

**Wheat Quality Council**  
**Hard Spring Wheat Technical Committee**  
**2014 Crop**



**February 17-19, 2015**

**Kansas City, MO**

**Wheat Quality Council**  
**Hard Spring Wheat Technical Committee**  
**2014 Crop**



**Sponsored by the Wheat Quality Council**  
**February 17-19, 2015**  
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# Wheat Quality Council

## Hard Spring Wheat Technical Committee

### 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.

Eleven experimental lines of hard spring wheat were grown at up to five locations in 2014 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 2014 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 2014 Wheat Quality Testing Program

## Source of Wheat

Source/Breeding Program	SWQAC Code #	Identification
World Wide Wheat L.L.C.	1	BR2306
University of Minnesota	2	MN08165-8
North Dakota State University	3	Glenn (Check #1)
North Dakota State University	4	Elgin-ND (Check #2)
North Dakota State University	5	ND817
World Wide Wheat L.L.C.	6	COI565W
South Dakota State University	7	SD4362
World Wide Wheat L.L.C.	8	AUBR30023W
University of Minnesota	9	MN10201-4
Limagrain	10	LNR10-0493
Agripro	11	SY Ingmar
Limagrain	12	LNR10-0125

## Field Plot Locations and Procedures

Coordinator: Dale Williams, Ph.D., 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 Farm (Watertown), South Shore, SD  
South Dakota State University, Brookings, SD – Jack Ingmanson
- Northwest Experiment Station, Crookston, MN – John Wiersma
- Agronomy Seed Farm, Casselton, ND – Tom Teigen
- North Central Agricultural Experiment Station, Minot, ND – Jay Fisher and Chad Anderson
- Williston Agricultural Experiment Station, 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

Variable	LOCATION				
	Watertown	Casselton	Crookston	Minot	Williston
<b>Planting Date</b>	5/15/2014	5/7/2014	5/20/2014	6/10/2014	5/15/2014
<b>Harvest Date</b>	9/8/2014	9/16/2014	9/3/2014	10/10/2014	8/20/2014
<b>Fertilizer (lb/A)</b>					
<b>N</b>	150	125	152	124	69
<b>P</b>	100	56	4	60	23
<b>K</b>	50	0	179	440	0
<b>Herbicide/rate/A</b>					
<b>Broadleaf</b>	Wolverine/1.5 pt.	Bronate/1 pt.	Bromac / 1pt./A	Huskie Complete/14 oz.	Goldsky/1 pt./A+
<b>Grass</b>	*	Axial XL/16.4 oz.	Axial XL /16 fl oz./A	*	Tilt/3 oz.
<b>Fungicide</b>	*	Prosaro/6.5 oz.	*	*	Prosaro / 7 oz. early flower

\*No application

Month	CLIMATOLOGIC DATA				
	Average Temperature (°F) / Precipitation				
	Watertown	Casselton	Crookston	Minot	Williston
<b>April</b>	*	38.9 / 4.04	37.3 / 2.39	37 / 2.1	41 / 1.52
<b>May</b>	n/a / 0.96	56.3 / 2.28	54.7 / 2.64	54 / 1.7	56 / 2.16
<b>June</b>	n/a / 1.20	66.7 / 5.24	65.7 / 6.80	62 / 7.1	62 / 1.90
<b>July</b>	n/a / 3.39	68.3 / 1.2	67.2 / 2.17	66 / 2.2	69 / 0.67
<b>August</b>	n/a / 3.07	68.9 / 2.96	67.7 / 1.65	67 / 4.4	69 / 3.23

\*Not applicable

SWQAC Code #	YIELD DATA				
	Yield (bu/acre) / Test Weight / % Moisture				
	Watertown	Casselton	Crookston	Minot	Williston
<b>1</b>	*	*	*	n/a	n/a
<b>2</b>	*	81.0 / 60 / 13.5	56 / 60 / 13.29	*	*
<b>3</b>	87.2 / 57.6 / 12.4	76.9 / 61 / 14.0	60 / 64 / 13.29	n/a	n/a
<b>4</b>	77.6 / 57.5 / 12.1	83.7 / 60 / 13.0	61 / 61 / 13.29	n/a	n/a
<b>5</b>	70.6 / 59.9 / 12.3	78.2 / 60.5 / 13.4	62 / 62 / 12.47	n/a	n/a
<b>6</b>	*	*	*	n/a	n/a
<b>7</b>	49.8 / 58.2 / 13.3	75.1 / 60 / 13.5	63 / 61 / 12.67	*	*
<b>8</b>	*	*	*	n/a	n/a
<b>9</b>	*	84.9 / 60 / 13.0	60 / 62 / 13.29	*	*
<b>10</b>	43.3 / 51.6 / 11.7	73.6 / 60 / 13.9	56 / 62 / 13.08	n/a	n/a
<b>11</b>	87.2 / 56.3 / 12.3	84.9 / 59 / 14.4	62 / 61 / 13.08	n/a	n/a
<b>12</b>	65.3 / 54.1 / 12.6	68.6 / 59.5 / 13.6	71 / 60 / 12.88	n/a	n/a
<b>Site Totals</b>	<b>7</b>	<b>9</b>	<b>9</b>	<b>9</b>	<b>9</b>

\*Not increased at this site

## Climate, Disease, and Field Conditions

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

	Watertown	Casselton	Crookston	Minot	Williston
<b>At Planting</b>	Very cool and wet conditions at planting.	Borderline too wet; tried to seed May 5 but rolled up the drills, waited 2 days and moved plot to slightly higher ground and "mudded it in." Harrowed the plot to help cover uncovered seed in the wheel tracks and luckily caught 0.7 rain two days after seeding resulting in good, even emergence in 7-8 days.	Late start this year because of rain in the latter half of April and first half of May	Trial planted later than normal but still within regional parameters	Seeded into fresh tilled flax stubble.
<b>During Growth</b>	Cool and wet May and June with flush of volunteer corn.	Plenty of rain but never any standing water on this trial. The growing season temp was about 2° below avg. except June which was 1° above avg. but no extremes. Only 3 days with a max temp above 90° and they were all in July.	Conditions of the crop looks good.	Very good growing conditions	Crop had a good start but put up with long spells of very little precipitation in July when it needed it the most.
<b>At Flowering</b>	Warmer with low humidity during flowering.	Moderate temps with highs in the low 80's and lows in the mid-50's with numerous little showers during the heading and flowering stages. Recorded rain 18 days in June. Flowering started around June 24 and ended 10-12 days later.	Normal temperatures with a little rain.	Ideal conditions for FHB development	Cool and humid best describes the flowering stage. The fungicides applied did a good job protecting the plant and little disease was observed.
<b>During Maturation</b>	Ideal conditions for grain fill.	No severe weather and a dry spell setting in the last week of July and first half of August. Crop matured slowly and filled well.	Slightly lower temperatures during maturity.	Ideal conditions.	No rain in early August, causing the crop to mature rather fast in turn reducing yield.
<b>At Harvest</b>	Dry with cooler than normal temps.	Lots of nuisance showers finished out August and a big (2.45 in.) rain in early Sept. followed by cool temp made for slow drying and delayed harvest.	There was some lodging.	Ideal conditions.	The crop was all standing good and thrashed out very well.

## Description of 2014 Hard Spring Wheat Lines

### SWQAC #1 - BR2306

BR2306 is a hard red spring bread wheat, developed by World Wide Wheat L.L.C. (W3), using the male sterile facilitated recurrent selection (MSFRS) population breeding methodology. It originated as a single F2 head selection out of a hard red W3 population group in 2003 at W3's Arizona nursery. Generation advancement continued as single head selection through the F5 generation. BR2306 has been tested in replicated yield trials at several W3 global locations with much success. The line possesses: 1) a good yielding potential under adequate and/or moderate moisture conditions, and 2) is moderately susceptible to stripe rust. BR2306 demonstrates erect growth at the juvenile stage and green color at the boot stage. At maturity, the head is dense, tapering in shape, slightly curved, and awned. The glumes are white in color, with wanting shoulders and acuminate beak. The seed of BR2306 is elliptical in shape with rounded cheek, medium brush size and medium in length. Seed crease is narrow and mid-deep.

### SWQAC #2 - MN08165-8

MN08165-8 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 MN08165-8 is MN02268-1/MN01333-A-1. MN08165-8 has excellent leaf rust resistance and moderate resistance to Fusarium head blight (FHB). MN08165-8 is resistant to preharvest sprouting and has exhibited good end-use quality characteristics.

### SWQAC #4 – Elgin-ND

Elgin-ND is a hard red spring wheat line that is released in 2013 by NDSU-AES. Elgin was selected from a 3-way cross involving an NDSU cultivar release (1999) 'Reeder,' NDSU experimental line ND721, and SDSU released cultivar 'Walworth.' Reeder has been a major cultivar grown in Western ND and MT. It is a cultivar well adapted to stressed environments. ND721 trace its parents to 'Glupro,' a high protein cultivar derived from *T. dicoccoides*, a source of resistance to Fusarium head blight (FHB) or scab. Therefore, Elgin has a medium resistance to FHB. Walworth is an SDSU cultivar released in 2001 for its high yield. Elgin has a very good resistance to other foliar diseases including stem and leaf rusts. Particularly, its reaction to the new emerging leaf rust race (Lr21) is medium. Compared to Glenn and Barlow, Elgin is a very high yielding cultivar with relatively high protein (close to Glenn). It is a medium early cultivar with medium straw strength and conventional height. Elgin has average test weight and overall very good milling and baking properties.

### SWQAC #5 – ND817

ND817 is a HRSW line that was developed by the NDSU Spring Wheat Breeding Program. ND817 was selected from a cross involving an NDSU cultivar release (2004) 'Steele-ND' and NDSU experimental line ND735. Steele-ND has been a commonly grown cultivar in ND since 2005 and has non-Chinese resistance to FHB. It is a cultivar well adapted to the US spring wheat region with high quality attributes. ND735 is an NDSU experimental line with good



resistances to foliar diseases including tan spot diseases. ND735 has also good resistance to FHB as it traces its pedigree to both Sumai-3 and non-Sumai3 resistance included in Steele-ND. ND817 has therefore an excellent resistance to FHB, better than any released NDSU cultivars. ND817 probably combines two FHB sources of resistance: Chinese Sumai3 and non-Sumai3 resistances. ND817 has very good resistance to other foliar diseases including stem and leaf rusts. However, its reaction to the new emerging leaf rust race (Lr21) is medium susceptible. Overall, compared to Barlow, Glenn, Faller, and Prosper, the NDSU leading cultivars in the spring wheat region, ND817 has conventional plant height and medium straw to weak strength. Its yield performance is superior than Barlow and Glenn, and less than Faller and Prosper. Protein levels of ND817 is similar to Barlow, slightly less than Glenn but higher than Faller and Prosper. Test weight is similar to Barlow, higher than Faller and Prosper, and lower than Glenn. Milling and baking properties are in general good, similar to Barlow with a slight improvement in mixing properties and loaf volume.

### **SWQAC #6 – COI565W**

COI565W is a hard white spring bread wheat, developed by World Wheat L.L.C. (W3), using the male sterile facilitated recurrent selection (MSFRS) population breeding methodology. It originated as a single F2 head selection out of a quality hard white W3 population group in 1995 in W3's Arizona nursery. Single head selection followed through the F6 generation. COI565W has been tested in replicated yield trials since 2003 at several W3 global locations with much success. COI565W has good yield potential under adequate and/or moderate moisture conditions, and is resistant to stripe rust.

COI565W demonstrates erect growth at the juvenile stage with blue-green color at the boot stage. At maturity, the head is lax, strap in shape, recurved, and awned. The glumes are white in color, with elevated shoulders and acuminate beak. The seed of COI565W is ovate in shape with rounded cheek, mid-sized brush size and short in length. Seed crease is narrow and shallow.

### **SWQAC #7 – SD4362**

SD4362 is an advanced experimental hard red spring wheat breeding line developed by the South Dakota Agricultural Experiment Station. It was derived as a single spike from within an F<sub>4</sub> population (SD3943-21/'Brick') that was originally created in fall 2007. During early generation advancement, the population was tested as 28325 and then renamed as SD4362 with its inclusion in the 2011 South Dakota State University Preliminary Yield Trial. Additionally, SD4362 was evaluated in the Advanced Yield Trial from 2012 through 2014, the 2014 Uniform Regional Spring Wheat Nursery, and the 2013 and 2014 South Dakota Crop Performance Testing trials. Points of note associated with SD4362 include:

- Good yield potential
- High test weight
- Moderate grain protein concentration
- Early heading date
- A good level of Fusarium Head Blight (FHB) resistance

### **SWQAC #8 – AUBR30023W**

AUBR30023W is a hard white spring bread wheat, developed by World Wide Wheat L.L.C. (W3), using the male sterile facilitated recurrent selection (MSFRS) population breeding methodology. It originated as a single F2 head selection out of a quality hard white W3 population group in 2001 in W3's Australia nursery. Generation advancement continued as single head selection through the F5 generation. AUBR30023W has been tested in replicated yield trials since 2003 at several W3 global locations with much success. The line possesses: 1) a high yielding potential under adequate and/or moderate moisture conditions, and 2) it is resistant to stripe rust. AUBR30023W demonstrates erect growth at the juvenile stage with green color at the boot stage. At maturity, the head is dense, tapering in shape, curved, and awned. The glumes are white in color, with wanting shoulders and acuminate beak. The seed of AUBR30023W is elliptical in shape with rounded cheek, small brush size and short in length. Seed crease is narrow and shallow. AUBR30023W has been identified as a 'superwhite variety' and may be found suitable for whole wheat products.

### **SWQAC #9 – MN10201-4**

MN10201-4 (MN97695-BYDV/Sabin) contains a gene that provides good resistance to Barley Yellow Dwarf Virus (BYDV). The BYDV resistance was responsible for its relatively good yield performance in 2012 and 2013. In years with little BYDV (e.g. 2014), its grain yield is average compared with current varieties. MN10201-4 has excellent straw strength, leaf rust resistance, pre-harvest sprouting resistance, and good resistance to bacterial leaf streak. The grain protein content and Fusarium head blight resistance of MN10201-4 are average.

### **SWQAC #10 – LNR10-0493**

LNR10-0493 is a hard red spring wheat marketed by Limagrain Cereal Seeds as LCS Pro. LCS Pro was selected for grain yield, grain protein, milling and baking quality, and reaction to main diseases in the Northern Plains. LCS Pro is adapted to the hard red spring wheat growing regions of Western North Dakota and Montana. LCS Pro is tall with good straw strength, average tillering capacity, medium maturity, large seed size, and very good test weight. LCS Pro has excellent loaf volume and internal crumb grain. Mix times meet or exceed industry preferred targets. Registered seed will be available for planting in Spring, 2015. Plant Variety Protection is applied for.

### **SWQAC #11 - SY Ingmar**

SY Ingmar is a hard red spring wheat variety developed by Syngenta Seeds, Inc. It has medium maturity and very good test weight. It is a standard semi-dwarf, slightly taller than Brennan. Straw strength is very good between Brennan and SY Soren. It is resistant to stem rust and moderately resistant to leaf rust. Protection to leaf spotting diseases has been good. Tolerance to FHB has been intermediate. Protein levels have been very high, slightly higher than SY Soren. Overall, breadmaking characteristics are very good. SY Ingmar is broadly adapted to the spring wheat growing areas of the Northern Plains. Certified seed will be available for the 2015 season.

## SWQAC #12 – LNR10-0125

LNR10-0125 is a hard red spring wheat marketed by Limagrain Cereal Seeds as LCS Nitro. LCS Nitro was selected for grain yield, agronomic type, and reaction to main diseases in the Northern Plains. LCS Nitro is adapted to the hard red spring wheat growing regions of North and South Dakota, Minnesota, and Montana. LCS Nitro has a short plant height and very stiff straw, excellent yield potential, medium maturity, and medium seed size. LCS Nitro is resistant to leaf rust, and intermediate in reaction to Fusarium Head Blight, Bacterial Leaf Streak, Septoria Leaf Blotch, and Tan Spot. Loaf volumes and internal crumb grain structure are excellent. LCS Nitro shows good response to late applications of nitrogen. Registered seed will be available for planting in Spring, 2015. Plant Variety Protection is applied for.

### Wheat Production Sites

SWQAC Code #	Entry	Source	Production Sites				
			Watertown	Casselton	Crookston	Minot	Williston
1	BR2306	WWW				X <sup>†</sup>	X
2	MN08165-8	UMN		X	X		
3	Glenn	Check #1	X	X	X	X	X
4	Elgin-ND	Check #2	X	X	X	X	X
5	ND817	NDSU	X	X	X	X	X
6	COI565W	WWW				X <sup>†</sup>	X
7	SD4362	SDSU	X	X	X		
8	AUBR30023W	WWW				X	X
9	MN10201-4	UMN		X	X		
10	LNR10-0493	Limagrain	n/a*	X	X	X	X
11	SY Ingmar	Agripro	n/a*	X	X	X	X
12	LNR10-0125	Limagrain	n/a*	X	X	X	X

\* Quality test results are not available. These entries were eliminated from quality evaluation due to cross-contamination with corn.

<sup>†</sup>Entries 1 and 6 from Minot were not milled and evaluated due to their high DON levels (> 10 ppm). Kernel quality results are only available.

## 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 – 1<sup>st</sup> Break, 2<sup>nd</sup> Break I, Break Dust, Sizing I, 2<sup>nd</sup> Break II, 3<sup>rd</sup> Break, Sizing II, 5<sup>th</sup> Break, 4<sup>th</sup> Break, 1<sup>st</sup> Middlings, 2<sup>nd</sup> Middlings, 3<sup>rd</sup> Middlings, 4<sup>th</sup> Middlings, 6<sup>th</sup> 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);
- Flour color (Minolta Colorimeter,  $L^*$  and  $b^*$  values);
- 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<sup>2</sup>): 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
- Bay State Milling – Winona, MN
- Cereal Food Processors, Inc. (Grain Craft) – Wichita, KS
- ConAgra Foods (Arden Mills) – Omaha, NE
- General Mills – Minneapolis, MN
- Horizon Milling (Arden Mills) – Minnetonka, MN
- Limagrain Cereal Seeds LLC – Fort Collins, CO
- North Dakota Mill – Grand Forks, ND
- North Dakota State University, Department of Plant Sciences – Fargo, ND
- Syngenta – Berthoud, CO
- 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 2014 Hard Spring Wheat Lines

### SWQAC #1 - BR2306

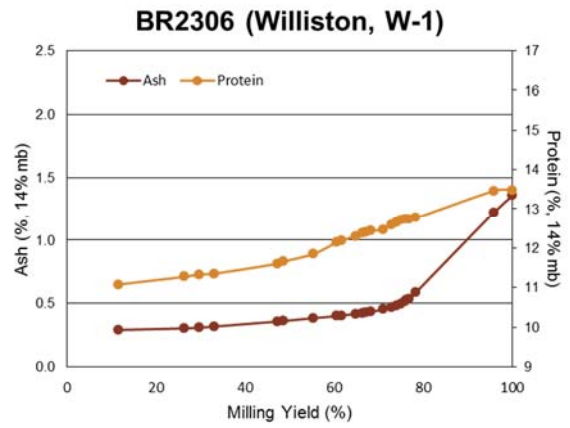
Quality Trait	Minot		Williston		
	Glenn	M-1	Glenn	W-1	
	M-3		W-3		
<b>I. USDA-ARS WQL Data</b>					
1	Wheat Protein (% , 12% mb)	14.6	14.2	14.4	13.5
2	Flour Protein (% , 12% mb)	14.1	n/a	13.6	12.7
3	Market Value (Score 1-6)	3.7	1.5	4.7	3.9
4	Market Value (Score 1-10)	10.0	5.6	10.0	8.2
5	DON (ppm)	2.14	13.26	nd	nd
6	Test Weight (lb/bu)	62.0	50.5	63.2	59.8
7	1000 Kernel Weight (g)	31.8	25.1	28.4	31.8
8	Kernel Size, % Large	69	26	29	39
9	Kernel Size, % Small	7	20	14	11
10	Wheat Moisture (%)	11.3	10.7	10.6	10.4
11	Wheat Ash (% , 14% mb)	2.05	1.94	1.27	1.27
12	Wheat Falling Number (sec)	370	278	428	410
13	SKCS Hardness Index	79.8	66.1	84.7	73.5
14	Vitreous Kernels (%)	85.5	53.9	96.3	85.1
<b>Flour Extraction (%)</b>					
15	Tempered Wheat Basis (%)	71.0	n/a	71.2	73.5
16	Total Product Basis (%)	73.9	n/a	73.2	73.9
17	Flour/Bu Wheat (lbs)	45.8	n/a	46.3	44.2
<b>Flour Quality</b>					
18	Flour Color Brightness ( <i>L</i> *)	89.7	n/a	90.4	90.3
19	Flour Color Yellowness ( <i>b</i> *)	8.0	n/a	8.8	8.1
20	Flour Moisture (%)	13.5	n/a	13.1	13.4
21	Flour Ash (% , 14% mb)	0.51	n/a	0.46	0.46
22	Flour Falling Number (Malted) (sec)	251	n/a	250	254
<b>Farinograph</b>					
23	Water Absorption (% , 500 BU)	64.9	n/a	62.9	60.6
24	Water Absorption (% , 14% mb)	64.3	n/a	61.9	59.9
25	Arrival Time (min)	4.0	n/a	2.4	1.9
26	Peak Time (min)	8.0	n/a	7.2	5.5
27	Dough Stability (min)	9.0	n/a	10.2	11.2
28	Mixing Tolerance Index (MTI) (BU)	34.0	n/a	31.0	18.0
29	Time To Breakdown (TTB) (min)	12.6	n/a	12.1	13.0
<b>II. Cooperator Results</b>					
30	Bake Absorption (Average %)	65.8	n/a	64.2	62.1
31	Loaf Volume (% of Check)		n/a		94.9

# SWQAC #1 - BR2306

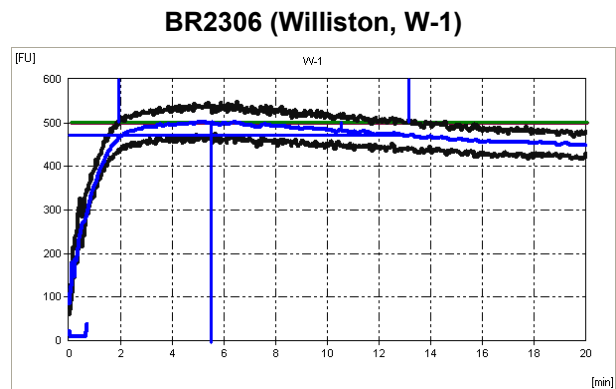
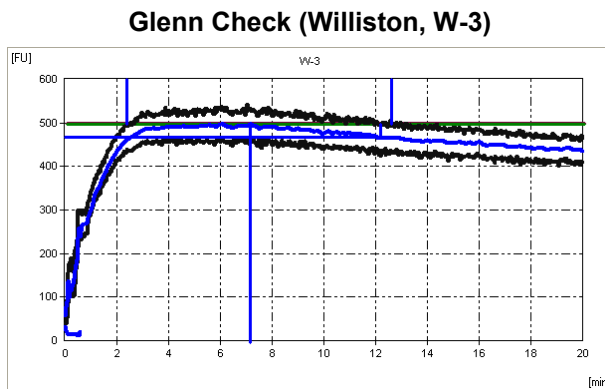
Quality Trait	Minot		Williston			
	Glenn M-3	M-1	Glenn W-3	W-1		
<b>II. Cooperator Results</b>						
32	<b>Mixing Requirement</b> 5 = Very Long 4 = Long 3 = Medium 2 = Short 1 = Very Short		3.8	n/a	4.3	4.3
33	<b>Dough Characteristics</b> 5 = Bucky – Tough 4 = Strong – Elastic 3 = Medium – Pliable 2 = Mellow – Very Pliable 1 = Weak – Short or Sticky		3.7	n/a	4.4	3.8
34	<b>Mixing Tolerance</b> 5 = Much More Tolerance Than Check 4 = More Tolerance Than Check 3 = Tolerance Equivalent To Check 2 = Less Tolerance Than Check 1 = Much Less Tolerance Than Check			n/a		2.9
35	<b>Internal Crumb Color</b> 5 = Much Brighter Than Check 4 = Brighter Than Check 3 = Equivalent To Check 2 = Poorer Than Check 1 = Much Poorer Than Check			n/a		3.3
36	<b>Internal Grain and Texture</b> 5 = Much Better Than Check 4 = Better Than Check 3 = Equivalent To Check 2 = Poorer Than Check 1 = Much Poorer Than Check			n/a		2.9
<b>III. Cooperator Evaluation</b>						
	<b>Quality Traits 1-2: Protein</b> 5 = Much Better Than Check 4 = Better Than Check 3 = Equivalent To Check 2 = Poorer Than Check 1 = Much Poorer Than Check			n/a		2.0
	<b>Quality Traits 3-22: Milling</b> 5 = Much Better Than Check 4 = Better Than Check 3 = Equivalent To Check 2 = Poorer Than Check 1 = Much Poorer Than Check			n/a		3.2
	<b>Quality Traits 23-36: Baking</b> 5 = Much Better Than Check 4 = Better Than Check 3 = Equivalent To Check 2 = Poorer Than Check 1 = Much Poorer Than Check			n/a		2.9
	<b>Quality Traits 1-36: Overall Comparison</b> 5 = Much Better Than Check 4 = Better Than Check 3 = Equivalent To Check 2 = Poorer Than Check 1 = Much Poorer Than Check			n/a		3.0



## Cumulative Ash and Protein Curves

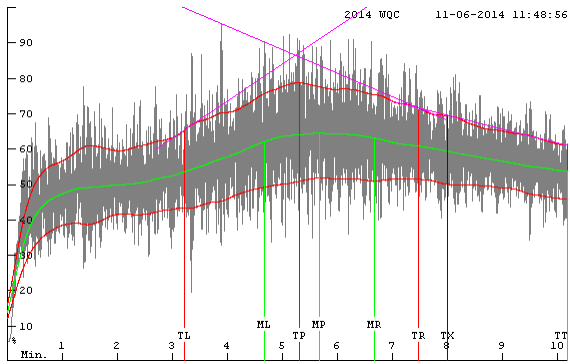


## Farinograms

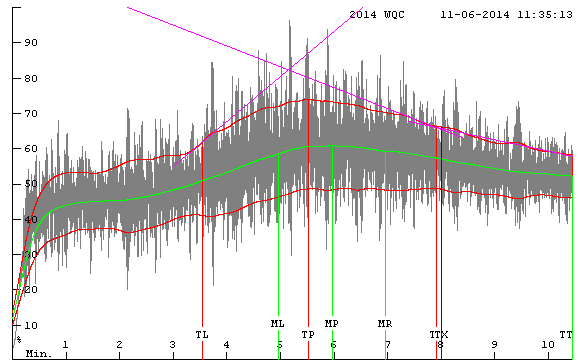


# Mixograms

Glenn Check (Williston, W-3)

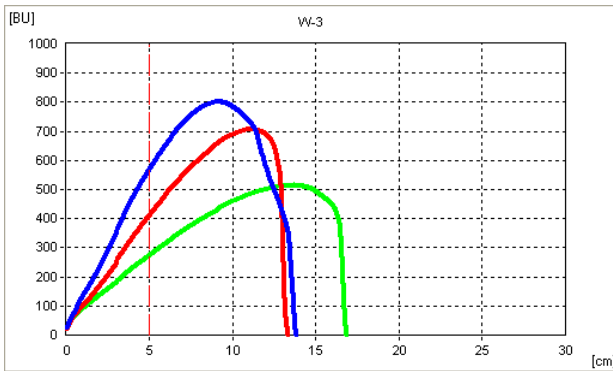


BR2306 (Williston, W-1)

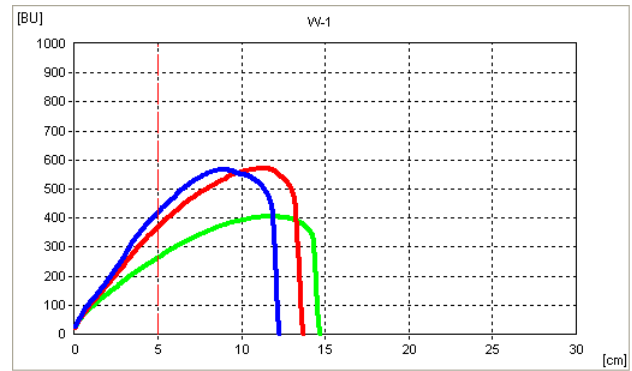


# Extensograms

Glenn Check (Williston, W-3)



BR2306 (Williston, W-1)



— 45 min; — 90 min; — 135 min

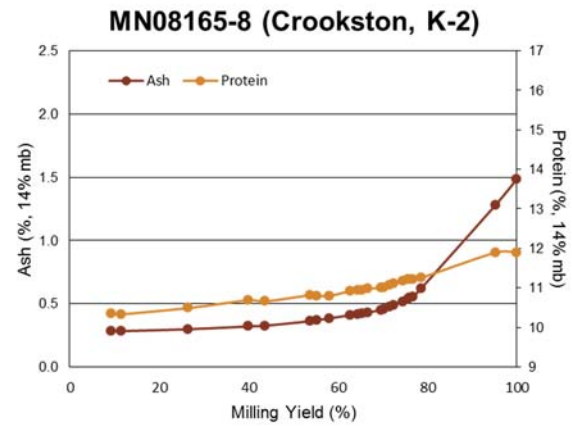
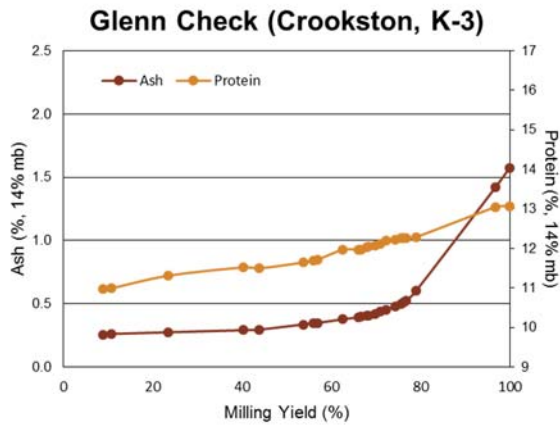
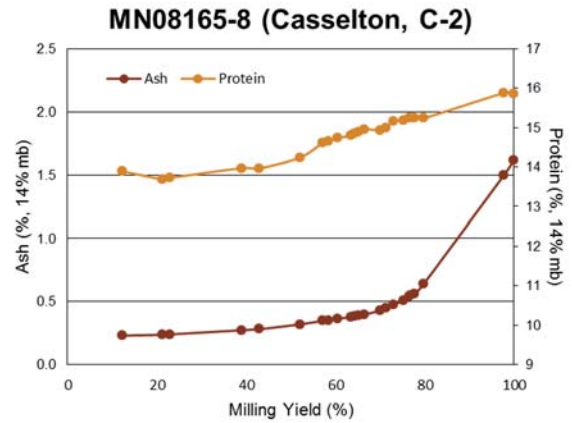
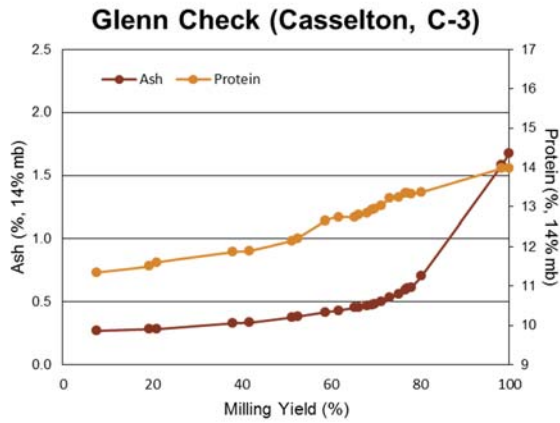
## SWQAC #2 - MN08165-8

Quality Trait	Casselton		Crookston		
	Glenn		Glenn		
	C-3	C-2	K-3	K-2	
<b>I. USDA-ARS WQL Data</b>					
1	Wheat Protein (% , 12% mb)	14.3	16.2	13.1	11.9
2	Flour Protein (% , 12% mb)	13.5	15.4	12.3	11.2
3	Market Value (Score 1-6)	4.5	5.2	4.3	4.0
4	Market Value (Score 1-10)	10.0	9.2	10.0	8.0
5	DON (ppm)	0.54	0.11	nd	nd
6	Test Weight (lb/bu)	63.4	61.3	65.2	62.5
7	1000 Kernel Weight (g)	34.4	35.6	31.9	33.0
8	Kernel Size, % Large	70	81	60	71
9	Kernel Size, % Small	6	4	7	6
10	Wheat Moisture (%)	11.1	10.8	10.7	9.4
11	Wheat Ash (% , 14% mb)	1.66	1.52	1.45	1.43
12	Wheat Falling Number (sec)	398	428	416	456
13	SKCS Hardness Index	78.2	79.5	95.7	83.0
14	Vitreous Kernels (%)	66.4	82.3	94.6	73.9
<b>Flour Extraction (%)</b>					
15	Tempered Wheat Basis (%)	71.8	70.7	70.9	70.7
16	Total Product Basis (%)	73.2	73.0	72.3	72.4
17	Flour/Bu Wheat (lbs)	46.4	44.7	47.2	45.3
<b>Flour Quality</b>					
18	Flour Color Brightness ( <i>L</i> *)	89.6	89.2	90.1	89.9
19	Flour Color Yellowness ( <i>b</i> *)	8.1	8.6	8.1	9.1
20	Flour Moisture (%)	12.9	13.4	13.6	13.4
21	Flour Ash (% , 14% mb)	0.51	0.49	0.47	0.52
22	Flour Falling Number (Malted) (sec)	254	256	250	250
<b>Farinograph</b>					
23	Water Absorption (% , 500 BU)	65.5	65.4	66.3	62.4
24	Water Absorption (% , 14% mb)	64.2	64.7	65.8	61.7
25	Arrival Time (min)	3.0	3.4	2.2	1.6
26	Peak Time (min)	8.2	10.5	5.5	2.9
27	Dough Stability (min)	10.1	16.0	10.8	7.3
28	Mixing Tolerance Index (MTI) (BU)	29.0	23.0	23.0	25.0
29	Time To Breakdown (TTB) (min)	12.3	17.9	12.6	8.7
<b>II. Cooperator Results</b>					
30	Bake Absorption (Average %)	65.7	66.5	65.8	62.8
31	Loaf Volume (% of Check)		100.2		97.9

## SWQAC #2 - MN08165-8

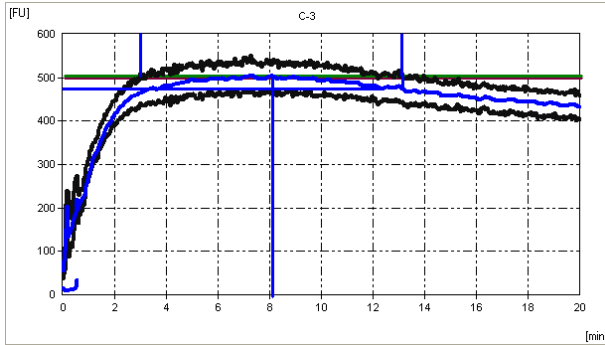
	Quality Trait	Casselton		Crookston	
		Glenn		Glenn	
		C-3	C-2	K-3	K-2
<b>II. Cooperator Results</b>					
32	<b>Mixing Requirement</b> 5 = Very Long 4 = Long 3 = Medium 2 = Short 1 = Very Short	3.7	3.8	3.8	3.6
33	<b>Dough Characteristics</b> 5 = Bucky – Tough 4 = Strong – Elastic 3 = Medium – Pliable 2 = Mellow – Very Pliable 1 = Weak – Short or Sticky	3.9	3.5	3.6	3.4
34	<b>Mixing Tolerance</b> 5 = Much More Tolerance Than Check 4 = More Tolerance Than Check 3 = Tolerance Equivalent To Check 2 = Less Tolerance Than Check 1 = Much Less Tolerance Than Check		3.3		2.6
35	<b>Internal Crumb Color</b> 5 = Much Brighter Than Check 4 = Brighter Than Check 3 = Equivalent To Check 2 = Poorer Than Check 1 = Much Poorer Than Check		2.6		2.6
36	<b>Internal Grain and Texture</b> 5 = Much Better Than Check 4 = Better Than Check 3 = Equivalent To Check 2 = Poorer Than Check 1 = Much Poorer Than Check		2.8		3.2
<b>III. Cooperator Evaluation</b>					
	<b>Quality Traits 1-2: Protein</b> 5 = Much Better Than Check 4 = Better Than Check 3 = Equivalent To Check 2 = Poorer Than Check 1 = Much Poorer Than Check		4.8		1.7
	<b>Quality Traits 3-22: Milling</b> 5 = Much Better Than Check 4 = Better Than Check 3 = Equivalent To Check 2 = Poorer Than Check 1 = Much Poorer Than Check		2.6		2.6
	<b>Quality Traits 23-36: Baking</b> 5 = Much Better Than Check 4 = Better Than Check 3 = Equivalent To Check 2 = Poorer Than Check 1 = Much Poorer Than Check		2.9		2.7
	<b>Quality Traits 1-36: Overall Comparison</b> 5 = Much Better Than Check 4 = Better Than Check 3 = Equivalent To Check 2 = Poorer Than Check 1 = Much Poorer Than Check		2.9		2.7

## Cumulative Ash and Protein Curves

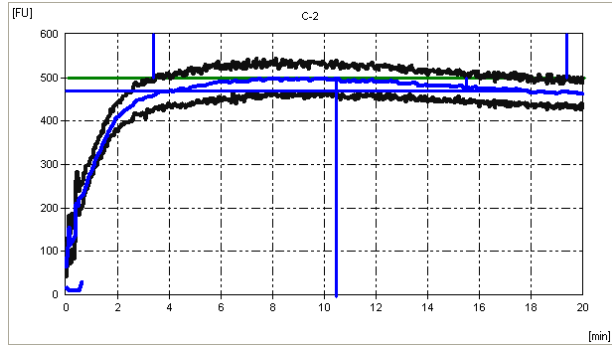


# Farinograms

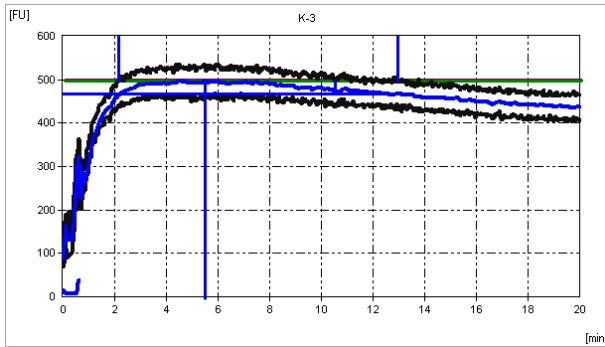
**Glenn Check (Casselton, C-3)**



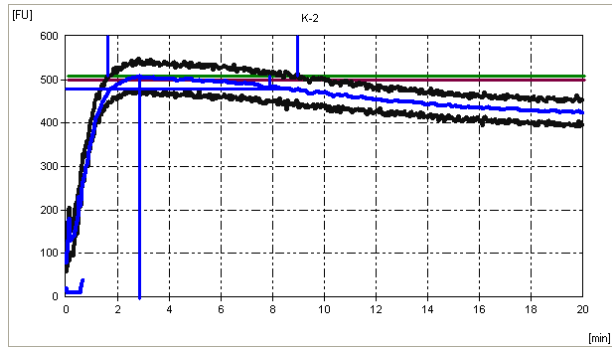
**MN08165-8 (Casselton, C-2)**



**Glenn Check (Crookston, K-3)**

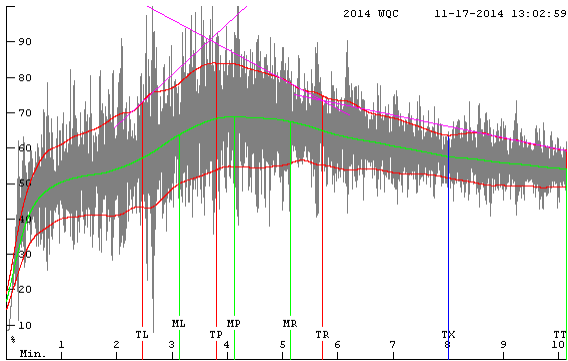


**MN08165-8 (Crookston, K-2)**

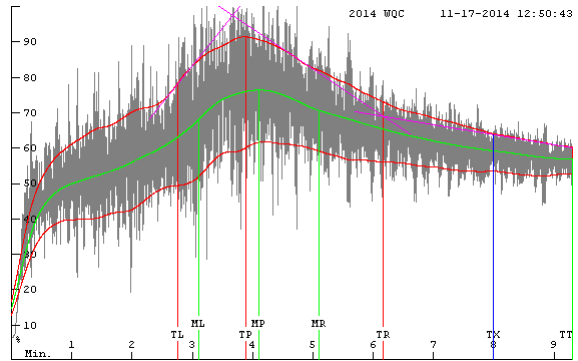


# Mixograms

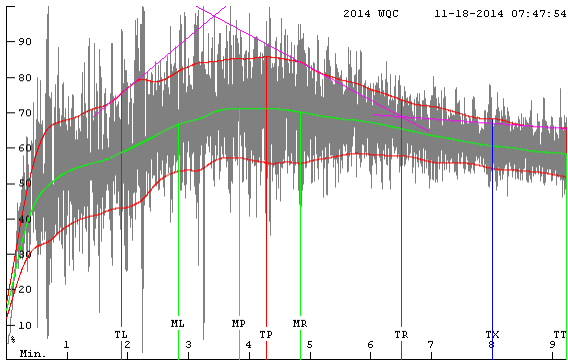
**Glenn Check (Casselton, C-3)**



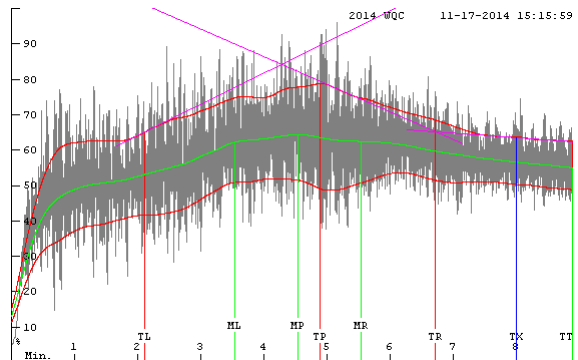
**MN08165-8 (Casselton, C-2)**



**Glenn Check (Crookston, K-3)**

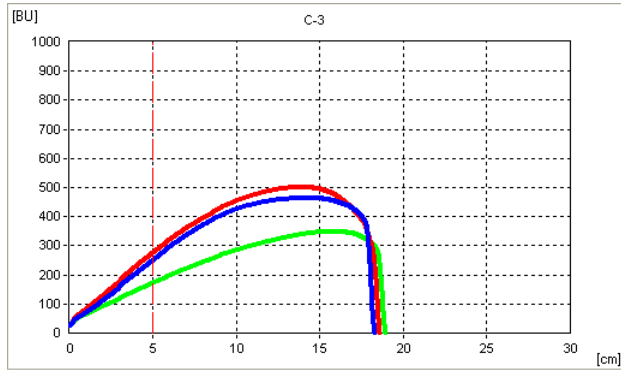


**MN08165-8 (Crookston, K-2)**

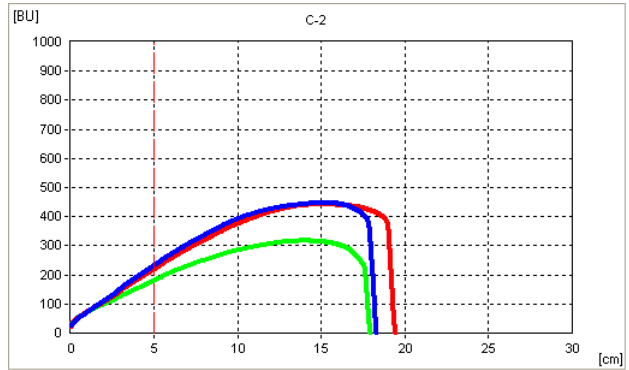


# Extensograms

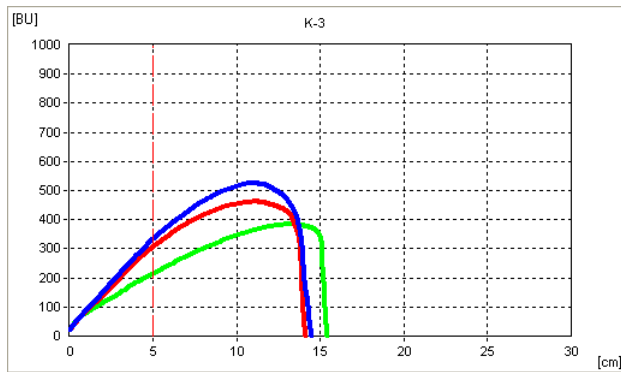
Glenn Check (Casselton, C-3)



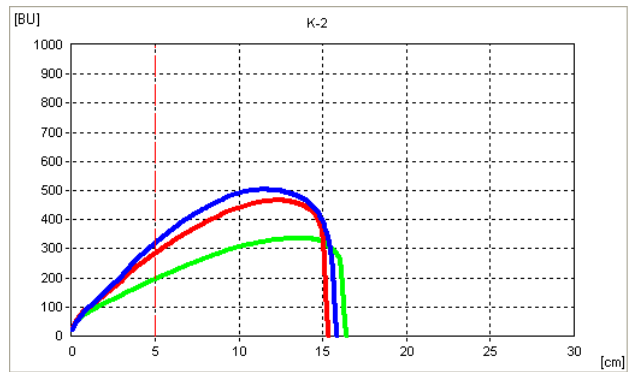
MN08165-8 (Casselton, C-2)



Glenn Check (Crookston, K-3)



MN08165-8 (Crookston, K-2)



— 45 min; — 90 min; — 135 min



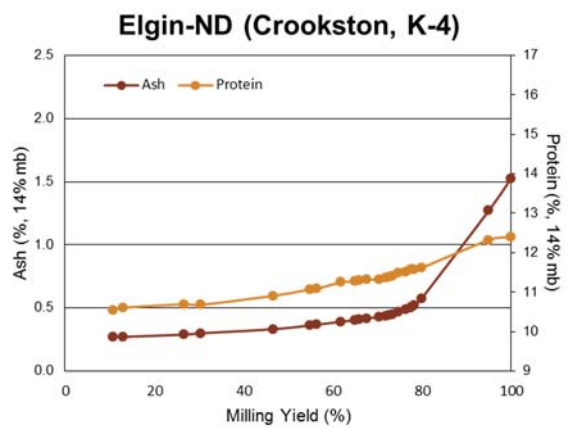
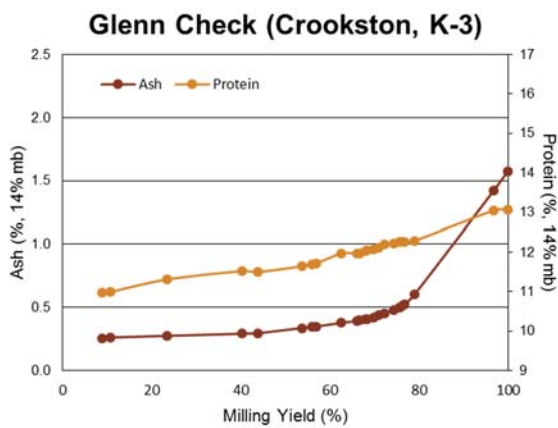
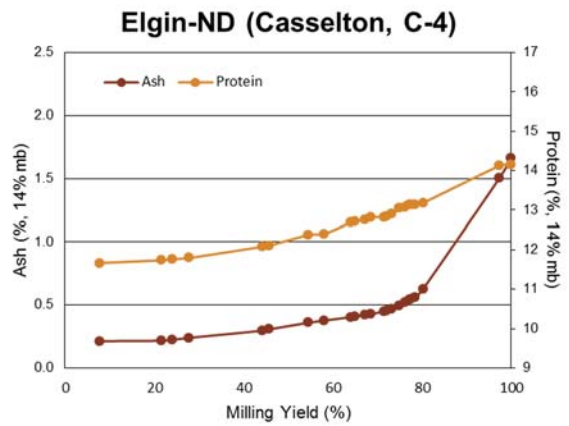
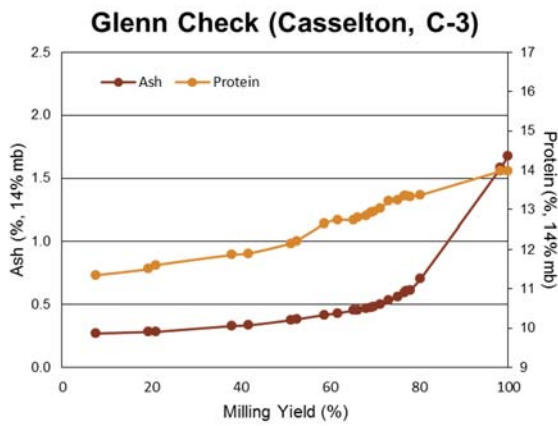
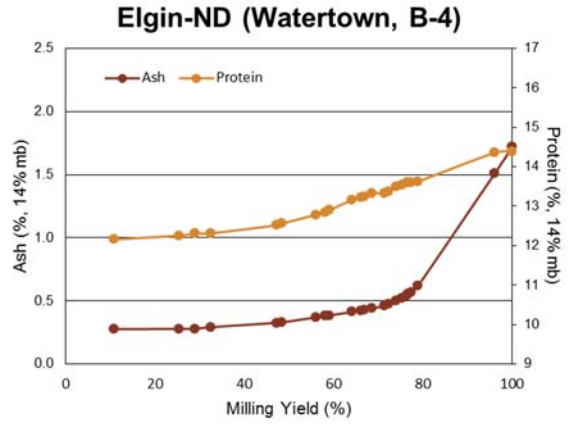
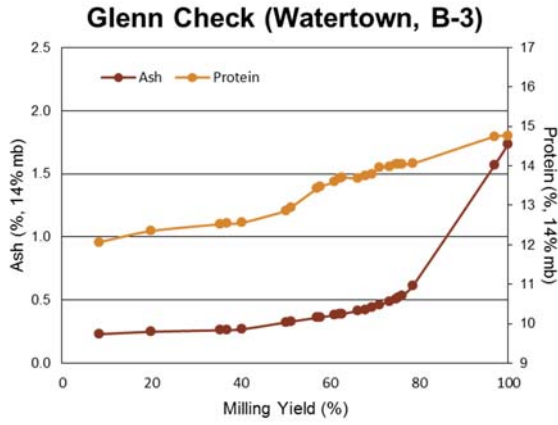
## SWQAC #4 - Elgin-ND

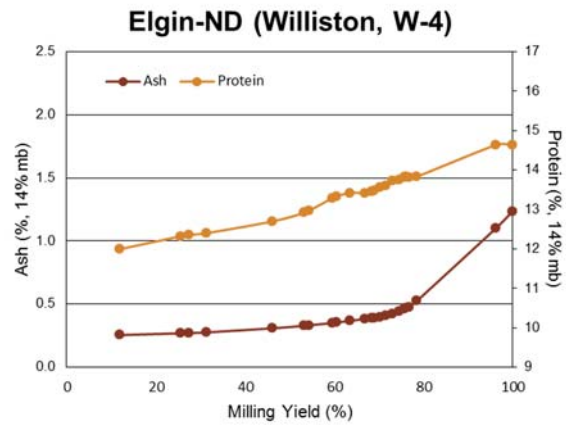
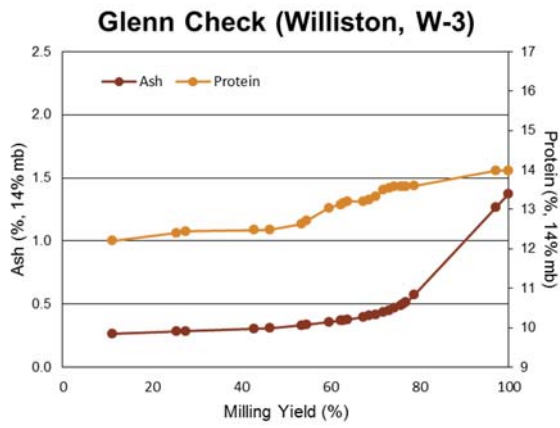
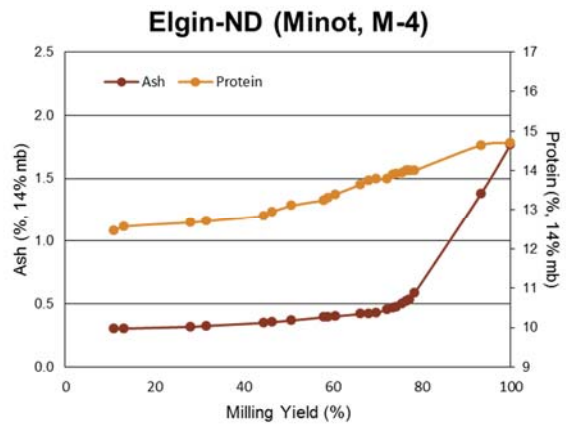
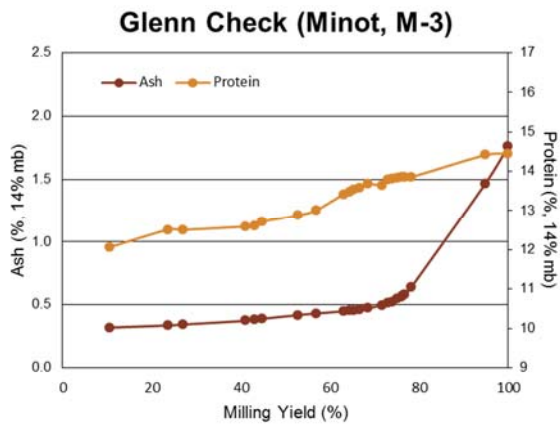
Quality Trait	Watertown		Casselton		Crookston		Minot		Williston		
	Glenn B-3	B-4	Glenn C-3	C-4	Glenn K-3	K-4	Glenn M-3	M-4	Glenn W-3	W-4	
<b>I. USDA-ARS WQL Data</b>											
1	Wheat Protein (% , 12% mb)	15.1	14.3	14.3	14.2	13.1	12.1	14.6	14.8	14.4	14.3
2	Flour Protein (% , 12% mb)	14.0	13.7	13.5	13.3	12.3	11.4	14.1	14.2	13.6	13.6
3	Market Value (Score 1-6)	3.6	3.6	4.5	4.0	4.3	4.0	3.7	2.1	4.7	4.0
4	Market Value (Score 1-10)	10.0	8.2	10.0	8.8	10.0	8.2	10.0	6.0	10.0	8.8
5	DON (ppm)	1.27	1.46	0.54	0.46	nd	nd	2.14	5.13	nd	nd
6	Test Weight (lb/bu)	62.1	59.9	63.4	61.2	65.2	62.7	62.0	57.9	63.2	59.8
7	1000 Kernel Weight (g)	34.4	30.7	34.4	32.1	31.9	29.8	31.8	27.2	28.4	27.1
8	Kernel Size, % Large	75	63	70	71	60	56	69	55	29	27
9	Kernel Size, % Small	5	9	6	7	7	10	7	11	14	18
10	Wheat Moisture (%)	11.7	11.5	11.1	10.4	10.7	8.2	11.3	10.4	10.6	10.5
11	Wheat Ash (% , 14% mb)	1.64	1.65	1.66	1.64	1.45	1.40	2.05	1.80	1.27	1.21
12	Wheat Falling Number (sec)	272	405	398	407	416	461	370	268	428	443
13	SKCS Hardness Index	87.3	80.2	78.2	74.9	95.7	91.3	79.8	75.5	84.7	79.9
14	Vitreous Kernels (%)	88.2	72.5	66.4	65.0	94.6	71.1	85.5	76.7	96.3	83.6
<b>Flour Extraction (%)</b>											
15	Tempered Wheat Basis (%)	69.7	72.4	71.8	73.6	70.9	73.2	71.0	72.1	71.2	70.8
16	Total Product Basis (%)	71.2	73.9	73.2	74.9	72.3	74.7	73.9	74.4	73.2	73.1
17	Flour/Bu Wheat (lbs)	44.2	44.3	46.4	45.8	47.2	46.9	45.8	43.1	46.3	43.8
<b>Flour Quality</b>											
18	Flour Color Brightness (L*)	89.5	89.6	89.6	89.6	90.1	90.6	89.7	89.9	90.4	90.4
19	Flour Color Yellowness (b*)	8.0	8.6	8.1	8.7	8.1	9.0	8.0	9.1	8.8	9.4
20	Flour Moisture (%)	13.4	13.3	12.9	12.9	13.6	13.3	13.5	13.2	13.1	12.9
21	Flour Ash (% , 14% mb)	0.49	0.50	0.51	0.52	0.47	0.46	0.51	0.48	0.46	0.45
22	Flour Falling Number (Malted) (sec)	252	252	254	258	250	252	251	251	250	251
<b>Farinograph</b>											
23	Water Absorption (% , 500 BU)	65.7	66.5	65.5	66.4	66.3	64.8	64.9	64.7	62.9	65.6
24	Water Absorption (% , 14% mb)	65.0	65.7	64.2	65.1	65.8	64.0	64.3	63.8	61.9	64.3
25	Arrival Time (min)	2.1	2.8	3.0	3.1	2.2	1.9	4.0	4.2	2.4	2.3
26	Peak Time (min)	4.0	6.2	8.2	6.5	5.5	3.2	8.0	7.2	7.2	6.5
27	Dough Stability (min)	7.0	9.1	10.1	8.4	10.8	7.2	9.0	7.7	10.2	12.0
28	Mixing Tolerance Index (MTI) (BU)	30.0	28.0	29.0	31.0	23.0	19.0	34.0	32.0	31.0	17.0
29	Time To Breakdown (TTB) (min)	8.6	11.8	12.3	10.9	12.6	9.0	12.6	11.9	12.1	14.1
<b>II. Cooperator Results</b>											
30	Bake Absorption (Average %)	66.2	66.3	65.7	65.8	65.8	64.2	65.8	65.5	64.2	65.7
31	Loaf Volume (% of Check)		97.6		95.6		97.6		95.4		96.5

