Wheat Quality Council
Hard Spring Wheat Technical Committee

2013 Crop Milling and Baking Quality Data

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Wheat Quality Council
Hard Spring Wheat Technical Committee
2013 Crop
Sponsored by the Wheat Quality Council

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Table of Contents

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Introduction

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

Eleven varieties/experimental lines of hard spring wheat were harvested at up to five locations in 2013 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. 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 2013 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

Line: BR0202W (Check- Glenn)

	Trait	Check C- 3	Line C- 1	Check M- 3	Line M- 1
I. USDA/ARS WQL Data					
1	Wheat Protein (12% mb)	15.4	14.4	15.0	14.7
2	Flour Protein (12% mb)	14.5	13.0	14.7	14.0
3	UPP/EPP (SDS unextractable/extractable polymeric proteins)	1.51	1.36	1.53	1.25
4	Market Value 1 (Score 1-6)	4.9	4.4	3.1	2.1
5	Market Value 2 (Score 1-10)	10.0	7.6	10.0	6.4
6	Test Weight (lb/bu)	65.4	62.0	62.0	54.5
7	1000 Kernel Weight (g)	30.2	32.7	25.2	28.9
	Kernel Size				
8	% Large	66	50	68	37
9	% Small	9	12	9	18
10	Wheat Moisture (%)	13.1	12.2	15.2	12.6
11	Wheat Ash (14% mb)	1.46	1.47	1.56	1.64
12	Wheat Falling Number (sec)	421	401	271	150
13	SKCS Hardness Index (SK-HI)	92.0	86.2	84.1	58.9
14	SK-HI Standard Deviation	18.1	17.7	17.2	20.0
15	Vitreous Kernels (%)	98	4	100	8
	Flour Extraction (%)				
16	Tempered Wheat Basis (%)	72.6	74.8	71.9	70.5
17	Total Product Basis (%)	74.0	75.1	73.6	73.5
18	Flour (Lbs)/ Wheat (Bu)	44.6	45.3	44.4	44.4
	Flour Characteristics				
19	Flour Color Brightness (L*)	90.8	90.5	90.9	90.9
20	Flour Color Yellow Scale (b*)	7.4	6.8	7.2	7.1
21	Flour Moisture (%)	13.2	13.1	13.7	13.6
22	Flour Ash (14% mb)	0.43	0.51	0.52	0.50
23	Falling Number (Malted) (sec)	249	246	252	229*
	Farinograph				
24	Water Absorption (500bu)	68.4	62.4	64.3	59.2
25	Water Absorption (14%mb)	67.4	61.6	63.9	58.9
26	Arrival Time (min)	5.0	2.1	2.2	1.6
27	Peak Time (min)	9.9	6.9	6.2	3.7
28	Dough Stability (min)	13.8	9.3	10.8	11.8
29	Mixing tolerance Index (bu)	15	32	24	9
30	Time To Breakdown (min)	18.3	11.1	11.4	12.8

Line: BR0202W

Trait	Check C- 3	Line C- 1	Check M- 3	Line M- 1
II. Cooperator Results				
31 Bake Absorption (%, 14% flour mb)	**68.4**	**63.6**	**66.4**	**63.0**
32 Loaf Volume (cc)	**100.0**	**98.0**	**100.0**	**99.9**
33 Mixing Requirement	**4.0**	**3.6**	**4.2**	**4.1**
5=Very Long, 4=Long, 3=Medium, 2=Short, 1=Very Short				
34 Dough Characteristics	**3.8**	**3.6**	**3.9**	**3.8**
5=Bucky-Tough, 4=Strong-Elastic, 3=Medium-Pliable, 2=Mellow-Very Pliable, 1=Weak-Short or Sticky				
35 Mixing Tolerance	**3.0**	**2.9**	**3.3**	**3.2**
5=Much More Tolerance, 4=More Tolerance, 3=Equivalent, 2=Less Tolerance, and 1=Much Less Tolerance when compared to check				
36 Internal Crumb Color	**3.0**	**3.0**	**3.0**	**3.6**
5=Much Brighter, 4=Brighter, 3=Equivalent, 2=Poorer, and 1=Much Poorer when compared to check				
37 Internal Grain and Texture	**3.0**	**3.1**	**3.0**	**3.5**
5=Much Better, 4=Better, 3=Equivalent, 2=Poorer, and 1=Much Poorer when compared to Check				
III. Cooperator Evaluation (37-40)				
5=Much Better, 4=Better, 3=Equivalent, 2=Poorer, and 1=Much Poorer when compared to Check				
38 Quality Trait 1-3: Protein	**3.0**	**1.8**	**3.0**	**2.5**
39 Quality Trait 4-22: Milling	**3.0**	**3.0**	**3.0**	**2.8**
40 Quality Trait 24-37: Baking	**3.0**	**2.6**	**3.0**	**3.4**
41 Quality Trait 1-37: Overall	**3.0**	**2.6**	**3.0**	**2.9**

Line: MN08165-8 (Check- Glenn)

	Trait	Check C- 3	Line C- 2	Check K- 3	Line K- 2
I. USDA/ARS WQL Data					
1	Wheat Protein (12% mb)	15.4	15.9	13.1	14.1
2	Flour Protein (12% mb)	14.5	15.4	12.5	13.6
3	UPP/EPP (SDS unextractable/extractable polymeric proteins)	1.51	1.56	1.29	1.14
4	Market Value 1 (Score 1-6)	4.9	5.4	4.3	5.0
5	Market Value 2 (Score 1-10)	10.0	9.2	10.0	9.0
6	Test Weight (lb/bu)	65.4	63.1	66.1	63.7
7	1000 Kernel Weight (g)	30.2	34.0	30.7	34.4
	Kernel Size				
8	% Large	66	80	56	73
9	% Small	9	5	10	6
10	Wheat Moisture (%)	13.1	12.7	12.5	12.0
11	Wheat Ash (14% mb)	1.46	1.46	1.20	1.35
12	Wheat Falling Number (sec)	421	437	404	456
13	SKCS Hardness Index (SK-HI)	92.0	90.0	90.3	88.6
14	SK-HI Standard Deviation	18.1	17.3	17.9	18.0
15	Vitreous Kernels (%)	98	90	97	87
	Flour Extraction (%)				
16	Tempered Wheat Basis (%)	72.6	73.7	72.7	73.0
17	Total Product Basis (%)	74.0	74.5	73.5	74.4
18	Flour (Lbs)/ Wheat (Bu)	44.6	44.9	44.4	44.9
	Flour Characteristics				
19	Flour Color Brightness (L*)	90.8	90.4	91.3	91.1
20	Flour Color Yellow Scale (b*)	7.4	7.8	7.4	8.5
21	Flour Moisture (%)	13.2	12.9	13.4	13.0
22	Flour Ash (14% mb)	0.43	0.46	0.47	0.52
23	Falling Number (Malted) (sec)	249	248	252	252
	Farinograph				
24	Water Absorption (500bu)	68.4	68.7	64.8	67.3
25	Water Absorption (14%mb)	67.4	67.2	64.4	66.0
26	Arrival Time (min)	5.0	4.7	3.0	4.4
27	Peak Time (min)	9.9	11.0	8.2	7.4
28	Dough Stability (min)	13.8	17.0	10.4	10.7
29	Mixing tolerance Index (bu)	15	14	33	19
30	Time To Breakdown (min)	18.3	20.4	12.6	14.6

Line: MN08165-8

Trait	Check C- 3	Line C- 2	Check K- 3	Line K- 2
II. Cooperator Results				
31 Bake Absorption (%, 14% flour mb)	**68.4**	**68.1**	**65.9**	**66.2**
32 Loaf Volume (cc)	**100.0**	**103.8**	**100.0**	**102.2**
33 Mixing Requirement	**4.0**	**4.0**	**4.0**	**3.8**
5=Very Long, 4=Long, 3=Medium, 2=Short, 1=Very Short				
34 Dough Characteristics	**3.8**	**4.0**	**3.8**	**3.9**
5=Bucky-Tough, 4=Strong-Elastic, 3=Medium-Pliable, 2=Mellow-Very Pliable, 1=Weak-Short or Sticky				
35 Mixing Tolerance	**3.0**	**3.3**	**3.0**	**3.0**
5=Much More Tolerance, 4=More Tolerance, 3=Equivalent, 2=Less Tolerance, and 1=Much Less Tolerance when compared to check				
36 Internal Crumb Color	**3.0**	**2.8**	**3.0**	**2.8**
5=Much Brighter, 4=Brighter, 3=Equivalent, 2=Poorer, and 1=Much Poorer when compared to check				
37 Internal Grain and Texture	**3.0**	**3.1**	**3.0**	**3.2**
5=Much Better, 4=Better, 3=Equivalent, 2=Poorer, and 1=Much Poorer when compared to Check				
III. Cooperator Evaluation (37-40)				
5=Much Better, 4=Better, 3=Equivalent, 2=Poorer, and 1=Much Poorer when compared to Check				
38 Quality Trait 1-3: Protein	**3.0**	**4.1**	**3.0**	**4.2**
39 Quality Trait 4-22: Milling	**3.0**	**3.2**	**3.0**	**3.0**
40 Quality Trait 24-37: Baking	**3.0**	**3.2**	**3.0**	**3.4**
41 Quality Trait 1-37: Overall	**3.0**	**3.2**	**3.0**	**3.4**

Line: Elgin-ND (Check- Glenn)

	Trait	Check B- 3	Line B- 4	Check C- 3	Line C- 4	Check K- 3	Line K- 4	Check M- 3	Line M- 4	Check W- 3	Line W- 4
I. USDA/ARS WQL Data											
1	Wheat Protein (12% mb)	14.8	14.5	15.4	14.4	13.1	13.1	15.0	15.6	13.7	13.8
2	Flour Protein (12% mb)	14.7	14.0	14.5	13.8	12.5	12.3	14.7	14.9	13.4	13.0
3	UPP/EPP (SDS unextractable/extractable polymeric proteins)	1.35	1.32	1.51	1.36	1.29	1.20	1.53	1.32	1.39	1.27
4	Market Value 1 (Score 1-6)	4.7	4.2	4.9	4.3	4.3	4.3	3.1	3.7	4.1	4.1
5	Market Value 2 (Score 1-10)	10.0	8.4	10.0	8.2	10.0	8.8	10.0	8.8	10.0	9.2
6	Test Weight (lb/bu)	64.7	61.2	65.4	62.6	66.1	63.0	62.0	59.1	64.2	61.8
7	1000 Kernel Weight (g)	31.6	29.4	30.2	27.1	30.7	29.6	25.2	31.0	29.2	28.9
	Kernel Size										
8	% Large	68	60	66	61	56	57	68	69	47	44
9	% Small	9	12	9	11	10	12	9	7	12	13
10	Wheat Moisture (%)	12.5	12.0	13.1	12.5	12.5	12.4	15.2	12.5	11.8	11.5
11	Wheat Ash (14% mb)	1.62	1.59	1.46	1.40	1.20	1.24	1.56	1.42	1.58	1.51
12	Wheat Falling Number (sec)	441	454	421	404	404	433	271	347	405	457
13	SKCS Hardness Index (SK-HI)	87.3	90.0	92.0	92.3	90.3	86.5	84.1	75.1	87.6	78.1
14	SK-HI Standard Deviation	19.1	19.9	18.1	16.8	17.9	17.5	17.2	17.4	15.5	17.7
15	Vitreous Kernels (%)	100	93	98	97	97	84	100	81	91	89
	Flour Extraction (%)										
16	Tempered Wheat Basis (%)	73.8	74.6	72.6	74.1	72.7	74.6	71.9	72.8	72.2	72.1
17	Total Product Basis (%)	75.6	75.7	74.0	75.5	73.5	76.8	73.6	75.4	74.6	74.3
18	Flour (Lbs)/ Wheat (Bu)	45.6	45.7	44.6	45.6	44.4	46.3	44.4	45.5	45.0	44.8
	Flour Characteristics										
19	Flour Color Brightness (L*)	90.4	90.8	90.8	90.6	91.3	91.2	90.9	90.3	90.9	91.0
20	Flour Color Yellow Scale (b*)	7.2	7.9	7.4	8.7	7.4	7.9	7.2	9.0	7.6	8.9
21	Flour Moisture (%)	13.2	12.8	13.2	13.1	13.4	13.4	13.7	13.3	13.7	13.1
22	Flour Ash (14% mb)	0.51	0.50	0.43	0.41	0.47	0.48	0.52	0.42	0.55	0.49
23	Falling Number (Malted) (sec)	252	257	249	246	252	257	252	251	259	257
	Farinograph										
24	Water Absorption (500bu)	65.4	68.2	68.4	69.2	64.8	69.0	64.3	67.0	68.6	68.2
25	Water Absorption (14%mb)	64.8	66.6	67.4	68.1	64.4	68.5	63.9	66.3	68.2	67.1
26	Arrival Time (min)	3.5	3.5	5.0	3.9	3.0	3.3	2.2	4.2	2.7	3.4
27	Peak Time (min)	7.9	7.2	9.9	7.0	8.2	6.4	6.2	6.9	7.9	8.2
28	Dough Stability (min)	9.6	7.9	13.8	7.7	10.4	7.3	10.8	8.7	10.9	11.9
29	Mixing tolerance Index (bu)	32	31	15	31	33	35	24	20	25	22
30	Time To Breakdown (min)	12.7	11.3	18.3	12.0	12.6	10.8	11.4	12.9	13.3	14.7

Line: Elgin-ND

Trait	Check B- 3	Line B- 4	Check C- 3	Line C- 4	Check K- 3	Line K- 4	Check M- 3	Line M- 4	Check W- 3	Line W- 4
II. Cooperator Results										
31 Bake Absorption (%, 14% flour mb)	66.6	67.1	68.4	67.5	65.9	67.1	66.4	66.6	67.6	66.6
32 Loaf Volume (cc)	100.0	96.5	100.0	97.6	100.0	95.0	100.0	102.2	100.0	100.9
33 Mixing Requirement	4.0	3.4	4.0	3.3	4.0	3.0	4.2	3.3	4.3	3.6
5=Very Long, 4=Long, 3=Medium, 2=Short, 1=Very Short										
34 Dough Characteristics	4.0	3.8	3.8	3.4	3.8	3.3	3.9	3.4	4.3	3.6
5=Bucky-Tough, 4=Strong-Elastic, 3=Medium-Pliable, 2=Mellow-Very Pliable, 1=Weak-Short or Sticky										
35 Mixing Tolerance	3.0	2.6	3.0	2.3	3.0	2.5	3.3	2.6	3.3	3.0
5=Much More Tolerance, 4=More Tolerance, 3=Equivalent, 2=Less Tolerance, and 1=Much Less Tolerance when compared to check										
36 Internal Crumb Color	3.0	3.0	3.0	2.9	3.0	2.7	3.0	3.1	3.0	3.0
5=Much Brighter, 4=Brighter, 3=Equivalent, 2=Poorer, and 1=Much Poorer when compared to check										
37 Internal Grain and Texture	3.0	2.9	3.0	3.0	3.0	2.7	3.0	3.1	3.0	3.3
5=Much Better, 4=Better, 3=Equivalent, 2=Poorer, and 1=Much Poorer when compared to Check										
III. Cooperator Evaluation (37-40)										
5=Much Better, 4=Better, 3=Equivalent, 2=Poorer, and 1=Much Poorer when compared to Check										
38 Quality Trait 1-3: Protein	3.0	2.7	3.0	2.2	3.0	3.0	3.0	3.5	3.0	2.7
39 Quality Trait 4-22: Milling	3.0	3.0	3.0	3.1	3.0	3.4	3.0	3.6	3.0	3.1
40 Quality Trait 24-37: Baking	3.0	2.8	3.0	2.7	3.0	2.4	3.0	3.3	3.0	3.2
41 Quality Trait 1-37: Overall	3.0	2.7	3.0	2.4	3.0	2.8	3.0	3.1	3.0	2.9

Line: ND 816 (Check- Glenn)

	Trait	Check B- 3	Line B- 5	Check C- 3	Line C- 5	Check K- 3	Line K- 5	Check M- 3	Line M- 5	Check W- 3	Line W- 5
I. USDA/ARS WQL Data											
1	Wheat Protein (12% mb)	14.8	14.4	15.4	15.1	13.1	12.3	15.0	13.9	13.7	14.2
2	Flour Protein (12% mb)	14.7	13.7	14.5	14.1	12.5	11.6	14.7	13.4	13.4	13.3
3	UPP/EPP (SDS unextractable/extractable polymeric proteins)	1.35	1.27	1.51	1.23	1.29	1.10	1.53	1.30	1.39	1.20
4	Market Value 1 (Score 1-6)	4.7	4.1	4.9	4.9	4.3	4.4	3.1	4.0	4.1	4.7
5	Market Value 2 (Score 1-10)	10.0	8.4	10.0	9.2	10.0	8.4	10.0	8.4	10.0	9.2
6	Test Weight (lb/bu)	64.7	60.1	65.4	63.0	66.1	63.8	62.0	61.3	64.2	62.6
7	1000 Kernel Weight (g)	31.6	33.2	30.2	32.7	30.7	34.0	25.2	32.9	29.2	34.2
	Kernel Size										
8	% Large	68	69	66	70	56	69	68	76	47	63
9	% Small	9	8	9	9	10	8	9	7	12	8
10	Wheat Moisture (%)	12.5	12.2	13.1	12.9	12.5	12.1	15.2	12.6	11.8	11.2
11	Wheat Ash (14% mb)	1.62	1.62	1.46	1.46	1.20	1.31	1.56	1.39	1.58	1.55
12	Wheat Falling Number (sec)	441	484	421	407	404	467	271	367	405	528
13	SKCS Hardness Index (SK-HI)	87.3	94.2	92.0	94.4	90.3	85.3	84.1	76.3	87.6	79.0
14	SK-HI Standard Deviation	19.1	18.3	18.1	18.7	17.9	21.3	17.2	21.2	15.5	16.2
15	Vitreous Kernels (%)	100	66	98	94	97	77	100	55	91	88
	Flour Extraction (%)										
16	Tempered Wheat Basis (%)	73.8	73.2	72.6	73.4	72.7	77.7	71.9	75.4	72.2	74.4
17	Total Product Basis (%)	75.6	74.3	74.0	75.7	73.5	77.8	73.6	76.8	74.6	75.7
18	Flour (Lbs)/ Wheat (Bu)	45.6	44.8	44.6	45.7	44.4	46.9	44.4	46.3	45.0	45.7
	Flour Characteristics										
19	Flour Color Brightness (L*)	90.4	90.8	90.8	90.5	91.3	91.0	90.9	90.7	90.9	91.2
20	Flour Color Yellow Scale (b*)	7.2	8.1	7.4	8.6	7.4	8.6	7.2	8.8	7.6	8.8
21	Flour Moisture (%)	13.2	13.0	13.2	13.6	13.4	12.9	13.7	13.2	13.7	13.3
22	Flour Ash (14% mb)	0.51	0.55	0.43	0.46	0.47	0.50	0.52	0.48	0.55	0.51
23	Falling Number (Malted) (sec)	252	256	249	252	252	252	252	265	259	255
	Farinograph										
24	Water Absorption (500bu)	65.4	68.3	68.4	69.2	64.8	65.7	64.3	65.0	68.6	69.3
25	Water Absorption (14%mb)	64.8	66.9	67.4	68.9	64.4	64.4	63.9	64.0	68.2	68.6
26	Arrival Time (min)	3.5	3.0	5.0	3.5	3.0	3.0	2.2	2.6	2.7	3.0
27	Peak Time (min)	7.9	7.0	9.9	5.4	8.2	5.2	6.2	5.6	7.9	5.9
28	Dough Stability (min)	9.6	8.4	13.8	6.0	10.4	5.2	10.8	7.8	10.9	8.1
29	Mixing tolerance Index (bu)	32	37	15	42	33	50	24	34	25	31
30	Time To Breakdown (min)	12.7	10.8	18.3	9.3	12.6	8.3	11.4	10.1	13.3	10.8

Line: ND 816

Trait	Check B-3	Line B-5	Check C-3	Line C-5	Check K-3	Line K-5	Check M-3	Line M-5	Check W-3	Line W-5
II. Cooperator Results										
31 Bake Absorption (%, 14% flour mb)	66.6	66.7	68.4	67.6	65.9	64.5	66.4	65.0	67.6	67.5
32 Loaf Volume (cc)	100.0	92.9	100.0	96.3	100.0	94.1	100.0	95.5	100.0	100.2
33 Mixing Requirement	4.0	3.4	4.0	2.9	4.0	2.9	4.2	3.4	4.3	3.7
5=Very Long, 4=Long, 3=Medium, 2=Short, 1=Very Short										
34 Dough Characteristics	4.0	3.3	3.8	3.3	3.8	3.3	3.9	3.2	4.3	3.6
5=Bucky-Tough, 4=Strong-Elastic, 3=Medium-Pliable, 2=Mellow-Very Pliable, 1=Weak-Short or Sticky										
35 Mixing Tolerance	3.0	2.6	3.0	2.1	3.0	2.3	3.3	2.5	3.3	2.8
5=Much More Tolerance, 4=More Tolerance, 3=Equivalent, 2=Less Tolerance, and 1=Much Less Tolerance when compared to check										
36 Internal Crumb Color	3.0	2.8	3.0	2.8	3.0	2.8	3.0	3.0	3.0	3.2
5=Much Brighter, 4=Brighter, 3=Equivalent, 2=Poorer, and 1=Much Poorer when compared to check										
37 Internal Grain and Texture	3.0	2.4	3.0	2.9	3.0	3.0	3.0	3.0	3.0	3.6
5=Much Better, 4=Better, 3=Equivalent, 2=Poorer, and 1=Much Poorer when compared to Check										
III. Cooperator Evaluation (37-40)										
5=Much Better, 4=Better, 3=Equivalent, 2=Poorer, and 1=Much Poorer when compared to Check										
38 Quality Trait 1-3: Protein	3.0	2.4	3.0	2.9	3.0	2.0	3.0	1.9	3.0	3.0
39 Quality Trait 4-22: Milling	3.0	2.6	3.0	3.2	3.0	3.7	3.0	4.0	3.0	3.6
40 Quality Trait 24-37: Baking	3.0	2.3	3.0	2.2	3.0	2.4	3.0	3.0	3.0	3.2
41 Quality Trait 1-37: Overall	3.0	2.3	3.0	2.4	3.0	2.6	3.0	2.8	3.0	3.2

Line: COI565W (Check- Glenn)

	Trait	Check C- 3	Line C- 6	Check M- 3	Line M- 6
I. USDA/ARS WQL Data					
1	Wheat Protein (12% mb)	15.4	13.6	15.0	12.7
2	Flour Protein (12% mb)	14.5	12.7	14.7	12.2
3	UPP/EPP (SDS unextractable/extractable polymeric proteins)	1.51	1.29	1.53	1.25
4	Market Value 1 (Score 1-6)	4.9	4.4	3.1	2.2
5	Market Value 2 (Score 1-10)	10.0	5.4	10.0	3.2
6	Test Weight (lb/bu)	65.4	63.3	62.0	57.2
7	1000 Kernel Weight (g)	30.2	40.7	25.2	40.3
	Kernel Size				
8	% Large	66	87	68	68
9	% Small	9	3	9	3
10	Wheat Moisture (%)	13.1	12.5	15.2	10.7
11	Wheat Ash (14% mb)	1.46	1.32	1.56	1.66
12	Wheat Falling Number (sec)	421	340	271	165
13	SKCS Hardness Index (SK-HI)	92.0	63.1	84.1	53.2
14	SK-HI Standard Deviation	18.1	19.8	17.2	18.9
15	Vitreous Kernels (%)	98	11	100	15
	Flour Extraction (%)				
16	Tempered Wheat Basis (%)	72.6	75.7	71.9	71.2
17	Total Product Basis (%)	74.0	76.5	73.6	74.8
18	Flour (Lbs)/ Wheat (Bu)	44.6	46.2	44.4	45.2
	Flour Characteristics				
19	Flour Color Brightness (L*)	90.8	90.7	90.9	90.3
20	Flour Color Yellow Scale (b*)	7.4	8.0	7.2	8.1
21	Flour Moisture (%)	13.2	13.5	13.7	13.7
22	Flour Ash (14% mb)	0.43	0.47	0.52	0.59
23	Falling Number (Malted) (sec)	249	257	252	194*
	Farinograph				
24	Water Absorption (500bu)	68.4	63.3	64.3	59.0
25	Water Absorption (14%mb)	67.4	62.5	63.9	58.7
26	Arrival Time (min)	5.0	3.5	2.2	1.4
27	Peak Time (min)	9.9	5.9	6.2	4.5
28	Dough Stability (min)	13.8	7.0	10.8	6.4
29	Mixing tolerance Index (bu)	15	32	24	48
30	Time To Breakdown (min)	18.3	10.6	11.4	7.9

Line: COI565W

Trait	Check C- 3	Line C- 6	Check M- 3	Line M- 6
II. Cooperator Results				
31 Bake Absorption (%, 14% flour mb)	68.4	63.8	66.4	61.2
32 Loaf Volume (cc)	100.0	96.1	100.0	91.3
33 Mixing Requirement	4.0	2.9	4.2	3.0
5=Very Long, 4=Long, 3=Medium, 2=Short, 1=Very Short				
34 Dough Characteristics	3.8	2.8	3.9	2.7
5=Bucky-Tough, 4=Strong-Elastic, 3=Medium-Pliable, 2=Mellow-Very Pliable, 1=Weak-Short or Sticky				
35 Mixing Tolerance	3.0	1.8	3.3	1.8
5=Much More Tolerance, 4=More Tolerance, 3=Equivalent, 2=Less Tolerance, and 1=Much Less Tolerance when compared to check				
36 Internal Crumb Color	3.0	2.9	3.0	2.6
5=Much Brighter, 4=Brighter, 3=Equivalent, 2=Poorer, and 1=Much Poorer when compared to check				
37 Internal Grain and Texture	3.0	2.9	3.0	2.2
5=Much Better, 4=Better, 3=Equivalent, 2=Poorer, and 1=Much Poorer when compared to Check				
III. Cooperator Evaluation (37-40)				
5=Much Better, 4=Better, 3=Equivalent, 2=Poorer, and 1=Much Poorer when compared to Check				
38 Quality Trait 1-3: Protein	3.0	1.4	3.0	1.3
39 Quality Trait 4-22: Milling	3.0	3.4	3.0	3.0
40 Quality Trait 24-37: Baking	3.0	2.4	3.0	2.2
41 Quality Trait 1-37: Overall	3.0	2.3	3.0	2.3

Line: SD4189 (Check- Glenn)

	Trait	Check B- 3	Line B- 7	Check C- 3	Line C- 7	Check K- 3	Line K- 7
I. USDA/ARS WQL Data							
1	Wheat Protein (12% mb)	14.8	14.0	15.4	14.0	13.1	11.7
2	Flour Protein (12% mb)	14.7	13.2	14.5	13.1	12.5	11.0
3	UPP/EPP (SDS unextractable/extractable polymeric proteins)	1.35	1.39	1.51	1.08	1.29	1.32
4	Market Value 1 (Score 1-6)	4.7	3.8	4.9	4.4	4.3	4.0
5	Market Value 2 (Score 1-10)	10.0	7.8	10.0	7.6	10.0	7.6
6	Test Weight (lb/bu)	64.7	60.1	65.4	62.4	66.1	63.5
7	1000 Kernel Weight (g)	31.6	31.0	30.2	32.4	30.7	30.9
	Kernel Size						
8	% Large	68	63	66	75	56	64
9	% Small	9	10	9	4	10	9
10	Wheat Moisture (%)	12.5	12.0	13.1	12.1	12.5	12.2
11	Wheat Ash (14% mb)	1.62	1.64	1.46	1.47	1.20	1.40
12	Wheat Falling Number (sec)	441	518	421	410	404	441
13	SKCS Hardness Index (SK-HI)	87.3	86.7	92.0	92.6	90.3	89.3
14	SK-HI Standard Deviation	19.1	19.5	18.1	16.2	17.9	17.5
15	Vitreous Kernels (%)	100	68	98	70	97	86
	Flour Extraction (%)						
16	Tempered Wheat Basis (%)	73.8	74.5	72.6	73.1	72.7	75.9
17	Total Product Basis (%)	75.6	75.8	74.0	74.5	73.5	77.1
18	Flour (Lbs)/ Wheat (Bu)	45.6	45.8	44.6	44.9	44.4	46.5
	Flour Characteristics						
19	Flour Color Brightness (L*)	90.4	91.0	90.8	91.0	91.3	91.3
20	Flour Color Yellow Scale (b*)	7.2	8.2	7.4	8.5	7.4	8.1
21	Flour Moisture (%)	13.2	13.1	13.2	13.5	13.4	13.1
22	Flour Ash (14% mb)	0.51	0.55	0.43	0.44	0.47	0.49
23	Falling Number (Malted) (sec)	252	260	249	250	252	257
	Farinograph						
24	Water Absorption (500bu)	65.4	64.7	68.4	65.2	64.8	63.8
25	Water Absorption (14%mb)	64.8	63.7	67.4	64.5	64.4	63.0
26	Arrival Time (min)	3.5	4.1	5.0	4.3	3.0	2.4
27	Peak Time (min)	7.9	7.6	9.9	7.2	8.2	6.2
28	Dough Stability (min)	9.6	9.2	13.8	8.4	10.4	8.0
29	Mixing tolerance Index (bu)	32	24	15	26	33	34
30	Time To Breakdown (min)	12.7	13.3	18.3	12.7	12.6	10.5

