

# The Quality of North Dakota's 1972 Hard Red Spring Wheat

L. D. Sibbitt and O. J. Banasik

The overall quality of North Dakota's 1972 hard red spring wheat is considered to be generally excellent and appears to be in certain instances similar to the crop produced in 1969. The average test weight is 60.2 pounds per bushel, which is about one pound lower than last year. The moisture content is low with an average of 11.5 per cent reported. Average wheat protein content is 14.4 per cent expressed on an "as is" moisture basis or when expressed on a 14.0 per cent moisture basis, it becomes 14.0 per cent which is 0.5 percentage points higher than the 1971 crop. Vitreous kernel content is 6 percentage points lower than last year, with foreign material, damaged kernels and wheat ash content about the same as last year. Shrunken and broken kernels and total defects are somewhat lower than were reported for the 1971 crop. Flour yield is lower than last year, with a flour ash content the same as last year. On the average, wet gluten and falling number are the highest since the 1967 crop. The general kernel appearance of the 1972 crop lacks the bright luster usually found in this wheat class. However, this kernel appearance did not adversely affect either the milling or the baking qualities of the crop.

Baking characteristics in general are excellent. Dough handling properties are very elastic with no "buckiness" of the doughs observed. Loaves of large volume with an excellent external appearance were obtained. Crumb grain and textures and crumb colors were very good, about the same as last year. Mixing time and tolerance as measured by the Farinograph are a little higher than last year's crop. Very good to excellent elastic properties, as indicated by the Extensograph, were also obtained. However, it has been observed that the overall quality of the crop is not as uniform throughout the state as that reported for last year.

---

*Sibbitt is associate professor, Banasik is professor and chairman, Department of Cereal Chemistry and Technology.*

The USDA estimates the North Dakota hard red spring (Dark Northern Spring) wheat crop at about 149 million bushels (4.1 million metric tons). This is about 28 per cent below last year's record crop, but is still the second largest crop produced in North Dakota. An estimated average yield of 29.0 bushels per acre is 2.5 bushels below a year ago. A preponderance of the crop (79 per cent) should grade U. S. No. 2 Dark Northern Spring or better. The USDA also estimates the total U. S. production of hard red (Northern Spring) wheat at about 286 million bushels.

## Samples and Methods

During the 1972 harvest, samples were collected and submitted by cooperating elevators from all of the counties producing substantial amounts of hard red spring wheat, with at least two elevators in each county participating. The number of collected samples reflected the anticipated crop production of each county. Elevator operators were requested to collect a sample from each truck load of hard red spring wheat delivered and place the sample in a suitable container. Twice a week, the samples were thoroughly mixed, a three-pound aliquot taken and placed in a moisture proof plastic bag, and sent to the Department of Cereal Chemistry and Technology at North Dakota State University, Fargo, for a complete grade and ultimate quality evaluation. These samples were uncleaned and reflected the condition of the grain delivered to the elevator.

Each of the individual wheat samples was tested 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 campus for a complete official grade.

To determine the milling, baking and other quality tests of this year's crop, measured aliquots of each sample were taken and composited for each county in the state.

## QUALITY DATA FOR COMPOSITES

### Wheat Data

Table 1 lists by county the averages for dockage, grade, and the various grading factors as well as the overall state average. Table 2 is presented to show the Grade Requirements for hard red spring wheat produced in the United States.

Test weight of this year's crop, as shown in Table 1, ranged from 57.6 to 61.8 with an average of 60.2 lbs. per bushel. Average test weight for each county sampled is presented in Fig. 1. Figure 2 is a bar graph showing the test weight distribution of all of the samples tested for both the 1972 and 1971 crops. This graph shows that about 87 per cent

Fig. 1. Average hard red spring wheat protein content and test weight for each county in North Dakota.

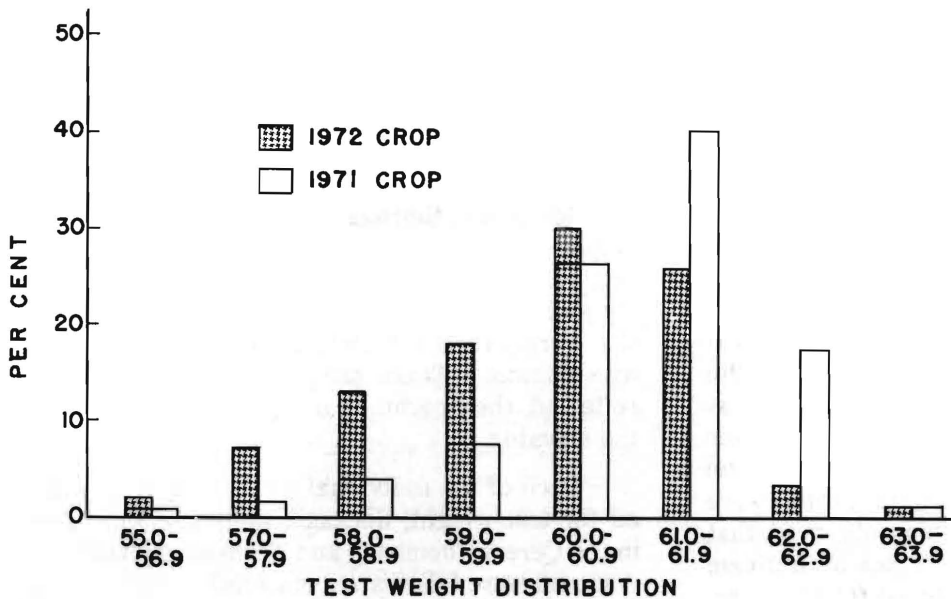
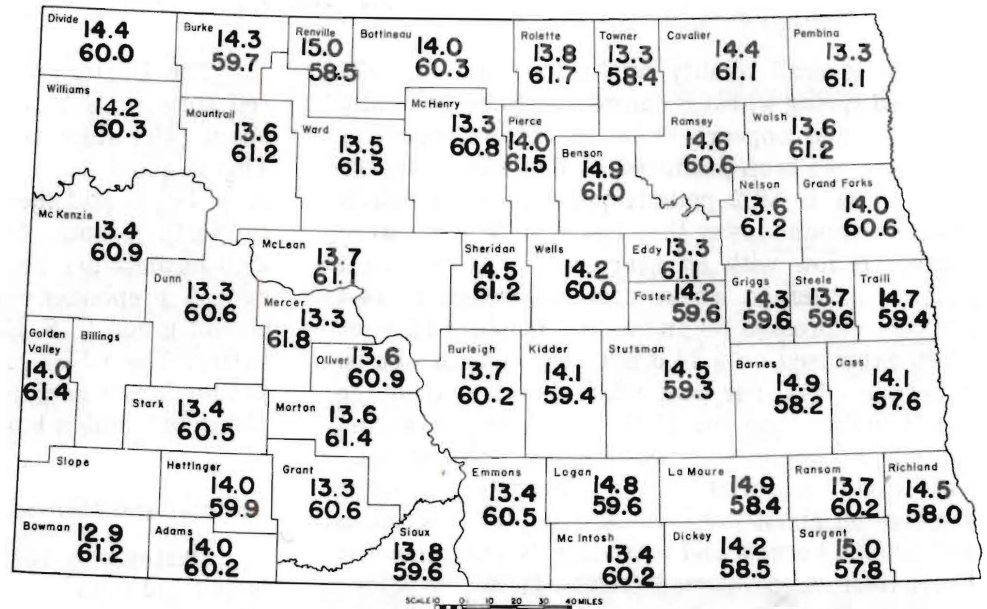


