The 1980 Six-Rowed Barley Crop

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The Department of Cereal Chemistry and Technology at North Dakota State University, in cooperation with and with the financial assistance of the Malting Barley Improvement Association, has conducted a protein survey of the 1980 six-rowed barley crop in North Dakota, Minnesota and South Dakota. This is the fourth consecutive year that such a survey has been undertaken. This report summarizes the data obtained on over 400 samples collected during harvest from elevators and from individual farms.

The 1980 survey was conducted in the same manner as the 1979 survey. Department personnel visited elevators and farms in the primary producing areas of the three states, collecting samples of the 1980 crop. Samples were returned to the Department and were cleaned to remove oats and other field debris. The color of the samples was determined on whole kernels using a Gardner Color Difference Meter. Moisture levels were determined on a Tag-Heppenstahl Moisture Meter and, after grinding, protein levels were determined by infrared reflectance analysis. County composites were then prepared, from which kernel assortments and test weights were determined. Due to the conditions encountered during harvest this year, each of the composites also was tested for germination. Two 100 kernel samples from each county composite were treated for 48 hours with 0.75% hydrogen peroxide. A kernel was considered to have germinated if the rootlets were visible.

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The data generated were analyzed by means of a computer program developed specificially for this purpose.

The 1980 Crop Year

The 1980 crop year, like 1979, was a difficult one for small grain producers, especially in North Dakota and Minnesota.

The growing season began early in April, but lack of top- and subsoil moisture across much of the area delayed planting. Early planted fields shows spotty emergence and drouth damage was widespread. Seeding of barley was about 50 percent complete at the beginning of May (compared to a 10 year average of only 10 percent).

Dry weather prevailed through May, crop conditions being rated fair to poor. Spotty showers were received late in May and good rainfall was received on a continuous basis through the end of June. This replenished soil moisture but the crop remained in fair to poor condition.

Harvest began about the middle of July and was approximately one-third complete early in August when considerable precipitation was again received. Heavy precipitation hindered harvest operations and caused considerable damage to swathed grain, which was subjected to showers on a regular basis for a period of about three weeks. As of September 21, 90 percent of the crop had been combined.

The weather has had a considerable effect on the 1980 survey. Counties in South Dakota, North Dakota and Minnesota south of I-94 were easily surveyed prior to the August rains. In counties to the north, the survey was hindered by lack of progress in the harvest and by the general deterioration of the crop which led many elevators to refuse barley. Thus, the 1980 survey is based primarily on the southern half of the growing area with less complete coverage of the northern sections.

Results

Table I contains data for protein and moisture levels and kernel color for samples collected from North Dakota. Protein and moisture levels increased over 1979, reflecting both the drouth conditions encountered early and the precipitation received late. Kernel color was the same as last year although, of course, barley from the northern areas which was badly stained is not represented. Protein and moisture levels increased by 0.4 percent over 1979 levels.

Tables II and III present comparable data for samples collected from South Dakota and Minnesota, respectively. Protein levels increased in both states, although only marginally in Minnesota. Moisture levels declined, the Minnesota decline being due in part to the absence of samples from northern areas. Kernel color was improved in both states.

Figure 1 shows the protein averages for those counties surveyed in 1980.

Tables IV and V show protein distribution data for the counties sampled in the three states. Table VI shows a summary of the protein distribution data for the three states for the years 1977 to 1980. The percentage of the crop below 13.5 percent protein dropped from 76.9 percent in 1979 to 59.8 percent in 1980. This is the lowest percentage since the 1977 crop, of which only 46.7 percent was below 13.5 percent protein.

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TABLE I. North Dakota County Averages, Ranges and Changes from 1979 for Protein and Moisture Content and Color