# SWQAC #4 - Elgin-ND

Quality Trait	Watertown		Casselton		Crookston		Minot		Williston			
	Glenn	B-4	Glenn	C-4	Glenn	K-4	Glenn	M-4	Glenn	W-4		
	B-3	B-4	C-3	C-4	K-3	K-4	M-3	M-4	W-3	W-4		
<b>II. Cooperator Results</b>												
32	<b>Mixing Requirement</b> 5 = Very Long 4 = Long 3 = Medium 2 = Short 1 = Very Short		3.6	3.6	3.7	3.1	3.8	3.6	3.8	3.2	4.3	3.8
33	<b>Dough Characteristics</b> 5 = Bucky – Tough 4 = Strong – Elastic 3 = Medium – Pliable 2 = Mellow – Very Pliable 1 = Weak – Short or Sticky		3.6	3.4	3.9	2.9	3.6	3.6	3.7	3.4	4.4	4.0
34	<b>Mixing Tolerance</b> 5 = Much More Tolerance Than Check 4 = More Tolerance Than Check 3 = Tolerance Equivalent To Check 2 = Less Tolerance Than Check 1 = Much Less Tolerance Than Check			2.9		2.5		2.7		2.4		2.9
35	<b>Internal Crumb Color</b> 5 = Much Brighter Than Check 4 = Brighter Than Check 3 = Equivalent To Check 2 = Poorer Than Check 1 = Much Poorer Than Check			2.9		2.7		2.6		2.3		2.8
36	<b>Internal Grain and Texture</b> 5 = Much Better Than Check 4 = Better Than Check 3 = Equivalent To Check 2 = Poorer Than Check 1 = Much Poorer Than Check			3.2		3.0		3.1		2.9		2.7
<b>III. Cooperator Evaluation</b>												
	<b>Quality Traits 1-2: Protein</b> 5 = Much Better Than Check 4 = Better Than Check 3 = Equivalent To Check 2 = Poorer Than Check 1 = Much Poorer Than Check			2.4		2.9		1.8		3.0		2.9
	<b>Quality Traits 3-22: Milling</b> 5 = Much Better Than Check 4 = Better Than Check 3 = Equivalent To Check 2 = Poorer Than Check 1 = Much Poorer Than Check			3.3		3.3		3.2		2.6		2.8
	<b>Quality Traits 23-36: Baking</b> 5 = Much Better Than Check 4 = Better Than Check 3 = Equivalent To Check 2 = Poorer Than Check 1 = Much Poorer Than Check			3.1		2.7		2.7		2.6		3.0
	<b>Quality Traits 1-36: Overall Comparison</b> 5 = Much Better Than Check 4 = Better Than Check 3 = Equivalent To Check 2 = Poorer Than Check 1 = Much Poorer Than Check			2.9		2.7		2.6		2.4		3.0

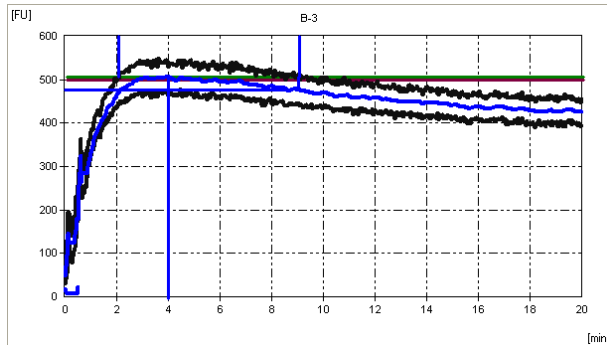
## Cumulative Ash and Protein Curves



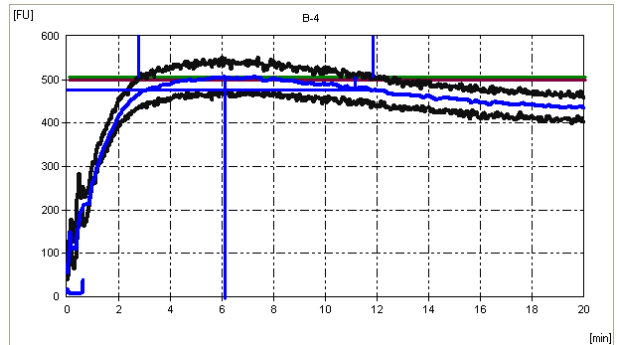


# Farinograms

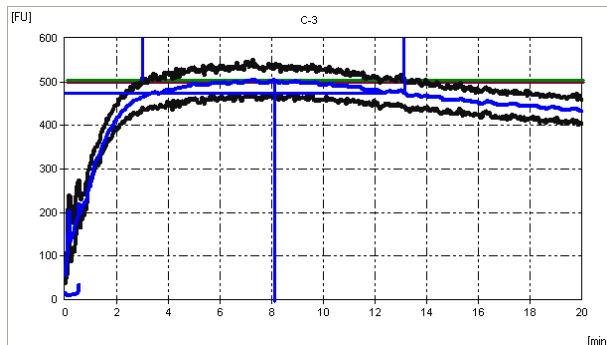
**Glenn Check (Watertown, B-3)**



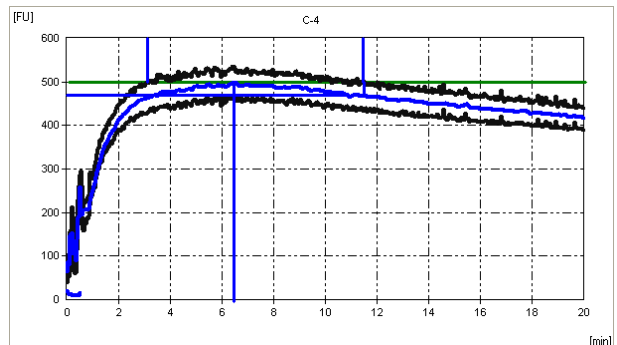
**Elgin-ND (Watertown, B-4)**



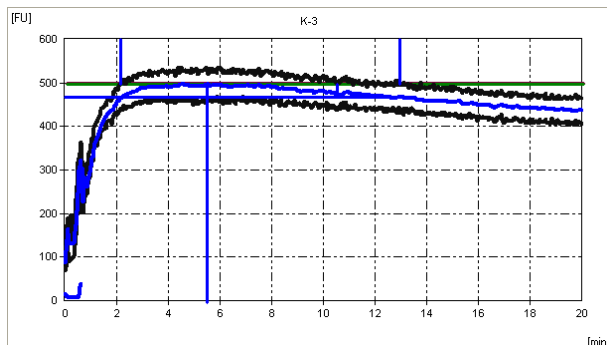
**Glenn Check (Casselton, C-3)**



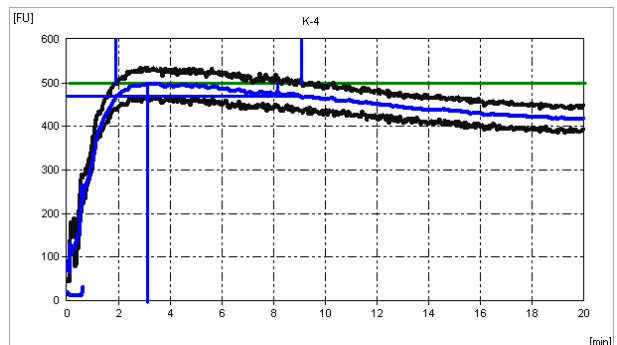
**Elgin-ND (Casselton, C-4)**



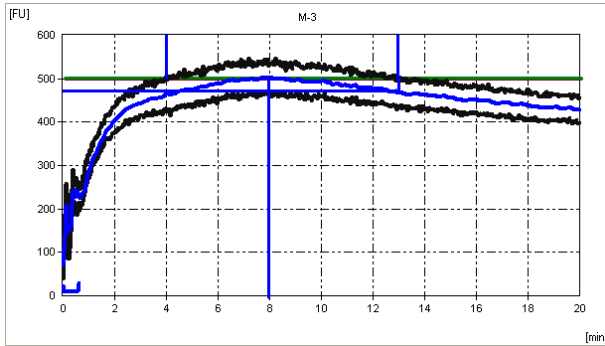
**Glenn Check (Crookston, K-3)**



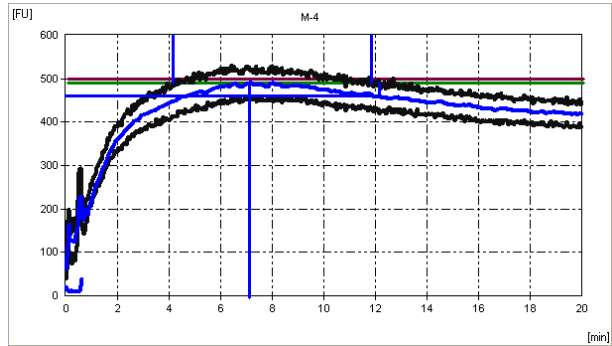
**Elgin-ND (Crookston, K-4)**



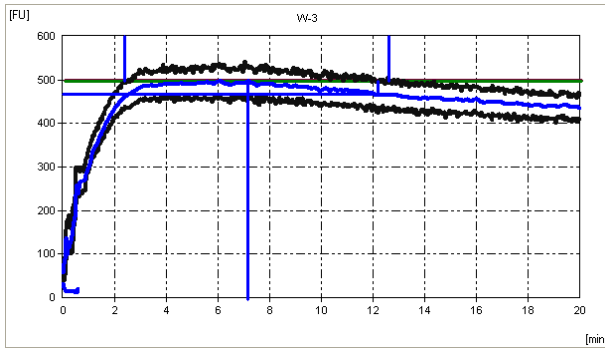
**Glenn Check (Minot, M-3)**



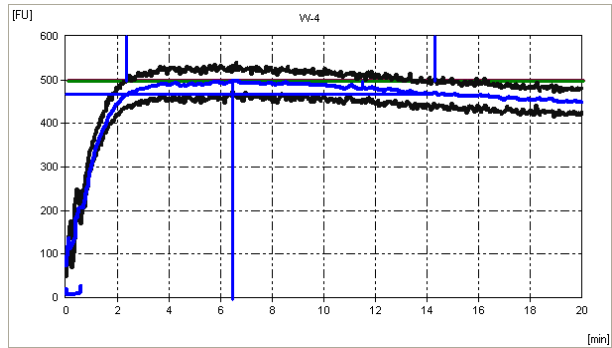
**Elgin-ND (Minot, M-4)**



**Glenn Check (Williston, W-3)**

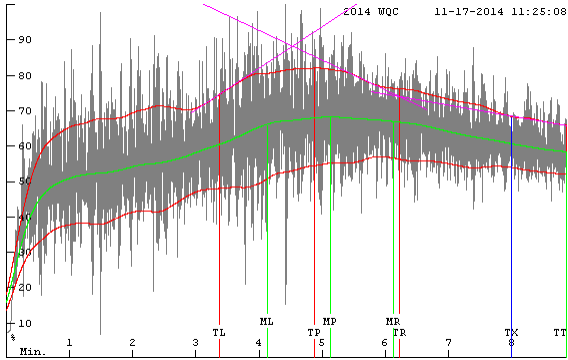


**Elgin-ND (Williston, W-4)**

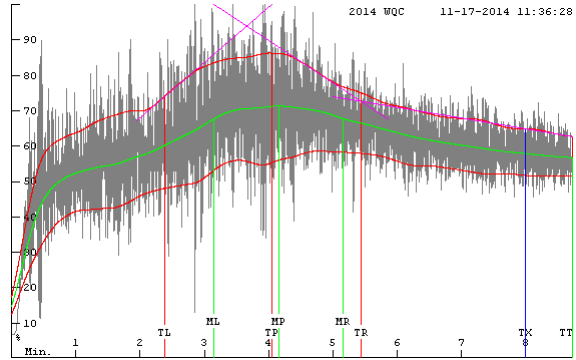


# Mixograms

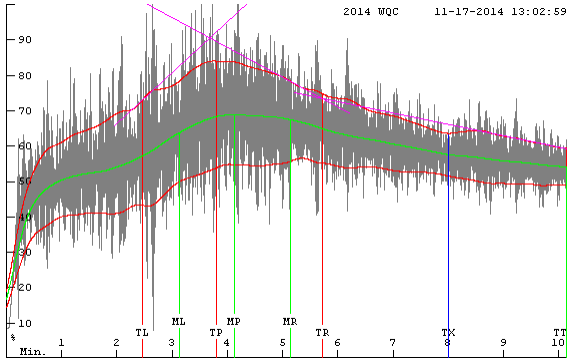
**Glenn Check (Watertown, B-3)**



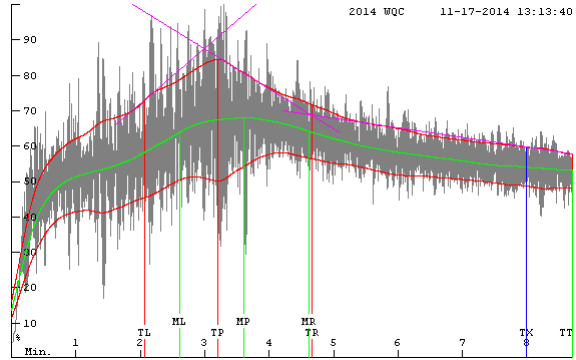
**Elgin-ND (Watertown, B-4)**



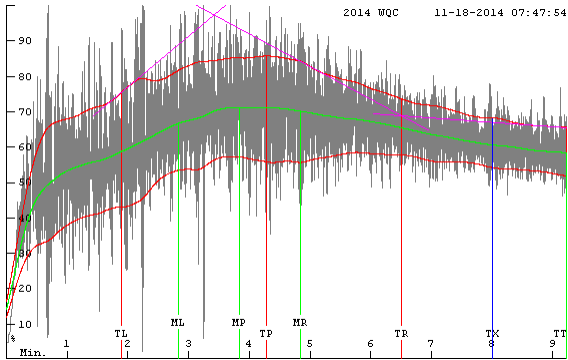
**Glenn Check (Casselton, C-3)**



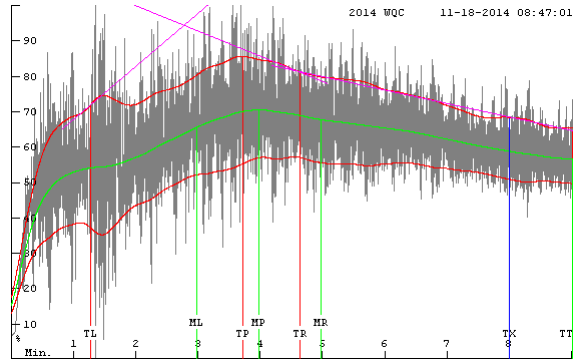
**Elgin-ND (Casselton, C-4)**



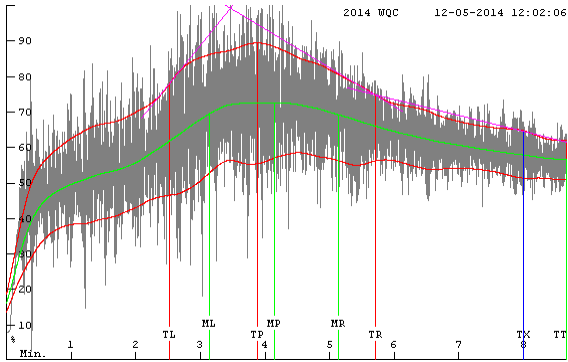
**Glenn Check (Crockston, K-3)**



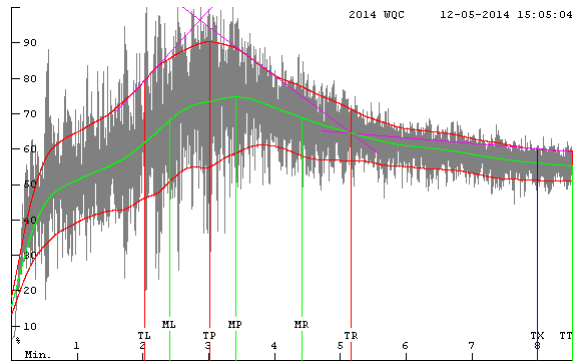
**Elgin-ND (Crockston, K-4)**



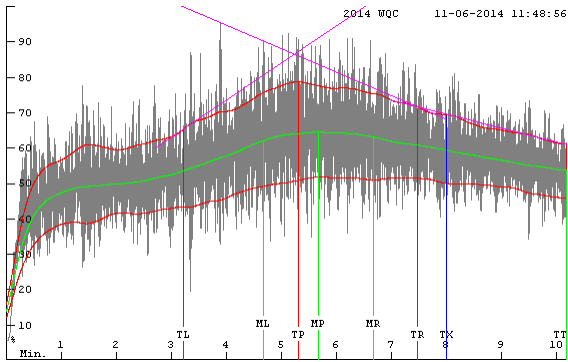
**Glenn Check (Minot, M-3)**



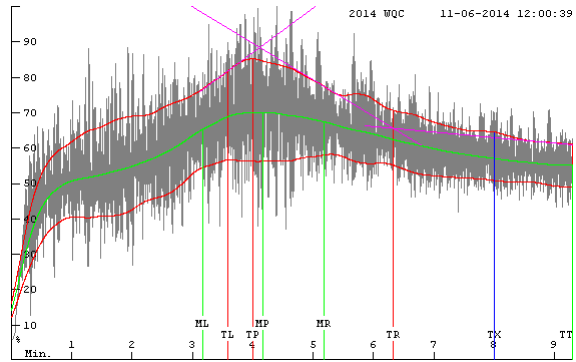
**Elgin-ND (Minot, M-4)**



**Glenn Check (Williston, W-3)**



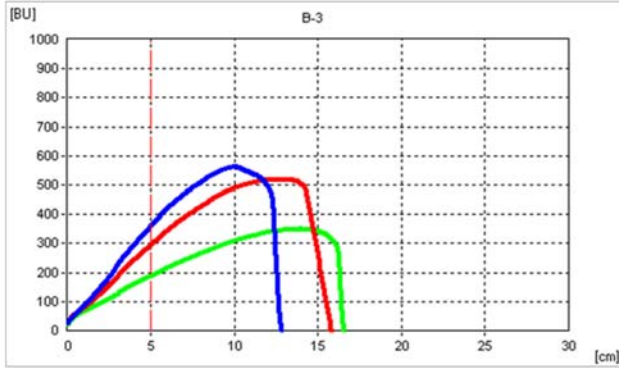
**Elgin-ND (Williston, W-4)**



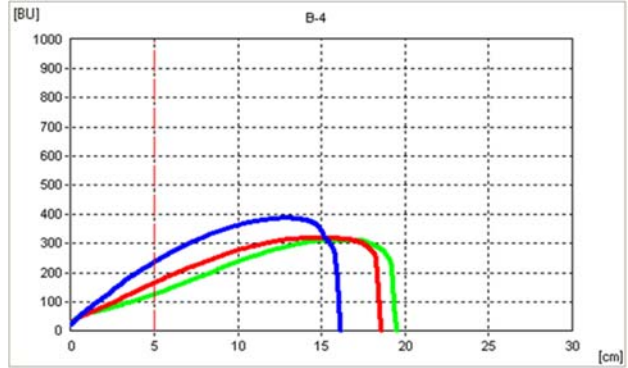


# Extensograms

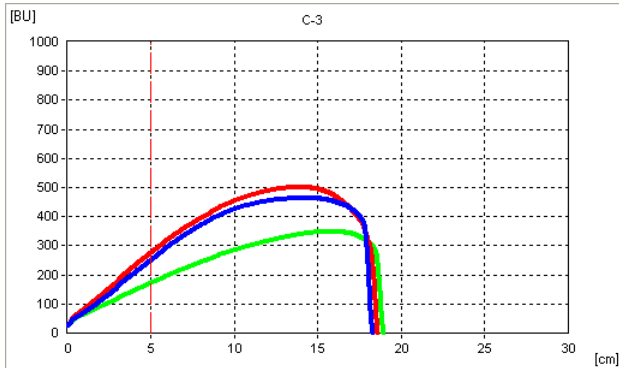
Glenn Check (Watertown, B-3)



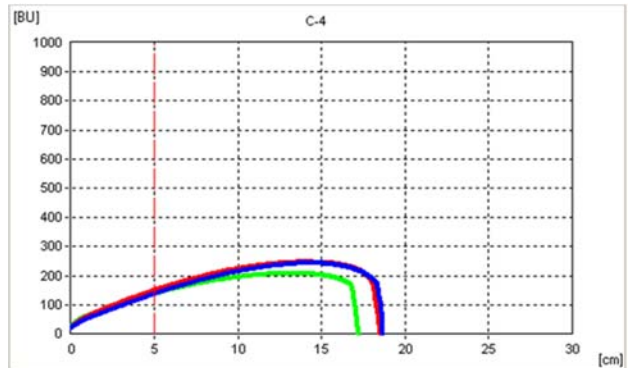
Elgin-ND (Watertown, B-4)



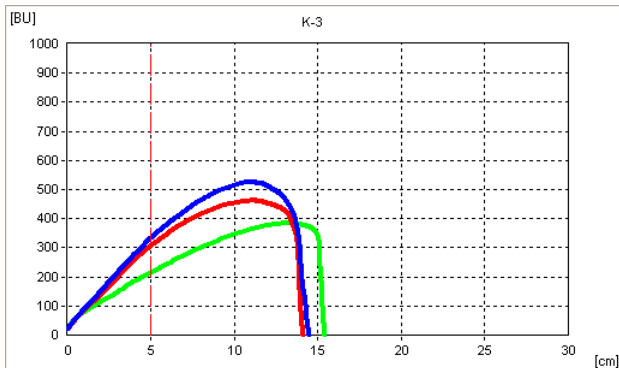
Glenn Check (Casselton, C-3)



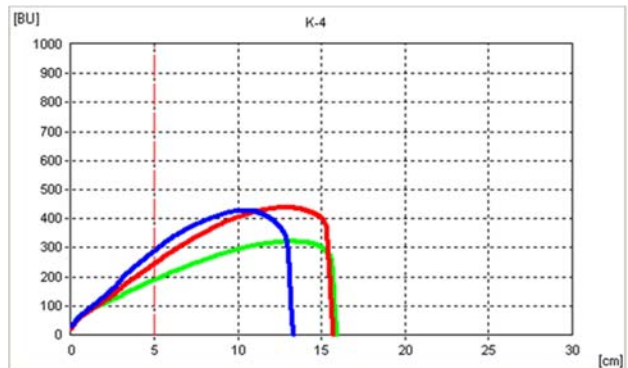
Elgin-ND (Casselton, C-4)



Glenn Check (Crookston, K-3)

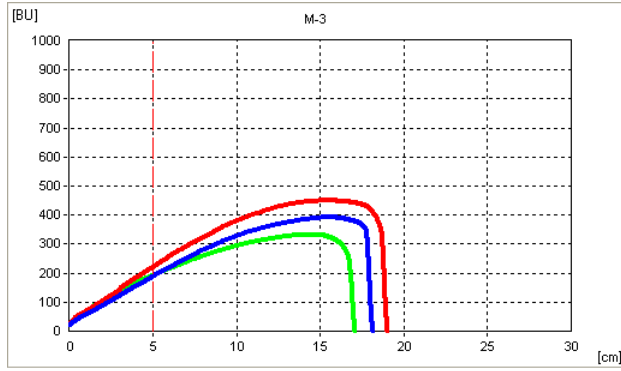


Elgin-ND (Crookston, K-4)

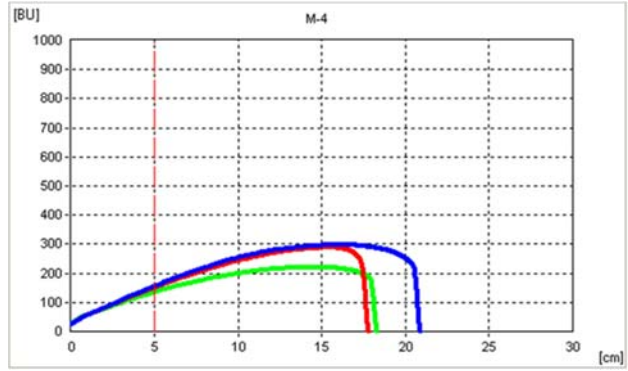


— 45 min; — 90 min; — 135 min

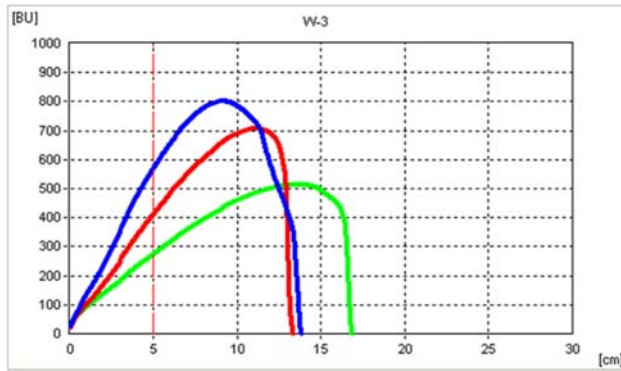
**Glenn Check (Minot, M-3)**



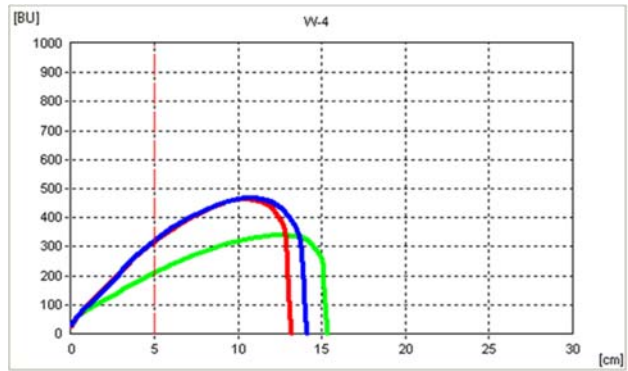
**Elgin-ND (Minot, M-4)**



**Glenn Check (Williston, W-3)**



**Elgin-ND (Williston, W-4)**



— 45 min; — 90 min; — 135 min

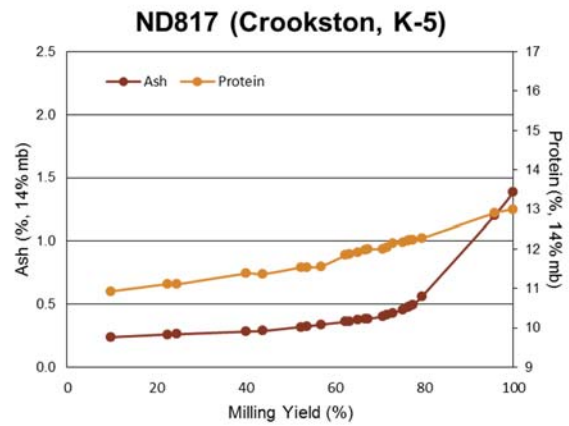
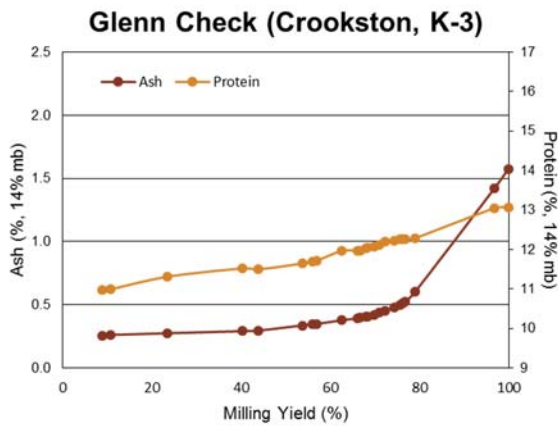
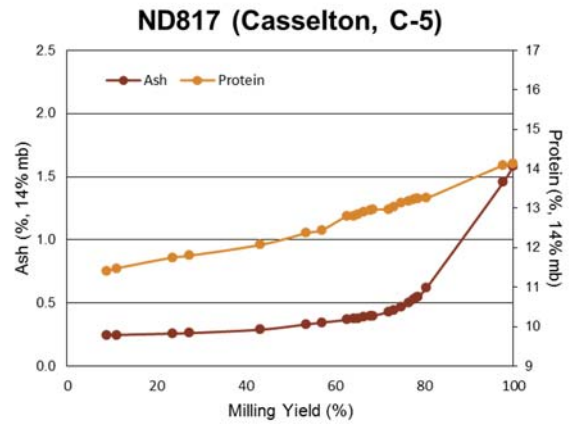
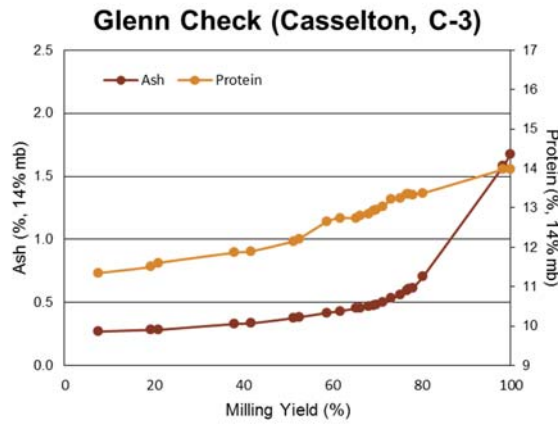
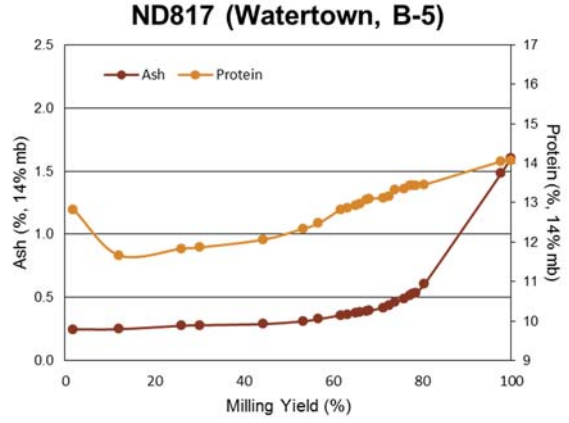
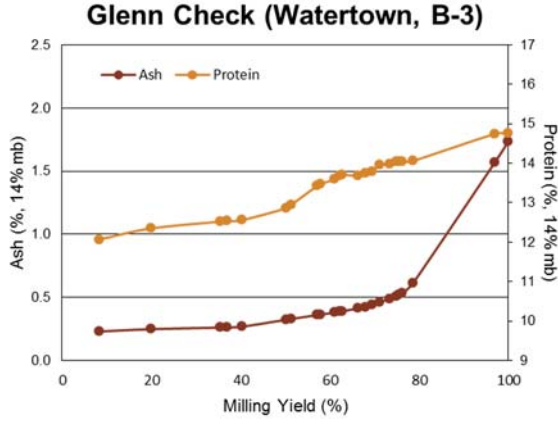
## SWQAC #5 - ND817

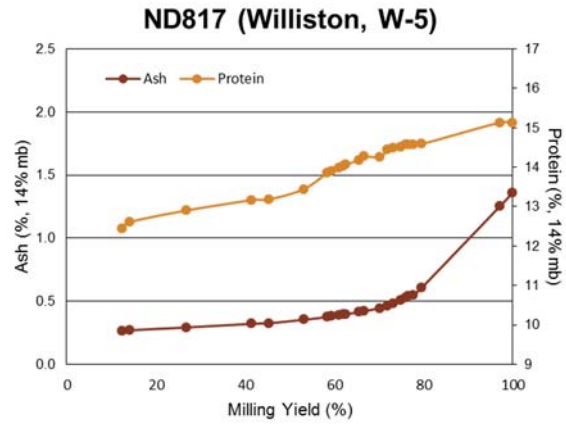
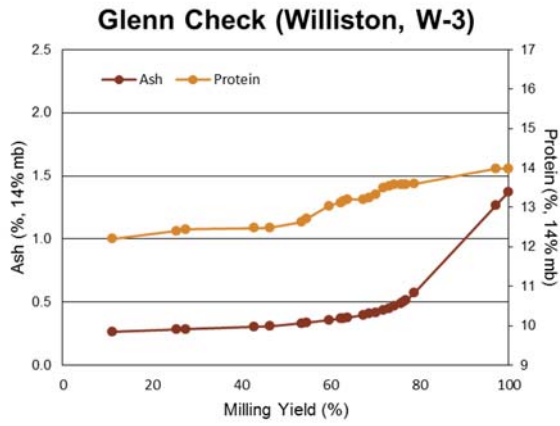
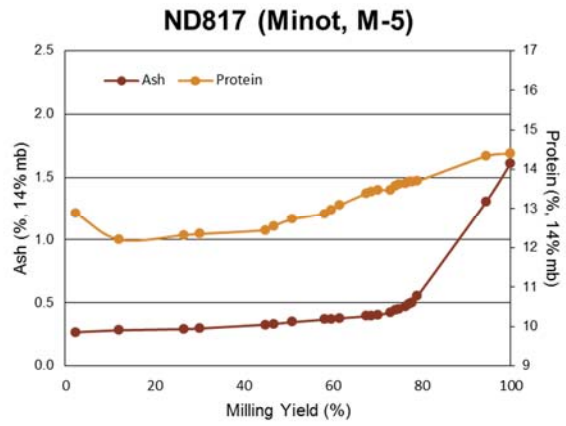
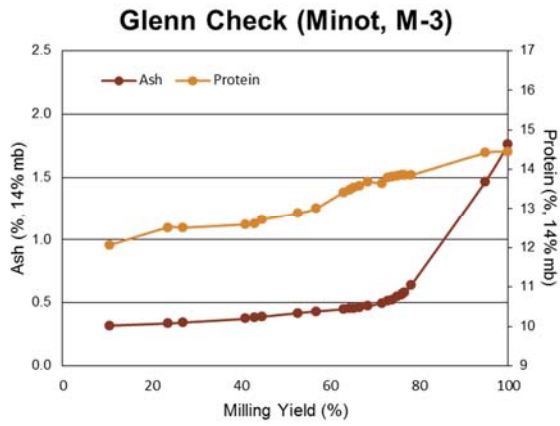
Quality Trait	Watertown		Casselton		Crookston		Minot		Williston		
	Glenn B-3	B-5	Glenn C-3	C-5	Glenn K-3	K-5	Glenn M-3	M-5	Glenn W-3	W-5	
<b>I. USDA-ARS WQL Data</b>											
1	Wheat Protein (% , 12% mb)	15.1	14.1	14.3	14.8	13.1	13.0	14.6	14.6	14.4	15.2
2	Flour Protein (% , 12% mb)	14.0	13.3	13.5	13.4	12.3	12.1	14.1	13.8	13.6	14.3
3	Market Value (Score 1-6)	3.6	4.1	4.5	4.5	4.3	4.2	3.7	3.5	4.7	4.5
4	Market Value (Score 1-10)	10.0	9.4	10.0	9.6	10.0	9.6	10.0	9.6	10.0	9.6
5	DON (ppm)	1.27	0.65	0.54	nd	nd	nd	2.14	1.01	nd	nd
6	Test Weight (lb/bu)	62.1	61.4	63.4	61.6	65.2	63.8	62.0	60.5	63.2	61.3
7	1000 Kernel Weight (g)	34.4	33.8	34.4	36.0	31.9	31.2	31.8	30.4	28.4	27.8
8	Kernel Size, % Large	75	80	70	84	60	72	69	70	29	37
9	Kernel Size, % Small	5	4	6	3	7	6	7	7	14	13
10	Wheat Moisture (%)	11.7	11.7	11.1	12.2	10.7	10.2	11.3	10.9	10.6	10.6
11	Wheat Ash (% , 14% mb)	1.64	1.50	1.66	1.49	1.45	1.24	2.05	1.64	1.27	1.26
12	Wheat Falling Number (sec)	272	375	398	380	416	397	370	355	428	438
13	SKCS Hardness Index	87.3	83.2	78.2	75.0	95.7	88.8	79.8	81.4	84.7	84.6
14	Vitreous Kernels (%)	88.2	64.6	66.4	58.4	94.6	78.7	85.5	51.9	96.3	86.2
<b>Flour Extraction (%)</b>											
15	Tempered Wheat Basis (%)	69.7	71.6	71.8	72.6	70.9	72.2	71.0	72.5	71.2	71.0
16	Total Product Basis (%)	71.2	74.1	73.2	74.8	72.3	73.0	73.9	74.9	73.2	73.2
17	Flour/Bu Wheat (lbs)	44.2	45.5	46.4	46.1	47.2	46.6	45.8	45.3	46.3	44.9
<b>Flour Quality</b>											
18	Flour Color Brightness (L*)	89.5	89.8	89.6	89.6	90.1	90.2	89.7	89.7	90.4	90.0
19	Flour Color Yellowness (b*)	8.0	8.4	8.1	8.6	8.1	9.2	8.0	8.8	8.8	9.6
20	Flour Moisture (%)	13.4	13.7	12.9	13.7	13.6	13.2	13.5	13.0	13.1	13.1
21	Flour Ash (% , 14% mb)	0.49	0.47	0.51	0.48	0.47	0.43	0.51	0.44	0.46	0.45
22	Flour Falling Number (Malted) (sec)	252	250	254	253	250	249	251	250	250	254
<b>Farinograph</b>											
23	Water Absorption (% , 500 BU)	65.7	66.1	65.5	67.6	66.3	66.0	64.9	66.1	62.9	67.0
24	Water Absorption (% , 14% mb)	65.0	65.7	64.2	67.2	65.8	65.1	64.3	64.9	61.9	66.0
25	Arrival Time (min)	2.1	2.5	3.0	2.5	2.2	2.3	4.0	4.1	2.4	3.3
26	Peak Time (min)	4.0	6.8	8.2	6.5	5.5	5.3	8.0	7.4	7.2	7.9
27	Dough Stability (min)	7.0	9.4	10.1	7.9	10.8	8.3	9.0	8.2	10.2	11.4
28	Mixing Tolerance Index (MTI) (BU)	30.0	28.0	29.0	40.0	23.0	27.0	34.0	32.0	31.0	24.0
29	Time To Breakdown (TTB) (min)	8.6	12.0	12.3	10.1	12.6	10.6	12.6	12.1	12.1	13.6
<b>II. Cooperator Results</b>											
30	Bake Absorption (Average %)	66.2	66.0	65.7	66.3	65.8	65.2	65.8	66.5	64.2	66.9
31	Loaf Volume (% of Check)		98.8		99.2		100.7		97.3		101.4

## SWQAC #5 - ND817

Quality Trait	Watertown		Casselton		Crookston		Minot		Williston	
	Glenn B-3	B-5	Glenn C-3	C-5	Glenn K-3	K-5	Glenn M-3	M-5	Glenn W-3	W-5
<b>II. Cooperator Results</b>										
32	<b>Mixing Requirement</b> 5 = Very Long 4 = Long 3 = Medium 2 = Short 1 = Very Short									
	3.6	3.5	3.7	2.8	3.8	3.4	3.8	3.4	4.3	4.0
33	<b>Dough Characteristics</b> 5 = Bucky – Tough 4 = Strong – Elastic 3 = Medium – Pliable 2 = Mellow – Very Pliable 1 = Weak – Short or Sticky									
	3.6	3.4	3.9	3.5	3.6	3.7	3.7	3.5	4.4	4.3
34	<b>Mixing Tolerance</b> 5 = Much More Tolerance Than Check 4 = More Tolerance Than Check 3 = Tolerance Equivalent To Check 2 = Less Tolerance Than Check 1 = Much Less Tolerance Than Check									
		2.9		2.2		2.2		2.5		2.9
35	<b>Internal Crumb Color</b> 5 = Much Brighter Than Check 4 = Brighter Than Check 3 = Equivalent To Check 2 = Poorer Than Check 1 = Much Poorer Than Check									
		3.3		3.0		2.8		2.7		2.6
36	<b>Internal Grain and Texture</b> 5 = Much Better Than Check 4 = Better Than Check 3 = Equivalent To Check 2 = Poorer Than Check 1 = Much Poorer Than Check									
		3.1		2.9		3.1		3.0		2.9
<b>III. Cooperator Evaluation</b>										
	<b>Quality Traits 1-2: Protein</b> 5 = Much Better Than Check 4 = Better Than Check 3 = Equivalent To Check 2 = Poorer Than Check 1 = Much Poorer Than Check									
		2.1		3.1		2.9		2.8		3.9
	<b>Quality Traits 3-22: Milling</b> 5 = Much Better Than Check 4 = Better Than Check 3 = Equivalent To Check 2 = Poorer Than Check 1 = Much Poorer Than Check									
		3.7		3.4		3.3		3.2		2.9
	<b>Quality Traits 23-36: Baking</b> 5 = Much Better Than Check 4 = Better Than Check 3 = Equivalent To Check 2 = Poorer Than Check 1 = Much Poorer Than Check									
		3.1		2.8		3.1		2.9		3.1
	<b>Quality Traits 1-36: Overall Comparison</b> 5 = Much Better Than Check 4 = Better Than Check 3 = Equivalent To Check 2 = Poorer Than Check 1 = Much Poorer Than Check									
		2.8		2.8		3.0		2.8		3.1

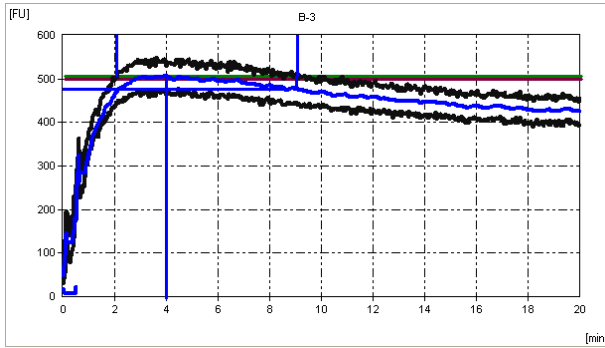
# Cumulative Ash and Protein Curves



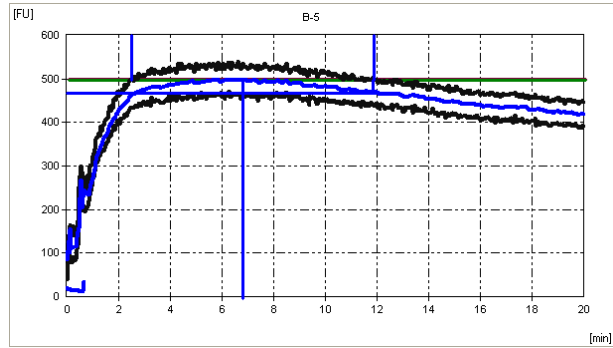


# Farinograms

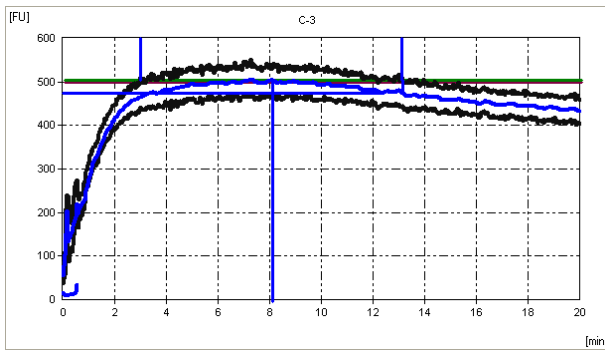
Glenn Check (Watertown, B-3)



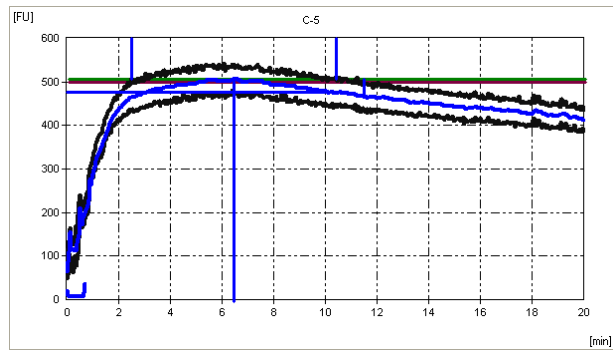
ND817 (Watertown, B-5)



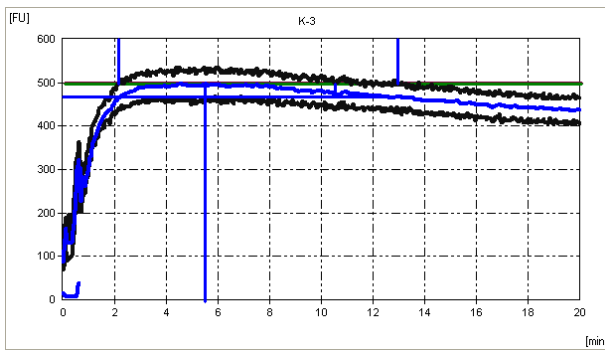
Glenn Check (Casselton, C-3)



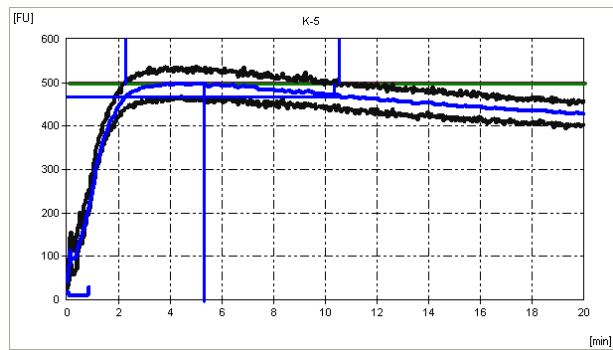
ND817 (Casselton, C-5)



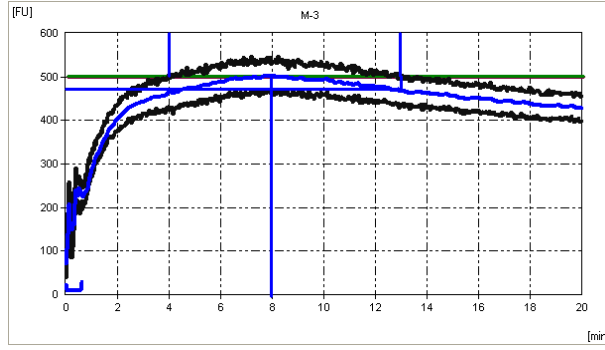
Glenn Check (Crookston, K-3)



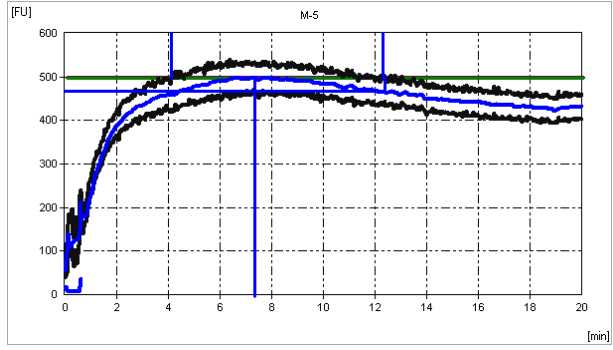
ND817 (Crookston, K-5)



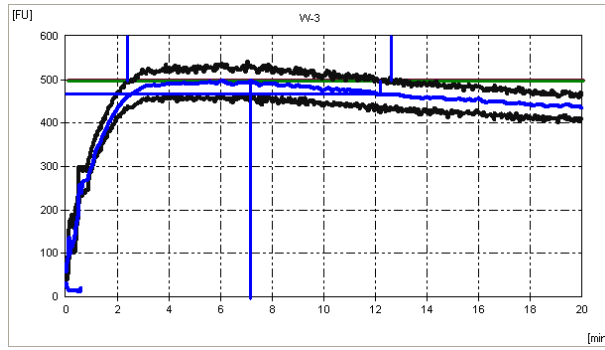
**Glenn Check (Minot, M-3)**



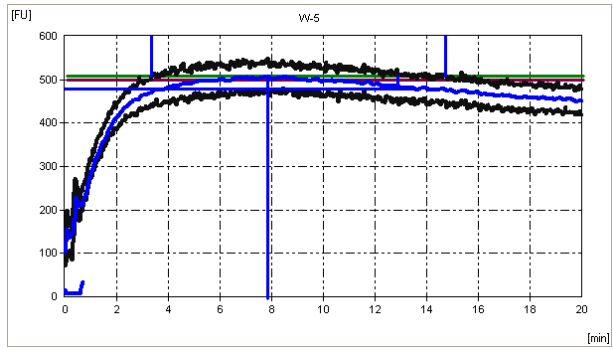
**ND817 (Minot, M-5)**



**Glenn Check (Williston, W-3)**



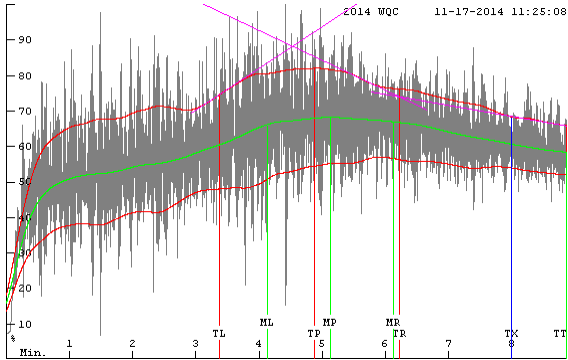
**ND817 (Williston, W-5)**



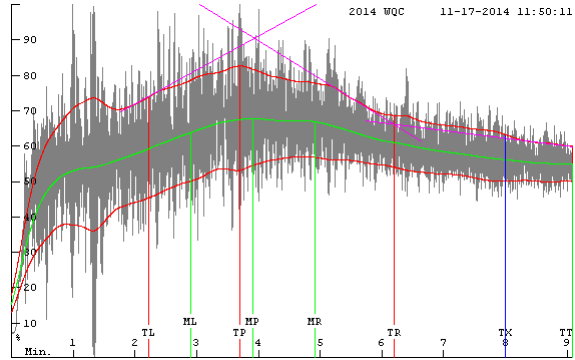


# Mixograms

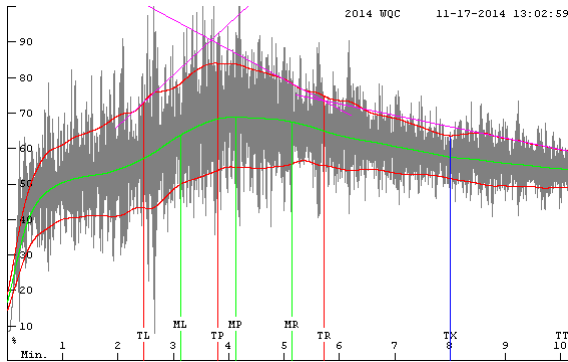
**Glenn Check (Watertown, B-3)**



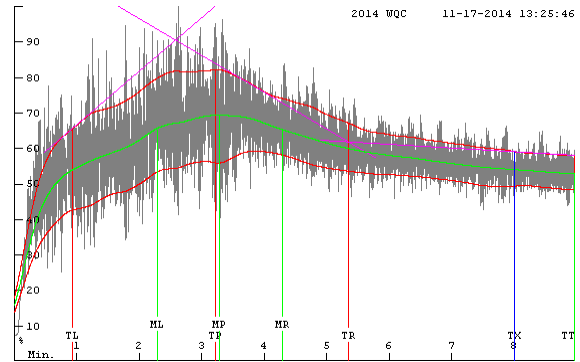
**ND817 (Watertown, B-5)**



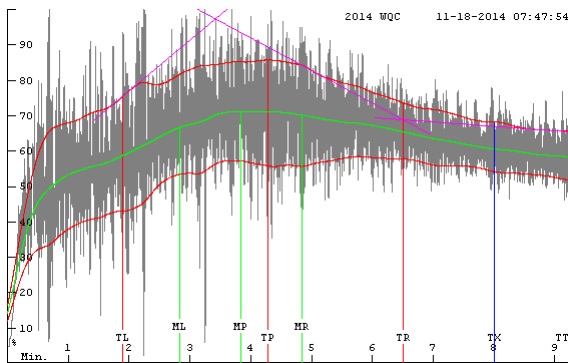
**Glenn Check (Casselton, C-3)**



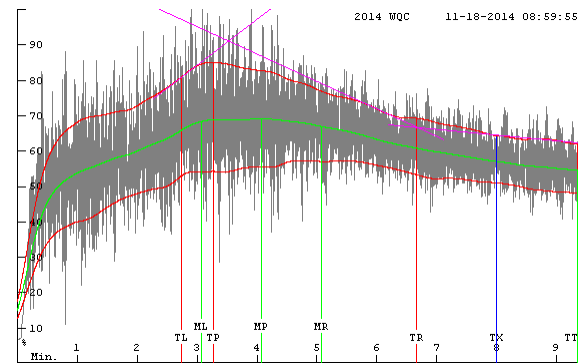
**ND817 (Casselton, C-5)**



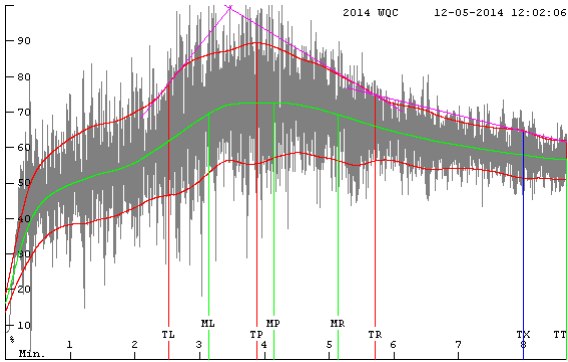
**Glenn Check (Crookston, K-3)**



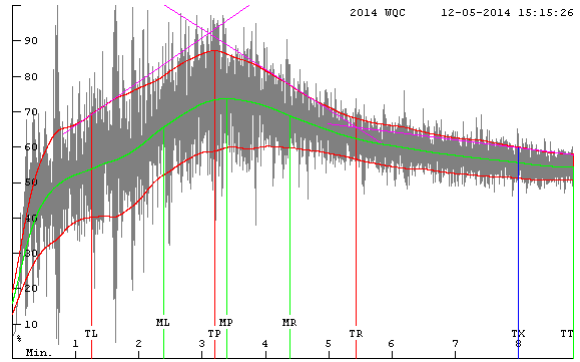
**ND817 (Crookston, K-5)**



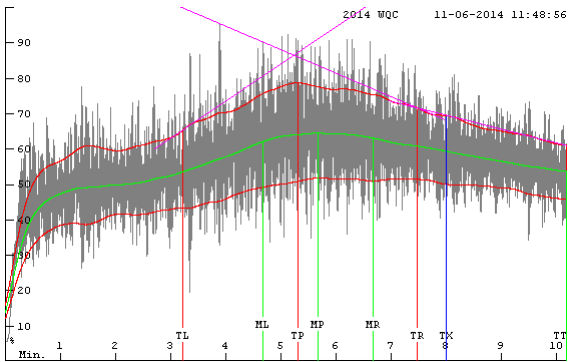
**Glenn Check (Minot, M-3)**



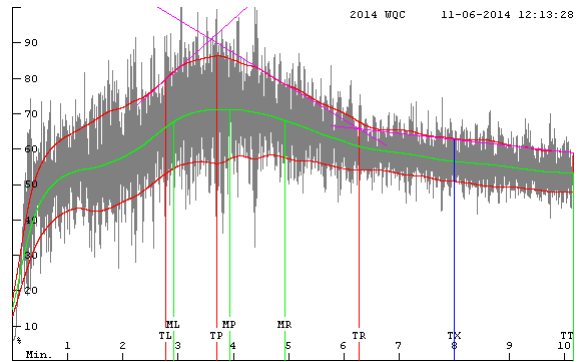
**ND817 (Minot, M-5)**



**Glenn Check (Williston, W-3)**

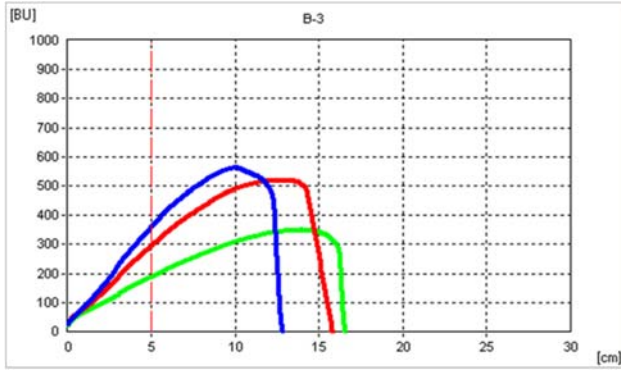


**ND817 (Williston, W-5)**

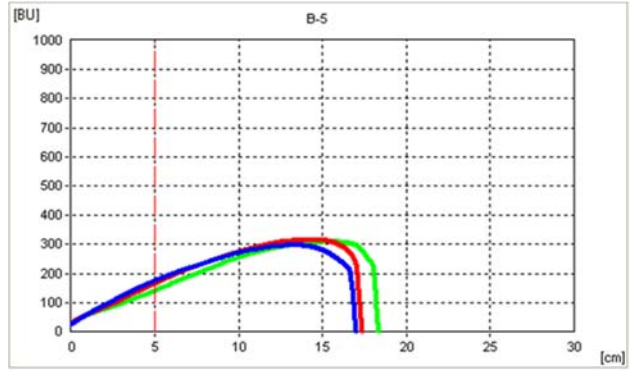


# Extensograms

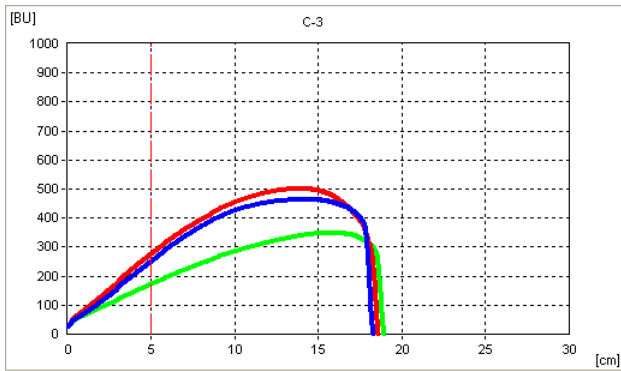
Glenn Check (Watertown, B-3)



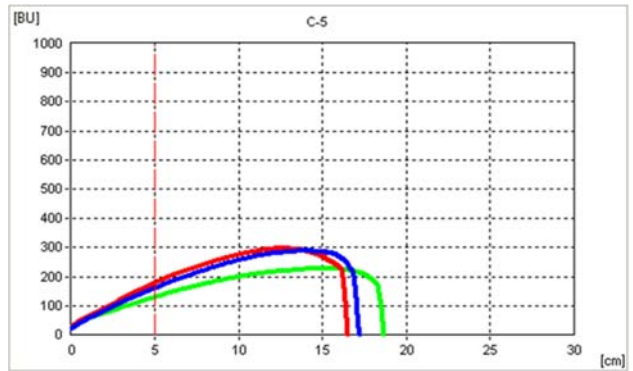
ND817 (Watertown, B-5)



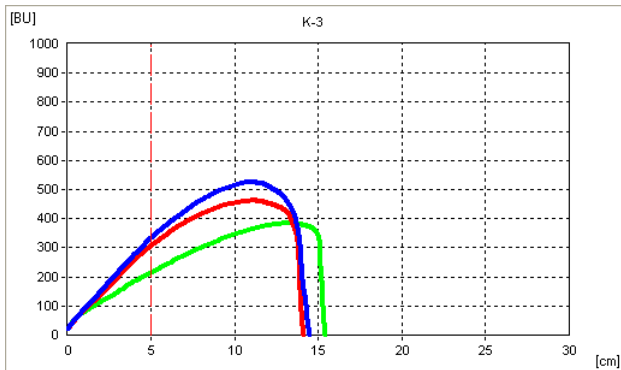
Glenn Check (Casselton, C-3)