Fig. 2. Test weight distribution (individual samples) of the 1972 and 1971 North Dakota hard red spring wheat crops.

of the 1972 crop would fall between 58.0 and 61.9 pounds per bushel. Average wheat moisture content for the state is 11.5 per cent. Vitreous kernels ranged from 70 to 93 with an average of 83 per cent.

Shrunken and broken kernels averaged 1.3 per cent, well below the allowable limit for the two top grades. Foreign material (FM) is quite low, showing an average of 0.3 per cent with a range of 0.1 to 0.5 per cent. Damaged kernels are also low,



ranging from zero to 0.5 with an average of 0.2 per cent. Total defects, which is the sum of shrunken and broken kernels, foreign material and dam-

aged kernels, including heat damaged kernels are, with the exception of one sample, within the limits listed for the two top grades. None of the samples

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

Counties	Dockage	Test	Moisture	Grade	Vitreous	Shrunken	F.M.	Damage	Total	Contrast-
		Weight			Kernels	and			Defects	ing
	%	lbs/bu	%		%	%	%	%	%	%
Adams	2.6	60.2	10.6	1 HDNS	88	1.3	0.3	0.3	1.9	0.0
Barnes	2.7	58.2	12.3	1 DNS	83	1.3	0.5	0.3	2.1	0.0
Benson	2.0	61.0	11.0	1 HDNS	91	0.8	0.2	0.3	1.3	0.0
Bottineau	1.6	60.3	12.4	1 HDNS	88	0.8	0.3	0.3	1.4	0.0
Bowman	1.9	61.2	10.8	1 HDNS	78	1.6	0.4	0.3	2.3	0.0
Burke	1.0	59.7	12.8	1 DNS	89	1.0	0.3	0.3	1.6	0.4
Burleigh	1.2	60.2	10.7	1 HDNS	77	1.4	0.3	0.2	1.9	0.3
Cass	1.0	57.6	12.5	2 NS	72	1.1	0.3	0.3	1.7	0.0
Cavalier	0.8	61.1	12.5	1 HDNS	80	0.7	0.2	0.2	1.1	0.0
Dickey	2.1	58.5	12.2	1 NS	70	1.6	0.4	0.2	2.2	0.0
Divide	1.4	60.0	13.5	1 HDNS	90	0.6	0.3	0.5	1.4	0.0
Dunn	1.2	60.6	10.7	1 HDNS	87	1.6	0.2	0.2	2.0	0.0
Eddy	0.9	61.1	11.3	1 HDNS	80	1.1	0.4	0.2	1.7	0.0
Emmons	1.6	60.5	11.0	1 HDNS	89	1.2	0.4	0.0	1.6	0.0
Foster	1.0	59.6	10.8	1 DNS	86	1.5	0.2	0.2	1.9	0.0
Golden Valley	0.6	61.4	11.5	1 HDNS	86	0.9	0.3	0.2	1.4	0.0
Grand Forks	1.7	60.6	12.1	1 HDNS	78	0.8	0.3	0.3	1.4	0.0
Grant	1.4	60.6	10.6	1 HDNS	87	1.3	0.4	0.2	1.9	0.0
Griggs	2.0	59.6	11.6	1 NS	71	1.1	0.4	0.4	1.9	0.0
Hettinger	2.1	59.9	10.9	1 DNS	86	1.5	0.3	0.2	2.0	0.0
Kidder	2.0	59.4	10.9	1 DNS	81	1.9	0.3	0.2	2.4	0.0
LaMoure	2.1	58.4	11.6	2 DNS	77	2.7	0.4	0.3	3.4	0.2
Logan	0.4	59.6	11.8	1 DNS	79	1.0	0.2	0.2	1.4	0.0
McHenry	3.9	60.8	10.9	1 HDNS	78	2.2	0.3	0.2	2.7	0.0
McIntosh	1.9	60.2	11.8	1 HDNS	81	1.5	0.4	0.2	2.1	0.0
McKenzie	1.8	60.9	11.5	1 HDNS	80	1.2	0.3	0.2	1.7	0.0
McLean	2.5	61.1	11.1	1 HDNS	85	1.3	0.3	0.2	1.8	0.0
Mercer	0.1	61.8	10.0	1 HDNS	88	1.3	0.2	0.1	1.6	0.0
Morton	0.9	61.4	10.8	1 HDNS	84	1.1	0.3	0.2	1.6	0.0
Mountrail	2.2	61.2	10.7	1 HDNS	90	2.3	0.2	0.2	2.7	0.0
Nelson	0.7	61.2	11.9	1 HDNS	78	0.9	0.2	0.3	1.4	0.0
Oliver	2.6	60.9	11.0	1 HDNS	88	1.5	0.4	0.4	2.3	0.0
Pembina	1.6	61.1	11.8	1 HDNS	77	1.0	0.3	0.2	1.5	0.0
Pierce	0.3	61.5	11.0	1 HDNS	82	0.9	0.3	0.2	1.4	0.0
Ramsey	2.5	60.6	12.0	1 HDNS	80	0.8	0.3	0.2	1.3	0.0
Ransom	0.3	60.2	12.1	1 HDNS	87	0.9	0.4	0.2	1.5	0.0
Renville	2.3	58.5	12.8	1 DNS	79	1.4	0.5	0.4	2.3	0.0
Richland	1.4	58.0	12.0	1 NS	72	1.5	0.3	0.4	2.2	0.0
Rolette	0.9	61.7	11.1	1 HDNS	87	1.1	0.5	0.2	1.8	0.0
Sargent	0.2	57.8	12.2	2 DNS	93	0.9	0.1	0.4	1.4	0.0
Sheridan	2.0	61.2	10.4	1 HDNS	91	1.3	0.4	0.3	2.0	0.0
Sioux	5.0	59.6	10.7	1 DNS	88	2.2	0.5	0.1	2.8	0.0
Stark	1.4	60.5	11.4	1 HDNS	80	1.4	0.3	0.3	2.0	0.0
Steele	1.1	59.6	12.4	1 DNS	78	1.0	0.3	0.2	1.5	0.0
Stutsman	3.0	59.3	11.9	1 DNS	77	1.2	0.3	0.2	1.7	0.1
Towner	5.2	58.4	13.5	1 DNS	80	0.6	0.4	0.3	1.3	0.0
Traill	1.1	59.4	11.7	1 DNS	76	1.0	0.2	0.4	1.6	0.0
Walsh	1.6	61.2	11.4	1 HDNS	80	1.5	0.2	0.2	1.9	0.0
Ward	2.2	61.3	10.6	1 HDNS	91	1.1	0.5	0.3	1.9	0.0
Wells	4.5	60.0	10.9	1 HDNS	81	1.9	0.4	0.3	2.6	0.0
Williams	1.3	60.3	11.9	1 HDNS	88	1.3	0.5	0.2	2.0	0.0
Average	1.8	60.2	11.5	1 HDNS	83	1.3	0.3	0.2	1.8	0.0