Line: SD4189

Trait	Check B- 3	Line B- 7	Check C- 3	Line C- 7	Check K- 3	Line K- 7
II. Cooperator Results						
31 Bake Absorption (%, 14% flour mb)	66.6	64.7	68.4	64.9	65.9	63.4
32 Loaf Volume (cc)	100.0	95.4	100.0	101.8	100.0	94.8
33 Mixing Requirement	4.0	4.1	4.0	3.8	4.0	3.5
5=Very Long, 4=Long, 3=Medium, 2=Short, 1=Very Short						
34 Dough Characteristics	4.0	3.8	3.8	3.8	3.8	3.3
5=Bucky-Tough, 4=Strong-Elastic, 3=Medium-Pliable, 2=Mellow-Very Pliable, 1=Weak-Short or Sticky						
35 Mixing Tolerance	3.0	2.8	3.0	2.8	3.0	2.7
5=Much More Tolerance, 4=More Tolerance, 3=Equivalent, 2=Less Tolerance, and 1=Much Less Tolerance when compared to check						
36 Internal Crumb Color	3.0	2.9	3.0	3.3	3.0	3.0
5=Much Brighter, 4=Brighter, 3=Equivalent, 2=Poorer, and 1=Much Poorer when compared to check						
37 Internal Grain and Texture	3.0	2.7	3.0	3.2	3.0	3.0
5=Much Better, 4=Better, 3=Equivalent, 2=Poorer, and 1=Much Poorer when compared to Check						
III. Cooperator Evaluation (37-40)						
5=Much Better, 4=Better, 3=Equivalent, 2=Poorer, and 1=Much Poorer when compared to Check						
38 Quality Trait 1-3: Protein	3.0	2.0	3.0	1.8	3.0	1.6
39 Quality Trait 4-22: Milling	3.0	2.8	3.0	2.9	3.0	3.4
40 Quality Trait 24-37: Baking	3.0	2.6	3.0	3.1	3.0	2.4
41 Quality Trait 1-37: Overall	3.0	2.6	3.0	2.7	3.0	2.5

Line: CHBR1481W (Check- Glenn)

	Trait	Check C- 3	Line C- 8	Check M- 3	Line M- 8
I. USDA/ARS WQL Data					
1	Wheat Protein (12% mb)	15.4	13.2	15.0	14.0
2	Flour Protein (12% mb)	14.5	12.3	14.7	13.0
3	UPP/EPP (SDS unextractable/extractable polymeric proteins)	1.51	1.18	1.53	1.40
4	Market Value 1 (Score 1-6)	4.9	3.9	3.1	2.1
5	Market Value 2 (Score 1-10)	10.0	6.0	10.0	6.0
6	Test Weight (lb/bu)	65.4	61.8	62.0	56.6
7	1000 Kernel Weight (g)	30.2	31.1	25.2	29.4
	Kernel Size				
8	% Large	66	52	68	51
9	% Small	9	13	9	15
10	Wheat Moisture (%)	13.1	12.6	15.2	13.1
11	Wheat Ash (14% mb)	1.46	1.35	1.56	1.48
12	Wheat Falling Number (sec)	421	384	271	224
13	SKCS Hardness Index (SK-HI)	92.0	85.3	84.1	65.3
14	SK-HI Standard Deviation	18.1	18.0	17.2	21.1
15	Vitreous Kernels (%)	98	38	100	12
	Flour Extraction (%)				
16	Tempered Wheat Basis (%)	72.6	74.1	71.9	74.2
17	Total Product Basis (%)	74.0	76.5	73.6	75.9
18	Flour (Lbs)/ Wheat (Bu)	44.6	46.1	44.4	45.8
	Flour Characteristics				
19	Flour Color Brightness (L*)	90.8	90.9	90.9	90.6
20	Flour Color Yellow Scale (b*)	7.4	7.7	7.2	7.7
21	Flour Moisture (%)	13.2	13.4	13.7	13.7
22	Flour Ash (14% mb)	0.43	0.44	0.52	0.53
23	Falling Number (Malted) (sec)	249	254	252	245*
	Farinograph				
24	Water Absorption (500bu)	68.4	61.0	64.3	59.6
25	Water Absorption (14%mb)	67.4	60.2	63.9	59.2
26	Arrival Time (min)	5.0	2.2	2.2	1.2
27	Peak Time (min)	9.9	6.7	6.2	3.2
28	Dough Stability (min)	13.8	9.0	10.8	10.4
29	Mixing tolerance Index (bu)	15	34	24	12
30	Time To Breakdown (min)	18.3	11.3	11.4	11.1

Line: CHBR1481W

Trait	Check C- 3	Line C- 8	Check M- 3	Line M- 8
II. Cooperator Results				
31 Bake Absorption (%, 14% flour mb)	68.4	62.6	66.4	62.4
32 Loaf Volume (cc)	100.0	95.6	100.0	94.9
33 Mixing Requirement	4.0	3.9	4.2	3.9
5=Very Long, 4=Long, 3=Medium, 2=Short, 1=Very Short				
34 Dough Characteristics	3.8	3.3	3.9	3.2
5=Bucky-Tough, 4=Strong-Elastic, 3=Medium-Pliable, 2=Mellow-Very Pliable, 1=Weak-Short or Sticky				
35 Mixing Tolerance	3.0	2.8	3.3	2.9
5=Much More Tolerance, 4=More Tolerance, 3=Equivalent, 2=Less Tolerance, and 1=Much Less Tolerance when compared to check				
36 Internal Crumb Color	3.0	3.0	3.0	3.3
5=Much Brighter, 4=Brighter, 3=Equivalent, 2=Poorer, and 1=Much Poorer when compared to check				
37 Internal Grain and Texture	3.0	3.3	3.0	3.2
5=Much Better, 4=Better, 3=Equivalent, 2=Poorer, and 1=Much Poorer when compared to Check				
III. Cooperator Evaluation (37-40)				
5=Much Better, 4=Better, 3=Equivalent, 2=Poorer, and 1=Much Poorer when compared to Check				
38 Quality Trait 1-3: Protein	3.0	1.2	3.0	1.6
39 Quality Trait 4-22: Milling	3.0	3.3	3.0	3.3
40 Quality Trait 24-37: Baking	3.0	2.8	3.0	2.8
41 Quality Trait 1-37: Overall	3.0	2.4	3.0	2.6

Line: ND 819 (Check- Glenn)

	Trait	Check B- 3	Line B- 9	Check C- 3	Line C- 9	Check K- 3	Line K- 9	Check M- 3	Line M- 9
I. USDA/ARS WQL Data									
1	Wheat Protein (12% mb)	14.8	14.8	15.4	14.6	13.1	12.2	15.0	14.4
2	Flour Protein (12% mb)	14.7	14.1	14.5	13.7	12.5	11.4	14.7	13.6
3	UPP/EPP (SDS unextractable/extractable polymeric proteins)	1.35	1.32	1.51	1.10	1.29	1.15	1.53	1.27
4	Market Value 1 (Score 1-6)	4.7	4.2	4.9	4.5	4.3	4.0	3.1	2.9
5	Market Value 2 (Score 1-10)	10.0	8.4	10.0	8.6	10.0	8.8	10.0	8.2
6	Test Weight (lb/bu)	64.7	61.2	65.4	63.0	66.1	64.5	62.0	59.7
7	1000 Kernel Weight (g)	31.6	28.4	30.2	28.8	30.7	31.3	25.2	30.0
	Kernel Size								
8	% Large	68	56	66	63	56	75	68	71
9	% Small	9	14	9	10	10	5	9	9
10	Wheat Moisture (%)	12.5	12.2	13.1	12.9	12.5	12.5	15.2	13.1
11	Wheat Ash (14% mb)	1.62	1.58	1.46	1.43	1.20	1.32	1.56	1.62
12	Wheat Falling Number (sec)	441	465	421	400	404	408	271	304
13	SKCS Hardness Index (SK-HI)	87.3	95.7	92.0	104.2	90.3	90.7	84.1	85.4
14	SK-HI Standard Deviation	19.1	18.3	18.1	19.9	17.9	17.8	17.2	19.8
15	Vitreous Kernels (%)	100	84	98	89	97	89	100	48
	Flour Extraction (%)								
16	Tempered Wheat Basis (%)	73.8	71.0	72.6	72.1	72.7	75.5	71.9	71.9
17	Total Product Basis (%)	75.6	74.3	74.0	73.7	73.5	75.3	73.6	74.2
18	Flour (Lbs)/ Wheat (Bu)	45.6	44.8	44.6	44.5	44.4	45.4	44.4	44.8
	Flour Characteristics								
19	Flour Color Brightness (L*)	90.4	90.2	90.8	90.4	91.3	90.3	90.9	90.5
20	Flour Color Yellow Scale (b*)	7.2	7.9	7.4	8.2	7.4	8.0	7.2	8.2
21	Flour Moisture (%)	13.2	13.2	13.2	13.7	13.4	12.7	13.7	13.0
22	Flour Ash (14% mb)	0.51	0.53	0.43	0.46	0.47	0.49	0.52	0.56
23	Falling Number (Malted) (sec)	252	248	249	252	252	249	252	252
	Farinograph								
24	Water Absorption (500bu)	65.4	68.5	68.4	70.5	64.8	70.6	64.3	69.3
25	Water Absorption (14%mb)	64.8	67.5	67.4	70.1	64.4	69.1	63.9	68.4
26	Arrival Time (min)	3.5	3.9	5.0	3.8	3.0	2.2	2.2	2.9
27	Peak Time (min)	7.9	7.9	9.9	6.5	8.2	5.7	6.2	5.9
28	Dough Stability (min)	9.6	8.6	13.8	7.7	10.4	7.0	10.8	7.7
29	Mixing tolerance Index (bu)	32	33	15	28	33	37	24	33
30	Time To Breakdown (min)	12.7	12.1	18.3	11.6	12.6	9.6	11.4	10.6

Line: ND 819

Trait	Check B- 3	Line B- 9	Check C- 3	Line C- 9	Check K- 3	Line K- 9	Check M- 3	Line M- 9
II. Cooperator Results								
31 Bake Absorption (%, 14% flour mb)	66.6	67.5	68.4	68.6	65.9	66.3	66.4	67.9
32 Loaf Volume (cc)	100.0	97.4	100.0	99.8	100.0	90.7	100.0	96.7
33 Mixing Requirement	4.0	3.5	4.0	3.1	4.0	2.6	4.2	3.3
5=Very Long, 4=Long, 3=Medium, 2=Short, 1=Very Short								
34 Dough Characteristics	4.0	4.0	3.8	3.5	3.8	3.1	3.9	3.3
5=Bucky-Tough, 4=Strong-Elastic, 3=Medium-Pliable, 2=Mellow-Very Pliable, 1=Weak-Short or Sticky								
35 Mixing Tolerance	3.0	2.8	3.0	2.2	3.0	2.2	3.3	2.5
5=Much More Tolerance, 4=More Tolerance, 3=Equivalent, 2=Less Tolerance, and 1=Much Less Tolerance when compared to check								
36 Internal Crumb Color	3.0	2.9	3.0	3.2	3.0	2.7	3.0	3.0
5=Much Brighter, 4=Brighter, 3=Equivalent, 2=Poorer, and 1=Much Poorer when compared to check								
37 Internal Grain and Texture	3.0	2.8	3.0	3.2	3.0	2.5	3.0	2.6
5=Much Better, 4=Better, 3=Equivalent, 2=Poorer, and 1=Much Poorer when compared to Check								
III. Cooperator Evaluation (37-40)								
5=Much Better, 4=Better, 3=Equivalent, 2=Poorer, and 1=Much Poorer when compared to Check								
38 Quality Trait 1-3: Protein	3.0	2.6	3.0	2.3	3.0	1.9	3.0	1.9
39 Quality Trait 4-22: Milling	3.0	2.4	3.0	2.8	3.0	3.1	3.0	3.1
40 Quality Trait 24-37: Baking	3.0	3.0	3.0	3.0	3.0	2.0	3.0	2.7
41 Quality Trait 1-37: Overall	3.0	2.7	3.0	2.5	3.0	2.2	3.0	2.5

Line: WB9507 (Check- Glenn)

	Trait	Check C- 3	Line C-10	Check W- 3	Line W-10
I. USDA/ARS WQL Data					
1	Wheat Protein (12% mb)	15.4	14.1	13.7	13.1
2	Flour Protein (12% mb)	14.5	13.1	13.4	12.5
3	UPP/EPP (SDS unextractable/extractable polymeric proteins)	1.51	1.11	1.39	1.25
4	Market Value 1 (Score 1-6)	4.9	4.4	4.1	4.2
5	Market Value 2 (Score 1-10)	10.0	7.2	10.0	7.0
6	Test Weight (lb/bu)	65.4	61.4	64.2	60.1
7	1000 Kernel Weight (g)	30.2	35.7	29.2	39.1
	Kernel Size				
8	% Large	66	63	47	82
9	% Small	9	11	12	3
10	Wheat Moisture (%)	13.1	13.0	11.8	11.6
11	Wheat Ash (14% mb)	1.46	1.44	1.58	1.57
12	Wheat Falling Number (sec)	421	400	405	486
13	SKCS Hardness Index (SK-HI)	92.0	93.1	87.6	73.0
14	SK-HI Standard Deviation	18.1	16.7	15.5	16.5
15	Vitreous Kernels (%)	98	92	91	48
	Flour Extraction (%)				
16	Tempered Wheat Basis (%)	72.6	73.4	72.2	72.8
17	Total Product Basis (%)	74.0	73.5	74.6	72.8
18	Flour (Lbs)/ Wheat (Bu)	44.6	44.3	45.0	43.9
	Flour Characteristics				
19	Flour Color Brightness (L*)	90.8	90.5	90.9	91.4
20	Flour Color Yellow Scale (b*)	7.4	7.4	7.6	6.9
21	Flour Moisture (%)	13.2	13.4	13.7	13.2
22	Flour Ash (14% mb)	0.43	0.47	0.55	0.57
23	Falling Number (Malted) (sec)	249	265	259	262
	Farinograph				
24	Water Absorption (500bu)	68.4	69.8	68.6	68.5
25	Water Absorption (14%mb)	67.4	69.3	68.2	67.6
26	Arrival Time (min)	5.0	2.9	2.7	2.6
27	Peak Time (min)	9.9	6.9	7.9	4.9
28	Dough Stability (min)	13.8	9.4	10.9	8.6
29	Mixing tolerance Index (bu)	15	28	25	25
30	Time To Breakdown (min)	18.3	12.3	13.3	11.5

Line: WB9507

Trait	Check C- 3	Line C-10	Check W- 3	Line W-10
II. Cooperator Results				
31 Bake Absorption (%, 14% flour mb)	**68.4**	**68.0**	**67.6**	**66.5**
32 Loaf Volume (cc)	**100.0**	**99.7**	**100.0**	**99.8**
33 Mixing Requirement	**4.0**	**3.8**	**4.3**	**4.0**
5=Very Long, 4=Long, 3=Medium, 2=Short, 1=Very Short				
34 Dough Characteristics	**3.8**	**3.7**	**4.3**	**4.0**
5=Bucky-Tough, 4=Strong-Elastic, 3=Medium-Pliable, 2=Mellow-Very Pliable, 1=Weak-Short or Sticky				
35 Mixing Tolerance	**3.0**	**2.7**	**3.3**	**3.0**
5=Much More Tolerance, 4=More Tolerance, 3=Equivalent, 2=Less Tolerance, and 1=Much Less Tolerance when compared to check				
36 Internal Crumb Color	**3.0**	**3.3**	**3.0**	**3.4**
5=Much Brighter, 4=Brighter, 3=Equivalent, 2=Poorer, and 1=Much Poorer when compared to check				
37 Internal Grain and Texture	**3.0**	**3.2**	**3.0**	**3.4**
5=Much Better, 4=Better, 3=Equivalent, 2=Poorer, and 1=Much Poorer when compared to Check				
III. Cooperator Evaluation (37-40)				
5=Much Better, 4=Better, 3=Equivalent, 2=Poorer, and 1=Much Poorer when compared to Check				
38 Quality Trait 1-3: Protein	**3.0**	**1.8**	**3.0**	**2.0**
39 Quality Trait 4-22: Milling	**3.0**	**2.9**	**3.0**	**2.8**
40 Quality Trait 24-37: Baking	**3.0**	**2.9**	**3.0**	**3.2**
41 Quality Trait 1-37: Overall	**3.0**	**2.6**	**3.0**	**3.1**

Line: ND 812 (Check- Glenn)

	Trait	Check B- 3	Line B-11	Check K- 3	Line K-11	Check M- 3	Line M-11
I. USDA/ARS WQL Data							
1	Wheat Protein (12% mb)	14.8	14.3	13.1	13.0	15.0	14.8
2	Flour Protein (12% mb)	14.7	13.9	12.5	12.1	14.7	14.0
3	UPP/EPP (SDS unextractable/extractable polymeric proteins)	1.35	1.31	1.29	1.15	1.53	1.23
4	Market Value 1 (Score 1-6)	4.7	4.5	4.3	4.4	3.1	4.0
5	Market Value 2 (Score 1-10)	10.0	8.6	10.0	10.0	10.0	10.0
6	Test Weight (lb/bu)	64.7	63.4	66.1	65.4	62.0	61.3
7	1000 Kernel Weight (g)	31.6	28.4	30.7	31.2	25.2	28.1
	Kernel Size						
8	% Large	68	55	56	69	68	75
9	% Small	9	12	10	8	9	6
10	Wheat Moisture (%)	12.5	12.6	12.5	12.6	15.2	13.3
11	Wheat Ash (14% mb)	1.62	1.48	1.20	1.18	1.56	1.45
12	Wheat Falling Number (sec)	441	444	404	421	271	387
13	SKCS Hardness Index (SK-HI)	87.3	99.1	90.3	93.5	84.1	94.7
14	SK-HI Standard Deviation	19.1	18.2	17.9	17.7	17.2	18.8
15	Vitreous Kernels (%)	100	88	97	97	100	86
	Flour Extraction (%)						
16	Tempered Wheat Basis (%)	73.8	75.1	72.7	75.7	71.9	75.0
17	Total Product Basis (%)	75.6	75.5	73.5	75.9	73.6	75.8
18	Flour (Lbs)/ Wheat (Bu)	45.6	45.5	44.4	45.8	44.4	45.8
	Flour Characteristics						
19	Flour Color Brightness (L*)	90.4	90.3	91.3	91.0	90.9	90.9
20	Flour Color Yellow Scale (b*)	7.2	8.0	7.4	8.1	7.2	8.5
21	Flour Moisture (%)	13.2	13.9	13.4	13.1	13.7	13.2
22	Flour Ash (14% mb)	0.51	0.53	0.47	0.48	0.52	0.49
23	Falling Number (Malted) (sec)	252	249	252	257	252	254
	Farinograph						
24	Water Absorption (500bu)	65.4	67.5	64.8	68.2	64.3	68.3
25	Water Absorption (14%mb)	64.8	66.8	64.4	67.5	63.9	67.3
26	Arrival Time (min)	3.5	3.1	3.0	3.3	2.2	3.4
27	Peak Time (min)	7.9	7.5	8.2	5.6	6.2	6.0
28	Dough Stability (min)	9.6	8.2	10.4	6.3	10.8	6.7
29	Mixing tolerance Index (bu)	32	36	33	33	24	35
30	Time To Breakdown (min)	12.7	11.1	12.6	10.2	11.4	10.1

Line: ND 812

Trait	Check B- 3	Line B-11	Check K- 3	Line K-11	Check M- 3	Line M-11
II. Cooperator Results						
31 Bake Absorption (%, 14% flour mb)	66.6	66.8	65.9	66.1	66.4	66.9
32 Loaf Volume (cc)	100.0	97.3	100.0	93.4	100.0	96.7
33 Mixing Requirement	4.0	3.5	4.0	2.6	4.2	3.1
5=Very Long, 4=Long, 3=Medium, 2=Short, 1=Very Short						
34 Dough Characteristics	4.0	3.3	3.8	2.9	3.9	3.4
5=Bucky-Tough, 4=Strong-Elastic, 3=Medium-Pliable, 2=Mellow-Very Pliable, 1=Weak-Short or Sticky						
35 Mixing Tolerance	3.0	2.4	3.0	2.0	3.3	2.4
5=Much More Tolerance, 4=More Tolerance, 3=Equivalent, 2=Less Tolerance, and 1=Much Less Tolerance when compared to check						
36 Internal Crumb Color	3.0	3.1	3.0	2.7	3.0	3.2
5=Much Brighter, 4=Brighter, 3=Equivalent, 2=Poorer, and 1=Much Poorer when compared to check						
37 Internal Grain and Texture	3.0	3.0	3.0	2.9	3.0	3.0
5=Much Better, 4=Better, 3=Equivalent, 2=Poorer, and 1=Much Poorer when compared to Check						
III. Cooperator Evaluation (37-40)						
5=Much Better, 4=Better, 3=Equivalent, 2=Poorer, and 1=Much Poorer when compared to Check						
38 Quality Trait 1-3: Protein	3.0	2.4	3.0	2.6	3.0	2.5
39 Quality Trait 4-22: Milling	3.0	3.1	3.0	3.5	3.0	3.7
40 Quality Trait 24-37: Baking	3.0	2.7	3.0	2.0	3.0	3.0
41 Quality Trait 1-37: Overall	3.0	2.6	3.0	2.6	3.0	2.8

Line: MT0832 (Duclair) (Check- Glenn)

	Trait	Check W- 3	Line W-12
I. USDA/ARS WQL Data			
1	Wheat Protein (12% mb)	13.7	12.9
2	Flour Protein (12% mb)	13.4	12.7
3	UPP/EPP (SDS unextractable/extractable polymeric proteins)	1.39	1.23
4	Market Value 1 (Score 1-6)	4.1	3.7
5	Market Value 2 (Score 1-10)	10.0	7.8
6	Test Weight (lb/bu)	64.2	60.1
7	1000 Kernel Weight (g)	29.2	28.7
	Kernel Size		
8	% Large	47	24
9	% Small	12	19
10	Wheat Moisture (%)	11.8	11.3
11	Wheat Ash (14% mb)	1.58	1.35
12	Wheat Falling Number (sec)	405	495
13	SKCS Hardness Index (SK-HI)	87.6	65.2
14	SK-HI Standard Deviation	15.5	17.1
15	Vitreous Kernels (%)	91	90
	Flour Extraction (%)		
16	Tempered Wheat Basis (%)	72.2	73.7
17	Total Product Basis (%)	74.6	74.4
18	Flour (Lbs)/ Wheat (Bu)	45.0	44.9
	Flour Characteristics		
19	Flour Color Brightness (L*)	90.9	91.0
20	Flour Color Yellow Scale (b*)	7.6	7.8
21	Flour Moisture (%)	13.7	13.2
22	Flour Ash (14% mb)	0.55	0.50
23	Falling Number (Malted) (sec)	259	260
	Farinograph		
24	Water Absorption (500bu)	68.6	61.1
25	Water Absorption (14%mb)	68.2	60.5
26	Arrival Time (min)	2.7	2.1
27	Peak Time (min)	7.9	5.6
28	Dough Stability (min)	10.9	9.5
29	Mixing tolerance Index (bu)	25	25
30	Time To Breakdown (min)	13.3	12.0

Line: MT0832 (Duclair)

Trait	Check W- 3	Line W-12
II. Cooperator Results		
31 Bake Absorption (%, 14% flour mb)	**67.6**	**62.5**
32 Loaf Volume (cc)	**100.0**	**102.8**
33 Mixing Requirement	**4.3**	**4.0**
5=Very Long, 4=Long, 3=Medium, 2=Short, 1=Very Short		
34 Dough Characteristics	**4.3**	**3.7**
5=Bucky-Tough, 4=Strong-Elastic, 3=Medium-Pliable, 2=Mellow-Very Pliable, 1=Weak-Short or Sticky		
35 Mixing Tolerance	**3.3**	**2.9**
5=Much More Tolerance, 4=More Tolerance, 3=Equivalent, 2=Less Tolerance, and 1=Much Less Tolerance when compared to check		
36 Internal Crumb Color	**3.0**	**3.2**
5=Much Brighter, 4=Brighter, 3=Equivalent, 2=Poorer, and 1=Much Poorer when compared to check		
37 Internal Grain and Texture	**3.0**	**3.4**
5=Much Better, 4=Better, 3=Equivalent, 2=Poorer, and 1=Much Poorer when compared to Check		
III. Cooperator Evaluation (37-40)		
5=Much Better, 4=Better, 3=Equivalent, 2=Poorer, and 1=Much Poorer when compared to Check		
38 Quality Trait 1-3: Protein	**3.0**	**2.1**
39 Quality Trait 4-22: Milling	**3.0**	**3.0**
40 Quality Trait 24-37: Baking	**3.0**	**3.3**
41 Quality Trait 1-37: Overall	**3.0**	**2.9**

Individual Cooperator Bake Data

Glenn (Check)

Glenn (Watertown, SD, B- 3)				
ID	Bake Absorption (%, 14% mb)	Loaf Volume (cc)	Mixing Require-ment	Dough Charact-eristics
A	61.0	2750	5	5
B	65.5	2225	3	3
C	64.0	955	3	4
D	65.0	2897	5	5
E	64.0	2600	5	4
F	64.8	2375	3	4
G	67.0	945	3	3
H	63.0	2900	3	4
I	70.0	1060	4	4
J	61.0	860	4	4
K	69.3	985	4	4
L	76.0	1050	5	4
M	70.1	838	4	3
Mean	66.6	-	4.0	4.0
Std Dev	4.2	-	0.9	0.6

Glenn (Casselton, ND, C- 3)				
ID	Bake Absorption (%, 14% mb)	Loaf Volume (cc)	Mixing Require-ment	Dough Charact-eristics
A	60.0	2700	5	5
B	68.5	1950	3	3
C	64.0	1005	4	4
D	66.0	3104	5	5
E	65.0	2600	5	4
F	67.4	2200	3	1
G	67.0	1025	3	3
H	66.0	2700	3	3
I	75.0	995	5	4
J	63.5	925	3.5	4
K	71.4	985	4	4
L	76.5	1060	4	4
M	70.1	795	4	3
Mean	68.4	-	4.0	3.8
Std Dev	4.6	-	0.8	1.0

Glenn (Crookston, MN, K- 3)				
ID	Bake Absorption (%, 14% mb)	Loaf Volume (cc)	Mixing Require-ment	Dough Charact-eristics
A	58.0	2700	5	5
B	65.0	2375	3	3
C	62.0	945	3	3
D	65.0	3015	5	5
E	62.0	2600	5	4
F	64.4	2400	3	2
G	64.0	935	3	4
H	65.0	2950	3	3
I	71.2	910	5	4
J	63.2	840	4	4
K	68.6	905	4	4
L	73.8	975	4	4
M	67.0	868	4	3
Mean	65.9	-	4.0	3.8
Std Dev	4.1	-	0.9	0.9

Glenn (Minot, ND, M- 3)				
ID	Bake Absorption (%, 14% mb)	Loaf Volume (cc)	Mixing Require-ment	Dough Charact-eristics
A	61.0	2900	5	5
B	64.5	2300	3	3
C	64.0	1025	4	4
D	63.0	3162	5	5
E	63.5	2625	5	5
F	63.9	2600	4	3
G	67.0	1025	3	3
H	62.0	2950	3	3
I	70.7	1065	4	5
J	55.6	910	4	4
K	73.8	1055	4	3
L	73.4	945	5	4
M	70.2	911	4.5	3
Mean	66.4	-	4.2	3.9
Std Dev	5.2	-	0.8	0.9

Glenn (Williston, ND, W- 3)				
ID	Bake Absorption (%, 14% mb)	Loaf Volume (cc)	Mixing Require-ment	Dough Charact-eristics
A	59.0	2900	5	5
B	68.2	2150	3	2
C	63.0	975	4	4
D	66.0	3074	5	5
E	66.0	2600	5	4
F	68.2	2500	5	1
G	65.0	910	3	4
H	65.0	3000	3	4
I	74.9	970	5	5
J	64.7	925	4	4
K	72.9	940	4	4
L	74.4	865	5	5
M	63.2	814	3	5
Mean	67.6	-	4.3	4.3
Std Dev	4.7	-	0.9	1.2

BR0202W

BR0202W (Casselton, ND, C- 1)

ID	Bake Absorption (%, 14% mb)	Loaf Volume (cc)	Loaf Volume (% of Check)	Mixing Requirement	Dough Characteristics	Quality Score Compared to Check (Glenn) Mixing Tolerance	Internal Crumb Color	Internal Grain and Texture	Protein	Milling	Baking	Overall
A	59.0	2750	101.9	3	3	2	3	4	2	2	2	2
B	62.5	2150	110.3	3	3	3	4	4	2	3	4	2
C	64.0	940	93.5	2	3	2	3	2	2	3	1	2
D	61.0	3045	98.1	5	5	3	2	4	2	3	2	2
E	61.0	2425	93.3	4	3	3	2	1	-	-	1	-
F	61.6	2275	103.4	2	4	5	2	2	2	1	3	3
G	64.0	930	90.7	3	3	2	3	2	2	3	2	2
H	60.0	2850	105.6	2	3	3	3	3	2	4	3	3
I	68.1	965	97.0	4	3	2	3	3	1	3	3	3
J	58.4	740	80.0	4	4	3	3	2	1	3.5	2	2.3
K	66.3	900	91.4	4	4	3	3	4	2	4	3	3
L	73.3	1020	96.2	5	4	4	3	3	1	2	4	4
M	62.7	755	95.0	4	4	2	4	4	1.5	2	2.5	2
Mean	63.6	-	98.0	3.6	3.6	2.9	3.0	3.1	1.8	3.0	2.6	2.6
Std Dev	4.1	-	7.7	1.1	0.7	0.9	0.6	1.0	0.5	0.9	1.0	0.7

BR0202W (Minot, ND, M- 1)

ID	Bake Absorption (%, 14% mb)	Loaf Volume (cc)	Loaf Volume (% of Check)	Mixing Requirement	Dough Characteristics	Quality Score Compared to Check (Glenn) Mixing Tolerance	Internal Crumb Color	Internal Grain and Texture	Protein	Milling	Baking	Overall
A	60.0	2900	100.0	3	3	2	3	3	3	2	3	3
B	59.0	2325	101.1	3.5	5	4	4	3	3	3	2	2
C	64.0	1005	98.0	3	3	2	4	3	3	3	2	3
D	59.0	3015	95.4	5	5	3	4	3	2	2	3	2
E	60.0	2650	101.0	5	4	3	3	4	-	-	3	-
F	58.9	2575	99.0	4	3	3	3	4	2	3	4	3
G	65.0	1025	100.0	4	2	3	3	3	3	3	4	3
H	58.0	3000	101.7	4	4	4	4	4	3	3	4	4
I	64.5	1025	96.2	4	4	3	3	3	2	3	3	2
J	59.8	860	94.5	4	4	3	4	2.5	2	3	2.8	2.7
K	68.8	975	92.4	4	3	3	4	5	2	3	4	3
L	72.4	995	105.3	5	4	3	3	3	2	3	4	4
M	64.3	976	107.1	4	3	4.5	4	3.5	2.5	0.5	3.5	2.5
Mean	63.0	-	99.9	4.1	3.8	3.2	3.6	3.5	2.5	2.8	3.4	2.9
Std Dev	4.4	-	4.2	0.7	0.9	0.7	0.5	0.7	0.5	0.8	0.7	0.7

