	72	4	12.2
Logan	62.2	82.6	30.5	0.4	2.8	23	73	4	11.9
McLean	58.8	78.1	26.6	0.7	10.3	7	82	11	15.2
Mountrail	59.3	78.8	28.2	0.5	7.0	6	86	8	14.3
Nelson	58.6	77.9	29.8	0.3	4.5	18	76	6	13.0
Pembina	57.9	76.9	32.9	0.2	2.7	40	58	2	12.8
Pierce	58.6	77.9	33.3	0.3	2.1	34	65	1	14.3
Ramsey	59.7	79.3	31.2	0.3	2.8	32	66	2	13.5
Renville	60.0	79.7	35.0	0.3	2.3	28	70	2	14.5
Richland	61.4	81.6	33.1	0.6	5.3	14	80	6	13.6
Rolette	58.4	77.6	33.8	0.3	5.3	28	69	3	13.4
Steele	60.5	80.4	32.8	0.4	3.3	18	79	2	11.7
Stutsman	60.4	80.2	31.2	0.5	4.8	19	75	6	13.3
Towner	59.7	79.3	34.7	0.3	3.7	24	73	3	13.3
Traill	60.3	80.1	33.6	0.3	2.7	29	68	3	12.9
Walsh	57.9	76.9	35.1	0.2	2.5	33	66	1	12.4
Ward	60.2	80.0	30.5	0.3	3.4	14	81	5	14.2
Wells	60.2	80.0	32.5	0.4	5.7	20	76	4	13.6
Williams	60.5	80.4	28.2	0.3	6.4	13	80	7	14.4
Average	59.5	79.1	32.0	0.4	4.5	24	72	4	13.3

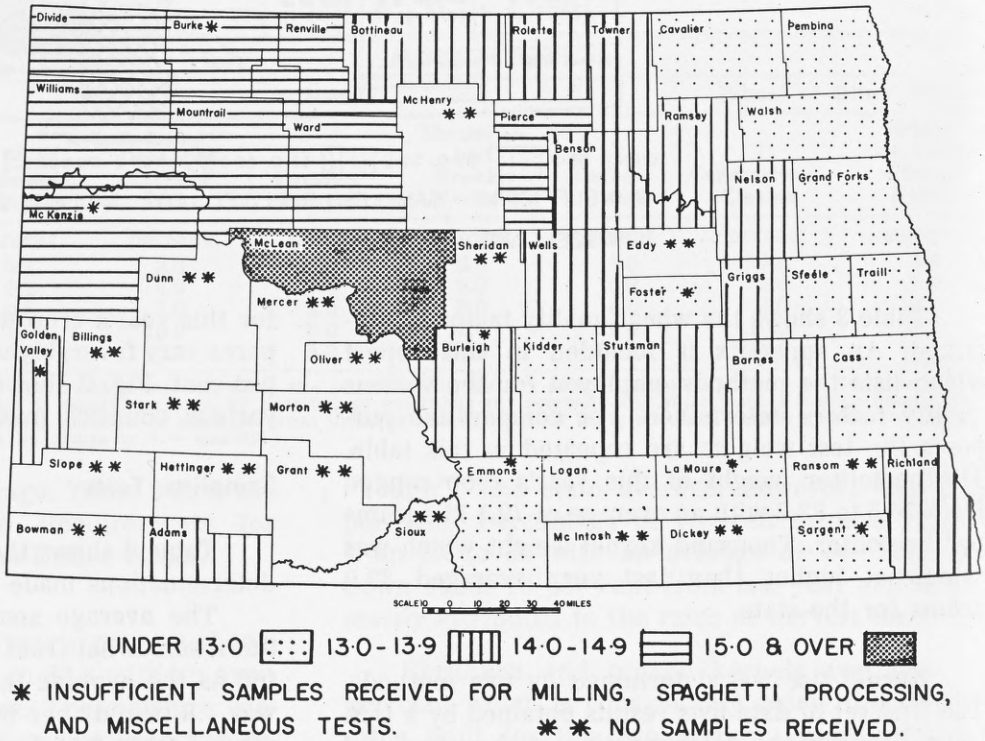

Fig. 2. The average protein content for each county in North Dakota.