is in excess of 3.4 per cent and the average is considerably less. Contrasting classes in this year's crop are negligible. The grades of the composites ranged from U.S. No. 2 Northern Spring to U.S. No. 1 Heavy Dark Northern Spring.

All of the 1972 samples were carefully examined for the presence of "ergot", a fungus which was observed in the 1971 Northern Spring Wheat Crop. Very little of this fungus was found in any of the samples; indeed, a very high percentage of

the samples were completely free from this disease. It is apparent that there will be no problem with "ergot" in the 1972 crop of Northern Spring Wheat from 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 reported. For comparative purposes only,

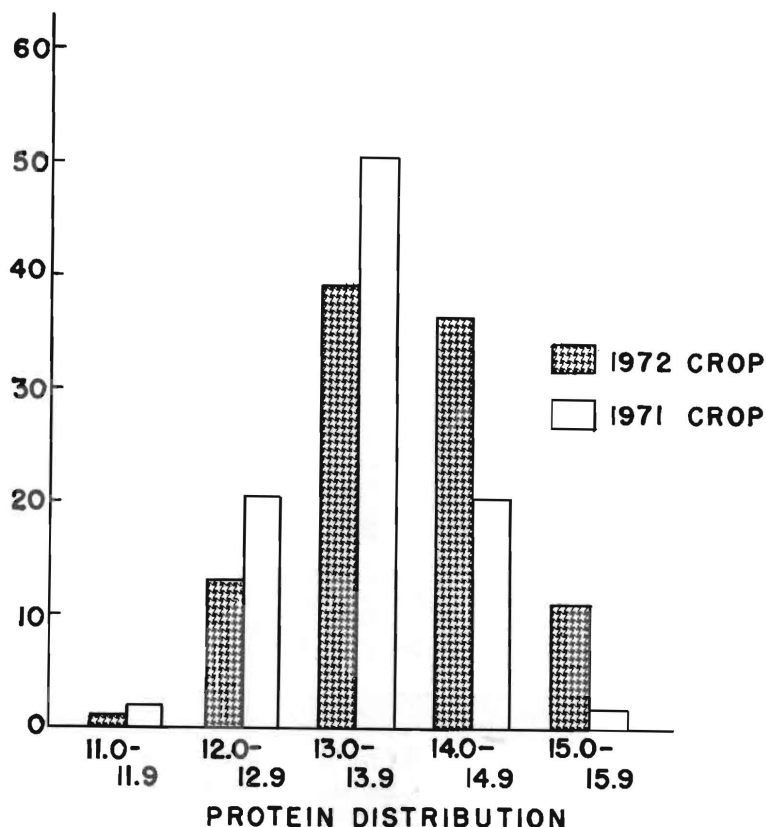
test weight is repeated in this table. The hectoliter weight of this year's crop ranged from 74.1 to 79.6 with an average of 77.4 kilograms per hectoliter. Thousand-kernel weight ranged from 27.8 to 36.1 with an average of 32.2 grams which is a little lower than last year.

Table 3 also shows wheat protein contents expressed on an "as is" moisture basis, on a 14.0

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

Grade	Maximum Limits Of							
	Minimum Test Weight Per Bushel	Defects				Wheat of Other Classes		
		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	
U.S. No. 1	58.0	0.1	2.0	0.5	3.0	3.0	1.0	3.0
U.S. No. 2	57.0	0.2	4.0	1.0	5.0	5.0	2.0	5.0
U.S. No. 3	55.0	0.5	7.0	2.0	8.0	8.0	3.0	10.0
U.S. No. 4	53.0	1.0	10.0	3.0	12.0	12.0	10.0	10.0
U.S. No. 5	50.0	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.



**Fig. 3. Wheat protein distribution (individual samples) of the 1972 and 1971 North Dakota hard red spring wheat crops.**



per cent moisture basis, and on a dry matter basis (DMB). The average protein content for the state