MN08165-8

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

ID	Bake Absorption (%, 14% mb)	Loaf Volume (cc)	Loaf Volume (% of Check)	Mixing Requirement	Dough Characteristics	Quality Score Compared to Check (Glenn): Mixing Tolerance	Internal Crumb Color	Internal Grain and Texture	Protein	Milling	Baking	Overall
A	61.0	2900	107.4	5	5	3	3	2	4	2	3	3
B	68.5	2125	109.0	3	3	3	4	4	4	3	4	3
C	64.0	975	97.0	3	4	2	2	3	3	3	2	2
D	66.0	2897	93.3	5	5	3	2	3	4	4	3	4
E	66.5	2475	95.2	5	4	3	2	3	-	-	2	-
F	67.2	2500	113.6	4	4	4	2	3	5	2	5	3
G	67.0	980	95.6	3	3	2	3	3	5	3	3	3
H	66.0	2750	101.9	5	4	5	4	4	4	4	4	3
I	73.7	1090	109.5	3	3	5	2	3	4	3	2	3
J	63.3	845	91.4	3.5	3	3	3	3	4	4	2.5	3.3
K	70.0	1070	108.6	4	4	2	3	3	4	3	3	3.3
L	78.7	1120	105.7	4	4	3	3	3	4	3	3	3
M	66.3	862	108.4	3	5	3	3	2	3.5	3	3.5	3.5
Mean	68.1	-	103.8	4.0	4.0	3.3	2.8	3.1	4.1	3.2	3.2	3.2
Std Dev	4.6	-	7.4	0.9	0.8	1.0	0.7	0.6	0.5	0.7	0.9	0.5

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

ID	Bake Absorption (%, 14% mb)	Loaf Volume (cc)	Loaf Volume (% of Check)	Mixing Requirement	Dough Characteristics	Quality Score Compared to Check (Glenn): Mixing Tolerance	Internal Crumb Color	Internal Grain and Texture	Protein	Milling	Baking	Overall
A	60.0	2700	100.0	5	5	3	3	3	4	2	3	3
B	67.5	2275	95.8	4	3	4	3	4	4	3	3	3
C	63.0	950	100.5	4	4	3	3	3	4	3	4	4
D	66.0	2927	97.1	5	5	3	2	3	4	4	3	4
E	65.5	2575	99.0	5	4	3	2	1	-	-	2	-
F	66.0	2525	105.2	3	3	3	4	3	3	2	5	3
G	65.0	825	88.2	3	4	2	1	2	4	3	2	2
H	63.0	2900	98.3	3	3	3	3	3	5	4	3	4
I	73.1	1020	112.1	3	3	3	3	3	4	3	4	4
J	60.2	885	105.4	4	4	3	2.5	4	4	2.5	3.2	3.1
K	68.1	975	107.7	3	4	2	2	3	4	4	3	3.7
L	73.8	1025	105.1	4	4	2	3	5	5	2	4	3
M	63.7	868	100.0	3	4	4	3.5	2	4	3	3	3
Mean	66.2	-	102.2	3.8	3.9	3.0	2.8	3.2	4.2	3.0	3.4	3.4
Std Dev	4.2	-	6.1	0.8	0.7	0.6	0.8	1.0	0.5	0.8	0.8	0.6

Elgin-ND

Elgin-ND (Watertown, SD, B- 4)												
		Loaf Volume				Quality Score Compared to Check (Glenn)						
ID	Bake Absorption (%, 14% mb)	(cc)	(% of Check)	Mixing Require-ment	Dough Charact-eristics	Mixing Tolerance	Internal Crumb Color	Internal Grain and Texture	Protein	Milling	Baking	Overall
A	60.0	2750	100.0	5	4	3	3	3	3	2	3	3
B	68.0	2225	100.0	2	3	3	3	3	2	3	3	2
C	64.0	900	94.2	3	3	2	3	3	3	2	2	2
D	66.0	2868	99.0	5	5	3	3	2	2	2	2	2
E	65.5	2600	100.0	4	3	4	3	2	-	-	4	-
F	66.6	2300	96.8	3	4	3	3	2	3	3	2	3
G	66.0	780	82.5	3	3	2	3	2	3	3	1	2
H	65.0	2700	93.1	2	2	2	3	3	3	4	2	2
I	73.2	1005	94.8	3	4	2	3	4	2	3	3	3
J	63.3	735	85.5	3.5	4	2	3	2	2.5	3.5	2	2.6
K	67.9	915	92.9	3	4	2	3	3	3	3	3	3
L	75.5	1105	105.2	3	4	2	3	4	3	4	4	4
M	64.4	806	96.2	3	4	3	3	4	2.5	3	3	3
Mean	67.1	-	96.5	3.4	3.8	2.6	3.0	2.9	2.7	3.0	2.8	2.7
Std Dev	4.1	-	6.1	0.9	0.8	0.7	0.0	0.8	0.4	0.7	0.9	0.6

Elgin-ND (Casselton, ND, C- 4)												
		Loaf Volume				Quality Score Compared to Check (Glenn)						
ID	Bake Absorption (%, 14% mb)	(cc)	(% of Check)	Mixing Require-ment	Dough Charact-eristics	Mixing Tolerance	Internal Crumb Color	Internal Grain and Texture	Protein	Milling	Baking	Overall
A	60.0	2700	100.0	4	4	3	3	3	3	2	3	3
B	69.0	2100	107.7	2.5	2	2	4	4	2	3	4	2
C	64.0	950	94.5	3	3	2	3	3	2	2	2	2
D	66.0	2986	96.2	5	5	3	2	2	2	2	2	2
E	66.0	2550	98.1	4	3	3	2	3	-	-	3	-
F	68.1	2250	102.3	3	4	4	2	2	2	4	3	3
G	65.0	875	85.4	3	3	2	1	2	3	3	2	2
H	66.0	2700	100.0	2	2	2	3	3	2	4	2	2
I	74.0	990	99.5	3	3	1	2	4	2	3	3	2
J	64.2	775	83.8	3	3	2	3	2	2	4	2	2.7
K	68.2	920	93.4	3	4	2	3	2	2	4	2	2.7
L	75.4	1055	99.5	4	4	1	4	4	2	3	3	3
M	63.7	754	94.8	2	3	2	4	4	2	2	3	2
Mean	67.5	-	97.6	3.3	3.4	2.3	2.9	3.0	2.2	3.1	2.7	2.4
Std Dev	4.2	-	6.5	0.9	0.9	0.8	0.9	0.9	0.4	0.9	0.7	0.5

Elgin-ND (Crookston, MN, K- 4)												
		Loaf Volume				Quality Score Compared to Check (Glenn)						
ID	Bake Absorption (%, 14% mb)	(cc)	(% of Check)	Mixing Require-ment	Dough Charact-eristics	Mixing Tolerance	Internal Crumb Color	Internal Grain and Texture	Protein	Milling	Baking	Overall
A	58.0	2700	100.0	2	3	2	3	3	3	2	2	2
B	69.0	2150	90.5	3	2	3	3	3	3	3	2	2
C	62.0	850	89.9	2	2	2	3	3	3	3	2	3
D	66.0	3104	103.0	5	5	3	2	2	3	2	2	3
E	67.0	2475	95.2	3	3	2	2	2	-	-	2	-
F	68.5	2200	91.7	2	3	2	2	2	3	3	1	3
G	62.0	740	79.1	3	4	1	1	2	3	4	2	2
H	66.0	2750	93.2	2	2	2	3	3	3	4	3	3
I	74.4	900	98.9	3	3	2	2	2	3	3	2	2
J	64.4	775	92.3	3.5	3	3	3	2	3	3.5	2.8	3.1
K	67.6	855	94.5	3	4	3	3	4	3	4	4	3.7
L	75.8	975	100.0	3	3	3	3	3	3	5	3	4
M	61.9	784	90.3	3	5	3	3.5	3	3	3	2.5	2.5
Mean	67.1	-	95.0	3.0	3.3	2.5	2.7	2.7	3.0	3.4	2.4	2.8
Std Dev	5.0	-	6.1	0.8	1.0	0.7	0.7	0.7	0.0	0.9	0.7	0.7

Elgin-ND (Minot, ND, M- 4)												
		Loaf Volume				Quality Score Compared to Check (Glenn)						
ID	Bake Absorption (%, 14% mb)	(cc)	(% of Check)	Mixing Require-ment	Dough Charact-eristics	Mixing Tolerance	Internal Crumb Color	Internal Grain and Texture	Protein	Milling	Baking	Overall
A	61.0	2600	89.7	3	3	2	2	1	3	2	2	2
B	67.0	2400	104.3	3	3	3	3	3	3	3	3	3
C	64.0	1020	99.5	4	4	3	3	3	4	3	3	3
D	66.0	3104	98.2	5	5	3	4	2	4	4	3	4
E	66.0	2650	101.0	4	3	3	3	4	-	-	4	-
F	66.3	2950	113.5	3	3	3	3	3	4	4	5	3
G	66.0	1020	99.5	3	3	1	3	3	4	4	3	3
H	64.0	3000	101.7	2	2	2	3	3	4	3	3	3
I	72.7	1090	102.3	3	3	2	3	2	3	3	3	3
J	62.1	890	97.8	3	4	3	3	3	3	3.5	3	3.2
K	67.4	950	90.0	3	3	2	3	3	3	4	2	3
L	72.5	1095	115.9	2	4	2	3	4	3	4	4	3
M	65.5	940	103.2	3	3	3	3.5	4	3	4	3	3
Mean	66.6	-	102.2	3.3	3.4	2.6	3.1	3.1	3.5	3.6	3.3	3.1
Std Dev	3.4	-	7.4	0.8	0.8	0.7	0.4	0.9	0.5	0.7	0.8	0.4

Elgin-ND (Williston, ND, W- 4)												
		Loaf Volume				Quality Score Compared to Check (Glenn)						
ID	Bake Absorption (%, 14% mb)	(cc)	(% of Check)	Mixing Require-ment	Dough Charact-eristics	Mixing Tolerance	Internal Crumb Color	Internal Grain and Texture	Protein	Milling	Baking	Overall
A	59.0	2900	100.0	4	4	3	3	3	3	2	3	3
B	67.1	2250	104.7	3	2	3	3	4	2	3	3	2
C	63.0	925	94.9	3	3	2	3	3	3	3	2	2
D	66.0	3045	99.1	4	4	2	2	2	3	3	2	3
E	65.5	2600	100.0	4	3	2	3	3	-	-	3	-
F	67.1	2725	109.0	5	3	4	3	3	3	4	5	3
G	64.0	890	97.8	3	4	2	3	3	3	3	2	3
H	65.0	2850	95.0	4	4	4	4	4	2	2	4	4
I	74.1	930	95.9	4	3	3	1	1	2	3	1	1
J	63.0	900	97.3	4	4	2.5	3	2.5	2.5	3.5	2.8	3
K	68.7	920	97.9	3	4	4	3	4	2	3	4	3
L	72.7	995	115.0	2	3	3	3	4	3	4	4	3
M	62.7	812	99.8	2.5	4	3	3	4	3	3	3	3
Mean	66.6	-	100.9	3.6	3.6	3.0	3.0	3.3	2.7	3.1	3.2	2.9
Std Dev	4.1	-	5.9	0.8	0.7	0.8	0.7	0.9	0.5	0.6	1.1	0.8

ND 816

ND 816 (Watertown, SD, B- 5)												
		Loaf Volume				Quality Score Compared to Check (Glenn)						
ID	Bake Absorption (%, 14% mb)	(cc)	(% of Check)	Mixing Require-ment	Dough Charact-eristics	Mixing Tolerance	Internal Crumb Color	Internal Grain and Texture	Protein	Milling	Baking	Overall
A	60.0	2700	98.2	4	4	3	3	3	3	2	3	3
B	68.5	2150	96.6	3	2	2	3	2	2	3	3	2
C	64.0	915	95.8	3	3	2	3	3	3	3	2	2
D	66.0	2809	97.0	5	5	3	3	2	2	2	2	2
E	64.5	2475	95.2	4	3	4	2	1	-	-	1	-
F	66.9	2125	89.5	3	4	3	2	2	2	3	2	3
G	65.0	710	75.1	3	3	2	1	1	2	3	1	1
H	65.0	2550	87.9	2	2	2	2	2	4	2	2	2
I	74.2	965	91.0	3	2	2	2	3	2	3	2	2
J	63.1	725	84.3	3.5	4	2	3	2	2	2	2	2
K	67.0	885	89.8	3	3	3	3	2	2	3	2	2.3
L	72.2	995	94.8	3	3	2	4	3	2	3	3	3
M	63.7	798	95.2	3	4	3	3	4	2	1	3	2
Mean	66.7	-	92.9	3.4	3.3	2.6	2.8	2.4	2.4	2.6	2.3	2.3
Std Dev	3.8	-	6.4	0.7	0.9	0.7	0.8	0.9	0.7	0.7	0.7	0.6

ND 816 (Casselton, ND, C- 5)

ID	Bake Absorption (%, 14% mb)	Loaf Volume (cc)	Loaf Volume (% of Check)	Mixing Requirement	Dough Characteristics	Quality Score Compared to Check (Glenn): Mixing Tolerance	Internal Crumb Color	Internal Grain and Texture	Protein	Milling	Baking	Overall
A	60.0	2700	100.0	2	3	2	3	2	3	2	2	2
B	69.0	1975	101.3	2	2	3	3	3	3	3	3	3
C	64.0	945	94.0	2	3	2	3	3	3	3	2	2
D	66.0	2927	94.3	5	5	3	2	3	2	3	2	2
E	65.0	2550	98.1	5	3	3	2	4	-	-	3	-
F	68.9	2125	96.6	3	2	3	2	1	3	3	1	3
G	66.0	735	71.7	3	4	2	1	1	3	3	1	1
H	67.0	2700	100.0	2	2	2	3	3	3	3	2	2
I	74.0	1000	100.5	3	2	1	2	3	2	3	2	2
J	64.8	785	84.9	3	3	1	3	2	2	3.5	2	2.5
K	68.2	890	90.4	3	4	2	3	3	4	4	3	3.7
L	74.5	1075	101.4	2	4	1	4	4	3	4	2	2
M	64.3	744	93.6	2	4	1	4	4	2.5	3	2.5	2.5
Mean	67.6	-	96.3	2.9	3.3	2.1	2.8	2.9	2.9	3.2	2.2	2.4
Std Dev	4.0	-	8.4	1.1	1.0	0.8	0.9	1.0	0.6	0.5	0.7	0.7

ND 816 (Crookston, MN, K- 5)

ID	Bake Absorption (%, 14% mb)	Loaf Volume (cc)	Loaf Volume (% of Check)	Mixing Requirement	Dough Characteristics	Quality Score Compared to Check (Glenn): Mixing Tolerance	Internal Crumb Color	Internal Grain and Texture	Protein	Milling	Baking	Overall
A	58.0	2750	101.9	3	3	2	3	3	2	2	2	2
B	65.5	2175	91.6	2	1	2	3	3	2	2	1	2
C	60.0	870	92.1	2	2	2	3	3	2	3	2	2
D	65.0	2956	98.0	5	5	3	3	3	2	3	3	3
E	61.5	2700	103.8	4	3	3	2	3	-	-	3	-
F	64.4	2200	91.7	1	3	1	2	2	2	3	1	3
G	62.0	750	80.2	3	5	2	1	2	2	4	2	2
H	64.0	2600	88.1	1	1	2	2	2	2	5	2	2
I	72.6	870	95.6	4	2	1	2	4	2	3	2	2
J	61.4	740	88.1	3	4	3	3	2	1	5	2.8	3.2
K	66.0	845	93.4	3	3	3	3	4	2	4	4	3.3
L	71.1	925	94.9	2	3	2	3	3	2	5	3	4
M	60.8	778	89.6	3	5	2	4	3.5	2	4	2	2.5
Mean	64.5	-	94.1	2.9	3.3	2.3	2.8	3.0	2.0	3.7	2.4	2.6
Std Dev	4.2	-	6.2	1.2	1.4	0.7	0.8	0.7	0.3	1.1	0.8	0.7

ND 816 (Minot, ND, M- 5)

ID	Bake Absorption (%, 14% mb)	Loaf Volume (cc)	Loaf Volume (% of Check)	Mixing Require-ment	Dough Charact-eristics	Quality Score Compared to Check (Glenn) Mixing Tolerance	Internal Crumb Color	Internal Grain and Texture	Protein	Milling	Baking	Overall
A	59.0	2600	89.7	3	3	2	2	1	2	2	2	2
B	65.0	2325	101.1	3	3	3	4	4	2	3	3	2
C	63.0	995	97.1	4	3	3	3	3	2	3	3	3
D	63.0	3162	100.0	5	5	3	4	3	2	4	3	3
E	62.0	2675	101.9	5	3	3	2	4	-	-	4	-
F	64.0	2850	109.6	3	3	3	3	2	1	4	5	3
G	65.0	925	90.2	3	2	2	3	2	2	4	2	3
H	63.0	2650	89.8	2	2	2	2	3	2	5	3	4
I	69.6	895	84.0	3	3	1	1	4	2	3	1	1
J	60.1	715	78.6	2	4	2	3	1	2	4.5	1	2.3
K	68.8	925	87.7	3	3	3	3	4	2	4	4	3.3
L	73.3	940	99.5	4	3	2	3	2	1	5	3	3
M	63.1	870	95.5	3	3	2	4	4	1.5	4	2.5	2.5
Mean	65.0	-	95.5	3.4	3.2	2.5	3.0	3.0	1.9	4.0	3.0	2.8
Std Dev	4.0	-	8.5	0.9	0.8	0.7	0.9	1.1	0.4	0.9	1.1	0.8

ND 816 (Williston, ND, W- 5)

ID	Bake Absorption (%, 14% mb)	Loaf Volume (cc)	Loaf Volume (% of Check)	Mixing Require-ment	Dough Charact-eristics	Quality Score Compared to Check (Glenn) Mixing Tolerance	Internal Crumb Color	Internal Grain and Texture	Protein	Milling	Baking	Overall
A	59.0	2800	96.6	5	5	3	3	3	3	2	3	3
B	68.6	2100	97.7	3	2	3	3	4	3	3	3	3
C	63.0	960	98.5	4	3	3	3	3	3	3	3	3
D	66.0	3104	101.0	5	5	3	2	3	3	4	3	3
E	64.5	2575	99.0	5	3	3	3	4	-	-	3	-
F	68.6	2550	102.0	4	3	4	3	3	3	4	3	3
G	65.0	910	100.0	3	4	2	3	4	3	4	2	3
H	66.0	2900	96.7	3	3	3	4	4	2	3	4	4
I	74.8	950	97.9	3	2	2	2	4	3	3	2	2
J	63.6	835	90.3	3	4	2.5	4	2	2.5	4	2.5	3
K	72.0	890	94.7	3	3	3	3	4	3	4	4	3.7
L	75.0	1030	119.1	3	4	2	4	4	3	4	5	3
M	63.0	812	99.8	3	4	2.5	3	3.5	3	4	3	3
Mean	67.5	-	100.2	3.7	3.6	2.8	3.2	3.6	3.0	3.6	3.2	3.2
Std Dev	4.8	-	6.6	0.9	1.0	0.6	0.6	0.6	0.3	0.7	0.8	0.5

COI565W

COI565W (Casselton, ND, C- 6)												
		Loaf Volume				Quality Score Compared to Check (Glenn)						
ID	Bake Absorption (%, 14% mb)	(cc)	(% of Check)	Mixing Require-ment	Dough Charact-eristics	Mixing Tolerance	Internal Crumb Color	Internal Grain and Texture	Protein	Milling	Baking	Overall
A	59.0	2600	96.3	2	2	2	3	4	2	2	2	2
B	63.5	2175	111.5	2	3	3	4	4	2	3	4	2
C	63.0	880	87.6	1	1	1	2	2	1	2	1	1
D	63.0	2633	84.8	5	5	3	2	1	1	2	2	2
E	62.5	2475	95.2	4	3	2	2	1	-	-	1	-
F	62.5	2375	108.0	3	2	2	2	2	1	3	4	3
G	63.0	870	84.9	3	2	1	3	3	1	4	2	2
H	61.0	2900	107.4	2	2	2	3	3	2	5	2	3
I	67.7	1020	102.5	3	3	1	3	4	1	3	3	2
J	59.2	845	91.4	3	3	2	2.5	3	1	4	2.5	2.8
K	66.9	870	88.3	3	3	1	3	2	2	4	2	2.7
L	70.4	945	89.2	2	3	1	3	3	1	4	2	2
M	62.4	722	90.8	3	2	2	4	4	1	3	2	2
Mean	63.8	-	96.1	2.9	2.8	1.8	2.9	2.9	1.4	3.4	2.4	2.3
Std Dev	3.2	-	9.2	1.0	1.0	0.7	0.7	1.1	0.5	1.0	0.9	0.6

COI565W (Minot, ND, M- 6)												
		Loaf Volume				Quality Score Compared to Check (Glenn)						
ID	Bake Absorption (%, 14% mb)	(cc)	(% of Check)	Mixing Require-ment	Dough Charact-eristics	Mixing Tolerance	Internal Crumb Color	Internal Grain and Texture	Protein	Milling	Baking	Overall
A	58.0	2400	82.8	1	1	1	2	1	2	2	1	2
B	59.0	2150	93.5	2	3	3	4	4	2	3	4	2
C	61.0	850	82.9	1	1	1	1	1	1	2	1	1
D	59.0	2633	83.3	3	3	2	3	1	1	3	1	1
E	59.0	2525	96.2	3	2	2	1	1	-	-	1	-
F	58.7	2600	100.0	3	3	3	2	1	1	2	4	3
G	62.0	935	91.2	3	2	1	1	2	1	3	2	2
H	58.0	2850	96.6	1	2	2	3	3	1	5	3	4
I	65.2	990	93.0	4	3	1	2	4	1	3	2	2
J	55.2	815	89.6	3	4	2	3	1.5	1	2.5	2.5	2.3
K	63.8	850	80.6	4	3	1	3	2	2	4	2	2.7
L	69.4	870	92.1	5	3	2	3	1	1	3	2	3
M	61.7	860	94.4	3.5	3	1	4	4.5	0.5	1	2	1
Mean	61.2	-	91.3	3.0	2.7	1.8	2.6	2.2	1.3	3.0	2.2	2.3
Std Dev	3.7	-	6.2	1.3	0.9	0.8	1.1	1.3	0.5	1.0	1.0	0.9

SD4189

SD4189 (Watertown, SD, B- 7)												
		Loaf Volume				Quality Score Compared to Check (Glenn)						
ID	Bake Absorption (%, 14% mb)	(cc)	(% of Check)	Mixing Require-ment	Dough Charact-eristics	Mixing Tolerance	Internal Crumb Color	Internal Grain and Texture	Protein	Milling	Baking	Overall
A	59.0	2800	101.8	5	4	3	3	3	2	2	3	3
B	64.5	2100	94.4	3	3	3	3	2	2	3	3	2
C	63.0	930	97.4	3	4	3	3	3	2	3	3	3
D	63.0	2809	97.0	5	5	3	3	3	2	2	2	2
E	62.5	2550	98.1	5	4	3	3	3	-	-	3	-
F	63.7	2325	97.9	4	4	3	3	2	2	3	2	3
G	64.0	845	89.4	3	4	2	3	2	2	3	2	2
H	62.0	2700	93.1	2	2	2	3	2	3	3	2	2
I	69.3	1005	94.8	4	2	3	2	3	1	3	2	2
J	60.8	785	91.3	4	4	2	3	2	2	2.5	2.5	2.4
K	67.2	885	89.8	4	4	2	3	3	2	3	3	2.7
L	73.9	1020	97.1	5	3	2	2	3	1	3	3	4
M	62.7	776	92.6	4	4	4	3	3.5	1.5	2	2.5	2
Mean	64.7	-	95.4	4.1	3.8	2.8	2.9	2.7	2.0	2.8	2.6	2.6
Std Dev	3.9	-	3.6	1.0	0.9	0.6	0.4	0.6	0.5	0.5	0.5	0.6

SD4189 (Casselton, ND, C- 7)												
		Loaf Volume				Quality Score Compared to Check (Glenn)						
ID	Bake Absorption (%, 14% mb)	(cc)	(% of Check)	Mixing Require-ment	Dough Charact-eristics	Mixing Tolerance	Internal Crumb Color	Internal Grain and Texture	Protein	Milling	Baking	Overall
A	59.0	2800	103.7	5	5	3	3	3	2	2	3	3
B	65.0	2250	115.4	3	3	3	4	4	2	3	4	2
C	63.0	960	95.5	3	4	2	3	2	2	3	2	3
D	65.0	2986	96.2	5	5	3	2	4	2	2	3	3
E	62.0	2600	100.0	5	3	3	2	4	-	-	3	-
F	64.5	2475	112.5	4	4	4	4	3	2	3	5	3
G	64.0	970	94.6	3	3	2	3	3	2	3	3	3
H	63.0	2950	109.3	2	2	2	3	3	2	3	2	2
I	69.7	1000	100.5	3	4	2	4	3	1	3	3	2
J	60.8	825	89.2	3	3	3	3.5	2	1	3	2.5	2.4
K	67.6	950	96.4	4	4	3	3	3	2	3	3	2.7
L	71.3	1015	95.8	4	4	3	3	3	1	3	3	3
M	62.9	810	101.9	3	4	2.5	4	3	1.5	3	3	2.5
Mean	64.9	-	101.8	3.8	3.8	2.8	3.3	3.2	1.8	2.9	3.1	2.7
Std Dev	3.4	-	7.6	1.0	0.9	0.6	0.7	0.6	0.5	0.4	0.8	0.4

SD4189 (Crookston, MN, K- 7)												
		Loaf Volume				Quality Score Compared to Check (Glenn)						
ID	Bake Absorption (%, 14% mb)	(cc)	(% of Check)	Mixing Require-ment	Dough Charact-eristics	Mixing Tolerance	Internal Crumb Color	Internal Grain and Texture	Protein	Milling	Baking	Overall
A	57.0	2750	101.9	2	2	2	3	3	2	2	2	2
B	64.0	2150	90.5	3	2	3	3	3	2	3	2	2
C	60.0	860	91.0	2	2	2	3	3	1	3	2	2
D	63.0	3045	101.0	5	5	3	2	3	1	2	3	2
E	61.0	2575	99.0	4	3	3	3	4	-	-	2	-
F	63.0	2250	93.8	2	3	2	2	2	3	3	1	3
G	62.0	785	84.0	3	4	3	1	2	1	4	2	2
H	62.0	2750	93.2	2	2	1	3	3	1	4	3	3
I	69.4	895	98.4	4	4	2	3	3	2	3	2	2
J	58.9	780	92.9	3.5	4	2	4	2	1	4.5	2.5	2.9
K	64.7	815	90.1	4	3	4	3	4	2	4	4	3.3
L	73.3	880	90.3	5	3	3	3	3	1	4	2	3
M	59.6	834	96.1	4	4	3	4	3.5	1.5	3	2	2
Mean	63.4	-	94.8	3.5	3.3	2.7	3.0	3.0	1.6	3.4	2.4	2.5
Std Dev	4.4	-	5.1	1.1	1.0	0.8	0.8	0.7	0.7	0.8	0.7	0.5

CHBR1481W

CHBR1481W (Casselton, ND, C- 8)												
		Loaf Volume				Quality Score Compared to Check (Glenn)						
ID	Bake Absorption (%, 14% mb)	(cc)	(% of Check)	Mixing Require-ment	Dough Charact-eristics	Mixing Tolerance	Internal Crumb Color	Internal Grain and Texture	Protein	Milling	Baking	Overall
A	58.0	2700	100.0	3	3	2	3	3	2	2	2	2
B	61.0	2125	109.0	3	3	3	4	4	1	3	4	2
C	62.0	930	92.5	3	3	2	3	3	1	3	2	2
D	60.0	2868	92.4	5	5	3	2	4	1	1	3	2
E	60.0	2475	95.2	5	3	3	2	3	-	-	2	-
F	60.2	2125	96.6	3	4	4	2	2	1	3	4	3
G	63.0	860	83.9	3	3	3	3	2	1	4	2	2
H	60.0	2850	105.6	2	2	2	3	3	1	4	2	2
I	66.5	935	94.0	5	3	2	3	4	1	3	3	2
J	59.7	740	80.0	3.5	4	2	3	1	1	4	2	2.5
K	66.1	870	88.3	4	3	4	3	4	2	4	4	3.3
L	70.5	985	92.9	5	3	3	3	4	1	4	3	4
M	61.9	768	96.6	4	3	2	4	4	0.5	2	2	1.5
Mean	62.6	-	95.6	3.9	3.3	2.8	3.0	3.3	1.2	3.3	2.8	2.4
Std Dev	3.5	-	7.9	1.0	0.7	0.8	0.6	1.0	0.4	1.0	0.9	0.7

CHBR1481W (Minot, ND, M- 8)												
		Loaf Volume				Quality Score Compared to Check (Glenn)						
ID	Bake Absorption (%, 14% mb)	(cc)	(% of Check)	Mixing Require-ment	Dough Charact-eristics	Mixing Tolerance	Internal Crumb Color	Internal Grain and Texture	Protein	Milling	Baking	Overall
A	59.0	2650	91.4	1	1	1	2	1	2	2	1	2
B	59.5	2200	95.7	2	2	3	4	4	2	3	4	2
C	63.0	965	94.1	3	3	2	4	4	2	2	2	2
D	59.0	2897	91.6	5	5	3	4	3	1	2	2	2
E	59.0	2550	97.1	5	3	3	3	3	-	-	1	-
F	59.2	2425	93.3	4	3	3	3	2	1	3	3	3
G	64.0	990	96.6	4	2	3	3	3	2	4	4	3
H	58.0	2750	93.2	3	3	3	2	2	2	5	2	3
I	65.8	1000	93.9	5	3	3	3	3	1	3	2	2
J	55.6	805	88.5	3	4	3	3	2.5	1.5	4	2.5	2.8
K	67.8	900	85.3	4	3	3	3	5	2	4	4	3.3
L	71.8	950	100.5	5	4	3	3	3	1	4	4	4
M	62.7	932	102.3	4	3	3	4	4	1.5	1	2.5	1.5
Mean	62.4	-	94.9	3.9	3.2	2.9	3.3	3.2	1.6	3.3	2.8	2.6
Std Dev	4.5	-	4.6	1.3	1.0	0.6	0.7	1.1	0.5	1.2	1.1	0.7

