Wheat Quality Council

Hard Spring Wheat Technical Committee
2011 Crop

February 14 – 16, 2012

Kansas City, MO

Wheat Quality Council
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2011 Crop

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February 14-16, 2012

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Introduction

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

Thirteen experimental lines of hard spring wheat were harvested at up to four locations in 2011 and evaluated for kernel, milling, and bread baking quality against the check cultivar 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. Samples of wheat 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 2011 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.

Wheat and Flour Quality Data

#1 ND905CL (Check- Glenn)

Trait	ID	Check W-8	Line W-1
I. USDA/ARS WQL Data			
1	Wheat Protein (12% mb)	16.8	17.5
2	Flour Protein (12% mb)	16.7	16.7
3	Market Value 1 (Score 1-6)	4.1	3.4
4	Market Value 2 (Score 1-10)	-	8.4
5	Test Weight (lb/bu)	60.4	56.0
6	1000 Kernel Weight (g)	23.2	23.9
	Kernel Size		
7	% Large	8	9
8	% Small	26	29
9	Wheat Moisture (%)	9.9	10.0
10	Wheat Ash (14% mb)	1.63	1.66
11	Wheat Falling Number (sec)	400	400
12	SKCS Hardness Index (SK-HI)	66.0	80.7
13	SK-HI Standard Deviation	17.6	18.0
14	Vitreous Kernels (%)	56	92
	Flour Extraction (%)		
15	Tempered Wheat Basis (%)	66.2	62.0
16	Total Product Basis (%)	69.3	67.8
17	Flour /Bu Wheat (lbs)	41.5	39.1
	Flour Characteristics		
18	Flour Color Brightness (L*)	91.1	90.0
19	Flour Color Yellowness (b*)	7.7	9.4
20	Flour Moisture (%)	13.3	12.8
21	Flour Ash (14% mb)	0.432	0.454
22	Falling Number (Malted) (sec)	250	242
	Farinograph		
23	Water Absorption (500bu)	62.6	65.0
24	Water Absorption (14%mb)	61.6	63.6
25	Arrival Time (min)	5.1	6.6
26	Peak Time (min)	20.0	14.2
27	Dough Stability (min)	14.9	13.3
28	MTI (bu)	3.0	11.0
29	TTB (min)	20.0	20.0

#1 ND905CL (Check- Glenn)

Trait	ID	Check W-8	Line W-1
II. Cooperator Results			
Bake Absorption (Average %)	30	63.8	65.0
Loaf Volume (% of Check)	31	100	106
Mixing Requirement	32	4.3	3.9
5=Very_Long, 4=Long, 3=Medium, 2=Short, 1=Very_Short			
Dough Characteristics	33	4.0	3.9
5=Bucky_Tough, 4=Strong_Elastic, 3=Medium_Pliable, 2=Mellow_Very Pliable, 1=Weak_Short or Sticky			
Mixing Tolerance	34		3.0
5=Much_More_Tolerance, 4=More_Tolerance, 3=Equivalent, 2=Less_Tolerance, and 1=Much_Less_Tolerance when compared to Check			
Internal Crumb Color	35		3.1
5=Much_Brighter, 4=Brighter, 3=Equivalent, 2=Poorer, and 1=Much_Poorer when compared to Check			
Internal Grain and Texture	36		3.2
5=Much_Better, 4=Better, 3=Equivalent, 2=Poorer, and 1=Much_Poorer when compared to Check			
III. Cooperator Evaluation			
5=Much Better, 4=Better, 3=Equivalent, 2=Poorer, and 1=Much_Poorer when compared to Check			
Quality Trait 1-2: Protein	37		3.8
Quality Trait 3-22: Milling	38		2.4
Quality Trait 23-36: Baking	39		3.6
Quality Trait 1-36: Overall	40		3.4

#2 A (BR0061) (Check- Glenn)

Trait	ID	Check W-8	Line W-2
I. USDA/ARS WQL Data			
1	Wheat Protein (12% mb)	16.8	16.8
2	Flour Protein (12% mb)	16.7	16.6
3	Market Value 1 (Score 1-6)	4.1	3.2
4	Market Value 2 (Score 1-10)	-	7.8
5	Test Weight (lb/bu)	60.4	54.6
6	1000 Kernel Weight (g)	23.2	22.7
	Kernel Size		
7	% Large	8	22
8	% Small	26	20
9	Wheat Moisture (%)	9.9	9.5
10	Wheat Ash (14% mb)	1.63	1.78
11	Wheat Falling Number (sec)	400	400
12	SKCS Hardness Index (SK-HI)	66.0	59.3
13	SK-HI Standard Deviation	17.6	15.3
14	Vitreous Kernels (%)	56	82
	Flour Extraction (%)		
15	Tempered Wheat Basis (%)	66.2	55.2
16	Total Product Basis (%)	69.3	62.5
17	Flour /Bu Wheat (lbs)	41.5	34.9
	Flour Characteristics		
18	Flour Color Brightness (L*)	91.1	91.4
19	Flour Color Yellowness (b*)	7.7	8.6
20	Flour Moisture (%)	13.3	12.4
21	Flour Ash (14% mb)	0.432	0.529
22	Falling Number (Malted) (sec)	250	249
	Farinograph		
23	Water Absorption (500bu)	62.6	62.3
24	Water Absorption (14%mb)	61.6	60.0
25	Arrival Time (min)	5.1	4.3
26	Peak Time (min)	20.0	9.0
27	Dough Stability (min)	14.9	15.6
28	MTI (bu)	3.0	12.0
29	TTB (min)	20.0	20.0

#2 A (BR0061) (Check- Glenn)

Trait	ID	Check W-8	Line W-2
II. Cooperator Results			
Bake Absorption (Average %)	30	63.8	63.3
Loaf Volume (% of Check)	31	100	106
Mixing Requirement 5=Very_Long, 4=Long, 3=Medium, 2=Short, 1=Very_Short	32	4.3	4.5
Dough Characteristics 5=Bucky_Tough, 4=Strong_Elastic, 3=Medium_Pliable, 2=Mellow_Very Pliable, 1=Weak_Short or Sticky	33	4.0	4.1
Mixing Tolerance 5=Much_More_Tolerance, 4=More_Tolerance, 3=Equivalent, 2=Less_Tolerance, and 1=Much_Less_Tolerance when compared to Check	34		3.3
Internal Crumb Color 5=Much_Brighter, 4=Brighter, 3=Equivalent, 2=Poorer, and 1=Much_Poorer when compared to Check	35		2.9
Internal Grain and Texture 5=Much_Better, 4=Better, 3=Equivalent, 2=Poorer, and 1=Much_Poorer when compared to Check	36		3.2
III. Cooperator Evaluation 5=Much Better, 4=Better, 3=Equivalent, 2=Poorer, and 1=Much_Poorer when compared to Check			
Quality Trait 1-2: Protein	37		3.0
Quality Trait 3-22: Milling	38		1.6
Quality Trait 23-36: Baking	39		3.3
Quality Trait 1-36: Overall	40		3.1

#3 ND818 (Check- Glenn)

Trait	ID	Check B-8	Line B-3	Check C-8	Line C-3	Check K-8	Line K-3	Check W-8	Line W-3
I. USDA/ARS WQL Data									
1	Wheat Protein (12% mb)	14.4	14.9	15.3	15.0	12.8	13.6	16.8	16.0
2	Flour Protein (12% mb)	13.8	14.1	14.4	14.3	12.3	13.1	16.7	15.1
3	Market Value 1 (Score 1-6)	3.0	2.3	3.4	2.9	3.8	3.5	4.1	3.6
4	Market Value 2 (Score 1-10)	-	7.4	-	9.2	-	8.8	-	9.0
5	Test Weight (lb/bu)	61.6	55.9	61.0	59.4	63.7	61.2	60.4	59.2
6	1000 Kernel Weight (g)	23.5	20.6	22.0	19.6	30.5	28.2	23.2	23.1
	Kernel Size								
7	% Large	14	10	8	4	55	38	8	17
8	% Small	24	32	32	47	8	13	26	26
9	Wheat Moisture (%)	10.6	10.8	10.4	10.7	11.0	10.2	9.9	9.6
10	Wheat Ash (14% mb)	1.89	1.99	1.94	2.03	1.70	1.76	1.63	1.66
11	Wheat Falling Number (sec)	349	381	400	400	400	400	400	400
12	SKCS Hardness Index (SK-HI)	82.1	74.9	79.3	77.0	97.4	87.1	66.0	78.1
13	SK-HI Standard Deviation	16.1	18.7	16.7	16.5	16.5	16.3	17.6	18.4
14	Vitreous Kernels (%)	88	84	91	90	92	87	56	87
	Flour Extraction (%)								
15	Tempered Wheat Basis (%)	64.6	66.2	66.5	68.2	60.8	70.1	66.2	64.0
16	Total Product Basis (%)	70.4	69.8	70.2	72.2	64.3	75.0	69.3	68.1
17	Flour /Bu Wheat (lbs)	40.5	41.8	41.9	43.0	38.4	44.3	41.5	40.2
	Flour Characteristics								
18	Flour Color Brightness (L*)	90.3	91.0	90.0	90.0	91.4	90.8	91.1	91.0
19	Flour Color Yellowness (b*)	7.8	8.3	8.2	9.8	7.0	9.0	7.7	9.0
20	Flour Moisture (%)	13.3	12.6	12.7	12.8	12.4	12.4	13.3	12.9
21	Flour Ash (14% mb)	0.550	0.578	0.521	0.572	0.480	0.520	0.432	0.409
22	Falling Number (Malted) (sec)	251	270	245	249	250	254	250	246
	Farinograph								
23	Water Absorption (500bu)	63.0	66.0	63.1	63.9	66.1	66.1	62.6	64.2
24	Water Absorption (14%mb)	62.1	64.3	61.6	62.3	64.2	64.3	61.6	63.0
25	Arrival Time (min)	1.7	1.7	2.4	3.4	1.7	2.9	5.1	5.2
26	Peak Time (min)	3.7	6.0	6.0	9	2.7	6.3	20.0	12.4
27	Dough Stability (min)	8.6	8.6	11.3	10.7	3.6	8.4	14.9	14.7
28	MTI (bu)	26.0	30.0	26.0	31.0	56.0	30.0	3.0	5.0
29	TTB (min)	9.6	11.0	11.8	13.0	5.2	10.9	20.0	20.0

#3 ND818 (Check- Glenn)

Trait	ID	Check B-8	Line B-3	Check C-8	Line C-3	Check K-8	Line K-3	Check W-8	Line W-3
II. Cooperator Results									
Bake Absorption (Average %)	30	62.4	64.0	62.6	62.9	63.1	63.8	63.8	64.2
Loaf Volume (% of Check)	31	100	100	100	100	100	103	100	100
Mixing Requirement	32	3.9	2.8	4.1	3.8	4.1	3.4	4.3	4.1
5=Very_Long, 4=Long, 3=Medium, 2=Short, 1=Very_Short									
Dough Characteristics	33	3.6	3.0	3.9	3.8	3.8	3.7	4.0	3.8
5=Bucky_Tough, 4=Strong_Elastic, 3=Medium_Pliable, 2=Mellow_Very Pliable, 1=Weak_Short or Sticky									
Mixing Tolerance	34		2.8		2.7		3.5		3.3
5=Much_More_Tolerance, 4=More_Tolerance, 3=Equivalent, 2=Less_Tolerance, and 1=Much_Less_Tolerance when compared to Check									
Internal Crumb Color	35		2.5		2.7		2.5		2.8
5=Much_Brighter, 4=Brighter, 3=Equivalent, 2=Poorer, and 1=Much_Poorer when compared to Check									
Internal Grain and Texture	36		2.5		3.0		2.9		3.3
5=Much_Better, 4=Better, 3=Equivalent, 2=Poorer, and 1=Much_Poorer when compared to Check									
III. Cooperator Evaluation									
5=Much Better, 4=Better, 3=Equivalent, 2=Poorer, and 1=Much_Poorer when compared to Check									
Quality Trait 1-2: Protein	37		3.6		2.9		4.0		2.3
Quality Trait 3-22: Milling	38		2.1		3.0		3.6		3.0
Quality Trait 23-36: Baking	39		3.0		3.2		3.3		3.5
Quality Trait 1-36: Overall	40		3.0		3.2		3.3		3.1

#4 MT0832 (Duclair) (Check- Glenn)

Trait	ID	Check W-8	Line W-4
I. USDA/ARS WQL Data			
1	Wheat Protein (12% mb)	16.8	16.7
2	Flour Protein (12% mb)	16.7	16.6
3	Market Value 1 (Score 1-6)	4.1	3.3
4	Market Value 2 (Score 1-10)	-	8.0
5	Test Weight (lb/bu)	60.4	54.6
6	1000 Kernel Weight (g)	23.2	22.5
	Kernel Size		
7	% Large	8	6
8	% Small	26	35
9	Wheat Moisture (%)	9.9	9.8
10	Wheat Ash (14% mb)	1.63	1.67
11	Wheat Falling Number (sec)	400	400
12	SKCS Hardness Index (SK-HI)	66.0	47.8
13	SK-HI Standard Deviation	17.6	17.2
14	Vitreous Kernels (%)	56	46
	Flour Extraction (%)		
15	Tempered Wheat Basis (%)	66.2	63.3
16	Total Product Basis (%)	69.3	68.0
17	Flour /Bu Wheat (lbs)	41.5	39.8
	Flour Characteristics		
18	Flour Color Brightness (L*)	91.1	91.6
19	Flour Color Yellowness (b*)	7.7	7.3
20	Flour Moisture (%)	13.3	12.7
21	Flour Ash (14% mb)	0.432	0.432
22	Falling Number (Malted) (sec)	250	246
	Farinograph		
23	Water Absorption (500bu)	62.6	61.1
24	Water Absorption (14%mb)	61.6	59.7
25	Arrival Time (min)	5.1	4.7
26	Peak Time (min)	20.0	10.7
27	Dough Stability (min)	14.9	15.2
28	MTI (bu)	3.0	16.0
29	TTB (min)	20.0	18.6

#4 MT0832 (Duclair) (Check- Glenn)

Trait	ID	Check W-8	Line W-4
II. Cooperator Results			
30 Bake Absorption (Average %)		**63.8**	**62.8**
31 Loaf Volume (% of Check)		**100**	**106**
32 Mixing Requirement		**4.3**	**4.3**
5=Very_Long, **4**=Long, **3**=Medium, **2**=Short, **1**=Very_Short			
33 Dough Characteristics		**4.0**	**4.3**
5=Bucky_Tough, **4**=Strong_Elastic, **3**=Medium_Pliable, **2**=Mellow_Very Pliable, **1**=Weak_Short or Sticky			
34 Mixing Tolerance			**3.2**
5=Much_More_Tolerance, **4**=More_Tolerance, **3**=Equivalent, **2**=Less_Tolerance, and **1**=Much_Less_Tolerance when compared to Check			
35 Internal Crumb Color			**3.2**
5=Much_Brighter, **4**=Brighter, **3**=Equivalent, **2**=Poorer, and **1**=Much_Poorer when compared to Check			
36 Internal Grain and Texture			**3.0**
5=Much_Better, **4**=Better, **3**=Equivalent, **2**=Poorer, and **1**=Much_Poorer when compared to Check			
III. Cooperator Evaluation			
5=Much Better, **4**=Better, **3**=Equivalent, **2**=Poorer, and **1**=Much_Poorer when compared to Check			
37 Quality Trait 1-2: Protein			**3.1**
38 Quality Trait 3-22: Milling			**2.3**
39 Quality Trait 23-36: Baking			**3.4**
40 Quality Trait 1-36: Overall			**3.3**

#5 B (BR5874C) (Check- Glenn)

Trait	ID	Check W-8	Line W-5
I. USDA/ARS WQL Data			
1	Wheat Protein (12% mb)	16.8	16.6
2	Flour Protein (12% mb)	16.7	16.5
3	Market Value 1 (Score 1-6)	4.1	3.3
4	Market Value 2 (Score 1-10)	-	8.0
5	Test Weight (lb/bu)	60.4	54.5
6	1000 Kernel Weight (g)	23.2	21.9
	Kernel Size		
7	% Large	8	4
8	% Small	26	39
9	Wheat Moisture (%)	9.9	9.9
10	Wheat Ash (14% mb)	1.63	1.62
11	Wheat Falling Number (sec)	400	400
12	SKCS Hardness Index (SK-HI)	66.0	54.8
13	SK-HI Standard Deviation	17.6	16.8
14	Vitreous Kernels (%)	56	55
	Flour Extraction (%)		
15	Tempered Wheat Basis (%)	66.2	59.8
16	Total Product Basis (%)	69.3	66.7
17	Flour /Bu Wheat (lbs)	41.5	37.7
	Flour Characteristics		
18	Flour Color Brightness (L*)	91.1	91.6
19	Flour Color Yellowness (b*)	7.7	7.3
20	Flour Moisture (%)	13.3	13.0
21	Flour Ash (14% mb)	0.432	0.457
22	Falling Number (Malted) (sec)	250	247
	Farinograph		
23	Water Absorption (500bu)	62.6	60.3
24	Water Absorption (14%mb)	61.6	58.8
25	Arrival Time (min)	5.1	4.0
26	Peak Time (min)	20.0	19.7
27	Dough Stability (min)	14.9	15.9
28	MTI (bu)	3.0	2.0
29	TTB (min)	20.0	20.0

#5 B (BR5874C) (Check- Glenn)

Trait	ID	Check W-8	Line W-5
II. Cooperator Results			
Bake Absorption (Average %)	30	63.8	62.2
Loaf Volume (% of Check)	31	100	99
Mixing Requirement	32	4.3	4.6
5=Very_Long, 4=Long, 3=Medium, 2=Short, 1=Very_Short			
Dough Characteristics	33	4.0	4.3
5=Bucky_Tough, 4=Strong_Elastic, 3=Medium_Pliable, 2=Mellow_Very Pliable, 1=Weak_Short or Sticky			
Mixing Tolerance	34		3.3
5=Much_More_Tolerance, 4=More_Tolerance, 3=Equivalent, 2=Less_Tolerance, and 1=Much_Less_Tolerance when compared to Check			
Internal Crumb Color	35		3.0
5=Much_Brighter, 4=Brighter, 3=Equivalent, 2=Poorer, and 1=Much_Poorer when compared to Check			
Internal Grain and Texture	36		2.7
5=Much_Better, 4=Better, 3=Equivalent, 2=Poorer, and 1=Much_Poorer when compared to Check			
III. Cooperator Evaluation			
5=Much Better, 4=Better, 3=Equivalent, 2=Poorer, and 1=Much_Poorer when compared to Check			
Quality Trait 1-2: Protein	37		3.0
Quality Trait 3-22: Milling	38		2.0
Quality Trait 23-36: Baking	39		3.0
Quality Trait 1-36: Overall	40		2.7

#6 SD3997 (Forefront) (Check- Glenn)

Trait	ID	Check B-8	Line B-6	Check C-8	Line C-6
I. USDA/ARS WQL Data					
1	Wheat Protein (12% mb)	14.4	13.8	15.3	15.0
2	Flour Protein (12% mb)	13.8	13.2	14.4	13.8
3	Market Value 1 (Score 1-6)	3.0	2.5	3.4	2.9
4	Market Value 2 (Score 1-10)	-	8.6	-	9.2
5	Test Weight (lb/bu)	61.6	59.4	61.0	58.7
6	1000 Kernel Weight (g)	23.5	23.0	22.0	22.1
	Kernel Size				
7	% Large	14	13	8	4
8	% Small	24	33	32	36
9	Wheat Moisture (%)	10.6	10.9	10.4	10.3
10	Wheat Ash (14% mb)	1.89	1.86	1.94	1.92
11	Wheat Falling Number (sec)	349	365	400	400
12	SKCS Hardness Index (SK-HI)	82.1	69.7	79.3	66.5
13	SK-HI Standard Deviation	16.1	17.3	16.7	16.1
14	Vitreous Kernels (%)	88	57	91	46
	Flour Extraction (%)				
15	Tempered Wheat Basis (%)	64.6	68.4	66.5	67.1
16	Total Product Basis (%)	70.4	74.7	70.2	71.3
17	Flour /Bu Wheat (lbs)	40.5	43.4	41.9	42.3
	Flour Characteristics				
18	Flour Color Brightness (L*)	90.3	90.2	90.0	90.5
19	Flour Color Yellowness (b*)	7.8	8.0	8.2	8.1
20	Flour Moisture (%)	13.3	12.6	12.7	12.5
21	Flour Ash (14% mb)	0.550	0.564	0.521	0.442
22	Falling Number (Malted) (sec)	251	260	245	260
	Farinograph				
23	Water Absorption (500bu)	63.0	63.2	63.1	61.9
24	Water Absorption (14%mb)	62.1	61.1	61.6	60.2
25	Arrival Time (min)	1.7	1.6	2.4	2.3
26	Peak Time (min)	3.7	5.7	6.0	7.4
27	Dough Stability (min)	8.6	8.4	11.3	10.9
28	MTI (bu)	26.0	36.0	26.0	28.0
29	TTB (min)	9.6	10.0	11.8	12.4

#6 SD3997 (Forefront) (Check- Glenn)

Trait	ID	Check B-8	Line B-6	Check C-8	Line C-6
II. Cooperator Results					
Bake Absorption (Average %)	30	62.4	62.0	62.6	61.5
Loaf Volume (% of Check)	31	100	99	100	100
Mixing Requirement	32	3.9	3.5	4.1	4.1
5=Very_Long, 4=Long, 3=Medium, 2=Short, 1=Very_Short					
Dough Characteristics	33	3.6	3.5	3.9	4.1
5=Bucky_Tough, 4=Strong_Elastic, 3=Medium_Pliable, 2=Mellow_Very Pliable, 1=Weak_Short or Sticky					
Mixing Tolerance	34		2.6		2.9
5=Much_More_Tolerance, 4=More_Tolerance, 3=Equivalent, 2=Less_Tolerance, and 1=Much_Less_Tolerance when compared to Check					
Internal Crumb Color	35		2.9		3.5
5=Much_Brighter, 4=Brighter, 3=Equivalent, 2=Poorer, and 1=Much_Poorer when compared to Check					
Internal Grain and Texture	36		2.6		3.1
5=Much_Better, 4=Better, 3=Equivalent, 2=Poorer, and 1=Much_Poorer when compared to Check					
III. Cooperator Evaluation					
5=Much Better, 4=Better, 3=Equivalent, 2=Poorer, and 1=Much_Poorer when compared to Check					
Quality Trait 1-2: Protein	37		2.4		2.7
Quality Trait 3-22: Milling	38		3.3		3.3
Quality Trait 23-36: Baking	39		3.0		3.4
Quality Trait 1-36: Overall	40		3.1		3.3

#7 Pivot (Check- Glenn)

Trait	ID	Check C-8	Line C-7	Check K-8	Line K-7
I. USDA/ARS WQL Data					
1	Wheat Protein (12% mb)	15.3	14.5	12.8	14.3
2	Flour Protein (12% mb)	14.4	13.7	12.3	13.4
3	Market Value 1 (Score 1-6)	3.4	2.3	3.8	3.3
4	Market Value 2 (Score 1-10)	-	6.8	-	8.0
5	Test Weight (lb/bu)	61.0	55.6	63.7	59.2
6	1000 Kernel Weight (g)	22.0	19.0	30.5	27.0
	Kernel Size				
7	% Large	8	3	55	32
8	% Small	32	38	8	15
9	Wheat Moisture (%)	10.4	10.0	11.0	9.5
10	Wheat Ash (14% mb)	1.94	2.07	1.70	1.64
11	Wheat Falling Number (sec)	400	400	400	400
12	SKCS Hardness Index (SK-HI)	79.3	66.4	97.4	76.0
13	SK-HI Standard Deviation	16.7	16.5	16.5	17.9
14	Vitreous Kernels (%)	91	32	92	45
	Flour Extraction (%)				
15	Tempered Wheat Basis (%)	66.5	66.6	60.8	67.3
16	Total Product Basis (%)	70.2	70.4	64.3	71.7
17	Flour /Bu Wheat (lbs)	41.9	42.1	38.4	42.6
	Flour Characteristics				
18	Flour Color Brightness (L*)	90.0	90.8	91.4	90.9
19	Flour Color Yellowness (b*)	8.2	10.1	7.0	10.1
20	Flour Moisture (%)	12.7	12.4	12.4	12.3
21	Flour Ash (14% mb)	0.521	0.579	0.480	0.497
22	Falling Number (Malted) (sec)	245	257	250	260
	Farinograph				
23	Water Absorption (500bu)	63.1	61.6	66.1	62.5
24	Water Absorption (14%mb)	61.6	60.0	64.2	60.7
25	Arrival Time (min)	2.4	2.0	1.7	2.8
26	Peak Time (min)	6.0	4.7	2.7	5.8
27	Dough Stability (min)	11.3	8.1	3.6	6.9
28	MTI (bu)	26.0	31.0	56.0	41.0
29	TTB (min)	11.8	9.6	5.2	9.8

#7 Pivot (Check- Glenn)

Trait	ID	Check C-8	Line C-7	Check K-8	Line K-7
II. Cooperator Results					
Bake Absorption (Average %)	30	62.6	61.3	63.1	61.8
Loaf Volume (% of Check)	31	100	98	100	106
Mixing Requirement	32	4.1	3.8	4.1	3.3
5=Very_Long, 4=Long, 3=Medium, 2=Short, 1=Very_Short					
Dough Characteristics	33	3.9	3.8	3.8	3.7
5=Bucky_Tough, 4=Strong_Elastic, 3=Medium_Pliable, 2=Mellow_Very Pliable, 1=Weak_Short or Sticky					
Mixing Tolerance	34		2.3		3.3
5=Much_More_Tolerance, 4=More_Tolerance, 3=Equivalent, 2=Less_Tolerance, and 1=Much_Less_Tolerance when compared to Check					
Internal Crumb Color	35		2.5		2.4
5=Much_Brighter, 4=Brighter, 3=Equivalent, 2=Poorer, and 1=Much_Poorer when compared to Check					
Internal Grain and Texture	36		2.5		2.9
5=Much_Better, 4=Better, 3=Equivalent, 2=Poorer, and 1=Much_Poorer when compared to Check					
III. Cooperator Evaluation					
5=Much Better, 4=Better, 3=Equivalent, 2=Poorer, and 1=Much_Poorer when compared to Check					
Quality Trait 1-2: Protein	37		2.2		4.6
Quality Trait 3-22: Milling	38		2.1		3.3
Quality Trait 23-36: Baking	39		2.3		3.1
Quality Trait 1-36: Overall	40		2.2		2.8

9 10 Fx Inc 1 (LCS Powerplay) (Check- Glenn)