Table 4. Durum Wheat Survey — 1968 Crop: Semolina Data (County Averages).

Counties	Yield	Ash	Specks	Protein	Wet Gluten	Diastatic Activity	Falling No.
	%	%		%	%	mg.	units
Adams	55.8	0.59	13	12.7	35.5	85	168
Barnes	53.7	0.60	20	12.2	29.6	110	335
Benson	50.6	0.61	17	12.7	27.8	122	241
Bottineau	50.7	0.62	27	12.9	24.1	167	275
Cass	55.0	0.63	17	11.3	22.8	97	451
Cavalier	50.5	0.64	20	11.4	22.0	127	313
Divide	50.8	0.59	23	13.1	36.7	146	182
Grand Forks	50.2	0.68	30	12.0	31.9	162	192
Griggs	50.0	0.64	30	12.2	35.4	161	187
Kidder	51.8	0.60	13	11.3	30.6	82	464
Logan	51.1	0.55	17	11.1	26.7	88	439
McLean	52.1	0.64	13	13.9	38.2	127	216
Mountrail	51.5	0.60	20	13.1	35.9	132	191
Nelson	50.2	0.62	23	11.9	30.8	127	230
Pembina	50.8	0.71	30	12.1	29.0	208	161
Pierce	50.5	0.65	27	13.4	35.8	249	83
Ramsey	50.7	0.60	27	12.6	32.4	153	204
Renville	50.0	0.58	23	13.2	36.2	137	256
Richland	51.5	0.62	20	13.0	31.6	87	460
Rolette	50.1	0.58	23	12.4	34.1	120	264
Steele	51.2	0.65	20	11.2	29.5	125	275
Stutsman	52.6	0.62	17	12.6	34.9	96	376
Towner	51.3	0.60	20	12.3	33.4	138	256
Traill	54.2	0.62	17	12.2	25.7	115	277
Walsh	49.3	0.68	27	11.6	27.0	178	125
Ward	52.2	0.59	20	13.1	26.4	143	174
Wells	50.0	0.56	17	12.4	30.7	118	273
Williams	53.0	0.56	17	13.2	34.8	143	224
Average	51.5	0.62	21	12.4	31.0	134	260

Table 5. Durum Wheat Survey — 1968 Crop: Physical Dough and Spaghetti Processing Data (County Averages).

	Farinogram			Spaghetti Processing				
Counties	Absorption	Mix Time	Classification	Absorption	Color	Cooked Wt.	Residue	Tenderness
	%	min.		%		%	%	g. cm.
Adams	55.0	2.5	3	32.0	9.5	374	5.0	5.2
Barnes	54.0	2.5	3	31.7	10.0	372	4.5	5.2
Benson	54.8	2.0	2	31.7	9.5	358	5.0	5.4
Bottineau	55.6	2.0	2	32.0	8.5	323	3.3	5.8
Cass	50.6	2.0	2	32.7	10.0	373	6.4	5.6
Cavalier	56.2	2.3	2	34.3	9.5	354	4.8	5.7
Divide	55.4	2.0	2	33.7	8.5	392	4.9	4.9
Grand Forks	55.0	2.5	3	33.0	10.0	396	5.2	5.5
Griggs	54.6	2.5	3	32.7	9.5	382	6.0	5.8
Kidder	53.2	2.5	3	33.0	9.5	357	5.2	6.2
Logan	52.6	2.0	3	32.7	9.5	313	3.9	5.8
McLean	55.6	2.3	3	32.7	9.5	368	4.8	7.1
Mountrail	55.2	2.5	3	33.7	9.0	364	4.8	7.1
Nelson	53.8	2.0	2	32.7	9.5	362	4.8	6.2
Pembina	55.2	2.0	1	32.3	8.5	363	5.6	4.9
Pierce	55.0	2.0	1	32.0	8.5	378	4.8	5.7
Ramsey	55.2	2.0	2	33.0	9.5	341	4.4	5.3
Renville	57.2	2.5	4	33.3	8.5	361	4.4	5.7
Richland	52.6	2.3	3	33.0	10.0	353	4.0	4.6
Rolette	56.2	2.3	3	33.7	9.5	354	4.0	5.4
Steele	53.2	2.0	2	33.0	10.0	354	4.4	5.1
Stutsman	53.6	2.0	2	33.0	10.0	362	4.0	5.5
Towner	56.0	2.0	2	33.7	9.5	383	4.4	5.5
Traill	52.8	2.0	2	32.0	9.5	373	4.0	5.7
Walsh	53.4	1.8	1	33.0	8.5	349	4.8	5.2
Ward	55.0	2.0	2	32.7	8.5	362	4.8	6.0
Wells	54.2	2.0	3	32.3	9.0	358	4.4	5.7
Williams	57.8	2.5	4	33.0	9.0	335	4.4	6.7
Average	54.6	2.2	2.4	32.8	9.3	361	4.7	5.7