ND 819

ND 819 (Watertown, SD, B- 9)												
		Loaf Volume				Quality Score Compared to Check (Glenn)						
ID	Bake Absorption (%, 14% mb)	(cc)	(% of Check)	Mixing Require-ment	Dough Charact-eristics	Mixing Tolerance	Internal Crumb Color	Internal Grain and Texture	Protein	Milling	Baking	Overall
A	60.0	2800	101.8	3	4	3	3	3	3	2	3	3
B	68.5	2325	104.5	3	4	4	3	3	2	3	3	2
C	64.0	910	95.3	3	3	3	3	2	3	2	3	3
D	66.0	2986	103.1	5	5	3	3	3	3	2	3	3
E	66.5	2575	99.0	5	3	3	3	3	-	-	3	-
F	67.5	2300	96.8	4	4	3	4	3	3	3	3	3
G	66.0	860	91.0	3	5	2	2	2	3	3	2	2
H	65.0	2650	91.4	2	2	2	2	2	2	2	2	2
I	74.4	1030	97.2	3	4	2	3	4	2	3	4	3
J	63.4	775	90.1	3.5	4	2	2	2	2.5	1	2.5	2
K	70.2	960	97.5	3	4	4	3	2	2	2	4	2.7
L	74.9	1055	100.5	4	3	2	3	3	3	2	3	3
M	64.1	756	90.2	3	5	3	3	3.5	2.5	2	2.5	2.5
Mean	67.5	-	97.4	3.5	4.0	2.8	2.9	2.8	2.6	2.4	3.0	2.7
Std Dev	4.2	-	5.0	0.9	0.9	0.7	0.6	0.7	0.5	0.6	0.6	0.5

ND 819 (Casselton, ND, C- 9)

ID	Bake Absorption (%, 14% mb)	Loaf Volume (cc)	Loaf Volume (% of Check)	Mixing Requirement	Dough Characteristics	Quality Score Compared to Check (Glenn) Mixing Tolerance	Internal Crumb Color	Internal Grain and Texture	Protein	Milling	Baking	Overall
A	60.0	2800	103.7	2	3	2	3	3	3	2	2	2
B	70.5	2200	112.8	3	1	2	4	4	2	3	4	2
C	64.0	950	94.5	3	4	2	3	3	3	3	2	3
D	66.0	3074	99.0	5	5	3	3	3	2	2	3	2
E	68.0	2550	98.1	3	3	2	3	3	-	-	3	-
F	70.1	2375	108.0	3	2	2	3	3	2	3	5	3
G	65.0	855	83.4	3	4	2	3	2	3	3	2	2
H	67.0	2750	101.9	2	2	2	3	3	2	2	2	2
I	74.8	995	100.0	4	2	1	2	4	2	3	3	3
J	66.0	775	83.8	3	4	2	3	2	2	3.5	2.5	2.8
K	70.9	945	95.9	3	4	3	3	3	2	3	3	2.7
L	77.5	1050	99.1	2	4	2	3	3	2	3	3	3
M	63.7	804	101.1	3	5	2.5	4	4	2	2	3.5	2.5
Mean	68.6	-	99.8	3.1	3.5	2.2	3.2	3.2	2.3	2.8	3.0	2.5
Std Dev	4.8	-	8.2	0.8	1.3	0.5	0.5	0.6	0.5	0.5	0.9	0.5

ND 819 (Crookston, MN, K- 9)

ID	Bake Absorption (%, 14% mb)	Loaf Volume (cc)	Loaf Volume (% of Check)	Mixing Requirement	Dough Characteristics	Quality Score Compared to Check (Glenn) Mixing Tolerance	Internal Crumb Color	Internal Grain and Texture	Protein	Milling	Baking	Overall
A	57.0	2600	96.3	2	2	2	3	3	2	2	2	2
B	70.5	2125	89.5	2	2	3	3	3	2	2	2	2
C	60.0	775	82.0	1	2	1	3	2	2	3	1	1
D	66.0	3045	101.0	3	3	1	3	1	2	2	2	2
E	63.0	2475	95.2	3	2	2	3	3	-	-	2	-
F	69.1	2225	92.7	2	3	2	2	2	2	3	1	3
G	62.0	665	71.1	3	5	2	1	1	2	3	1	1
H	66.0	2650	89.8	2	2	2	2	2	2	5	2	3
I	76.7	865	95.1	3	3	1	2	3	2	3	2	2
J	65.7	765	91.1	3	4	2	2.5	2.5	1	4.5	2.5	2.9
K	67.7	805	89.0	3	4	4	3	4	2	4	4	3.3
L	68.7	790	81.0	2	2	2	2	1	1	2	2	1
M	60.4	740	85.3	3	5	3	3.5	3	1.5	3	2	2
Mean	66.3	-	90.7	2.6	3.1	2.2	2.7	2.5	1.9	3.1	2.0	2.2
Std Dev	5.2	-	7.8	0.7	1.2	0.9	0.7	0.9	0.4	1.0	0.8	0.8

ND 819 (Minot, ND, M- 9)												
		Loaf Volume				Quality Score Compared to Check (Glenn)						
ID	Bake Absorption (%, 14% mb)	(cc)	(% of Check)	Mixing Require-ment	Dough Charact-eristics	Mixing Tolerance	Internal Crumb Color	Internal Grain and Texture	Protein	Milling	Baking	Overall
A	60.0	2700	93.1	1	1	1	2	1	2	2	1	2
B	69.5	2250	97.8	3	1	2	4	3	2	3	3	2
C	64.0	955	93.2	3	3	3	3	3	2	3	2	2
D	66.0	3162	100.0	5	5	3	4	2	2	3	3	3
E	66.5	2675	101.9	4	3	3	3	3	-	-	4	-
F	68.4	2675	102.9	3	4	5	3	3	1	3	5	3
G	65.0	845	82.4	3	4	2	3	2	2	3	2	2
H	66.0	2700	91.5	2	2	2	2	2	2	5	2	3
I	75.0	985	92.5	4	1	1	1	1	2	3	1	1
J	67.9	885	97.3	3	4	3	3	2.5	2	2.5	2.9	2.6
K	69.8	910	86.3	3	3	2	3	2	2	3	2	2.3
L	72.9	985	104.2	3	4	2	3	4	1	3	3	3
M	63.7	906	99.5	3	5	2	3.5	3.5	2	3	2.5	2.5
Mean	67.9	-	96.7	3.3	3.3	2.5	3.0	2.6	1.9	3.1	2.7	2.5
Std Dev	4.0	-	6.5	1.0	1.4	1.0	0.8	0.9	0.4	0.7	1.1	0.6

WB9507

WB9507 (Casselton, ND, C-10)												
		Loaf Volume				Quality Score Compared to Check (Glenn)						
ID	Bake Absorption (%, 14% mb)	(cc)	(% of Check)	Mixing Require-ment	Dough Charact-eristics	Mixing Tolerance	Internal Crumb Color	Internal Grain and Texture	Protein	Milling	Baking	Overall
A	59.0	2800	103.7	5	5	3	3	3	2	2	3	3
B	70.0	2050	105.1	3	1	2	3	3	2	3	3	2
C	63.0	975	97.0	3	4	3	3	3	2	3	3	3
D	66.0	3045	98.1	5	5	3	3	4	2	2	4	2
E	67.0	2600	100.0	5	4	3	3	4	-	-	3	-
F	69.3	2275	103.4	4	2	2	4	4	2	3	3	3
G	64.0	930	90.7	3	4	2	3	2	2	3	2	2
H	67.0	2800	103.7	2	2	2	3	3	2	3	2	2
I	74.3	1015	102.0	3	2	2	4	3	1	3	3	2
J	65.1	850	91.9	3	4	3	3	2	1	3	2.5	2.4
K	69.6	930	94.4	3	4	3	3	3	2	3	3	2.6
L	77.7	1060	100.0	4	3	4	3	3	1	3	3	4
M	62.9	772	97.1	4	5	2.5	4	3	1.5	3	2.5	2.5
Mean	68.0	-	99.7	3.8	3.7	2.7	3.3	3.2	1.8	2.9	2.9	2.6
Std Dev	5.0	-	4.7	1.0	1.3	0.6	0.4	0.6	0.5	0.4	0.5	0.6

WB9507 (Williston, ND, W-10)												
		Loaf Volume				Quality Score Compared to Check (Glenn)						
ID	Bake Absorption (%, 14% mb)	(cc)	(% of Check)	Mixing Require-ment	Dough Charact-eristics	Mixing Tolerance	Internal Crumb Color	Internal Grain and Texture	Protein	Milling	Baking	Overall
A	58.0	2800	96.6	5	5	3	3	3	2	2	3	3
B	67.6	2050	95.3	2.5	1	2	3	3	2	3	1	2
C	62.0	1000	102.6	4	4	3	3	3	2	3	3	3
D	66.0	3104	101.0	5	5	3	3	3	2	3	3	3
E	65.0	2750	105.8	5	3	3	4	3	-	-	4	-
F	67.6	2450	98.0	4	4	4	5	4	2	3	2	3
G	63.0	875	96.2	3	4	4	3	3	2	3	3	3
H	66.0	2900	96.7	3	3	3	4	4	2	2	4	4
I	74.2	905	93.3	4	3	2	3	3	2	3	2	2
J	63.5	905	97.8	3	4	2.5	3	2.5	2	3	2.8	2.7
K	67.1	860	91.5	4	4	3	3	4	2	3	4	3
L	73.7	945	109.2	4	4	3	4	4	2	2	4	4
M	62.1	854	104.9	3.5	5	3	3	3.5	2.5	3	3.5	3
Mean	66.5	-	99.8	4.0	4.0	3.0	3.4	3.4	2.0	2.8	3.2	3.1
Std Dev	4.5	-	5.2	0.8	1.1	0.6	0.7	0.5	0.1	0.5	0.9	0.6

ND 812

ND 812 (Watertown, SD, B-11)												
		Loaf Volume				Quality Score Compared to Check (Glenn)						
ID	Bake Absorption (%, 14% mb)	(cc)	(% of Check)	Mixing Require-ment	Dough Charact-eristics	Mixing Tolerance	Internal Crumb Color	Internal Grain and Texture	Protein	Milling	Baking	Overall
A	60.0	2800	101.8	3	3	2	3	3	3	3	2	3
B	67.5	2175	97.8	3	3	3	3	2	2	3	3	2
C	64.0	940	98.4	3	3	2	3	3	3	3	3	3
D	66.0	3104	107.1	5	5	3	3	2	2	2	3	2
E	65.0	2550	98.1	5	4	3	3	3	-	-	2	-
F	66.8	2250	94.7	4	3	2	5	4	2	3	4	3
G	65.0	860	91.0	3	3	2	3	2	3	3	2	2
H	65.0	2550	87.9	2	2	2	2	2	2	4	2	2
I	71.9	1050	99.1	3	3	2	1	4	2	3	2	2
J	63.4	800	93.0	3.5	4	3	3	3	2.5	4	2.5	3
K	69.0	925	93.9	3	2	2	3	3	3	3	3	3
L	74.2	1020	97.1	4	4	2	3	4	2	2	3	3
M	64.1	805	96.1	3	3	3	3	3.5	2	3	3	3
Mean	66.8	-	97.3	3.5	3.3	2.4	3.1	3.0	2.4	3.1	2.7	2.6
Std Dev	3.7	-	4.8	0.9	0.8	0.5	0.9	0.8	0.5	0.6	0.6	0.5

ND 812 (Crookston, MN, K-11)

ID	Bake Absorption (%, 14% mb)	Loaf Volume (cc)	Loaf Volume (% of Check)	Mixing Require-ment	Dough Charact-eristics	Quality Score Compared to Check (Glenn) Mixing Tolerance	Internal Crumb Color	Internal Grain and Texture	Protein	Milling	Baking	Overall
A	58.0	2600	96.3	2	2	2	3	3	3	3	2	3
B	68.0	2175	91.6	2	2	3	3	3	3	3	2	2
C	61.0	815	86.2	1	2	1	3	3	3	3	1	1
D	66.0	2809	93.2	3	3	1	2	2	2	3	1	2
E	65.0	2575	99.0	3	2	2	3	3	-	-	2	-
F	67.5	2325	96.9	2	3	2	2	3	2	3	2	3
G	62.0	780	83.4	3	4	1	1	2	3	3	2	2
H	66.0	2600	88.1	2	2	2	1	1	3	5	1	2
I	73.9	910	100.0	3	3	1	3	4	2	3	3	4
J	63.3	715	85.1	3	4	3	2.5	2.5	1	4.5	2	2.7
K	67.0	865	95.6	3	3	2	3	3	2	4	2	2.7
L	72.1	945	96.9	2	3	2	3	3	3	4	3	3
M	61.1	802	92.4	3	4	3	4	3	2.5	3	2.5	2.5
Mean	66.1	-	93.4	2.6	2.9	2.0	2.7	2.9	2.6	3.5	2.0	2.6
Std Dev	4.5	-	5.5	0.7	0.8	0.8	0.9	0.7	0.7	0.7	0.7	0.8

ND 812 (Minot, ND, M- 11)

ID	Bake Absorption (%, 14% mb)	Loaf Volume (cc)	Loaf Volume (% of Check)	Mixing Require-ment	Dough Charact-eristics	Quality Score Compared to Check (Glenn) Mixing Tolerance	Internal Crumb Color	Internal Grain and Texture	Protein	Milling	Baking	Overall
A	60.0	2600	89.7	1	1	1	2	1	3	2	1	2
B	68.5	2250	97.8	2	1	2	3	3	3	3	3	3
C	64.0	980	95.6	3	3	3	3	3	3	3	3	3
D	66.0	3162	100.0	5	5	3	4	2	2	3	3	3
E	64.5	2600	99.0	5	3	3	3	3	-	-	3	-
F	67.0	2600	100.0	3	3	3	3	3	2	4	5	3
G	65.0	815	79.5	3	5	2	3	2	3	4	2	2
H	66.0	2900	98.3	2	2	2	4	4	3	5	4	4
I	74.1	995	93.4	3	3	1	4	3	2	3	2	2
J	63.2	815	89.6	3	4	3	2	2.5	2	4.5	2.5	3.1
K	69.2	985	93.4	3	4	3	3	3	2	4	3	3
L	71.8	1026	108.6	2	4	2	3	4	2	3	3	2
M	63.9	866	95.1	3	4	2	3.5	3.5	2.5	4	2	2.5
Mean	66.9	-	96.7	3.1	3.4	2.4	3.2	3.0	2.5	3.7	3.0	2.8
Std Dev	3.8	-	6.9	1.1	1.3	0.8	0.7	0.8	0.5	0.8	1.0	0.6

MT0832 (Duclair)

MT0832 (Duclair) (Williston, ND, W-12)												
		Loaf Volume				Quality Score Compared to Check (Glenn)						
ID	Bake Absorption (%, 14% mb)	(cc)	(% of Check)	Mixing Require-ment	Dough Charact-eristics	Mixing Tolerance	Internal Crumb Color	Internal Grain and Texture	Protein	Milling	Baking	Overall
A	59.0	2600	89.7	4	3	2	3	3	2	2	3	2
B	60.5	2400	111.6	3	2	3	2	3	2	3	3	2
C	61.0	975	100.0	4	3	3	3	3	2	2	3	2
D	60.0	3162	102.9	5	5	3	2	2	2	2	2	2
E	62.5	2800	107.7	5	4	3	3	2	-	-	2	-
F	60.5	2725	109.0	5	4	4	4	5	2	4	5	3
G	63.0	875	96.2	3	3	2	3	3	2	3	3	3
H	59.0	2750	91.7	3	3	3	4	4	2	2	3	3
I	66.6	955	98.5	4	3	2	3	4	2	3	3	3
J	59.5	780	84.3	3	4	2.5	4	1.5	2	4	1	2.2
K	65.5	945	100.5	4	3	3	3	5	3	3	4	3.3
L	69.9	1070	123.7	5	4	3	3	4	2	4	5	5
M	62.1	829	101.8	3.5	5	3	3	3	2.5	3	3	3
Mean	62.5	-	102.8	4.0	3.7	2.9	3.2	3.4	2.1	3.0	3.3	2.9
Std Dev	3.3	-	10.3	0.8	0.9	0.6	0.6	1.1	0.3	0.8	1.1	0.9

Appendix

Source of Wheat

Source-Breeding Program	Code No.	Identification
World Wide Wheat L.L.C. (W3)	SWQAC 1	BR0202W (Line C)
University of Minnesota (UMN)	SWQAC 2	MN08165-8
North Dakota State University (NDSU)	SWQAC 4	Elgin-ND (Check #2)
North Dakota State University (NDSU)	SWQAC 5	ND 816
World Wide Wheat L.L.C. (W3)	SWQAC 6	COI565W (Line B)
South Dakota State University (SDSU)	SWQAC 7	SD4189
World Wide Wheat L.L.C. (W3)	SWQAC 8	CHBR1481W (Line A)
North Dakota State University (NDSU)	SWQAC 9	ND 819
WestBred	SWQAC 10	WB9507
North Dakota State University (NDSU)	SWQAC 11	ND 812
Montana State University (MTSU)	SWQAC 12	MT0832 (Duclair)
North Dakota State University (NDSU)	SWQAC 3	Glenn (Check #1)

Field Plot Locations and Procedures

Coordinator: Dale Williams, PhD, Director, Foundation Seedstocks, Department of Plant Sciences, North Dakota State University.

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

- Northeast Research Farm (Watertown), South Shore, SD 57263
  South 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
- 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 No.	Entry	Source	Watertown (B)	Casselton (C)	Crookston (K)	Minot (M)	Williston (W)
SWQAC 1	BR0202W (Line C)	WWW		X		X	
SWQAC 2	MN08165-8	UMN		X	X		
SWQAC 4	Elgin-ND	Check #2	X	X	X	X	X
SWQAC 5	ND 816	NDSU	X	X	X	X	X
SWQAC 6	COI565W (Line B)	WWW		X		X	
SWQAC 7	SD4189	SDSU	X	X	X		
SWQAC 8	CHBR1481W (Line A)	WWW		X		X	
SWQAC 9	ND 819	NDSU	X	X	X	X	
SWQAC 10	WB9507	WestBred		X			X
SWQAC 11	ND 812	NDSU	X		X	X	
SWQAC 12	MT0832 (Duclair)	MTSU				X	X
SWQAC 3	Glenn	Check #1	X	X	X	X	X

Field Production Data

	Location				
Variable	**Watertown**	**Casselton**	**Crookston**	**Minot**	**Williston**
Planting Date	5/3/2013	5/11/2013	5/23/2013	6/18/2013	6/7/2013
Harvest Date	8/27/2013	8/26/2013	8/23/2013	9/26/2013	9/17/2013
Fertilizer (lb/A)					
N	150	250	135	125#	100
P	100	60	10	30#	0
K	50	0	368	0	0
Herbicide/rate/Ac					
Broadleaf	1 pt. bronate	13.7 oz Huskie Complete	Bromac/1 pt/A	1pt widematch, .3oz harmony	Wolverine 1 pt/A
Grass	.66 pt. puma	above	Axial XL/16 fl oz/A	1pt/ac. Axial	-
Fungicide	none	2oz Topaz/6.5oz Prosaro	-	6oz. Headline, 8 oz. Prosaro	Tilt 3 oz/A

* = No Application .

Climatologic Data

	Location: Average Temperature (°F)/Precipitation (in)				
Month	**Watertown**	**Casselton**	**Crookston**	**Minot**	**Williston**
April	*	32.2/1.29	32.2/0.65	37 deg/1.48"	35.6/0.35
May	53.8/0.96in.	56.1/4.29	55.0/4.23	63 deg./6.45"	56.6/6.20
June	64.3/5.05in.	67.7/9.82	66.2/3.19	72deg./5.14"	63.8/4.21
July	68.6/4.90in.	71.1/0.89	69.6/0.92	77deg./5.82"	68.9/1.75
August	*	69.0/0.42	68.5/1.28	79deg./4.12"	64.3/1.97

* = Not Applicable

Yield Data

	Location: Yield (bu/acre) / Test Weight / % Moisture				
Entry No.	**Watertown**	**Casselton**	**Crookston**	**Minot**	**Williston**
SWQAC 1	*	81.1/60/13.5	*	**	*
SWQAC 2	*	88.4/61/13.6	36/62/12.88	**	*
SWQAC 3	47.5/12.5/58.8	72/63/13.7	49/63/12.47	**	180# plot prod.
SWQAC 4	47.5/12.7/59.3	74/61/14.3	50/63/12.36	**	240#
SWQAC 5	45.3/12.5/57.2	76.9/59/14.7	47/61/12.05	**	240# plot prod.
SWQAC 6	*	86.7/60/14.1	*	**	*
SWQAC 7	44.5/12.6/59.0	79.9/60/13.4	44/62/12.26	**	*
SWQAC 8	*	78.6/60/13.4	*	**	*
SWQAC 9	47.0/12.3/58.1	71.7/61/13.7	49/64/12.36	**	*
SWQAC 10	*	80.8/60/13.6	*	**	300# plot prod.
SWQAC 11	50.5/12.7/60.1	*	51/64/12.88	**	*
SWQAC 12	*	*	*	**	180# plot prod.
Site Totals	6	10	7	9	5

* 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	Cool and wet at planting.
During Growth	Nearly no moisture or excessive heat stress during growth stage.
At Flowering	Dry and low humidity during flowering.
During Maturation	Dry and average heat during dry down.
At Harvest	Dry and average temps during Harvest. Almost a perfect growing season for small Grains at the NE farm.

Casselton, ND

At Planting	Good conditions but later than optimal date, relatively dry subsoil moisture.
During Growth	Moderate temps, heavy rains during first six weeks.
At Flowering	Dry environment, low humidity.
During Maturation	Relatively cool temps, dry environment, cooler than normal temperature.
At Harvest	Dry soil, hot and humid, high dew point.

Crookston, MN

At Planting	Like last year, we had below normal moisture at planting, but then we recovered a little with rains in May and June.
During Growth	Conditions of the crop look good.
At Flowering	Dry and hot.
During Maturation	We continue to have temperatures in the upper 80's and 90's with no rainfall. Crop looks clean of any disease, and we may have normal yields even without adequate rains.
At Harvest	There were no problems at harvest, and we had no lodging.

Minot, ND

At Planting	The planting season was excessively wet at the NCREC. We also experienced cool conditions throughout the planting season.
During Growth	Cool and wet condition continued with the NCREC receiving it's annual precipitation total for the year by the end of June.
At Flowering	There was continued cool and wet weather but a window of no rainfall during flowering.
During Maturation	The wet conditions continued allowing the crop to mature with more than adequate water supply. The cool weather also continued allowing the crop to little to no heat stress. It should be noted that Jan. Feb. & March were

	extremely wet months, and that by the end of July the NCREC had received nearly 30" of precipitation for the year.
At Harvest	Limited rainfall allowed harvest to occur with limited quality issues.

Williston, ND

At Planting	Adequate moisture, warm ground temperature.
During Growth	Good conditions, Never lacking in moisture. Cooler weather.
At Flowering	Adequate moisture. Good conditions.
During Maturation	Some moisture. No excessive heat.
At Harvest	Fully mature, good warm and dry conditions. Crop stood up very well for harvest. In general good clean (weed free) trials.

Description of 2013 Hard Spring Wheat Lines

SWQAC #1- BR0202W (Line C)

BR0202W is a hard white spring bread wheat, developed by World Wide Wheat L.L.C. (W3), using the male sterile facilitated recurrent selection (MSFRS) population breeding methodology. It originated as a single F2 head selection out of a quality hard white W3 population group in 2000 in W3's Arizona nursery. Generation advancement continued as single head selection through the F5 generation. BR0202W has been tested in replicated yield trials since 2003 at many W3 global locations with much success. This line is high yielding under adequate and/or moderate moisture conditions, and is resistant to stripe rust. BR0202W demonstrates erect growth at the juvenile stage with green color at the boot stage. At maturity, the head is lax, tapering in shape, recurved, and awned. The glumes are white in color, with oblique shoulders and acuminate beak. The seed of BR0202W is elliptical in shape with rounded cheek, small brush size and medium in length. Seed crease is narrow and shallow.

SWQAC #2- MN08165-8

MN08165-8 is a mid-late maturity hard red spring wheat with very high grain protein content, competitive grain yields, and good straw strength. The pedigree of MN08165-8 is MN02268-1/MN01333-A-1. MN08165-8 has excellent leaf rust resistance and moderate resistance to Fusarium head blight. MN08165-8 is resistant to preharvest sprouting and has exhibited good end-use quality characteristics.

SWQAC #4- Elgin-ND

Elgin-ND is a hard red spring wheat (HRSW) line that is released in 2013 by the NSDSU-AES. Elgin was selected from a 3-way cross involving an NDSU cultivar release (1999) 'Reeder', NDSU experimental line ND721, and SDSU released cultivar 'Walworth'. Reeder has been a major cultivar grown in Western ND and MT. It is a cultivar well adapted to stressed environments. ND721 trace its parents to 'Glupro' a high protein cultivar derived from T. dicoccoides, a source of resistance to Fusarium head blight (FHB) or scab. Therefore, Elgin has a medium resistance to FHB. Walworth is a SDSU cultivar released in 2001 for its high yield. Elgin 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, Elgin 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. Elgin has average test weigh and overall very good milling and baking properties.

SWQAC #5- ND 816

ND816 is a HRSW line that developed by the NDSU spring wheat breeding program. ND816 was selected from a cross involving an NDSU cultivar release (2005) 'Glenn' and NDSU experimental line ND2831. Glenn has been the leading cultivar in ND from 2007 to 2011. It is a cultivar well adapted to the US spring wheat region with very high quality attributes. ND2831 trace its parent toND2709, another NDSU experimental line with resistance to Fusarium head blight (FHB) or scab from Chinese cultivar 'Sumai3'. ND816 has therefore, a medium resistance to FHB. ND816 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. Overall, Compared to Barlow, Glenn, Faller, and Prosper, the leading cultivars in ND/MN, ND816 yield performance is similar or better than Barlow, superior to Glenn, and less that Faller and Prosper. Protein of ND816 is similar to Glenn and Barlow but higher than Faller and Prosper. Test weight similar to Barlow, higher than Faller and Prosper, and lower than Glenn. Milling and baking properties are in general good. It is a medium early line with medium straw strength and conventional height.

SWQAC #6- COI565W (Line B)

COI565W is a hard white spring bread wheat, developed by World Wheat L.L.C. (W3), using the male sterile facilitated recurrent selection (MSFRS) population breeding methodology. It originated as a single F2 head selection out of a quality hard white W3 population group in 1995 in W3's Arizona nursery. Single head selection followed through the F6 generation. COI565W has been tested in replicated yield trials since 2003 at several W3 global locations with much success. COI565W has good yield potential under adequate and/or moderate moisture conditions, and is resistant to stripe rust. COI565W demonstrates erect growth at the juvenile stage with blue-green color at the boot stage. At maturity, the head is lax, strap in shape, recurved, and awned. The glumes are white in color, with elevated shoulders and acuminate beak. The seed of COI565W is ovate in shape with rounded cheek, mid-sized brush size and short in length. Seed crease is narrow and shallow.

SWQAC #7- SD4189

SD4189 is a hard red spring wheat F_4 line derivation from within the cross Briggs/FHBC02-5. Its first year of testing in the AYT was 2009. Over years 2011-2012, grain yield of SD4189 (40.6 bu/ac) was statistically similar to Forefront, Advance, Traverse, Select, and Briggs, which ranged from 42 to 40.5 bu/ac. Test weight (54.8 lb/bu) has been statistically greater than Faller (53.3) and Traverse (51.8), similar to Granger (55.2), and less than Forefront (57.2) and Brick (56.8). Protein concentration of SD4189 (15.6%) was significantly less than Kelby (16.2), similar to Forefront (15.7) and Briggs (15.6), yet higher than Advance (15.4). Loaf volume data collected from 2010 and 2011 seasons, however, shows that its average loaf volume (205.6 ml) is significantly greater than Select (200.4), Faller (198.0), Brick (196.6), Briggs (196.2), and Traverse (190.9 ml), but similar to Advance (208.2) and Kelby (202.1 ml). The height of SD4189 (34.1 in) is slightly shorter than Forefront, Granger, and Traverse. Information supporting release of SD4189 was presented to the variety review and release committee in fall 2013. It will not be released.

SWQAC #8- CHBR1481W (Line A)

CHBR1481W is a hard white spring bread wheat, developed by World White Wheat L.L.C (W3), using the male sterile facilitated recurrent selection (MSFRS) population breeding methodology. It originated as a single F2 head selection out of a quality hard white W3 population group in 2002 in W3's Chilean nursery. Generation advancement continued as single head selection through the F5 generation. CHBR1481W has been tested in replicated yield trials since 2005 at several W3 North America locations with much success. The line possesses a high yielding potential under adequate moisture conditions, and is moderately resistant to stripe rust. CHBR1481W 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 CHBR1481W is ovate in shape with rounded cheek, small brush size and long in length. Seed crease is narrow and shallow.

SWQAC #9- ND 819

ND819 is a HRSW line that developed by the NDSU spring wheat breeding program. ND819 was selected from a cross involving two NDSU experimental lines (ND744 and ND72). ND744 is sister line of Glenn, released in 2005 and has been the leading cultivar in ND from 2007 to 2011. NDSU experimental line ND721 is a widely adapted line. 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. ND819 has excellent disease resistance package including foliar diseases such as stem and leaf rusts. Its reaction to the new emerging leaf rust race (Lr21) is medium. Compared to Barlow, Glenn, Faller, and Prosper, the leading cultivars in ND/MN, ND819 has high yield, superior to Glenn, similar to Barlow but less than Faller and Prosper. Protein of ND819 is similar to Glenn and Barlow but higher than Faller and Prosper. Its test weight is average, similar to Barlow, higher than Faller and Prosper but lower than Glenn. In general, milling and baking properties of ND819 are good. ND819 is short (semi-dwarf to conventional) and medium early.

SWQAC #10- WB9507

WB9507 (WestBred) is a new Hard Red Spring variety with broad adaptation in the Northern Plains region, best adapted to the western and central areas of both North Dakota and South Dakota. WB9507 can also be planted in areas of the Red River Valley. WB9507 has an excellent disease package with very good Fusarium Head Blight resistance as well as very good resistance to leaf rust, stem rust, and overall foliar diseases. This medium height and medium maturity variety has very good test weight, protein, and milling/baking quality characteristics.

