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2003 Crop Quality Report

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2003 Regional Barley Crop Quality for North Dakota & Minnesota

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Introduction

This report presents the results of the 25th annual survey of regional barley crop quality.

Six-rowed barley samples (266) were collected in all crop reporting districts (CRD) of North Dakota and in the northwestern and west central districts of Minnesota (Figure I).

Two-rowed barley samples (40) were collected in the five districts of North Dakota where significant amounts of two-rowed barley are produced.

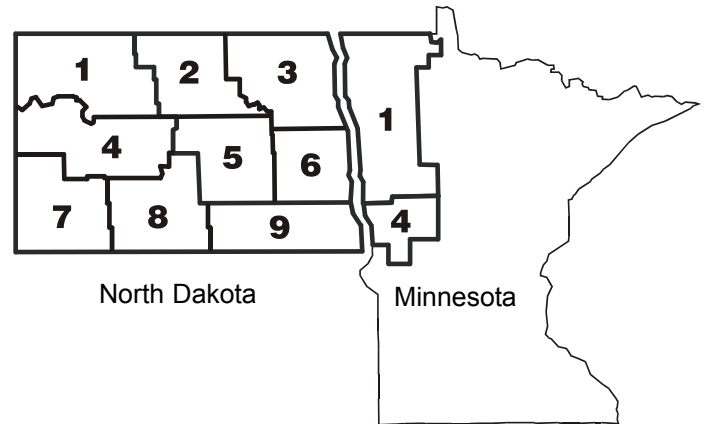
The sample collections at the farms and elevators were coordinated by the United States Department of Agriculture (USDA) North Dakota Agricultural Statistics Service in Fargo, North Dakota.

Grain quality evaluations were conducted by the Department of Plant Sciences at North Dakota State University (NDSU). Grade determinations were performed by the North Dakota Grain Inspection Service, Inc. of Fargo, North Dakota.

Financial support was provided by the North Dakota Barley Council of Fargo, North Dakota and the

Crop Reporting Districts (CRD) in North Dakota and Minnesota

Figure I.



American Malting Barley Association, Inc. (AMBA) of Milwaukee, Wisconsin.

2003 Production & Varieties

The U.S. Department of Agriculture (September 30, 2003) estimated the 2003 barley production in North Dakota and Minnesota at 132 million bushels (2.9 million metric tons), an increase of approximately 68 million bushels (1.5 million metric tons) from the 2002 level.

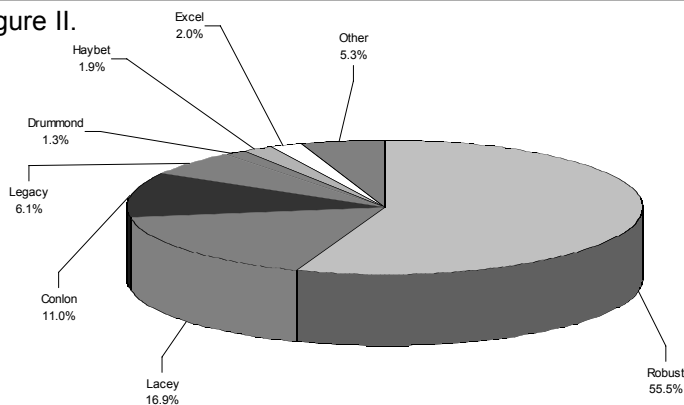
The increased production was the result of increased harvested acreage and increased yields. Harvested acreage increased 53% from last year to

2.15 million acres. Yields in North Dakota and Minnesota increased from 46 and 39 bushels/acre to 60 and 75 bushels/acre, respectively.

According to the USDA/National Agricultural Statistics Service and State Statistics Services, over 80% of barley acreage in the North Dakota and Minnesota survey region was seeded to six-rowed malting varieties (Figure II). The six-rowed malting varieties include Robust, Lacey, Legacy, Excel, Drummond, Stander and Morex. Robust was the most widely seeded six-rowed malting variety accounting for 55.5% of the planted acreage. In 2003, the percentage of acreage planted with the six-rowed barley varieties Lacey and Legacy increased to 16.9% and 6.1%, respectively. Two-rowed barley varieties are primarily seeded in the western and southern crop reporting districts of North Dakota. The two-rowed barley in this region consists of both feed and malting varieties. The two-rowed feed varieties include Haybet, Stark, Bowman and Logan. Conlon, a two-rowed malting variety, was the most widely planted two-rowed variety representing 11% of the 2003 barley acreage in the North Dakota and Minnesota survey region.

Regional Barley Variety Distribution

Figure II.



