Wheat Quality Council

Hard Spring Wheat Technical Committee

2016 Crop

February 21-23, 2017

Kansas City, MO

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Sponsored by the Wheat Quality Council
February 21-23, 2017

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Table of Contents

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Introduction

Breeders' experimental lines of wheat are evaluated for overall quality before being released for commercial production. The Hard Spring Wheat Technical Committee provides milling and baking quality data on breeders' experimental lines of wheat that are annually submitted to the Wheat Quality Council (WQC). The impact is the commercialization of high quality wheat for production and processing.

Seven experimental lines of hard spring wheat were grown at up to five locations in 2016 and evaluated for kernel, milling, and bread baking quality against the check variety Glenn. To avoid any bias in the test procedures, code numbers were assigned to the experimental lines and maintained throughout the growing and harvesting of the plots and the milling and baking trials. Wheat samples were milled at the USDA Hard Red Spring and Durum Wheat Quality Laboratory (WQL), Fargo, ND. Flour samples were shipped to independent laboratories and tested for bread baking quality.

From this report:

The WQC makes no representation regarding the accuracy or conclusiveness of the data developed by and received from the participating laboratories. The data has been scientifically determined and accurately reported from the perspective of the Hard Spring Wheat Technical Committee.

The results relate only to test samples that were volunteered for testing in the 2016 crop year. Test results from other crop years may differ from those reported herein.

The Hard Spring Wheat Technical Committee, by compilation of data and issuance of this report, does not make or intend any general recommendations or conclusions on its part with respect to the desirability of any wheat included in the tests. Mention of a vendor, product, proprietary product, or procedure does not constitute a guarantee or warranty of the vendor, product, or procedure by the Hard Spring Wheat Technical Committee or by cooperating laboratories, and does not imply its approval to the exclusion of other vendors, products, or procedures that may also be suitable. Data reported herein are not to be used in any publication or literature or for advertising or publicity purposes.

The 2016 Wheat Quality Testing Program

Source of Wheat

Source/Breeding Program	SWQAC Code #	Identification
North Dakota State University	1	Glenn (Check #2)
North Dakota State University	2	ND825
South Dakota State University	3	Boost
WestBred	4	WB9653
University of Minnesota	5	MN10261-1
WestBred	6	WB9507
University of Minnesota	7	Bolles (Check #1)
Syngenta	8	SY Rustler

Field Plot Locations and Procedures

Coordinators: Dale Williams, Ph.D., Director and Gonzalo Rojas-Cifuentes, Ph.D., Assistant Director, Foundation Seedstocks, Department of Plant Sciences, North Dakota State University.

The experimental lines and check variety were grown at the following locations in the spring wheat region:

- Northeast Research Station (Watertown), South Shore, SD
  South Dakota State University, Brookings, SD – Jack Ingemansen;
- Agronomy Seed Farm, Casselton, ND – Brian Otteson;
- Northwest Research and Outreach Center, Crookston, MN – Dr. Albert Sims;
- North Central Agricultural Experiment Station, Minot, ND – Chad Anderson;
- Williston Research Extension Center, Williston, ND – Kyle Dragseth.

Wheat was seeded in large-scale plots of ½ acre in size to approximate commercial production. Cultural practices such as tillage and weed control common to each area were used. Consideration was also given to germination, seed size, and planting depth to provide stand uniformity. Based on soil test results from each locations, nitrogen fertilizer was applied to the test plots at rates approaching higher levels than used commercially to more fully express the potential of each experimental line. Levels of phosphorus and potassium were applied in sufficient amounts so as not to be limiting factors. Each plot was individually harvested and the grain produced was thoroughly blended to obtain a uniform sample representing the entire plot.

Field Production Data

	LOCATION				
Variable	**Watertown**	**Casselton**	**Crookston**	**Minot**	**Williston**
Planting Date	4/14/2016	5/3/2016	4/22/2016	5/20/2016	5/20/2016
Harvest Date	8/3/2016	8/17/2016	8/15/2016	8/24/2016	8/18/2016
Fertilizer (lb/A)					
N	150	150 lbs N	171	112	85 lbs
P	100	0	3 ppm	30	17 ppm
K	50	0	176 ppm	425	340 ppm
Herbicide/rate/A					
Broadleaf	Wolverine (1.7 pt/A)	Bronate (1 pt/A)	Bromac (1 pt/A)	Widematch (1 pt/A)	Supremacy (6 oz/A)
Grass	Wolverine (1.7 pt/A)	Puma (0.5 pt/A)	Axial XL (1 pt/A)	Everest (1 oz); Puma (10 oz)	Parity (8 oz/A)
Fungicide	Prosaro (6 oz/A)	*	*	*	Tilt (3 oz/A); Prosaro (8 oz/A)

*No application.

	CLIMATOLOGICAL DATA				
	Average Temperature (°F) / Precipitation (in)				
Month	**Watertown**	**Casselton**	**Crookston**	**Minot**	**Williston**
April	44.8/2.29	41.1/2.78	39/1.02	42/2.82	49/*
May	59.4/1.45	59.6/3.10	59/6.68	58/2.08	61/2.04
June	72.7/0.42	67.6/1.52	64.3/1.78	65/2.46	68/1.88
July	74.8/2.94	70.1/4.18	68.7/3.51	68/3.42	64/1.7
August	*	71.0/1.38	68.1/3.34	69/1.20	71/0.09

*Data not available.

	YIELD DATA				
	Yield (bu/acre) / Test Weight / % Moisture				
SWQAC Code #	**Watertown**	**Casselton**	**Crookston**	**Minot**	**Williston**
1	67.9/61.5/12.9	67.9/59/13.9	39/59/13.5	**	51/61.23/**
2	*	67.1/61/12.9	*	**	52/60.6/**
3	61.6/58.9/12.7	66.6/59/12.5	70/60/12.88	**	*
4	70.8/59.1/12.5	81.9/58/12.9	62/58/12.78	**	55/58.85/**
5	66.2/60.1/13.1	62.6/58/13.0	51/61/12.88	**	54/60.02/**
6	86.3/54.6/12.4	73.6/57/12.3	71/58/12.57	**	53/57.51/**
7	63.7/59.0/12.4	56.9/56/12.0	62/59/12.88	**	49/58.24/**
8	*	68.0/57/12.3	*	**	51/57.8/**
Site Totals	**6**	**8**	**6**	**8**	**7**

*Not increased at this site.
** Data not available

Climate, Disease, and Field Conditions

Notes on production related to climate condition, diseases (scab, etc.), and field conditions that could affect grain quality.

	Watertown	Casselton	Crookston	Minot	Williston
At Planting	Very good plant conditions.	Very dry conditions at planting.	Started out with adequate moisture for emergence.	Good planting conditions.	Planted with a 10” spacing hoe drill. Side-banded 75 lbs/A of MicroEssentials fertilizer (12·40·0·10·1)
During Growth	Good moisture in April and the first half of May. Turning very dry the last half of May and June.	Good growing conditions for wheat. Timely rains during the season.	On the last day of May – 4 ½ inches of rain.	Good growing conditions.	Applied herbicide and fungicide at 5 leaf (Supremacy, Parity, and Tilt)
At Flowering	Very dry. Very little rainfall. Very low humidity.	Mostly dry, very little scab pressure.	Normal weather conditions.	No issues to report.	Applied fungicide Prosaro (8 oz/A)
During Maturation	Dry conditions early July. Decent rain last half of July.	Warm, dry temperatures.	Normal weather conditions.	Generally warm and dry.	Hot and dry.
At Harvest	Dry conditions. Fast drydown at harvest.	Occasional spotty, small rains, but overall good harvest conditions	No lodging present at harvest but SWQAC #1 was thin stands at east end; may be due to excess water. This will show in the yield of #1.	Good harvest conditions.	No lodging.

Description of 2016 Hard Spring Wheat Lines

SWQAC #2 – ND825

ND825 is an experimental hard red spring wheat line developed by the North Dakota State University spring wheat breeding program. ND825 was selected from the cross ND2849/ND721//ND735/3/Glenn. ND825 is an awned, medium height variety with plant height similar to Faller. It is early-medium maturing, with heading dates similar to Barlow. It has good straw strength and resists lodging, as good or better than Glenn, and Bolles. ND825 has shown excellent test weight and grain protein, with good yield potential, similar to Glenn. ND825 is moderately resistant to stem rust, and is moderately susceptible to races of leaf rust virulent to *Lr*21. It has excellent resistance to Fusarium head blight, similar to Glenn.

SWQAC #3 – Boost

Boost is a hard red spring wheat cultivar developed and released in 2015 by the South Dakota Agricultural Experiment Station. It was derived as a single spike from within an F_4 population (SD3900/FN1705-146/BRICK) that was originally created in fall 2005. During early generation observation, the population was tested as 28045 and then renamed as SD4299 with its placement into the 2010 South Dakota State University Preliminary Yield Trial. Additionally, Boost was evaluated in the Spring Wheat Breeding program Advanced Yield Trial from 2011 through 2015, the Uniform Regional Spring Wheat Nursery during 2013 and 2014 as well as the South Dakota Crop Performance Testing trials from 2012 through 2015. United States Plant Variety Protection coverage will be sought.

Points of note associated with Boost include:

1. Good yield potential;
2. Moderate test weight;
3. Higher than average grain protein concentration;
4. Late heading date
5. Above average level of Fusarium head blight and bacterial leaf streak resistance;
6. Higher than average bread loaf volume.

SWQAC #4 – WB9653

WB9653, a hard red spring wheat variety, is known for its strong disease resistance package, offering excellent resistance to leaf rust and very good resistance to yellow (stripe) rust and Fusarium head blight (scab). This variety also provides excellent yield potential and test weight along with very good standability.

SWQAC #5 – MN10261-1

MN10261-1 (Glenn/Sabin) is mid-maturity hard red spring wheat that has relatively high grain yield and protein and has good overall disease resistance, including Fusarium head blight. MN10261-1 ranked 2nd out of 39 entries in the 2013 Uniform Regional Nursery trial, a rarity for a higher protein line. Therefore, this line seems to be widely adapted. Straw strength is above average. MN10261-1 is resistant to pre-harvest sprouting and has exhibited good end-use quality characteristics.

SWQAC #6 – WB9507

WB9507 is a hard red spring wheat variety that is very competitive in the market because of its excellent yield potential and very good protein content. This variety offers growers excellent resistance to tan spot and very good resistance to Fusarium head blight (scab). Other benefits of WB9507 include excellent emergence and tillering potential.

SWQAC #7 – Bolles

Bolles is a mid-late maturity hard red spring wheat with very high grain protein content, competitive grain yields, and good straw strength. The pedigree of Bolles is MN02268-1/MN01333-A-1. Bolles has excellent leaf rust resistance and moderate resistance to Fusarium head blight. Bolles is resistant to pre-harvest sprouting and has exhibited excellent end-use quality characteristics.

SWQAC #8 – SY Rustler

SY Rustler is a hard red spring wheat bred and developed by Syngenta Seeds, Inc.
SY Rustler has a pedigree of 99S0372-5/00S0132-10 and was tested under the experimental designation 05S0242-6. SY Rustler is adapted for the spring wheat growing areas of Northern Plains of the US. It has medium-early heading and good test weight. It is a short semi-dwarf, similar to SY Rowyn in height. It has good lodging tolerance, slightly stronger strawed than RB07. It is resistant to stem rust and moderately resistant to leaf rust. Tolerance to leaf spotting diseases has been intermediate. It is moderately susceptible to FHB. Protein levels have been medium, similar to SY Rowyn. Overall, breadmaking characteristics are acceptable.

Wheat Production Sites

SWQAC Code #	Entry	Source	Production Sites				
			Watertown	Casselton	Crookston	Minot	Williston
1	Glenn	NDSU	X	X	X	X	X
2	ND825	NDSU		X		X	X
3	Boost	SDSU	X	X	X	X	
4	WB9653	Westbred	X	X	X	X	X
5	MN10261-1	UMN	X	X	X	X	X
6	WB9507	Westbred	X	X	X	X	X
7	Bolles	UMN	X	X	X	X	X
8	SY Rustler	Syngenta		X		X	X

Grain Cleaning and Milling Procedures

Wheat (approximately 3 bu/line) was cleaned in a Carter-Day Bulldog seed cleaner that was equipped with two rotating indent cylinders (#24 – coarse; #16 – fine), a sizer cylinder (#5), vibrator, and air aspiration.

Cleaned wheat (110 lbs) was tempered to 16.5% moisture content and conditioned for approximately 20-24 hours before milling. Milling was performed on the Miag Multomat. Feed rate was set at 180 lbs/hour. Break rollers were adjusted to the following releases through a U.S. 16 S.S. sieve: first break – 30%; second break – 53%; and third break, clean-up – 66%.

Flour blending: Sixteen mill streams were selected among 23 streams based on cumulative ash curves and blended to long patent flour. Cumulative ash content was calculated based on product basis milling yield (14% moisture basis).

Milling streams blended to long patent flour – 1st Break, 2nd Break I, Break Dust, Sizing I, 2nd Break II, 3rd Break, Sizing II, 5th Break, 4th Break, 1st Middlings, 2nd Middlings, 3rd Middlings, 4th Middlings, 6th Middlings, Tail Flour, and Tail Cyclone Flour.

Methods of Analysis

- Wheat Market Value Score;
- DON levels - analyzed by NDSU, Department of Plant Sciences (gas chromatography method, J. AOAC Int. 79:472, 1996);
- Test weight (AACCI Method 55-10);
- Wheat and flour protein (AACCI Method 46-30 – combustion method);
- Wheat and flour ash (AACCI Method 08-01);
- Kernel Size (Sieving according to USDA-ARS WQL);
- Wheat and flour Falling Number (Perten Falling Number System);
- Single kernel characteristics (Perten Single Kernel Characterization System – SKCS):
    - Mean and standard deviation values were calculated from 300 kernels.
- Vitreous kernel content (DHV analysis by FGIS Grain Testing Service, Fargo, ND);
- Flour color (Minolta Colorimeter, *L** and *b** values);
- Polymeric to monomeric protein ratio (TPP/TMP), insoluble polymeric protein (IPP), and high-molecular weight glutenin composition (HMW-GS) – analyzed by Michael

Tilley/Sushma Prakash, USDA-ARS-CGAHR, Manhattan, KS (Cereal Chem. 75:374, 1998; J. Cereal Sci. 18:23, 1993; J. Cereal Sci. 46:157, 2007);

- Flour extraction: % Total product basis (TPB), % tempered wheat basis (TWB), and estimated pounds patent flour/bushel wheat;

- Farinograph (AACCI Method 54-21, Brabender Computerized Farinograph system with 50 g mixing bowl):

    - Water absorption: 500 BU and 14% mb;

    - Arrival time: time required for the top of the curve to reach the 500 BU line after addition of water;

    - Peak time: time between addition of water and development of the maximum consistency of the dough;

    - Stability: difference in time between the point at which the top of the curve first intercepts the 500 BU line (arrival time) and the point at which the top of the curve leaves the 500 BU line (departure time);

    - Mechanical Tolerance Index (MTI): difference in BU between the top of the curve at the peak and the top of the curve measured 5 minutes after the peak is reached;

    - Time to Breakdown (TTB): time from the start of mixing to the time at which consistency has decreased 30 BU from the peak point.

- Mixograph (AACCI Method 54-40A, mixograph with 35 g mixing bowl):

    - Water absorption (14% mb) = Protein (14% mb) x 1.5 + 43.6
    (The Mixograph Handbook, 1997).

- Extensograph (AACCI Method 54-10 with modifications):

    - Flour (100 g, 14% mb), 2.0% NaCl (U.S.P.), and water (farinograph absorption - 2%) were mixed to optimum development in a pin mixer (National Mfg. Co.);

    - Dough was scaled to 150 g, rounded, molded, placed in extensograph holders, and rested for 45, 90, and 135 minutes at 30°C and 78% relative humidity. The dough was then stretched as described in the procedure referenced above. For conversion purposes, 500 g = 400 BU;

    - Extensograph parameters:

        - Energy (cm^2): area under the curve;

        - Resistance to extension (BU): height of the curve 50 mm after the beginning of torque increase;

- Extensibility (cm): total length of the curve at the baseline;
- Maximum resistance (BU): maximum curve height;
- Ratio number: quotient of resistance to extension and extensibility;
- Ratio number (max.): quotient of maximum resistance and extensibility.

Test Bake Procedures

Samples of flour were shipped to cooperators for evaluation of baking properties. The flour had been uniformly malted to a falling number of approximately 250 seconds. Bleach was not added to the flour. Each cooperator test baked the flour according to their standard method using straight dough, sponge and dough, or other test bake methods. Cooperator data were returned to the WQL for compilation of results.

Bake Cooperators

- ADM Milling – Overland Park, KS;
- Ardent Mills – Denver, CO;
- Bay State Milling – Winona, MN;
- General Mills – Minneapolis, MN;
- Grain Craft – Wichita, KS;
- Limagrain Cereal Seeds LLC – Fort Collins, CO;
- North Dakota Mill – Grand Forks, ND;
- North Dakota State University, Department of Plant Sciences – Fargo, ND;
- USDA-ARS Hard Red Spring & Durum Wheat Quality Laboratory – Fargo, ND;
- USDA-ARS Hard Winter Wheat Quality Laboratory – Manhattan, KS;
- USDA-ARS Western Wheat Quality Laboratory – Pullman, WA;
- Wheat Marketing Center – Portland, OR.

The Wheat Quality Council acknowledges the dedication and sacrifice of time by those individuals who are involved in test baking hard spring wheat samples. Your efforts are well appreciated by wheat breeders, commercial flour millers and bakers, and wheat marketing personnel who inspire the overall industry to improve the quality of U.S. wheat.

Quality Data of 2016 Hard Spring Wheat Lines

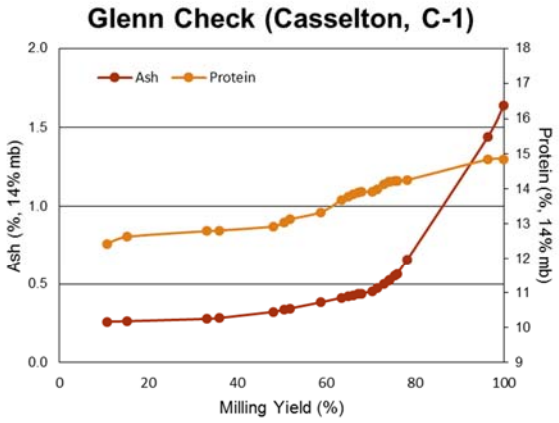
SWQAC #2 – ND825

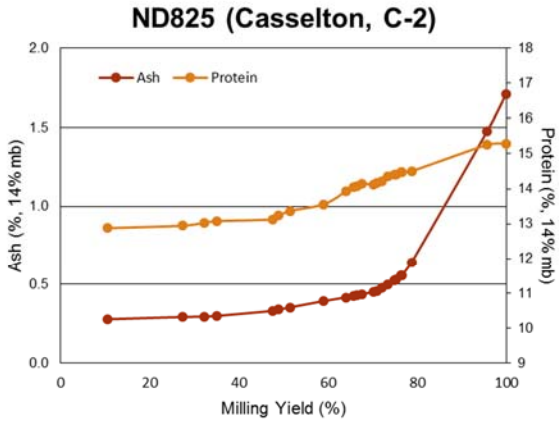
		Casselton		Minot		Williston	
		Glenn		Glenn		Glenn	
	Quality Trait	C-1	C-2	M-1	M-2	W-1	W-2
	I. USDA-ARS WQL Data						
1	Wheat Protein (%, 12% mb)	15.0	15.4	13.7	16.0	14.0	16.6
2	Flour Protein (%, 14% mb)	14.1	14.5	12.6	15.1	13.5	15.8
3	Market Value (Score 1-6)	4.1	4.4	4.7	5.4	4.6	5.5
4	Market Value (Score 1-10)	10.0	10.0	10.0	9.4	10.0	9.4
5	DON (ppm)	nd	nd	nd	0.12	nd	nd
6	Test Weight (lb/bu)	61.8	62.1	64.1	63.7	64.6	63.9
7	1000 Kernel Weight (g)	27.0	28.7	33.6	34.0	30.5	31.2
8	Kernel Size, % Large	34	53	72	72	48	53
9	Kernel Size, % Small	17	13	6	7	11	8
10	Wheat Moisture (%)	10.7	10.8	10.0	10.8	9.7	9.6
11	Wheat Ash (%, 14% mb)	1.68	1.63	1.39	1.47	1.44	1.37
12	Wheat Falling Number (sec)	407	409	419	426	427	432
13	SKCS Hardness Index	77.6	78.7	69.4	69.2	78.5	73.9
14	Vitreous Kernels (%)	87.5	93.4	81.4	98.0	98.6	99.0
	Flour Extraction (%)						
15	Tempered Wheat Basis (%)	71.2	72.2	72.1	70.5	70.9	72.4
16	Total Product Basis (%)	73.0	73.5	73.6	72.6	72.3	73.5
17	Flour/Bu Wheat (lbs)	44.2	45.3	47.0	44.8	46.9	46.5
	Flour Quality						
18	Flour Color Brightness (*L**)	89.4	89.4	90.0	89.6	90.0	90.0
19	Flour Color Yellowness (*b**)	8.6	9.4	9.0	8.8	8.6	9.3
20	Flour Moisture (%)	13.2	13.6	12.8	12.8	13.3	13.0
21	Flour Ash (%, 14% mb)	0.52	0.48	0.44	0.44	0.44	0.41
22	Flour Falling Number (Malted) (sec)	254	252	265	255	251	243
	Farinograph						
23	Water Absorption (%, 500 BU)	64.0	64.6	65.1	65.4	64.0	66.0
24	Water Absorption (%, 14% mb)	63.0	64.0	63.8	63.7	62.5	64.4
25	Arrival Time (min)	2.2	3.6	3.4	4.4	2.4	4.9
26	Peak Time (min)	5.0	6.9	8.0	7.5	7.0	8.5
27	Dough Stability (min)	8.9	8.6	9.7	6.9	13.6	10.3
28	Mixing Tolerance Index (MTI) (BU)	21.0	33.0	27.0	34.0	15.0	20.0
29	Time To Breakdown (TTB) (min)	11.0	11.7	12.6	11.5	14.6	14.5
	II. Cooperator Results						
30	Bake Absorption (Average %)	66.1	66.5	65.9	66.9	65.6	67.7
31	Loaf Volume (% of Check)		101.8		104.5		108.9

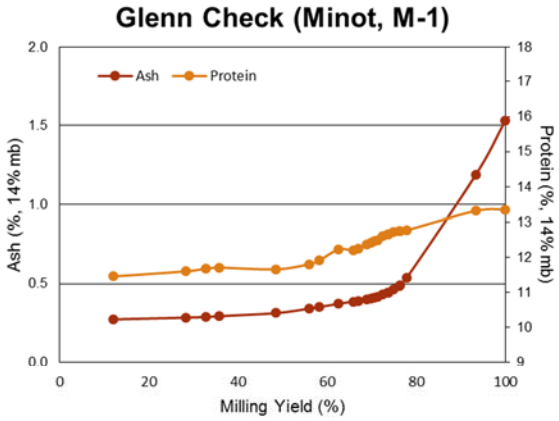
SWQAC #2 – ND825

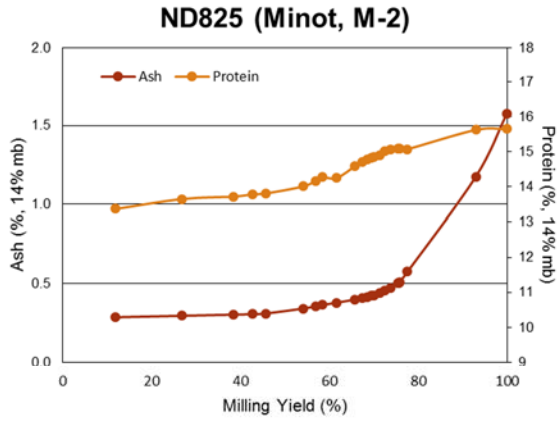
	Quality Trait	Casselton Glenn C-1	Casselton Glenn C-2	Minot Glenn M-1	Minot Glenn M-2	Williston Glenn W-1	Williston Glenn W-2
	II. Cooperator Results						
32	**Mixing Requirement** 9 = Very Long 7 = Long 5 = Medium 3 = Short 1 = Very Short	7.2	5.3	5.2	4.1	6.6	5.4
33	**Dough Characteristics** 9 = Bucky – Tough 7 = Strong – Elastic 5 = Medium – Pliable 3 = Mellow – Very Pliable 1 = Weak – Short or Sticky	7.1	5.9	5.8	5.0	7.1	6.2
34	**Mixing Tolerance** 9 = Much More Tolerance Than Check 7 = More Tolerance Than Check 5 = Tolerance Equivalent To Check 3 = Less Tolerance Than Check 1 = Much Less Tolerance Than Check		4.2		3.6		4.4
35	**Internal Crumb Color** 9 = Much Brighter Than Check 7 = Brighter Than Check 5 = Equivalent To Check 3 = Poorer Than Check 1 = Much Poorer Than Check		5.2		5.3		5.3
36	**Internal Grain and Texture** 9 = Much Better Than Check 7 = Better Than Check 5 = Equivalent To Check 3 = Poorer Than Check 1 = Much Poorer Than Check		5.2		5.8		5.3
	III. Cooperator Evaluation						
	Quality Traits 1-2: Protein 9 = Much Better Than Check 7 = Better Than Check 5 = Equivalent To Check 3 = Poorer Than Check 1 = Much Poorer Than Check		5.5		7.2		7.3
	Quality Traits 3-22: Milling 9 = Much Better Than Check 7 = Better Than Check 5 = Equivalent To Check 3 = Poorer Than Check 1 = Much Poorer Than Check		5.9		4.3		5.6
	Quality Traits 23-36: Baking 9 = Much Better Than Check 7 = Better Than Check 5 = Equivalent To Check 3 = Poorer Than Check 1 = Much Poorer Than Check		4.8		5.7		6.1
	Quality Traits 1-36: Overall Comparison 9 = Much Better Than Check 7 = Better Than Check 5 = Equivalent To Check 3 = Poorer Than Check 1 = Much Poorer Than Check		5.5		5.4		6.2

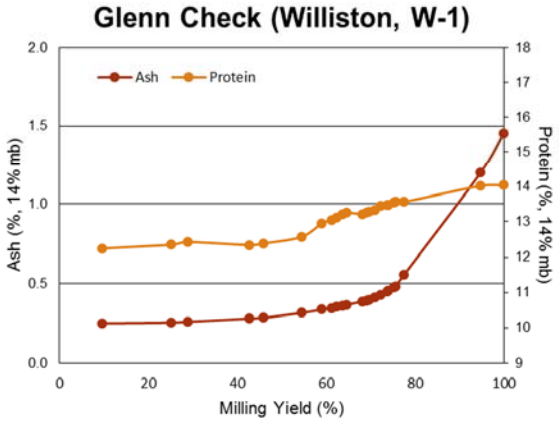
Cumulative Ash and Protein Curves

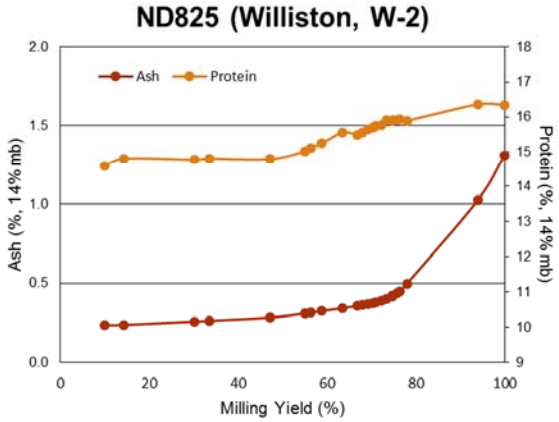






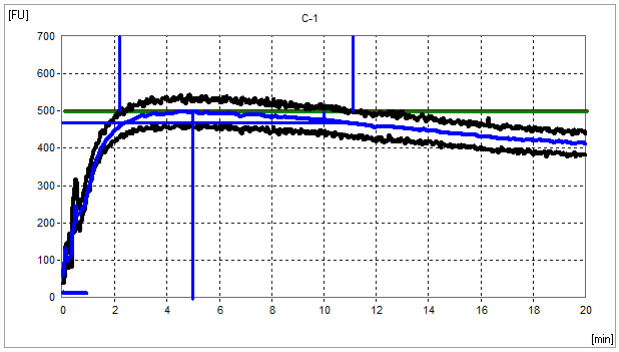




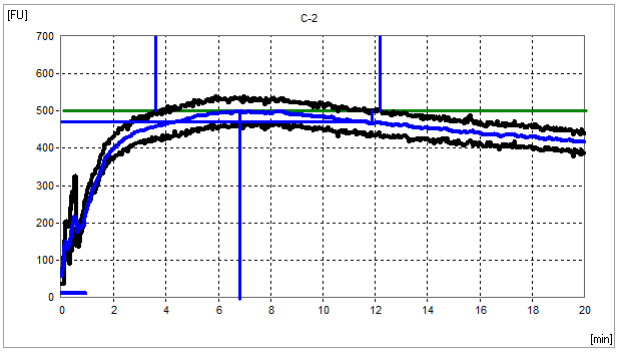


Farinograms

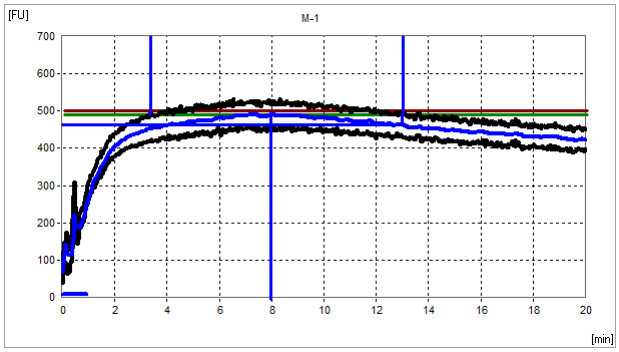
Glenn Check (Casselton, C-1)



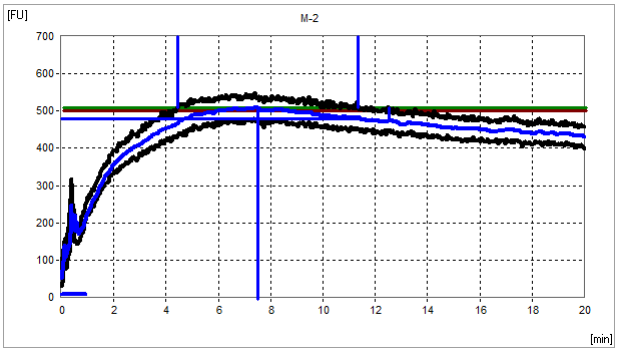
Glenn Check (Casselton, C-2)



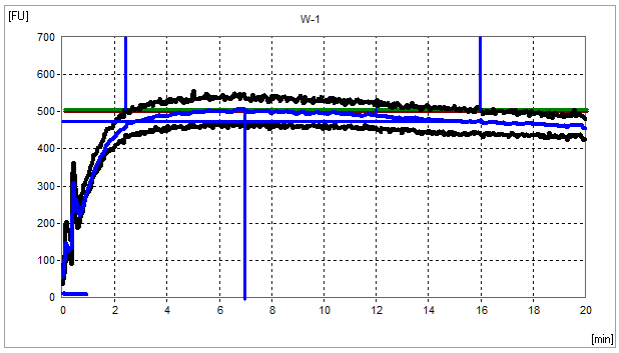
Glenn Check (Minot, M-1)



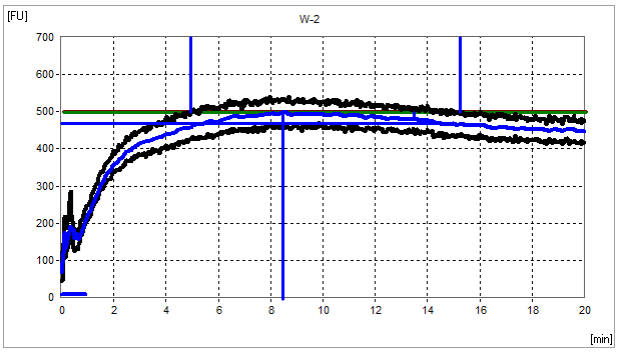
ND825 (Minot, M-2)



Glenn Check (Williston, W-1)

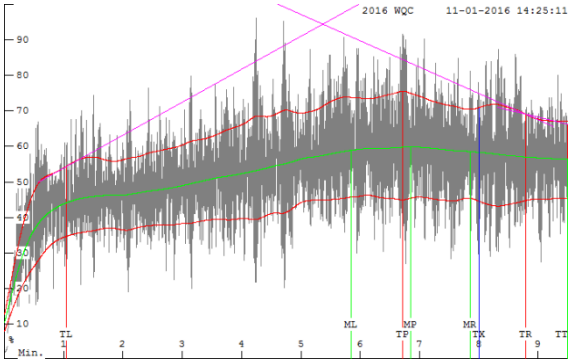


ND825 (Williston, W-2)



Mixograms

Glenn Check (Casselton, C-1)



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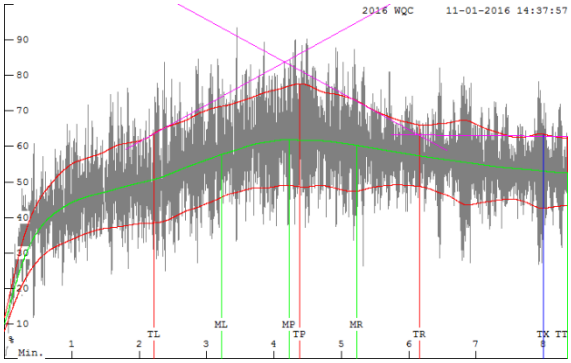
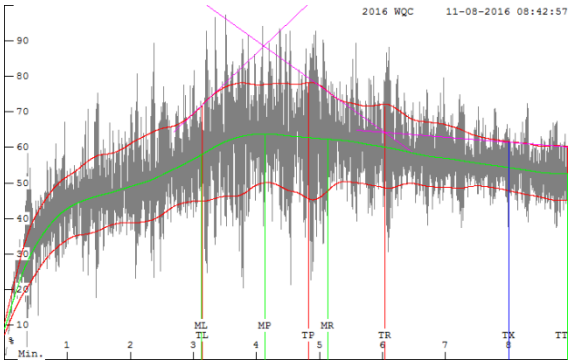


Glenn Check (Minot, M-1)



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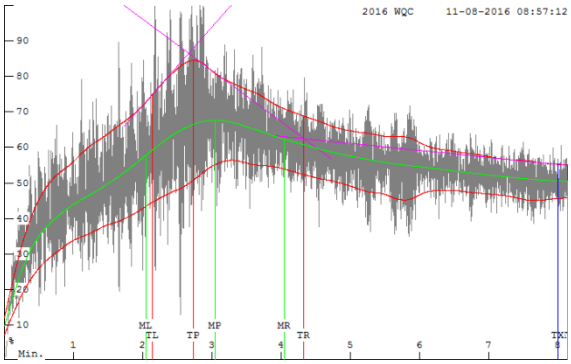
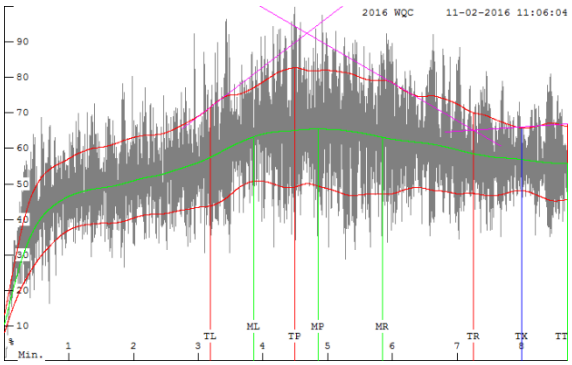


Glenn Check (Williston, W-1)



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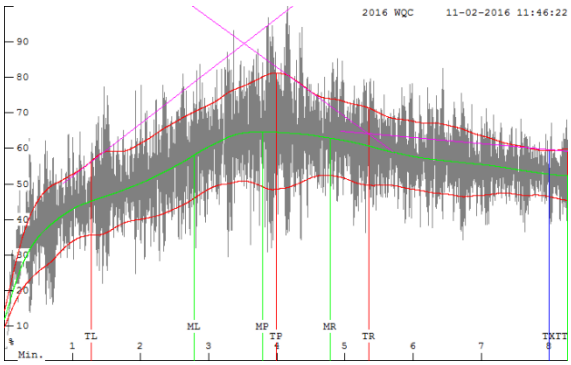
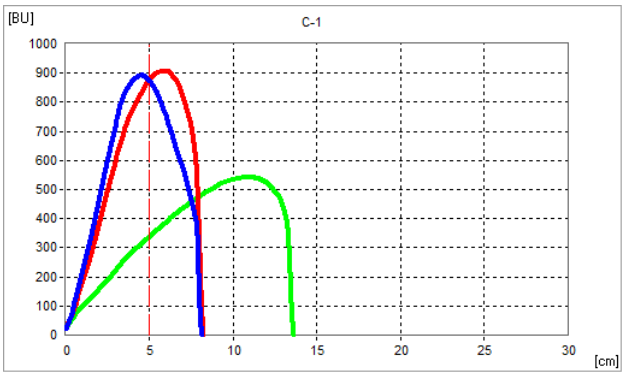
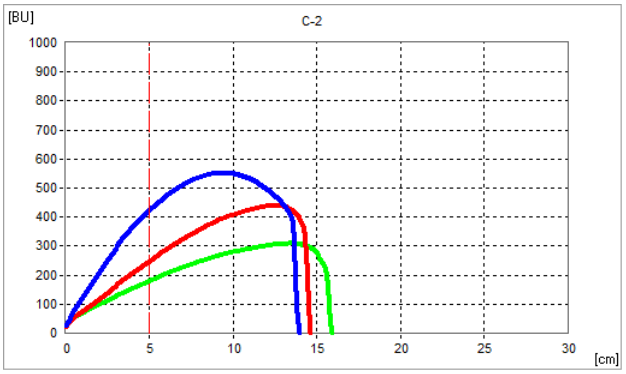


Extensograms

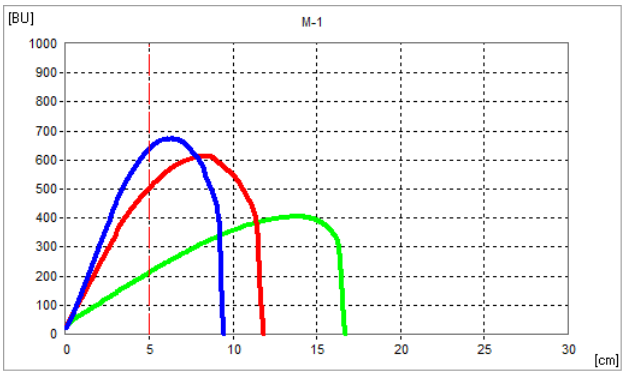
Glenn Check (Casselton, C-1)



ND825 (Casselton, C-2)



Glenn Check (Minot, M-1)



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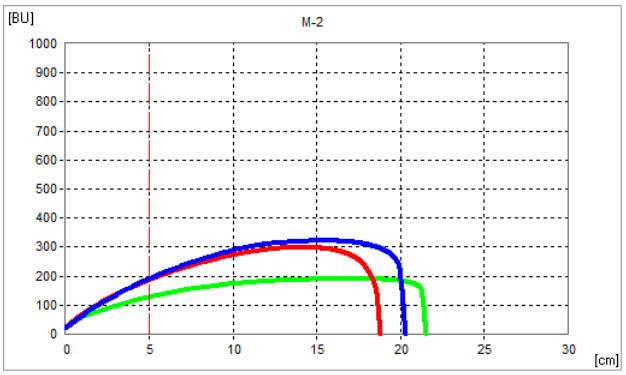
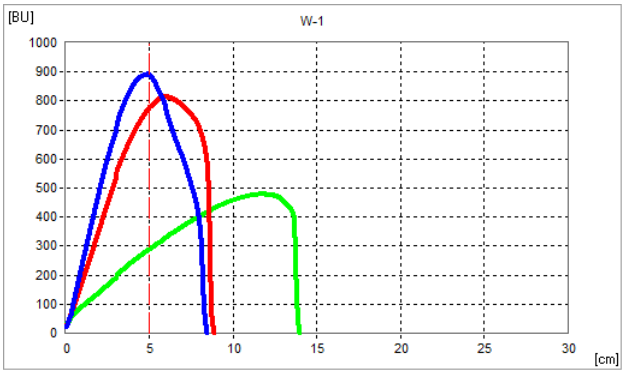
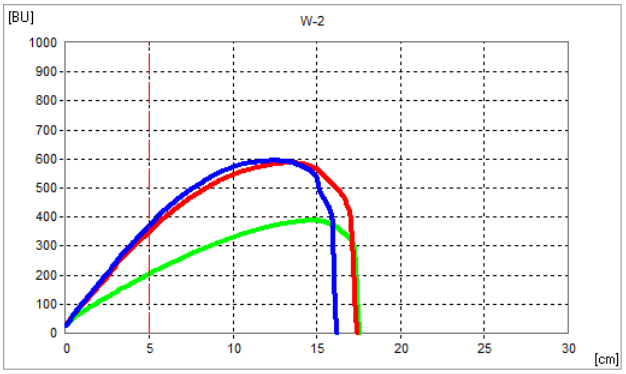


Glenn Check (Williston, W-1)



ND825 (Williston, W-2)



45 min; 90 min; 135 min

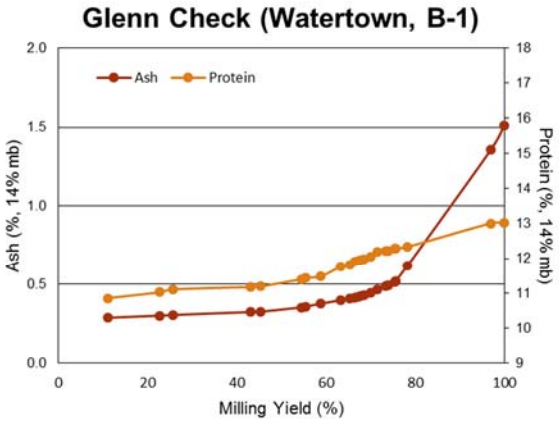
SWQAC #3 – Boost

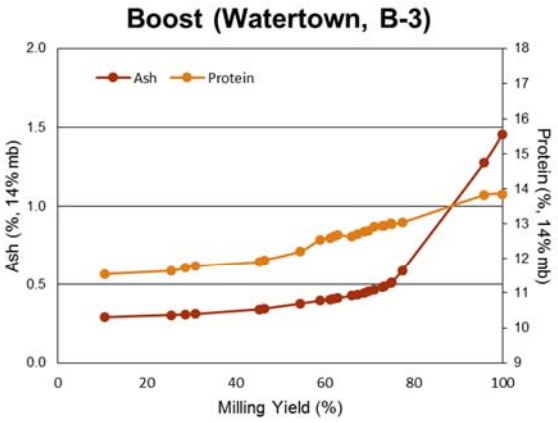
		Watertown		Casselton		Crookston		Minot	
		Glenn		Glenn		Glenn		Glenn	
	Quality Trait	B-1	B-3	C-1	C-3	K-1	K-3	M-1	M-3
	I. USDA-ARS WQL Data								
1	Wheat Protein (%, 12% mb)	13.0	13.9	15.0	15.6	13.3	13.9	13.7	15.9
2	Flour Protein (%, 14% mb)	12.1	13.0	14.1	14.7	12.5	13.2	12.6	14.9
3	Market Value (Score 1-6)	4.2	4.2	4.1	4.2	4.2	4.5	4.7	5.1
4	Market Value (Score 1-10)	10.0	8.8	10.0	9.6	10.0	8.8	10.0	8.6
5	DON (ppm)	nd	nd	nd	nd	nd	nd	nd	0.25
6	Test Weight (lb/bu)	64.4	60.4	61.8	59.9	64.2	61.0	64.1	61.2
7	1000 Kernel Weight (g)	32.3	31.9	27.0	29.7	30.9	34.0	33.6	35.2
8	Kernel Size, % Large	61	57	34	60	54	69	72	80
9	Kernel Size, % Small	10	11	17	9	8	6	6	5
10	Wheat Moisture (%)	10.7	10.4	10.7	10.5	10.6	10.6	10.0	11.5
11	Wheat Ash (%, 14% mb)	1.48	1.42	1.68	1.61	1.41	1.27	1.39	1.46
12	Wheat Falling Number (sec)	406	432	407	427	400	474	419	445
13	SKCS Hardness Index	82.7	76.9	77.6	75.6	79.6	71.4	69.4	76.1
14	Vitreous Kernels (%)	66.0	71.3	87.5	75.0	54.1	39.1	81.4	91.5
	Flour Extraction (%)								
15	Tempered Wheat Basis (%)	70.0	70.0	71.2	70.7	72.5	73.4	72.1	72.4
16	Total Product Basis (%)	71.5	71.3	73.0	72.6	74.0	74.4	73.6	74.2
17	Flour/Bu Wheat (lbs)	45.6	42.9	44.2	42.9	46.9	45.5	47.0	44.4
	Flour Quality								
18	Flour Color Brightness (*L**)	90.0	89.8	89.4	89.3	89.8	89.8	90.0	89.3
19	Flour Color Yellowness (*b**)	8.8	10.0	8.6	9.9	8.5	9.7	9.0	9.4
20	Flour Moisture (%)	13.7	13.8	13.2	13.9	13.9	13.8	12.8	12.6
21	Flour Ash (%, 14% mb)	0.48	0.45	0.52	0.51	0.47	0.40	0.44	0.48
22	Flour Falling Number (Malted) (sec)	251	264	254	262	255	258	265	247
	Farinograph								
23	Water Absorption (%, 500 BU)	63.7	66.0	64.0	65.9	63.1	62.5	65.1	67.3
24	Water Absorption (%, 14% mb)	63.5	65.9	63.0	65.4	62.3	61.7	63.8	65.5
25	Arrival Time (min)	2.0	2.3	2.2	4.3	1.6	2.8	3.4	4.4
26	Peak Time (min)	3.5	6.5	5.0	7.4	3.4	7.0	8.0	7.5
27	Dough Stability (min)	10.5	9.6	8.9	8.4	10.3	12.4	9.7	8.1
28	Mixing Tolerance Index (MTI) (BU)	11.0	28.0	21.0	31.0	20.0	16.0	27.0	29.0
29	Time To Breakdown (TTB) (min)	12.2	12.0	11.0	12.3	10.3	14.7	12.6	12.3
	II. Cooperator Results								
30	Bake Absorption (Average %)	65.1	66.7	66.1	67.4	64.7	64.5	65.9	67.6
31	Loaf Volume (% of Check)		103.1		103.7		105.6		104.1

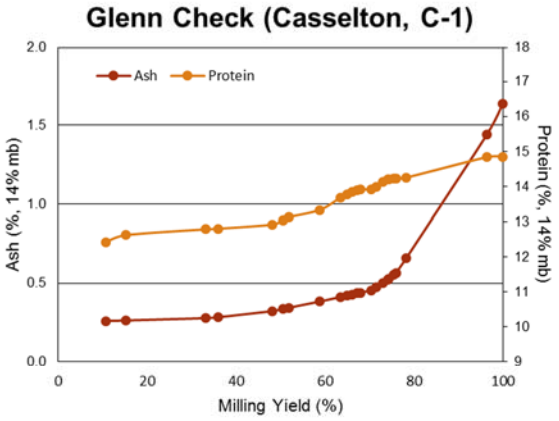
SWQAC #3 – Boost

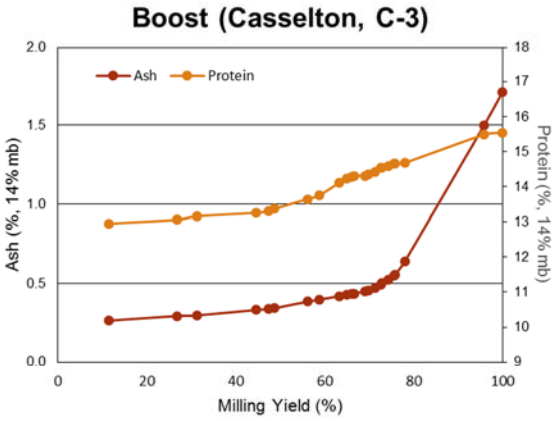
	Quality Trait	Watertown Glenn B-1	Watertown Glenn B-3	Casselton Glenn C-1	Casselton Glenn C-3	Crookston Glenn K-1	Crookston Glenn K-3	Minot Glenn M-1	Minot Glenn M-3
	II. Cooperator Results								
32	**Mixing Requirement** 9 = Very Long 7 = Long 5 = Medium 3 = Short 1 = Very Short	6.4	6.7	7.2	5.9	6.7	6.8	5.2	4.3
33	**Dough Characteristics** 9 = Bucky – Tough 7 = Strong – Elastic 5 = Medium – Pliable 3 = Mellow – Very Pliable 1 = Weak – Short or Sticky	6.7	6.3	7.1	6.3	6.8	6.5	5.8	5.3
34	**Mixing Tolerance** 9 = Much More Tolerance Than Check 7 = More Tolerance Than Check 5 = Tolerance Equivalent To Check 3 = Less Tolerance Than Check 1 = Much Less Tolerance Than Check		4.9		4.6		5.8		4.4
35	**Internal Crumb Color** 9 = Much Brighter Than Check 7 = Brighter Than Check 5 = Equivalent To Check 3 = Poorer Than Check 1 = Much Poorer Than Check		5.1		5.3		5.2		5.2
36	**Internal Grain and Texture** 9 = Much Better Than Check 7 = Better Than Check 5 = Equivalent To Check 3 = Poorer Than Check 1 = Much Poorer Than Check		5.1		5.2		6.1		5.6
	III. Cooperator Evaluation								
	Quality Traits 1-2: Protein 9 = Much Better Than Check 7 = Better Than Check 5 = Equivalent To Check 3 = Poorer Than Check 1 = Much Poorer Than Check		6.8		5.9		6.2		7.2
	Quality Traits 3-22: Milling 9 = Much Better Than Check 7 = Better Than Check 5 = Equivalent To Check 3 = Poorer Than Check 1 = Much Poorer Than Check		4.3		4.7		5.0		4.4
	Quality Traits 23-36: Baking 9 = Much Better Than Check 7 = Better Than Check 5 = Equivalent To Check 3 = Poorer Than Check 1 = Much Poorer Than Check		6.0		5.7		6.0		5.7
	Quality Traits 1-36: Overall Comparison 9 = Much Better Than Check 7 = Better Than Check 5 = Equivalent To Check 3 = Poorer Than Check 1 = Much Poorer Than Check		5.7		5.5		6.2		5.6

