

The Quality of North Dakota's 1970 Hard Red Spring Wheat

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The overall quality of North Dakota's 1970 hard red spring wheat crop is considered to be generally excellent, and appears to be in certain instances similar to the crop produced in 1969. However, due to late seeding, growing and harvesting conditions experienced in North Dakota this past year, the average test weight is 59.3 pounds per bushel, about one pound lower than last year. Moisture content of the grain is low with an average of 11.2 per cent reported. Average wheat protein content is 14.8 per cent which is 0.7 percentage points higher than last year. This is the second highest protein level since this type of a quality report was initiated nine years ago. Vitreous kernel content, shrunken and broken kernels, foreign material, damaged kernels and total defects are about the same as last year. The falling number and wet gluten are also about the same as last year.

Baking characteristics, in general, are excellent. Dough handling properties are very elastic with no "buckiness" of the doughs observed. Loaves of large volume having excellent crumb color were produced. Loaf volumes, which were larger than last year, tended to open up the crumb grain and textures a little. Mixing time and tolerance, as measured by the Farinograph, are somewhat higher than last year's crop. Properties shown by the extensograms also indicated excellent elastic characteristics. The crop, generally, is very uniform throughout the entire state.

The USDA estimates the North Dakota hard red spring wheat crop at about 108 million bushels (2.9 million metric tons). This compares with the 1969 crop of 109 million bushels. An estimated average yield of 23 bushels per acre is five bushels below a year ago. A preponderance of the crop (83 per cent) should grade U. S. No. 2 Dark Northern Spring or better.

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Samples and Methods

During the 1970 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 Cereal Chemistry and Technology Department 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 the campus for a complete official grade.

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

QUALITY DATA FOR COMPOSITES

Wheat Tests

Table 1 lists by county the averages for dockage, grades, and the various grading factors as well as the overall state average. Table 2 is presented to show the "Official" Grades and 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 55.7 to 61.1 with an average

of 59.3 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 the 1970 crop. Average wheat moisture content for the state is 11.2 per cent. Vitreous kernels ranged from 66 to 94 per cent with an average of 87 per cent.

Shrunken and broken kernels averaged 2.0 per cent, well below the allowable limit for the top two grades. Foreign material (FM) is quite low, showing an average of 0.4 per cent with a range of 0.2 to 2.9 per cent. Damaged kernels are also low, ranging from 0.2 per cent to 1.8 per cent with an average of 0.4 per cent. Total defects,

Table 1. HRS Wheat Survey - 1970 Crop: Grading Information (County Averages)

Counties	Dockage	Test Weight	Moisture	Grade	Shrunken and Broken		F.M.	Damage	Total Contrasting	
					Vitreous Kernels	Broken			Defects	Classes
	%	lbs/bu	%		%	%	%	%	%	%
Adams	2.9	59.5	10.4	1 DNS	91	2.0	0.4	0.3	2.7	0.0
Barnes	2.0	58.5	10.8	2 DNS	91	2.5	0.6	0.2	3.3	0.0
Benson	1.3	58.5	12.8	1 NS	66	0.6	0.3	0.5	1.4	0.0
Bottineau	4.9	60.0	11.2	2 HDNS	92	2.4	0.5	0.4	3.3	0.0
Bowman	1.9	59.7	10.2	1 DNS	93	2.3	0.4	0.3	3.0	0.0
Burke	3.9	59.4	10.9	1 DNS	92	1.8	0.5	0.2	2.5	0.0
Burleigh	4.2	59.7	10.7	2 DNS	86	3.4	0.6	0.2	4.2	0.0
Cass	0.9	59.1	11.3	1 DNS	86	1.6	0.4	0.3	2.3	0.0
Cavalier	3.1	56.6	12.6	3 DNS	84	1.5	0.5	0.6	2.6	0.0
Dickey	1.6	56.6	13.0	3 DNS	85	2.8	0.5	0.4	3.7	0.0
Divide	1.8	60.7	11.7	1 HDNS	93	0.9	0.3	0.3	1.5	0.1
Dunn	4.7	60.2	10.6	1 HDNS	91	1.8	0.4	0.4	2.6	0.0
Eddy	4.0	58.6	11.1	2 DNS	88	2.4	0.6	0.4	3.4	0.0
Emmons	1.5	57.0	11.7	2 DNS	92	2.4	0.3	0.2	2.9	0.0
Foster	5.3	59.7	10.3	1 DNS	91	2.3	0.4	0.3	3.0	0.0
Golden Valley	2.0	60.8	9.6	1 HDNS	92	1.8	0.4	0.4	2.6	0.1
Grand Forks	3.3	60.4	11.9	1 HDNS	81	1.7	0.4	0.3	2.4	0.0
Grant	2.5	58.7	10.4	2 DNS	88	2.9	0.4	0.2	3.5	0.0
Griggs	2.2	58.7	11.6	2 DNS	88	2.6	0.9	0.4	3.9	0.0
Hettinger	1.7	59.4	9.4	2 DNS	86	2.7	0.4	0.3	3.4	0.0
Kidder	2.5	58.3	10.8	2 DNS	92	3.1	0.5	0.3	3.9	0.0
LaMoure	1.3	58.0	10.7	2 DNS	90	3.2	0.4	0.3	3.9	0.0
Logan	0.7	58.8	11.4	1 DNS	86	1.7	0.4	0.2	2.3	0.0
McHenry	7.6	59.5	10.8	1 DNS	86	2.1	0.5	0.4	3.0	0.0
McIntosh	2.7	57.4	12.0	2 DNS	88	3.6	0.4	0.3	4.3	0.0
McKenzie	2.5	61.1	10.3	1 HDNS	91	2.1	0.3	0.2	2.6	0.0
McClellan	4.3	59.6	11.1	1 DNS	86	1.7	0.3	0.3	2.3	0.0
Mercer	5.2	60.0	10.4	1 HDNS	90	2.0	0.4	0.4	2.8	0.0
Morton	3.8	59.5	10.6	2 DNS	87	2.4	0.4	0.4	3.2	0.0
Mountrail	3.8	59.8	10.5	1 DNS	86	1.0	0.4	0.3	1.7	0.0
Nelson	0.6	59.3	11.1	1 DNS	87	1.1	0.3	0.2	1.6	0.0
Oliver	0.2	60.7	10.3	1 HDNS	88	1.0	0.4	0.3	1.7	0.0
Pembina	3.0	58.4	12.7	1 DNS	79	1.3	0.3	1.1	2.7	0.0
Pierce	0.3	59.9	11.1	1 DNS	86	1.2	0.2	0.4	1.8	0.0
Ramsey	2.9	58.8	12.2	1 DNS	86	0.8	0.3	1.8	2.9	0.0
Ransom	2.3	57.5	10.8	2 DNS	87	2.6	0.6	0.4	3.6	0.0
Renville	4.6	59.8	11.5	1 DNS	88	1.9	0.5	0.3	2.7	0.0
Richland	0.7	59.1	11.4	1 DNS	88	1.9	0.3	0.6	2.8	0.0
Rolette	1.5	56.8	12.1	3 DNS	80	1.7	0.6	0.4	2.7	0.0
Sargent	3.0	55.7	11.1	3 DNS	84	3.8	2.9	0.3	7.0	0.0
Sheridan	1.8	61.0	10.9	1 HDNS	94	1.3	0.4	0.4	2.1	0.0
Sioux	3.4	57.6	10.9	2 DNS	86	3.8	0.6	0.3	4.7	0.0
Stark	3.5	60.0	10.6	1 HDNS	89	2.3	0.4	0.3	3.0	0.0
Steele	2.1	60.1	12.0	1 HDNS	90	1.7	0.3	0.3	2.3	0.0
Stutsman	1.8	59.7	11.3	2 DNS	91	2.8	0.4	0.3	3.5	0.0
Towner	4.0	57.7	12.3	2 DNS	77	2.2	0.3	0.6	3.1	0.0
Trall	2.3	58.8	11.6	1 DNS	87	1.9	0.4	0.3	2.6	0.0
Walsh	1.6	58.6	11.8	1 DNS	85	1.6	0.3	0.3	2.2	0.0
Ward	4.1	59.6	11.8	1 DNS	86	1.2	0.3	0.4	1.9	0.0
Wells	6.0	59.8	11.2	1 DNS	87	2.2	0.4	0.3	2.9	0.0
Williams	2.8	60.6	10.9	1 HDNS	91	1.9	0.4	0.3	2.6	0.0
Average	2.8	59.3	11.2	1 DNS	87	2.0	0.4	0.4	2.8	0.001