Materials and Methods

Samples weighing from one - to two-pounds each were collected during the 2003 barley harvest from all counties in North Dakota and selected counties in Minnesota. Samples were collected from farms and country elevators at the time of harvest. The objective was to collect a representative number of samples from each selected county within the survey region. The number of samples collected in each county was based on the expected production for each county. The total number of six- and two-rowed samples collected within each county is shown in Appendix I (Page 8). Two - and six -rowed samples were differentiated based upon varietal identification by the grower or kernel morphology.

All samples were cleaned on a Carter Dockage Tester after a small portion (50 grams) was removed. The 50-gram portions were later used to prepare district composite samples for dockage and district

grade estimates.

Upon receipt, the initial barley moisture content was recorded and samples in excess of 13.5% were allowed to air-dry prior to subsequent analyses.

Test weight, moisture, protein, kernel assortment and kernel color were determined for each of the 266 six-rowed and 40 two-rowed dockage-free samples. Every third sample collected within a county was analyzed for 1000 kernel weight. The values for district, state and regional averages represent the average of all samples within their respective area. Separate district, state and regional averages were calculated for two - and six - rowed barley.

District composite samples were submitted to the North Dakota Grain Inspection Service, Inc. for determination of grade. A portion of each district composite sample was cleaned for determination of dockage.

Crop Quality Data

Test Weight

The regional average test weight for the two-rowed barley crop was 48.8 pounds/bushel (lbs/bu) (Table I), and 87% of samples collected were in excess of 45.9 lbs/bu (59.1 kg/hl) (Figure III). The lowest two-rowed barley district average test weight of 47.3 lbs/bu was observed in

the south central district. The region's six-rowed barley crop exhibited an average test weight of 47.7 lbs/bushel (Table II). Approximately 83% of the six-rowed barley samples collected in 2003 exhibited test weights in excess of 45.9 lbs/bu (Figure III).