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

Counties	Test Weight	Hectoliter Weight	1000 Kernel Weight	Protein <sup>1</sup>	Protein <sup>2</sup>	Protein <sup>3</sup>	Ash
	lbs/bu	kg.	g.	%	%	%	%
Adams	60.2	77.5	31.3	14.7	14.0	16.3	1.59
Barnes	58.2	74.9	32.4	15.3	14.9	17.3	1.72
Benson	61.0	78.5	36.1	15.5	14.9	17.3	1.58
Bottineau	60.3	77.6	32.5	14.4	14.0	16.3	1.61
Bowman	61.2	78.8	33.4	13.4	12.9	15.0	1.51
Burke	59.7	76.8	29.7	14.7	14.3	16.6	1.66
Burleigh	60.2	77.5	32.9	14.3	13.7	15.9	1.45
Cass	57.6	74.1	30.2	14.4	14.1	16.4	1.63
Cavalier	61.1	78.6	36.0	14.7	14.4	16.7	1.53
Dickey	58.5	75.3	30.1	14.7	14.2	16.5	1.63
Divide	60.0	77.2	31.8	14.5	14.4	16.7	1.71
Dunn	60.6	78.0	28.5	13.8	13.3	15.5	1.48
Eddy	61.1	78.6	34.4	13.6	13.3	15.5	1.55
Emmons	60.5	77.9	29.9	13.9	13.4	15.6	1.60
Foster	59.6	76.7	31.9	14.8	14.2	16.5	1.46
Golden Valley	61.4	79.0	33.6	14.5	14.0	16.3	1.53
Grand Forks	60.6	78.0	31.6	14.1	13.7	15.9	1.46
Grant	60.6	78.0	29.4	13.9	13.3	15.5	1.52
Griggs	59.6	76.7	32.3	14.8	14.3	16.6	1.43
Hettinger	59.9	77.1	31.4	14.6	14.0	16.3	1.57
Kidder	59.4	76.4	30.0	14.7	14.1	16.4	1.52
LaMoure	58.4	75.2	30.2	15.4	14.9	17.3	1.57
Logan	59.6	76.7	30.3	15.3	14.8	17.2	1.51
McHenry	60.8	78.3	30.0	13.8	13.3	15.5	1.64
McIntosh	60.2	77.5	30.7	13.8	13.4	15.6	1.58
McKenzie	60.9	78.4	30.3	13.8	13.4	15.6	1.58
McLean	61.1	78.6	32.3	14.2	13.7	15.9	1.60
Mercer	61.8	79.6	33.8	13.8	13.3	15.5	1.56
Morton	61.4	79.0	32.3	14.1	13.6	15.8	1.48
Mountrail	61.2	78.8	30.9	14.1	13.6	15.8	1.53
Nelson	61.2	78.8	34.6	14.0	13.6	15.8	1.53
Oliver	60.9	78.4	33.9	14.1	13.6	15.8	1.66
Pembina	61.1	78.6	35.0	13.7	13.3	15.5	1.53
Pierce	61.5	79.2	34.8	14.5	14.0	16.3	1.66
Ramsey	60.6	78.0	33.2	15.0	14.6	17.0	1.48
Ransom	60.2	77.5	27.8	14.3	13.7	15.9	1.60
Renville	58.5	75.3	34.1	15.2	15.0	17.4	1.71
Richland	58.0	74.6	30.5	14.9	14.5	16.9	1.72
Rolette	61.7	79.4	31.6	14.3	13.8	16.0	1.59
Sargent	57.8	74.4	29.0	15.5	15.0	17.4	1.83
Sheridan	61.2	78.8	33.4	15.2	14.5	16.9	1.52
Sioux	59.6	76.7	31.5	14.4	13.8	16.0	1.58
Stark	60.5	77.9	32.2	14.0	13.4	15.6	1.62
Steele	59.6	76.7	31.9	14.1	13.7	15.9	1.54
Stutsman	59.3	76.3	33.0	14.9	14.5	16.9	1.55
Towner	58.4	75.2	34.6	13.4	13.3	15.5	1.67
Traill	59.4	76.4	33.3	15.2	14.7	17.1	1.62
Walsh	61.2	78.8	35.0	14.1	13.6	15.8	1.39
Ward	61.3	78.9	35.1	14.1	13.5	15.7	1.61
Wells	60.0	77.2	35.5	14.8	14.2	16.5	1.50
Williams	60.3	77.6	30.7	14.6	14.2	16.5	1.64
Average	60.2	77.5	32.2	14.4	14.0	16.2	1.58

<sup>1</sup>As is Moisture Basis.  
<sup>2</sup>14.0% Moisture Basis.  
<sup>3</sup>Dry Matter Basis.

of this year's crop is 14.0 per cent on a 14.0 per cent moisture basis. This is 0.5 per cent higher than the 1971 crop. When this protein content (14.0 per cent) is expressed on an "as is" moisture basis, it becomes 14.4 per cent, and on a dry matter basis, it is reported at 16.2 per cent. Protein contents shown on grain grading certificates are expressed on an "as is" moisture basis.

Figure 1 shows the average protein content (14.0 per cent moisture basis) for the various counties sampled. The bar graph in Figure 3 shows the wheat protein distribution (14.0 per cent moisture basis) of both the 1972 and 1971 crops. These data show for the 1972 crop that about 86 per cent of the crop would fall between 13.0 and 15.9 per cent, or if expressed on a DMB, it becomes 15.1 to 18.5 per cent. The average wheat ash for the state is 1.58 with a range of 1.39 to 1.83 per cent. This is the same average ash level reported for the past year.

#### Flour Data

Table 4 shows the experimental flour yield data which ranged from 66.5 to 71.1 per cent with a state average of 69.2 per cent. This is, on the average, 0.8 per cent lower than that reported for the 1971 crop. Because of the lower test weight of the 1972 crop, this slightly lower flour yield is to be expected. The ash content of this long patent experimentally milled flour ranged from 0.39 per cent in Burleigh county to 0.48 per cent in Sargent county with an average for the state of 0.43 per cent.

None of the samples displayed any abnormal milling characteristics. The milling properties, in general, with the exception of the slightly lower flour yields, were quite similar to the hard red spring wheat produced in 1971. The flour protein content average is 13.3 per cent with a range of 12.2 to 14.4 per cent, expressed on a 14.0 per cent moisture basis. This average flour protein content is five-tenths of a per cent higher than last year. The average drop in protein from wheat to flour is less than 1.0 per cent. The average baking absorption for the state is 64.5 per cent expressed on a 14.0 per cent moisture basis, with a range of 62.2 to 66.6 per cent. This is seven-tenths of a per cent higher than last year's average and is also the highest level reported since the 1967 crop. Wet gluten ranged from 33.6 to 55.7 with an average of 44.6 per cent. This average wet gluten figure is higher than last year by 5.7 per cent and is the highest reported since the 1967 crop. The average falling number for the state is 490 units. In all cases, the



falling numbers reported for the counties are at levels which indicate the absence of excessive enzyme activity (sprout damaged kernels) in this year's crop.