which is the sum of shrunken and broken kernels, foreign material and damaged 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 is in excess of 7.0 per

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

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

Grade	Maximum limits of							
	Defects					Wheat of Other Classes		
	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
1	58.0	0.1	2.0	0.5	3.0	3.0	1.0	3.0
2	57.0	0.2	4.0	1.0	5.0	5.0	2.0	5.0
3	55.0	0.5	7.0	2.0	8.0	8.0	3.0	10.0
4	53.0	1.0	10.0	3.0	12.0	12.0	10.0	10.0
5	50.0	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.

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

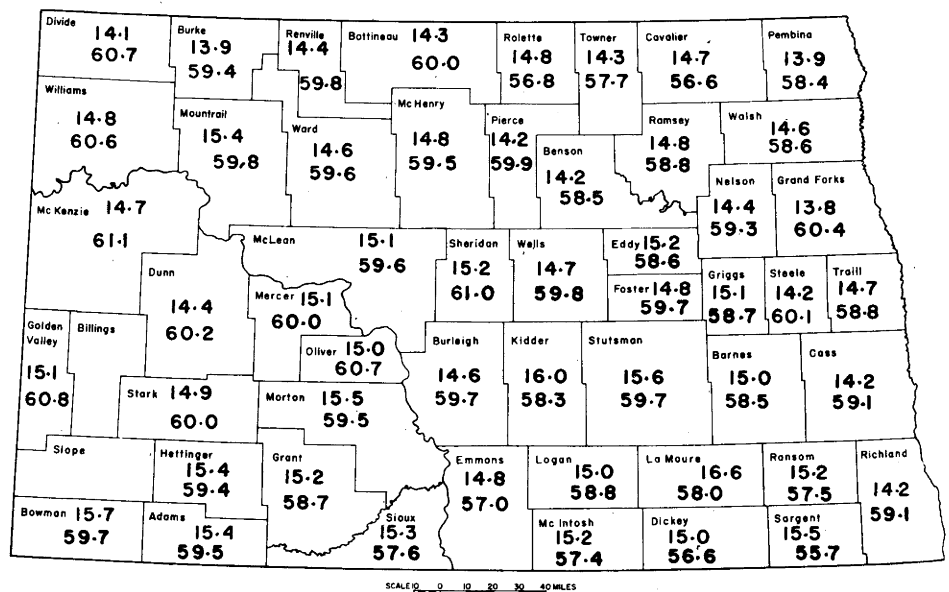


Table 3 shows the wheat quality factors determined. For comparative purposes only, test weight is repeated in this table. The hectoliter weight of this year's crop ranged from 74.0 to 81.1 with an average of 78.7 kilograms per hectoliter. Thousand-kernel weight ranged from 21.6 to 32.4 with an average of 27.5.

The wheat protein content expressed on a

14.0 per cent moisture basis ranged from 13.8 to 16.6 per cent with a state average of 14.8 per cent, which is 0.7 percentage points higher than last year. Figure I shows the average protein content for the various counties sampled. Figure 3 is a bar-graph showing the wheat protein distribution of the 1970 crop. For the benefit of certain wheat importers, wheat protein is also expressed on a

Table 3. HRS Wheat Survey — 1970 Crop: Wheat Data (County Averages).