FIGURE III. 2003 Regional Barley Test Weight Distribution

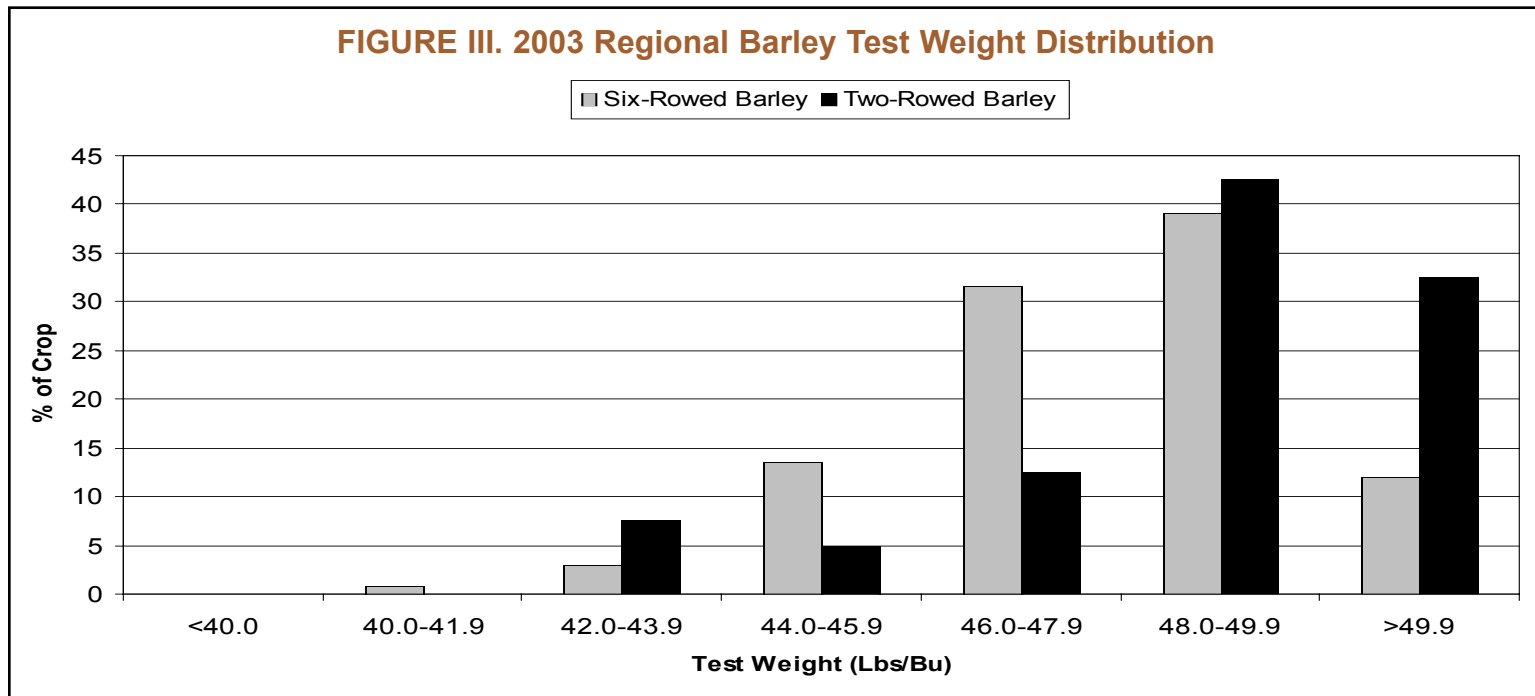


TABLE I. 2003 REGIONAL TWO-ROWED BARLEY CROP QUALITY

State and Crop Reporting District (CRD)	Dockage (%)	Moisture Content (%)	Test Weight (lbs/bu) (kg/hl)	1000 Kernel Weight (g)*	Protein Content (%)	Color Score**	Kernel Assortment*** %Plump	%Thin	
ND CRD 1	0.4	11.1	49.4	63.6	50.0	12.6	6	94.6	0.9
ND CRD 2	0.1	13.0	49.7	64.0	50.5	13.1	6	93.9	0.9
ND CRD 4	0.5	10.9	48.1	61.9	41.7	12.4	3	72.7	3.7
ND CRD 7	0.4	10.4	48.0	61.8	42.8	14.1	3	68.4	4.9
ND CRD 8	0.2	10.2	47.3	60.9	39.8	14.3	2	84.6	1.9
State Average	0.3	11.2	48.8	62.8	46.2	13.3	4	84.1	2.4

TABLE II. 2003 REGIONAL SIX-ROWED BARLEY CROP QUALITY

State and Crop Reporting District (CRD)	Dockage (%)	Moisture Content (%)	Test Weight (lbs/bu) (kg/hl)	1000 Kernel Weight (g)*	Protein Content (%)	Color Score**	Kernel Assortment*** %Plump	%Thin	
ND CRD 1	0.4	11.2	47.2	60.8	35.5	12.7	4	67.2	4.2
ND CRD 2	0.4	12.3	48.5	62.4	38.2	12.7	6	81.4	2.3
ND CRD 3	0.4	12.5	48.3	62.2	37.5	12.5	7	79.7	2.8
ND CRD 4	0.4	11.3	46.9	60.4	33.5	12.6	3	61.9	6.5
ND CRD 5	0.3	12.4	47.7	61.4	36.0	12.9	7	80.5	2.6
ND CRD 6	0.3	12.7	47.3	60.9	35.8	12.8	7	79.9	2.5
ND CRD 7	0.2	10.5	46.7	60.1	31.4	15.2	2	36.5	14.4
ND CRD 8	0.2	11.4	46.9	60.4	30.6	14.3	3	54.5	9.4
ND CRD 9	0.4	13.3	47.6	61.3	35.3	13.4	5	75.9	3.8
ND Average	0.4	12.2	47.7	61.4	35.8	12.9	6	74.5	3.8
MN CRD 1	0.6	13.7	48.1	61.9	39.4	12.0	7	88.8	1.3
MN CRD 4	0.4	12.3	47.8	61.5	37.4	13.0	7	83.0	2.6
MN Average	0.6	13.5	48.0	61.8	38.9	12.1	7	87.9	1.5
Regional Average	0.4	13.8	47.7	61.4	36.3	12.8	6	76.5	3.5

Comments for Table I and II

* 1000 kernel weight was determined on every third sample collected.