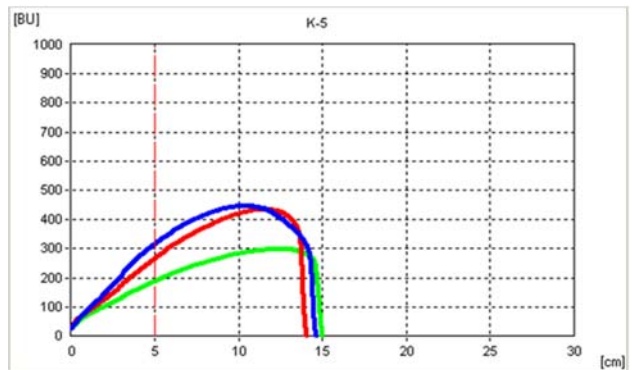
ND817 (Casselton, C-5)



Glenn Check (Crookston, K-3)

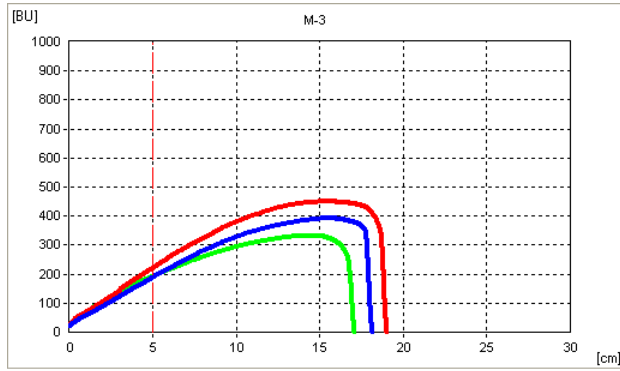


ND817 (Crookston, K-5)

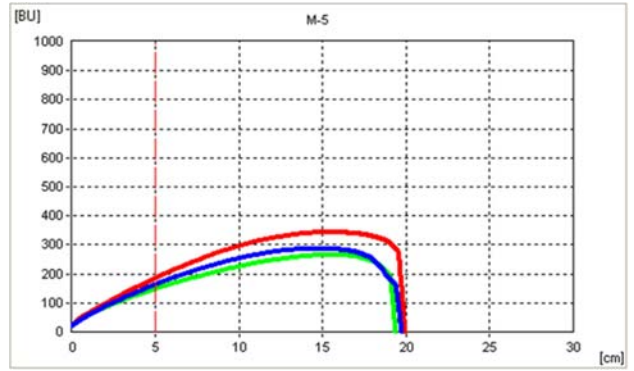


— 45 min; — 90 min; — 135 min

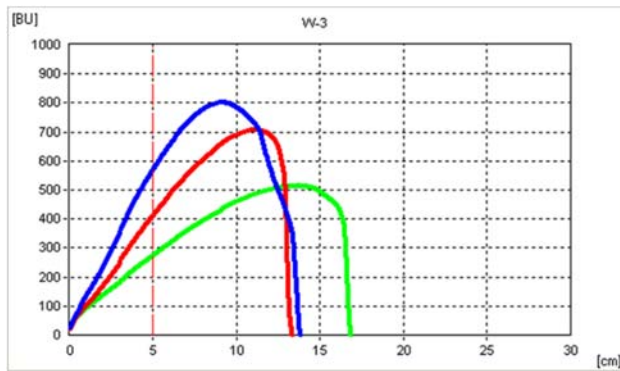
**Glenn Check (Minot, M-3)**



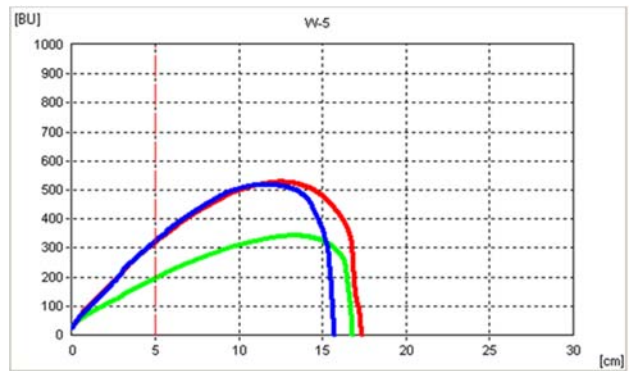
**ND817 (Minot, M-5)**



**Glenn Check (Williston, W-3)**



**ND817 (Williston, W-5)**



— 45 min; — 90 min; — 135 min

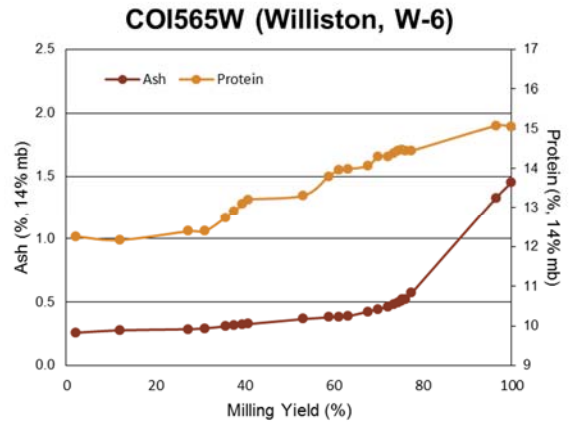
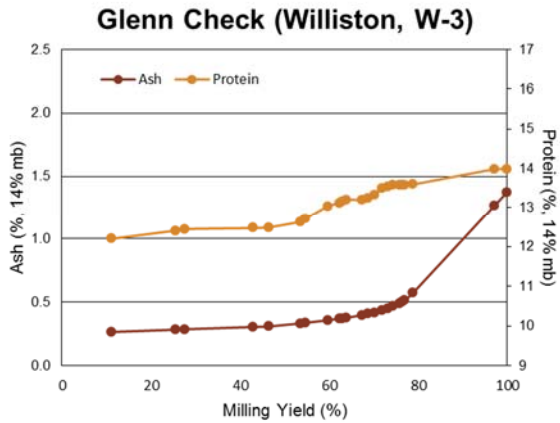
## SWQAC #6 - COI565W

	Quality Trait	Minot		Williston	
		Glenn M-3	M-6	Glenn W-3	W-6
<b>I. USDA-ARS WQL Data</b>					
1	Wheat Protein (% , 12% mb)	14.6	13.4	14.4	15.0
2	Flour Protein (% , 12% mb)	14.1	n/a	13.6	14.5
3	Market Value (Score 1-6)	3.7	1.6	4.7	3.4
4	Market Value (Score 1-10)	10.0	4.0	10.0	6.2
5	DON (ppm)	2.14	12.20	nd	nd
6	Test Weight (lb/bu)	62.0	53.6	63.2	59.8
7	1000 Kernel Weight (g)	31.8	27.1	28.4	32.5
8	Kernel Size, % Large	69	38	29	38
9	Kernel Size, % Small	7	17	14	13
10	Wheat Moisture (%)	11.3	9.7	10.6	10.4
11	Wheat Ash (% , 14% mb)	2.05	1.70	1.27	1.40
12	Wheat Falling Number (sec)	370	242	428	295
13	SKCS Hardness Index	79.8	47.9	84.7	54.0
14	Vitreous Kernels (%)	85.5	15.4	96.3	40.5
<b>Flour Extraction (%)</b>					
15	Tempered Wheat Basis (%)	71.0	n/a	71.2	69.6
16	Total Product Basis (%)	73.9	n/a	73.2	73.7
17	Flour/Bu Wheat (lbs)	45.8	n/a	46.3	44.1
<b>Flour Quality</b>					
18	Flour Color Brightness ( <i>L</i> *)	89.7	n/a	90.4	90.3
19	Flour Color Yellowness ( <i>b</i> *)	8.0	n/a	8.8	9.0
20	Flour Moisture (%)	13.5	n/a	13.1	12.9
21	Flour Ash (% , 14% mb)	0.51	n/a	0.46	0.47
22	Flour Falling Number (Malted) (sec)	251	n/a	250	262
<b>Farinograph</b>					
23	Water Absorption (% , 500 BU)	64.9	n/a	62.9	59.2
24	Water Absorption (% , 14% mb)	64.3	n/a	61.9	57.9
25	Arrival Time (min)	4.0	n/a	2.4	1.8
26	Peak Time (min)	8.0	n/a	7.2	6.2
27	Dough Stability (min)	9.0	n/a	10.2	18.3
28	Mixing Tolerance Index (MTI) (BU)	34.0	n/a	31.0	14.0
29	Time To Breakdown (TTB) (min)	12.6	n/a	12.1	15.3
<b>II. Cooperator Results</b>					
30	Bake Absorption (Average %)	65.8	n/a	64.2	62.7
31	Loaf Volume (% of Check)		n/a		99.8

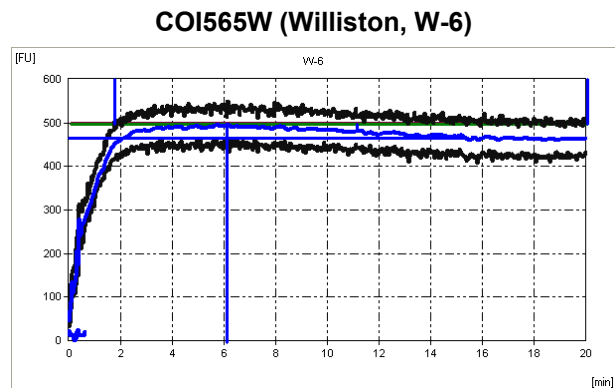
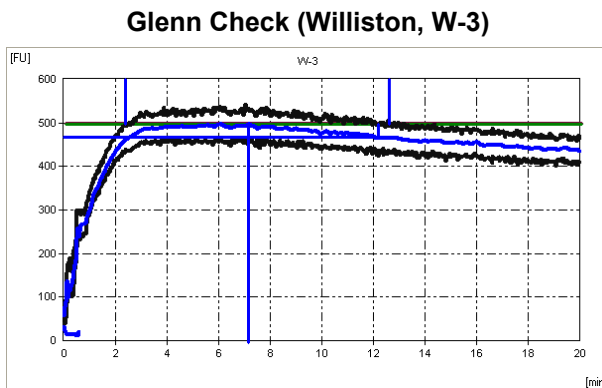
## SWQAC #6 - COI565W

Quality Trait	Minot		Williston			
	Glenn M-3	M-6	Glenn W-3	W-6		
<b>II. Cooperator Results</b>						
32	<b>Mixing Requirement</b> 5 = Very Long 4 = Long 3 = Medium 2 = Short 1 = Very Short		3.8	n/a	4.3	4.7
33	<b>Dough Characteristics</b> 5 = Bucky – Tough 4 = Strong – Elastic 3 = Medium – Pliable 2 = Mellow – Very Pliable 1 = Weak – Short or Sticky		3.7	n/a	4.4	4.5
34	<b>Mixing Tolerance</b> 5 = Much More Tolerance Than Check 4 = More Tolerance Than Check 3 = Tolerance Equivalent To Check 2 = Less Tolerance Than Check 1 = Much Less Tolerance Than Check			n/a		3.3
35	<b>Internal Crumb Color</b> 5 = Much Brighter Than Check 4 = Brighter Than Check 3 = Equivalent To Check 2 = Poorer Than Check 1 = Much Poorer Than Check			n/a		2.8
36	<b>Internal Grain and Texture</b> 5 = Much Better Than Check 4 = Better Than Check 3 = Equivalent To Check 2 = Poorer Than Check 1 = Much Poorer Than Check			n/a		2.9
<b>III. Cooperator Evaluation</b>						
	<b>Quality Traits 1-2: Protein</b> 5 = Much Better Than Check 4 = Better Than Check 3 = Equivalent To Check 2 = Poorer Than Check 1 = Much Poorer Than Check			n/a		3.9
	<b>Quality Traits 3-22: Milling</b> 5 = Much Better Than Check 4 = Better Than Check 3 = Equivalent To Check 2 = Poorer Than Check 1 = Much Poorer Than Check			n/a		2.5
	<b>Quality Traits 23-36: Baking</b> 5 = Much Better Than Check 4 = Better Than Check 3 = Equivalent To Check 2 = Poorer Than Check 1 = Much Poorer Than Check			n/a		2.6
	<b>Quality Traits 1-36: Overall Comparison</b> 5 = Much Better Than Check 4 = Better Than Check 3 = Equivalent To Check 2 = Poorer Than Check 1 = Much Poorer Than Check			n/a		2.6

## Cumulative Ash and Protein Curves

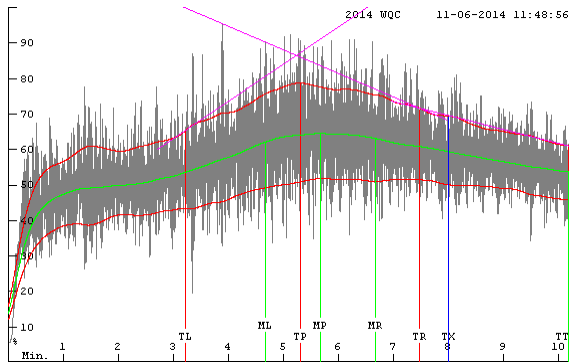


## Farinograms

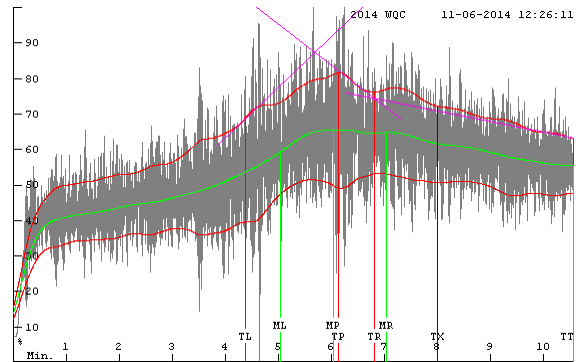


## Mixograms

Glenn Check (Williston, W-3)

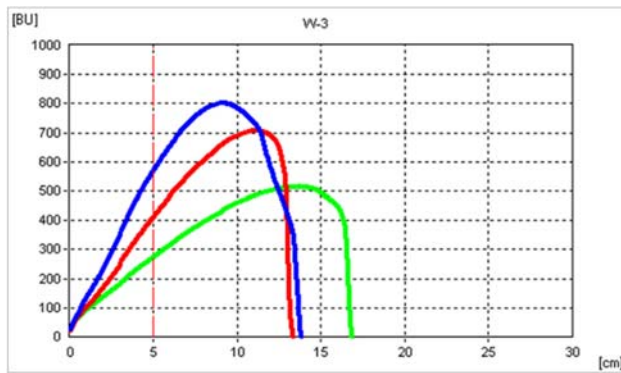


COI565W (Williston, W-6)

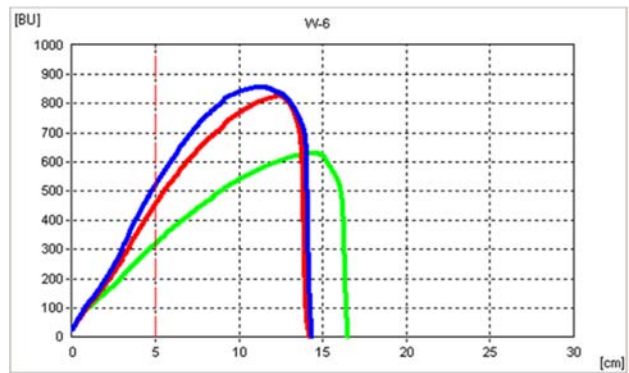


## Extensograms

Glenn Check (Williston, W-3)



COI565W (Williston, W-6)



— 45 min; — 90 min; — 135 min



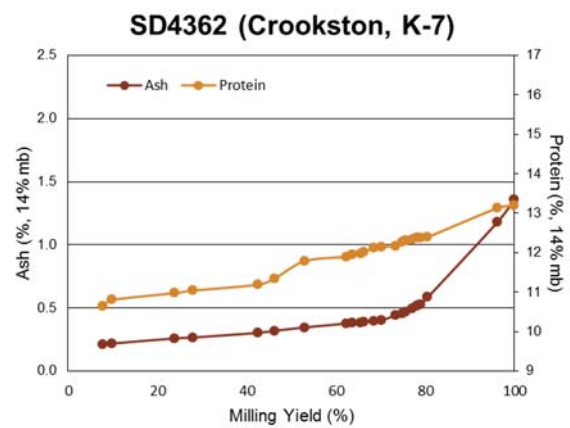
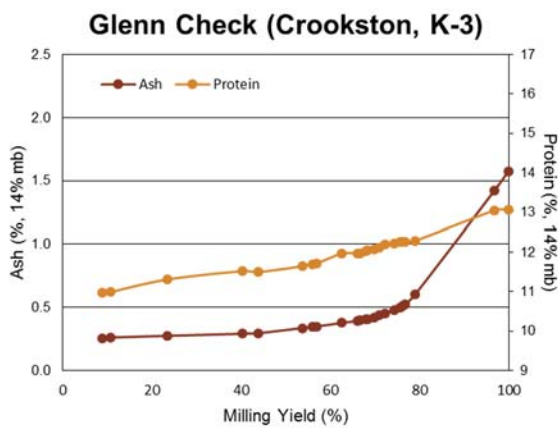
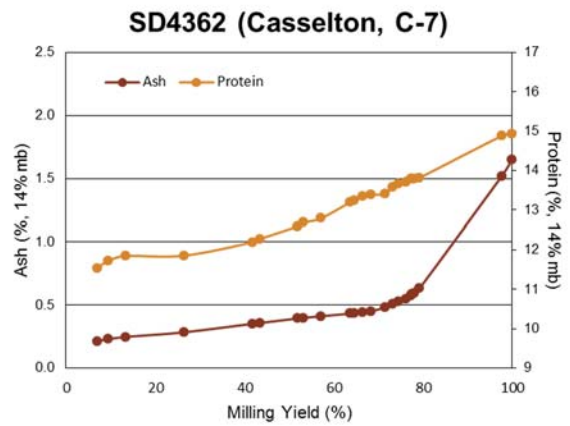
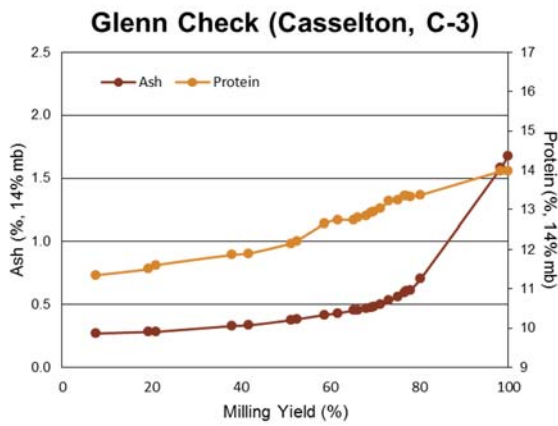
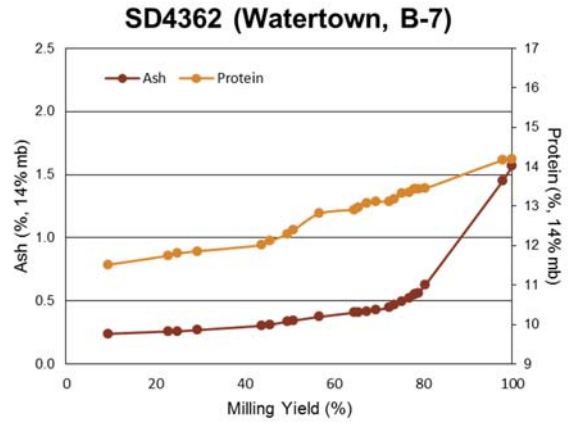
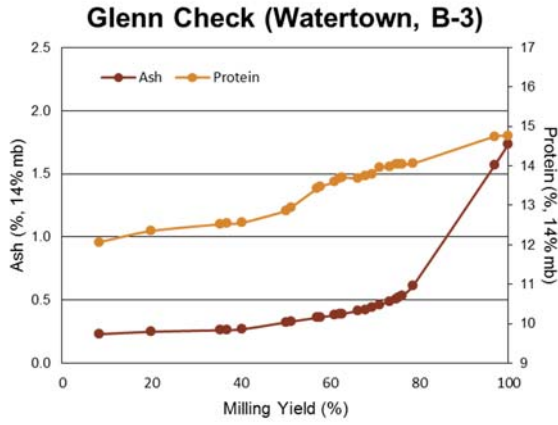
## SWQAC #7 - SD4362

Quality Trait	Watertown		Casselton		Crookston		
	Glenn B-3	B-7	Glenn C-3	C-7	Glenn K-3	K-7	
<b>I. USDA-ARS WQL Data</b>							
1	Wheat Protein (% , 12% mb)	15.1	14.1	14.3	15.5	13.1	13.5
2	Flour Protein (% , 12% mb)	14.0	13.4	13.5	14.0	12.3	12.6
3	Market Value (Score 1-6)	3.6	3.5	4.5	3.8	4.3	4.3
4	Market Value (Score 1-10)	10.0	8.6	10.0	8.0	10.0	9.2
5	DON (ppm)	1.27	0.67	0.54	0.36	nd	nd
6	Test Weight (lb/bu)	62.1	60.4	63.4	60.9	65.2	63.5
7	1000 Kernel Weight (g)	34.4	31.3	34.4	32.2	31.9	31.4
8	Kernel Size, % Large	75	63	70	74	60	62
9	Kernel Size, % Small	5	8	6	6	7	8
10	Wheat Moisture (%)	11.7	11.7	11.1	12.4	10.7	10.6
11	Wheat Ash (% , 14% mb)	1.64	1.53	1.66	1.69	1.45	1.27
12	Wheat Falling Number (sec)	272	356	398	346	416	384
13	SKCS Hardness Index	87.3	70.2	78.2	61.0	95.7	74.5
14	Vitreous Kernels (%)	88.2	70.5	66.4	60.0	94.6	69.9
<b>Flour Extraction (%)</b>							
15	Tempered Wheat Basis (%)	69.7	73.2	71.8	71.2	70.9	73.0
16	Total Product Basis (%)	71.2	75.3	73.2	74.5	72.3	75.7
17	Flour/Bu Wheat (lbs)	44.2	45.5	46.4	45.3	47.2	48.1
<b>Flour Quality</b>							
18	Flour Color Brightness ( $L^*$ )	89.5	89.1	89.6	89.0	90.1	89.5
19	Flour Color Yellowness ( $b^*$ )	8.0	9.0	8.1	8.8	8.1	9.1
20	Flour Moisture (%)	13.4	13.5	12.9	13.6	13.6	13.9
21	Flour Ash (% , 14% mb)	0.49	0.54	0.51	0.52	0.47	0.51
22	Flour Falling Number (Malted) (sec)	252	262	254	253	250	253
<b>Farinograph</b>							
23	Water Absorption (% , 500 BU)	65.7	62.2	65.5	63.5	66.3	62.6
24	Water Absorption (% , 14% mb)	65.0	61.6	64.2	63.0	65.8	62.5
25	Arrival Time (min)	2.1	3.0	3.0	4.2	2.2	3.9
26	Peak Time (min)	4.0	7.5	8.2	8.0	5.5	7.4
27	Dough Stability (min)	7.0	9.5	10.1	7.4	10.8	7.5
28	Mixing Tolerance Index (MTI) (BU)	30.0	32.0	29.0	39.0	23.0	38.0
29	Time To Breakdown (TTB) (min)	8.6	11.9	12.3	11.8	12.6	11.5
<b>II. Cooperator Results</b>							
30	Bake Absorption (Average %)	66.2	63.5	65.7	64.7	65.8	63.5
31	Loaf Volume (% of Check)		100.8		99.3		104.8

## SWQAC #7 - SD4362

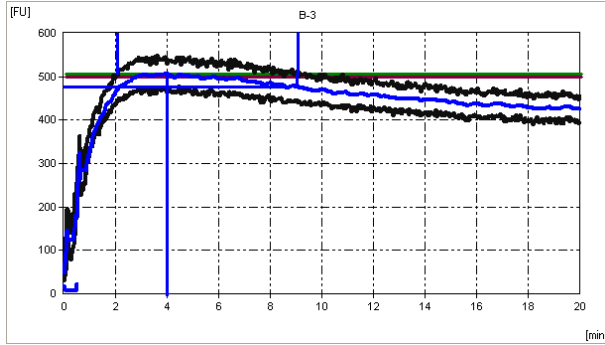
Quality Trait	Watertown		Casselton		Crookston	
	Glenn B-3	B-7	Glenn C-3	C-7	Glenn K-3	K-7
<b>II. Cooperator Results</b>						
32	<b>Mixing Requirement</b> 5 = Very Long 4 = Long 3 = Medium 2 = Short 1 = Very Short					
	3.6	3.7	3.7	3.4	3.8	3.4
33	<b>Dough Characteristics</b> 5 = Bucky – Tough 4 = Strong – Elastic 3 = Medium – Pliable 2 = Mellow – Very Pliable 1 = Weak – Short or Sticky					
	3.6	3.4	3.9	3.1	3.6	3.4
34	<b>Mixing Tolerance</b> 5 = Much More Tolerance Than Check 4 = More Tolerance Than Check 3 = Tolerance Equivalent To Check 2 = Less Tolerance Than Check 1 = Much Less Tolerance Than Check					
		3.2		2.6		2.2
35	<b>Internal Crumb Color</b> 5 = Much Brighter Than Check 4 = Brighter Than Check 3 = Equivalent To Check 2 = Poorer Than Check 1 = Much Poorer Than Check					
		3.4		3.3		3.3
36	<b>Internal Grain and Texture</b> 5 = Much Better Than Check 4 = Better Than Check 3 = Equivalent To Check 2 = Poorer Than Check 1 = Much Poorer Than Check					
		3.2		3.3		3.2
<b>III. Cooperator Evaluation</b>						
<b>Quality Traits 1-2: Protein</b>						
		2.1		3.8		3.4
<b>Quality Traits 3-22: Milling</b>						
		3.8		2.7		3.8
<b>Quality Traits 23-36: Baking</b>						
		3.1		3.1		3.3
<b>Quality Traits 1-36: Overall Comparison</b>						
		2.9		3.0		3.2

## Cumulative Ash and Protein Curves

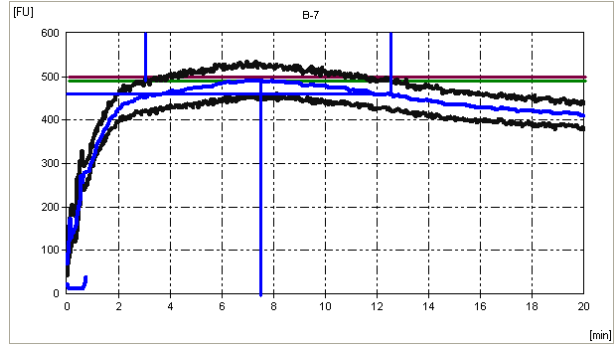


# Farinograms

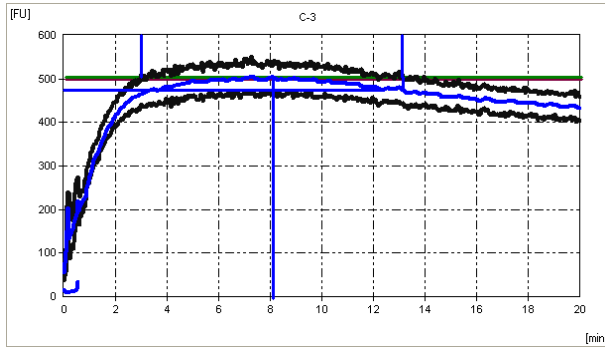
Glenn Check (Watertown, B-3)



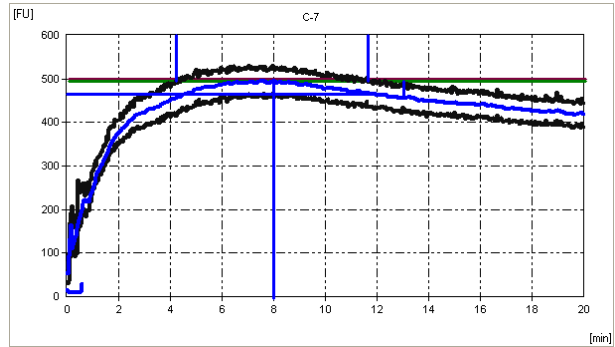
SD4362 (Watertown, B-7)



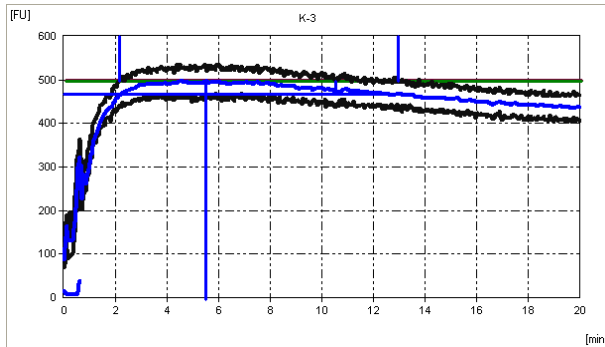
Glenn Check (Casselton, C-3)



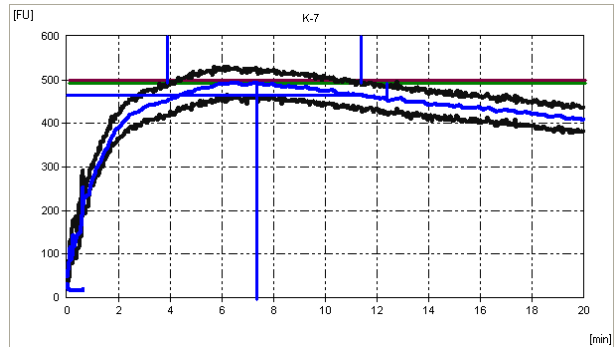
SD4362 (Casselton, C-7)



Glenn Check (Crookston, K-3)

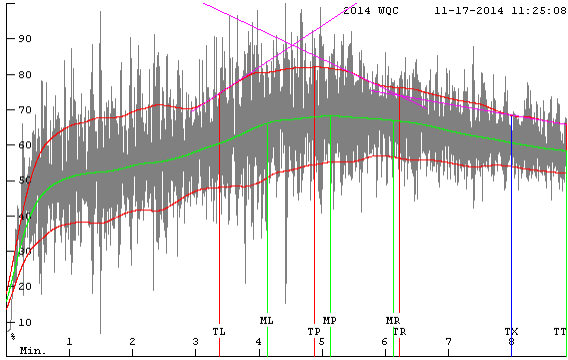


SD4362 (Crookston, K-7)

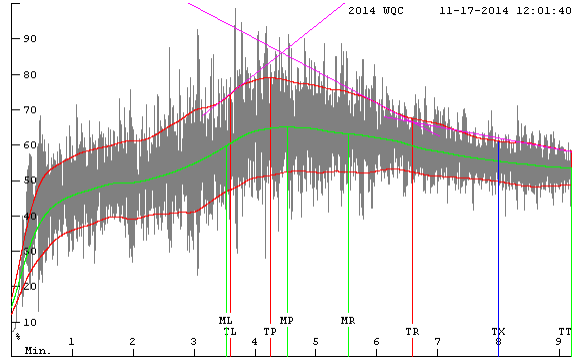


# Mixograms

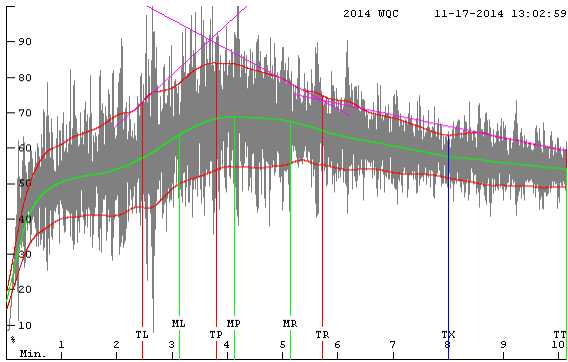
**Glenn Check (Watertown, B-3)**



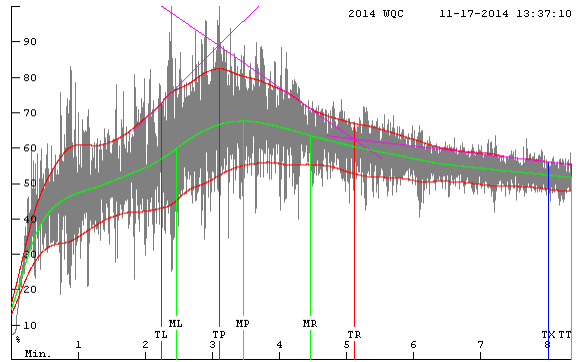
**SD4362 (Watertown, B-7)**



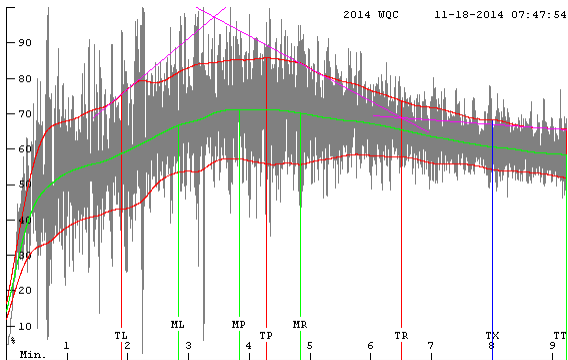
**Glenn Check (Casselton, C-3)**



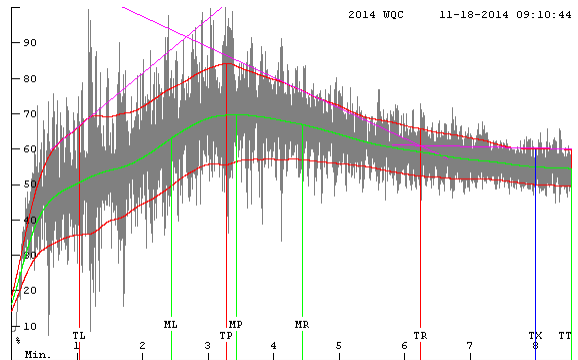
**SD4362 (Casselton, C-7)**



**Glenn Check (Crookston, K-3)**

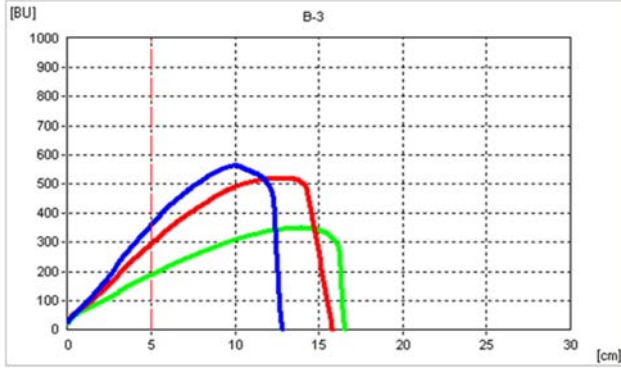


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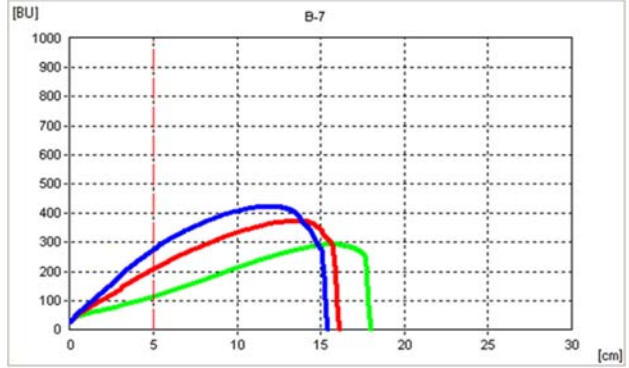


# Extensograms

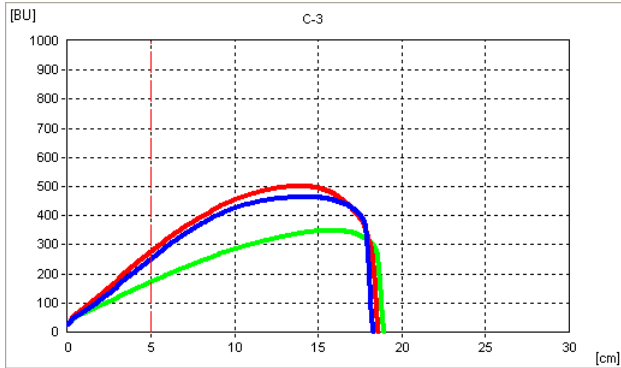
Glenn Check (Watertown, B-3)



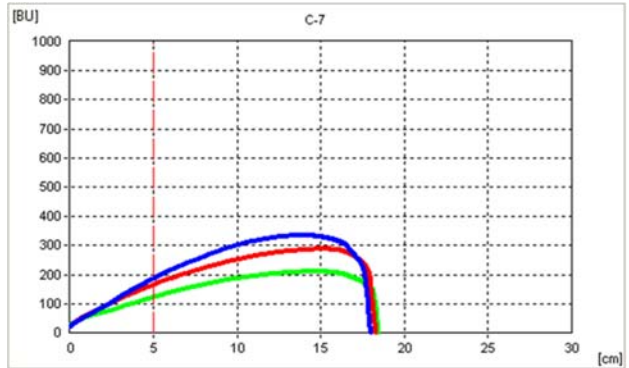
SD4362 (Watertown, B-7)



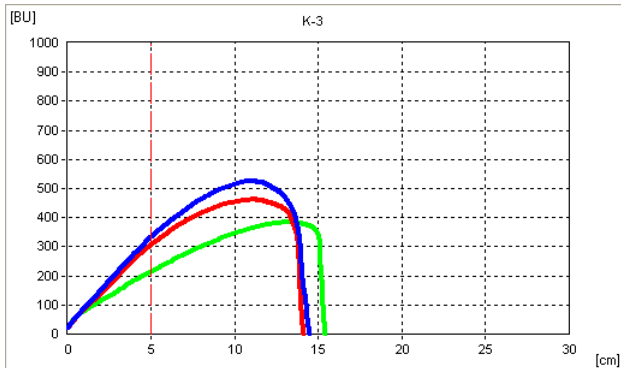
Glenn Check (Casselton, C-3)



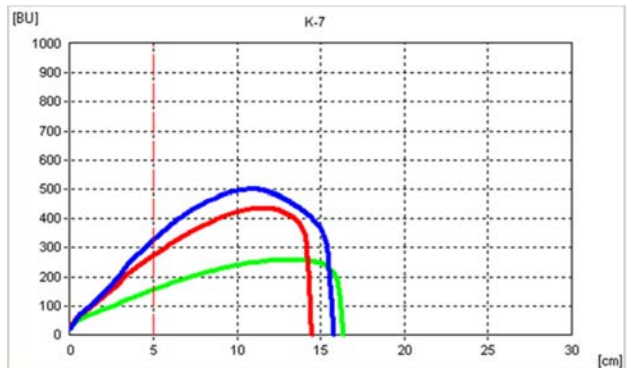
SD4362 (Casselton, C-7)



Glenn Check (Crookston, K-3)



SD4362 (Crookston, K-7)



— 45 min; — 90 min; — 135 min

## SWQAC #8 - AUBR30023W

Quality Trait	Minot		Williston		
	Glenn M-3	M-8	Glenn W-3	W-8	
<b>I. USDA-ARS WQL Data</b>					
1	Wheat Protein (% <sup>12</sup> mb)	14.6	14.7	14.4	13.6
2	Flour Protein (% <sup>12</sup> mb)	14.1	14.1	13.6	13.0
3	Market Value (Score 1-6)	3.7	1.6	4.7	3.5
4	Market Value (Score 1-10)	10.0	5.2	10.0	7.8
5	DON (ppm)	2.14	3.71	nd	nd
6	Test Weight (lb/bu)	62.0	53.1	63.2	60.9
7	1000 Kernel Weight (g)	31.8	23.6	28.4	29.3
8	Kernel Size, % Large	69	28	29	32
9	Kernel Size, % Small	7	26	14	16
10	Wheat Moisture (%)	11.3	9.8	10.6	10.4
11	Wheat Ash (% <sup>14</sup> mb)	2.05	1.99	1.27	1.28
12	Wheat Falling Number (sec)	370	280	428	357
13	SKCS Hardness Index	79.8	59.4	84.7	67.8
14	Vitreous Kernels (%)	85.5	12.6	96.3	69.9
<b>Flour Extraction (%)</b>					
15	Tempered Wheat Basis (%)	71.0	74.6	71.2	70.9
16	Total Product Basis (%)	73.9	71.6	73.2	78.3*
17	Flour/Bu Wheat (lbs)	45.8	38.0	46.3	47.7
<b>Flour Quality</b>					
18	Flour Color Brightness ( <i>L</i> *)	89.7	89.6	90.4	90.7
19	Flour Color Yellowness ( <i>b</i> *)	8.0	10.3	8.8	10.3
20	Flour Moisture (%)	13.5	12.6	13.1	12.5
21	Flour Ash (% <sup>14</sup> mb)	0.51	0.58	0.46	0.44
22	Flour Falling Number (Malted) (sec)	251	251	250	254
<b>Farinograph</b>					
23	Water Absorption (% <sup>500</sup> BU)	64.9	61.9	62.9	59.3
24	Water Absorption (% <sup>14</sup> mb)	64.3	60.3	61.9	57.6
25	Arrival Time (min)	4.0	3.4	2.4	2.3
26	Peak Time (min)	8.0	7.8	7.2	8.8
27	Dough Stability (min)	9.0	8.2	10.2	16.9
28	Mixing Tolerance Index (MTI) (BU)	34.0	37.0	31.0	17.0
29	Time To Breakdown (TTB) (min)	12.6	12.0	12.1	18.7
<b>II. Cooperator Results</b>					
30	Bake Absorption (Average %)	65.8	63.9	64.2	61.5
31	Loaf Volume (% of Check)		89.1		95.0

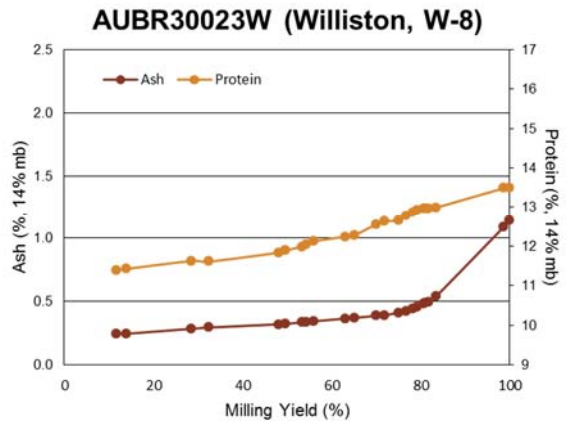
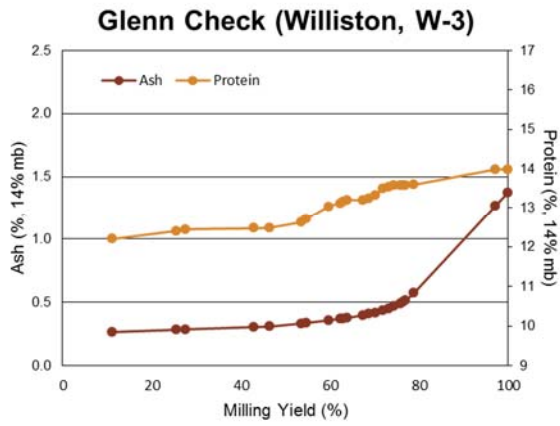
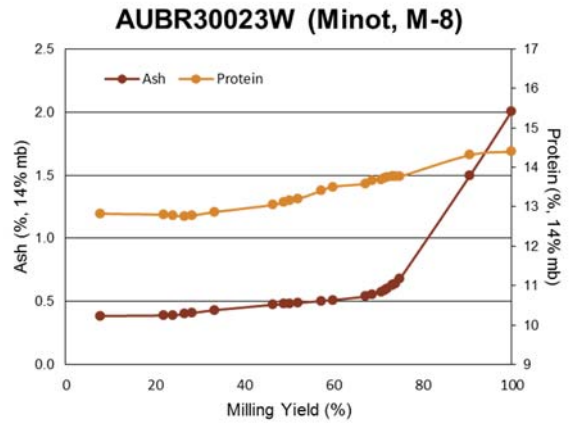
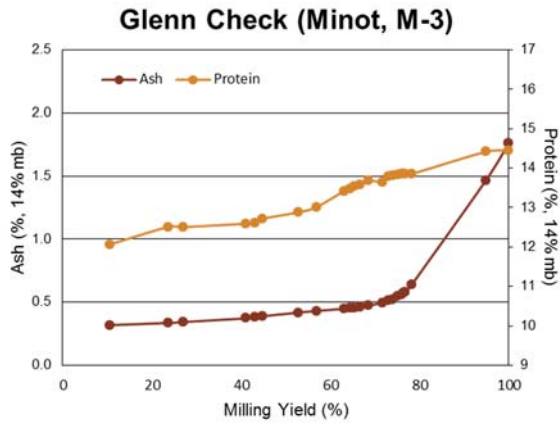
\*Choke on bran was found and cleaned during sample W-10. This affected TPB but not patent flour characteristics.

## SWQAC #8 - AUBR30023W

Quality Trait	Minot		Williston			
	Glenn M-3	M-8	Glenn W-3	W-8		
<b>II. Cooperator Results</b>						
32	<b>Mixing Requirement</b> 5 = Very Long 4 = Long 3 = Medium 2 = Short 1 = Very Short		3.8	2.9	4.3	3.9
33	<b>Dough Characteristics</b> 5 = Bucky – Tough 4 = Strong – Elastic 3 = Medium – Pliable 2 = Mellow – Very Pliable 1 = Weak – Short or Sticky		3.7	2.9	4.4	3.8
34	<b>Mixing Tolerance</b> 5 = Much More Tolerance Than Check 4 = More Tolerance Than Check 3 = Tolerance Equivalent To Check 2 = Less Tolerance Than Check 1 = Much Less Tolerance Than Check			1.7		2.8
35	<b>Internal Crumb Color</b> 5 = Much Brighter Than Check 4 = Brighter Than Check 3 = Equivalent To Check 2 = Poorer Than Check 1 = Much Poorer Than Check			1.8		2.5
36	<b>Internal Grain and Texture</b> 5 = Much Better Than Check 4 = Better Than Check 3 = Equivalent To Check 2 = Poorer Than Check 1 = Much Poorer Than Check			2.4		2.4
<b>III. Cooperator Evaluation</b>						
	<b>Quality Traits 1-2: Protein</b> 5 = Much Better Than Check 4 = Better Than Check 3 = Equivalent To Check 2 = Poorer Than Check 1 = Much Poorer Than Check			3.0		2.2
	<b>Quality Traits 3-22: Milling</b> 5 = Much Better Than Check 4 = Better Than Check 3 = Equivalent To Check 2 = Poorer Than Check 1 = Much Poorer Than Check			2.2		3.4
	<b>Quality Traits 23-36: Baking</b> 5 = Much Better Than Check 4 = Better Than Check 3 = Equivalent To Check 2 = Poorer Than Check 1 = Much Poorer Than Check			2.1		2.4
	<b>Quality Traits 1-36: Overall Comparison</b> 5 = Much Better Than Check 4 = Better Than Check 3 = Equivalent To Check 2 = Poorer Than Check 1 = Much Poorer Than Check			2.1		2.5

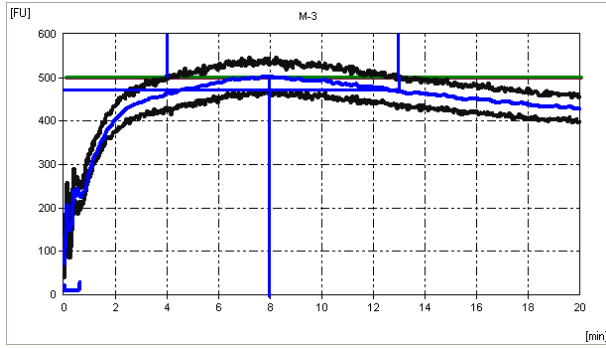


## Cumulative Ash and Protein Curves

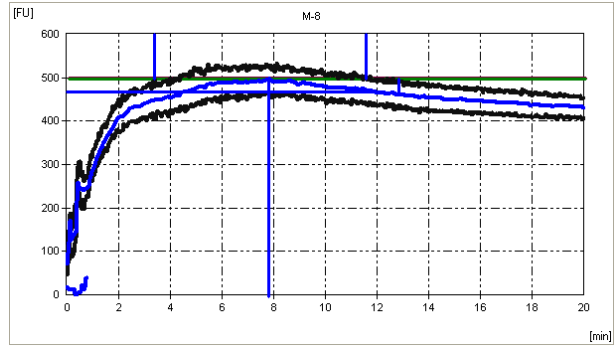


# Farinograms

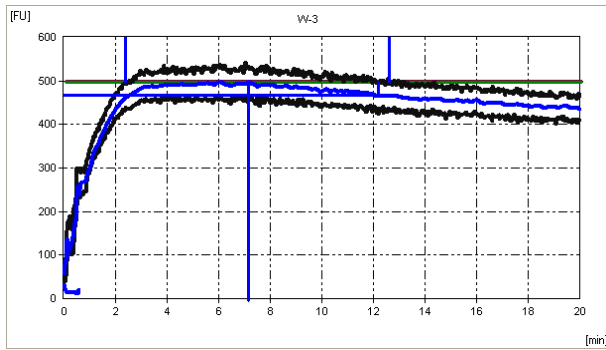
Glenn Check (Minot, M-3)



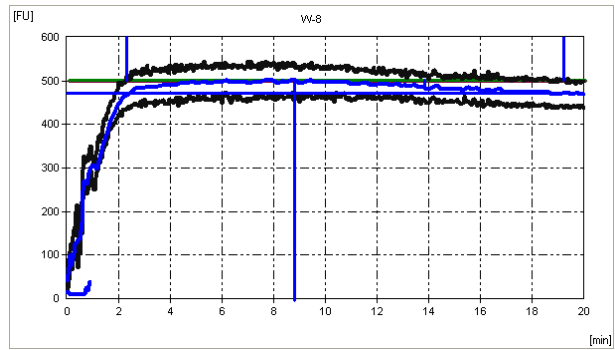
AUBR30023W (Minot, M-8)



Glenn Check (Williston, W-3)

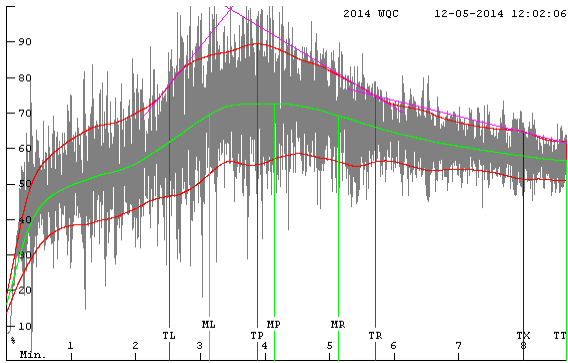


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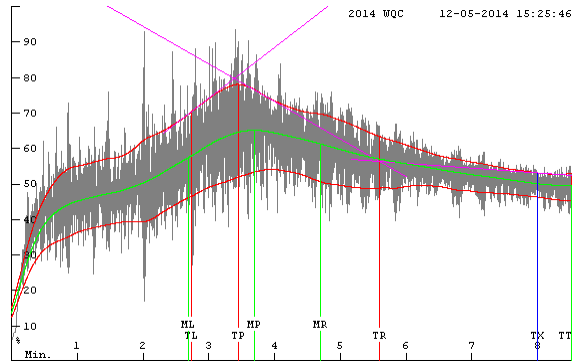


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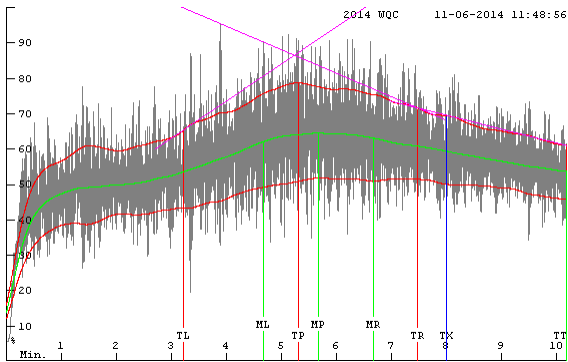
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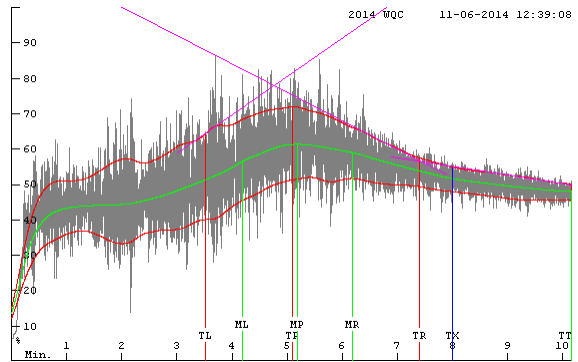
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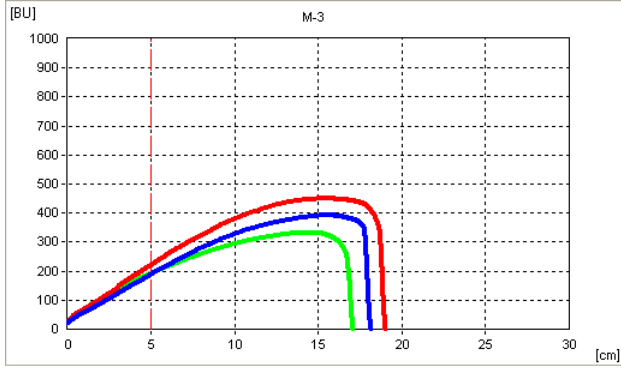


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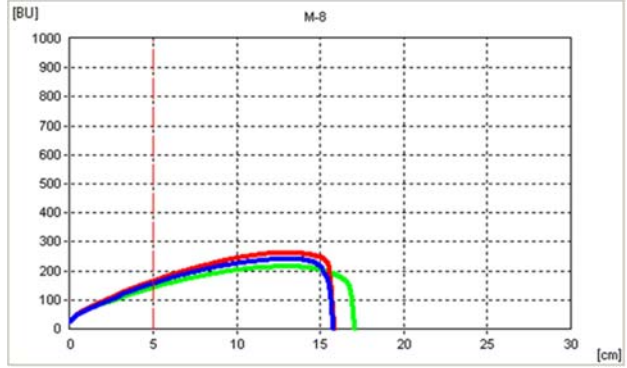


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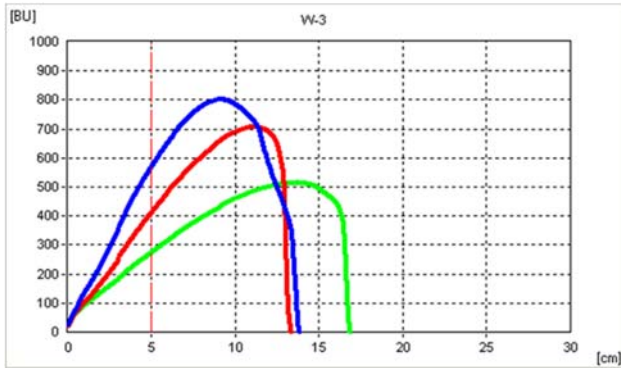
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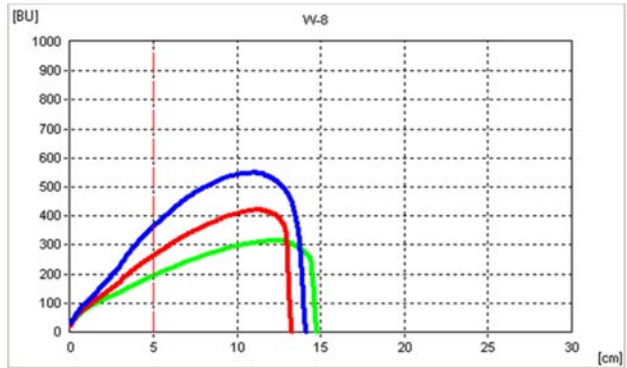
AUBR30023W (Minot, M-8)



Glenn Check (Williston, W-3)



AUBR30023W (Williston, W-8)



— 45 min; — 90 min; — 135 min

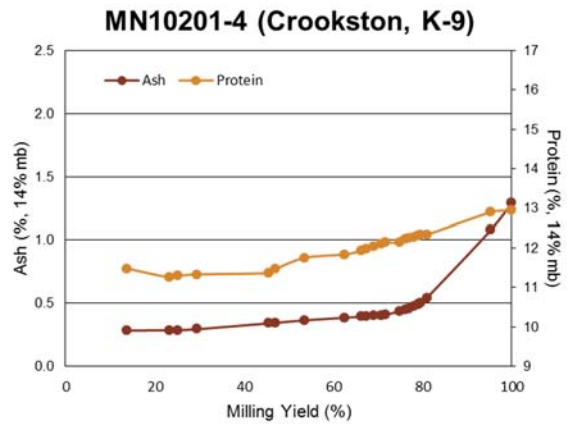
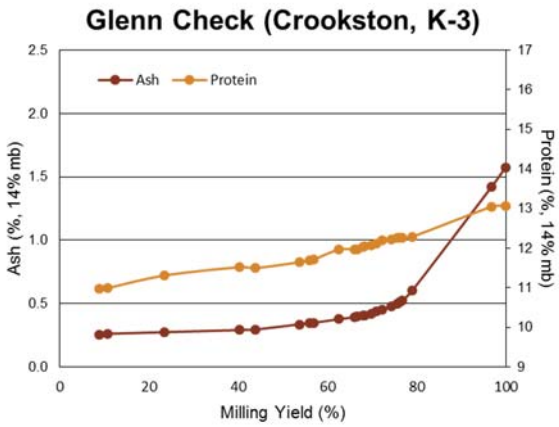
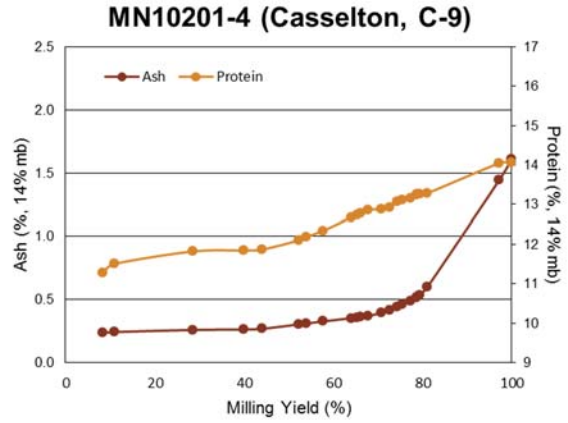
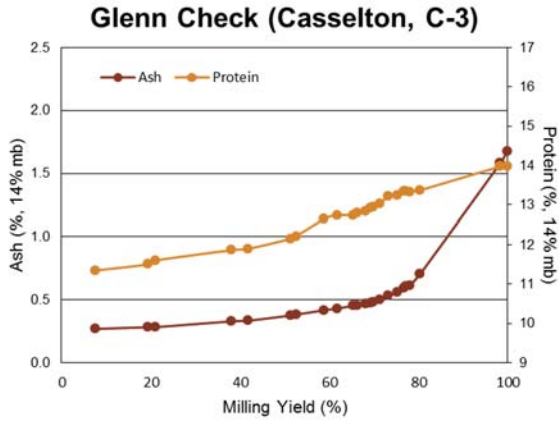
## SWQAC #9 - MN10201-4