average speck count for the state was 21 with a range of 13 to 30, which is a little higher than a year ago. The protein content and wet gluten are both at acceptable levels for good quality durum wheat. The diastatic activity and falling number methods, which are tests for enzyme activity, are on the average at acceptable levels. However, data from certain geographical areas indicate the presence of sprouted wheat.

Physical Dough Properties and Spaghetti Processing

Table 5 lists the data obtained from the Farinograms (physical dough characteristics), spaghetti processing, color and cooking properties.

The Farinograph absorption ranged from 50.6 to 57.8 with an average of 54.6 per cent. The mixing times were quite similar with an average of 2.2 minutes which is similar to the 1967 durum crop average of 2.4 minutes. The overall farinogram average classification was 2.4 which is just a little lower than last year's 3.0 classification. Fig. 3 shows an average farinogram for the 1968 crop.

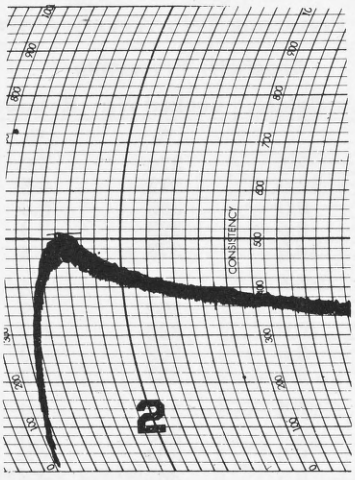

Fig. 3. Farinogram showing average mixing strength of the 1968 crop.

The spaghetti processing absorption averaged 32.8 per cent; the range was 31.7 to 34.3 per cent. The color of the finished products was surprisingly good. The color scores (which were obtained from a new objective measurement) ranged from a low of 8.5 to a high of 10.0 which is the maximum score assigned. All of the products produced were of a deep, clear yellow color. The average color score for the state was 9.3 which is just a little below the 1968 crop average of 9.8.

Spaghetti cooking qualities are reported for the first time. The methods employed for these evaluations are given in the Appendix. The average spaghetti cooked weight for the state was 361 per cent and the range was 313 to 396 per cent. All figures are at excellent levels. A relatively low cooking residue is considered desirable. These data, which ranged from 3.3 to 6.4 per cent with an average of 4.7 per cent, indicate acceptable levels.

Tenderness refers to organoleptic properties of the cooked spaghetti. According to connoisseurs, cooked pasta products should be firm but not "rubbery" or "mushy". These data, obtained with a new laboratory shearing instrument evaluate this important characteristic. The figures presented (Table 5) are relative units and indicate that tenderness is within desirable limits.