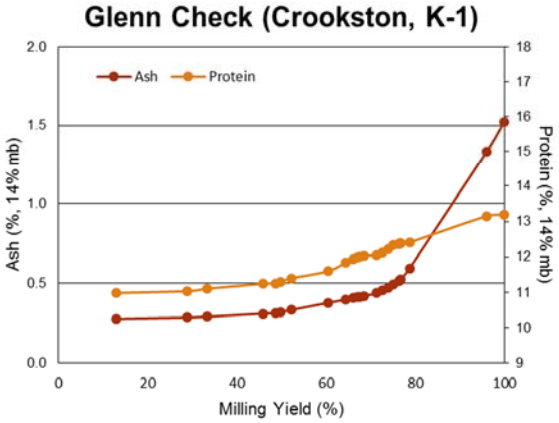
Cumulative Ash and Protein Curves

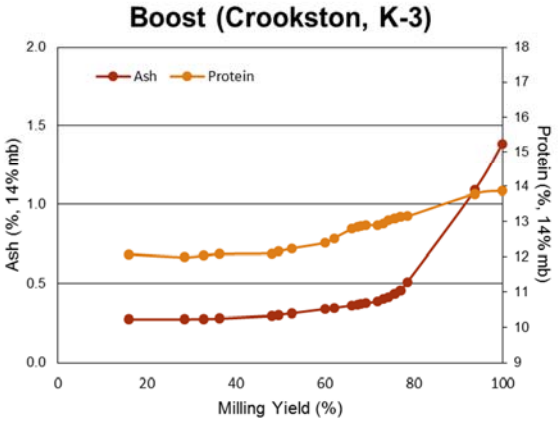


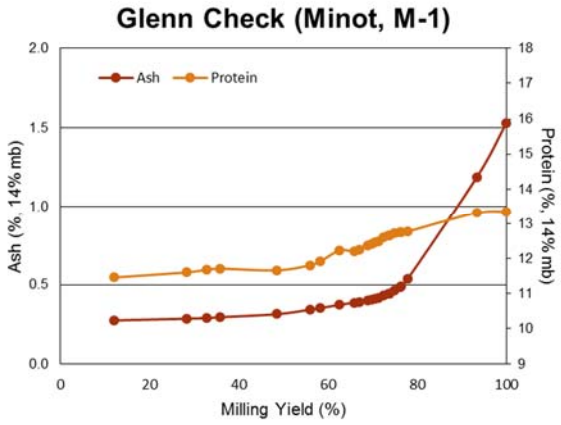


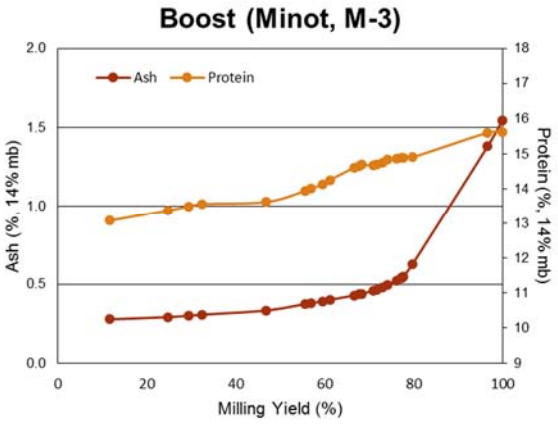






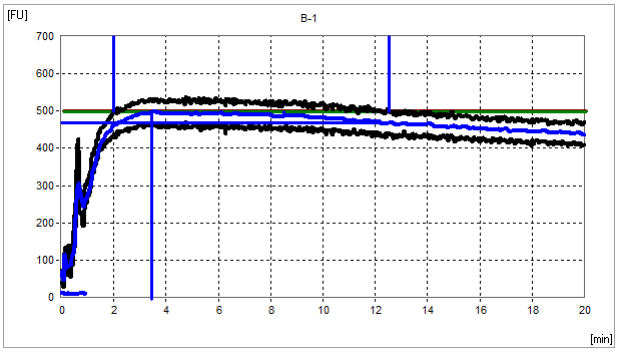



Glenn Check (Minot, M-1)
Ash
Protein
Ash (%, 14% mb)
Protein (%, 14% mb)
Milling Yield (%)
2.0
1.5
1.0
0.5
0.0
18
17
16
15
14
13
12
11
10
9
0
20
40
60
80
100

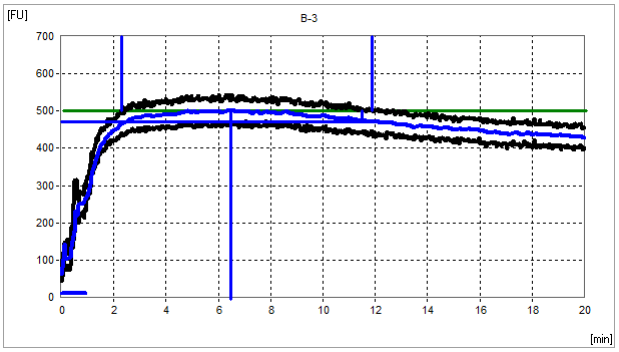

Boost (Minot, M-3)
Ash
Protein
Ash (%, 14% mb)
Protein (%, 14% mb)
Milling Yield (%)
2.0
1.5
1.0
0.5
0.0
18
17
16
15
14
13
12
11
10
9
0
20
40
60
80
100

Farinograms

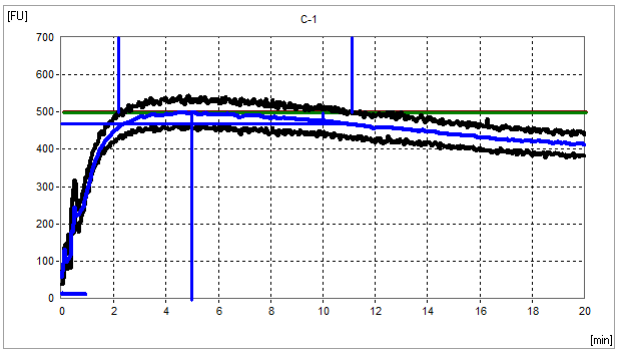
Glenn Check (Watertown, B-1)



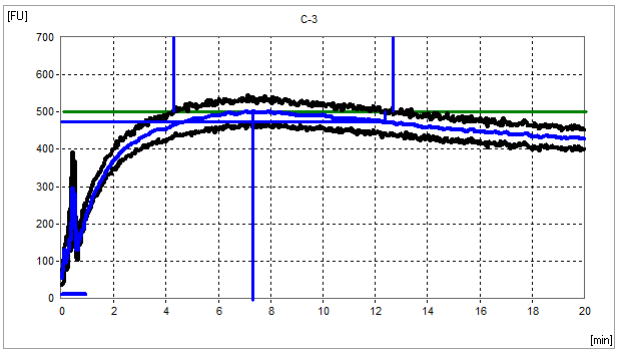
Boost (Watertown, B-3)



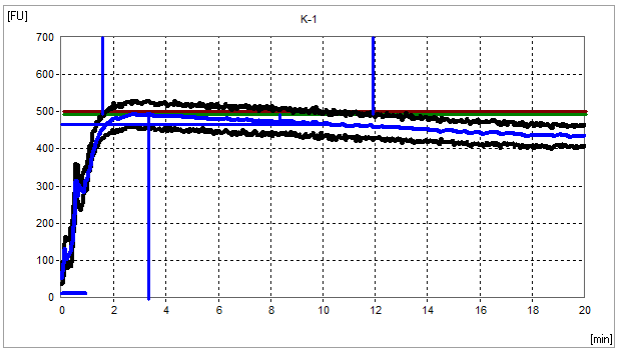
Glenn Check (Casselton, C-1)



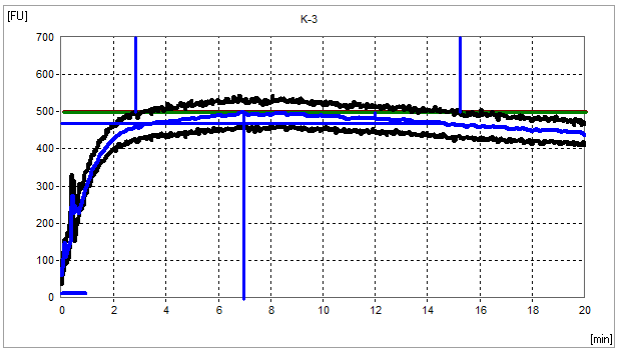
Boost (Casselton, C-3)



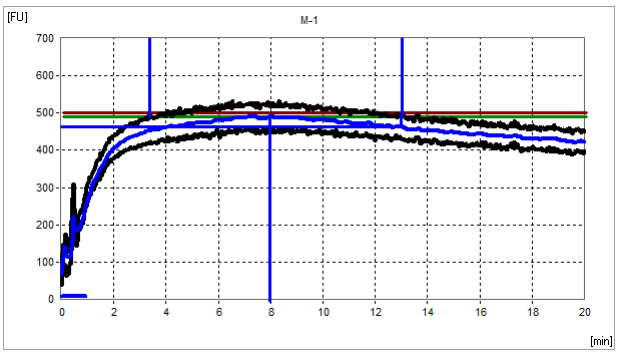
Glenn Check (Crookston, K-1)



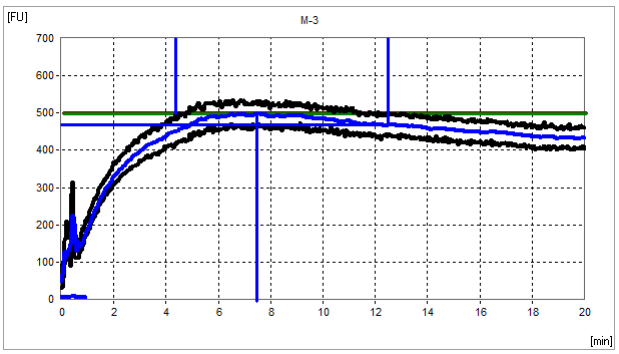
Boost (Crookston, K-3)



Glenn Check (Minot, M-1)

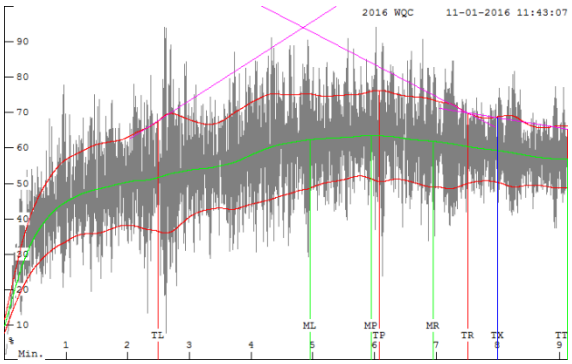


Boost (Minot, M-3)

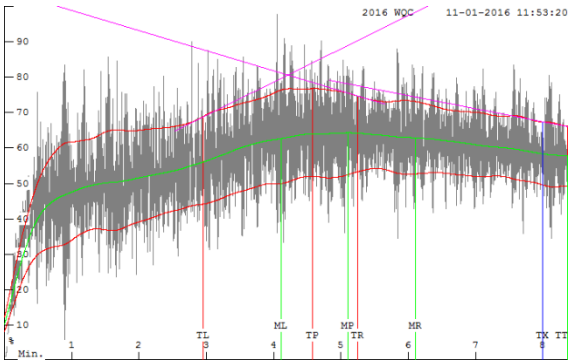


Mixograms

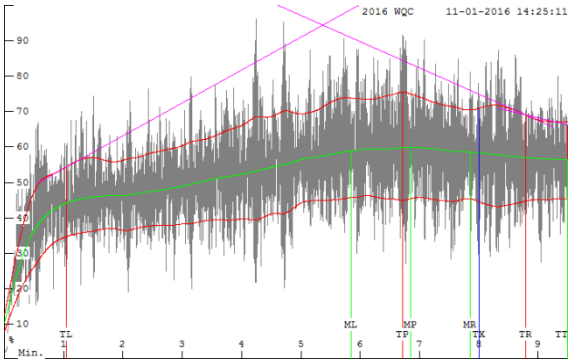
Glenn Check (Watertown, B-1)



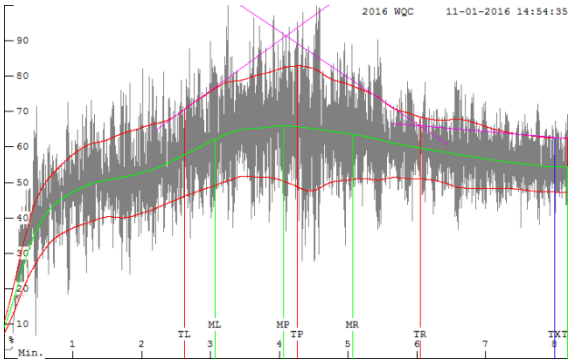
Boost (Watertown, B-3)



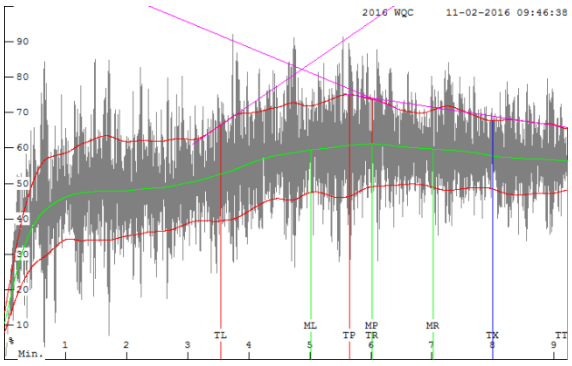
Glenn Check (Casselton, C-1)



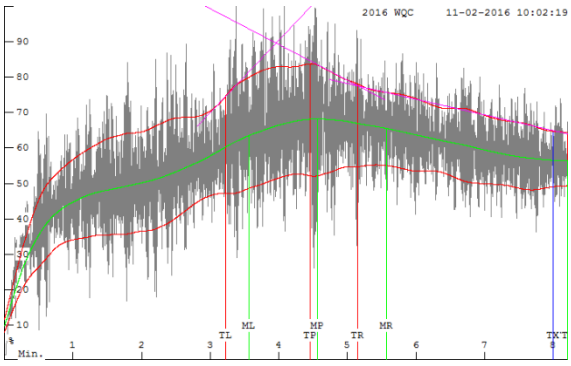
Boost (Casselton, C-3)



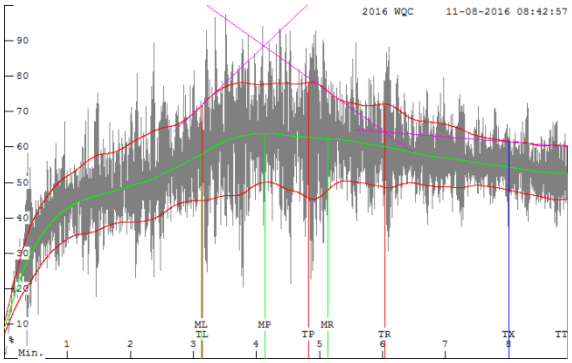
Glenn Check (Crookston, K-1)



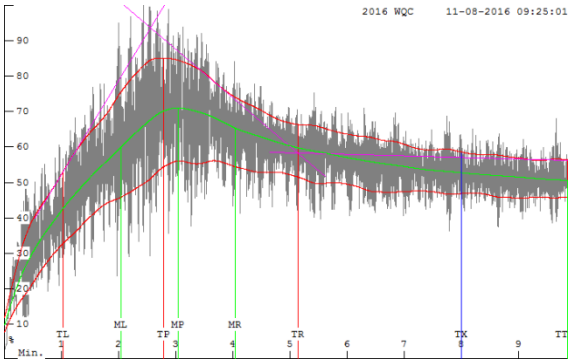
Boost (Crookston, K-3)



Glenn Check (Minot, M-1)

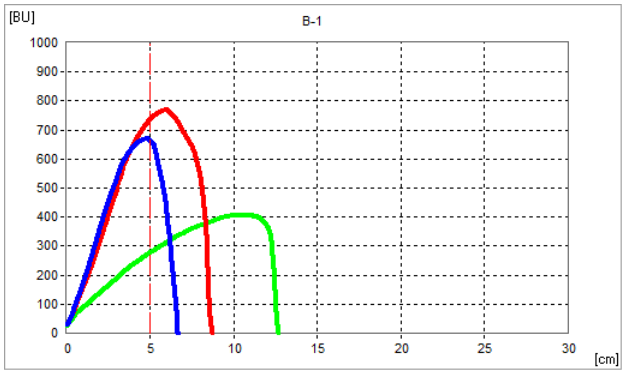


Boost (Minot, M-3)

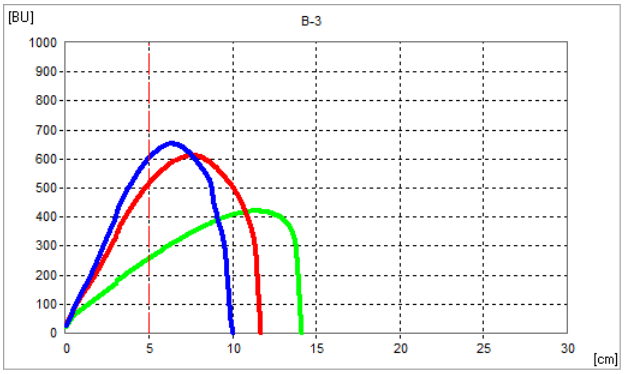


Extensograms

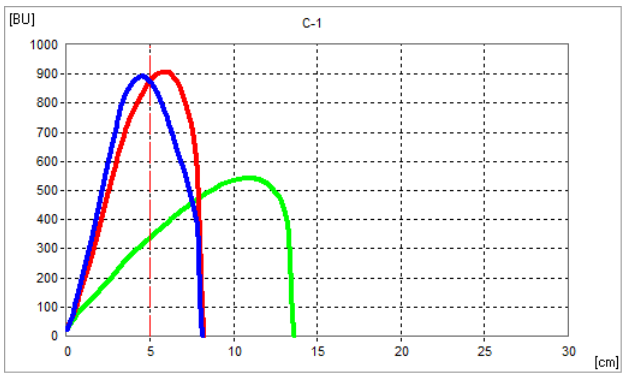
Glenn Check (Watertown, B-1)



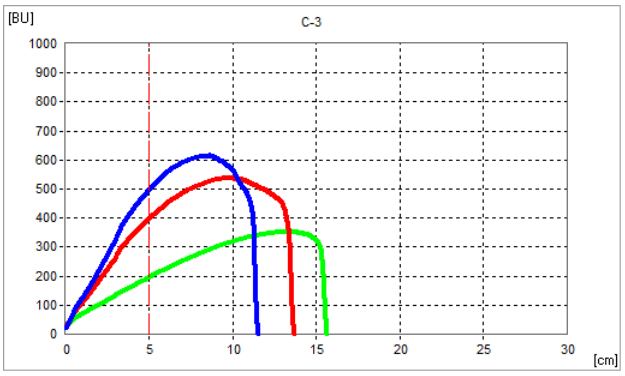
Boost (Watertown, B-3)



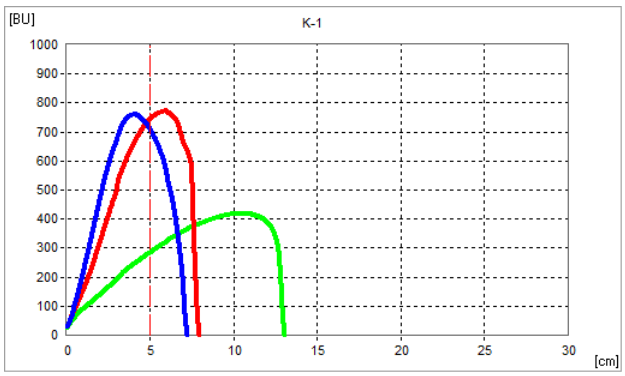
Glenn Check (Casselton, C-1)



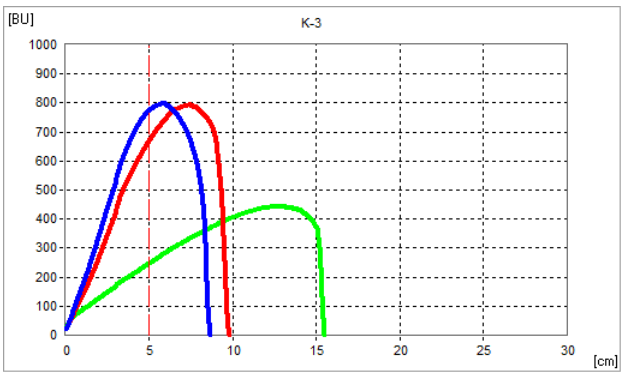
Boost (Casselton, C-3)



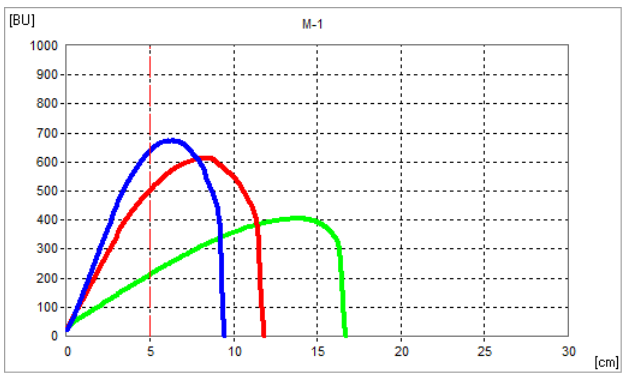
Glenn Check (Crookston, K-1)



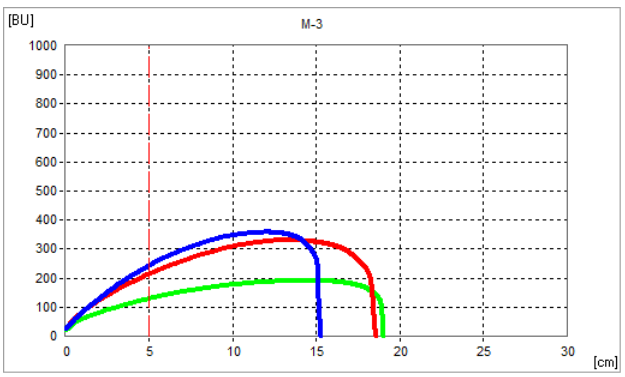
Boost (Crookston, K-3)



Glenn Check (Minot, M-1)



Boost (Minot, M-3)



45 min; 90 min; 135 min

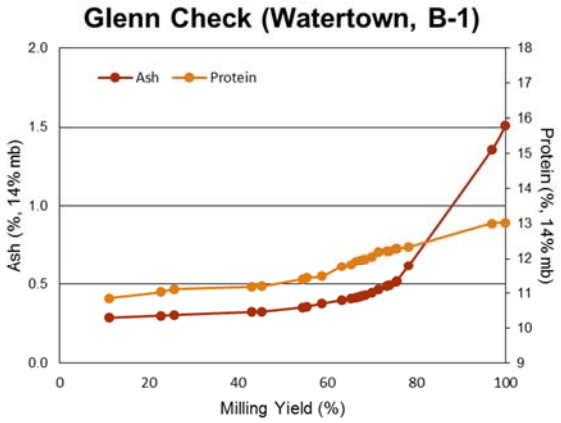
SWQAC #4 – WB9653

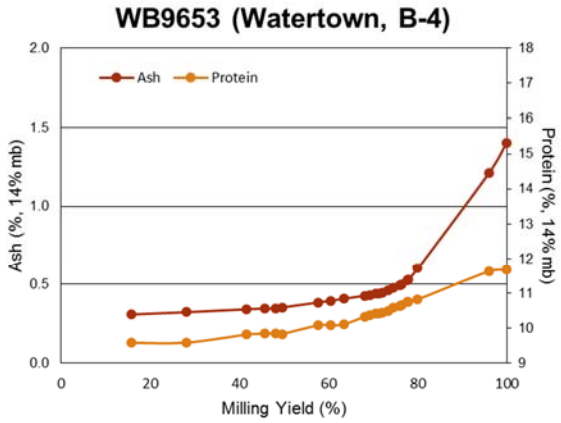
		Watertown		Casselton		Crookston		Minot		Williston	
		Glenn		Glenn		Glenn		Glenn		Glenn	
	Quality Trait	B-1	B-4	C-1	C-4	K-1	K-4	M-1	M-4	W-1	W-4
	I. USDA-ARS WQL Data										
1	Wheat Protein (%, 12% mb)	13.0	11.7	15.0	14.8	13.3	13.0	13.7	14.3	14.0	13.1
2	Flour Protein (%, 14% mb)	12.1	10.8	14.1	13.9	12.5	12.0	12.6	13.2	13.5	12.5
3	Market Value (Score 1-6)	4.2	3.4	4.1	3.7	4.2	3.8	4.7	4.2	4.6	4.3
4	Market Value (Score 1-10)	10.0	7.2	10.0	9.2	10.0	8.4	10.0	8.4	10.0	8.2
5	DON (ppm)	nd	nd	nd	nd	nd	nd	nd	0.44	nd	nd
6	Test Weight (lb/bu)	64.4	60.0	61.8	58.8	64.2	60.0	64.1	59.7	64.6	61.4
7	1000 Kernel Weight (g)	32.3	31.7	27.0	27.0	30.9	31.1	33.6	32.5	30.5	33.8
8	Kernel Size, % Large	61	62	34	41	54	57	72	63	48	63
9	Kernel Size, % Small	10	10	17	16	8	8	6	9	11	7
10	Wheat Moisture (%)	10.7	10.4	10.7	10.5	10.6	10.9	10.0	11.1	9.7	10.1
11	Wheat Ash (%, 14% mb)	1.48	1.37	1.68	1.57	1.41	1.20	1.39	1.41	1.44	1.23
12	Wheat Falling Number (sec)	406	451	407	471	400	462	419	448	427	486
13	SKCS Hardness Index	82.7	72.1	77.6	81.3	79.6	75.4	69.4	78.6	78.5	77.9
14	Vitreous Kernels (%)	66.0	40.3	87.5	52.4	54.1	47.0	81.4	90.1	98.6	93.4
	Flour Extraction (%)										
15	Tempered Wheat Basis (%)	70.0	73.0	71.2	71.8	72.5	73.5	72.1	71.0	70.9	72.8
16	Total Product Basis (%)	71.5	74.6	73.0	73.2	74.0	74.5	73.6	72.2	72.3	74.0
17	Flour/Bu Wheat (lbs)	45.6	44.0	44.2	42.9	46.9	44.5	47.0	42.2	46.9	45.5
	Flour Quality										
18	Flour Color Brightness (*L**)	90.0	89.8	89.4	89.0	89.8	89.5	90.0	89.3	90.0	89.7
19	Flour Color Yellowness (*b**)	8.8	10.5	8.6	11.0	8.5	10.9	9.0	10.2	8.6	10.2
20	Flour Moisture (%)	13.7	13.5	13.2	13.7	13.9	13.8	12.8	12.6	13.3	12.8
21	Flour Ash (%, 14% mb)	0.48	0.47	0.52	0.52	0.47	0.41	0.44	0.44	0.44	0.40
22	Flour Falling Number (Malted) (sec)	251	249	254	264	255	255	265	264	251	250
	Farinograph										
23	Water Absorption (%, 500 BU)	63.7	64.0	64.0	64.5	63.1	61.9	65.1	64.7	64.0	64.9
24	Water Absorption (%, 14% mb)	63.5	63.2	63.0	63.9	62.3	61.2	63.8	63.0	62.5	63.0
25	Arrival Time (min)	2.0	1.5	2.2	2.5	1.6	1.7	3.4	4.0	2.4	2.1
26	Peak Time (min)	3.5	2.9	5.0	6.2	3.4	6.8	8.0	6.7	7.0	6.3
27	Dough Stability (min)	10.5	6.9	8.9	8.9	10.3	11.1	9.7	7.0	13.6	11.0
28	Mixing Tolerance Index (MTI) (BU)	11.0	29.0	21.0	29.0	20.0	26.0	27.0	36.0	15.0	21.0
29	Time To Breakdown (TTB) (min)	12.2	8.1	11.0	11.4	10.3	12.6	12.6	11.0	14.6	12.4
	II. Cooperator Results										
30	Bake Absorption (Average %)	65.1	64.5	66.1	65.9	64.7	63.8	65.9	65.7	65.6	65.6
31	Loaf Volume (% of Check)		94.8		98.9		99.7		100.4		98.6

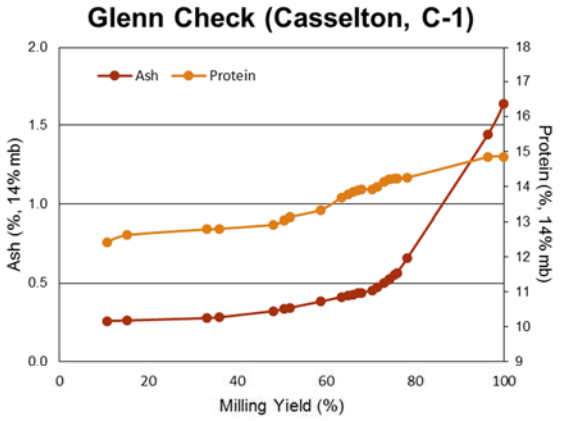
SWQAC #4 – WB9653

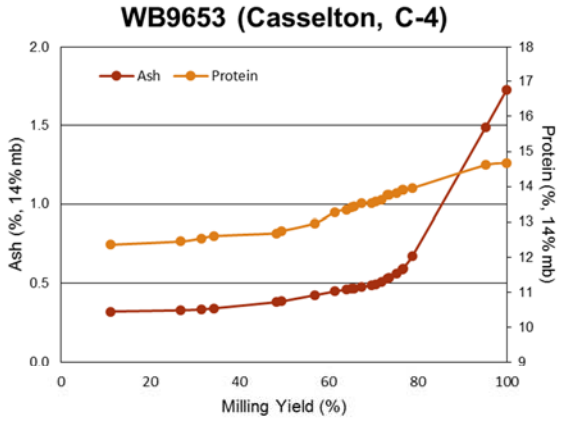
	Quality Trait	Watertown Glenn B-1	Watertown Glenn B-4	Casselton Glenn C-1	Casselton Glenn C-4	Crookston Glenn K-1	Crookston Glenn K-4	Minot Glenn M-1	Minot Glenn M-4	Williston Glenn W-1	Williston Glenn W-4
	II. Cooperator Results										
32	**Mixing Requirement** 9 = Very Long 7 = Long 5 = Medium 3 = Short 1 = Very Short	6.4	5.2	7.2	5.8	6.7	6.1	5.2	4.0	6.6	4.6
33	**Dough Characteristics** 9 = Bucky – Tough 7 = Strong – Elastic 5 = Medium – Pliable 3 = Mellow – Very Pliable 1 = Weak – Short or Sticky	6.7	5.1	7.1	6.3	6.8	6.1	5.8	4.6	7.1	5.7
34	**Mixing Tolerance** 9 = Much More Tolerance Than Check 7 = More Tolerance Than Check 5 = Tolerance Equivalent To Check 3 = Less Tolerance Than Check 1 = Much Less Tolerance Than Check		4.2		4.7		4.9		3.6		4.3
35	**Internal Crumb Color** 9 = Much Brighter Than Check 7 = Brighter Than Check 5 = Equivalent To Check 3 = Poorer Than Check 1 = Much Poorer Than Check		4.3		4.3		4.4		4.3		4.3
36	**Internal Grain and Texture** 9 = Much Better Than Check 7 = Better Than Check 5 = Equivalent To Check 3 = Poorer Than Check 1 = Much Poorer Than Check		5.4		5.3		5.6		5.0		5.5
	III. Cooperator Evaluation										
	Quality Traits 1-2: Protein 9 = Much Better Than Check 7 = Better Than Check 5 = Equivalent To Check 3 = Poorer Than Check 1 = Much Poorer Than Check		2.8		4.8		4.6		5.5		3.5
	Quality Traits 3-22: Milling 9 = Much Better Than Check 7 = Better Than Check 5 = Equivalent To Check 3 = Poorer Than Check 1 = Much Poorer Than Check		6.0		4.5		4.8		3.3		5.9
	Quality Traits 23-36: Baking 9 = Much Better Than Check 7 = Better Than Check 5 = Equivalent To Check 3 = Poorer Than Check 1 = Much Poorer Than Check		4.5		4.7		4.7		4.4		4.8
	Quality Traits 1-36: Overall Comparison 9 = Much Better Than Check 7 = Better Than Check 5 = Equivalent To Check 3 = Poorer Than Check 1 = Much Poorer Than Check		4.2		4.5		5.2		4.3		4.8

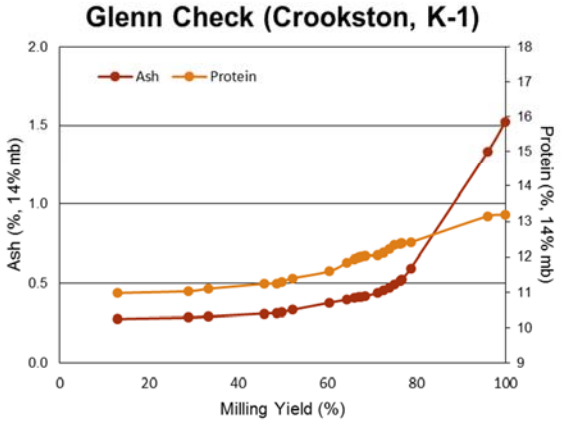
Cumulative Ash and Protein Curves

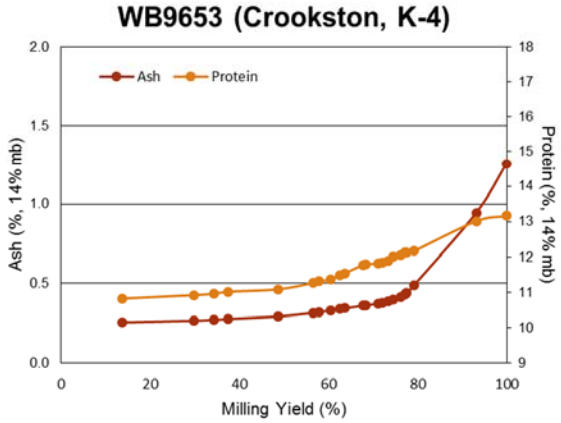


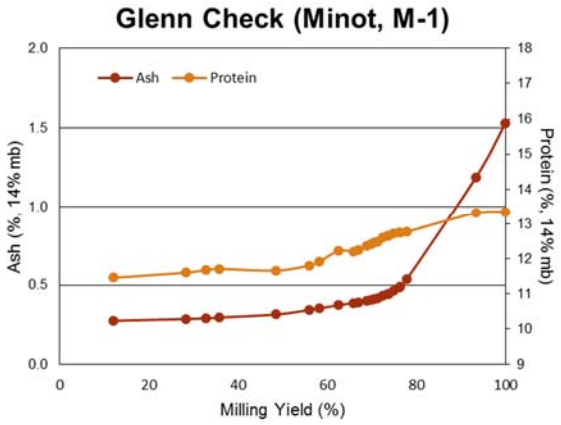


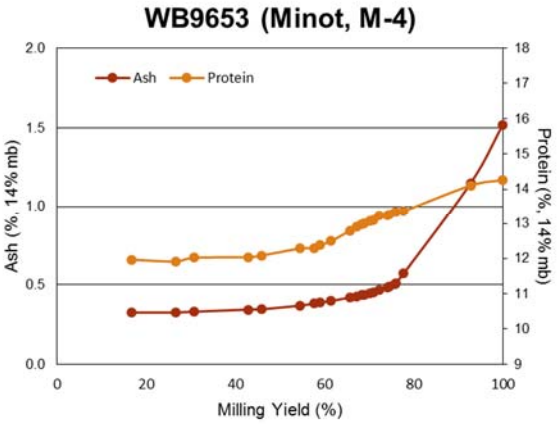


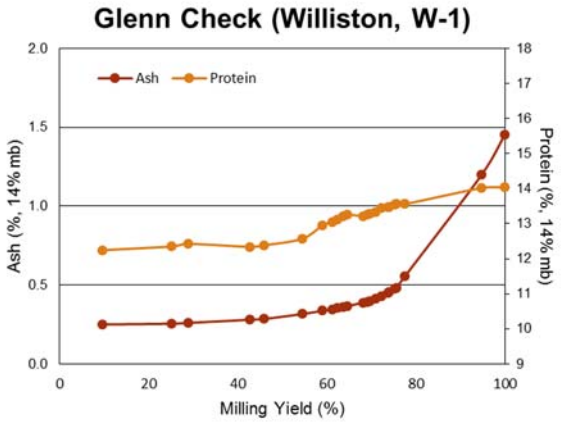


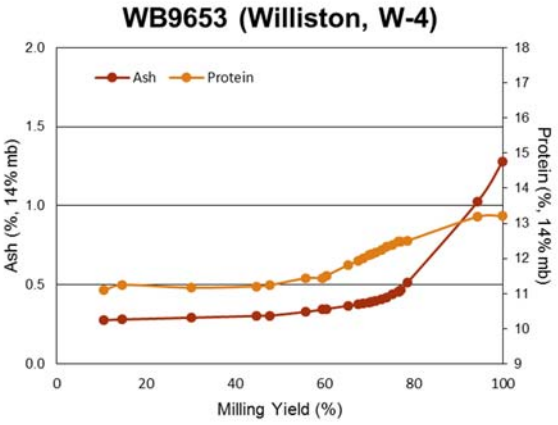





Glenn Check (Minot, M-1)
Ash
Protein
Ash (%, 14% mb)
Protein (%, 14% mb)
Milling Yield (%)

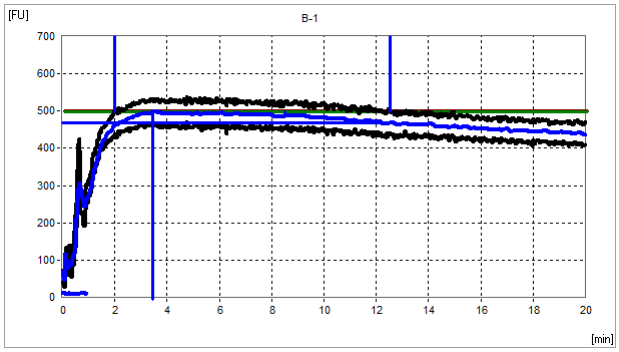

WB9653 (Minot, M-4)
Ash
Protein
Ash (%, 14% mb)
Protein (%, 14% mb)
Milling Yield (%)


Glenn Check (Williston, W-1)
Ash
Protein
Ash (%, 14% mb)
Protein (%, 14% mb)
Milling Yield (%)

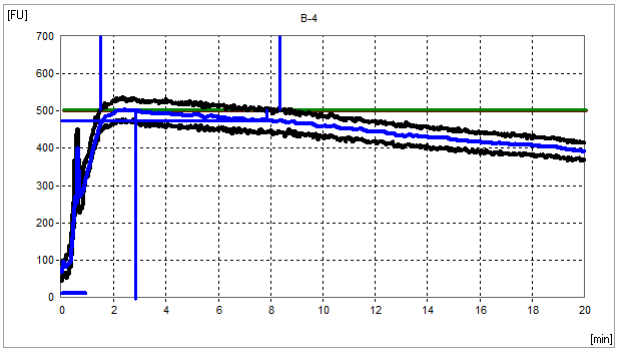

WB9653 (Williston, W-4)
Ash
Protein
Ash (%, 14% mb)
Protein (%, 14% mb)
Milling Yield (%)

Farinograms

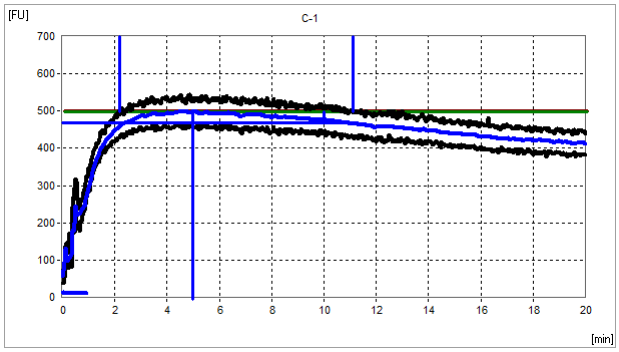
Glenn Check (Watertown, B-1)



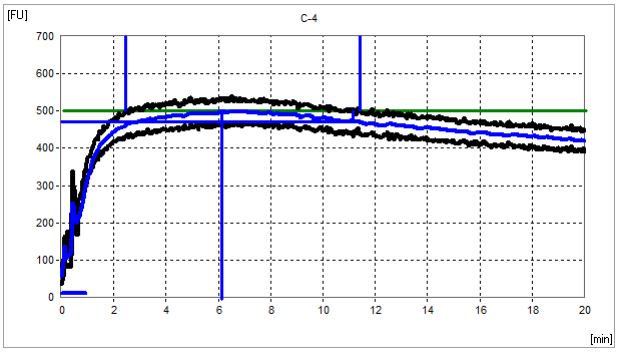
WB9653 (Watertown, B-4)



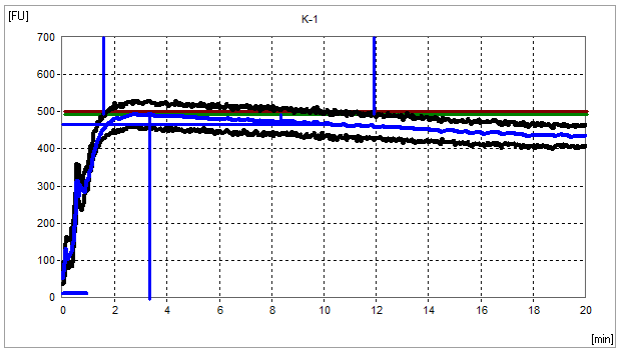
Glenn Check (Casselton, C-1)



WB9653 (Casselton, C-4)



Glenn Check (Crookston, K-1)



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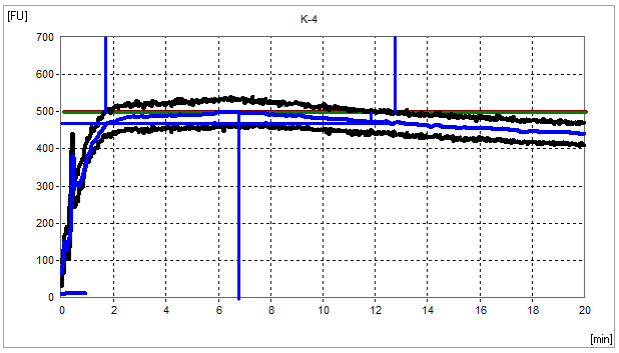
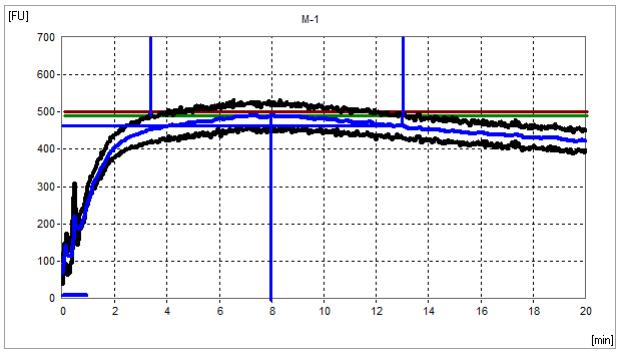
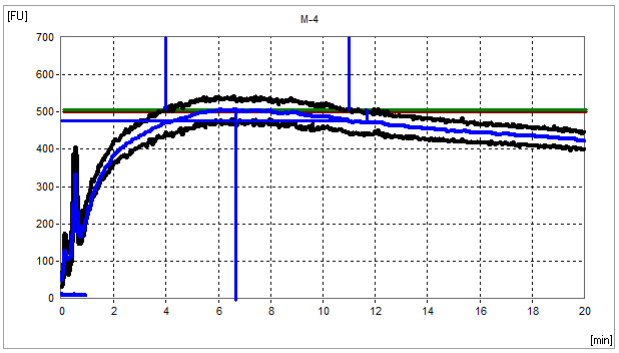


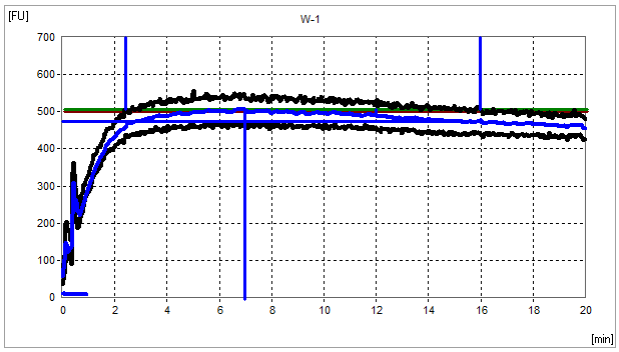
Glenn Check (Minot, M-1)



WB9653 (Minot, M-4)



Glenn Check (Williston, W-1)



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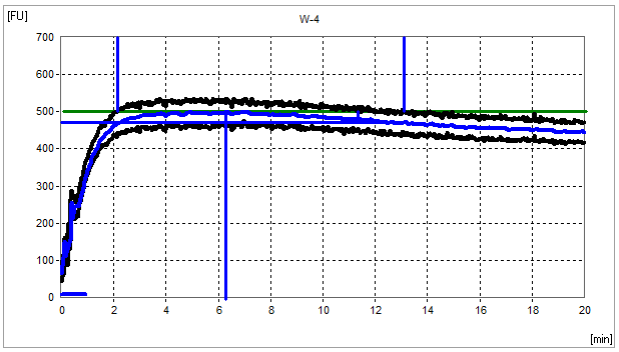
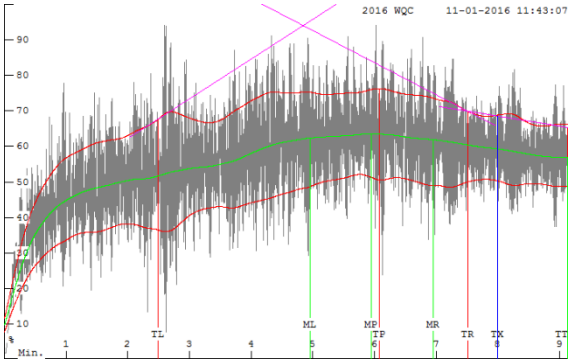
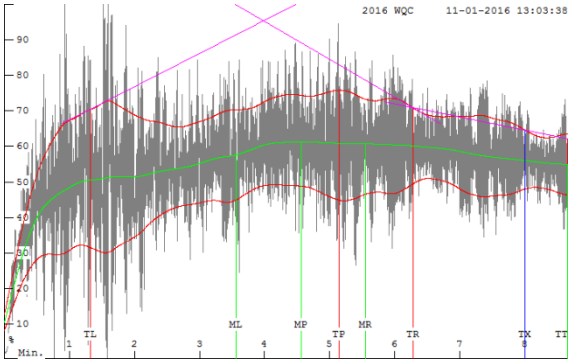


Mixograms

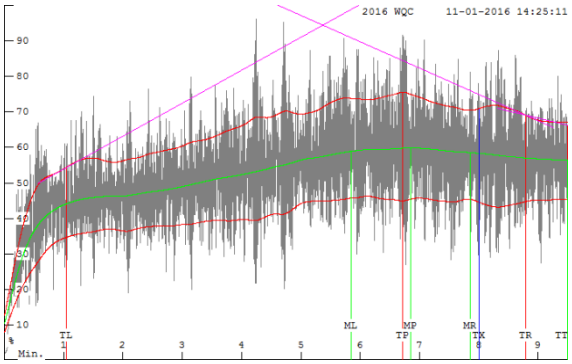
Glenn Check (Watertown, B-1)



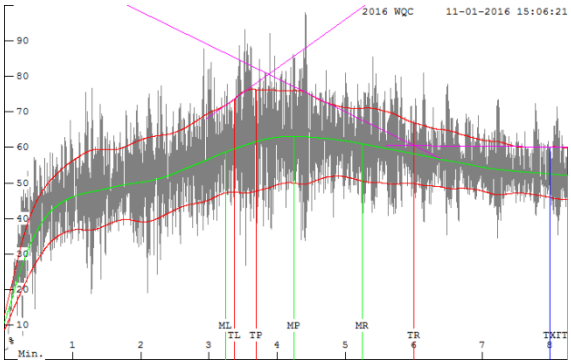
WB9653 (Watertown, B-4)



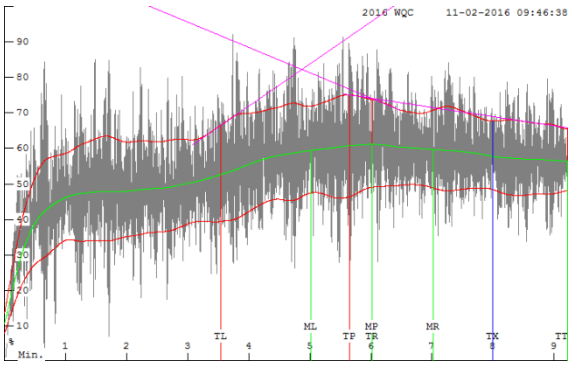
Glenn Check (Casselton, C-1)



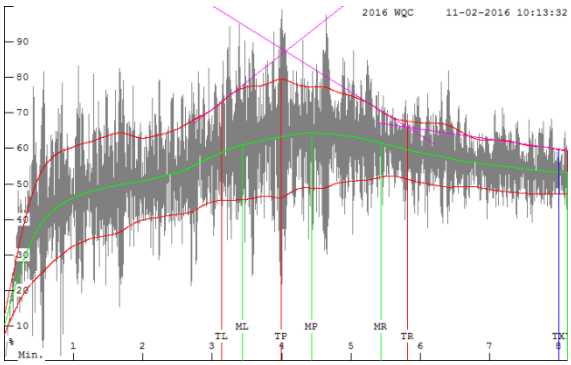
WB9653 (Casselton, C-4)



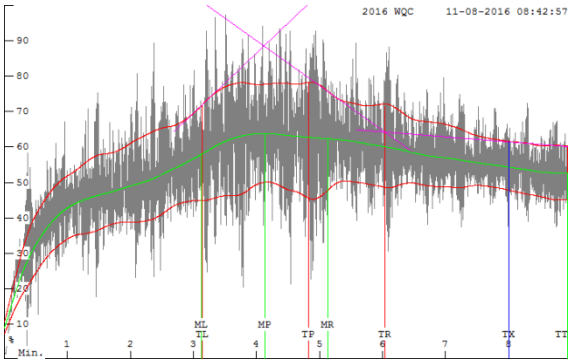
Glenn Check (Crookston, K-1)



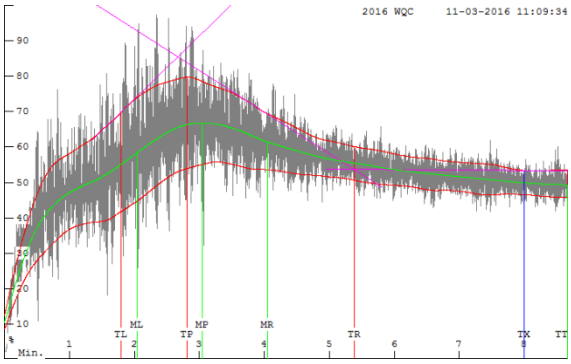
WB9653 (Crookston, K-4)



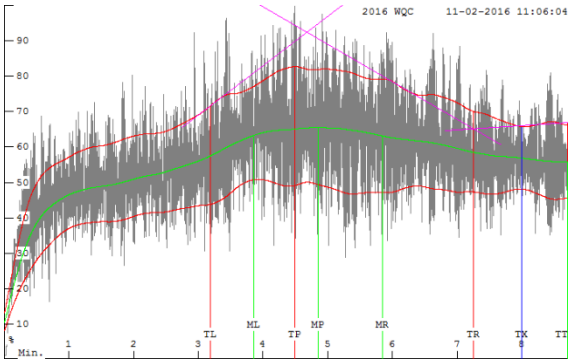
Glenn Check (Minot, M-1)