Quality Trait	Casselton		Crookston		
	Glenn		Glenn		
	C-3	C-9	K-3	K-9	
<b>I. USDA-ARS WQL Data</b>					
1	Wheat Protein (% , 12% mb)	14.3	14.2	13.1	13.0
2	Flour Protein (% , 12% mb)	13.5	13.3	12.3	12.6
3	Market Value (Score 1-6)	4.5	4.4	4.3	4.3
4	Market Value (Score 1-10)	10.0	9.2	10.0	9.6
5	DON (ppm)	0.54	0.10	nd	nd
6	Test Weight (lb/bu)	63.4	61.1	65.2	63.6
7	1000 Kernel Weight (g)	34.4	33.7	31.9	31.6
8	Kernel Size, % Large	70	71	60	56
9	Kernel Size, % Small	6	7	7	10
10	Wheat Moisture (%)	11.1	12.2	10.7	9.1
11	Wheat Ash (% , 14% mb)	1.66	1.49	1.45	1.23
12	Wheat Falling Number (sec)	398	418	416	401
13	SKCS Hardness Index	78.2	74.3	95.7	82.5
14	Vitreous Kernels (%)	66.4	86.9	94.6	92.3
<b>Flour Extraction (%)</b>					
15	Tempered Wheat Basis (%)	71.8	74.0	70.9	75.0
16	Total Product Basis (%)	73.2	75.4	72.3	77.1
17	Flour/Bu Wheat (lbs)	46.4	46.1	47.2	49.0
<b>Flour Quality</b>					
18	Flour Color Brightness ( <i>L</i> *)	89.6	89.2	90.1	89.7
19	Flour Color Yellowness ( <i>b</i> *)	8.1	9.6	8.1	9.9
20	Flour Moisture (%)	12.9	13.4	13.6	13.4
21	Flour Ash (% , 14% mb)	0.51	0.49	0.47	0.45
22	Flour Falling Number (Malted) (sec)	254	261	250	250
<b>Farinograph</b>					
23	Water Absorption (% , 500 BU)	65.5	63.3	66.3	62.0
24	Water Absorption (% , 14% mb)	64.2	62.7	65.8	61.4
25	Arrival Time (min)	3.0	3.0	2.2	2.0
26	Peak Time (min)	8.2	7.0	5.5	6.3
27	Dough Stability (min)	10.1	9.4	10.8	10.8
28	Mixing Tolerance Index (MTI) (BU)	29.0	27.0	23.0	28.0
29	Time To Breakdown (TTB) (min)	12.3	12.3	12.6	11.6
<b>II. Cooperator Results</b>					
30	Bake Absorption (Average %)	65.7	64.4	65.8	63.7
31	Loaf Volume (% of Check)		96.2		101.9

## SWQAC #9 - MN10201-4

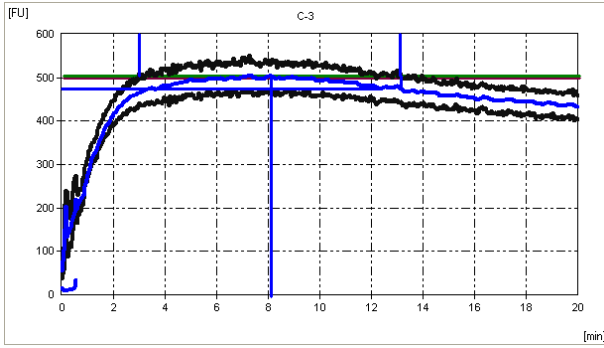
Quality Trait	Casselton		Crookston			
	Glenn		Glenn			
	C-3	C-9	K-3	K-9		
<b>II. Cooperator Results</b>						
32	<b>Mixing Requirement</b> 5 = Very Long 4 = Long 3 = Medium 2 = Short 1 = Very Short		3.7	3.5	3.8	3.8
33	<b>Dough Characteristics</b> 5 = Bucky – Tough 4 = Strong – Elastic 3 = Medium – Pliable 2 = Mellow – Very Pliable 1 = Weak – Short or Sticky		3.9	3.4	3.6	3.9
34	<b>Mixing Tolerance</b> 5 = Much More Tolerance Than Check 4 = More Tolerance Than Check 3 = Tolerance Equivalent To Check 2 = Less Tolerance Than Check 1 = Much Less Tolerance Than Check			2.8		2.9
35	<b>Internal Crumb Color</b> 5 = Much Brighter Than Check 4 = Brighter Than Check 3 = Equivalent To Check 2 = Poorer Than Check 1 = Much Poorer Than Check			2.5		2.4
36	<b>Internal Grain and Texture</b> 5 = Much Better Than Check 4 = Better Than Check 3 = Equivalent To Check 2 = Poorer Than Check 1 = Much Poorer Than Check			2.9		3.1
<b>III. Cooperator Evaluation</b>						
	<b>Quality Traits 1-2: Protein</b> 5 = Much Better Than Check 4 = Better Than Check 3 = Equivalent To Check 2 = Poorer Than Check 1 = Much Poorer Than Check			2.9		3.1
	<b>Quality Traits 3-22: Milling</b> 5 = Much Better Than Check 4 = Better Than Check 3 = Equivalent To Check 2 = Poorer Than Check 1 = Much Poorer Than Check			3.6		4.3
	<b>Quality Traits 23-36: Baking</b> 5 = Much Better Than Check 4 = Better Than Check 3 = Equivalent To Check 2 = Poorer Than Check 1 = Much Poorer Than Check			2.7		2.8
	<b>Quality Traits 1-36: Overall Comparison</b> 5 = Much Better Than Check 4 = Better Than Check 3 = Equivalent To Check 2 = Poorer Than Check 1 = Much Poorer Than Check			2.9		3.1

## Cumulative Ash and Protein Curves

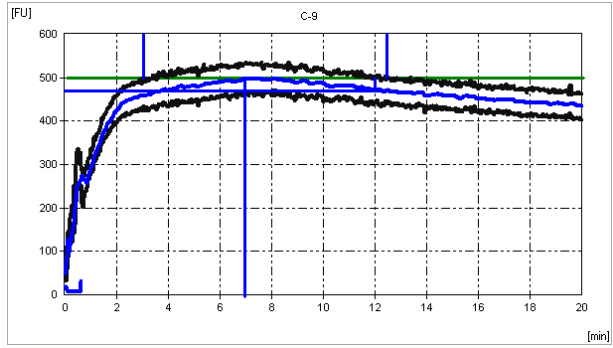


# Farinograms

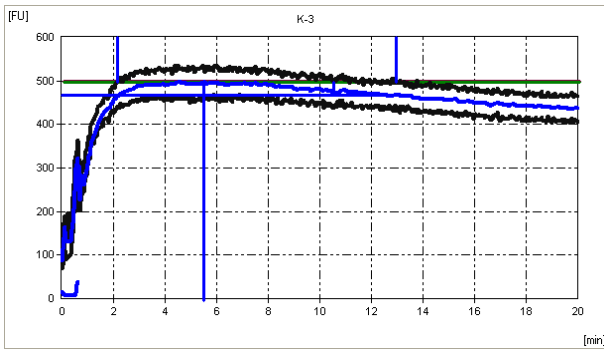
Glenn Check (Casselton, C-3)



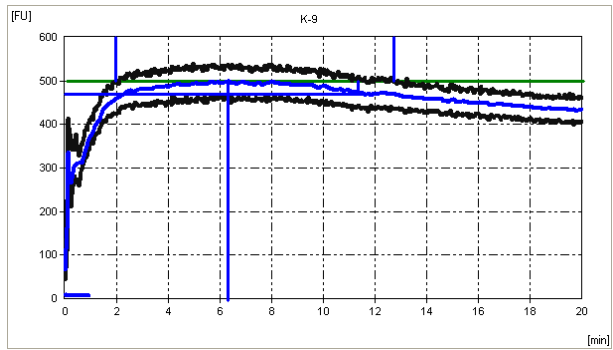
MN10201-4 (Casselton, C-9)



Glenn Check (Crookston, K-3)



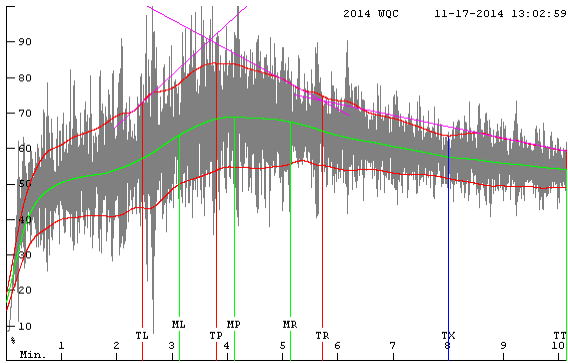
MN10201-4 (Crookston, K-9)



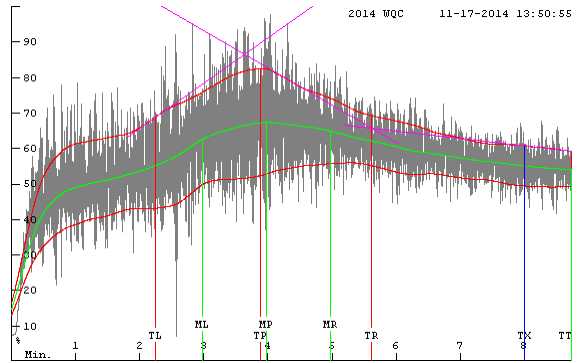


# Mixograms

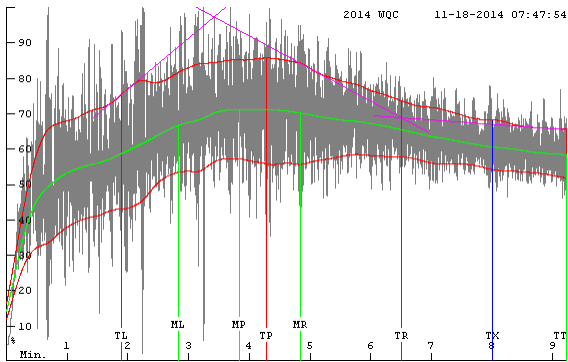
**Glenn Check (Casselton, C-3)**



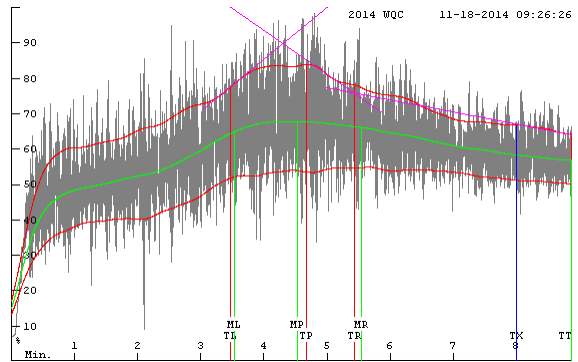
**MN10201-4 (Casselton, C-9)**



**Glenn Check (Crookston, K-3)**

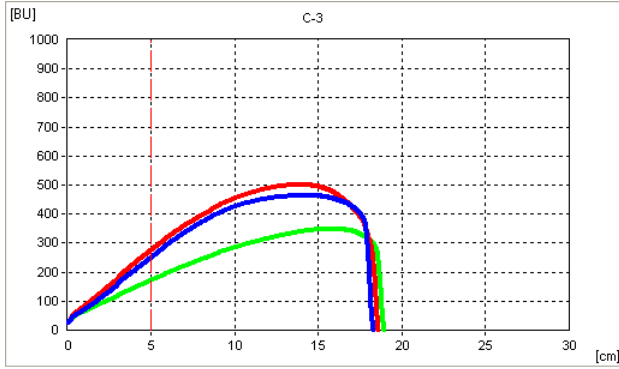


**MN10201-4 (Crookston, K-9)**

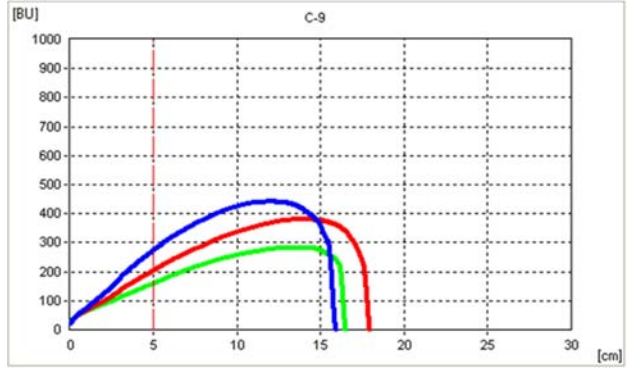


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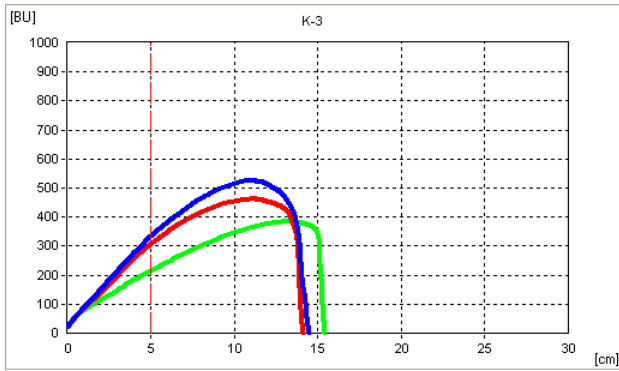
Glenn Check (Casselton, C-3)



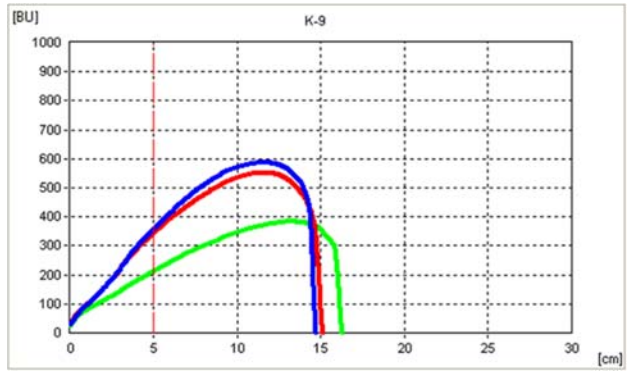
MN10201-4 (Casselton, C-9)



Glenn Check (Crookston, K-3)



MN10201-4 (Crookston, K-9)



— 45 min; — 90 min; — 135 min

## SWQAC #10 - LNR10-0493

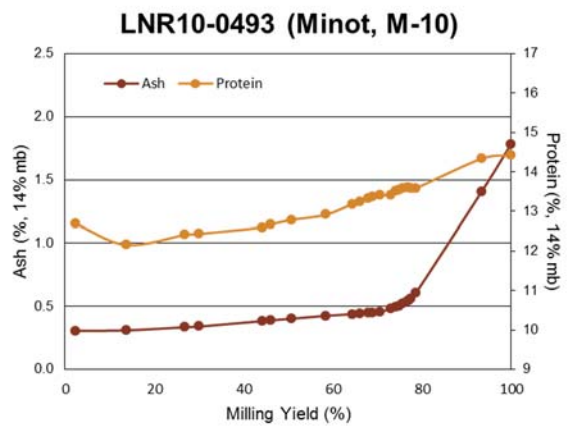
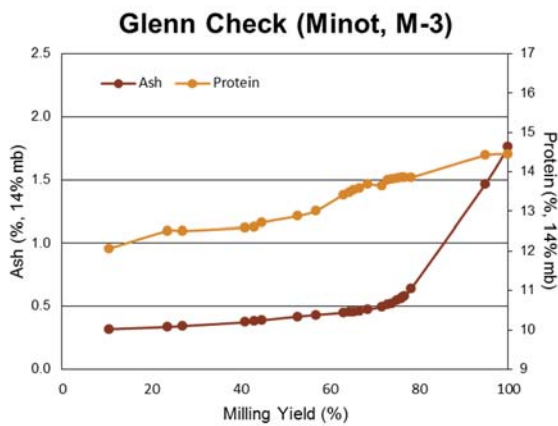
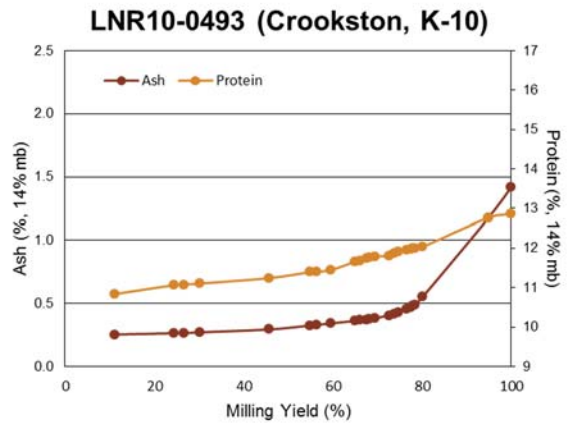
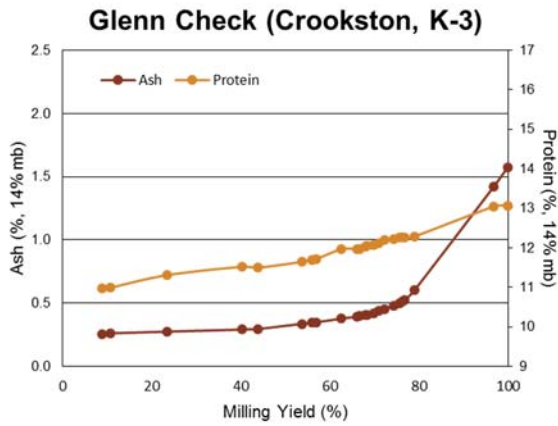
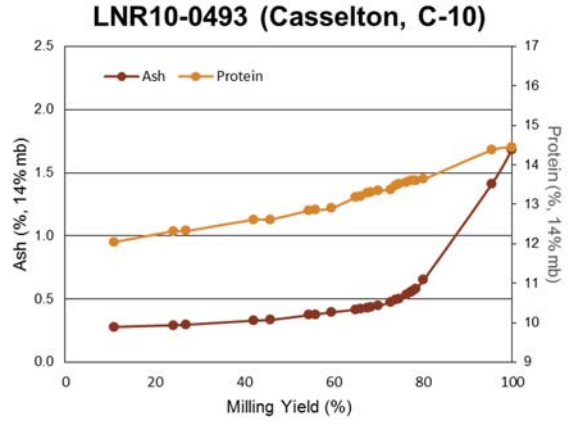
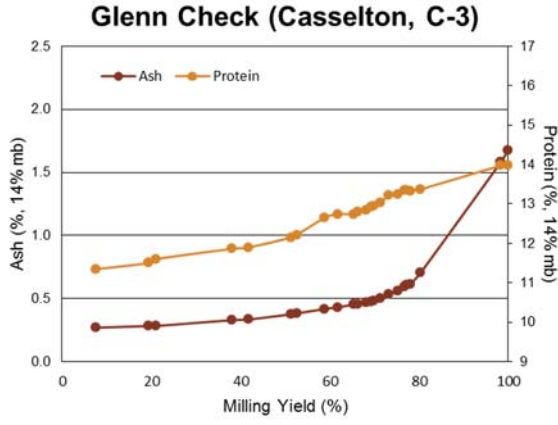
Quality Trait	Casselton		Crookston		Minot		Williston		
	Glenn C-3	C-10	Glenn K-3	K-10	Glenn M-3	M-10	Glenn W-3	W-10	
<b>I. USDA-ARS WQL Data</b>									
1	Wheat Protein (% 12% mb)	14.3	15.1	13.1	12.8	14.6	14.3	14.4	14.4
2	Flour Protein (% 12% mb)	13.5	13.7	12.3	11.9	14.1	13.7	13.6	13.6
3	Market Value (Score 1-6)	4.5	4.3	4.3	4.5	3.7	3.1	4.7	4.2
4	Market Value (Score 1-10)	10.0	8.4	10.0	10.0	10.0	8.8	10.0	8.8
5	DON (ppm)	0.54	1.85	nd	nd	2.14	4.65	nd	nd
6	Test Weight (lb/bu)	63.4	61.3	65.2	64.5	62.0	59.8	63.2	59.5
7	1000 Kernel Weight (g)	34.4	38.5	31.9	35.7	31.8	31.9	28.4	32.2
8	Kernel Size, % Large	70	65	60	80	69	70	29	45
9	Kernel Size, % Small	6	4	7	4	7	6	14	9
10	Wheat Moisture (%)	11.1	12.2	10.7	9.7	11.3	10.5	10.6	10.5
11	Wheat Ash (% 14% mb)	1.66	1.65	1.45	1.34	2.05	1.78	1.27	1.33
12	Wheat Falling Number (sec)	398	351	416	400	370	339	428	423
13	SKCS Hardness Index	78.2	73.3	95.7	86.1	79.8	78.6	84.7	80.6
14	Vitreous Kernels (%)	66.4	81.3	94.6	77.4	85.5	67.1	96.3	87.3
<b>Flour Extraction (%)</b>									
15	Tempered Wheat Basis (%)	71.8	72.5	70.9	72.6	71.0	72.7	71.2	72.0
16	Total Product Basis (%)	73.2	74.8	72.3	74.6	73.9	74.8	73.2	68.8*
17	Flour/Bu Wheat (lbs)	46.4	45.8	47.2	48.1	45.8	44.7	46.3	40.9
<b>Flour Quality</b>									
18	Flour Color Brightness (L*)	89.6	89.2	90.1	89.6	89.7	89.2	90.4	90.1
19	Flour Color Yellowness (b*)	8.1	9.0	8.1	9.8	8.0	9.6	8.8	10.0
20	Flour Moisture (%)	12.9	13.8	13.6	14.0	13.5	13.1	13.1	12.3
21	Flour Ash (% 14% mb)	0.51	0.52	0.47	0.43	0.51	0.50	0.46	0.43
22	Flour Falling Number (Malted) (sec)	254	259	250	249	251	255	250	258
<b>Farinograph</b>									
23	Water Absorption (% 500 BU)	65.5	67.2	66.3	65.0	64.9	64.8	62.9	65.1
24	Water Absorption (% 14% mb)	64.2	67.0	65.8	65.0	64.3	63.8	61.9	63.2
25	Arrival Time (min)	3.0	3.8	2.2	1.7	4.0	3.2	2.4	3.3
26	Peak Time (min)	8.2	7.0	5.5	2.7	8.0	7.7	7.2	6.4
27	Dough Stability (min)	10.1	8.0	10.8	7.9	9.0	9.3	10.2	10.1
28	Mixing Tolerance Index (MTI) (BU)	29.0	33.0	23.0	20.0	34.0	30.0	31.0	20.0
29	Time To Breakdown (TTB) (min)	12.3	11.9	12.6	9.3	12.6	12.4	12.1	12.6
<b>II. Cooperator Results</b>									
30	Bake Absorption (Average %)	65.7	66.6	65.8	64.9	65.8	65.5	64.2	65.3
31	Loaf Volume (% of Check)		97.9		99.1		93.9		98.6

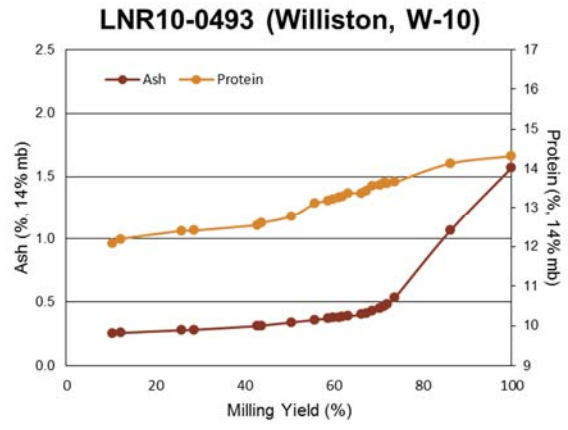
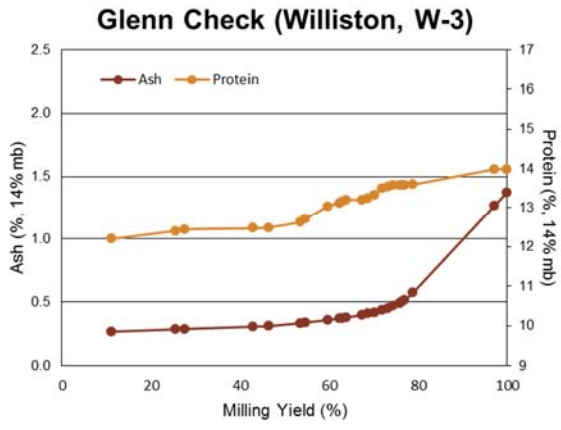
\*Choke on bran was found and cleaned during sample W-10. Bran may be from W-10 and W-8. This affected TPB but not patent flour characteristics.

# SWQAC #10 - LNR10-0493

Quality Trait	Casselton		Crookston		Minot		Williston			
	Glenn C-3	C-10	Glenn K-3	K-10	Glenn M-3	M-10	Glenn W-3	W-10		
<b>II. Cooperator Results</b>										
32	<b>Mixing Requirement</b> 5 = Very Long 4 = Long 3 = Medium 2 = Short 1 = Very Short		3.7	3.6	3.8	3.9	3.8	3.8	4.3	4.3
33	<b>Dough Characteristics</b> 5 = Bucky – Tough 4 = Strong – Elastic 3 = Medium – Pliable 2 = Mellow – Very Pliable 1 = Weak – Short or Sticky		3.9	3.3	3.6	4.0	3.7	3.7	4.4	4.2
34	<b>Mixing Tolerance</b> 5 = Much More Tolerance Than Check 4 = More Tolerance Than Check 3 = Tolerance Equivalent To Check 2 = Less Tolerance Than Check 1 = Much Less Tolerance Than Check			2.7		3.1		2.9		3.1
35	<b>Internal Crumb Color</b> 5 = Much Brighter Than Check 4 = Brighter Than Check 3 = Equivalent To Check 2 = Poorer Than Check 1 = Much Poorer Than Check			2.5		2.6		2.8		2.5
36	<b>Internal Grain and Texture</b> 5 = Much Better Than Check 4 = Better Than Check 3 = Equivalent To Check 2 = Poorer Than Check 1 = Much Poorer Than Check			2.6		3.3		2.9		2.8
<b>III. Cooperator Evaluation</b>										
	<b>Quality Traits 1-2: Protein</b> 5 = Much Better Than Check 4 = Better Than Check 3 = Equivalent To Check 2 = Poorer Than Check 1 = Much Poorer Than Check			3.4		2.3		2.5		3.0
	<b>Quality Traits 3-22: Milling</b> 5 = Much Better Than Check 4 = Better Than Check 3 = Equivalent To Check 2 = Poorer Than Check 1 = Much Poorer Than Check			3.3		3.9		3.0		2.3
	<b>Quality Traits 23-36: Baking</b> 5 = Much Better Than Check 4 = Better Than Check 3 = Equivalent To Check 2 = Poorer Than Check 1 = Much Poorer Than Check			2.6		2.9		2.7		3.1
	<b>Quality Traits 1-36: Overall Comparison</b> 5 = Much Better Than Check 4 = Better Than Check 3 = Equivalent To Check 2 = Poorer Than Check 1 = Much Poorer Than Check			2.6		2.9		2.6		2.9

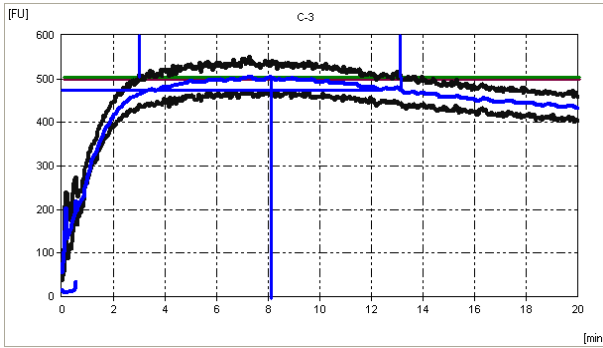
# Cumulative Ash and Protein Curves



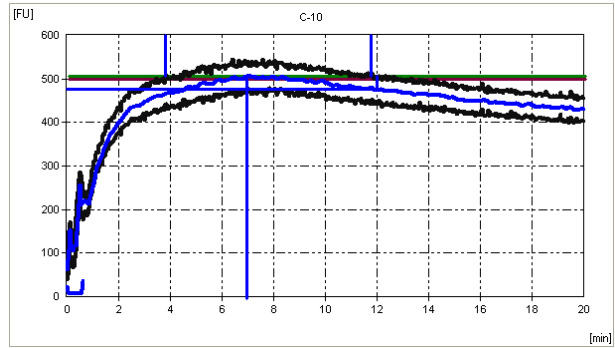


# Farinograms

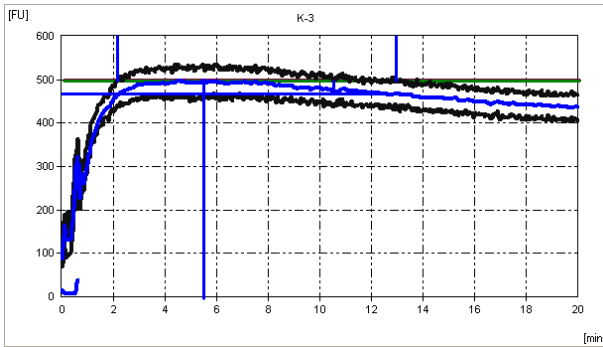
Glenn Check (Casselton, C-3)



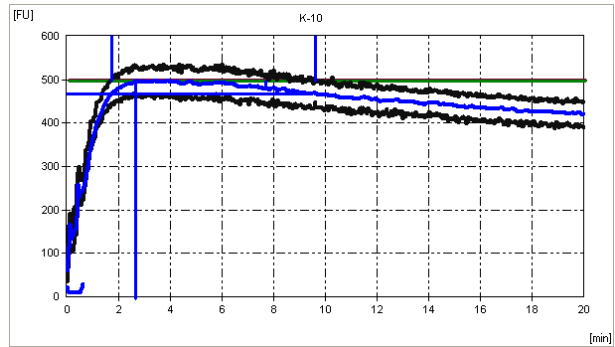
LNR10-0493 (Casselton, C-10)



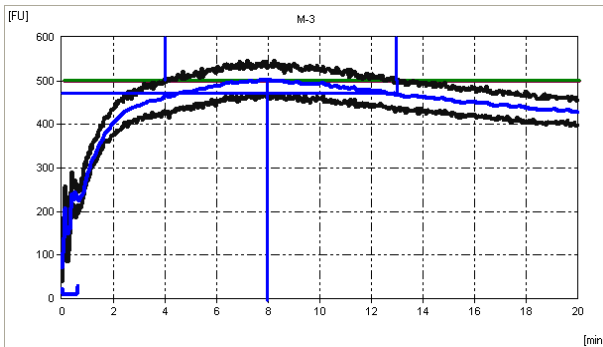
Glenn Check (Crookston, K-3)



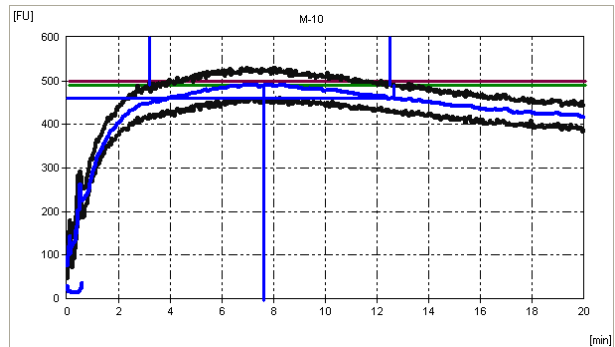
LNR10-0493 (Crookston, K-10)



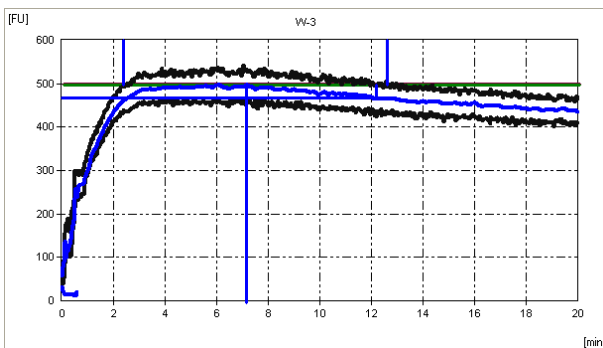
Glenn Check (Minot, M-3)



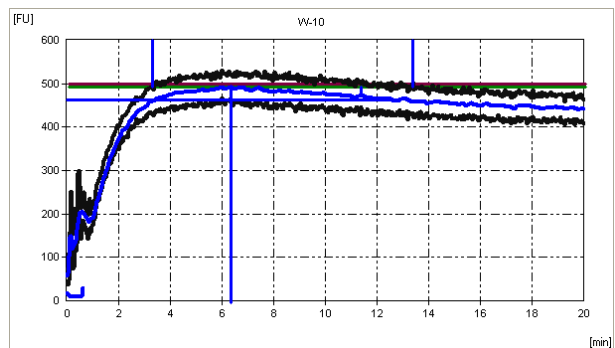
LNR10-0493 (Minot, M-10)



Glenn Check (Williston, W-3)

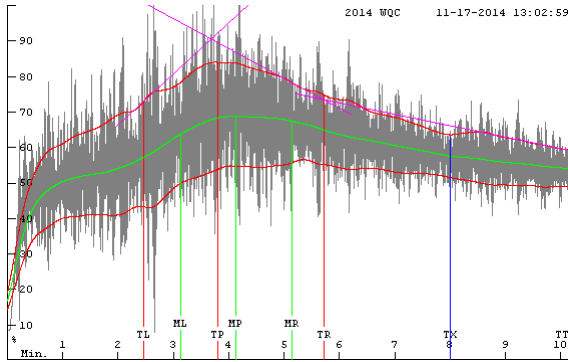


LNR10-0493 (Williston, W-10)

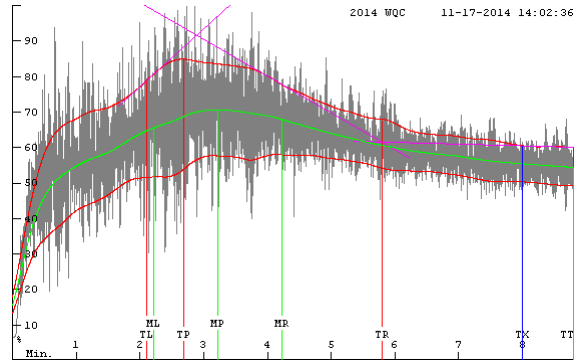


# Mixograms

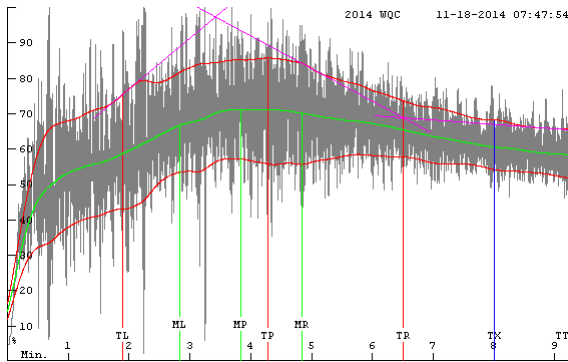
**Glenn Check (Casselton, C-3)**



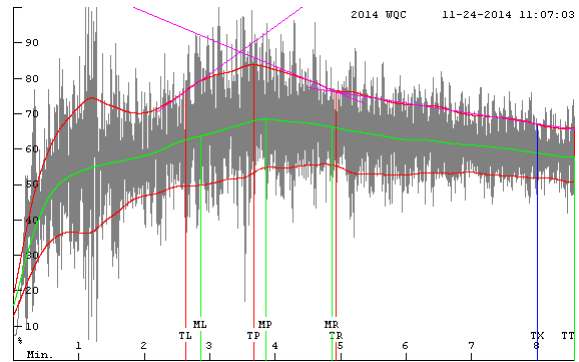
**LNR10-0493 (Casselton, C-10)**



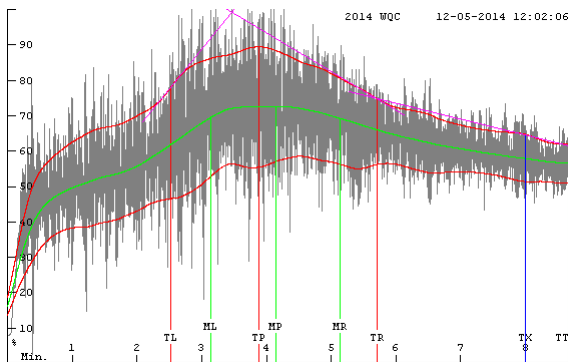
**Glenn Check (Crookston, K-3)**



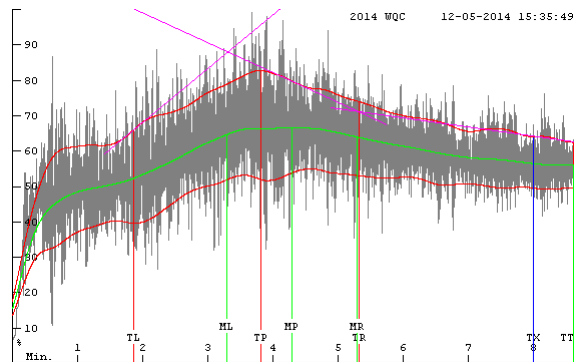
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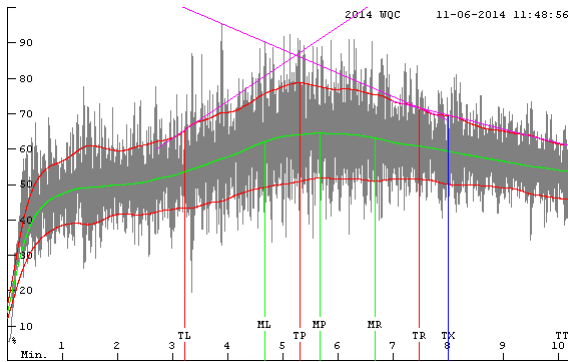
**Glenn Check (Minot, M-3)**



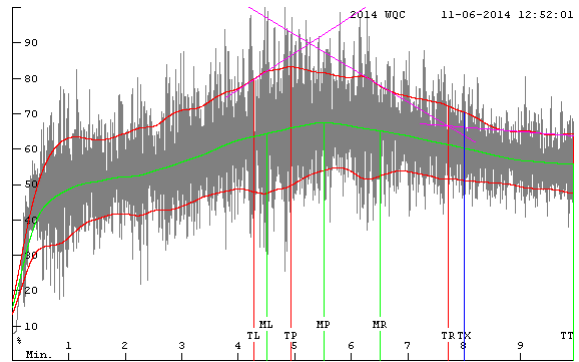
**LNR10-0493 (Minot, M-10)**



**Glenn Check (Williston, W-3)**



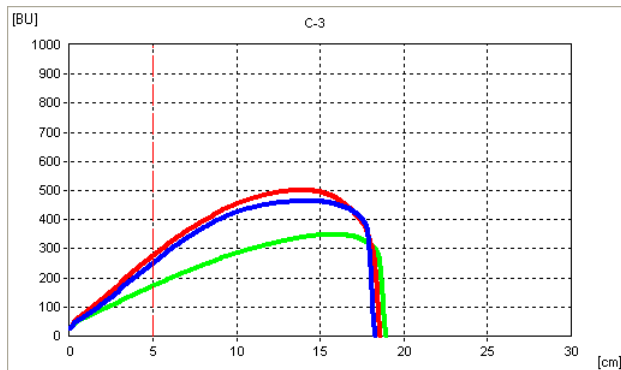
**LNR10-0493 (Williston, W-10)**



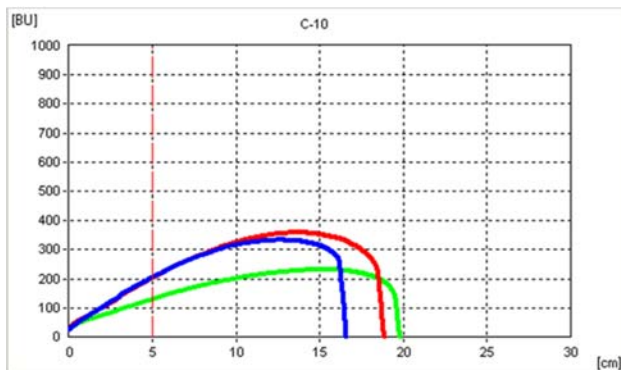


# Extensograms

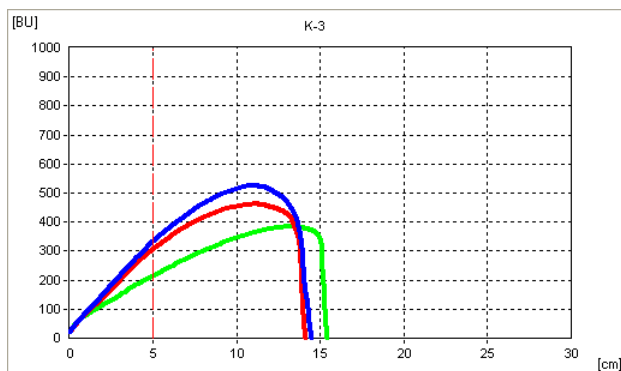
**Glenn Check (Casselton, C-3)**



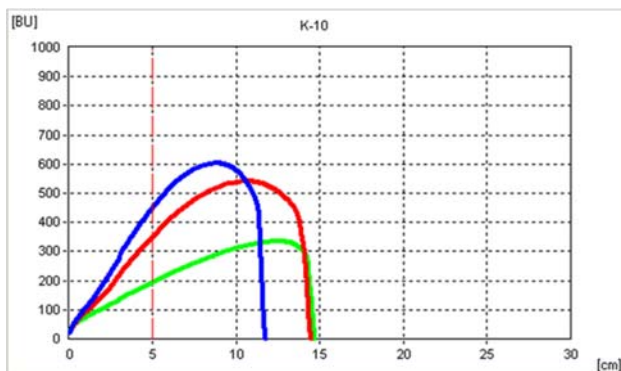
**LNR10-0493 (Casselton, C-10)**



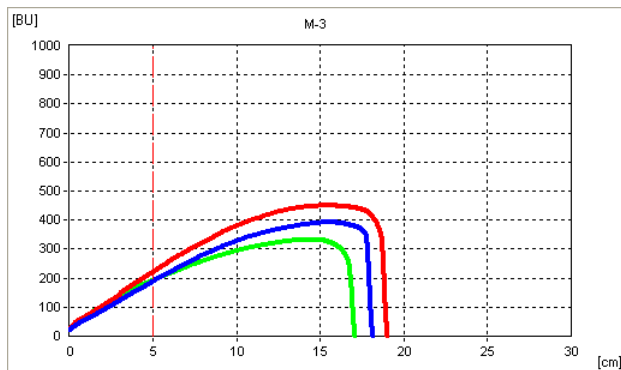
**Glenn Check (Crookston, K-3)**



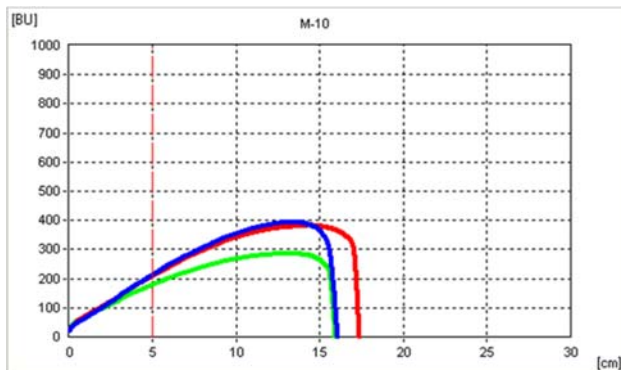
**LNR10-0493 (Crookston, K-10)**



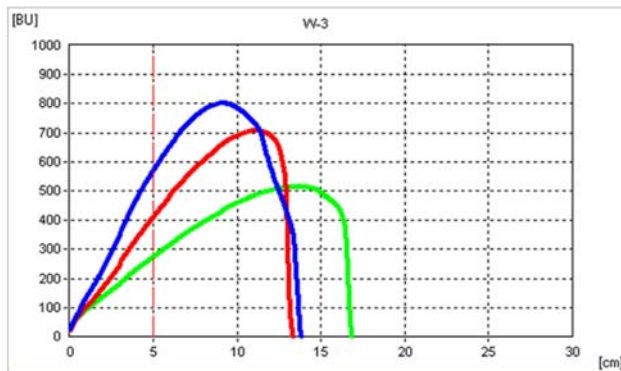
**Glenn Check (Minot, M-3)**



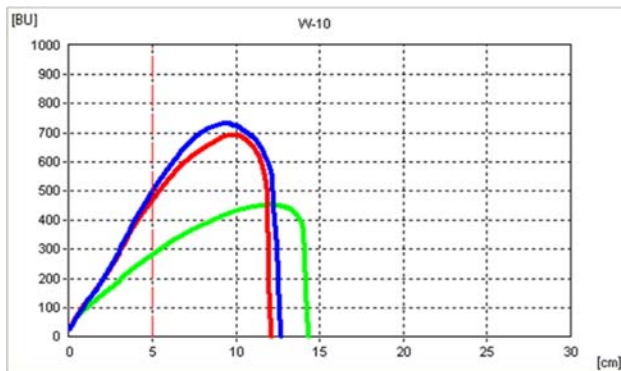
**LNR10-0493 (Minot, M-10)**



**Glenn Check (Williston, W-3)**



**LNR10-0493 (Williston, W-10)**



— 45 min; — 90 min; — 135 min

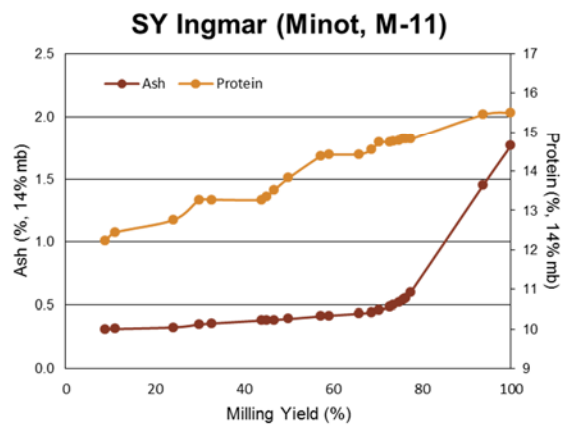
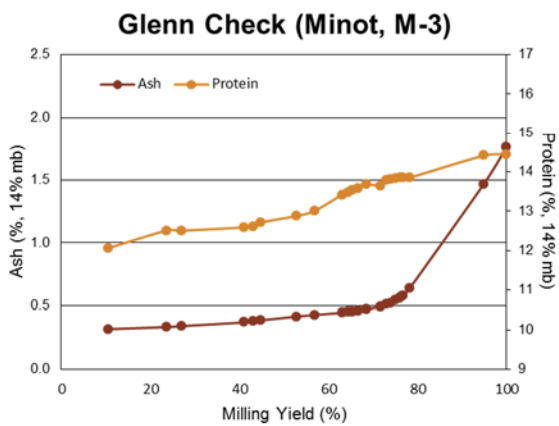
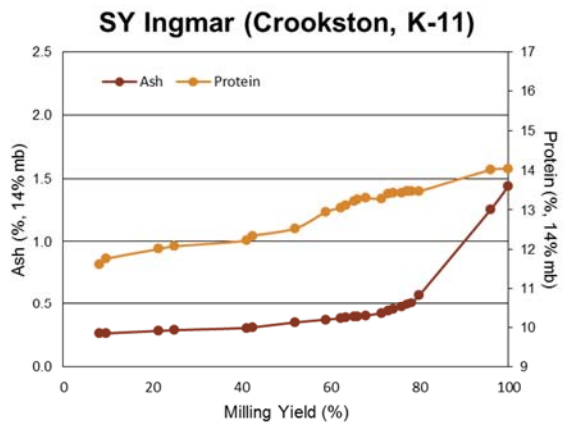
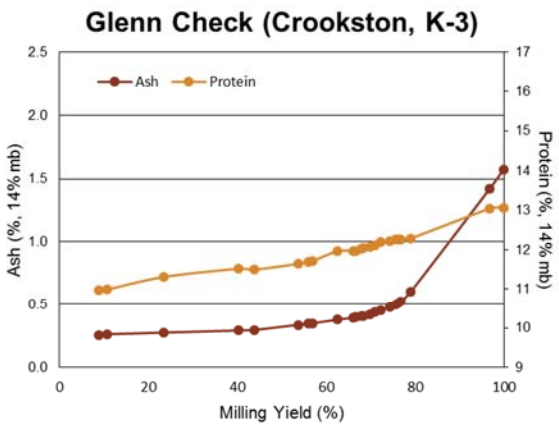
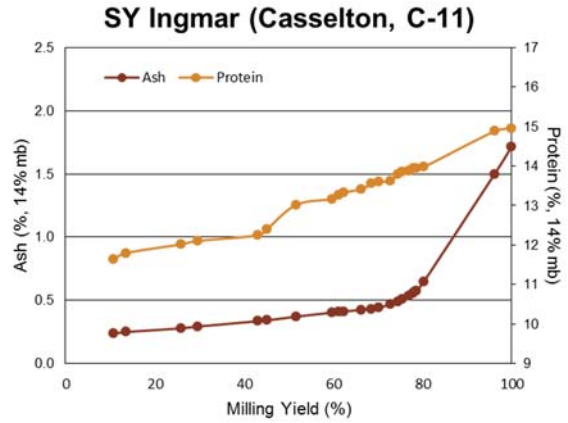
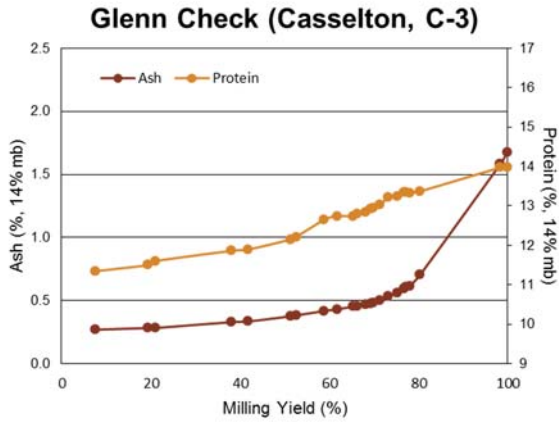
## SWQAC #11 - SY Ingmar

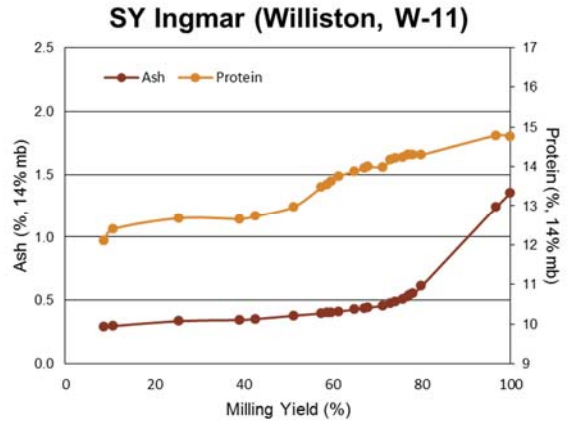
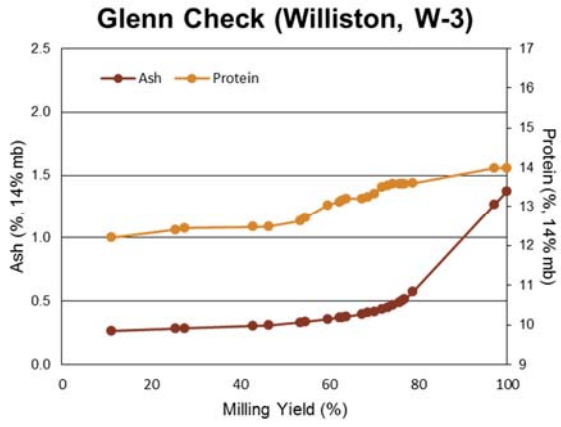
Quality Trait	Casselton		Crookston		Minot		Williston		
	Glenn C-3	C-11	Glenn K-3	K-11	Glenn M-3	M-11	Glenn W-3	W-11	
<b>I. USDA-ARS WQL Data</b>									
1	Wheat Protein (% 12% mb)	14.3	15.3	13.1	13.9	14.6	15.6	14.4	14.7
2	Flour Protein (% 12% mb)	13.5	14.1	12.3	13.3	14.1	14.9	13.6	14.1
3	Market Value (Score 1-6)	4.5	4.4	4.3	4.4	3.7	3.5	4.7	4.3
4	Market Value (Score 1-10)	10.0	9.6	10.0	8.8	10	8.0	10.0	9.2
5	DON (ppm)	0.54	0.25	nd	nd	2.14	1.28	nd	nd
6	Test Weight (lb/bu)	63.4	61.5	65.2	62.6	62.0	58.6	63.2	61.2
7	1000 Kernel Weight (g)	34.4	32.9	31.9	28.9	31.8	27.2	28.4	26.2
8	Kernel Size, % Large	70	72	60	45	69	49	29	28
9	Kernel Size, % Small	6	8	7	15	7	15	14	19
10	Wheat Moisture (%)	11.1	12.3	10.7	11.2	11.3	10.0	10.6	10.5
11	Wheat Ash (% 14% mb)	1.66	1.63	1.45	1.39	2.05	1.70	1.27	1.34
12	Wheat Falling Number (sec)	398	389	416	419	370	393	428	433
13	SKCS Hardness Index	78.2	66.6	95.7	86.0	79.8	68.7	84.7	79.4
14	Vitreous Kernels (%)	66.4	70.1	94.6	89.3	85.5	72.1	96.3	84.9
<b>Flour Extraction (%)</b>									
15	Tempered Wheat Basis (%)	71.8	73.6	70.9	72.8	71.0	70.0	71.2	72.6
16	Total Product Basis (%)	73.2	75.4	72.3	74.2	73.9	73.7	73.2	74.2
17	Flour/Bu Wheat (lbs)	46.4	46.4	47.2	46.5	45.8	43.1	46.3	45.4
<b>Flour Quality</b>									
18	Flour Color Brightness (L*)	89.6	89.4	90.1	89.5	89.7	89.0	90.4	89.6
19	Flour Color Yellowness (b*)	8.1	9.8	8.1	10.7	8.0	10.3	8.8	11.2
20	Flour Moisture (%)	12.9	13.8	13.6	13.8	13.5	13.0	13.1	13.4
21	Flour Ash (% 14% mb)	0.51	0.52	0.47	0.46	0.51	0.49	0.46	0.48
22	Flour Falling Number (Malted) (sec)	254	258	250	250	251	253	250	256
<b>Farinograph</b>									
23	Water Absorption (% 500 BU)	65.5	63.3	66.3	63.2	64.9	63.4	62.9	62.8
24	Water Absorption (% 14% mb)	64.2	63.1	65.8	63.0	64.3	62.2	61.9	62.2
25	Arrival Time (min)	3.0	3.6	2.2	2.1	4.0	4.2	2.4	3.0
26	Peak Time (min)	8.2	8.7	5.5	6.2	8.0	7.8	7.2	5.7
27	Dough Stability (min)	10.1	9.5	10.8	9.5	9.0	8.7	10.2	10.0
28	Mixing Tolerance Index (MTI) (BU)	29.0	35.0	23.0	27.0	34.0	27.0	31.0	19.0
29	Time To Breakdown (TTB) (min)	12.3	12.8	12.6	11.8	12.6	12.3	12.1	12.4
<b>II. Cooperator Results</b>									
30	Bake Absorption (Average %)	65.7	64.6	65.8	64.1	65.8	65.3	64.2	63.9
31	Loaf Volume (% of Check)		100.9		106.9		95.4		103.3

## SWQAC #11 - SY Ingmar

Quality Trait	Casselton		Crookston		Minot		Williston			
	Glenn C-3	C-11	Glenn K-3	K-11	Glenn M-3	M-11	Glenn W-11	W-11		
<b>II. Cooperator Results</b>										
32	<b>Mixing Requirement</b> 5 = Very Long 4 = Long 3 = Medium 2 = Short 1 = Very Short		3.7	3.6	3.8	3.9	3.8	3.9	4.3	4.6
33	<b>Dough Characteristics</b> 5 = Bucky – Tough 4 = Strong – Elastic 3 = Medium – Pliable 2 = Mellow – Very Pliable 1 = Weak – Short or Sticky		3.9	3.6	3.6	3.8	3.7	4.1	4.4	4.6
34	<b>Mixing Tolerance</b> 5 = Much More Tolerance Than Check 4 = More Tolerance Than Check 3 = Tolerance Equivalent To Check 2 = Less Tolerance Than Check 1 = Much Less Tolerance Than Check			2.9		3.0		3.3		3.1
35	<b>Internal Crumb Color</b> 5 = Much Brighter Than Check 4 = Brighter Than Check 3 = Equivalent To Check 2 = Poorer Than Check 1 = Much Poorer Than Check			2.9		2.3		2.3		2.5
36	<b>Internal Grain and Texture</b> 5 = Much Better Than Check 4 = Better Than Check 3 = Equivalent To Check 2 = Poorer Than Check 1 = Much Poorer Than Check			3.0		3.0		3.0		2.9
<b>III. Cooperator Evaluation</b>										
	<b>Quality Traits 1-2: Protein</b> 5 = Much Better Than Check 4 = Better Than Check 3 = Equivalent To Check 2 = Poorer Than Check 1 = Much Poorer Than Check			3.9		4.1		3.9		3.5
	<b>Quality Traits 3-22: Milling</b> 5 = Much Better Than Check 4 = Better Than Check 3 = Equivalent To Check 2 = Poorer Than Check 1 = Much Poorer Than Check			3.5		3.1		2.4		3.1
	<b>Quality Traits 23-36: Baking</b> 5 = Much Better Than Check 4 = Better Than Check 3 = Equivalent To Check 2 = Poorer Than Check 1 = Much Poorer Than Check			2.8		3.1		2.6		3.3
	<b>Quality Traits 1-36: Overall Comparison</b> 5 = Much Better Than Check 4 = Better Than Check 3 = Equivalent To Check 2 = Poorer Than Check 1 = Much Poorer Than Check			3.0		3.1		2.6		3.2