SWQAC #11- ND 812

ND812 is a hard red spring wheat (HRSW) developed by the NDSU HRSW breeding program. It was selected from a cross involving two NDSU experimental lines (ND721 and ND 2849). NDSU experimental line ND721 is a widely adapted line. 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 whereas ND2849 is a line selected from a cross deigned to introgress scab (FHB) resistance from Chinese source Sumai3. Therefore, ND812 has a medium resistance to FHB. ND812 is also very resistant to major races of foliar diseases including stem and leaf rusts. However, its reaction to the new emerging leaf rust race (Lr21) is medium susceptible to medium resistant. Compared to Barlow, Glenn, Faller, and Prosper, the leading cultivars in ND/MN, ND812 has good yield level higher than Glenn but slightly lower than Barlow, Faller, and Prosper with overall, above average milling and baking properties. Test weight is good higher than both Barlow, Faller, and Prosper but lower than Glenn. Protein of ND812 is close to that of Glenn and Barlow but higher than Faller and Prosper. It is a medium early line with medium straw strength and conventional height.

SWQAC #12- MT0832 (Duclair)

'Duclair' hard red spring wheat (*Triticum aestivum* L.) (Reg. No. CV-1060, PI 660981) was developed by the Montana Agricultural Experiment Station and released in 2011. The objective for the development of Duclair was to provide a solid-stemmed, semidwarf cultivar for areas infested by the wheat stem sawfl y (*Cephus cinctus* Nort.). Duclair was developed through initial generations of single seed descent of F2 seed from a 'Choteau'/MT0249 cross. Progeny lines were selected to have solid stems from Choteau, and extended green leaf duration from MT0249. Duclair was tested as MT0832 at sites across Montana in 2008, 2009, and 2010. Stem solidity of Duclair is similar to the solid-stemmed cultivar 'Fortuna' and slightly less than 'Choteau'. Duclair has shown good yield potential throughout Montana and its height is more desirable for dry conditions than Choteau. Duclair has grain protein levels similar to other hard red spring wheat cultivars and acceptable milling and baking characteristics. Duclair will be of interest to wheat growers in sawfly-infested areas of Montana and adjoining regions.

Cleaning and Milling Procedure

Wheat (approximately 3 bu/line) 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.

Cleaned wheat (150 lbs) was tempered to -16.5 % moisture content and conditioned approximately for 16-20 hours before milling. Milling was performed on the Miag Multomat. Feed rate was set at -180 lbs per hour. The mill was warmed up and adjusted using approximately 40 lbs of sample, individually, after which 110 lbs of leftover sample were milled. Break rollers were adjusted to the following releases through a U.S. 16 S.S. sieve: first break- 30%; second break -53%; and third break- clean-up -66%.

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

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

Calculation of flour extraction

- Total Product Basis (TPB, %): long patent flour percentage of the total mill product on a 14 % moisture basis (mb)
- Tempered Wheat Basis (TWB, %): long patent flour extraction percentage of tempered wheat (14 % mb)
- Pounds of Long Patent Flour/Bushel Wheat (FBW): estimated pounds of long patent flour (14 % mb) produced from a standard bushel of wheat (60 pound on 13.5 % mb).

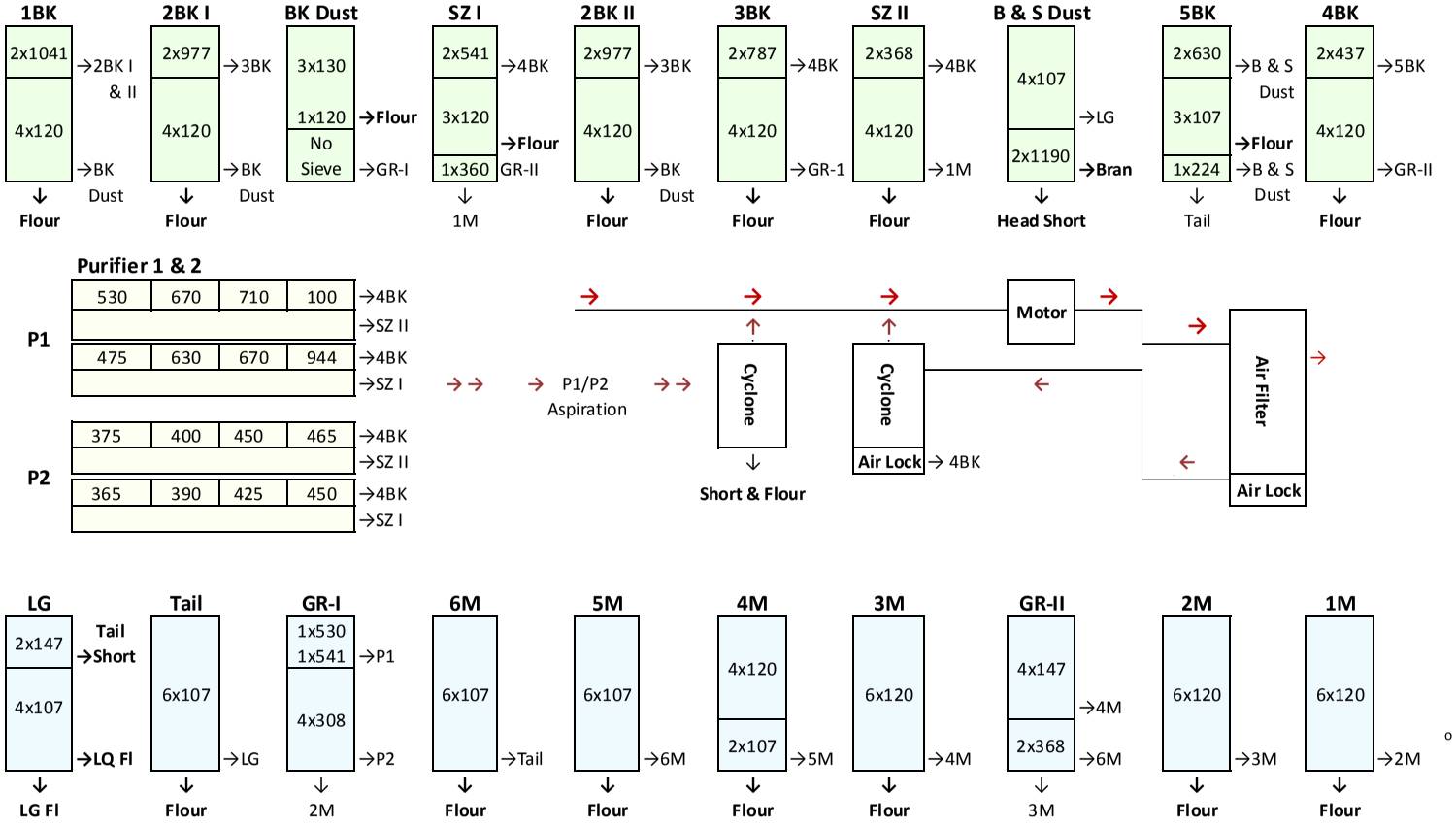
Miag Mill Streams

Mill Stream	Abb.	No	Product		
1st Break	1 Bk	1	Long Patent Flour	Straight Grade Flour	Whole Wheat Flour
2nd Break I	2 Bk I	2			
Break Dust	Bk Dust	3			
Sizing I	Sz I	4			
2nd Break II	2 Bk II	5			
3rd Break	3 Bk	6			
Sizing II	Sz II	7			
4th Break	4 Bk	8			
5th Break	5 Bk	9			
1st Middlings	1 M	10			
2nd Middlings	2 M	11			
3rd Middlings	3 M	12			
4th Middlings	4 M	13			
6th Middlings	6 M	15			
Tail Flour	Tail	16			
Tail Cyclone Flour*	TC Fl	22			
5th Middlings	5 M	14	Clear Flour		
Low Grade	LG	17			
Low Quality	LQ	18			
Tail Shorts	Tail St	19	Short & Bran		
Tail Cyclone Shorts*	TC St	23			
Head Shorts	Head St	20			
Bran	Bran	21			

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

Miag Multomato Mill Flow Chart

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



Sieve Openning Size: µm

Methods of Analyses

Test Weight (AACCI Method 55-10)

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

Protein molecular weight distribution – a size exclusion high performance liquid chromatography was performed to evaluate protein composition (Ohm, J. B. et al, 2009. Size-Exclusion HPLC of Protein Using a Narrow-Bore Column for Evaluation of Breadmaking Quality of Hard Spring Wheat Flours. Cereal Chem. 86:463–469).

Wheat and Flour Ash (AACCI Method 08-01- Oven method)

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 (Shuey W. C. 1960. A wheat sizing technique for predicting flour milling yield. *Cereal Sci Today* 5:71–72, 75.)

Wheat Falling Number (Perten Falling Number Instrument)

Vitreous Kernel Content : DHV analyses by FGIS grain testing service (Grain Inspection Handbook—Book II. Grain Grading Procedures. Grain Inspection, Packers and Stockyards Administration: Washington, DC. USDA. 1997.)

Flour Color (Minolta Colorimeter L* and b* values)

Flour starch damage: Each sample was tested in triplicate using the SDmatic (Chopin Technologies, Villeneuve La Garenne, France) according to the AACCI Approved Method 76-33.01.

Farinograph: Farinograph was performed by AACCI Approved 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)

Extensograph: AACCI Method 54-10 was modified as follows: (a) 100 gram of flour (14 % mb), 2.0 percent sodium chloride (U.S.P.) and water (equal to farinograph absorption minus 2 %) 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, 90, and 135 minutes at 30°C and 78 % relative humidity. The dough was then stretched as described in the procedure referenced above. For conversion purposes, 500 g 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 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 methods. Cooperator data were returned to the WQL for compilation of results. The adjusted mean of evaluation scores was calculated from individual cooperators' scores excluding a minimum score.

Wheat Marketing Score

The development of a Wheat Marketing Score (WMS) or Export Marketing Score was discussed at the Hard Spring Wheat planning meeting in March, 2004. The purpose for developing a WMS was to facilitate a better understanding of wheat quality in marketing systems. Two WMS methods were developed and tested. For each method, the quality variables of Test Weight (TW), 1000 Kernel Weight (KWT), Falling Number (FN), Wheat Protein (WP), and Wheat Ash (WA) were incorporated for calculating the WMS. Method #1 was developed on a scale of 0 to 6 where 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 (TW) (Lb/Bu)	1000 Kernel Weight (KWT) (g)	Falling Number (FN) (Sec)	Wheat Protein (WP) (%, 12% mb)	Wheat Ash (WA) (%, 14% mb)
	6	63	39	425	16.5	1.35
	5	62	36	400	15.5	1.45
	4	61	33	375	14.5	1.55
Target Value	3	60	30	350	13.5	1.65
	2	59	26	325	12.5	1.75
	1	58	22	300	11.5	1.85
	0	57	18	275	10.5	1.95
Variation(+/-) from Target Value:		1	3g up, 4g down	25	1.0	0.10

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

Wheat Marketing Score – Method #2

Rules for score calculation -Difference (Diff)= Entered line value - Check value

Component Score	Wheat Protein (WP) (%, 12% mb)	Test Weight (TW) (Lb/Bu)	Falling Number (FN) (Sec)	1000 Kernel Weight (KWT) (g)	Wheat Ash (WA) (%, 14% mb)
0	Diff > 6.0	Diff > 10	Diff < -125	Diff > 20	Diff > 0.5
2	5.0 < Diff ≤ 6.0	8 < Diff ≤ 10	-125 ≤ Diff < -100	16 < Diff ≤ 20	0.4 < Diff ≤ 0.5
4	4.0 < Diff ≤ 5.0	6 < Diff ≤ 8	-100 ≤ Diff < -75	12 < Diff ≤ 16	0.3 < Diff ≤ 0.4
6	3.0 < Diff ≤ 4.0	4 < Diff ≤ 6	-75 ≤ Diff < -50	8 < Diff ≤ 12	0.2 < Diff ≤ 0.3
8	2.0 < Diff ≤ 3.0	2 < Diff ≤ 4	-50 ≤ Diff < -25	4 < Diff ≤ 8	0.1 < Diff ≤ 0.2
10	-0.5 ≤ Diff ≤ 2.0	-1 ≤ Diff ≤ 2	Diff ≥ -25	-2 ≤ Diff ≤ 4	Diff ≤ 0.1
8	-1.0 ≤ Diff < -0.5	-2 ≤ Diff < -1	-	-4 ≤ Diff < -2	-
6	-1.5 ≤ Diff < -1.0	-3 ≤ Diff < -2	-	-6 ≤ Diff < -4	-
4	-2.0 ≤ Diff < -1.5	-4 ≤ Diff < -3	-	-8 ≤ Diff < -6	-
2	-2.5 ≤ Diff < -2.0	-5 ≤ Diff < -4	-	-10 ≤ Diff < -8	-
0	Diff < -2.5	Diff < -5	-	Diff < -10	-
Weighting	0.3	0.2	0.2	0.2	0.1

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

Bake Cooperators

ADM Milling, Olathe, Kansas

Bay State Milling Company, Winona, Minnesota

Horizon Milling, Minnetonka, Minnesota

Cereal Food Processors, Inc., Wichita, Kansas

ConAgra Foods, Omaha, Nebraska

General Mills, Inc., Minneapolis, Minnesota

Limagrain Cereal Seeds LLC, Fort Collins, CO

North Dakota State Mill, Grand Forks, North Dakota

North Dakota State University, Department of Cereal Science, Fargo, North Dakota USDA/ARS

USDA/ARS Hard Red Spring & Durum Wheat Quality Laboratory, Fargo, North Dakota

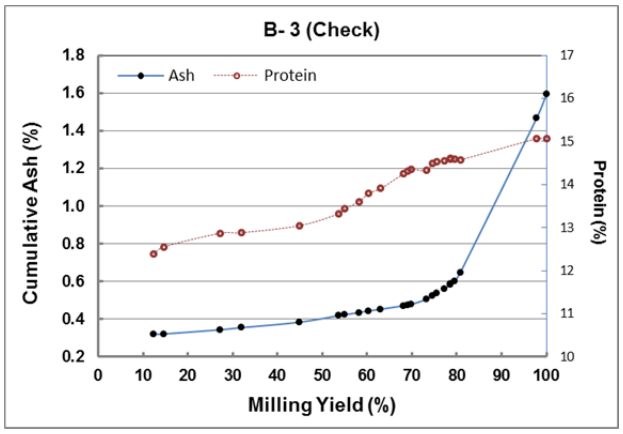
USDA/ARS Hard Winter Wheat Quality Laboratory, Manhattan, Kansas

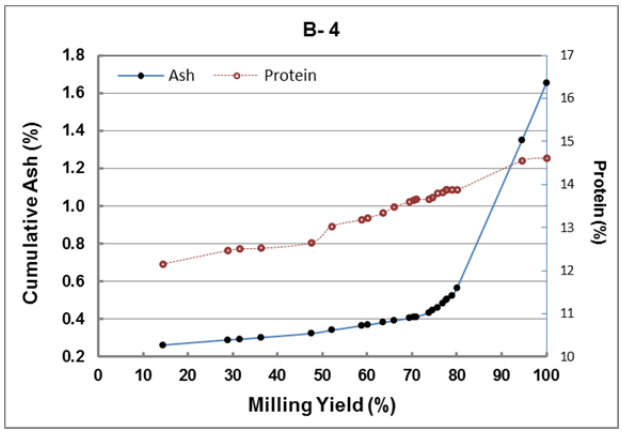
USDA/ARS Western Wheat Quality Laboratory, Pullman, Washington

Wheat Marketing Center, Portland, Oregon

Cumulative Ash Curves

Watertown, SD (Group B)



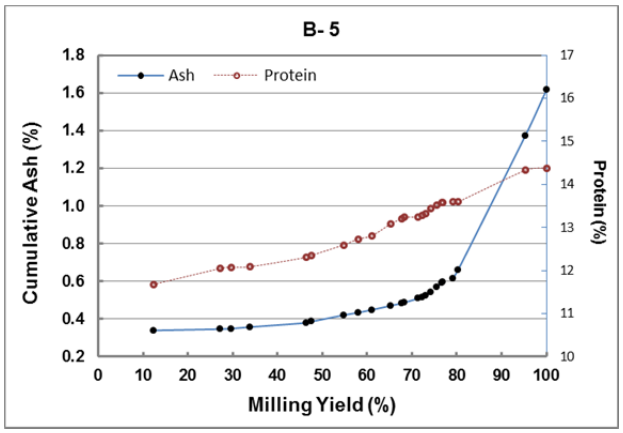


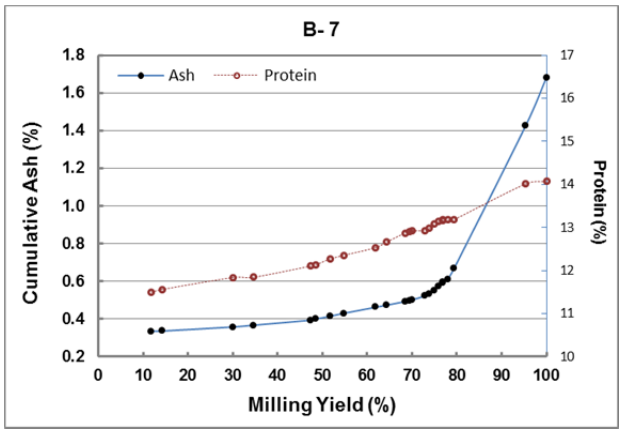
Glenn

Cumulative Ash:	B- 3 (Check)					
Mill	Stream (%, 14% mb)			Cumulative (%, 14% mb)		
Stream	Yield	Ash	Protein	Yield	Ash	Protein
Patent						
1 M	12.3	0.32	12.4	12.3	0.32	12.4
Sz I	2.3	0.33	13.5	14.6	0.32	12.6
2 M	12.5	0.37	13.2	27.1	0.34	12.9
Sz II	4.8	0.42	13.0	31.9	0.36	12.9
3 M	13.0	0.46	13.4	44.9	0.38	13.0
4 M	8.7	0.60	14.7	53.6	0.42	13.3
1 Bk	1.4	0.61	17.8	55.0	0.42	13.4
Bk Dust	3.2	0.63	16.5	58.2	0.44	13.6
3 Bk	2.2	0.67	18.9	60.4	0.44	13.8
TC Fl	2.6	0.67	16.5	63.0	0.45	13.9
4 Bk	5.1	0.69	18.5	68.1	0.47	14.3
2 Bk II	1.0	0.71	18.8	69.1	0.47	14.3
2 Bk I	0.7	0.82	18.7	69.8	0.48	14.4
6 M	3.4	1.06	13.6	73.2	0.50	14.3
5 Bk	1.4	1.46	23.0	74.5	0.52	14.5
Tail	1.1	1.48	17.4	75.6	0.54	14.5
Clear flour						
5 M	1.7	1.73	15.2	77.3	0.56	14.5
LG	1.2	2.04	18.4	78.5	0.58	14.6
LQ	0.2	2.55	14.2	78.7	0.59	14.6
Bran & shorts						
TC St	0.8	1.68	14.6	79.4	0.60	14.6
Tail St	1.4	3.51	13.2	80.8	0.65	14.6
Head St	17.0	5.36	17.4	97.8	1.47	15.1
Bran	2.2	7.28	15.2	100.0	1.59	15.1
Patent*		0.51	14.3			
Wheat		1.62	14.5			
*Rebolted						

Elgin-ND

Cumulative Ash:	B- 4					
Mill	Stream (%, 14% mb)			Cumulative (%, 14% mb)		
Stream	Yield	Ash	Protein	Yield	Ash	Protein
Patent						
1 M	14.4	0.26	12.2	14.4	0.26	12.2
2 M	14.5	0.32	12.8	28.9	0.29	12.5
Sz I	2.7	0.32	12.9	31.7	0.29	12.5
Sz II	4.7	0.37	12.6	36.4	0.30	12.5
3 M	11.3	0.40	13.1	47.6	0.32	12.7
4 Bk	4.4	0.52	17.1	52.0	0.34	13.0
4 M	6.7	0.55	14.4	58.7	0.36	13.2
1 Bk	1.3	0.57	15.3	60.0	0.37	13.2
Bk Dust	3.5	0.60	15.2	63.5	0.38	13.3
3 Bk	2.5	0.63	17.3	66.0	0.39	13.5
TC Fl	3.4	0.67	15.8	69.4	0.41	13.6
2 Bk II	1.0	0.68	16.6	70.4	0.41	13.6
2 Bk I	0.7	0.80	16.3	71.1	0.41	13.7
6 M	2.7	0.99	13.4	73.7	0.43	13.7
Tail	0.9	1.52	17.0	74.6	0.45	13.7
5 Bk	1.1	1.55	20.6	75.7	0.46	13.8
Clear flour						
5 M	1.1	1.85	15.9	76.8	0.48	13.8
LG	0.9	2.17	18.4	77.7	0.50	13.9
LQ	0.1	2.77	14.0	77.8	0.50	13.9
Bran & shorts						
TC St	1.2	1.75	13.9	79.0	0.52	13.9
Tail St	1.1	3.68	13.5	80.0	0.57	13.9
Head St	14.5	5.67	18.3	94.5	1.35	14.6
Bran	5.5	6.93	15.6	100.0	1.65	14.6
Patent*		0.50	13.7			
Wheat		1.59	14.1			
*Rebolted						



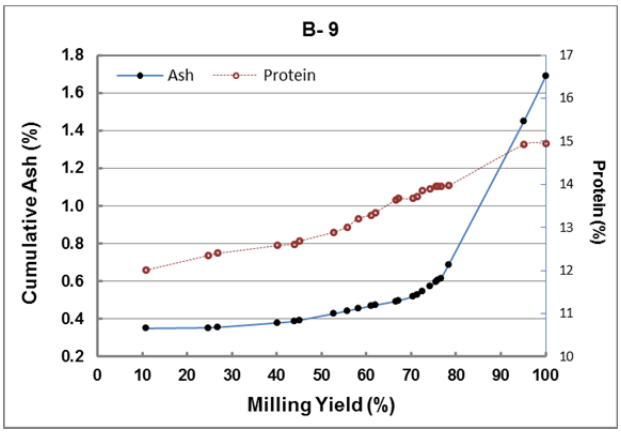


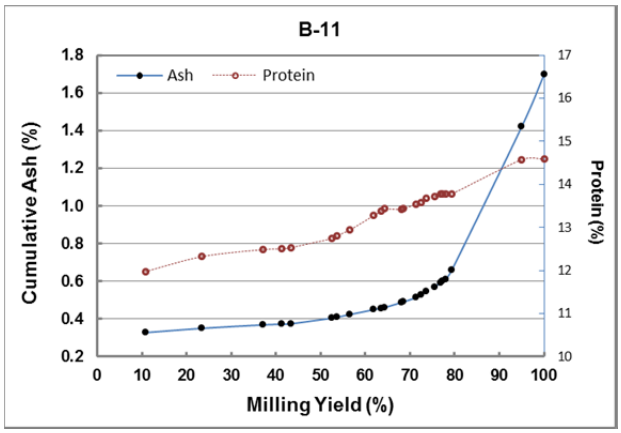
ND 816

Cumulative Ash:	B- 5					
Mill	Stream (%, 14% mb)			Cumulative (%, 14% mb)		
Stream	Yield	Ash	Protein	Yield	Ash	Protein
Patent						
1 M	12.3	0.34	11.7	12.3	0.34	11.7
2 M	15.0	0.35	12.4	27.2	0.35	12.0
Sz I	2.3	0.38	12.5	29.6	0.35	12.1
Sz II	4.4	0.41	12.2	33.9	0.36	12.1
3 M	12.4	0.44	12.9	46.4	0.38	12.3
1 Bk	1.2	0.64	14.2	47.5	0.39	12.4
4 M	7.2	0.65	14.2	54.7	0.42	12.6
TC Fl	3.3	0.66	15.0	58.0	0.43	12.7
Bk Dust	3.0	0.73	14.3	61.0	0.45	12.8
4 Bk	4.3	0.79	17.0	65.3	0.47	13.1
3 Bk	2.4	0.82	16.6	67.7	0.48	13.2
2 Bk I	0.7	0.93	16.0	68.4	0.49	13.2
6 M	3.0	0.99	13.6	71.4	0.51	13.2
2 Bk II	0.8	0.99	16.0	72.2	0.51	13.3
Tail	0.9	1.43	17.2	73.1	0.53	13.3
5 Bk	1.1	1.67	20.8	74.3	0.54	13.4
Clear flour						
LG	1.3	2.07	18.6	75.5	0.57	13.5
5 M	1.2	2.20	16.6	76.7	0.59	13.6
LQ	0.2	2.52	15.1	76.9	0.60	13.6
Bran & shorts						
TC St	2.2	1.23	14.3	79.1	0.62	13.6
Tail St	1.1	3.69	13.3	80.3	0.66	13.6
Head St	15.0	5.18	18.2	95.3	1.37	14.3
Bran	4.7	6.53	15.5	100.0	1.62	14.4
Patent*		0.55	13.4			
Wheat		1.62	14.1			
*Rebolted						

SD4189

Cumulative Ash:	B- 7					
Mill	Stream (%, 14% mb)			Cumulative (%, 14% mb)		
Stream	Yield	Ash	Protein	Yield	Ash	Protein
Patent						
1 M	11.8	0.33	11.5	11.8	0.33	11.5
Sz I	2.3	0.35	11.9	14.2	0.34	11.6
2 M	15.9	0.38	12.1	30.1	0.36	11.8
Sz II	4.5	0.43	11.9	34.6	0.37	11.8
3 M	12.7	0.47	12.8	47.3	0.39	12.1
1 Bk	1.3	0.64	13.5	48.6	0.40	12.1
TC Fl	3.2	0.64	14.3	51.8	0.42	12.3
Bk Dust	3.0	0.69	13.8	54.7	0.43	12.4
4 M	7.2	0.71	13.9	61.9	0.46	12.5
3 Bk	2.4	0.75	16.0	64.3	0.47	12.7
4 Bk	4.1	0.79	16.2	68.5	0.49	12.9
2 Bk II	0.9	0.88	15.0	69.4	0.50	12.9
2 Bk I	0.6	0.93	15.0	70.0	0.50	12.9
6 M	2.9	1.01	13.1	72.9	0.52	12.9
Tail	0.9	1.50	16.9	73.7	0.53	13.0
5 Bk	1.1	1.68	19.7	74.9	0.55	13.1
Clear flour						
LG	1.0	2.21	17.7	75.8	0.57	13.1
5 M	1.0	2.26	15.9	76.8	0.59	13.2
LQ	0.1	2.94	14.8	76.9	0.60	13.2
Bran & shorts						
TC St	1.1	1.58	13.3	78.0	0.61	13.2
Tail St	1.4	3.95	13.8	79.4	0.67	13.2
Head St	15.9	5.19	18.1	95.4	1.43	14.0
Bran	4.6	6.95	15.2	100.0	1.68	14.1
Patent*		0.55	12.9			
Wheat		1.64	13.6			
*Rebolted						





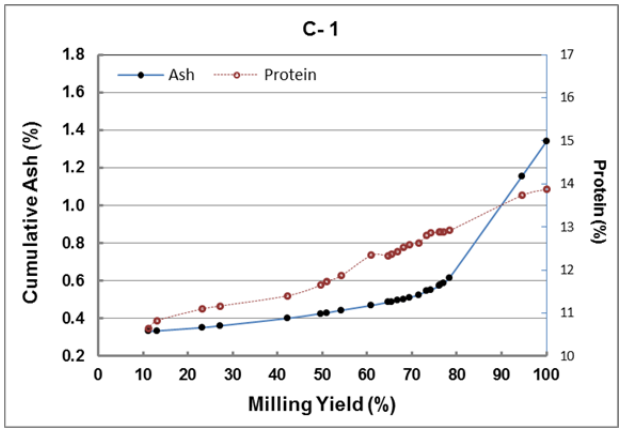
ND 819

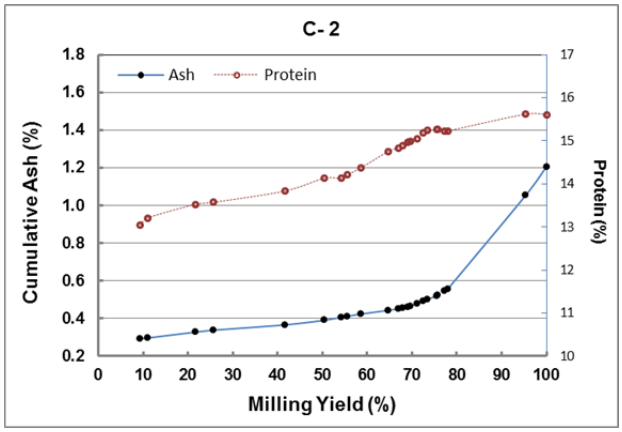
Cumulative Ash:	B- 9					
Mill	Stream (%, 14% mb)			Cumulative (%, 14% mb)		
Stream	Yield	Ash	Protein	Yield	Ash	Protein
Patent						
1 M	10.9	0.35	12.0	10.9	0.35	12.0
2 M	13.9	0.36	12.6	24.8	0.35	12.4
Sz I	2.1	0.39	13.0	26.8	0.36	12.4
3 M	13.2	0.43	12.9	40.1	0.38	12.6
Sz II	3.8	0.47	13.0	43.9	0.39	12.6
1 Bk	1.1	0.63	15.3	45.0	0.39	12.7
4 M	7.7	0.63	14.1	52.7	0.43	12.9
TC Fl	3.0	0.71	15.2	55.7	0.44	13.0
3 Bk	2.4	0.72	17.7	58.1	0.45	13.2
Bk Dust	2.9	0.75	15.0	61.0	0.47	13.3
2 Bk II	1.0	0.77	16.9	62.0	0.47	13.3
4 Bk	4.6	0.77	17.6	66.5	0.49	13.6
2 Bk I	0.6	0.90	16.8	67.2	0.50	13.7
6 M	3.2	0.95	13.7	70.3	0.52	13.7
Tail	1.0	1.39	17.0	71.3	0.53	13.7
5 Bk	1.3	1.48	21.6	72.6	0.55	13.9
Clear flour						
5 M	1.7	1.75	15.7	74.3	0.57	13.9
LG	1.3	1.87	17.3	75.6	0.60	14.0
LQ	0.3	2.43	15.3	75.9	0.60	14.0
Bran & shorts						
TC St	0.8	1.80	14.2	76.7	0.62	14.0
Tail St	1.7	3.98	14.5	78.4	0.69	14.0
Head St	16.8	5.01	19.4	95.1	1.45	14.9
Bran	4.9	6.35	15.5	100.0	1.69	15.0
Patent*		0.53	13.8			
Wheat		1.58	14.4			
*Rebolted						