Trait	ID	Check B-8	Line B-9	Check C-8	Line C-9	Check K-8	Line K-9
I. USDA/ARS WQL Data							
1	Wheat Protein (12% mb)	14.4	13.2	15.3	13.8	12.8	10.9
2	Flour Protein (12% mb)	13.8	12.1	14.4	13.0	12.3	10.0
3	Market Value 1 (Score 1-6)	3.0	2.5	3.4	2.9	3.8	3.3
4	Market Value 2 (Score 1-10)	-	8.4	-	8.2	-	7.8
5	Test Weight (lb/bu)	61.6	59.8	61.0	60.3	63.7	62.5
6	1000 Kernel Weight (g)	23.5	22.4	22.0	22.1	30.5	31.6
	Kernel Size						
7	% Large	14	15	8	9	55	68
8	% Small	24	28	32	26	8	7
9	Wheat Moisture (%)	10.6	10.6	10.4	10.0	11.0	10.2
10	Wheat Ash (14% mb)	1.89	1.90	1.94	1.92	1.70	1.64
11	Wheat Falling Number (sec)	349	388	400	400	400	400
12	SKCS Hardness Index (SK-HI)	82.1	75.5	79.3	79.4	97.4	70.9
13	SK-HI Standard Deviation	16.1	19.2	16.7	18.7	16.5	19.0
14	Vitreous Kernels (%)	88	48	91	49	92	10
	Flour Extraction (%)						
15	Tempered Wheat Basis (%)	64.6	65.9	66.5	66.5	60.8	71.2
16	Total Product Basis (%)	70.4	69.7	70.2	70.5	64.3	77.0
17	Flour /Bu Wheat (lbs)	40.5	41.6	41.9	41.9	38.4	44.7
	Flour Characteristics						
18	Flour Color Brightness (L*)	90.3	91.1	90.0	91.2	91.4	90.7
19	Flour Color Yellowness (b*)	7.8	7.6	8.2	7.6	7.0	8.2
20	Flour Moisture (%)	13.3	12.8	12.7	12.8	12.4	12.8
21	Flour Ash (14% mb)	0.550	0.525	0.521	0.536	0.480	0.531
22	Falling Number (Malted) (sec)	251	258	245	253	250	250
	Farinograph						
23	Water Absorption (500bu)	63.0	63.6	63.1	64.0	66.1	62.6
24	Water Absorption (14%mb)	62.1	62.0	61.6	62.4	64.2	61.2
25	Arrival Time (min)	1.7	1.6	2.4	2.4	1.7	1.3
26	Peak Time (min)	3.7	3.3	6.0	5.2	2.7	2.0
27	Dough Stability (min)	8.6	6.8	11.3	9.4	3.6	2.1
28	MTI (bu)	26.0	33.0	26.0	19.0	56.0	56.0
29	TTB (min)	9.6	8.1	11.8	11.4	5.2	3.6

9 10 Fx Inc 1 (LCS Powerplay) (Check- Glenn)

Trait	ID	Check B-8	Line B-9	Check C-8	Line C-9	Check K-8	Line K-9
II. Cooperator Results							
Bake Absorption (Average %)	30	62.4	62.1	62.6	62.5	63.1	60.2
Loaf Volume (% of Check)	31	100	97	100	96	100	92
Mixing Requirement	32	3.9	3.6	4.1	3.8	4.1	3.2
5=Very_Long, 4=Long, 3=Medium, 2=Short, 1=Very_Short							
Dough Characteristics	33	3.6	3.5	3.9	3.9	3.8	2.8
5=Bucky_Tough, 4=Strong_Elastic, 3=Medium_Pliable, 2=Mellow_Very Pliable, 1=Weak_Short or Sticky							
Mixing Tolerance	34		2.7		2.4		2.6
5=Much_More_Tolerance, 4=More_Tolerance, 3=Equivalent, 2=Less_Tolerance, and 1=Much_Less_Tolerance when compared to Check							
Internal Crumb Color	35		3.1		3.3		2.9
5=Much_Brighter, 4=Brighter, 3=Equivalent, 2=Poorer, and 1=Much_Poorer when compared to Check							
Internal Grain and Texture	36		3.1		3.1		3.2
5=Much_Better, 4=Better, 3=Equivalent, 2=Poorer, and 1=Much_Poorer when compared to Check							
III. Cooperator Evaluation							
5=Much Better, 4=Better, 3=Equivalent, 2=Poorer, and 1=Much_Poorer when compared to Check							
Quality Trait 1-2: Protein	37		1.6		1.4		1.3
Quality Trait 3-22: Milling	38		2.6		2.8		3.7
Quality Trait 23-36: Baking	39		3.0		2.9		2.6
Quality Trait 1-36: Overall	40		2.8		2.6		2.3

10 ND SW 703 (Check-Glenn)

	Trait	ID	Check C-8	Line C-10	Check W-8	Line W-10
I. USDA/ARS WQL Data						
1	Wheat Protein (12% mb)		15.3	13.3	16.8	16.8
2	Flour Protein (12% mb)		14.4	12.4	16.7	15.6
3	Market Value 1 (Score 1-6)		3.4	2.2	4.1	3.3
4	Market Value 2 (Score 1-10)		-	6.2	-	7.8
5	Test Weight (lb/bu)		61.0	53.0	60.4	51.4
6	1000 Kernel Weight (g)		22.0	24.5	23.2	25.8
	Kernel Size					
7	% Large		8	6	8	11
8	% Small		32	25	26	28
9	Wheat Moisture (%)		10.4	9.8	9.9	9.6
10	Wheat Ash (14% mb)		1.94	1.89	1.63	1.82
11	Wheat Falling Number (sec)		400	400	400	400
12	SKCS Hardness Index (SK-HI)		79.3	51.3	66.0	51.2
13	SK-HI Standard Deviation		16.7	17.0	17.6	16.9
14	Vitreous Kernels (%)		91	9	56	6
	Flour Extraction (%)					
15	Tempered Wheat Basis (%)		66.5	66.4	66.2	61.2
16	Total Product Basis (%)		70.2	71.9	69.3	65.0
17	Flour /Bu Wheat (lbs)		41.9	42.1	41.5	38.7
	Flour Characteristics					
18	Flour Color Brightness (L*)		90.0	91.6	91.1	91.3
19	Flour Color Yellowness (b*)		8.2	7.9	7.7	8.0
20	Flour Moisture (%)		12.7	12.3	13.3	12.4
21	Flour Ash (14% mb)		0.521	0.567	0.432	0.454
22	Falling Number (Malted) (sec)		245	249	250	246
	Farinograph					
23	Water Absorption (500bu)		63.1	62.2	62.6	64.3
24	Water Absorption (14%mb)		61.6	59.9	61.6	62.5
25	Arrival Time (min)		2.4	2.3	5.1	4.8
26	Peak Time (min)		6.0	5.0	20.0	8.0
27	Dough Stability (min)		11.3	6.1	14.9	13.2
28	MTI (bu)		26.0	46.0	3.0	22.0
29	TTB (min)		11.8	8.4	20.0	15.4

10 ND SW 703 (Check-Glenn)

Trait	ID	Check C-8	Line C-10	Check W-8	Line W-10
II. Cooperator Results					
Bake Absorption (Average %)	30	62.6	60.9	63.8	64.2
Loaf Volume (% of Check)	31	100	91	100	94
Mixing Requirement	32	4.1	3.3	4.3	3.8
5=Very_Long, 4=Long, 3=Medium, 2=Short, 1=Very_Short					
Dough Characteristics	33	3.9	3.5	4.0	4.2
5=Bucky_Tough, 4=Strong_Elastic, 3=Medium_Pliable, 2=Mellow_Very Pliable, 1=Weak_Short or Sticky					
Mixing Tolerance	34		2.0		2.7
5=Much_More_Tolerance, 4=More_Tolerance, 3=Equivalent, 2=Less_Tolerance, and 1=Much_Less_Tolerance when compared to Check					
Internal Crumb Color	35		2.9		2.5
5=Much_Brighter, 4=Brighter, 3=Equivalent, 2=Poorer, and 1=Much_Poorer when compared to Check					
Internal Grain and Texture	36		2.8		2.7
5=Much_Better, 4=Better, 3=Equivalent, 2=Poorer, and 1=Much_Poorer when compared to Check					
III. Cooperator Evaluation					
5=Much Better, 4=Better, 3=Equivalent, 2=Poorer, and 1=Much_Poorer when compared to Check					
Quality Trait 1-2: Protein	37		1.1		2.8
Quality Trait 3-22: Milling	38		2.5		1.9
Quality Trait 23-36: Baking	39		2.3		2.7
Quality Trait 1-36: Overall	40		2.0		2.4

#11 MN06028 (Check- Glenn)

Trait	ID	Check C-8	Line C-11	Check K-8	Line K-11
I. USDA/ARS WQL Data					
1	Wheat Protein (12% mb)	15.3	14.0	12.8	13.0
2	Flour Protein (12% mb)	14.4	13.2	12.3	12.2
3	Market Value 1 (Score 1-6)	3.4	2.8	3.8	3.9
4	Market Value 2 (Score 1-10)	-	8.0	-	9.2
5	Test Weight (lb/bu)	61.0	58.3	63.7	62.0
6	1000 Kernel Weight (g)	22.0	25.5	30.5	34.7
	Kernel Size				
7	% Large	8	16	55	63
8	% Small	32	19	8	6
9	Wheat Moisture (%)	10.4	10.0	11.0	10.3
10	Wheat Ash (14% mb)	1.94	1.85	1.70	1.72
11	Wheat Falling Number (sec)	400	400	400	400
12	SKCS Hardness Index (SK-HI)	79.3	81.2	97.4	87.7
13	SK-HI Standard Deviation	16.7	15.9	16.5	16.8
14	Vitreous Kernels (%)	91	54	92	47
	Flour Extraction (%)				
15	Tempered Wheat Basis (%)	66.5	67.5	60.8	67.1
16	Total Product Basis (%)	70.2	71.6	64.3	71.0
17	Flour /Bu Wheat (lbs)	41.9	42.9	38.4	42.4
	Flour Characteristics				
18	Flour Color Brightness (L*)	90.0	91.2	91.4	91.8
19	Flour Color Yellowness (b*)	8.2	7.2	7.0	6.5
20	Flour Moisture (%)	12.7	12.5	12.4	12.5
21	Flour Ash (14% mb)	0.521	0.482	0.480	0.496
22	Falling Number (Malted) (sec)	245	247	250	245
	Farinograph				
23	Water Absorption (500bu)	63.1	61.7	66.1	61.7
24	Water Absorption (14%mb)	61.6	59.8	64.2	59.9
25	Arrival Time (min)	2.4	2.2	1.7	2.3
26	Peak Time (min)	6.0	6.2	2.7	4.2
27	Dough Stability (min)	11.3	11.0	3.6	9.6
28	MTI (bu)	26.0	28.0	56.0	19.0
29	TTB (min)	11.8	11.0	5.2	10.7

11 MN06028 (Check- Glenn)

Trait	ID	Check C-8	Line C-11	Check K-8	Line K-11
II. Cooperator Results					
Bake Absorption (Average %)	30	62.6	61.4	63.1	61.4
Loaf Volume (% of Check)	31	100	96	100	98
Mixing Requirement	32	4.1	4.1	4.1	4.3
5=Very_Long, 4=Long, 3=Medium, 2=Short, 1=Very_Short					
Dough Characteristics	33	3.9	3.7	3.8	3.9
5=Bucky_Tough, 4=Strong_Elastic, 3=Medium_Pliable, 2=Mellow_Very Pliable, 1=Weak_Short or Sticky					
Mixing Tolerance	34		2.9		3.8
5=Much_More_Tolerance, 4=More_Tolerance, 3=Equivalent, 2=Less_Tolerance, and 1=Much_Less_Tolerance when compared to Check					
Internal Crumb Color	35		3.1		3.5
5=Much_Brighter, 4=Brighter, 3=Equivalent, 2=Poorer, and 1=Much_Poorer when compared to Check					
Internal Grain and Texture	36		2.7		3.5
5=Much_Better, 4=Better, 3=Equivalent, 2=Poorer, and 1=Much_Poorer when compared to Check					
III. Cooperator Evaluation					
5=Much Better, 4=Better, 3=Equivalent, 2=Poorer, and 1=Much_Poorer when compared to Check					
Quality Trait 1-2: Protein	37		2.0		3.0
Quality Trait 3-22: Milling	38		3.2		3.5
Quality Trait 23-36: Baking	39		2.8		3.2
Quality Trait 1-36: Overall	40		2.6		2.9

12 Sy Soren (Check- Glenn)

Trait	ID	Check B-8	Line B-12	Check C-8	Line C-12	Check K-8	Line K-12
I. USDA/ARS WQL Data							
1	Wheat Protein (12% mb)	14.4	13.8	15.3	14.6	12.8	13.3
2	Flour Protein (12% mb)	13.8	12.9	14.4	13.8	12.3	12.3
3	Market Value 1 (Score 1-6)	3.0	2.5	3.4	2.8	3.8	3.6
4	Market Value 2 (Score 1-10)	-	7.8	-	8.6	-	8.8
5	Test Weight (lb/bu)	61.6	58.3	61.0	58.8	63.7	61.6
6	1000 Kernel Weight (g)	23.5	21.4	22.0	20.7	30.5	27.9
	Kernel Size						
7	% Large	14	9	8	5	55	45
8	% Small	24	31	32	33	8	11
9	Wheat Moisture (%)	10.6	10.5	10.4	9.9	11.0	10.1
10	Wheat Ash (14% mb)	1.89	1.89	1.94	1.88	1.70	1.62
11	Wheat Falling Number (sec)	349	400	400	400	400	400
12	SKCS Hardness Index (SK-HI)	82.1	76.0	79.3	79.2	97.4	84.8
13	SK-HI Standard Deviation	16.1	17.6	16.7	17.4	16.5	16.8
14	Vitreous Kernels (%)	88	55	91	54	92	52
	Flour Extraction (%)						
15	Tempered Wheat Basis (%)	64.6	60.3	66.5	66.2	60.8	63.9
16	Total Product Basis (%)	70.4	64.0	70.2	70.2	64.3	67.7
17	Flour /Bu Wheat (lbs)	40.5	38.4	41.9	41.7	38.4	40.4
	Flour Characteristics						
18	Flour Color Brightness (L*)	90.3	91.2	90.0	90.7	91.4	91.2
19	Flour Color Yellowness (b*)	7.8	9.3	8.2	10.2	7.0	9.4
20	Flour Moisture (%)	13.3	12.1	12.7	12.6	12.4	12.4
21	Flour Ash (14% mb)	0.550	0.569	0.521	0.518	0.480	0.511
22	Falling Number (Malted) (sec)	251	251	245	255	250	260
	Farinograph						
23	Water Absorption (500bu)	63.0	63.8	63.1	62.7	66.1	64.4
24	Water Absorption (14%mb)	62.1	61.5	61.6	61.1	64.2	62.3
25	Arrival Time (min)	1.7	2.1	2.4	3.6	1.7	1.8
26	Peak Time (min)	3.7	5.4	6.0	6.7	2.7	4.7
27	Dough Stability (min)	8.6	8.1	11.3	8.7	3.6	8.0
28	MTI (bu)	26.0	32.0	26.0	33.0	56.0	35.0
29	TTB (min)	9.6	10.3	11.8	11.5	5.2	9.5

12 Sy Soren (Check- Glenn)

Trait	ID	Check B-8	Line B-12	Check C-8	Line C-12	Check K-8	Line K-12
II. Cooperator Results							
Bake Absorption (Average %)	30	62.4	62.0	62.6	62.1	63.1	62.5
Loaf Volume (% of Check)	31	100	101	100	101	100	104
Mixing Requirement	32	3.9	3.9	4.1	3.4	4.1	3.8
5=Very_Long, 4=Long, 3=Medium, 2=Short, 1=Very_Short							
Dough Characteristics	33	3.6	3.6	3.9	3.5	3.8	3.9
5=Bucky_Tough, 4=Strong_Elastic, 3=Medium_Pliable, 2=Mellow_Very Pliable, 1=Weak_Short or Sticky							
Mixing Tolerance	34		2.9		2.5		3.6
5=Much_More_Tolerance, 4=More_Tolerance, 3=Equivalent, 2=Less_Tolerance, and 1=Much_Less_Tolerance when compared to Check							
Internal Crumb Color	35		2.5		2.8		2.9
5=Much_Brighter, 4=Brighter, 3=Equivalent, 2=Poorer, and 1=Much_Poorer when compared to Check							
Internal Grain and Texture	36		2.7		3.0		3.2
5=Much_Better, 4=Better, 3=Equivalent, 2=Poorer, and 1=Much_Poorer when compared to Check							
III. Cooperator Evaluation							
5=Much Better, 4=Better, 3=Equivalent, 2=Poorer, and 1=Much_Poorer when compared to Check							
Quality Trait 1-2: Protein	37		2.2		2.5		3.5
Quality Trait 3-22: Milling	38		1.9		2.5		3.1
Quality Trait 23-36: Baking	39		3.1		2.9		3.4
Quality Trait 1-36: Overall	40		2.8		2.8		3.1

13 SD4023 (Advance) (Check- Glenn)

Trait	ID	Check B-8	Line B-13	Check C-8	Line C-13
I. USDA/ARS WQL Data					
1	Wheat Protein (12% mb)	14.4	13.1	15.3	13.5
2	Flour Protein (12% mb)	13.8	12.1	14.4	12.4
3	Market Value 1 (Score 1-6)	3.0	2.5	3.4	2.7
4	Market Value 2 (Score 1-10)	-	8.0	-	7.8
5	Test Weight (lb/bu)	61.6	58.9	61.0	59.8
6	1000 Kernel Weight (g)	23.5	22.9	22.0	21.8
	Kernel Size				
7	% Large	14	13	8	6
8	% Small	24	26	32	32
9	Wheat Moisture (%)	10.6	10.8	10.4	9.9
10	Wheat Ash (14% mb)	1.89	1.86	1.94	1.94
11	Wheat Falling Number (sec)	349	400	400	400
12	SKCS Hardness Index (SK-HI)	82.1	71.2	79.3	64.3
13	SK-HI Standard Deviation	16.1	17.6	16.7	18.5
14	Vitreous Kernels (%)	88	52	91	58
	Flour Extraction (%)				
15	Tempered Wheat Basis (%)	64.6	66.2	66.5	66.7
16	Total Product Basis (%)	70.4	70.8	70.2	70.4
17	Flour /Bu Wheat (lbs)	40.5	41.8	41.9	42.1
	Flour Characteristics				
18	Flour Color Brightness (L*)	90.3	91.3	90.0	91.0
19	Flour Color Yellowness (b*)	7.8	8.7	8.2	9.6
20	Flour Moisture (%)	13.3	12.6	12.7	12.1
21	Flour Ash (14% mb)	0.550	0.556	0.521	0.503
22	Falling Number (Malted) (sec)	251	258	245	248
	Farinograph				
23	Water Absorption (500bu)	63.0	60.5	63.1	60.1
24	Water Absorption (14%mb)	62.1	58.9	61.6	58.3
25	Arrival Time (min)	1.7	1.8	2.4	2.2
26	Peak Time (min)	3.7	3.0	6.0	6.5
27	Dough Stability (min)	8.6	8.1	11.3	8.3
28	MTI (bu)	26.0	23.0	26.0	45.0
29	TTB (min)	9.6	9.2	11.8	10.0

13 SD4023 (Advance) (Check- Glenn)

Trait	ID	Check B-8	Line B-13	Check C-8	Line C-13
II. Cooperator Results					
30 Bake Absorption (Average %)		**62.4**	**60.3**	**62.6**	**59.7**
31 Loaf Volume (% of Check)		**100**	**100**	**100**	**96**
32 Mixing Requirement		**3.9**	**3.8**	**4.1**	**3.9**
5=Very_Long, **4**=Long, **3**=Medium, **2**=Short, **1**=Very_Short					
33 Dough Characteristics		**3.6**	**3.2**	**3.9**	**3.4**
5=Bucky_Tough, **4**=Strong_Elastic, **3**=Medium_Pliable, **2**=Mellow_Very Pliable, **1**=Weak_Short or Sticky					
34 Mixing Tolerance			**2.7**		**2.1**
5=Much_More_Tolerance, **4**=More_Tolerance, **3**=Equivalent, **2**=Less_Tolerance, and **1**=Much_Less_Tolerance when compared to Check					
35 Internal Crumb Color			**2.8**		**2.9**
5=Much_Brighter, **4**=Brighter, **3**=Equivalent, **2**=Poorer, and **1**=Much_Poorer when compared to Check					
36 Internal Grain and Texture			**3.3**		**3.1**
5=Much_Better, **4**=Better, **3**=Equivalent, **2**=Poorer, and **1**=Much_Poorer when compared to Check					
III. Cooperator Evaluation					
5=Much Better, **4**=Better, **3**=Equivalent, **2**=Poorer, and **1**=Much_Poorer when compared to Check					
37 Quality Trait 1-2: Protein			**1.7**		**1.2**
38 Quality Trait 3-22: Milling			**3.0**		**2.6**
39 Quality Trait 23-36: Baking			**3.0**		**2.7**
40 Quality Trait 1-36: Overall			**2.7**		**2.4**

14 WB-Mayville (Check- Glenn)

Trait	ID	Check C-8	Line C-14	Check K-8	Line K-14
I. USDA/ARS WQL Data					
1	Wheat Protein (12% mb)	15.3	14.0	12.8	12.6
2	Flour Protein (12% mb)	14.4	13.4	12.3	11.9
3	Market Value 1 (Score 1-6)	3.4	3.0	3.8	3.7
4	Market Value 2 (Score 1-10)	-	8.4	-	9.6
5	Test Weight (lb/bu)	61.0	59.8	63.7	62.0
6	1000 Kernel Weight (g)	22.0	23.1	30.5	33.1
	Kernel Size				
7	% Large	8	28	55	73
8	% Small	32	18	8	7
9	Wheat Moisture (%)	10.4	10.0	11.0	10.1
10	Wheat Ash (14% mb)	1.94	1.82	1.70	1.67
11	Wheat Falling Number (sec)	400	400	400	400
12	SKCS Hardness Index (SK-HI)	79.3	73.9	97.4	76.9
13	SK-HI Standard Deviation	16.7	16.1	16.5	15.5
14	Vitreous Kernels (%)	91	55	92	45
	Flour Extraction (%)				
15	Tempered Wheat Basis (%)	66.5	67.2	60.8	66.5
16	Total Product Basis (%)	70.2	71.2	64.3	70.4
17	Flour /Bu Wheat (lbs)	41.9	42.5	38.4	42.0
	Flour Characteristics				
18	Flour Color Brightness (L*)	90.0	90.4	91.4	91.3
19	Flour Color Yellowness (b*)	8.2	8.6	7.0	7.8
20	Flour Moisture (%)	12.7	12.6	12.4	12.0
21	Flour Ash (14% mb)	0.521	0.458	0.480	0.511
22	Falling Number (Malted) (sec)	245	254	250	265
	Farinograph				
23	Water Absorption (500bu)	63.1	62.0	66.1	62.4
24	Water Absorption (14%mb)	61.6	60.3	64.2	60.2
25	Arrival Time (min)	2.4	2.2	1.7	1.9
26	Peak Time (min)	6.0	4.5	2.7	3.4
27	Dough Stability (min)	11.3	8.0	3.6	7.1
28	MTI (bu)	26.0	27.0	56.0	23.0
29	TTB (min)	11.8	9.8	5.2	8.6

14 WB-Mayville (Check- Glenn)

Trait	ID	Check C-8	Line C-14	Check K-8	Line K-14
II. Cooperator Results					
Bake Absorption (Average %)	30	62.6	61.2	63.1	61.1
Loaf Volume (% of Check)	31	100	93	100	97
Mixing Requirement	32	4.1	3.6	4.1	3.8
5=Very_Long, 4=Long, 3=Medium, 2=Short, 1=Very_Short					
Dough Characteristics	33	3.9	3.4	3.8	3.8
5=Bucky_Tough, 4=Strong_Elastic, 3=Medium_Pliable, 2=Mellow_Very Pliable, 1=Weak_Short or Sticky					
Mixing Tolerance	34		2.0		3.7
5=Much_More_Tolerance, 4=More_Tolerance, 3=Equivalent, 2=Less_Tolerance, and 1=Much_Less_Tolerance when compared to Check					
Internal Crumb Color	35		3.1		3.3
5=Much_Brighter, 4=Brighter, 3=Equivalent, 2=Poorer, and 1=Much_Poorer when compared to Check					
Internal Grain and Texture	36		3.2		3.0
5=Much_Better, 4=Better, 3=Equivalent, 2=Poorer, and 1=Much_Poorer when compared to Check					
III. Cooperator Evaluation					
5=Much Better, 4=Better, 3=Equivalent, 2=Poorer, and 1=Much_Poorer when compared to Check					
Quality Trait 1-2: Protein	37		1.9		2.5
Quality Trait 3-22: Milling	38		3.4		3.6
Quality Trait 23-36: Baking	39		2.4		3.0
Quality Trait 1-36: Overall	40		2.5		2.7

Individual Cooperator Bake Data

Glenn Checks (2011 Crop Years)

Watertown (B8)

Cooperator	2011 Hard Spring Wheat Crop			
	Bake Absorption (%)	Loaf Volume (cc)	Mixing Requirement	Dough Characteristics
A	60.0	2900	**5**	**4**
B	58.0	3000	3	3
C	64.0	1055	4	4
D	62.0	3104	5	5
E	60.5	2600	5	3
F	64.1	2425	3	3
G	61.0	2600	3	3
H	58.5	1070	3	3
I	62.0	905	3	4
J	67.0	1000	4	4
K	67.8	985	4	4
L	63.5	919	5	3
Mean	62.4		3.9	3.6
Std Dev	3.1		0.9	0.7

Casselton (C8)

Cooperator	2011 Hard Spring Wheat Crop			
	Bake Absorption (%)	Loaf Volume (cc)	Mixing Requirement	Dough Characteristics
A	60.0	3050	5	5
B	57.5	3100	3	3
C	64.0	1085	5	4
D	61.0	3162	5	5
E	61.0	2625	5	5
F	63.6	2325	3	3
G	60.0	2750	3	3
H	57.9	1075	4	5
I	62.1	875	3	4
J	69.5	1000	5	2
K	69.7	1080	5	4
L	64.4	1078	3	4
Mean	62.6		4.1	3.9
Std Dev	3.9		1.0	1.0

Glenn Checks (2011 Crop Years)

Crookston (K8)

Cooperator	2011 Hard Spring Wheat Crop			
	Bake Absorption (%)	Loaf Volume (cc)	Mixing Requirement	Dough Characteristics
A	58.0	2900	5	5
B	60.0	2950	3	3
C	61.0	975	3	3
D	64.0	3104	5	5
E	62.0	2600	5	4
F	66.2	2125	2	1
G	64.0	2850	3	3
H	61.7	1025	5	4
I	65.6	855	3	4
J	66.9	815	5	4
K	65.8	878	5	5
L	61.6	932	5	4
Mean	63.1		4.1	3.8
Std Dev	2.8		1.2	1.1

Williston (W8)