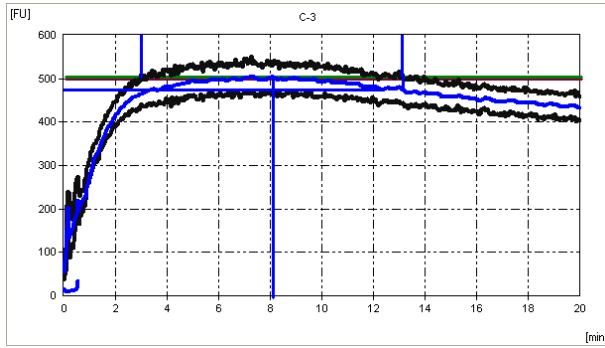
## Cumulative Ash and Protein Curves



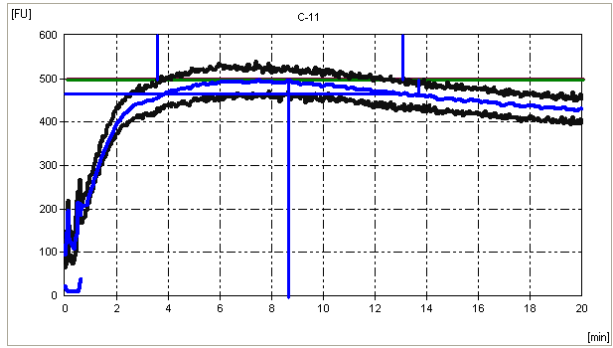


# Farinograms

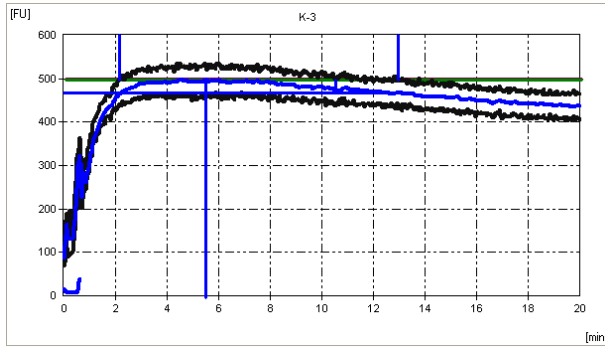
**Glenn Check (Casselton, C-3)**



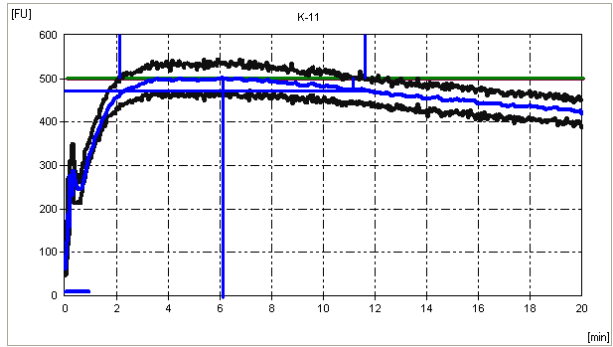
**SY Ingmar (Casselton, C-11)**



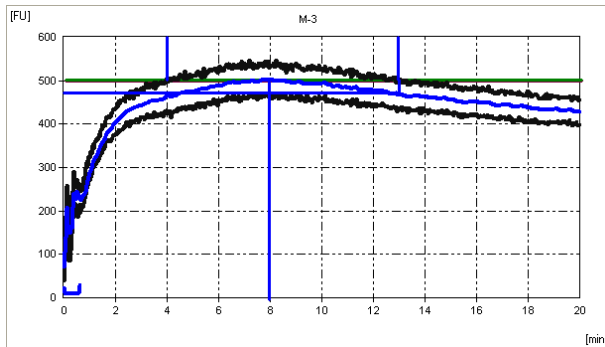
**Glenn Check (Crookston, K-3)**



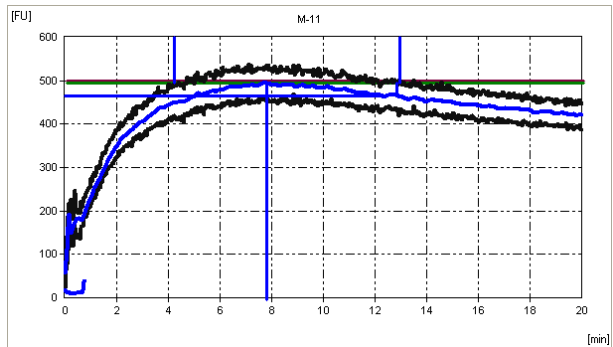
**SY Ingmar (Crookston, K-11)**



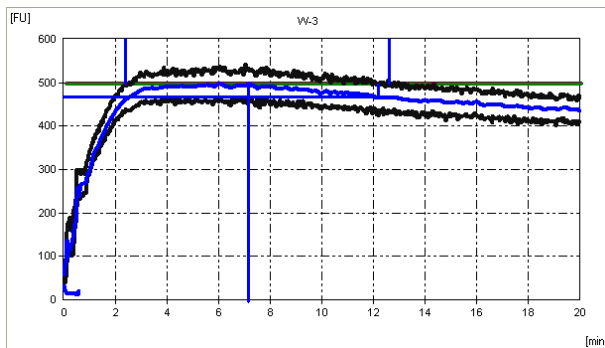
**Glenn Check (Minot, M-3)**



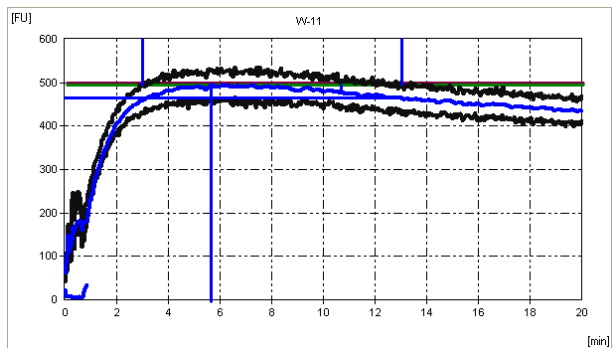
**SY Ingmar (Minot, M-11)**



**Glenn Check (Williston, W-3)**

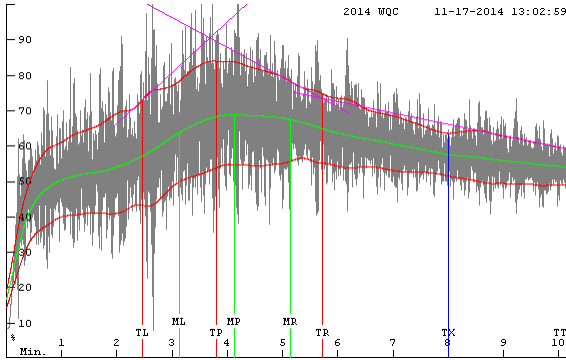


**SY Ingmar (Williston, W-11)**

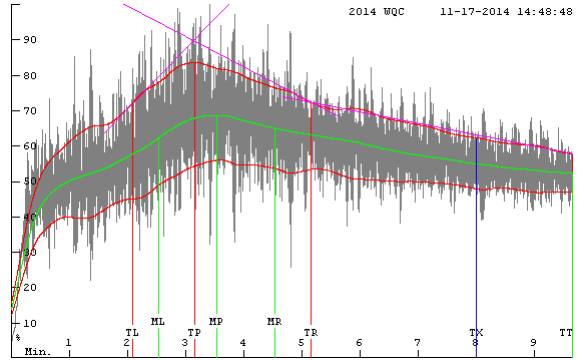


# Mixograms

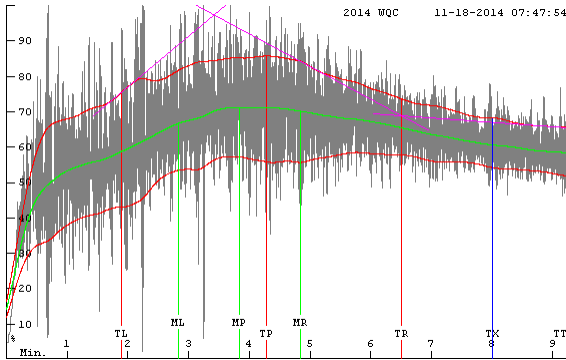
**Glenn Check (Casselton, C-3)**



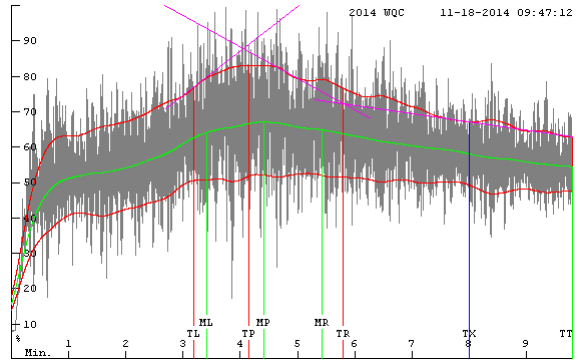
**SY Ingmar (Casselton, C-11)**



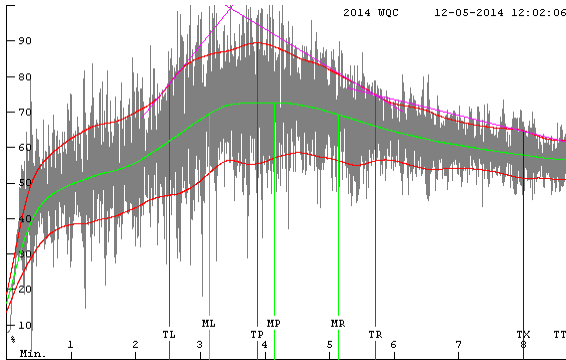
**Glenn Check (Crocketon, K-3)**



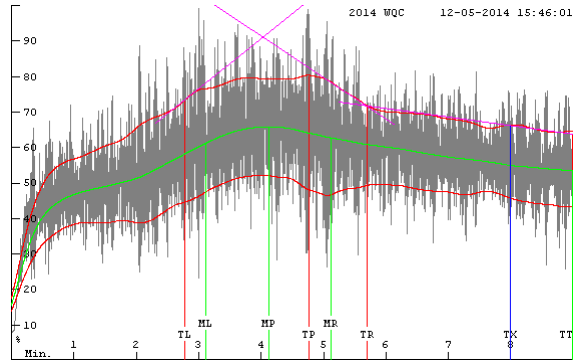
**SY Ingmar (Crocketon, K-11)**



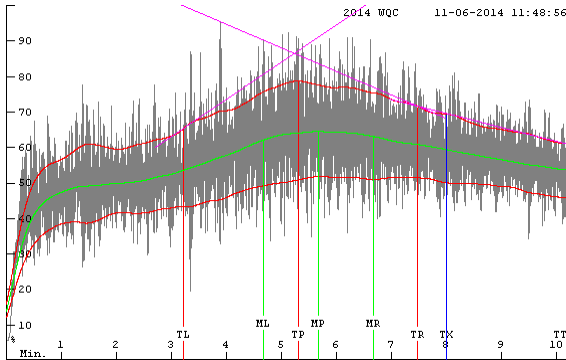
**Glenn Check (Minot, M-3)**



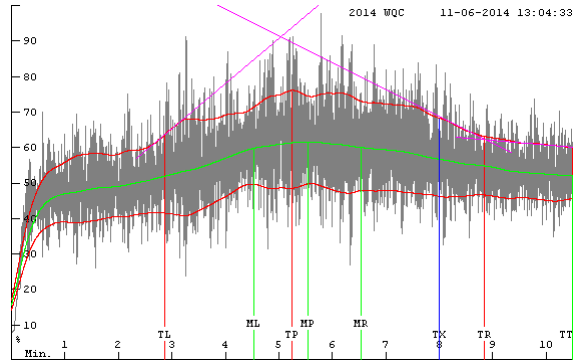
**SY Ingmar (Minot, M-11)**



**Glenn Check (Williston, W-3)**



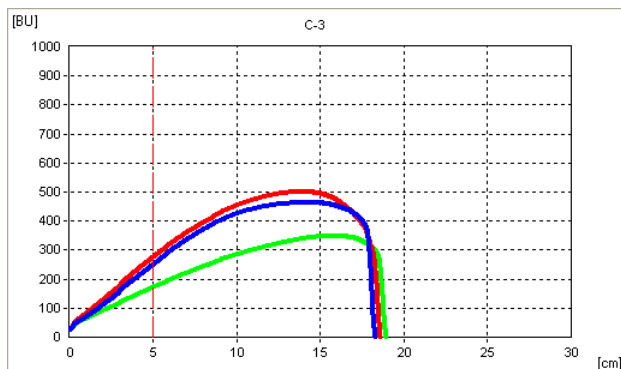
**SY Ingmar (Williston, W-11)**



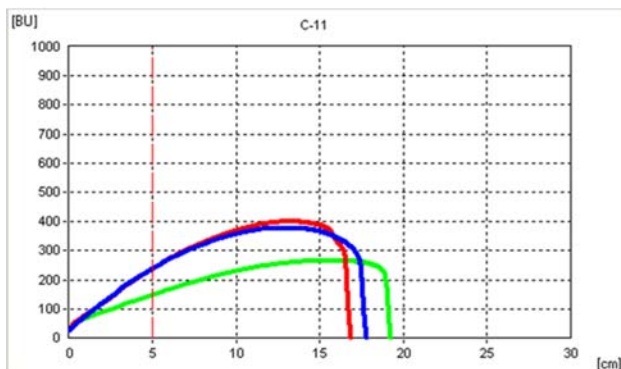


# Extensograms

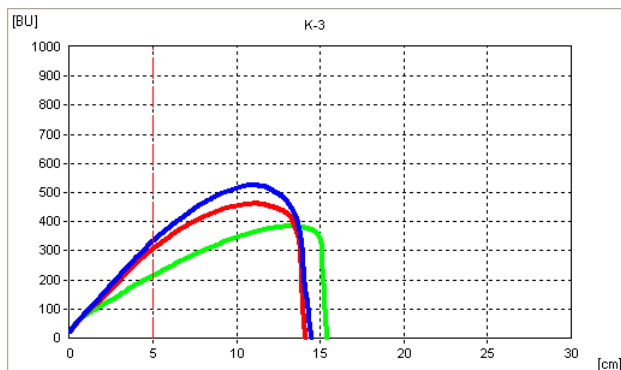
**Glenn Check (Casselton, C-3)**



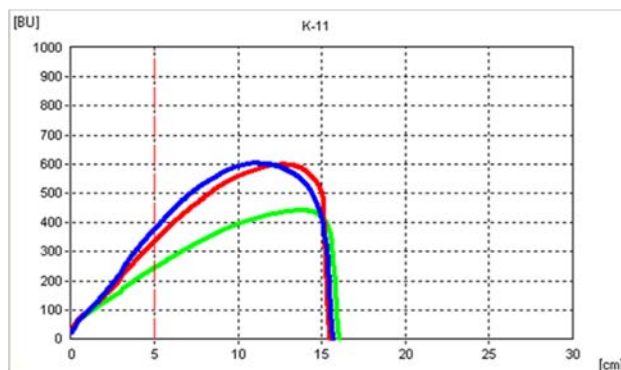
**SY Ingmar (Casselton, C-11)**



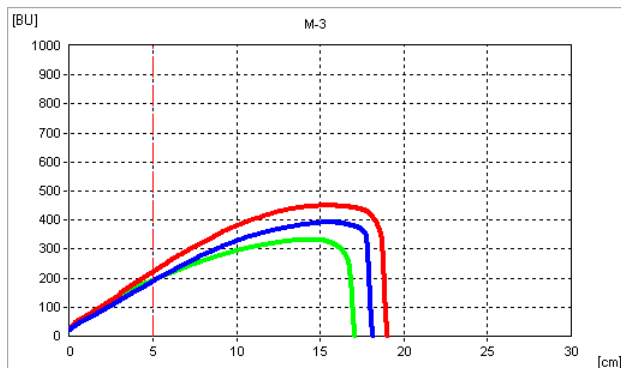
**Glenn Check (Crookston, K-3)**



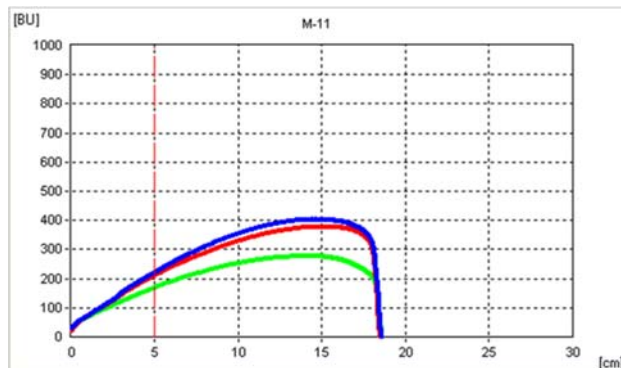
**SY Ingmar (Crookston, K-11)**



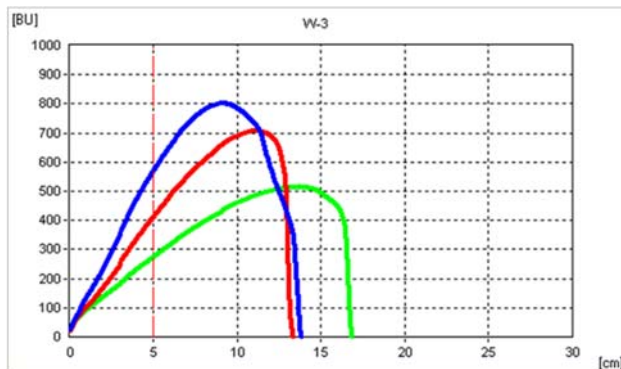
**Glenn Check (Minot, M-3)**



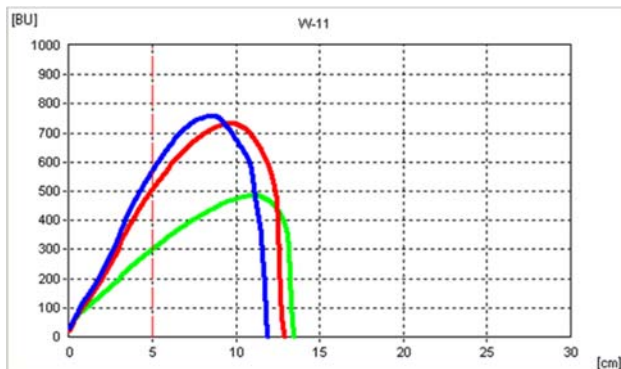
**SY Ingmar (Minot, M-11)**



**Glenn Check (Williston, W-3)**



**SY Ingmar (Williston, W-11)**



— 45 min; — 90 min; — 135 min



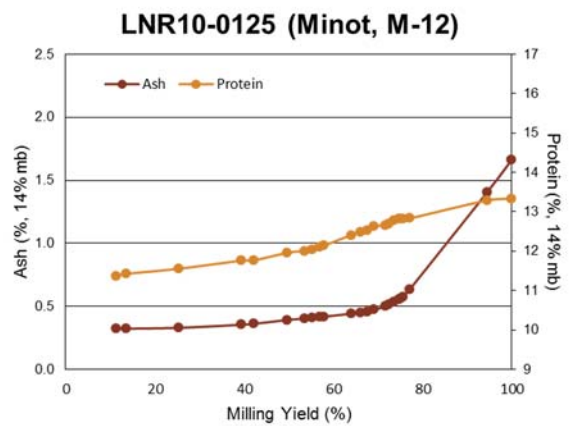
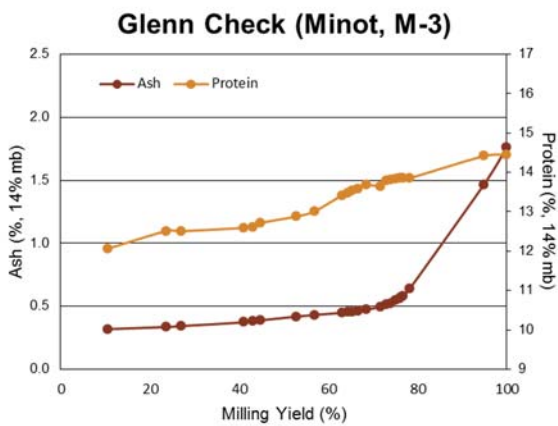
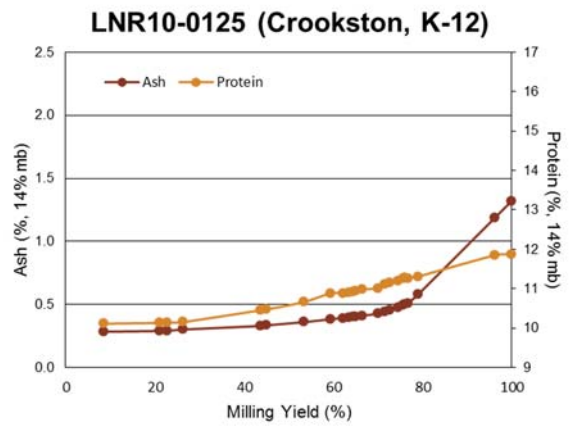
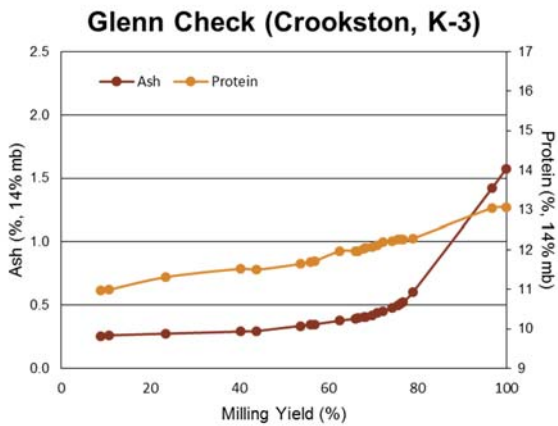
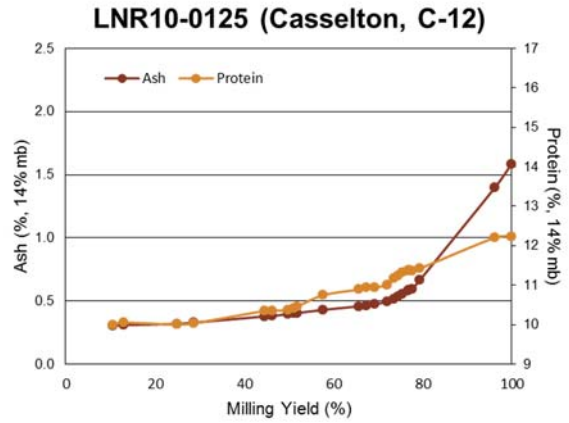
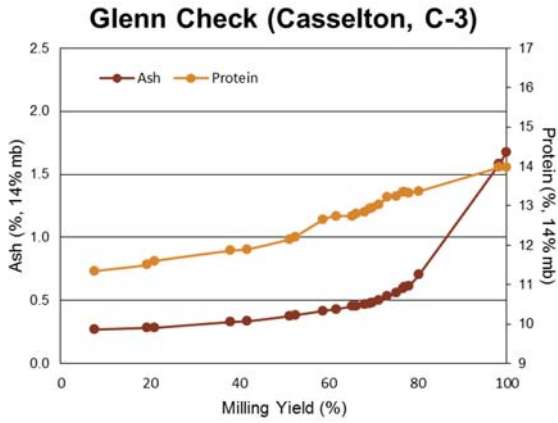
## SWQAC #12 - LNR10-0125

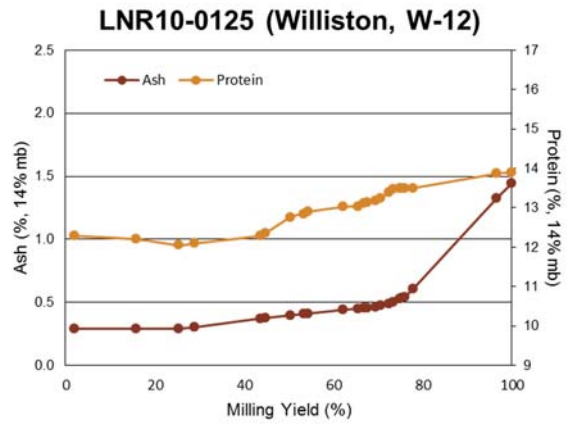
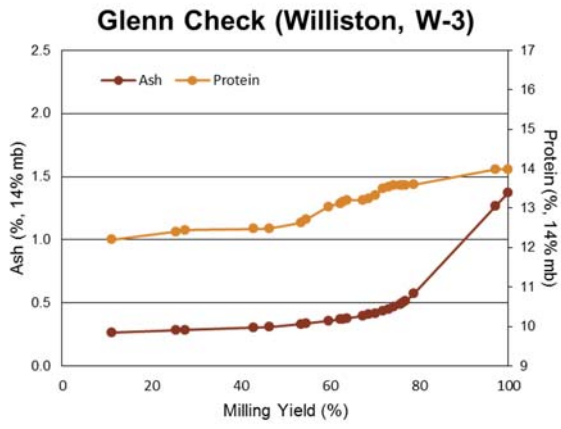
Quality Trait	Casselton		Crookston		Minot		Williston		
	Glenn C-3	C-12	Glenn K-3	K-12	Glenn M-3	M-12	Glenn W-3	W-12	
<b>I. USDA-ARS WQL Data</b>									
1	Wheat Protein (% 12% mb)	14.3	11.9	13.1	11.9	14.6	13.2	14.4	14.0
2	Flour Protein (% 12% mb)	13.5	11.1	12.3	11.1	14.1	12.7	13.6	13.5
3	Market Value (Score 1-6)	4.5	3.2	4.3	3.9	3.7	2.6	4.7	4.0
4	Market Value (Score 1-10)	10.0	6.4	10.0	7.6	10.0	6.0	10.0	8.8
5	DON (ppm)	0.54	0.02	nd	nd	2.14	2.31	nd	nd
6	Test Weight (lb/bu)	63.4	59.7	65.2	61.6	62.0	55.7	63.2	60.1
7	1000 Kernel Weight (g)	34.4	35.7	31.9	31.9	31.8	26.3	28.4	28.4
8	Kernel Size, % Large	70	67	60	40	69	27	29	18
9	Kernel Size, % Small	6	6	7	11	7	21	14	17
10	Wheat Moisture (%)	11.1	12.2	10.7	10.0	11.3	10.6	10.6	10.3
11	Wheat Ash (% 14% mb)	1.66	1.53	1.45	1.27	2.05	1.71	1.27	1.36
12	Wheat Falling Number (sec)	398	376	416	453	370	415	428	438
13	SKCS Hardness Index	78.2	55.3	95.7	80.6	79.8	73.7	84.7	67.4
14	Vitreous Kernels (%)	66.4	8.2	94.6	46.6	85.5	20.4	96.3	53.3
<b>Flour Extraction (%)</b>									
15	Tempered Wheat Basis (%)	71.8	73.2	70.9	70.9	71.0	71.1	71.2	70.8
16	Total Product Basis (%)	73.2	74.5	72.3	72.6	73.9	72.5	73.2	72.4
17	Flour/Bu Wheat (lbs)	46.4	44.5	47.2	44.8	45.8	40.4	46.3	43.5
<b>Flour Quality</b>									
18	Flour Color Brightness (L*)	89.6	90.0	90.1	90.0	89.7	89.5	90.4	90.4
19	Flour Color Yellowness (b*)	8.1	8.8	8.1	9.7	8.0	10.1	8.8	9.1
20	Flour Moisture (%)	12.9	13.6	13.6	13.3	13.5	12.4	13.1	13.2
21	Flour Ash (% 14% mb)	0.51	0.52	0.47	0.45	0.51	0.53	0.46	0.44
22	Flour Falling Number (Malted) (sec)	254	253	250	251	251	254	250	253
<b>Farinograph</b>									
23	Water Absorption (% 500 BU)	65.5	60.9	66.3	62.9	64.9	62.9	62.9	60.8
24	Water Absorption (% 14% mb)	64.2	60.4	65.8	62.1	64.3	61.1	61.9	59.9
25	Arrival Time (min)	3.0	1.5	2.2	1.3	4.0	2.2	2.4	2.1
26	Peak Time (min)	8.2	2.8	5.5	2.7	8.0	8.5	7.2	5.2
27	Dough Stability (min)	10.1	6.1	10.8	5.3	9.0	12.2	10.2	19.8
28	Mixing Tolerance Index (MTI) (BU)	29.0	34.0	23.0	38.0	34.0	29.0	31.0	22.0
29	Time To Breakdown (TTB) (min)	12.3	7.6	12.6	6.4	12.6	14.6	12.1	14.1
<b>II. Cooperator Results</b>									
30	Bake Absorption (Average %)	65.7	61.3	65.8	62.7	65.8	63.8	64.2	62.9
31	Loaf Volume (% of Check)		94.2		98.4		90.5		98.6

## SWQAC #12 - LNR10-0125

Quality Trait	Casselton		Crookston		Minot		Williston			
	Glenn C-3	C-12	Glenn K-3	K-12	Glenn M-3	M-12	Glenn W-3	W-12		
<b>II. Cooperator Results</b>										
32	<b>Mixing Requirement</b> 5 = Very Long 4 = Long 3 = Medium 2 = Short 1 = Very Short		3.7	3.7	3.8	3.9	3.8	4.0	4.3	4.4
33	<b>Dough Characteristics</b> 5 = Bucky – Tough 4 = Strong – Elastic 3 = Medium – Pliable 2 = Mellow – Very Pliable 1 = Weak – Short or Sticky		3.9	3.3	3.6	3.6	3.7	4.0	4.4	4.4
34	<b>Mixing Tolerance</b> 5 = Much More Tolerance Than Check 4 = More Tolerance Than Check 3 = Tolerance Equivalent To Check 2 = Less Tolerance Than Check 1 = Much Less Tolerance Than Check			2.7		2.4		3.1		3.4
35	<b>Internal Crumb Color</b> 5 = Much Brighter Than Check 4 = Brighter Than Check 3 = Equivalent To Check 2 = Poorer Than Check 1 = Much Poorer Than Check			3.1		2.6		2.3		3.3
36	<b>Internal Grain and Texture</b> 5 = Much Better Than Check 4 = Better Than Check 3 = Equivalent To Check 2 = Poorer Than Check 1 = Much Poorer Than Check			3.1		2.9		2.7		2.9
<b>III. Cooperator Evaluation</b>										
	<b>Quality Traits 1-2: Protein</b> 5 = Much Better Than Check 4 = Better Than Check 3 = Equivalent To Check 2 = Poorer Than Check 1 = Much Poorer Than Check			1.4		1.6		1.9		3.0
	<b>Quality Traits 3-22: Milling</b> 5 = Much Better Than Check 4 = Better Than Check 3 = Equivalent To Check 2 = Poorer Than Check 1 = Much Poorer Than Check			3.0		2.5		2.1		2.4
	<b>Quality Traits 23-36: Baking</b> 5 = Much Better Than Check 4 = Better Than Check 3 = Equivalent To Check 2 = Poorer Than Check 1 = Much Poorer Than Check			2.6		2.7		2.4		3.3
	<b>Quality Traits 1-36: Overall Comparison</b> 5 = Much Better Than Check 4 = Better Than Check 3 = Equivalent To Check 2 = Poorer Than Check 1 = Much Poorer Than Check			2.4		2.5		2.3		3.1

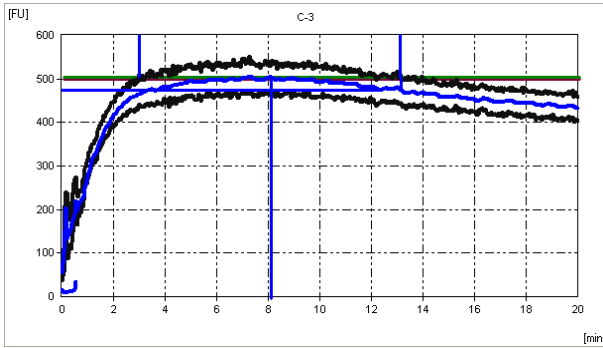
## Cumulative Ash and Protein Curves



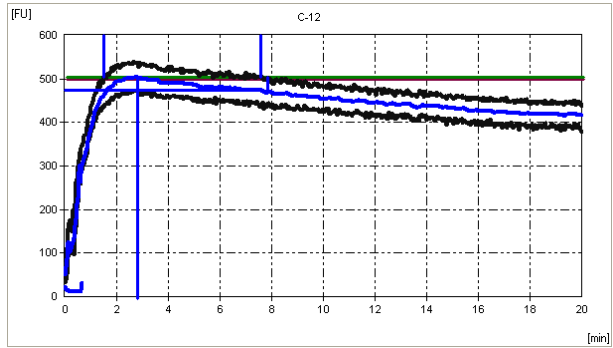


# Farinograms

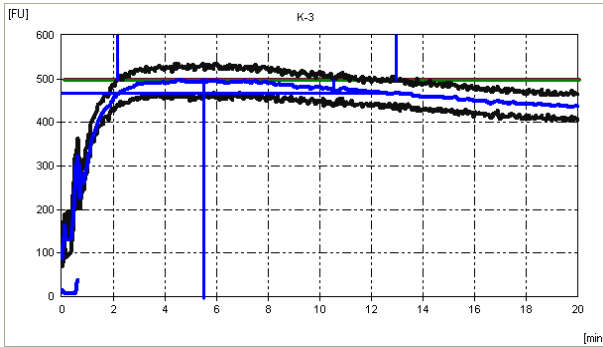
Glenn Check (Casselton, C-3)



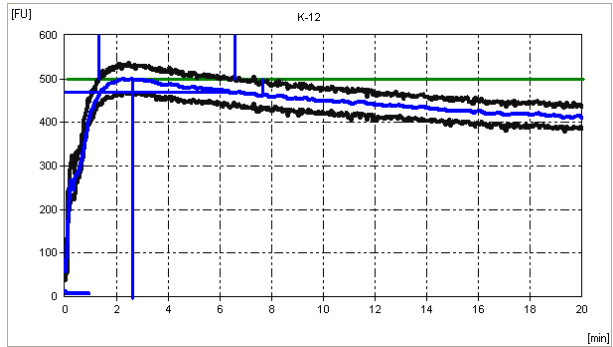
LNR10-0125 (Casselton, C-12)



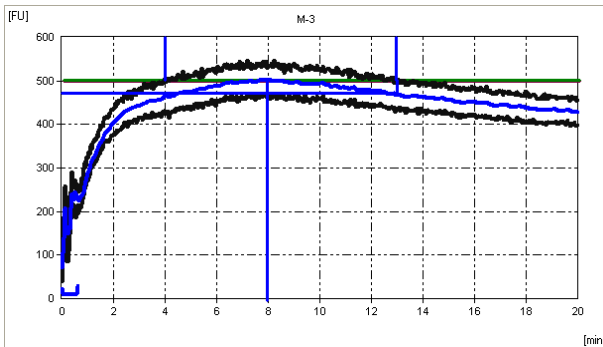
Glenn Check (Crookston, K-3)



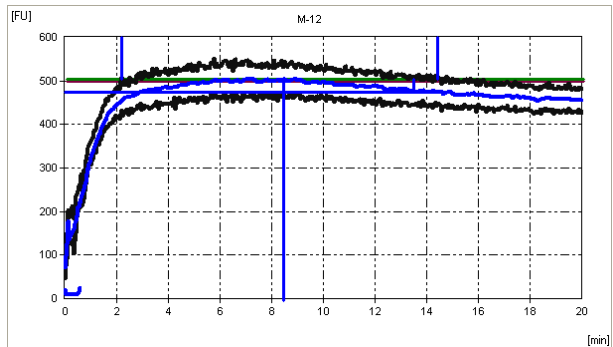
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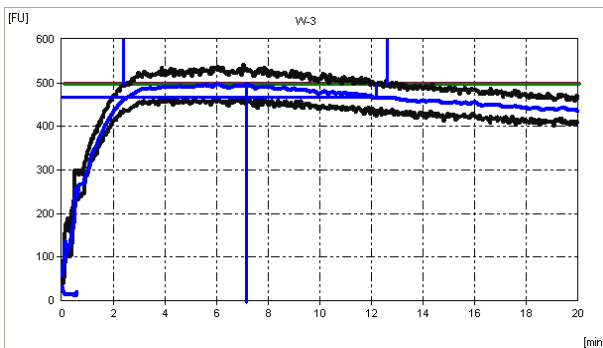
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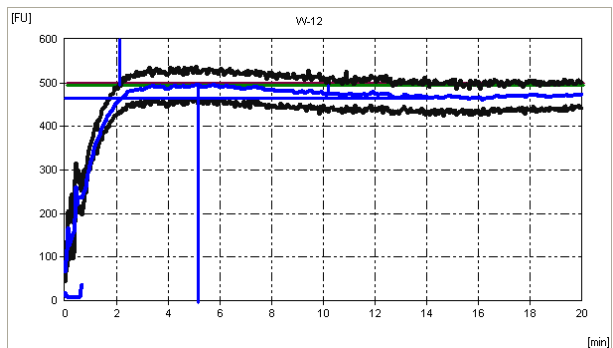
LNR10-0125 (Minot, M-12)



Glenn Check (Williston, W-3)

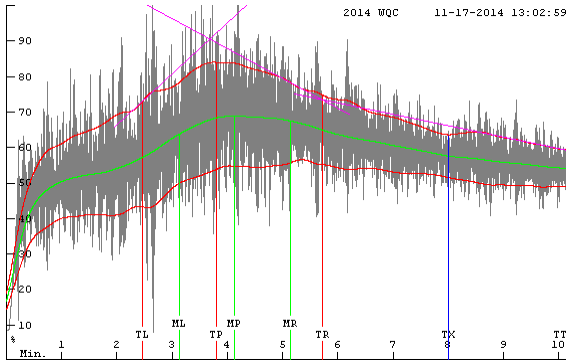


LNR10-0125 (Williston, W-12)

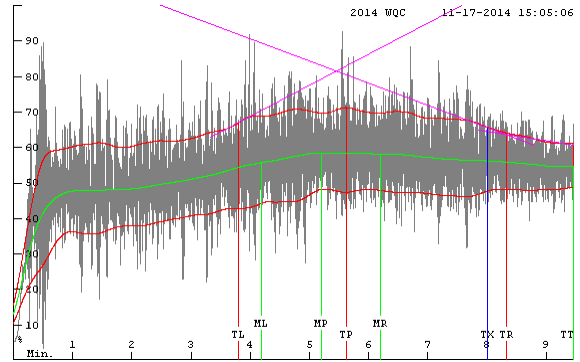


# Mixograms

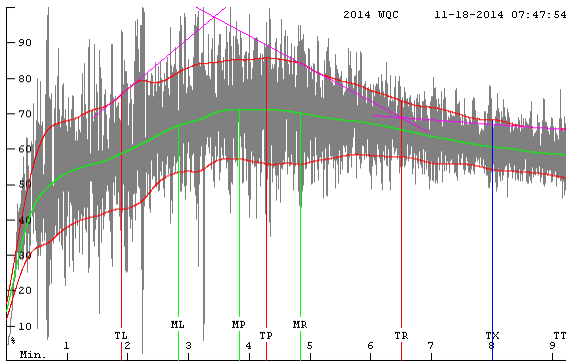
Glenn Check (Casselton, C-3)



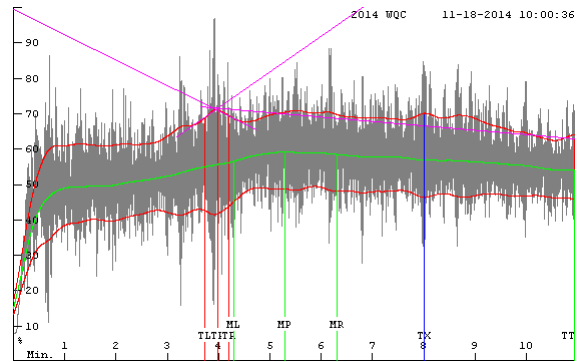
LNR10-0125 (Casselton, C-12)



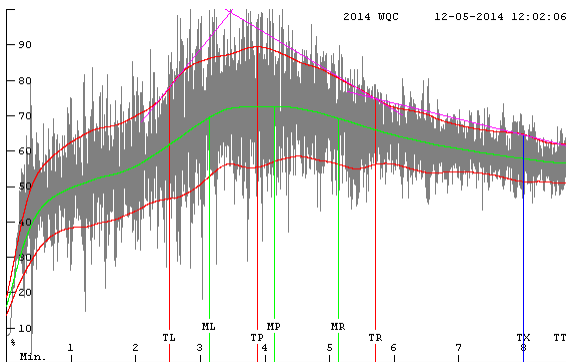
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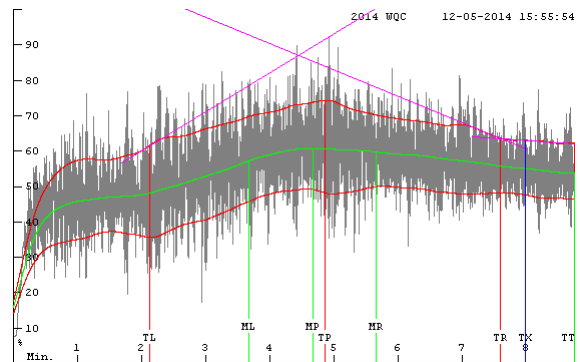
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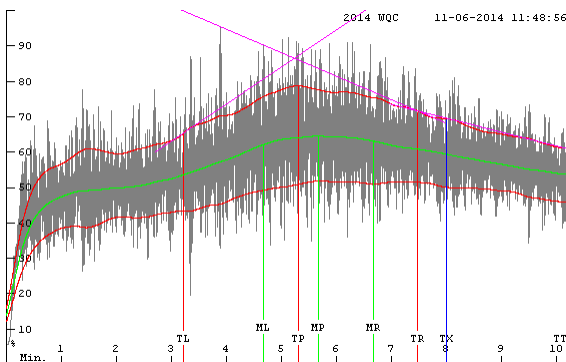
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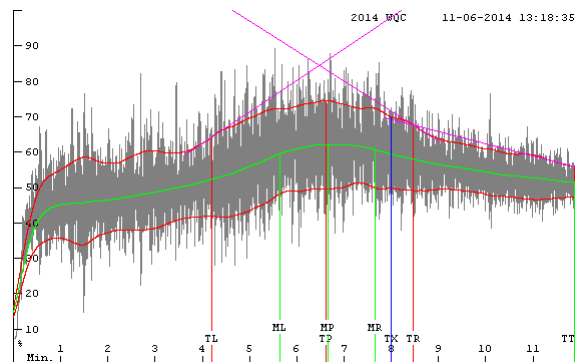
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Glenn Check (Williston, W-3)

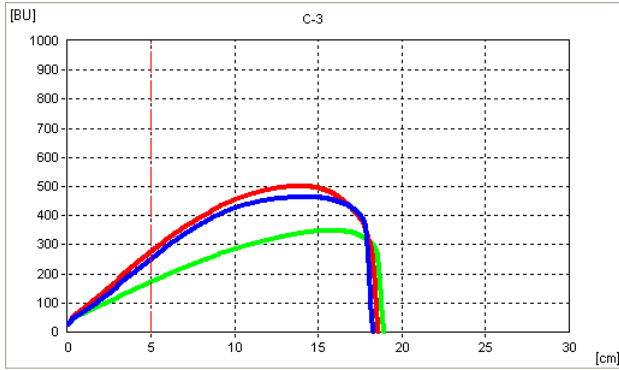


LNR10-0125 (Williston, W-12)

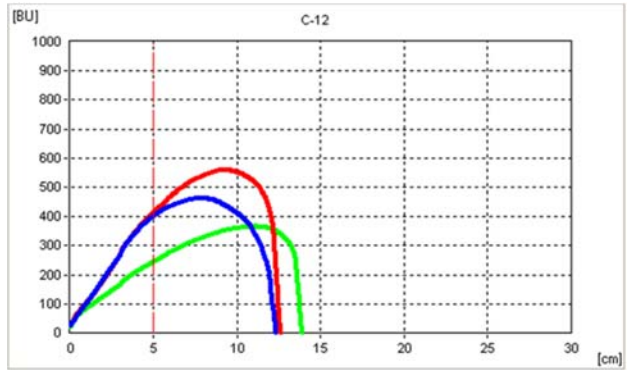


# Extensograms

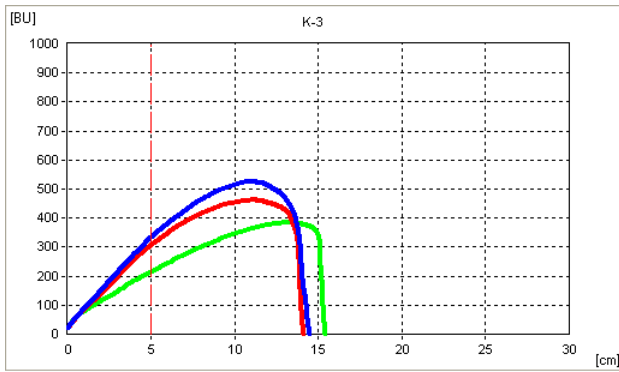
**Glenn Check (Casselton, C-3)**



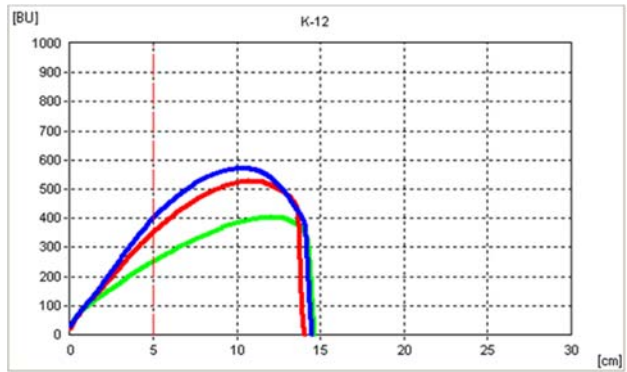
**LNR10-0125 (Casselton, C-12)**



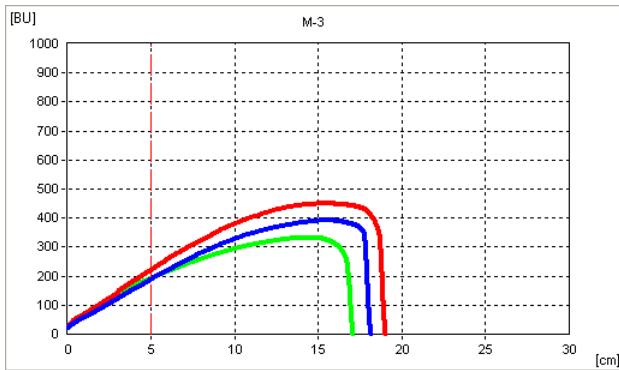
**Glenn Check (Crookston, K-3)**



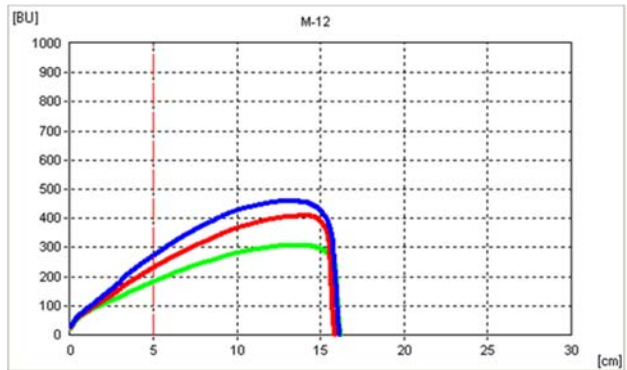
**LNR10-0125 (Crookston, K-12)**



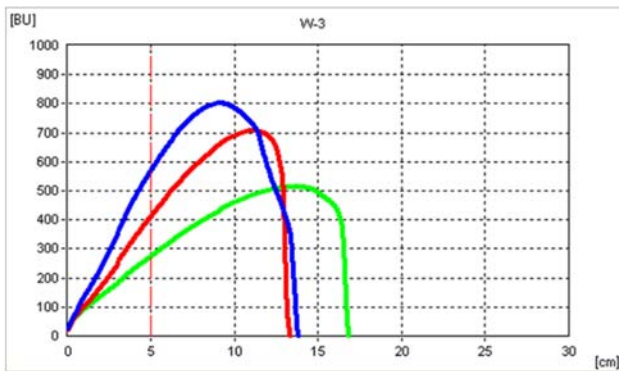
**Glenn Check (Minot, M-3)**



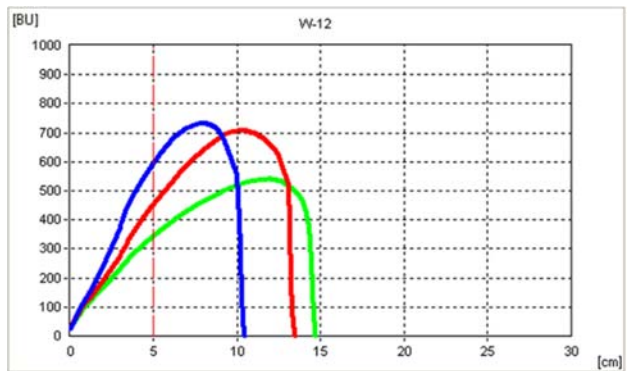
**LNR10-0125 (Minot, M-12)**



**Glenn Check (Williston, W-3)**



**LNR10-0125 (Williston, W-12)**



— 45 min; — 90 min; — 135 min

## Appendix

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## 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	
<b>Target Value</b>	<b>3</b>	<b>60</b>	<b>30</b>	<b>13.5</b>	<b>1.65</b>	
2	59	26	325	12.5	1.75	
1	58	22	300	11.5	1.85	
0	57	18	275	10.5	1.95	
<b>Variation (+/-) from Target Value</b>	<b>1</b>	<b>3 g up, 4 g down</b>	<b>25</b>	<b>1.0</b>	<b>0.10</b>	

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

## 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
<b>10</b>	<b>-0.5 ≤ Diff ≤ 2.0</b>	<b>-1 ≤ Diff ≤ 2</b>	<b>Diff ≥ -25</b>	<b>-2 ≤ Diff ≤ 4</b>	<b>Diff ≤ 0.1</b>
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	--
<b>Weight of each factor</b>	<b>0.3</b>	<b>0.2</b>	<b>0.2</b>	<b>0.2</b>	<b>0.1</b>

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

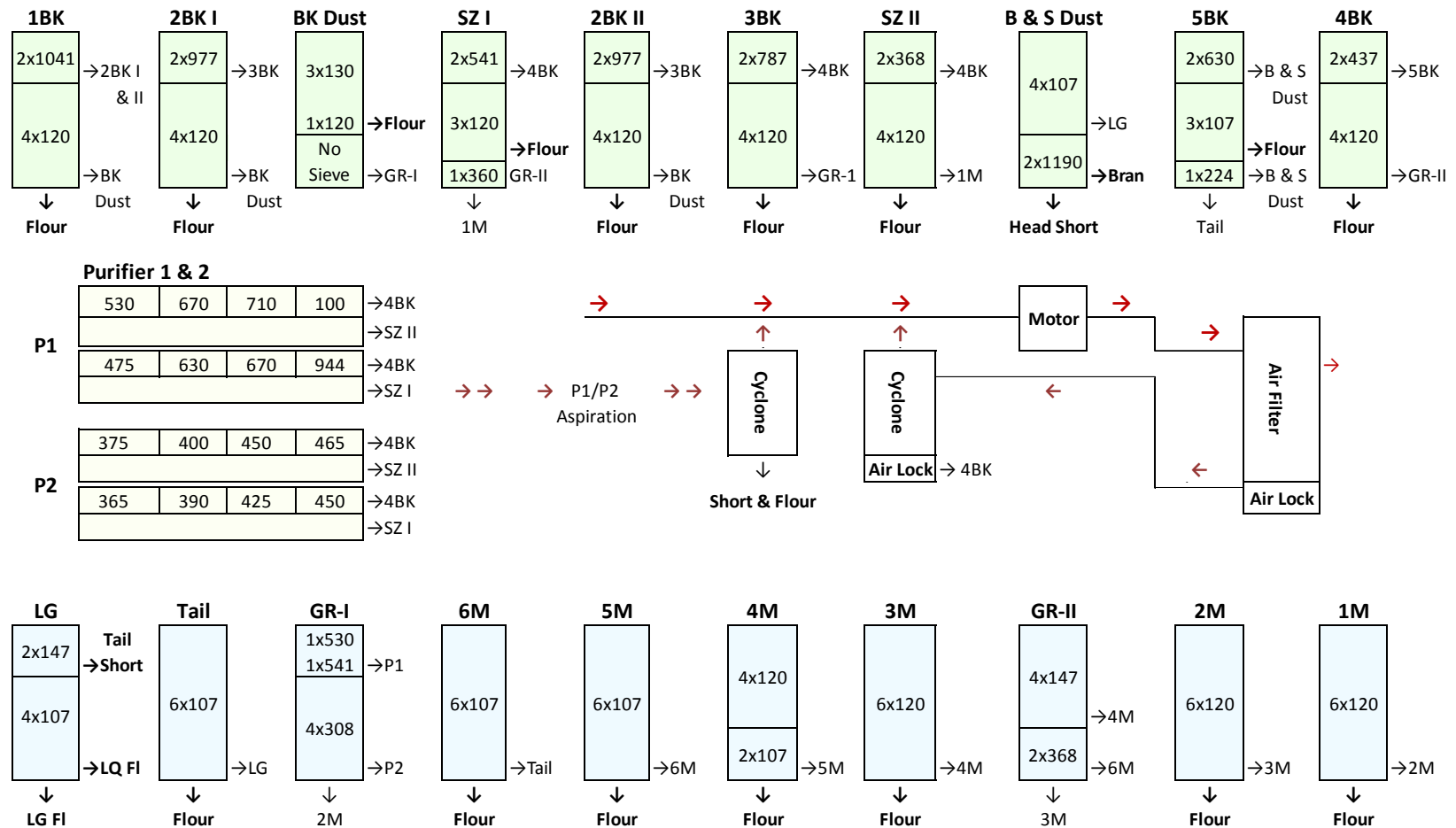
\*Tail Cyclone fraction was separated into flour and short by rebolting using NDSU and NCI sieves.