** The lower the color score the brighter the barley (scale 1 to 10).

*** % Plump: kernels retained on or above a 6/64 x 3/4 inch (2.4 x 19 mm) slotted sieve.

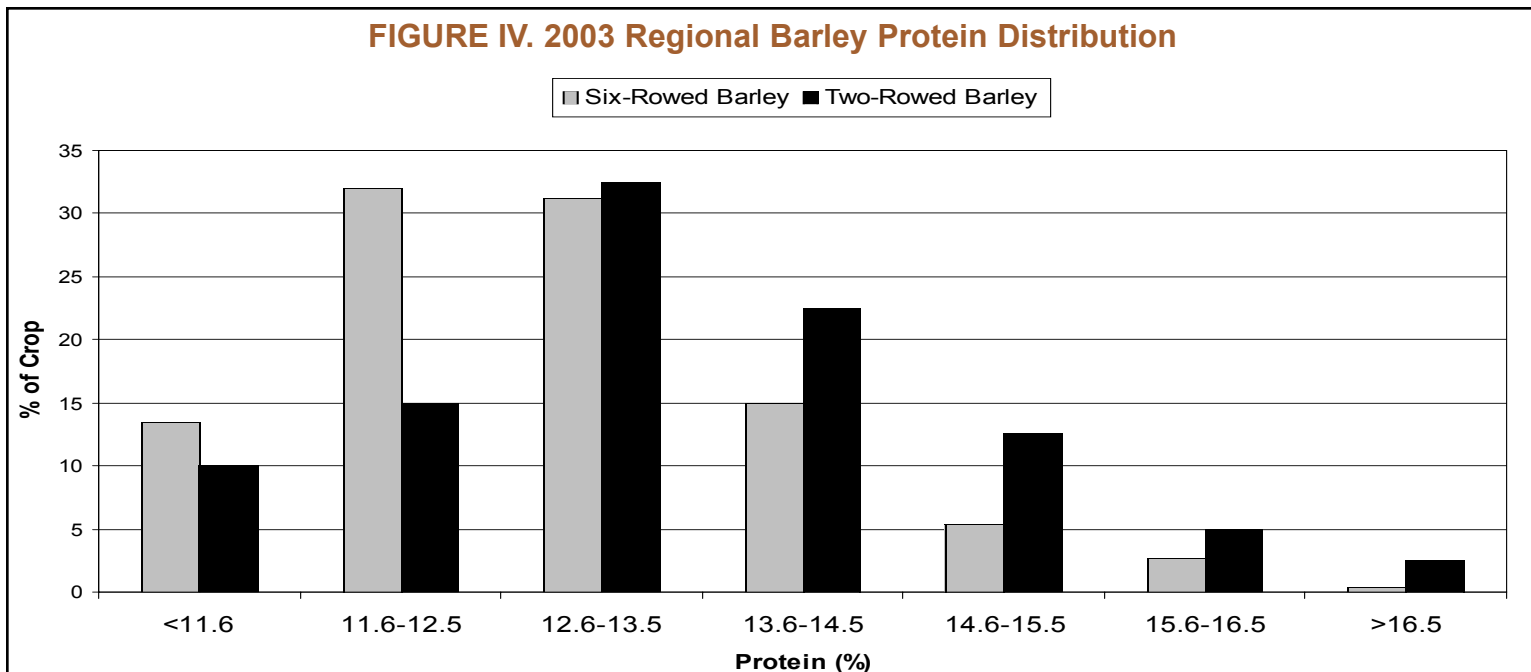
% Thin: kernels passing through a 5/64 x 3/4 inch (2.0 x 19 mm) slotted sieve.

Protein

The 2003 regional two-rowed barley crop exhibited an average protein content of 13.3% (Table I). The average protein for the 2003 six-rowed barley crop was 12.8% (Table II). Approximately 77% of six-rowed samples displayed protein levels of 13.5% or lower, while 58% of the two-rowed crop was at or

below this level (Figure IV). The lowest district average six-rowed barley protein was recorded in Minnesota's northwestern district (12.0%). Protein levels were highest in the southwestern and south central districts of North Dakota.

FIGURE IV. 2003 Regional Barley Protein Distribution



Kernel Plumpness

The average kernel plumpness level for the 2003 regional barley two-rowed barley crop was 84.1% plump (Table I). Approximately 83% of the regional two-rowed samples were in excess of 70% plump (Figure V). The average kernel plumpness level for

the 2003 regional barley six-rowed barley crop was 76.5% (Table II), and approximately 77% of the regional samples exhibited kernel plumpness in excess of 70% (Figure V).