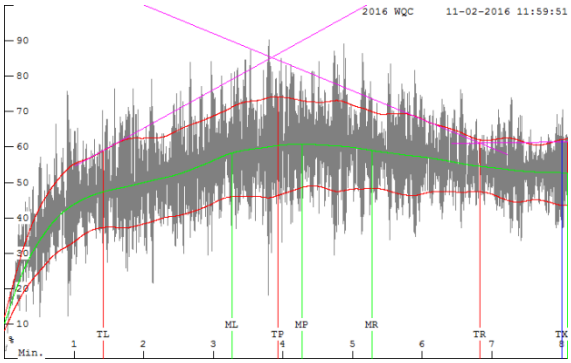
WB9653 (Minot, M-4)



Glenn Check (Williston, W-1)

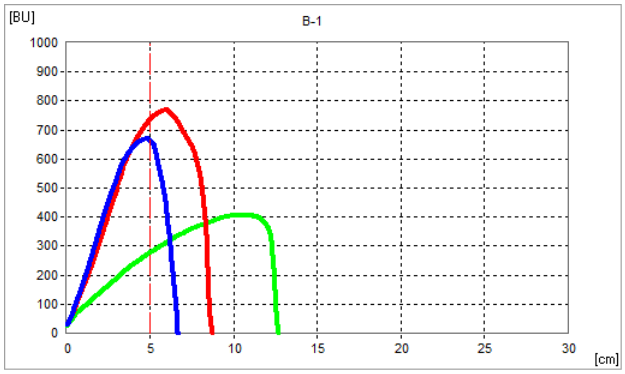


WB9653 (Williston, W-4)

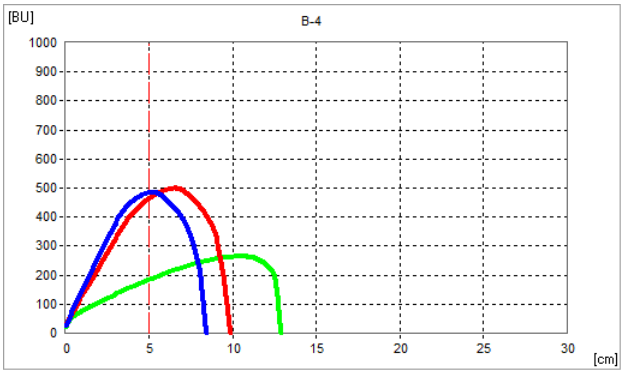


Extensograms

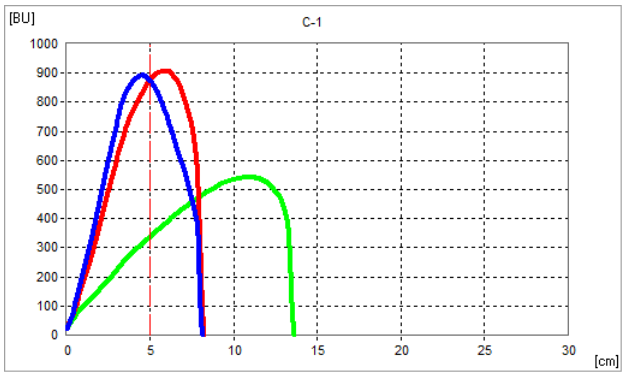
Glenn Check (Watertown, B-1)



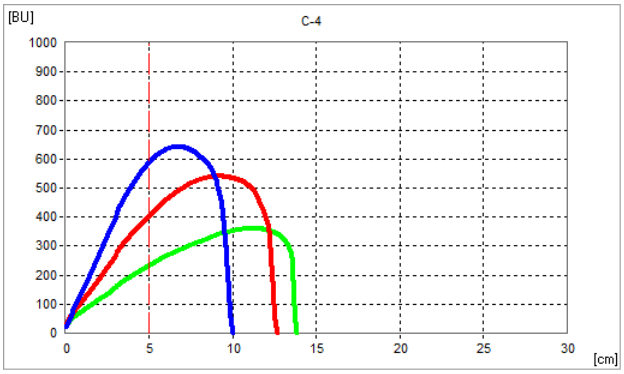
WB9653 (Watertown, B-4)



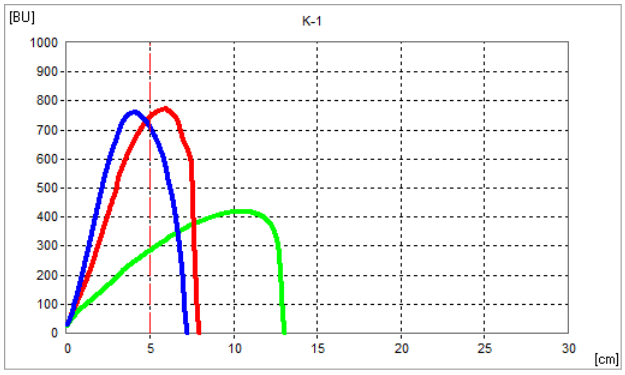
Glenn Check (Casselton, C-1)



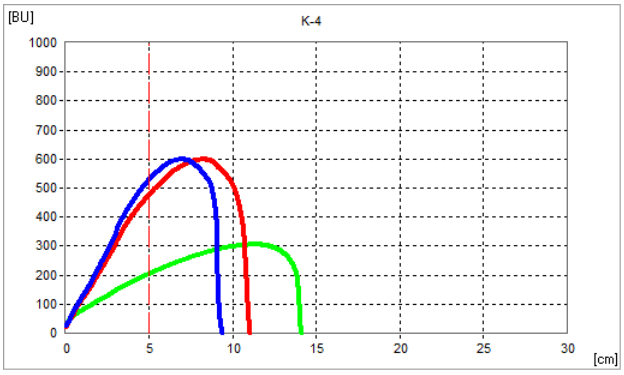
WB9653 (Casselton, C-4)



Glenn Check (Crookston, K-1)

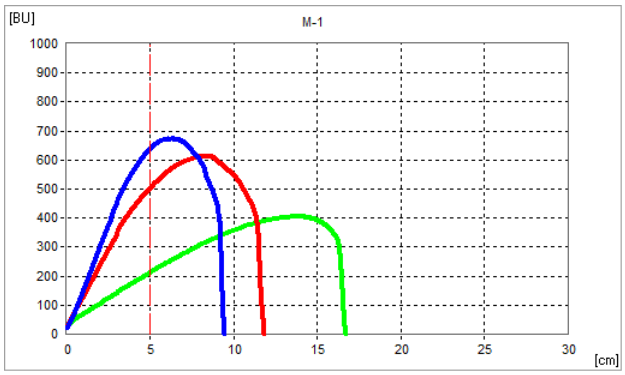


WB9653 (Crookston, K-4)



45 min; 90 min; 135 min

Glenn Check (Minot, M-1)



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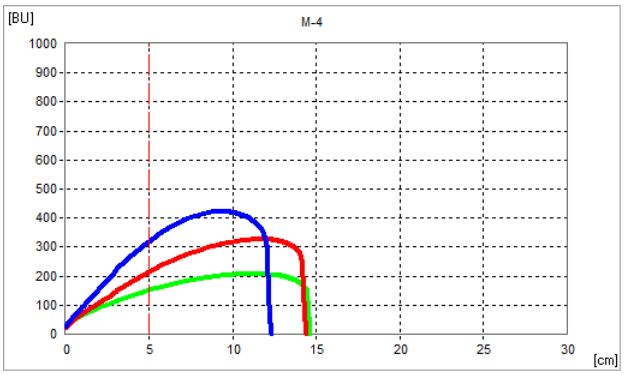
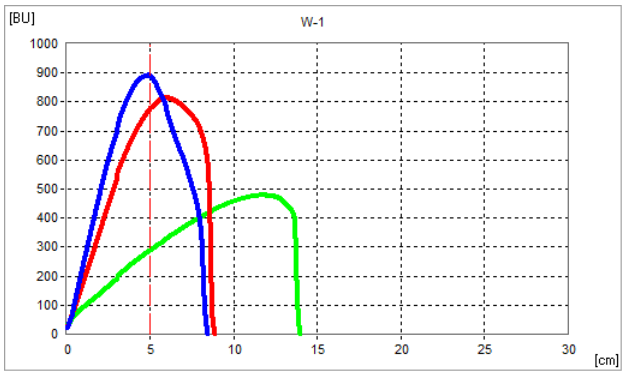
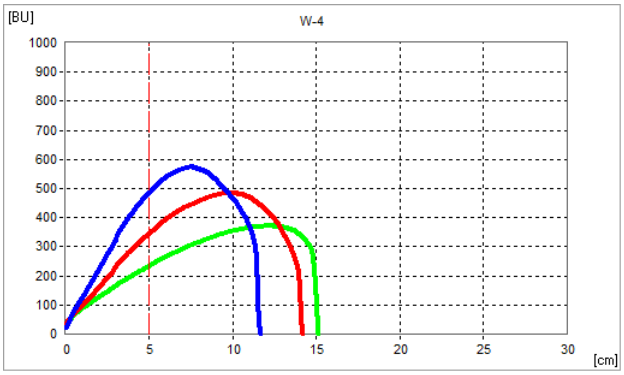


Glenn Check (Williston, W-1)



WB9653 (Williston, W-4)



45 min; 90 min; 135 min

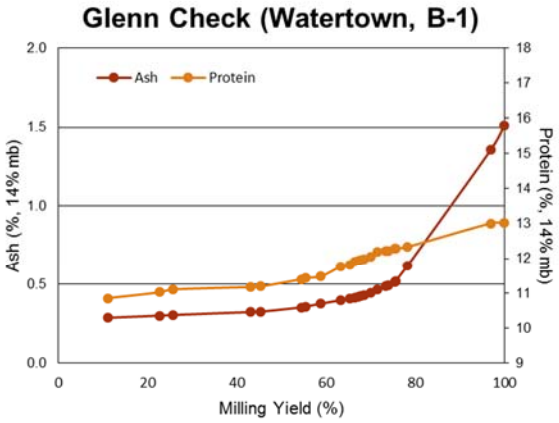
SWQAC #5 – MN10261-1

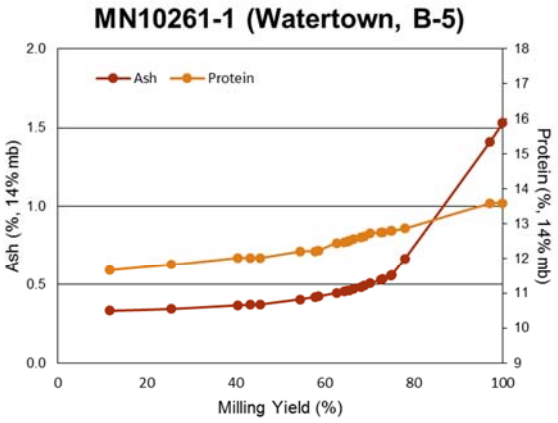
		Watertown		Casselton		Crookston		Minot		Williston	
		Glenn		Glenn		Glenn		Glenn		Glenn	
	Quality Trait	B-1	B-5	C-1	C-5	K-1	K-5	M-1	M-5	W-1	W-5
	I. USDA-ARS WQL Data										
1	Wheat Protein (%, 12% mb)	13.0	13.8	15.0	15.3	13.3	14.0	13.7	16.0	14.0	14.4
2	Flour Protein (%, 14% mb)	12.1	12.8	14.1	14.5	12.5	13.0	12.6	15.3	13.5	13.7
3	Market Value (Score 1-6)	4.2	4.2	4.1	3.7	4.2	4.7	4.7	5.0	4.6	4.7
4	Market Value (Score 1-10)	10.0	8.8	10.0	9.2	10.0	9.6	10.0	8.6	10.0	9.6
5	DON (ppm)	nd	nd	nd	nd	nd	nd	nd	0.34	nd	nd
6	Test Weight (lb/bu)	64.4	62.1	61.8	59.4	64.2	63.0	64.1	62.6	64.6	62.7
7	1000 Kernel Weight (g)	32.3	29.1	27.0	25.1	30.9	31.2	33.6	30.1	30.5	29.6
8	Kernel Size, % Large	61	33	34	25	54	50	72	49	48	29
9	Kernel Size, % Small	10	18	17	21	8	11	6	10	11	17
10	Wheat Moisture (%)	10.7	10.0	10.7	10.5	10.6	10.6	10.0	10.8	9.7	9.7
11	Wheat Ash (%, 14% mb)	1.48	1.48	1.68	1.71	1.41	1.37	1.39	1.48	1.44	1.38
12	Wheat Falling Number (sec)	406	432	407	450	400	430	419	430	427	464
13	SKCS Hardness Index	82.7	84.2	77.6	81.0	79.6	85.7	69.4	78.1	78.5	80.2
14	Vitreous Kernels (%)	66.0	84.7	87.5	91.3	54.1	94.0	81.4	96.6	98.6	96.7
	Flour Extraction (%)										
15	Tempered Wheat Basis (%)	70.0	69.6	71.2	68.8	72.5	70.0	72.1	72.8	70.9	70.5
16	Total Product Basis (%)	71.5	70.3	73.0	69.8	74.0	71.5	73.6	74.5	72.3	71.9
17	Flour/Bu Wheat (lbs)	45.6	43.6	44.2	41.2	46.9	45.0	47.0	45.4	46.9	44.6
	Flour Quality										
18	Flour Color Brightness (*L**)	90.0	89.7	89.4	89.1	89.8	89.7	90.0	89.2	90.0	89.6
19	Flour Color Yellowness (*b**)	8.8	9.2	8.6	9.6	8.5	9.0	9.0	9.0	8.6	8.9
20	Flour Moisture (%)	13.7	13.3	13.2	13.3	13.9	14.4	12.8	12.5	13.3	13.3
21	Flour Ash (%, 14% mb)	0.48	0.51	0.52	0.56	0.47	0.46	0.44	0.49	0.44	0.44
22	Flour Falling Number (Malted) (sec)	251	250	254	248	255	262	265	251	251	249
	Farinograph										
23	Water Absorption (%, 500 BU)	63.7	66.4	64.0	65.4	63.1	64.3	65.1	65.9	64.0	62.9
24	Water Absorption (%, 14% mb)	63.5	65.5	63.0	64.4	62.3	64.3	63.8	63.7	62.5	61.5
25	Arrival Time (min)	2.0	2.0	2.2	2.8	1.6	2.4	3.4	4.3	2.4	2.4
26	Peak Time (min)	3.5	4.7	5.0	6.2	3.4	5.0	8.0	7.5	7.0	6.0
27	Dough Stability (min)	10.5	7.9	8.9	7.9	10.3	9.3	9.7	6.3	13.6	8.2
28	Mixing Tolerance Index (MTI) (BU)	11.0	27.0	21.0	40.0	20.0	21.0	27.0	49.0	15.0	35.0
29	Time To Breakdown (TTB) (min)	12.2	10.0	11.0	10.4	10.3	11.5	12.6	10.3	14.6	10.3
	II. Cooperator Results										
30	Bake Absorption (Average %)	65.1	66.6	66.1	66.9	64.7	66.2	65.9	66.9	65.6	65.3
31	Loaf Volume (% of Check)		100.2		101.6		98.9		104.8		99.9

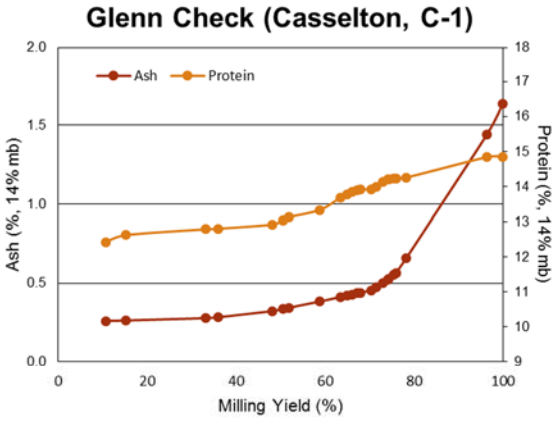
SWQAC #5 – MN10261-1

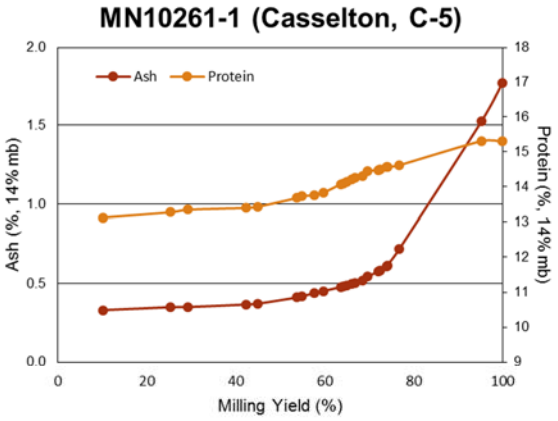
	Quality Trait	Watertown Glenn B-1	Watertown Glenn B-5	Casselton Glenn C-1	Casselton Glenn C-5	Crookston Glenn K-1	Crookston Glenn K-5	Minot Glenn M-1	Minot Glenn M-5	Williston Glenn W-1	Williston Glenn W-5
	II. Cooperator Results										
32	**Mixing Requirement** 9 = Very Long 7 = Long 5 = Medium 3 = Short 1 = Very Short	6.4	5.9	7.2	5.8	6.7	6.1	5.2	4.2	6.6	5.9
33	**Dough Characteristics** 9 = Bucky – Tough 7 = Strong – Elastic 5 = Medium – Pliable 3 = Mellow – Very Pliable 1 = Weak – Short or Sticky	6.7	5.6	7.1	5.9	6.8	5.8	5.8	5.3	7.1	6.1
34	**Mixing Tolerance** 9 = Much More Tolerance Than Check 7 = More Tolerance Than Check 5 = Tolerance Equivalent To Check 3 = Less Tolerance Than Check 1 = Much Less Tolerance Than Check		4.4		3.8		4.9		3.5		4.1
35	**Internal Crumb Color** 9 = Much Brighter Than Check 7 = Brighter Than Check 5 = Equivalent To Check 3 = Poorer Than Check 1 = Much Poorer Than Check		4.9		5.1		5.3		5.5		5.2
36	**Internal Grain and Texture** 9 = Much Better Than Check 7 = Better Than Check 5 = Equivalent To Check 3 = Poorer Than Check 1 = Much Poorer Than Check		4.9		5.3		5.2		5.5		5.3
	III. Cooperator Evaluation										
	Quality Traits 1-2: Protein 9 = Much Better Than Check 7 = Better Than Check 5 = Equivalent To Check 3 = Poorer Than Check 1 = Much Poorer Than Check		6.2		5.3		6.1		7.3		4.9
	Quality Traits 3-22: Milling 9 = Much Better Than Check 7 = Better Than Check 5 = Equivalent To Check 3 = Poorer Than Check 1 = Much Poorer Than Check		3.8		3.1		3.8		4.5		4.3
	Quality Traits 23-36: Baking 9 = Much Better Than Check 7 = Better Than Check 5 = Equivalent To Check 3 = Poorer Than Check 1 = Much Poorer Than Check		5.3		5.2		5.1		5.3		4.7
	Quality Traits 1-36: Overall Comparison 9 = Much Better Than Check 7 = Better Than Check 5 = Equivalent To Check 3 = Poorer Than Check 1 = Much Poorer Than Check		5.1		4.7		4.9		5.4		4.7

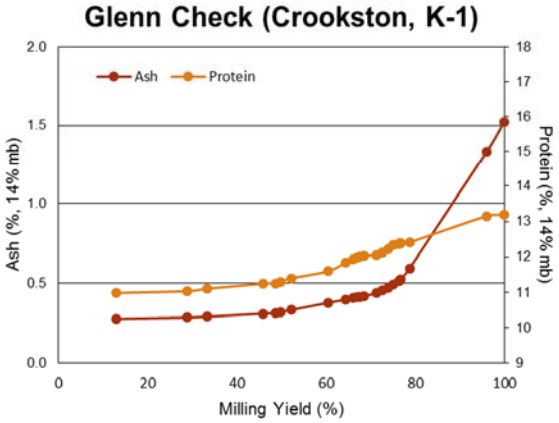
Cumulative Ash and Protein Curves

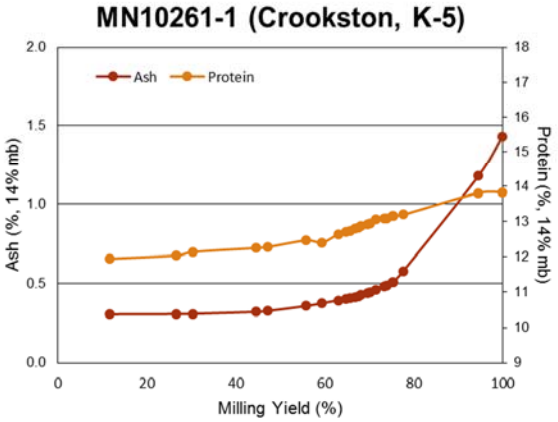


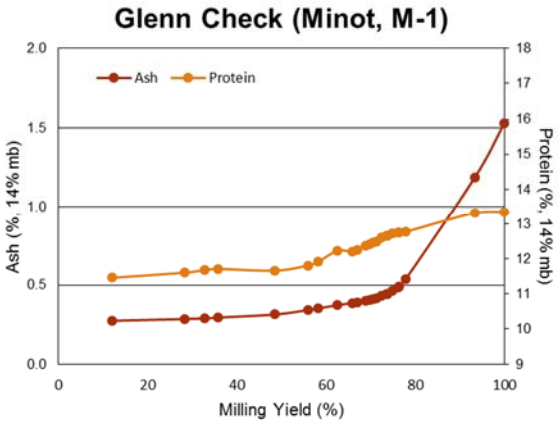


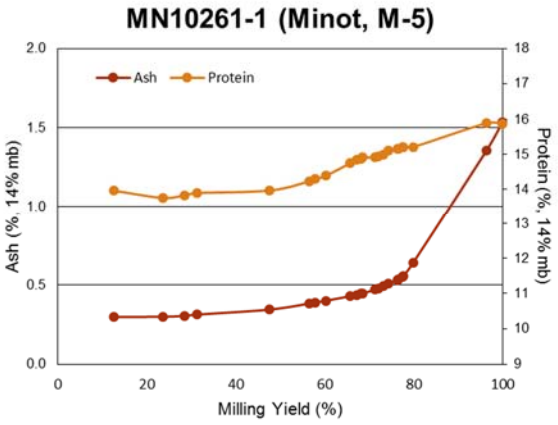


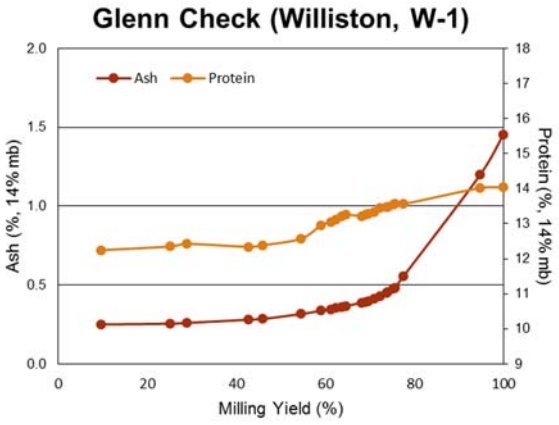


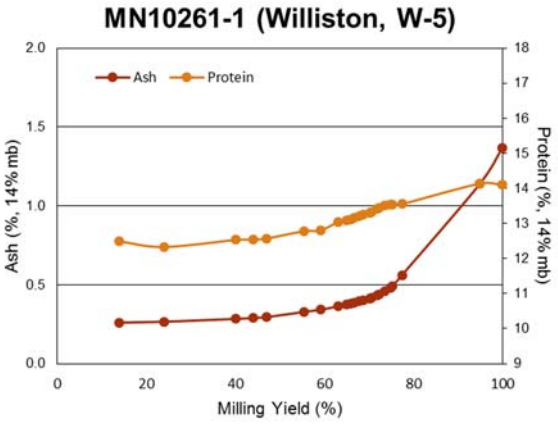





Glenn Check (Minot, M-1)
Ash
Protein
Ash (%, 14% mb)
Protein (%, 14% mb)
Milling Yield (%)

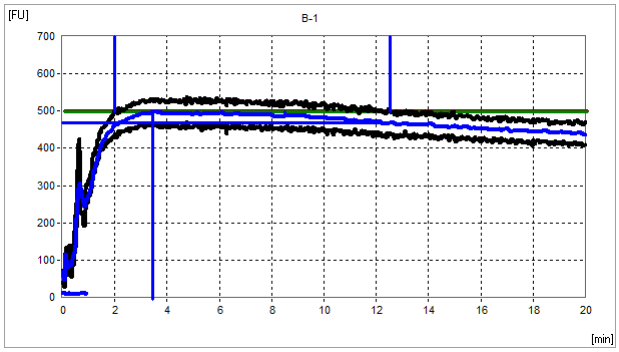

MN10261-1 (Minot, M-5)
Ash
Protein
Ash (%, 14% mb)
Protein (%, 14% mb)
Milling Yield (%)


Glenn Check (Williston, W-1)
Ash
Protein
Ash (%, 14% mb)
Protein (%, 14% mb)
Milling Yield (%)

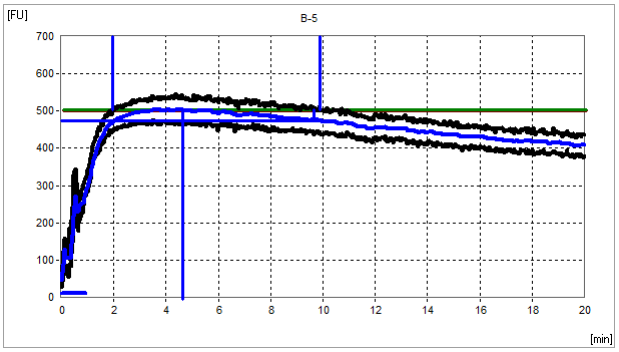

MN10261-1 (Williston, W-5)
Ash
Protein
Ash (%, 14% mb)
Protein (%, 14% mb)
Milling Yield (%)

Farinograms

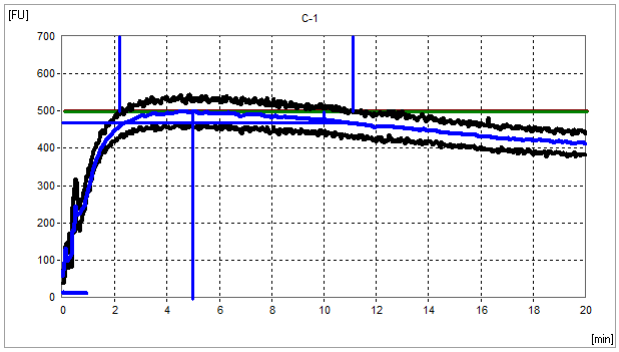
Glenn Check (Watertown, B-1)



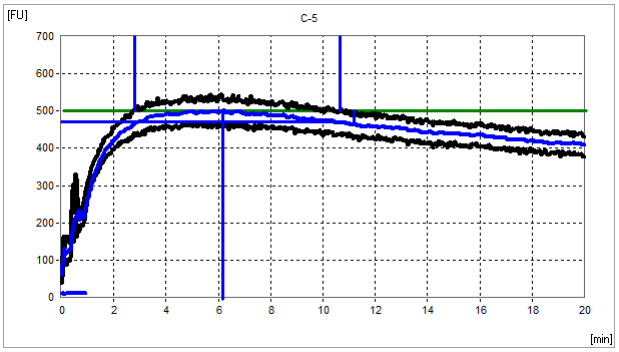
MN10261-1 (Watertown, B-5)



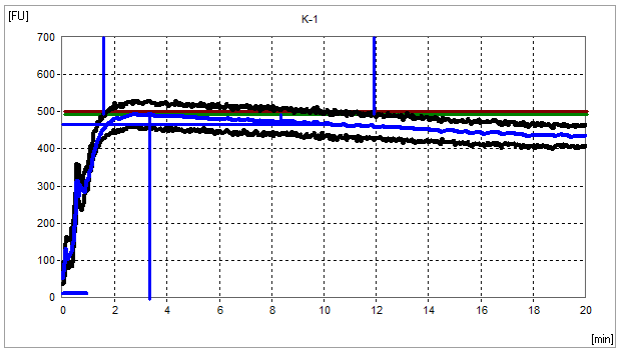
Glenn Check (Casselton, C-1)



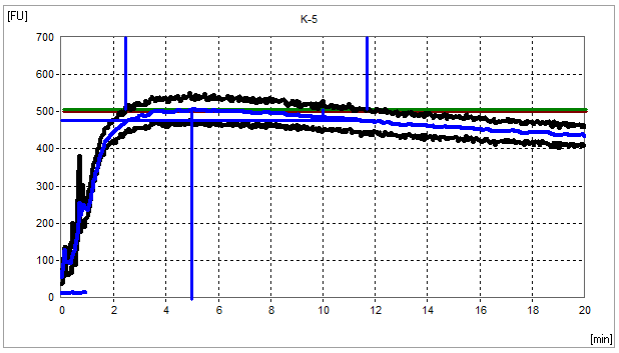
MN10261-1 (Casselton, C-5)



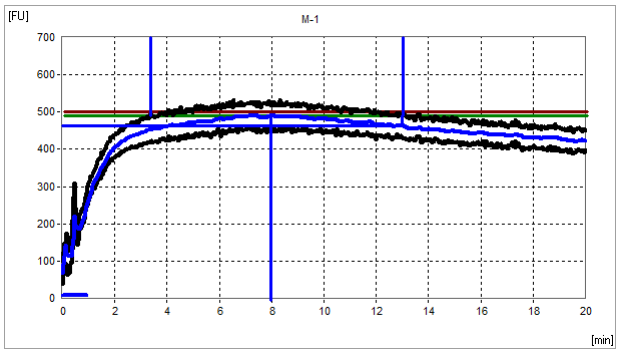
Glenn Check (Crookston, K-1)



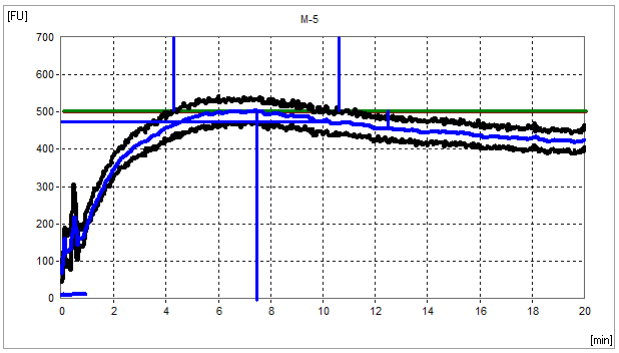
MN10261-1 (Crookston, K-5)



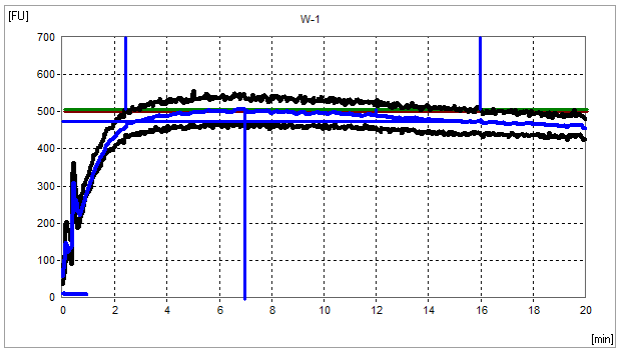
Glenn Check (Minot, M-1)



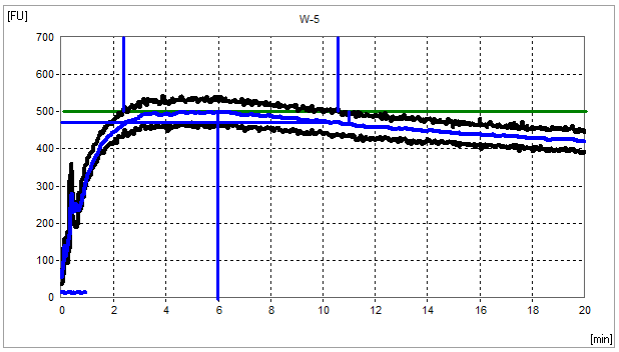
MN10261-1 (Minot, M-5)



Glenn Check (Williston, W-1)

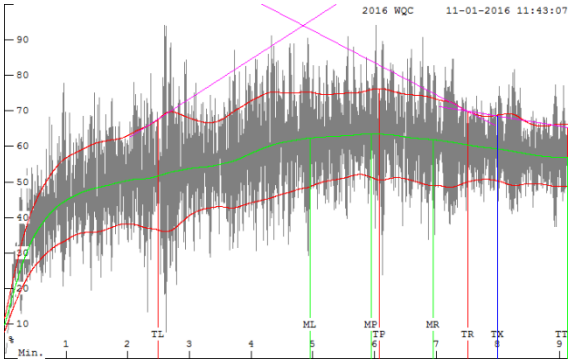


MN10261-1 (Williston, W-5)

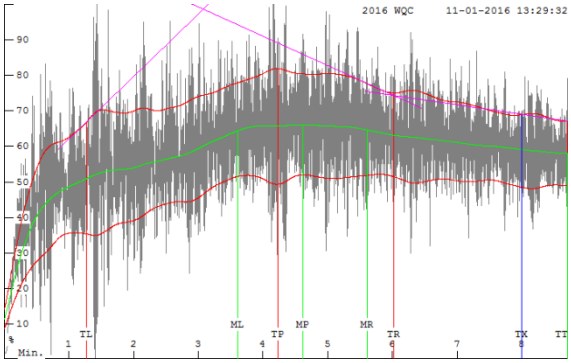


Mixograms

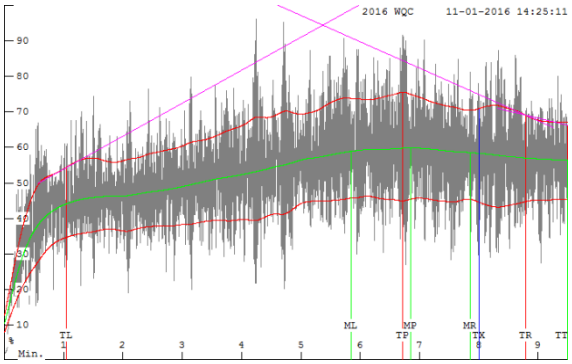
Glenn Check (Watertown, B-1)



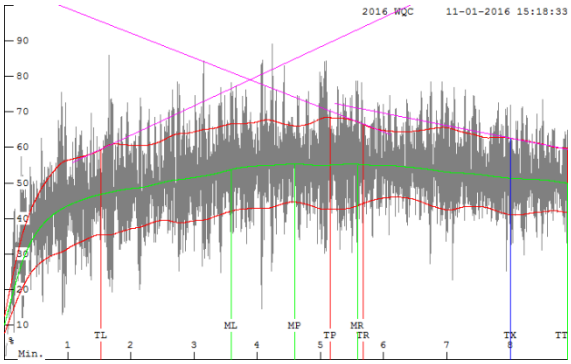
MN10261-1 (Watertown, B-5)



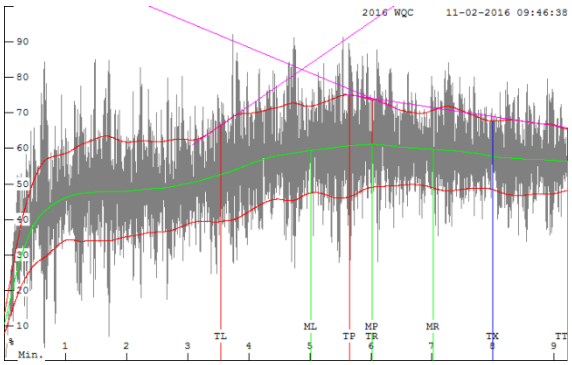
Glenn Check (Casselton, C-1)



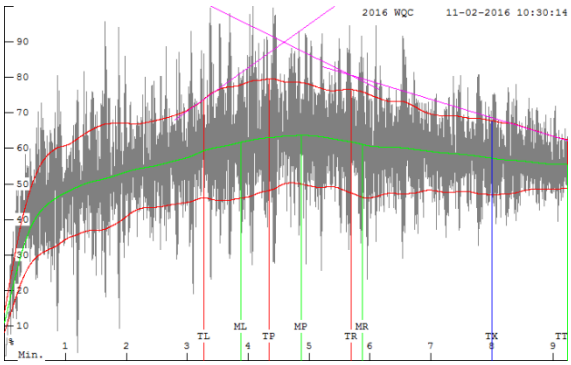
MN10261-1 (Casselton, C-5)



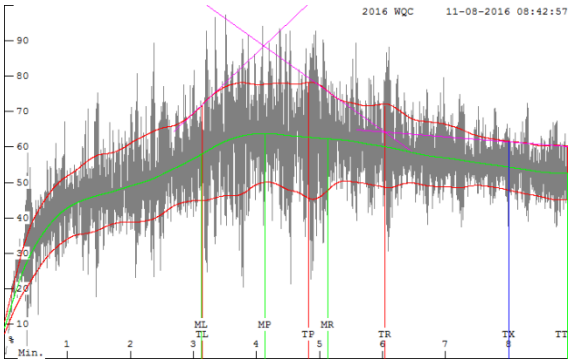
Glenn Check (Crookston, K-1)



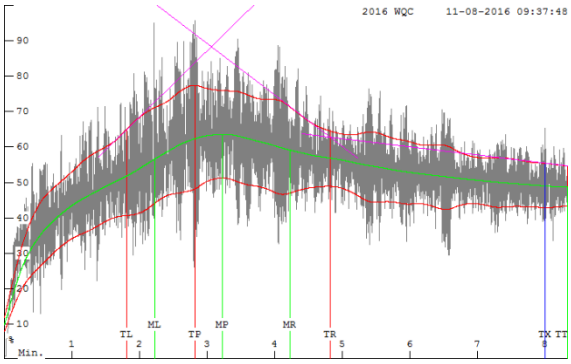
MN10261-1 (Crookston, K-5)



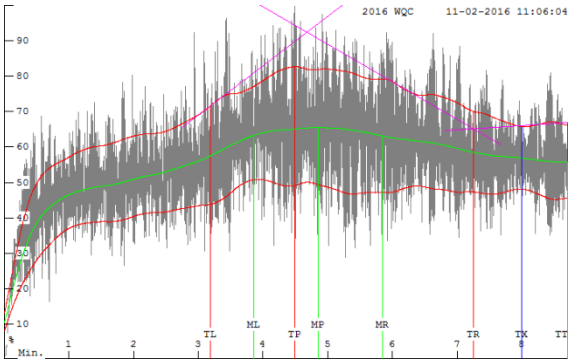
Glenn Check (Minot, M-1)



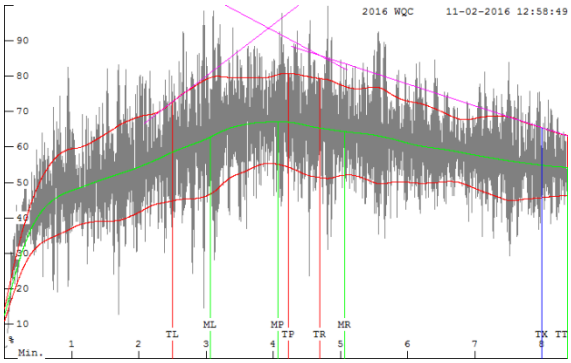
MN10261-1 (Minot, M-5)



Glenn Check (Williston, W-1)

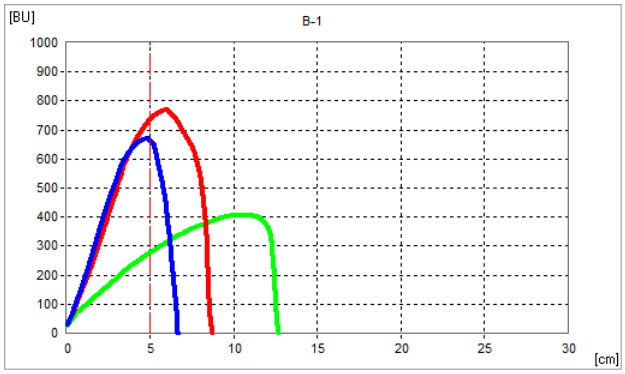


MN10261-1 (Williston, W-5)

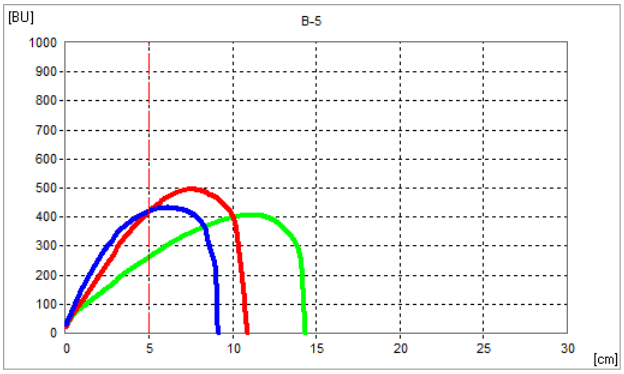


Extensograms

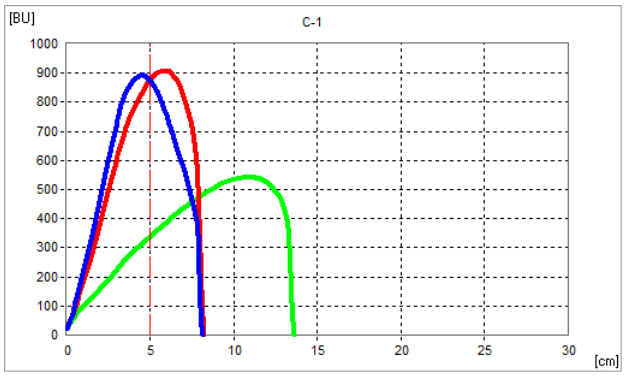
Glenn Check (Watertown, B-1)



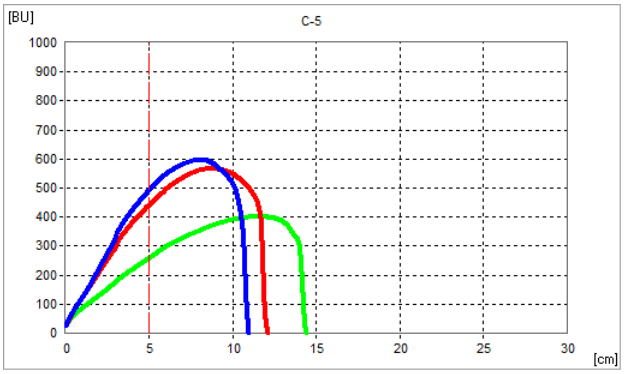
MN10261-1 (Watertown, B-5)



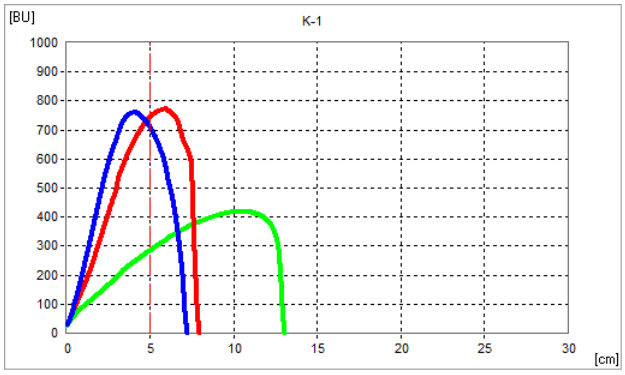
Glenn Check (Casselton, C-1)



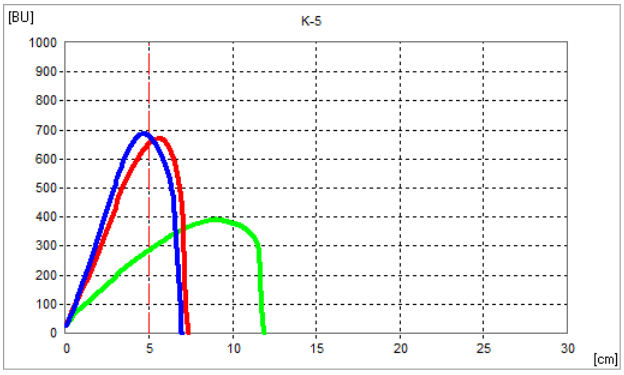
MN10261-1 (Casselton, C-5)



Glenn Check (Crookston, K-1)

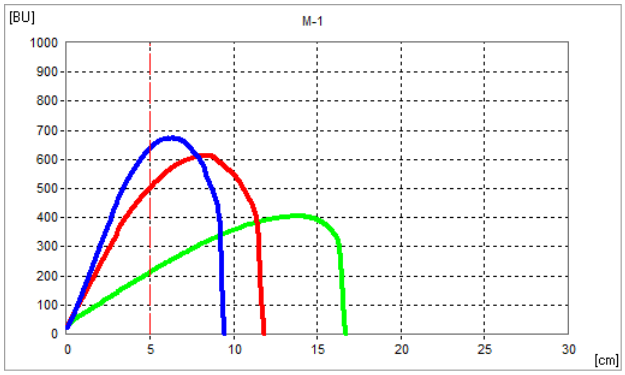


MN10261-1 (Crookston, K-5)

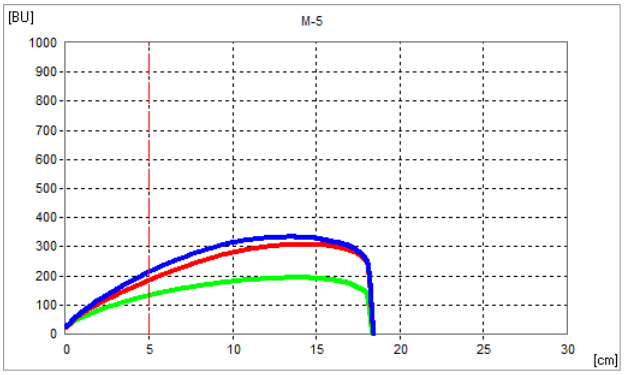


45 min; 90 min; 135 min

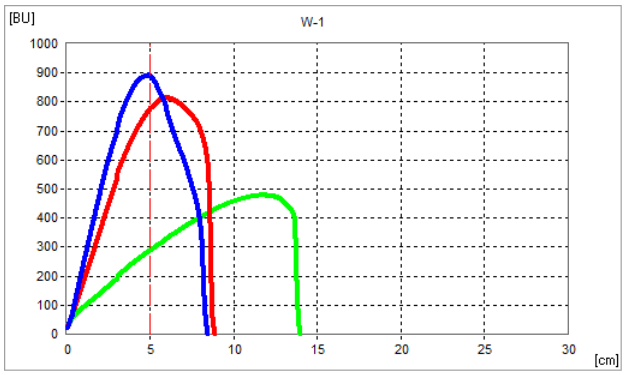
Glenn Check (Minot, M-1)



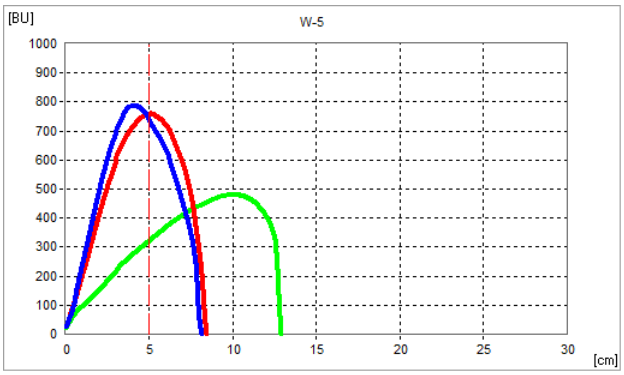
MN10261-1 (Minot, M-5)



Glenn Check (Williston, W-1)



MN10261-1 (Williston, W-5)



45 min; 90 min; 135 min

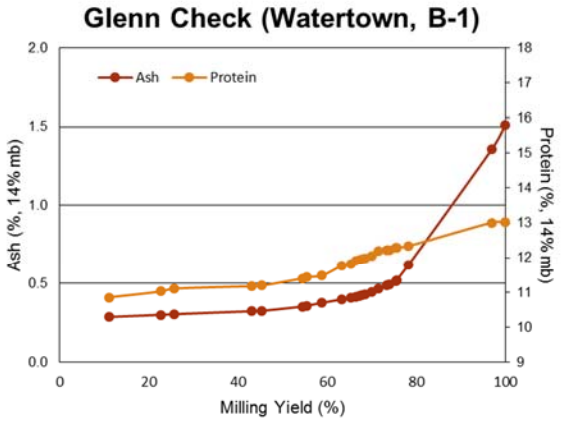
SWQAC #6 – WB9507

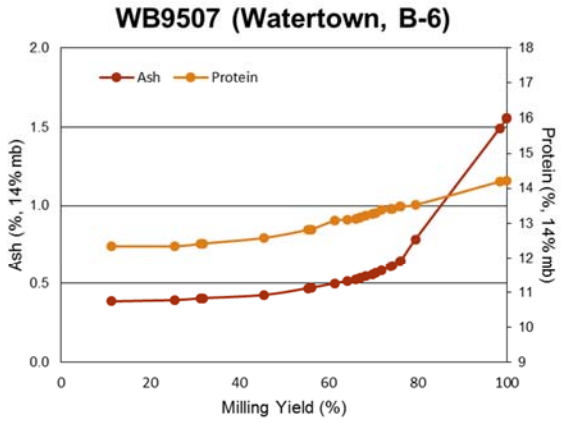
		Watertown		Casselton		Crookston		Minot		Williston	
		Glenn		Glenn		Glenn		Glenn		Glenn	
	Quality Trait	B-1	B-6	C-1	C-6	K-1	K-6	M-1	M-6	W-1	W-6
	I. USDA-ARS WQL Data										
1	Wheat Protein (%, 12% mb)	13.0	14.0	15.0	15.6	13.3	12.5	13.7	14.9	14.0	15.1
2	Flour Protein (%, 14% mb)	12.1	13.3	14.1	14.7	12.5	11.4	12.6	14.0	13.5	14.3
3	Market Value (Score 1-6)	4.2	3.4	4.1	3.7	4.2	4.0	4.7	4.7	4.6	4.6
4	Market Value (Score 1-10)	10.0	8.0	10.0	7.4	10.0	7.4	10.0	8.0	10.0	7.6
5	DON (ppm)	nd	nd	nd	nd	nd	nd	nd	0.75	nd	nd
6	Test Weight (lb/bu)	64.4	56.6	61.8	56.6	64.2	59.4	64.1	59.6	64.6	59.3
7	1000 Kernel Weight (g)	32.3	31.8	27.0	32.9	30.9	37.5	33.6	39.2	30.5	36.1
8	Kernel Size, % Large	61	41	34	55	54	76	72	77	48	68
9	Kernel Size, % Small	10	15	17	10	8	6	6	6	11	6
10	Wheat Moisture (%)	10.7	10.5	10.7	10.6	10.6	10.9	10.0	10.7	9.7	10.0
11	Wheat Ash (%, 14% mb)	1.48	1.56	1.68	1.79	1.41	1.31	1.39	1.47	1.44	1.40
12	Wheat Falling Number (sec)	406	447	407	462	400	430	419	424	427	460
13	SKCS Hardness Index	82.7	76.6	77.6	77.1	79.6	66.0	69.4	70.5	78.5	73.3
14	Vitreous Kernels (%)	66.0	79.9	87.5	62.4	54.1	29.9	81.4	83.7	98.6	95.0
	Flour Extraction (%)										
15	Tempered Wheat Basis (%)	70.0	70.1	71.2	70.2	72.5	71.0	72.1	71.1	70.9	68.8
16	Total Product Basis (%)	71.5	71.9	73.0	72.4	74.0	72.4	73.6	72.9	72.3	71.1
17	Flour/Bu Wheat (lbs)	45.6	39.7	44.2	40.5	46.9	42.9	47.0	42.8	46.9	41.0
	Flour Quality										
18	Flour Color Brightness (*L**)	90.0	89.2	89.4	89.0	89.8	90.1	90.0	89.3	90.0	89.5
19	Flour Color Yellowness (*b**)	8.8	8.3	8.6	8.7	8.5	8.3	9.0	8.0	8.6	8.1
20	Flour Moisture (%)	13.7	13.3	13.2	13.6	13.9	14.2	12.8	13.0	13.3	13.3
21	Flour Ash (%, 14% mb)	0.48	0.57	0.52	0.60	0.47	0.41	0.44	0.51	0.44	0.49
22	Flour Falling Number (Malted) (sec)	251	265	254	255	255	252	265	264	251	255
	Farinograph										
23	Water Absorption (%, 500 BU)	63.7	67.5	64.0	66.9	63.1	61.6	65.1	67.3	64.0	65.9
24	Water Absorption (%, 14% mb)	63.5	66.7	63.0	66.3	62.3	61.4	63.8	65.9	62.5	64.4
25	Arrival Time (min)	2.0	2.6	2.2	4.0	1.6	2.1	3.4	4.3	2.4	3.5
26	Peak Time (min)	3.5	7.4	5.0	8.4	3.4	3.7	8.0	7.5	7.0	7.8
27	Dough Stability (min)	10.5	10.2	8.9	10.4	10.3	11.1	9.7	7.9	13.6	14.4
28	Mixing Tolerance Index (MTI) (BU)	11.0	29.0	21.0	24.0	20.0	14.0	27.0	32.0	15.0	18.0
29	Time To Breakdown (TTB) (min)	12.2	11.9	11.0	14.4	10.3	12.9	12.6	11.6	14.6	16.0
	II. Cooperator Results										
30	Bake Absorption (Average %)	65.1	67.6	66.1	67.8	64.7	63.4	65.9	67.5	65.6	67.1
31	Loaf Volume (% of Check)		108.3		105.0		100.7		105.2		103.7