Counties	Test Weight	Hectoliter Weight	1000 Kernel Weight	Protein ¹	Protein ²	Ash
	lbs/bu	Kg.	g.	%	%	%
Adams	59.5	79.1	29.2	15.4	17.9	1.65
Barnes	58.5	77.7	25.3	15.0	17.4	1.63
Benson	58.5	77.7	27.0	14.2	16.5	1.75
Bottineau	60.0	79.6	28.1	14.3	16.6	1.64
Bowman	59.7	79.3	27.4	15.7	18.3	1.77
Burke	59.4	78.9	27.8	13.9	16.2	1.58
Burleigh	59.7	79.3	26.2	14.6	17.0	1.60
Cass	59.1	78.5	28.3	14.2	16.5	1.67
Cavalier	56.6	75.1	25.3	14.7	17.1	1.62
Dickey	56.6	75.1	24.6	15.0	17.4	1.64
Divide	60.7	80.6	28.5	14.1	16.4	1.59
Dunn	60.2	79.9	27.6	14.4	16.7	1.70
Eddy	58.6	77.8	25.0	15.2	17.7	1.64
Emmons	57.0	75.7	22.7	14.8	17.2	1.74
Foster	59.7	79.3	26.0	14.8	17.2	1.65
Golden Valley	60.8	80.8	31.2	15.1	17.6	1.65
Grand Forks	60.4	80.2	30.2	13.8	16.0	1.70
Grant	58.7	78.0	25.3	15.2	17.7	1.60
Griggs	58.7	78.0	25.1	15.1	17.6	1.64
Hettinger	59.4	79.0	25.8	15.4	17.9	1.53
Kidder	58.3	77.5	21.6	16.0	18.6	1.70
LaMoure	58.0	77.1	24.5	16.6	19.3	1.65
Logan	58.8	78.0	24.3	15.0	17.4	1.59
McHenry	59.5	79.1	26.0	14.8	17.2	1.62
McIntosh	57.4	76.2	23.6	15.2	17.7	1.68
McKenzie	61.1	81.1	29.1	14.7	17.1	1.56
McLean	59.6	79.1	29.0	15.1	17.6	1.64
Mercer	60.0	79.1	32.2	15.1	17.6	1.65
Morton	59.5	79.0	28.2	15.5	18.0	1.64
Mountrail	59.8	79.5	30.2	15.4	17.9	1.61
Nelson	59.3	78.8	26.1	14.4	16.7	1.66
Oliver	60.7	80.6	27.7	15.0	17.4	1.54
Pembina	58.4	77.6	29.7	14.9	16.2	1.64
Pierce	59.9	79.6	27.7	14.2	16.5	1.62
Ramsey	58.8	78.1	32.4	14.8	17.2	1.71
Ransom	57.5	76.3	24.0	15.2	17.7	1.62
Renville	59.8	79.4	30.0	14.4	16.7	1.59
Richland	59.1	78.5	29.5	14.2	16.5	1.77
Roulette	56.8	75.4	26.1	14.8	17.2	1.67
Sargent	55.7	74.0	27.2	15.5	18.0	1.73
Sheridan	61.0	81.1	28.3	15.2	17.7	1.58
Sioux	57.6	76.4	30.4	15.3	17.8	1.67
Stark	60.0	79.8	29.7	14.9	17.3	1.64
Steele	60.1	79.9	29.4	14.2	16.5	1.62
Stutsman	59.7	79.3	28.0	15.6	18.1	1.63
Towner	57.7	76.6	24.9	14.3	16.6	1.54
Traill	58.8	78.2	27.2	14.7	17.1	1.62
Walsh	58.6	77.8	30.3	14.6	17.0	1.65
Ward	59.6	79.2	31.7	14.6	17.0	1.63
Wells	59.8	79.5	29.2	14.7	17.1	1.64
Williams	60.6	80.5	29.2	14.8	17.2	1.68
Average	59.3	78.7	27.5	14.8	17.3	1.64

¹14.0% moisture basis.
²Dry matter basis.

dry matter basis in Table 3. These data show a protein range of 16.0 to 19.3 per cent with an average of 17.3 per cent. The average wheat ash for the state is 1.64 per cent with a range of 1.53 to 1.77 per cent.

Table 4. HRS Wheat Survey — 1970 Crop: Flour Data (County Averages).