FIGURE V. 2003 Regional Barley Kernel Plumpness Distribution

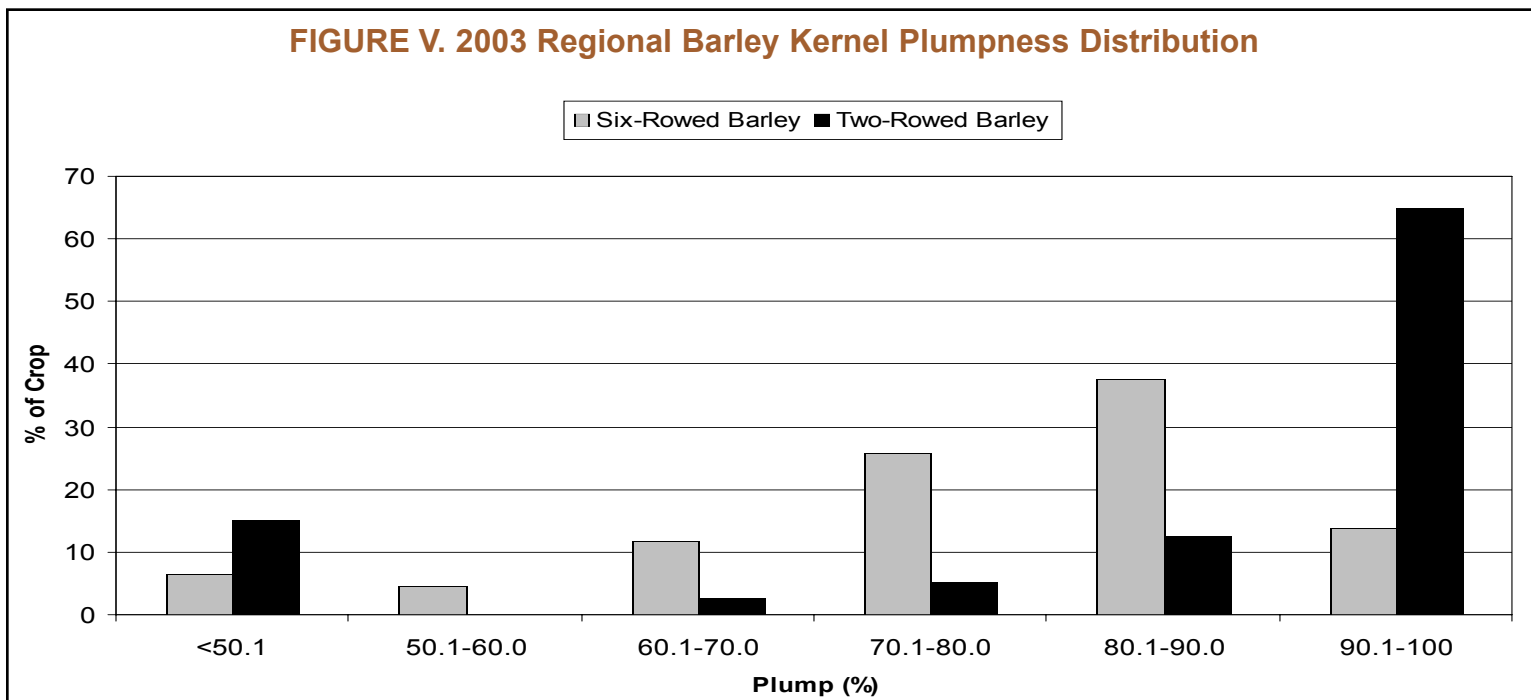


TABLE III. GRADE AND GRADE REQUIREMENTS FOR THE SUBCLASSES SIX-ROWED BARLEY, TWO-ROWED BARLEY AND THE CLASS BARLEY

Grade	Minimum limits of-			Maximum limits of-				
	Test Weight		Sound Barley*	Damaged Kernels*	Heat Damaged Kernels	Foreign Material	Broken Kernels	Thin Barley
	(lbs/bu)	(kg/hl)	(%)	(%)	(%)	(%)	(%)	(%)
U.S. No. 1	47.0	60.5	97.0	2.0	0.2	1.0	4.0	10.0
U.S. No. 2	45.0	57.9	94.0	3.0	0.3	2.0	8.0	15.0
U.S. No. 3	43.0	55.3	90.0	4.0	0.5	3.0	12.0	25.0
U.S. No. 4	40.0	51.5	85.0	8.0	1.0	4.0	18.0	35.0
U.S. No. 5	36.0	46.3	75.0	10.0	3.0	5.0	28.0	75.0

U. S. Sample grade shall be barley that:

- (a) Does not meet the requirements for the grades U.S. Nos. 1, 2, 3, 4 or 5; or
- (b) Contains 8 or more stones or any number of stones which have a aggregate weight in excess of 0.2 percent of the sample weight , 2 or more pieces of glass, 3 or more crotalaria seeds (*Crotalaria* spp.), 2 or more castor beans (*Ricinus communis* L.), 4 or more particles of an unknown foreign substance(s) or a commonly recognized harmful or toxic substance(s), 8 or more cock lebur (*Xanthium* spp.) or similar seeds singly or in combination, 10 or more rodent pellets, bird droppings, or equivalent quality of other animal filth per 1-1/8 to 1-1/4 quarts of barley; or
- (c) Has a musty, sour, or commercially objectionable foreign odor (except smut or garlic odor); or
- (d) Is heating or otherwise of distinctly low quality.

*Injured-by-frost kernels and injured-by-mold kernels are not considered damaged kernels or considered against sound barley.