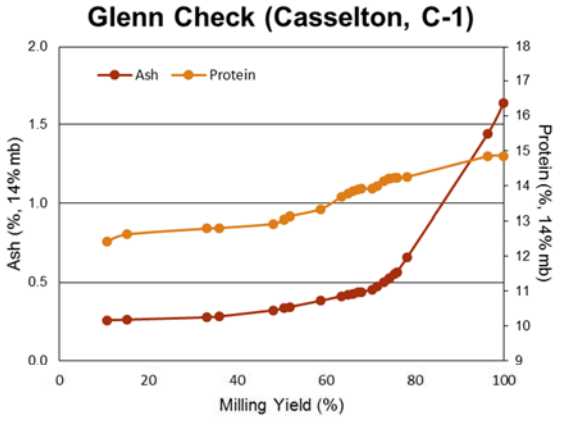
SWQAC #6 – WB9507

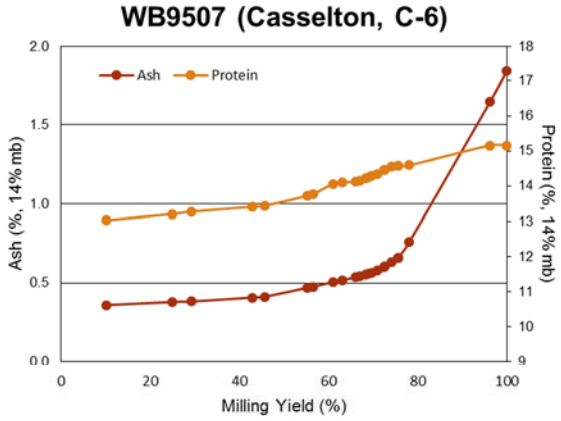
	Quality Trait	Watertown Glenn B-1	Watertown Glenn B-6	Casselton Glenn C-1	Casselton Glenn C-6	Crookston Glenn K-1	Crookston Glenn K-6	Minot Glenn M-1	Minot Glenn M-6	Williston Glenn W-1	Williston Glenn W-6
	II. Cooperator Results										
32	**Mixing Requirement** 9 = Very Long 7 = Long 5 = Medium 3 = Short 1 = Very Short	6.4	6.6	7.2	5.9	6.7	6.9	5.2	4.5	6.6	6.4
33	**Dough Characteristics** 9 = Bucky – Tough 7 = Strong – Elastic 5 = Medium – Pliable 3 = Mellow – Very Pliable 1 = Weak – Short or Sticky	6.7	6.9	7.1	5.8	6.8	7.3	5.8	5.7	7.1	6.3
34	**Mixing Tolerance** 9 = Much More Tolerance Than Check 7 = More Tolerance Than Check 5 = Tolerance Equivalent To Check 3 = Less Tolerance Than Check 1 = Much Less Tolerance Than Check		5.2		4.8		5.9		4.3		5.3
35	**Internal Crumb Color** 9 = Much Brighter Than Check 7 = Brighter Than Check 5 = Equivalent To Check 3 = Poorer Than Check 1 = Much Poorer Than Check		5.2		5.1		5.3		5.8		5.5
36	**Internal Grain and Texture** 9 = Much Better Than Check 7 = Better Than Check 5 = Equivalent To Check 3 = Poorer Than Check 1 = Much Poorer Than Check		6.3		6.0		5.7		5.8		5.5
	III. Cooperator Evaluation										
	Quality Traits 1-2: Protein 9 = Much Better Than Check 7 = Better Than Check 5 = Equivalent To Check 3 = Poorer Than Check 1 = Much Poorer Than Check		7.0		6.1		3.6		6.3		6.3
	Quality Traits 3-22: Milling 9 = Much Better Than Check 7 = Better Than Check 5 = Equivalent To Check 3 = Poorer Than Check 1 = Much Poorer Than Check		3.1		3.3		3.8		3.8		2.9
	Quality Traits 23-36: Baking 9 = Much Better Than Check 7 = Better Than Check 5 = Equivalent To Check 3 = Poorer Than Check 1 = Much Poorer Than Check		6.7		5.9		5.3		6.5		6.0
	Quality Traits 1-36: Overall Comparison 9 = Much Better Than Check 7 = Better Than Check 5 = Equivalent To Check 3 = Poorer Than Check 1 = Much Poorer Than Check		5.5		5.3		4.8		5.5		4.8

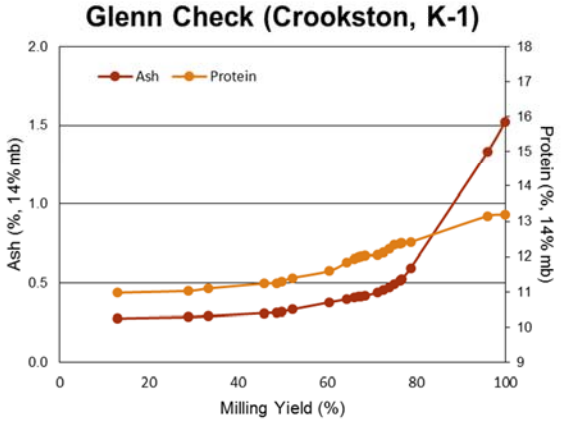
Cumulative Ash and Protein Curves

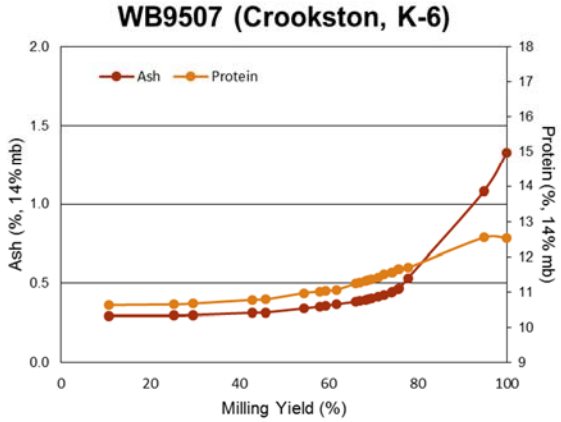


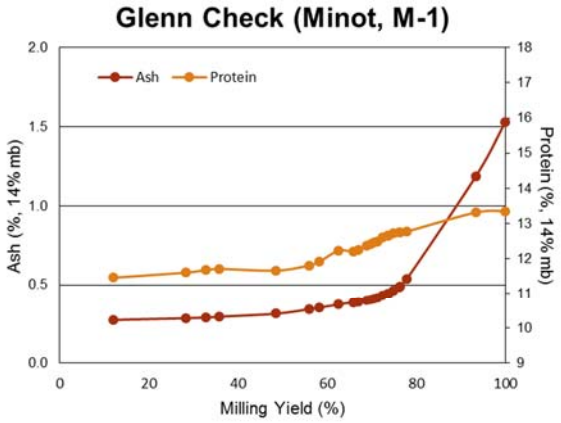


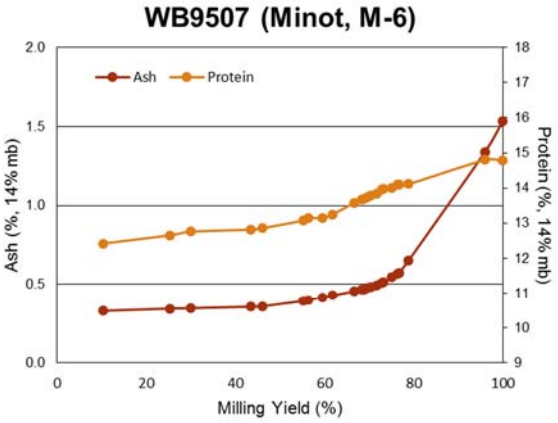


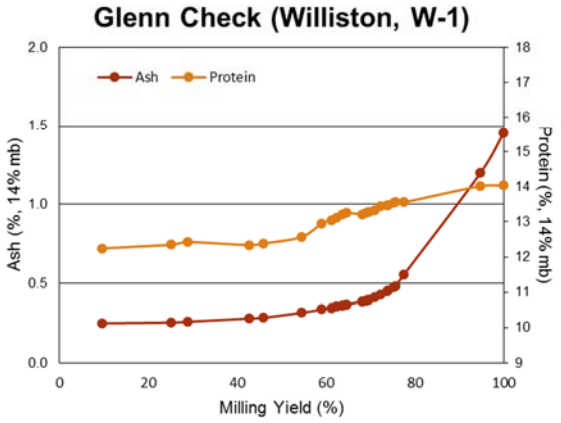


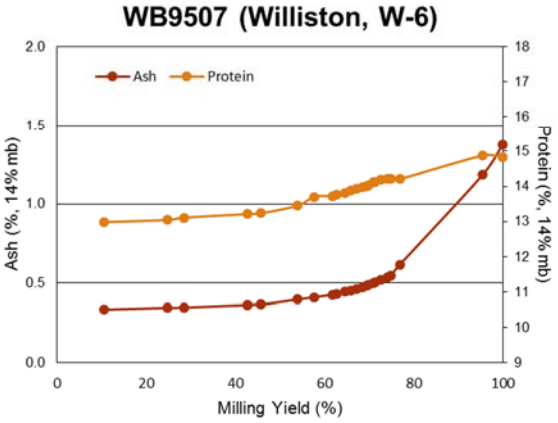





Glenn Check (Minot, M-1)
Ash
Protein
Ash (%, 14% mb)
Protein (%, 14% mb)
Milling Yield (%)

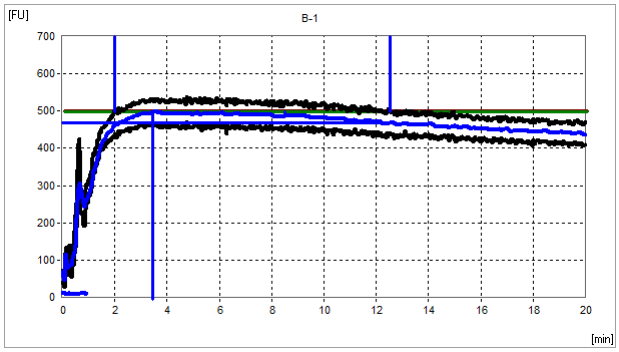

WB9507 (Minot, M-6)
Ash
Protein
Ash (%, 14% mb)
Protein (%, 14% mb)
Milling Yield (%)


Glenn Check (Williston, W-1)
Ash
Protein
Ash (%, 14% mb)
Protein (%, 14% mb)
Milling Yield (%)

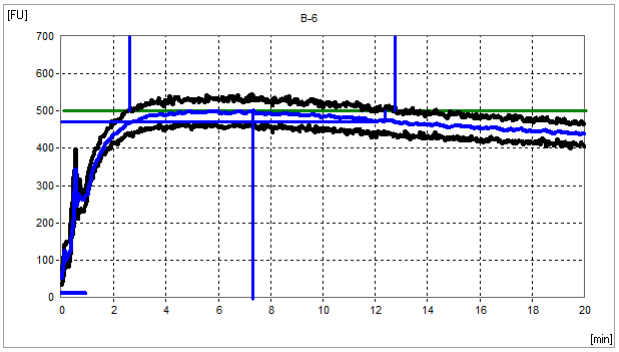

WB9507 (Williston, W-6)
Ash
Protein
Ash (%, 14% mb)
Protein (%, 14% mb)
Milling Yield (%)

Farinograms

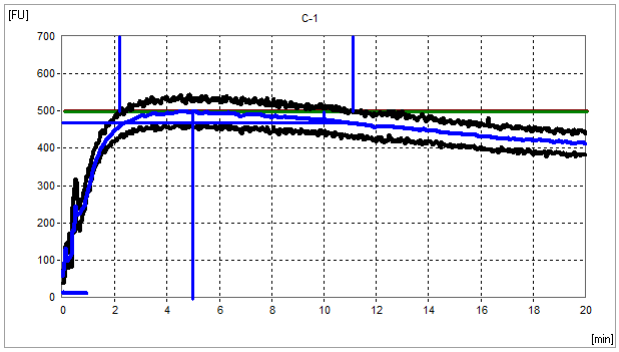
Glenn Check (Watertown, B-1)



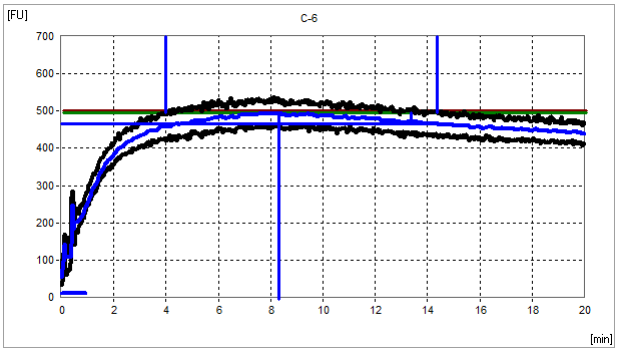
WB9507 (Watertown, B-6)



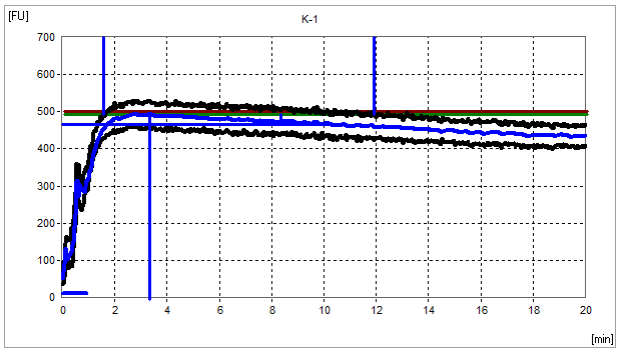
Glenn Check (Casselton, C-1)



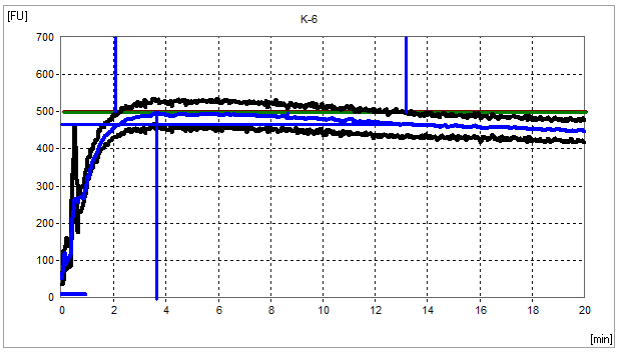
WB9507 (Casselton, C-6)



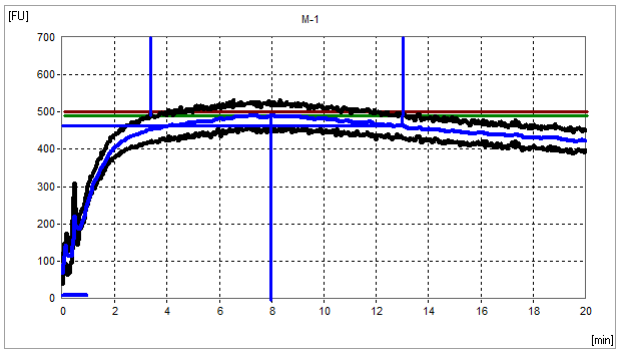
Glenn Check (Crookston, K-1)



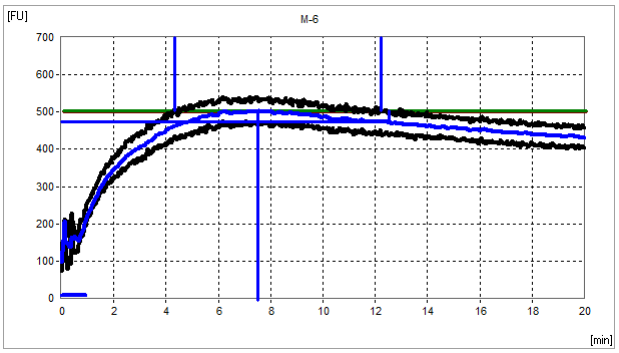
WB9507 (Crookston, K-6)



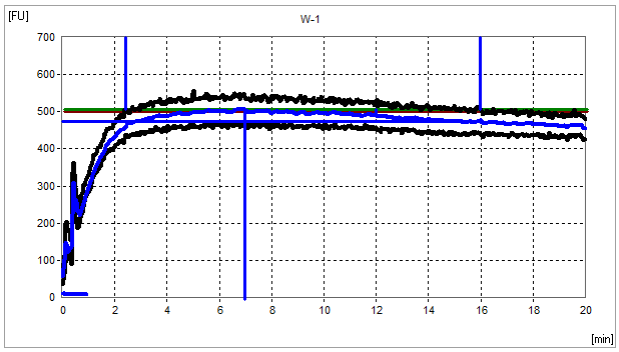
Glenn Check (Minot, M-1)



WB9507 (Minot, M-6)



Glenn Check (Williston, W-1)



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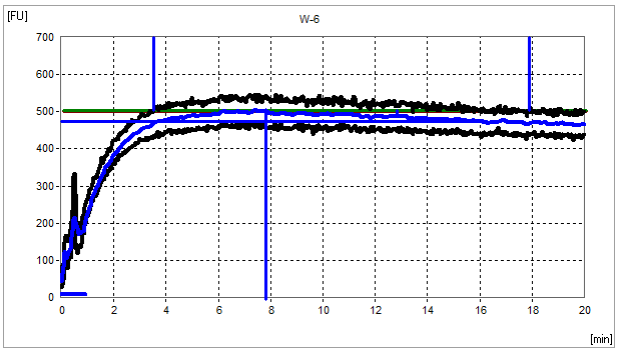
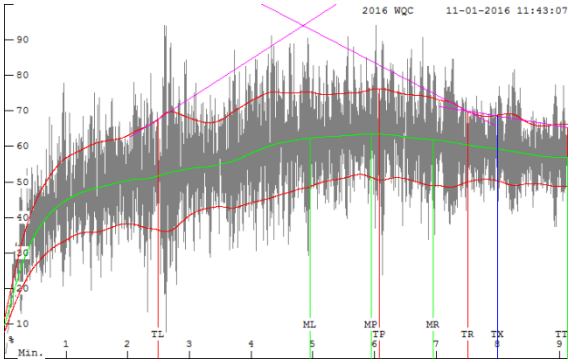
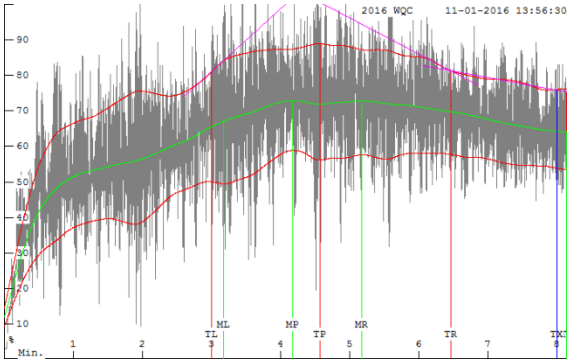


Mixograms

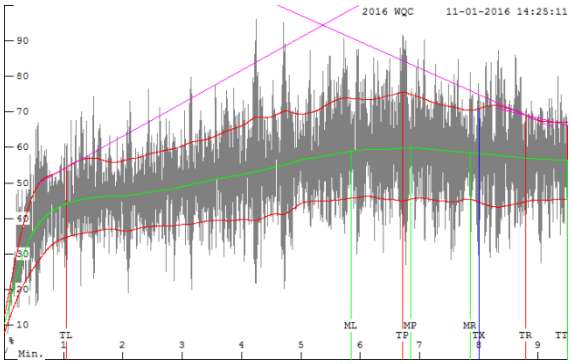
Glenn Check (Watertown, B-1)



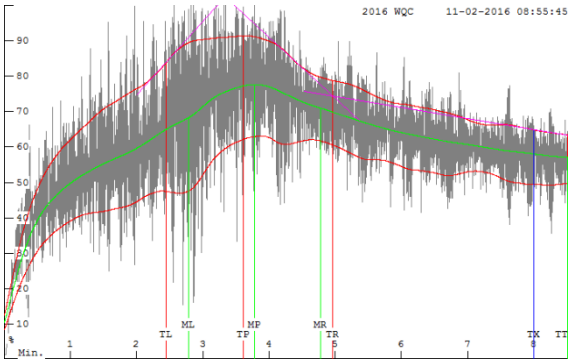
WB9507 (Watertown, B-6)



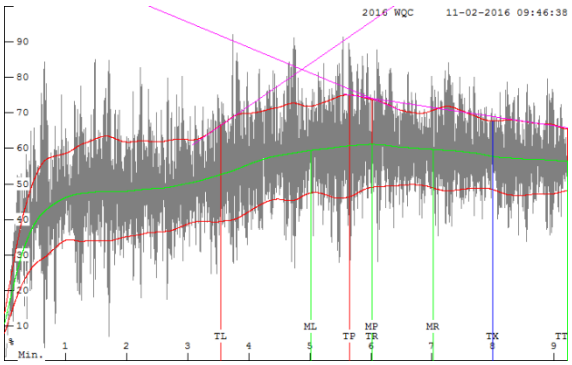
Glenn Check (Casselton, C-1)



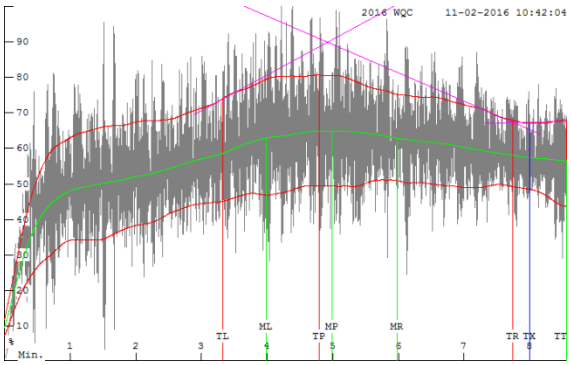
WB9507 (Casselton, C-6)



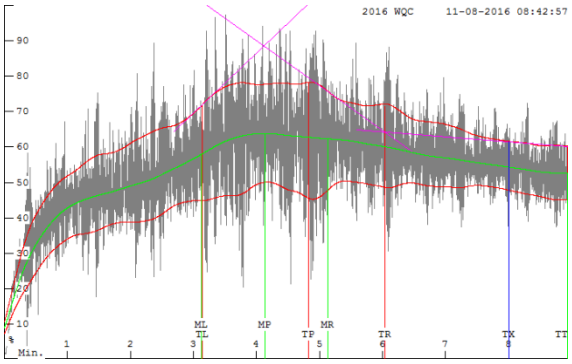
Glenn Check (Crookston, K-1)



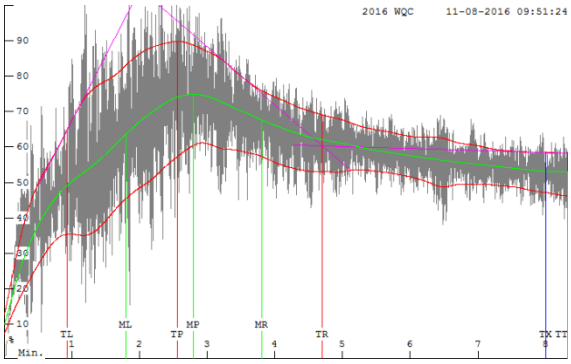
WB9507 (Crookston, K-6)



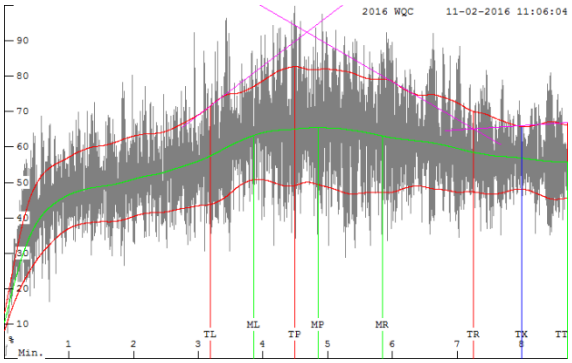
Glenn Check (Minot, M-1)



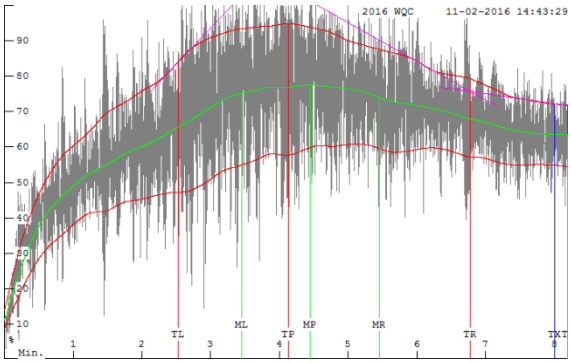
WB9507 (Minot, M-6)



Glenn Check (Williston, W-1)

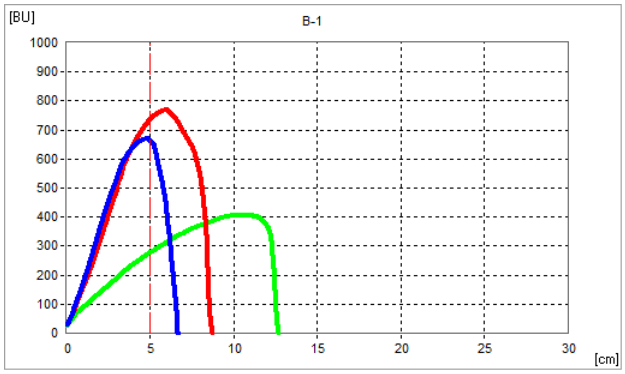


WB9507 (Williston, W-6)

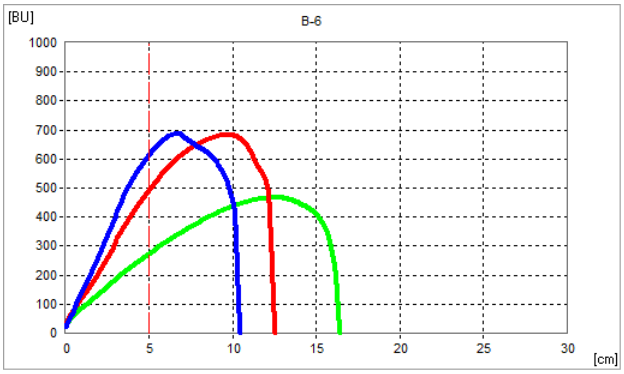


Extensograms

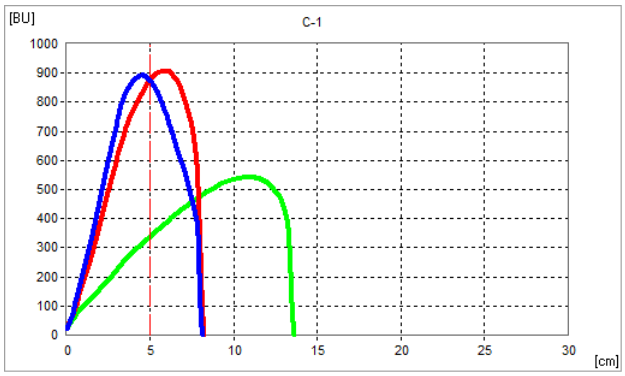
Glenn Check (Watertown, B-1)



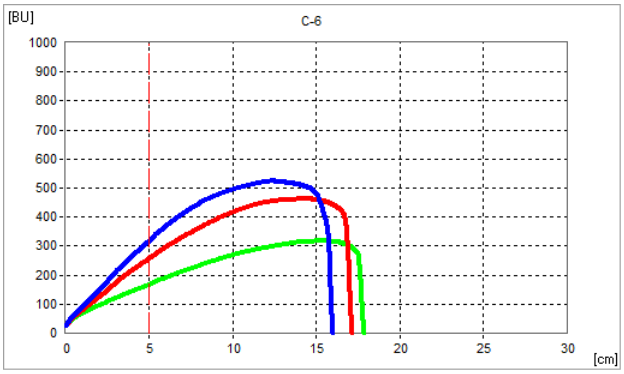
WB9507 (Watertown, B-6)



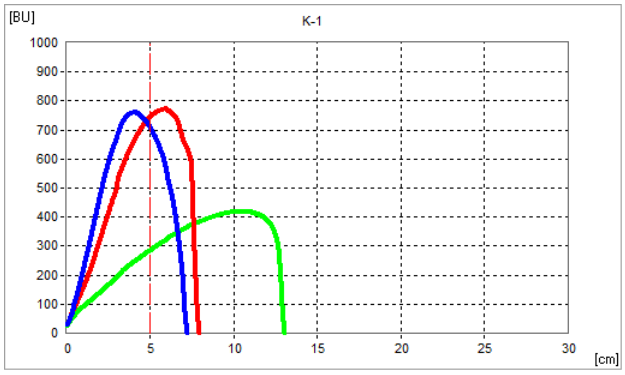
Glenn Check (Casselton, C-1)



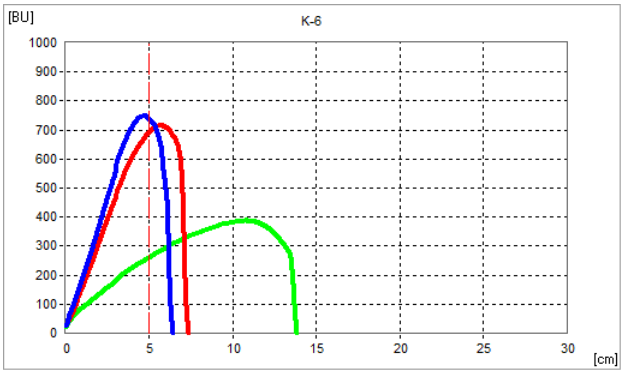
WB9507 (Casselton, C-6)



Glenn Check (Crookston, K-1)

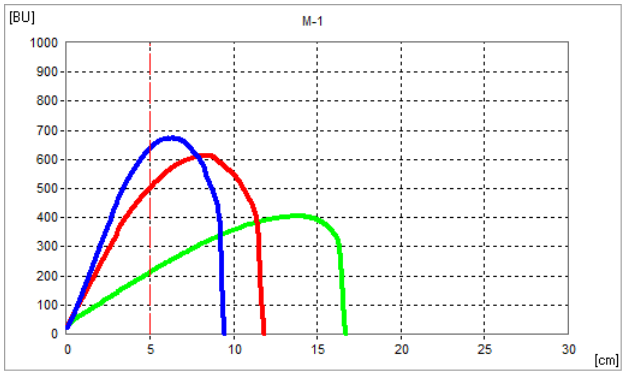


WB9507 (Crookston, K-6)

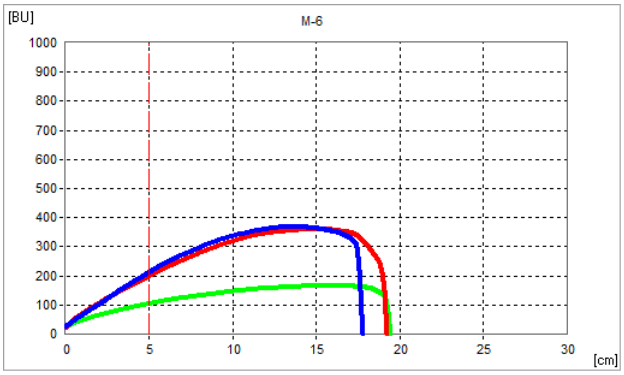


45 min; 90 min; 135 min

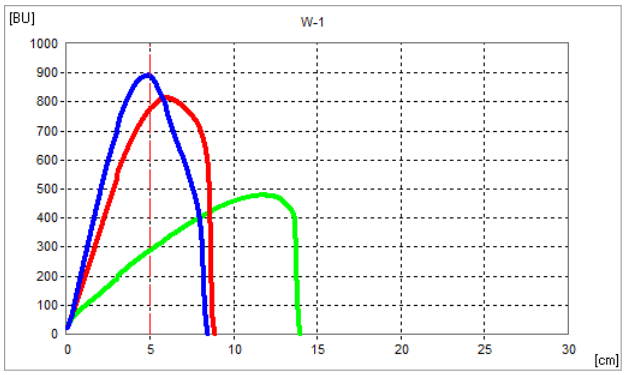
Glenn Check (Minot, M-1)



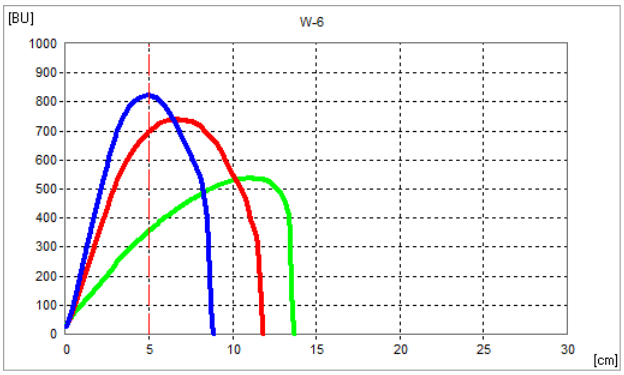
WB9507 (Minot, M-6)



Glenn Check (Williston, W-1)



WB9507 (Williston, W-6)



45 min; 90 min; 135 min

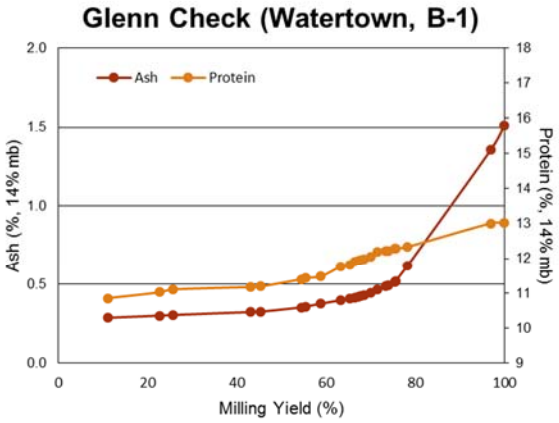
SWQAC #7 – Bolles

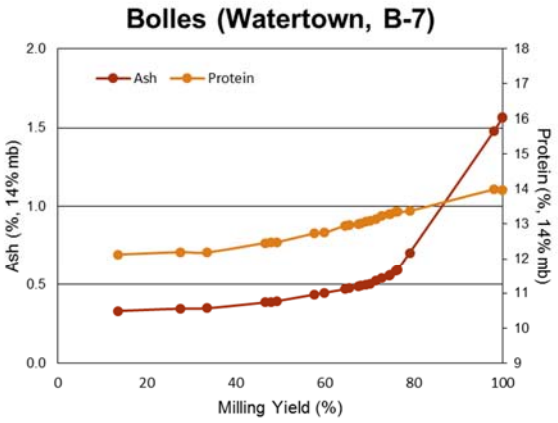
		Watertown		Casselton		Crookston		Minot		Williston	
		Glenn		Glenn		Glenn		Glenn		Glenn	
	Quality Trait	B-1	B-7	C-1	C-7	K-1	K-7	M-1	M-7	W-1	W-7
	I. USDA-ARS WQL Data										
1	Wheat Protein (%, 12% mb)	13.0	13.9	15.0	17.4	13.3	15.1	13.7	14.8	14.0	16.9
2	Flour Protein (%, 14% mb)	12.1	13.2	14.1	16.5	12.5	14.4	12.6	14.0	13.5	16.1
3	Market Value (Score 1-6)	4.2	4.3	4.1	3.4	4.2	4.6	4.7	5.2	4.6	5.3
4	Market Value (Score 1-10)	10.0	8.8	10.0	7.6	10.0	9.2	10.0	9.4	10.0	8.6
5	DON (ppm)	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
6	Test Weight (lb/bu)	64.4	60.6	61.8	57.0	64.2	61.1	64.1	63.7	64.6	61.6
7	1000 Kernel Weight (g)	32.3	33.6	27.0	25.4	30.9	32.8	33.6	38.2	30.5	33.6
8	Kernel Size, % Large	61	63	34	37	54	69	72	86	48	68
9	Kernel Size, % Small	10	9	17	17	8	8	6	4	11	8
10	Wheat Moisture (%)	10.7	10.9	10.7	10.6	10.6	10.8	10.0	11.0	9.7	9.5
11	Wheat Ash (%, 14% mb)	1.48	1.44	1.68	1.88	1.41	1.48	1.39	1.51	1.44	1.41
12	Wheat Falling Number (sec)	406	457	407	471	400	466	419	423	427	468
13	SKCS Hardness Index	82.7	78.2	77.6	75.6	79.6	77.1	69.4	78.6	78.5	70.2
14	Vitreous Kernels (%)	66.0	52.1	87.5	80.8	54.1	89.6	81.4	93.4	98.6	94.3
	Flour Extraction (%)										
15	Tempered Wheat Basis (%)	70.0	70.9	71.2	69.9	72.5	68.1	72.1	73.6	70.9	69.7
16	Total Product Basis (%)	71.5	72.8	73.0	72.0	74.0	72.2	73.6	75.4	72.3	71.3
17	Flour/Bu Wheat (lbs)	45.6	43.2	44.2	40.4	46.9	42.2	47.0	46.8	46.9	43.0
	Flour Quality										
18	Flour Color Brightness (*L**)	90.0	89.7	89.4	88.9	89.8	89.7	90.0	89.5	90.0	89.7
19	Flour Color Yellowness (*b**)	8.8	9.3	8.6	9.5	8.5	9.2	9.0	9.2	8.6	9.3
20	Flour Moisture (%)	13.7	13.5	13.2	13.5	13.9	14.2	12.8	12.7	13.3	12.9
21	Flour Ash (%, 14% mb)	0.48	0.52	0.52	0.59	0.47	0.42	0.44	0.51	0.44	0.47
22	Flour Falling Number (Malted) (sec)	251	257	254	249	255	255	265	250	251	251
	Farinograph										
23	Water Absorption (%, 500 BU)	63.7	65.9	64.0	65.2	63.1	61.0	65.1	64.6	64.0	65.7
24	Water Absorption (%, 14% mb)	63.5	65.1	63.0	64.4	62.3	60.9	63.8	63.0	62.5	63.8
25	Arrival Time (min)	2.0	2.0	2.2	4.0	1.6	2.1	3.4	3.7	2.4	4.2
26	Peak Time (min)	3.5	6.7	5.0	11.2	3.4	8.8	8.0	7.2	7.0	11.9
27	Dough Stability (min)	10.5	12.4	8.9	40.1	10.3	35.7	9.7	10.1	13.6	28.0
28	Mixing Tolerance Index (MTI) (BU)	11.0	20.0	21.0	11.0	20.0	8.0	27.0	20.0	15.0	12.0
29	Time To Breakdown (TTB) (min)	12.2	13.4	11.0	44.4	10.3	39.3	12.6	13.4	14.6	32.8
	II. Cooperator Results										
30	Bake Absorption (Average %)	65.1	66.9	66.1	67.5	64.7	64.3	65.9	66.1	65.6	67.4
31	Loaf Volume (% of Check)		102.9		109.9		107.6		103.6		107.7

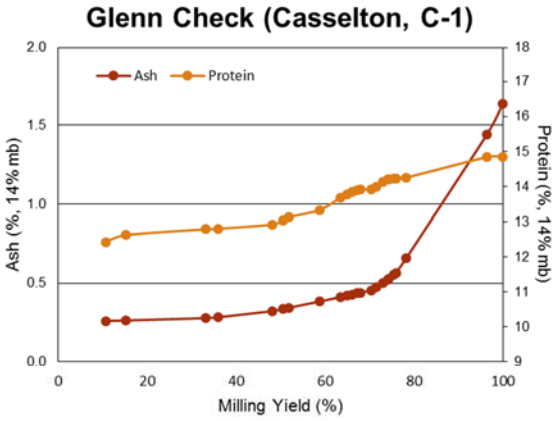
SWQAC #7 – Bolles

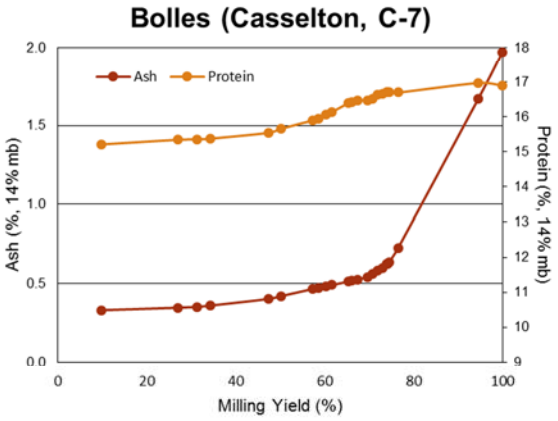
	Quality Trait	Watertown Glenn B-1	Watertown Glenn B-7	Casselton Glenn C-1	Casselton Glenn C-7	Crookston Glenn K-1	Crookston Glenn K-7	Minot Glenn M-1	Minot Glenn M-7	Williston Glenn W-1	Williston Glenn W-7
	II. Cooperator Results										
32	**Mixing Requirement** 9 = Very Long 7 = Long 5 = Medium 3 = Short 1 = Very Short	6.4	6.8	7.2	7.8	6.7	7.7	5.2	5.2	6.6	7.2
33	**Dough Characteristics** 9 = Bucky – Tough 7 = Strong – Elastic 5 = Medium – Pliable 3 = Mellow – Very Pliable 1 = Weak – Short or Sticky	6.7	6.9	7.1	7.6	6.8	7.3	5.8	5.8	7.1	7.3
34	**Mixing Tolerance** 9 = Much More Tolerance Than Check 7 = More Tolerance Than Check 5 = Tolerance Equivalent To Check 3 = Less Tolerance Than Check 1 = Much Less Tolerance Than Check		5.7		6.9		7.0		5.2		5.8
35	**Internal Crumb Color** 9 = Much Brighter Than Check 7 = Brighter Than Check 5 = Equivalent To Check 3 = Poorer Than Check 1 = Much Poorer Than Check		4.9		5.1		5.1		4.8		4.6
36	**Internal Grain and Texture** 9 = Much Better Than Check 7 = Better Than Check 5 = Equivalent To Check 3 = Poorer Than Check 1 = Much Poorer Than Check		5.8		5.8		5.9		5.2		5.1
	III. Cooperator Evaluation										
	Quality Traits 1-2: Protein 9 = Much Better Than Check 7 = Better Than Check 5 = Equivalent To Check 3 = Poorer Than Check 1 = Much Poorer Than Check		6.8		7.8		7.9		6.6		7.7
	Quality Traits 3-22: Milling 9 = Much Better Than Check 7 = Better Than Check 5 = Equivalent To Check 3 = Poorer Than Check 1 = Much Poorer Than Check		4.8		2.8		2.9		5.8		3.8
	Quality Traits 23-36: Baking 9 = Much Better Than Check 7 = Better Than Check 5 = Equivalent To Check 3 = Poorer Than Check 1 = Much Poorer Than Check		6.1		6.1		5.8		5.6		6.3
	Quality Traits 1-36: Overall Comparison 9 = Much Better Than Check 7 = Better Than Check 5 = Equivalent To Check 3 = Poorer Than Check 1 = Much Poorer Than Check		6.0		5.5		5.8		5.8		5.4

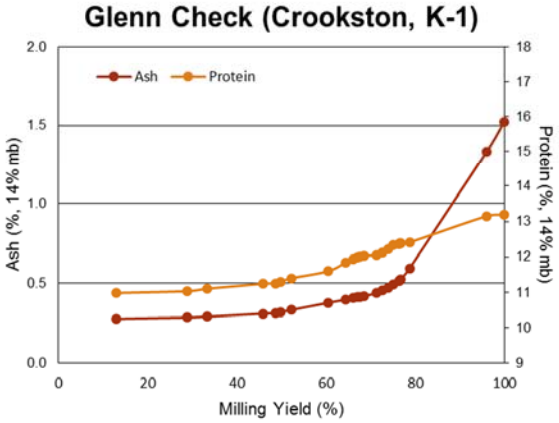
Cumulative Ash and Protein Curves

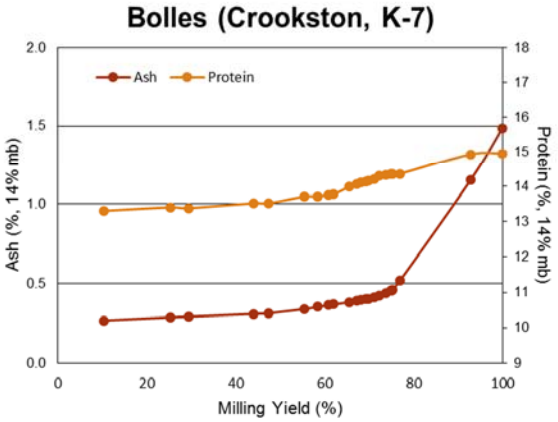


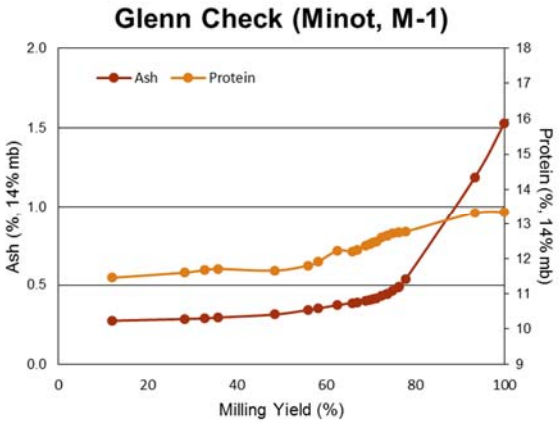


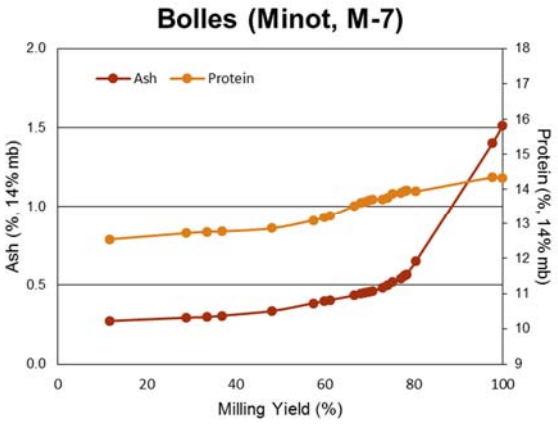


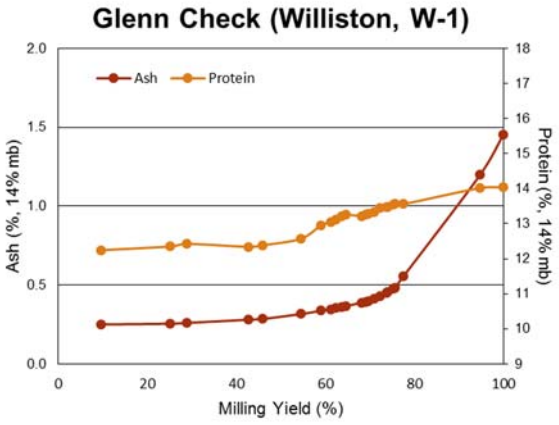


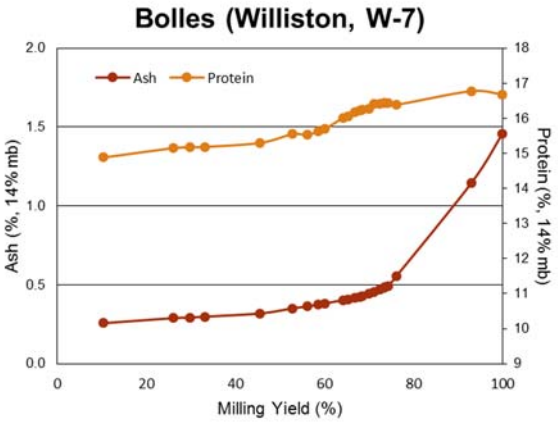





Glenn Check (Minot, M-1)
Ash
Protein
Ash (%, 14% mb)
Protein (%, 14% mb)
Milling Yield (%)

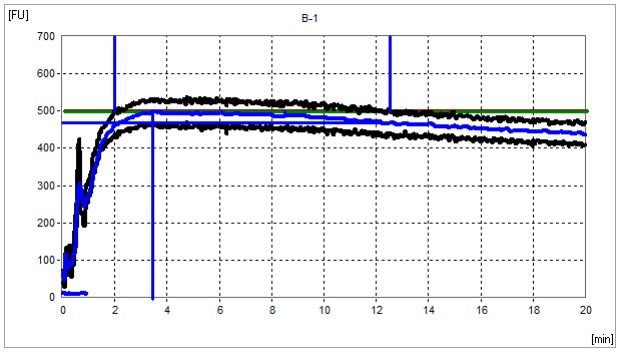

Bolles (Minot, M-7)
Ash
Protein
Ash (%, 14% mb)
Protein (%, 14% mb)
Milling Yield (%)


Glenn Check (Williston, W-1)
Ash
Protein
Ash (%, 14% mb)
Protein (%, 14% mb)
Milling Yield (%)

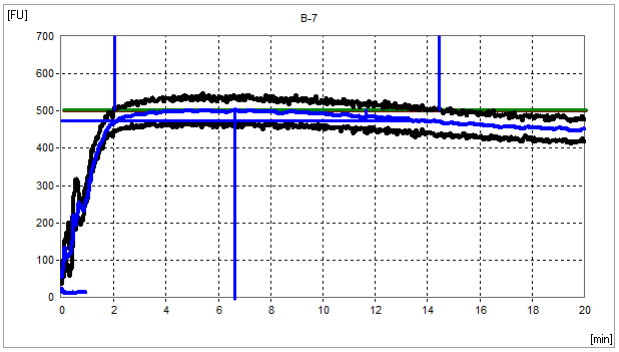

Bolles (Williston, W-7)
Ash
Protein
Ash (%, 14% mb)
Protein (%, 14% mb)
Milling Yield (%)