Counties	Yield	Ash	Protein	Baking Absorption	Wet Gluten	Falling No.
	%	%	%	%	%	Units
Adams	66.9	0.42	14.9	64.5	44.1	489
Barnes	67.4	0.43	14.6	63.2	41.3	463
Benson	69.1	0.40	13.6	60.9	38.0	244
Bottineau	67.0	0.42	13.9	62.7	39.9	378
Bowman	67.8	0.42	15.1	64.7	44.7	406
Burke	68.7	0.42	13.4	61.9	37.4	467
Burleigh	69.2	0.41	14.2	62.7	41.4	451
Cass	68.4	0.42	13.5	61.2	37.8	474
Cavalier	67.8	0.40	13.7	62.3	40.7	396
Dickey	67.4	0.43	14.5	61.9	40.4	476
Divide	69.4	0.41	13.5	62.3	38.9	469
Dunn	66.3	0.44	13.8	63.3	41.1	474
Eddy	68.4	0.41	14.7	62.8	43.1	452
Emmons	67.8	0.41	14.4	60.7	40.4	497
Foster	69.0	0.42	14.1	63.0	41.6	476
Golden Valley	66.2	0.44	14.7	64.4	45.6	475
Grand Forks	66.8	0.42	13.0	61.9	36.7	375
Grant	67.6	0.40	14.2	62.2	40.8	441
Griggs	67.0	0.41	14.4	63.3	41.6	485
Hettinger	67.0	0.43	15.0	63.9	43.0	450
Kidder	66.6	0.41	15.2	62.7	43.1	447
LaMoure	67.4	0.41	16.1	63.9	45.1	475
Logan	67.9	0.40	14.6	61.8	41.7	446
McHenry	67.4	0.42	14.2	63.5	42.4	442
McIntosh	66.3	0.48	14.5	61.7	40.0	457
McKenzie	69.7	0.39	14.2	62.8	43.3	429
McLean	68.6	0.44	14.6	63.1	42.1	425
Mercer	69.4	0.43	14.8	63.8	44.5	484
Morton	68.3	0.43	15.0	63.7	44.7	465
Mountrail	68.4	0.42	14.8	63.5	44.5	456
Nelson	70.0	0.43	13.8	62.8	41.0	445
Oliver	67.8	0.38	14.3	64.0	42.6	477
Pembina	65.7	0.41	12.9	61.0	35.8	322
Pierce	68.2	0.41	13.7	63.7	39.2	484
Ramsey	67.7	0.41	13.9	64.3	40.3	489
Ransom	67.2	0.41	14.4	63.5	41.3	439
Renville	68.3	0.40	13.8	63.8	44.9	421
Richland	67.6	0.43	13.4	61.9	42.0	446
Roulette	67.2	0.40	14.2	63.2	48.1	423
Sargent	66.6	0.44	14.8	62.4	44.2	479
Sheridan	67.6	0.39	14.8	63.7	48.0	484
Sioux	68.0	0.43	14.6	63.1	45.3	470
Stark	67.4	0.42	14.2	62.4	45.5	439
Steele	68.5	0.41	13.5	61.7	41.0	479
Stutsman	66.4	0.41	14.6	63.0	45.0	495
Towner	67.6	0.41	13.9	62.9	41.8	527
Traill	68.6	0.41	14.0	62.2	43.5	485
Walsh	68.4	0.42	13.8	61.6	41.9	504
Ward	67.2	0.41	13.9	63.4	44.2	424
Wells	68.3	0.42	14.0	63.7	45.9	517
Williams	68.6	0.41	14.1	64.1	45.7	482
Average	67.8	0.42	14.2	62.9	42.3	453

Flour Tests

Table 4 shows the experimental flour yield data which ranged from 65.7 to 70.0 per cent with a state average of 67.8 per cent. This is lower than

the flour yield reported for the 1968 or 1969 crops. It is, however, higher than the 1965, 1966 or 1967 crops. The ash of this straight grade flour ranged from 0.38 per cent in Oliver county to 0.48 per cent in McIntosh county with an average for the

Table 5. HRS Wheat Survey — 1970 Crop: Baking Data (County Averages).

Counties	Dough Char	Loaf Volume cc.	Grain & Texture	Crumb Color	Crust Color	Symm.
Adams	4	830	8.0	9.0	4	4.5
Barnes	4	895	8.5	8.5	4	4.5
Benson	4	800	8.5	8.5	4	4.5
Bottineau	4	875	9.0	8.5	4	4.5
Bowman	4	860	8.5	9.5	4	4.5
Burke	4	855	9.0	9.5	4	4.5
Burleigh	4	900	8.5	9.0	4	4.5
Cass	4	785	9.0	9.0	4	4.5
Cavalier	4	820	8.5	9.0	4	4.5
Dickey	4	820	9.0	9.0	4	4.5
Divide	4	875	8.0	8.5	4	4.5
Dunn	4	840	8.5	9.0	4	4.5
Eddy	4	890	9.0	8.5	4	4.5
Emmons	4	845	9.0	9.0	4	4.5
Foster	4	860	8.0	8.0	4	4.5
Golden Valley	4	835	8.0	8.5	4	4.5
Grand Forks	4	805	8.0	9.0	4	4.5
Grant	4	850	8.5	8.5	4	4.5
Griggs	4	950	8.0	9.0	4	4.5
Hettinger	4	865	8.0	9.0	4	4.5
Kidder	4	930	9.0	9.0	4	4.5
LaMoure	4	1060	8.0	9.0	4	4.5
Logan	4	880	8.5	8.5	4	4.5
McHenry	4	870	8.5	9.0	4	4.5
McIntosh	4	850	9.0	9.0	4	4.5
McKenzie	4	850	8.5	9.0	4	4.5
McLean	4	890	8.5	8.5	4	4.5
Mercer	4	855	8.5	9.0	4	4.5
Morton	4	920	8.5	9.5	4	4.5
Mountrail	4	860	8.5	9.0	4	4.5
Nelson	4	870	9.0	8.5	4	4.5
Oliver	4	915	8.0	9.5	4	4.5
Pembina	4	800	9.0	8.5	4	4.5
Pierce	4	870	8.5	9.5	4	4.5
Ramsey	4	875	9.0	9.5	4	4.5
Ransom	4	855	8.5	8.0	4	4.5
Renville	4	890	8.5	9.0	4	4.5
Richland	4	765	9.0	9.5	4	4.0
Rolette	4	905	8.0	9.0	4	4.5
Sargent	4	870	8.0	9.5	4	4.5
Sheridan	4	895	8.5	9.0	4	4.5
Sioux	4	860	8.5	9.5	4	4.5
Stark	4	815	8.5	9.0	4	4.0
Steele	4	810	8.5	9.0	4	4.0
Stutsman	4	910	8.5	9.5	4	4.5
Towner	4	865	9.0	9.5	4	4.5
Traill	4	865	8.5	9.0	4	4.5
Walsh	4	840	8.5	8.5	4	4.5
Ward	4	850	9.0	9.0	4	4.5
Wells	4	875	9.0	9.5	4	4.5
Williams	4	875	8.5	9.5	4	4.5
Average	4	865	8.5	9.0	4	4.5

state of 0.42 per cent. None of the samples displayed any abnormal milling characteristics. However, the milling properties, in general, appeared to be a little mellower than last year. The flour protein content average is 14.2 per cent with a range of 12.7 to 16.1 per cent, expressed on a 14.0 per cent moisture basis. Baking absorptions, as determined experimentally, are a little lower than expected, but are still well within the range for high absorption flours. Wet gluten ranged from 35.8 to 48.0 per cent with an average of 42.3 per cent, which is the same as last year's crop. The falling numbers of all the samples, with the exception of Benson county, are at levels which indicate the absence of excessive enzyme activity (sprout damage) in this year's crop.