**Table 4. HRS Wheat Survey — 1972 Crop: Flour Data (County Averages).**

Counties	Yield	Ash	Protein	Baking Absorption	Wet Gluten	Falling No.
	%	%	%	%	%	units
Adams	68.3	0.41	13.5	63.5	43.2	571
Barnes	67.3	0.43	14.2	64.2	48.2	590
Benson	70.3	0.40	14.3	64.8	52.6	434
Bottineau	70.5	0.41	13.5	65.0	47.4	508
Bowman	69.1	0.40	12.2	64.8	39.2	454
Burke	66.7	0.41	13.6	65.9	51.0	442
Burleigh	69.6	0.39	12.9	64.2	40.0	442
Cass	67.3	0.43	13.2	62.9	33.6	468
Cavalier	67.4	0.40	13.5	64.8	44.6	515
Dickey	68.9	0.44	13.8	64.3	41.4	562
Divide	69.2	0.43	13.7	65.4	49.5	375
Dunn	67.2	0.41	12.7	64.3	38.0	521
Eddy	69.7	0.43	12.7	65.7	36.0	470
Emmons	69.3	0.45	13.0	65.7	39.5	491
Foster	69.5	0.42	13.6	65.5	42.4	465
Golden Valley	69.8	0.40	13.5	64.8	41.4	500
Grand Forks	68.9	0.41	13.0	63.8	37.8	346
Grant	69.3	0.42	12.6	65.6	38.8	516
Griggs	69.1	0.43	13.4	65.3	43.5	368
Hettinger	68.4	0.44	13.1	65.6	40.0	578
Kidder	70.1	0.43	13.8	65.3	41.2	459
LaMoure	69.1	0.44	14.4	63.0	50.7	500
Logan	70.3	0.43	14.2	63.8	48.2	551
McHenry	69.6	0.42	12.5	64.2	41.8	515
McIntosh	70.3	0.48	12.7	62.4	41.1	468
McKenzie	70.1	0.40	12.6	63.4	41.1	628
McLean	69.5	0.43	13.1	65.9	46.3	610
Mercer	70.5	0.44	12.5	64.9	44.2	452
Morton	70.3	0.44	12.8	64.7	40.9	550
Mountrail	69.7	0.42	13.0	63.6	43.6	559
Nelson	70.1	0.42	13.0	65.0	48.0	409
Oliver	69.9	0.42	12.5	64.5	43.8	402
Pembina	70.1	0.43	12.6	63.6	43.6	505
Pierce	67.7	0.46	13.3	65.5	47.9	622
Ramsey	68.9	0.43	13.5	64.2	49.5	375
Ransom	71.1	0.43	12.9	62.3	43.2	448
Renville	68.7	0.46	14.4	64.8	55.7	409
Richland	69.8	0.44	13.6	62.2	43.5	401
Rolette	68.6	0.43	13.2	65.6	45.6	540
Sargent	67.4	0.48	14.4	64.5	49.7	545
Sheridan	70.5	0.43	13.9	65.1	47.1	489
Sioux	68.9	0.46	13.4	64.2	40.7	467
Stark	66.5	0.44	12.7	62.7	46.9	389
Steele	69.9	0.43	13.0	63.6	46.0	545
Stutsman	69.3	0.43	14.1	64.2	51.9	438
Towner	68.9	0.46	12.7	62.7	44.5	591
Trail	70.2	0.43	13.9	64.0	49.7	460
Walsh	69.7	0.43	13.0	64.1	44.1	473
Ward	69.1	0.43	12.8	66.4	48.6	468
Wells	70.5	0.43	13.6	66.6	48.8	538
Williams	69.5	0.42	13.4	65.9	50.5	579
Average	69.2	0.43	13.3	64.5	44.6	490

### Baking Data

In general, the baking characteristics of the 1972 crop as shown in Table 5 are considered very

**Table 5. HRS Wheat Survey — 1972 Crop: Baking Data (County Averages).**

Counties	Dough Char.	Loaf Volume	Grain & Texture	Crumb Color	Crust Color	Symm.
		cc.				
Adams	4	835	8.5	9.0	4	4.5
Barnes	4	990	8.5	8.5	4	4.5
Benson	4	935	9.0	8.5	4	4.5
Bottineau	4	965	9.0	9.0	4	4.5
Bowman	4	800	9.0	8.5	4	4.5
Burke	4	910	8.5	8.5	4	4.5
Burleigh	4	845	9.0	8.5	4	4.5
Cass	4	900	9.0	9.0	4	4.5
Cavalier	4	885	8.5	9.0	4	4.5
Dickey	4	935	8.5	8.5	4	4.5
Divide	4	955	8.5	8.5	4	4.5
Dunn	4	845	9.0	8.5	4	4.5
Eddy	4	830	9.0	8.0	4	4.5
Emmons	4	870	9.0	8.5	4	4.5
Foster	4	920	8.5	8.5	4	4.5
Golden Valley	4	905	8.5	8.5	4	4.5
Grand Forks	4	900	8.5	8.5	4	4.5
Grant	4	835	9.0	8.5	4	4.5
Griggs	4	905	8.5	8.5	4	4.5
Hettinger	4	880	8.5	8.0	4	4.5
Kidder	4	885	8.0	8.5	4	4.5
LaMoure	4	945	8.0	8.5	4	4.5
Logan	4	940	8.5	8.5	4	4.5
McHenry	4	815	8.5	9.0	4	4.5
McIntosh	4	830	8.0	8.5	4	4.5
McKenzie	4	810	9.0	9.0	4	4.5
McLean	4	860	8.5	8.5	4	4.5
Mercer	4	845	8.5	8.0	4	4.5
Morton	4	800	9.0	8.5	4	4.5
Mountrail	4	810	9.0	8.5	4	4.5
Nelson	4	850	9.0	8.5	4	4.5
Oliver	4	820	9.0	8.0	4	4.5
Pembina	4	860	8.5	8.5	4	4.5
Pierce	4	850	9.0	8.5	4	4.5
Ramsey	4	940	9.0	9.0	4	4.5
Ransom	4	915	8.5	8.0	4	4.5
Renville	4	950	8.0	8.5	4	4.5
Richland	4	885	8.5	8.5	4	4.5
Rolette	4	860	9.0	9.0	4	4.5
Sargent	4	920	8.0	8.0	4	4.5
Sheridan	4	910	9.0	9.0	4	4.5
Sioux	4	375	9.0	9.0	4	4.5
Stark	4	825	9.0	9.0	4	4.5
Steele	4	890	8.5	9.0	4	4.5
Stutsman	4	905	8.5	9.0	4	4.5
Towner	4	870	8.0	8.0	4	4.5
Trail	4	940	8.0	8.5	4	4.5
Walsh	4	865	8.5	8.0	4	4.5
Ward	4	850	8.5	8.5	4	4.5
Wells	4	925	8.0	8.5	4	4.5
Williams	4	880	8.5	8.0	4	4.5
Average	4	882	8.6	8.5	4	4.5



good to excellent. Dough handling properties are excellent with no "buckiness" of the doughs observed. The flour produced loaves of large volume coupled with good break and shred and excellent crust color. The loaves possessed good crumb colors and good crumb grain and textures. Loaf volumes

ranged from 800 to 990 cc's with an average of 882 cc's. Individual loaf volumes were all within about 10 per cent of the mean loaf volume for the state. Crumb grain and texture and crumb colors showed a range of about 5 per cent from the mean. For the second consecutive year, this year's flours required

Table 6. HRS Wheat Survey — 1972 Crop: Physical Dough Properties (County Averages).