### Calculation of flour extraction:

- Total product basis (TPB, %): long patent flour percentage of the total mill product (14% mb);
- Tempered wheat basis (TWB, %): long patent flour extraction percentage of tempered wheat (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 -  $\mu\text{m}$

## Wheat Kernel Characteristics by Location

93

Location	ID	Entry	Wheat Protein (%, 12% mb)	Wheat Marketing Score			Test Weight (lbs/bu)	1000 Kernel Weight (g)	Kernel Size		Wheat Moisture (%)	Wheat Ash (%, 14% mb)	Falling Number (sec)	SKCS Hardness Index	Vitreous Kernels (%)	
				1-6	1-10	DON (ppm)			Large (%)	Small (%)						
Watertown	<b>B-3</b>	<b>Glenn</b>	<b>15.1</b>	<b>3.6</b>	<b>10.0</b>	<b>1.27</b>	<b>62.1</b>	<b>34.4</b>	<b>75</b>	<b>5</b>	<b>11.7</b>	<b>1.64</b>	<b>272</b>	<b>87.3</b>	<b>88.2</b>	
	B-4	Elgin-ND	14.3	3.6	8.2	1.46	59.9	30.7	63	9	11.5	1.65	405	80.2	72.5	
	B-5	ND817	14.1	4.1	9.4	0.65	61.4	33.8	80	4	11.7	1.50	375	83.2	64.6	
	B-7	SD4362	14.1	3.5	8.6	0.67	60.4	31.3	63	8	11.7	1.53	356	70.2	70.5	
Casselton	C-2	MN08165-8	16.2	5.2	9.2	0.11	61.3	35.6	81	4	10.8	1.52	428	79.5	82.3	
	<b>C-3</b>	<b>Glenn</b>	<b>14.3</b>	<b>4.5</b>	<b>10.0</b>	<b>0.54</b>	<b>63.4</b>	<b>34.4</b>	<b>70</b>	<b>6</b>	<b>11.1</b>	<b>1.66</b>	<b>398</b>	<b>78.2</b>	<b>66.4</b>	
	C-4	Elgin-ND	14.2	4.0	8.8	0.46	61.2	32.1	71	7	10.4	1.64	407	74.9	65.0	
	C-5	ND817	14.8	4.5	9.6	nd	61.6	36.0	84	3	12.2	1.49	380	75.0	58.4	
	C-7	SD4362	15.5	3.8	8.0	0.36	60.9	32.2	74	6	12.4	1.69	346	61.0	60.0	
	C-9	MN10201-4	14.2	4.4	9.2	0.10	61.1	33.7	71	7	12.2	1.49	418	74.3	86.9	
	C-10	LNR10-0493	15.1	4.3	8.4	1.85	61.3	38.5	65	4	12.2	1.65	351	73.3	81.3	
	C-11	SY Ingmar	15.3	4.4	9.6	0.25	61.5	32.9	72	8	12.3	1.63	389	66.6	70.1	
	C-12	LNR10-0125	11.9	3.2	6.4	0.02	59.7	35.7	67	6	12.2	1.53	376	55.3	8.2	
	Crookston	K-2	MN08165-8	11.9	4.0	8.0	nd	62.5	33.0	71	6	9.4	1.43	456	83.0	73.9
		<b>K-3</b>	<b>Glenn</b>	<b>13.1</b>	<b>4.3</b>	<b>10.0</b>	<b>nd</b>	<b>65.2</b>	<b>31.9</b>	<b>60</b>	<b>7</b>	<b>10.7</b>	<b>1.45</b>	<b>416</b>	<b>95.7</b>	<b>94.6</b>
		K-4	Elgin-ND	12.1	4.0	8.2	nd	62.7	29.8	56	10	8.2	1.40	461	91.3	71.1
K-5		ND817	13.0	4.2	9.6	nd	63.8	31.2	72	6	10.2	1.24	397	88.8	78.7	
K-7		SD4362	13.5	4.3	9.2	nd	63.5	31.4	62	8	10.6	1.27	384	74.5	69.9	
K-9		MN10201-4	13.0	4.3	9.6	nd	63.6	31.6	56	10	9.1	1.23	401	82.5	92.3	
K-10		LNR10-0493	12.8	4.5	10.0	nd	64.5	35.7	80	4	9.7	1.34	400	86.1	77.4	
K-11		SY Ingmar	13.9	4.4	8.8	nd	62.6	28.9	45	15	11.2	1.39	419	86.0	89.3	
K-12		LNR10-0125	11.9	3.9	7.6	nd	61.6	31.9	40	11	10.0	1.27	453	80.6	46.6	
Minot		M-1	BR2306	14.2	1.5	5.6	13.26	50.5	25.1	26	20	10.7	1.94	278	66.1	53.9
		<b>M-3</b>	<b>Glenn</b>	<b>14.6</b>	<b>3.7</b>	<b>10.0</b>	<b>2.14</b>	<b>62.0</b>	<b>31.8</b>	<b>69</b>	<b>7</b>	<b>11.3</b>	<b>2.05</b>	<b>370</b>	<b>79.8</b>	<b>85.5</b>
		M-4	Elgin-ND	14.8	2.1	6.0	5.13	57.9	27.2	55	11	10.4	1.80	268	75.5	76.7
	M-5	ND817	14.6	3.5	9.6	1.01	60.5	30.4	70	7	10.9	1.64	355	81.4	51.9	
	M-6	COI565W	13.4	1.6	4.0	12.20	53.6	27.1	38	17	9.7	1.70	242	47.9	15.4	
	M-8	AUBR30023W	14.7	1.6	5.2	3.71	53.1	23.6	28	26	9.8	1.99	280	59.4	12.6	
	M-10	LNR10-0493	14.3	3.1	8.8	4.65	59.8	31.9	70	6	10.5	1.78	339	78.6	67.1	
	M-11	SY Ingmar	15.6	3.5	8.0	1.28	58.6	27.2	49	15	10.0	1.70	393	68.7	72.1	
Williston	M-12	LNR10-0125	13.2	2.6	6.0	2.31	55.7	26.3	27	21	10.6	1.71	415	73.7	20.4	
	W-1	BR2306	13.5	3.9	8.2	nd	59.8	31.8	39	11	10.4	1.27	410	73.5	85.1	
	<b>W-3</b>	<b>Glenn</b>	<b>14.4</b>	<b>4.7</b>	<b>10.0</b>	<b>nd</b>	<b>63.2</b>	<b>28.4</b>	<b>29</b>	<b>14</b>	<b>10.6</b>	<b>1.27</b>	<b>428</b>	<b>84.7</b>	<b>96.3</b>	
	W-4	Elgin-ND	14.3	4.0	8.8	nd	59.8	27.1	27	18	10.5	1.21	443	79.9	83.6	
	W-5	ND817	15.2	4.5	9.6	nd	61.3	27.8	37	13	10.6	1.26	438	84.6	86.2	
	W-6	COI565W	15.0	3.4	6.2	nd	59.8	32.5	38	13	10.4	1.40	295	54.0	40.5	
	W-8	AUBR30023W	13.6	3.5	7.8	nd	60.9	29.3	32	16	10.4	1.28	357	67.8	69.9	
	W-10	LNR10-0493	14.4	4.2	8.8	nd	59.5	32.2	45	9	10.5	1.33	423	80.6	87.3	
	W-11	SY Ingmar	14.7	4.3	9.2	nd	61.2	26.2	28	19	10.5	1.34	433	79.4	84.9	
	W-12	LNR10-0125	14.0	4.0	8.8	nd	60.1	28.4	18	17	10.3	1.36	438	67.4	53.3	

## Flour Characteristics by Location

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Location	ID	Entry	Flour Extraction			Flour Color				Flour Moisture (%)	Flour Protein (% (%, 12% mb))	Flour Ash (% (%, 14% mb))	Flour FN Malted (sec)
			TWB (%)	TPB (%)	Flour/bu Wheat (lbs)	L*	b*	L	b				
Watertown	<b>B-3</b>	<b>Glenn</b>	<b>69.7</b>	<b>71.2</b>	<b>44.2</b>	<b>89.5</b>	<b>8.0</b>	<b>86.7</b>	<b>7.7</b>	<b>13.4</b>	<b>14.0</b>	<b>0.49</b>	<b>252</b>
	B-4	Elgin-ND	72.4	73.9	44.3	89.6	8.6	86.9	8.3	13.3	13.7	0.50	252
	B-5	ND817	71.6	74.1	45.5	89.8	8.4	87.1	8.1	13.7	13.3	0.47	250
	B-7	SD4362	73.2	75.3	45.5	89.1	9.0	86.2	8.5	13.5	13.4	0.54	262
	C-2	MN08165-8	70.7	73.0	44.7	89.2	8.6	86.4	8.2	13.4	15.4	0.49	256
Casselton	<b>C-3</b>	<b>Glenn</b>	<b>71.8</b>	<b>73.2</b>	<b>46.4</b>	<b>89.6</b>	<b>8.1</b>	<b>86.8</b>	<b>7.7</b>	<b>12.9</b>	<b>13.5</b>	<b>0.51</b>	<b>254</b>
	C-4	Elgin-ND	73.6	74.9	45.8	89.6	8.7	86.8	8.3	12.9	13.3	0.52	258
	C-5	ND817	72.6	74.8	46.1	89.6	8.6	86.8	8.2	13.7	13.4	0.48	253
	C-7	SD4362	71.2	74.5	45.3	89.0	8.8	86.1	8.4	13.6	14.0	0.52	253
	C-9	MN10201-4	74.0	75.4	46.1	89.2	9.6	86.3	9.1	13.4	13.3	0.49	261
	C-10	LNR10-0493	72.5	74.8	45.8	89.2	9.0	86.3	8.5	13.8	13.7	0.52	259
	C-11	SY Ingmar	73.6	75.4	46.4	89.4	9.8	86.6	9.3	13.8	14.1	0.52	258
	C-12	LNR10-0125	73.2	74.5	44.5	90.0	8.8	87.4	8.4	13.6	11.1	0.52	253
Crookston	K-2	MN08165-8	70.7	72.4	45.3	89.9	9.1	87.2	8.7	13.4	11.2	0.52	250
	<b>K-3</b>	<b>Glenn</b>	<b>70.9</b>	<b>72.3</b>	<b>47.2</b>	<b>90.1</b>	<b>8.1</b>	<b>87.5</b>	<b>7.8</b>	<b>13.6</b>	<b>12.3</b>	<b>0.47</b>	<b>250</b>
	K-4	Elgin-ND	73.2	74.7	46.9	90.6	9.0	88.1	8.6	13.3	11.4	0.46	252
	K-5	ND817	72.2	73.0	46.6	90.2	9.2	87.6	8.8	13.2	12.1	0.43	249
	K-7	SD4362	73.0	75.7	48.1	89.5	9.1	86.7	8.6	13.9	12.6	0.51	253
	K-9	MN10201-4	75.0	77.1	49.0	89.7	9.9	87.0	9.4	13.4	12.6	0.45	250
	K-10	LNR10-0493	72.6	74.6	48.1	89.6	9.8	86.9	9.3	14.0	11.9	0.43	249
	K-11	SY Ingmar	72.8	74.2	46.5	89.5	10.7	86.8	10.1	13.8	13.3	0.46	250
Minot	K-12	LNR10-0125	70.9	72.6	44.8	90.0	9.7	87.3	9.2	13.3	11.1	0.45	251
	<b>M-3</b>	<b>Glenn</b>	<b>71.0</b>	<b>73.9</b>	<b>45.8</b>	<b>89.7</b>	<b>8.0</b>	<b>87.0</b>	<b>7.7</b>	<b>13.5</b>	<b>14.1</b>	<b>0.51</b>	<b>251</b>
	M-4	Elgin-ND	72.1	74.4	43.1	89.9	9.1	87.2	8.7	13.2	14.2	0.48	251
	M-5	ND817	72.5	74.9	45.3	89.7	8.8	87.0	8.4	13.0	13.8	0.44	250
	M-8	AUBR30023W	74.6	71.6	38.0	89.6	10.3	86.9	9.8	12.6	14.1	0.58	251
	M-10	LNR10-0493	72.7	74.8	44.7	89.2	9.6	86.4	9.1	13.1	13.7	0.50	255
	M-11	SY Ingmar	70.0	73.7	43.1	89.0	10.3	86.1	9.7	13.0	14.9	0.49	253
M-12	LNR10-0125	71.1	72.5	40.4	89.5	10.1	86.8	9.6	12.4	12.7	0.53	254	
Williston	W-1	BR2306	73.5	73.9	44.2	90.3	8.1	87.7	7.8	13.4	12.7	0.46	254
	<b>W-3</b>	<b>Glenn</b>	<b>71.2</b>	<b>73.2</b>	<b>46.3</b>	<b>90.4</b>	<b>8.8</b>	<b>87.8</b>	<b>8.5</b>	<b>13.1</b>	<b>13.6</b>	<b>0.46</b>	<b>250</b>
	W-4	Elgin-ND	70.8	73.1	43.8	90.4	9.4	87.9	9.0	12.9	13.6	0.45	251
	W-5	ND817	71.0	73.2	44.9	90.0	9.6	87.3	9.2	13.1	14.3	0.45	254
	W-6	CO1565W	69.6	73.7	44.1	90.3	9.0	87.7	8.6	12.9	14.5	0.47	262
	W-8	AUBR30023W	70.9	78.3*	47.7	90.7	10.3	88.2	9.8	12.5	13.0	0.44	254
	W-10	LNR10-0493	72.0	68.8*	40.9	90.1	10.0	87.5	9.5	12.3	13.6	0.43	258
	W-11	SY Ingmar	72.6	74.2	45.4	89.6	11.2	86.9	10.5	13.4	14.1	0.48	256
W-12	LNR10-0125	70.8	72.4	43.5	90.4	9.1	87.9	8.7	13.2	13.5	0.44	253	

\*Choke on bran was found and cleaned during sample W-10. Bran may be from W-10 and W-8. This affected TPB but not patent flour characteristics.

## Farinograph Characteristics by Location

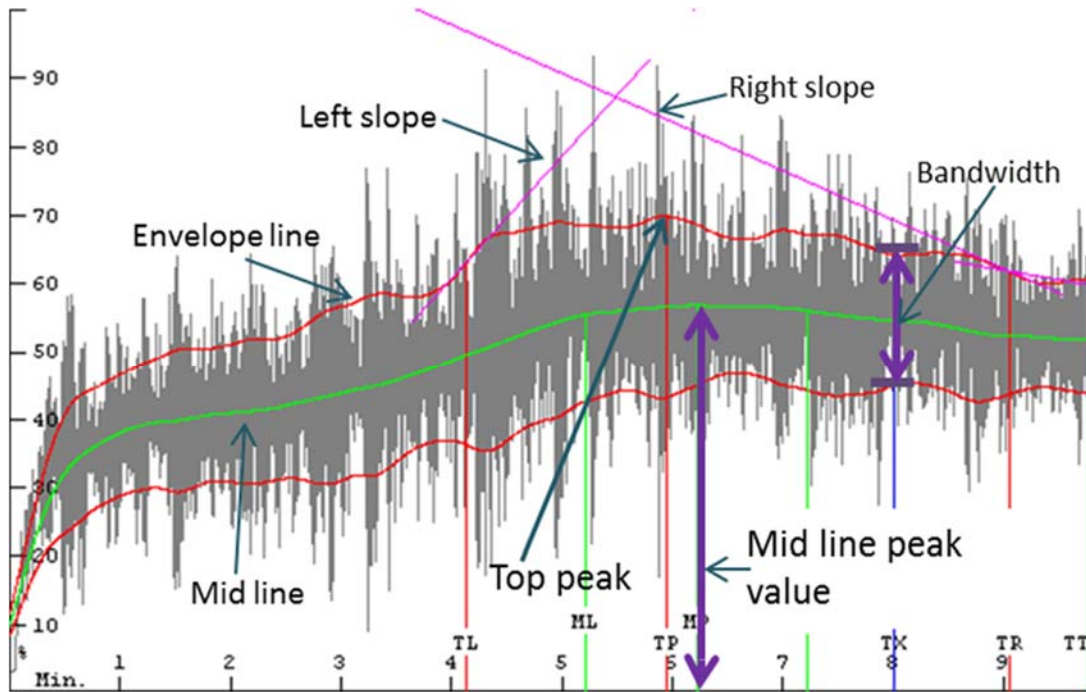
Location	ID	Entry	Water Abs. (%, 500 BU)	Water Abs. (%, 14% mb)	Arrival Time (min)	Peak Time (min)	Dough Stability (min)	MTI (BU)	TTB (min)
Watertown	<b>B-3</b>	<b>Glenn</b>	<b>65.7</b>	<b>65.0</b>	<b>2.1</b>	<b>4.0</b>	<b>7.0</b>	<b>30.0</b>	<b>8.6</b>
	B-4	Elgin-ND	66.5	65.7	2.8	6.2	9.1	28.0	11.8
	B-5	ND817	66.1	65.7	2.5	6.8	9.4	28.0	12.0
	B-7	SD4362	62.2	61.6	3.0	7.5	9.5	32.0	11.9
Casselton	C-2	MN08165-8	65.4	64.7	3.4	10.5	16.0	23.0	17.9
	<b>C-3</b>	<b>Glenn</b>	<b>65.5</b>	<b>64.2</b>	<b>3.0</b>	<b>8.2</b>	<b>10.1</b>	<b>29.0</b>	<b>12.3</b>
	C-4	Elgin-ND	66.4	65.1	3.1	6.5	8.4	31.0	10.9
	C-5	ND817	67.6	67.2	2.5	6.5	7.9	40.0	10.1
	C-7	SD4362	63.5	63.0	4.2	8.0	7.4	39.0	11.8
	C-9	MN10201-4	63.3	62.7	3.0	7.0	9.4	27.0	12.3
	C-10	LNR10-0493	67.2	67.0	3.8	7.0	8.0	33.0	11.9
	C-11	SY Ingmar	63.3	63.1	3.6	8.7	9.5	35.0	12.8
C-12	LNR10-0125	60.9	60.4	1.5	2.8	6.1	34.0	7.6	
Crookston	K-2	MN08165-8	62.4	61.7	1.6	2.9	7.3	25.0	8.7
	<b>K-3</b>	<b>Glenn</b>	<b>66.3</b>	<b>65.8</b>	<b>2.2</b>	<b>5.5</b>	<b>10.8</b>	<b>23.0</b>	<b>12.6</b>
	K-4	Elgin-ND	64.8	64.0	1.9	3.2	7.2	19.0	9.0
	K-5	ND817	66.0	65.1	2.3	5.3	8.3	27.0	10.6
	K-7	SD4362	62.6	62.5	3.9	7.4	7.5	38.0	11.5
	K-9	MN10201-4	62.0	61.4	2.0	6.3	10.8	28.0	11.6
	K-10	LNR10-0493	65.0	65.0	1.7	2.7	7.9	20.0	9.3
	K-11	SY Ingmar	63.2	63.0	2.1	6.2	9.5	27.0	11.8
K-12	LNR10-0125	62.9	62.1	1.3	2.7	5.3	38.0	6.4	
Minot	<b>M-3</b>	<b>Glenn</b>	<b>64.9</b>	<b>64.3</b>	<b>4.0</b>	<b>8.0</b>	<b>9.0</b>	<b>34.0</b>	<b>12.6</b>
	M-4	Elgin-ND	64.7	63.8	4.2	7.2	7.7	32.0	11.9
	M-5	ND817	66.1	64.9	4.1	7.4	8.2	32.0	12.1
	M-8	AUBR30023W	61.9	60.3	3.4	7.8	8.2	37.0	12.0
	M-10	LNR10-0493	64.8	63.8	3.2	7.7	9.3	30.0	12.4
	M-11	SY Ingmar	63.4	62.2	4.2	7.8	8.7	27.0	12.3
M-12	LNR10-0125	62.9	61.1	2.2	8.5	12.2	29.0	14.6	
Williston	W-1	BR2306	60.6	59.9	1.9	5.5	11.2	18.0	13.0
	<b>W-3</b>	<b>Glenn</b>	<b>62.9</b>	<b>61.9</b>	<b>2.4</b>	<b>7.2</b>	<b>10.2</b>	<b>31.0</b>	<b>12.1</b>
	W-4	Elgin-ND	65.6	64.3	2.3	6.5	12.0	17.0	14.1
	W-5	ND817	67.0	66.0	3.3	7.9	11.4	24.0	13.6
	W-6	COI565W	59.2	57.9	1.8	6.2	18.3	14.0	15.3
	W-8	AUBR30023W	59.3	57.6	2.3	8.8	16.9	17.0	18.7
	W-10	LNR10-0493	65.1	63.2	3.3	6.4	10.1	20.0	12.6
	W-11	SY Ingmar	62.8	62.2	3.0	5.7	10.0	19.0	12.4
W-12	LNR10-0125	60.8	59.9	2.1	5.2	19.8	22.0	14.1	

## 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)
<b>Watertown</b>	<b>B-3</b>	<b>Glenn</b>	<b>4.9</b>	<b>82.0</b>	<b>27.6</b>	<b>5.1</b>	<b>68.2</b>	<b>26.5</b>	<b>285.8</b>
	B-4	Elgin-ND	4.1	86.3	30.9	4.2	71.3	30.1	236.8
	B-5	ND817	3.7	82.6	29.5	3.9	67.7	27.2	217.8
	B-7	SD4362	4.3	79.0	27.6	4.5	65.1	25.8	229.3
	C-2	MN08165-8	3.9	91.4	31.3	4.1	76.4	29.0	233.1
<b>Casselton</b>	<b>C-3</b>	<b>Glenn</b>	<b>3.8</b>	<b>84.0</b>	<b>30.1</b>	<b>4.1</b>	<b>68.8</b>	<b>29.0</b>	<b>225.9</b>
	C-4	Elgin-ND	3.2	84.4	34.3	3.6	68.0	26.3	197.6
	C-5	ND817	3.2	82.2	26.3	3.3	69.4	26.3	186.5
	C-7	SD4362	3.1	82.4	30.2	3.5	67.6	25.2	179.0
	C-9	MN10201-4	3.9	82.5	30.1	4.0	67.3	29.6	211.1
	C-10	LNR10-0493	2.7	84.9	31.0	3.2	70.6	25.9	183.8
	C-11	SY Ingmar	3.2	83.6	29.3	3.5	68.6	25.9	190.3
	C-12	LNR10-0125	5.6	71.2	23.9	5.2	58.5	21.5	255.8
<b>Crookston</b>	K-2	MN08165-8	4.9	78.8	29.7	4.5	64.3	26.3	239.2
	<b>K-3</b>	<b>Glenn</b>	<b>4.3</b>	<b>85.7</b>	<b>29.9</b>	<b>3.8</b>	<b>71.2</b>	<b>27.9</b>	<b>219.2</b>
	K-4	Elgin-ND	3.7	85.6	30.3	4.0	70.5	27.7	224.0
	K-5	ND817	3.3	85.1	30.8	4.1	69.1	27.1	235.5
	K-7	SD4362	3.3	84.2	28.7	3.4	69.7	26.9	187.2
	K-9	MN10201-4	4.7	83.9	30.4	4.5	67.7	29.5	244.5
	K-10	LNR10-0493	3.7	83.8	30.4	3.9	68.4	28.4	216.3
	K-11	SY Ingmar	4.2	83.0	31.3	4.4	67.1	30.8	241.7
<b>Minot</b>	K-12	LNR10-0125	4.0	71.0	29.3	5.3	59.2	21.8	268.3
	<b>M-3</b>	<b>Glenn</b>	<b>3.9</b>	<b>89.4</b>	<b>34.0</b>	<b>4.1</b>	<b>72.6</b>	<b>31.4</b>	<b>234.9</b>
	M-4	Elgin-ND	3.0	90.3	35.3	3.4	74.7	29.7	195.0
	M-5	ND817	3.2	87.2	28.4	3.4	73.7	26.4	191.6
	M-8	AUBR30023W	3.5	78.0	26.1	3.7	65.1	23.2	182.2
	M-10	LNR10-0493	3.8	82.7	30.7	4.3	66.6	26.0	231.0
	M-11	SY Ingmar	4.8	80.3	32.2	4.1	65.8	27.1	213.3
<b>Williston</b>	M-12	LNR10-0125	4.9	74.3	26.1	4.7	60.7	24.6	230.5
	W-1	BR2306	5.5	73.9	25.4	6.0	60.8	24.9	291.0
	<b>W-3</b>	<b>Glenn</b>	<b>5.3</b>	<b>78.7</b>	<b>27.9</b>	<b>5.7</b>	<b>64.5</b>	<b>25.7</b>	<b>296.8</b>
	W-4	Elgin-ND	4.0	85.2	28.9	4.2	70.1	28.2	230.3
	W-5	ND817	3.7	86.3	30.4	3.9	71.2	28.5	224.0
	W-6	COI565W	6.1	81.5	32.4	6.0	65.5	31.3	289.1
	W-8	AUBR30023W	5.1	71.9	20.7	5.2	61.4	20.4	245.9
	W-10	LNR10-0493	4.9	83.2	33.5	5.5	67.5	27.6	300.9
	W-11	SY Ingmar	5.3	76.0	27.6	5.5	61.5	24.8	283.2
	W-12	LNR10-0125	6.6	74.5	25.0	6.7	62.1	25.0	331.9



## 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 <sup>2</sup> )	Resistance (BU)	Extensibility (mm)	Maximum (BU)	Ratio Number	Ratio Number (max)
Watertown	<b>B-3</b>	<b>Glenn</b>	<b>70</b>	<b>190</b>	<b>166</b>	<b>350</b>	<b>1.2</b>	<b>2.1</b>
	B-4	Elgin-ND	71	127	195	311	0.7	1.6
	B-5	ND817	68	142	184	309	0.8	1.7
	B-7	SD4362	58	114	180	294	0.6	1.6
	C-2	MN08165-8	73	183	179	317	1.0	1.8
Casselton	<b>C-3</b>	<b>Glenn</b>	<b>81</b>	<b>174</b>	<b>189</b>	<b>349</b>	<b>0.9</b>	<b>1.9</b>
	C-4	Elgin-ND	48	139	172	208	0.8	1.2
	C-5	ND817	55	131	186	228	0.7	1.2
	C-7	SD4362	50	123	184	210	0.7	1.1
	C-9	MN10201-4	58	161	165	283	1.0	1.7
	C-10	LNR10-0493	60	131	198	232	0.7	1.2
	C-11	SY Ingmar	67	149	192	266	0.8	1.4
	C-12	LNR10-0125	63	246	139	366	1.8	2.6
Crookston	K-2	MN08165-8	69	198	164	336	1.2	2.0
	<b>K-3</b>	<b>Glenn</b>	<b>71</b>	<b>216</b>	<b>154</b>	<b>383</b>	<b>1.4</b>	<b>2.5</b>
	K-4	Elgin-ND	64	191	159	321	1.2	2.0
	K-5	ND817	56	190	149	299	1.3	2.0
	K-7	SD4362	54	157	164	259	1.0	1.6
	K-9	MN10201-4	76	214	163	384	1.3	2.4
	K-10	LNR10-0493	59	195	147	335	1.3	2.3
	K-11	SY Ingmar	86	247	161	443	1.5	2.8
Minot	K-12	LNR10-0125	73	254	146	403	1.7	2.8
	<b>M-3</b>	<b>Glenn</b>	<b>71</b>	<b>195</b>	<b>171</b>	<b>332</b>	<b>1.1</b>	<b>2.0</b>
	M-4	Elgin-ND	53	136	183	219	0.7	1.2
	M-5	ND817	66	150	194	265	0.8	1.4
	M-8	AUBR30023W	49	143	171	214	0.8	1.3
	M-10	LNR10-0493	59	180	159	286	1.1	1.8
	M-11	SY Ingmar	68	170	186	277	0.9	1.5
Williston	M-12	LNR10-0125	63	184	162	307	1.1	1.9
	W-1	BR2306	75	265	147	404	1.8	2.8
	<b>W-3</b>	<b>Glenn</b>	<b>105</b>	<b>276</b>	<b>169</b>	<b>515</b>	<b>1.6</b>	<b>3.1</b>
	W-4	Elgin-ND	65	211	154	339	1.4	2.2
	W-5	ND817	71	197	168	342	1.2	2.0
	W-6	COI565W	121	323	165	629	2.0	3.8
	W-8	AUBR30023W	58	196	147	315	1.3	2.1
	W-10	LNR10-0493	80	284	143	454	2.0	3.2
	W-11	SY Ingmar	77	303	135	484	2.3	3.6
W-12	LNR10-0125	97	346	147	540	2.4	3.7	

90 Minutes Resting								
Location	ID	Entry	Energy (cm <sup>2</sup> )	Resistance (BU)	Extensibility (mm)	Maximum (BU)	Ratio Number	Ratio Number (max)
Watertown	<b>B-3</b>	<b>Glenn</b>	<b>96</b>	<b>297</b>	<b>159</b>	<b>518</b>	<b>1.9</b>	<b>3.3</b>
	B-4	Elgin-ND	74	166	186	319	0.9	1.7
	B-5	ND817	67	167	174	316	1.0	1.8
	B-7	SD4362	73	210	162	373	1.3	2.3
Casselton	C-2	MN08165-8	107	221	194	442	1.1	2.3
	<b>C-3</b>	<b>Glenn</b>	<b>116</b>	<b>278</b>	<b>186</b>	<b>500</b>	<b>1.5</b>	<b>2.7</b>
	C-4	Elgin-ND	60	153	185	246	0.8	1.3
	C-5	ND817	62	180	165	297	1.1	1.8
	C-7	SD4362	67	166	183	288	0.9	1.6
	C-9	MN10201-4	84	206	179	381	1.2	2.1
	C-10	LNR10-0493	86	206	189	359	1.1	1.9
	C-11	SY Ingmar	85	240	169	400	1.4	2.4
Crookston	C-12	LNR10-0125	86	416	126	559	3.3	4.4
	K-2	MN08165-8	89	286	154	465	1.9	3.0
	<b>K-3</b>	<b>Glenn</b>	<b>80</b>	<b>309</b>	<b>141</b>	<b>461</b>	<b>2.2</b>	<b>3.3</b>
	K-4	Elgin-ND	84	246	157	438	1.6	2.8
	K-5	ND817	73	269	140	434	1.9	3.1
	K-7	SD4362	77	275	144	435	1.9	3.0
	K-9	MN10201-4	101	347	151	551	2.3	3.7
	K-10	LNR10-0493	95	353	144	542	2.4	3.8
Minot	K-11	SY Ingmar	111	339	155	598	2.2	3.9
	K-12	LNR10-0125	92	355	140	527	2.5	3.8
	<b>M-3</b>	<b>Glenn</b>	<b>105</b>	<b>224</b>	<b>190</b>	<b>450</b>	<b>1.2</b>	<b>2.4</b>
	M-4	Elgin-ND	63	152	178	289	0.9	1.6
	M-5	ND817	88	187	199	343	0.9	1.7
	M-8	AUBR30023W	54	167	159	262	1.1	1.7
	M-10	LNR10-0493	83	211	174	383	1.2	2.2
Williston	M-11	SY Ingmar	89	213	185	378	1.2	2.0
	M-12	LNR10-0125	79	233	159	409	1.5	2.6
	W-1	BR2306	94	373	137	570	2.7	4.2
	<b>W-3</b>	<b>Glenn</b>	<b>106</b>	<b>416</b>	<b>133</b>	<b>707</b>	<b>3.1</b>	<b>5.3</b>
	W-4	Elgin-ND	75	319	132	463	2.4	3.5
	W-5	ND817	114	323	174	527	1.9	3.0
	W-6	COI565W	131	463	142	825	3.3	5.8
	W-8	AUBR30023W	66	266	132	421	2.0	3.2
	W-10	LNR10-0493	98	475	121	692	3.9	5.7
	W-11	SY Ingmar	111	511	129	731	4.0	5.7
	W-12	LNR10-0125	112	457	135	708	3.4	5.3

135 Minutes Resting								
Location	ID	Entry	Energy (cm <sup>2</sup> )	Resistance (BU)	Extensibility (mm)	Maximum (BU)	Ratio Number	Ratio Number (max)
Watertown	<b>B-3</b>	<b>Glenn</b>	<b>83</b>	<b>363</b>	<b>128</b>	<b>561</b>	<b>2.8</b>	<b>4.4</b>
	B-4	Elgin-ND	78	238	162	387	1.5	2.4
	B-5	ND817	63	176	170	297	1.0	1.8
	B-7	SD4362	82	276	154	423	1.8	2.7
Casselton	C-2	MN08165-8	102	234	183	447	1.3	2.5
	<b>C-3</b>	<b>Glenn</b>	<b>107</b>	<b>253</b>	<b>183</b>	<b>464</b>	<b>1.4</b>	<b>2.5</b>
	C-4	Elgin-ND	58	139	186	243	0.8	1.3
	C-5	ND817	62	162	172	289	0.9	1.7
	C-7	SD4362	75	188	180	334	1.0	1.9
	C-9	MN10201-4	87	276	159	441	1.7	2.8
	C-10	LNR10-0493	71	207	166	333	1.3	2.0
	C-11	SY Ingmar	88	240	178	378	1.4	2.1
Crookston	C-12	LNR10-0125	72	405	123	462	3.3	3.8
	K-2	MN08165-8	100	322	159	503	2.0	3.2
	<b>K-3</b>	<b>Glenn</b>	<b>90</b>	<b>336</b>	<b>144</b>	<b>525</b>	<b>2.3</b>	<b>3.6</b>
	K-4	Elgin-ND	70	291	133	428	2.2	3.2
	K-5	ND817	82	319	146	447	2.2	3.1
	K-7	SD4362	99	329	158	499	2.1	3.2
	K-9	MN10201-4	104	360	147	586	2.5	4.0
	K-10	LNR10-0493	85	454	117	602	3.9	5.1
Minot	K-11	SY Ingmar	116	381	157	603	2.4	3.8
	K-12	LNR10-0125	103	404	144	570	2.8	4.0
	<b>M-3</b>	<b>Glenn</b>	<b>85</b>	<b>192</b>	<b>181</b>	<b>392</b>	<b>1.1</b>	<b>2.2</b>
	M-4	Elgin-ND	80	157	208	298	0.8	1.4
	M-5	ND817	73	165	197	287	0.8	1.5
	M-8	AUBR30023W	49	158	158	240	1.0	1.5
	M-10	LNR10-0493	76	215	161	393	1.3	2.5
Williston	M-11	SY Ingmar	95	223	186	403	1.2	2.2
	M-12	LNR10-0125	92	274	162	459	1.7	2.8
	W-1	BR2306	85	423	122	568	3.5	4.6
	<b>W-3</b>	<b>Glenn</b>	<b>130</b>	<b>576</b>	<b>138</b>	<b>802</b>	<b>4.2</b>	<b>5.8</b>
	W-4	Elgin-ND	82	322	141	467	2.3	3.3
	W-5	ND817	101	327	157	518	2.1	3.3
	W-6	COI565W	146	527	143	857	3.7	6.0
	W-8	AUBR30023W	94	366	141	548	2.6	3.9
	W-10	LNR10-0493	109	505	127	732	4.0	5.8
	W-11	SY Ingmar	105	576	119	758	4.9	6.4
	W-12	LNR10-0125	91	600	105	733	5.7	7.0

# Ash/Protein Content in Mill Streams

## Watertown (Group B)

### Glenn Check (B-3)

Mill Stream	Stream (%, 14% mb)			Cumulative (%, 14% mb)		
	Yield	Ash	Protein	Yield	Ash	Protein
<b>Patent:</b>						
1 M	8.3	0.23	12.1	8.3	0.23	12.1
2 M	11.6	0.26	12.5	19.9	0.25	12.3
3 M	15.6	0.28	12.7	35.4	0.26	12.5
Sz I	1.5	0.29	12.9	36.9	0.26	12.5
Sz II	3.4	0.33	12.8	40.3	0.27	12.6
4 M	9.8	0.55	14.1	50.1	0.32	12.9
1 Bk	1.2	0.59	16.6	51.4	0.33	12.9
4 Bk	5.8	0.64	17.7	57.2	0.36	13.4
2 Bk II	0.8	0.65	17.0	57.9	0.36	13.5
Bk Dust	3.2	0.67	15.7	61.1	0.38	13.6
3 Bk	1.1	0.77	18.2	62.3	0.39	13.7
2 Bk I	0.6	0.77	17.5	62.8	0.39	13.7
6 M	3.6	0.82	13.2	66.4	0.41	13.7
TC	1.7	0.85	16.1	68.0	0.42	13.7
Tail	1.5	1.22	16.4	69.5	0.44	13.8
5 Bk	1.7	1.40	20.7	71.2	0.46	14.0
<b>Clear Flour:</b>						
5 M	2.3	1.26	14.4	73.5	0.49	14.0
LG	1.4	1.58	17.4	74.9	0.51	14.0
LQ	0.6	2.03	14.3	75.5	0.52	14.0
<b>Bran &amp; Shorts:</b>						
TC Sh	0.6	1.80	13.7	76.2	0.53	14.0
Tail Sh	2.5	3.11	14.8	78.7	0.61	14.1
Head Sh	18.3	5.67	17.7	97.0	1.57	14.7
Bran	3.0	7.04	15.2	100.0	1.73	14.8
Patent (Rebolted)	0.49		13.7			
Wheat	1.64		14.7			

### Elgin-ND (B-4)

Mill Stream	Stream (%, 14% mb)			Cumulative (%, 14% mb)		
	Yield	Ash	Protein	Yield	Ash	Protein
<b>Patent:</b>						
1 M	10.8	0.28	12.2	10.8	0.28	12.2
2 M	14.5	0.28	12.3	25.3	0.28	12.3
Sz I	3.5	0.28	12.7	28.8	0.28	12.3
Sz II	3.6	0.39	12.4	32.4	0.29	12.3
3 M	14.8	0.40	13.0	47.2	0.33	12.5
1 Bk	1.2	0.48	14.2	48.4	0.33	12.6
4 M	7.6	0.62	14.2	56.0	0.37	12.8
Bk Dust	2.0	0.66	14.7	58.0	0.38	12.8
2 Bk II	1.0	0.70	15.8	59.1	0.39	12.9
4 Bk	5.0	0.74	16.2	64.1	0.41	13.2
TC	2.0	0.80	15.0	66.1	0.42	13.2
2 Bk I	0.7	0.80	15.9	66.8	0.43	13.2
3 Bk	1.7	0.89	16.7	68.6	0.44	13.3
6 M	2.8	0.95	13.3	71.4	0.46	13.3
Tail	1.0	1.47	16.7	72.4	0.47	13.4
5 Bk	1.5	1.61	19.5	73.9	0.50	13.5
<b>Clear Flour:</b>						
5 M	1.3	1.80	15.3	75.2	0.52	13.5
LG	1.1	2.09	18.3	76.3	0.54	13.6
LQ	0.3	2.68	14.8	76.7	0.55	13.6
<b>Bran &amp; Shorts:</b>						
TC Sh	0.7	1.83	12.7	77.4	0.56	13.6
Tail Sh	1.5	3.41	14.9	78.9	0.62	13.6
Head Sh	17.3	5.60	17.7	96.1	1.51	14.4
Bran	3.9	6.86	15.1	100.0	1.72	14.4
Patent (Rebolted)	0.50		13.4			
Wheat	1.65		14.0			

### ND817 (B-5)

Mill Stream	Stream (%, 14% mb)			Cumulative (%, 14% mb)		
	Yield	Ash	Protein	Yield	Ash	Protein
<b>Patent:</b>						
Sz I	1.9	0.25	12.8	1.9	0.25	12.8
1 M	10.2	0.25	11.5	12.1	0.25	11.7
2 M	13.9	0.30	12.0	26.0	0.27	11.8
Sz II	4.1	0.30	12.0	30.2	0.28	11.9
3 M	14.3	0.31	12.5	44.5	0.29	12.1
4 M	8.9	0.42	13.7	53.4	0.31	12.3
Bk Dust	3.4	0.60	14.5	56.8	0.33	12.5
4 Bk	5.0	0.69	16.9	61.8	0.36	12.8
1 Bk	1.5	0.71	14.7	63.3	0.37	12.9
TC	1.9	0.72	14.8	65.1	0.38	12.9
2 Bk II	0.9	0.73	16.6	66.1	0.38	13.0
3 Bk	1.6	0.78	17.0	67.7	0.39	13.1
2 Bk I	0.6	0.84	16.5	68.3	0.39	13.1
6 M	3.1	0.94	13.3	71.4	0.42	13.1
Tail	1.2	1.48	16.4	72.6	0.44	13.2
5 Bk	1.5	1.77	20.8	74.1	0.46	13.3
<b>Clear Flour:</b>						
5 M	2.0	1.32	14.4	76.1	0.49	13.3
LG	1.3	2.08	17.9	77.4	0.51	13.4
LQ	0.5	2.87	14.3	77.9	0.53	13.4
<b>Bran &amp; Shorts:</b>						
TC Sh	0.7	1.35	12.7	78.6	0.53	13.4
Tail Sh	2.0	3.44	14.8	80.6	0.60	13.5
Head Sh	17.2	5.59	16.8	97.8	1.48	14.0
Bran	2.2	7.06	14.6	100.0	1.61	14.1
Patent (Rebolted)	0.47		13.0			
Wheat	1.50		13.8			

### SD4362 (B-7)

Mill Stream	Stream (%, 14% mb)			Cumulative (%, 14% mb)		
	Yield	Ash	Protein	Yield	Ash	Protein
<b>Patent:</b>						
1 M	9.4	0.24	11.5	9.4	0.24	11.5
2 M	13.5	0.27	11.9	22.9	0.26	11.7
Sz I	2.2	0.28	12.4	25.1	0.26	11.8
Sz II	4.3	0.32	12.2	29.4	0.27	11.9
3 M	14.6	0.37	12.3	44.0	0.30	12.0
1 Bk	1.8	0.51	14.6	45.8	0.31	12.1
Bk Dust	3.9	0.62	14.3	49.6	0.34	12.3
2 Bk II	1.4	0.63	16.1	51.1	0.34	12.4
4 Bk	5.7	0.64	16.6	56.8	0.37	12.8
4 M	7.8	0.65	13.6	64.6	0.41	12.9
2 Bk I	0.9	0.65	16.1	65.5	0.41	13.0
3 Bk	2.0	0.69	16.9	67.5	0.42	13.1
TC	2.1	0.70	14.5	69.5	0.43	13.1
6 M	2.9	0.97	13.1	72.5	0.45	13.1
Tail	1.2	1.69	16.8	73.7	0.47	13.2
5 Bk	1.6	1.72	20.5	75.3	0.50	13.3
<b>Clear Flour:</b>						
5 M	1.6	1.66	14.5	76.9	0.52	13.4
LG	1.1	2.47	18.3	78.0	0.55	13.4
LQ	0.3	2.88	14.8	78.3	0.56	13.4
<b>Bran &amp; Shorts:</b>						
TC Sh	0.7	1.43	13.0	78.9	0.56	13.4
Tail Sh	1.7	3.73	14.7	80.6	0.63	13.5
Head Sh	17.2	5.28	17.5	97.9	1.45	14.2
Bran	2.1	7.02	15.0	100.0	1.57	14.2
Patent (Rebolted)	0.54		13.1			
Wheat	1.53		13.8			

## Casselton (Group C)

### MN08165-8 (C-2)

Mill Stream	Stream (%, 14% mb)			Cumulative (%, 14% mb)		
	Yield	Ash	Protein	Yield	Ash	Protein
<b>Patent:</b>						
2 M	12.3	0.23	13.9	12.3	0.23	13.9
1 M	8.9	0.24	13.4	21.2	0.24	13.7
Sz I	1.7	0.28	14.1	22.9	0.24	13.7
3 M	16.1	0.32	14.3	39.0	0.27	14.0
Sz II	4.0	0.36	13.9	43.0	0.28	14.0
4 M	9.1	0.50	15.5	52.1	0.32	14.2
4 Bk	5.1	0.63	18.5	57.2	0.35	14.6
1 Bk	1.2	0.63	16.2	58.4	0.35	14.7
TC	2.2	0.64	16.8	60.6	0.36	14.7
Bk Dust	3.0	0.69	16.3	63.6	0.38	14.8
2 Bk I	0.7	0.77	18.3	64.3	0.38	14.8
2 Bk II	0.9	0.78	18.7	65.1	0.39	14.9
3 Bk	1.3	0.82	18.1	66.5	0.40	15.0
6 M	3.5	1.03	14.5	70.0	0.43	14.9
Tail	1.4	1.52	18.1	71.4	0.45	15.0
5 Bk	1.6	1.69	23.0	73.0	0.48	15.2
<b>Clear Flour:</b>						
5 M	2.3	1.43	15.7	75.3	0.51	15.2
LG	1.2	2.62	19.1	76.5	0.54	15.3
LQ	0.3	2.82	15.5	76.9	0.55	15.3
<b>Bran &amp; Shorts:</b>						
TC Sh	0.9	1.29	14.6	77.8	0.56	15.2
Tail Sh	2.0	3.78	15.0	79.8	0.64	15.2
Head Sh	18.0	5.31	18.7	97.8	1.50	15.9
Bran	2.2	6.62	14.9	100.0	1.61	15.9
<b>Patent (Rebolted)</b>						
Wheat		0.49	15.1			
		1.52	15.8			

### Glenn Check (C-3)

Mill Stream	Stream (%, 14% mb)			Cumulative (%, 14% mb)		
	Yield	Ash	Protein	Yield	Ash	Protein
<b>Patent:</b>						
1 M	7.7	0.27	11.3	7.7	0.27	11.3
2 M	11.8	0.29	11.6	19.4	0.28	11.5
Sz I	1.6	0.29	12.8	21.0	0.28	11.6
3 M	17.0	0.38	12.2	38.0	0.33	11.9
Sz II	3.9	0.40	12.3	41.9	0.33	11.9
4 M	9.5	0.55	13.3	51.4	0.38	12.2
1 Bk	1.2	0.70	15.0	52.6	0.38	12.2
4 Bk	6.3	0.70	16.3	58.9	0.42	12.6
Bk Dust	2.9	0.72	14.7	61.8	0.43	12.7
6 M	3.7	0.82	12.7	65.5	0.45	12.7
2 Bk II	0.9	0.84	17.2	66.3	0.46	12.8
TC	1.8	0.85	14.7	68.2	0.47	12.8
3 Bk	1.1	0.90	17.3	69.3	0.48	12.9
2 Bk I	0.6	0.91	17.0	69.9	0.48	13.0
Tail	1.5	1.43	16.2	71.4	0.50	13.0
5 Bk	1.9	1.77	20.7	73.2	0.53	13.2
<b>Clear Flour:</b>						
5 M	2.0	1.50	14.1	75.3	0.56	13.2
LG	1.5	2.41	18.4	76.7	0.59	13.3
LQ	0.5	2.68	14.1	77.2	0.60	13.3
<b>Bran &amp; Shorts:</b>						
TC Sh	0.8	1.43	12.5	78.0	0.61	13.3
Tail Sh	2.4	3.72	14.6	80.4	0.71	13.4
Head Sh	17.9	5.51	16.7	98.4	1.58	14.0
Bran	1.6	7.40	14.3	100.0	1.68	14.0
<b>Patent (Rebolted)</b>						
Wheat		0.51	13.2			
		1.66	14.0			

### Elgin-ND (C-4)

Mill Stream	Stream (%, 14% mb)			Cumulative (%, 14% mb)		
	Yield	Ash	Protein	Yield	Ash	Protein
<b>Patent:</b>						
1 M	7.8	0.21	11.7	7.8	0.21	11.7
2 M	13.8	0.22	11.8	21.6	0.22	11.7
Sz I	2.4	0.29	12.0	24.1	0.22	11.8
Sz II	3.8	0.34	12.0	27.9	0.24	11.8
3 M	16.4	0.39	12.6	44.2	0.30	12.1
1 Bk	1.4	0.61	12.9	45.7	0.31	12.1
4 M	8.9	0.63	13.8	54.6	0.36	12.4
Bk Dust	3.6	0.64	12.9	58.2	0.38	12.4
4 Bk	5.8	0.68	15.5	64.0	0.40	12.7
2 Bk II	1.0	0.73	15.2	65.0	0.41	12.7
TC	2.4	0.76	13.8	67.3	0.42	12.8
3 Bk	1.3	0.84	15.8	68.6	0.43	12.8
6 M	2.9	0.88	13.1	71.5	0.45	12.8
2 Bk I	0.7	0.89	14.8	72.2	0.45	12.8
Tail	1.1	1.49	16.4	73.3	0.47	12.9
5 Bk	1.6	1.71	19.6	74.9	0.49	13.0
<b>Clear Flour:</b>						
5 M	1.3	1.90	15.1	76.2	0.52	13.1
LG	1.0	2.33	17.9	77.2	0.54	13.1
LQ	0.2	3.09	14.8	77.4	0.55	13.1
<b>Bran &amp; Shorts:</b>						
TC Sh	1.1	1.31	12.5	78.5	0.56	13.1
Tail Sh	1.7	3.74	15.3	80.3	0.63	13.2
Head Sh	17.1	5.61	18.5	97.4	1.50	14.1
Bran	2.6	7.49	15.2	100.0	1.66	14.1
<b>Patent (Rebolted)</b>						
Wheat		0.52	13.0			
		1.64	13.9			

### ND817 (C-5)

Mill Stream	Stream (%, 14% mb)			Cumulative (%, 14% mb)		
	Yield	Ash	Protein	Yield	Ash	Protein
<b>Patent:</b>						
1 M	8.8	0.24	11.4	8.8	0.24	11.4
Sz I	2.3	0.26	11.8	11.1	0.25	11.5
2 M	12.5	0.27	12.0	23.6	0.26	11.8
Sz II	3.7	0.28	12.1	27.4	0.26	11.8
3 M	16.0	0.34	12.6	43.4	0.29	12.1
4 M	10.2	0.51	13.6	53.6	0.33	12.4
Bk Dust	3.5	0.57	13.6	57.1	0.34	12.4
4 Bk	5.7	0.58	16.4	62.8	0.37	12.8
1 Bk	1.4	0.67	12.4	64.2	0.37	12.8
2 Bk II	1.0	0.70	15.5	65.2	0.38	12.8
3 Bk	1.3	0.78	16.6	66.5	0.39	12.9
TC	1.4	0.78	14.7	67.9	0.39	12.9
2 Bk I	0.7	0.80	14.8	68.6	0.40	13.0
6 M	3.4	1.00	13.1	72.0	0.43	13.0
Tail	1.2	1.42	16.4	73.2	0.44	13.0
5 Bk	1.6	1.62	18.1	74.8	0.47	13.1
<b>Clear Flour:</b>						
5 M	1.8	1.76	14.5	76.6	0.50	13.2
LG	1.2	2.27	17.0	77.8	0.53	13.2
LQ	0.5	2.81	14.4	78.3	0.54	13.2
<b>Bran &amp; Shorts:</b>						
TC Sh	0.5	1.94	12.7	78.7	0.55	13.2
Tail Sh	1.9	3.68	14.2	80.6	0.62	13.3
Head Sh	17.2	5.38	18.0	97.8	1.46	14.1
Bran	2.2	7.22	15.5	100.0	1.58	14.1
<b>Patent (Rebolted)</b>						
Wheat		0.48	13.1			
		1.49	14.4			

## SD4362 (C-7)

Mill Stream	Stream (%, 14% mb)			Cumulative (%, 14% mb)		
	Yield	Ash	Protein	Yield	Ash	Protein
<b>Patent:</b>						
1 M	7.0	0.21	11.5	7.0	0.21	11.5
Sz I	2.5	0.27	12.2	9.5	0.23	11.7
Sz II	3.9	0.29	12.1	13.3	0.25	11.8
2 M	13.1	0.32	11.9	26.4	0.28	11.9
3 M	15.3	0.47	12.8	41.8	0.35	12.2
1 Bk	1.7	0.52	14.3	43.5	0.36	12.3
4 M	8.4	0.58	14.3	51.9	0.39	12.6
2 Bk II	1.4	0.58	16.0	53.3	0.40	12.7
Bk Dust	3.9	0.59	14.2	57.2	0.41	12.8
4 Bk	6.6	0.61	16.8	63.8	0.43	13.2
2 Bk I	0.9	0.65	15.9	64.7	0.44	13.2
3 Bk	1.7	0.66	17.0	66.4	0.44	13.3
TC	1.9	0.82	15.0	68.3	0.45	13.4
6 M	3.2	1.08	13.9	71.5	0.48	13.4
5 Bk	1.7	1.62	21.1	73.2	0.51	13.6
Tail	1.2	1.63	17.9	74.5	0.53	13.7
<b>Clear Flour:</b>						
5 M	1.7	1.68	15.8	76.1	0.55	13.7
LG	1.1	2.31	18.7	77.3	0.58	13.8
LQ	0.3	2.76	16.4	77.6	0.58	13.8
<b>Bran &amp; Shorts:</b>						
TC Sh	0.6	1.67	14.1	78.1	0.59	13.8
Tail Sh	1.1	3.49	15.7	79.3	0.63	13.8
Head Sh	18.4	5.33	19.5	97.7	1.52	14.9
Bran	2.3	7.16	16.9	100.0	1.65	14.9
Patent (Rebolted)	0.52	13.7				
Wheat	1.69	15.1				

## MN10201-4 (C-9)

Mill Stream	Stream (%, 14% mb)			Cumulative (%, 14% mb)		
	Yield	Ash	Protein	Yield	Ash	Protein
<b>Patent:</b>						
1 M	8.4	0.23	11.3	8.4	0.23	11.3
Sz I	2.6	0.27	12.2	11.0	0.24	11.5
3 M	17.5	0.27	12.0	28.5	0.26	11.8
2 M	11.5	0.27	11.9	40.0	0.26	11.8
Sz II	4.0	0.32	12.1	44.0	0.27	11.9
4 M	8.4	0.49	13.4	52.4	0.30	12.1
1 Bk	1.6	0.52	15.0	54.0	0.31	12.2
Bk Dust	3.8	0.57	14.5	57.8	0.33	12.3
4 Bk	6.3	0.59	15.8	64.1	0.35	12.7
2 Bk II	1.2	0.62	16.0	65.3	0.36	12.7
2 Bk I	0.8	0.68	16.0	66.1	0.36	12.8
3 Bk	1.6	0.69	16.5	67.7	0.37	12.9
6 M	3.1	0.94	13.0	70.9	0.39	12.9
TC	1.7	1.32	15.0	72.6	0.42	12.9
5 Bk	1.7	1.51	19.2	74.3	0.44	13.1
Tail	1.1	1.59	16.9	75.4	0.46	13.1
<b>Clear Flour:</b>						
5 M	1.9	1.59	14.8	77.4	0.49	13.2
LG	1.2	2.37	18.7	78.6	0.52	13.3
LQ	0.3	2.75	14.8	78.8	0.52	13.3
<b>Bran &amp; Shorts:</b>						
TC Sh	0.5	1.92	13.3	79.4	0.53	13.3
Tail Sh	1.7	3.64	14.6	81.1	0.60	13.3
Head Sh	16.1	5.70	17.9	97.3	1.44	14.0
Bran	2.7	7.35	14.8	100.0	1.61	14.1
Patent (Rebolted)	0.49	13.0				
Wheat	1.49	13.9				

## LNR10-0493 (C-10)

Mill Stream	Stream (%, 14% mb)			Cumulative (%, 14% mb)		
	Yield	Ash	Protein	Yield	Ash	Protein
<b>Patent:</b>						
1 M	11.0	0.28	12.0	11.0	0.28	12.0
2 M	13.2	0.30	12.5	24.3	0.29	12.3
Sz I	2.8	0.33	12.4	27.0	0.30	12.3
3 M	15.1	0.39	13.1	42.1	0.33	12.6
Sz II	3.7	0.39	12.7	45.8	0.33	12.6
4 M	8.6	0.58	14.0	54.5	0.37	12.8
1 Bk	1.5	0.60	13.3	56.0	0.38	12.9
Bk Dust	3.6	0.64	13.7	59.6	0.39	12.9
4 Bk	5.3	0.67	16.2	64.9	0.42	13.2
2 Bk II	1.1	0.72	15.1	66.1	0.42	13.2
3 Bk	1.6	0.74	16.5	67.7	0.43	13.3
2 Bk I	0.7	0.87	15.2	68.4	0.43	13.3
TC	1.7	0.92	15.2	70.1	0.45	13.3
6 M	2.7	1.20	13.9	72.8	0.47	13.4
5 Bk	1.2	1.52	20.2	74.0	0.49	13.5
Tail	0.8	1.54	16.9	74.8	0.50	13.5
<b>Clear Flour:</b>						
5 M	1.6	1.85	15.1	76.4	0.53	13.6
LG	1.0	2.11	17.3	77.4	0.55	13.6
LQ	0.5	2.82	15.2	77.9	0.57	13.6
<b>Bran &amp; Shorts:</b>						
TC Sh	0.6	2.29	12.6	78.4	0.58	13.6
Tail Sh	1.8	3.86	15.1	80.2	0.65	13.6
Head Sh	15.2	5.42	18.2	95.5	1.41	14.4
Bran	4.5	7.43	16.0	100.0	1.68	14.4
Patent (Rebolted)	0.52	13.4				
Wheat	1.65	14.7				

## SY Ingmar (C-11)

Mill Stream	Stream (%, 14% mb)			Cumulative (%, 14% mb)		
	Yield	Ash	Protein	Yield	Ash	Protein
<b>Patent:</b>						
1 M	10.8	0.23	11.6	10.8	0.23	11.6
Sz I	2.7	0.30	12.4	13.5	0.25	11.8
2 M	12.4	0.31	12.3	25.9	0.28	12.0
Sz II	3.8	0.39	12.7	29.6	0.29	12.1
3 M	13.6	0.43	12.6	43.2	0.33	12.2
1 Bk	2.0	0.48	15.8	45.2	0.34	12.4
4 Bk	6.5	0.58	17.3	51.7	0.37	13.0
4 M	8.1	0.61	14.1	59.8	0.40	13.2
2 Bk II	1.5	0.61	17.2	61.3	0.41	13.3
2 Bk I	1.0	0.62	17.1	62.3	0.41	13.3
Bk Dust	4.1	0.63	14.8	66.4	0.42	13.4
3 Bk	2.2	0.64	17.8	68.6	0.43	13.6
TC	1.6	0.79	15.7	70.2	0.44	13.6
6 M	2.7	1.24	13.8	72.9	0.47	13.6
5 Bk	1.7	1.45	21.9	74.5	0.49	13.8
Tail	0.9	1.76	17.9	75.4	0.51	13.8
<b>Clear Flour:</b>						
5 M	1.5	1.88	15.5	76.9	0.53	13.9
LG	1.0	2.31	18.8	77.9	0.56	13.9
LQ	0.4	3.26	15.3	78.3	0.57	13.9
<b>Bran &amp; Shorts:</b>						
TC Sh	0.5	2.09	13.5	78.7	0.58	13.9
Tail Sh	1.6	4.10	15.5	80.3	0.65	14.0
Head Sh	15.9	5.81	19.5	96.2	1.50	14.9
Bran	3.8	7.16	16.7	100.0	1.72	15.0
Patent (Rebolted)	0.52	13.7				
Wheat	1.63	15.0				

**LNR10-0125 (C-12)**

Mill Stream	Stream (%, 14% mb)			Cumulative (%, 14% mb)		
	Yield	Ash	Protein	Yield	Ash	Protein
<b>Patent:</b>						
1 M	10.5	0.31	10.0	10.5	0.31	10.0
Sz I	2.5	0.32	10.3	13.0	0.31	10.1
2 M	12.0	0.33	10.0	25.0	0.32	10.0
Sz II	3.8	0.40	10.3	28.8	0.33	10.0
3 M	15.9	0.47	10.9	44.7	0.38	10.4
1 Bk	1.7	0.47	10.5	46.4	0.38	10.4
Bk Dust	3.5	0.59	10.5	49.9	0.40	10.4
2 Bk II	1.2	0.59	12.3	51.1	0.40	10.4
2 Bk I	0.9	0.62	13.1	52.0	0.40	10.5
4 Bk	5.7	0.65	13.3	57.7	0.43	10.7
4 M	8.1	0.66	11.9	65.7	0.46	10.9
3 Bk	1.7	0.73	13.0	67.4	0.46	10.9
TC	1.9	0.74	11.1	69.3	0.47	10.9
6 M	2.7	1.14	12.5	72.0	0.50	11.0
5 Bk	1.6	1.43	18.9	73.6	0.52	11.2
Tail	0.9	1.67	15.8	74.5	0.53	11.2
<b>Clear Flour:</b>						
LG	1.0	2.09	18.1	75.5	0.55	11.3
5 M	1.2	2.16	14.6	76.7	0.58	11.4
LQ	0.3	3.09	14.4	77.0	0.59	11.4
<b>Bran &amp; Shorts:</b>						
TC Sh	0.7	1.60	9.8	77.7	0.60	11.4
Tail Sh	1.7	3.89	14.0	79.5	0.67	11.4
Head Sh	16.7	4.86	15.9	96.2	1.40	12.2
Bran	3.8	6.35	13.1	100.0	1.59	12.2
<b>Patent (Rebolted)</b>		<b>0.52</b>	<b>10.9</b>			
<b>Wheat</b>		<b>1.53</b>	<b>11.7</b>			

**Crookston (Group K)**

**MN08165-8 (K-2)**

Mill Stream	Stream (%, 14% mb)			Cumulative (%, 14% mb)		
	Yield	Ash	Protein	Yield	Ash	Protein
<b>Patent:</b>						
1 M	9.3	0.28	10.3	9.3	0.28	10.3
Sz I	2.3	0.29	10.3	11.5	0.28	10.3
2 M	15.0	0.31	10.6	26.5	0.30	10.5
3 M	13.4	0.36	11.1	39.9	0.32	10.7
Sz II	3.8	0.39	10.4	43.7	0.33	10.7
4 M	10.1	0.52	11.5	53.8	0.36	10.8
1 Bk	1.4	0.64	10.2	55.2	0.37	10.8
Bk Dust	2.9	0.68	10.7	58.1	0.38	10.8
4 Bk	4.7	0.72	12.4	62.8	0.41	10.9
TC	1.7	0.73	11.6	64.4	0.42	10.9
2 Bk II	0.9	0.79	11.4	65.3	0.42	10.9
3 Bk	1.4	0.84	12.4	66.7	0.43	11.0
6 M	3.0	0.85	11.7	69.7	0.45	11.0
2 Bk I	0.6	0.89	11.3	70.3	0.45	11.0
5 Bk	1.2	1.55	14.8	71.5	0.47	11.1
Tail	0.9	1.74	14.1	72.4	0.49	11.1
<b>Clear Flour:</b>						
5 M	2.1	1.48	12.8	74.6	0.52	11.2
LG	1.1	1.84	14.7	75.7	0.54	11.2
LQ	0.4	2.71	12.6	76.1	0.55	11.2
<b>Bran &amp; Shorts:</b>						
TC Sh	0.7	1.41	11.1	76.7	0.55	11.2
Tail Sh	1.9	3.31	12.6	78.6	0.62	11.3
Head Sh	16.6	4.40	14.9	95.2	1.28	11.9
Bran	4.8	5.55	12.0	100.0	1.48	11.9
<b>Patent (Rebolted)</b>		<b>0.52</b>	<b>11.0</b>			
<b>Wheat</b>		<b>1.43</b>	<b>11.6</b>			

**Glenn Check (K-3)**

Mill Stream	Stream (%, 14% mb)			Cumulative (%, 14% mb)		
	Yield	Ash	Protein	Yield	Ash	Protein
<b>Patent:</b>						
1 M	9.0	0.26	11.0	9.0	0.26	11.0
Sz I	1.8	0.28	11.1	10.8	0.26	11.0
2 M	12.8	0.28	11.6	23.5	0.27	11.3
3 M	16.7	0.31	11.8	40.3	0.29	11.5
Sz II	3.7	0.35	11.3	43.9	0.30	11.5
4 M	9.8	0.52	12.3	53.7	0.34	11.6
Bk Dust	2.3	0.53	13.0	56.1	0.34	11.7
1 Bk	0.9	0.60	12.6	57.0	0.35	11.7
4 Bk	5.6	0.66	14.5	62.6	0.38	12.0
6 M	3.5	0.67	11.9	66.1	0.39	12.0
2 Bk II	0.6	0.81	13.5	66.7	0.40	12.0
3 Bk	1.2	0.84	14.9	67.9	0.40	12.0
2 Bk I	0.5	0.89	13.8	68.4	0.41	12.0
TC	1.4	0.91	13.6	69.8	0.42	12.1
Tail	1.2	1.47	14.3	71.0	0.44	12.1
5 Bk	1.3	1.48	16.8	72.3	0.45	12.2
<b>Clear Flour:</b>						
5 M	2.1	1.29	12.8	74.4	0.48	12.2
LG	1.3	1.78	14.5	75.7	0.50	12.3
LQ	0.5	2.41	13.0	76.3	0.51	12.3
<b>Bran &amp; Shorts:</b>						
TC Sh	0.5	1.83	12.2	76.8	0.52	12.3
Tail Sh	2.3	3.34	13.4	79.1	0.60	12.3
Head Sh	17.7	5.06	16.4	96.7	1.42	13.0
Bran	3.3	6.28	13.6	100.0	1.58	13.1
<b>Patent (Rebolted)</b>		<b>0.47</b>	<b>12.1</b>			
<b>Wheat</b>		<b>1.45</b>	<b>12.8</b>			