ND 812

Cumulative Ash:	B-11					
Mill	Stream (%, 14% mb)			Cumulative (%, 14% mb)		
Stream	Yield	Ash	Protein	Yield	Ash	Protein
Patent						
1 M	10.8	0.33	12.0	10.8	0.33	12.0
2 M	12.6	0.37	12.6	23.3	0.35	12.3
3 M	13.8	0.40	12.8	37.1	0.37	12.5
Sz II	4.2	0.41	12.7	41.3	0.37	12.5
Sz I	2.1	0.42	13.2	43.4	0.38	12.5
4 M	9.1	0.54	13.7	52.6	0.40	12.7
1 Bk	1.0	0.64	16.0	53.6	0.41	12.8
TC Fl	2.9	0.69	15.5	56.5	0.42	12.9
4 Bk	5.3	0.72	16.8	61.9	0.45	13.3
3 Bk	1.6	0.74	17.3	63.5	0.46	13.4
2 Bk II	0.9	0.75	17.2	64.4	0.46	13.4
6 M	3.6	0.95	13.1	68.0	0.49	13.4
2 Bk I	0.5	0.95	17.1	68.6	0.49	13.4
Bk Dust	2.8	1.07	15.7	71.4	0.51	13.5
Tail	1.1	1.48	16.5	72.5	0.53	13.6
5 Bk	1.1	1.59	20.3	73.6	0.55	13.7
Clear flour						
5 M	1.8	1.53	15.0	75.5	0.57	13.7
LG	1.3	1.88	17.3	76.8	0.59	13.8
LQ	0.4	2.13	14.4	77.2	0.60	13.8
Bran & shorts						
TC St	0.9	1.74	14.2	78.1	0.61	13.8
Tail St	1.3	3.46	13.6	79.3	0.66	13.8
Head St	15.7	5.28	18.6	95.0	1.42	14.6
Bran	5.0	6.94	14.7	100.0	1.70	14.6
Patent*		0.53	13.5			
Wheat		1.48	14.0			
*Rebolted						

Casselton, ND (Group C)



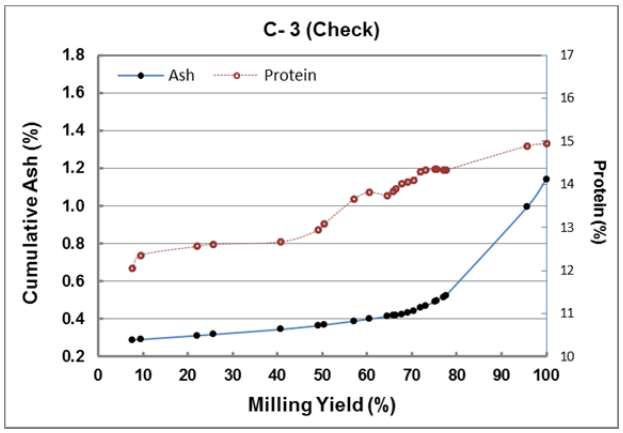


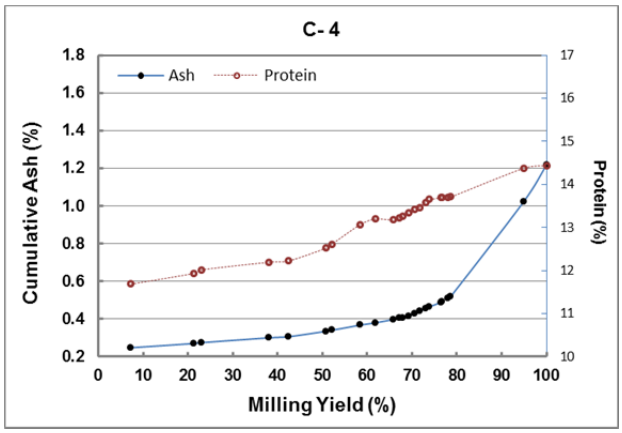
BR0202W

Cumulative Ash:	C- 1					
Mill	Stream (%, 14% mb)			Cumulative (%, 14% mb)		
Stream	Yield	Ash	Protein	Yield	Ash	Protein
Patent						
1 M	11.1	0.33	10.6	11.1	0.33	10.6
Sz I	2.0	0.35	11.9	13.1	0.33	10.8
2 M	10.0	0.37	11.5	23.1	0.35	11.1
Sz II	4.2	0.42	11.6	27.3	0.36	11.2
3 M	15.0	0.47	11.8	42.2	0.40	11.4
4 M	7.4	0.57	13.0	49.6	0.43	11.6
1 Bk	1.4	0.58	14.9	51.0	0.43	11.7
Bk Dust	3.3	0.65	14.0	54.3	0.44	11.9
4 Bk	6.6	0.68	16.2	60.9	0.47	12.3
6 M	3.8	0.76	12.0	64.7	0.49	12.3
2 Bk I	0.8	0.77	15.9	65.5	0.49	12.4
2 Bk II	1.2	0.77	16.0	66.7	0.49	12.4
3 Bk	1.5	0.81	16.7	68.2	0.50	12.5
Tail	1.3	1.00	15.7	69.5	0.51	12.6
TC Fl	2.0	1.02	14.2	71.5	0.53	12.6
5 Bk	1.7	1.35	20.2	73.2	0.54	12.8
Clear flour						
LG	1.0	1.00	16.8	74.2	0.55	12.9
5 M	1.9	1.41	13.8	76.1	0.57	12.9
LQ	0.3	1.95	13.8	76.3	0.58	12.9
Bran & shorts						
TC St	0.7	1.72	13.5	77.0	0.59	12.9
Tail St	1.4	2.27	14.2	78.4	0.62	12.9
Head St	16.1	3.77	17.7	94.5	1.15	13.7
Bran	5.5	4.52	16.3	100.0	1.34	13.9
Patent*		0.51	12.7			
Wheat		1.47	14.0			
*Rebolted						

MN08165-8

Cumulative Ash:	C- 2					
Mill	Stream (%, 14% mb)			Cumulative (%, 14% mb)		
Stream	Yield	Ash	Protein	Yield	Ash	Protein
Patent						
1 M	9.3	0.29	13.0	9.3	0.29	13.0
Sz I	1.7	0.32	14.2	11.0	0.30	13.2
2 M	10.7	0.36	13.9	21.7	0.33	13.5
Sz II	4.0	0.39	13.8	25.7	0.34	13.6
3 M	15.9	0.41	14.3	41.6	0.37	13.8
4 M	8.8	0.51	15.5	50.4	0.39	14.1
6 M	3.9	0.62	14.1	54.3	0.41	14.1
1 Bk	1.3	0.63	17.9	55.5	0.41	14.2
Bk Dust	3.1	0.63	17.3	58.6	0.42	14.4
4 Bk	6.0	0.63	18.4	64.7	0.44	14.8
TC Fl	2.2	0.69	17.1	66.9	0.45	14.8
2 Bk II	1.1	0.77	18.8	68.0	0.46	14.9
3 Bk	1.1	0.79	19.2	69.1	0.46	15.0
2 Bk I	0.5	0.80	18.8	69.6	0.46	15.0
Tail	1.5	1.11	17.9	71.1	0.48	15.1
5 Bk	1.4	1.26	22.6	72.5	0.49	15.2
Clear flour						
LG	1.0	1.11	18.5	73.5	0.50	15.2
5 M	2.0	1.21	16.1	75.5	0.52	15.3
LQ	0.3	1.72	15.1	75.7	0.52	15.3
Bran & shorts						
Tail St	1.5	1.60	13.9	77.3	0.55	15.2
TC St	0.7	1.76	14.7	77.9	0.56	15.2
Head St	17.4	3.28	17.4	95.4	1.05	15.6
Bran	4.6	4.32	15.4	100.0	1.21	15.6
Patent*		0.46	15.1			
Wheat		1.46	15.5			
*Rebolted						



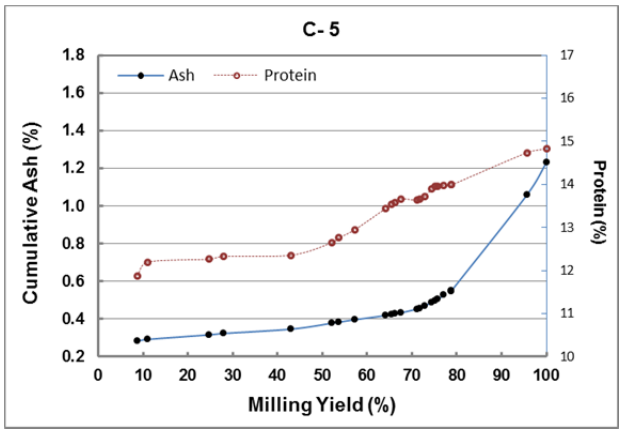


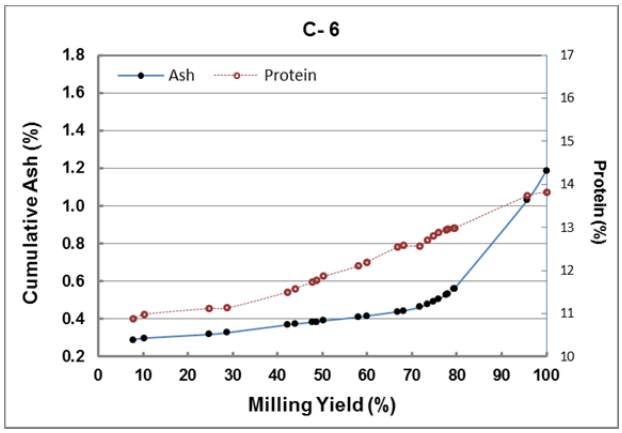
Glenn

Cumulative Ash:	C- 3 (Check)					
Mill	Stream (%, 14% mb)			Cumulative (%, 14% mb)		
Stream	Yield	Ash	Protein	Yield	Ash	Protein
Patent						
1 M	7.7	0.29	12.0	7.7	0.29	12.0
Sz I	1.8	0.30	13.7	9.4	0.29	12.4
2 M	12.6	0.33	12.7	22.0	0.31	12.6
Sz II	3.7	0.36	12.9	25.6	0.32	12.6
3 M	15.1	0.39	12.8	40.8	0.35	12.7
4 M	8.2	0.46	14.3	49.0	0.36	12.9
1 Bk	1.4	0.51	18.2	50.4	0.37	13.1
4 Bk	6.7	0.54	18.0	57.1	0.39	13.7
Bk Dust	3.3	0.58	16.6	60.4	0.40	13.8
6 M	4.1	0.62	12.7	64.5	0.41	13.7
2 Bk II	1.2	0.64	18.8	65.7	0.42	13.8
2 Bk I	0.7	0.68	19.2	66.4	0.42	13.9
3 Bk	1.4	0.69	19.5	67.8	0.43	14.0
TC Fl	1.2	0.72	17.0	69.0	0.43	14.1
Tail	1.3	1.12	16.6	70.3	0.44	14.1
5 Bk	1.6	1.18	22.5	71.9	0.46	14.3
Clear flour						
LG	1.1	1.11	17.8	73.0	0.47	14.3
5 M	2.1	1.23	14.6	75.1	0.49	14.4
LQ	0.4	1.63	13.4	75.5	0.50	14.3
Bran & shorts						
Tail St	1.6	1.41	13.6	77.1	0.52	14.3
TC St	0.4	1.86	14.7	77.5	0.52	14.3
Head St	18.3	3.01	17.3	95.8	1.00	14.9
Bran	4.2	4.44	16.1	100.0	1.14	14.9
Patent*		0.43	14.2			
Wheat		1.46	15.0			
*Rebolted						

Elgin-ND

Cumulative Ash:	C- 4					
Mill	Stream (%, 14% mb)			Cumulative (%, 14% mb)		
Stream	Yield	Ash	Protein	Yield	Ash	Protein
Patent						
1 M	7.3	0.25	11.7	7.3	0.25	11.7
2 M	14.0	0.28	12.1	21.3	0.27	11.9
Sz I	1.7	0.33	13.0	23.0	0.28	12.0
3 M	15.0	0.34	12.5	38.1	0.30	12.2
Sz II	4.4	0.36	12.5	42.4	0.31	12.2
4 M	8.3	0.48	14.0	50.7	0.33	12.5
1 Bk	1.4	0.55	16.1	52.1	0.34	12.6
4 Bk	6.3	0.59	16.8	58.4	0.37	13.1
Bk Dust	3.4	0.59	15.4	61.9	0.38	13.2
6 M	3.9	0.67	12.8	65.7	0.40	13.2
TC Fl	1.5	0.70	15.8	67.2	0.40	13.2
2 Bk I	0.7	0.77	17.1	67.9	0.41	13.3
2 Bk II	1.3	0.93	17.1	69.2	0.42	13.3
3 Bk	1.4	1.01	17.4	70.6	0.43	13.4
Tail	1.1	1.15	16.6	71.7	0.44	13.5
5 Bk	1.3	1.35	20.2	73.0	0.46	13.6
Clear flour						
LG	0.9	1.15	18.6	73.9	0.46	13.7
5 M	2.6	1.17	14.9	76.5	0.49	13.7
LQ	0.3	1.64	14.5	76.8	0.49	13.7
Bran & shorts						
Tail St	1.3	1.63	14.3	78.1	0.51	13.7
TC St	0.6	1.69	14.2	78.7	0.52	13.7
Head St	16.3	3.45	17.6	94.9	1.02	14.4
Bran	5.1	4.86	15.5	100.0	1.22	14.4
Patent*		0.41	13.4			
Wheat		1.40	14.1			
*Rebolted						



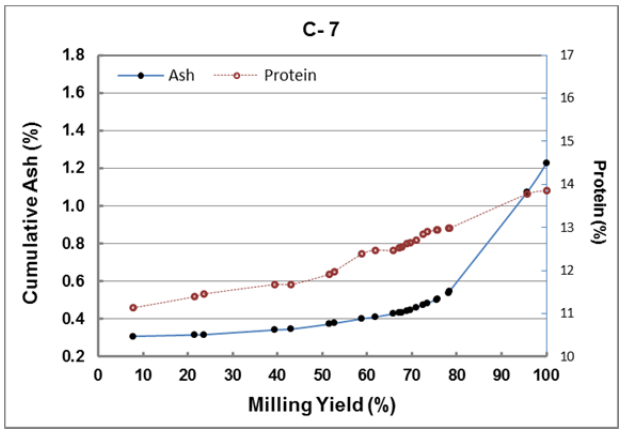


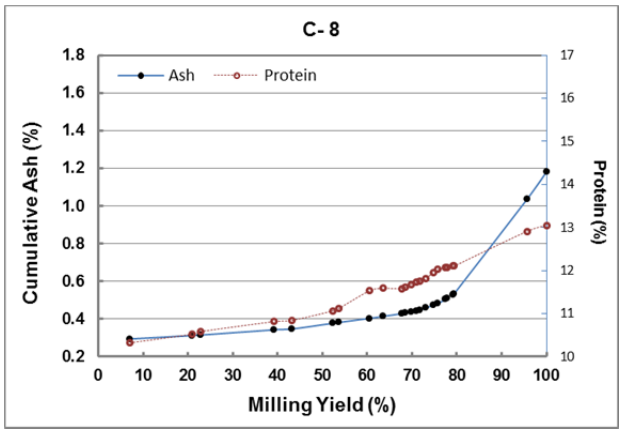
ND 816

COI565W

Cumulative Ash:	C- 5					
Mill	Stream (%, 14% mb)			Cumulative (%, 14% mb)		
Stream	Yield	Ash	Protein	Yield	Ash	Protein
Patent						
1 M	8.8	0.28	11.9	8.8	0.28	11.9
Sz I	2.3	0.32	13.4	11.1	0.29	12.2
2 M	13.6	0.34	12.3	24.7	0.32	12.3
Sz II	3.3	0.38	12.8	27.9	0.32	12.3
3 M	15.1	0.39	12.4	43.1	0.35	12.4
4 M	9.1	0.53	14.0	52.2	0.38	12.7
1 Bk	1.5	0.55	16.6	53.7	0.38	12.8
Bk Dust	3.5	0.60	15.8	57.2	0.40	12.9
4 Bk	7.0	0.60	17.5	64.2	0.42	13.4
2 Bk II	1.3	0.66	17.9	65.5	0.42	13.5
2 Bk I	0.7	0.73	17.8	66.1	0.43	13.6
3 Bk	1.4	0.73	18.0	67.5	0.43	13.7
6 M	3.6	0.82	13.0	71.1	0.45	13.6
TC Fl	0.6	1.00	17.4	71.7	0.46	13.7
Tail	1.2	1.24	17.3	72.9	0.47	13.7
5 Bk	1.5	1.37	22.4	74.3	0.49	13.9
Clear flour						
LG	0.9	1.23	18.7	75.2	0.50	14.0
LQ	0.5	1.67	14.2	75.7	0.50	14.0
5 M	1.4	1.73	15.6	77.1	0.53	14.0
Bran & shorts						
Tail St	1.6	1.57	14.3	78.7	0.55	14.0
TC St	0.1	3.16	14.1	78.8	0.55	14.0
Head St	16.8	3.44	18.2	95.7	1.06	14.7
Bran	4.3	5.01	16.7	100.0	1.23	14.8
Patent*		0.46	13.8			
Wheat		1.46	14.8			
*Rebolted						

Cumulative Ash:	C- 6					
Mill	Stream (%, 14% mb)			Cumulative (%, 14% mb)		
Stream	Yield	Ash	Protein	Yield	Ash	Protein
Patent						
1 M	7.8	0.29	10.9	7.8	0.29	10.9
Sz I	2.5	0.32	11.3	10.3	0.30	11.0
2 M	14.5	0.33	11.2	24.8	0.32	11.1
Sz II	4.0	0.39	11.2	28.8	0.33	11.1
3 M	13.4	0.46	12.3	42.2	0.37	11.5
1 Bk	1.6	0.48	13.7	43.8	0.37	11.6
Bk Dust	3.9	0.49	13.4	47.8	0.38	11.7
2 Bk I	0.9	0.50	14.0	48.6	0.39	11.8
2 Bk II	1.6	0.54	14.4	50.3	0.39	11.9
4 M	7.8	0.54	13.7	58.1	0.41	12.1
3 Bk	1.7	0.61	15.2	59.8	0.42	12.2
4 Bk	6.9	0.63	15.5	66.8	0.44	12.5
TC Fl	1.4	0.68	14.2	68.1	0.44	12.6
6 M	3.7	0.84	12.5	71.8	0.46	12.6
5 Bk	1.7	1.18	18.6	73.5	0.48	12.7
Tail	1.4	1.28	17.7	74.8	0.49	12.8
Clear flour						
LG	1.0	1.28	19.0	75.9	0.50	12.9
5 M	1.7	1.55	15.6	77.5	0.53	12.9
LQ	0.4	1.80	15.7	77.9	0.53	13.0
Bran & shorts						
Tail St	1.4	1.96	14.2	79.3	0.56	13.0
TC St	0.2	2.03	14.0	79.5	0.56	13.0
Head St	16.3	3.33	17.4	95.8	1.03	13.7
Bran	4.2	4.72	15.7	100.0	1.19	13.8
Patent*		0.47	12.4			
Wheat		1.32	13.3			
*Rebolted						



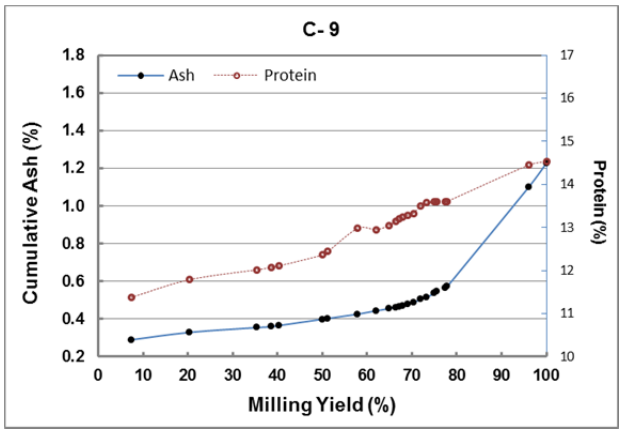


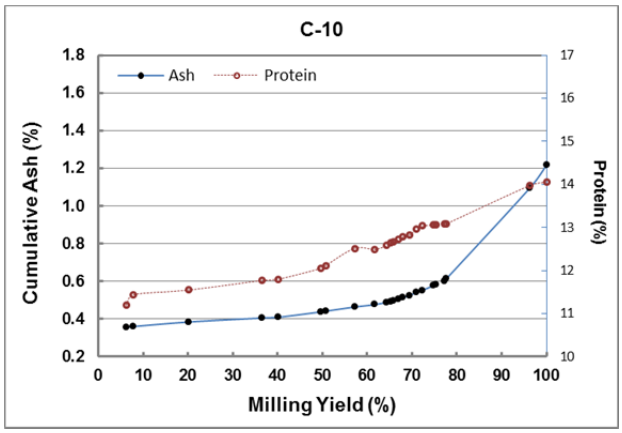
SD4189

Cumulative Ash:	C- 7					
Mill	Stream (%, 14% mb)			Cumulative (%, 14% mb)		
Stream	Yield	Ash	Protein	Yield	Ash	Protein
Patent						
1 M	7.8	0.31	11.1	7.8	0.31	11.1
2 M	13.7	0.32	11.5	21.6	0.32	11.4
Sz I	2.0	0.34	12.1	23.5	0.32	11.5
3 M	15.8	0.38	12.0	39.3	0.34	11.7
Sz II	3.8	0.40	11.7	43.1	0.35	11.7
4 M	8.4	0.50	13.1	51.5	0.37	11.9
1 Bk	1.2	0.58	15.0	52.7	0.38	12.0
4 Bk	6.2	0.60	15.8	58.8	0.40	12.4
Bk Dust	3.1	0.61	14.3	61.9	0.41	12.5
6 M	4.0	0.68	12.2	65.9	0.43	12.5
2 Bk II	1.2	0.72	16.0	67.1	0.43	12.5
2 Bk I	0.6	0.74	15.8	67.7	0.44	12.6
3 Bk	1.3	0.76	16.5	68.9	0.44	12.6
TC Fl	0.8	0.90	15.4	69.7	0.45	12.7
Tail	1.3	1.14	16.0	71.0	0.46	12.7
5 Bk	1.5	1.28	19.3	72.5	0.48	12.8
Clear flour						
LG	1.0	1.13	17.1	73.5	0.48	12.9
5 M	2.0	1.17	14.4	75.5	0.50	12.9
LQ	0.2	1.65	14.1	75.7	0.51	12.9
Bran & shorts						
Tail St	2.4	1.58	14.1	78.1	0.54	13.0
TC St	0.2	3.10	12.8	78.3	0.55	13.0
Head St	17.3	3.45	17.4	95.6	1.07	13.8
Bran	4.4	4.59	15.7	100.0	1.23	13.9
Patent*		0.44	12.8			
Wheat		1.47	13.7			
*Rebolted						

CHBR1481W

Cumulative Ash:	C- 8					
Mill	Stream (%, 14% mb)			Cumulative (%, 14% mb)		
Stream	Yield	Ash	Protein	Yield	Ash	Protein
Patent						
1 M	7.0	0.29	10.3	7.0	0.29	10.3
2 M	13.9	0.32	10.6	20.9	0.31	10.5
Sz I	2.0	0.35	11.2	22.9	0.32	10.6
3 M	16.4	0.38	11.1	39.3	0.34	10.8
Sz II	3.8	0.39	11.1	43.1	0.35	10.8
4 M	9.2	0.52	12.1	52.3	0.38	11.1
1 Bk	1.3	0.55	13.2	53.6	0.38	11.1
4 Bk	6.9	0.57	14.7	60.5	0.40	11.5
Bk Dust	3.0	0.62	12.7	63.5	0.41	11.6
6 M	4.2	0.65	11.5	67.7	0.43	11.6
2 Bk I	0.7	0.71	14.5	68.4	0.43	11.6
3 Bk	1.4	0.71	15.3	69.8	0.44	11.7
2 Bk II	1.1	0.71	14.7	70.9	0.44	11.7
TC Fl	0.9	0.90	14.1	71.8	0.45	11.8
Tail	1.2	1.11	14.9	73.1	0.46	11.8
5 Bk	1.7	1.14	18.3	74.7	0.47	12.0
Clear flour						
LG	1.0	1.10	17.0	75.8	0.48	12.0
5 M	1.7	1.47	13.7	77.5	0.50	12.1
LQ	0.3	1.67	13.1	77.8	0.51	12.1
Bran & shorts						
Tail St	1.4	1.64	14.0	79.2	0.53	12.1
TC St	0.2	2.77	13.0	79.4	0.53	12.1
Head St	16.3	3.49	16.9	95.7	1.04	12.9
Bran	4.3	4.36	16.1	100.0	1.18	13.1
Patent*		0.44	12.0			
Wheat		1.35	12.9			
*Rebolted						





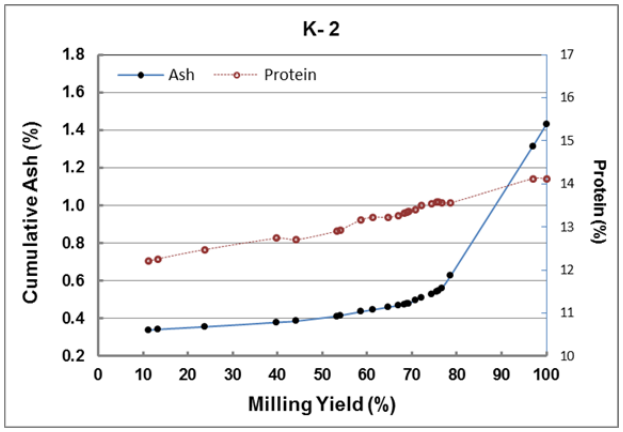
ND 819

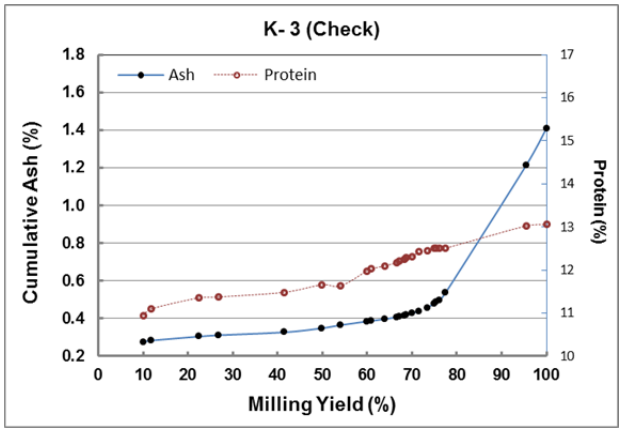
Cumulative Ash:	C- 9					
Mill	Stream (%, 14% mb)			Cumulative (%, 14% mb)		
Stream	Yield	Ash	Protein	Yield	Ash	Protein
Patent						
1 M	7.3	0.29	11.4	7.3	0.29	11.4
2 M	12.9	0.35	12.0	20.3	0.33	11.8
3 M	15.2	0.39	12.3	35.5	0.35	12.0
Sz II	3.2	0.40	12.7	38.6	0.36	12.1
Sz I	1.7	0.53	13.0	40.3	0.37	12.1
4 M	9.8	0.54	13.4	50.1	0.40	12.4
1 Bk	1.2	0.58	15.9	51.3	0.40	12.4
4 Bk	6.5	0.60	17.2	57.8	0.43	13.0
6 M	4.2	0.69	12.6	62.0	0.44	13.0
Bk Dust	2.9	0.70	15.1	64.9	0.46	13.0
3 Bk	1.5	0.78	17.7	66.4	0.46	13.2
2 Bk II	0.9	0.80	17.2	67.2	0.47	13.2
2 Bk I	0.6	0.81	17.4	67.8	0.47	13.2
TC Fl	1.2	0.88	15.6	69.0	0.48	13.3
Tail	1.3	1.07	15.8	70.3	0.49	13.3
5 Bk	1.6	1.19	21.3	71.9	0.50	13.5
Clear flour						
LG	1.3	1.07	17.1	73.2	0.51	13.6
5 M	1.8	1.49	14.4	75.0	0.54	13.6
LQ	0.6	1.50	13.4	75.6	0.54	13.6
Bran & shorts						
Tail St	1.9	1.36	14.2	77.5	0.56	13.6
TC St	0.4	2.21	14.3	77.9	0.57	13.6
Head St	18.1	3.36	18.1	96.0	1.10	14.4
Bran	4.0	4.30	16.4	100.0	1.23	14.5
Patent*		0.46	13.4			
Wheat		1.43	14.3			
*Rebolted						

WB9507

Cumulative Ash:	C-10					
Mill	Stream (%, 14% mb)			Cumulative (%, 14% mb)		
Stream	Yield	Ash	Protein	Yield	Ash	Protein
Patent						
1 M	6.2	0.35	11.2	6.2	0.35	11.2
Sz I	1.7	0.38	12.4	7.8	0.36	11.4
2 M	12.2	0.40	11.6	20.1	0.38	11.5
3 M	16.4	0.43	12.0	36.5	0.41	11.8
Sz II	3.7	0.45	12.1	40.2	0.41	11.8
4 M	9.5	0.56	13.1	49.6	0.44	12.1
1 Bk	1.1	0.63	15.1	50.7	0.44	12.1
4 Bk	6.4	0.64	15.7	57.2	0.46	12.5
6 M	4.5	0.64	12.1	61.7	0.48	12.5
Bk Dust	2.7	0.77	14.8	64.4	0.49	12.6
2 Bk II	0.9	0.88	16.3	65.3	0.49	12.6
2 Bk I	0.6	0.94	16.3	65.8	0.50	12.7
TC Fl	1.1	0.97	15.5	67.0	0.51	12.7
3 Bk	1.0	0.99	16.9	67.9	0.51	12.8
Tail	1.6	1.09	15.1	69.5	0.53	12.8
5 Bk	1.5	1.30	19.3	71.0	0.54	13.0
Clear flour						
LG	1.3	1.08	17.0	72.3	0.55	13.0
5 M	2.5	1.32	14.0	74.8	0.58	13.1
LQ	0.6	1.46	13.2	75.3	0.58	13.1
Bran & shorts						
Tail St	1.9	1.34	13.6	77.2	0.60	13.1
TC St	0.5	2.60	14.3	77.7	0.61	13.1
Head St	18.6	3.10	17.7	96.2	1.09	14.0
Bran	3.8	4.34	16.1	100.0	1.22	14.1
Patent*		0.47	12.8			
Wheat		1.44	13.8			
*Rebolted						