Baking Tests

Overall baking properties of the 1970 crop, as shown in Table 5, are excellent. Dough handling properties are excellent with no "buckiness" of the doughs observed. The flour produced loaves of large volume having excellent crumb color. Crumb color scores of this year's crop were, on the average, the highest ever reported for a North Dakota crop. Loaf volumes, which are considerably larger than last year, tended to produce crumb grain and textures which are a little more open than last year's loaves. Color of the crust, as well as the overall appearance (symmetry) of the loaves, is excellent. In general, the baking performance of the 1970 crop is very uniform. Dough handling characteristics, loaf crust colors and symmetry are scored almost the same for all samples. Individual loaf volumes are all within 12 per cent of the mean loaf volume with the exception of the sample from LaMoure county. Crumb grain and texture showed a range of about 5 per cent from the mean. Crumb color, with the exception of the samples from Foster and Ransom counties, also gave a range of about 5 per cent from the mean.

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 strong. Farinogram absorption averaged 63.1 per cent which is 0.2 per cent higher than the actual average baking absorption. Mixing time ranged from 5.0 to 12.0 minutes with an average of 7.4 minutes. Mixing tolerance average is 11.0

minutes with a range of 6.1 to 20.0 minutes. On the average, both mixing time and tolerance are higher than last year. These better mixing characteristics are probably attributed to the higher wheat protein content of this year's crop. The MTI value (mixing

tolerance index) depicts the characteristics of a medium strong curve. Average overall empirical farinogram classification is 5.7. This is higher than either the 1969 or 1968 crops. Figure 4 shows an average farinogram for the 1970 crop.

Table 6. HRS Wheat Survey — 1970 Crop: Physical Dough Properties (County Averages).

Counties	Farinogram					Extensogram					Classification
	Absorption	Mixing		MTI	Classification	Extensibility		Resistance		Area	
		%	Time			Tolerance	45 min.	180 min.	45 min.		
Adams	64.6	7.0	8.9	20	5	23.7	20.9	6.0	7.5	116	6
Barnes	63.3	7.0	13.8	10	6	24.8	22.2	7.3	9.0	140	7
Benson	60.9	6.0	9.7	15	5	26.3	25.0	7.0	10.6	195	8
Bottineau	62.9	7.5	9.3	20	5	22.4	22.4	6.9	8.5	135	6
Bowman	64.9	6.5	8.9	20	5	23.5	22.7	6.3	9.2	165	7
Burke	62.1	7.0	10.2	15	6	20.6	21.3	6.9	10.3	160	8
Burleigh	62.9	9.0	15.0	10	6	23.0	22.5	7.8	10.6	170	8
Cass	61.3	5.0	16.2	10	7	23.3	21.5	8.4	11.4	180	8
Cavalier	62.3	6.0	6.8	20	5	21.3	22.5	6.7	9.1	155	7
Dickey	62.0	9.5	18.0	5	7	23.6	18.0	9.5	12.4	160	8
Divide	63.3	6.5	7.2	25	5	26.0	22.8	6.8	9.1	150	7
Dunn	63.9	6.0	6.2	35	5	24.0	23.7	6.4	7.8	140	6
Eddy	63.3	7.0	8.4	25	5	24.5	21.7	7.1	9.5	150	7
Emmons	61.3	9.0	17.5	5	7	25.0	23.0	9.2	12.6	200	8
Foster	63.6	7.5	10.0	20	6	23.8	23.5	7.1	9.9	160	7
Golden Valley	65.0	5.5	6.1	25	5	22.1	22.3	4.8	6.1	105	4
Grand Forks	61.9	7.0	9.2	20	6	24.3	23.5	7.2	10.2	170	8
Grant	62.7	9.0	13.8	15	7	22.4	21.3	8.5	11.6	180	8
Griggs	63.7	7.5	9.2	20	6	22.7	22.8	7.4	9.4	155	7
Hettinger	64.5	9.5	11.2	15	6	24.5	21.6	8.7	10.5	165	8
Kidder	63.3	9.5	15.0	10	7	23.1	20.9	7.5	10.7	160	8
LaMoure	64.4	8.0	13.6	10	7	23.6	21.4	7.3	9.5	150	7
Logan	62.5	12.0	20.0	5	7	25.4	24.2	9.7	13.9	235	9
McHenry	64.0	6.0	8.5	10	5	25.7	23.5	5.9	9.5	160	7
McIntosh	62.3	8.0	18.0	10	7	24.4	22.1	9.3	13.3	210	9
McKenzie	63.2	7.0	7.5	20	5	24.0	22.7	5.4	8.9	140	7
McLean	63.6	6.5	10.0	20	5	22.9	24.2	6.3	8.9	160	7
Mercer	64.6	7.0	11.8	10	5	24.3	23.7	6.5	8.2	150	6
Morton	64.3	9.5	11.2	15	6	23.3	23.2	7.5	10.2	175	8
Mountrail	63.9	7.0	9.3	25	5	19.7	21.6	5.7	9.2	150	7
Nelson	62.8	7.5	8.7	20	5	21.7	20.3	5.7	8.5	125	7
Oliver	63.9	8.5	11.1	15	6	22.8	23.1	6.6	9.3	155	7
Pembina	60.9	6.0	8.3	25	5	22.0	19.4	8.2	11.3	155	8
Pierce	63.7	7.0	8.5	25	5	23.6	24.3	5.9	9.2	165	7
Ramsey	64.2	6.0	8.5	20	5	27.9	24.1	5.0	6.7	120	5
Ransom	63.3	7.0	12.2	10	6	23.7	21.3	7.2	9.0	135	7
Renville	63.6	6.0	8.9	20	5	23.0	23.7	5.8	7.5	130	6
Richland	61.9	6.5	12.4	15	7	20.8	19.9	7.3	9.5	145	7
Rolette	62.8	6.0	9.5	25	5	23.5	19.7	6.6	8.5	125	7
Sargent	62.3	8.0	14.4	5	6	23.7	21.2	8.9	12.1	194	8
Sheridan	63.6	7.0	9.7	20	5	23.7	22.3	6.7	8.1	140	6
Sioux	63.1	11.0	11.2	10	6	20.4	15.4	8.9	14.2	140	9
Stark	62.2	8.5	14.1	15	6	24.7	22.3	7.5	10.9	175	8
Steele	61.7	5.5	9.5	15	6	23.9	22.2	6.9	10.5	170	8
Stutsman	62.9	8.5	13.5	15	6	24.3	21.3	7.7	11.0	165	8
Towner	62.2	7.0	9.3	20	5	22.5	20.0	6.0	7.7	110	6
Trail	61.8	8.0	13.5	15	6	23.2	25.0	6.8	9.6	180	7
Walsh	61.7	7.0	10.6	15	5	23.6	18.4	7.4	8.8	125	7
Ward	63.2	7.0	8.5	30	5	23.7	21.7	6.2	7.2	120	5
Wells	63.5	6.5	10.5	10	5	23.5	21.0	6.1	7.2	110	5
Williams	63.9	7.0	6.6	25	5	21.6	22.5	5.6	7.7	125	6
Average	63.1	7.4	11.0	17	5.7	23.4	22.0	7.1	9.6	154	7.1