### Elgin-ND (K-4)

Mill Stream	Stream (%, 14% mb)			Cumulative (%, 14% mb)		
	Yield	Ash	Protein	Yield	Ash	Protein
<b>Patent:</b>						
1 M	10.7	0.27	10.5	10.7	0.27	10.5
Sz I	2.4	0.27	10.9	13.1	0.27	10.6
2 M	13.5	0.31	10.8	26.6	0.29	10.7
Sz II	3.9	0.37	10.6	30.5	0.30	10.7
3 M	16.2	0.39	11.3	46.6	0.33	10.9
4 M	8.3	0.53	12.0	55.0	0.36	11.1
1 Bk	1.4	0.59	11.6	56.4	0.37	11.1
4 Bk	5.4	0.63	13.0	61.9	0.39	11.3
Bk Dust	3.1	0.64	11.7	65.0	0.40	11.3
2 Bk II	1.0	0.72	12.6	66.0	0.41	11.3
TC	1.7	0.73	12.1	67.7	0.42	11.3
6 M	2.8	0.76	11.7	70.5	0.43	11.3
3 Bk	1.4	0.76	13.0	71.9	0.44	11.4
2 Bk I	0.7	0.84	13.0	72.6	0.44	11.4
Tail	0.9	1.34	14.5	73.5	0.45	11.4
5 Bk	1.2	1.43	15.8	74.7	0.47	11.5
<b>Clear Flour:</b>						
5 M	1.6	1.40	13.1	76.3	0.49	11.5
LG	1.1	1.70	15.3	77.4	0.50	11.6
LQ	0.3	2.48	13.3	77.7	0.51	11.6
<b>Bran &amp; Shorts:</b>						
TC Sh	0.6	1.58	11.2	78.3	0.52	11.6
Tail Sh	1.7	3.28	13.5	79.9	0.58	11.6
Head Sh	15.0	4.96	16.1	95.0	1.27	12.3
Bran	5.0	6.35	13.8	100.0	1.53	12.4
<b>Patent (Rebolted)</b>						
Wheat	1.40	11.8				

### ND817 (K-5)

Mill Stream	Stream (%, 14% mb)			Cumulative (%, 14% mb)		
	Yield	Ash	Protein	Yield	Ash	Protein
<b>Patent:</b>						
1 M	9.8	0.24	10.9	9.8	0.24	10.9
2 M	12.8	0.28	11.3	22.5	0.26	11.1
Sz I	2.1	0.28	11.1	24.7	0.26	11.1
3 M	15.4	0.32	11.8	40.1	0.28	11.4
Sz II	3.7	0.35	11.2	43.9	0.29	11.4
4 M	8.5	0.48	12.4	52.4	0.32	11.5
1 Bk	1.4	0.50	11.9	53.8	0.32	11.5
Bk Dust	3.1	0.58	11.9	56.9	0.34	11.6
4 Bk	5.5	0.59	14.7	62.4	0.36	11.8
2 Bk II	1.0	0.66	13.7	63.4	0.36	11.9
TC	1.9	0.69	13.5	65.3	0.37	11.9
3 Bk	1.5	0.69	14.7	66.8	0.38	12.0
2 Bk I	0.7	0.73	13.1	67.5	0.38	12.0
6 M	3.2	0.75	12.3	70.7	0.40	12.0
Tail	1.1	1.22	15.0	71.8	0.41	12.0
5 Bk	1.2	1.36	17.4	73.0	0.43	12.1
<b>Clear Flour:</b>						
5 M	2.2	1.30	13.3	75.2	0.46	12.2
LG	1.2	1.76	15.2	76.4	0.48	12.2
LQ	0.4	2.28	13.5	76.8	0.48	12.2
<b>Bran &amp; Shorts:</b>						
TC Sh	0.7	1.32	12.6	77.5	0.49	12.2
Tail Sh	2.0	3.19	14.0	79.5	0.56	12.3
Head St	16.3	4.33	16.0	95.8	1.20	12.9
Bran	4.2	5.53	15.2	100.0	1.38	13.0
<b>Patent (Rebolted)</b>						
Wheat	1.24	12.7				

### SD4362 (K-7)

Mill Stream	Stream (%, 14% mb)			Cumulative (%, 14% mb)		
	Yield	Ash	Protein	Yield	Ash	Protein
<b>Patent:</b>						
1 M	7.9	0.21	10.7	7.9	0.21	10.7
Sz I	2.0	0.24	11.4	9.9	0.22	10.8
2 M	13.9	0.29	11.1	23.8	0.26	11.0
Sz II	4.2	0.31	11.4	28.0	0.27	11.0
3 M	14.6	0.37	11.5	42.6	0.30	11.2
Bk Dust	3.8	0.51	13.1	46.3	0.32	11.3
4 Bk	6.7	0.53	14.8	53.0	0.35	11.8
4 M	9.3	0.55	12.5	62.4	0.38	11.9
2 Bk II	1.3	0.56	14.8	63.7	0.38	12.0
1 Bk	1.8	0.57	12.8	65.5	0.39	12.0
2 Bk I	0.8	0.59	14.6	66.3	0.39	12.0
3 Bk	2.2	0.63	15.2	68.5	0.40	12.1
TC	1.7	0.70	13.6	70.2	0.40	12.2
6 M	3.2	1.26	12.5	73.4	0.44	12.2
5 Bk	1.5	1.29	17.9	74.8	0.46	12.3
Tail	0.9	1.61	15.2	75.7	0.47	12.3
<b>Clear Flour:</b>						
5 M	1.4	1.84	13.8	77.2	0.50	12.3
LG	1.0	1.89	15.4	78.2	0.51	12.4
LQ	0.3	2.74	13.0	78.4	0.52	12.4
<b>Bran &amp; Shorts:</b>						
TC Sh	0.5	1.56	12.6	79.0	0.53	12.4
Tail Sh	1.6	3.29	13.3	80.6	0.58	12.4
Head Sh	15.6	4.25	16.9	96.2	1.18	13.1
Bran	3.8	5.88	14.7	100.0	1.36	13.2
<b>Patent (Rebolted)</b>						
Wheat	1.27	13.2				

### MN10201-4 (K-9)

Mill Stream	Stream (%, 14% mb)			Cumulative (%, 14% mb)		
	Yield	Ash	Protein	Yield	Ash	Protein
<b>Patent:</b>						
2 M	13.8	0.28	11.5	13.8	0.28	11.5
1 M	9.4	0.29	10.9	23.2	0.29	11.3
Sz I	2.0	0.29	11.7	25.2	0.29	11.3
Sz II	4.2	0.34	11.5	29.5	0.29	11.3
3 M	16.1	0.42	11.4	45.6	0.34	11.4
1 Bk	1.5	0.47	14.4	47.1	0.34	11.5
4 Bk	6.5	0.50	13.8	53.6	0.36	11.8
4 M	8.9	0.51	12.3	62.5	0.38	11.8
Bk Dust	3.7	0.52	13.5	66.3	0.39	11.9
2 Bk II	1.1	0.54	15.1	67.3	0.40	12.0
TC	1.7	0.59	13.9	69.1	0.40	12.0
3 Bk	1.8	0.61	15.1	70.9	0.41	12.1
2 Bk I	0.8	0.62	15.0	71.7	0.41	12.1
6 M	3.2	1.05	12.0	74.8	0.43	12.1
5 Bk	1.3	1.15	17.1	76.2	0.45	12.2
Tail	0.9	1.37	14.9	77.1	0.46	12.3
<b>Clear Flour:</b>						
5 M	1.0	1.67	13.5	78.1	0.47	12.3
LG	0.9	1.85	16.4	79.0	0.49	12.3
LQ	0.2	2.64	12.6	79.2	0.50	12.3
<b>Bran &amp; Shorts:</b>						
TC Sh	0.5	1.41	12.8	79.7	0.50	12.3
Tail Sh	1.3	3.08	13.1	81.0	0.54	12.3
Head Sh	14.3	4.11	16.0	95.3	1.08	12.9
Bran	4.7	5.60	13.8	100.0	1.29	12.9
<b>Patent (Rebolted)</b>						
Wheat	1.23	12.7				

**LNR10-0493 (K-10)**

Mill Stream	Stream (%, 14% mb)			Cumulative (%, 14% mb)		
	Yield	Ash	Protein	Yield	Ash	Protein
<b>Patent:</b>						
1 M	11.2	0.25	10.8	11.2	0.25	10.8
2 M	13.3	0.27	11.3	24.5	0.26	11.1
Sz I	2.1	0.28	11.2	26.6	0.26	11.1
Sz II	3.7	0.32	11.3	30.3	0.27	11.1
3 M	15.4	0.34	11.5	45.7	0.29	11.2
4 M	9.2	0.48	12.1	54.9	0.32	11.4
1 Bk	1.5	0.53	11.9	56.4	0.33	11.4
Bk Dust	3.3	0.55	12.2	59.7	0.34	11.5
4 Bk	5.4	0.58	14.0	65.1	0.36	11.7
2 Bk II	1.0	0.64	13.3	66.1	0.37	11.7
3 Bk	1.5	0.65	14.3	67.6	0.37	11.7
2 Bk I	0.7	0.74	13.1	68.3	0.38	11.8
TC	1.3	0.80	13.5	69.5	0.38	11.8
6 M	3.2	0.88	12.2	72.7	0.41	11.8
5 Bk	1.1	1.31	16.6	73.8	0.42	11.9
Tail	0.9	1.42	14.6	74.6	0.43	11.9
<b>Clear Flour:</b>						
5 M	1.9	1.41	13.3	76.5	0.45	11.9
LG	1.0	1.66	14.9	77.5	0.47	12.0
LQ	0.4	2.34	13.3	77.9	0.48	12.0
<b>Bran &amp; Shorts:</b>						
TC Sh	0.5	1.98	12.0	78.4	0.49	12.0
Tail Sh	1.8	3.34	13.8	80.1	0.55	12.0
Head Sh	14.8	4.57	16.8	94.9	1.18	12.8
Bran	5.1	5.89	14.4	100.0	1.42	12.9
Patent (Rebolted)	0.43	11.7				
Wheat	1.34	12.5				

**SY Ingmar (K-11)**

Mill Stream	Stream (%, 14% mb)			Cumulative (%, 14% mb)		
	Yield	Ash	Protein	Yield	Ash	Protein
<b>Patent:</b>						
1 M	8.2	0.26	11.6	8.2	0.26	11.6
Sz I	1.6	0.27	12.5	9.7	0.26	11.8
2 M	11.7	0.30	12.2	21.4	0.28	12.0
Sz II	3.6	0.32	12.5	25.0	0.29	12.1
3 M	16.2	0.33	12.4	41.2	0.31	12.2
1 Bk	1.5	0.47	15.8	42.7	0.31	12.3
4 M	9.5	0.53	13.4	52.2	0.35	12.5
4 Bk	6.7	0.54	16.1	58.9	0.37	12.9
Bk Dust	3.4	0.57	14.8	62.3	0.38	13.1
2 Bk II	1.2	0.59	16.7	63.5	0.39	13.1
3 Bk	1.8	0.60	17.1	65.3	0.39	13.2
2 Bk I	0.8	0.62	16.4	66.1	0.40	13.3
TC	1.9	0.73	14.7	68.0	0.41	13.3
6 M	3.6	0.79	12.8	71.6	0.42	13.3
5 Bk	1.5	1.13	19.2	73.1	0.44	13.4
Tail	1.1	1.32	15.2	74.2	0.45	13.4
<b>Clear Flour:</b>						
5 M	1.9	1.42	13.9	76.1	0.48	13.4
LG	1.1	1.66	16.0	77.2	0.49	13.5
LQ	0.3	2.64	13.3	77.5	0.50	13.5
<b>Bran &amp; Shorts:</b>						
TC Sh	0.7	1.56	13.1	78.2	0.51	13.5
Tail Sh	1.8	3.35	13.6	80.0	0.58	13.5
Head Sh	16.0	4.65	16.7	96.1	1.26	14.0
Bran	3.9	5.97	14.5	100.0	1.44	14.0
Patent (Rebolted)	0.46	13.0				
Wheat	1.39	13.5				

**LNR10-0125 (K-12)**

Mill Stream	Stream (%, 14% mb)			Cumulative (%, 14% mb)		
	Yield	Ash	Protein	Yield	Ash	Protein
<b>Patent:</b>						
1 M	8.5	0.28	10.1	8.5	0.28	10.1
2 M	12.6	0.29	10.1	21.1	0.29	10.1
Sz I	1.7	0.31	10.3	22.8	0.29	10.1
Sz II	3.5	0.37	10.2	26.3	0.30	10.2
3 M	17.3	0.37	10.9	43.6	0.33	10.5
1 Bk	1.3	0.49	11.1	45.0	0.33	10.5
4 M	8.4	0.50	11.7	53.4	0.36	10.7
4 Bk	6.0	0.59	12.8	59.3	0.38	10.9
Bk Dust	2.9	0.59	11.0	62.2	0.39	10.9
TC	1.3	0.66	11.5	63.5	0.40	10.9
2 Bk II	0.9	0.66	12.3	64.4	0.40	10.9
2 Bk I	0.7	0.70	13.2	65.1	0.40	10.9
3 Bk	1.3	0.70	13.0	66.4	0.41	11.0
6 M	3.6	0.72	11.6	70.0	0.43	11.0
5 Bk	1.5	1.16	15.4	71.5	0.44	11.1
Tail	1.1	1.18	14.2	72.6	0.45	11.2
<b>Clear Flour:</b>						
5 M	1.8	1.40	12.7	74.5	0.48	11.2
LG	1.2	1.55	15.6	75.7	0.49	11.3
LQ	0.4	2.44	12.7	76.1	0.50	11.3
<b>Bran &amp; Shorts:</b>						
TC Sh	0.7	1.20	10.6	76.7	0.51	11.3
Tail Sh	2.3	2.94	12.7	79.0	0.58	11.3
Head Sh	17.2	3.97	14.3	96.2	1.19	11.8
Bran	3.8	4.77	12.5	100.0	1.32	11.9
Patent (Rebolted)	0.45	10.9				
Wheat	1.27	11.6				

## Minot (Group M)

### Glenn Check (M-3)

Mill Stream	Stream (%, 14% mb)			Cumulative (%, 14% mb)		
	Yield	Ash	Protein	Yield	Ash	Protein
<b>Patent:</b>						
1 M	10.6	0.32	12.1	10.6	0.32	12.1
2 M	13.1	0.35	12.9	23.7	0.34	12.5
Sz II	3.4	0.40	12.5	27.1	0.34	12.5
3 M	14.0	0.43	12.7	41.1	0.37	12.6
Sz I	1.9	0.56	12.8	43.1	0.38	12.6
1 Bk	1.7	0.58	15.5	44.8	0.39	12.7
4 M	8.0	0.58	13.8	52.8	0.42	12.9
Bk Dust	4.1	0.60	14.7	56.9	0.43	13.0
4 Bk	6.1	0.61	17.2	63.0	0.45	13.4
2 Bk II	1.5	0.67	16.3	64.5	0.45	13.5
2 Bk I	0.9	0.71	16.9	65.4	0.46	13.5
TC	1.3	0.74	15.9	66.7	0.46	13.6
3 Bk	1.9	0.84	17.5	68.6	0.47	13.7
6 M	3.1	1.00	12.9	71.7	0.50	13.7
5 Bk	1.4	1.27	20.7	73.1	0.51	13.8
Tail	0.8	1.59	15.9	73.9	0.52	13.8
<b>Clear Flour:</b>						
5 M	1.2	1.87	14.6	75.2	0.54	13.8
LG	1.0	1.91	16.0	76.1	0.56	13.9
LQ	0.3	3.02	13.8	76.4	0.57	13.9
<b>Bran &amp; Shorts:</b>						
TC Sh	0.4	2.17	14.2	76.8	0.58	13.9
Tail Sh	1.4	3.77	13.8	78.2	0.64	13.9
Head Sh	16.7	5.35	17.0	94.9	1.47	14.4
Bran	5.1	7.20	15.1	100.0	1.76	14.4
<b>Patent (Rebolted)</b>		0.51	13.8			
<b>Wheat</b>		2.05	14.3			

### Elgin-ND (M-4)

Mill Stream	Stream (%, 14% mb)			Cumulative (%, 14% mb)		
	Yield	Ash	Protein	Yield	Ash	Protein
<b>Patent:</b>						
1 M	11.0	0.30	12.5	11.0	0.30	12.5
Sz I	2.2	0.32	13.1	13.2	0.30	12.6
2 M	14.9	0.33	12.8	28.2	0.32	12.7
Sz II	3.6	0.38	12.9	31.8	0.33	12.7
3 M	12.9	0.41	13.2	44.7	0.35	12.8
1 Bk	1.8	0.49	15.5	46.5	0.36	12.9
Bk Dust	4.4	0.51	14.8	50.9	0.37	13.1
4 M	7.2	0.57	14.2	58.0	0.39	13.2
2 Bk I	1.0	0.59	16.7	59.1	0.40	13.3
2 Bk II	1.6	0.59	16.8	60.7	0.40	13.4
4 Bk	5.6	0.61	16.3	66.3	0.42	13.6
3 Bk	1.9	0.61	17.2	68.2	0.43	13.7
TC	1.6	0.67	15.6	69.8	0.43	13.8
6 M	2.6	1.02	13.6	72.4	0.45	13.8
5 Bk	1.3	1.30	20.0	73.7	0.47	13.9
Tail	0.7	1.62	17.2	74.4	0.48	13.9
<b>Clear Flour:</b>						
5 M	1.3	1.83	15.3	75.7	0.50	13.9
LG	0.9	2.01	17.8	76.6	0.52	14.0
LQ	0.3	3.22	14.8	76.9	0.53	14.0
<b>Bran &amp; Shorts:</b>						
TC Sh	0.4	2.06	13.8	77.3	0.54	14.0
Tail Sh	1.2	3.86	14.7	78.5	0.59	14.0
Head Sh	14.9	5.55	18.0	93.4	1.38	14.6
Bran	6.6	7.24	15.5	100.0	1.77	14.7
<b>Patent (Rebolted)</b>		0.48	13.9			
<b>Wheat</b>		1.80	14.4			

### ND817 (M-5)

Mill Stream	Stream (%, 14% mb)			Cumulative (%, 14% mb)		
	Yield	Ash	Protein	Yield	Ash	Protein
<b>Patent:</b>						
Sz I	2.4	0.27	12.9	2.4	0.27	12.9
1 M	9.8	0.28	12.0	12.2	0.28	12.2
2 M	14.5	0.30	12.4	26.6	0.29	12.3
Sz II	3.7	0.34	12.6	30.3	0.30	12.3
3 M	14.7	0.39	12.7	45.0	0.33	12.4
1 Bk	1.8	0.49	15.2	46.8	0.33	12.6
Bk Dust	4.2	0.50	14.6	51.1	0.35	12.7
4 M	7.2	0.51	13.9	58.3	0.37	12.9
2 Bk II	1.4	0.55	16.5	59.7	0.37	13.0
3 Bk	1.9	0.55	17.2	61.6	0.38	13.1
4 Bk	6.1	0.56	16.5	67.7	0.39	13.4
2 Bk I	1.0	0.57	16.5	68.6	0.39	13.4
TC	1.6	0.64	15.4	70.2	0.40	13.5
6 M	2.7	1.06	13.3	73.0	0.43	13.5
5 Bk	1.2	1.26	20.0	74.2	0.44	13.6
Tail	0.7	1.55	16.8	74.9	0.45	13.6
<b>Clear Flour:</b>						
5 M	1.4	1.50	14.9	76.3	0.47	13.6
LG	0.9	2.01	17.7	77.2	0.49	13.7
LQ	0.3	2.91	14.7	77.5	0.50	13.7
<b>Bran &amp; Shorts:</b>						
TC Sh	0.4	2.06	13.6	77.9	0.50	13.7
Tail Sh	1.2	3.66	14.5	79.1	0.55	13.7
Head Sh	15.4	5.17	17.6	94.5	1.31	14.3
Bran	5.5	6.87	15.4	100.0	1.61	14.4
<b>Patent (Rebolted)</b>		0.44	13.5			
<b>Wheat</b>		1.64	14.2			

### AUBR30023W (M-8)

Mill Stream	Stream (%, 14% mb)			Cumulative (%, 14% mb)		
	Yield	Ash	Protein	Yield	Ash	Protein
<b>Patent:</b>						
1 M	7.7	0.38	12.8	7.7	0.38	12.8
2 M	14.3	0.39	12.8	22.0	0.39	12.8
Sz I	2.1	0.40	12.5	24.1	0.39	12.8
Sz II	2.5	0.50	12.5	26.6	0.40	12.8
1 Bk	1.7	0.52	13.1	28.3	0.41	12.8
Bk Dust	5.1	0.56	13.4	33.4	0.43	12.9
3 M	13.0	0.58	13.5	46.5	0.47	13.0
2 Bk II	2.4	0.59	14.5	48.9	0.48	13.1
2 Bk I	1.4	0.61	14.8	50.3	0.48	13.2
TC	1.9	0.65	14.0	52.1	0.49	13.2
4 Bk	5.1	0.65	15.5	57.3	0.50	13.4
3 Bk	2.6	0.68	15.8	59.9	0.51	13.5
4 M	7.4	0.77	14.2	67.3	0.54	13.6
5 Bk	1.4	1.22	17.8	68.7	0.55	13.7
6 M	2.0	1.36	14.1	70.7	0.58	13.7
Tail	0.8	1.70	16.8	71.6	0.59	13.7
<b>Clear Flour:</b>						
LG	0.6	1.96	16.4	72.2	0.60	13.7
5 M	1.0	2.18	15.4	73.2	0.62	13.8
LQ	0.2	3.52	14.0	73.5	0.63	13.8
<b>Bran &amp; Shorts:</b>						
TC Sh	0.5	1.30	13.4	73.9	0.64	13.8
Tail Sh	1.0	3.69	13.8	75.0	0.68	13.8
Head Sh	15.6	5.40	16.9	90.6	1.49	14.3
Bran	9.4	6.94	15.3	100.0	2.01	14.4
<b>Patent (Rebolted)</b>		0.58	13.8			
<b>Wheat</b>		1.99	14.3			

**LNR10-0493 (M-10)**

Mill Stream	Stream (%, 14% mb)			Cumulative (%, 14% mb)		
	Yield	Ash	Protein	Yield	Ash	Protein
<b>Patent:</b>						
Sz I	2.3	0.31	12.7	2.3	0.31	12.7
1 M	11.3	0.31	12.0	13.7	0.31	12.2
2 M	13.1	0.36	12.7	26.8	0.33	12.4
Sz II	3.3	0.39	12.6	30.1	0.34	12.4
3 M	14.1	0.48	12.9	44.2	0.38	12.6
1 Bk	2.0	0.53	14.3	46.1	0.39	12.7
Bk Dust	4.6	0.53	13.9	50.7	0.40	12.8
4 M	7.8	0.57	13.8	58.5	0.42	12.9
4 Bk	5.9	0.57	15.9	64.4	0.44	13.2
2 Bk II	1.6	0.58	15.5	66.0	0.44	13.2
3 Bk	1.9	0.62	16.3	68.0	0.45	13.3
2 Bk I	1.0	0.64	15.8	69.0	0.45	13.4
TC	1.6	0.76	15.1	70.6	0.46	13.4
6 M	2.4	1.11	13.6	73.0	0.48	13.4
5 Bk	1.2	1.35	19.3	74.2	0.49	13.5
Tail	0.6	1.69	16.0	74.8	0.50	13.5
<b>Clear Flour:</b>						
LG	0.9	1.89	17.0	75.7	0.52	13.6
5 M	1.1	2.00	15.1	76.8	0.54	13.6
LQ	0.3	3.13	14.2	77.1	0.55	13.6
<b>Bran &amp; Shorts:</b>						
TC Sh	0.4	2.33	12.4	77.5	0.56	13.6
Tail Sh	1.2	3.86	13.7	78.7	0.61	13.6
Head Sh	14.7	5.68	18.3	93.4	1.41	14.3
Bran	6.6	7.10	15.7	100.0	1.78	14.4
<b>Patent (Rebolted)</b>						
Wheat	0.50	13.4	1.78	14.0		

**SY Ingmar (M-11)**

Mill Stream	Stream (%, 14% mb)			Cumulative (%, 14% mb)		
	Yield	Ash	Protein	Yield	Ash	Protein
<b>Patent:</b>						
1 M	9.0	0.31	12.2	9.0	0.31	12.2
Sz I	2.2	0.32	13.3	11.2	0.31	12.4
2 M	13.1	0.34	13.0	24.3	0.33	12.8
Bk Dust	5.7	0.45	15.4	29.9	0.35	13.3
Sz II	2.9	0.45	13.4	32.8	0.36	13.3
3 M	11.3	0.45	13.2	44.1	0.38	13.3
1 Bk	1.1	0.45	16.9	45.2	0.38	13.4
2 Bk I	1.7	0.46	18.0	46.9	0.39	13.5
3 Bk	3.2	0.50	18.3	50.1	0.39	13.8
4 Bk	7.2	0.56	18.3	57.3	0.41	14.4
TC	1.9	0.56	15.6	59.2	0.42	14.4
4 M	6.9	0.57	14.5	66.0	0.43	14.4
2 Bk II	2.7	0.67	17.4	68.7	0.44	14.5
5 Bk	1.8	1.05	22.2	70.5	0.46	14.7
6 M	2.4	1.32	14.5	72.9	0.49	14.7
Tail	0.8	1.69	17.6	73.7	0.50	14.8
<b>Clear Flour:</b>						
5 M	1.2	1.85	15.8	74.8	0.52	14.8
LG	1.0	2.03	18.1	75.8	0.54	14.8
LQ	0.3	3.30	14.7	76.1	0.55	14.8
<b>Bran &amp; Shorts:</b>						
TC Sh	0.4	1.81	14.0	76.5	0.56	14.8
Tail Sh	1.1	3.87	14.8	77.6	0.60	14.8
Head Sh	16.2	5.50	18.5	93.8	1.45	15.5
Bran	6.2	6.51	16.4	100.0	1.76	15.5
<b>Patent (Rebolted)</b>						
Wheat	0.49	14.6	1.70	15.2		

**LNR10-0125 (M-12)**

Mill Stream	Stream (%, 14% mb)			Cumulative (%, 14% mb)		
	Yield	Ash	Protein	Yield	Ash	Protein
<b>Patent:</b>						
1 M	11.4	0.32	11.4	11.4	0.32	11.4
Sz I	2.2	0.33	11.7	13.6	0.32	11.4
2 M	11.9	0.34	11.7	25.4	0.33	11.6
3 M	13.9	0.40	12.1	39.3	0.35	11.8
Sz II	2.8	0.46	11.9	42.1	0.36	11.8
4 M	7.6	0.56	13.0	49.7	0.39	12.0
Bk Dust	3.9	0.56	12.6	53.6	0.40	12.0
1 Bk	1.6	0.57	12.9	55.2	0.41	12.0
2 Bk II	1.7	0.61	14.4	56.9	0.41	12.1
2 Bk I	1.0	0.61	14.4	57.9	0.42	12.1
4 Bk	6.0	0.66	15.0	64.0	0.44	12.4
3 Bk	2.1	0.67	15.1	66.0	0.45	12.5
TC	1.7	0.73	13.5	67.7	0.45	12.5
5 Bk	1.5	1.24	17.7	69.2	0.47	12.6
6 M	2.6	1.26	13.5	71.8	0.50	12.7
Tail	0.8	1.68	16.8	72.5	0.51	12.7
<b>Clear Flour:</b>						
LG	1.0	1.89	18.4	73.6	0.53	12.8
5 M	1.2	1.90	15.0	74.8	0.55	12.8
LQ	0.3	3.23	13.7	75.0	0.56	12.8
<b>Bran &amp; Shorts:</b>						
TC Sh	0.6	1.79	12.0	75.6	0.57	12.8
Tail Sh	1.6	3.70	13.7	77.2	0.64	12.8
Head Sh	17.3	4.83	15.3	94.5	1.40	13.3
Bran	5.5	6.06	14.0	100.0	1.66	13.3
<b>Patent (Rebolted)</b>						
Wheat	0.53	12.4	1.71	12.9		

## Williston (Group W)

### BR2306 (W-1)

Mill Stream	Stream (%, 14% mb)			Cumulative (%, 14% mb)		
	Yield	Ash	Protein	Yield	Ash	Protein
<b>Patent:</b>						
1 M	11.6	0.29	11.1	11.6	0.29	11.1
2 M	14.8	0.31	11.4	26.4	0.30	11.3
Sz I	3.4	0.35	11.8	29.7	0.31	11.3
Sz II	3.3	0.40	11.5	33.0	0.32	11.3
3 M	14.3	0.45	12.2	47.3	0.36	11.6
1 Bk	1.2	0.52	13.7	48.5	0.36	11.7
4 M	6.8	0.54	13.2	55.3	0.38	11.8
4 Bk	5.1	0.57	15.3	60.4	0.40	12.1
2 Bk II	1.3	0.64	14.7	61.7	0.40	12.2
Bk Dust	3.0	0.69	14.4	64.7	0.42	12.3
3 Bk	1.6	0.69	15.3	66.3	0.42	12.4
2 Bk I	0.7	0.70	15.7	67.0	0.43	12.4
TC	1.2	0.82	14.6	68.3	0.43	12.4
6 M	2.8	0.88	12.8	71.1	0.45	12.5
5 Bk	1.8	1.09	18.2	72.8	0.47	12.6
Tail	1.1	1.30	15.8	73.9	0.48	12.6
<b>Clear Flour:</b>						
LG	1.0	1.72	17.6	74.9	0.50	12.7
5 M	1.0	2.04	15.1	75.9	0.52	12.7
LQ	0.4	2.63	14.0	76.3	0.53	12.7
<b>Bran &amp; Shorts:</b>						
TC Sh	0.5	1.92	12.6	76.7	0.54	12.7
Tail Sh	1.6	3.12	13.9	78.3	0.59	12.8
Head Sh	17.6	4.05	16.6	95.9	1.22	13.5
Bran	4.1	4.47	14.0	100.0	1.36	13.5
<b>Patent (Rebolted)</b>		0.46	12.4			
<b>Wheat</b>		1.27	13.2			

### Glenn Check (W-3)

Mill Stream	Stream (%, 14% mb)			Cumulative (%, 14% mb)		
	Yield	Ash	Protein	Yield	Ash	Protein
<b>Patent:</b>						
1 M	11.2	0.26	12.2	11.2	0.26	12.2
2 M	14.3	0.30	12.6	25.5	0.28	12.4
Sz I	2.1	0.33	12.9	27.7	0.29	12.4
3 M	15.3	0.34	12.5	43.0	0.30	12.5
Sz II	3.5	0.37	12.7	46.5	0.31	12.5
4 M	7.1	0.48	13.6	53.6	0.33	12.6
1 Bk	1.1	0.56	16.4	54.7	0.34	12.7
4 Bk	5.0	0.58	16.6	59.7	0.36	13.0
Bk Dust	2.7	0.63	15.2	62.4	0.37	13.1
2 Bk I	0.6	0.67	17.4	63.0	0.37	13.2
2 Bk II	0.9	0.74	16.6	63.8	0.38	13.2
6 M	3.7	0.75	13.0	67.5	0.40	13.2
TC	1.3	0.87	15.9	68.8	0.41	13.3
3 Bk	1.4	0.99	17.2	70.2	0.42	13.3
5 Bk	1.6	1.16	20.2	71.9	0.44	13.5
Tail	1.3	1.17	15.7	73.2	0.45	13.5
<b>Clear Flour:</b>						
LG	1.1	1.56	16.5	74.3	0.47	13.6
5 M	1.6	1.65	14.2	75.9	0.49	13.6
LQ	0.6	2.31	13.6	76.5	0.50	13.6
<b>Bran &amp; Shorts:</b>						
TC Sh	0.4	1.93	13.8	76.9	0.51	13.6
Tail Sh	1.9	2.97	13.9	78.8	0.57	13.6
Head Sh	18.3	4.25	15.6	97.1	1.26	14.0
Bran	2.9	5.04	14.0	100.0	1.37	14.0
<b>Patent (Rebolted)</b>		0.46	13.3			
<b>Wheat</b>		1.27	14.0			

### Elgin-ND (W-4)

Mill Stream	Stream (%, 14% mb)			Cumulative (%, 14% mb)		
	Yield	Ash	Protein	Yield	Ash	Protein
<b>Patent:</b>						
1 M	11.9	0.25	12.0	11.9	0.25	12.0
2 M	13.7	0.28	12.6	25.6	0.27	12.3
Sz I	1.8	0.30	12.9	27.4	0.27	12.4
Sz II	3.9	0.31	12.7	31.3	0.28	12.4
3 M	14.9	0.38	13.3	46.2	0.31	12.7
4 M	7.1	0.45	14.3	53.3	0.33	12.9
1 Bk	1.0	0.53	15.5	54.3	0.33	13.0
4 Bk	5.2	0.54	16.7	59.5	0.35	13.3
2 Bk II	0.9	0.61	16.2	60.5	0.35	13.3
Bk Dust	3.0	0.64	15.2	63.5	0.37	13.4
6 M	3.3	0.65	13.4	66.8	0.38	13.4
TC	1.6	0.65	14.8	68.4	0.39	13.5
2 Bk I	0.6	0.68	16.6	69.0	0.39	13.5
3 Bk	1.3	0.70	17.3	70.3	0.40	13.6
Tail	1.2	1.12	16.6	71.5	0.41	13.6
5 Bk	1.6	1.12	19.8	73.1	0.42	13.7
<b>Clear Flour:</b>						
5 M	1.5	1.42	14.9	74.6	0.44	13.8
LG	1.1	1.57	18.0	75.7	0.46	13.8
LQ	0.3	2.28	14.7	76.0	0.47	13.8
<b>Bran &amp; Shorts:</b>						
TC Sh	0.8	1.10	12.8	76.9	0.48	13.8
Tail Sh	1.6	2.84	14.8	78.5	0.52	13.8
Head Sh	17.8	3.66	18.2	96.3	1.10	14.6
Bran	3.7	4.70	14.4	100.0	1.24	14.6
<b>Patent (Rebolted)</b>		0.45	13.3			
<b>Wheat</b>		1.21	14.0			

### ND817 (W-5)

Mill Stream	Stream (%, 14% mb)			Cumulative (%, 14% mb)		
	Yield	Ash	Protein	Yield	Ash	Protein
<b>Patent:</b>						
1 M	12.4	0.26	12.4	12.4	0.26	12.4
Sz I	1.8	0.30	13.7	14.2	0.27	12.6
2 M	12.6	0.32	13.2	26.8	0.29	12.9
3 M	14.7	0.37	13.6	41.5	0.32	13.2
Sz II	3.8	0.38	13.3	45.3	0.33	13.2
4 M	7.8	0.51	15.0	53.1	0.35	13.4
4 Bk	5.3	0.59	18.0	58.5	0.38	13.9
1 Bk	0.9	0.69	16.8	59.4	0.38	13.9
TC	1.7	0.69	16.3	61.1	0.39	14.0
2 Bk II	0.9	0.72	17.6	62.0	0.39	14.0
2 Bk I	0.6	0.77	18.3	62.6	0.40	14.1
Bk Dust	2.9	0.78	16.7	65.5	0.41	14.2
3 Bk	1.3	0.84	18.9	66.8	0.42	14.3
6 M	3.6	0.87	14.1	70.3	0.44	14.3
5 Bk	1.6	1.30	22.1	72.0	0.46	14.4
Tail	1.2	1.38	17.6	73.2	0.48	14.5
<b>Clear Flour:</b>						
5 M	1.7	1.61	15.7	74.9	0.51	14.5
LG	1.1	1.84	18.9	76.0	0.53	14.6
LQ	0.6	2.49	14.8	76.6	0.54	14.6
<b>Bran &amp; Shorts:</b>						
TC Sh	1.2	1.16	14.3	77.8	0.55	14.6
Tail Sh	1.8	3.03	14.9	79.6	0.61	14.6
Head Sh	17.5	4.18	17.6	97.1	1.25	15.1
Bran	2.9	4.95	15.1	100.0	1.36	15.1
<b>Patent (Rebolted)</b>		0.45	14.0			
<b>Wheat</b>		1.26	14.8			

**COI565W (W-6)**

Mill Stream	Stream (%, 14% mb)			Cumulative (%, 14% mb)		
	Yield	Ash	Protein	Yield	Ash	Protein
<b>Patent:</b>						
Sz I	2.2	0.26	12.3	2.2	0.26	12.3
1 M	9.8	0.28	12.1	12.0	0.28	12.2
2 M	15.4	0.29	12.6	27.4	0.29	12.4
Sz II	3.7	0.34	12.4	31.1	0.29	12.4
Bk Dust	4.7	0.42	15.1	35.8	0.31	12.7
1 Bk	1.9	0.43	16.0	37.7	0.32	12.9
2 Bk II	1.9	0.45	16.8	39.6	0.32	13.1
2 Bk I	1.2	0.48	17.1	40.8	0.33	13.2
3 M	12.5	0.50	13.6	53.3	0.37	13.3
4 Bk	5.6	0.50	18.4	58.9	0.38	13.8
3 Bk	2.3	0.52	18.0	61.2	0.38	14.0
TC	2.1	0.53	14.9	63.3	0.39	14.0
4 M	4.5	0.93	15.1	67.8	0.43	14.1
5 Bk	2.2	1.01	21.9	70.0	0.44	14.3
6 M	2.4	1.09	14.3	72.3	0.46	14.3
Tail	1.3	1.33	18.8	73.7	0.48	14.4
<b>Clear Flour:</b>						
LG	0.8	1.77	19.6	74.5	0.49	14.4
5 M	0.7	2.11	16.1	75.2	0.51	14.5
LQ	0.2	2.79	14.5	75.5	0.52	14.5
<b>Bran &amp; Shorts:</b>						
TC Sh	0.8	1.12	13.3	76.2	0.52	14.5
Tail Sh	1.3	3.30	14.4	77.6	0.57	14.5
Head Sh	19.0	4.42	17.7	96.6	1.33	15.1
Bran	3.4	4.89	14.4	100.0	1.45	15.1
Patent (Rebolted)	0.47	14.1				
Wheat	1.40	14.7				

**AUBR30023W (W-8)**

Mill Stream	Stream (%, 14% mb)			Cumulative (%, 14% mb)		
	Yield	Ash	Protein	Yield	Ash	Protein
<b>Patent:</b>						
1 M	11.8	0.24	11.4	11.8	0.24	11.4
Sz I	2.2	0.25	11.6	14.0	0.25	11.4
2 M	14.6	0.32	11.8	28.6	0.28	11.6
Sz II	3.9	0.36	11.5	32.5	0.29	11.6
3 M	15.6	0.37	12.3	48.1	0.32	11.8
1 Bk	1.5	0.44	13.5	49.6	0.32	11.9
Bk Dust	3.7	0.49	13.4	53.3	0.33	12.0
2 Bk I	1.0	0.51	15.1	54.3	0.34	12.0
2 Bk II	1.6	0.52	14.6	55.9	0.34	12.1
4 M	7.3	0.54	13.2	63.2	0.37	12.2
TC	1.9	0.55	13.5	65.1	0.37	12.3
4 Bk	4.9	0.59	16.1	70.0	0.39	12.5
3 Bk	1.9	0.59	15.7	72.0	0.39	12.6
6 M	3.2	0.86	13.1	75.2	0.41	12.7
5 Bk	1.6	1.02	19.2	76.8	0.42	12.8
Tail	1.5	1.19	16.9	78.3	0.44	12.9
<b>Clear Flour:</b>						
LG	0.9	1.71	19.0	79.2	0.45	12.9
5 M	1.6	1.83	15.0	80.8	0.48	13.0
LQ	0.3	2.72	13.5	81.0	0.49	13.0
<b>Bran &amp; Shorts:</b>						
TC Sh	0.8	0.94	12.7	81.8	0.49	13.0
Tail Sh	1.6	2.87	13.9	83.5	0.54	13.0
Head Sh	15.2	4.10	16.2	98.7	1.09	13.5
Bran	1.3*	5.13	14.2	100.0	1.14	13.5
Patent (Rebolted)	0.44	12.7				
Wheat	1.28	13.3				

**LNR10-0493 (W-10)**

Mill Stream	Stream (%, 14% mb)			Cumulative (%, 14% mb)		
	Yield	Ash	Protein	Yield	Ash	Protein
<b>Patent:</b>						
1 M	10.5	0.25	12.1	10.5	0.25	12.1
Sz I	1.9	0.26	12.9	12.3	0.25	12.2
2 M	13.5	0.30	12.6	25.9	0.28	12.4
Sz II	2.9	0.31	12.5	28.8	0.28	12.4
3 M	14.1	0.37	12.8	42.9	0.31	12.6
1 Bk	1.1	0.48	14.8	44.0	0.31	12.6
4 M	6.7	0.50	13.9	50.6	0.34	12.8
4 Bk	5.2	0.56	16.3	55.8	0.36	13.1
Bk Dust	3.0	0.57	14.6	58.8	0.37	13.2
2 Bk II	1.1	0.57	15.6	59.9	0.37	13.2
TC	1.4	0.58	14.5	61.3	0.38	13.3
2 Bk I	0.6	0.62	16.3	62.0	0.38	13.3
3 Bk	1.4	0.66	17.1	63.4	0.39	13.4
6 M	2.9	0.69	13.5	66.3	0.40	13.4
Tail	1.0	1.18	16.7	67.3	0.41	13.4
5 Bk	1.4	1.18	19.8	68.8	0.43	13.6
<b>Clear Flour:</b>						
5 M	1.6	1.32	14.5	70.4	0.45	13.6
LG	0.9	1.54	17.7	71.2	0.46	13.6
LQ	0.4	2.50	14.6	71.6	0.47	13.6
<b>Bran &amp; Shorts:</b>						
TC Sh	0.6	1.35	13.0	72.2	0.48	13.6
Tail Sh	1.7	2.97	14.9	73.9	0.53	13.7
Head Sh	12.5	4.23	17.0	86.3	1.07	14.1
Bran	13.7*	4.72	15.5	100.0	1.57	14.3
Patent (Rebolted)	0.43	13.3				
Wheat	1.33	14.1				

**SY Ingmar (W-11)**

Mill Stream	Stream (%, 14% mb)			Cumulative (%, 14% mb)		
	Yield	Ash	Protein	Yield	Ash	Protein
<b>Patent:</b>						
1 M	8.8	0.29	12.1	8.8	0.29	12.1
Sz I	1.9	0.33	13.7	10.7	0.30	12.4
3 M	14.7	0.36	12.9	25.5	0.33	12.7
2 M	13.8	0.36	12.6	39.3	0.34	12.7
Sz II	3.5	0.43	13.5	42.8	0.35	12.7
4 M	8.5	0.51	14.2	51.3	0.38	13.0
4 Bk	6.2	0.55	17.6	57.5	0.40	13.5
1 Bk	1.3	0.60	17.1	58.8	0.40	13.5
2 Bk II	1.1	0.62	17.7	59.8	0.40	13.6
3 Bk	1.6	0.67	18.4	61.5	0.41	13.7
Bk Dust	3.5	0.68	16.3	64.9	0.43	13.9
TC	2.3	0.73	15.8	67.2	0.44	14.0
2 Bk I	0.8	0.79	18.4	68.0	0.44	14.0
6 M	3.3	0.80	13.7	71.3	0.46	14.0
5 Bk	1.8	1.16	21.3	73.1	0.47	14.2
Tail	1.0	1.29	17.0	74.2	0.49	14.2
<b>Clear Flour:</b>						
5 M	1.6	1.61	15.1	75.8	0.51	14.2
LG	1.1	1.74	19.2	76.9	0.53	14.3
LQ	0.5	2.56	14.6	77.4	0.54	14.3
<b>Bran &amp; Shorts:</b>						
TC Sh	0.8	1.67	13.7	78.2	0.55	14.3
Tail Sh	1.9	3.07	14.4	80.0	0.61	14.3
Head Sh	16.8	4.23	17.1	96.9	1.24	14.8
Bran	3.1	4.86	13.9	100.0	1.35	14.8
Patent (Rebolted)	0.48	13.8				
Wheat	1.34	14.4				

\*Choke on bran was found and cleaned during sample W-10. Bran may be from W-10 and W-8. This affected TPB but not patent flour characteristics.

### LNR10-0125 (W-12)

Mill Stream	Stream (%, 14% mb)			Cumulative (%, 14% mb)		
	Yield	Ash	Protein	Yield	Ash	Protein
<b>Patent:</b>						
Sz I	2.0	0.29	12.3	2.0	0.29	12.3
2 M	13.8	0.29	12.2	15.7	0.29	12.2
1 M	9.5	0.30	11.8	25.3	0.29	12.1
Sz II	3.7	0.37	12.4	29.0	0.30	12.1
3 M	14.6	0.51	12.7	43.6	0.37	12.3
1 Bk	1.2	0.53	14.7	44.8	0.38	12.4
4 Bk	5.6	0.56	16.0	50.4	0.40	12.8
Bk Dust	3.0	0.58	14.3	53.4	0.41	12.8
2 Bk II	1.0	0.62	15.7	54.4	0.41	12.9
4 M	7.9	0.64	13.9	62.2	0.44	13.0
6 M	3.3	0.66	13.4	65.6	0.45	13.0
3 Bk	1.3	0.66	16.7	66.9	0.46	13.1
2 Bk I	0.7	0.68	16.1	67.6	0.46	13.1
TC	1.8	0.69	14.5	69.4	0.46	13.2
Tail	1.2	1.03	16.6	70.6	0.47	13.2
5 Bk	1.8	1.10	19.8	72.4	0.49	13.4
<b>Clear Flour:</b>						
LG	1.0	1.55	18.2	73.5	0.50	13.5
5 M	1.5	1.62	14.8	74.9	0.53	13.5
LQ	0.4	2.41	14.1	75.3	0.54	13.5
<b>Bran &amp; Shorts:</b>						
TC Sh	0.6	1.58	12.3	76.0	0.54	13.5
Tail Sh	2.0	3.08	14.2	78.0	0.61	13.5
Head Sh	18.7	4.32	15.4	96.7	1.33	13.9
Bran	3.3	4.79	14.7	100.0	1.44	13.9
Patent (Rebolted)	0.44		13.2			
Wheat	1.36		13.7			

# Cooperators' Bake Data

## Glenn Checks

WATERTOWN (B-3)				
Cooperator	Bake Absorption (%)	Loaf Volume (cc)	Mixing Requirement	Dough Characteristics
A	60.0	2900	3	3
B	65.5	1850	2	3
C	65.0	3045	5	5
D	64.0	2550	4	3
E	65.7	2360	3	2
F	64.0	978	4	4
G	64.7	1035	4	4
H	65.0	2950	3	3
I	69.4	1065	5	4
J	68.5	1050	3	4
K	66.0	1150	4	4
L	68.7	1075	3	4
M	71.0	958	5	3
N	68.9	970	3	4
<b>Avg.</b>	<b>66.2</b>		<b>3.6</b>	<b>3.6</b>
<b>S.D.</b>	<b>2.9</b>		<b>0.9</b>	<b>0.8</b>

CASSELTON (C-3)				
Cooperator	Bake Absorption (%)	Loaf Volume (cc)	Mixing Requirement	Dough Characteristics
A	59.0	3000	4	4
B	65.5	2175	3	4
C	65.0	3104	5	5
D	62.0	2500	5	5
E	65.5	2675	3	3
F	64.0	993	4	4
G	64.2	1065	3	4
H	64.0	3000	3	3
I	70.6	985	5	4
J	66.7	1050	3	3
K	66.2	1095	4	4
L	69.1	1010	3	3
M	69.4	1023	4	4
N	68.5	938	3	4
<b>Avg.</b>	<b>65.7</b>		<b>3.7</b>	<b>3.9</b>
<b>S.D.</b>	<b>3.1</b>		<b>0.8</b>	<b>0.7</b>



CROOKSTON (K-3)				
Cooperator	Bake Absorption (%)	Loaf Volume (cc)	Mixing Requirement	Dough Characteristics
A	58.0	3000	3	3
B	66.5	2000	3	3
C	65.0	3104	5	5
D	65.0	2700	5	3
E	66.3	2075	4	2
F	60.0	868	4	4
G	62.5	925	3	4
H	65.0	2700	3	3
I	70.8	970	5	4
J	66.3	1025	3	4
K	66.9	1070	4	4
L	69.6	910	4	3
M	69.7	905	4	4
N	70.1	872	3	5
<b>Avg.</b>	<b>65.8</b>		<b>3.8</b>	<b>3.6</b>
<b>S.D.</b>	<b>3.7</b>		<b>0.8</b>	<b>0.8</b>

MINOT (M-3)				
Cooperator	Bake Absorption (%)	Loaf Volume (cc)	Mixing Requirement	Dough Characteristics
A	60.0	2900	4	4
B	65.0	2150	4	3
C	65.0	3104	5	5
D	62.0	2550	5	3
E	64.9	2825	3	3
F	63.0	1108	4	4
G	64.6	1060	3	3
H	63.0	2600	3	3
I	69.5	1115	4	5
J	68.5	965	3	4
K	65.6	1120	4	4
L	69.7	1080	3	3
M	72.1	1090	4	4
N	68.8	950	4	4
<b>Avg.</b>	<b>65.8</b>		<b>3.8</b>	<b>3.7</b>
<b>S.D.</b>	<b>3.4</b>		<b>0.7</b>	<b>0.7</b>

WILLISTON (W-3)				
Cooperator	Bake Absorption (%)	Loaf Volume (cc)	Mixing Requirement	Dough Characteristics
A	60.0	3000	5	5
B	63.0	2250	3	4
C	61.0	3045	5	5
D	62.0	2600	5	5
E	62.9	2450	4	4
F	64.0	1083	4	4
G	64.5	1035	4	4
H	61.0	2900	3	3
I	67.8	985	5	5
J	66.0	975	4	5
K	63.7	920	5	4
L	67.5	1000	5	5
M	70.7	1008	5	4
N	64.1	906	3	5
<b>Avg.</b>	<b>64.2</b>		<b>4.3</b>	<b>4.4</b>
<b>S.D.</b>	<b>3.0</b>		<b>0.8</b>	<b>0.6</b>

## BR2306

WILLISTON (W-1)												
Cooperator	Bake Absorption (%)	Loaf Volume		Quality Score Compared to Check (Glenn)								
		(cc)	(% of Check)	Mixing Requirement	Dough Characteristics	Mixing Tolerance	Internal Crumb Color	Internal Grain & Texture	Protein	Milling	Baking	Overall
<b>A</b>	59.0	2950	98.3	3	3	2	3	3	2	3	3	3
<b>B</b>	60.5	2225	98.9	4	5	3	2	3	3	4	3	3
<b>C</b>	59.0	3015	99.0	5	5	3	4	3	2	3	3	3
<b>D</b>	60.5	2575	99.0	5	5	3	4	1	2	3	4	4
<b>E</b>	60.6	2475	101.0	4	3	2	4	3	1	2	3	4
<b>F</b>	62.0	905	83.6	3	3	2	3	3	2	3	2	2
<b>G</b>	62.7	960	92.8	4	3	2	3	2	2	2	2	2
<b>H</b>	59.0	2700	93.1	4	4	4	3	3	2	5	3	3
<b>I</b>	65.3	950	96.4	5	3	4	4	3	2	3	4	3
<b>J</b>	63.0	880	90.3	4	5	2	4	3	2	4	3	3
<b>K</b>	61.4	825	89.7	5	3	2	3	3	2	3	1	2
<b>L</b>	64.9	940	94.0	5	3	3	3	3	2	3	3	3
<b>M</b>	66.0	1015	100.7	5	5	4	n/a	3	2	3	4	4
<b>N</b>	66.0	834	92.1	4	3	4	3	4	2	4	3	3
<b>Avg.</b>	<b>62.1</b>		<b>94.9</b>	<b>4.3</b>	<b>3.8</b>	<b>2.9</b>	<b>3.3</b>	<b>2.9</b>	<b>2.0</b>	<b>3.2</b>	<b>2.9</b>	<b>3.0</b>
<b>S.D.</b>	<b>2.6</b>		<b>5.0</b>	<b>0.7</b>	<b>1.0</b>	<b>0.9</b>	<b>0.6</b>	<b>0.7</b>	<b>0.4</b>	<b>0.8</b>	<b>0.8</b>	<b>0.7</b>

## MN08165-8

CASSELTON (C-2)												
Cooperator	Bake Absorption (%)	Loaf Volume		Quality Score Compared to Check (Glenn)								
		(cc)	(% of Check)	Mixing Requirement	Dough Characteristics	Mixing Tolerance	Internal Crumb Color	Internal Grain & Texture	Protein	Milling	Baking	Overall
A	61.0	2900	96.7	4	4	3	2	3	4	3	3	3
B	65.5	2200	101.1	4	3	3	3	3	5	3	3	4
C	65.0	3045	98.1	5	5	3	2	2	5	2	2	2
D	65.0	2500	100.0	5	3	3	1	1	5	3	3	1
E	65.4	2650	99.1	3	4	4	3	3	5	1	3	3
F	64.0	998	100.5	4	4	3	3	3	4	2	3	3
G	66.6	950	89.2	3	3	3	2	2	5	2	2	2
H	64.0	3000	100.0	4	3	3	4	3	4	3	3	3
I	70.1	1130	114.7	4	3	5	3	3	5	2	4	4
J	69.5	960	91.4	3	2	3	1	2	5	3	2	2
K	65.4	960	87.7	4	3	2	2	4	5	3	2	3
L	68.4	1125	111.4	3	4	3	3	3	5	3	3	4
M	72.5	1128	110.3	4	4	4	4	4	5	3	3	3
N	68.6	964	102.8	3	4	4	3	3	5	3	4	4
<b>Avg.</b>	<b>66.5</b>		<b>100.2</b>	<b>3.8</b>	<b>3.5</b>	<b>3.3</b>	<b>2.6</b>	<b>2.8</b>	<b>4.8</b>	<b>2.6</b>	<b>2.9</b>	<b>2.9</b>
<b>S.D.</b>	<b>3.0</b>		<b>7.9</b>	<b>0.7</b>	<b>0.8</b>	<b>0.7</b>	<b>0.9</b>	<b>0.8</b>	<b>0.4</b>	<b>0.6</b>	<b>0.7</b>	<b>0.9</b>

CROOKSTON (K-2)												
Cooperator	Bake Absorption (%)	Loaf Volume		Quality Score Compared to Check (Glenn)								
		(cc)	(% of Check)	Mixing Requirement	Dough Characteristics	Mixing Tolerance	Internal Crumb Color	Internal Grain & Texture	Protein	Milling	Baking	Overall
A	57.0	2850	95.0	3	3	3	3	4	2	3	4	3
B	62.5	2175	108.8	3	3	3	3	3	2	3	3	2
C	61.0	2897	93.3	5	5	3	2	3	1	2	2	2
D	62.0	2600	96.3	3	3	1	2	2	1	3	4	2
E	62.4	2150	103.6	3	2	3	3	4	1	1	2	4
F	60.0	913	105.2	3	3	2	3	3	2	3	3	3
G	60.8	940	101.6	3	4	3	2	3	2	2	3	4
H	61.0	2600	96.3	2	3	2	3	3	2	3	2	3
I	67.1	880	90.7	5	3	2	3	3	2	3	2	2
J	63.5	990	96.6	3	4	3	2	3	2	3	3	3
K	63.3	925	86.4	4	3	3	2	4	1	2	1	1
L	65.5	930	102.2	4	4	2	2	3	2	3	3	3
M	66.0	925	102.2	5	3	3	3	3	2	2	4	4
N	66.5	810	92.9	4	4	3	3	4	2	3	2	2
<b>Avg.</b>	<b>62.8</b>		<b>97.9</b>	<b>3.6</b>	<b>3.4</b>	<b>2.6</b>	<b>2.6</b>	<b>3.2</b>	<b>1.7</b>	<b>2.6</b>	<b>2.7</b>	<b>2.7</b>
<b>S.D.</b>	<b>2.8</b>		<b>6.2</b>	<b>0.9</b>	<b>0.7</b>	<b>0.6</b>	<b>0.5</b>	<b>0.6</b>	<b>0.5</b>	<b>0.6</b>	<b>0.9</b>	<b>0.9</b>

## Elgin-ND

WATERTOWN (B-4)												
Cooperator	Bake Absorption (%)	Loaf Volume		Quality Score Compared to Check (Glenn)								
		(cc)	(% of Check)	Mixing Requirement	Dough Characteristics	Mixing Tolerance	Internal Crumb Color	Internal Grain & Texture	Protein	Milling	Baking	Overall
A	60.0	2975	102.6	3	3	3	3	4	3	2	3	3
B	66.5	2200	118.9	3	3	4	5	5	4	4	5	4
C	65.0	2956	97.1	5	4	2	2	3	2	3	3	3
D	63.5	2500	98.0	5	3	4	3	2	2	4	3	3
E	66.5	2400	101.7	3	2	3	3	2	2	4	3	3
F	64.0	958	98.0	3	3	2	3	3	2	3	2	2
G	64.0	950	91.8	3	4	2	2	2	2	3	2	2
H	65.0	3000	101.7	4	4	4	4	4	2	4	4	4
I	70.3	1010	94.8	4	3	4	2	3	2	4	2	2
J	67.5	915	87.1	3	3	2	1	2	2	4	2	1
K	67.5	950	82.6	4	4	2	2	4	2	3	3	3
L	68.4	1005	93.5	3	4	3	3	3	2	2	3	3
M	70.9	1050	109.6	4	4	3	4	4	3	4	4	4
N	69.5	858	88.5	3	4	3	4	4	3	2	4	3
<b>Avg.</b>	<b>66.3</b>		<b>97.6</b>	<b>3.6</b>	<b>3.4</b>	<b>2.9</b>	<b>2.9</b>	<b>3.2</b>	<b>2.4</b>	<b>3.3</b>	<b>3.1</b>	<b>2.9</b>
<b>S.D.</b>	<b>3.0</b>		<b>9.3</b>	<b>0.8</b>	<b>0.6</b>	<b>0.8</b>	<b>1.1</b>	<b>1.0</b>	<b>0.6</b>	<b>0.8</b>	<b>0.9</b>	<b>0.9</b>