In general, the cooking properties of spaghetti made from the 1968 crop of North Dakota durum wheat are of excellent quality and no difficulties should be encountered in the preparation of this nutritious food.

Table 6 compares some of the pertinent average quality factors for the 1963, 1964, 1965, 1966, 1967 and 1968 durum wheat crops. Also, the 5-year (1963-1967) average is shown.

When this crop is compared with the 5-year average, it is higher in weight per 1000 kernels; it is, however, lower in percentage of vitreous kernels, semolina yield and farinogram classification. The other quality factors are somewhat similar.

In general, the overall quality of the 1968 crop was about the same as that produced in 1966 which was classified as good.

These yearly quality differences are to be expected and are attributed to both variable environmental conditions and the wheat varieties grown. Leeds, a relatively new durum wheat variety released jointly in 1966 by this Station, has taken over much of the acreage formerly seeded to the varieties Wells and Lakota. It is estimated that about 50 per cent of the 1968 durum wheat acreage in North Dakota was seeded to this new variety. Briefly, the desirable features of Leeds over Wells or Lakota are better stem rust resistance, higher test weight, 1000 kernel weight, kernel size distribution, protein content and the color of the finished pasta products.

Table 6. Durum Wheat Survey: Comparison of Average Quality Factors for North Dakota 1963, 1964, 1965, 1966, 1967 and 1968 Crops.

(Milling and Analytical Data)

Crop Year	Test Weight	Hectoliter Weight	1000 Kernel Weight	Vit. Kernels	Wheat Protein	Falling Number	Sprout Damage	Diastatic Activity
	lbs/bu	kg.	g.	%	%	units	%	
1963	58.3	77.5	26.4	94	13.9	—	0.0	—
1964	59.5	79.1	28.4	88	13.8	—	0.0	160
1965*	58.8	78.1	30.0	71	13.2	280	4.5	277
1966	59.6	79.1	28.2	74	13.6	272	4.0	126
1967	61.3	81.4	31.1	85	13.5	431	0.0	102
1968	59.5	79.1	32.0	74	13.3	260		134
5-year Ave.	59.5	79.0	28.8	82	13.6	—	1.7	—

(Semolina, Macaroni and Physical Dough Data)

Crop Year	Semolina Yield	Semolina Protein	Semolina Ash	Semolina Specks	Spaghetti Processing Absorption	Spaghetti Color	Farinogram Classification
	%	%	%		%		
1963	53.6	13.4	0.70	20	28.6	8.8	3.7
1964	59.8	13.2	0.78	32	28.6	9.1	4.0
1965*	54.0	12.4	0.63	21	33.4	9.5	3.0
1966	56.3	12.5	0.68	16	33.6	9.6	3.7
1967	54.8	12.6	0.61	14	35.7	9.8	3.0
1968	51.5	12.4	0.62	21	32.8	9.3	2.4
5-year Ave.	55.7	12.8	0.68	21	32.0	9.4	3.5

*Calculated weighted average for the "pre" and "post" rain crops of 1965.

GRADE AND MARKET QUALITY FACTORS

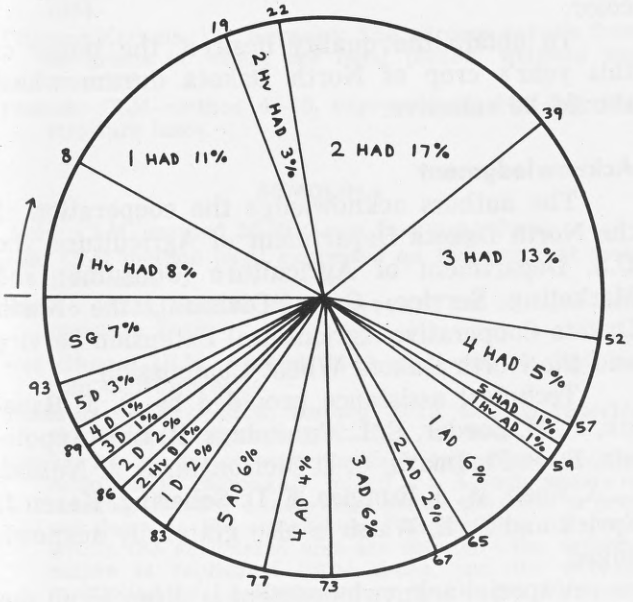

Fig. 4. Diagram showing grade distribution of the 1968 crop.