Information from-
 United States Department of Agriculture Federal Grain Inspection Service
 Official United States Standards for Grain, July 1, 1997

TABLE IV. GRADING INFORMATION FOR THE 2003 TWO-ROWED BARLEY CROP IN NORTH DAKOTA

State and Crop Reporting	Test Weight		Sound Barley	Damaged Kernels	Heat Damaged Kernels	Foreign Material	Broken Kernels	Thin Barley*	Grade
District (CRD)	(lbs/bu)	(kg/hl)	(%)	(%)	(%)	(%)	(%)	(%)	
North Dakota									
CRD-1	49.2	63.3	100.0	0.0	0.0	0.0	0.2	1.0	U.S. No. 1 Two-Rowed Barley
CRD-2	50.2	64.6	100.0	0.0	0.0	0.0	0.0	0.5	U.S. No. 1 Two-Rowed Barley
CRD-4	48.0	61.8	100.0	0.0	0.0	0.0	0.1	3.2	U.S. No. 1 Two-Rowed Barley
CRD-7	48.7	62.7	100.0	0.0	0.0	0.0	0.2	3.1	U.S. No. 1 Two-Rowed Barley
CRD-8	47.7	61.4	100.0	0.0	0.0	0.0	0.0	1.3	U.S. No. 1 Two-Rowed Barley
State Average	48.8	62.8	100.0	0.0	0.0	0.0	0.1	1.8	U.S. No. 1 Two-Rowed Barley
(An average of the CRD composites)									
*% Thin: kernels passing through a 5/64 x 3/4-inch (2.0 x 19 mm) slotted sieve.									

TABLE V. GRADE AND GRADE REQUIREMENTS FOR THE SUBCLASSES SIX-ROWED MALTING BARLEY AND SIX-ROWED BLUE MALTING BARLEY

Grade	Minimum limits of-				Maximum limits of-				
	Test Weight (lbs/bu) (kg/hl)	Suitable Malting Type (%)	Sound Barley* (%)	Damaged Kernels* (%)	Foreign Material (%)	Other Grains (%)	Skinned and Broken Kernels (%)	Thin Barley (%)	
U.S. No. 1	47.0	60.5	95.0	97.0	2.0	0.5	2.0	4.0	7.5
U.S. No. 2	45.0	57.9	95.0	94.0	3.0	1.0	3.0	6.0	10.0
U.S. No. 3	43.0	55.3	95.0	90.0	4.0	2.0	5.0	8.0	15.0
U.S. No. 4	43.0	55.3	95.0	87.0	5.0	3.0	5.0	10.0	15.0

*Injured-by-frost kernels and injured-by-mold kernels are not considered damaged kernels or considered against sound barley.

Information from-

United States Department of Agriculture

Federal Grain Inspection Service

Official United States Standards for Grain - July 1, 1997

TABLE VI. GRADING INFORMATION FOR THE 2003 SIX-ROWED BARLEY CROP IN NORTH DAKOTA, MINNESOTA AND THE REGION

State and Crop Reporting District (CRD)	Test Weight		Suitable Malting Type (%)	Sound Barley* (%)	Damaged Kernels* (%)	Foreign Material (%)	Other Grains (%)	Skinned & Broken & Thin		Grade
	(lbs/bu)	(kg/hl)						Kernels (%)	Barley (%)	
North Dakota										
CRD-1	47.6	61.3	>95.0	100.0	0.0	0.0	0.0	2.0	3.5	U.S. No. 1 Six-rowed Malting Barley
CRD-2	48.7	62.7	>95.0	99.8	0.0	0.0	0.2	3.1	1.7	U.S. No. 1 Six-rowed Malting Barley
CRD-3	48.6	62.6	>95.0	100.0	0.0	0.0	0.0	2.2	1.9	U.S. No. 1 Six-rowed Malting Barley
CRD-4	47.2	60.8	>95.0	99.3	0.0	0.0	0.7	3.3	4.8	U.S. No. 1 Six-rowed Malting Barley
CRD-5	48.0	61.8	>95.0	99.8	0.0	0.0	0.2	3.6	2.0	U.S. No. 1 Six-rowed Malting Barley
CRD-6	47.5	61.1	>95.0	100.0	0.0	0.0	0.0	3.3	2.0	U.S. No. 1 Six-rowed Malting Barley
CRD-7	46.7	60.1	>95.0	100.0	0.0	0.0	0.0	3.0	11.5	U.S. No. 3 Six-rowed Malting Barley
CRD-8	47.5	61.1	>95.0	100.0	0.0	0.0	0.0	3.0	5.3	U.S. No. 1 Six-rowed Malting Barley
CRD-9	48.3	62.2	>95.0	100.0	0.0	0.0	0.0	1.9	2.7	U.S. No. 1 Six-rowed Malting Barley
State Avg. (An average of the CRD composites)	47.8	61.5	>95.0	99.9	0.0	0.0	0.1	2.8	3.9	U.S. No. 1 Six-rowed Malting Barley
Minnesota										
CRD-1	48.5	62.4	>95.0	100.0	0.0	0.0	0.0	3.0	1.0	U.S. No. 1 Six-rowed Malting Barley
CRD-4	47.8	61.5	>95.0	100.0	0.0	0.0	0.0	2.2	1.9	U.S. No. 1 Six-rowed Malting Barley
State Avg. (An average of the CRD composites)	48.2	62.0	>95.0	100.0	0.0	0.0	0.0	2.6	1.5	U.S. No. 1 Six-rowed Malting Barley
Regional Avg. (An average of the CRD composites)	47.9	61.6	>95.0	99.9	0.0	0.0	0.1	2.8	3.5	U.S. No. 1 Six-rowed Malting Barley