Farinograms

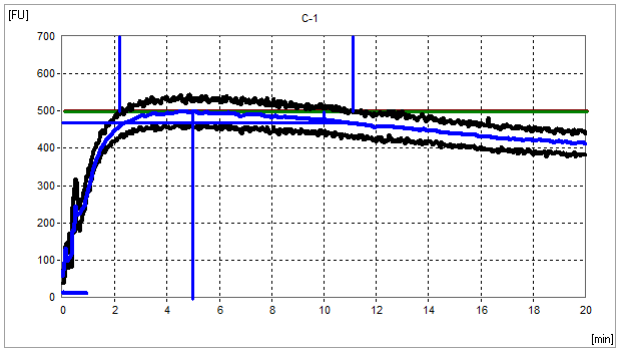
Glenn Check (Watertown, B-1)



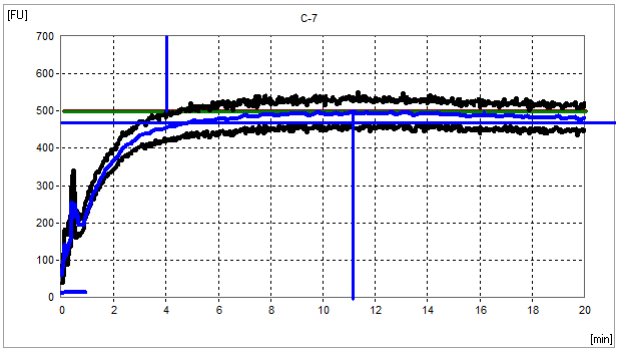
Bolles (Watertown, B-7)



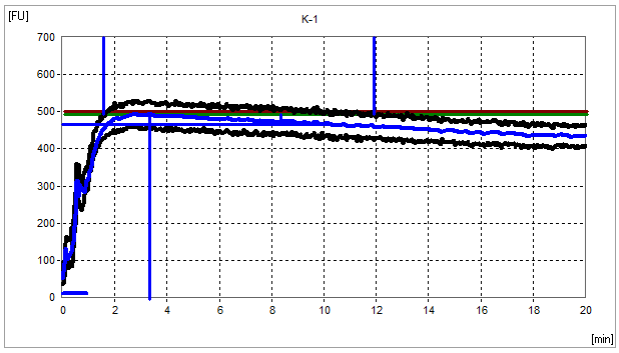
Glenn Check (Casselton, C-1)



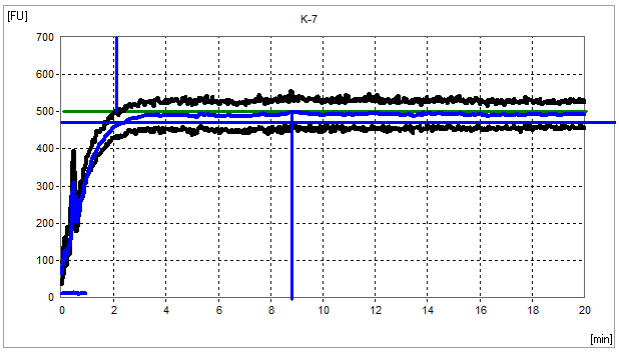
Bolles (Casselton, C-7)



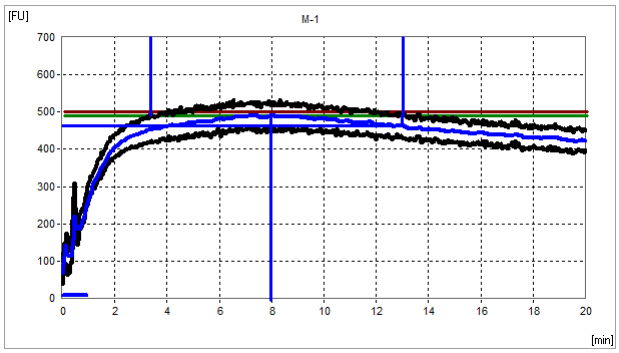
Glenn Check (Crookston, K-1)



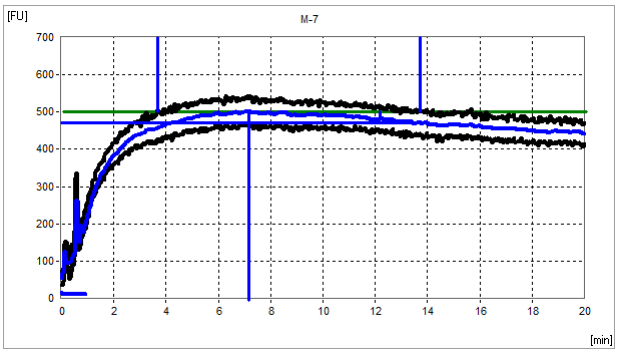
Bolles (Crookston, K-7)



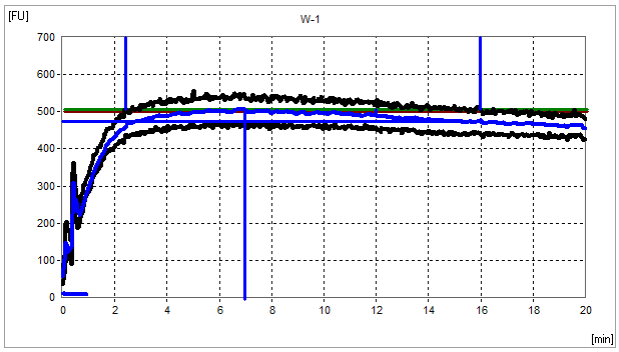
Glenn Check (Minot, M-1)



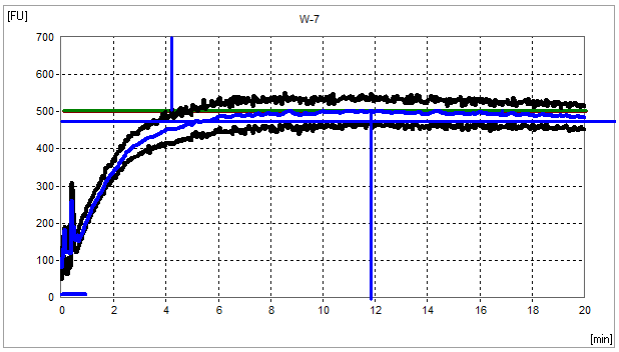
Bolles (Minot, M-7)



Glenn Check (Williston, W-1)

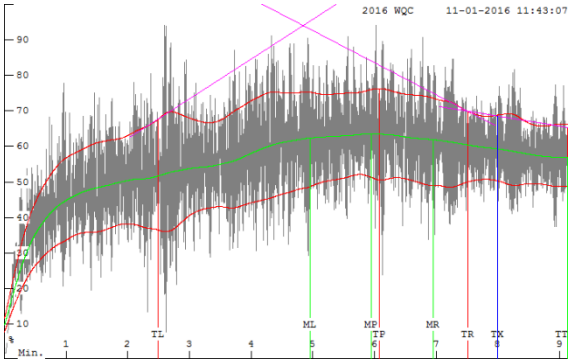


Bolles (Williston, W-7)

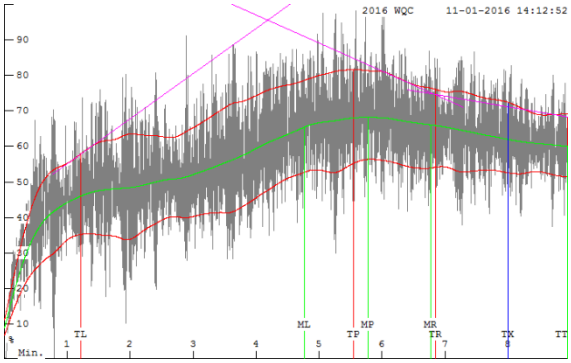


Mixograms

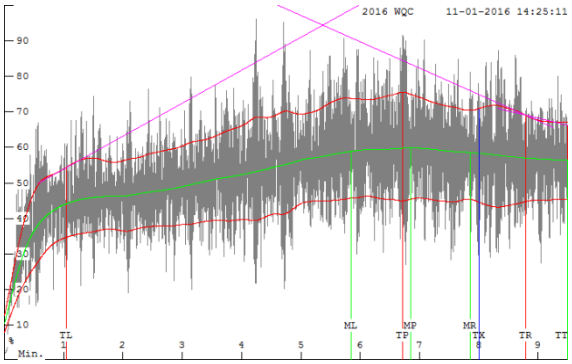
Glenn Check (Watertown, B-1)



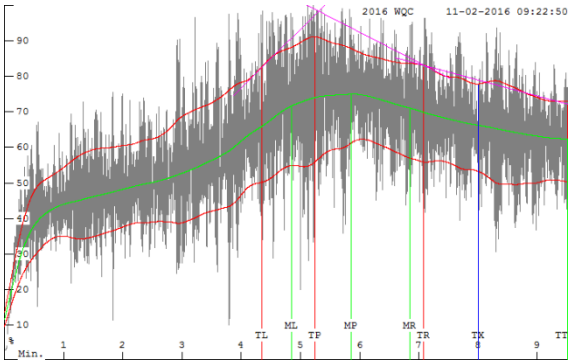
Bolles (Watertown, B-7)



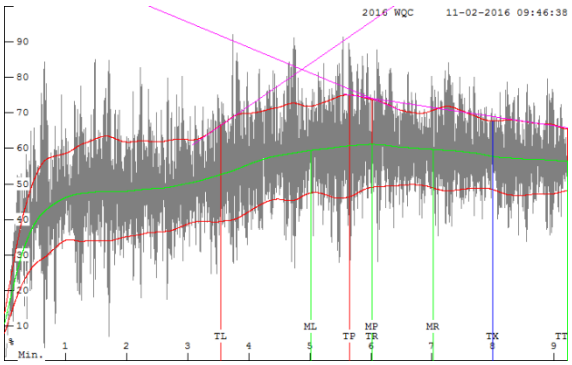
Glenn Check (Casselton, C-1)



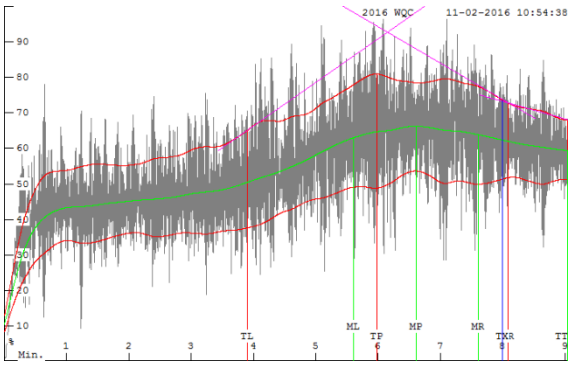
Bolles (Casselton, C-7)



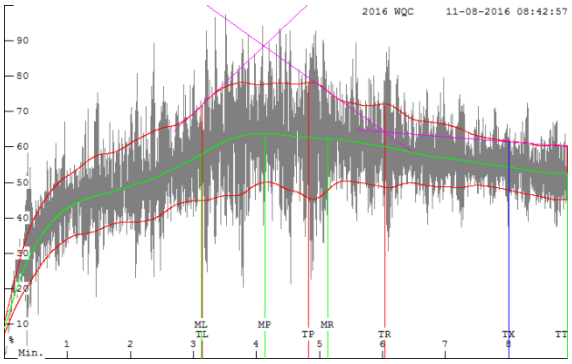
Glenn Check (Crookston, K-1)



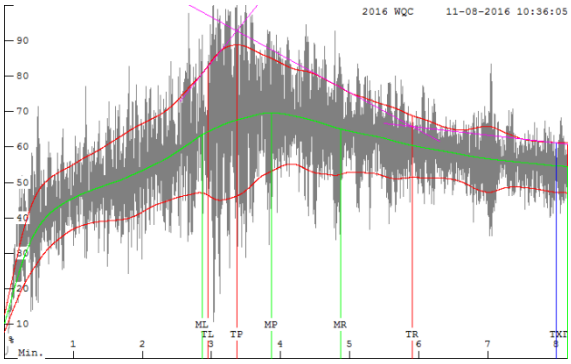
Bolles (Crookston, K-7)



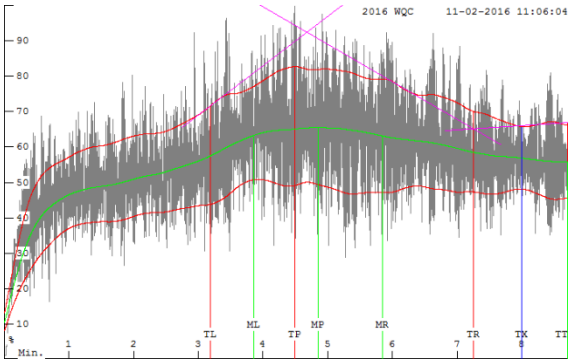
Glenn Check (Minot, M-1)



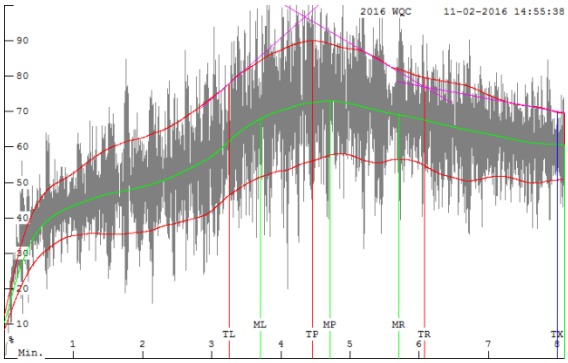
Bolles (Minot, M-7)



Glenn Check (Williston, W-1)

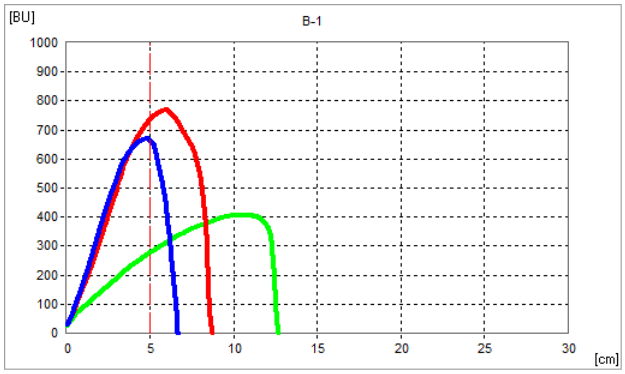


Bolles (Williston, W-7)

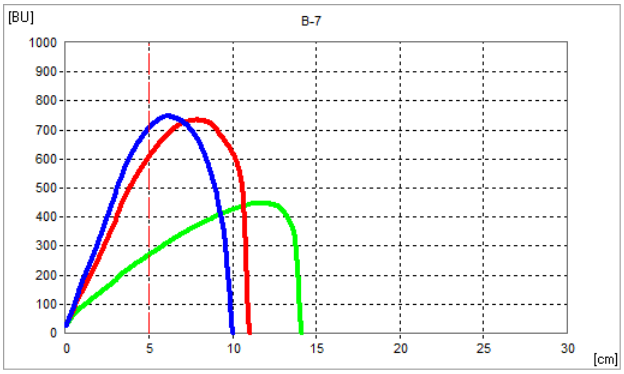


Extensograms

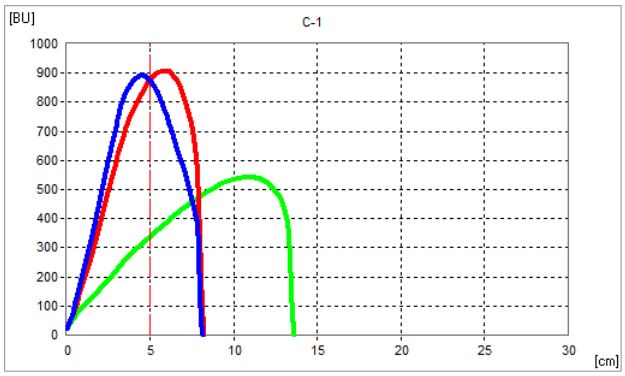
Glenn Check (Watertown, B-1)



Bolles (Watertown, B-7)



Glenn Check (Casselton, C-1)



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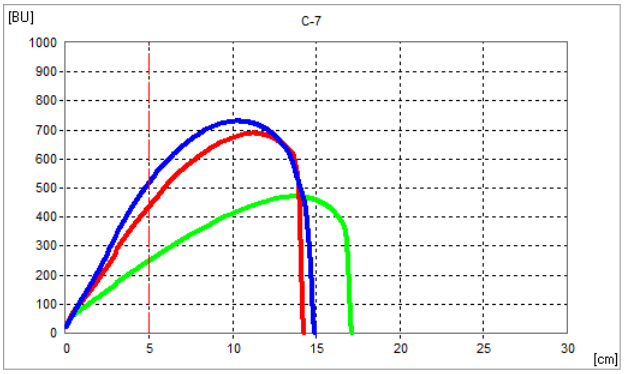
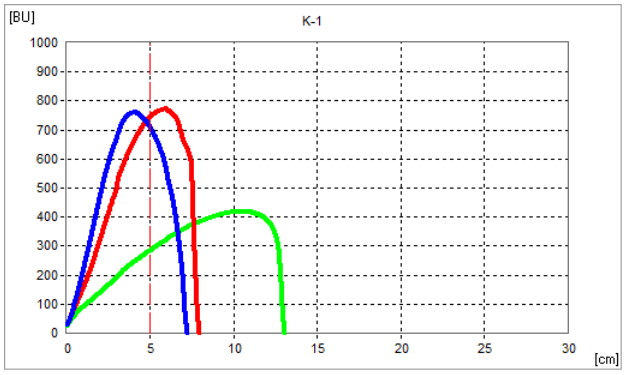


Glenn Check (Crookston, K-1)



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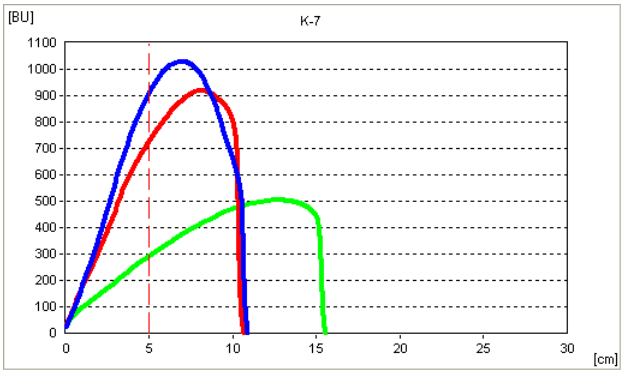

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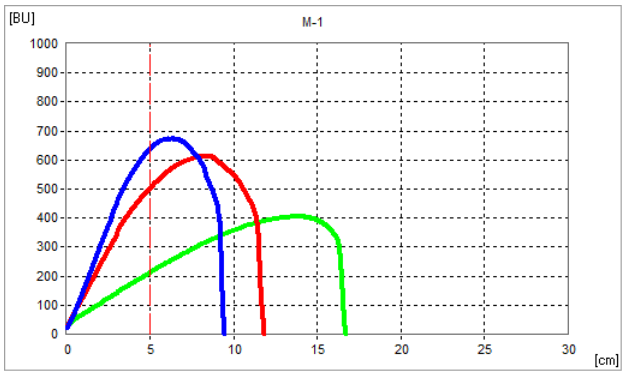
Glenn Check (Minot, M-1)



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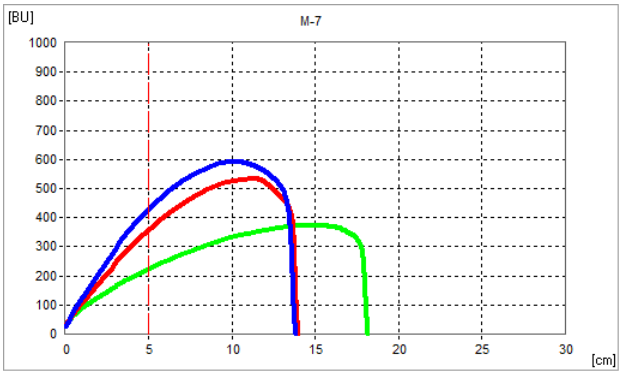
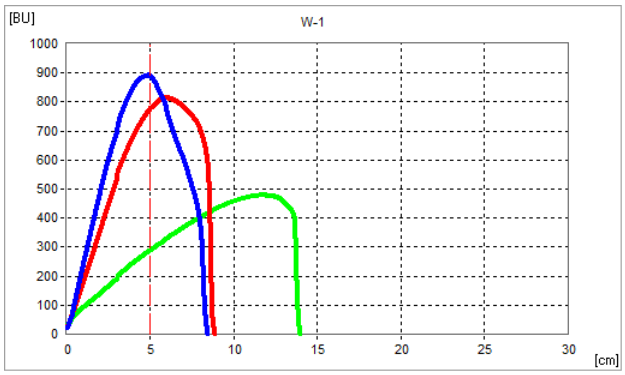


Glenn Check (Williston, W-1)



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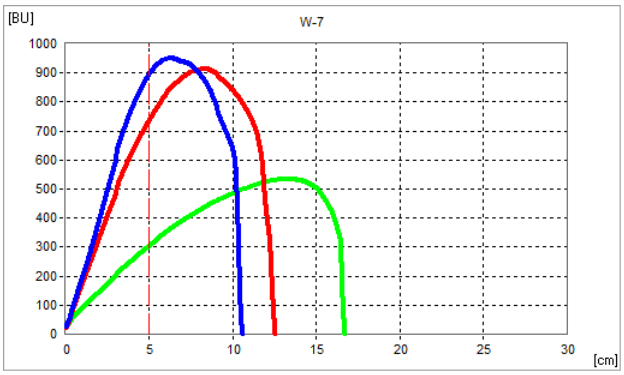


45 min; 90 min; 135 min

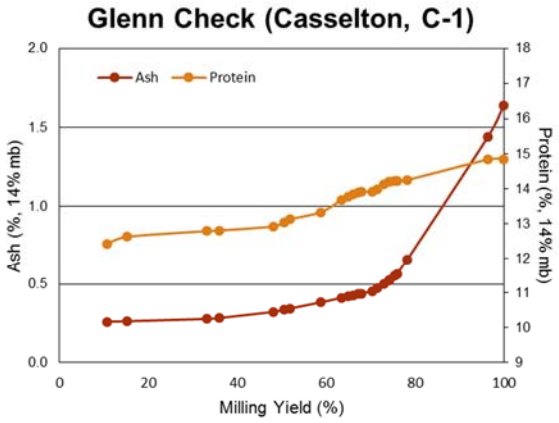
SWQAC #8 – SY Rustler

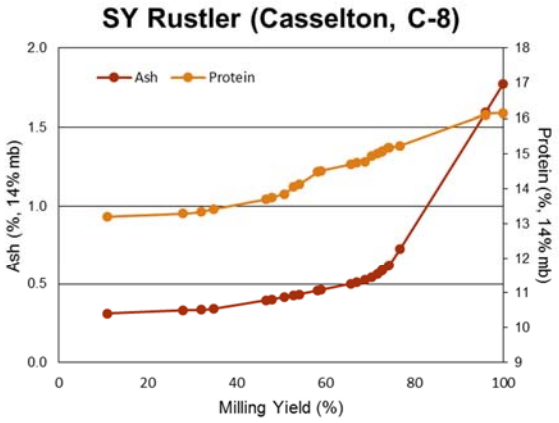
		Casselton		Minot		Williston	
		Glenn		Glenn		Glenn	
	Quality Trait	C-1	C-8	M-1	M-8	W-1	W-8
	I. USDA-ARS WQL Data						
1	Wheat Protein (%, 12% mb)	15.0	16.3	13.7	16.0	14.0	14.2
2	Flour Protein (%, 14% mb)	14.1	15.3	12.6	14.6	13.5	12.8
3	Market Value (Score 1-6)	4.1	3.6	4.7	4.6	4.6	4.1
4	Market Value (Score 1-10)	10.0	8.2	10.0	7.4	10.0	8.0
5	DON (ppm)	nd	nd	nd	1.85	nd	nd
6	Test Weight (lb/bu)	61.8	57.1	64.1	58.7	64.6	59.5
7	1000 Kernel Weight (g)	27.0	27.2	33.6	34.4	30.5	30.7
8	Kernel Size, % Large	34	32	72	71	48	41
9	Kernel Size, % Small	17	15	6	6	11	9
10	Wheat Moisture (%)	10.7	10.5	10.0	10.9	9.7	9.9
11	Wheat Ash (%, 14% mb)	1.68	1.79	1.39	1.44	1.44	1.32
12	Wheat Falling Number (sec)	407	493	419	433	427	497
13	SKCS Hardness Index	77.6	70.5	69.4	69.1	78.5	70.0
14	Vitreous Kernels (%)	87.5	73.5	81.4	85.0	98.6	87.5
	Flour Extraction (%)						
15	Tempered Wheat Basis (%)	71.2	70.5	72.1	70.9	70.9	68.2
16	Total Product Basis (%)	73.0	71.7	73.6	72.6	72.3	70.6
17	Flour/Bu Wheat (lbs)	44.2	40.6	47.0	41.7	46.9	40.6
	Flour Quality						
18	Flour Color Brightness (*L**)	89.4	89.2	90.0	89.2	90.0	89.9
19	Flour Color Yellowness (*b**)	8.6	9.3	9.0	8.5	8.6	9.1
20	Flour Moisture (%)	13.2	13.2	12.8	12.6	13.3	12.5
21	Flour Ash (%, 14% mb)	0.52	0.55	0.44	0.48	0.44	0.44
22	Flour Falling Number (Malted) (sec)	254	263	265	251	251	256
	Farinograph						
23	Water Absorption (%, 500 BU)	64.0	68.3	65.1	67.7	64.0	65.0
24	Water Absorption (%, 14% mb)	63.0	66.9	63.8	65.9	62.5	62.6
25	Arrival Time (min)	2.2	4.6	3.4	3.5	2.4	3.2
26	Peak Time (min)	5.0	9.2	8.0	5.3	7.0	6.9
27	Dough Stability (min)	8.9	9.9	9.7	5.4	13.6	8.9
28	Mixing Tolerance Index (MTI) (BU)	21.0	32.0	27.0	33.0	15.0	33.0
29	Time To Breakdown (TTB) (min)	11.0	14.0	12.6	8.9	14.6	11.6
	II. Cooperator Results						
30	Bake Absorption (Average %)	66.1	68.4	65.9	67.7	65.6	66.0
31	Loaf Volume (% of Check)		101.2		93.6		95.9

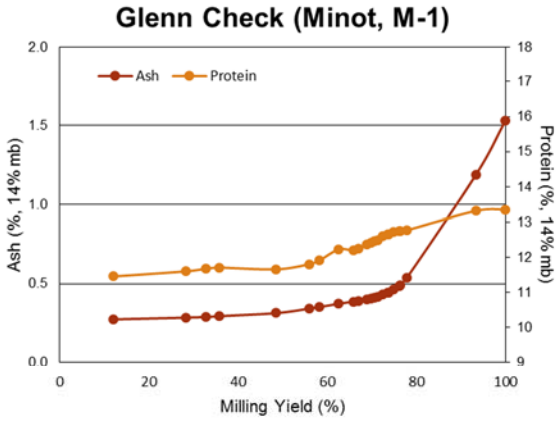
SWQAC #8 – SY Rustler

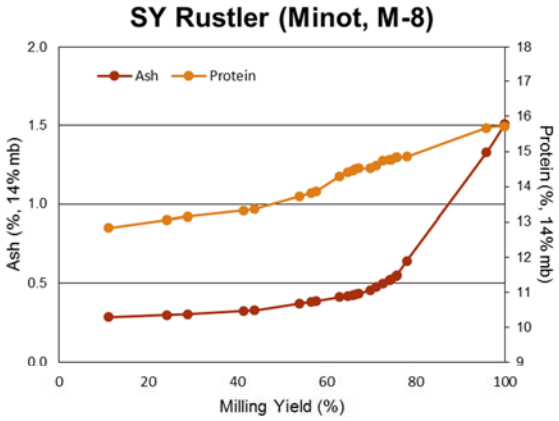
	Quality Trait	Casselton Glenn C-1	Casselton Glenn C-8	Minot Glenn M-1	Minot Glenn M-8	Williston Glenn W-1	Williston Glenn W-8
	II. Cooperator Results						
32	**Mixing Requirement** 9 = Very Long 7 = Long 5 = Medium 3 = Short 1 = Very Short	7.2	5.5	5.2	3.4	6.6	5.5
33	**Dough Characteristics** 9 = Bucky – Tough 7 = Strong – Elastic 5 = Medium – Pliable 3 = Mellow – Very Pliable 1 = Weak – Short or Sticky	7.1	6.3	5.8	3.9	7.1	5.8
34	**Mixing Tolerance** 9 = Much More Tolerance Than Check 7 = More Tolerance Than Check 5 = Tolerance Equivalent To Check 3 = Less Tolerance Than Check 1 = Much Less Tolerance Than Check		4.7		2.5		4.1
35	**Internal Crumb Color** 9 = Much Brighter Than Check 7 = Brighter Than Check 5 = Equivalent To Check 3 = Poorer Than Check 1 = Much Poorer Than Check		5.0		4.7		5.2
36	**Internal Grain and Texture** 9 = Much Better Than Check 7 = Better Than Check 5 = Equivalent To Check 3 = Poorer Than Check 1 = Much Poorer Than Check		5.6		4.2		5.4
	III. Cooperator Evaluation						
	Quality Traits 1-2: Protein 9 = Much Better Than Check 7 = Better Than Check 5 = Equivalent To Check 3 = Poorer Than Check 1 = Much Poorer Than Check		6.8		6.8		4.4
	Quality Traits 3-22: Milling 9 = Much Better Than Check 7 = Better Than Check 5 = Equivalent To Check 3 = Poorer Than Check 1 = Much Poorer Than Check		3.2		3.4		2.8
	Quality Traits 23-36: Baking 9 = Much Better Than Check 7 = Better Than Check 5 = Equivalent To Check 3 = Poorer Than Check 1 = Much Poorer Than Check		5.3		2.8		4.5
	Quality Traits 1-36: Overall Comparison 9 = Much Better Than Check 7 = Better Than Check 5 = Equivalent To Check 3 = Poorer Than Check 1 = Much Poorer Than Check		4.7		2.8		3.8

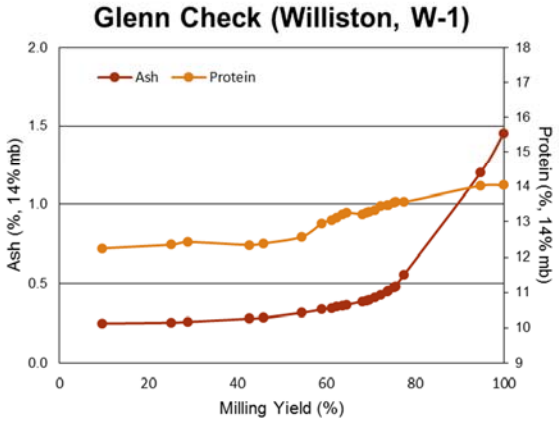
Cumulative Ash and Protein Curves

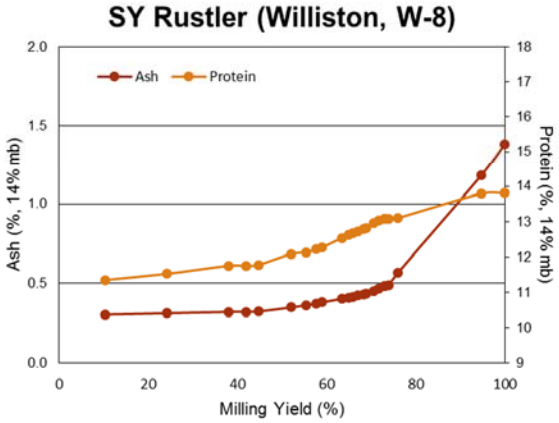






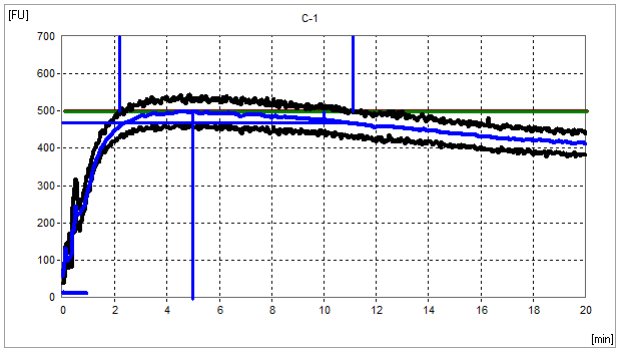




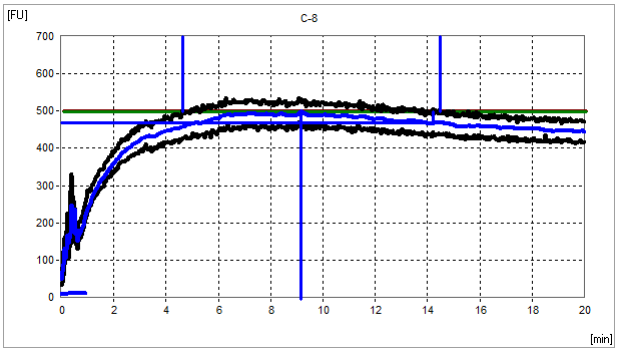


Farinograms

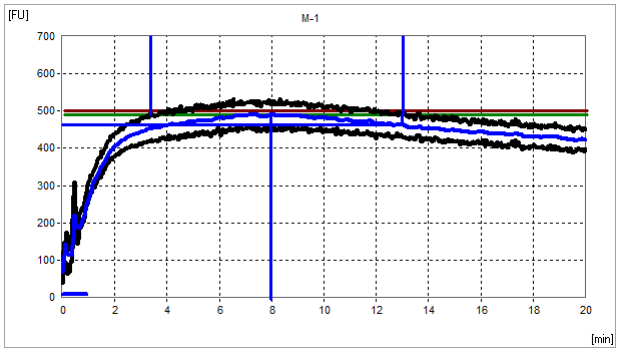
Glenn Check (Casselton, C-1)



SY Rustler (Casselton, C-8)



Glenn Check (Minot, M-1)



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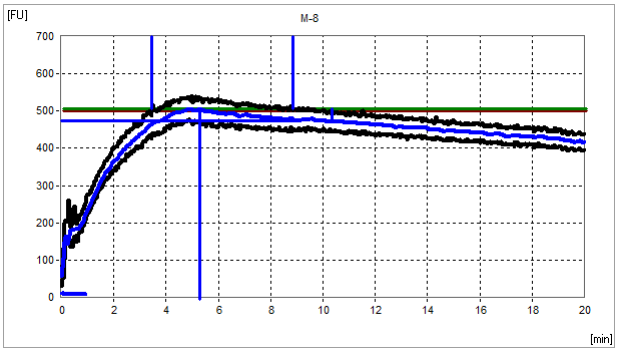
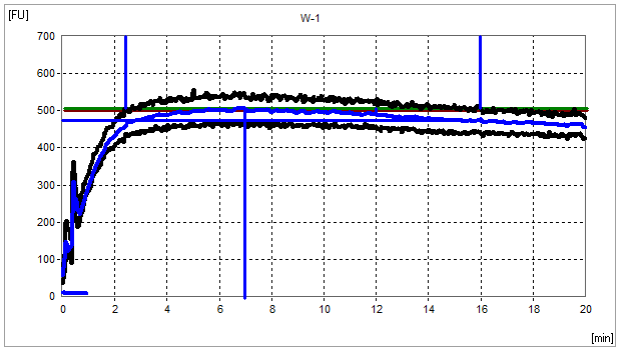


Glenn Check (Williston, W-1)



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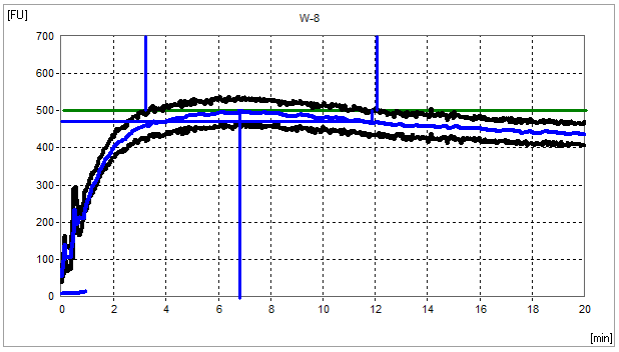
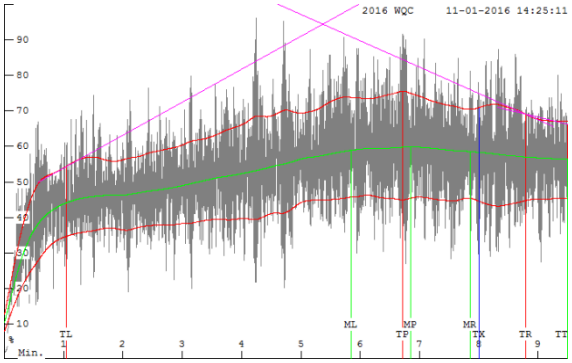


Mixograms

Glenn Check (Casselton, C-1)



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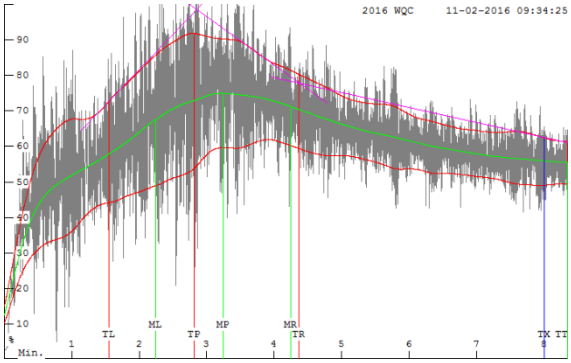

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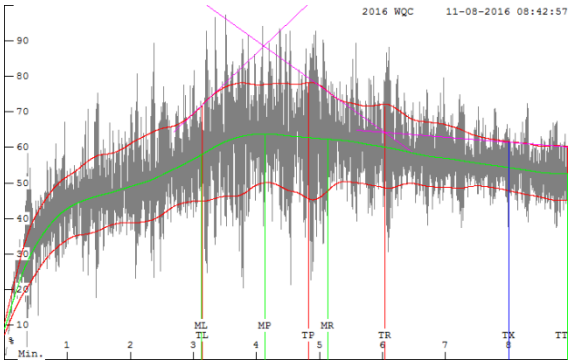

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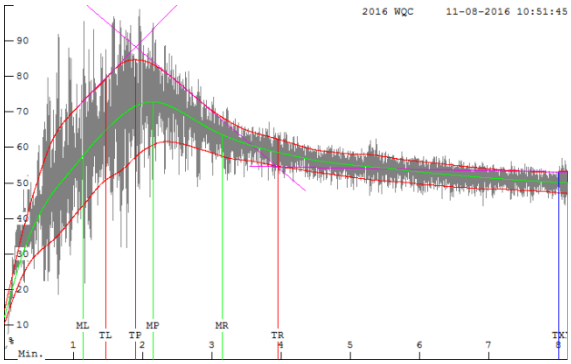

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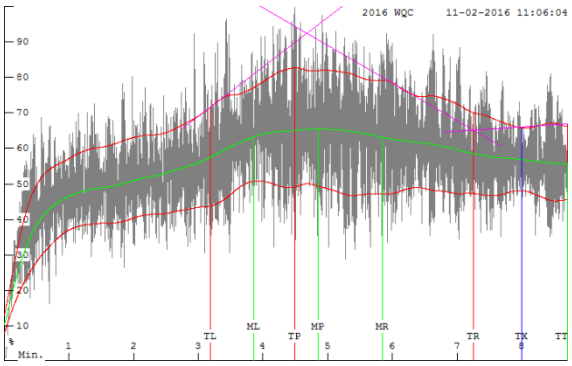

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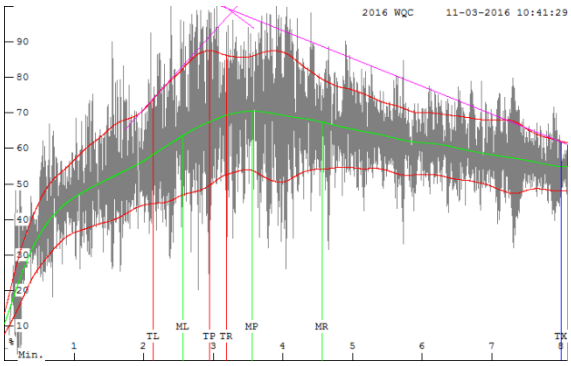
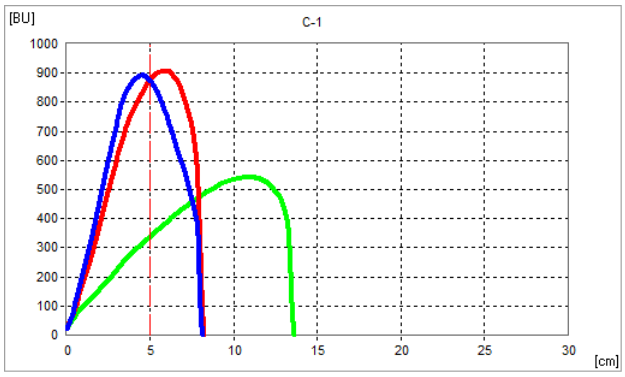


Extensograms

Glenn Check (Casselton, C-1)



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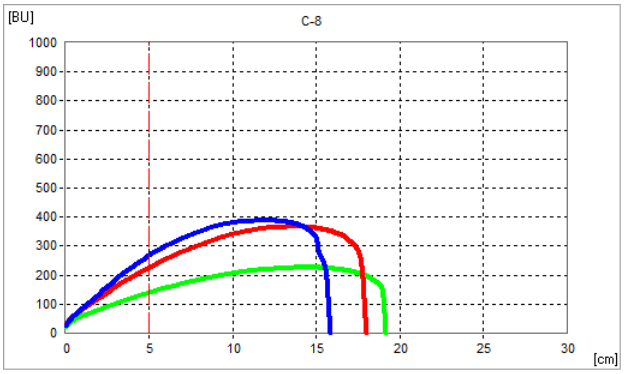

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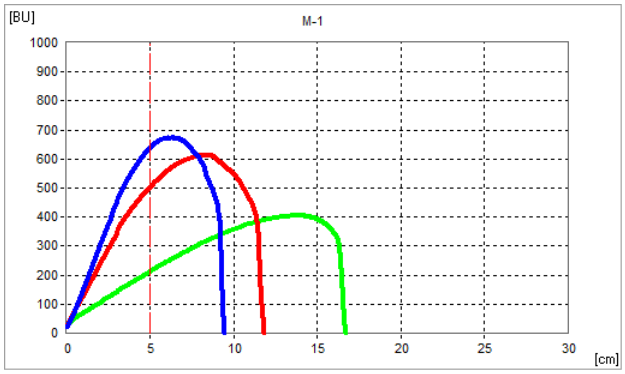

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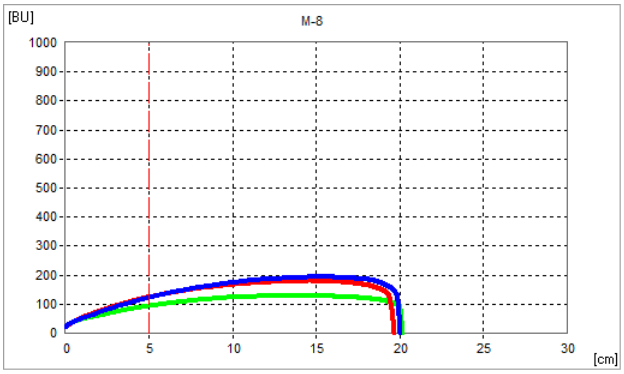

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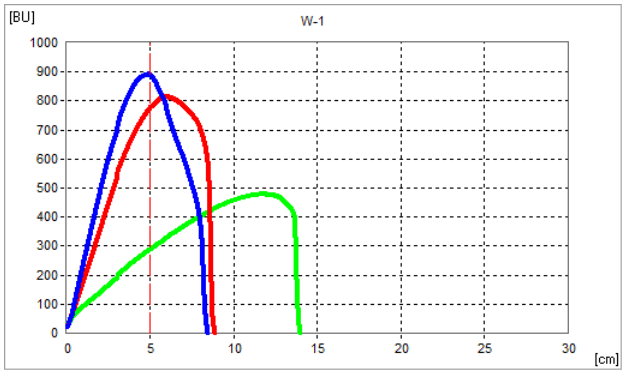

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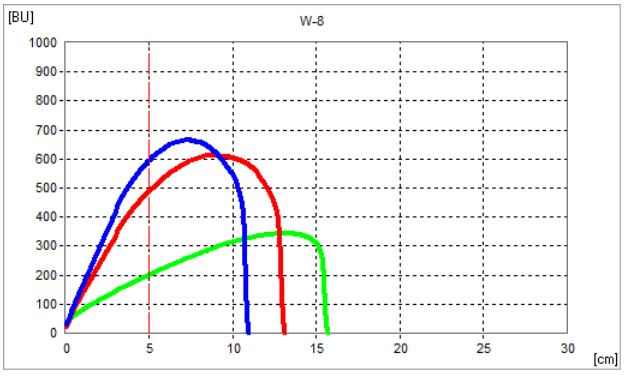


45 min; 90 min; 135 min

Appendix

Wheat Marketing Score

The development of a Wheat Marketing Score (WMS) or Export Marketing Score was discussed at the Hard Spring Wheat Planning Meeting in March, 2004. The purpose for developing a WMS was to facilitate a better understanding of wheat quality in marketing systems. Two WMS methods were developed and tested. For each method, the quality variables of Test Weight (TW), 1000 Kernel Weight (KWT), Falling Number (FN), Wheat Protein (WP), and Wheat Ash (WA) were incorporated for calculating the WMS. Method #1 was developed on a scale of 0 to 6 where Glenn Check was evaluated along with the experimental lines for each growing locations. Method #2 was developed on a scale of 0 to 10 where the experimental lines were evaluated against the Glenn Check for each growing locations.

Wheat Marketing Score – Method #1

Wheat Marketing Score or Export Marketing Score						
	Score	Test Weight (lb/bu)	1000 KWT (g)	Falling Number (sec)	Wheat Protein (%, 12% mb)	Wheat Ash (%, 14% mb)
	6	63	39	425	16.5	1.35
	5	62	36	400	15.5	1.45
	4	61	33	375	14.5	1.55
Target Value	**3**	**60**	**30**	**350**	**13.5**	**1.65**
	2	59	26	325	12.5	1.75
	1	58	22	300	11.5	1.85
	0	57	18	275	10.5	1.95
Variation (+/-) from Target Value		**1**	**3 g up, 4 g down**	**25**	**1.0**	**0.10**

Wheat Marketing Score = [(TW*2) + (1000 KWT*2) + (FN*2) + (WP *3) + WA] / 10

Wheat Marketing Score – Method #2

Component Score	Wheat Protein (%, 12% mb)	Test Weight (lb/bu)	Falling Number (sec)	1000 Kernel Weight (g)	Wheat Ash (%, 14% mb)
0	Diff > 6.0	Diff > 10	Diff < -125	Diff > 20	Diff > 0.5
2	5.0 < Diff ≤ 6.0	8 < Diff ≤ 10	-125 ≤ Diff < -100	16 < Diff ≤ 20	0.4 < Diff ≤ 0.5
4	4.0 < Diff ≤ 5.0	6 < Diff ≤ 8	-100 ≤ Diff < -75	12 < Diff ≤ 16	0.3 < Diff ≤ 0.4
6	3.0 < Diff ≤ 4.0	4 < Diff ≤ 6	-75 ≤ Diff < -50	8 < Diff ≤ 12	0.2 < Diff ≤ 0.3
8	2.0 < Diff ≤ 3.0	2 < Diff ≤ 4	-50 ≤ Diff < -25	4 < Diff ≤ 8	0.1 < Diff ≤ 0.2
10	**-0.5 ≤ Diff ≤ 2.0**	**-1 ≤ Diff ≤ 2**	**Diff ≥ -25**	**-2 ≤ Diff ≤ 4**	**Diff ≤ 0.1**
8	-1.0 ≤ Diff < -0.5	-2 ≤ Diff < -1	--	-4 ≤ Diff < -2	--
6	-1.5 ≤ Diff < -1.0	-3 ≤ Diff < -2	--	-6 ≤ Diff < -4	--
4	-2.0 ≤ Diff ≤ -1.5	-4 ≤ Diff < -3	--	-8 ≤ Diff < -6	--
2	-2.5 ≤ Diff < -2.0	-5 ≤ Diff < -4	--	-10 ≤ Diff < -8	--
0	Diff < -2.5	Diff < -5	--	Diff < -10	--
Weight of each factor	**0.3**	**0.2**	**0.2**	**0.2**	**0.1**

Wheat Marketing Score = (WP*0.3) + (TW*0.2) + (FN*0.2) + (1000 TKW*0.2) + (WA*0.1)

Miag Mill Streams

Mill Stream	Abbreviation	Mill Stream #	Product		
1st Break	1 Bk	1	**Long Patent Flour**	**Straight Grade Flour**	**Whole Wheat Flour**
2nd Break I	2 Bk I	2			
Break Dust	Bk Dust	3			
Sizing I	Sz I	4			
2nd Break II	2 Bk II	5			
3rd Break	3 Bk	6			
Sizing II	Sz II	7			
5th Break	5 Bk	8			
4th Break	4 Bk	9			
1st Middlings	1 M	10			
2nd Middlings	2 M	11			
3rd Middlings	3 M	12			
4th Middlings	4 M	13			
6th Middlings	6 M	15			
Tail Flour	Tail	16			
Tail Cyclone Flour*	TC	22			
5th Middlings	5 M	14	**Clear Flour**		
Low Grade	LG	17			
Low Quality	LQ	18			
Tail Shorts	Tail Sh	19	**Short & Bran**		
Head Shorts	Head Sh	20			
Bran	Bran	21			
Tail Cyclone Shorts*	TC Sh	23			

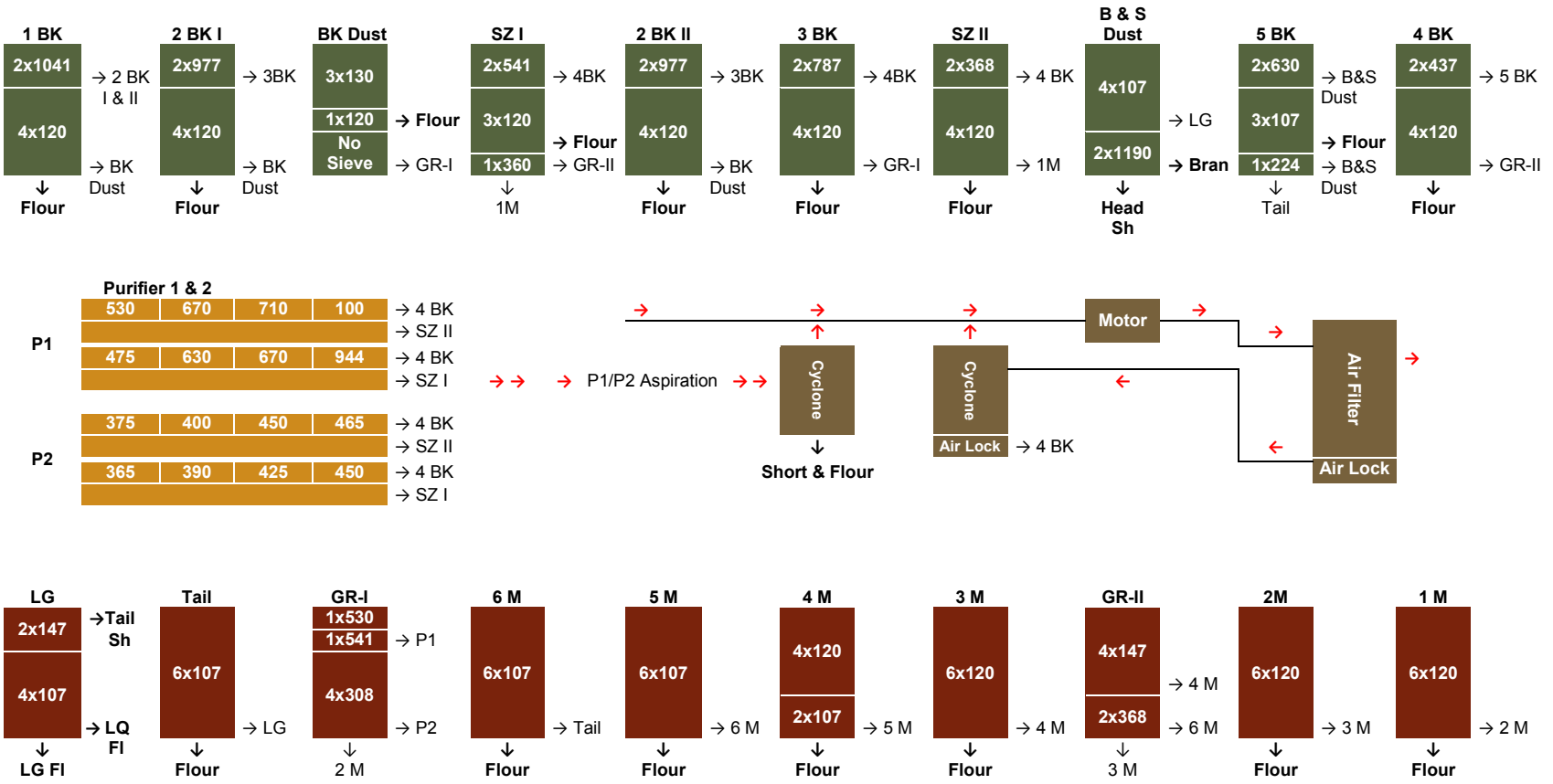
*Tail Cyclone fraction was separated into flour and short by rebolting.