Cooperator	2011 Hard Spring Wheat Crop			
	Bake Absorption (%)	Loaf Volume (cc)	Mixing Requirement	Dough Characteristics
A	63.0	2700	5	5
B	57.5	2850	3	3
C	64.0	1133	5	5
D	61.0	2986	5	5
E	65.5	2300	5	5
F	63.6	2025	3	1
G	61.0	2900	3	3
H	56.6	1205	5	5
I	61.4	935	2	4
J	69.8	1250	5	4
K	73.3	1118	5	5
L	68.5	1214	5	3
Mean	63.8		4.3	4.0
Std Dev	4.9		1.1	1.3

ND905CL

Williston (W1)

Coope-rator	Bake Abs. (%)	Loaf Volume (cc)	Loaf Volume (% of CK)	Mixing Req.	Dough Char.	Quality Characteristics Compared to Glenn Check: Mix Tol.	Crumb Color	Grain & Texture	Protein	Milling	Baking	Overall
A	63.0	2900	107.4	5	5	3	3	3	5	2	3	3
B	59.5	3050	107.0	4	2	4	5	4	5	2	4	4
C	64.0	1150	101.5	5	5	3	3	2	4	2	3	3
D	63.0	3104	104.0	5	5	4	3	4	4	3	4	4
E	67.0	2700	117.4	5	5	3	4	3	-	-	4	4
F	65.6	2450	121.0	3	3	3	2	2	4	4	4	4
G	63.0	3000	103.4	2	2	2	4	4	5	2	4	3
H	58.8	1340	111.2	3	5	2	2	2	4	2	3	3
I	63.0	945	101.1	1	4	3	3	2	3	3	3	3
J	71.9	1160	92.8	5	3	3	3	4	4	2	4	4
K	73.2	1173	104.9	5	4.5	3	2	5	3	2	4	3
L	68.5	1192	98.2	4	3	2	3	3	4	2	3	3
Mean	65.0	-	105.8	3.9	3.9	2.9	3.1	3.2	4.1	2.4	3.6	3.4
Std Dev	4.4	-	7.8	1.4	1.2	0.7	0.9	1.0	0.7	0.7	0.5	0.5

Line A (BR0061)

Williston (W2)

Coope-rator	Bake Abs. (%)	Loaf Volume		Mixing Req.	Dough Char.	Quality Characteristics Compared to Glenn Check						
		(cc)	(% of CK)			Mix Tol.	Crumb Color	Grain & Texture	Protein	Milling	Baking	Overall
A	63.0	2950	109.3	5	5	3	3	3	3	1	3	3
B	56.0	2800	98.2	3	3	3	2	2	5	1	2	2
C	64.0	1150	101.5	5	5	3	3	4	3	1	3	2
D	60.0	3162	105.9	5	5	4	3	3	3	2	3	3
E	64.0	2600	113.0	5	5	3	3	5	-	-	4	4
F	62.0	2625	129.6	4	1	1	3	3	4	4	5	5
G	61.0	2900	100.0	4	4	4	4	3	3	2	3	3
H	56.3	1235	102.5	5	5	4	2	2	3	1	2	2
I	60.7	970	103.7	3	4	3	3	2	3	2	3	3
J	72.2	1250	100.0	5	4	3	3	5	3	2	4	4
K	72.3	1238	110.7	5	5	5	2.5	3	3	1	5	4
L	68.3	1199	98.8	5	3	2	3	3	3	1	3	2
Mean	63.3	-	106.1	4.5	4.1	3.2	2.9	3.2	3.3	1.6	3.3	3.1
Std Dev	5.3	-	8.9	0.8	1.2	1.0	0.5	1.0	0.6	0.9	1.0	1.0

ND818

Watertown (B3)

Coope-rator	Bake Abs. (%)	Loaf Volume		Mixing Req.	Dough Char.	Quality Characteristics Compared to Glenn Check						
		(cc)	(% of CK)			Mix Tol.	Crumb Color	Grain & Texture	Protein	Milling	Baking	Overall
A	60.0	2800	96.6	3	3	2	3	3	4	2	2	2
B	60.5	3200	106.7	3	2	4	3	2	4	1	4	4
C	64.0	1038	98.4	3	3	2	3	2	4	1	2	2
D	64.0	3015	97.1	4	4	2	2	4	4	2	3	3
E	61.5	2600	100.0	4	3	3	2	1	-	-	2	2
F	66.3	2725	112.4	3	2	3	3	2	3	3	5	5
G	64.0	2450	94.2	2	2	2	3	3	3	3	4	4
H	60.7	1110	103.7	2	2	3	2	2	4	3	2	2
I	64.0	850	93.9	2	3	3	2	2	3	2	3	3
J	69.2	970	97.0	3	4	2	2	3	4	2	3	3
K	69.1	1028	104.4	2	4	4	3.5	3	3	3	3	3
L	64.5	858	93.4	3	4	3	2	3	4	1	3	3
Mean	64.0	-	99.8	2.8	3.0	2.8	2.5	2.5	3.6	2.1	3.0	3.0
Std Dev	3.1	-	5.8	0.7	0.9	0.8	0.6	0.8	0.5	0.8	1.0	1.0

Casselton (C3)

Coope-rator	Bake Abs. (%)	Loaf Volume		Mixing Req.	Dough Char.	Quality Characteristics Compared to Glenn Check						
		(cc)	(% of CK)			Mix Tol.	Crumb Color	Grain & Texture	Protein	Milling	Baking	Overall
A	60.0	2900	95.1	5	5	3	3	4	3	5	3	3
B	58.5	3150	101.6	4	4	4	4	3	4	3	4	4
C	64.0	1092	100.6	5	4	3	3	2	3	2	3	3
D	62.0	3162	100.0	5	5	3	2	2	2	2	2	2
E	62.5	2600	99.0	5	4	2	2	4	-	-	2	2
F	64.3	2525	108.6	2	3	2	2	3	3	3	4	4
G	60.0	2750	100.0	3	3	3	3	3	3	2	3	3
H	58.8	1140	106.0	3	4	2	2	3	3	4	4	4
I	61.9	825	94.3	2	4	3	2	2	3	3	3	3
J	69.3	990	99.0	4	2	2	3	4	3	4	4	4
K	69.2	1060	98.1	4	4	3	3.5	3	3	3	3	3
L	64.4	998	92.6	3	3	2	3	3	3	3	3	3
Mean	62.9	-	99.6	3.8	3.8	2.7	2.7	3.0	3.0	3.1	3.2	3.2
Std Dev	3.6	-	4.6	1.1	0.9	0.7	0.7	0.7	0.4	0.9	0.7	0.7

ND818

Crookston (K3)

Coope-rator	Bake Abs. (%)	Loaf Volume		Mixing Req.	Dough Char.	Quality Characteristics Compared to Glenn Check						
		(cc)	(% of CK)			Mix Tol.	Crumb Color	Grain & Texture	Protein	Milling	Baking	Overall
A	59.0	2900	100.0	3	3	2	2	2	5	5	2	2
B	60.5	3050	103.4	3	3	4	3	3	2	4	4	4
C	63.0	1037	106.4	4	4	4	3	3	4	2	4	3
D	64.0	2986	96.2	5	5	3	2	3	4	4	3	4
E	64.5	2700	103.8	4	3	2	2	2	-	-	3	3
F	66.3	2175	102.4	4	3	4	2	2	4	3	3	3
G	64.0	2850	100.0	4	4	4	4	4	4	2	4	3
H	61.7	1070	104.4	3	3	4	1	3	4	5	3	3
I	65.1	800	93.6	2	4	4	2	3	3	3	2	2
J	68.4	885	108.6	4	4	3	3	4	4	4	4	4
K	66.3	1015	115.6	3	4.5	2	3	3	4	5	4	4
L	63.1	979	105.0	2	4	5	3	3	4	3	4	4
Mean	63.8	-	103.3	3.4	3.7	3.4	2.5	2.9	3.8	3.6	3.3	3.3
Std Dev	2.6	-	5.7	0.9	0.7	1.0	0.8	0.7	0.8	1.1	0.8	0.8

Williston (W3)

Coope-rator	Bake Abs. (%)	Loaf Volume		Mixing Req.	Dough Char.	Quality Characteristics Compared to Glenn Check						
		(cc)	(% of CK)			Mix Tol.	Crumb Color	Grain & Texture	Protein	Milling	Baking	Overall
A	61.0	2750	101.9	5	5	3	3	3	1	2	3	3
B	59.0	3000	105.3	4	3	3	3	2	5	4	4	4
C	64.0	1143	100.9	5	5	3	3	4	2	3	3	3
D	63.0	3015	101.0	5	5	4	2	4	2	3	4	3
E	67.0	2500	108.7	5	5	3	2	3	-	-	3	3
F	65.0	2200	108.6	4	1	1	2	2	4	4	3	3
G	62.0	2800	96.6	3	3	3	4	4	3	3	4	3
H	57.8	1170	97.1	3	5	3	2	3	2	2	2	2
I	62.8	875	93.6	2	4	3	3	2	3	3	3	3
J	70.6	1055	84.4	5	2	3	3	5	2	2	4	3
K	71.8	1175	105.1	5	5	5	4	4	2	3	5	4
L	65.9	1109	91.4	3	3	3	3	3	2	4	3	3
Mean	64.2	-	99.5	4.1	3.8	3.1	2.8	3.3	2.5	3.0	3.4	3.1
Std Dev	4.2	-	7.3	1.1	1.4	0.9	0.7	1.0	1.1	0.8	0.8	0.5

MT0832 (Duclair)

Williston (W4)

Coope-rator	Bake Abs. (%)	Loaf Volume		Mixing Req.	Dough Char.	Quality Characteristics Compared to Glenn Check						
		(cc)	(% of CK)			Mix Tol.	Crumb Color	Grain & Texture	Protein	Milling	Baking	Overall
A	63.0	2700	100.0	5	5	3	3	3	3	2	3	3
B	55.5	3500	122.8	4	3	3	5	5	5	3	5	5
C	64.0	1150	101.5	5	5	3	3	3	3	1	3	2
D	60.0	3045	102.0	5	5	4	3	3	3	3	3	3
E	64.0	2650	115.2	5	5	3	3	3	-	-	4	4
F	61.7	3025	149.4	4	4	5	3	3	4	3	5	5
G	60.0	2850	98.3	4	4	4	4	4	3	2	4	3
H	55.2	1165	96.7	3	5	3	3	3	3	2	2	2
I	59.5	800	85.6	2	4	3	2	1	3	2	2	2
J	70.4	1220	97.6	5	4	3	3	2	4	2	2	3
K	71.7	1263	113.0	5	4.5	2	3	3	3	3	5	4
L	68.5	1122	92.4	4	3	2	3	3	3	2	3	3
Mean	62.8	-	106.2	4.3	4.3	3.2	3.2	3.0	3.4	2.3	3.4	3.3
Std Dev	5.3	-	17.0	1.0	0.8	0.8	0.7	1.0	0.7	0.6	1.2	1.1

Line B (BR5874C)

Williston (W5)

Coope-rator	Bake Abs. (%)	Loaf Volume		Mixing Req.	Dough Char.	Quality Characteristics Compared to Glenn Check						
		(cc)	(% of CK)			Mix Tol.	Crumb Color	Grain & Texture	Protein	Milling	Baking	Overall
A	63.0	2700	100.0	5	5	3	3	3	3	1	3	3
B	55.0	2800	98.2	4	4	3	3	2	5	3	3	3
C	64.0	1125	99.3	5	5	3	3	3	3	1	3	2
D	59.0	2986	100.0	5	5	4	4	3	3	2	2	2
E	64.0	2550	110.9	5	5	3	3	3	-	-	3	3
F	60.8	2100	103.7	4	2	2	2	2	4	4	3	3
G	58.0	2500	86.2	4	4	4	4	4	3	2	4	3
H	54.1	1135	94.2	5	5	4	2	2	3	2	2	2
I	59.3	970	103.7	3	4	3	4	2	3	2	3	3
J	69.4	1190	95.2	5	4	2	3	3	3	2	3	3
K	71.9	1048	93.7	5	5	4	2.5	2	3	2	3	2.5
L	68.3	1222	100.7	5	3	3	3	3	3	1	3	2
Mean	62.2	-	98.8	4.6	4.3	3.2	3.0	2.7	3.3	2.0	2.9	2.6
Std Dev	5.6	-	6.2	0.7	1.0	0.7	0.7	0.7	0.6	0.9	0.5	0.5

SD3997 (Forefront)

Watertown (B6)

Coope-rator	Bake Abs. (%)	Loaf Volume (cc)	Loaf Volume (% of CK)	Mixing Req.	Dough Char.	Quality Characteristics Compared to Glenn Check: Mix Tol.	Crumb Color	Grain & Texture	Protein	Milling	Baking	Overall
A	59.0	2900	100.0	5	5	3	4	3	2	5	3	3
B	57.0	2950	98.3	3	4	2	2	2	2	2	3	3
C	63.0	1010	95.7	2	4	1	3	2	2	2	1	2
D	61.0	3162	101.9	5	5	3	4	3	2	4	3	4
E	62.0	2600	100.0	5	3	3	2	1	-	-	2	2
F	63.1	2600	107.2	2	2	3	3	2	3	3	4	4
G	61.0	2600	100.0	2	2	2	3	3	3	3	4	4
H	58.9	1035	96.7	3	3	3	3	3	2	4	3	2
I	62.0	850	93.9	3	4	3	2	2	3	3	3	3
J	65.9	960	96.0	4	3	3	3	4	2	4	4	4
K	68.0	990	100.5	4	4	3	2.5	3	3	3	3	3
L	63.0	948	103.2	4	3	2	3	3	2	3	3	3
Mean	62.0	-	99.5	3.5	3.5	2.6	2.9	2.6	2.4	3.3	3.0	3.1
Std Dev	3.0	-	3.7	1.2	1.0	0.7	0.7	0.8	0.5	0.9	0.9	0.8

Casselton (C6)

Coope-rator	Bake Abs. (%)	Loaf Volume (cc)	Loaf Volume (% of CK)	Mixing Req.	Dough Char.	Quality Characteristics Compared to Glenn Check: Mix Tol.	Crumb Color	Grain & Texture	Protein	Milling	Baking	Overall
A	60.0	3100	101.6	5	5	3	3	3	3	4	3	3
B	56.0	3150	101.6	4	4	4	5	4	4	5	5	5
C	64.0	1090	100.5	5	4	3	3	3	3	2	4	3
D	60.0	3162	100.0	5	5	3	4	3	2	3	3	3
E	60.5	2750	104.8	5	5	3	3	4	-	-	3	3
F	62.2	2475	106.5	2	5	2	3	2	2	3	4	4
G	59.0	2800	101.8	3	3	3	3	3	2	2	3	3
H	57.2	1050	97.7	4	4	3	3	3	3	4	3	3
I	60.1	870	99.4	2	4	3	4	1	3	3	3	3
J	67.2	935	93.5	5	3	3	4	5	3	4	4	4
K	67.8	1023	94.7	5	4	2	3	2	3	4	3	3
L	63.6	1022	94.8	4	3	3	4	4	3	3	3	3
Mean	61.5	-	99.7	4.1	4.1	2.9	3.5	3.1	2.8	3.4	3.4	3.3
Std Dev	3.6	-	4.0	1.2	0.8	0.5	0.7	1.1	0.6	0.9	0.7	0.7

Pivot

Casselton (C7)

Coope-rator	Bake Abs. (%)	Loaf Volume (cc)	Loaf Volume (% of CK)	Mixing Req.	Dough Char.	Quality Characteristics Compared to Glenn Check: Mix Tol.	Crumb Color	Grain & Texture	Protein	Milling	Baking	Overall
A	60.0	3050	100.0	5	5	3	4	3	2	3	3	3
B	56.0	3250	104.8	4	4	4	4	3	3	2	4	3
C	64.0	1079	99.4	4	4	2	2	3	2	1	2	2
D	60.0	3162	100.0	5	5	3	2	3	2	2	3	2
E	59.0	2650	101.0	5	5	3	2	2	-	-	2	2
F	62.0	2150	92.5	1	3	1	2	2	2	3	1	1
G	58.0	2800	101.8	2	2	2	2	3	1	2	2	2
H	57.2	1100	102.3	4	3	1	1	3	2	3	2	2
I	59.6	790	90.3	2	3	2	1	1	3	2	2	2
J	67.4	945	94.5	5	4	3	2	2	3	3	2	3
K	68.8	990	91.7	5	4	2	4	2	3	2	2	2
L	63.6	1032	95.7	4	3	2	4	3	2	1	3	2
Mean	61.3	-	97.8	3.8	3.8	2.3	2.5	2.5	2.3	2.2	2.3	2.2
Std Dev	4.0	-	4.7	1.4	1.0	0.9	1.2	0.7	0.6	0.8	0.8	0.6

Crookston (K7)

Coope-rator	Bake Abs. (%)	Loaf Volume (cc)	Loaf Volume (% of CK)	Mixing Req.	Dough Char.	Quality Characteristics Compared to Glenn Check: Mix Tol.	Crumb Color	Grain & Texture	Protein	Milling	Baking	Overall
A	59.0	2900	100.0	5	5	3	2	3	5	5	3	3
B	56.5	3250	110.2	4	4	3	2	2	3	3	2	3
C	64.0	1040	106.7	3	2	2	2	2	5	2	2	2
D	64.0	2986	96.2	5	5	3	2	3	4	4	3	4
E	59.0	2675	102.9	4	4	3	2	4	-	-	2	2
F	62.7	2500	117.6	3	3	4	2	3	4	3	5	2
G	61.0	2750	96.5	4	4	4	4	4	5	2	4	3
H	58.2	1175	114.6	3	2	4	1	1	5	4	2	2
I	61.0	810	94.7	2	4	4	2	3	4	2	2	2
J	67.1	885	108.6	3	3	3	3	4	5	4	5	4
K	65.7	1035	117.9	2	4	2	3.5	3	4	5	4	4
L	63.2	973	104.4	2	4	4	3	3	5	2	3	3
Mean	61.8	-	105.9	3.3	3.7	3.3	2.4	2.9	4.5	3.3	3.1	2.8
Std Dev	3.2	-	8.2	1.1	1.0	0.8	0.8	0.9	0.7	1.2	1.2	0.8

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Watertown (B9)

Coope-rator	Bake Abs. (%)	Loaf Volume (cc)	Loaf Volume (% of CK)	Mixing Req.	Dough Char.	Quality Characteristics Compared to Glenn Check: Mix Tol.	Crumb Color	Grain & Texture	Protein	Milling	Baking	Overall
A	58.0	2850	98.3	5	5	3	4	3	1	2	3	3
B	58.0	3050	101.7	3	2	4	4	3	1	3	4	3
C	62.0	1017	96.4	3	3	2	3	2	1	2	1	1
D	62.0	3104	100.0	5	5	2	3	3	2	3	3	3
E	61.0	2625	101.0	5	3	3	3	4	-	-	3	3
F	64.0	2375	97.9	1	3	3	3	2	2	3	3	3
G	61.0	2750	105.8	3	3	3	2	4	3	3	4	4
H	59.7	960	89.7	4	3	1	2	3	1	3	2	2
I	63.0	810	89.5	3	4	3	3	2	2	3	2	2
J	65.3	905	90.5	3	3	3	4	4	2	2	4	4
K	69.7	1025	104.1	4	4	3	3.5	4	2	3	4	3.5
L	61.4	874	95.1	4	4	2	3	3	1	2	3	2
Mean	62.1	-	97.5	3.6	3.5	2.7	3.1	3.1	1.6	2.6	3.0	2.8
Std Dev	3.2	-	5.5	1.2	0.9	0.8	0.7	0.8	0.7	0.5	1.0	0.9

Casselton (C9)

Coope-rator	Bake Abs. (%)	Loaf Volume (cc)	Loaf Volume (% of CK)	Mixing Req.	Dough Char.	Quality Characteristics Compared to Glenn Check: Mix Tol.	Crumb Color	Grain & Texture	Protein	Milling	Baking	Overall
A	59	2900	95.1	5	5	3	3	4	1	3	3	3
B	58.5	3000	96.8	3	3	2	5	4	2	3	4	3
C	63.0	1005	92.6	3	4	2	3	3	1	3	2	2
D	62	3104	98.2	5	5	3	4	3	1	3	3	3
E	62.0	2650	101.0	5	4	2	2	2	-	-	3	3
F	64.4	2325	100.0	1	3	1	3	3	2	3	3	3
G	60.0	2700	98.2	2	2	2	2	3	1	2	2	2
H	58.8	1085	100.9	4	5	2	3	4	1	3	3	2
I	63.3	840	96.0	3	4	3	4	3	2	3	3	3
J	67.7	890	89.0	5	3	3	4	3	2	3	2	2
K	68.7	1058	98.0	5	4	2	3	1.5	2	3	4	3.5
L	62.4	954	88.5	4	5	4	3	4	1	3	3	2
Mean	62.5	-	96.2	3.8	3.9	2.4	3.3	3.1	1.5	2.9	2.9	2.6
Std Dev	3.3	-	4.2	1.4	1.0	0.8	0.9	0.8	0.5	0.3	0.7	0.6

Crookston (K9)

Coope-rator	Bake Abs. (%)	Loaf Volume (cc)	Loaf Volume (% of CK)	Mixing Req.	Dough Char.	Quality Characteristics Compared to Glenn Check: Mix Tol.	Crumb Color	Grain & Texture	Protein	Milling	Baking	Overall
A	56	2700	93.1	3	2	2	3	3	1	5	2	2
B	57.0	2850	96.6	4	4	4	3	4	0	5	3	2
C	60.0	896	91.9	2	1	1	3	3	1	4	1	2
D	61	2868	92.4	4	4	2	2	3	1	3	2	2
E	59.5	2625	101.0	3	4	3	2	4	-	-	2	2
F	63.2	2200	103.5	2	1	2	4	3	1	3	3	2
G	61.0	2300	80.7	3	3	3	4	4	2	2	4	3
H	58.8	820	80.0	5	2	2	2	1	1	5	1	1
I	62.1	710	83.0	2	3	3	3	2	2	2	2	2
J	60.3	770	94.5	4	3	3	3	4	1	4	4	4
K	64.8	833	94.9	3	3	2	3	3	1	5	4	4
L	58.3	822	88.2	3	4	3	3	4	1	3	3	2
Mean	60.2	-	91.6	3.2	2.8	2.5	2.9	3.2	1.1	3.7	2.6	2.3
Std Dev	2.5	-	7.5	0.9	1.1	0.8	0.7	0.9	0.5	1.2	1.1	0.9

ND SW 703

Casselton (C10)

Coope-rator	Bake Abs. (%)	Loaf Volume (cc)	Loaf Volume (% of CK)	Mixing Req.	Dough Char.	Quality Characteristics Compared to Glenn Check: Mix Tol.	Crumb Color	Grain & Texture	Protein	Milling	Baking	Overall
A	58.0	2800	91.8	5	5	3	4	4	1	5	3	3
B	56.0	2950	95.2	3	2	3	4	4	1	1	3	2
C	62.0	978	90.1	2	3	1	3	2	1	1	1	1
D	60.0	3045	96.3	5	5	3	2	3	1	2	3	2
E	59.0	2600	99.0	5	4	2	3	1	-	-	1	1
F	61.9	2125	91.4	1	5	1	2	2	1	3	1	1
G	58.0	2450	89.1	1	1	1	2	3	1	2	2	2
H	57.3	1025	95.3	3	3	1	2	2	1	4	2	2
I	61.2	795	90.9	2	3	2	2	2	2	2	2	2
J	66.2	835	83.5	5	2	2	4	4	2	4	3	3
K	69.1	995	92.1	4	4	3	3	2	1	3	3	3
L	61.7	889	82.5	3	5	2	4	4	1	2	3	2
Mean	60.9	-	91.4	3.3	3.5	2.0	2.9	2.8	1.2	2.6	2.3	2.0
Std Dev	3.8	-	4.9	1.5	1.4	0.9	0.9	1.1	0.4	1.3	0.9	0.7

Williston (W10)

Coope-rator	Bake Abs. (%)	Loaf Volume (cc)	Loaf Volume (% of CK)	Mixing Req.	Dough Char.	Quality Characteristics Compared to Glenn Check: Mix Tol.	Crumb Color	Grain & Texture	Protein	Milling	Baking	Overall
A	62.0	2700	100.0	5	5	3	3	3	3	1	3	3
B	58.5	3100	108.8	3	5	2	3	2	5	2	3	2
C	64.0	998	88.1	5	5	2	3	3	3	1	2	2
D	63.0	3162	105.9	5	5	3	2	4	3	2	4	3
E	65.5	2325	101.1	5	5	3	2	2	-	-	2	2
F	64.5	2075	102.5	4	3	3	2	2	4	4	3	3
G	62.0	2800	96.6	2	2	3	4	3	3	2	3	3
H	58.1	1020	84.6	3	5	2	1	2	3	2	1	1
I	62.3	810	86.6	1	4	3	2	1	3	2	2	2
J	69.9	1005	80.4	5	4	3	2	4	2	2	4	3
K	73.9	1008	90.2	5	4.5	3	3	2	2	2	3	2.5
L	66.7	1024	84.3	3	3	1	3	4	3	1	2	2
Mean	64.2	-	94.1	3.8	4.2	2.6	2.5	2.7	3.1	1.9	2.7	2.4
Std Dev	4.5	-	9.5	1.4	1.0	0.7	0.8	1.0	0.8	0.8	0.9	0.6

MN06028

Casselton (C11)

Coope-rator	Bake Abs. (%)	Loaf Volume (cc)	Loaf Volume (% of CK)	Mixing Req.	Dough Char.	Quality Characteristics Compared to Glenn Check: Mix Tol.	Crumb Color	Grain & Texture	Protein	Milling	Baking	Overall
A	59.0	2900	95.1	5	5	3	3	4	2	5	3	3
B	56.0	3000	96.8	3	3	3	3	3	2	3	3	3
C	63.0	1013	93.4	4	3	3	4	2	2	3	2	2
D	60.0	3074	97.2	5	5	3	3	3	2	3	3	2
E	60.0	2425	92.4	5	5	3	2	1	-	-	1	1
F	61.8	2525	108.6	3	3	3	2	2	2	2	4	4
G	58.0	2500	90.9	3	2	2	2	2	2	2	1	1
H	57.1	1100	102.3	4	4	3	3	3	2	4	2	2
I	60.9	855	97.7	3	4	3	4	2	3	3	3	3
J	67.1	885	88.5	4	2	3	4	4	2	4	4	4
K	70.5	1025	94.9	5	4	3	3.5	2.5	2	3	3	3
L	63.1	1045	96.9	5	4	3	4	4	2	4	4	3
Mean	61.4	-	96.2	4.1	3.7	2.9	3.1	2.7	2.1	3.3	2.8	2.6
Std Dev	4.2	-	5.3	0.9	1.1	0.3	0.8	1.0	0.3	0.9	1.1	1.0

Crookston (K11)