Crookston, MN (Group K)



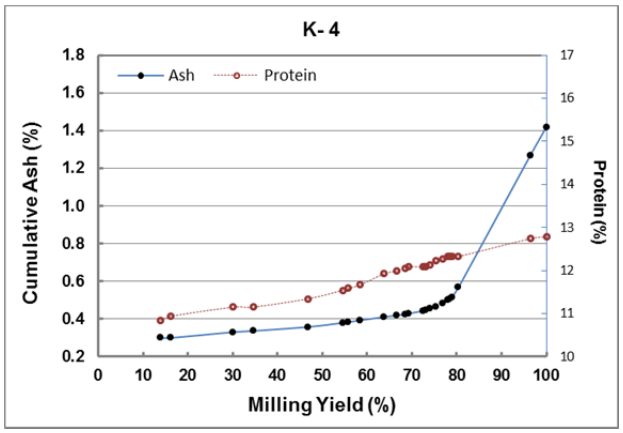


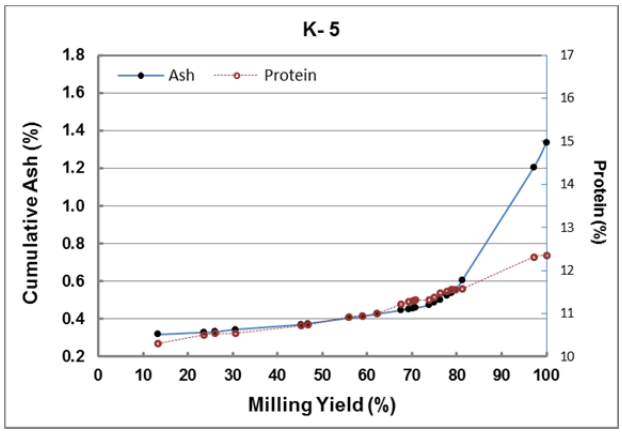
MN08165-8

Cumulative Ash:	K- 2					
Mill	Stream (%, 14% mb)			Cumulative (%, 14% mb)		
Stream	Yield	Ash	Protein	Yield	Ash	Protein
Patent						
1 M	11.2	0.34	12.2	11.2	0.34	12.2
Sz I	2.0	0.37	12.6	13.2	0.34	12.3
2 M	10.6	0.37	12.7	23.8	0.36	12.5
3 M	16.0	0.41	13.1	39.8	0.38	12.7
Sz II	4.4	0.45	12.4	44.1	0.39	12.7
4 M	9.0	0.54	13.9	53.2	0.41	12.9
1 Bk	0.8	0.65	14.8	54.0	0.42	12.9
4 Bk	4.5	0.67	15.9	58.5	0.44	13.2
TC Fl	2.7	0.67	14.7	61.3	0.45	13.2
6 M	3.4	0.71	13.2	64.7	0.46	13.2
Bk Dust	2.2	0.73	14.6	66.9	0.47	13.3
3 Bk	1.3	0.78	15.9	68.2	0.48	13.3
2 Bk II	0.7	0.84	15.4	68.9	0.48	13.3
2 Bk I	0.4	0.86	15.4	69.3	0.48	13.4
Tail	1.4	1.22	15.9	70.7	0.50	13.4
5 Bk	1.3	1.26	18.9	72.0	0.51	13.5
Clear flour						
5 M	2.4	1.09	14.4	74.4	0.53	13.5
LG	1.3	1.45	15.9	75.6	0.54	13.6
LQ	0.2	2.17	13.6	75.9	0.55	13.6
Bran & shorts						
TC St	0.8	1.60	13.4	76.7	0.56	13.6
Tail St	2.0	3.26	13.2	78.6	0.63	13.6
Head St	18.3	4.26	16.5	97.0	1.31	14.1
Bran	3.0	5.16	13.8	100.0	1.43	14.1
Patent*		0.52	13.3			
Wheat		1.35	13.7			
*Rebolted						

Glenn

Cumulative Ash:	K- 3 (Check)					
Mill	Stream (%, 14% mb)			Cumulative (%, 14% mb)		
Stream	Yield	Ash	Protein	Yield	Ash	Protein
Patent						
1 M	10.0	0.28	10.9	10.0	0.28	10.9
Sz I	1.8	0.33	12.0	11.8	0.28	11.1
2 M	10.6	0.33	11.6	22.4	0.30	11.4
Sz II	4.3	0.35	11.5	26.7	0.31	11.4
3 M	14.7	0.36	11.7	41.4	0.33	11.5
4 M	8.3	0.46	12.5	49.8	0.35	11.7
6 M	4.3	0.56	11.4	54.1	0.37	11.6
4 Bk	5.7	0.56	15.2	59.8	0.38	12.0
1 Bk	1.1	0.56	14.8	61.0	0.39	12.0
TC Fl	2.9	0.59	13.5	63.8	0.40	12.1
Bk Dust	2.7	0.66	13.9	66.5	0.41	12.2
2 Bk II	0.7	0.70	15.6	67.2	0.41	12.2
3 Bk	1.0	0.73	15.7	68.2	0.42	12.3
2 Bk I	0.5	0.76	15.7	68.8	0.42	12.3
Tail	1.3	0.97	14.1	70.1	0.43	12.3
5 Bk	1.5	0.99	18.0	71.6	0.44	12.4
Clear flour						
5 M	1.9	1.13	12.7	73.5	0.46	12.4
LG	1.4	1.64	16.2	74.9	0.48	12.5
LQ	0.4	1.75	12.3	75.3	0.49	12.5
Bran & shorts						
TC St	0.9	1.31	12.5	76.2	0.50	12.5
Tail St	1.4	2.89	12.5	77.5	0.54	12.5
Head St	17.9	4.13	15.2	95.5	1.21	13.0
Bran	4.5	5.56	13.7	100.0	1.41	13.1
Patent*		0.47	12.2			
Wheat		1.20	12.8			
*Rebolted						



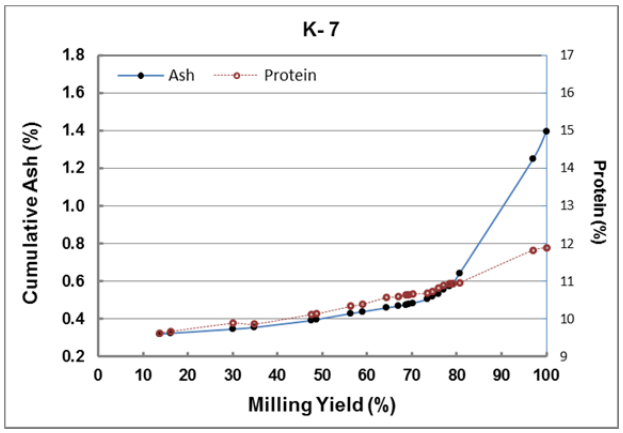


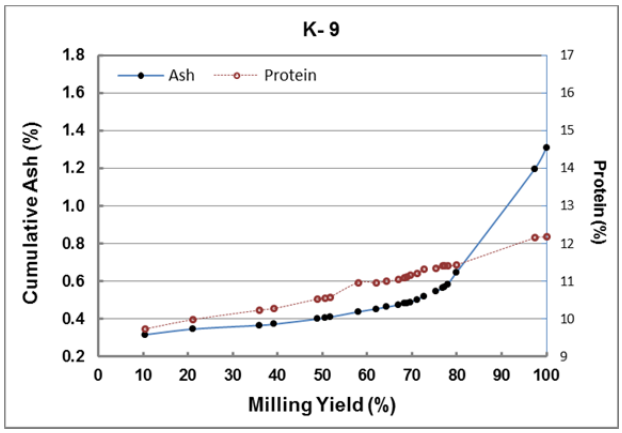
Elgin-ND

ND 816

Cumulative Ash:	K- 4					
Mill	Stream (%, 14% mb)			Cumulative (%, 14% mb)		
Stream	Yield	Ash	Protein	Yield	Ash	Protein
Patent						
1 M	13.8	0.30	10.8	13.8	0.30	10.8
Sz I	2.4	0.30	11.5	16.2	0.30	10.9
2 M	13.8	0.37	11.4	30.0	0.33	11.2
Sz II	4.6	0.38	11.2	34.5	0.34	11.2
3 M	12.3	0.42	11.9	46.8	0.36	11.3
4 M	7.8	0.51	12.8	54.6	0.38	11.5
1 Bk	1.1	0.55	13.6	55.7	0.38	11.6
TC Fl	2.7	0.59	13.4	58.5	0.39	11.7
4 Bk	5.4	0.60	14.8	63.8	0.41	11.9
Bk Dust	2.8	0.60	13.4	66.6	0.42	12.0
3 Bk	1.8	0.67	14.7	68.4	0.43	12.1
2 Bk II	0.8	0.71	14.4	69.3	0.43	12.1
6 M	3.3	0.74	12.0	72.6	0.44	12.1
2 Bk I	0.5	0.74	14.4	73.0	0.45	12.1
Tail	1.0	1.14	15.3	74.0	0.45	12.1
5 Bk	1.3	1.18	17.4	75.3	0.47	12.2
Clear flour						
5 M	1.4	1.42	14.1	76.8	0.48	12.3
LG	1.3	1.52	15.6	78.0	0.50	12.3
LQ	0.3	2.24	13.4	78.3	0.51	12.3
Bran & shorts						
TC St	0.6	1.79	11.8	78.9	0.52	12.3
Tail St	1.5	3.28	12.6	80.4	0.57	12.3
Head St	16.1	4.78	14.8	96.4	1.27	12.7
Bran	3.6	5.48	14.0	100.0	1.42	12.8
Patent*		0.48	12.0			
Wheat		1.24	12.8			
*Rebolted						

Cumulative Ash:	K- 5					
Mill	Stream (%, 14% mb)			Cumulative (%, 14% mb)		
Stream	Yield	Ash	Protein	Yield	Ash	Protein
Patent						
1 M	13.4	0.32	10.3	13.4	0.32	10.3
2 M	10.2	0.34	10.8	23.6	0.33	10.5
Sz I	2.5	0.35	10.8	26.1	0.33	10.5
Sz II	4.5	0.42	10.6	30.6	0.34	10.5
3 M	14.8	0.42	11.1	45.4	0.37	10.7
1 Bk	1.5	0.55	11.3	46.9	0.38	10.7
4 M	9.0	0.55	11.9	55.9	0.41	10.9
Bk Dust	3.1	0.59	11.4	59.0	0.41	10.9
TC Fl	3.2	0.64	12.1	62.2	0.43	11.0
4 Bk	5.4	0.67	13.7	67.6	0.45	11.2
3 Bk	1.6	0.70	13.5	69.2	0.45	11.3
2 Bk II	1.0	0.72	13.0	70.2	0.46	11.3
2 Bk I	0.7	0.78	13.0	70.9	0.46	11.3
6 M	3.0	0.82	11.6	73.8	0.47	11.3
Tail	1.1	1.31	14.3	74.9	0.49	11.4
5 Bk	1.4	1.40	17.0	76.3	0.50	11.5
Clear flour						
5 M	1.5	1.55	13.5	77.8	0.52	11.5
LG	1.0	1.67	15.5	78.8	0.54	11.6
LQ	0.2	2.37	12.9	79.0	0.54	11.6
Bran & shorts						
TC St	0.8	1.73	11.4	79.7	0.55	11.6
Tail St	1.5	3.54	12.6	81.2	0.61	11.6
Head St	16.0	4.25	16.1	97.2	1.21	12.3
Bran	2.8	5.90	13.6	100.0	1.34	12.4
Patent*		0.50	11.4			
Wheat		1.31	12.0			
*Rebolted						



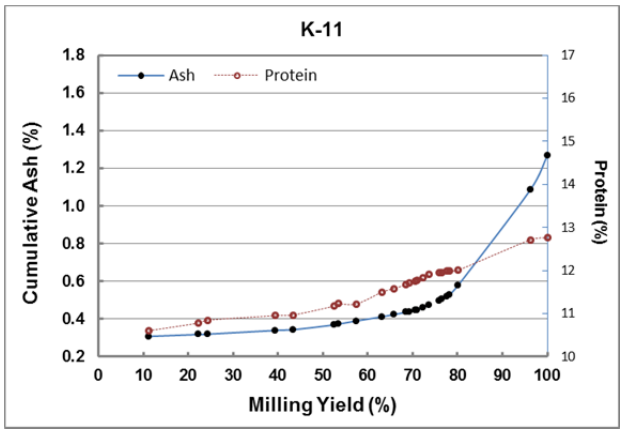


SD4189

Cumulative Ash:	K- 7					
Mill	Stream (%, 14% mb)			Cumulative (%, 14% mb)		
Stream	Yield	Ash	Protein	Yield	Ash	Protein
Patent						
1 M	13.7	0.32	9.6	13.7	0.32	9.6
Sz I	2.4	0.35	9.9	16.2	0.32	9.7
2 M	13.9	0.37	10.1	30.1	0.35	9.9
Sz II	4.8	0.41	9.7	34.8	0.36	9.9
3 M	12.6	0.49	10.8	47.5	0.39	10.1
1 Bk	1.2	0.62	10.8	48.7	0.40	10.1
4 M	7.6	0.63	11.6	56.3	0.43	10.3
TC Fl	2.7	0.65	11.6	59.1	0.44	10.4
4 Bk	5.3	0.69	12.5	64.4	0.46	10.6
Bk Dust	2.6	0.69	11.0	67.0	0.47	10.6
3 Bk	1.6	0.78	12.6	68.7	0.48	10.6
2 Bk I	0.6	0.86	11.9	69.2	0.48	10.6
2 Bk II	1.0	0.86	11.9	70.2	0.48	10.7
6 M	3.2	0.93	11.1	73.4	0.50	10.7
Tail	1.2	1.40	14.2	74.6	0.52	10.7
5 Bk	1.4	1.46	15.3	75.9	0.53	10.8
Clear flour						
LG	1.2	1.79	15.8	77.1	0.55	10.9
5 M	1.2	1.96	13.4	78.3	0.58	10.9
LQ	0.2	2.40	12.7	78.5	0.58	10.9
Bran & shorts						
TC St	0.7	1.72	11.3	79.1	0.59	10.9
Tail St	1.5	3.46	12.2	80.6	0.64	11.0
Head St	16.4	4.23	16.1	97.0	1.25	11.8
Bran	3.0	6.18	13.8	100.0	1.40	11.9
Patent*		0.49	10.7			
Wheat		1.40	11.4			
*Rebolted						

ND 819

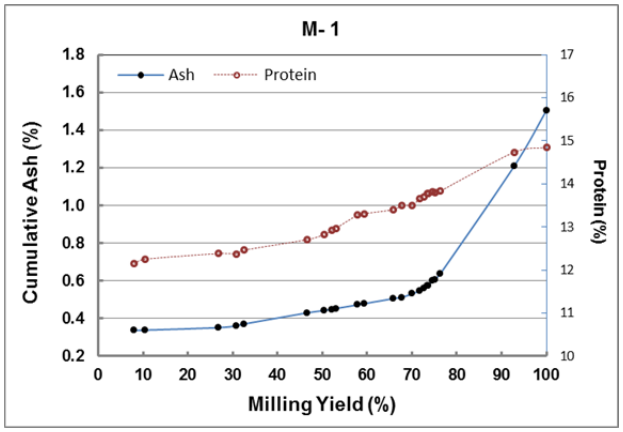
Cumulative Ash:	K- 9					
Mill	Stream (%, 14% mb)			Cumulative (%, 14% mb)		
Stream	Yield	Ash	Protein	Yield	Ash	Protein
Patent						
1 M	10.5	0.32	9.7	10.5	0.32	9.7
2 M	10.6	0.38	10.2	21.1	0.35	10.0
3 M	14.8	0.39	10.6	35.9	0.37	10.2
Sz II	3.4	0.44	10.8	39.3	0.37	10.3
4 M	9.6	0.51	11.5	48.8	0.40	10.5
Sz I	1.8	0.56	11.1	50.6	0.41	10.5
1 Bk	1.1	0.61	12.2	51.7	0.41	10.6
4 Bk	6.3	0.67	14.2	58.0	0.44	11.0
6 M	4.0	0.68	10.9	62.0	0.45	11.0
TC Fl	2.4	0.72	12.1	64.4	0.46	11.0
Bk Dust	2.6	0.75	12.0	67.0	0.47	11.0
3 Bk	1.3	0.82	14.5	68.2	0.48	11.1
2 Bk I	0.6	0.89	13.7	68.8	0.48	11.1
2 Bk II	0.8	0.93	13.6	69.6	0.49	11.2
Tail	1.5	1.09	13.3	71.1	0.50	11.2
5 Bk	1.5	1.36	17.1	72.6	0.52	11.3
Clear flour						
5 M	2.6	1.25	12.2	75.3	0.55	11.4
LG	1.7	1.43	13.8	76.9	0.57	11.4
LQ	0.4	1.63	11.7	77.3	0.57	11.4
Bran & shorts						
TC St	0.6	1.94	11.5	77.9	0.58	11.4
Tail St	2.0	3.22	12.5	79.9	0.65	11.4
Head St	17.5	3.71	15.4	97.4	1.20	12.2
Bran	2.6	5.50	13.1	100.0	1.31	12.2
Patent*		0.49	11.1			
Wheat		1.32	11.9			
*Rebolted						

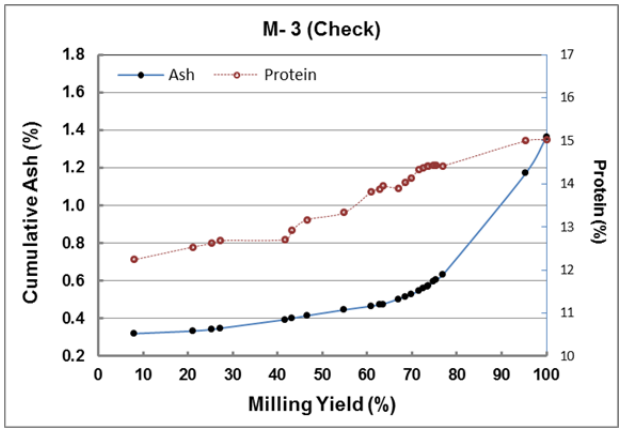


ND 812

Cumulative Ash:	K-11					
Mill	Stream (%, 14% mb)			Cumulative (%, 14% mb)		
Stream	Yield	Ash	Protein	Yield	Ash	Protein
Patent						
1 M	11.2	0.31	10.6	11.2	0.31	10.6
2 M	11.1	0.33	11.0	22.3	0.32	10.8
Sz I	1.9	0.34	11.6	24.3	0.32	10.8
3 M	15.1	0.37	11.1	39.4	0.34	11.0
Sz II	4.0	0.38	11.1	43.4	0.34	11.0
4 M	9.1	0.49	12.2	52.4	0.37	11.2
1 Bk	1.0	0.60	14.0	53.4	0.37	11.2
6 M	4.1	0.61	11.2	57.5	0.39	11.2
4 Bk	5.6	0.64	14.3	63.1	0.41	11.5
TC Fl	2.8	0.71	13.6	65.9	0.42	11.6
Bk Dust	2.7	0.71	13.9	68.6	0.44	11.7
2 Bk II	0.8	0.78	15.1	69.3	0.44	11.7
3 Bk	1.1	0.82	14.6	70.5	0.45	11.8
2 Bk I	0.5	0.89	14.9	71.0	0.45	11.8
Tail	1.4	1.04	14.2	72.3	0.46	11.8
5 Bk	1.2	1.36	17.0	73.6	0.47	11.9
Clear flour						
5 M	2.4	1.23	12.9	75.9	0.50	11.9
LQ	0.5	1.31	12.1	76.4	0.50	11.9
LG	1.2	1.49	14.7	77.6	0.52	12.0
Bran & shorts						
TC St	0.7	1.86	12.8	78.3	0.53	12.0
Tail St	1.9	2.67	12.8	80.2	0.58	12.0
Head St	16.0	3.61	16.2	96.2	1.09	12.7
Bran	3.8	5.89	14.0	100.0	1.27	12.8
Patent*		0.48	11.8			
Wheat		1.18	12.7			
*Rebolted						

Minot, MN (Group M)



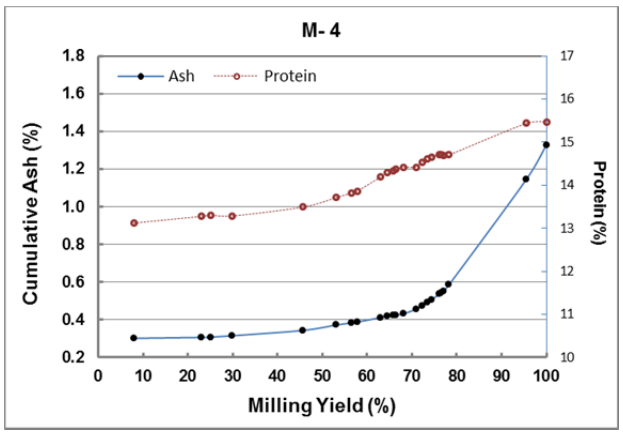


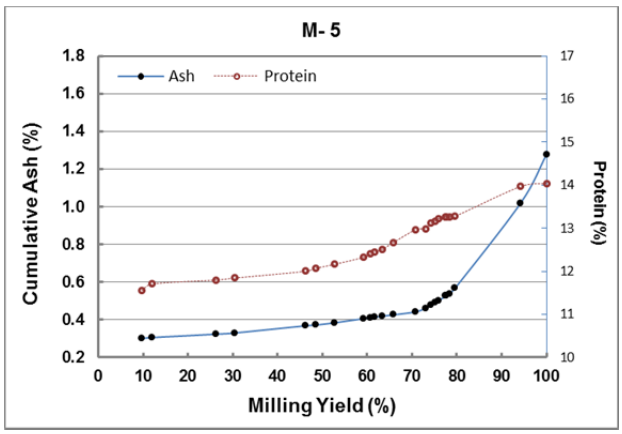
BR0202W

Cumulative Ash:	M- 1					
Mill	Stream (%, 14% mb)			Cumulative (%, 14% mb)		
Stream	Yield	Ash	Protein	Yield	Ash	Protein
Patent						
1 M	8.0	0.34	12.2	8.0	0.34	12.2
Sz I	2.4	0.34	12.6	10.4	0.34	12.3
2 M	16.4	0.36	12.5	26.8	0.35	12.4
Sz II	4.0	0.42	12.3	30.8	0.36	12.4
1 Bk	1.7	0.55	14.0	32.4	0.37	12.5
3 M	14.2	0.57	13.3	46.6	0.43	12.7
Bk Dust	3.8	0.59	14.2	50.4	0.44	12.8
2 Bk II	1.7	0.64	15.8	52.1	0.45	12.9
2 Bk I	1.0	0.68	16.0	53.0	0.45	13.0
4 Bk	4.9	0.69	16.7	57.9	0.47	13.3
TC Fl	1.4	0.74	14.6	59.3	0.48	13.3
4 M	6.6	0.75	14.2	65.8	0.51	13.4
3 Bk	1.9	0.75	16.9	67.7	0.51	13.5
6 M	2.4	1.06	13.7	70.1	0.53	13.5
5 Bk	1.6	1.25	20.1	71.7	0.55	13.7
Tail	0.9	1.55	17.4	72.6	0.56	13.7
Clear flour						
LG	0.9	1.55	19.1	73.5	0.57	13.8
LQ	0.2	1.90	15.7	73.7	0.58	13.8
5 M	0.9	2.60	16.7	74.6	0.60	13.8
Bran & shorts						
TC St	0.5	1.75	13.3	75.1	0.61	13.8
Tail St	1.2	2.48	15.6	76.3	0.64	13.8
Head St	16.5	3.85	18.9	92.8	1.21	14.7
Bran	7.2	5.30	16.3	100.0	1.50	14.8
Patent*		0.50	13.7			
Wheat		1.64	14.4			
*Rebolted						

Glenn

Cumulative Ash:	M- 3 (Check)					
Mill	Stream (%, 14% mb)			Cumulative (%, 14% mb)		
Stream	Yield	Ash	Protein	Yield	Ash	Protein
Patent						
1 M	8.0	0.32	12.2	8.0	0.32	12.2
2 M	13.1	0.34	12.7	21.1	0.33	12.5
Sz II	4.3	0.38	13.0	25.4	0.34	12.6
Sz I	1.9	0.43	13.6	27.3	0.35	12.7
3 M	14.4	0.48	12.7	41.6	0.39	12.7
1 Bk	1.6	0.57	18.7	43.2	0.40	12.9
Bk Dust	3.5	0.60	16.3	46.7	0.42	13.2
4 M	8.1	0.62	14.3	54.8	0.45	13.3
4 Bk	6.0	0.65	18.2	60.8	0.47	13.8
TC Fl	1.8	0.71	16.3	62.7	0.47	13.9
2 Bk I	0.8	0.73	19.4	63.5	0.48	13.9
6 M	3.4	0.99	13.1	66.9	0.50	13.9
3 Bk	1.6	1.03	19.3	68.5	0.51	14.0
2 Bk II	1.3	1.17	19.3	69.8	0.53	14.1
5 Bk	1.7	1.34	22.6	71.4	0.55	14.3
Tail	1.1	1.41	17.2	72.5	0.56	14.4
Clear flour						
LG	0.9	1.40	18.3	73.5	0.57	14.4
LQ	0.2	1.87	13.9	73.7	0.57	14.4
5 M	1.1	2.10	15.3	74.8	0.60	14.4
Bran & shorts						
TC St	0.6	1.81	14.5	75.4	0.61	14.4
Tail St	1.5	1.96	13.6	76.9	0.63	14.4
Head St	18.5	3.41	17.4	95.4	1.17	15.0
Bran	4.6	5.35	15.6	100.0	1.36	15.0
Patent*		0.52	14.3			
Wheat		1.56	14.6			
*Rebolted						



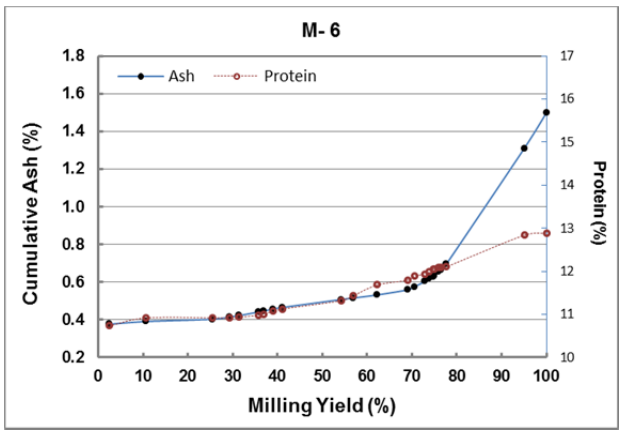


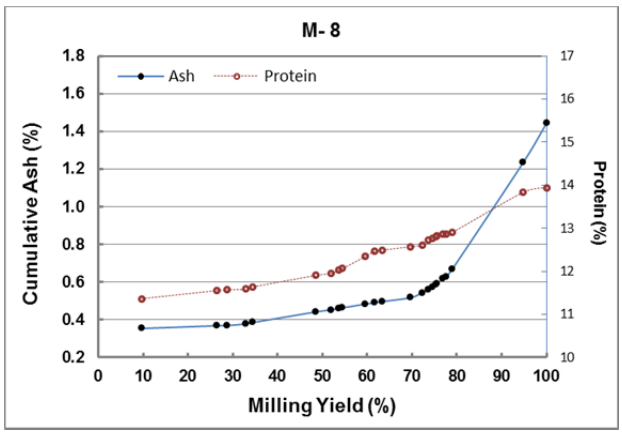
Elgin-ND

ND 816

Cumulative Ash:	M- 4					
Mill	Stream (%, 14% mb)			Cumulative (%, 14% mb)		
Stream	Yield	Ash	Protein	Yield	Ash	Protein
Patent						
1 M	7.9	0.30	13.1	7.9	0.30	13.1
2 M	15.1	0.31	13.4	23.0	0.31	13.3
Sz I	2.0	0.32	13.7	25.0	0.31	13.3
Sz II	4.8	0.35	13.2	29.8	0.32	13.3
3 M	15.8	0.40	13.9	45.6	0.34	13.5
4 M	7.4	0.55	15.1	53.1	0.37	13.7
Bk Dust	3.4	0.56	15.5	56.4	0.38	13.8
1 Bk	1.4	0.57	15.8	57.8	0.39	13.9
4 Bk	5.2	0.68	17.8	63.0	0.41	14.2
3 Bk	1.5	0.68	18.2	64.5	0.42	14.3
2 Bk II	1.2	0.69	17.1	65.7	0.42	14.3
2 Bk I	0.7	0.69	16.9	66.4	0.43	14.4
TC Fl	1.8	0.69	16.5	68.2	0.43	14.4
6 M	2.9	1.06	14.5	71.0	0.46	14.4
5 Bk	1.3	1.47	21.0	72.3	0.48	14.5
Tail	1.1	1.63	18.8	73.5	0.49	14.6
Clear flour						
LG	0.8	1.62	19.2	74.3	0.51	14.7
5 M	1.9	1.75	16.6	76.2	0.54	14.7
LQ	0.2	2.03	15.8	76.4	0.54	14.7
Bran & shorts						
TC St	0.6	2.09	13.0	77.0	0.55	14.7
Tail St	1.3	2.59	15.1	78.3	0.59	14.7
Head St	17.2	3.68	18.8	95.5	1.14	15.4
Bran	4.5	5.20	16.2	100.0	1.33	15.5
Patent*		0.42	14.6			
Wheat		1.42	15.3			
*Rebolted						

Cumulative Ash:	M- 5					
Mill	Stream (%, 14% mb)			Cumulative (%, 14% mb)		
Stream	Yield	Ash	Protein	Yield	Ash	Protein
Patent						
1 M	9.7	0.30	11.6	9.7	0.30	11.6
Sz I	2.3	0.33	12.4	12.0	0.31	11.7
2 M	14.2	0.34	11.9	26.1	0.32	11.8
Sz II	4.3	0.37	12.1	30.5	0.33	11.8
3 M	15.8	0.44	12.3	46.3	0.37	12.0
1 Bk	2.2	0.45	13.5	48.4	0.37	12.1
Bk Dust	4.2	0.52	13.2	52.6	0.38	12.2
4 M	6.5	0.58	13.6	59.1	0.41	12.3
2 Bk II	1.6	0.59	15.5	60.7	0.41	12.4
2 Bk I	0.9	0.60	15.7	61.6	0.41	12.5
TC Fl	1.8	0.61	14.5	63.4	0.42	12.5
3 Bk	2.4	0.61	16.8	65.8	0.43	12.7
4 Bk	5.0	0.65	16.9	70.8	0.44	13.0
6 M	2.2	1.09	13.4	73.1	0.46	13.0
5 Bk	1.2	1.44	21.5	74.3	0.48	13.1
Tail	0.8	1.55	17.4	75.1	0.49	13.2
Clear flour						
LG	0.7	1.55	18.8	75.9	0.50	13.2
5 M	1.6	1.71	15.1	77.5	0.53	13.3
LQ	0.2	2.05	14.2	77.7	0.53	13.3
Bran & shorts						
TC St	0.7	1.53	13.1	78.4	0.54	13.3
Tail St	1.2	2.44	14.0	79.6	0.57	13.3
Head St	14.6	3.47	17.7	94.2	1.02	14.0
Bran	5.8	5.47	15.2	100.0	1.28	14.0
Patent*		0.48	13.1			
Wheat		1.39	13.6			
*Rebolted						