Calculation of flour extraction:

- Tempered wheat basis (TWB, %): long patent flour extraction percentage of tempered wheat (14% mb);
- Total product basis (TPB, %): long patent flour percentage of the total mill product (14% mb);
- Pounds of long patent flour / bushel wheat (FWB): estimated pounds of long patent flour (14% mb) per bushel of wheat sample.

Miag Multomat Mill Flow Chart

(Hard Red Spring & Durum Wheat Quality Laboratory, Cereal Crops Research Unit, USDA-ARS-RRVARC, Fargo, ND)



Sieve Opening Size - µm

Wheat Kernel Characteristics by Location

Location	ID	Entry	Wheat Protein (%, 12% mb)	Wheat Marketing Score 1-6	Wheat Marketing Score 1-10	DON (ppm)	Test Weight (lbs/bu)	1000 Kernel Weight (g)	Kernel Size Large (%)	Kernel Size Small (%)	Wheat Moisture (%)	Wheat Ash (%, 14% mb)	Falling Number (sec)	SKCS Hardness Index	Vitreous Kernels (%)
Watertown	B-1	Glenn	13.0	4.2	10.0	nd	64.4	32.3	61	10	10.7	1.48	406	82.7	66.0
	B-3	Boost	13.9	4.2	8.8	nd	60.4	31.9	57	11	10.4	1.42	432	76.9	71.3
	B-4	WB9653	11.7	3.4	7.2	nd	60.0	31.7	62	10	10.4	1.37	451	72.1	40.3
	B-5	MN10261-1	13.8	4.2	8.8	nd	62.1	29.1	33	18	10.0	1.48	432	84.2	84.7
	B-6	WB9507	14.0	3.4	8.0	nd	56.6	31.8	41	15	10.5	1.56	447	76.6	79.9
	B-7	Bolles	13.9	4.3	8.8	nd	60.6	33.6	63	9	10.9	1.44	457	78.2	52.1
Casselton	C-1	Glenn	15.0	4.1	10.0	nd	61.8	27.0	34	17	10.7	1.68	407	77.6	87.5
	C-2	ND825	15.4	4.4	10.0	nd	62.1	28.7	53	13	10.8	1.63	409	78.7	93.4
	C-3	Boost	15.6	4.2	9.6	nd	59.9	29.7	60	9	10.5	1.61	427	75.6	75.0
	C-4	WB9653	14.8	3.7	9.2	nd	58.8	27.0	41	16	10.5	1.57	471	81.3	52.4
	C-5	MN10261-1	15.3	3.7	9.2	nd	59.4	25.1	25	21	10.5	1.71	450	81.0	91.3
	C-6	WB9507	15.6	3.7	7.4	nd	56.6	32.9	55	10	10.6	1.79	462	77.1	62.4
	C-7	Bolles	17.4	3.4	7.6	nd	57.0	25.4	37	17	10.6	1.88	471	75.6	80.8
	C-8	SY Rustler	16.3	3.6	8.2	nd	57.1	27.2	32	15	10.5	1.79	493	70.5	73.5
Crookston	K-1	Glenn	13.3	4.2	10.0	nd	64.2	30.9	54	8	10.6	1.41	400	79.6	54.1
	K-3	Boost	13.9	4.5	8.8	nd	61.0	34.0	69	6	10.6	1.27	474	71.4	39.1
	K-4	WB9653	13.0	3.8	8.4	nd	60.0	31.1	57	8	10.9	1.20	462	75.4	47.0
	K-5	MN10261-1	14.0	4.7	9.6	nd	63.0	31.2	50	11	10.6	1.37	430	85.7	94.0
	K-6	WB9507	12.5	4.0	7.4	nd	59.4	37.5	76	6	10.9	1.31	430	66.0	29.9
	K-7	Bolles	15.1	4.6	9.2	nd	61.1	32.8	69	8	10.8	1.48	466	77.1	89.6
Minot	M-1	Glenn	13.7	4.7	10.0	nd	64.1	33.6	72	6	10.0	1.39	419	69.4	81.4
	M-2	ND825	16.0	5.4	9.4	0.12	63.7	34.0	72	7	10.8	1.47	426	69.2	98.0
	M-3	Boost	15.9	5.1	8.6	0.25	61.2	35.2	80	5	11.5	1.46	445	76.1	91.5
	M-4	WB9653	14.3	4.2	8.4	0.44	59.7	32.5	63	9	11.1	1.41	448	78.6	90.1
	M-5	MN10261-1	16.0	5.0	8.6	0.34	62.6	30.1	49	10	10.8	1.48	430	78.1	96.6
	M-6	WB9507	14.9	4.7	8.0	0.75	59.6	39.2	77	6	10.7	1.47	424	70.5	83.7
	M-7	Bolles	14.8	5.2	9.4	nd	63.7	38.2	86	4	11.0	1.51	423	78.6	93.4
	M-8	SY Rustler	16.0	4.6	7.4	1.85	58.7	34.4	71	6	10.9	1.44	433	69.1	85.0
Williston	W-1	Glenn	14.0	4.6	10.0	nd	64.6	30.5	48	11	9.7	1.44	427	78.5	98.6
	W-2	ND825	16.6	5.5	9.4	nd	63.9	31.2	53	8	9.6	1.37	432	73.9	99.0
	W-4	WB9653	13.1	4.3	8.2	nd	61.4	33.8	63	7	10.1	1.23	486	77.9	93.4
	W-5	MN10261-1	14.4	4.7	9.6	nd	62.7	29.6	29	17	9.7	1.38	464	80.2	96.7
	W-6	WB9507	15.1	4.6	7.6	nd	59.3	36.1	68	6	10.0	1.40	460	73.3	95.0
	W-7	Bolles	16.9	5.3	8.6	nd	61.6	33.6	68	8	9.5	1.41	468	70.2	94.3
	W-8	SY Rustler	14.2	4.1	8.0	nd	59.5	30.7	41	9	9.9	1.32	497	70.0	87.5

Flour Characteristics by Location

Location	ID	Entry	Flour Extraction			Flour Color				Flour Moisture	Flour Protein	Flour Ash	Flour FN
			TWB* (%)	TPB* (%)	Flour/bu Wheat (lbs)	*L**	*b**	*L*	*b*	(%)	(%, 14% mb)	(%, 14% mb)	Malted (sec)
Watertown	**B-1**	**Glenn**	**70.0**	**71.5**	**45.6**	**90.0**	**8.8**	**87.4**	**8.4**	**13.7**	**12.1**	**0.48**	**251**
	B-3	Boost	70.0	71.3	42.9	89.8	10.0	87.1	9.5	13.8	13.0	0.45	264
	B-4	WB9653	73.0	74.6	44.0	89.8	10.5	87.1	9.9	13.5	10.8	0.47	249
	B-5	MN10261-1	69.6	70.3	43.6	89.7	9.2	86.9	8.8	13.3	12.8	0.51	250
	B-6	WB9507	70.1	71.9	39.7	89.2	8.3	86.3	7.9	13.3	13.3	0.57	265
	B-7	Bolles	70.9	72.8	43.2	89.7	9.3	86.9	8.8	13.5	13.2	0.52	257
Casselton	**C-1**	**Glenn**	**71.2**	**73.0**	**44.2**	**89.4**	**8.6**	**86.6**	**8.2**	**13.2**	**14.1**	**0.52**	**254**
	C-2	ND825	72.2	73.5	45.3	89.4	9.4	86.6	8.9	13.6	14.5	0.48	252
	C-3	Boost	70.7	72.6	42.9	89.3	9.9	86.5	9.4	13.9	14.7	0.51	262
	C-4	WB9653	71.8	73.2	42.9	89.0	11.0	86.1	10.3	13.7	13.9	0.52	264
	C-5	MN10261-1	68.8	69.8	41.2	89.1	9.6	86.2	9.1	13.3	14.5	0.56	248
	C-6	WB9507	70.2	72.4	40.5	89.0	8.7	86.1	8.3	13.6	14.7	0.60	255
	C-7	Bolles	69.9	72.0	40.4	88.9	9.5	86.0	9.0	13.5	16.5	0.59	249
	C-8	SY Rustler	70.5	71.7	40.6	89.2	9.3	86.4	8.8	13.2	15.3	0.55	263
Crookston	**K-1**	**Glenn**	**72.5**	**74.0**	**46.9**	**89.8**	**8.5**	**87.1**	**8.2**	**13.9**	**12.5**	**0.47**	**255**
	K-3	Boost	73.4	74.4	45.5	89.8	9.7	87.1	9.2	13.8	13.2	0.40	258
	K-4	WB9653	73.5	74.5	44.5	89.5	10.9	86.7	10.3	13.8	12.0	0.41	255
	K-5	MN10261-1	70.0	71.5	45.0	89.7	9.0	86.9	8.6	14.4	13.0	0.46	262
	K-6	WB9507	71.0	72.4	42.9	90.1	8.3	87.4	8.0	14.2	11.4	0.41	252
	K-7	Bolles	68.1	72.2	42.2	89.7	9.2	87.0	8.8	14.2	14.4	0.42	255
Minot	**M-1**	**Glenn**	**72.1**	**73.6**	**47.0**	**90.0**	**9.0**	**87.4**	**8.6**	**12.8**	**12.6**	**0.44**	**265**
	M-2	ND825	70.5	72.6	44.8	89.6	8.8	86.8	8.4	12.8	15.1	0.44	255
	M-3	Boost	72.4	74.2	44.4	89.3	9.4	86.5	8.9	12.6	14.9	0.48	247
	M-4	WB9653	71.0	72.2	42.2	89.3	10.2	86.5	9.6	12.6	13.2	0.44	264
	M-5	MN10261-1	72.8	74.5	45.4	89.2	9.0	86.3	8.6	12.5	15.3	0.49	251
	M-6	WB9507	71.1	72.9	42.8	89.3	8.0	86.5	7.7	13.0	14.0	0.51	264
	M-7	Bolles	73.6	75.4	46.8	89.5	9.2	86.7	8.8	12.7	14.0	0.51	250
	M-8	SY Rustler	70.9	72.6	41.7	89.2	8.5	86.4	8.1	12.6	14.6	0.48	251
Williston	**W-1**	**Glenn**	**70.9**	**72.3**	**46.9**	**90.0**	**8.6**	**87.4**	**8.2**	**13.3**	**13.5**	**0.44**	**251**
	W-2	ND825	72.4	73.5	46.5	90.0	9.3	87.3	8.9	13.0	15.8	0.41	243
	W-4	WB9653	72.8	74.0	45.5	89.7	10.2	87.0	9.7	12.8	12.5	0.40	250
	W-5	MN10261-1	70.5	71.9	44.6	89.6	8.9	86.9	8.5	13.3	13.7	0.44	249
	W-6	WB9507	68.8	71.1	41.0	89.5	8.1	86.8	7.7	13.3	14.3	0.49	255
	W-7	Bolles	69.7	71.3	43.0	89.7	9.3	87.0	8.9	12.9	16.1	0.47	251
	W-8	SY Rustler	68.2	70.6	40.6	89.9	9.1	87.2	8.7	12.5	12.8	0.44	256

TWB = Tempered wheat basis.
TPB = Total product basis.

Flour Protein Characteristics by Location

Location	ID	Entry	TPP/TMP*	IPP	HMW Glutenin Subunits		
					GLU-A1	GLU-B1	GLU-D1
Watertown	**B-1**	**Glenn**	**0.88**	**54.67**	**2***	**7+9**	**5+10**
	B-3	Boost	0.89	55.05	2*	7+9	5+10
	B-4	WB9653	0.94	54.65	2*	7+9	5+10
	B-5	MN10261-1	0.94	53.44	2*	7+8	5+10
	B-6	WB9507	0.90	54.06	2*	7+8	5+10
	B-7	Bolles	0.91	56.78	2*	7+8	5+10
Casselton	**C-1**	**Glenn**	**0.91**	**57.77**	**2***	**7+9**	**5+10**
	C-2	ND825	0.87	53.27	2*	7+9	5+10
	C-3	Boost	0.91	54.77	2*	7+9	5+10
	C-4	WB9653	0.91	54.35	2*	7+8	5+10
	C-5	MN10261-1	0.90	54.22	2*	7+8	5+10
	C-6	WB9507	0.88	52.23	2*	7+8	5+10
	C-7	Bolles	0.88	59.25	2*	7+8	5+10
	C-8	SY Rustler	0.87	50.81	2*	7+8	5+10
Crookston	**K-1**	**Glenn**	**0.99**	**55.01**	**2***	**7+9**	**5+10**
	K-3	Boost	0.91	52.55	2*	7+9	5+10
	K-4	WB9653	0.95	53.62	2*	7+9	5+10
	K-5	MN10261-1	0.94	55.11	2*	7+8	5+10
	K-6	WB9507	0.93	52.23	2*	7+8	5+10
	K-7	Bolles	0.93	55.77	2*	7+8	5+10
Minot	**M-1**	**Glenn**	**0.94**	**50.67**	**2***	**7+9**	**5+10**
	M-2	ND825	0.85	47.21	2*	7+9	5+10
	M-3	Boost	0.89	49.68	2*	7+9	5+10
	M-4	WB9653	0.89	49.84	2*	7+9	5+10
	M-5	MN10261-1	0.89	50.37	2*	7+8	5+10
	M-6	WB9507	0.85	49.84	2*	7+8	5+10
	M-7	Bolles	0.93	53.72	2*	7+8	5+10
	M-8	SY Rustler	0.81	44.75	2*	7+8	5+10
Williston	**W-1**	**Glenn**	**0.91**	**53.39**	**2***	**7+9**	**5+10**
	W-2	ND825	0.85	51.62	2*	7+9	5+10
	W-4	WB9653	0.91	51.81	2*	7+9	5+10
	W-5	MN10261-1	0.90	52.84	2*	7+8	5+10
	W-6	WB9507	0.83	51.59	2*	7+8	5+10
	W-7	Bolles	0.90	55.48	2*	7+8	5+10
	W-8	SY Rustler	0.88	49.47	2*	7+8	5+10

TPP/TMP = Total polymeric protein / total monomeric protein.
IPP = Insoluble polymeric protein.

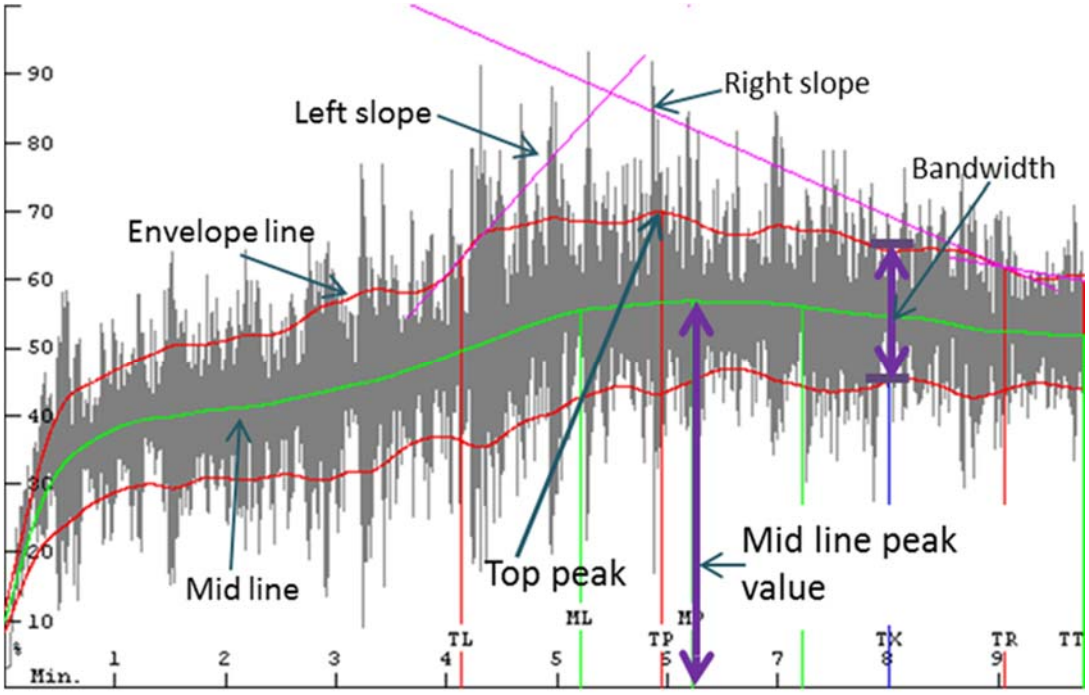
Farinograph Characteristics by Location

Location	ID	Entry	Water Abs. (%, 500 BU)	Water Abs. (%, 14% mb)	Arrival Time (min)	Peak Time (min)	Dough Stability (min)	MTI (BU)	TTB (min)
Watertown	B-1	Glenn	63.7	63.5	2.0	3.5	10.5	11.0	12.2
	B-3	Boost	66.0	65.9	2.3	6.5	9.6	28.0	12.0
	B-4	WB9653	64.0	63.2	1.5	2.9	6.9	29.0	8.1
	B-5	MN10261-1	66.4	65.5	2.0	4.7	7.9	27.0	10.0
	B-6	WB9507	67.5	66.7	2.6	7.4	10.2	29.0	11.9
	B-7	Bolles	65.9	65.1	2.0	6.7	12.4	20.0	13.4
Casselton	C-1	Glenn	64.0	63.0	2.2	5.0	8.9	21.0	11.0
	C-2	ND825	64.6	64.0	3.6	6.9	8.6	33.0	11.7
	C-3	Boost	65.9	65.4	4.3	7.4	8.4	31.0	12.3
	C-4	WB9653	64.5	63.9	2.5	6.2	8.9	29.0	11.4
	C-5	MN10261-1	65.4	64.4	2.8	6.2	7.9	40.0	10.4
	C-6	WB9507	66.9	66.3	4.0	8.4	10.4	24.0	14.4
	C-7	Bolles	65.2	64.4	4.0	11.2	40.1	11.0	44.4
	C-8	SY Rustler	68.3	66.9	4.6	9.2	9.9	32.0	14.0
Crookston	K-1	Glenn	63.1	62.3	1.6	3.4	10.3	20.0	10.3
	K-3	Boost	62.5	61.7	2.8	7.0	12.4	16.0	14.7
	K-4	WB9653	61.9	61.2	1.7	6.8	11.1	26.0	12.6
	K-5	MN10261-1	64.3	64.3	2.4	5.0	9.3	21.0	11.5
	K-6	WB9507	61.6	61.4	2.1	3.7	11.1	14.0	12.9
	K-7	Bolles	61.0	60.9	2.1	8.8	35.7	8.0	39.3
Minot	M-1	Glenn	65.1	63.8	3.4	8.0	9.7	27.0	12.6
	M-2	ND825	65.4	63.7	4.4	7.5	6.9	34.0	11.5
	M-3	Boost	67.3	65.5	4.4	7.5	8.1	29.0	12.3
	M-4	WB9653	64.7	63.0	4.0	6.7	7.0	36.0	11.0
	M-5	MN10261-1	65.9	63.7	4.3	7.5	6.3	49.0	10.3
	M-6	WB9507	67.3	65.9	4.3	7.5	7.9	32.0	11.6
	M-7	Bolles	64.6	63.0	3.7	7.2	10.1	20.0	13.4
	M-8	SY Rustler	67.7	65.9	3.5	5.3	5.4	33.0	8.9
Williston	W-1	Glenn	64.0	62.5	2.4	7.0	13.6	15.0	14.6
	W-2	ND825	66.0	64.4	4.9	8.5	10.3	20.0	14.5
	W-4	WB9653	64.9	63.0	2.1	6.3	11.0	21.0	12.4
	W-5	MN10261-1	62.9	61.5	2.4	6.0	8.2	35.0	10.3
	W-6	WB9507	65.9	64.4	3.5	7.8	14.4	18.0	16.0
	W-7	Bolles	65.7	63.8	4.2	11.9	28.0	12.0	32.8
	W-8	SY Rustler	65.0	62.6	3.2	6.9	8.9	33.0	11.6

Mixograph Characteristics by Location

Location	ID	Entry	Envelope Peak Time (min)	Envelope Peak Value (%)	Envelope Peak Width (%)	Midline Peak Time (min)	Midline Peak Value (%)	Midline Peak Width (%)	Midline Peak Integral (% TQ*min)
Watertown	B-1	Glenn	6.1	76.3	25.7	6.0	63.5	24.8	308.4
	B-3	Boost	4.6	76.8	24.8	5.1	64.3	23.0	269.6
	B-4	WB9653	5.2	75.8	31.0	4.6	61.3	25.6	231.5
	B-5	MN10261-1	4.2	81.9	32.6	4.6	66.1	28.5	248.8
	B-6	WB9507	4.6	88.9	32.8	4.2	72.9	28.6	234.9
	B-7	Bolles	5.6	81.6	26.4	5.8	68.2	25.0	300.6
Casselton	C-1	Glenn	6.7	75.4	30.6	6.9	59.9	29.5	339.9
	C-2	ND825	4.4	77.6	28.9	4.2	61.9	28.1	206.2
	C-3	Boost	4.3	82.9	34.2	4.1	66.0	32.1	210.0
	C-4	WB9653	3.7	76.4	28.6	4.3	63.1	26.1	211.0
	C-5	MN10261-1	5.2	68.5	25.7	4.6	55.3	21.5	214.9
	C-6	WB9507	3.6	91.4	29.2	3.8	77.6	28.3	215.4
	C-7	Bolles	5.2	91.1	35.3	5.9	75.0	26.7	318.3
	C-8	SY Rustler	2.8	91.8	38.0	3.3	75.0	30.6	185.0
Crookston	K-1	Glenn	5.7	75.1	28.7	6.0	61.1	24.7	303.0
	K-3	Boost	4.5	83.8	31.6	4.6	68.2	31.3	234.9
	K-4	WB9653	4.0	79.4	33.4	4.4	64.4	28.5	225.7
	K-5	MN10261-1	4.4	79.6	31.5	4.9	63.6	28.6	257.4
	K-6	WB9507	4.8	80.6	31.2	5.0	65.0	31.1	263.0
	K-7	Bolles	6.0	80.9	32.1	6.6	66.2	24.8	328.9
Minot	M-1	Glenn	4.8	78.3	32.7	4.1	63.8	27.6	198.4
	M-2	ND825	2.7	84.5	33.7	3.1	67.6	25.7	148.9
	M-3	Boost	2.8	85.2	30.7	3.1	71.1	28.4	149.6
	M-4	WB9653	2.8	79.7	25.8	3.1	66.8	23.5	152.6
	M-5	MN10261-1	2.8	77.4	29.2	3.2	63.6	24.7	154.4
	M-6	WB9507	2.6	89.8	32.6	2.8	74.8	28.2	151.3
	M-7	Bolles	3.4	88.9	42.7	3.9	69.7	31.8	201.5
	M-8	SY Rustler	1.9	84.7	27.3	2.1	72.8	22.8	113.6
Williston	W-1	Glenn	4.5	82.7	33.6	4.9	65.5	32.5	252.6
	W-2	ND825	4.0	81.2	32.7	3.8	64.6	30.8	183.9
	W-4	WB9653	3.9	74.2	27.9	4.3	60.8	24.6	206.9
	W-5	MN10261-1	4.2	80.8	26.4	4.1	67.1	25.3	216.0
	W-6	WB9507	4.1	94.8	37.2	4.5	77.5	34.0	265.1
	W-7	Bolles	4.5	90.0	34.0	4.7	73.0	31.5	247.8
	W-8	SY Rustler	3.0	87.5	37.9	3.6	70.5	32.3	186.0

Interpreting Mixogram Results



Among the numbers on the previous page, the time to peak (maximum mixing resistance) for both the top of the envelope and midline is shown, including envelope and midline % of full value. These values are traditionally the most meaningful. A midline peak time around 3-5 minutes and 60% scale are usually about right for bread flour. Very steep slopes for left-of-peak and right-of-peak are undesirable, which indicate a flour sample with low tolerance and high sensitivity to mixing time.

Delayed peaks and narrow widths (especially at about 8 minutes) are often taken as indicating "weakness."

Integral values for the midline section are for the areas beneath the midline from time 0 to the peak. Units are the vertical axis (% torque) multiplied by the horizontal axis (minutes). These values represent the work put into the flour and water in order to develop the dough.

In summary, the midline time to peak and % peak values, the top line ascending and descending slopes, and the bandwidth at 8 minutes are the values most used. "Best" values are typically determined by the breeder, miller, and baker. (MixSmart Documentation and Instructions, A.E. Walker and C.E. Walker, 2004, National Manufacturing Company)

Extensograph Characteristics by Location

45 Minutes Resting								
Location	ID	Entry	Energy (cm^2)	Resistance (BU)	Extensibility (mm)	Maximum (BU)	Ratio Number	Ratio Number (max)
Watertown	**B-1**	**Glenn**	**63**	**279**	**127**	**406**	**2.2**	**3.2**
	B-3	Boost	72	259	141	421	1.8	3.0
	B-4	WB9653	43	185	129	264	1.4	2.1
	B-5	MN10261-1	72	264	143	406	1.9	2.8
	B-6	WB9507	94	274	164	467	1.7	2.8
	B-7	Bolles	75	272	141	448	1.9	3.2
Casselton	**C-1**	**Glenn**	**88**	**340**	**136**	**542**	**2.5**	**4.0**
	C-2	ND825	60	181	159	308	1.1	1.9
	C-3	Boost	67	197	157	352	1.3	2.3
	C-4	WB9653	61	234	138	361	1.7	2.6
	C-5	MN10261-1	72	261	144	400	1.8	2.8
	C-6	WB9507	70	169	179	318	1.0	1.8
	C-7	Bolles	98	251	171	470	1.5	2.7
	C-8	SY Rustler	58	141	191	226	0.7	1.2
Crookston	**K-1**	**Glenn**	**67**	**287**	**130**	**420**	**2.2**	**3.2**
	K-3	Boost	83	249	155	443	1.6	2.9
	K-4	WB9653	54	206	141	305	1.5	2.2
	K-5	MN10261-1	57	287	119	391	2.4	3.3
	K-6	WB9507	66	262	138	387	1.9	2.8
	K-7	Bolles	96	294	156	505	1.9	3.2
Minot	**M-1**	**Glenn**	**81**	**214**	**167**	**404**	**1.3**	**2.4**
	M-2	ND825	59	129	216	192	0.6	0.9
	M-3	Boost	51	131	190	192	0.7	1.0
	M-4	WB9653	41	152	146	207	1.0	1.4
	M-5	MN10261-1	49	134	184	193	0.7	1.1
	M-6	WB9507	44	105	194	166	0.5	0.9
	M-7	Bolles	88	224	181	373	1.2	2.1
	M-8	SY Rustler	38	94	201	129	0.5	0.6
Williston	**W-1**	**Glenn**	**80**	**291**	**139**	**478**	**2.1**	**3.4**
	W-2	ND825	83	206	176	388	1.2	2.2
	W-4	WB9653	71	235	151	370	1.6	2.5
	W-5	MN10261-1	74	323	129	480	2.5	3.7
	W-6	WB9507	90	358	137	537	2.6	3.9
	W-7	Bolles	109	306	167	533	1.8	3.2
	W-8	SY Rustler	67	202	157	342	1.3	2.2

90 Minutes Resting								
Location	ID	Entry	Energy (cm^2)	Resistance (BU)	Extensibility (mm)	Maximum (BU)	Ratio Number	Ratio Number (max)
Watertown	**B-1**	**Glenn**	**77**	**740**	**87**	**768**	**8.5**	**8.8**
	B-3	Boost	87	520	117	612	4.5	5.2
	B-4	WB9653	60	466	99	499	4.7	5.0
	B-5	MN10261-1	66	421	109	496	3.9	4.6
	B-6	WB9507	104	496	125	682	4.0	5.4
	B-7	Bolles	99	614	110	734	5.6	6.7
Casselton	**C-1**	**Glenn**	**86**	**879**	**82**	**906**	**10.7**	**11.1**
	C-2	ND825	75	248	146	439	1.7	3.0
	C-3	Boost	94	401	137	537	2.9	3.9
	C-4	WB9653	85	406	127	541	3.2	4.3
	C-5	MN10261-1	86	444	121	569	3.7	4.7
	C-6	WB9507	99	259	171	462	1.5	2.7
	C-7	Bolles	120	440	142	689	3.1	4.8
	C-8	SY Rustler	87	227	180	366	1.3	2.0
Crookston	**K-1**	**Glenn**	**70**	**749**	**79**	**772**	**9.5**	**9.8**
	K-3	Boost	90	675	98	793	6.9	8.1
	K-4	WB9653	79	481	110	599	4.4	5.4
	K-5	MN10261-1	55	656	73	670	9.0	9.1
	K-6	WB9507	59	695	73	716	9.5	9.8
	K-7	Bolles	117	734	107	921	6.9	8.6
Minot	**M-1**	**Glenn**	**90**	**506**	**118**	**613**	**4.3**	**5.2**
	M-2	ND825	74	189	188	299	1.0	1.6
	M-3	Boost	82	216	186	330	1.2	1.8
	M-4	WB9653	59	215	144	327	1.5	2.3
	M-5	MN10261-1	75	187	184	307	1.0	1.7
	M-6	WB9507	89	201	192	359	1.1	1.9
	M-7	Bolles	92	358	139	531	2.6	3.8
	M-8	SY Rustler	50	125	196	180	0.6	0.9
Williston	**W-1**	**Glenn**	**87**	**779**	**88**	**813**	**8.8**	**9.2**
	W-2	ND825	129	351	174	586	2.0	3.4
	W-4	WB9653	85	347	142	484	2.5	3.4
	W-5	MN10261-1	76	759	84	759	9.0	9.0
	W-6	WB9507	111	700	118	739	5.9	6.3
	W-7	Bolles	141	743	125	914	5.9	7.3
	W-8	SY Rustler	104	490	131	613	3.7	4.7

135 Minutes Resting								
Location	ID	Entry	Energy (cm^2)	Resistance (BU)	Extensibility (mm)	Maximum (BU)	Ratio Number	Ratio Number (max)
Watertown	**B-1**	**Glenn**	**50**	**663**	**68**	**669**	**9.8**	**9.9**
	B-3	Boost	77	607	100	652	6.1	6.5
	B-4	WB9653	50	485	84	486	5.8	5.8
	B-5	MN10261-1	53	421	92	432	4.6	4.7
	B-6	WB9507	88	617	105	686	5.9	6.6
	B-7	Bolles	90	710	100	748	7.1	7.5
Casselton	**C-1**	**Glenn**	**83**	**871**	**81**	**894**	**10.7**	**11.0**
	C-2	ND825	100	424	139	551	3.0	4.0
	C-3	Boost	88	499	115	614	4.3	5.3
	C-4	WB9653	79	591	100	642	5.9	6.4
	C-5	MN10261-1	81	495	110	597	4.5	5.4
	C-6	WB9507	105	319	160	523	2.0	3.3
	C-7	Bolles	136	521	149	730	3.5	4.9
	C-8	SY Rustler	81	270	159	388	1.7	2.4
Crookston	**K-1**	**Glenn**	**64**	**704**	**72**	**761**	**9.8**	**10.6**
	K-3	Boost	81	777	86	800	9.0	9.3
	K-4	WB9653	67	532	94	599	5.7	6.4
	K-5	MN10261-1	54	677	70	688	9.6	9.8
	K-6	WB9507	53	737	64	748	11.5	11.7
	K-7	Bolles	132	918	109	1027	8.4	9.4
Minot	**M-1**	**Glenn**	**79**	**641**	**95**	**673**	**6.8**	**7.1**
	M-2	ND825	87	193	203	322	1.0	1.6
	M-3	Boost	71	244	153	358	1.6	2.3
	M-4	WB9653	66	320	123	422	2.6	3.4
	M-5	MN10261-1	82	215	184	333	1.2	1.8
	M-6	WB9507	84	214	178	368	1.2	2.1
	M-7	Bolles	104	429	138	591	3.1	4.3
	M-8	SY Rustler	53	124	200	193	0.6	1.0
Williston	**W-1**	**Glenn**	**86**	**887**	**84**	**892**	**10.6**	**10.6**
	W-2	ND825	122	372	162	593	2.3	3.7
	W-4	WB9653	82	488	117	573	4.2	4.9
	W-5	MN10261-1	74	732	81	787	9.0	9.7
	W-6	WB9507	90	821	88	823	9.3	9.3
	W-7	Bolles	125	901	106	950	8.5	9.0
	W-8	SY Rustler	94	597	110	666	5.5	6.1

Ash/Protein Content in Mill Streams

Watertown (Group B)

Glenn Check (B-1)

Mill Stream	Stream (%, 14% mb) Yield	Ash	Protein	Cumulative (%, 14% mb) Yield	Ash	Protein
Patent:						
1 M	11.1	0.29	10.9	11.1	0.29	10.9
2 M	11.7	0.31	11.2	22.8	0.30	11.0
Sz I	3.0	0.34	11.7	25.8	0.30	11.1
3 M	17.4	0.35	11.3	43.2	0.32	11.2
Sz II	2.1	0.37	11.5	45.3	0.33	11.2
4 M	9.2	0.49	12.4	54.5	0.35	11.4
1 Bk	1.0	0.65	14.1	55.5	0.36	11.4
6 M	3.4	0.68	12.0	58.8	0.38	11.5
4 Bk	4.5	0.69	15.5	63.4	0.40	11.8
Bk Dust	2.0	0.69	13.7	65.4	0.41	11.8
3 Bk	1.2	0.82	15.9	66.6	0.41	11.9
2 Bk II	0.8	0.83	15.6	67.3	0.42	11.9
2 Bk I	0.4	0.87	15.7	67.8	0.42	12.0
TC	0.8	1.06	14.5	68.5	0.43	12.0
Tail	1.6	1.10	14.9	70.1	0.44	12.1
5 Bk	1.4	1.48	18.6	71.5	0.46	12.2
Clear Flour:						
5 M	1.9	1.32	13.4	73.5	0.49	12.2
LQ	0.4	1.45	12.9	73.9	0.49	12.2
LG	1.6	1.59	15.7	75.5	0.52	12.3
Bran & Shorts:						
TC Sh	0.1	3.25	12.0	75.6	0.52	12.3
Tail Sh	2.7	3.44	13.5	78.3	0.62	12.3
Head Sh	18.7	4.45	15.8	97.0	1.36	13.0
Bran	3.0	6.38	13.1	100.0	1.51	13.0
Patent (Rebolted)		**0.48**	**12.1**			
Wheat		**1.48**	**12.7**			

Boost (B-3)

Mill Stream	Stream (%, 14% mb) Yield	Ash	Protein	Cumulative (%, 14% mb) Yield	Ash	Protein
Patent:						
1 M	10.5	0.29	11.5	10.5	0.29	11.5
2 M	15.1	0.31	11.7	25.6	0.30	11.6
Sz I	3.1	0.34	12.5	28.7	0.31	11.7
Sz II	2.2	0.34	12.3	30.9	0.31	11.8
3 M	14.6	0.41	12.2	45.5	0.34	11.9
1 Bk	1.1	0.50	14.1	46.6	0.34	12.0
4 M	8.0	0.56	13.7	54.6	0.38	12.2
4 Bk	4.4	0.61	16.6	59.0	0.39	12.5
Bk Dust	2.3	0.64	13.9	61.3	0.40	12.6
2 Bk I	0.7	0.71	15.7	62.0	0.41	12.6
2 Bk II	1.0	0.72	15.6	63.0	0.41	12.7
6 M	3.1	0.72	12.0	66.1	0.43	12.6
3 Bk	1.3	0.74	16.5	67.4	0.43	12.7
Tail	1.6	0.98	14.9	69.0	0.44	12.8
TC	0.9	1.00	15.1	69.9	0.45	12.8
5 Bk	1.4	1.14	19.2	71.3	0.47	12.9
Clear Flour:						
5 M	1.8	1.17	13.8	73.1	0.48	12.9
LQ	0.4	1.21	13.6	73.5	0.49	12.9
LG	1.5	1.53	16.0	75.0	0.51	13.0
Bran & Shorts:						
TC Sh	0.2	2.79	12.3	75.2	0.51	13.0
Tail Sh	2.3	3.00	14.2	77.5	0.59	13.0
Head Sh	18.5	4.18	17.1	96.0	1.28	13.8
Bran	4.0	5.74	14.7	100.0	1.46	13.9
Patent (Rebolted)		**0.45**	**13.0**			
Wheat		**1.42**	**13.6**			

WB9653 (B-4)

Mill Stream	Stream (%, 14% mb) Yield	Ash	Protein	Cumulative (%, 14% mb) Yield	Ash	Protein
Patent:						
2 M	15.8	0.31	9.6	15.8	0.31	9.6
1 M	12.4	0.34	9.6	28.2	0.32	9.6
3 M	13.5	0.38	10.3	41.7	0.34	9.8
Sz I	4.1	0.39	10.1	45.8	0.35	9.8
Sz II	2.3	0.39	10.1	48.1	0.35	9.9
1 Bk	1.5	0.52	9.3	49.6	0.35	9.8
4 M	8.2	0.58	11.6	57.8	0.39	10.1
Bk Dust	2.8	0.62	10.0	60.6	0.40	10.1
6 M	3.0	0.68	10.8	63.6	0.41	10.1
4 Bk	4.6	0.69	13.3	68.2	0.43	10.3
2 Bk II	1.0	0.74	12.4	69.2	0.43	10.4
3 Bk	1.5	0.76	12.7	70.7	0.44	10.4
2 Bk I	0.6	0.77	12.0	71.3	0.44	10.4
TC	0.8	1.02	12.1	72.1	0.45	10.4
Tail	1.3	1.13	13.6	73.4	0.46	10.5
5 Bk	1.2	1.46	16.5	74.6	0.48	10.6
Clear Flour:						
5 M	1.5	1.46	12.8	76.1	0.50	10.6
LQ	0.3	1.49	12.6	76.4	0.50	10.6
LG	1.3	1.86	16.9	77.8	0.52	10.8
Bran & Shorts:						
TC Sh	0.2	2.79	10.6	78.0	0.53	10.8
Tail Sh	2.1	3.33	13.3	80.1	0.60	10.8
Head Sh	16.0	4.27	15.7	96.1	1.21	11.6
Bran	3.9	6.06	12.7	100.0	1.40	11.7
Patent (Rebolted)		**0.47**	**10.8**			
Wheat		**1.37**	**11.4**			

MN10261-1 (B-5)

Mill Stream	Stream (%, 14% mb) Yield	Ash	Protein	Cumulative (%, 14% mb) Yield	Ash	Protein
Patent:						
1 M	11.8	0.33	11.7	11.8	0.33	11.7
2 M	13.9	0.35	12.0	25.7	0.34	11.8
3 M	14.9	0.41	12.4	40.6	0.37	12.0
Sz I	2.8	0.41	12.1	43.3	0.37	12.0
Sz II	2.3	0.44	12.1	45.6	0.37	12.0
4 M	8.9	0.57	13.1	54.5	0.40	12.2
6 M	3.4	0.67	12.5	57.8	0.42	12.2
1 Bk	0.8	0.68	13.3	58.7	0.42	12.2
4 Bk	4.1	0.77	15.6	62.7	0.45	12.5
Bk Dust	1.7	0.79	13.3	64.4	0.46	12.5
2 Bk II	0.7	0.87	14.2	65.1	0.46	12.5
2 Bk I	0.4	0.91	14.5	65.5	0.46	12.5
3 Bk	1.0	0.96	15.7	66.5	0.47	12.6
Tail	1.6	0.97	14.5	68.1	0.48	12.6
TC	0.8	1.16	14.8	69.0	0.49	12.6
5 Bk	1.3	1.43	18.0	70.3	0.51	12.7
Clear Flour:						
5 M	2.3	1.13	13.4	72.6	0.53	12.8
LQ	0.5	1.29	13.4	73.1	0.53	12.8
LG	1.7	1.50	15.2	74.9	0.55	12.8
Bran & Shorts:						
TC Sh	0.2	2.74	13.1	75.1	0.56	12.8
Tail Sh	3.0	3.31	14.2	78.0	0.67	12.9
Head Sh	19.1	4.44	16.5	97.1	1.41	13.6
Bran	2.9	5.68	13.5	100.0	1.53	13.6
Patent (Rebolted)		**0.51**	**12.8**			
Wheat		**1.48**	**13.5**			

WB9507 (B-6)

Mill Stream	Stream (%, 14% mb) Yield	Ash	Protein	Cumulative (%, 14% mb) Yield	Ash	Protein
Patent:						
1 M	11.3	0.39	12.3	11.3	0.39	12.3
2 M	14.2	0.40	12.3	25.5	0.40	12.3
Sz I	5.8	0.46	12.7	31.3	0.41	12.4
Sz II	0.6	0.47	12.9	31.9	0.41	12.4
3 M	13.6	0.47	13.0	45.5	0.43	12.6
4 M	9.9	0.67	13.9	55.4	0.47	12.8
1 Bk	0.8	0.72	13.9	56.3	0.47	12.8
4 Bk	5.2	0.80	15.8	61.4	0.50	13.1
6 M	2.9	0.87	13.8	64.3	0.52	13.1
Bk Dust	1.9	0.89	13.9	66.2	0.53	13.1
2 Bk II	0.7	0.98	15.4	66.8	0.53	13.2
2 Bk I	0.4	1.06	15.7	67.3	0.54	13.2
3 Bk	1.1	1.08	16.1	68.3	0.55	13.2
Tail	1.5	1.22	15.7	69.8	0.56	13.3
TC	0.7	1.27	15.3	70.6	0.57	13.3
5 Bk	1.4	1.51	18.3	71.9	0.59	13.4
Clear Flour:						
5 M	2.0	1.48	14.6	73.9	0.61	13.4
LQ	0.4	1.68	14.7	74.4	0.62	13.4
LG	1.7	1.72	16.7	76.1	0.64	13.5
Bran & Shorts:						
TC Sh	0.2	3.10	12.8	76.3	0.65	13.5
Tail Sh	3.2	4.04	14.3	79.5	0.79	13.5
Head Sh	18.9	4.47	17.0	98.4	1.49	14.2
Bran	1.6	5.35	12.6	100.0	1.55	14.2
Patent (Rebolted)		**0.57**	**13.3**			
Wheat		**1.56**	**13.7**			

Bolles (B-7)

Mill Stream	Stream (%, 14% mb) Yield	Ash	Protein	Cumulative (%, 14% mb) Yield	Ash	Protein
Patent:						
1 M	13.6	0.33	12.1	13.6	0.33	12.1
2 M	14.0	0.36	12.3	27.7	0.35	12.2
Sz I	6.0	0.36	12.2	33.6	0.35	12.2
3 M	13.0	0.48	13.2	46.6	0.39	12.5
Sz II	1.3	0.48	13.0	48.0	0.39	12.5
1 Bk	1.2	0.61	12.8	49.2	0.39	12.5
4 M	8.5	0.68	14.2	57.8	0.44	12.7
Bk Dust	2.2	0.74	13.3	60.0	0.45	12.8
4 Bk	4.7	0.76	15.6	64.7	0.47	13.0
2 Bk II	0.8	0.90	14.8	65.5	0.47	13.0
6 M	2.2	0.90	13.7	67.7	0.49	13.0
2 Bk I	0.5	0.91	14.8	68.2	0.49	13.0
3 Bk	1.1	0.97	15.9	69.3	0.50	13.1
TC	0.9	0.99	14.8	70.2	0.51	13.1
Tail	1.4	1.40	16.2	71.6	0.52	13.1
5 Bk	1.3	1.61	18.5	72.8	0.54	13.2
Clear Flour:						
5 M	1.7	1.33	14.9	74.5	0.56	13.3
LQ	0.3	1.83	15.0	74.8	0.56	13.3
LG	1.2	1.88	17.1	76.0	0.59	13.3
Bran & Shorts:						
TC Sh	0.3	2.37	13.7	76.3	0.59	13.3
Tail Sh	2.8	3.78	14.1	79.1	0.71	13.4
Head Sh	19.0	4.71	16.5	98.1	1.48	14.0
Bran	1.9	5.93	13.0	100.0	1.56	14.0
Patent (Rebolted)		**0.52**	**13.2**			
Wheat		**1.44**	**13.6**			

Casselton (Group C)

Glenn Check (C-1)

Mill Stream	Stream (%, 14% mb) Yield	Ash	Protein	Cumulative (%, 14% mb) Yield	Ash	Protein
Patent:						
1 M	10.7	0.26	12.4	10.7	0.26	12.4
Sz I	4.7	0.27	13.1	15.4	0.26	12.6
2 M	17.8	0.29	12.9	33.2	0.28	12.8
Sz II	3.0	0.35	13.0	36.1	0.28	12.8
3 M	12.1	0.44	13.3	48.2	0.32	12.9
Bk Dust	2.3	0.62	15.4	50.5	0.34	13.0
1 Bk	1.3	0.62	16.5	51.9	0.34	13.1
4 M	7.0	0.68	14.9	58.9	0.38	13.3
4 Bk	4.5	0.77	18.1	63.4	0.41	13.7
3 Bk	1.6	0.77	18.0	65.1	0.42	13.8
2 Bk II	1.1	0.84	17.2	66.2	0.43	13.8
TC	1.1	0.85	16.4	67.3	0.44	13.9
2 Bk I	0.7	0.92	17.5	68.0	0.44	13.9
6 M	2.4	0.92	13.9	70.4	0.46	13.9
Tail	1.1	1.51	17.5	71.5	0.47	14.0
5 Bk	1.5	1.73	21.1	73.0	0.50	14.1
Clear Flour:						
LG	1.1	2.14	18.7	74.1	0.52	14.2
LQ	0.2	2.26	15.8	74.4	0.53	14.2
5 M	1.1	2.29	16.1	75.5	0.56	14.2
Bran & Shorts:						
TC Sh	0.5	1.99	15.4	76.0	0.57	14.2
Tail Sh	2.4	3.75	14.9	78.3	0.66	14.3
Head Sh	18.1	4.82	17.4	96.4	1.44	14.8
Bran	3.6	6.83	15.3	100.0	1.63	14.9
Patent (Rebolted)		**0.52**	**14.1**			
Wheat		**1.68**	**14.7**			

ND825 (C-2)

Mill Stream	Stream (%, 14% mb) Yield	Ash	Protein	Cumulative (%, 14% mb) Yield	Ash	Protein
Patent:						
1 M	10.6	0.28	12.9	10.6	0.28	12.9
2 M	16.8	0.30	13.0	27.4	0.29	12.9
Sz I	4.8	0.31	13.5	32.2	0.29	13.0
Sz II	2.9	0.35	13.7	35.1	0.30	13.1
3 M	12.5	0.42	13.3	47.6	0.33	13.1
1 Bk	1.4	0.61	16.9	49.0	0.34	13.2
Bk Dust	2.5	0.64	16.0	51.5	0.35	13.4
4 M	7.6	0.66	14.9	59.1	0.39	13.6
4 Bk	4.9	0.70	18.3	64.0	0.42	13.9
3 Bk	1.8	0.73	18.5	65.8	0.43	14.0
2 Bk I	0.6	0.77	17.8	66.4	0.43	14.1
2 Bk II	1.1	0.78	17.6	67.6	0.43	14.1
6 M	2.6	0.93	13.9	70.2	0.45	14.1
TC	0.8	0.99	17.4	71.0	0.46	14.2
Tail	1.2	1.47	17.7	72.2	0.48	14.2
5 Bk	1.3	1.63	21.7	73.5	0.50	14.4
Clear Flour:						
5 M	1.4	1.86	16.0	74.9	0.52	14.4
LQ	0.3	2.03	15.8	75.2	0.53	14.4
LG	1.2	2.13	18.6	76.5	0.55	14.5
Bran & Shorts:						
TC Sh	0.1	3.05	15.0	76.6	0.56	14.5
Tail Sh	2.2	3.60	15.8	78.8	0.64	14.5
Head Sh	17.0	5.34	18.7	95.7	1.48	15.3
Bran	4.3	6.94	16.0	100.0	1.71	15.3
Patent (Rebolted)		**0.48**	**14.5**			
Wheat		**1.63**	**15.1**			

Boost (C-3)

Mill Stream	Stream (%, 14% mb) Yield	Ash	Protein	Cumulative (%, 14% mb) Yield	Ash	Protein
Patent:						
1 M	11.6	0.26	13.0	11.6	0.26	13.0
2 M	15.3	0.31	13.1	26.9	0.29	13.1
Sz I	4.4	0.32	13.7	31.3	0.30	13.2
3 M	13.4	0.41	13.5	44.7	0.33	13.3
Sz II	2.8	0.42	13.9	47.5	0.34	13.3
1 Bk	1.2	0.56	16.2	48.7	0.34	13.4
4 M	7.6	0.65	15.5	56.2	0.38	13.6
Bk Dust	2.5	0.68	16.0	58.8	0.40	13.7
4 Bk	4.5	0.71	18.8	63.3	0.42	14.1
3 Bk	1.8	0.71	18.7	65.0	0.43	14.2
2 Bk II	1.1	0.76	17.4	66.1	0.43	14.3
2 Bk I	0.6	0.78	17.4	66.8	0.44	14.3
6 M	2.3	0.84	14.1	69.1	0.45	14.3
TC	0.9	1.03	17.2	70.0	0.46	14.3
Tail	1.3	1.31	18.0	71.3	0.47	14.4
5 Bk	1.3	1.66	21.7	72.6	0.49	14.5
Clear Flour:						
LQ	0.3	1.72	16.0	72.9	0.50	14.5
5 M	1.4	1.80	16.3	74.3	0.52	14.6
LG	1.3	2.01	18.6	75.7	0.55	14.6
Bran & Shorts:						
TC Sh	0.2	2.57	13.5	75.9	0.56	14.6
Tail Sh	2.2	3.55	15.9	78.1	0.64	14.7
Head Sh	17.8	5.27	19.0	95.9	1.50	15.5
Bran	4.1	6.58	16.7	100.0	1.71	15.5
Patent (Rebolted)		**0.51**	**14.7**			
Wheat		**1.61**	**15.2**			