Coope-rator	Bake Abs. (%)	Loaf Volume (cc)	Loaf Volume (% of CK)	Mixing Req.	Dough Char.	Quality Characteristics Compared to Glenn Check: Mix Tol.	Crumb Color	Grain & Texture	Protein	Milling	Baking	Overall
A	58.0	2725	94.0	5	5	5	4	3	3	5	3	3
B	56.0	2800	94.9	4	4	3	3	3	1	3	2	2
C	61.0	957	98.2	3	3	3	4	3	3	4	3	3
D	60.0	2956	95.2	5	5	3	2	3	3	3	3	3
E	60.5	2600	100.0	5	5	4	3	5	-	-	2	2
F	61.2	2275	107.1	2	4	2	4	3	3	3	3	2
G	60.0	2500	87.7	5	4	5	4	4	3	2	4	3
H	58.0	1000	97.6	5	2	5	3	3	3	4	3	3
I	61.3	835	97.7	3	4	4	4	3	3	3	3	3
J	68.0	805	98.8	5	4	3	4	4	3	4	4	4
K	71.0	975	111.0	5	4	3	3	3.5	3	5	4	4
L	61.5	926	99.4	4	3	5	4	4	3	3	4	3
Mean	61.4	-	98.5	4.3	3.9	3.8	3.5	3.5	2.8	3.5	3.2	2.9
Std Dev	4.2	-	6.0	1.1	0.9	1.1	0.7	0.7	0.6	0.9	0.7	0.7

SY Soren

Watertown (B12)

Coope-rator	Bake Abs. (%)	Loaf Volume (cc)	Loaf Volume (% of CK)	Mixing Req.	Dough Char.	Quality Characteristics Compared to Glenn Check: Mix Tol.	Crumb Color	Grain & Texture	Protein	Milling	Baking	Overall
A	59.0	3000	103.4	5	5	3	3	2	2	1	3	3
B	57.5	3000	100.0	3	3	3	3	2	2	2	3	3
C	63.0	1060	100.5	4	4	3	3	3	2	2	3	3
D	61.0	3104	100.0	5	5	2	2	3	2	2	3	2
E	61.0	2700	103.8	5	4	4	2	3	-	-	3	3
F	63.5	2825	116.5	3	2	3	3	3	2	3	5	5
G	62.0	2800	107.7	3	3	3	3	4	3	4	5	5
H	60.2	1085	101.4	3	3	2	1	2	2	1	1	1
I	62.3	805	89.0	3	3	3	2	2	3	2	2	2
J	64.7	875	87.5	5	4	3	2	3	2	2	3	3
K	67.9	988	100.3	4	4	4	3.5	2	2	1	3	2
L	62.4	894	97.3	4	3	2	2	3	2	1	3	2
Mean	62.0	-	100.6	3.9	3.6	2.9	2.5	2.7	2.2	1.9	3.1	2.8
Std Dev	2.7	-	7.6	0.9	0.9	0.7	0.7	0.7	0.4	0.9	1.1	1.2

Casselton (C12)

Coope-rator	Bake Abs. (%)	Loaf Volume (cc)	Loaf Volume (% of CK)	Mixing Req.	Dough Char.	Quality Characteristics Compared to Glenn Check: Mix Tol.	Crumb Color	Grain & Texture	Protein	Milling	Baking	Overall
A	60.0	3075	100.8	5	5	3	4	4	2	3	3	3
B	57.0	3150	101.6	2	3	3	4	4	3	3	4	4
C	64.0	1095	100.9	4	4	3	2	3	2	2	3	3
D	61.0	3162	100.0	5	5	3	2	3	2	3	3	3
E	61.0	2800	106.7	5	5	3	2	3	-	-	2	2
F	63.1	2400	103.2	1	1	1	2	2	3	2	3	3
G	59.0	2500	90.9	1	1	1	2	2	3	2	2	2
H	57.1	1100	102.3	3	4	2	3	3	2	3	2	2
I	61.2	890	101.7	3	4	3	2	2	3	3	3	3
J	68.3	950	95.0	5	2	3	3	4	3	3	3	3
K	69.6	1105	102.3	4	4	3	3	2	3	3	4	3.5
L	64.0	1095	101.6	3	4	2	4	4	2	2	3	2
Mean	62.1	-	100.6	3.4	3.5	2.5	2.8	3.0	2.5	2.6	2.9	2.8
Std Dev	3.9	-	4.0	1.5	1.4	0.8	0.9	0.9	0.5	0.5	0.7	0.7

Crookston (K12)

Coope-rator	Bake Abs. (%)	Loaf Volume (cc)	Loaf Volume (% of CK)	Mixing Req.	Dough Char.	Quality Characteristics Compared to Glenn Check: Tol.	Color	Texture	Protein	Milling	Baking	Overall
A	58.0	2950	101.7	5	5	5	3	3	4	4	3	3
B	58.5	3200	108.5	2	3	2	3	3	1	3	3	3
C	62.0	1037	106.4	4	4	4	3	3	4	2	4	3
D	62.0	2986	96.2	5	5	3	2	3	4	3	3	3
E	63.0	2725	104.8	5	4	3	2	3	-	-	4	4
F	64.3	2450	115.3	3	4	4	4	5	3	3	4	2
G	62.0	2600	91.2	4	4	4	4	4	3	2	4	4
H	59.9	990	96.6	3	3	4	2	2	4	4	2	2
I	63.9	850	99.4	3	4	4	3	2	3	3	3	3
J	66.7	870	106.7	5	3	3	3	3	3	4	3	3
K	68.3	993	113.1	4	4	2	2.5	3.5	3	4	4	4
L	61.6	963	103.3	3	4	4	3	4	4	2	4	3
Mean	62.5	-	103.6	3.8	3.9	3.5	2.9	3.2	3.3	3.1	3.4	3.1
Std Dev	3.0	-	7.1	1.0	0.7	0.9	0.7	0.8	0.9	0.8	0.7	0.7

SD4023 (Advance)

Watertown (B13)

Coope-rator	Bake Abs. (%)	Loaf Volume		Mixing Req.	Dough Char.	Quality Characteristics Compared to Glenn Check						
		(cc)	(% of CK)			Mix Tol.	Crumb Color	Grain & Texture	Protein	Milling	Baking	Overall
A	58.0	3100	106.9	3	3	2	3	2	1	4	2	2
B	55.5	2950	98.3	3	3	2	3	3	1	3	3	2
C	62.0	1028	97.4	3	3	2	3	3	1	2	2	2
D	59.0	2897	93.3	4	4	2	3	4	2	3	4	3
E	58.5	2700	103.8	5	4	4	2	5	-	-	2	2
F	60.9	2825	116.5	3	3	3	3	2	2	3	5	5
G	61.0	2800	107.7	3	2	3	4	4	4	4	4	4
H	56.2	1025	95.8	5	3	2	2	3	1	3	1	1
I	59.9	765	84.5	2	3	3	2	2	2	3	2	2
J	64.2	865	86.5	5	3	3	3	4	2	3	4	4
K	67.0	1013	102.8	5	4	3	3	5	2	3	4	3.5
L	61.5	968	105.3	5	3	3	3	3	1	2	3	2
Mean	60.3	-	99.9	3.8	3.2	2.7	2.8	3.3	1.7	3.0	3.0	2.7
Std Dev	3.2	-	9.2	1.1	0.6	0.7	0.6	1.1	0.9	0.6	1.2	1.2

Casselton (C13)

Coope-rator	Bake Abs. (%)	Loaf Volume		Mixing Req.	Dough Char.	Quality Characteristics Compared to Glenn Check						
		(cc)	(% of CK)			Mix Tol.	Crumb Color	Grain & Texture	Protein	Milling	Baking	Overall
A	58.0	3100	101.6	5	5	3	3	4	1	3	3	3
B	55.5	3000	96.8	4	2	3	4	4	1	3	3	3
C	62.0	1043	96.1	4	4	2	3	2	1	2	2	2
D	59.0	3104	98.2	5	5	3	2	4	1	3	4	3
E	58.0	2725	103.8	5	4	2	2	4	-	-	3	3
F	60.3	2125	91.4	1	1	1	2	2	1	2	1	1
G	58.0	2550	92.7	1	1	1	2	2	2	2	2	2
H	55.5	1050	97.7	4	5	1	3	3	1	3	2	1
I	59.3	870	99.4	3	4	2	3	2	2	3	3	3
J	66.0	910	91.0	5	2	3	3	4	2	3	3	3
K	63.5	978	90.6	5	4.5	2	3.5	2	1	3	3	3
L	61.8	993	92.1	5	3	2	4	4	1	3	3	2
Mean	59.7	-	96.0	3.9	3.4	2.1	2.9	3.1	1.3	2.7	2.7	2.4
Std Dev	3.1	-	4.4	1.5	1.5	0.8	0.7	1.0	0.5	0.5	0.8	0.8

WB-Mayville

Casselton (C14)

Coope-rator	Bake Abs. (%)	Loaf Volume		Mixing Req.	Dough Char.	Quality Characteristics Compared to Glenn Check						
		(cc)	(% of CK)			Mix Tol.	Crumb Color	Grain & Texture	Protein	Milling	Baking	Overall
A	59.0	2900	95.1	5	5	3	3	4	2	4	3	3
B	56.5	3150	101.6	4	2	2	5	5	2	4	3	3
C	63.0	1017	93.7	3	4	1	3	2	2	3	1	2
D	60.0	3045	96.3	5	5	3	3	3	2	3	3	3
E	61.5	2675	101.9	5	4	2	2	4	-	-	3	3
F	62.3	2125	91.4	1	1	1	2	2	1	2	1	1
G	58.0	2450	89.1	1	1	1	2	2	2	2	1	1
H	57.1	980	91.2	4	4	1	3	3	2	4	2	2
I	61.2	800	91.4	2	4	2	3	2	3	3	2	2
J	66.7	900	90.0	5	4	3	4	4	2	4	4	4
K	65.6	1013	93.8	4	4	2	3.5	2.5	2	4	3	3
L	63.0	907	84.1	4	3	3	4	5	2	5	3	3
Mean	61.2	-	93.3	3.6	3.4	2.0	3.1	3.2	2.0	3.5	2.4	2.5
Std Dev	3.2	-	5.0	1.5	1.4	0.9	0.9	1.2	0.4	0.9	1.0	0.9

Crookston (K14)

Coope-rator	Bake Abs. (%)	Loaf Volume		Mixing Req.	Dough Char.	Quality Characteristics Compared to Glenn Check						
		(cc)	(% of CK)			Mix Tol.	Crumb Color	Grain & Texture	Protein	Milling	Baking	Overall
A	58.0	2800	96.6	5	5	5	4	3	2	5	3	3
B	56.0	2750	93.2	2	3	2	3	3	0	4	2	2
C	61.0	960	98.5	3	4	3	3	3	3	4	3	3
D	60.0	2927	94.3	5	5	3	3	3	3	3	3	3
E	60.0	2575	99.0	4	4	3	2	2	-	-	1	1
F	62.2	2475	116.5	3	3	4	4	4	2	3	4	2
G	60.0	2600	91.2	4	4	4	4	4	2	2	4	3
H	59.2	910	88.8	4	3	4	3	2	3	4	2	2
I	61.9	720	84.2	2	4	4	2	1	3	3	2	2
J	66.6	825	101.2	5	3	3	4	4	2	4	4	4
K	67.9	940	107.1	4	4	3	3	3	3	5	4	4
L	60.9	846	90.8	4	3	5	4	4	3	3	4	3
Mean	61.1	-	96.8	3.8	3.8	3.6	3.3	3.0	2.4	3.6	3.0	2.7
Std Dev	3.3	-	8.7	1.1	0.8	0.9	0.8	1.0	0.9	0.9	1.0	0.9

Appendix

Source of Wheat

Source – Breeding Program	Code #	Identification
North Dakota State University	1	ND905CL
WWW	2	Line A (BR0061)
North Dakota State University	3	ND818
Montana State University	4	MT0832 (Duclair)
WWW	5	Line B (BR5874C)
South Dakota State University	6	SD3997 (Forefront)
Westbred	7	Pivot
Limagrain	9	10 Fx Inc 1 (LCS Powerplay)
North Dakota State University	10	ND SW 703
University of Minnesota	11	MN06028
AgriPro	12	SY Soren
South Dakota State University	13	SD4023 (Advance)
Westbred	14	WB-Mayville
North Dakota State University	8	Glenn (Check)

Field Plot Locations and Procedures

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

Northeast Research Farm (Watertown), South Shore, SD 57263
S Dakota State Univ., 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 & Chad Anderson (No production in 2011)
Williston Agricultural Experiment Station, Williston, ND- Sanford Qvale

Wheat was seeded in large-scale plots of 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 location, 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.

Wheat Production Sites

Entry #	Entry	Source	Production Sites			
			Watertown	Casselton	Crookston	Williston
1	ND905CL	NDSU				x
2	Line A (BR0061)	WWW				x
3	ND818	NDSU	x	x	x	x
4	MT0832 (Duclair)	MTSU				x
5	Line B (BR5874C)	WWW				x
6	SD3997 (Forefront)	SDSU	x	x		
7	Pivot	Westbred		x	x	
8	Glenn	NDSU	x	x	x	x
9	10 Fx Inc 1 (LCS Powerplay)	Limagrain	x	x	x	
10	ND SW 703	NDSU		x		x
11	MN06028	UMN		x	x	
12	SY Soren	AgriPro	x	x	x	
13	SD4023 (Advance)	SDSU	x	x		
14	WB-Mayville	Westbred		x	x	

Field Production Data

Field Production Data 2011 Spring Wheat (WQC) Quality Trials

	Location			
Variable	**Watertown**	**Casselton**	**Crookston**	**Williston**
Planting Date	5/16/2011	5/18/2011 (+6/3/2011)	5/18/2011	6/8-9/2011
Harvest Date		8/24/2011	8/18/2011	9/8/2011
Fertilizer (lb/A)				
N	181	130	133	Urea 150
P	84	50	12	*
K	296	0	328	*
Herbicide/rate				
Broadleaf	Bronate Ultra 0.8pt.	Bronate/ 1 pt	Bromac/1.5 pts/A	*
Grass	Puma 0.66 pt.	Puma/ 6 oz.	Axial XL/16.4 fl oz/A	Wolvrine/1.7pts/A
Fungicide	Folicur 4oz.	*	*	*
* = No Application	.			

	Climatologic Data			
	Average Temperature (^{0}F)/Precipitation (in)			
Month	**Watertown**	**Casselton**	**Crookston**	**Williston**
April		42/2.18	41.3/1.97	41.6/2.19
May	53/5.0	53.4/3.86	53.6/2.25	53.3/6.46
June	64/4.2	65.3 / 5.83	64.4/2.62	64.6/2.39
July	76/4.9	74.2 / 5.81	71.7/2.69	73.1/1.43
August	70/1.44	70.1 / 2.94	68.8/2.09	72.9/0.93
* = Not Applicable				

	Yield Data			
	Yield (bu/acre) / Test Wt / % Moisture			
Cultivar	**Watertown**	**Casselton**	**Crookston**	**Williston**
SWQAC 1	*	*	*	**
SWQAC 2	*	*	*	**
SWQAC 3	14.0/51.1/12.8	10.75 bu/Ac	37/59/15.13	**
SWQAC 4	*	*	*	**
SWQAC 5	*	*	*	**
SWQAC 6	15.5/ 57.5/13.1	23.25 bu/Ac	*	*
SWQAC 7	*	16.96 bu/Ac	50/54/13.5	*
SWQAC 8	17.7/53.6/12.9	20.83 bu/ Ac	42.5/61/13.91	**
SWQAC 9	12.3/56.0/13.4	24.22 bu/Ac	48/60/14.11	*
SWQAC 10	*	24.22 bu/Ac	*	**
SWQAC 11	*	30.52 bu/Ac	46/60/13.5	*
SWQAC 12	13.0/54.8/12.9	24.22 bu/Ac	46/59/13.29	*
SWQAC 13	15.0/56.7/13.2	16.47 bu/Ac	*	*
SWQAC 14	*	29.10 bu/Ac	47/59/13.5	*
Site Totals	6	10	7	7

* Not Increased at this site ** = No data available

Climate, Disease, Field Conditions

Notes on Production Related to Climatic Conditions, Disease (Scab, etc.), and Field Conditions That Could Affect Grain Quality

Watertown, SD

At Planting	The seed was planted late due to the arrival of seed. Condition at planting was less than ideal because of wet conditions. A 3 inch rain a week after planting.
During Growth	Higher than normal rainfall in late May and June affected root growth.
At Flowering	Conditions were somewhat wet although head scab infections were minor. There was a 4.25 inch rain that flooded the fields for an extended time. Water tables were at a record level.
During Maturation	High temperatures during grain filling period affected both yield and test weight.
At Harvest	Normal Dry conditions

Casselton, ND

At Planting	Conditions were near normal, with dry surface and good subsoil moisture.
During Growth	Growing conditions throughout the season were excessively wet. It started with enough rain at several times during the seedling stage to cause water logged soils and significant stunting of the wheat seedlings. This situation continued throughout the entire season with excessive rainfall during tillering, heading, and grain filling stages to the extent that yellowing of the plants and ponding of water in areas of the field.
At Flowering	As noted above, too much rain was detrimental to the plants during this stage of plant growth and there was also a short hot spell during the early filling portion of plant growth.
During Maturation	The only good part of the season was the last two weeks which was dry for grain drying.
At Harvest	Harvest was adversely affected by a major breakdown on combine that we use to harvest these plots, which required us to use a plot combine with no return grain system which, in turn, resulted in more chaffy samples than normal.

Crookston, MN

At Planting	Adequate moisture at planting.
During Growth	Average growing season for the 2011 wheat crop.
At Flowering	Plenty of humidity during the flowering stage which was inducive for Fusarium.
During Maturation	Average temperatures during maturity.
At Harvest	There were no problems at harvest.

Williston, ND

At Planting	Excessive moisture
During Growth	Excessive moisture for early growing season
At Flowering	
During Maturation	At filling stage moisture was minimal as the plant had an inadequate root system to survive the lack of timely rainfall
At Harvest	Harvest condition was good

Description of 2011 Hard Spring Wheat Lines

SWQAC #1- ND905CL

ND905CL has the Clearfield (Beyond) herbicide resistant genes that belongs to BASF Company. It has wide adaptation but intended to the Western ND same as ND901CLPLus. Overall, grain yield of ND905CL is superior to ND901CLPlus. It is a conventional height line; medium early (similar to ND901CLPlus and earlier than Mott); and has medium to strong straw strength similar to Faller. Protein of ND905CL is high, similar to ND901CL and better than Reeder. Milling is good with flour extraction better than ND901CLPlus. Similarly, baking of ND905CL is good b similar to Steele-ND and better than Reeder. Test weight of ND905CL is average similar to Reeder. Overall, ND905CL has a very good leaf diseases package. It is resistant/medium resistant to leaf and stem rusts and medium resistant to scab similar to Alsen.

SWQAC #2- Line A (BR0061)

BR0061 is a hard red spring bread wheat, developed by World Wide Wheat LLC (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 quality W3 population group, in W3's 2000 breeding nursery in Arizona. Single head selections continued through the F6.

BR0061 has been tested in replicated yield trials since 2002 at several W3 global locations. The line possesses: 1) average yielding potential under adequate and/or moderate moisture conditions; and 2) a good disease package. It is resistant to stripe rust.

BR0061 demonstrates erect growth at the juvenile stage with green color at the boot stage. At maturity the head is lax, tapering in shape, re-curved, and awned. The glumes are white in color, with elevated shoulder and acuminate beak. The seed of BR0061 is ovate in shape with rounded cheek and medium brush. Seed crease is narrow in width and shallow in depth.

SWQAC #3- ND818

ND 818 was selected from a 3-way cross involving an NDSU cultivar release (1999) 'Reeder', NDSU experimental line ND721, and SDSU released cultivar 'Wolworth'. 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, ND 818 has a medium resistance to FHB. Wolworth is a SDSU cultivar released in 2001 for its high yield. ND 818 has 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, ND 818 is a very high yielding cultivar with relatively high protein (close to Glenn). It is a medium early cultivar with medium straw strength conventional height. ND 818 has average test weigh and overall very good milling and baking properties.

SWQAC #4- MT0832 (Duclair)

MT0832 is 'Duclair' a new solid stemmed hard red spring wheat. Pedigree is Choteau//Scholar/Reeder. Foundation Seed was grown in 2011. PVP title V has been applied for.

SWQAC #5- Line B (BR5874C)

BR5874C is a hard red spring bread wheat, developed by World Wide Wheat LLC (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 red W3 population group in 1995 at Maricopa, AZ. Generation advancement continued as single head selection through the F7 generation.

BR5874C has been tested in replicated yield trials 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 moderately resistant to stripe rust.

BR5874C demonstrates erect growth at the juvenile stage with green color at the boot stage. At maturity, the head is dense, tapering in shape, inclined, and awned. The glumes are white in color, with wanting shoulders and acuminate beak. The seed of BR5874C is ovate in shape with rounded cheek, large brush size and medium in length. Seed crease is mid-wide and mid-deep.

SWQAC #6- SD3997 (Forefront)

'Forefront' is a hard red spring wheat cultivar developed and released in 2011 by the South Dakota Agricultural Experiment Station. It was derived as a single spike from within an F_4 population (FN1700-155/FN1500-074//Walworth) that was originally created in spring 2001. During early generation advancement Forefront was tested as population 23775T and as SD3997 within South Dakota State University Preliminary Yield Trials (2005) and Advanced Yield Trials (AYT) from 2006 through 2011. Forefront was tested in the Uniform Regional Spring Wheat Nursery (URN) during 2009 and 2010 as well as the South Dakota Crop Performance Testing (CPT) trials in 2008 through 2011. Forefront was also evaluated by the Wheat Quality Council in 2011. Coverage under the United States Plant Variety Protection Act will be sought.

Points of note associated with Forefront include:

1 Good yield potential
2 High test weight
3 Good grain protein concentration
4 Early heading date
5 A good level of Fusarium Head Blight (FHB) resistance
6 Resistant to moderately resistant ratings for both leaf and stem rust

SWQAC #7- Pivot

Pivot (WestBred) is a medium early maturing hard red spring wheat (HRSW) variety. Pivot is a very short semi-dwarf variety adapted to the high yield production areas of Eastern ND and Western MN. Pivot is moderately susceptible to stem rust, and foliar disease (Tan Spot and Septoria tritici), moderately resistant to leaf rust, but susceptible to scab (Fusarium Head Blight). Fungicide application at heading for scab suppression is a must. Grain protein and test weight of Pivot are average; bread making quality is good based on SDS sedimentation values above 110 mm.

SWQAC #9- 10 Fx Inc 1 (LCS Powerplay)

LCS Powerplay is an awned, white-glumed Hard Red Spring Wheat derived from a cross Buck Antorcha/Norm-8B//SD3546 ('Granger'). It is resistant to stripe-, leaf-, and stem rusts, and intermediate to bacterial blight, tan spot and scab. It is well adapted in the Northern Plains states of Minnesota and North Dakota. It has the high molecular weight glutenin subunit (HMWGS) formula of 2*, 7+9, 5+10, which is the same formula as that of Glenn, the Wheat Quality Council's benchmark for bread. It also produces good grain protein, quality Baking tests, *per se,* have not been performed, but the protein and HMWGS formula auger well for satisfactory quality for breadstuffs. LCS Powerplay is most like 'Faller' but differs in that it has better test weight, higher protein, heads about a day earlier, which leads to slightly earlier maturity, has shorter plant height, and better resistance to lodging. Faller, however, exhibits slightly less leaf disease. LCS Powerplay produces about 1% higher protein, heads about 2.5 days earlier and is 0.5 - 1 inch shorter than LCS Albany. Plant Variety Protection is being applied for under the Title V option and we anticipate Certified seed sales in the Spring of 2013.

SWQAC #10- ND SW 703

NDSW703 is a hard white spring wheat (HWSW). However, it does not have all white color genes. It has wide adaptation but intended to the Central and Western ND where the risks of pre-harvesting sprouting is prominent. Overall, grain yield of NDSW703 is high compared to Alpine and Agawam white wheat cultivars. It is a semi-dwarf; medium late (similar to Alpine), and has a medium to strong straw strength similar to Alpine. Protein of NDSW703 is medium similar to Alpine and Faller; slightly higher than Agawam; but lower than Glenn. Milling of NDS703 is relatively lower compared the most grown HRSW cultivars high, including Glenn, Barlow, and Faller. Baking of NDSW703 is also slightly lower than the HRSW cultivars Glenn, faller and Barlow. NDSW703 test weight is low to average close to Alpine. Overall, NDSW703 has an excellent good leaf diseases package. It is resistant to medium resistant to leaf and stem rusts. It is susceptible to scab.

SWQAC #11- MN06028

MN06028 is a mid maturity hard red spring wheat with excellent straw strength, high grain protein content, and competitive grain yields. The pedigree of MN06028 is MN97695-4/Ada sel. MN06028 has moderate resistance to Fusarium head blight and prevalent races of leaf rust. MN06028 is resistant to preharvest sprouting and has exhibited good end-use quality characteristics.

SWQAC #12- SY Soren

SY Soren is a hard red spring wheat developed by Syngenta Cereals. Certified seed will be available to growers for the 2012 season. Its pedigree is "Norpro/Kelby". It has medium-early maturity and very good test weight. It is a short semidwarf, slightly taller than Kelby. Straw strength is very good, between Kelby and Kuntz. It is resistant to stem rust and moderately resistant to leaf rust. Protection to foliar diseases has been very good. Tolerance to FHB has been intermediate. Protein levels have been high, slight lower than Kelby. SY Soren is broadly adapted for the spring wheat growing areas of the Northern Plains.

SWQAC #13- SD4023 (Advance)

'Advance' is a hard red spring wheat cultivar developed and released in 2011 by the South Dakota Agricultural Experiment Station. It was derived as a single spike from within an F_4 population (Granger/N98-0230) that was originally created in fall 2001. During early generation advancement Advance was tested as population 24023 and as SD4023 within South Dakota State University Preliminary Yield Trials (2006) and Advanced Yield Trials (AYT) from 2007 through 2011. Advance was tested in the Uniform Regional Spring Wheat Nursery (URN) during 2010 as well as the South Dakota Crop Performance Testing (CPT) trials in 2007 through 2011. Advance was also evaluated by the Wheat Quality Council in 2011. Coverage under the United States Plant Variety Protection Act will be sought.

Points of note associated with Advance include:

1 High yield potential
2 Good test weight
3 Adequate grain protein concentration
4 Late heading date
5 Resistant to moderately resistant ratings for leaf rust, stem rust, and Bacterial leaf streak.