The percentage of the crop falling into the various grades is depicted in Fig. 4. The 1968 durum crop encompassed 20 different official grades. The figures shown on the outside of the circle are an accumulative percentage of the grades. For example the number 52 on this figure indicates that 52 per cent of the 1968 durum crop should grade 3 Hard Amber Durum or better.

These data indicate that 58 per cent of the North Dakota crop (approximately 47.5 million bushels) should be of Hard Amber Durum quality, 25 per cent Amber Durum, 10 per cent Durum and 7 per cent Sample Grade. (U.S. official grain standards for durum wheat state that a minimum of 75 per cent of hard and vitreous kernels of amber color falls in the "Hard Amber Durum" subclass; durum containing a minimum of 60 per cent of hard and vitreous kernels of amber color but less than 75 per cent of such kernels is classified as "Amber Durum". Any durum containing less than 60 per cent of hard and vitreous kernels of amber color is classified as "Durum").

Although the vitreous kernel content was somewhat lower and total defects considerably higher than last year, the semolina and spaghetti quality was reduced only a little. These factors did not adversely affect the crop to the extent that was anticipated.

WEATHER AND HARVEST

To acquaint the reader with the seeding, growing and harvesting conditions encountered this past year in North Dakota a brief resumè is presented.

Some seeding of the 1968 durum wheat crop was made in the southeastern counties as early as April 9. By April 23 about 24 per cent was planted, and by the end of the month 54 per cent was completed. By mid-May about 86 per cent of the state was seeded and by the end of May the planting of durum was virtually completed according to the "North Dakota Weekly Weather and Crop Report."

Excellent growing conditions prevailed during June, July and up to mid-August. Toward the end of August rains and heavy dew hampered the harvest and this continued for some time, causing considerable concern. The rains abated about mid-September but returned again toward the end of the month. During this period some sprouting had occurred. The durum harvest was only about 73 per cent in the bin by September 24. This compares with 62 per cent the previous week, while a year ago the crop was virtually all harvested.

In a wet year, sprouting, bleaching and low vitreous kernel contents are damage factors of concern to the grain industry. In localized areas where sprouting was a factor, farmers and grain merchants were urged not to attempt to blend sound with sprouted wheat.

The 1968 North Dakota durum wheat production was a record 81.9 million bushels. This compares with the 1967 crop of 54.9 million bushels and the 5-year average of 55.2 million bushels. The average yield was estimated at 28.0 bushels per acre, which is 4.0 bushels higher than last year but lower than the 5-year average of 28.7 bushels per acre. This increase in production was due obviously to an increase in planted acres, which was 28 per cent higher than last year and 52 per cent higher than the 5-year average. As in the past North Dakota will provide about 84 per cent of the nation's production of durum wheat.

Summary

Although the weather conditions of harvest were far from ideal, North Dakota farmers produced a record crop (82 million bushels) of durum wheat in 1968. The excessive rains and heavy dews which delayed the harvest of this specialty crop did not adversely affect the overall quality to the extent that was anticipated. Unfortunately, some sprouting did occur in localized regions.

It is estimated that 19 per cent of the crop should grade No. 1 Hard Amber Durum with 52 per cent grading No. 3 Hard Amber Durum or better. The average dockage for the state was 1.0 per cent with a range of 0.2 to 2.2 per cent. The average moisture and protein contents were 13.2 and 13.3 per cent, respectively. Test weights ranged from 57.6 to 62.6 with a state average of 59.5 pounds per bushel. The average vitreous kernel content was 74 per cent with a range from 63 to 86 per cent. Damaged kernels which consisted mostly of sprouted and some black point kernels ranged from 0.3 to 19.7 per cent with an average for the state of 4.7 per cent.