Counties	Farinogram					Extensogram					
	Absorp- tion %	Mixing		MTI	Classifi- cation	Extensibility		Resistance		Area sq. cm.	Classifi- cation
		Time min.	Tolerance min.			45 min. cm.	180 min. cm.	45 min. cm.	180 min. cm.		
Adams	63.1	7.0	8.2	30	5	22.2	22.7	6.8	8.9	154	7
Barnes	63.7	7.0	8.1	35	6	23.0	22.3	6.4	8.5	146	6
Benson	64.3	6.5	7.2	40	5	27.5	24.4	6.3	8.1	153	6
Bottineau	64.4	6.0	7.5	35	5	23.9	24.6	6.3	8.3	159	6
Bowman	64.7	5.5	4.3	55	5	23.5	20.8	5.8	8.9	125	6
Burke	65.5	5.0	5.2	60	4	18.4	21.3	4.3	5.8	100	4
Burleigh	64.3	6.5	8.5	30	6	22.0	21.5	7.0	8.8	144	7
Cass	62.5	6.0	7.7	40	6	24.8	21.5	7.7	10.4	169	8
Cavalier	64.8	6.5	10.3	30	6	24.3	20.4	6.6	8.9	133	7
Dickey	64.4	6.5	8.9	25	7	23.6	20.2	8.0	11.6	160	8
Divide	64.7	6.0	6.7	35	5	22.3	22.6	4.7	6.5	114	5
Dunn	64.3	7.0	8.6	25	6	18.9	19.6	6.0	8.9	130	7
Eddy	66.5	5.5	7.0	40	5	21.6	21.4	6.3	8.3	139	6
Emmons	66.1	7.0	7.0	35	6	24.2	22.9	6.6	8.9	155	7
Foster	65.9	6.5	7.0	30	5	23.4	25.0	6.0	8.6	159	6
Golden Valley	65.3	6.5	5.5	50	5	21.6	25.9	5.2	7.1	143	5
Grand Forks	64.3	6.5	8.2	35	5	23.1	22.5	6.5	9.3	163	7
Grant	66.0	6.0	6.9	45	5	21.0	19.7	6.1	8.7	132	7
Griggs	65.7	6.5	6.5	40	5	22.5	22.0	6.4	7.7	132	6
Hettinger	66.1	6.0	7.0	40	5	22.0	22.0	6.8	8.4	143	6
Kidder	65.7	7.0	8.9	40	6	24.7	21.2	6.6	8.5	136	6
LaMoure	62.9	7.5	8.1	40	6	23.5	25.5	5.4	8.7	166	7
Logan	63.3	8.0	10.4	20	6	25.0	22.8	7.2	9.4	163	7
McHenry	63.8	4.5	6.1	35	5	16.7	20.8	4.7	8.5	128	6
McIntosh	62.3	6.0	9.0	20	6	23.5	21.9	6.9	10.1	170	8
McKenzie	63.2	6.0	9.0	35	5	21.6	19.8	5.6	8.1	120	6
McLean	65.7	5.5	6.0	35	5	23.1	20.4	4.8	6.9	117	5
Mercer	64.7	6.5	4.9	55	4	22.3	18.8	5.3	7.0	103	5
Morton	64.8	6.0	5.7	40	5	23.9	19.0	6.5	8.9	132	7
Mountrail	63.7	6.0	6.9	40	5	21.1	19.0	6.4	8.6	120	6
Nelson	64.5	6.0	7.7	30	5	23.9	23.5	6.0	7.6	134	6
Oliver	64.4	6.5	6.0	60	4	25.3	21.3	5.3	6.7	115	5
Pembina	63.5	8.5	11.6	25	6	21.7	20.9	6.7	9.0	146	7
Pierce	65.5	5.5	6.5	40	5	23.1	21.2	5.0	6.5	110	5
Ramsey	64.0	7.0	8.6	40	5	27.0	22.9	6.4	8.1	139	6
Ransom	62.4	5.5	8.3	30	6	27.4	22.3	6.3	9.0	152	6
Renville	64.7	7.0	8.3	40	6	28.2	23.1	6.1	7.7	160	6
Richland	62.3	5.0	8.5	30	6	27.7	24.0	6.9	9.7	181	7
Rolette	65.7	6.0	5.3	35	5	24.1	22.7	6.1	8.0	138	6
Sargent	64.7	6.0	7.9	35	6	25.2	21.9	7.2	8.7	144	6
Sheridan	65.3	6.5	7.0	30	6	22.5	19.0	6.4	7.4	106	5
Sioux	64.7	7.5	7.2	45	6	21.2	22.4	6.4	8.8	146	7
Stark	62.1	5.5	6.4	45	5	23.9	21.3	6.2	7.3	120	5
Steele	63.4	6.0	7.5	40	5	20.7	19.8	5.4	6.5	100	5
Stutsman	63.3	8.0	11.3	25	6	26.2	24.0	7.0	8.1	155	6
Towner	62.6	5.5	7.5	40	5	25.5	21.2	6.5	8.1	123	6
Traill	63.8	6.0	6.7	40	5	26.4	25.4	5.8	7.3	145	5
Walsh	64.1	7.5	11.3	25	6	27.7	23.8	6.2	8.9	161	7
Ward	66.4	6.0	7.3	45	5	22.6	19.6	5.0	6.4	97	5
Wells	66.4	7.5	7.7	40	5	25.1	21.5	5.1	6.4	105	5
Williams	65.7	7.0	6.5	45	5	20.3	20.5	4.3	5.7	92	4
Average	64.4	6.4	7.6	37	5.3	23.4	21.9	6.1	8.2	137	6.1



very little, if any, oxidizing agents. This is unusual, as in previous years 10 ppm of potassium bromate on flours produced from North Dakota bread wheats were required to obtain optimum baking results when using a relatively lean formula. This, of course, is a plus factor for this year's Northern Spring Wheat crop, particularly in countries that do not permit the addition of oxidizing agents to the doughs.

### Physical Dough Properties

Table 6 shows farinogram and extensogram data. Mixing characteristics of this year's crop as indicated by the farinogram pattern are classified as medium. Farinogram absorption averaged 64.4 per cent which is 1.4 per cent lower than the surprisingly high level of last year's flours. Mixing time ranged from 4.5 to 8.5 minutes with an average of 6.4 minutes. Mixing tolerance average is 7.6 minutes with a range of 4.3 to 11.6 minutes. Generally, both mixing time and tolerance are slightly higher than last year. The MTI value (mixing tolerance index) depicts the characteristics of a medium type curve. The average overall empirical farinogram classification is 5.3. This is a little higher than last year's classification which was 5.0. Figure 4 shows an average farinogram for the 1972 crop.