SWQAC #14- WB-Mayville

WB-Mayville (WestBred) is a medium early, short statured, hard red spring wheat (HRSW) variety. WB-Mayville produces very high yields of high protein grain. Standability of WB-Mayville is excellent. WB-Mayville is a better yielding, higher protein, free threshing version of the WestBred variety Trooper. It is adapted, as a high yielding management wheat, to the HRSW growing areas of ND, SD, and MN. Best yields are achieved at higher planting rates. Bread making quality of WB-Mayville is good based on average SDS sedimentation values above 110 mm

WB-Mayville is resistant to stem rust, moderately resistant to leaf rust, moderately susceptible-susceptible to foliar disease (Tan Spot and Septoria tritici), and susceptible to scab (Fusarium Head Blight). Fungicide application at heading for scab suppression is a must; fungicide at the 3-5 leaf stage for foliar disease suppression is beneficial.

Grain Cleaning and Milling Procedures

Wheat (approximately 2 bu/variety) was cleaned in a Carter-Day Bulldog seed cleaner that was equipped with two rotating indent cylinders (#24 – coarse and #16 fine), a sizer cylinder (#5), vibrator, and air aspiration. From the Watertown, Casselton, Crookston, and Williston locations, sixty pounds of cleaned wheat was tempered to 16.5% moisture basis and conditioned 16-18 hours. The tempered wheat was milled in Buhler Experimental Mills, at an average feed rate of 100 g/min. Four samples (B8, K3, B6, and K9) were milled on Buhler MLU 202 and the other samples were milled on NDSU Buhler mill. Flour from three break (B1, B2, B3) and two reduction (R1, R2) sections of the mill were combined to patent flour. R3 flour was not included in the patent flour due to the high ash content, but was included in calculating straight grade flour yield.

Methods of Analyses

Wheat Market Value Score

Test Weight (AACCI Method 55-10)

Wheat and Flour Protein (AACCI Method 46-30 – combustion method)

Wheat and Flour Ash (AACCI Method 08-01)

Single Kernel Characteristics: kernel hardness index, weight, and diameter values were measured by Single Kernel Characterization System (Perten). Mean and standard deviation values were calculated from data of 300 kernels.

Kernel Size (Sieving according to USDA/ARS WQL)

Wheat Falling Number (Perten Falling Number Instrument)

Vitreous Kernel Content (DHV analyses by FGIS grain testing service)

Mycotoxin (Deoxynivalenol, DON): analysis was done on ground wheat using a gas chromatograph with an electron capture detector as described in J. Assoc. Official Anal.Chem 79,472 (1996). (Analytical work was done at NDSU Hard Spring Wheat Quality Lab.)

Flour Color (Minolta Colorimeter L* b* values)

Flour Extraction: % Total Product Basis (TPB), % Tempered Wheat Basis (TWB), and estimated Pounds of Straight Grade Flour/Bushel Wheat.

Flour starch damage: Megazyme Int. Inc. assay kit (Megazyme International Inc., Wicklow, Ireland) was used to measure the level of starch damage according to AACCI approved method 76-31.01. Samples of wheat flour (0.1g) were weighed into reaction tubes and incubated with α-amylase at 40°C for exactly ten minutes. The reaction was stopped using 0.2% sulfuric acid and the samples were filtered. Amyloglucosidase was added to an aliquot (0.1ml) of each sample and the samples were incubated at 40°C for ten minutes. GOPOD was added to each sample and allowed to incubate at 40°C for an additional 20 minutes. The absorbance was read at 492nm and the percent starch

damage was calculated on an “as is” basis. (Analytical work was done at NDSU Hard Spring Wheat Quality Lab.).

Farinograph: Farinograph was performed by AACCI Method 54-21 using a Brabender Computerized Farinograph system with a 50 g mixing bowl on constant flour weight (50 g, 14 % mb).

- Water Absorption: amount of water required to center curve peak on the 500 BU line, expressed on 14 percent moisture basis.
- 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 min 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 standard mixograph procedure (Method 54-40A) was performed using a 35 g mixograph. Water absorption was calculated by following equation: Water absorption (%, 14% flour mb) = Protein (14% mb) x 1.5 + 43.6 (The Mixograph Handbook, 1997)

Extensigraph: AACCI Method 54-10 was modified as follows: (a) 100 gram of flour (14 percent moisture basis), 2.0 percent sodium chloride (U.S.P.) and water (equal to farinograph absorption minus 2 percent) was mixed to optimum development in a National pin dough mixer; (b) dough was scaled to 150 g, rounded, moulded, placed in extensigraph holders, and rested for 45 minutes at 30°C and 78 percent relative humidity. The dough was then stretched as described in the procedure referenced above. For conversion purposes, 500 g equals 400 B.U.

- Extensibility: total length of the curve at the base line in centimeters.
- Maximum resistance: maximum curve height, reported in Brabender units (BU).
- Area: the area under the curve is measured and reported in square centimeters.
- Resistance to extension at 50 mm: height of the curve 50 mm after beginning of torque increase in BU.
- Ratio number: quotient of resistance to extension (50 mm) and extensibility
- Ratio number (max.): Quotient of maximum resistance and extensibility

Test Bake Procedures

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

Bake Cooperators

ADM Milling, Olathe, Kansas
Bay State Milling Company, Winona, Minnesota
Cargill (Horizon Milling), Minnetonka, Minnesota
Cereal Food Processors, Inc., Wichita, Kansas
ConAgra Foods, Omaha, Nebraska
General Mills, Inc., Minneapolis, Minnesota
North Dakota State Mill, Grand Forks, North Dakota
North Dakota State University, Department of Cereal Science, Fargo, North Dakota
USDA/ARS Hard Red Spring & Durum Wheat Quality Laboratory, Fargo, North Dakota
USDA/ARS Hard Winter Wheat Quality Laboratory, Manhattan, Kansas
USDA/ARS Western Wheat Quality Laboratory, Pullman, Washington
Wheat Marketing Center, Portland, Oregon

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 TW, 1000 KWT, FN, Wheat Protein, and Wheat Ash were incorporated for calculating the WMS. Method #1 was developed on a scale of 0 to 6 where the Glenn Check was evaluated along with the experimental lines for each growing location. Method #2 was developed on a scale of 0 to 10 where the experimental lines were evaluated against the Glenn Check for each growing location.

Wheat Marketing Score – Method #1

WHEAT MARKETING SCORE or EXPORT MARKETING SCORE

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

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

Wheat Marketing Score (Method #2): Rules for score calculation

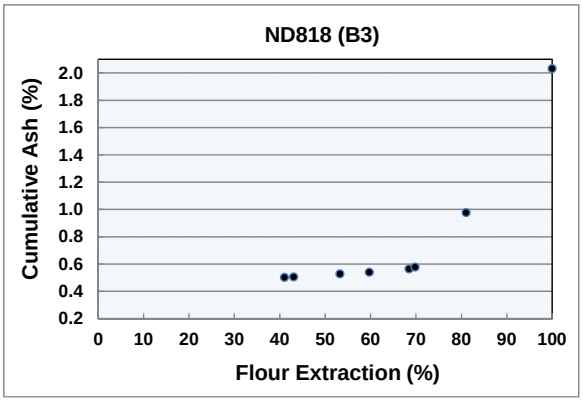
-Entered line minus check value equals difference (Diff)

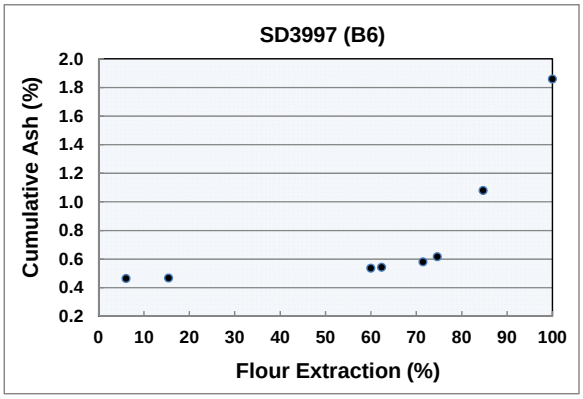
Component Score	Wheat Protein	Test Weight	Falling Number	Thousand Kernel Weight	Wheat Ash
0	Diff<-2.5	Diff<-5	Diff<-125	Diff<-10	
2	-2.501<Diff<-2	-5.001<Diff<-4	-125.01<Diff<-100	-10.001<Diff<-8	
4	-2.001<Diff<-1.5	-4.001<Diff<-3	-100.01<Diff<75	-8.001<Diff<-6	
6	-1.501<Diff<-1	-3.001<Diff<-2	-75.01<Diff<50	-6.001<Diff<-4	
8	-1.001<Diff<-0.5	-2.001<Diff<-1	-50.01<Diff<-25	-4.001<Diff<-2	
10	-0.501<Diff<2.001	-1.001<Diff<2.001	-25.01<Diff	-2.001<Diff<4.001	Diff<0.101
8	2<Diff<3.001	2<Diff<4.001		4<Diff<8.001	0.1<Diff<0.201
6	3<Diff<4.001	4<Diff<6.001		8<Diff<12.001	0.2<Diff<0.301
4	4<Diff<5.001	6<Diff<8.001		12<Diff<16.001	0.3<Diff<0.401
2	5<Diff<6.001	8<Diff<10.001		16<Diff<20.001	0.4<Diff<0.501
0	Diff>6	Diff>10		Diff>20	Diff>0.5
Weighting	0.3	0.2	0.2	0.2	0.1

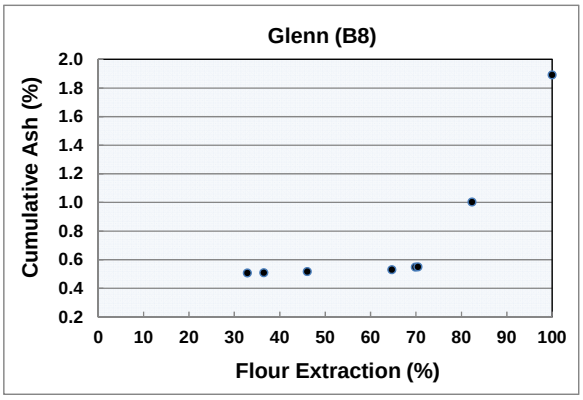
Wheat Marketing Score = (Protein*0.3) + (TW*0.2) + (FN*0.2) + (1000 KWT*0.2) + (Ash*0.1)

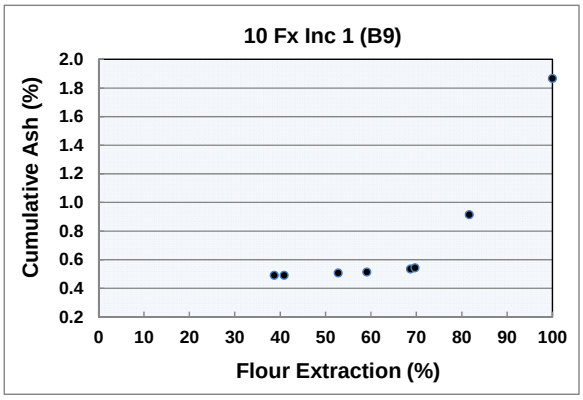
Cumulative Ash Curves

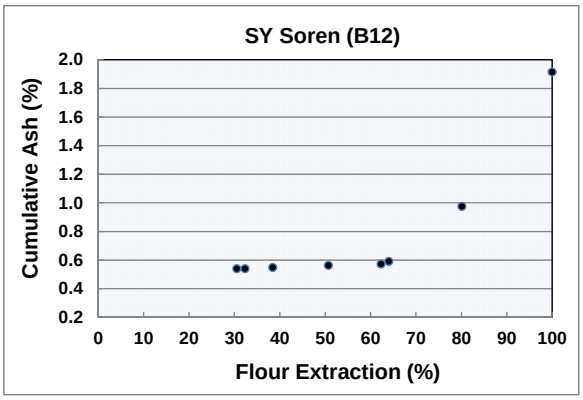
Watertown Cumulative Ash Curves

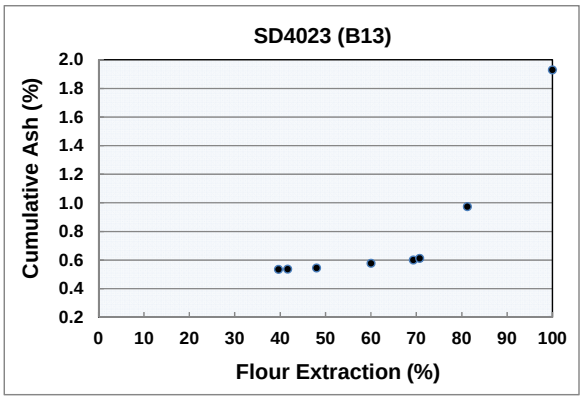




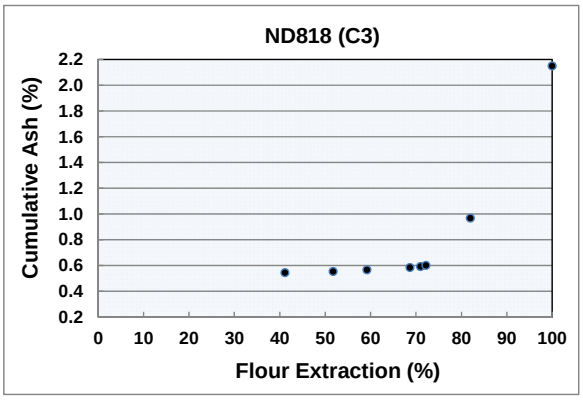


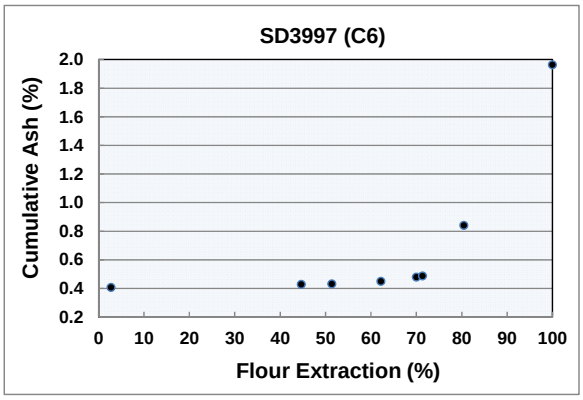


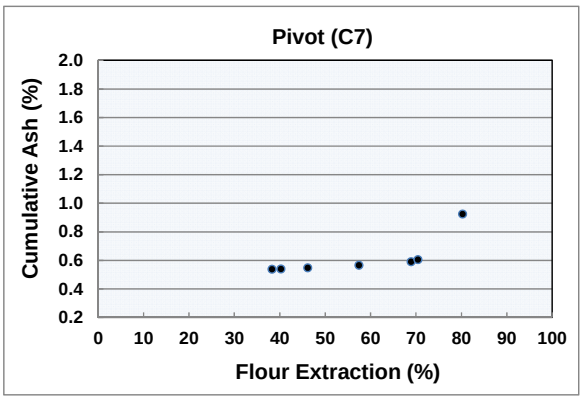


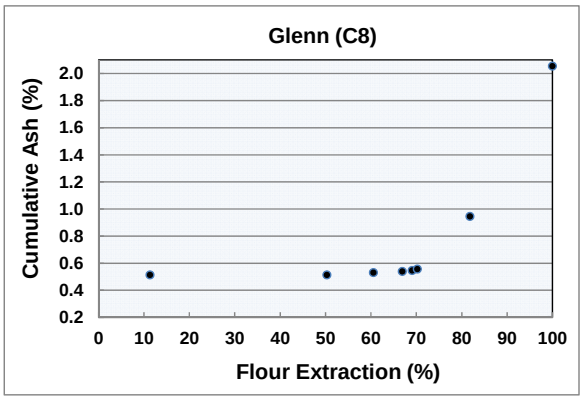


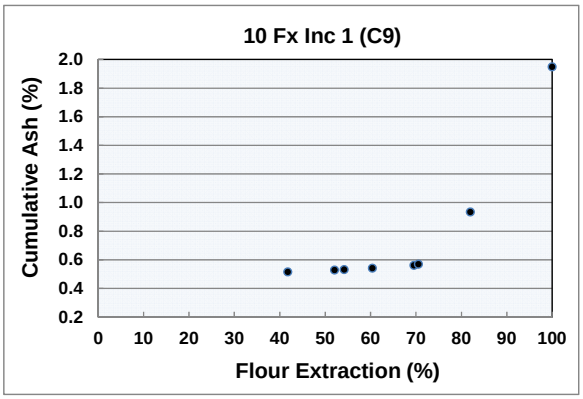
Casselton Cumulative Ash Curves

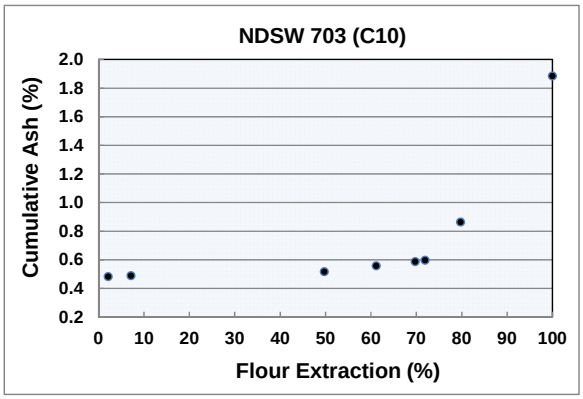


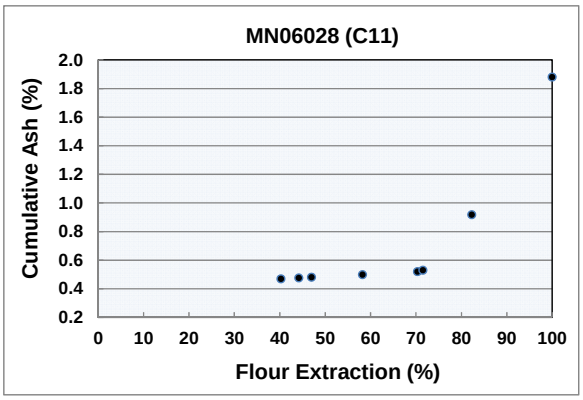


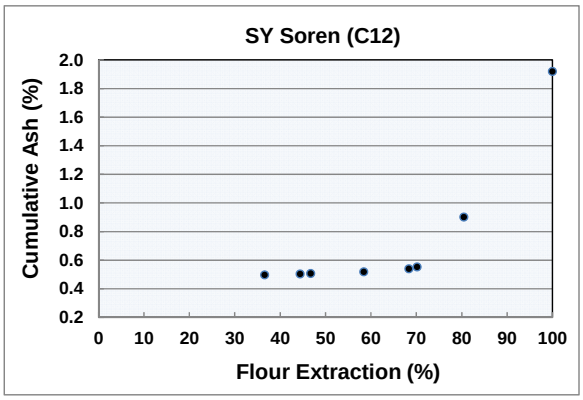


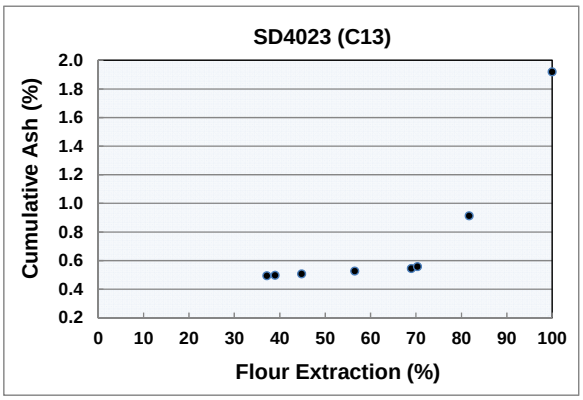


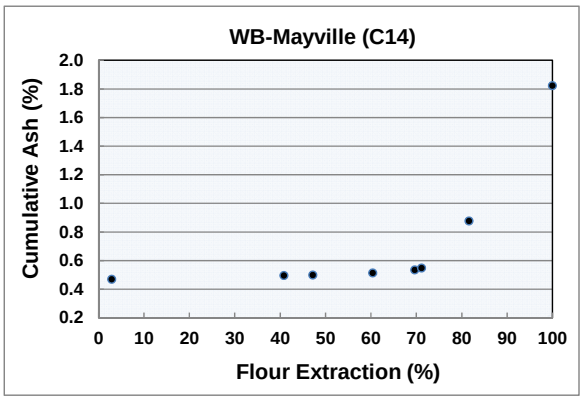




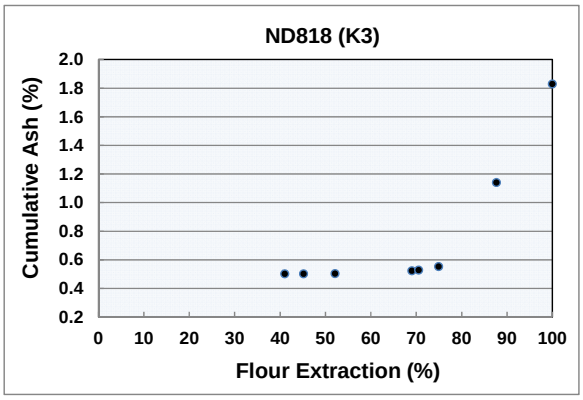


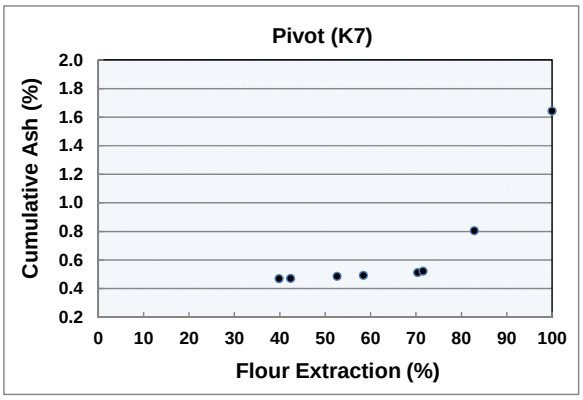


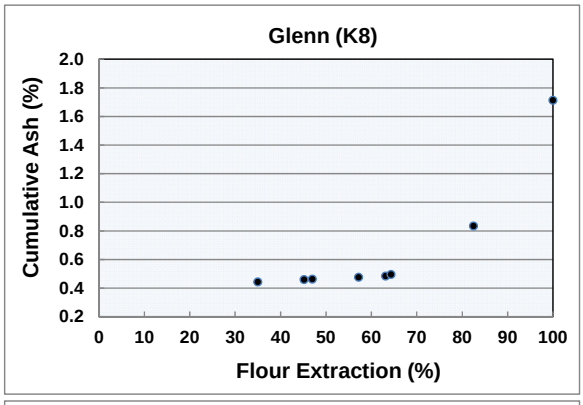

SD4023 (C13)
Cumulative Ash (%)
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0
10
20
30
40
50
60
70
80
90
100
Flour Extraction (%)

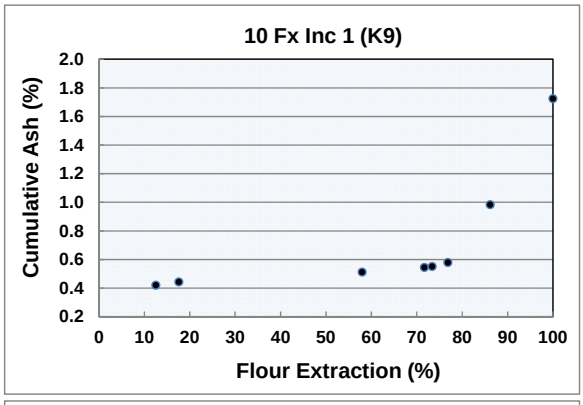

WB-Mayville (C14)
Cumulative Ash (%)
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0
10
20
30
40
50
60
70
80
90
100
Flour Extraction (%)