Fig. 2. Test weight distribution of the 1970 North Dakota hard red spring wheat crop.

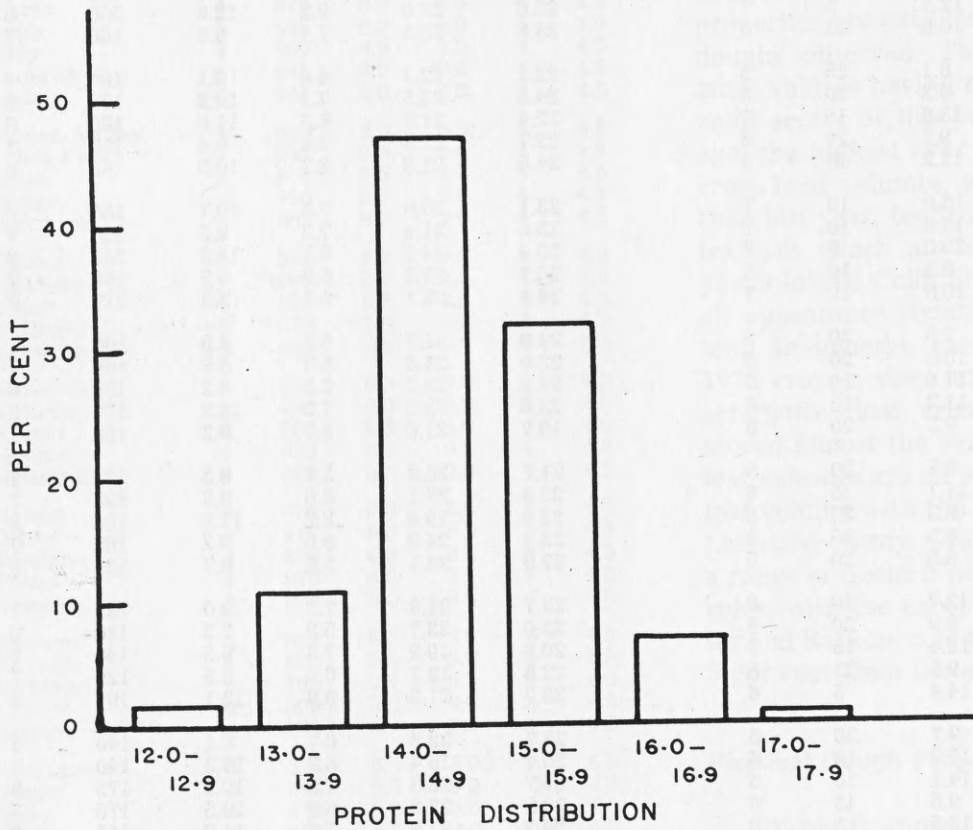
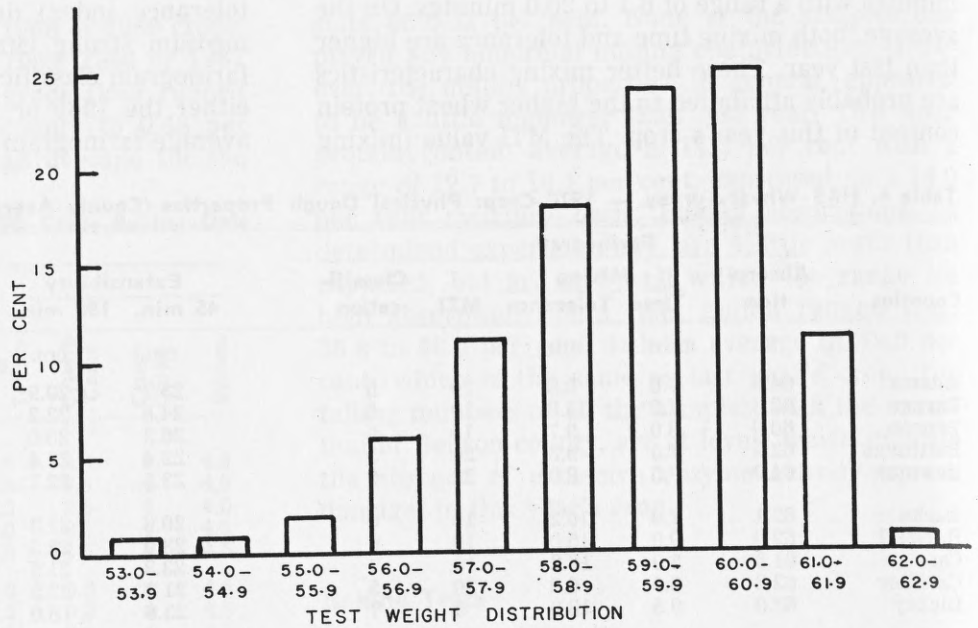


Fig. 3. Wheat protein distribution of the 1970 North Dakota hard red spring wheat crop.