County	PROTEIN			MOISTURE			COLOR		
	1980	Range	Change*	1980	Range	Change*	1980	Range	Change*
Barnes	13.8	11.8-16.7	+1.0	12.2	9.5-13.8	−0.5	6	4- 7	−1
Benson	13.1	13.0-13.1	+0.4	13.2	13.0-13.4	+1.2	8	8	+3
Cass	13.4	11.9-15.5	+0.4	11.8	10.8-12.7	−0.9	6	3- 8	−1
Cavalier	13.6	12.6-15.0	+0.6	12.2	9.6-13.8	−0.2	8	7- 9	+2
Dickey	13.4	10.6-16.1	+0.6	11.8	11.1-12.6	−1.0	5	3-10	−3
Grand Forks	13.6	11.5-15.4	+1.0	12.1	11.2-13.4	−0.1	6	4-10	−1
Griggs	14.4	12.5-17.3	+1.5	11.7	10.8-12.2	−1.1	6	4- 8	−1
LaMoure	13.1	11.2-14.7	+0.4	11.5	10.7-12.1	−1.5	5	3- 8	−3
Nelson	12.9	12.0-13.8	+0.4	11.1	10.9-11.2	−0.8	8	7- 8	+2
Pembina	13.9	-------	+0.4	13.1	-------	−1.2	7	----	+1
Ramsey	14.1	13.3-14.5	+1.4	10.9	9.1-13.4	−0.9	9	8-10	+3
Ransom	12.3	11.2-13.8	+0.8	11.3	10.7-11.8	−0.3	7	4-10	+1
Richland	12.7	10.2-17.6	+0.1	11.8	8.7-14.0	−0.8	6	3- 8	−2
Sargent	12.7	10.7-15.4	−0.4	10.9	9.8-12.1	−0.8	5	3- 8	−2
Steele	14.0	12.9-15.1	+1.0	11.5	8.6-13.4	−0.3	5	4- 7	−2
Stutsman	14.8	13.9-16.5	+1.3	12.1	11.7-12.4	−0.3	7	6- 7	--
Traill	13.5	12.0-15.9	+0.6	11.8	8.4-13.5	---	6	4- 8	−1
Walsh	13.6	9.3-15.5	+0.4	12.6	11.2-14.3	+0.6	7	5- 9	+1
Average	13.4		+0.4	11.9		+0.4	6		--

*Change from 1979.

TABLE II. South Dakota County Averages, Ranges and Changes from 1979 for Protein and Moisture Content and Color

County	PROTEIN			MOISTURE			COLOR		
	1980	Range	Change*	1980	Range	Change*	1980	Range	Change*
Brown	13.1	11.5-15.7	+0.8	10.6	9.9-11.8	−2.1	5	3-10	−2
Marshall-Roberts	12.7	11.8-14.0	+1.2	10.8	9.9-11.6	−2.0	6	4- 8	−2
Average	13.0		+1.0	10.7		−2.0	6		−1

*Change from 1979.