WB9653 (C-4)

Mill Stream	Stream (%, 14% mb) Yield	Ash	Protein	Cumulative (%, 14% mb) Yield	Ash	Protein
Patent:						
1 M	11.2	0.32	12.4	11.2	0.32	12.4
2 M	15.7	0.34	12.5	26.9	0.33	12.5
Sz I	4.6	0.37	13.0	31.5	0.34	12.5
Sz II	2.8	0.42	13.3	34.4	0.34	12.6
3 M	14.0	0.48	12.9	48.3	0.38	12.7
1 Bk	1.2	0.58	15.1	49.5	0.39	12.7
4 M	7.5	0.69	14.5	57.0	0.43	13.0
4 Bk	4.5	0.75	17.2	61.5	0.45	13.3
Bk Dust	2.6	0.75	15.0	64.1	0.46	13.3
2 Bk II	1.1	0.76	16.7	65.2	0.47	13.4
2 Bk I	0.6	0.77	16.7	65.8	0.47	13.4
3 Bk	1.6	0.78	17.8	67.4	0.48	13.5
6 M	2.3	0.79	13.4	69.8	0.49	13.5
TC	0.8	1.19	16.6	70.6	0.50	13.6
Tail	1.3	1.34	17.1	71.9	0.51	13.6
5 Bk	1.3	1.67	20.9	73.2	0.53	13.8
Clear Flour:						
LQ	0.4	1.70	15.6	73.6	0.54	13.8
5 M	1.6	1.72	15.8	75.2	0.56	13.8
LG	1.3	2.09	18.8	76.6	0.59	13.9
Bran & Shorts:						
TC Sh	0.2	2.91	12.4	76.8	0.60	13.9
Tail Sh	2.1	3.52	16.1	78.9	0.67	14.0
Head Sh	16.4	5.39	17.7	95.2	1.49	14.6
Bran	4.8	6.53	15.9	100.0	1.73	14.7
Patent (Rebolted)		**0.52**	**13.9**			
Wheat		**1.57**	**14.5**			

MN10261-1 (C-5)

Mill Stream	Stream (%, 14% mb) Yield	Ash	Protein	Cumulative (%, 14% mb) Yield	Ash	Protein
Patent:						
1 M	10.2	0.33	13.1	10.2	0.33	13.1
2 M	15.2	0.36	13.4	25.5	0.35	13.3
Sz I	3.8	0.36	13.8	29.2	0.35	13.3
3 M	13.1	0.40	13.5	42.3	0.37	13.4
Sz II	2.7	0.46	14.0	45.0	0.37	13.4
4 M	8.9	0.61	15.0	53.9	0.41	13.7
1 Bk	1.0	0.81	16.6	54.9	0.42	13.7
6 M	2.9	0.82	14.2	57.8	0.44	13.8
Bk Dust	2.0	0.84	16.0	59.8	0.45	13.8
4 Bk	3.9	0.87	17.7	63.6	0.48	14.1
2 Bk I	0.5	0.92	17.6	64.2	0.48	14.1
2 Bk II	0.9	0.96	17.4	65.0	0.49	14.1
3 Bk	1.2	1.01	18.1	66.2	0.50	14.2
TC	0.8	1.21	17.4	67.0	0.50	14.2
Tail	1.5	1.24	17.0	68.5	0.52	14.3
5 Bk	1.3	1.80	21.0	69.8	0.54	14.4
Clear Flour:						
5 M	2.3	1.54	15.9	72.0	0.58	14.5
LQ	0.5	1.62	15.8	72.5	0.58	14.5
LG	1.4	1.92	18.3	73.9	0.61	14.6
Bran & Shorts:						
TC Sh	0.2	3.03	13.8	74.1	0.61	14.6
Tail Sh	2.7	3.57	16.2	76.8	0.72	14.6
Head Sh	18.4	4.88	18.2	95.3	1.52	15.3
Bran	4.7	6.66	15.1	100.0	1.77	15.3
Patent (Rebolted)		**0.56**	**14.5**			
Wheat		**1.71**	**14.9**			

WB9507 (C-6)

Mill Stream	Stream (%, 14% mb) Yield	Ash	Protein	Cumulative (%, 14% mb) Yield	Ash	Protein
Patent:						
1 M	10.2	0.36	13.0	10.2	0.36	13.0
2 M	14.8	0.39	13.3	25.0	0.38	13.2
Sz I	4.3	0.41	13.7	29.3	0.38	13.3
3 M	13.8	0.46	13.7	43.0	0.41	13.4
Sz II	2.7	0.50	13.9	45.8	0.41	13.4
4 M	9.6	0.74	15.1	55.4	0.47	13.7
1 Bk	1.2	0.77	15.6	56.5	0.48	13.8
4 Bk	4.5	0.87	17.8	61.0	0.50	14.1
Bk Dust	2.2	0.88	15.4	63.2	0.52	14.1
6 M	2.9	0.93	14.4	66.1	0.54	14.1
2 Bk II	0.9	1.01	17.0	67.1	0.54	14.2
3 Bk	1.4	1.03	17.7	68.5	0.55	14.2
2 Bk I	0.5	1.05	17.1	69.0	0.56	14.3
TC	0.7	1.34	17.1	69.7	0.56	14.3
Tail	1.4	1.38	17.1	71.1	0.58	14.3
5 Bk	1.3	1.76	21.1	72.4	0.60	14.5
Clear Flour:						
LQ	0.3	1.83	16.0	72.7	0.61	14.5
LG	1.4	1.86	18.4	74.2	0.63	14.5
5 M	1.5	1.93	16.1	75.6	0.66	14.6
Bran & Shorts:						
TC Sh	0.1	3.51	12.5	75.7	0.66	14.6
Tail Sh	2.4	3.82	15.2	78.1	0.76	14.6
Head Sh	18.1	5.46	17.6	96.3	1.64	15.2
Bran	3.7	6.84	15.0	100.0	1.84	15.2
Patent (Rebolted)		**0.60**	**14.7**			
Wheat		**1.79**	**15.3**			

Bolles (C-7)

Mill Stream	Stream (%, 14% mb) Yield	Ash	Protein	Cumulative (%, 14% mb) Yield	Ash	Protein
Patent:						
1 M	9.9	0.33	15.2	9.9	0.33	15.2
2 M	17.1	0.36	15.4	27.0	0.35	15.3
Sz I	4.3	0.39	15.4	31.3	0.35	15.4
Sz II	3.1	0.44	15.6	34.4	0.36	15.4
3 M	13.1	0.51	16.0	47.5	0.40	15.5
Bk Dust	2.8	0.72	17.6	50.2	0.42	15.7
4 M	7.1	0.78	17.6	57.3	0.47	15.9
1 Bk	1.3	0.79	17.7	58.6	0.47	15.9
3 Bk	1.7	0.83	20.6	60.4	0.48	16.1
2 Bk II	1.2	0.86	19.3	61.6	0.49	16.1
4 Bk	3.8	0.88	20.6	65.4	0.51	16.4
2 Bk I	0.8	0.94	19.1	66.2	0.52	16.4
TC	1.2	0.98	19.2	67.4	0.53	16.5
6 M	2.2	1.04	16.3	69.6	0.54	16.5
Tail	1.2	1.56	19.6	70.8	0.56	16.5
5 Bk	1.2	1.78	23.0	72.0	0.58	16.6
Clear Flour:						
5 M	1.0	2.13	18.8	73.0	0.60	16.7
LG	1.0	2.21	20.2	74.0	0.62	16.7
LQ	0.2	2.37	17.6	74.2	0.63	16.7
Bran & Shorts:						
TC Sh	0.4	2.59	16.6	74.5	0.64	16.7
Tail Sh	2.0	4.02	16.0	76.5	0.72	16.7
Head Sh	18.0	5.79	18.1	94.6	1.67	17.0
Bran	5.4	6.82	15.7	100.0	1.97	16.9
Patent (Rebolted)		**0.59**	**16.5**			
Wheat		**1.88**	**17.0**			

SY Rustler (C-8)

Mill Stream	Stream (%, 14% mb) Yield	Ash	Protein	Cumulative (%, 14% mb) Yield	Ash	Protein
Patent:						
1 M	11.0	0.31	13.2	11.0	0.31	13.2
2 M	16.9	0.35	13.3	27.9	0.33	13.3
Sz I	4.2	0.35	13.7	32.1	0.34	13.3
Sz II	2.7	0.43	14.4	34.8	0.34	13.4
3 M	11.9	0.56	14.5	46.7	0.40	13.7
1 Bk	1.3	0.60	16.0	48.0	0.40	13.8
Bk Dust	2.7	0.68	15.5	50.8	0.42	13.9
3 Bk	2.1	0.70	18.7	52.9	0.43	14.0
2 Bk II	1.2	0.70	17.2	54.1	0.43	14.1
4 Bk	4.3	0.78	19.0	58.4	0.46	14.5
2 Bk I	0.7	0.80	18.0	59.0	0.46	14.5
4 M	6.8	0.84	16.3	65.8	0.50	14.7
TC	1.2	0.95	17.2	67.0	0.51	14.7
6 M	2.0	1.04	15.7	69.0	0.53	14.8
5 Bk	1.5	1.45	22.3	70.5	0.55	14.9
Tail	1.2	1.54	19.7	71.7	0.56	15.0
Clear Flour:						
5 M	1.0	2.18	18.9	72.7	0.58	15.1
LQ	0.2	2.25	17.4	72.9	0.59	15.1
LG	1.3	2.26	21.1	74.2	0.62	15.2
Bran & Shorts:						
TC Sh	0.2	2.71	15.4	74.4	0.62	15.2
Tail Sh	2.4	3.89	16.8	76.8	0.73	15.2
Head Sh	19.3	5.05	19.6	96.1	1.59	16.1
Bran	3.9	6.14	16.9	100.0	1.77	16.1
Patent (Rebolted)		**0.55**	**15.3**			
Wheat		**1.79**	**15.9**			

Crookston (Group K)

Glenn Check (K-1)

Mill Stream	Stream (%, 14% mb) Yield	Ash	Protein	Cumulative (%, 14% mb) Yield	Ash	Protein
Patent:						
1 M	13.0	0.28	11.0	13.0	0.28	11.0
2 M	16.0	0.29	11.1	29.0	0.29	11.0
Sz I	4.5	0.33	11.5	33.4	0.29	11.1
3 M	12.4	0.36	11.6	45.9	0.31	11.2
Sz II	2.8	0.37	11.5	48.7	0.31	11.3
1 Bk	1.1	0.61	13.2	49.9	0.32	11.3
Bk Dust	2.4	0.61	13.4	52.2	0.33	11.4
4 M	8.2	0.66	12.9	60.5	0.38	11.6
4 Bk	4.1	0.70	15.6	64.5	0.40	11.8
3 Bk	1.6	0.73	15.5	66.2	0.41	11.9
2 Bk II	0.9	0.78	14.7	67.1	0.41	12.0
2 Bk I	0.6	0.82	14.9	67.7	0.42	12.0
TC	0.8	0.86	14.5	68.5	0.42	12.0
6 M	2.9	0.87	12.5	71.4	0.44	12.0
Tail	1.2	1.36	15.8	72.7	0.45	12.1
5 Bk	1.3	1.43	18.7	74.0	0.47	12.2
Clear Flour:						
LG	1.2	1.86	18.6	75.2	0.49	12.3
5 M	1.2	1.88	14.6	76.4	0.52	12.4
LQ	0.3	1.91	14.1	76.7	0.52	12.4
Bran & Shorts:						
TC Sh	0.1	2.68	12.8	76.8	0.52	12.4
Tail Sh	2.0	3.30	13.8	78.8	0.59	12.4
Head Sh	17.3	4.69	16.5	96.1	1.33	13.2
Bran	3.9	6.22	14.1	100.0	1.52	13.2
Patent (Rebolted)		**0.47**	**12.5**			
Wheat		**1.41**	**13.0**			

Boost (K-3)

Mill Stream	Stream (%, 14% mb) Yield	Ash	Protein	Cumulative (%, 14% mb) Yield	Ash	Protein
Patent:						
2 M	16.0	0.27	12.1	16.0	0.27	12.1
1 M	12.5	0.28	11.9	28.5	0.27	12.0
Sz I	4.5	0.28	12.3	32.9	0.28	12.0
Sz II	3.4	0.31	12.5	36.4	0.28	12.1
3 M	11.8	0.35	12.2	48.2	0.30	12.1
1 Bk	1.5	0.48	13.8	49.7	0.30	12.1
Bk Dust	2.9	0.48	13.7	52.6	0.31	12.2
4 M	7.6	0.52	13.5	60.2	0.34	12.4
3 Bk	1.9	0.54	16.6	62.1	0.34	12.5
4 Bk	4.0	0.60	16.8	66.2	0.36	12.8
2 Bk II	1.3	0.60	15.5	67.4	0.36	12.8
2 Bk I	0.8	0.65	15.5	68.2	0.37	12.9
TC	1.1	0.69	15.1	69.3	0.37	12.9
6 M	2.7	0.74	12.6	72.0	0.39	12.9
Tail	1.2	1.17	15.8	73.1	0.40	12.9
5 Bk	1.3	1.24	19.1	74.4	0.41	13.0
Clear Flour:						
5 M	1.3	1.44	14.7	75.7	0.43	13.1
LQ	0.2	1.75	14.5	75.9	0.43	13.1
LG	1.0	1.82	17.1	76.9	0.45	13.1
Bran & Shorts:						
TC Sh	0.2	2.12	12.1	77.1	0.46	13.1
Tail Sh	1.5	3.06	14.0	78.6	0.51	13.1
Head Sh	15.2	4.10	17.1	93.8	1.09	13.8
Bran	6.2	5.86	15.1	100.0	1.38	13.9
Patent (Rebolted)		**0.40**	**13.2**			
Wheat		**1.27**	**13.6**			

WB9653 (K-4)

Mill Stream	Stream (%, 14% mb) Yield	Ash	Protein	Cumulative (%, 14% mb) Yield	Ash	Protein
Patent:						
1 M	13.8	0.26	10.8	13.8	0.26	10.8
2 M	16.0	0.28	11.0	29.8	0.27	10.9
Sz I	4.5	0.30	11.2	34.3	0.27	11.0
Sz II	3.2	0.34	11.6	37.5	0.28	11.0
3 M	11.2	0.35	11.3	48.7	0.29	11.1
4 M	7.8	0.45	12.4	56.5	0.32	11.3
1 Bk	1.4	0.52	13.1	57.9	0.32	11.3
Bk Dust	2.7	0.57	12.7	60.6	0.33	11.4
3 Bk	1.9	0.60	15.1	62.5	0.34	11.5
2 Bk II	1.2	0.60	14.5	63.7	0.34	11.5
4 Bk	4.1	0.61	15.5	67.7	0.36	11.8
2 Bk I	0.7	0.62	14.4	68.4	0.36	11.8
6 M	2.8	0.62	12.0	71.2	0.37	11.8
TC	1.0	0.81	14.4	72.2	0.38	11.8
Tail	1.2	0.99	15.3	73.4	0.39	11.9
5 Bk	1.2	1.14	18.8	74.5	0.40	12.0
Clear Flour:						
5 M	1.6	1.07	13.7	76.2	0.41	12.0
LG	1.1	1.60	17.5	77.3	0.43	12.1
LQ	0.2	1.61	13.7	77.4	0.43	12.1
Bran & Shorts:						
TC Sh	0.2	2.30	11.8	77.6	0.44	12.1
Tail Sh	1.6	2.95	14.6	79.3	0.49	12.2
Head Sh	13.9	3.53	17.8	93.2	0.95	13.0
Bran	6.8	5.51	15.2	100.0	1.26	13.2
Patent (Rebolted)		**0.41**	**12.0**			
Wheat		**1.20**	**12.7**			

MN10261-1 (K-5)

Mill Stream	Stream (%, 14% mb) Yield	Ash	Protein	Cumulative (%, 14% mb) Yield	Ash	Protein
Patent:						
1 M	11.8	0.31	11.9	11.8	0.31	11.9
2 M	15.0	0.31	12.1	26.8	0.31	12.0
Sz I	3.7	0.32	12.9	30.4	0.31	12.1
3 M	14.2	0.35	12.5	44.6	0.32	12.3
Sz II	2.7	0.43	12.7	47.3	0.33	12.3
4 M	8.6	0.53	13.5	55.9	0.36	12.5
6 M	3.6	0.65	11.4	59.4	0.38	12.4
4 Bk	3.7	0.70	16.6	63.1	0.39	12.6
Bk Dust	1.8	0.72	14.6	64.9	0.40	12.7
1 Bk	0.9	0.75	15.4	65.7	0.41	12.7
3 Bk	1.2	0.85	16.8	66.9	0.41	12.8
2 Bk II	0.7	0.96	16.1	67.5	0.42	12.8
TC	0.7	0.99	15.8	68.2	0.43	12.9
Tail	1.6	1.02	15.3	69.8	0.44	12.9
2 Bk I	0.5	1.07	16.2	70.2	0.44	12.9
5 Bk	1.2	1.31	19.4	71.5	0.46	13.1
Clear Flour:						
5 M	2.0	1.26	14.1	73.5	0.48	13.1
LQ	0.4	1.35	14.4	73.9	0.49	13.1
LG	1.5	1.53	16.2	75.4	0.51	13.2
Bran & Shorts:						
TC Sh	0.1	2.67	12.1	75.5	0.51	13.2
Tail Sh	2.3	2.89	14.6	77.8	0.58	13.2
Head Sh	16.9	3.94	16.6	94.6	1.18	13.8
Bran	5.4	5.91	14.2	100.0	1.43	13.8
Patent (Rebolted)		**0.46**	**13.0**			
Wheat		**1.37**	**13.7**			

WB9507 (K-6)

Mill Stream	Stream (%, 14% mb) Yield	Ash	Protein	Cumulative (%, 14% mb) Yield	Ash	Protein
Patent:						
1 M	10.7	0.30	10.6	10.7	0.30	10.6
2 M	14.6	0.30	10.7	25.3	0.30	10.7
Sz I	4.4	0.32	10.8	29.7	0.30	10.7
3 M	13.3	0.34	11.0	43.0	0.31	10.8
Sz II	3.0	0.36	11.0	46.0	0.32	10.8
4 M	8.6	0.48	11.9	54.6	0.34	11.0
6 M	3.5	0.53	11.7	58.1	0.35	11.0
1 Bk	1.3	0.60	12.1	59.3	0.36	11.0
Bk Dust	2.4	0.60	11.7	61.8	0.37	11.1
4 Bk	4.3	0.61	13.8	66.1	0.38	11.2
2 Bk II	1.0	0.75	13.7	67.1	0.39	11.3
3 Bk	1.3	0.77	13.8	68.3	0.40	11.3
2 Bk I	0.6	0.78	13.3	68.9	0.40	11.3
TC	0.8	0.88	12.9	69.7	0.40	11.4
Tail	1.5	0.97	14.0	71.2	0.42	11.4
5 Bk	1.3	1.12	17.0	72.4	0.43	11.5
Clear Flour:						
5 M	1.6	1.04	13.3	74.1	0.44	11.6
LQ	0.3	1.27	13.4	74.4	0.45	11.6
LG	1.4	1.42	15.9	75.8	0.46	11.6
Bran & Shorts:						
TC Sh	0.1	2.69	11.2	75.8	0.47	11.6
Tail Sh	2.0	3.06	13.6	77.9	0.53	11.7
Head Sh	17.0	3.59	16.2	94.9	1.08	12.5
Bran	5.1	5.89	13.3	100.0	1.33	12.5
Patent (Rebolted)		**0.41**	**11.4**			
Wheat		**1.31**	**12.2**			

Bolles (K-7)

Mill Stream	Stream (%, 14% mb) Yield	Ash	Protein	Cumulative (%, 14% mb) Yield	Ash	Protein
Patent:						
1 M	10.4	0.27	13.3	10.4	0.27	13.3
2 M	15.0	0.30	13.5	25.4	0.29	13.4
Sz I	4.0	0.32	13.2	29.4	0.29	13.4
3 M	14.7	0.34	13.8	44.1	0.31	13.5
Sz II	3.3	0.38	13.5	47.4	0.31	13.5
4 M	8.0	0.49	14.8	55.4	0.34	13.7
6 M	3.0	0.60	13.7	58.4	0.35	13.7
Bk Dust	2.4	0.61	15.0	60.9	0.36	13.8
1 Bk	1.2	0.63	14.6	62.1	0.37	13.8
4 Bk	3.5	0.63	17.8	65.6	0.38	14.0
3 Bk	1.6	0.70	17.4	67.2	0.39	14.1
2 Bk II	1.0	0.72	16.1	68.2	0.40	14.1
TC	1.1	0.75	16.6	69.3	0.40	14.1
2 Bk I	0.6	0.76	15.9	69.9	0.40	14.2
Tail	1.2	0.99	16.7	71.1	0.41	14.2
5 Bk	1.1	1.12	20.2	72.2	0.42	14.3
Clear Flour:						
5 M	1.6	1.08	15.6	73.9	0.44	14.3
LG	1.0	1.48	16.3	74.9	0.45	14.3
LQ	0.2	1.52	15.4	75.1	0.46	14.4
Bran & Shorts:						
TC Sh	0.2	2.22	14.8	75.3	0.46	14.4
Tail Sh	1.7	3.00	14.7	77.0	0.52	14.4
Head Sh	15.9	4.23	17.7	92.9	1.15	14.9
Bran	7.1	5.81	15.3	100.0	1.48	15.0
Patent (Rebolted)		**0.42**	**14.4**			
Wheat		**1.48**	**14.7**			

Minot (Group M)

Glenn Check (M-1)

Mill Stream	Stream (%, 14% mb) Yield	Ash	Protein	Cumulative (%, 14% mb) Yield	Ash	Protein
Patent:						
1 M	12.2	0.27	11.5	12.2	0.27	11.5
2 M	16.3	0.29	11.7	28.5	0.28	11.6
Sz I	4.5	0.31	12.2	32.9	0.29	11.7
Sz II	2.9	0.36	12.1	35.8	0.29	11.7
3 M	12.7	0.37	11.5	48.6	0.31	11.7
4 M	7.4	0.53	12.8	56.0	0.34	11.8
Bk Dust	2.3	0.60	14.4	58.3	0.35	11.9
4 Bk	4.4	0.65	16.5	62.6	0.37	12.2
6 M	3.3	0.66	11.5	65.9	0.39	12.2
1 Bk	1.1	0.69	15.7	67.0	0.39	12.3
3 Bk	1.9	0.72	16.7	68.9	0.40	12.4
2 Bk II	1.1	0.82	16.1	69.9	0.41	12.4
TC	0.8	0.87	15.6	70.7	0.41	12.5
2 Bk I	0.6	0.93	16.9	71.3	0.42	12.5
5 Bk	1.3	1.16	18.8	72.6	0.43	12.6
Tail	1.1	1.28	15.6	73.6	0.44	12.7
Clear Flour:						
LQ	0.2	1.62	13.2	73.8	0.44	12.7
LG	1.1	1.68	17.2	74.9	0.46	12.7
5 M	1.4	1.76	14.8	76.2	0.49	12.8
Bran & Shorts:						
TC Sh	0.2	2.48	14.1	76.4	0.49	12.8
Tail Sh	1.5	2.94	13.6	78.0	0.54	12.8
Head Sh	15.5	4.46	16.0	93.5	1.19	13.3
Bran	6.5	6.37	13.9	100.0	1.53	13.4
Patent (Rebolted)		**0.44**	**12.6**			
Wheat		**1.39**	**13.4**			

ND825 (M-2)

Mill Stream	Stream (%, 14% mb) Yield	Ash	Protein	Cumulative (%, 14% mb) Yield	Ash	Protein
Patent:						
1 M	12.0	0.29	13.4	12.0	0.29	13.4
2 M	14.9	0.30	13.9	26.9	0.30	13.7
3 M	11.5	0.32	13.9	38.4	0.30	13.7
Sz I	4.3	0.33	14.4	42.7	0.31	13.8
Sz II	3.0	0.37	14.2	45.7	0.31	13.8
4 M	8.4	0.51	15.1	54.1	0.34	14.0
Bk Dust	2.8	0.64	17.2	57.0	0.36	14.2
1 Bk	1.5	0.64	18.4	58.5	0.36	14.3
6 M	3.2	0.66	13.7	61.6	0.38	14.2
4 Bk	4.2	0.69	19.6	65.8	0.40	14.6
3 Bk	1.6	0.77	19.5	67.4	0.41	14.7
2 Bk II	1.1	0.86	18.9	68.5	0.42	14.8
TC	0.9	0.95	18.5	69.4	0.42	14.8
2 Bk I	0.6	0.97	19.1	70.0	0.43	14.9
Tail	1.3	1.24	17.1	71.4	0.44	14.9
5 Bk	1.2	1.37	22.5	72.6	0.46	15.0
Clear Flour:						
LG	1.2	1.49	17.6	73.8	0.47	15.1
5 M	1.8	1.67	15.8	75.5	0.50	15.1
LQ	0.2	1.76	15.0	75.7	0.51	15.1
Bran & Shorts:						
TC Sh	0.2	2.75	16.8	75.9	0.51	15.1
Tail Sh	1.7	3.47	14.4	77.6	0.57	15.1
Head Sh	15.4	4.21	18.4	93.0	1.18	15.6
Bran	7.0	6.90	15.9	100.0	1.58	15.6
Patent (Rebolted)		**0.44**	**15.1**			
Wheat		**1.47**	**15.6**			

Boost (M-3)

Mill Stream	Stream (%, 14% mb) Yield	Ash	Protein	Cumulative (%, 14% mb) Yield	Ash	Protein
Patent:						
1 M	11.8	0.28	13.1	11.8	0.28	13.1
2 M	13.0	0.30	13.6	24.8	0.29	13.4
Sz I	4.7	0.35	14.1	29.5	0.30	13.5
Sz II	2.9	0.38	14.2	32.4	0.31	13.6
3 M	14.4	0.39	13.8	46.9	0.33	13.6
4 M	8.9	0.60	15.7	55.7	0.38	13.9
1 Bk	1.3	0.61	16.9	57.0	0.38	14.0
Bk Dust	2.6	0.66	16.7	59.6	0.39	14.1
3 Bk	1.7	0.73	18.8	61.3	0.40	14.3
4 Bk	5.4	0.74	18.6	66.7	0.43	14.6
2 Bk II	1.1	0.81	17.8	67.8	0.44	14.7
2 Bk I	0.6	0.86	17.9	68.4	0.44	14.7
6 M	2.7	0.98	14.1	71.0	0.46	14.7
TC	0.8	1.01	17.6	71.8	0.47	14.7
Tail	1.3	1.36	18.0	73.1	0.48	14.8
5 Bk	1.1	1.65	20.9	74.2	0.50	14.8
Clear Flour:						
5 M	2.1	1.38	15.1	76.3	0.52	14.9
LG	1.0	1.85	17.7	77.3	0.54	14.9
LQ	0.2	1.97	15.4	77.4	0.54	14.9
Bran & Shorts:						
TC Sh	0.3	2.05	17.0	77.7	0.55	14.9
Tail Sh	2.1	3.67	15.1	79.8	0.63	14.9
Head Sh	16.9	4.94	18.9	96.7	1.38	15.6
Bran	3.3	6.33	16.3	100.0	1.55	15.6
Patent (Rebolted)		**0.48**	**14.9**			
Wheat		**1.46**	**15.6**			

WB9653 (M-4)

Mill Stream	Stream (%, 14% mb) Yield	Ash	Protein	Cumulative (%, 14% mb) Yield	Ash	Protein
Patent:						
2 M	16.9	0.32	12.0	16.9	0.32	12.0
1 M	9.8	0.33	11.8	26.7	0.32	11.9
Sz I	4.0	0.36	12.7	30.7	0.33	12.0
3 M	12.3	0.38	12.1	43.0	0.34	12.0
Sz II	3.0	0.38	12.8	46.0	0.35	12.1
4 M	8.5	0.49	13.3	54.5	0.37	12.3
6 M	3.3	0.61	12.5	57.8	0.38	12.3
1 Bk	1.2	0.63	16.3	59.0	0.39	12.4
Bk Dust	2.5	0.66	15.3	61.5	0.40	12.5
4 Bk	4.2	0.73	17.1	65.7	0.42	12.8
3 Bk	1.6	0.77	17.5	67.3	0.43	12.9
2 Bk II	1.0	0.82	17.2	68.3	0.43	13.0
2 Bk I	0.6	0.88	17.3	68.9	0.44	13.0
Tail	1.3	0.99	16.3	70.3	0.45	13.1
TC	0.8	1.06	16.8	71.0	0.45	13.1
5 Bk	1.2	1.30	20.5	72.2	0.47	13.2
Clear Flour:						
5 M	2.0	1.10	13.9	74.2	0.48	13.3
LQ	0.3	1.21	13.7	74.5	0.49	13.3
LG	1.3	1.56	17.7	75.8	0.51	13.3
Bran & Shorts:						
TC Sh	0.2	2.79	14.7	76.0	0.51	13.3
Tail Sh	1.8	3.13	14.8	77.8	0.57	13.4
Head Sh	15.1	4.14	17.9	92.9	1.15	14.1
Bran	7.1	6.29	16.3	100.0	1.52	14.3
Patent (Rebolted)		**0.44**	**13.2**			
Wheat		**1.41**	**13.9**			

MN10261-1 (M-5)

Mill Stream	Stream (%, 14% mb) Yield	Ash	Protein	Cumulative (%, 14% mb) Yield	Ash	Protein
Patent:						
2 M	12.7	0.30	14.0	12.7	0.30	14.0
1 M	11.0	0.30	13.5	23.7	0.30	13.8
Sz I	4.9	0.33	14.2	28.6	0.30	13.8
Sz II	2.9	0.39	14.5	31.5	0.31	13.9
3 M	16.3	0.40	14.1	47.7	0.34	14.0
4 M	9.0	0.59	15.7	56.7	0.38	14.2
1 Bk	1.2	0.64	17.3	57.9	0.39	14.3
Bk Dust	2.4	0.68	16.5	60.3	0.40	14.4
4 Bk	5.4	0.74	18.7	65.7	0.43	14.7
3 Bk	1.6	0.82	19.0	67.3	0.44	14.8
2 Bk II	0.8	0.91	18.1	68.1	0.44	14.9
2 Bk I	0.5	0.92	18.5	68.6	0.44	14.9
6 M	2.8	1.04	14.9	71.4	0.47	14.9
TC	0.7	1.04	18.0	72.1	0.47	14.9
Tail	1.2	1.39	18.8	73.3	0.49	15.0
5 Bk	1.2	1.62	22.4	74.5	0.51	15.1
Clear Flour:						
5 M	1.9	1.31	16.2	76.3	0.53	15.1
LQ	0.3	1.98	16.0	76.6	0.53	15.1
LG	0.9	2.00	19.7	77.5	0.55	15.2
Bran & Shorts:						
TC Sh	0.3	2.14	16.6	77.8	0.55	15.2
Tail Sh	2.2	3.73	15.3	80.0	0.64	15.2
Head Sh	16.5	4.84	19.2	96.5	1.36	15.9
Bran	3.5	6.36	15.3	100.0	1.54	15.9
Patent (Rebolted)		**0.49**	**15.3**			
Wheat		**1.48**	**15.6**			

WB9507 (M-6)

Mill Stream	Stream (%, 14% mb) Yield	Ash	Protein	Cumulative (%, 14% mb) Yield	Ash	Protein
Patent:						
1 M	10.4	0.33	12.4	10.4	0.33	12.4
2 M	15.0	0.35	12.8	25.4	0.34	12.7
Sz I	4.6	0.36	13.3	30.0	0.35	12.8
3 M	13.5	0.38	13.0	43.5	0.36	12.8
Sz II	2.7	0.42	13.5	46.1	0.36	12.9
4 M	9.2	0.56	14.2	55.4	0.39	13.1
1 Bk	1.0	0.70	17.1	56.3	0.40	13.1
6 M	3.2	0.75	13.3	59.6	0.42	13.2
Bk Dust	2.3	0.77	15.8	61.9	0.43	13.3
4 Bk	4.9	0.78	17.8	66.8	0.46	13.6
3 Bk	1.6	0.86	17.3	68.4	0.47	13.7
2 Bk I	0.5	1.00	17.7	68.8	0.47	13.7
2 Bk II	0.9	1.01	17.5	69.8	0.48	13.7
TC	0.7	1.12	17.2	70.4	0.48	13.8
Tail	1.3	1.23	17.1	71.7	0.50	13.8
5 Bk	1.2	1.39	21.4	72.9	0.51	14.0
Clear Flour:						
LQ	0.4	1.52	14.8	73.3	0.52	14.0
5 M	1.9	1.70	15.5	75.2	0.55	14.0
LG	1.3	1.75	19.0	76.5	0.57	14.1
Bran & Shorts:						
TC Sh	0.3	2.51	15.7	76.7	0.57	14.1
Tail Sh	2.1	3.49	14.6	78.9	0.65	14.1
Head Sh	17.1	4.50	18.0	96.0	1.34	14.8
Bran	4.0	6.22	14.2	100.0	1.53	14.8
Patent (Rebolted)		**0.51**	**14.0**			
Wheat		**1.47**	**14.5**			

Bolles (M-7)

Mill Stream	Stream (%, 14% mb) Yield	Ash	Protein	Cumulative (%, 14% mb) Yield	Ash	Protein
Patent:						
1 M	11.7	0.27	12.6	11.7	0.27	12.6
2 M	17.1	0.31	12.8	28.8	0.29	12.7
Sz I	4.8	0.32	13.0	33.7	0.30	12.8
Sz II	3.3	0.39	12.9	36.9	0.30	12.8
3 M	11.1	0.43	13.2	48.1	0.33	12.9
4 M	9.5	0.64	14.3	57.5	0.38	13.1
Bk Dust	2.5	0.69	15.1	60.0	0.40	13.2
1 Bk	1.2	0.74	15.6	61.2	0.40	13.2
4 Bk	5.5	0.77	16.7	66.8	0.43	13.5
3 Bk	1.5	0.85	17.3	68.2	0.44	13.6
TC	0.8	0.88	16.7	69.0	0.45	13.6
2 Bk II	1.1	0.89	16.7	70.1	0.45	13.7
2 Bk I	0.7	0.97	16.8	70.8	0.46	13.7
6 M	2.3	1.17	13.6	73.1	0.48	13.7
Tail	1.1	1.49	17.1	74.2	0.50	13.8
5 Bk	1.2	1.81	20.7	75.4	0.52	13.9
Clear Flour:						
5 M	1.7	1.52	15.1	77.1	0.54	13.9
LG	0.9	1.97	18.4	77.9	0.56	13.9
LQ	0.2	2.23	14.6	78.1	0.56	14.0
Bran & Shorts:						
TC Sh	0.3	2.18	15.8	78.4	0.56	14.0
Tail Sh	2.1	3.75	13.3	80.5	0.65	13.9
Head Sh	17.2	4.93	16.2	97.7	1.40	14.3
Bran	2.3	6.33	13.4	100.0	1.51	14.3
Patent (Rebolted)		**0.51**	**14.0**			
Wheat		**1.51**	**14.4**			

SY Rustler (M-8)

Mill Stream	Stream (%, 14% mb) Yield	Ash	Protein	Cumulative (%, 14% mb) Yield	Ash	Protein
Patent:						
1 M	11.2	0.29	12.8	11.2	0.29	12.8
2 M	13.1	0.31	13.3	24.3	0.30	13.1
Sz I	4.5	0.33	13.6	28.8	0.31	13.1
3 M	12.6	0.37	13.7	41.4	0.33	13.3
Sz II	2.5	0.37	14.1	43.9	0.33	13.4
4 M	10.0	0.56	15.3	54.0	0.37	13.7
Bk Dust	2.6	0.60	15.8	56.6	0.38	13.8
1 Bk	1.2	0.63	16.6	57.8	0.39	13.9
4 Bk	5.2	0.68	18.9	63.0	0.41	14.3
3 Bk	1.8	0.69	18.6	64.8	0.42	14.4
2 Bk II	1.2	0.80	17.4	66.0	0.43	14.5
2 Bk I	0.6	0.80	17.8	66.6	0.43	14.5
TC	0.6	0.95	17.1	67.2	0.44	14.5
6 M	2.7	1.01	14.5	69.8	0.46	14.5
Tail	1.3	1.47	18.5	71.2	0.48	14.6
5 Bk	1.5	1.52	22.0	72.6	0.50	14.7
Clear Flour:						
5 M	1.6	1.48	15.9	74.2	0.52	14.8
LQ	0.3	2.03	15.7	74.5	0.52	14.8
LG	1.1	2.11	19.0	75.6	0.55	14.8
Bran & Shorts:						
TC Sh	0.2	2.02	16.7	75.8	0.55	14.8
Tail Sh	2.2	3.79	15.4	78.0	0.64	14.9
Head Sh	17.9	4.31	19.2	95.9	1.33	15.7
Bran	4.1	5.72	16.9	100.0	1.51	15.7
Patent (Rebolted)		**0.48**	**14.6**			
Wheat		**1.44**	**15.6**			

Williston (Group W)

Glenn Check (W-1)

Mill Stream	Stream (%, 14% mb) Yield	Ash	Protein	Cumulative (%, 14% mb) Yield	Ash	Protein
Patent:						
1 M	9.6	0.25	12.2	9.6	0.25	12.2
2 M	15.6	0.26	12.4	25.2	0.26	12.3
Sz I	3.8	0.29	12.9	29.0	0.26	12.4
3 M	13.9	0.32	12.2	42.8	0.28	12.3
Sz II	3.2	0.35	13.0	46.0	0.28	12.4
4 M	8.6	0.48	13.6	54.5	0.32	12.6
4 Bk	4.5	0.59	17.6	59.1	0.34	13.0
Bk Dust	2.2	0.62	15.5	61.3	0.35	13.0
1 Bk	1.1	0.67	16.4	62.4	0.35	13.1
3 Bk	1.3	0.72	17.7	63.7	0.36	13.2
2 Bk II	0.9	0.74	17.3	64.6	0.37	13.3
6 M	3.6	0.79	12.4	68.3	0.39	13.2
TC	0.8	0.79	16.5	69.1	0.39	13.3
2 Bk I	0.5	0.81	17.3	69.6	0.40	13.3
Tail	1.4	1.17	15.6	71.0	0.41	13.3
5 Bk	1.3	1.29	20.7	72.3	0.43	13.5
Clear Flour:						
5 M	1.4	1.60	14.4	73.7	0.45	13.5
LQ	0.3	1.64	13.6	74.0	0.45	13.5
LG	1.3	1.65	17.9	75.3	0.48	13.6
Bran & Shorts:						
TC Sh	0.3	2.19	14.7	75.6	0.48	13.6
Tail Sh	2.0	3.37	13.5	77.6	0.56	13.6
Head Sh	17.1	4.10	16.1	94.8	1.20	14.0
Bran	5.2	6.06	13.6	100.0	1.45	14.0
Patent (Rebolted)		**0.44**	**13.5**			
Wheat		**1.44**	**13.6**			

ND825 (W-2)

Mill Stream	Stream (%, 14% mb) Yield	Ash	Protein	Cumulative (%, 14% mb) Yield	Ash	Protein
Patent:						
1 M	10.1	0.24	14.6	10.1	0.24	14.6
Sz I	4.2	0.24	15.3	14.3	0.24	14.8
2 M	16.0	0.28	14.7	30.3	0.26	14.8
Sz II	3.3	0.31	15.1	33.6	0.26	14.8
3 M	13.6	0.33	14.8	47.2	0.28	14.8
4 M	7.9	0.46	16.3	55.1	0.31	15.0
1 Bk	1.3	0.55	19.3	56.3	0.32	15.1
Bk Dust	2.6	0.56	18.2	58.9	0.33	15.2
4 Bk	4.6	0.57	19.6	63.6	0.34	15.6
6 M	3.3	0.61	14.2	66.9	0.36	15.5
2 Bk II	1.1	0.68	20.0	68.0	0.36	15.6
3 Bk	1.4	0.71	20.2	69.4	0.37	15.7
TC	1.1	0.78	19.2	70.5	0.38	15.7
2 Bk I	0.6	0.79	20.3	71.0	0.38	15.7
Tail	1.3	1.02	17.4	72.3	0.39	15.8
5 Bk	1.2	1.11	23.9	73.5	0.40	15.9
Clear Flour:						
5 M	1.2	1.48	15.7	74.7	0.42	15.9
LQ	0.1	1.49	15.3	74.8	0.42	15.9
LG	1.2	1.52	17.3	75.9	0.44	15.9
Bran & Shorts:						
TC Sh	0.4	2.14	17.4	76.4	0.45	15.9
Tail Sh	1.7	2.80	14.5	78.1	0.50	15.9
Head Sh	15.9	3.61	18.6	94.0	1.02	16.4
Bran	6.0	5.77	16.1	100.0	1.31	16.3
Patent (Rebolted)		**0.41**	**15.8**			
Wheat		**1.37**	**16.2**			

WB9653 (W-4)

Mill Stream	Stream (%, 14% mb) Yield	Ash	Protein	Cumulative (%, 14% mb) Yield	Ash	Protein
Patent:						
1 M	10.7	0.28	11.1	10.7	0.28	11.1
Sz I	4.1	0.29	11.7	14.8	0.28	11.2
2 M	15.5	0.30	11.1	30.2	0.29	11.2
3 M	14.5	0.33	11.3	44.8	0.30	11.2
Sz II	3.0	0.33	11.7	47.8	0.30	11.2
4 M	8.1	0.47	12.6	55.9	0.33	11.4
6 M	3.7	0.56	11.5	59.5	0.34	11.4
1 Bk	1.0	0.61	15.8	60.6	0.35	11.5
4 Bk	4.8	0.62	15.5	65.4	0.37	11.8
Bk Dust	2.3	0.66	15.0	67.7	0.38	11.9
2 Bk II	1.0	0.73	17.5	68.7	0.38	12.0
3 Bk	1.4	0.77	16.6	70.0	0.39	12.1
2 Bk I	0.5	0.82	17.8	70.5	0.39	12.1
TC	0.9	0.88	15.7	71.5	0.40	12.2
Tail	1.4	0.91	15.4	72.8	0.41	12.2
5 Bk	1.1	1.21	19.3	74.0	0.42	12.3
Clear Flour:						
5 M	1.4	1.37	14.9	75.3	0.44	12.4
LG	1.2	1.47	18.0	76.6	0.46	12.5
LQ	0.2	1.49	13.1	76.8	0.46	12.5
Bran & Shorts:						
TC Sh	0.4	2.06	13.5	77.2	0.47	12.5
Tail Sh	1.5	2.96	13.6	78.7	0.52	12.5
Head Sh	15.6	3.59	16.6	94.4	1.03	13.2
Bran	5.6	5.54	13.6	100.0	1.28	13.2
Patent (Rebolted)		**0.40**	**12.5**			
Wheat		**1.23**	**12.8**			

MN10261-1 (W-5)

Mill Stream	Stream (%, 14% mb) Yield	Ash	Protein	Cumulative (%, 14% mb) Yield	Ash	Protein
Patent:						
2 M	14.0	0.26	12.5	14.0	0.26	12.5
1 M	10.0	0.27	12.1	24.0	0.27	12.3
3 M	16.1	0.31	12.8	40.1	0.28	12.5
Sz I	3.9	0.35	12.7	44.0	0.29	12.5
Sz II	3.0	0.38	13.0	47.0	0.30	12.6
4 M	8.4	0.51	13.9	55.4	0.33	12.8
6 M	3.7	0.55	13.1	59.1	0.34	12.8
4 Bk	4.0	0.68	16.6	63.1	0.36	13.0
Bk Dust	2.0	0.73	14.6	65.1	0.37	13.1
1 Bk	1.0	0.76	15.4	66.0	0.38	13.1
2 Bk II	0.7	0.93	16.0	66.8	0.39	13.2
3 Bk	1.1	0.94	16.7	67.8	0.39	13.2
TC	0.9	0.94	16.1	68.7	0.40	13.2
Tail	1.5	0.97	16.0	70.2	0.41	13.3
2 Bk I	0.4	1.02	16.3	70.6	0.42	13.3
5 Bk	1.3	1.25	19.2	71.9	0.43	13.4
Clear Flour:						
LQ	0.3	1.51	14.3	72.2	0.44	13.4
LG	1.3	1.64	17.8	73.5	0.46	13.5
5 M	1.4	1.69	15.1	74.9	0.48	13.5
Bran & Shorts:						
TC Sh	0.4	2.24	14.6	75.4	0.49	13.5
Tail Sh	2.1	3.07	13.9	77.5	0.56	13.6
Head Sh	17.5	3.71	16.7	95.0	1.14	14.1
Bran	5.0	5.65	13.4	100.0	1.37	14.1
Patent (Rebolted)		**0.44**	**13.7**			
Wheat		**1.38**	**14.1**			

WB9507 (W-6)

Mill Stream	Stream (%, 14% mb) Yield	Ash	Protein	Cumulative (%, 14% mb) Yield	Ash	Protein
Patent:						
1 M	10.6	0.33	13.0	10.6	0.33	13.0
2 M	14.2	0.35	13.1	24.8	0.35	13.0
Sz I	3.6	0.36	13.6	28.5	0.35	13.1
3 M	14.2	0.39	13.4	42.7	0.36	13.2
Sz II	3.1	0.40	13.6	45.8	0.37	13.2
4 M	8.2	0.57	14.6	54.0	0.40	13.4
4 Bk	3.8	0.61	17.4	57.7	0.41	13.7
6 M	4.1	0.65	14.0	61.8	0.43	13.7
1 Bk	1.0	0.79	16.1	62.8	0.43	13.8
Bk Dust	1.9	0.83	15.7	64.7	0.44	13.8
3 Bk	1.3	0.98	17.2	66.0	0.45	13.9
TC	1.2	1.00	16.5	67.2	0.46	13.9
Tail	1.4	1.00	16.3	68.6	0.48	14.0
2 Bk II	0.9	1.07	16.5	69.4	0.48	14.0
2 Bk I	0.4	1.13	16.8	69.8	0.49	14.0
5 Bk	1.2	1.30	19.7	71.1	0.50	14.1
Clear Flour:						
LQ	0.3	1.30	14.5	71.4	0.50	14.1
LG	1.3	1.34	17.5	72.7	0.52	14.2
5 M	1.5	1.40	15.6	74.1	0.54	14.2
Bran & Shorts:						
TC Sh	0.7	1.60	15.1	74.8	0.55	14.2
Tail Sh	2.2	3.11	13.9	77.0	0.62	14.2
Head Sh	18.5	3.54	17.6	95.5	1.18	14.9
Bran	4.5	5.44	14.0	100.0	1.38	14.8
Patent (Rebolted)		**0.49**	**14.3**			
Wheat		**1.40**	**14.7**			

Bolles (W-7)

Mill Stream	Stream (%, 14% mb) Yield	Ash	Protein	Cumulative (%, 14% mb) Yield	Ash	Protein
Patent:						
1 M	10.5	0.26	14.9	10.5	0.26	14.9
2 M	15.5	0.31	15.3	26.0	0.29	15.1
Sz I	3.8	0.32	15.3	29.9	0.29	15.2
Sz II	3.4	0.34	15.3	33.2	0.30	15.2
3 M	12.4	0.37	15.6	45.6	0.32	15.3
4 M	7.3	0.55	17.1	52.9	0.35	15.5
6 M	3.3	0.56	15.2	56.2	0.36	15.5
Bk Dust	2.4	0.66	17.9	58.6	0.38	15.6
TC	1.6	0.67	18.4	60.2	0.38	15.7
4 Bk	4.1	0.69	20.7	64.3	0.40	16.0
1 Bk	1.2	0.72	18.6	65.5	0.41	16.1
3 Bk	1.5	0.78	20.8	67.0	0.42	16.2
2 Bk II	1.1	0.97	19.3	68.0	0.43	16.2
2 Bk I	0.6	0.97	19.5	68.7	0.43	16.2
Tail	1.4	0.99	18.0	70.0	0.44	16.3
5 Bk	1.3	1.20	23.6	71.3	0.45	16.4
Clear Flour:						
5 M	1.3	1.39	16.4	72.5	0.47	16.4
LG	1.0	1.40	18.1	73.5	0.48	16.4
LQ	0.1	1.48	15.7	73.6	0.48	16.4
Bran & Shorts:						
TC Sh	0.7	1.03	16.4	74.3	0.49	16.4
Tail Sh	1.9	3.13	14.7	76.2	0.56	16.4
Head Sh	16.8	3.82	18.5	93.0	1.14	16.8
Bran	7.0	5.59	15.4	100.0	1.46	16.7
Patent (Rebolted)		**0.47**	**16.1**			
Wheat		**1.41**	**16.6**			

SY Rustler (W-8)

Mill Stream	Stream (%, 14% mb) Yield	Ash	Protein	Cumulative (%, 14% mb) Yield	Ash	Protein
Patent:						
1 M	10.4	0.31	11.4	10.4	0.31	11.4
2 M	13.9	0.32	11.7	24.3	0.31	11.5
3 M	13.7	0.34	12.2	38.0	0.32	11.8
Sz I	4.0	0.34	11.8	42.0	0.32	11.8
Sz II	2.7	0.35	12.1	44.7	0.32	11.8
4 M	7.4	0.50	14.0	52.1	0.35	12.1
6 M	3.5	0.59	12.9	55.6	0.36	12.1
Bk Dust	2.2	0.65	14.3	57.8	0.38	12.2
TC	1.3	0.69	14.8	59.1	0.38	12.3
4 Bk	4.4	0.70	16.1	63.5	0.40	12.5
3 Bk	1.5	0.76	16.4	65.0	0.41	12.6
1 Bk	1.1	0.77	15.5	66.0	0.42	12.7
2 Bk II	1.1	0.84	15.8	67.1	0.42	12.7
Tail	1.4	0.89	16.3	68.5	0.43	12.8
2 Bk I	0.5	0.91	16.4	69.0	0.44	12.8
5 Bk	1.7	0.99	18.3	70.6	0.45	13.0
Clear Flour:						
LG	1.2	1.40	18.1	71.8	0.47	13.0
5 M	1.2	1.50	15.7	73.0	0.48	13.1
LQ	0.1	1.64	14.1	73.1	0.48	13.1
Bran & Shorts:						
TC Sh	0.9	1.09	13.2	74.0	0.49	13.1
Tail Sh	2.1	3.31	13.9	76.1	0.57	13.1
Head Sh	18.6	3.68	16.6	94.7	1.18	13.8
Bran	5.3	4.96	14.1	100.0	1.38	13.8
Patent (Rebolted)		**0.44**	**12.8**			
Wheat		**1.32**	**13.9**			