CASSELTON (C-4)												
Cooperator	Bake Absorption (%)	Loaf Volume		Quality Score Compared to Check (Glenn)								
		(cc)	(% of Check)	Mixing Requirement	Dough Characteristics	Mixing Tolerance	Internal Crumb Color	Internal Grain & Texture	Protein	Milling	Baking	Overall
A	59.0	2950	98.3	3	3	2	3	4	3	3	3	3
B	66.5	2200	101.1	3	3	3	3	3	2	4	3	2
C	65.0	3104	100.0	5	5	3	2	4	3	3	3	3
D	62.5	2600	104.0	3	3	1	2	3	3	4	4	3
E	66.4	2700	100.9	3	4	4	3	4	3	2	4	4
F	63.0	933	94.0	3	3	3	3	3	3	2	2	2
G	63.5	905	85.0	3	2	2	2	2	2	3	2	2
H	64.0	3000	100.0	2	3	3	4	4	4	4	3	3
I	71.5	950	96.4	3	1	2	1	2	3	4	1	2
J	66.1	865	82.4	3	2	2	2	2	3	4	2	2
K	67.5	940	85.8	4	2	2	2	2	3	3	2	3
L	67.1	965	95.5	3	3	2	3	2	2	3	3	3
M	69.9	1005	98.2	3	3	3	4	3	3	4	3	3
N	69.0	909	96.9	3	4	3	4	4	3	3	3	3
<b>Avg.</b>	<b>65.8</b>		<b>95.6</b>	<b>3.1</b>	<b>2.9</b>	<b>2.5</b>	<b>2.7</b>	<b>3.0</b>	<b>2.9</b>	<b>3.3</b>	<b>2.7</b>	<b>2.7</b>
<b>S.D.</b>	<b>3.3</b>		<b>6.6</b>	<b>0.7</b>	<b>1.0</b>	<b>0.8</b>	<b>0.9</b>	<b>0.9</b>	<b>0.5</b>	<b>0.7</b>	<b>0.8</b>	<b>0.6</b>

CROOKSTON (K-4)												
Cooperator	Bake Absorption (%)	Loaf Volume		Quality Score Compared to Check (Glenn)								
		(cc)	(% of Check)	Mixing Requirement	Dough Characteristics	Mixing Tolerance	Internal Crumb Color	Internal Grain & Texture	Protein	Milling	Baking	Overall
A	57.0	2900	96.7	3	3	3	3	4	2	3	3	3
B	65.0	2150	107.5	5	3	3	3	3	2	4	3	2
C	63.0	2927	94.3	5	5	3	2	2	1	3	2	2
D	63.5	2650	98.1	4	4	2	2	3	1	4	4	3
E	64.8	2250	108.4	3	1	2	3	4	1	2	2	3
F	60.0	888	102.3	3	3	2	3	3	2	3	3	3
G	61.0	895	96.8	3	5	3	2	3	2	3	2	3
H	63.0	2500	92.6	2	3	2	3	3	2	5	2	2
I	68.6	880	90.7	4	4	2	2	3	2	3	2	2
J	64.0	940	91.7	3	3	3	2	4	2	4	3	3
K	65.8	900	84.1	5	4	3	2	3	2	3	2	2
L	66.4	900	98.9	4	3	3	3	2	2	3	3	3
M	68.4	970	107.2	4	5	3	4	3	2	3	4	4
N	68.2	846	97.0	3	5	4	3	4	2	2	3	2
<b>Avg.</b>	<b>64.2</b>		<b>97.6</b>	<b>3.6</b>	<b>3.6</b>	<b>2.7</b>	<b>2.6</b>	<b>3.1</b>	<b>1.8</b>	<b>3.2</b>	<b>2.7</b>	<b>2.6</b>
<b>S.D.</b>	<b>3.3</b>		<b>7.0</b>	<b>0.9</b>	<b>1.2</b>	<b>0.6</b>	<b>0.6</b>	<b>0.7</b>	<b>0.4</b>	<b>0.8</b>	<b>0.7</b>	<b>0.6</b>

MINOT (M-4)												
Cooperator	Bake Absorption (%)	Loaf Volume		Quality Score Compared to Check (Glenn)								
		(cc)	(% of Check)	Mixing Requirement	Dough Characteristics	Mixing Tolerance	Internal Crumb Color	Internal Grain & Texture	Protein	Milling	Baking	Overall
A	60.0	2900	100.0	3	3	2	2	3	3	2	3	3
B	65.0	2275	105.8	3	3	4	3	3	2	3	3	2
C	63.0	3104	100.0	5	5	3	2	3	3	2	3	2
D	62.5	2600	102.0	3	3	1	1	3	3	4	3	2
E	64.7	2725	96.5	3	4	4	2	3	3	2	2	2
F	63.0	968	87.4	4	4	2	3	3	3	2	2	2
G	64.8	975	92.0	3	3	2	2	3	3	1	2	2
H	63.0	2650	101.9	2	3	2	3	3	3	4	4	4
I	69.6	1070	96.0	3	2	2	3	4	3	3	3	3
J	69.3	825	85.5	3	4	2	2	2	3	4	2	2
K	64.7	915	81.7	4	4	2	1	2	3	2	1	2
L	70.5	995	92.1	3	2	2	3	2	4	2	2	2
M	69.8	1103	101.2	3	4	3	n/a	3	3	3	3	3
N	67.7	884	93.1	3	3	3	3	4	3	2	3	3
<b>Avg.</b>	<b>65.5</b>		<b>95.4</b>	<b>3.2</b>	<b>3.4</b>	<b>2.4</b>	<b>2.3</b>	<b>2.9</b>	<b>3.0</b>	<b>2.6</b>	<b>2.6</b>	<b>2.4</b>
<b>S.D.</b>	<b>3.3</b>		<b>7.1</b>	<b>0.7</b>	<b>0.8</b>	<b>0.9</b>	<b>0.8</b>	<b>0.6</b>	<b>0.4</b>	<b>0.9</b>	<b>0.8</b>	<b>0.6</b>

WILLISTON (W-4)													
Cooperator	Bake Absorption (%)	Loaf Volume		Quality Score Compared to Check (Glenn)									
		(cc)	(% of Check)	Mixing Requirement	Dough Characteristics	Mixing Tolerance	Internal Crumb Color	Internal Grain & Texture	Protein	Milling	Baking	Overall	
A	60.0	2800	93.3	3	2	2	2	3	3	3	3	2	2
B	65.5	2350	104.4	3	5	3	3	3	3	3	3	3	3
C	63.0	3015	99.0	5	5	3	3	3	3	3	2	3	3
D	65.5	2600	100.0	5	3	3	4	1	2	3	3	4	3
E	65.6	2325	94.9	4	3	2	4	3	3	2	3	3	3
F	64.0	953	88.0	4	4	3	3	3	3	3	3	3	2
G	64.3	945	91.3	3	5	2	2	3	3	2	2	2	2
H	63.0	2800	96.6	4	4	4	3	3	3	3	3	4	4
I	69.7	1020	103.6	4	4	4	3	3	3	3	3	4	4
J	66.0	885	90.8	3	5	2	2	3	3	3	3	3	3
K	66.4	800	87.0	4	4	2	2	2	3	3	2	2	3
L	67.8	1005	100.5	4	3	3	3	2	3	3	3	2	3
M	69.4	1075	106.6	4	5	4	n/a	3	3	3	3	4	4
N	69.0	860	94.9	3	4	4	3	3	3	3	3	3	3
<b>Avg.</b>	<b>65.7</b>		<b>96.5</b>	<b>3.8</b>	<b>4.0</b>	<b>2.9</b>	<b>2.8</b>	<b>2.7</b>	<b>2.9</b>	<b>2.8</b>	<b>3.0</b>	<b>3.0</b>	<b>3.0</b>
<b>S.D.</b>	<b>2.7</b>		<b>6.1</b>	<b>0.7</b>	<b>1.0</b>	<b>0.8</b>	<b>0.7</b>	<b>0.6</b>	<b>0.3</b>	<b>0.4</b>	<b>0.8</b>	<b>0.7</b>	<b>0.7</b>

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WATERTOWN (B-5)													
Cooperator	Bake Absorption (%)	Loaf Volume		Quality Score Compared to Check (Glenn)									
		(cc)	(% of Check)	Mixing Requirement	Dough Characteristics	Mixing Tolerance	Internal Crumb Color	Internal Grain & Texture	Protein	Milling	Baking	Overall	
<b>A</b>	59.0	3000	103.4	3	3	3	3	4	3	3	3	3	3
<b>B</b>	66.0	2225	120.3	3	3	4	5	4	4	4	4	5	4
<b>C</b>	65.0	2868	94.2	5	5	3	3	3	2	4	3	3	3
<b>D</b>	64.5	2525	99.0	3	3	2	4	2	1	4	3	2	2
<b>E</b>	66.1	2400	101.7	4	3	4	4	4	2	5	4	3	3
<b>F</b>	63.0	993	101.5	4	4	3	3	3	2	3	3	3	3
<b>G</b>	63.5	955	92.3	3	3	2	2	2	2	4	2	2	2
<b>H</b>	65.0	3000	101.7	4	4	4	4	4	2	4	4	4	4
<b>I</b>	69.5	940	88.3	4	2	4	2	3	2	4	1	1	1
<b>J</b>	66.5	1060	101.0	3	4	2	3	3	2	4	3	2	2
<b>K</b>	66.7	1035	90.0	4	3	2	2	3	1	4	3	3	3
<b>L</b>	69.4	1050	97.7	3	3	2	3	3	2	2	3	3	3
<b>M</b>	70.4	943	98.4	3	4	3	4	3	3	4	3	3	3
<b>N</b>	69.3	910	93.8	3	4	3	4	3	2	3	3	3	3
<b>Avg.</b>	<b>66.0</b>		<b>98.8</b>	<b>3.5</b>	<b>3.4</b>	<b>2.9</b>	<b>3.3</b>	<b>3.1</b>	<b>2.1</b>	<b>3.7</b>	<b>3.1</b>	<b>2.8</b>	
<b>S.D.</b>	<b>3.1</b>		<b>7.8</b>	<b>0.7</b>	<b>0.8</b>	<b>0.8</b>	<b>0.9</b>	<b>0.7</b>	<b>0.8</b>	<b>0.7</b>	<b>0.9</b>	<b>0.8</b>	

CASSELTON (C-5)													
Cooperator	Bake Absorption (%)	Loaf Volume		Quality Score Compared to Check (Glenn)									
		(cc)	(% of Check)	Mixing Requirement	Dough Characteristics	Mixing Tolerance	Internal Crumb Color	Internal Grain & Texture	Protein	Milling	Baking	Overall	
<b>A</b>	59.0	2950	98.3	3	3	2	3	4	3	3	3	3	3
<b>B</b>	67.5	2250	103.4	3	4	3	3	3	2	3	3	2	2
<b>C</b>	66.0	3104	100.0	5	5	3	3	3	4	3	3	3	3
<b>D</b>	65.0	2600	104.0	2	3	1	3	2	3	4	5	3	3
<b>E</b>	67.6	2700	100.9	3	4	4	4	4	3	3	4	4	4
<b>F</b>	64.0	945	95.2	3	3	2	3	3	3	2	2	2	2
<b>G</b>	63.8	1000	93.9	2	3	2	2	2	3	3	2	2	2
<b>H</b>	65.0	3000	100.0	2	3	3	3	4	4	4	3	3	3
<b>I</b>	71.0	990	100.5	3	2	1	2	2	4	4	1	2	2
<b>J</b>	66.8	1095	104.3	3	3	2	3	4	3	4	3	3	3
<b>K</b>	64.2	955	87.2	3	5	2	3	2	3	4	1	3	3
<b>L</b>	66.9	1035	102.5	3	3	2	3	2	3	3	3	3	3
<b>M</b>	69.4	1020	99.7	2	4	2	4	3	3	4	3	3	3
<b>N</b>	71.7	932	99.4	2	4	2	3	3	3	4	3	3	3
<b>Avg.</b>	<b>66.3</b>		<b>99.2</b>	<b>2.8</b>	<b>3.5</b>	<b>2.2</b>	<b>3.0</b>	<b>2.9</b>	<b>3.1</b>	<b>3.4</b>	<b>2.8</b>	<b>2.8</b>	
<b>S.D.</b>	<b>3.2</b>		<b>4.6</b>	<b>0.8</b>	<b>0.9</b>	<b>0.8</b>	<b>0.6</b>	<b>0.8</b>	<b>0.5</b>	<b>0.6</b>	<b>1.1</b>	<b>0.6</b>	

CROOKSTON (K-5)												
Cooperator	Bake Absorption (%)	Loaf Volume		Quality Score Compared to Check (Glenn)								
		(cc)	(% of Check)	Mixing Requirement	Dough Characteristics	Mixing Tolerance	Internal Crumb Color	Internal Grain & Texture	Protein	Milling	Baking	Overall
A	58.0	2750	91.7	3	3	3	3	4	3	3	3	3
B	66.0	2200	110.0	4	5	2	3	3	2	4	3	2
C	65.0	3104	100.0	4	4	2	2	2	3	3	2	2
D	65.0	2600	96.3	3	3	1	3	2	3	4	4	3
E	66.0	2475	119.3	3	2	3	4	3	3	2	4	4
F	60.0	908	104.6	4	4	3	3	3	3	3	4	4
G	62.1	915	98.9	3	5	2	2	4	3	3	3	3
H	64.0	2550	94.4	2	3	2	3	3	3	4	2	2
I	70.9	895	92.3	5	3	2	2	3	3	4	2	2
J	64.5	1010	98.5	3	5	2	3	4	3	4	3	4
K	66.8	960	89.7	4	3	2	2	2	3	3	3	3
L	66.4	955	104.9	3	4	2	3	3	3	3	3	3
M	69.3	978	108.1	3	4	3	3	4	3	3	5	4
N	69.4	877	100.6	3	4	2	3	4	3	3	3	3
<b>Avg.</b>	<b>65.2</b>		<b>100.7</b>	<b>3.4</b>	<b>3.7</b>	<b>2.2</b>	<b>2.8</b>	<b>3.1</b>	<b>2.9</b>	<b>3.3</b>	<b>3.1</b>	<b>3.0</b>
<b>S.D.</b>	<b>3.5</b>		<b>8.1</b>	<b>0.7</b>	<b>0.9</b>	<b>0.6</b>	<b>0.6</b>	<b>0.8</b>	<b>0.3</b>	<b>0.6</b>	<b>0.9</b>	<b>0.8</b>

MINOT (M-5)												
Cooperator	Bake Absorption (%)	Loaf Volume		Quality Score Compared to Check (Glenn)								
		(cc)	(% of Check)	Mixing Requirement	Dough Characteristics	Mixing Tolerance	Internal Crumb Color	Internal Grain & Texture	Protein	Milling	Baking	Overall
A	60.0	2875	99.1	3	3	2	3	3	3	3	3	3
B	66.0	2275	105.8	4	3	3	3	3	2	3	3	2
C	65.0	3104	100.0	5	5	3	3	3	3	3	3	3
D	65.5	2550	100.0	4	3	2	3	4	3	4	4	4
E	66.1	2650	93.8	3	4	4	3	3	2	3	3	2
F	63.0	1000	90.3	4	4	3	3	3	3	3	2	2
G	64.4	1050	99.1	3	4	2	3	3	3	2	3	3
H	64.0	2600	100.0	2	2	2	2	2	3	4	4	4
I	70.1	1065	95.5	3	2	2	2	3	3	3	2	2
J	69.0	885	91.7	3	5	2	2	3	3	4	2	2
K	66.4	970	86.6	4	4	2	2	3	3	3	2	3
L	70.3	1070	99.1	3	2	2	3	3	2	3	3	3
M	71.5	1083	99.4	3	4	3	n/a	3	3	4	3	3
N	69.0	966	101.7	3	4	3	3	3	3	3	3	3
<b>Avg.</b>	<b>66.5</b>		<b>97.3</b>	<b>3.4</b>	<b>3.5</b>	<b>2.5</b>	<b>2.7</b>	<b>3.0</b>	<b>2.8</b>	<b>3.2</b>	<b>2.9</b>	<b>2.8</b>
<b>S.D.</b>	<b>3.2</b>		<b>5.1</b>	<b>0.7</b>	<b>1.0</b>	<b>0.7</b>	<b>0.5</b>	<b>0.4</b>	<b>0.4</b>	<b>0.6</b>	<b>0.7</b>	<b>0.7</b>



WILLISTON (W-5)													
Cooperator	Bake Absorption (%)	Loaf Volume		Quality Score Compared to Check (Glenn)									
		(cc)	(% of Check)	Mixing Requirement	Dough Characteristics	Mixing Tolerance	Internal Crumb Color	Internal Grain & Texture	Protein	Milling	Baking	Overall	
A	60.0	2900	96.7	5	5	3	3	3	3	3	3	3	3
B	67.0	2350	104.4	3	4	4	3	4	3	3	4	4	3
C	66.0	3015	99.0	5	5	3	3	2	4	3	3	3	3
D	66.5	2700	103.8	5	3	3	3	1	4	3	4	4	3
E	67.0	2525	103.1	4	3	2	3	4	5	2	3	3	2
F	64.0	1113	102.8	4	4	4	3	3	4	3	4	4	3
G	65.3	1010	97.6	3	5	2	2	3	3	2	3	3	3
H	64.0	2850	98.3	4	4	4	2	3	4	3	4	4	4
I	70.9	990	100.5	5	4	4	2	2	4	3	2	3	3
J	67.7	975	100.0	3	5	2	2	3	5	3	3	3	3
K	66.7	900	97.8	4	5	2	2	3	4	3	2	2	3
L	68.4	1100	110.0	4	4	2	3	2	4	3	2	2	3
M	72.2	1050	104.2	4	5	3	n/a	4	3	3	3	3	3
N	70.7	914	100.9	3	4	3	3	3	4	3	4	4	4
<b>Avg.</b>	<b>66.9</b>		<b>101.4</b>	<b>4.0</b>	<b>4.3</b>	<b>2.9</b>	<b>2.6</b>	<b>2.9</b>	<b>3.9</b>	<b>2.9</b>	<b>3.1</b>	<b>3.1</b>	
<b>S.D.</b>	<b>3.2</b>		<b>3.6</b>	<b>0.8</b>	<b>0.7</b>	<b>0.8</b>	<b>0.5</b>	<b>0.9</b>	<b>0.7</b>	<b>0.4</b>	<b>0.8</b>	<b>0.5</b>	

## COI565W

WILLISTON (W-6)												
Cooperator	Bake Absorption (%)	Loaf Volume		Quality Score Compared to Check (Glenn)								
		(cc)	(% of Check)	Mixing Requirement	Dough Characteristics	Mixing Tolerance	Internal Crumb Color	Internal Grain & Texture	Protein	Milling	Baking	Overall
<b>A</b>	60.0	2700	90.0	5	5	3	3	3	3	3	3	3
<b>B</b>	59.0	2300	102.2	5	5	2	3	1	5	2	2	3
<b>C</b>	57.0	3104	101.9	5	5	3	3	2	4	2	2	2
<b>D</b>	61.0	2500	96.2	5	5	3	2	3	4	3	3	3
<b>E</b>	59.2	2450	100.0	5	4	3	4	3	5	2	3	2
<b>F</b>	64.0	1073	99.1	4	4	3	3	3	4	2	3	2
<b>G</b>	65.3	1060	102.4	4	4	3	3	4	3	2	4	4
<b>H</b>	58.0	2700	93.1	5	4	4	2	3	4	4	3	3
<b>I</b>	64.2	1055	107.1	5	5	5	3	3	4	2	2	2
<b>J</b>	68.5	990	101.5	4	4	3	2	2	4	3	2	3
<b>K</b>	61.5	920	100.0	5	4	3	2	3	4	2	1	2
<b>L</b>	68.5	1015	101.5	5	4	3	4	4	4	2	4	3
<b>M</b>	69.4	988	98.0	5	5	4	n/a	2	3	3	2	2
<b>N</b>	62.4	941	103.9	4	5	4	3	4	4	3	3	3
<b>Avg.</b>	<b>62.7</b>		<b>99.8</b>	<b>4.7</b>	<b>4.5</b>	<b>3.3</b>	<b>2.8</b>	<b>2.9</b>	<b>3.9</b>	<b>2.5</b>	<b>2.6</b>	<b>2.6</b>
<b>S.D.</b>	<b>4.1</b>		<b>4.4</b>	<b>0.5</b>	<b>0.5</b>	<b>0.7</b>	<b>0.7</b>	<b>0.9</b>	<b>0.6</b>	<b>0.7</b>	<b>0.8</b>	<b>0.6</b>

## SD4362

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WATERTOWN (B-7)												
Cooperator	Bake Absorption (%)	Loaf Volume		Quality Score Compared to Check (Glenn)								
		(cc)	(% of Check)	Mixing Requirement	Dough Characteristics	Mixing Tolerance	Internal Crumb Color	Internal Grain & Texture	Protein	Milling	Baking	Overall
A	59.0	3100	106.9	3	2	3	3	4	3	3	3	3
B	62.0	2175	117.6	3	3	4	5	3	4	4	5	4
C	61.0	2956	97.1	5	5	3	3	3	2	4	3	3
D	60.0	2650	103.9	5	4	5	5	2	1	5	2	2
E	62.2	2475	104.9	3	3	4	4	3	2	5	4	4
F	63.0	1070	109.4	4	4	3	3	3	2	3	3	3
G	63.7	1025	99.0	4	4	3	3	3	2	4	4	4
H	60.0	2850	96.6	3	4	3	3	2	2	4	3	2
I	66.8	1020	95.8	4	4	4	3	5	2	4	3	2
J	66.5	1100	104.8	3	3	2	3	2	2	5	2	2
K	62.7	1010	87.8	4	2	2	2	4	1	3	2	2
L	67.7	950	88.4	4	3	3	3	4	2	2	3	3
M	69.1	978	102.1	4	3	3	4	3	3	4	3	3
N	65.7	938	96.7	3	4	3	4	4	2	3	3	3
<b>Avg.</b>	<b>63.5</b>		<b>100.8</b>	<b>3.7</b>	<b>3.4</b>	<b>3.2</b>	<b>3.4</b>	<b>3.2</b>	<b>2.1</b>	<b>3.8</b>	<b>3.1</b>	<b>2.9</b>
<b>S.D.</b>	<b>3.2</b>		<b>8.0</b>	<b>0.7</b>	<b>0.9</b>	<b>0.8</b>	<b>0.9</b>	<b>0.9</b>	<b>0.8</b>	<b>0.9</b>	<b>0.8</b>	<b>0.8</b>

CASSELTON (C-7)												
Cooperator	Bake Absorption (%)	Loaf Volume		Quality Score Compared to Check (Glenn)								
		(cc)	(% of Check)	Mixing Requirement	Dough Characteristics	Mixing Tolerance	Internal Crumb Color	Internal Grain & Texture	Protein	Milling	Baking	Overall
A	60.0	3100	103.3	3	2	2	3	4	3	3	3	3
B	63.0	2250	103.4	4	3	4	3	3	2	3	3	2
C	63.0	3104	100.0	5	5	3	3	3	4	2	3	3
D	60.5	2700	108.0	4	3	2	3	3	4	4	5	4
E	63.5	2500	93.5	3	5	5	4	4	4	2	5	4
F	64.0	983	99.0	4	4	3	3	3	4	2	3	3
G	64.3	1055	99.1	3	2	2	3	3	3	2	3	3
H	61.0	3000	100.0	3	3	3	3	3	4	3	3	3
I	68.0	950	96.4	3	3	1	3	3	5	2	2	2
J	66.8	1095	104.3	3	2	2	4	3	4	3	3	3
K	65.4	1015	92.7	3	4	2	3	3	5	3	2	3
L	68.3	1035	102.5	3	3	2	3	3	4	3	3	3
M	70.7	980	95.8	3	3	3	4	4	3	4	3	3
N	67.0	865	92.2	3	2	2	4	4	4	2	3	3
<b>Avg.</b>	<b>64.7</b>		<b>99.3</b>	<b>3.4</b>	<b>3.1</b>	<b>2.6</b>	<b>3.3</b>	<b>3.3</b>	<b>3.8</b>	<b>2.7</b>	<b>3.1</b>	<b>3.0</b>
<b>S.D.</b>	<b>3.2</b>		<b>4.8</b>	<b>0.6</b>	<b>1.0</b>	<b>1.0</b>	<b>0.5</b>	<b>0.5</b>	<b>0.8</b>	<b>0.7</b>	<b>0.9</b>	<b>0.6</b>

CROOKSTON (K-7)

Cooperator	Loaf Volume			Quality Score Compared to Check (Glenn)								
	Bake Absorption (%)	(cc)	(% of Check)	Mixing Requirement	Dough Characteristics	Mixing Tolerance	Internal Crumb Color	Internal Grain & Texture	Protein	Milling	Baking	Overall
A	59.0	3100	103.3	3	3	3	4	4	3	3	3	3
B	62.5	2200	110.0	3	3	3	4	3	2	4	3	2
C	63.0	3104	100.0	5	4	2	3	4	4	3	4	3
D	62.5	2650	98.1	4	3	2	3	1	3	5	3	3
E	62.6	2450	118.1	3	2	3	2	3	4	4	3	3
F	61.0	980	112.9	4	4	3	3	3	3	3	4	4
G	62.7	1025	110.8	3	4	2	3	4	3	4	4	4
H	60.0	2900	107.4	2	2	2	2	2	4	5	4	3
I	65.7	880	90.7	4	5	2	4	3	4	4	3	3
J	64.0	1080	105.4	3	3	2	4	2	3	4	2	3
K	63.0	965	90.2	4	4	2	3	4	4	3	2	3
L	67.1	980	107.7	3	3	2	3	4	4	3	4	4
M	68.1	995	109.9	3	4	2	4	3	3	4	4	4
N	67.2	898	103.0	3	4	1	4	5	3	4	3	3
<b>Avg.</b>	<b>63.5</b>		<b>104.8</b>	<b>3.4</b>	<b>3.4</b>	<b>2.2</b>	<b>3.3</b>	<b>3.2</b>	<b>3.4</b>	<b>3.8</b>	<b>3.3</b>	<b>3.2</b>
<b>S.D.</b>	<b>2.7</b>		<b>8.0</b>	<b>0.7</b>	<b>0.9</b>	<b>0.6</b>	<b>0.7</b>	<b>1.1</b>	<b>0.6</b>	<b>0.7</b>	<b>0.7</b>	<b>0.6</b>

## AUBR30023W

MINOT (M-8)												
Cooperator	Bake Absorption (%)	Loaf Volume		Quality Score Compared to Check (Glenn)								
		(cc)	(% of Check)	Mixing Requirement	Dough Characteristics	Mixing Tolerance	Internal Crumb Color	Internal Grain & Texture	Protein	Milling	Baking	Overall
A	60.0	2800	96.6	2	2	1	2	3	3	2	2	2
B	62.0	2300	107.0	4	5	2	3	3	2	4	3	2
C	60.0	2956	95.2	5	4	2	2	2	3	2	2	2
D	63.0	2550	100.0	2	2	1	1	3	3	2	3	2
E	61.9	2550	90.3	3	3	3	2	4	3	1	4	4
F	63.0	870	78.5	1	1	1	1	1	3	1	1	1
G	64.9	870	82.1	3	4	2	2	2	3	1	1	1
H	60.0	2500	96.2	2	2	2	3	3	3	5	4	4
I	67.2	970	87.0	3	3	2	2	3	3	4	2	3
J	67.0	750	77.7	3	2	1	1	1	3	2	1	1
K	62.9	830	74.1	4	3	1	1	2	3	2	1	2
L	67.4	905	83.8	3	1	1	2	2	4	2	2	2
M	70.6	1050	96.3	3	4	3	n/a	1	3	2	2	2
N	64.6	786	82.7	3	4	2	2	4	3	1	2	2
<b>Avg.</b>	<b>63.9</b>		<b>89.1</b>	<b>2.9</b>	<b>2.9</b>	<b>1.7</b>	<b>1.8</b>	<b>2.4</b>	<b>3.0</b>	<b>2.2</b>	<b>2.1</b>	<b>2.1</b>
<b>S.D.</b>	<b>3.2</b>		<b>9.7</b>	<b>1.0</b>	<b>1.2</b>	<b>0.7</b>	<b>0.7</b>	<b>1.0</b>	<b>0.4</b>	<b>1.3</b>	<b>1.0</b>	<b>0.9</b>

WILLISTON (W-8)												
Cooperator	Bake Absorption (%)	Loaf Volume		Quality Score Compared to Check (Glenn)								
		(cc)	(% of Check)	Mixing Requirement	Dough Characteristics	Mixing Tolerance	Internal Crumb Color	Internal Grain & Texture	Protein	Milling	Baking	Overall
A	59.0	2700	90.0	3	3	2	2	3	3	3	2	2
B	59.5	2325	103.3	3	5	2	4	1	4	3	3	3
C	59.0	2809	92.2	4	3	2	3	2	2	2	2	2
D	60.0	2800	107.7	5	3	3	3	1	2	5	4	4
E	59.3	2400	98.0	3	4	3	3	3	1	4	4	2
F	63.0	965	89.1	3	3	2	3	3	2	3	2	2
G	63.4	935	90.3	3	3	2	1	2	2	4	2	2
H	58.0	2800	96.6	5	4	4	3	3	2	3	3	3
I	63.6	940	95.4	5	3	5	1	3	2	3	2	2
J	63.5	850	87.2	3	4	2	1	2	2	3	1	2
K	62.0	865	94.0	5	5	1	1	2	2	3	1	2
L	62.7	905	90.5	5	3	2	3	2	2	2	2	2
M	65.5	1028	102.0	5	5	5	n/a	3	3	5	4	4
N	62.2	850	93.8	3	5	4	4	4	2	4	2	3
<b>Avg.</b>	<b>61.5</b>		<b>95.0</b>	<b>3.9</b>	<b>3.8</b>	<b>2.8</b>	<b>2.5</b>	<b>2.4</b>	<b>2.2</b>	<b>3.4</b>	<b>2.4</b>	<b>2.5</b>
<b>S.D.</b>	<b>2.3</b>		<b>6.0</b>	<b>1.0</b>	<b>0.9</b>	<b>1.3</b>	<b>1.1</b>	<b>0.9</b>	<b>0.7</b>	<b>0.9</b>	<b>1.0</b>	<b>0.8</b>

## MN10201-4

CASSETON (C-9)												
Cooperator	Bake Absorption (%)	Loaf Volume		Quality Score Compared to Check (Glenn)								
		(cc)	(% of Check)	Mixing Requirement	Dough Characteristics	Mixing Tolerance	Internal Crumb Color	Internal Grain & Texture	Protein	Milling	Baking	Overall
A	59.0	2900	96.7	3	3	2	2	3	3	3	3	3
B	63.5	2100	96.6	4	3	3	2	3	3	4	3	3
C	63.0	3104	100.0	5	5	3	2	3	3	3	3	3
D	62.5	2625	105.0	4	3	2	2	2	3	5	3	3
E	63.3	2150	80.4	3	4	4	2	2	3	3	2	2
F	63.0	960	96.7	3	3	3	3	3	3	2	3	3
G	63.5	1025	96.2	3	4	3	2	3	2	3	3	3
H	61.0	3000	100.0	3	3	3	3	3	4	5	3	3
I	68.0	1000	101.5	4	4	2	2	4	3	4	3	3
J	65.5	935	89.0	3	2	2	2	2	3	5	2	2
K	64.1	995	90.9	4	3	3	2	3	3	4	1	3
L	68.1	990	98.0	3	3	3	3	3	2	3	3	3
M	70.5	983	96.1	4	4	3	4	4	3	4	3	3
N	66.9	933	99.5	3	4	3	4	3	3	3	3	3
<b>Avg.</b>	<b>64.4</b>		<b>96.2</b>	<b>3.5</b>	<b>3.4</b>	<b>2.8</b>	<b>2.5</b>	<b>2.9</b>	<b>2.9</b>	<b>3.6</b>	<b>2.7</b>	<b>2.9</b>
<b>S.D.</b>	<b>3.1</b>		<b>6.1</b>	<b>0.7</b>	<b>0.8</b>	<b>0.6</b>	<b>0.8</b>	<b>0.6</b>	<b>0.5</b>	<b>0.9</b>	<b>0.6</b>	<b>0.4</b>

CROOKSTON (K-9)												
Cooperator	Bake Absorption (%)	Loaf Volume		Quality Score Compared to Check (Glenn)								
		(cc)	(% of Check)	Mixing Requirement	Dough Characteristics	Mixing Tolerance	Internal Crumb Color	Internal Grain & Texture	Protein	Milling	Baking	Overall
A	59.0	2875	95.8	3	3	3	3	4	3	3	3	3
B	62.0	2200	110.0	3	4	3	2	3	3	5	3	4
C	61.0	3015	97.1	5	5	3	2	4	3	3	2	3
D	62.5	2575	95.4	5	5	3	2	1	3	5	1	2
E	62.0	2325	112.0	3	3	4	2	4	4	5	4	2
F	61.0	935	107.7	4	4	3	3	3	3	4	4	4
G	62.6	960	103.8	3	4	3	2	4	3	5	3	3
H	60.0	2600	96.3	3	3	2	3	2	4	5	2	3
I	68.9	960	99.0	5	3	3	1	2	3	4	1	2
J	64.7	1010	98.5	3	4	3	2	4	3	5	4	4
K	63.2	950	88.8	4	4	3	2	3	3	4	2	3
L	68.6	945	103.8	4	3	3	3	3	3	3	3	3
M	70.0	1015	112.2	5	4	3	3	3	3	5	4	4
N	65.9	930	106.7	3	5	2	3	4	3	4	3	3
<b>Avg.</b>	<b>63.7</b>		<b>101.9</b>	<b>3.8</b>	<b>3.9</b>	<b>2.9</b>	<b>2.4</b>	<b>3.1</b>	<b>3.1</b>	<b>4.3</b>	<b>2.8</b>	<b>3.1</b>
<b>S.D.</b>	<b>3.5</b>		<b>7.1</b>	<b>0.9</b>	<b>0.8</b>	<b>0.5</b>	<b>0.6</b>	<b>0.9</b>	<b>0.4</b>	<b>0.8</b>	<b>1.1</b>	<b>0.7</b>

## LNR10-0493

CASSELTON (C-10)												
Cooperator	Bake Absorption (%)	Loaf Volume		Quality Score Compared to Check (Glenn)								
		(cc)	(% of Check)	Mixing Requirement	Dough Characteristics	Mixing Tolerance	Internal Crumb Color	Internal Grain & Texture	Protein	Milling	Baking	Overall
A	60.0	3100	103.3	4	3	3	4	4	3	3	3	3
B	67.0	2375	109.2	4	3	3	2	4	2	3	3	2
C	66.0	3104	100.0	5	5	3	2	3	4	3	3	3
D	63.0	2600	104.0	4	3	2	1	1	3	4	3	2
E	67.2	2650	99.1	3	3	3	3	3	4	2	3	2
F	64.0	928	93.5	3	3	3	3	3	4	2	2	2
G	64.1	965	90.6	3	3	3	2	2	3	3	2	2
H	65.0	3000	100.0	3	3	3	3	3	4	4	3	3
I	70.6	910	92.4	5	3	2	1	2	4	4	2	2
J	66.8	1045	99.5	3	3	2	2	2	4	4	2	2
K	67.2	1025	93.6	4	3	3	2	2	4	2	3	3
L	67.1	955	94.6	3	3	2	4	2	3	3	2	3
M	73.0	983	96.1	3	4	3	3	3	3	4	3	3
N	71.7	894	95.3	3	4	3	3	3	3	5	3	4
<b>Avg.</b>	<b>66.6</b>		<b>97.9</b>	<b>3.6</b>	<b>3.3</b>	<b>2.7</b>	<b>2.5</b>	<b>2.6</b>	<b>3.4</b>	<b>3.3</b>	<b>2.6</b>	<b>2.6</b>
<b>S.D.</b>	<b>3.5</b>		<b>5.2</b>	<b>0.8</b>	<b>0.6</b>	<b>0.5</b>	<b>0.9</b>	<b>0.8</b>	<b>0.6</b>	<b>0.9</b>	<b>0.5</b>	<b>0.6</b>

CROOKSTON (K-10)												
Cooperator	Bake Absorption (%)	Loaf Volume		Quality Score Compared to Check (Glenn)								
		(cc)	(% of Check)	Mixing Requirement	Dough Characteristics	Mixing Tolerance	Internal Crumb Color	Internal Grain & Texture	Protein	Milling	Baking	Overall
A	58.0	2900	96.7	3	3	3	3	4	3	3	3	3
B	65.0	2125	106.3	4	3	4	3	3	2	4	3	2
C	65.0	3045	98.1	5	5	3	3	4	2	3	3	3
D	64.5	2600	96.3	5	4	3	2	2	2	4	3	2
E	65.0	2375	114.5	3	3	4	3	4	2	4	3	3
F	60.0	913	105.2	4	4	3	3	3	3	4	4	4
G	61.6	930	100.5	3	5	3	2	3	2	4	3	3
H	63.0	2700	100.0	3	3	2	3	3	2	4	3	3
I	68.2	915	94.3	5	4	2	1	3	2	4	1	2
J	64.5	975	95.1	3	5	3	3	5	2	4	4	4
K	65.7	935	87.4	4	4	3	2	3	2	4	1	2
L	67.2	830	91.2	4	4	3	2	2	2	3	2	2
M	70.7	895	98.9	5	5	3	3	3	3	4	3	4
N	69.5	896	102.8	4	4	4	3	4	3	5	4	4
<b>Avg.</b>	<b>64.9</b>		<b>99.1</b>	<b>3.9</b>	<b>4.0</b>	<b>3.1</b>	<b>2.6</b>	<b>3.3</b>	<b>2.3</b>	<b>3.9</b>	<b>2.9</b>	<b>2.9</b>
<b>S.D.</b>	<b>3.5</b>		<b>6.8</b>	<b>0.8</b>	<b>0.8</b>	<b>0.6</b>	<b>0.6</b>	<b>0.8</b>	<b>0.5</b>	<b>0.5</b>	<b>0.9</b>	<b>0.8</b>

MINOT (M-10)												
Cooperator	Bake Absorption (%)	Loaf Volume		Quality Score Compared to Check (Glenn)								
		(cc)	(% of Check)	Mixing Requirement	Dough Characteristics	Mixing Tolerance	Internal Crumb Color	Internal Grain & Texture	Protein	Milling	Baking	Overall
A	60.0	2950	101.7	4	4	3	4	3	3	3	3	3
B	65.0	2175	101.2	4	3	3	3	3	3	4	3	3
C	63.0	2986	96.2	5	5	3	2	3	2	2	3	2
D	62.5	2600	102.0	5	3	3	2	4	3	4	3	3
E	64.8	2775	98.2	3	4	4	4	4	2	2	4	4
F	63.0	970	87.5	4	4	2	3	3	3	3	2	2
G	64.0	960	90.6	3	4	3	3	3	2	2	2	2
H	62.0	2550	98.1	3	3	3	2	2	3	4	4	4
I	69.7	1010	90.6	4	3	2	3	2	2	3	2	2
J	68.0	855	88.6	3	4	3	2	4	3	4	3	3
K	66.1	940	83.9	4	4	3	2	3	2	2	2	2
L	68.9	970	89.8	3	3	2	3	2	2	3	2	2
M	72.7	1030	94.5	4	4	3	n/a	2	3	3	2	2
N	67.7	874	92.0	4	4	4	3	3	2	3	3	3
<b>Avg.</b>	<b>65.5</b>		<b>93.9</b>	<b>3.8</b>	<b>3.7</b>	<b>2.9</b>	<b>2.8</b>	<b>2.9</b>	<b>2.5</b>	<b>3.0</b>	<b>2.7</b>	<b>2.6</b>
<b>S.D.</b>	<b>3.5</b>		<b>5.8</b>	<b>0.7</b>	<b>0.6</b>	<b>0.6</b>	<b>0.7</b>	<b>0.7</b>	<b>0.5</b>	<b>0.8</b>	<b>0.7</b>	<b>0.7</b>

WILLISTON (W-10)												
Cooperator	Bake Absorption (%)	Loaf Volume		Quality Score Compared to Check (Glenn)								
		(cc)	(% of Check)	Mixing Requirement	Dough Characteristics	Mixing Tolerance	Internal Crumb Color	Internal Grain & Texture	Protein	Milling	Baking	Overall
A	60.0	2900	96.7	5	5	3	2	3	3	3	3	3
B	65.0	2250	100.0	4	5	2	3	2	3	3	2	2
C	63.0	3104	101.9	5	5	3	3	3	3	2	3	3
D	63.0	2700	103.8	5	5	3	3	2	3	1	3	3
E	65.1	2400	98.0	4	3	2	3	4	3	1	4	3
F	64.0	1090	100.6	4	4	4	3	3	3	3	4	3
G	64.3	990	95.7	3	5	3	2	3	3	1	3	3
H	63.0	2750	94.8	3	4	4	2	3	3	4	3	3
I	69.7	950	96.4	5	3	3	2	2	3	3	2	2
J	67.0	935	95.9	3	5	3	2	4	3	2	3	3
K	67.0	910	98.9	5	4	3	2	2	3	3	2	3
L	67.4	980	98.0	5	1	3	3	2	3	2	3	3
M	67.2	1043	103.5	5	5	4	n/a	3	3	1	4	3
N	68.1	876	96.7	4	5	4	3	3	3	3	4	3
<b>Avg.</b>	<b>65.3</b>		<b>98.6</b>	<b>4.3</b>	<b>4.2</b>	<b>3.1</b>	<b>2.5</b>	<b>2.8</b>	<b>3.0</b>	<b>2.3</b>	<b>3.1</b>	<b>2.9</b>
<b>S.D.</b>	<b>2.6</b>		<b>2.9</b>	<b>0.8</b>	<b>1.2</b>	<b>0.7</b>	<b>0.5</b>	<b>0.7</b>	<b>0.0</b>	<b>1.0</b>	<b>0.7</b>	<b>0.4</b>



## SY Ingmar

CASSELTON (C-11)												
Cooperator	Bake Absorption (%)	Loaf Volume		Quality Score Compared to Check (Glenn)								
		(cc)	(% of Check)	Mixing Requirement	Dough Characteristics	Mixing Tolerance	Internal Crumb Color	Internal Grain & Texture	Protein	Milling	Baking	Overall
A	60.0	3100	103.3	4	5	3	3	4	3	3	3	3
B	63.5	2200	101.1	4	4	3	4	3	3	4	3	3
C	63.0	3104	100.0	5	5	3	2	3	4	3	2	3
D	64.0	2600	104.0	5	3	3	3	1	4	5	4	4
E	63.3	2500	93.5	3	3	3	4	4	5	3	3	4
F	64.0	1093	110.1	4	4	4	3	3	4	2	3	3
G	64.5	1075	100.9	3	2	3	3	3	3	3	3	3
H	61.0	3000	100.0	3	3	3	3	3	4	5	3	3
I	66.7	1010	102.5	3	1	2	2	3	4	4	2	2
J	65.5	1030	98.1	3	4	2	2	2	4	4	2	2
K	63.4	1000	91.3	4	4	4	2	3	5	3	2	3
L	67.0	1070	105.9	3	4	2	3	3	4	3	3	3
M	70.5	1058	103.4	4	4	3	3	3	4	4	3	3
N	67.6	926	98.7	3	4	3	3	4	4	3	3	3
<b>Avg.</b>	<b>64.6</b>		<b>100.9</b>	<b>3.6</b>	<b>3.6</b>	<b>2.9</b>	<b>2.9</b>	<b>3.0</b>	<b>3.9</b>	<b>3.5</b>	<b>2.8</b>	<b>3.0</b>
<b>S.D.</b>	<b>2.7</b>		<b>4.8</b>	<b>0.7</b>	<b>1.1</b>	<b>0.6</b>	<b>0.7</b>	<b>0.8</b>	<b>0.6</b>	<b>0.9</b>	<b>0.6</b>	<b>0.6</b>

CROOKSTON (K-11)												
Cooperator	Bake Absorption (%)	Loaf Volume		Quality Score Compared to Check (Glenn)								
		(cc)	(% of Check)	Mixing Requirement	Dough Characteristics	Mixing Tolerance	Internal Crumb Color	Internal Grain & Texture	Protein	Milling	Baking	Overall
A	59.0	3100	103.3	4	4	4	3	3	4	3	3	4
B	63.0	2125	106.3	2	3	3	3	3	3	4	3	3
C	63.0	3104	100.0	5	5	3	2	4	4	3	3	3
D	63.5	2700	100.0	5	5	3	1	2	4	4	1	3
E	63.2	2300	110.8	3	1	2	3	3	5	2	3	3
F	62.0	1098	126.5	5	5	4	3	3	4	2	5	4
G	63.6	1035	111.9	3	4	3	2	4	4	3	4	3
H	61.0	2750	101.9	3	2	2	2	2	5	4	3	3
I	66.6	985	101.5	5	3	2	1	2	4	4	2	2
J	64.5	1065	103.9	3	3	4	2	3	5	4	3	3
K	63.6	940	87.9	4	5	3	2	3	4	2	2	3
L	66.7	1030	113.2	4	4	4	2	2	4	2	3	3
M	70.5	1075	118.8	5	5	3	3	5	4	4	5	4
N	67.6	970	111.2	3	4	2	3	3	4	2	3	3
<b>Avg.</b>	<b>64.1</b>		<b>106.9</b>	<b>3.9</b>	<b>3.8</b>	<b>3.0</b>	<b>2.3</b>	<b>3.0</b>	<b>4.1</b>	<b>3.1</b>	<b>3.1</b>	<b>3.1</b>
<b>S.D.</b>	<b>2.9</b>		<b>9.4</b>	<b>1.0</b>	<b>1.3</b>	<b>0.8</b>	<b>0.7</b>	<b>0.9</b>	<b>0.5</b>	<b>0.9</b>	<b>1.1</b>	<b>0.5</b>

MINOT (M-11)												
Cooperator	Bake Absorption (%)	Loaf Volume		Quality Score Compared to Check (Glenn)								
		(cc)	(% of Check)	Mixing Requirement	Dough Characteristics	Mixing Tolerance	Internal Crumb Color	Internal Grain & Texture	Protein	Milling	Baking	Overall
A	61.0	3100	106.9	5	5	4	2	2	3	3	3	3
B	63.5	2275	105.8	4	3	4	3	4	3	2	4	3
C	63.0	2986	96.2	5	5	3	2	3	4	2	3	2
D	63.5	2550	100.0	5	5	3	1	3	4	3	1	2
E	63.4	2725	96.5	3	5	5	2	4	5	2	3	3
F	64.0	978	88.3	4	4	3	3	3	4	2	2	2
G	65.9	985	92.9	3	4	3	2	3	4	1	2	2
H	61.0	2500	96.2	3	4	3	3	3	4	3	3	3
I	68.4	1065	95.5	4	3	3	4	4	4	2	3	3
J	69.0	855	88.6	3	4	2	1	1	4	3	1	2
K	63.9	810	72.3	4	4	4	1	1	4	3	1	3
L	68.8	1035	95.8	4	3	2	3	5	4	3	5	4
M	72.0	1140	104.6	4	4	3	n/a	3	3	3	3	3
N	66.7	913	96.1	4	4	4	3	3	4	2	3	2
<b>Avg.</b>	<b>65.3</b>		<b>95.4</b>	<b>3.9</b>	<b>4.1</b>	<b>3.3</b>	<b>2.3</b>	<b>3.0</b>	<b>3.9</b>	<b>2.4</b>	<b>2.6</b>	<b>2.6</b>
<b>S.D.</b>	<b>3.3</b>		<b>8.7</b>	<b>0.7</b>	<b>0.7</b>	<b>0.8</b>	<b>0.9</b>	<b>1.1</b>	<b>0.5</b>	<b>0.6</b>	<b>1.2</b>	<b>0.6</b>

WILLISTON (W-11)												
Cooperator	Bake Absorption (%)	Loaf Volume		Quality Score Compared to Check (Glenn)								
		(cc)	(% of Check)	Mixing Requirement	Dough Characteristics	Mixing Tolerance	Internal Crumb Color	Internal Grain & Texture	Protein	Milling	Baking	Overall
A	60.0	3000	100.0	5	5	3	2	3	3	3	3	3
B	63.0	2300	102.2	4	5	2	3	3	3	4	3	2
C	61.0	3104	101.9	5	5	3	3	2	4	2	2	2
D	62.0	2800	107.7	5	5	3	1	3	4	4	2	4
E	62.8	2350	95.9	4	2	1	3	4	4	3	4	4
F	64.0	1200	110.8	5	5	5	3	3	3	3	5	4
G	64.9	1040	100.5	5	5	4	2	3	3	3	3	3
H	61.0	2700	93.1	3	4	4	3	3	3	5	4	4
I	62.5	1060	107.6	5	5	3	3	2	3	3	3	2
J	65.5	1010	103.6	4	5	2	2	4	4	4	4	4
K	63.3	945	102.7	5	5	3	2	3	4	2	3	3
L	66.8	1050	105.0	5	5	3	3	2	4	3	2	3
M	71.0	1080	107.1	5	5	4	n/a	3	3	3	4	4
N	66.7	982	108.4	4	4	4	3	3	4	2	4	3
<b>Avg.</b>	<b>63.9</b>		<b>103.3</b>	<b>4.6</b>	<b>4.6</b>	<b>3.1</b>	<b>2.5</b>	<b>2.9</b>	<b>3.5</b>	<b>3.1</b>	<b>3.3</b>	<b>3.2</b>
<b>S.D.</b>	<b>2.9</b>		<b>4.9</b>	<b>0.6</b>	<b>0.8</b>	<b>1.0</b>	<b>0.7</b>	<b>0.6</b>	<b>0.5</b>	<b>0.9</b>	<b>0.9</b>	<b>0.8</b>

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CASSELTON (C-12)												
Cooperator	Bake Absorption (%)	Loaf Volume		Quality Score Compared to Check (Glenn)								
		(cc)	(% of Check)	Mixing Requirement	Dough Characteristics	Mixing Tolerance	Internal Crumb Color	Internal Grain & Texture	Protein	Milling	Baking	Overall
A	57.0	3100	103.3	3	3	2	3	4	2	2	3	3
B	61.0	2075	95.4	2	3	4	4	3	1	4	4	1
C	60.0	3104	100.0	5	5	3	2	3	2	2	2	2
D	59.0	2600	104.0	5	3	3	3	2	1	4	3	3
E	60.9	2750	102.8	2	2	2	3	3	1	1	2	3
F	60.0	928	93.5	3	3	3	3	3	1	2	2	2
G	60.7	845	79.3	4	3	4	3	2	1	2	1	2
H	59.0	3000	100.0	2	3	3	3	4	3	5	3	3
I	64.4	910	92.4	5	3	1	2	2	1	4	2	2
J	61.6	975	92.9	3	5	2	3	4	1	4	4	3
K	61.4	950	86.8	5	4	3	2	3	1	2	1	1
L	62.7	900	89.1	4	3	3	4	3	2	3	3	3
M	65.7	905	88.5	5	3	2	4	3	1	4	3	3
N	64.6	849	90.5	4	3	3	4	4	1	3	3	2
<b>Avg.</b>	<b>61.3</b>		<b>94.2</b>	<b>3.7</b>	<b>3.3</b>	<b>2.7</b>	<b>3.1</b>	<b>3.1</b>	<b>1.4</b>	<b>3.0</b>	<b>2.6</b>	<b>2.4</b>
<b>S.D.</b>	<b>2.4</b>		<b>7.2</b>	<b>1.2</b>	<b>0.8</b>	<b>0.8</b>	<b>0.7</b>	<b>0.7</b>	<b>0.6</b>	<b>1.2</b>	<b>0.9</b>	<b>0.7</b>

CROOKSTON (K-12)												
Cooperator	Bake Absorption (%)	Loaf Volume		Quality Score Compared to Check (Glenn)								
		(cc)	(% of Check)	Mixing Requirement	Dough Characteristics	Mixing Tolerance	Internal Crumb Color	Internal Grain & Texture	Protein	Milling	Baking	Overall
A	57.0	2800	93.3	3	3	3	3	4	2	3	3	3
B	63.0	2225	111.3	5	5	2	4	3	1	3	3	1
C	61.0	2927	94.3	5	4	2	3	2	2	2	2	2
D	62.5	2700	100.0	5	3	3	2	2	2	3	4	3
E	62.9	2200	106.0	1	1	2	2	3	1	1	2	2
F	60.0	948	109.2	4	4	3	3	3	2	3	4	4
G	60.8	885	95.7	5	4	5	2	2	1	2	2	3
H	61.0	2650	98.1	1	2	2	2	2	1	3	4	4
I	67.6	910	93.8	5	3	1	2	4	2	3	1	1
J	62.0	905	88.3	3	5	3	2	3	1	3	3	3
K	63.7	945	88.3	5	4	2	2	3	1	2	1	1
L	63.8	870	95.6	4	3	3	3	2	2	2	3	2
M	65.4	958	105.9	5	5	2	3	3	2	3	4	4
N	66.5	858	98.4	4	5	1	4	5	2	2	2	2
<b>Avg.</b>	<b>62.7</b>		<b>98.4</b>	<b>3.9</b>	<b>3.6</b>	<b>2.4</b>	<b>2.6</b>	<b>2.9</b>	<b>1.6</b>	<b>2.5</b>	<b>2.7</b>	<b>2.5</b>
<b>S.D.</b>	<b>2.7</b>		<b>7.2</b>	<b>1.4</b>	<b>1.2</b>	<b>1.0</b>	<b>0.7</b>	<b>0.9</b>	<b>0.5</b>	<b>0.7</b>	<b>1.1</b>	<b>1.1</b>

MINOT (M-12)												
Cooperator	Bake Absorption (%)	Loaf Volume		Quality Score Compared to Check (Glenn)								
		(cc)	(% of Check)	Mixing Requirement	Dough Characteristics	Mixing Tolerance	Internal Crumb Color	Internal Grain & Texture	Protein	Milling	Baking	Overall
A	59.0	2900	100.0	5	5	4	3	3	2	2	3	3
B	63.0	2100	97.7	4	3	3	3	3	4	3	3	4
C	61.0	2927	94.3	5	5	3	2	3	2	2	2	2
D	62.0	2525	99.0	4	3	2	1	1	2	2	3	2
E	62.9	2450	86.7	3	4	4	2	5	1	1	3	3
F	61.0	938	84.7	3	3	2	3	3	2	1	2	1
G	63.2	880	83.0	3	4	3	2	3	2	1	1	1
H	61.0	2750	105.8	4	4	4	2	2	2	3	3	3
I	68.4	985	88.3	5	3	4	3	3	1	3	3	2
J	66.2	750	77.7	3	5	2	1	2	2	2	2	2
K	64.1	850	75.9	4	5	3	2	2	1	3	1	2
L	66.7	915	84.7	4	3	2	3	3	2	2	2	2
M	69.3	990	90.8	5	5	3	n/a	2	2	3	3	3
N	65.6	934	98.3	4	4	4	3	3	2	1	3	2
<b>Avg.</b>	<b>63.8</b>		<b>90.5</b>	<b>4.0</b>	<b>4.0</b>	<b>3.1</b>	<b>2.3</b>	<b>2.7</b>	<b>1.9</b>	<b>2.1</b>	<b>2.4</b>	<b>2.3</b>
<b>S.D.</b>	<b>3.0</b>		<b>9.0</b>	<b>0.8</b>	<b>0.9</b>	<b>0.8</b>	<b>0.8</b>	<b>0.9</b>	<b>0.7</b>	<b>0.8</b>	<b>0.8</b>	<b>0.8</b>

WILLISTON (W-12)												
Cooperator	Bake Absorption (%)	Loaf Volume		Quality Score Compared to Check (Glenn)								
		(cc)	(% of Check)	Mixing Requirement	Dough Characteristics	Mixing Tolerance	Internal Crumb Color	Internal Grain & Texture	Protein	Milling	Baking	Overall
A	60.0	2800	93.3	3	3	2	3	3	3	3	3	3
B	61.0	2125	94.4	4	4	4	4	3	5	3	4	4
C	59.0	3104	101.9	5	5	3	4	2	2	2	2	2
D	61.2	2650	101.9	5	5	3	5	2	3	2	4	4
E	60.8	2375	96.9	4	5	4	3	3	3	2	3	4
F	63.0	1010	93.3	4	4	4	3	3	3	3	4	3
G	64.1	1010	97.6	4	4	4	2	3	3	2	3	2
H	59.0	2800	96.6	5	4	4	3	3	3	3	4	4
I	65.6	995	101.0	5	4	5	4	4	2	3	4	3
J	65.0	975	100.0	4	4	2	3	3	3	2	3	3
K	62.7	935	101.6	5	5	3	3	3	3	2	3	3
L	65.4	950	95.0	5	5	3	3	2	3	3	2	3
M	69.3	1070	106.2	5	4	4	n/a	4	3	3	4	4
N	64.5	911	100.6	4	5	3	3	3	3	1	3	2
<b>Avg.</b>	<b>62.9</b>		<b>98.6</b>	<b>4.4</b>	<b>4.4</b>	<b>3.4</b>	<b>3.3</b>	<b>2.9</b>	<b>3.0</b>	<b>2.4</b>	<b>3.3</b>	<b>3.1</b>
<b>S.D.</b>	<b>2.9</b>		<b>3.9</b>	<b>0.6</b>	<b>0.6</b>	<b>0.9</b>	<b>0.8</b>	<b>0.6</b>	<b>0.7</b>	<b>0.6</b>	<b>0.7</b>	<b>0.8</b>

## Hard Red Spring Wheat Breeding Quality Target Values\*

	Quality Parameter	Extra Strong	Traditional Strong
<b>Wheat</b>	Test Weight (lb/bu, Grading Factor)	60	60
	Protein (% , 12% mb)	14.5	14.5
	Ash (% , 14% mb)	< 1.65	< 1.65
	Vitreousness (% dark, hard & vitreous, DHV)	80	80
	1000 Kernel Weight (g)	> 31	> 31
	Falling Number (sec)	400	400
	Wheat Hardness (SKCS)	80	80
	Wheat Hardness (NIR)	70	70
<b>Milling</b>	Flour Extraction:		
	Buhler Lab Mill (% , 0.48% ash)	70	70
	Quadrumat Senior (% , 0.48% ash)	70	70
	Protein Loss (%)	< 1.0	< 1.0
<b>Flour</b>	Ash (% , 14% mb)	0.48	0.48
	Color ( <i>L*</i> value)	90	90
	Wet Gluten (% , 14% mb, 13.5% protein)	36	36
<b>Farinograph (50 g bowl)</b>	Absorption (%)	64	64
	Peak Time (min)	15	10
	Stability (min)	25	15
	Classification (1 = Weak; 8 = Strong) <sup>†</sup>	8	6.5
<b>Extensograph (45 min resting)</b>	Maximum Resistance to Extension (BU)	800	600
	Extensibility (cm)	20	22
<b>Mixograph</b>	Classification (1 = Weak; 8 = Strong) <sup>†</sup>	8	6
<b>Bread Baking<sup>‡</sup></b>	Loaf Volume (cc)	1050	1050
	Grain & Texture (1 = poor, 10 = excellent) <sup>†</sup>	8.5	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.

<sup>†</sup>Subjective ratings and classifications are from North Dakota State University, Hard Red Spring Wheat Quality Laboratory.

<sup>‡</sup>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. **Breeding target values are a tool.** 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. “Traditional strong” and “extra strong” categories differ in their gluten strength or end-use functionality. In a 2003 survey, over 75% of our export markets prefer HRS wheat with quality represented by the “traditional strong” target values.
7. 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.