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 1969 crop. In general, the 1970 crop produced doughs with excellent elastic properties. An average extensogram is shown in Fig. 5.

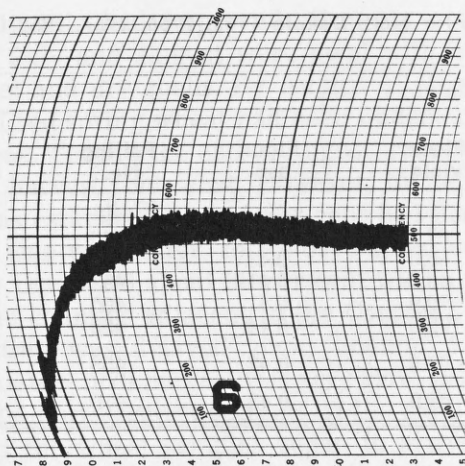


Fig. 4. Farinogram showing average mixing strength of the 1970 North Dakota hard red spring wheat crop.

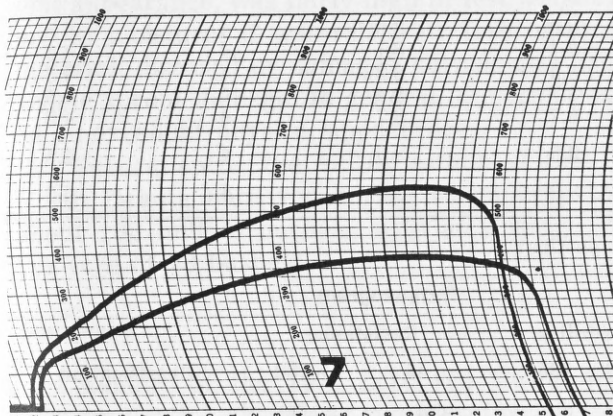


Fig. 5. Extensogram showing average properties of the 1970 North Dakota hard red spring wheat crop.

Table 7 compares some of the pertinent average quality factors for the 1965, 1966, 1967, 1968, 1969 and 1970 hard red spring wheat crops. Also, the five-year (1965-1969) average is shown. The data from this year's crop, when compared with the 1969 crop, shows a lower test weight and hectoliter weight, lower experimental flour yield, flour ash and a lower baking absorption. Wheat protein, loaf volume, crumb color scores and all of the physical dough properties as measured by the Farinograph and Extensograph are all higher than those reported for the 1969 crop. The remaining quality factors determined are quite similar to last year.

When compared with the five-year average, the 1970 crop is better in wheat protein content, loaf volume and crumb color score. Test weight, hectoliter weight, flour ash, falling number, dough handling properties, crumb grain and texture, crust color and general shape of the loaf (symmetry) are all about the same as that shown for the five-year average. Flour yield, percentage of wet gluten, baking absorption and physical dough pro-

perties are all a little lower than the five-year average.

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 1966, 75 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 1967, the acreage for Justin dropped to about 47 per cent while Chris, a better wheat agronomically but displaying mellow 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 is similar to Chris in general dough properties. 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. These figures show that in five years, the North Dakota bread wheat crop changed from 85 per cent very strong type wheats (Pembina, also a very strong wheat, represented 10 per cent of the 1966 crop) and 15 per cent mellow types to about 8 per cent very strong and 92 per cent mellow wheats in 1970.

GRADE AND MARKET QUALITY FACTORS

The percentage of the crop falling into the various grades is depicted in the diagram shown in Fig. 6. The figures shown on the outside of the

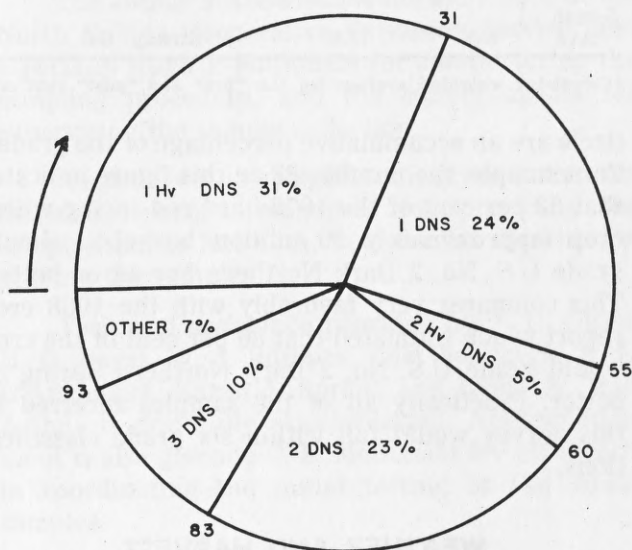


Fig. 6. Diagram showing grade distribution of the 1970 North Dakota hard red spring wheat crop.