Cooperators' Bake Data

Glenn Checks

WATERTOWN (B-1)				
Cooperator	Bake Absorption (%)	Loaf Volume (cc)	Mixing Requirement	Dough Characteristics
A	70.9	845	6	8
B	65.0	760	7	5
C	61.0	2300	9	7
D	67.6	990	5	7
E	68.7	886	7	5
F	68.9	950	6	8
G	69.3	940	7	7
H	61.0	2650	5	5
I	63.7	2720	6	7
J	63.0	3045	7	8
K	58.0	2950	9	8
L	63.5	2250	3	5
Avg.	65.1		6.4	6.7
S.D.	4.0		1.7	1.3

CASSSELTON (C-1)				
Cooperator	Bake Absorption (%)	Loaf Volume (cc)	Mixing Requirement	Dough Characteristics
A	72.8	973	8	8
B	69.0	805	9	5
C	64.0	2600	9	7
D	67.2	1073	5	7
E	68.1	986	8	7
F	69.6	1055	7	8
G	69.7	1060	9	7
H	62.0	2600	5	5
I	64.0	2957	5	6
J	63.0	3015	7	9
K	60.0	3000	9	9
L	64.0	2475	5	7
Avg.	66.1		7.2	7.1
S.D.	3.8		1.7	1.3

CROOKSTON (K-1)				
Cooperator	Bake Absorption (%)	Loaf Volume (cc)	Mixing Requirement	Dough Characteristics
A	72.1	943	7	7
B	66.0	785	8	5
C	62.0	2750	7	5
D	67.0	975	5	7
E	67.1	922	7	7
F	68.2	970	6	8
G	66.8	935	7	5
H	61.0	2600	5	5
I	63.1	2802	6	7
J	62.0	3104	6	9
K	58.0	3000	9	9
L	63.0	2250	7	7
Avg.	64.7		6.7	6.8
S.D.	3.8		1.2	1.5

MINOT (M-1)				
Cooperator	Bake Absorption (%)	Loaf Volume (cc)	Mixing Requirement	Dough Characteristics
A	72.3	918	5	7
B	66.0	940	5	5
C	63.0	2925	7	7
D	67.3	1009	4	6
E	69.0	856	5	5
F	71.1	980	5	6
G	67.5	1050	5	5
H	63.0	2650	5	5
I	65.1	2840	5	5
J	63.0	3045	7	9
K	58.0	2900	4	4
L	65.0	2250	5	5
Avg.	65.9		5.2	5.8
S.D.	3.9		0.9	1.4

WILLISTON (W-1)				
Cooperator	Bake Absorption (%)	Loaf Volume (cc)	Mixing Requirement	Dough Characteristics
A	72.4	970	7	7
B	68.0	970	7	5
C	63.0	2700	9	7
D	66.6	991	4	7
E	67.5	881	6	6
F	69.6	1050	6	8
G	69.1	990	7	7
H	62.0	2600	5	5
I	64.0	2839	7	8
J	62.0	2839	7	9
K	59.0	2900	9	9
L	64.0	2350	5	7
Avg.	65.6		6.6	7.1
S.D.	3.9		1.5	1.3

ND825

CASSELTON (C-2)												
		Loaf Volume				Quality Score Compared to Check (Glenn)						
Cooperator	Bake Absorption (%)	(cc)	(% of Check)	Mixing Requirement	Dough Characteristics	Mixing Tolerance	Internal Crumb Color	Internal Grain & Texture	Protein	Milling	Baking	Overall
A	73.7	1045	107.4	6	7	4	5	5	5	5	4	5
B	69.0	1000	124.2	6	3	4	5	6	6	8	8	7
C	64.0	2675	102.9	7	5	5	5	5	7	7	5	7
D	66.9	985	91.8	4	6	4	5	5	5	6	5	5
E	68.8	942	95.5	4	6	4	5	5	5	7	1	4
F	69.9	985	93.4	5	7	5	5	4	6	5	4	4
G	69.2	1045	98.6	5	7	3	5	7	5	5	7	7
H	62.5	2750	105.8	5	5	5	6	6	6	7	7	7
I	64.6	2989	101.1	5	6	5	6	5	5	5	5	6
J	64.0	3045	101.0	7	9	4	5	5	6	6	5	6
K	61.0	3100	103.3	5	5	4	5	4	5	5	4	5
L	64.5	2400	97.0	5	5	3	5	5	5	5	3	3
Avg.	**66.5**		**101.8**	**5.3**	**5.9**	**4.2**	**5.2**	**5.2**	**5.5**	**5.9**	**4.8**	**5.5**
S.D.	**3.7**		**8.5**	**1.0**	**1.5**	**0.7**	**0.4**	**0.8**	**0.7**	**1.1**	**1.9**	**1.4**

MINOT (M-2)												
		Loaf Volume				Quality Score Compared to Check (Glenn)						
Cooperator	Bake Absorption (%)	(cc)	(% of Check)	Mixing Requirement	Dough Characteristics	Mixing Tolerance	Internal Crumb Color	Internal Grain & Texture	Protein	Milling	Baking	Overall
A	72.8	1073	116.9	4	7	4	7	8	7	5	4	5
B	71.0	1120	119.1	3	9	3	6	6	8	4	9	9
C	64.0	2875	98.3	9	7	5	5	5	9	3	5	3
D	68.6	1010	100.1	3	6	4	6	7	4	5	5	5
E	69.0	962	112.4	4	4	4	6	7	7	4	8	6
F	70.4	1110	113.3	4	3	3	6	2	7	4	5	5
G	69.4	1095	104.3	3	5	3	5	9	9	5	9	9
H	63.0	2500	94.3	2	2	2	3	4	9	3	4	4
I	65.4	2636	92.8	5	5	5	5	8	7	4	5	5
J	63.0	3015	99.0	6	6	4	4	5	9	4	5	6
K	61.0	2950	101.7	3	3	3	5	5	7	5	4	5
L	65.5	2300	102.2	3	3	3	5	3	3	5	5	3
Avg.	**66.9**		**104.5**	**4.1**	**5.0**	**3.6**	**5.3**	**5.8**	**7.2**	**4.3**	**5.7**	**5.4**
S.D.	**3.8**		**8.8**	**1.9**	**2.1**	**0.9**	**1.1**	**2.1**	**1.9**	**0.8**	**1.9**	**1.9**

WILLISTON (W-2)												
		Loaf Volume				Quality Score Compared to Check (Glenn)						
Cooperator	Bake Absorption (%)	(cc)	(% of Check)	Mixing Requirement	Dough Characteristics	Mixing Tolerance	Internal Crumb Color	Internal Grain & Texture	Protein	Milling	Baking	Overall
A	76.0	1075	110.8	5	8	5	5	5	7	6	4	5
B	72.0	1205	124.2	4	3	3	5	6	8	5	9	9
C	64.0	2900	107.4	9	7	5	5	5	9	7	5	7
D	67.4	1030	103.9	3	6	4	5	7	4	6	6	5
E	69.3	976	110.8	5	6	6	5	5	9	5	5	6
F	71.8	1120	106.7	5	5	3	5	1	8	5	6	6
G	70.5	1175	118.7	5	7	5	7	9	9	3	9	7
H	63.0	2700	103.8	3	3	4	5	5	9	7	5	5
I	66.0	2968	104.5	5	6	4	5	7	6	6	6	5
J	64.0	3045	107.3	7	9	4	5	5	8	7	6	7
K	62.0	2975	102.6	9	9	5	4	3	7	5	5	5
L	66.0	2500	106.4	5	5	5	7	5	3	5	7	7
Avg.	**67.7**		**108.9**	**5.4**	**6.2**	**4.4**	**5.3**	**5.3**	**7.3**	**5.6**	**6.1**	**6.2**
S.D.	**4.3**		**6.5**	**2.0**	**2.0**	**0.9**	**0.9**	**2.0**	**2.0**	**1.2**	**1.6**	**1.3**

Boost

WATERTOWN (B-3)												
		Loaf Volume				Quality Score Compared to Check (Glenn)						
Cooperator	Bake Absorption (%)	(cc)	(% of Check)	Mixing Requirement	Dough Characteristics	Mixing Tolerance	Internal Crumb Color	Internal Grain & Texture	Protein	Milling	Baking	Overall
A	73.5	885	104.7	7	8	3	6	6	6	5	5	5
B	67.0	800	105.3	8	4	6	3	5	7	4	6	6
C	63.0	2700	117.4	9	7	7	5	5	7	3	9	7
D	68.6	978	98.8	5	7	5	5	5	7	5	5	6
E	70.7	878	99.1	7	7	5	5	6	6	3	5	5
F	71.2	990	104.2	6	5	4	5	1	7	5	6	5
G	67.3	985	104.8	7	7	5	5	7	7	3	7	7
H	63.0	2600	98.1	4	4	4	5	5	7	5	5	5
I	66.0	2806	103.2	6	6	5	5	5	6	5	6	6
J	65.0	3045	100.0	7	7	3	5	5	7	6	6	6
K	59.0	3000	101.7	9	8	5	5	4	7	5	5	5
L	66.0	2250	100.0	5	5	7	7	7	7	3	7	5
Avg.	**66.7**		**103.1**	**6.7**	**6.3**	**4.9**	**5.1**	**5.1**	**6.8**	**4.3**	**6.0**	**5.7**
S.D.	**4.0**		**5.2**	**1.6**	**1.4**	**1.3**	**0.9**	**1.6**	**0.5**	**1.1**	**1.2**	**0.8**

CASSELTON (C-3)												
		Loaf Volume				Quality Score Compared to Check (Glenn)						
Cooperator	Bake Absorption (%)	(cc)	(% of Check)	Mixing Requirement	Dough Characteristics	Mixing Tolerance	Internal Crumb Color	Internal Grain & Texture	Protein	Milling	Baking	Overall
A	73.6	1053	108.2	5	7	4	5	7	5	5	6	6
B	69.0	1000	124.2	6	4	4	5	6	6	4	8	7
C	64.0	2600	100.0	9	5	5	5	5	7	3	5	3
D	67.4	1068	99.5	4	6	5	6	5	6	4	6	6
E	70.6	1005	101.9	5	6	4	7	7	6	8	6	7
F	71.0	1045	99.1	4	7	4	5	3	6	5	4	5
G	71.5	1055	99.5	7	5	5	5	5	5	5	5	5
H	63.5	2800	107.7	4	5	5	6	6	7	4	6	6
I	65.9	2980	100.8	6	6	5	5	4	5	5	5	5
J	65.0	3104	103.0	7	9	4	5	5	7	5	7	6
K	61.0	3100	103.3	9	9	5	5	4	6	5	5	5
L	66.0	2400	97.0	5	7	5	5	5	5	3	5	5
Avg.	**67.4**		**103.7**	**5.9**	**6.3**	**4.6**	**5.3**	**5.2**	**5.9**	**4.7**	**5.7**	**5.5**
S.D.	**3.8**		**7.3**	**1.8**	**1.6**	**0.5**	**0.7**	**1.2**	**0.8**	**1.3**	**1.1**	**1.1**

CROOKSTON (K-3)

Cooperator	Bake Absorption (%)	Loaf Volume (cc)	Loaf Volume (% of Check)	Mixing Requirement	Dough Characteristics	Quality Score Compared to Check (Glenn): Mixing Tolerance	Internal Crumb Color	Internal Grain & Texture	Protein	Milling	Baking	Overall
A	71.5	1045	110.8	7	8	5	5	6	5	5	5	5
B	67.0	1055	134.4	6	6	4	6	6	6	5	8	8
C	63.0	2800	101.8	9	7	7	5	7	7	3	9	7
D	65.0	1000	102.6	5	6	6	5	7	6	6	6	6
E	66.7	958	103.9	7	6	7	6	6	6	7	7	7
F	67.7	1050	108.2	5	5	6	4	5	6	5	5	5
G	68.3	925	98.9	7	3	7	5	7	7	3	7	7
H	60.0	2500	96.2	8	7	7	4	4	6	6	5	5
I	62.5	2981	106.4	5	5	5	5	5	6	5	4	6
J	61.0	3104	100.0	7	9	6	5	6	7	7	4	6
K	59.0	3000	100.0	9	9	5	5	7	5	5	5	5
L	62.5	2350	104.4	7	7	5	7	7	7	3	7	7
Avg.	**64.5**		**105.6**	**6.8**	**6.5**	**5.8**	**5.2**	**6.1**	**6.2**	**5.0**	**6.0**	**6.2**
S.D.	**3.8**		**9.9**	**1.4**	**1.7**	**1.0**	**0.8**	**1.0**	**0.7**	**1.4**	**1.6**	**1.0**

MINOT (M-3)

Cooperator	Bake Absorption (%)	Loaf Volume (cc)	Loaf Volume (% of Check)	Mixing Requirement	Dough Characteristics	Quality Score Compared to Check (Glenn): Mixing Tolerance	Internal Crumb Color	Internal Grain & Texture	Protein	Milling	Baking	Overall
A	70.1	1085	118.2	4	7	5	7	8	7	5	6	6
B	70.0	1085	115.4	3	7	3	6	7	8	3	8	8
C	64.0	2400	82.1	7	7	5	5	5	9	3	3	3
D	68.5	1033	102.4	3	5	6	6	7	4	5	6	5
E	70.6	969	113.2	4	4	5	6	5	7	4	9	7
F	73.5	1170	119.4	4	4	4	5	5	7	5	6	6
G	69.3	1075	102.4	3	5	3	5	3	9	3	3	5
H	64.0	2500	94.3	3	3	3	3	4	9	5	4	4
I	67.3	2768	97.5	5	5	5	5	7	7	5	6	6
J	65.0	3104	101.9	6	7	5	4	6	9	5	7	7
K	61.0	2900	100.0	4	4	4	5	5	7	5	5	5
L	67.5	2300	102.2	5	5	5	5	5	3	5	5	5
Avg.	**67.6**		**104.1**	**4.3**	**5.3**	**4.4**	**5.2**	**5.6**	**7.2**	**4.4**	**5.7**	**5.6**
S.D.	**3.5**		**10.9**	**1.3**	**1.4**	**1.0**	**1.0**	**1.4**	**1.9**	**0.9**	**1.8**	**1.4**

WB9653

WATERTOWN (B-4)

Cooperator	Bake Absorption (%)	Loaf Volume (cc)	Loaf Volume (% of Check)	Mixing Requirement	Dough Characteristics	Quality Score Compared to Check (Glenn) Mixing Tolerance	Internal Crumb Color	Internal Grain & Texture	Protein	Milling	Baking	Overall
A	70.1	833	98.6	6	7	3	4	5	3	7	6	6
B	63.0	630	82.9	8	3	5	3	5	4	5	2	2
C	60.0	2450	106.5	3	5	5	5	5	3	3	7	5
D	67.6	853	86.2	5	6	6	3	4	3	6	4	4
E	68.4	833	94.0	6	7	5	4	7	3	7	2	4
F	70.4	895	94.2	7	2	2	4	7	2	7	4	3
G	64.0	850	90.4	7	7	5	5	9	3	7	7	7
H	62.0	2600	98.1	3	4	4	5	5	2	8	4	5
I	64.0	2513	92.4	5	5	4	5	6	4	7	4	4
J	63.0	3074	101.0	6	5	3	5	5	1	7	5	4
K	57.0	2900	98.3	5	5	3	5	4	3	5	4	3
L	64.0	2125	94.4	1	5	5	3	3	3	3	5	3
Avg.	**64.5**		**94.8**	**5.2**	**5.1**	**4.2**	**4.3**	**5.4**	**2.8**	**6.0**	**4.5**	**4.2**
S.D.	**4.0**		**6.4**	**2.0**	**1.6**	**1.2**	**0.9**	**1.6**	**0.8**	**1.7**	**1.6**	**1.4**

CASSELTON (C-4)

Cooperator	Bake Absorption (%)	Loaf Volume (cc)	Loaf Volume (% of Check)	Mixing Requirement	Dough Characteristics	Quality Score Compared to Check (Glenn) Mixing Tolerance	Internal Crumb Color	Internal Grain & Texture	Protein	Milling	Baking	Overall
A	71.9	968	99.5	6	7	4	4	5	5	5	5	5
B	68.0	950	118.0	6	2	4	2	6	5	4	7	6
C	64.0	2550	98.1	9	7	5	5	7	5	3	5	3
D	66.2	925	86.2	4	6	5	3	5	5	5	4	5
E	68.7	938	95.1	5	6	5	6	7	5	3	3	4
F	69.7	955	90.5	5	8	5	3	2	5	5	3	3
G	68.3	1020	96.2	5	5	3	5	5	3	5	5	5
H	62.0	2650	101.9	5	5	5	6	6	5	6	6	6
I	64.5	2879	97.4	5	5	5	5	4	5	5	4	4
J	63.0	3104	103.0	7	9	5	5	5	4	5	6	5
K	60.0	3150	105.0	8	8	5	5	6	5	5	5	5
L	64.5	2375	96.0	5	7	5	3	5	5	3	3	3
Avg.	**65.9**		**98.9**	**5.8**	**6.3**	**4.7**	**4.3**	**5.3**	**4.8**	**4.5**	**4.7**	**4.5**
S.D.	**3.5**		**7.9**	**1.5**	**1.9**	**0.7**	**1.3**	**1.4**	**0.6**	**1.0**	**1.3**	**1.1**

CROOKSTON (K-4)

Cooperator	Bake Absorption (%)	Loaf Volume (cc)	Loaf Volume (% of Check)	Mixing Requirement	Dough Characteristics	Quality Score Compared to Check (Glenn): Mixing Tolerance	Internal Crumb Color	Internal Grain & Texture	Protein	Milling	Baking	Overall
A	69.5	943	100.0	5	7	5	5	6	5	6	5	5
B	65.0	860	109.6	6	7	4	5	5	5	4	6	6
C	61.0	2550	92.7	9	5	5	5	5	3	3	5	5
D	66.3	990	101.5	5	6	6	4	4	5	6	5	5
E	66.2	838	90.9	6	7	5	4	6	5	5	2	4
F	67.1	945	97.4	5	5	5	2	7	5	5	5	5
G	67.0	1050	112.3	7	3	5	5	7	3	3	7	7
H	60.0	2600	100.0	7	7	7	5	5	5	6	6	6
I	61.9	2771	98.9	5	6	5	4	5	5	5	3	5
J	61.0	3045	98.1	6	9	4	4	5	4	7	4	5
K	58.0	2900	96.7	5	4	3	5	7	5	5	3	4
L	62.0	2200	97.8	7	7	5	5	5	5	3	5	5
Avg.	**63.8**		**99.7**	**6.1**	**6.1**	**4.9**	**4.4**	**5.6**	**4.6**	**4.8**	**4.7**	**5.2**
S.D.	**3.5**		**6.1**	**1.2**	**1.6**	**1.0**	**0.9**	**1.0**	**0.8**	**1.3**	**1.4**	**0.8**

MINOT (M-4)

Cooperator	Bake Absorption (%)	Loaf Volume (cc)	Loaf Volume (% of Check)	Mixing Requirement	Dough Characteristics	Quality Score Compared to Check (Glenn): Mixing Tolerance	Internal Crumb Color	Internal Grain & Texture	Protein	Milling	Baking	Overall
A	71.1	1013	110.3	4	5	4	6	6	5	4	5	5
B	67.0	1000	106.4	4	7	3	3	6	5	1	8	6
C	64.0	2825	96.6	5	5	3	5	5	5	1	3	1
D	66.9	938	93.0	3	6	5	5	7	6	4	5	5
E	68.1	931	108.8	4	4	3	5	6	5	1	2	3
F	70.8	1035	105.6	4	2	3	3	4	5	5	5	5
G	67.4	1025	97.6	5	5	3	5	3	7	3	3	5
H	62.0	2500	94.3	2	2	2	3	3	6	4	3	3
I	64.7	2717	95.7	5	4	4	5	7	6	4	5	5
J	63.0	2956	97.1	5	6	4	4	5	7	5	4	5
K	59.0	2900	100.0	4	4	4	5	5	6	5	5	5
L	64.5	2250	100.0	3	5	5	3	3	3	3	5	3
Avg.	**65.7**		**100.4**	**4.0**	**4.6**	**3.6**	**4.3**	**5.0**	**5.5**	**3.3**	**4.4**	**4.3**
S.D.	**3.5**		**5.9**	**1.0**	**1.5**	**0.9**	**1.1**	**1.5**	**1.1**	**1.6**	**1.6**	**1.4**

WILLISTON (W-4)												
		Loaf Volume				Quality Score Compared to Check (Glenn)						
Cooperator	Bake Absorption (%)	(cc)	(% of Check)	Mixing Requirement	Dough Characteristics	Mixing Tolerance	Internal Crumb Color	Internal Grain & Texture	Protein	Milling	Baking	Overall
A	72.3	940	96.9	5	7	5	4	6	4	6	5	5
B	66.0	905	93.3	6	4	4	4	4	4	5	4	4
C	62.0	3000	111.1	1	7	5	5	7	3	9	5	7
D	66.9	968	97.7	4	6	6	4	4	3	7	4	5
E	68.0	837	95.0	5	6	6	4	5	4	8	2	5
F	70.9	940	89.5	5	5	4	3	7	4	5	4	4
G	67.8	915	92.4	5	7	3	3	7	3	3	7	5
H	62.5	2700	103.8	3	3	3	5	5	3	7	5	5
I	64.9	2683	94.5	5	5	3	5	7	3	6	6	4
J	63.0	3045	107.3	6	8	4	5	4	3	7	6	5
K	58.0	2900	100.0	5	5	3	4	3	5	5	4	4
L	65.0	2400	102.1	5	5	5	5	7	3	3	5	5
Avg.	**65.6**		**98.6**	**4.6**	**5.7**	**4.3**	**4.3**	**5.5**	**3.5**	**5.9**	**4.8**	**4.8**
S.D.	**4.0**		**6.4**	**1.4**	**1.4**	**1.1**	**0.8**	**1.5**	**0.7**	**1.8**	**1.3**	**0.8**

MN10261-1

WATERTOWN (B-5)												
		Loaf Volume				Quality Score Compared to Check (Glenn)						
Cooperator	Bake Absorption (%)	(cc)	(% of Check)	Mixing Requirement	Dough Characteristics	Mixing Tolerance	Internal Crumb Color	Internal Grain & Texture	Protein	Milling	Baking	Overall
A	69.9	885	104.7	5	8	3	5	5	6	4	5	5
B	66.0	740	97.4	7	4	4	6	5	7	5	5	5
C	63.0	2625	114.1	9	7	5	5	5	7	3	9	7
D	69.4	933	94.2	5	7	4	5	4	6	4	4	5
E	70.6	895	101.0	6	7	5	5	5	6	1	4	4
F	73.0	940	98.9	6	1	3	5	4	7	5	5	5
G	68.7	895	95.2	5	5	5	3	5	7	3	5	5
H	63.0	2650	100.0	4	4	5	5	5	6	4	5	5
I	66.4	2771	101.9	5	5	4	5	7	6	4	6	6
J	65.0	3074	101.0	7	6	3	5	7	7	4	6	6
K	58.0	2900	98.3	9	8	5	5	4	6	5	5	5
L	66.5	2150	95.6	3	5	7	5	3	3	3	5	3
Avg.	66.6		100.2	5.9	5.6	4.4	4.9	4.9	6.2	3.8	5.3	5.1
S.D.	4.1		5.3	1.8	2.0	1.2	0.7	1.2	1.1	1.1	1.3	1.0

CASSELTON (C-5)												
		Loaf Volume				Quality Score Compared to Check (Glenn)						
Cooperator	Bake Absorption (%)	(cc)	(% of Check)	Mixing Requirement	Dough Characteristics	Mixing Tolerance	Internal Crumb Color	Internal Grain & Texture	Protein	Milling	Baking	Overall
A	74.4	1040	106.9	5	8	3	5	5	5	3	5	5
B	69.0	945	117.4	6	3	3	5	5	6	2	7	6
C	64.0	2750	105.8	9	5	5	5	5	7	3	5	3
D	68.2	1010	94.1	4	6	5	5	6	5	3	5	4
E	69.6	970	98.4	5	7	2	5	5	5	1	2	3
F	71.0	960	91.0	6	7	4	5	4	5	4	4	4
G	68.9	1020	96.2	7	7	3	5	9	5	3	9	7
H	62.0	2700	103.8	3	4	5	6	7	6	2	6	6
I	65.4	2904	98.2	5	5	5	6	5	5	4	4	6
J	64.0	3104	103.0	8	9	3	5	5	6	4	7	6
K	61.0	3100	103.3	5	5	3	4	3	5	5	3	3
L	65.5	2500	101.0	7	5	5	5	5	3	3	5	3
Avg.	66.9		101.6	5.8	5.9	3.8	5.1	5.3	5.3	3.1	5.2	4.7
S.D.	3.9		6.9	1.7	1.7	1.1	0.5	1.5	1.0	1.1	1.9	1.5

CROOKSTON (K-5)

Cooperator	Bake Absorption (%)	Loaf Volume (cc)	Loaf Volume (% of Check)	Mixing Requirement	Dough Characteristics	Quality Score Compared to Check (Glenn): Mixing Tolerance	Internal Crumb Color	Internal Grain & Texture	Protein	Milling	Baking	Overall
A	73.7	903	95.8	7	7	5	5	5	5	4	4	4
B	67.0	825	105.1	7	8	5	5	5	6	4	6	5
C	63.0	2725	99.1	9	7	5	5	5	7	3	5	5
D	67.7	960	98.5	4	6	5	6	8	6	5	5	5
E	69.2	881	95.6	6	6	6	5	5	6	2	4	4
F	69.0	900	92.8	6	3	4	5	4	6	4	4	4
G	70.9	945	101.1	7	3	7	5	3	7	3	5	5
H	62.0	2700	103.8	4	4	4	7	6	7	2	7	7
I	64.3	2724	97.2	5	6	5	6	4	6	3	6	5
J	64.0	3104	100.0	6	9	5	5	5	7	5	7	6
K	59.0	2950	98.3	5	4	3	5	5	5	5	3	4
L	64.5	2250	100.0	7	7	5	5	7	5	5	5	5
Avg.	**66.2**		**98.9**	**6.1**	**5.8**	**4.9**	**5.3**	**5.2**	**6.1**	**3.8**	**5.1**	**4.9**
S.D.	**4.1**		**3.5**	**1.4**	**1.9**	**1.0**	**0.7**	**1.3**	**0.8**	**1.1**	**1.2**	**0.9**

MINOT (M-5)

Cooperator	Bake Absorption (%)	Loaf Volume (cc)	Loaf Volume (% of Check)	Mixing Requirement	Dough Characteristics	Quality Score Compared to Check (Glenn): Mixing Tolerance	Internal Crumb Color	Internal Grain & Texture	Protein	Milling	Baking	Overall
A	71.5	1100	119.8	3	7	3	6	7	7	5	4	4
B	71.0	1080	114.9	4	8	3	6	7	9	4	9	8
C	64.0	2800	95.7	7	7	5	5	5	9	3	5	3
D	67.7	935	92.7	3	5	5	6	7	4	5	5	5
E	68.7	946	110.5	4	4	1	6	6	7	1	3	4
F	72.1	1035	105.6	4	4	2	5	5	7	5	5	6
G	69.2	1050	100.0	3	5	3	5	5	9	5	5	7
H	63.0	2750	103.8	2	2	2	5	5	9	6	5	5
I	65.9	2935	103.3	5	5	5	7	6	7	5	5	6
J	63.0	3015	99.0	5	6	2	5	5	9	5	5	6
K	61.0	2925	100.9	5	6	6	5	5	7	5	6	6
L	66.0	2500	111.1	5	5	5	5	3	3	5	7	5
Avg.	**66.9**		**104.8**	**4.2**	**5.3**	**3.5**	**5.5**	**5.5**	**7.3**	**4.5**	**5.3**	**5.4**
S.D.	**3.7**		**8.0**	**1.3**	**1.6**	**1.6**	**0.7**	**1.2**	**2.0**	**1.3**	**1.5**	**1.4**

WILLISTON (W-5)												
		Loaf Volume				Quality Score Compared to Check (Glenn)						
Cooperator	Bake Absorption (%)	(cc)	(% of Check)	Mixing Requirement	Dough Characteristics	Mixing Tolerance	Internal Crumb Color	Internal Grain & Texture	Protein	Milling	Baking	Overall
A	74.4	915	94.3	8	8	4	5	6	5	5	5	5
B	68.0	980	101.0	7	2	5	5	5	5	4	5	5
C	64.0	2825	104.6	9	7	5	5	5	5	5	5	5
D	65.9	933	94.1	4	6	5	6	6	5	4	5	5
E	66.5	908	103.1	5	7	3	5	5	5	3	1	3
F	68.5	960	91.4	5	7	2	5	4	5	5	4	4
G	67.8	955	96.5	7	5	5	5	7	5	3	7	5
H	61.0	2700	103.8	2	3	3	4	5	6	5	5	5
I	62.9	2870	101.1	6	7	4	6	8	5	5	4	5
J	61.0	3089	108.8	6	9	3	7	4	6	5	6	6
K	60.0	2950	101.7	5	5	3	4	3	6	5	4	5
L	63.0	2300	97.9	7	7	7	5	5	1	3	5	3
Avg.	**65.3**		**99.9**	**5.9**	**6.1**	**4.1**	**5.2**	**5.3**	**4.9**	**4.3**	**4.7**	**4.7**
S.D.	**4.1**		**5.1**	**1.9**	**2.0**	**1.4**	**0.8**	**1.4**	**1.3**	**0.9**	**1.4**	**0.9**

WB9507

WATERTOWN (B-6)

Cooperator	Bake Absorption (%)	Loaf Volume (cc)	Loaf Volume (% of Check)	Mixing Requirement	Dough Characteristics	Quality Score Compared to Check (Glenn): Mixing Tolerance	Internal Crumb Color	Internal Grain & Texture	Protein	Milling	Baking	Overall
A	72.9	1035	122.5	6	8	3	6	7	6	3	6	5
B	67.0	875	115.1	7	6	6	6	7	7	3	7	8
C	63.0	2550	110.9	9	9	7	5	5	7	1	9	3
D	70.2	1085	109.6	5	6	4	6	6	7	3	6	5
E	71.6	889	100.3	7	7	5	5	5	7	1	6	5
F	73.1	1135	119.5	5	6	5	6	7	7	5	7	6
G	69.7	1050	111.7	7	7	6	5	9	7	3	9	7
H	64.0	2750	103.8	6	6	5	4	4	7	5	4	4
I	67.5	2756	101.3	5	5	5	5	7	7	5	6	5
J	66.0	3104	101.9	8	9	3	5	7	8	3	8	6
K	59.0	2950	100.0	9	9	6	4	4	7	4	5	5
L	67.5	2325	103.3	5	5	7	5	7	7	1	7	7
Avg.	**67.6**		**108.3**	**6.6**	**6.9**	**5.2**	**5.2**	**6.3**	**7.0**	**3.1**	**6.7**	**5.5**
S.D.	**4.2**		**7.7**	**1.5**	**1.5**	**1.3**	**0.7**	**1.5**	**0.4**	**1.5**	**1.5**	**1.4**

CASSELTON (C-6)

Cooperator	Bake Absorption (%)	Loaf Volume (cc)	Loaf Volume (% of Check)	Mixing Requirement	Dough Characteristics	Quality Score Compared to Check (Glenn): Mixing Tolerance	Internal Crumb Color	Internal Grain & Texture	Protein	Milling	Baking	Overall
A	72.2	1105	113.6	5	7	5	6	8	5	4	6	5
B	69.0	1020	126.7	4	4	4	4	6	6	1	8	7
C	64.0	2700	103.8	9	5	5	5	5	7	1	5	3
D	68.8	1080	100.7	3	6	3	5	6	6	3	6	5
E	71.3	954	96.8	5	5	6	4	7	6	5	5	5
F	73.2	1140	108.1	5	4	6	5	4	6	5	6	6
G	70.1	1125	106.1	5	5	3	5	9	5	3	9	7
H	64.0	2800	107.7	6	6	6	7	7	7	4	6	6
I	66.9	2740	92.7	5	5	5	8	5	5	5	3	5
J	66.0	3104	103.0	8	9	5	5	6	7	3	9	6
K	61.0	3150	105.0	9	9	5	4	4	6	5	5	5
L	67.0	2375	96.0	7	5	5	3	5	7	1	3	3
Avg.	**67.8**		**105.0**	**5.9**	**5.8**	**4.8**	**5.1**	**6.0**	**6.1**	**3.3**	**5.9**	**5.3**
S.D.	**3.7**		**9.0**	**1.9**	**1.7**	**1.0**	**1.4**	**1.5**	**0.8**	**1.6**	**2.0**	**1.3**

CROOKSTON (K-6)

Cooperator	Bake Absorption (%)	Loaf Volume (cc)	Loaf Volume (% of Check)	Mixing Requirement	Dough Characteristics	Quality Score Compared to Check (Glenn): Mixing Tolerance	Internal Crumb Color	Internal Grain & Texture	Protein	Milling	Baking	Overall
A	70.9	943	100.0	6	7	6	5	5	4	4	5	4
B	64.0	900	114.6	7	7	5	6	5	3	2	6	6
C	60.0	2800	101.8	9	9	7	5	5	3	1	7	5
D	64.4	998	102.4	5	6	6	5	6	3	4	6	4
E	66.3	887	96.2	6	7	8	5	6	4	7	5	5
F	66.4	880	90.7	6	8	5	3	5	4	5	4	3
G	67.7	935	100.0	7	5	5	5	7	3	3	7	5
H	60.0	2750	105.8	7	7	7	7	7	4	3	7	7
I	61.6	2816	100.5	6	7	5	6	4	4	4	3	5
J	61.0	3104	100.0	8	9	7	5	6	3	5	4	4
K	57.0	2975	99.2	9	9	5	6	7	3	5	5	5
L	61.5	2200	97.8	7	7	5	5	5	5	3	5	5
Avg.	**63.4**		**100.7**	**6.9**	**7.3**	**5.9**	**5.3**	**5.7**	**3.6**	**3.8**	**5.3**	**4.8**
S.D.	**3.9**		**5.7**	**1.2**	**1.2**	**1.1**	**1.0**	**1.0**	**0.7**	**1.6**	**1.3**	**1.0**

MINOT (M-6)

Cooperator	Bake Absorption (%)	Loaf Volume (cc)	Loaf Volume (% of Check)	Mixing Requirement	Dough Characteristics	Quality Score Compared to Check (Glenn): Mixing Tolerance	Internal Crumb Color	Internal Grain & Texture	Protein	Milling	Baking	Overall
A	71.0	1118	121.8	4	7	5	7	7	6	4	4	4
B	69.0	1090	116.0	3	8	2	6	7	6	2	9	8
C	64.0	2850	97.4	9	7	5	5	5	7	1	5	1
D	68.6	1043	103.4	3	6	4	7	7	7	3	6	5
E	70.8	938	109.6	3	5	4	6	7	6	6	9	7
F	73.1	1065	108.7	3	3	4	7	6	6	5	7	7
G	69.6	1050	100.0	3	5	3	5	5	7	5	5	7
H	64.0	2750	103.8	3	3	3	6	6	7	4	6	6
I	67.3	2717	95.7	5	5	5	7	6	6	4	6	6
J	65.0	3104	101.9	6	7	4	5	6	8	4	7	6
K	60.0	2900	100.0	7	7	7	5	5	6	5	7	6
L	67.5	2350	104.4	5	5	5	3	3	3	3	7	3
Avg.	**67.5**		**105.2**	**4.5**	**5.7**	**4.3**	**5.8**	**5.8**	**6.3**	**3.8**	**6.5**	**5.5**
S.D.	**3.7**		**7.7**	**2.0**	**1.6**	**1.3**	**1.2**	**1.2**	**1.2**	**1.4**	**1.5**	**2.0**

WILLISTON (W-6)												
		Loaf Volume				Quality Score Compared to Check (Glenn)						
Cooperator	Bake Absorption (%)	(cc)	(% of Check)	Mixing Requirement	Dough Characteristics	Mixing Tolerance	Internal Crumb Color	Internal Grain & Texture	Protein	Milling	Baking	Overall
A	74.4	1033	106.5	6	7	5	7	5	5	3	5	4
B	68.0	1010	104.1	6	3	5	5	5	5	1	8	5
C	64.0	2950	109.3	9	7	5	5	5	7	1	5	3
D	67.7	1050	106.0	4	6	6	6	6	7	3	6	5
E	69.6	880	99.9	5	6	7	5	5	6	3	5	5
F	71.5	1085	103.3	6	6	5	6	5	6	5	5	5
G	70.5	1040	105.1	7	7	5	7	9	7	3	9	7
H	63.5	2750	105.8	6	6	6	6	6	8	3	6	6
I	65.9	2737	96.4	5	6	4	5	6	6	4	7	5
J	64.0	3000	105.7	7	8	5	5	6	7	3	6	5
K	60.0	2950	101.7	9	9	5	4	3	6	5	5	5
L	66.0	2375	101.1	7	5	5	5	5	5	1	5	3
Avg.	**67.1**		**103.7**	**6.4**	**6.3**	**5.3**	**5.5**	**5.5**	**6.3**	**2.9**	**6.0**	**4.8**
S.D.	**4.0**		**3.5**	**1.5**	**1.5**	**0.8**	**0.9**	**1.4**	**1.0**	**1.4**	**1.3**	**1.1**

Bolles

WATERTOWN (B-7)												
		Loaf Volume				Quality Score Compared to Check (Glenn)						
Cooperator	Bake Absorption (%)	(cc)	(% of Check)	Mixing Requirement	Dough Characteristics	Mixing Tolerance	Internal Crumb Color	Internal Grain & Texture	Protein	Milling	Baking	Overall
A	72.6	980	116.0	7	9	4	5	6	6	3	6	5
B	67.0	855	112.5	7	4	5	6	6	7	4	7	7
C	63.0	2425	105.4	7	7	7	5	5	7	3	7	5
D	69.6	1005	101.5	5	6	6	5	7	7	5	6	6
E	69.9	858	96.8	7	7	6	4	5	6	6	5	6
F	71.3	965	101.6	6	8	7	5	5	7	6	5	6
G	69.8	975	103.7	9	7	5	5	9	7	7	9	9
H	64.5	2600	98.1	7	7	7	4	5	7	6	5	5
I	65.9	2621	96.4	5	6	4	5	6	7	6	4	5
J	64.0	3104	101.9	8	9	5	5	5	7	4	7	6
K	59.0	2900	98.3	9	8	5	5	5	7	5	5	5
L	66.0	2300	102.2	5	5	7	5	5	7	3	7	7
Avg.	66.9		102.9	6.8	6.9	5.7	4.9	5.8	6.8	4.8	6.1	6.0
S.D.	3.9		6.0	1.4	1.5	1.2	0.5	1.2	0.4	1.4	1.4	1.2

CASSELTON (C-7)												
		Loaf Volume				Quality Score Compared to Check (Glenn)						
Cooperator	Bake Absorption (%)	(cc)	(% of Check)	Mixing Requirement	Dough Characteristics	Mixing Tolerance	Internal Crumb Color	Internal Grain & Texture	Protein	Milling	Baking	Overall
A	74.6	1188	122.1	8	8	6	6	8	7	3	6	5
B	73.0	1185	147.2	9	3	6	4	7	8	1	9	9
C	64.0	2450	94.2	7	9	7	5	5	9	1	3	3
D	68.4	1088	101.4	5	7	6	4	7	3	4	7	5
E	69.4	1086	110.1	7	8	8	5	7	9	1	9	6
F	70.6	1175	111.4	5	8	9	5	4	8	5	6	7
G	71.8	1205	113.7	9	7	5	5	5	9	3	5	7
H	62.0	2600	100.0	7	5	6	7	7	9	3	5	5
I	65.2	3309	111.9	9	9	9	6	5	7	4	6	5
J	64.0	3104	103.0	9	9	7	5	5	9	3	7	6
K	62.0	3000	100.0	9	9	5	4	4	7	5	5	5
L	65.0	2575	104.0	9	9	9	5	5	9	1	5	3
Avg.	67.5		109.9	7.8	7.6	6.9	5.1	5.8	7.8	2.8	6.1	5.5
S.D.	4.4		14.0	1.5	1.9	1.5	0.9	1.4	1.7	1.5	1.7	1.7

CROOKSTON (K-7)

Cooperator	Bake Absorption (%)	Loaf Volume (cc)	Loaf Volume (% of Check)	Mixing Requirement	Dough Characteristics	Quality Score Compared to Check (Glenn): Mixing Tolerance	Internal Crumb Color	Internal Grain & Texture	Protein	Milling	Baking	Overall
A	72.4	1038	110.1	8	8	6	5	6	7	4	6	6
B	69.0	1080	137.6	9	6	3	6	6	9	1	8	9
C	64.0	2700	98.2	9	7	5	5	5	9	1	5	3
D	64.6	990	101.5	5	6	7	5	8	8	4	7	6
E	65.8	940	102.0	8	6	9	5	6	7	3	9	6
F	65.8	1080	111.3	6	7	9	5	7	7	3	7	7
G	68.1	1120	119.8	9	7	9	5	7	9	3	7	7
H	60.0	2550	98.1	7	7	7	4	4	8	1	4	4
I	61.0	3120	111.3	9	9	9	6	4	7	3	3	3
J	60.0	3104	100.0	6	9	8	5	6	9	4	4	6
K	60.0	2900	96.7	9	9	5	5	7	6	5	5	5
L	61.0	2350	104.4	7	7	7	5	5	9	3	5	7
Avg.	**64.3**		**107.6**	**7.7**	**7.3**	**7.0**	**5.1**	**5.9**	**7.9**	**2.9**	**5.8**	**5.8**
S.D.	**4.1**		**11.7**	**1.4**	**1.2**	**2.0**	**0.5**	**1.2**	**1.1**	**1.3**	**1.8**	**1.8**

MINOT (M-7)

Cooperator	Bake Absorption (%)	Loaf Volume (cc)	Loaf Volume (% of Check)	Mixing Requirement	Dough Characteristics	Quality Score Compared to Check (Glenn): Mixing Tolerance	Internal Crumb Color	Internal Grain & Texture	Protein	Milling	Baking	Overall
A	72.2	1075	117.1	4	7	6	5	7	6	5	5	5
B	69.0	1075	114.4	5	7	4	6	6	6	5	9	8
C	64.0	2750	94.0	9	7	5	5	5	7	5	5	5
D	67.4	938	93.0	4	6	6	4	7	7	5	5	6
E	67.8	963	112.5	5	6	6	5	5	6	9	9	8
F	69.6	1100	112.2	4	5	5	5	6	6	6	6	6
G	69.3	1065	101.4	5	5	5	5	3	9	5	5	7
H	62.0	2600	98.1	5	5	6	4	4	7	7	5	5
I	64.6	2807	98.8	6	5	5	5	5	6	6	4	5
J	63.0	3045	100.0	7	9	6	4	5	8	6	5	6
K	60.0	2900	100.0	3	3	3	5	4	6	5	4	4
L	64.5	2300	102.2	5	5	5	5	5	5	5	5	5
Avg.	**66.1**		**103.6**	**5.2**	**5.8**	**5.2**	**4.8**	**5.2**	**6.6**	**5.8**	**5.6**	**5.8**
S.D.	**3.6**		**8.2**	**1.6**	**1.5**	**0.9**	**0.6**	**1.2**	**1.1**	**1.2**	**1.7**	**1.3**

WILLISTON (W-7)												
		Loaf Volume				Quality Score Compared to Check (Glenn)						
Cooperator	Bake Absorption (%)	(cc)	(% of Check)	Mixing Requirement	Dough Characteristics	Mixing Tolerance	Internal Crumb Color	Internal Grain & Texture	Protein	Milling	Baking	Overall
A	75.4	1130	116.5	6	8	5	5	7	7	4	6	5
B	72.0	1190	122.7	7	4	5	5	6	8	3	9	9
C	64.0	2700	100.0	9	7	5	5	5	9	3	5	3
D	68.0	975	98.4	4	6	6	4	5	4	4	5	4
E	68.9	908	103.1	6	6	8	4	5	9	4	9	7
F	71.6	1110	105.7	5	7	8	2	3	8	5	4	5
G	69.3	1190	120.2	7	7	5	5	7	9	3	7	7
H	63.0	2600	100.0	7	7	6	6	6	9	4	6	6
I	65.7	3062	107.9	9	9	6	5	7	7	5	6	5
J	63.0	3089	108.8	8	9	5	3	4	8	3	7	6
K	62.0	2900	100.0	9	9	5	4	3	7	5	5	5
L	65.5	2575	109.6	9	9	5	7	3	7	3	7	3
Avg.	**67.4**		**107.7**	**7.2**	**7.3**	**5.8**	**4.6**	**5.1**	**7.7**	**3.8**	**6.3**	**5.4**
S.D.	**4.2**		**8.3**	**1.7**	**1.6**	**1.1**	**1.3**	**1.6**	**1.4**	**0.8**	**1.6**	**1.7**

SY Rustler

CASSELTON (C-8)												
		Loaf Volume				Quality Score Compared to Check (Glenn)						
Cooperator	Bake Absorption (%)	(cc)	(% of Check)	Mixing Requirement	Dough Characteristics	Mixing Tolerance	Internal Crumb Color	Internal Grain & Texture	Protein	Milling	Baking	Overall
A	74.3	1115	114.6	4	7	4	5	7	6	4	6	5
B	70.0	1005	124.8	4	4	3	4	7	7	1	8	7
C	64.0	2450	94.2	7	7	5	5	5	7	1	1	1
D	71.0	1018	94.9	3	6	3	4	6	4	4	4	4
E	71.6	1004	101.8	4	6	4	6	8	7	2	7	5
F	73.0	990	93.8	4	5	6	4	3	7	5	4	4
G	68.6	1100	103.8	3	5	3	5	7	7	3	9	7
H	64.0	2600	100.0	6	6	7	6	6	9	4	5	5
I	68.3	2605	88.1	5	5	5	6	4	6	4	3	4
J	66.0	3074	102.0	8	9	4	5	5	8	4	6	6
K	62.0	3000	100.0	9	9	5	5	4	7	5	5	5
L	68.5	2375	96.0	9	7	7	5	5	7	1	5	3
Avg.	**68.4**		**101.2**	**5.5**	**6.3**	**4.7**	**5.0**	**5.6**	**6.8**	**3.2**	**5.3**	**4.7**
S.D.	**3.8**		**10.0**	**2.2**	**1.6**	**1.4**	**0.7**	**1.5**	**1.2**	**1.5**	**2.2**	**1.7**

MINOT (M-8)												
		Loaf Volume				Quality Score Compared to Check (Glenn)						
Cooperator	Bake Absorption (%)	(cc)	(% of Check)	Mixing Requirement	Dough Characteristics	Mixing Tolerance	Internal Crumb Color	Internal Grain & Texture	Protein	Milling	Baking	Overall
A	70.1	975	106.2	3	5	4	6	5	7	5	2	3
B	69.0	880	93.6	4	8	1	6	5	7	1	4	3
C	64.0	2400	82.1	7	5	1	5	5	9	1	1	1
D	69.5	875	86.7	2	2	2	2	2	4	4	2	3
E	71.1	813	95.0	3	5	4	6	8	6	1	2	3
F	73.9	905	92.3	3	1	1	5	3	7	5	3	4
G	69.3	875	83.3	1	5	1	5	1	9	3	1	3
H	64.0	2650	100.0	5	5	5	3	3	9	4	4	4
I	67.7	2561	90.2	5	3	3	6	5	7	4	7	3
J	65.0	2839	93.2	4	4	4	4	4	9	5	2	5
K	61.0	2850	98.3	1	1	1	5	4	6	5	1	1
L	67.5	2300	102.2	3	3	3	3	5	1	3	5	1
Avg.	**67.7**		**93.6**	**3.4**	**3.9**	**2.5**	**4.7**	**4.2**	**6.8**	**3.4**	**2.8**	**2.8**
S.D.	**3.6**		**7.4**	**1.7**	**2.0**	**1.5**	**1.4**	**1.8**	**2.4**	**1.6**	**1.9**	**1.3**

WILLISTON (W-8)												
		Loaf Volume				Quality Score Compared to Check (Glenn)						
Cooperator	Bake Absorption (%)	(cc)	(% of Check)	Mixing Requirement	Dough Characteristics	Mixing Tolerance	Internal Crumb Color	Internal Grain & Texture	Protein	Milling	Baking	Overall
A	73.0	963	99.3	5	7	4	5	7	5	4	4	4
B	67.0	880	90.7	5	4	4	5	4	4	1	4	3
C	63.0	2525	93.5	9	7	5	5	5	5	1	3	1
D	67.6	893	90.1	3	6	4	4	6	5	3	4	4
E	67.7	851	96.6	5	5	4	5	6	5	1	1	2
F	71.2	1030	98.1	5	7	3	5	5	5	4	5	5
G	68.0	915	92.4	5	5	5	5	7	3	3	7	5
H	63.0	2650	101.9	2	3	3	6	6	5	3	6	6
I	65.0	2674	94.2	5	5	4	5	7	5	4	6	5
J	62.0	2824	99.5	6	8	3	7	4	5	4	4	4
K	59.0	2800	96.6	9	8	5	5	5	5	5	5	5
L	65.0	2300	97.9	7	5	5	5	3	1	1	5	1
Avg.	**66.0**		**95.9**	**5.5**	**5.8**	**4.1**	**5.2**	**5.4**	**4.4**	**2.8**	**4.5**	**3.8**
S.D.	**3.9**		**3.7**	**2.1**	**1.6**	**0.8**	**0.7**	**1.3**	**1.2**	**1.5**	**1.6**	**1.7**

Hard Red Spring Wheat Breeding Quality Target Values

	Quality Parameter	Target Value*
Wheat	Test Weight (lb/bu, Grading Factor)	60
	Protein (%, 12% mb)	14.5
	Ash (%, 14% mb)	< 1.65
	Vitreousness (% dark, hard & vitreous, DHV)	80
	1000 Kernel Weight (g)	> 31
	Falling Number (sec)	400
	Wheat Hardness (SKCS)	80
	Wheat Hardness (NIR)	70
Milling	Flour Extraction:	
	Buhler Lab Mill (%, 0.48% ash)	70
	Quadrumat Senior (%, 0.48% ash)	70
	Protein Loss (%)	< 1.0
Flour	Ash (%, 14% mb)	0.48
	Color (*L** value)	90
	Wet Gluten (%, 14% mb, 13.5% protein)	36
Farinograph (50 g bowl)	Absorption (%)	64
	Peak Time (min)	6-8
	Stability (min)	15-17
Mixograph	Peak time (min)	5
Bread Baking‡	Loaf Volume (cc)	1050
	Grain & Texture (1 = poor, 10 = excellent)†	8.5

*HRS Wheat Breeding Quality Targets were developed by a committee of HRS wheat breeders and quality personnel. Contact Senay Simsek, North Dakota State University, Department of Plant Sciences, for more information.
†Subjective ratings and classifications are from North Dakota State University, Hard Red Spring Wheat Quality Laboratory.
‡Bread quality based on 100 g pup loaf, straight dough method (North Dakota State University, Hard Red Spring Wheat Quality Laboratory).

Important points for use:

1. **<u>Breeding target values are a tool.</u>** The values shown are targets and should be seen as a tool to help breeders meet the market needs for end-use quality.
2. They reflect the surveyed quality needs of our export markets and they also meet the needs of the domestic markets.
3. Standard or check varieties and different locations are still needed due to location and yearly weather variations.
4. Target values should be compared to actual quality data on experimental lines after several years of testing at multiple locations to help determine if the line would meet the industry needs for quality before being released as a named variety.
5. These targets will be reviewed periodically and updated as needed.
6. Utilization of these breeding targets by all HRS wheat breeders is essential to provide better uniformity and consistency and meeting the needs of our domestic and export markets.