The quality of the 1968 North Dakota durum crop can be classed from fair to good and, in general, is somewhat similar to that produced in 1966. It is, however, below the excellent quality produced in North Dakota last year.

The wheat milled in a normal manner but the yield of semolina was relatively low. The semolina contained more specks than last year, but was the same as the 5-year average. Weight per 1000 kernels is considerably higher than last year or the 5-year average. Possibly the main differences that will be observed in this year's crop will be a lower percentage of vitreous kernels, a little speckier and lower semolina yield with some loss in spaghetti color.

To obtain the quality desired, the buyer of this year's crop of North Dakota durum wheat should be selective.

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METHODS - DURUM

WHEAT

Test Weight per Bushel: Cereal Laboratory Methods (CLM)*; method 84-10.

Hectoliter Weight: Calculated from the test weight per bushel.

Thousand Kernel Weight: Ten grams of cleaned wheat (free from foreign material and broken kernels) are counted using an electronic seed counter. The calculated weight for 1,000 kernels is reported.

Kernel Size (0.064 x ⅜ sieve): A 0.064 x ⅜ sieve is a metal sieve 0.0319 inch thick perforated with oblong holes 0.064 inch by 0.0375 (⅜) inch which are ⅛ (0.1250) inch from center to center and with 0.0525 inch end bridges. The perforations are staggered in relation to the adjacent rows. One hundred grams of wheat are placed on the sieve, which is rotated 30 times. The material passing through the sieve is reported.

Kernel Size (2-10 x 20 sieve): This sieve, which is used extensively in Europe, is a metal sieve with slotted holes 2.1 mm wide by 20 mm long with 84 perforations per 10 sq. cm. One hundred grams of wheat are placed on the sieve which is rotated 30 times. The material passing through the sieve is reported.

Kernel Distribution: One hundred grams of cleaned wheat are placed in a unit similar to the one described in Cereal Science Today, Vol. 5, No. 3, 71-75 (1960). The operation time is 3 minutes. Wheat remaining on the top sieve (Tyler No. 7, with 2.92 mm. opening) is classified as "large"; material passing through the top sieve but remaining on the second sieve (Tyler No. 9, with 2.24 mm. opening) are the "medium" sized kernels; the kernels passing through the second sieve are classed as "small". The weighed fractions are reported.

Grade: The grade is determined by a United States licensed inspector using the Official Grain Standards of the United States (SRA-AMS-177) as revised May, 1964.

Vitreous Kernels (Vit. Kernels): The vitreous kernels from 50 grams of wheat are hand picked, weighed and reported.

Protein: CLM method 46-10, expressed on 14.0 per cent moisture basis.

SEMOLINA

Yield: CLM, method 26-30 (Long flow procedure)

Ash: CLM method 08-01 expressed on 14.0 per cent moisture basis.

Protein: CLM, method 46-10 expressed on 14.0 per cent moisture basis.

Wet Gluten: CLM, method 38-11 expressed on 14.0 per cent moisture basis.

Diastatic Activity: CLM, method 22-15. Results reported as milligrams maltose per 10 g. of flour.

Specks: An aliquot of experimentally milled and purified semolina is thoroughly mixed - a 1 inch square is marked on a 3 x 4 inch glass plate - the plate is pressed down on the semolina and the number of specks within the designated area are counted - the determination is replicated three times, and the average multiplied by 10. Expressed as specks per 10 square inches.

Falling Number: Flour is obtained by passing the wheat through a Brabender Quadramat Jr. mill and sifting the ground whole wheat through a No. 70 US standard sieve (200u). The procedure, described in Cereal Chem. 38, 202-203 (1961) requires 7.0 g. flour (15.0% M.B.) and 25 ml. distilled water. Results are expressed in units (seconds).