Table 7. HRS Wheat Survey: Comparison of Average Quality Factors for North Dakota 1965, 1966, 1967, 1968, 1969 and 1970 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.
1965*	58.4	77.6	96	14.4	67.3	0.42	349	48.0
1966	58.4	77.6	94	15.2	66.9	0.43	343	51.6
1967	59.9	79.6	95	14.4	66.8	0.41	493	47.6
1968	58.7	78.0	87	14.0	70.9	0.41	405	40.6
1969	60.4	80.2	89	14.1	72.6	0.44	458	42.3
1970	59.3	78.7	87	14.8	67.8	0.42	453	42.3
5-year Ave.	59.2	78.6	92	14.4	68.9	0.42	410	46.0

(Baking data)

Crop Year	Absorption	Dough char.	Loaf vol.	Gr. and tex.	Crumb color	Crust color	Symmetry
	%		cc.				
1965*	64.2	4	845	8.6	8.0	4	4.5
1966	66.4	4	850	8.4	8.1	4	4.5
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
5-year Ave.	64.6	4	833	8.6	8.3	4	4.5

(Physical dough properties)

Crop Year	Farinogram			Extensogram				
	Mixing		Classification	Extensibility		Resistance		Classification
	time	tolerance		45	180	45	180	
	min.	min.		cm.	cm.	cm.	cm.	
1965*	9.0	22.0	Strong 7.5	23.7	22.9	7.3	10.4	V. Strong 7.7
1966	11.2	25.9	V. Strong 7.9	23.8	23.4	8.2	11.7	V. Strong 8.1
1967	8.9	17.0	Strong 7.7	21.8	21.4	7.8	11.4	V. Strong 8.1
1968	5.7	7.0	Medium 5.3	21.6	20.7	6.8	9.5	Strong 7.0
1969	5.4	6.1	Medium 5.4	22.3	21.0	5.8	7.4	M. Strong 5.6
1970	7.4	11.0	M. Strong 5.7	23.4	22.0	7.1	9.6	Strong 7.1
5-year Ave.	8.0	15.6	M. Strong 6.8	22.6	21.9	7.2	10.1	Strong 7.3

*Calculated weighted average for the "pre" and "post" rain crops of 1965. 5-year average — 1965-1969.

circle are an accumulative percentage of the grades. For example, the number 83 on this figure indicates that 83 per cent of the 1970 hard red spring wheat crop (approximately 90 million bushels) should grade U.S. No. 2 Dark Northern Spring or better. This compares very favorably with the 1968 crop report which estimated that 86 per cent of the crop would grade U.S. No. 2 Dark Northern Spring or better. Practically all of the samples received in this survey would fall within six grade classifications.

WEATHER AND HARVEST

For the purpose of historic interest, a summary of the seeding, growing and harvesting con-

ditions is presented.

Seeding of hard red spring wheat in North Dakota was delayed considerably beyond the usual planting time. This was caused by a late spring thaw and excessive moisture in the ground which prohibited the planting operations. By May 12, only about 16 per cent of the hard red spring wheat was seeded. Intermittent rains continued to hamper the seeding operation to the extent that by May 26, about 48 per cent of the wheat was in the ground. It was not until June 19 that virtually all of the hard red spring wheat acreage had been planted.

Fairly good growing conditions prevailed during the latter part of June. However, in early July some areas were short of topsoil moisture, but by

mid-July this had improved. Growing conditions during July and August were good with intermittent wet and dry spells. By August 18, harvesting of hard red spring wheat had been underway about one week. Toward the end of August, rains hampered the harvest somewhat. However, by September 1, it was estimated that 64 per cent had been combined. One week later, this moved to 80 per cent, and by October 6 about 98 per cent was in the bin. In some counties adjacent to the Canadian border, harvesting was delayed about another week. In general, the 1970 harvest was very slow, particularly in the northeastern sections of the state.

As the wheat samples began to arrive in the laboratory, it became apparent that an excellent crop was in the making. The wheat had an excellent appearance, was fairly high in test weight and low in moisture. It was relatively free of foreign material, diseased or damaged kernels and had no visible sprout damage. In general, the crop possessed an excellent physical appearance.

Subsequently, the USDA estimated the 1970 North Dakota hard red spring wheat crop to be about 108 million bushels, with an average yield per acre of 23 bushels.

Summary

Seeding of the 1970 hard red spring wheat crop in North Dakota was considerably later than usual. Fairly good growing conditions prevailed during June, July and August, and by mid-August harvesting had started. Rains in September hampered the harvest in certain areas. However, by October 6 the harvest was virtually completed.

The crop is estimated by USDA to be about 108 million bushels, with an average yield per acre of 23 bushels. The physical appearance of this crop is excellent. It possesses a fairly high test weight, a high vitreous kernel content, and a low moisture. The wheat is relatively free of foreign material, diseased or damaged kernels with no visible sprout damage. It is estimated that 83 per cent of the crop will grade U.S. No. 2 Dark Northern Spring or better. Average dockage for the state, of wheat going to the local elevator, is 2.8 per cent with a range of 0.2 to 6.0 per cent. Average moisture and protein contents are 11.2 and 14.8 per cent, respectively. Test weight average for the state is 59.3 pounds per bushel. As would be expected, hectoliter weight showed an average of 78.7 kilograms per hectoliter. Weight per 1000 kernels is about the same as reported last year. The state average for wheat ash is 1.64 per cent and showed a range of 0.24 per cent.

The wheat milled satisfactorily and produced flour of good color and low ash. Test weight and experimental flour yield are below last year's excellent crop. The falling number, wet gluten, dough handling properties, loaf crust color and the general shape of the loaf are all about the same as last year. Wheat protein and flour protein contents are considerably higher than last year; in fact, this is the second highest level in the past nine years or since extensive quality reports on commercially produced hard red spring wheat were initiated in 1962. Loaf volumes and crumb colors, on the average, are also higher than the results reported for the past nine years. The mixing time, mixing tolerance and the overall extensogram data indicate that the doughs are a little stronger than last year.

When the 1970 crop is compared with the five-year average it is better in wheat and flour protein contents, falling number, loaf volume, and the crumb color of the loaf. It is about equal in test weight, hectoliter weight, percentage of vitreous kernels, flour ash, dough handling properties, crumb grain and texture and general loaf external appearance. It is also about equal in physical dough properties. Flour yield and absorption are both a little lower than the five-year average.

These yearly quality differences are to be expected because the predominating varieties and environmental conditions are subject to yearly changes.

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