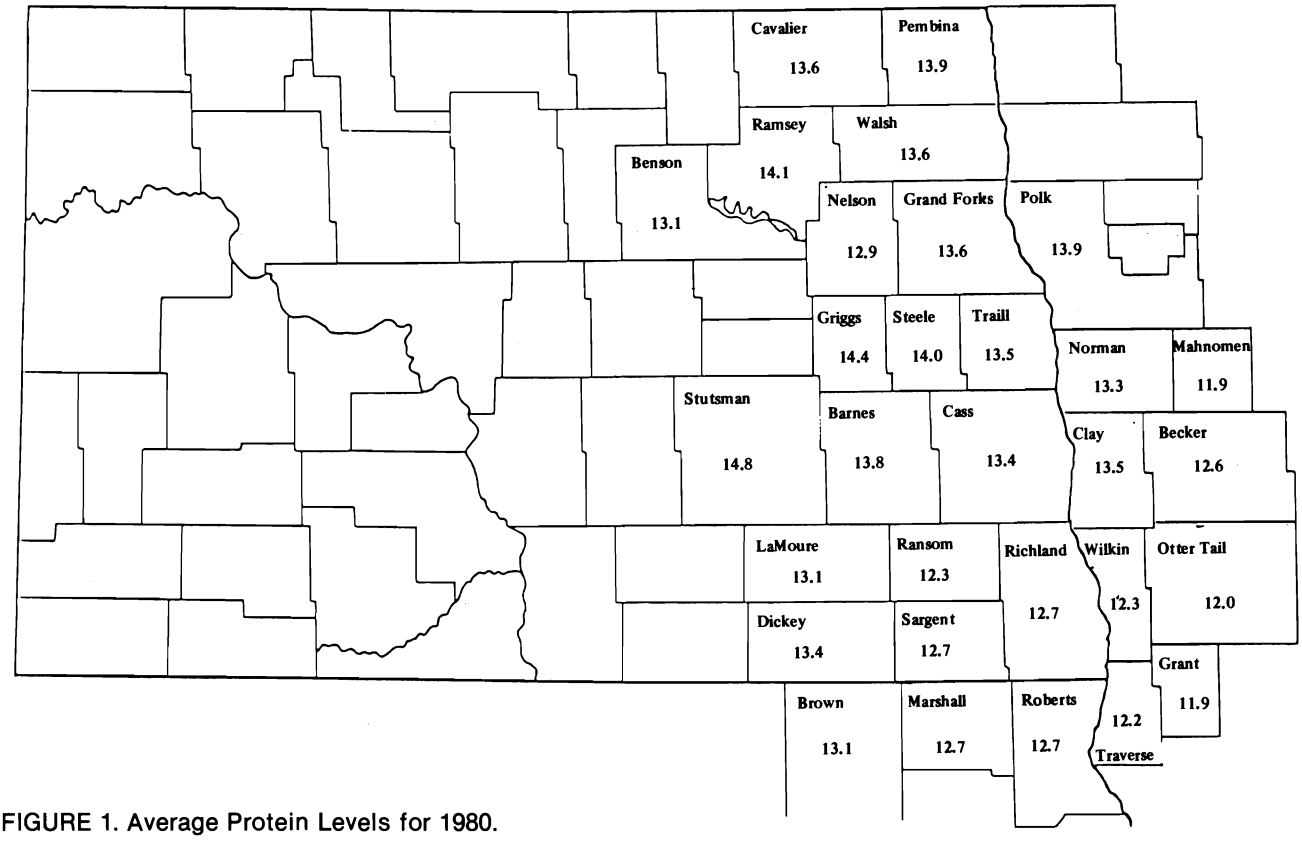

FIGURE 1. Average Protein Levels for 1980.

TABLE III. Minnesota County Averages, Ranges and Change from 1979 for Protein and Moisture Contents and Color

County	PROTEIN			MOISTURE			COLOR		
	1980	Range	Change*	1980	Range	Change*	1980	Range	Change*
Becker	12.6	11.0-14.2	+0.4	10.5	9.1-11.9	−2.3	7	6- 7	−1
Clay	13.5	10.7-15.4	−0.2	11.9	10.3-13.5	−0.5	6	3-10	−1
Grant	11.9	10.8-13.2	+0.4	11.5	10.5-12.5	−1.0	6	4- 8	−2
Mahnomen	11.9	11.2-12.7	−1.7	12.4	11.6-13.0	−0.4	7	6- 8	−1
Norman	13.3	12.2-13.9	−0.1	12.0	11.0-12.9	+0.2	6	4- 7	−2
Otter Tail	12.0	11.0-13.1	−0.7	12.2	11.5-13.3	−1.1	7	5- 8	−1
Polk	13.9	11.9-16.6	+0.6	11.9	8.7-13.8	−0.6	6	3- 9	−2
Traverse	12.2	10.2-14.1	−0.1	11.6	10.3-12.6	−1.6	5	3- 7	−2
Wilkin	12.3	10.6-14.5	+0.4	11.7	8.9-12.7	−1.6	7	4-10	−1
Average	12.9		+0.1	11.6		−1.0	6		−2

*Change from 1979.

TABLE IV. Protein Distribution for the 1980 North Dakota Crop

County	11.6	11.6-12.5	12.6-13.5	13.6-14.5	14.6-15.5	15.5
Barnes	0	4	10	10	5	2
Benson	0	0	2	0	0	0
Cass	0	5	14	11	2	0
Cavalier	0	0	3	0	1	0
Dickey	2	5	1	4	1	3
Grand Forks	1	5	7	9	5	0
Griggs	0	1	0	2	0	1
LaMoure	2	1	3	3	1	0
Nelson	0	1	0	1	0	0
Pembina	0	0	0	1	0	0
Ramsey	0	0	1	2	0	0
Ransom	1	5	1	1	0	0
Richland	5	8	10	4	0	1
Sargent	2	2	6	1	1	0
Steele	0	0	4	4	4	0
Stutsman	0	0	0	2	0	1
Traill	0	7	12	7	3	1
Walsh	3	0	5	12	4	0

TABLE V. Protein Distribution for the 1980 Minnesota and South Dakota Crops

County	< 11.6	11.6-12.5	12.6-13.5	13.6-14.5	14.6-15.5	>15.5
			MINNESOTA			
Becker	1	0	0	1	0	0
Clay	2	6	6	13	4	0
Grant	4	5	4	0	0	0
Mahnomen	2	1	1	0	0	0
Norman	0	1	5	3	0	0
Otter Tail	2	4	2	0	0	0
Polk	0	2	4	19	4	1
Traverse	5	4	3	2	0	0
			SOUTH DAKOTA			
Marshall-Robert	0	5	3	2	0	0
Brown	1	4	8	3	0	1

Table VII gives test weight and plumpness data for the three states. Test weights increased in North Dakota and Minnesota but declined slightly in South Dakota. The percentage of plump kernels declined slightly in North Dakota, very significantly in South Dakota and rose slightly in Minnesota.