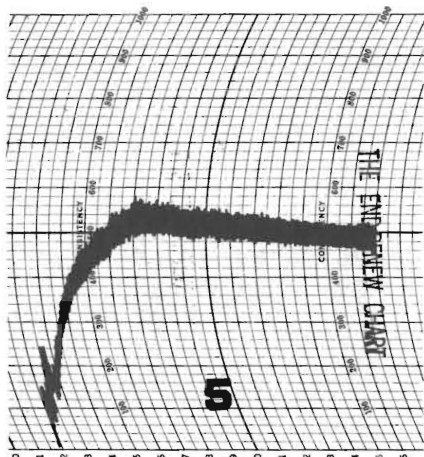


Fig. 4. Farinogram showing average mixing strength of the 1972 North Dakota hard red spring wheat crop.

The Extensograph measures the extensibility and resistance to extension of doughs after various periods of rest time. Measurements are made to determine extensibility (curve length), the resistance (curve height) and general dough strength (area of curve). These data also presented in Table 6 are, on the average, higher than those obtained for the 1971 crop. An average extensogram is

shown in Fig. 5. In general, the 1972 crop produced doughs with excellent elastic properties and are classed as stronger and more elastic than last year.

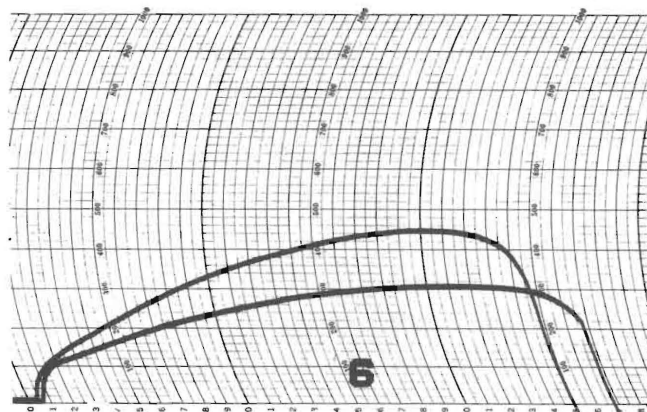


Fig. 5. Extensogram showing average properties of the 1972 North Dakota hard red spring wheat crop.

### Grade and Market Quality Factors

The diagram in Fig. 6 shows the percentage of the crop falling into the various grades. Values shown on the outside of the circle are an accumulative percentage of the grades. For example, the number 79 on this figure indicates that 79 per cent of the 1972 hard red spring wheat crop (approximately 118 million bushels) should grade U. S. No. 2 Dark Northern Spring or better. This is lower

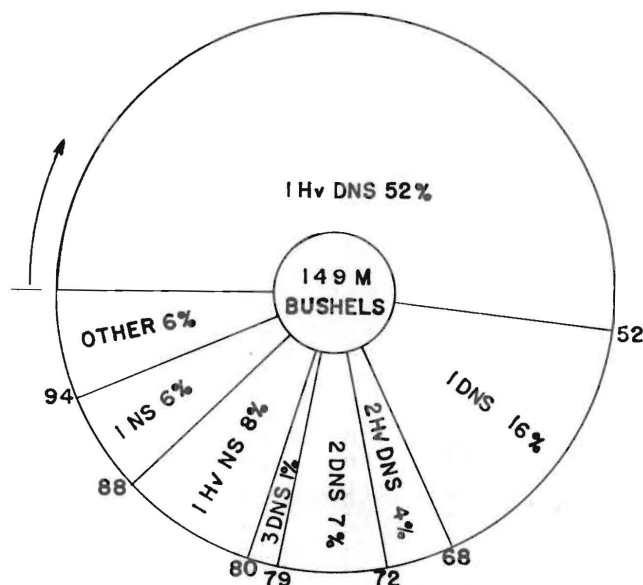


Fig. 6. Diagram showing grade distribution of the 1972 North Dakota hard red spring wheat crop.

than the 1971 crop, which estimated that 96 per cent should grade U. S. No. 2 Dark Northern Spring or better.



**Quality Comparisons of the 1972  
Crop with Other Years**

Table 7 compares some of the pertinent average quality factors for 1967, 1968, 1969, 1970, 1971 and 1972 hard red spring wheat crops. Also, the five-year (1967-1971) average is shown. The average

data from this year's crop, when compared with the 1971 crop shows a lower test weight, hectoliter weight, percentage of vitreous kernels, and to a lesser degree, flour yield. Wheat protein content, falling number, wet gluten, baking absorption, loaf volume and all of the physical dough properties as measured by the Farinograph and Extensograph,

**Table 7. HRS 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	Hecto-liter Weight	Vit. Kernels	Wheat Protein	Flour Yield	Flour Ash	Falling No.	Wet Gluten
	lbs/bu	Kg.	%	%	%	%	units	gm.
1967	59.9	77.1	95	14.4	66.8	0.41	493	47.6
1968	58.7	75.6	87	14.0	70.9	0.41	405	40.6
1969	60.4	77.7	89	14.1	72.6	0.44	458	42.3
1970	59.3	76.3	87	14.8	67.8	0.42	453	42.3
1971	61.3	78.9	90	13.5	70.0	0.43	412	38.9
1972	60.2	77.5	83	14.0	69.2	0.43	490	44.6
5-year Ave.	59.9	77.1	90	14.2	69.6	0.42	444	42.3

(Baking Data)							
Crop Year	Absorption	Dough Char.	Loaf Vol.	Gr. & Tex.	Crumb Color	Crust Color	Symm.
	%		cc.				
1967	64.6	4	840	8.5	8.2	4	4.5
1968	63.6	4	791	8.7	8.4	4	4.5
1969	64.1	4	839	8.7	8.7	4	4.5
1970	62.9	4	865	8.5	9.0	4	4.5
1971	63.8	4	846	8.5	8.4	4	4.5
1972	64.5	4	882	8.6	8.5	4	4.5
5-year Ave.	63.8	4	836	8.6	8.5	4	4.5

(Physical Dough Properties)										
Crop Year	Farinogram					Extensogram				
	Mixing		Classification			Extensibility		Resistance		Classification
	Time	Tolerance					45	180		
	min.	min.			45	180	45	180		
1967	8.9	17.0	Strong	7.7	cm.	cm.	cm.	cm.	V. Strong	8.1
1968	5.7	7.0	Medium	5.3	21.8	21.4	7.8	11.4	Strong	7.0
1969	5.4	6.1	Medium	5.4	21.6	20.7	6.8	9.5	M. Strong	5.6
1970	7.4	11.0	M. Strong	5.7	22.3	21.0	5.8	7.4	Strong	7.1
1971	6.2	7.3	Medium	5.0	23.4	22.0	7.1	9.6	Strong	7.1
1972	6.4	7.6	Medium	5.3	22.8	21.1	5.9	7.7	M. Strong	5.7
5-year Ave.	6.7	9.7	M. Strong	5.8	23.4	21.9	6.1	8.2	M. Strong	6.1

are all significantly higher than last year's crop. The remaining quality factors determined are more or less similar to those reported for the 1971 crop.