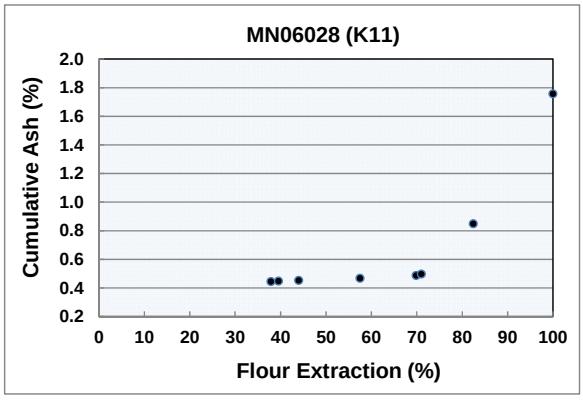
Crookston Cumulative Ash Curves

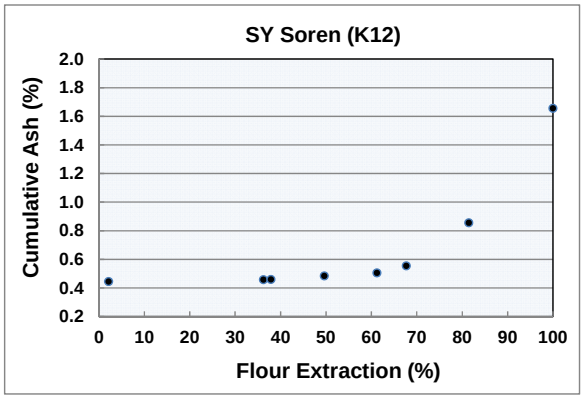


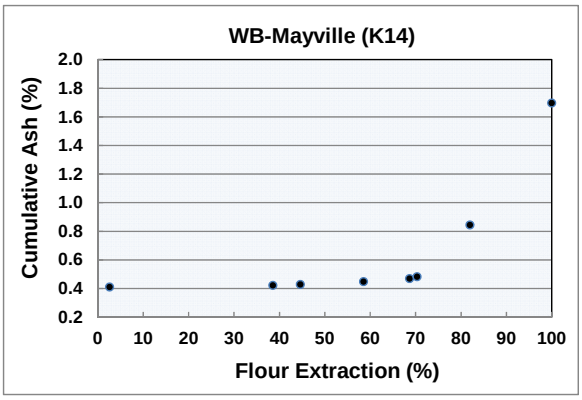




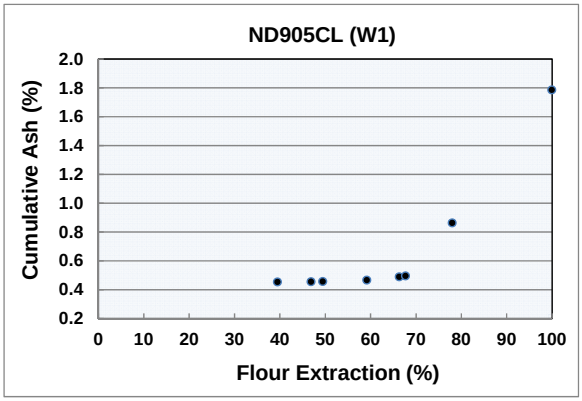


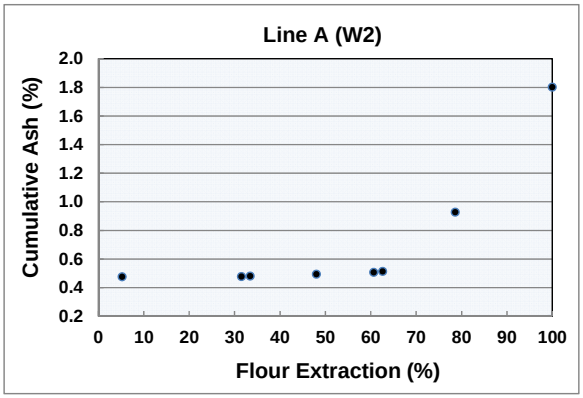


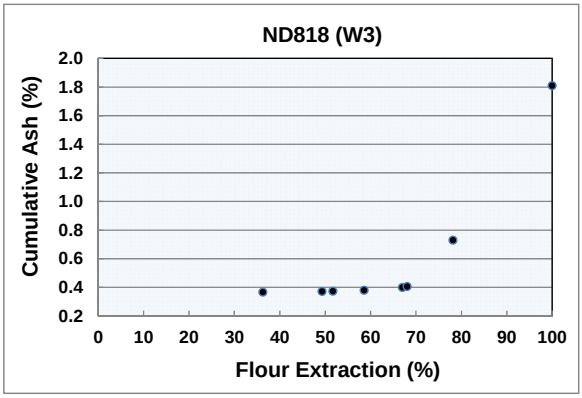


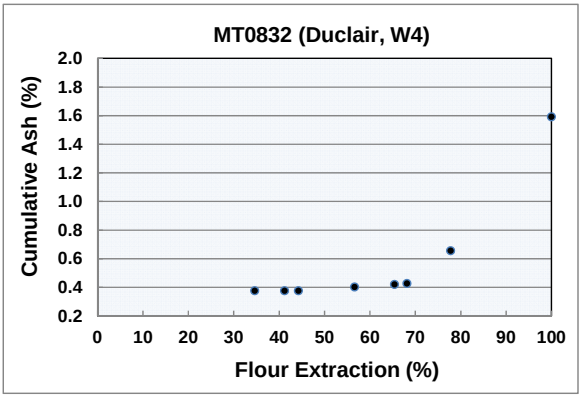


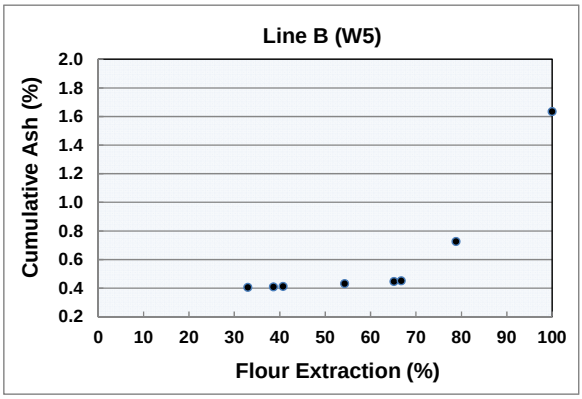
Williston Cumulative Ash Curves

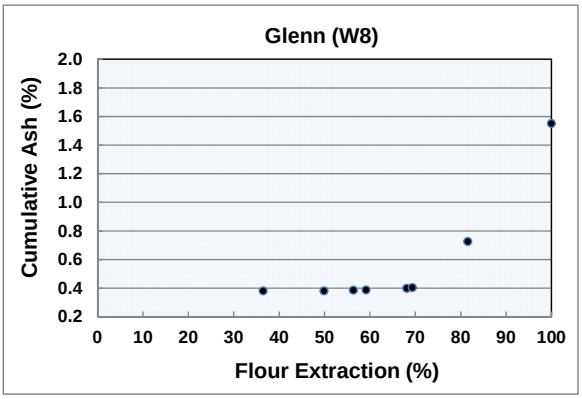


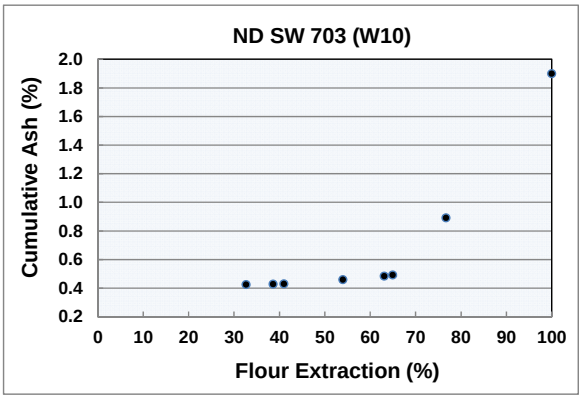






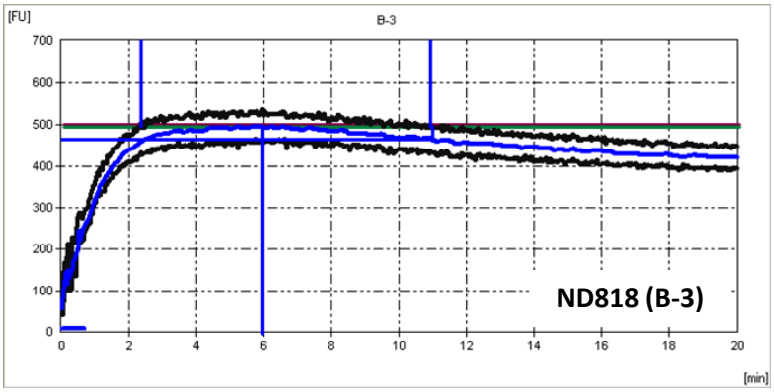


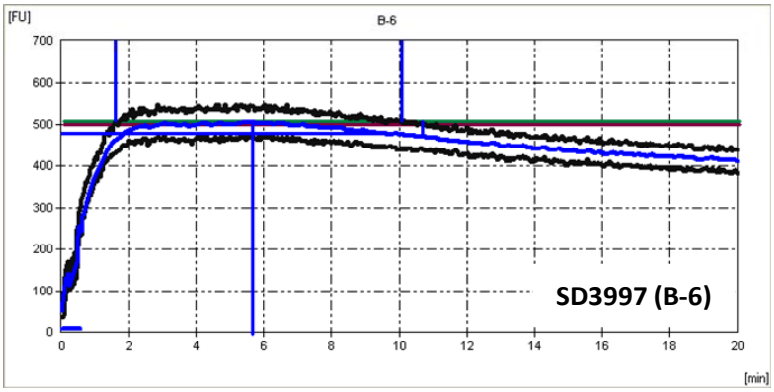


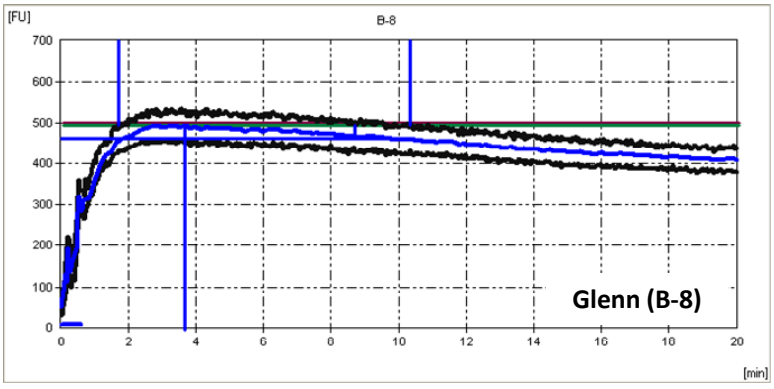


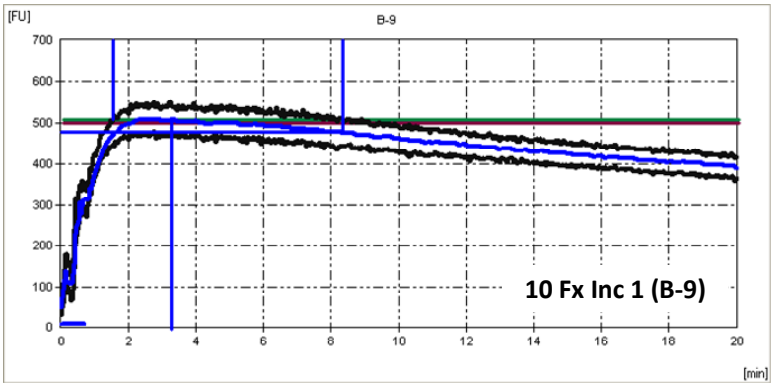
Farinograms

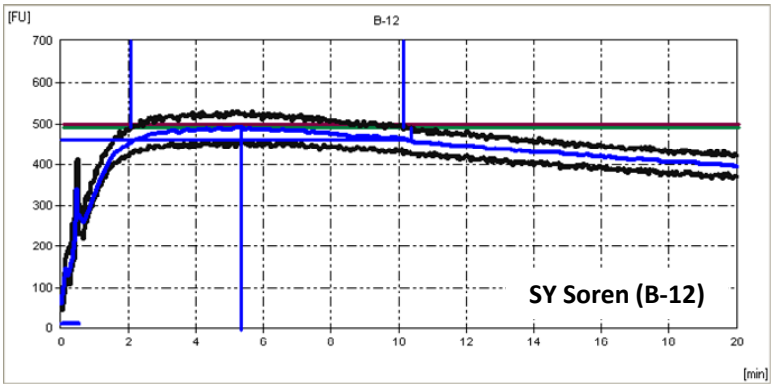
Watertown Farinograms








[FU]
B-9
700
600
500
400
300
200
100
0
0
2
4
6
8
10
12
14
16
18
20
[min]
10 Fx Inc 1 (B-9)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2
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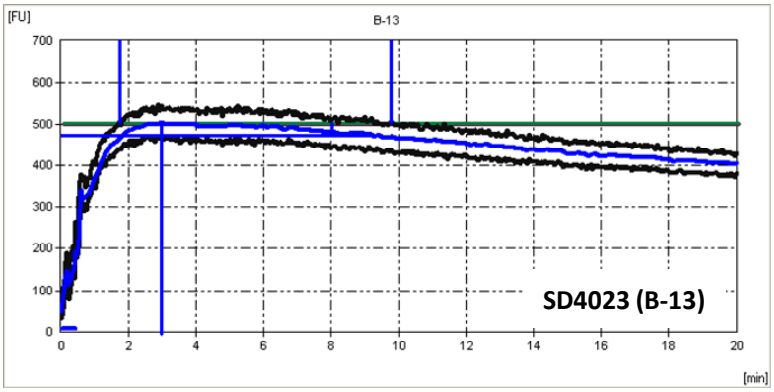
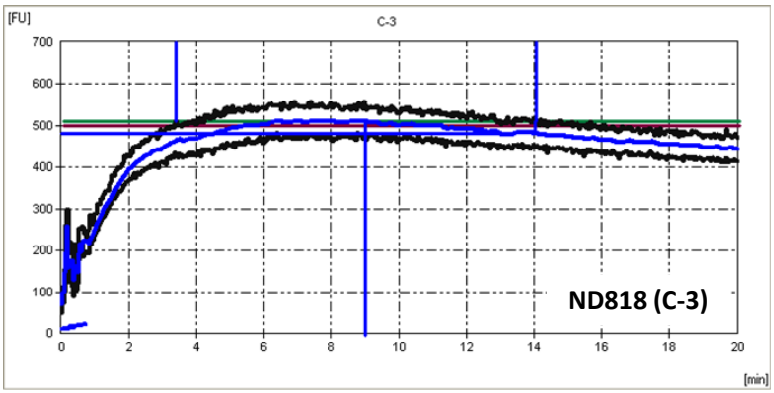
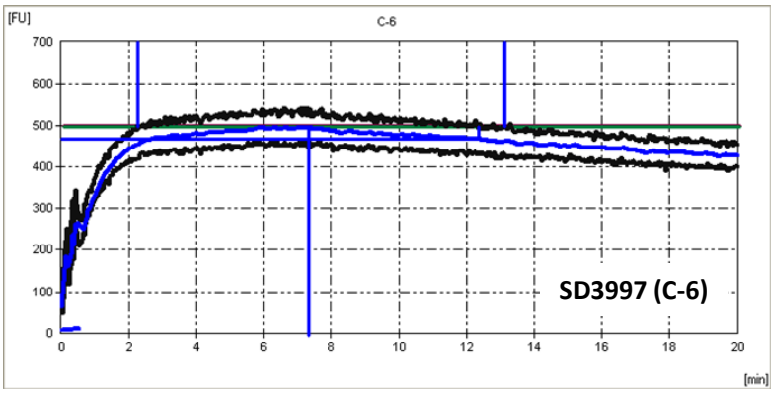
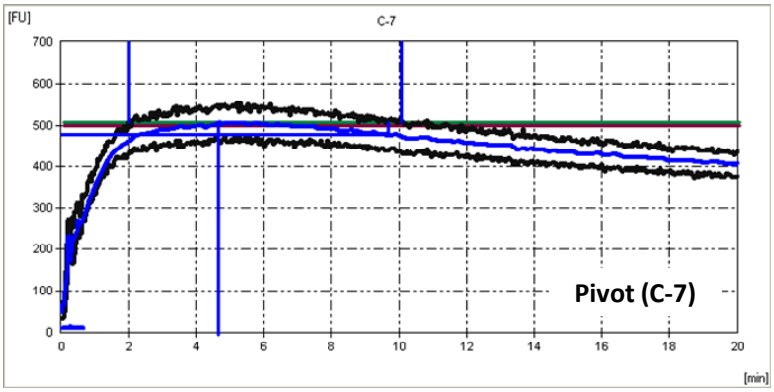
16
18
20
[min]
SY Soren (B-12)

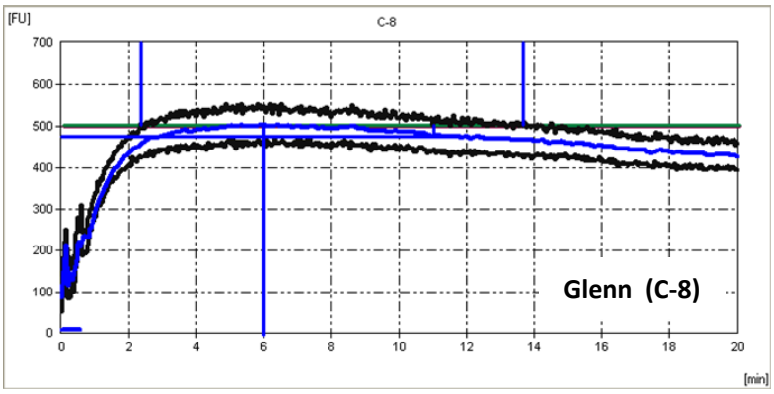

[FU]
B-13
700
600
500
400
300
200
100
0
0
2
4
6
8
10
12
14
16
18
20
[min]
SD4023 (B-13)

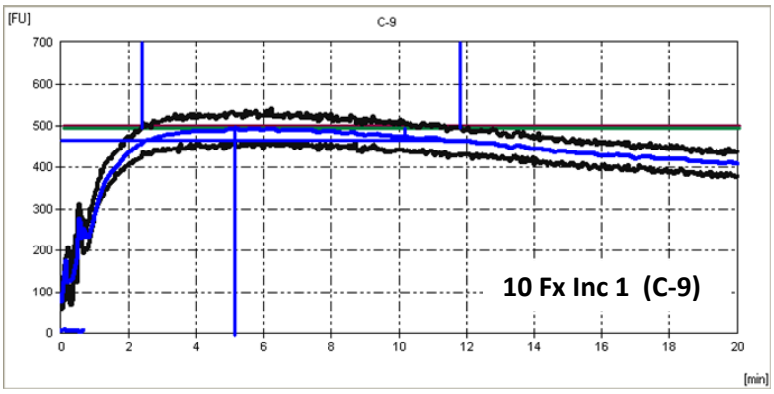
Casselton Farinograms

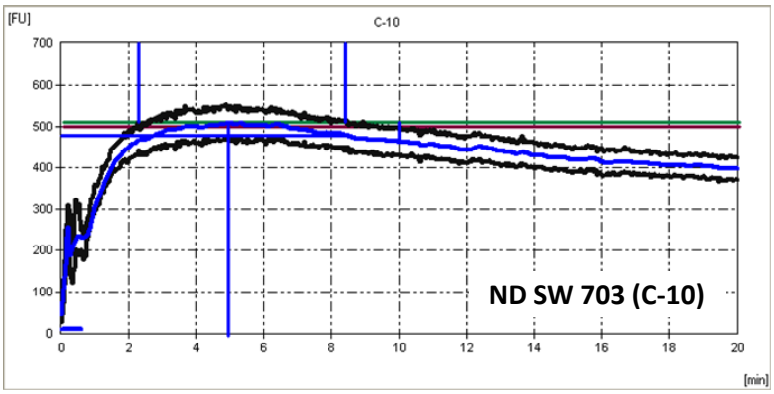


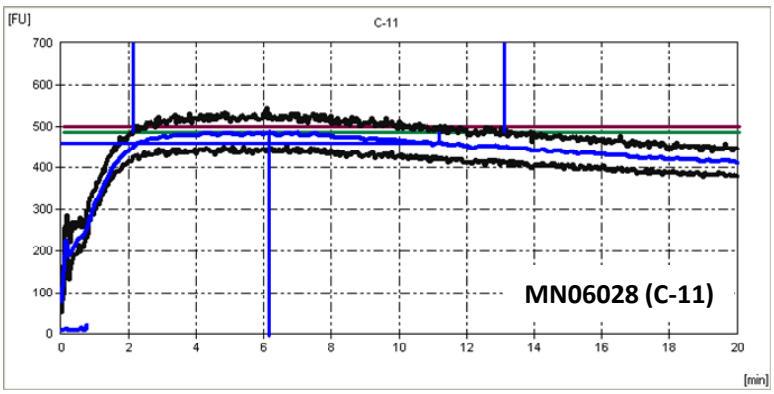


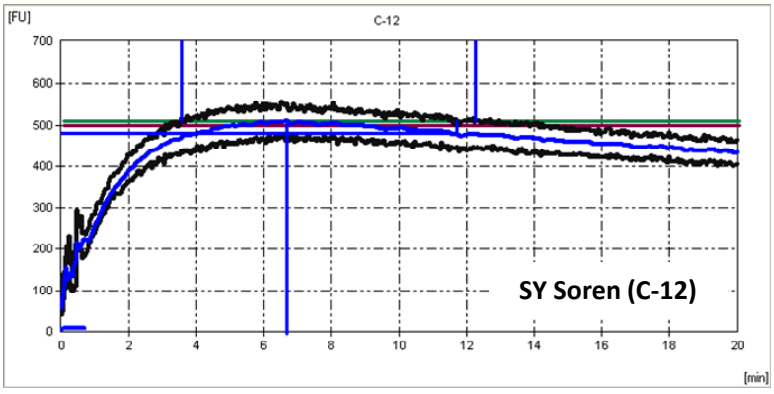


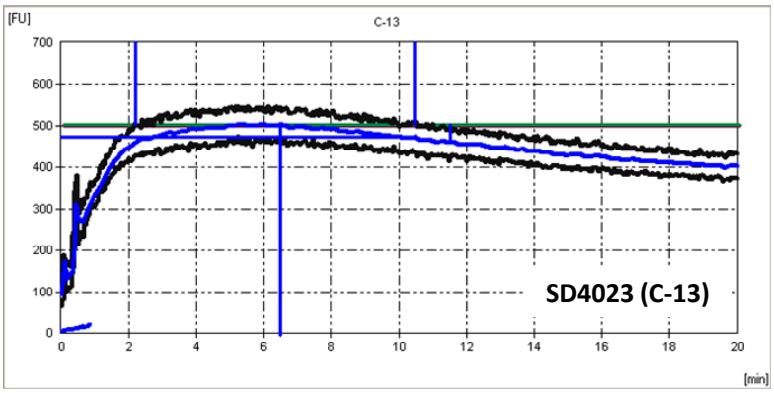


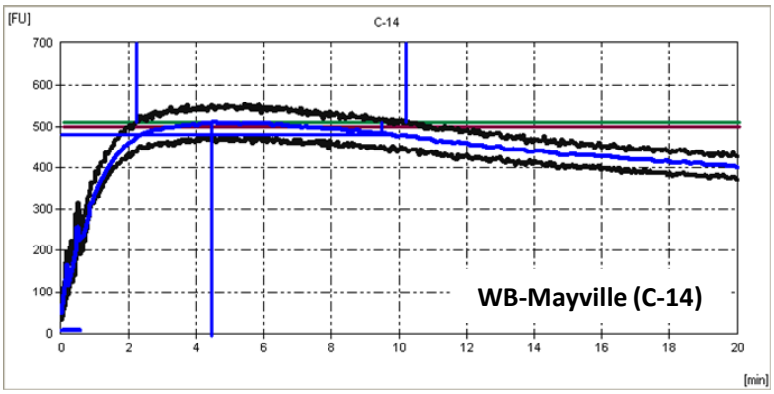

[FU]
C-9
700
600
500
400
300
200
100
0
0
2
4
6
8
10
12
14
16
18
20
[min]
10 Fx Inc 1 (C-9)


[FU]
C-10
700
600
500
400
300
200
100
0
0
2
4
6
8
10
12
14
16
18
20
[min]
ND SW 703 (C-10)


[FU]
C-11
700
600
500
400
300
200
100
0
0
2
4
6
8
10
12
14
16
18
20
[min]
MN06028 (C-11)


[FU]
C-12
700
600
500
400
300
200
100
0
0
2
4
6
8
10
12
14
16
18
20
[min]
SY Soren (C-12)


[FU]
C-13
700
600
500
400
300
200
100
0
0
2
4
6
8
10
12
14
16
18
20
[min]
SD4023 (C-13)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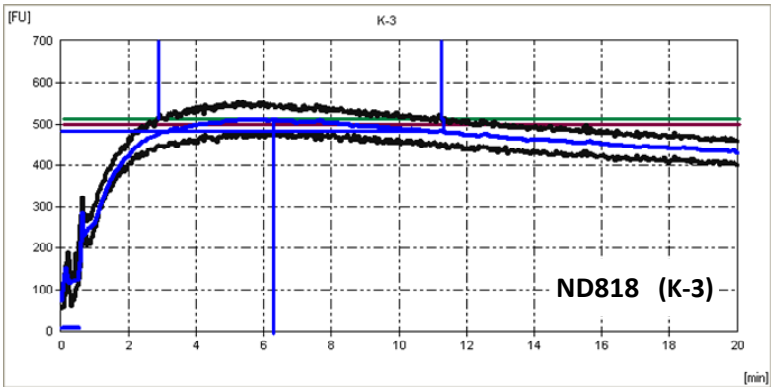
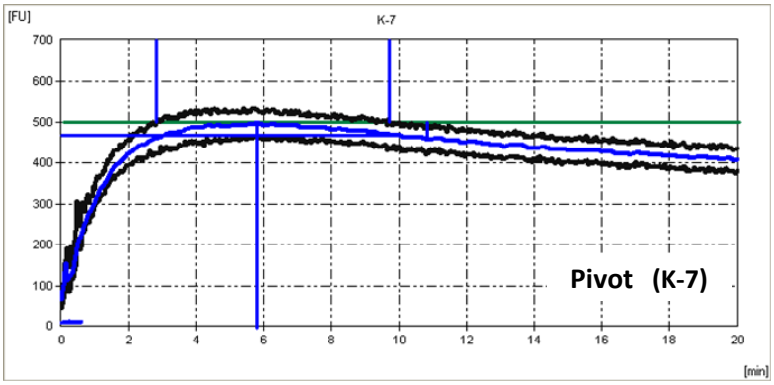
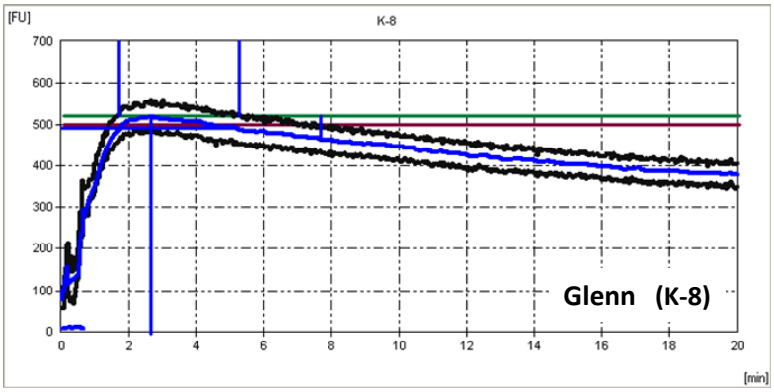
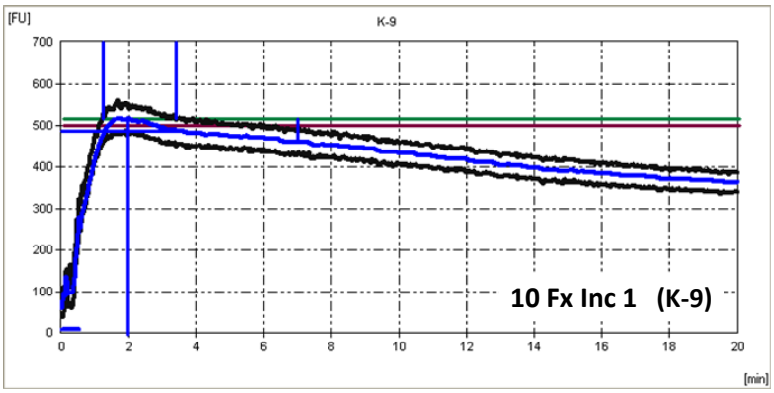
C-14
700
600
500
400
300
200
100
0
0
2
4
6
8
10
12
14
16
18
20
[min]
WB-Mayville (C-14)