Table VIII summarizes the data collected during the four surveys undertaken. Due to the extremely wet conditions during harvest and reports of field sprouting in some small grains, it was decided to test the county composites for germination. The data obtained are presented in Table IX. Several counties showed evidence of reduced germination, most notably, Cavalier and Ramsey counties from northern North Dakota. These were among the counties which received heavy precipitation during harvest.

TABLE VI. Cumulative Protein Distributions for 1977-1980

	<11.6	11.6-12.5	12.6-13.5	13.6-14.5	14.6-15.5	>15.5
North Dakota	16	44	79	74	27	9
South Dakota	1	9	11	5	0	1
Minnesota	21	34	32	40	8	1
Percent in class	9.2	21.0	29.6	28.9	8.5	2.7
Cumulative percentage						
1980	9.2	30.2	59.8	88.7	97.2	100.0
1979	9.7	35.7	76.9	95.1	99.7	100.0
1978	13.7	36.0	65.1	86.2	97.0	100.0
1977	9.8	26.4	46.7	72.6	92.3	100.0

TABLE VII. Test Weight and Plumpness of 1980 Crop

	Test Weight (lbs/bu)		Plumpness**	
	1980	Change*	1980	Change*
North Dakota	45.0	+1.2	68.1	− 4.3
South Dakota	42.0	−1.5	50.7	−18.0
Minnesota	45.1	+2.1	64.4	+ 2.6

*Per cent retained on 6/64 inch screen.
**From 1979.

TABLE VIII. Summary of Data for 1977-1980

Year	Number of Samples	Protein (%,d.b.)	Moisture (%)	Color	Test Weight (lbs/bu)	Plumpness (%)
1977	803	13.6	11.8	6	46.5	74.4
1978	871	13.0	11.6	5	44.5	68.1
1979	731	12.9	11.8	7	43.6	69.6
1980	412	13.2	11.7	6	44.8	65.7

TABLE IX. Germination Levels of 1980 Crop Samples

STATE	COUNTY	% GERMINATION*
North Dakota	Barnes	97.0
	Benson	90.5
	Cass	96.0
	Cavalier	69.0
	Dickey	89.5
	Grand Forks	93.5
	Griggs	96.0
	LaMoure	93.5
	Nelson	95.0
	Pembina	97.5
	Ramsey	54.5
	Ransom	92.5
	Richland	98.0
	Sargent	88.0
	Steele	96.0
	Stutsman	91.0
	Traill	95.5
	Walsh	89.0
Minnesota	Becker	92.0
	Clay	95.5
	Grant	95.0
	Mahnomen	96.5
	Norman	97.5
	Otter Tail	95.0
	Polk	95.0
	Traverse	93.5
	Wilkin	96.5
South Dakota	Brown	93.5
	Marshall-Roberts	89.5

*Average of duplicate 100 kernel samples held at room temperature for 48 hours in 0.75% hydrogen peroxide.

Summary

The 1980 six-rowed malting barley crop grown in North Dakota, South Dakota and Minnesota has an average protein content of 13.2 percent, an increase of 0.3 percent over 1979. Moisture levels and color were virtually unchanged. Test weights increased slightly and the level of plump kernels declined by 4 percent.

One factor which may have led to the very small increase in protein levels may have been the dramatic shift, seen this year, away from Larker to lower protein varieties such as Glenn and Morex. Had this shift not taken place, the average protein level of the 1980 would, most likely, have been higher.

It should be noted that samples were largely unavailable from areas in which the greatest weather damage occurred, as much of this production was not being accepted by elevators and thus will not be available for malting purposes. This report is, therefore, biased toward that part of the crop which was relatively undamaged and will be available for malting.

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Summary

In conclusion, although the falling number test offers the advantages of a simple, rapid, and fairly accurate method for measurement of sprout damage in wheat, there are certain disadvantages. It is vitally important to have a good understanding of the factors which affect the falling number test. These include varietal and environmental influences as well as operational factors. It must be remembered that the falling number value does not indicate the exact amount of amylase enzyme present in a particular sample. For instance, two samples of highly sprouted wheat could each give very low falling number values (near 60 sec.). However, one of the two samples could have 10 times more alpha-amylase enzyme present thn the other. Likewise, with falling number values above 400 sec. it may very well be that the response is not due to the absence of amylase enzyme but rather to a starch effect.

Other test methods and instruments for measurement of alpha-amylase activity which do not depend on starch viscosity but rather measure more directly the amount of alpha-amylase enzyme present in a wheat sample are being evaluated. Because of the importance of sprouting in hard red spring and durum wheat both in the domestic and export market, studies are being continued at North Dakota State University to better measure alpha-anylase activity in wheat and to elucidate the effects of sprout damage on biochemical constituents as well as on baking and pasta quality.

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