When compared with the five-year average, the 1972 crop is better in test weight, hectoliter weight, falling number, wet gluten, baking absorption and loaf volume. With the exception of the physical dough properties, the other quality factors are quite similar to the five-year average results.

These yearly quality differences are to be expected and are attributed to both the changing

environmental conditions and the wheat varieties grown. For example, in 1967, about 50 per cent of the acreage was devoted to Justin which is a very strong hard red spring wheat variety. It is possibly the strongest hard red spring wheat released and grown extensively in North Dakota. In that same year, Chris, a better wheat variety agronomically, but displaying mellower quality characteristics, occupied about 33 per cent of the acreage. In 1969, Justin was seeded on about 15 per cent of the wheat acreage; Chris, 40 per cent; and Manitou 30 per



cent. Manitou, when grown in North Dakota, is considered to be a little lower in bread baking potential than Chris.

In 1970, Justin was seeded on about 8 per cent of the acreage; Chris, 17 per cent; Manitou, 24 per cent; and Waldron, a new hard red spring wheat release, 27 per cent. In 1971, Justin had dropped to 4 per cent of the acreage, Chris represented 10 per cent, Manitou about 8 per cent with Waldron being the predominant variety representing 62 per cent of the total North Dakota hard red spring wheat acreage. The estimated 1972 acreage seeded to Waldron in North Dakota is about 53 per cent, Chris 9 per cent, Manitou 5 per cent, and Justin about 3 per cent. A new variety named W. S. 1809 is purported to occupy about 11 per cent of the acreage. These figures show that in six years, the North Dakota bread wheat crop changed from about 50 per cent very strong type wheats and 50 per cent mellower types, to about 3 per cent very strong and 97 per cent mellower wheats in 1972.

#### WEATHER AND HARVEST

For the purpose of historic interest, a summary of the seeding, growing and harvesting conditions is presented.

Seeding of the 1972 crop of hard red spring wheat in North Dakota was delayed considerably beyond the usual planting time. Due to inclement weather conditions in April and early May, only 28 per cent of the hard red spring wheat was seeded by May 16. This compares with 80 per cent at this time a year ago and 74 per cent for the 10-year average. Intermittent rains continued to hamper the seeding operation to the extent that by May 30, only about 73 per cent of the wheat was in the ground. Last year, on May 30, 98 per cent was seeded with the 10-year average set at 95 per cent. During the first week of June, the seeding of hard red spring wheat made rapid progress and by the end of the week it was about 92 per cent completed.

Fairly good growing conditions prevailed during the latter part of June. However, in early July some areas were short of topsoil moisture. By mid-July, the wheat was suffering in many areas from moisture shortages. Scattered showers in mid and late July helped improve crop prospects considerably. Intermittent rains continued until about mid-August. These showers and heavy morning dew hampered harvesting operations which were already well behind last year and the 10-year average. By the end of August, about 38 per cent of the crop was combined, and by mid-September, this increased to about 80 per cent. Scattered showers

and cool weather the latter part of September continued to hamper harvesting operations. However, by October 3rd, 92 per cent of the hard red spring wheat crop was in the bin, with an additional 5 per cent swathed. In general, the 1972 North Dakota wheat harvest was about three weeks later than usual.

As the wheat samples began to arrive in the laboratory, it became apparent that a very good crop was being harvested. The wheat was fairly high in test weight and low in moisture. It was relatively free of diseased or damaged kernels and had no visible sprout damage. All of the samples were carefully examined for the presence of the fungus "ergot", which was observed in the 1971 hard red spring wheat crop. Very little of this fungus was in any of the samples; in fact, a very high percentage of the samples were completely free from this disease. When more than half of the samples that were expected in the survey were examined, it became apparent that there would be no problem with "ergot" in the 1972 crop.

Subsequently, the USDA estimated the 1972 North Dakota hard red spring wheat crop to be about 149 million bushels, with an average yield of 29.0 bushels per acre. This is the second largest North Dakota hard red spring wheat crop on record; also, the yield of bushels per acre is next to the record for the state.

#### SUMMARY

Seeding of the 1972 hard red spring wheat crop in North Dakota was considerably later than usual. Fairly good growing conditions prevailed during June, July and August and resulted in a crop estimated by the USDA to be about 149 million bushels (4.1 million metric tons). This is the second largest hard red spring wheat crop on record for the state.

The physical appearance of the grain is very good but it lacks the luster usually found in Northern Spring Wheat from North Dakota. It possesses on the average a test weight of 60.2 lbs./bu., a hectoliter weight of 77.4 kg., a vitreous kernel content of 83 per cent and a moisture content of 11.5 per cent. The wheat is relatively free of diseased or damaged kernels and has no sprout damage. It is estimated that 79 per cent of the crop should grade U. S. No. 2 Dark Northern Spring or better. Average dockage for the state, of the wheat going to the local elevator, is 1.8 per cent. The percentage of shrunken and broken kernels, and total defects are both lower than those reported for the 1971 crop. The average wheat protein content for



the state is 14.4 per cent expressed on an "as is" moisture basis, or when expressed on a 14.0 per cent moisture basis it becomes 14.0 per cent which is five-tenths of a per cent higher than last year. Percentage of wet gluten is the highest since the 1967 crop.

The wheat milled satisfactorily and produced a flour of high yield, good color and a low ash. The baking absorption is, on the average, 0.7 per cent higher than last year and five-year average. The average loaf volume is considerably higher than last year or the five-year average. External and internal characteristics of the loaves are excellent. In general, the overall baking performance of the 1972 crop is considered to be excellent.

#### **ACKNOWLEDGEMENTS**

The authors acknowledge the assistance of the North Dakota Cooperative Extension Service and especially Hugh J. McDonald for administering

the sampling procedure, and the county agents for supervising the sample collection.

A special acknowledgement is given to the participating elevator managers for providing the samples, to Everett A. Tool for his direction in grading the samples and to C. E. McDonald for his efforts in coordinating the initial quality testing program.

Technical assistance provided by T. C. Olson, D. O. Pagel, G. J. Matthiensen, W. J. Rumpca, Linda Kokes, B. L. D'Appolonia, Linda MacArthur, and M. Jeanne Flood is gratefully acknowledged.

Special thanks is given to the following people for their translation of the "summary" into foreign language: George Graf (German), Masayuki Hayaishi (Japanese), Bert D'Appolonia (French), and Andres Iruegas (Spanish).

In addition, the financial assistance of the North Dakota State Wheat Commission is gratefully acknowledged.



A view of the Cereal Chemistry and Technology Building at North Dakota State University, Fargo.