*Injured-by-frost kernels and injured-by-mold kernels are not considered damaged kernels or considered against sound barley.

1000 Kernel Weight

Every third sample collected was analyzed for 1000 kernel weight. The 2003 regional two-rowed barley crop displayed an average 1000 kernel weight of 46.2 grams (Table I). The regional six-rowed barley average was 36.3 grams (Table II). The highest district average six-rowed barley 1000 kernel weight of 39.4 grams was recorded in Minnesota's northwestern district.

Color

Color score is based on a scale of 1 to 10, with a lower score indicating brighter barley. The 2003 two-rowed barley crop exhibited an average color score (brightness) of four (Table I). The regional average color for the 2003 six-rowed barley crop was six (Table II). Drier conditions in southwestern and south central North Dakota produced the brightest district average colors.

Grade

A portion of each sample collected within a district was blended to prepare district composite samples. These district composites were submitted to the federally-licensed North Dakota Grain Inspection Service, Inc. for determination of an average district grade. Separate composites were prepared for two and six-rowed barley. As the two-rowed district composite samples were a mixture of malting and feed varieties, they were graded according to the requirements of two-rowed barley (Table III). All 2003 two-rowed barley district composites were graded as U.S. No. 1 Two-Rowed Barley (Table IV). All composite samples from North Dakota districts with significant production of six-rowed barley were graded as U.S. No. 1 Six-Rowed Malting Barley (Tables V and VI). Thin barley kernels and lower test weight in the composite sample for the southwestern district of North Dakota resulted in the grade of US No. 3 Six-Rowed Malting Barley. This composite, however, is based upon the results of only three samples.

TABLE VII. REGIONAL (NORTH DAKOTA AND MINNESOTA) SIX-ROWED BARLEY QUALITY DATA, 1999-2003

Year	Samples	Moisture	Test Weight		1000 Kernel	Protein	Color	Kernel Assortment***	
		Content (%)	(lbs/bu)	(kg/hl)	Weight (g)*	Content (%)	Score**	%Plump	%Thin
2003	266	12.4	47.7	61.5	36.3	12.8	6	76.5	3.5
2002	243	13.8	45.3	58.3	35.0	13.5	7	75.9	3.6
2001	270	12.3	45.7	58.9	33.8	13.1	7	73.7	3.4
2000	391	12.8	46.2	59.4	34.2	13.7	7	69.3	5.9
1999	563	13.1	45.2	58.2	33.6	12.7	7	68.7	6.2

*1000 kernel weight was determined on every third sample collected.

**The lower the color score the brighter the barley (scale 1 to 10).

***% Plump: kernels retained on or above a 6/64 x 3/4 inch (2.4 x 19 mm) slotted sieve.

% Thin: kernels passing through a 5/64 x 3/4 inch (2.0 x 19 mm) slotted sieve.

Conclusion

The quality of the 2003 regional six-rowed barley crop represented an improvement over that of past years (Table VII). Regional average test weight, 1000 kernel weight and kernel plumpness were the highest observed in the past five years. The average protein of the 2003 regional six-rowed barley crop was the

lowest of the past five years, while barley color was the brightest. Evaluation of protein and kernel plumpness levels suggests that over 62% of the regional six-rowed crop was of malting quality. Approximately 67% of Conlon samples collected and analyzed met malting quality requirements.

Methods Employed and Definition of Terms and Symbols

North Dakota State University
Agriculture Experiment Station
Department of Plant Sciences

TEST WEIGHT - Test weight was determined on dockage-free barley using a Seedbuo Model 8800 computer grain scale. Test weight was expressed in pounds per bushel. In the event sample moisture exceeded 13.5%, the sample was allowed to air-dry prior to test weight determination.

MOISTURE - Moisture was expressed as a percentage of total weight and was determined with a Motomco Model 919ES Flowthrough Moisture Meter.