MACARONI

Processing: CLM, method 66-42, Micro Scale.

Processing Absorption: An indication of processing absorption is obtained from the farinogram absorption. Also 30 grams of semolina (14.0% M.B.) are mechanically mixed, kneaded and the dough extruded through a single hole die. The desired pressure (which is applied uniformly) of extrusion is 500 lbs. per square inch. Subsequent doughs are prepared until this pressue is obtained.

Color: Color scores were determined by light reflectance, using a Hunter Color-Difference Meter (Model D25) equipped with a D 25 A optical unit. The entire 2 in. diameter specimen area was covered with spaghetti strands, readings were taken against a black background having zero per cent reflectance. (These color scores have a high correlation with the former visual scores reported in previous reports). Highest score is 10.0.

Cooked Weight: Increase in weight of ten grams spaghetti after twenty minutes of cooking in 300 ml. of boiling distilled water. Results expressed on percentage basis.

Residue: The amount of solids sloughed off during the cooking (as outlined above). The cooking water evaporated to dryness. Residue weighed and reported on percentage basis.

Tenderness: This is a relative score obtained with the use of a new laboratory "shearing" instrument. Results are expressed as grams centimeter.

FARINOGRAM

Procedure: Water-semolina farinograms are made using the settings on the Farinograph which are normally employed for hard red spring wheat flours. Fifty grams of semolina are mixed in a small stainless steel Farinograph bowl with sufficient distilled water to give a maximum dough consistency centered on the 460 Brabender Unit Line.

Absorption: Amount of water (ml.) required to center curve peak on the 460 Brabender Unit Line.

Mixing Time: Time in minutes for the center portion of the farinogram to reach the 460 Brabender Unit Line.

Classification: An overall empirical classification incorporating mixing time and general charactristics is assigned.

*American Association of Cereal Chemists, Cereal Laboratory Methods (7th Edition) St. Paul, Minn., 1962.

Fig. 3. Trade missions and visitors from many countries come to see wheat research conducted at North Dakota State University.

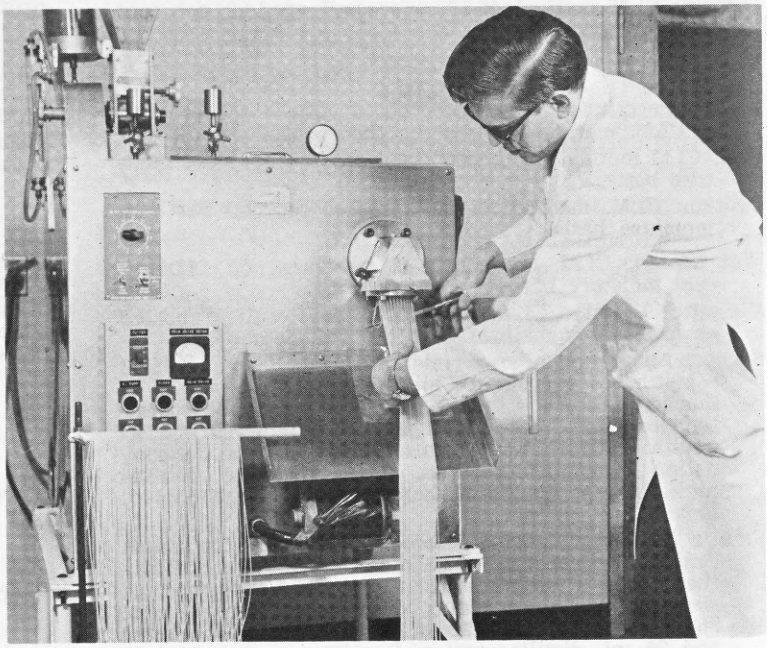

Fig. 4. Ultimate test of the value of a new wheat variety is its usefulness to the industry and to consumers. In the Cereal Technology Laboratory, Technician David Horn makes spaghetti on a vacuum macaroni press for evaluation of a particular durum variety.