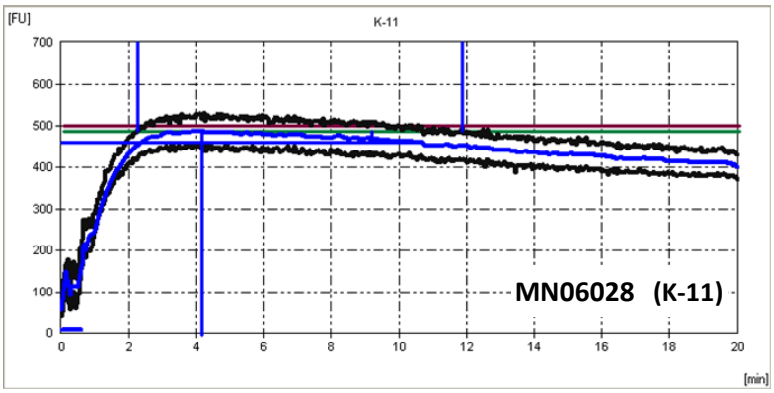
Crookston Farinograms







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K-11
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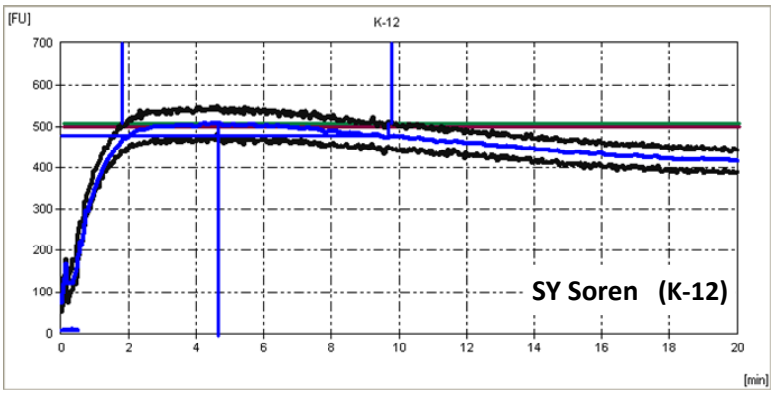
600
500
400
300
200
100
0
0
2
4
6
8
10
12
14
16
18
20
[min]
MN06028 (K-11)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600
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2
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16
18
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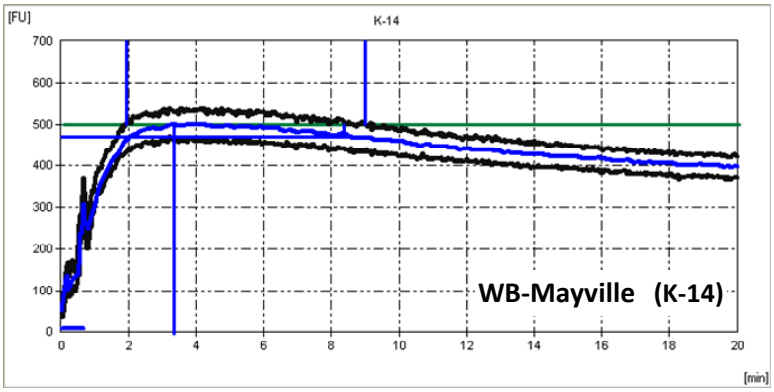
SY Soren (K-12)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500
400
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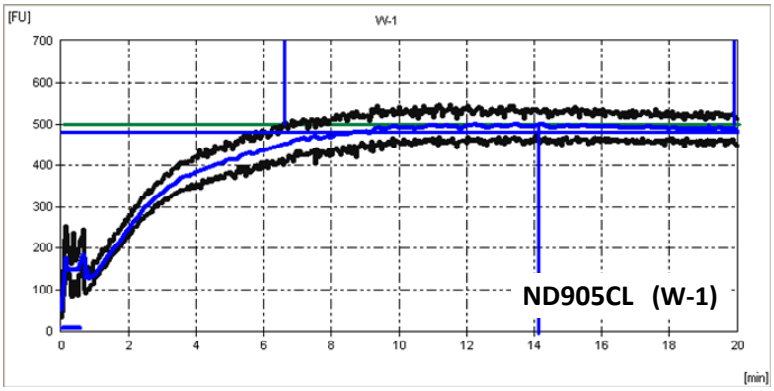
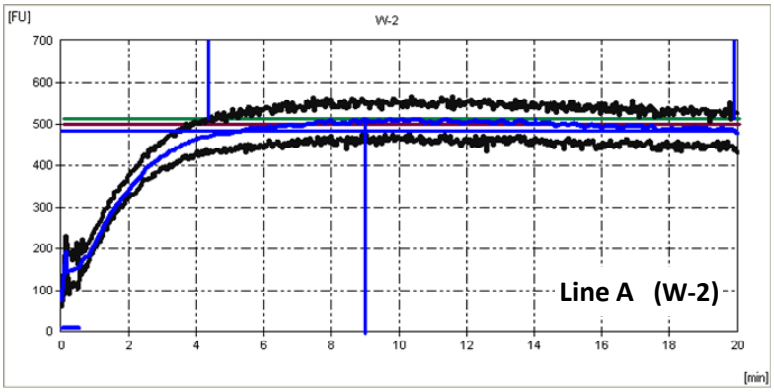
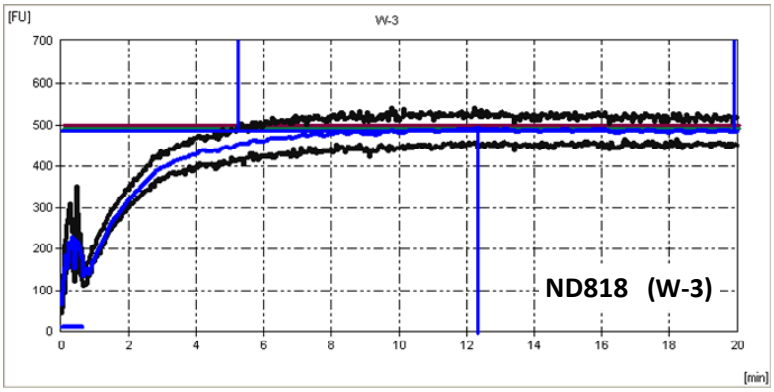
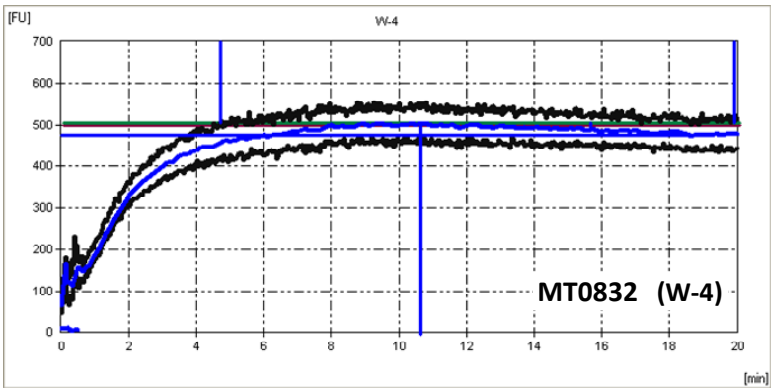
12
14
16
18
20
[min]
WB-Mayville (K-14)

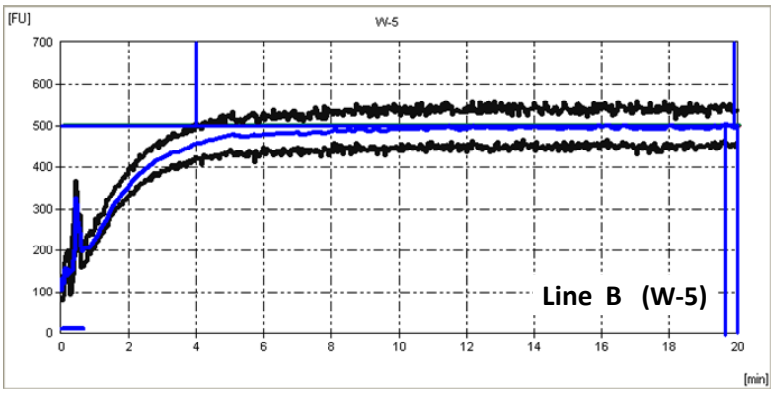
Williston Farinograms

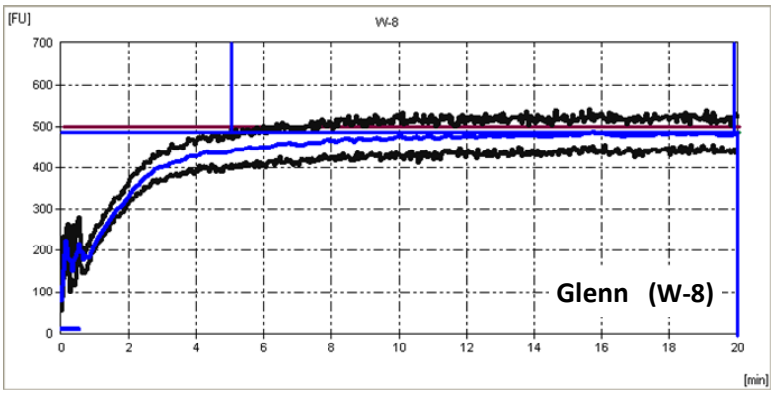









[FU]
W-5
700
600
500
400
300
200
100
0
0
2
4
6
8
10
12
14
16
18
20
[min]
Line B (W-5)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W-8
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600
500
400
300
200
100
0
0
2
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6
8
10
12
14
16
18
20
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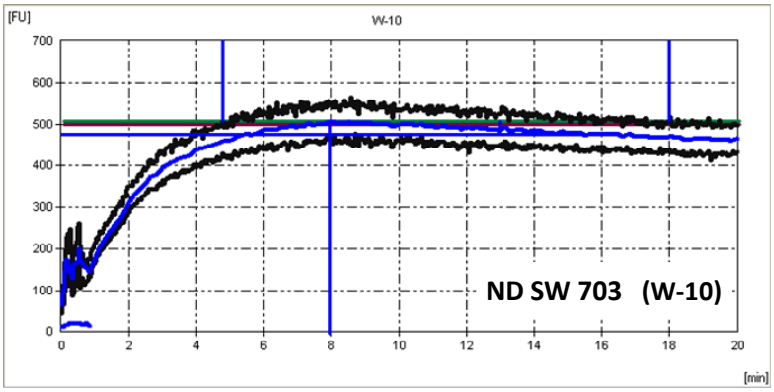
Glenn (W-8)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W-10
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600
500
400
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100
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2
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6
8
10
12
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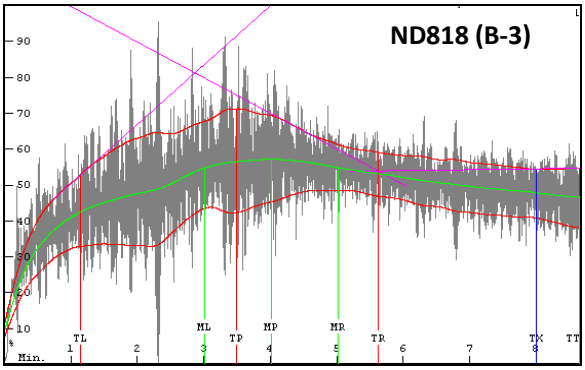
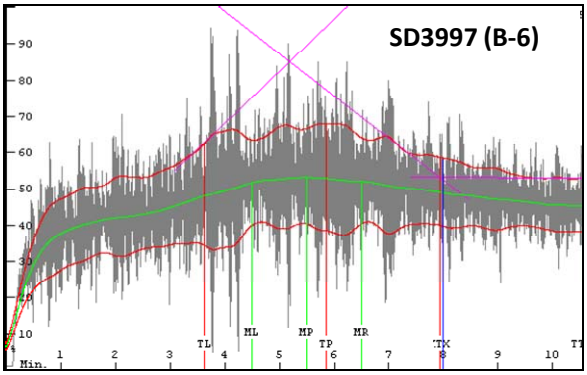
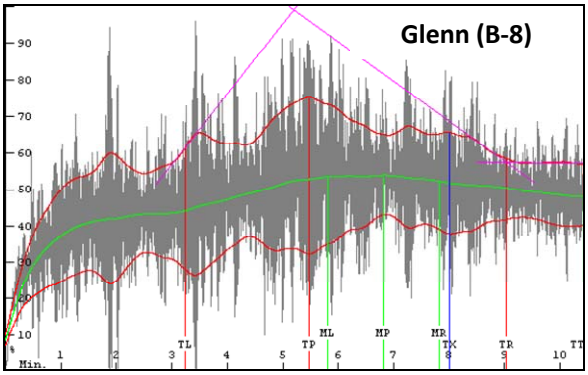
18
20
[min]
ND SW 703 (W-10)

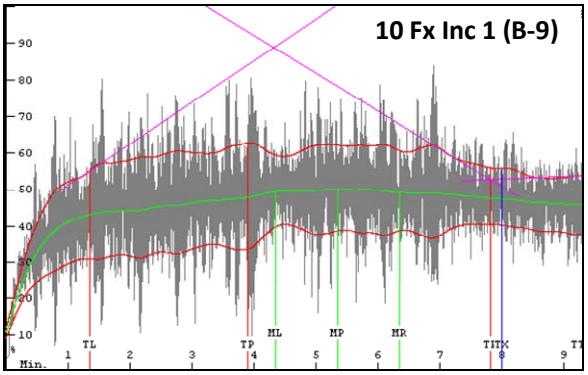
Mixograms

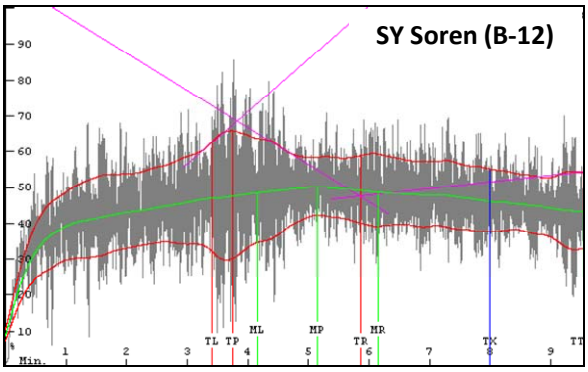
Watertown Mixograms

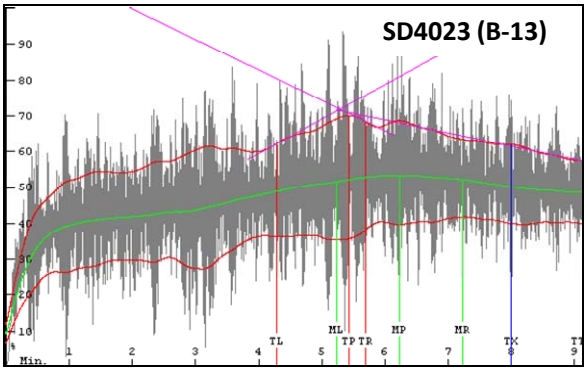




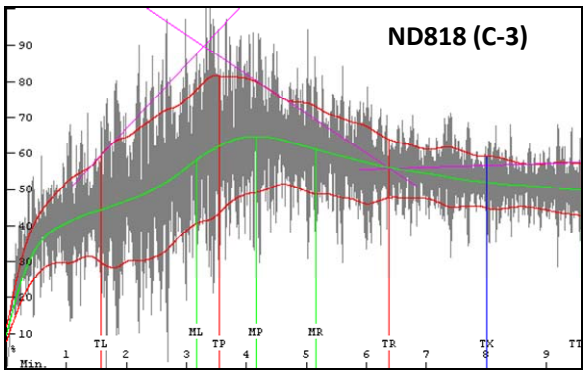


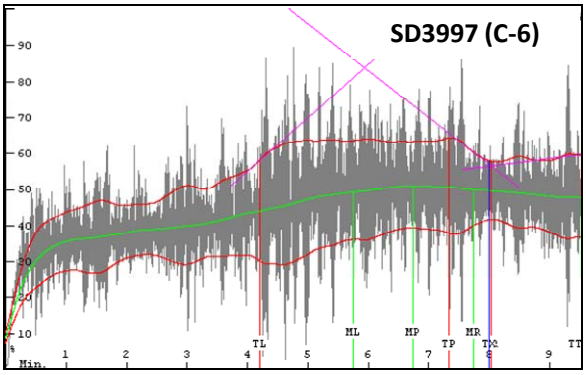


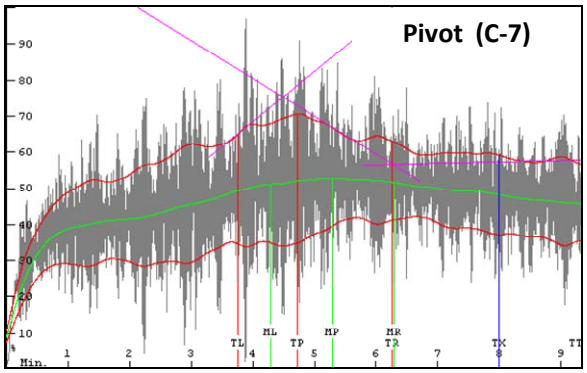


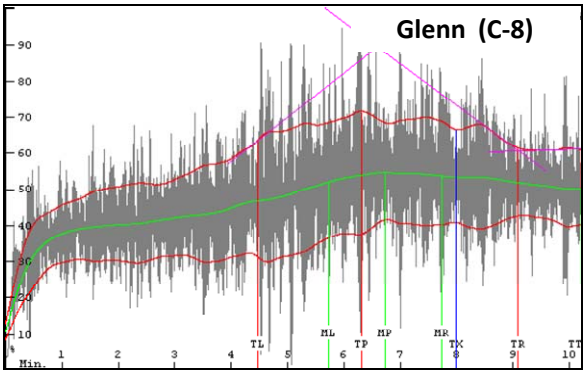


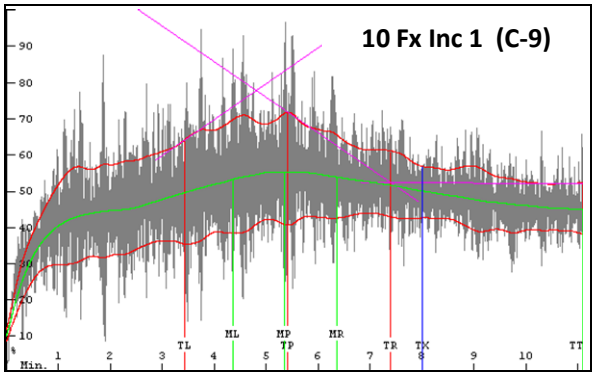
Casselton Mixograms

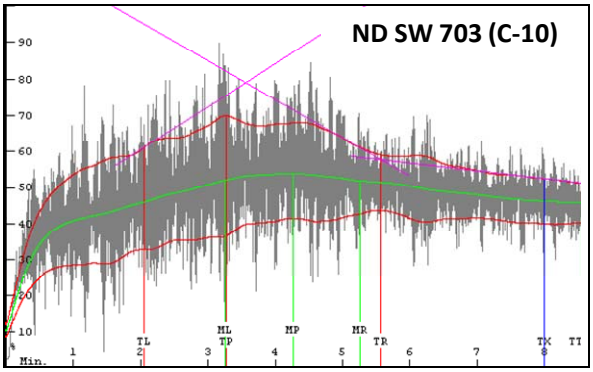


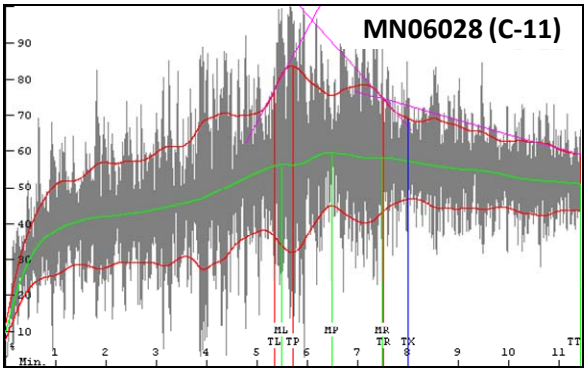


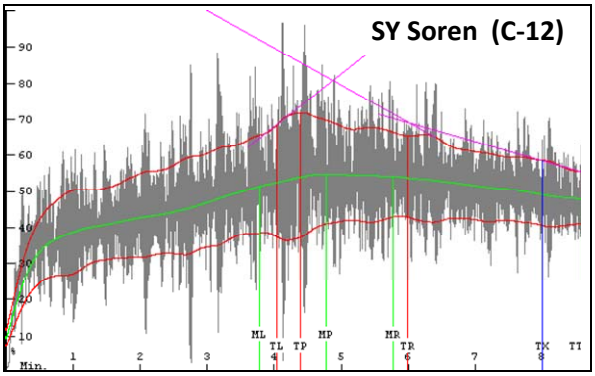


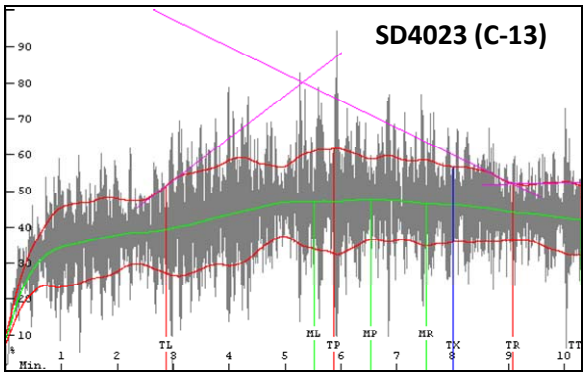


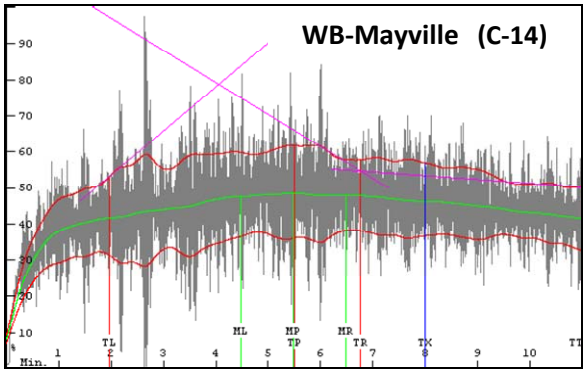









SD4023 (C-13)
90
80
70
60
50
40
30
20
10
%
Min.
1
2
3
4
5
6
7
8
9
10
TL
ML
TP
MP
MR
TX
TR
TT


WB-Mayville (C-14)
90
80
70
60
50
40
30
20
10
%
Min.
1
2
3
4
5
6
7
8
9
10
TL
ML
MP
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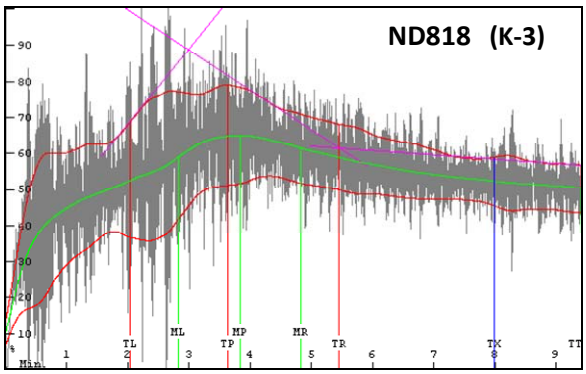
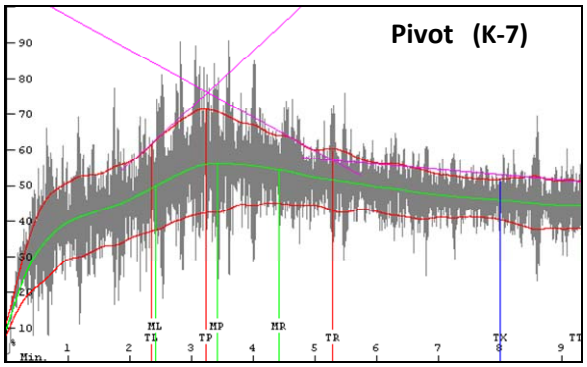
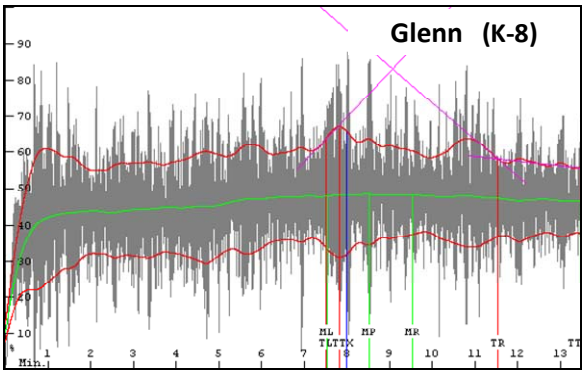
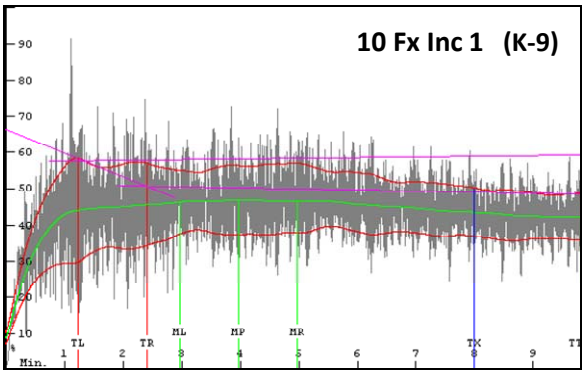
MR
TR
TX
TT