PROTEIN - Percent total protein, calculated on a dry matter basis, was determined by measuring the thermal conductivity of nitrogen, following combustion of the sample, using a Leco Model FP-528 Nitrogen Determinator System.

KERNEL ASSORTMENT - Barley (100 g) kernel assortment was determined by standard ASBC method Barley 2-B (Methods of Analysis of the American Society of Brewing Chemists, 1992) using a Eureka-Niagara Sample Barley grader.

1000 KERNEL WEIGHT - 1000 kernel weight was determined by ASBC method Barley-2D (Methods of Analysis of the American Society of Brewing Chemists, 1992) with an electronic kernel counter.

COLOR - Color was determined by a modification of ASBC standard method, Barley-9 (Methods of Analysis of the American Society of Brewing Chemists, 1992) using the L value obtained from a Pacific Scientific XL-800 Series Gardner Colorimeter with XL-845 circumferential sensor. The L-value was converted to a color score (1-10), with a score of 1 representing bright barley and a score of 10 representing dark or heavily stained barley.

Appendix I.

NUMBER OF BARLEY SAMPLES COLLECTED BY TYPE AND LOCATION		
LOCATION		
NORTH DAKOTA	SIX-ROWED	TWO-ROWED
CRD-1	28	14
CRD-2	31	8
CRD-3	47	0
CRD-4	20	2
CRD-5	34	0
CRD-6	27	0
CRD-7	3	13
CRD-8	14	3
CRD-9	23	0
STATE TOTAL	227	40
MINNESOTA		
CRD-1	33	0
CRD-4	6	0
STATE TOTAL	3	0
REGIONAL TOTAL	266	40

ACKNOWLEDGEMENT

We want to take an opportunity to thank all of the members from the North Dakota National Agricultural Statistics Service that were involved with the collection of samples, as well as James Gillespie and Deborah Hatzenbeller for their assistance in sample preparation and analysis.

A special thanks also goes to the North Dakota Barley Council and the American Malting Barley Association for their financial contributions, which make this publication possible - it is greatly appreciated and acknowledged.

Without the financial help and the excellent cooperation of the barley producers and county elevator operators, this survey would not have been possible.

Conversions

U.S. To Metric

Quarts (QT)	
Wet	x 0.946 = Liters (L)
Dry	x 1.101 = Liters
Gallons (GAL)	
Wet	x 3.785 = Liters
Wet	x 0.038 = Hectoliters (HL)
Dry	x 4.404 = Liters
Dry	x 0.044 = Hectoliters
Bushels (BU)	x 0.352 = Hectoliters
Acres (A)	x 0.405 = Hectares (HA)
Pounds (LB)	x 0.454 = Kilograms (KG)
Miles (MI)	x 1.609 = Kilometers (KM)
LB/BU	x 1.287 = KG/HL
BU/A	x 0.870 = HL/HA
BU/A (Barley)	x 0.054 = MT/HA
BU (Barley)	x 0.022 = MT
BU (Malt)	x 0.015 = MT

Metric To U.S.

Liters (L) Wet	x 1.057 = Quarts (QT)
Dry	x 0.908 = Quarts
Wet	x 0.264 = Gallons (GAL)
Dry	x 0.227 = Gallons
Hectoliter (HL)	
Wet	x 26.418 = Gallons
Dry	x 22.700 = Gallons
Dry	x 2.838 = Bushels (BU)
Hectares (HA)	x 2.471 = Acres (A)
Kilograms (KG)	x 2.205 = Pounds (LB)
Kilometers (KM)	x 0.621 = Miles (MI)
KG/HL	x 0.777 = LB/BU (Test Wt.)
HL/HA	x 1.149 = BU/A (Yield)
MT/HA (Barley)	x 18.587 = BU/A
MT (Barley)	x 45.929 = BU
MT (Malt)	x 64.842 = BU

Standards

	LB/BU	KG/BU	KG/HL	Seeds/Pound	
				Range	Average
Malt	34	15.42	43.76		
Barley	48	21.77	61.78	10,000 - 15,000	13,000
Wheat	60	27.21	77.22	8,000 - 24,000	16,000
Corn	56	25.40	72.07	900 - 1,500	1,200
Flax	56	25.40	72.07	65,000 - 120,000	80,000
Oats	32	14.51	41.18	11,000 - 17,000	14,000
Sorghum	56	25.40	72.07	10,000 - 21,000	20,000
Rye	56	25.40	72.07	10,000 - 21,000	18,000
Sunflower	30	13.61	38.61	4,500 - 8,000	
Soybeans	60	27.21	77.22	2,500 - 3,500	

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Email: sheisel@execpc.com
Internet: www.AMBAinc.org



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