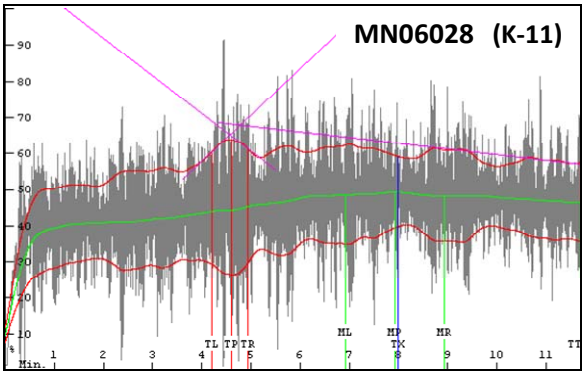
Crookston Mixograms

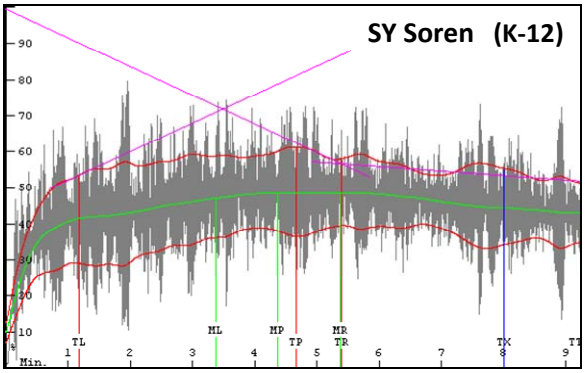


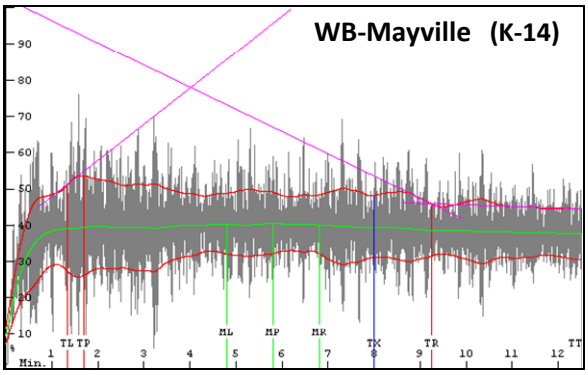




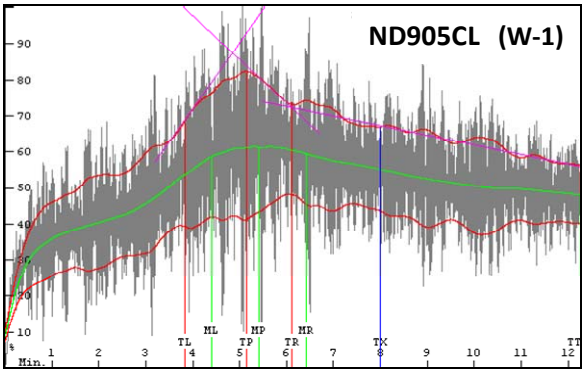


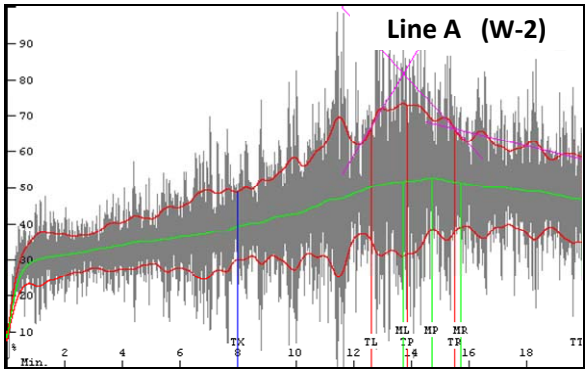


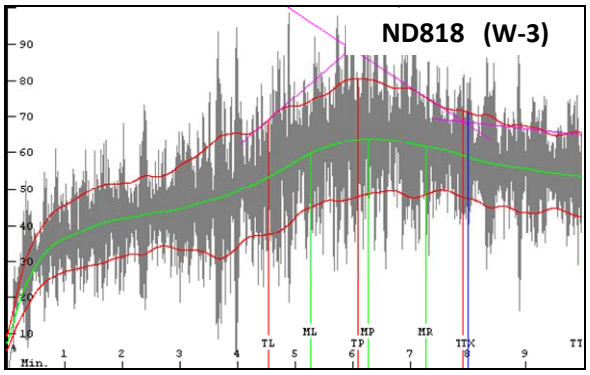


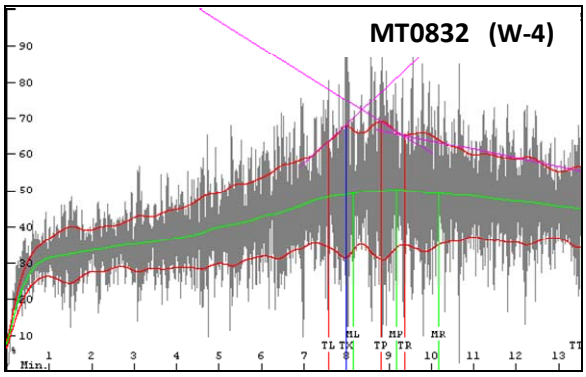


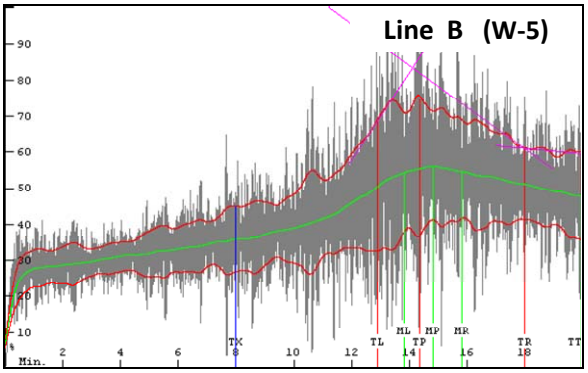
Williston Mixograms

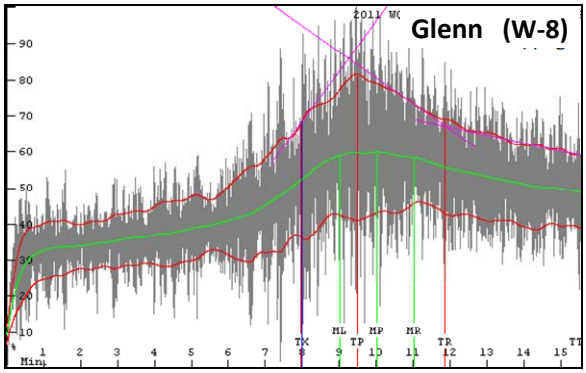


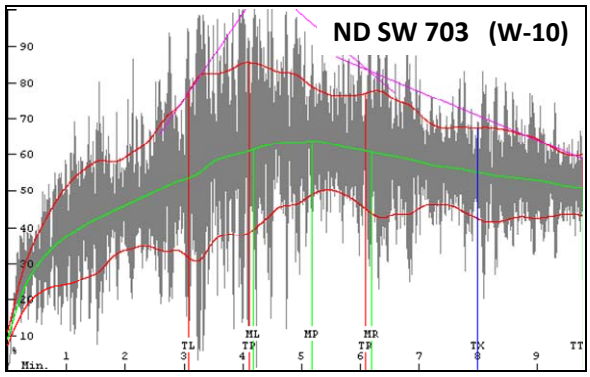












Wheat Kernel Characteristics by Location

ID		Protein (12% mb)		Market Score		Test Weight (lb/bu)	1000 Kernel Weight (g)	Kernel Size		Wheat Ash (14% mb) (%)	Wheat Falling No (sec)
		Wheat (%)	Flour (%)	1 to 6	1 to 10			Large (%)	Small (%)		
Watertown (B)											
ND818	B3	14.9	14.1	2.3	7.4	55.9	20.6	10	32	1.99	381
SD3997	B6	13.8	13.2	2.5	8.6	59.4	23.0	13	33	1.86	365
Glenn	B8	14.4	13.8	3.0	-	61.6	23.5	14	24	1.89	349
10 Fx Inc 1	B9	13.2	12.1	2.5	8.4	59.8	22.4	15	28	1.90	388
SY Soren	B12	13.8	12.9	2.5	7.8	58.3	21.4	9	31	1.89	400+
SD4023	B13	13.1	12.1	2.5	8.0	58.9	22.9	13	26	1.86	400+
Casselton (C)											
ND818	C3	15.0	14.3	2.9	9.2	59.4	19.6	4	47	2.03	400+
SD3997	C6	15.0	13.8	2.9	9.2	58.7	22.1	4	36	1.92	400+
Pivot	C7	14.5	13.7	2.3	6.8	55.6	19.0	3	38	2.07	400+
Glenn	C8	15.3	14.4	3.4	-	61.0	22.0	8	32	1.94	400+
10 Fx Inc 1	C9	13.8	13.0	2.9	8.2	60.3	22.1	9	26	1.92	400+
ND SW 703	C10	13.3	12.4	2.2	6.2	53.0	24.5	6	25	1.89	400+
MN06028	C11	14.0	13.2	2.8	8.0	58.3	25.5	16	19	1.85	400+
SY Soren	C12	14.6	13.8	2.8	8.6	58.8	20.7	5	33	1.88	400+
SD4023	C13	13.5	12.4	2.7	7.8	59.8	21.8	6	32	1.94	400+
WB-Mayville	C14	14.0	13.4	3.0	8.4	59.8	23.1	28	18	1.82	400+
Crookston (K)											
ND818	K3	13.6	13.1	3.5	8.8	61.2	28.2	38	13	1.76	400+
Pivot	K7	14.3	13.4	3.3	8.0	59.2	27.0	32	15	1.64	400+
Glenn	K8	12.8	12.3	3.8	-	63.7	30.5	55	8	1.70	400+
10 Fx Inc 1	K9	10.9	10.0	3.3	7.8	62.5	31.6	68	7	1.64	400+
MN06028	K11	13.0	12.2	3.9	9.2	62.0	34.7	63	6	1.72	400+
SY Soren	K12	13.3	12.3	3.6	8.8	61.6	27.9	45	11	1.62	400+
WB-Mayville	K14	12.6	11.9	3.7	9.6	62.0	33.1	73	7	1.67	400+
Williston (W)											
ND905CL	W1	17.5	16.7	3.4	8.4	56.0	23.9	9	29	1.66	400+
Line A	W2	16.8	16.5	3.2	7.8	54.6	22.7	22	20	1.78	400+
ND818	W3	16.0	15.1	3.6	9.0	59.2	23.1	17	26	1.66	400+
MT0832	W4	16.7	16.6	3.3	8.0	54.6	22.5	6	35	1.67	400+
Line B	W5	16.6	16.5	3.3	8.0	54.5	21.9	4	39	1.62	400+
Glenn	W8	16.8	16.7	4.1	-	60.4	23.2	8	26	1.63	400+
ND SW 703	W10	16.8	15.6	3.3	7.8	51.4	25.8	11	28	1.82	400+

Wheat Single Kernel Characteristics, Vitreous Kernel, Mycotoxin, and Flour Damaged Starch Data by Location

		Single Kernel Characteristics*						Vitreous Kernels	Mycotoxin (DON)**	Flour Damaged Starch**
		Hardness		Weight (mg)		Diameter (mm)				
ID		Mean	SD	Mean	SD	Mean	SD	(%)	(ppm, as is)	(%, as is)
Watertown (B)										
ND818	B3	74.9	18.7	22.1	6.4	2.26	0.25	84	3.25	7.4
SD3997	B6	69.7	17.3	23.5	6.5	2.34	0.26	57	1.45	6.6
Glenn	B8	82.1	16.1	24.7	6.1	2.45	0.24	88	2.43	7.4
10 Fx Inc 1	B9	75.5	19.2	24.6	6.8	2.38	0.28	48	1.76	7.9
SY Soren	B12	76.0	17.6	22.6	6.3	2.33	0.24	55	1.12	6.6
SD4023	B13	71.2	17.6	23.9	6.2	2.36	0.25	52	3.00	7.3
Casselton (C)										
ND818	C3	77.0	16.5	21.1	6.3	2.20	0.25	90	0.38	6.2
SD3997	C6	66.5	16.1	22.3	5.4	2.30	0.24	46	0.41	5.1
Povot	C7	66.4	16.5	21.3	5.9	2.26	0.23	32	1.53	6.4
Glenn	C8	79.3	16.7	22.9	6.4	2.37	0.27	91	0.86	6.9
10 Fx Inc 1	C9	79.4	18.7	23.4	6.4	2.39	0.25	49	0.79	8.0
ND SW 703	C10	51.3	17.0	24.7	6.9	2.32	0.25	9	2.27	5.9
MN06028	C11	81.2	15.9	24.2	6.0	2.42	0.26	54	1.21	5.9
SY Soren	C12	79.2	17.4	20.7	5.6	2.32	0.23	54	0.29	6.0
SD4023	C13	64.3	18.5	23.6	5.9	2.35	0.23	58	1.00	5.9
WB-Mayville	C14	73.9	16.1	24.5	5.9	2.47	0.25	55	0.95	5.4
Crookston (K)										
ND818	K3	87.1	16.3	26.4	6.9	2.52	0.26	87	1.00	8.1
Povot	K7	76.0	17.9	25.2	7.0	2.51	0.28	45	2.37	7.2
Glenn	K8	97.4	16.5	27.1	5.7	2.65	0.25	92	0.83	9.9
10 Fx Inc 1	K9	70.9	19.0	29.3	7.3	2.72	0.31	10	0.97	8.0
MN06028	K11	87.7	16.8	28.9	7.1	2.66	0.27	47	1.62	7.2
SY Soren	K12	84.8	16.8	25.6	6.4	2.60	0.25	52	1.04	8.5
WB-Mayville	K14	76.9	15.5	30.5	6.5	2.75	0.28	45	0.00	7.3
Williston (W)										
ND905CL	W1	80.7	18.0	23.1	7.3	2.40	0.24	92	0.00	6.2
Line A	W2	59.3	15.3	25.4	6.8	2.40	0.26	82	0.00	4.6
ND818	W3	78.1	18.4	23.8	6.8	2.35	0.26	87	0.00	6.3
MT0832	W4	47.8	17.2	23.9	7.5	2.31	0.24	46	0.00	4.3
Line B	W5	54.8	16.8	22.3	6.4	2.16	0.23	55	0.00	4.1
Glenn	W8	66.0	17.6	23.4	7.3	2.40	0.23	56	0.00	5.7
ND SW 703	W10	51.2	16.9	26.1	7.6	2.34	0.26	6	0.00	5.0

*Mean and standard deviation (SD) values of single kernel characteristics were calculated from 300 kernels

**Deoxynivalenol (DON) and flour damaged starch values were provided by NDSU Hard Spring Wheat Quality Lab.

Flour Characteristics by Location

ID		Flour Extraction			Flour Color				Flour Moisture (%)	Flour Ash (14% mb) (%)	Falling No (Malted) (sec)
		TWB (%)	TPB (%)	Flour /Bu Wheat (lbs)	L*	b*	L	b			
Watertown (B)											
ND818	B3	66.2	69.8	41.8	91.0	8.3	88.5	8.0	12.6	0.578	270
SD3997	B6	68.4	74.7	43.4	90.2	8.0	87.7	7.7	12.6	0.564	260
Glenn	B8	64.6	70.4	40.5	90.3	7.8	87.7	7.5	13.3	0.550	251
10 Fx Inc 1	B9	65.9	69.7	41.6	91.1	7.6	88.7	7.3	12.8	0.525	258
SY Soren	B12	60.3	64.0	38.4	91.2	9.3	88.9	9.0	12.1	0.569	251
SD4023	B13	66.2	70.8	41.8	91.3	8.7	89.0	8.4	12.6	0.556	258
Casselton (C)											
ND818	C3	68.2	72.2	43.0	90.0	9.8	87.4	9.3	12.8	0.572	249
SD3997	C6	67.1	71.3	42.3	90.5	8.1	87.9	7.8	12.5	0.442	260
Pivot	C7	66.6	70.4	42.1	90.8	10.1	88.3	9.6	12.4	0.579	257
Glenn	C8	66.5	70.2	41.9	90.0	8.2	87.3	7.9	12.7	0.521	245
10 Fx Inc 1	C9	66.5	70.5	41.9	91.2	7.6	88.8	7.4	12.8	0.536	253
ND SW 703	C10	66.4	71.9	42.1	91.6	7.9	89.3	7.7	12.3	0.567	249
MN06028	C11	67.5	71.6	42.9	91.2	7.2	88.9	7.0	12.5	0.482	247
SY Soren	C12	66.2	70.2	41.7	90.7	10.2	88.2	9.7	12.6	0.518	255
SD4023	C13	66.7	70.4	42.1	91.0	9.6	88.6	9.2	12.1	0.503	248
WB-Mayville	C14	67.2	71.2	42.5	90.4	8.6	87.9	8.3	12.6	0.458	254
Crookston (K)											
ND818	K3	70.1	75.0	44.3	90.8	9.0	88.4	8.7	12.4	0.520	254
Pivot	K7	67.3	71.7	42.6	90.9	10.1	88.5	9.6	12.3	0.497	260
Glenn	K8	60.8	64.3	38.4	91.4	7.0	89.0	6.8	12.4	0.480	250
10 Fx Inc 1	K9	71.2	77.0	44.7	90.7	8.2	88.2	7.9	12.8	0.531	250
MN06028	K11	67.1	71.0	42.4	91.8	6.5	89.6	6.3	12.5	0.496	245
SY Soren	K12	63.9	67.7	40.4	91.2	9.4	88.9	9.0	12.4	0.511	260
WB-Mayville	K14	66.5	70.4	42.0	91.3	7.8	88.9	7.6	12.0	0.511	265
Williston (W)											
ND905CL	W1	62.0	67.8	39.1	90.0	9.4	87.4	9.0	12.8	0.454	242
Line A	W2	55.2	62.5	34.9	91.4	8.6	89.0	8.3	12.4	0.529	249
ND818	W3	64.0	68.1	40.2	91.0	9.0	88.6	8.6	12.9	0.409	246
MT0832	W4	63.3	68.0	39.8	91.6	7.3	89.3	7.1	12.7	0.432	246
Line B	W5	59.8	66.7	37.7	91.6	7.3	89.3	7.1	13.0	0.457	247
Glenn	W8	66.2	69.3	41.5	91.1	7.7	88.7	7.5	13.3	0.432	250
ND SW 703	W10	61.2	65.0	38.7	91.3	8.0	88.9	7.8	12.4	0.454	246

Farinograph Characteristics by Location

Sample ID		Water Abs (500bu) (%)	Water Abs (14% mb) (%)	Arrival Time (min)	Peak Time (min)	Dough Stability (min)	MTI (bu)	TTB (min)
Watertown (B)								
ND818	B3	66.0	64.3	1.7	6.0	8.6	30.0	11.0
SD3997	B6	63.2	61.1	1.6	5.7	8.4	36.0	10.0
Glenn	B8	63.0	62.1	1.7	3.7	8.6	26.0	9.6
10 Fx Inc 1	B9	63.6	62.0	1.6	3.3	6.8	33.0	8.1
SY Soren	B12	63.8	61.5	2.1	5.4	8.1	32.0	10.3
SD4023	B13	60.5	58.9	1.8	3.0	8.1	23.0	9.2
Casselton (C)								
ND818	C3	63.9	62.3	3.4	9.0	10.7	31.0	13.0
SD3997	C6	61.9	60.2	2.3	7.4	10.9	28.0	12.4
Pivot	C7	61.6	60.0	2.0	4.7	8.1	31.0	9.6
Glenn	C8	63.1	61.6	2.4	6.0	11.3	26.0	11.8
10 Fx Inc 1	C9	64.0	62.4	2.4	5.2	9.4	19.0	11.4
ND SW 703	C10	62.2	59.9	2.3	5.0	6.1	46.0	8.4
MN06028	C11	61.7	59.8	2.2	6.2	11.0	28.0	11.0
SY Soren	C12	62.7	61.1	3.6	6.7	8.7	33.0	11.5
SD4023	C13	60.1	58.3	2.2	6.5	8.3	45.0	10.0
WB-Mayville	C14	62.0	60.3	2.2	4.5	8.0	27.0	9.8
Crookston (K)								
ND818	K3	66.1	64.3	2.9	6.3	8.4	30.0	10.9
Pivot	K7	62.5	60.7	2.8	5.8	6.9	41.0	9.8
Glenn	K8	66.1	64.2	1.7	2.7	3.6	56.0	5.2
10 Fx Inc 1	K9	62.6	61.2	1.3	2.0	2.1	56.0	3.6
MN06028	K11	61.7	59.9	2.3	4.2	9.6	19.0	10.7
SY Soren	K12	64.4	62.3	1.8	4.7	8.0	35.0	9.5
WB-Mayville	K14	62.4	60.2	1.9	3.4	7.1	23.0	8.6
Williston (W)								
ND905CL	W1	65.0	63.6	6.6	14.2	13.3	11.0	20.0
Line A	W2	62.3	60.0	4.3	9.0	15.6	12.0	20.0
ND818	W3	64.2	63.0	5.2	12.4	14.7	5.0	20.0
MT0832	W4	61.1	59.7	4.7	10.7	15.2	16.0	18.6
Line B	W5	60.3	58.8	4.0	19.7	15.9	2.0	20.0
Glenn	W8	62.6	61.6	5.1	20.0	14.9	3.0	20.0
ND SW 703	W10	64.3	62.5	4.8	8.0	13.2	22.0	15.4

Mixograph Characteristics by Location

Sample ID		Water Abs* (14% mb)	Envelope Peak Time (min)	Envelope Peak Value (%)	Envelope Peak Width (%)	Midline Peak Time (min)	Midline Peak Value (%)	Midline Peak Width (%)	Midline Peak Integral (%TQ*min)
Watertown (B)									
ND818	B3	64.4	3.5	71.3	28.9	4.0	57.2	24.0	182.7
SD3997	B6	62.8	5.9	68.1	29.6	5.5	53.2	26.3	234.6
Glenn	B8	63.8	5.5	75.2	43.1	6.8	54.0	22.0	301.9
10 Fx Inc 1	B9	61.3	3.9	62.9	29.3	5.4	50.2	23.5	232.7
SY Soren	B12	62.5	3.7	65.8	35.8	5.2	50.2	16.1	218.7
SD4023	B13	61.3	5.4	70.0	34.3	6.2	53.4	29.1	273.8
Casselton (C)									
ND818	C3	64.6	3.6	81.6	37.9	4.2	64.6	30.7	197.2
SD3997	C6	63.8	7.3	64.3	26.4	6.8	51.0	23.9	276.4
Pivot	C7	63.8	4.7	70.5	35.8	5.3	52.7	27.1	227.7
Glenn	C8	64.6	6.3	71.5	34.1	6.7	54.6	26.9	289.6
10 Fx Inc 1	C9	62.6	5.4	71.6	31.0	5.4	55.4	30.7	241.7
ND SW 703	C10	61.8	3.3	69.8	33.2	4.3	53.8	26.5	189.4
MN06028	C11	63.0	5.7	83.5	51.7	6.5	59.5	30.6	292.6
SY Soren	C12	63.8	4.4	71.8	34.5	4.8	54.7	28.8	206.8
SD4023	C13	61.9	5.9	61.7	29.1	6.5	47.6	22.3	259.9
WB-Mayville	C14	63.2	5.5	61.8	25.7	5.5	48.4	25.8	226.6
Crookston (K)									
ND818	K3	62.9	3.6	79.0	27.9	3.8	64.9	26.8	191.5
Pivot	K7	63.2	3.2	71.4	29.0	3.4	56.1	28.2	145.9
Glenn	K8	61.5	7.8	67.0	36.0	8.5	48.3	29.2	376.2
10 Fx Inc 1	K9	58.2	1.2	58.3	28.5	4.0	46.7	18.9	165.8
MN06028	K11	61.6	4.6	63.8	37.2	7.9	49.2	20.0	339.3
SY Soren	K12	61.7	4.7	61.3	24.8	4.4	48.5	22.1	183.2
WB-Mayville	K14	61.1	1.7	53.6	27.5	5.8	40.5	16.9	220.2
Williston (W)									
ND905CL	W1	68.7	5.1	82.2	41.0	5.4	61.3	37.3	242.5
Line A	W2	68.4	13.9	73.1	41.2	14.7	52.6	30.5	577.8
ND818	W3	66.0	6.1	80.5	32.4	6.3	63.7	31.5	288.2
MT0832	W4	68.4	8.8	69.0	38.2	9.2	50.1	32.2	356.6
Line B	W5	68.4	14.4	74.8	39.1	14.8	56.0	30.1	548.0
Glenn	W8	68.7	9.5	81.4	40.5	10.0	59.9	35.8	416.6
ND SW 703	W10	66.6	4.1	85.5	46.7	5.2	63.7	29.9	250.9

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

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 mid line is shown, including envelope and mid line % of full value. These values are traditionally the most meaningful. A mid line peak time around 3 to 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 mid line from time zero to the point in question. 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 mid line 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 Mfg.)

Extensigraph Characteristics by Location

(measured 45 min after mixing)

ID		Water Abs. (%)	Energy (Area) (cm^2)	Extensibility (mm)	Resistance at 50 mm Extension (BU)	Maximum Resistance (BU)	Ratio Number	Ratio Number (Max.)
Watertown (B)								
ND818	B3	64.0	124	228	238	399	1.0	1.7
SD3997	B6	61.2	131	195	282	523	1.4	2.7
Glenn	B8	61.0	160	216	296	573	1.4	2.7
10 Fx Inc 1	B9	61.6	124	192	289	485	1.5	2.5
SY Soren	B12	61.8	133	196	299	529	1.5	2.7
SD4023	B13	58.5	145	208	302	522	1.5	2.5
Casselton (C)								
ND818	C3	61.9	154	250	232	478	0.9	1.9
SD3997	C6	59.9	151	232	245	510	1.1	2.2
Povot	C7	59.6	144	228	259	476	1.1	2.1
Glenn	C8	61.1	182	251	273	555	1.1	2.2
10 Fx Inc 1	C9	62.0	147	211	293	538	1.4	2.5
ND SW 703	C10	60.2	134	191	322	532	1.7	2.8
MN06028	C11	59.7	201	252	296	628	1.2	2.5
SY Soren	C12	60.7	165	250	246	514	1.0	2.1
SD4023	C13	58.1	154	230	249	523	1.1	2.3
WB-Mayville	C14	60	154	216	304	542	1.4	2.5
Crookston (K)								
ND818	K3	64.1	149	249	248	443	1.0	1.8
Povot	K7	60.5	142	237	250	448	1.1	1.9
Glenn	K8	64.1	131	207	267	482	1.3	2.3
10 Fx Inc 1	K9	60.6	79	166	241	352	1.5	2.1
MN06028	K11	59.7	171	221	308	589	1.4	2.7
SY Soren	K12	62.4	118	203	258	438	1.3	2.2
WB-Mayville	K14	60.4	125	189	309	499	1.6	2.6
Williston (W)								
ND905CL	W1	63.0	151	250	228	484	0.9	1.9
Line A	W2	60.3	224	254	311	736	1.2	2.9
ND818	W3	62.2	164	252	252	495	1.0	2.0
MT0832	W4	59.1	179	251	264	570	1.1	2.3
Line B	W5	58.3	201	255	284	644	1.1	2.5
Glenn	W8	60.6	155	252	226	509	0.9	2.0
ND SW 703	W10	64.3	178	251	289	532	1.2	2.1

Hard Red Spring Wheat Breeding Quality Target Values

	Quality Parameter	Extra Strong	Traditional Strong
Wheat	Test Weight (lb/bu) (Grading Factor)	60	60
	Protein (12% m.b.)	14.5	14.5
	Ash (14% m.b.)	<1.65	<1.65
	Vitreousness (% Dark Hard & Vitreous, DHV)	80	80
	1000 kernel weight (g)	>31	>31
	Falling Number (seconds)	400	400
	Wheat Hardness (SKCS)	80	80
	Wheat Hardness (NIR)	70	70
Milling	Flour Extraction		
	Buhler Lab Mill (%, @ 0.48 ash)	70	70
	Quadrumat Senior (%, @ 0.48 ash)	70	70
	Protein Loss (%)	<1.0	<1.0
Flour	Ash (14%m.b.)	0.48	0.48
	Color (L* value)	90	90
	Wet Gluten (%, 14% m.b. @ 13.5% protein)	36	36
Farinograph	Absorption (%)	64	64
(50 g bowl)	Peak Time (Minutes)	15	10
	Stability (Minutes)	25	15
	Classification (1-weak, 8-strong)[1]	8	6.5
Extensograph	Maximum Resistance to Extension (BU)	800	600
(45 min. stretch)	Extensibility (cm)	20	22
Mixograph	Classification (1=weak, 8=strong)[1]	8	6
Bread[2]	Loaf Volume (cc)	1050	1050
	Grain & Texture (1=poor -10 excellent)[1]	8.5	8.5

[1]Subjective ratings and classifications are from the North Dakota State University - Hard Red Spring Wheat Quality Laboratory

[2]Bread Quality based on 100g pup loaf, straight dough method, North Dakota State University - Hard Red Spring Wheat Quality Laboratory

Note: HRS Wheat Breeding Quality Targets were developed by a committee of HRS wheat breeders and quality personnel. Contact Brian Sorenson, Northern Crops Institute for more information.

HRS Wheat Breeding Quality Target Values 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, but 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 release 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 Hard Red Spring Wheat with quality represented by the "Traditional Strong" target values.
7. Utilization of these breeding targets by all HRS wheat breeders is essential to providing better uniformity and consistency and meeting the needs of our domestic and export markets.