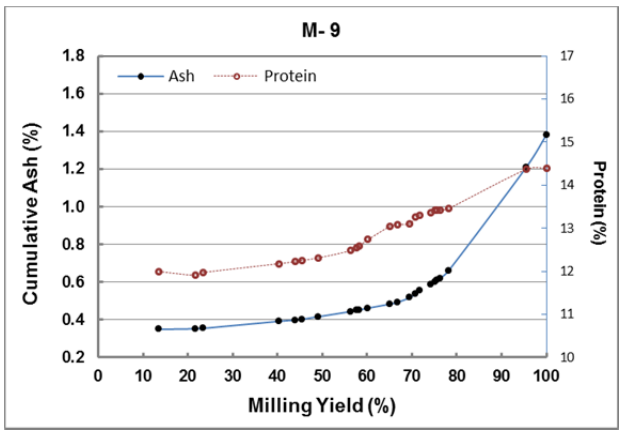


COI565W

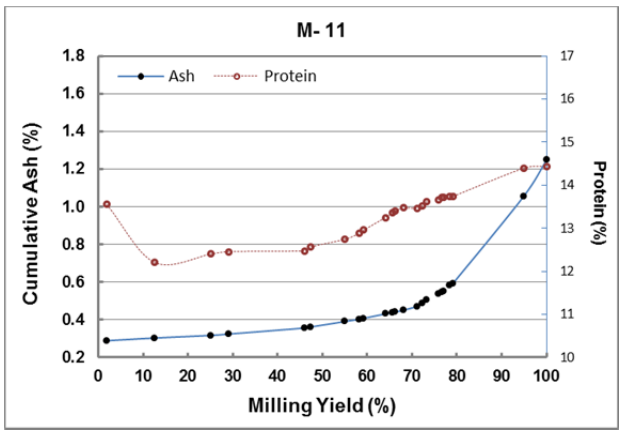
Cumulative Ash:	M- 6					
Mill	Stream (%, 14% mb)			Cumulative (%, 14% mb)		
Stream	Yield	Ash	Protein	Yield	Ash	Protein
Patent						
Sz I	2.4	0.38	10.7	2.4	0.38	10.7
1 M	8.2	0.39	11.0	10.7	0.39	10.9
2 M	14.9	0.41	10.9	25.6	0.40	10.9
Sz II	3.8	0.50	10.9	29.3	0.42	10.9
1 Bk	2.0	0.52	11.3	31.3	0.42	10.9
Bk Dust	4.5	0.58	11.3	35.8	0.44	11.0
2 Bk I	1.1	0.61	12.0	36.9	0.45	11.0
TC Fl	2.1	0.64	12.1	39.0	0.46	11.1
2 Bk II	2.0	0.64	12.2	41.1	0.47	11.1
3 M	13.2	0.64	11.9	54.2	0.51	11.3
3 Bk	2.7	0.68	13.7	57.0	0.52	11.4
4 Bk	5.3	0.71	14.4	62.2	0.53	11.7
4 M	6.9	0.81	12.8	69.1	0.56	11.8
5 Bk	1.5	1.33	16.5	70.6	0.58	11.9
6 M	2.3	1.48	12.8	73.0	0.61	11.9
Tail	0.9	1.64	16.4	73.9	0.62	12.0
Clear flour						
LG	0.8	1.63	18.3	74.7	0.63	12.1
LQ	0.2	2.04	14.1	74.9	0.63	12.1
5 M	0.9	2.52	14.8	75.9	0.66	12.1
Bran & shorts						
TC St	0.7	1.41	11.7	76.6	0.66	12.1
Tail St	1.1	2.94	13.2	77.7	0.70	12.1
Head St	17.4	4.06	16.1	95.1	1.31	12.8
Bran	4.9	5.12	13.7	100.0	1.50	12.9
Patent*		0.59	12.0			
Wheat		1.66	12.4			
*Rebolted						

CHBR1481W

Cumulative Ash:	M- 8					
Mill	Stream (%, 14% mb)			Cumulative (%, 14% mb)		
Stream	Yield	Ash	Protein	Yield	Ash	Protein
Patent						
1 M	9.6	0.35	11.4	9.6	0.35	11.4
2 M	16.8	0.38	11.7	26.4	0.37	11.6
Sz I	2.3	0.38	11.8	28.7	0.37	11.6
Sz II	4.3	0.44	11.7	33.0	0.38	11.6
1 Bk	1.5	0.54	12.8	34.5	0.39	11.6
3 M	14.0	0.58	12.6	48.5	0.44	11.9
Bk Dust	3.5	0.61	12.6	52.0	0.45	12.0
2 Bk II	1.6	0.68	14.3	53.6	0.46	12.0
2 Bk I	0.9	0.68	14.4	54.5	0.46	12.1
4 Bk	5.1	0.70	15.4	59.6	0.48	12.3
3 Bk	2.1	0.71	15.8	61.6	0.49	12.5
TC Fl	1.8	0.71	13.6	63.4	0.50	12.5
4 M	6.3	0.72	13.4	69.7	0.52	12.6
6 M	2.5	1.28	13.4	72.2	0.54	12.6
5 Bk	1.5	1.35	18.8	73.7	0.56	12.7
Tail	0.9	1.74	16.6	74.6	0.57	12.8
Clear flour						
LG	0.8	1.74	16.7	75.4	0.59	12.8
LQ	0.2	2.05	15.1	75.6	0.59	12.8
5 M	1.3	2.33	15.8	76.9	0.62	12.9
Bran & shorts						
TC St	0.8	1.63	13.1	77.7	0.63	12.9
Tail St	1.3	2.98	14.9	79.0	0.67	12.9
Head St	15.9	4.06	18.5	94.9	1.24	13.8
Bran	5.1	5.24	15.9	100.0	1.44	13.9
Patent*		0.53	12.7			
Wheat		1.48	13.6			
*Rebolted						



ND 819

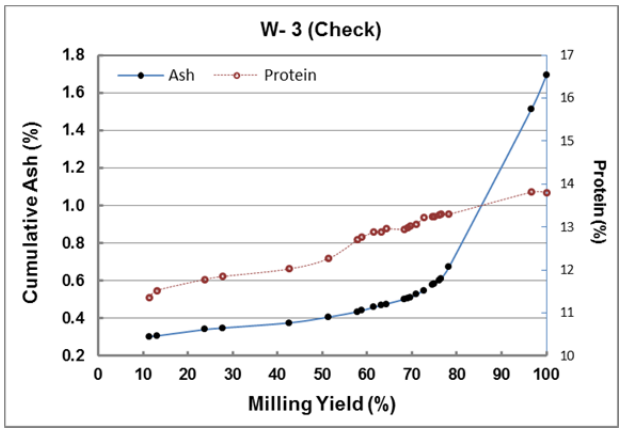


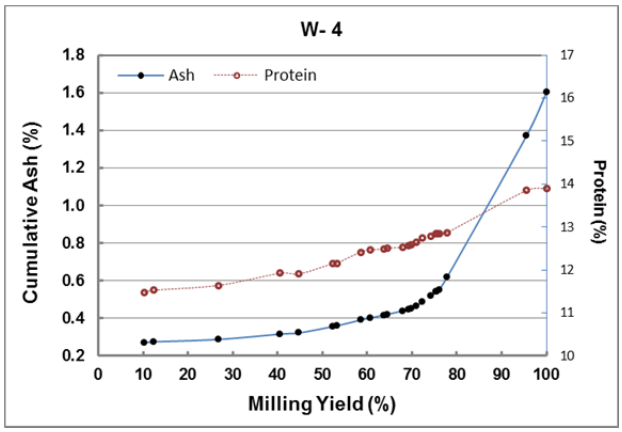
ND 812

Cumulative Ash:	**M- 9**					
Mill	**Stream (%, 14% mb)**			**Cumulative (%, 14% mb)**		
Stream	**Yield**	**Ash**	**Protein**	**Yield**	**Ash**	**Protein**
Patent						
2 M	13.6	0.35	12.0	13.6	0.35	12.0
1 M	8.0	0.36	11.8	21.6	0.35	11.9
Sz I	1.8	0.39	12.7	23.4	0.35	12.0
3 M	16.9	0.44	12.5	40.3	0.39	12.2
Sz II	3.6	0.47	12.7	43.9	0.40	12.2
1 Bk	1.6	0.51	13.2	45.4	0.40	12.3
Bk Dust	3.5	0.59	13.0	49.0	0.42	12.3
4 M	7.3	0.63	13.6	56.3	0.44	12.5
2 Bk II	1.3	0.69	15.8	57.6	0.45	12.6
2 Bk I	0.7	0.74	15.9	58.3	0.45	12.6
3 Bk	1.9	0.74	17.1	60.2	0.46	12.7
4 Bk	4.9	0.75	16.9	65.1	0.48	13.0
TC Fl	1.7	0.84	14.6	66.7	0.49	13.1
6 M	2.7	1.12	13.6	69.5	0.52	13.1
5 Bk	1.3	1.59	21.3	70.8	0.54	13.3
Tail	1.0	1.70	16.8	71.8	0.55	13.3
Clear flour						
5 M	2.3	1.56	14.7	74.2	0.59	13.4
LG	1.0	1.70	17.7	75.2	0.60	13.4
LQ	0.4	2.04	15.1	75.6	0.61	13.4
Bran & shorts						
TC St	0.7	1.95	13.3	76.3	0.62	13.4
Tail St	1.8	2.26	15.0	78.2	0.66	13.5
Head St	17.3	3.68	18.5	95.4	1.21	14.4
Bran	4.6	5.03	14.9	100.0	1.38	14.4
Patent*		0.56	13.3			
Wheat		1.62	14.1			
*Rebolted						

Cumulative Ash:	**M- 11**					
Mill	**Stream (%, 14% mb)**			**Cumulative (%, 14% mb)**		
Stream	**Yield**	**Ash**	**Protein**	**Yield**	**Ash**	**Protein**
Patent						
Sz I	1.9	0.29	13.6	1.9	0.29	13.6
1 M	10.6	0.31	12.0	12.5	0.30	12.2
2 M	12.6	0.33	12.6	25.1	0.32	12.4
Sz II	4.1	0.37	12.8	29.2	0.32	12.5
3 M	16.9	0.41	12.5	46.1	0.36	12.5
1 Bk	1.3	0.56	15.8	47.4	0.36	12.6
4 M	7.6	0.57	13.8	55.0	0.39	12.7
Bk Dust	3.1	0.61	15.3	58.2	0.40	12.9
2 Bk II	1.1	0.70	17.2	59.2	0.41	13.0
4 Bk	4.9	0.72	16.8	64.1	0.43	13.3
3 Bk	1.6	0.74	17.7	65.7	0.44	13.4
2 Bk I	0.6	0.76	17.6	66.3	0.44	13.4
TC Fl	1.8	0.79	16.1	68.1	0.45	13.5
6 M	3.0	0.94	13.4	71.1	0.47	13.5
Tail	1.1	1.52	16.6	72.2	0.49	13.5
5 Bk	1.1	1.65	20.7	73.3	0.51	13.6
Clear flour						
5 M	2.5	1.43	14.9	75.8	0.54	13.7
LG	0.9	1.52	18.3	76.8	0.55	13.7
LQ	0.2	2.08	14.8	77.0	0.55	13.7
Bran & shorts						
Tail St	1.5	2.06	14.6	78.5	0.58	13.7
TC St	0.7	2.08	14.0	79.1	0.59	13.7
Head St	15.8	3.37	17.7	94.9	1.06	14.4
Bran	5.1	4.84	15.2	100.0	1.25	14.4
Patent*		0.49	13.7			
Wheat		1.45	14.4			
*Rebolted						

Williston, ND (Group W)



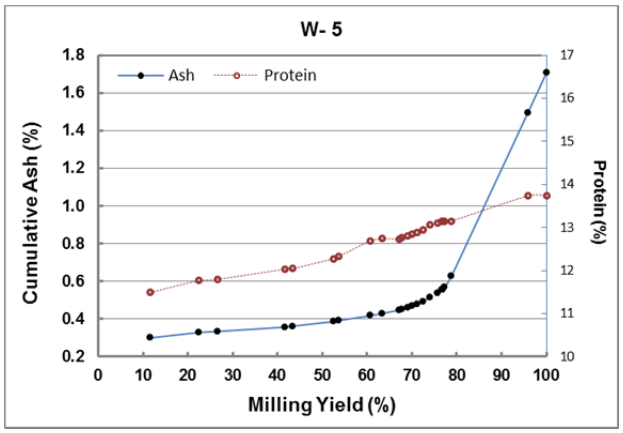


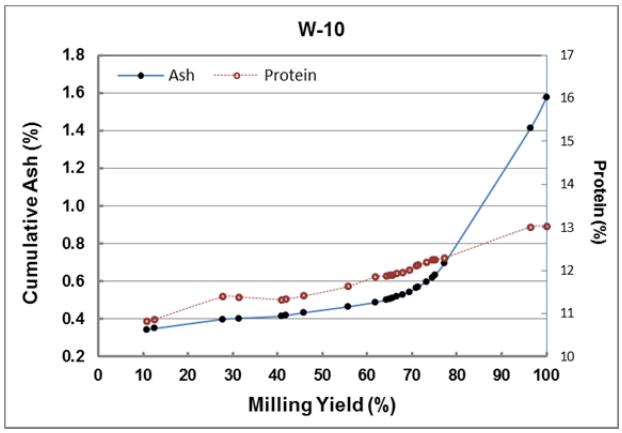
Glenn

Cumulative Ash:	W- 3 (Check)					
Mill	Stream (%, 14% mb)			Cumulative (%, 14% mb)		
Stream	Yield	Ash	Protein	Yield	Ash	Protein
Patent						
1 M	11.4	0.30	11.4	11.4	0.30	11.4
Sz I	1.7	0.33	12.6	13.1	0.31	11.5
2 M	10.8	0.38	12.1	23.8	0.34	11.8
Sz II	3.8	0.40	12.3	27.7	0.35	11.8
3 M	14.9	0.43	12.4	42.6	0.38	12.0
4 M	8.8	0.56	13.4	51.4	0.41	12.3
4 Bk	6.4	0.66	16.2	57.8	0.44	12.7
1 Bk	1.0	0.82	16.4	58.9	0.44	12.8
Bk Dust	2.6	0.83	15.3	61.5	0.46	12.9
TC Fl	1.6	0.87	13.3	63.1	0.47	12.9
3 Bk	1.2	0.88	16.8	64.2	0.48	13.0
6 M	4.1	0.89	12.7	68.3	0.50	12.9
2 Bk II	0.8	0.91	16.9	69.1	0.51	13.0
2 Bk I	0.6	1.07	16.9	69.7	0.51	13.0
Tail	1.3	1.39	15.7	71.0	0.53	13.1
5 Bk	1.7	1.47	19.5	72.7	0.55	13.2
Clear flour						
5 M	2.0	1.68	14.0	74.6	0.58	13.2
LQ	0.4	1.75	13.6	75.0	0.58	13.2
LG	1.0	1.87	16.7	76.1	0.60	13.3
Bran & shorts						
TC St	0.4	2.18	15.0	76.5	0.61	13.3
Tail St	1.8	3.36	13.3	78.3	0.67	13.3
Head St	18.4	5.09	16.0	96.7	1.51	13.8
Bran	3.3	6.89	13.7	100.0	1.69	13.8
Patent*		0.55	13.1			
Wheat		1.58	13.4			
*Rebolted						

Elgin-ND

Cumulative Ash:	W- 4					
Mill	Stream (%, 14% mb)			Cumulative (%, 14% mb)		
Stream	Yield	Ash	Protein	Yield	Ash	Protein
Patent						
1 M	10.3	0.27	11.5	10.3	0.27	11.5
Sz I	2.1	0.30	11.8	12.4	0.28	11.5
2 M	14.3	0.30	11.7	26.7	0.29	11.6
3 M	13.9	0.37	12.5	40.6	0.32	11.9
Sz II	4.1	0.38	11.7	44.7	0.32	11.9
4 M	7.5	0.55	13.6	52.2	0.36	12.1
1 Bk	1.0	0.60	12.9	53.2	0.36	12.2
4 Bk	5.3	0.70	15.0	58.5	0.39	12.4
TC Fl	2.3	0.71	13.8	60.8	0.40	12.5
Bk Dust	2.9	0.72	13.0	63.7	0.42	12.5
2 Bk II	0.9	0.77	14.1	64.6	0.42	12.5
6 M	3.4	0.78	12.8	68.0	0.44	12.5
3 Bk	1.3	0.82	14.9	69.3	0.45	12.6
2 Bk I	0.5	0.82	13.8	69.8	0.45	12.6
Tail	1.1	1.44	16.2	70.9	0.47	12.6
5 Bk	1.4	1.53	17.6	72.3	0.49	12.7
Clear flour						
5 M	1.9	1.70	15.0	74.3	0.52	12.8
LG	1.2	1.97	16.4	75.4	0.54	12.9
LQ	0.2	2.30	14.4	75.6	0.54	12.9
Bran & shorts						
TC St	0.5	1.84	12.3	76.1	0.55	12.9
Tail St	1.7	3.51	13.9	77.8	0.62	12.9
Head St	17.7	4.67	18.1	95.6	1.37	13.9
Bran	4.4	6.56	14.9	100.0	1.60	13.9
Patent*		0.49	12.7			
Wheat		1.51	13.5			
*Rebolted						



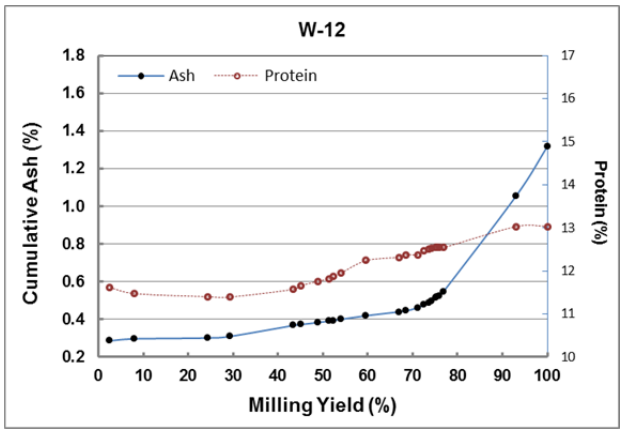


ND 816

Cumulative Ash:	W- 5					
Mill	Stream (%, 14% mb)			Cumulative (%, 14% mb)		
Stream	Yield	Ash	Protein	Yield	Ash	Protein
Patent						
1 M	11.6	0.30	11.5	11.6	0.30	11.5
2 M	10.9	0.36	12.1	22.5	0.33	11.8
Sz II	4.1	0.37	12.0	26.6	0.33	11.8
3 M	15.0	0.40	12.4	41.6	0.36	12.0
Sz I	1.8	0.48	12.4	43.4	0.36	12.0
4 M	9.1	0.50	13.4	52.5	0.39	12.3
1 Bk	1.1	0.60	14.7	53.6	0.39	12.3
4 Bk	7.0	0.62	15.4	60.6	0.42	12.7
Bk Dust	2.7	0.68	13.9	63.3	0.43	12.7
6 M	3.8	0.76	12.7	67.1	0.45	12.7
2 Bk I	0.6	0.81	15.5	67.7	0.45	12.8
TC Fl	1.4	0.92	14.7	69.1	0.46	12.8
2 Bk II	1.0	1.07	15.7	70.1	0.47	12.8
3 Bk	1.2	1.20	15.9	71.2	0.48	12.9
Tail	1.2	1.31	16.0	72.4	0.49	12.9
5 Bk	1.6	1.41	18.9	74.0	0.51	13.1
Clear flour						
5 M	1.7	1.56	14.6	75.7	0.54	13.1
LG	1.0	1.79	16.5	76.7	0.55	13.1
LQ	0.2	1.86	13.9	76.9	0.56	13.1
Bran & shorts						
TC St	0.4	2.77	12.5	77.3	0.57	13.1
Tail St	1.5	3.64	13.5	78.8	0.63	13.2
Head St	17.0	5.50	16.4	95.8	1.49	13.7
Bran	4.2	6.60	13.9	100.0	1.71	13.7
Patent*		0.51	13.0			
Wheat		1.55	13.8			
*Rebolted						

WB9507

Cumulative Ash:	W-10					
Mill	Stream (%, 14% mb)			Cumulative (%, 14% mb)		
Stream	Yield	Ash	Protein	Yield	Ash	Protein
Patent						
1 M	10.9	0.34	10.8	10.9	0.34	10.8
Sz I	1.7	0.38	11.2	12.5	0.35	10.9
3 M	15.2	0.44	11.8	27.7	0.40	11.4
Sz II	3.7	0.44	11.3	31.5	0.40	11.4
2 M	9.4	0.45	11.1	40.9	0.41	11.3
1 Bk	1.0	0.58	11.9	41.8	0.42	11.3
6 M	4.1	0.59	12.1	45.9	0.43	11.4
4 M	9.8	0.61	12.7	55.7	0.47	11.6
4 Bk	6.0	0.70	13.9	61.8	0.49	11.9
Bk Dust	2.5	0.82	12.2	64.2	0.50	11.9
2 Bk II	0.9	0.91	13.5	65.1	0.51	11.9
2 Bk I	0.5	0.92	13.5	65.6	0.51	11.9
3 Bk	1.0	1.04	13.9	66.5	0.52	11.9
TC Fl	1.4	1.09	13.3	68.0	0.53	12.0
Tail	1.5	1.22	14.7	69.4	0.54	12.0
5 Bk	1.5	1.49	16.8	70.9	0.56	12.1
Clear flour						
LQ	0.5	1.48	13.7	71.4	0.57	12.1
5 M	1.9	1.72	14.3	73.2	0.60	12.2
LG	1.4	1.81	16.1	74.6	0.62	12.3
Bran & shorts						
TC St	0.5	2.62	12.3	75.1	0.63	12.3
Tail St	2.2	2.84	13.6	77.3	0.70	12.3
Head St	19.1	4.30	15.9	96.4	1.41	13.0
Bran	3.6	5.95	13.6	100.0	1.57	13.0
Patent*		0.57	12.2			
Wheat		1.57	12.8			
*Rebolted						

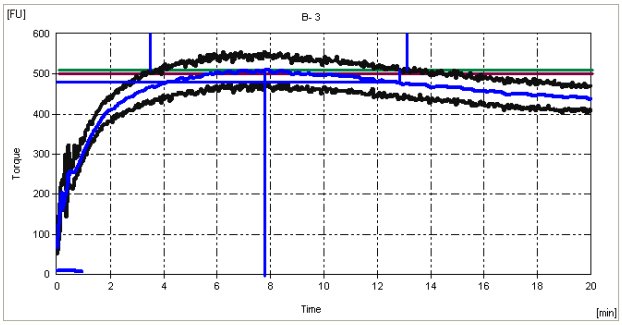


MT0832 (Duclair)

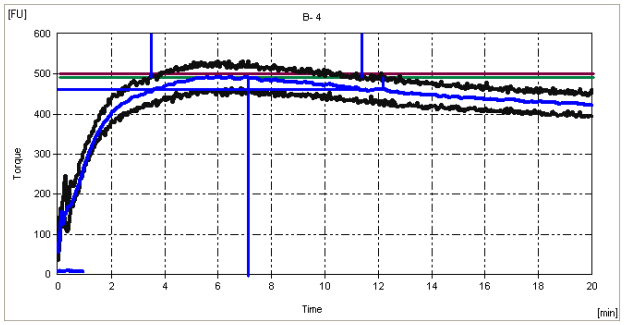
Cumulative Ash:	W-12					
Mill	Stream (%, 14% mb)			Cumulative (%, 14% mb)		
Stream	Yield	Ash	Protein	Yield	Ash	Protein
Patent						
Sz I	2.5	0.29	11.6	2.5	0.29	11.6
1 M	5.5	0.30	11.4	8.1	0.30	11.5
2 M	16.3	0.30	11.4	24.3	0.30	11.4
Sz II	4.9	0.35	11.4	29.2	0.31	11.4
3 M	14.2	0.49	11.9	43.4	0.37	11.6
1 Bk	1.7	0.51	13.9	45.1	0.37	11.7
Bk Dust	3.9	0.51	12.9	49.0	0.38	11.8
TC Fl	2.4	0.55	13.0	51.4	0.39	11.8
2 Bk I	1.0	0.56	14.4	52.3	0.39	11.9
2 Bk II	1.7	0.57	14.6	54.1	0.40	12.0
4 Bk	5.5	0.61	15.0	59.6	0.42	12.2
4 M	7.3	0.61	12.9	66.9	0.44	12.3
3 Bk	1.6	0.64	14.9	68.5	0.44	12.4
6 M	2.6	0.93	12.3	71.2	0.46	12.4
5 Bk	1.4	1.20	16.7	72.6	0.48	12.5
Tail	1.0	1.39	15.6	73.6	0.49	12.5
Clear flour						
LG	0.7	1.37	16.2	74.3	0.50	12.5
5 M	0.9	2.02	14.1	75.1	0.52	12.6
LQ	0.2	2.04	13.0	75.3	0.52	12.6
Bran & shorts						
TC St	0.7	1.22	12.0	76.0	0.52	12.6
Tail St	0.9	2.50	11.7	76.9	0.55	12.5
Head St	16.2	3.47	15.4	93.1	1.06	13.0
Bran	6.9	4.82	13.1	100.0	1.32	13.0
Patent*		0.50	12.4			
Wheat		1.35	12.6			
*Rebolted						

Farinograms

Watertown, SD (Group B)



Glenn



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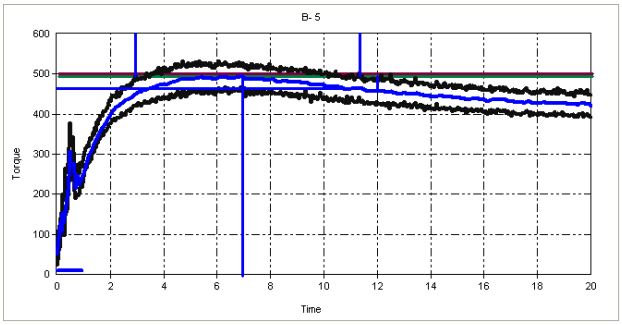
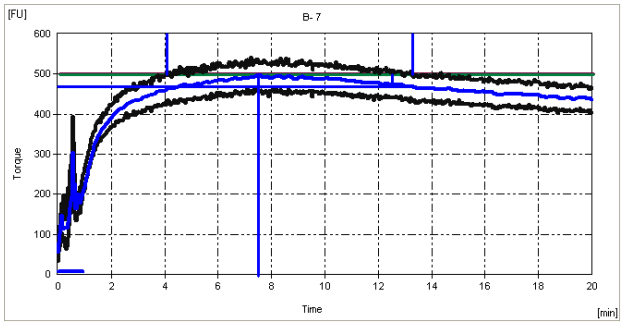
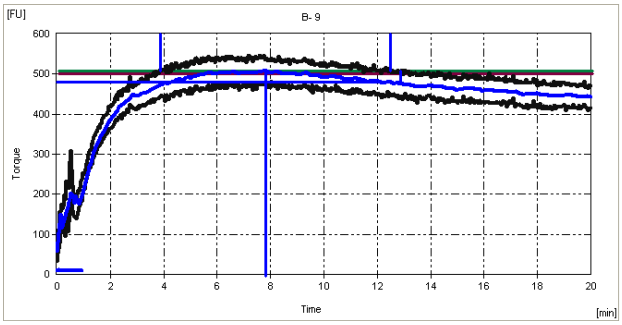


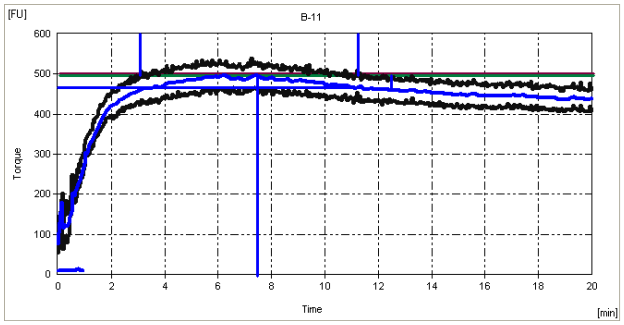
ND 816



SD4189

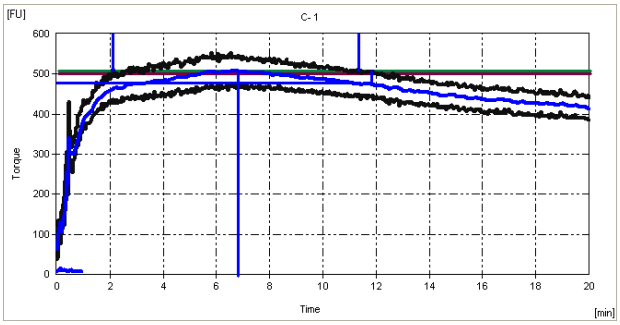


ND 819

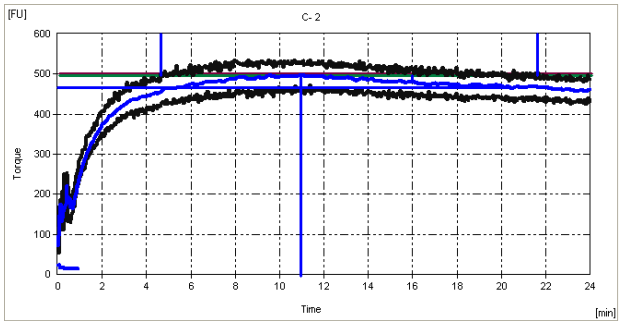


ND 812

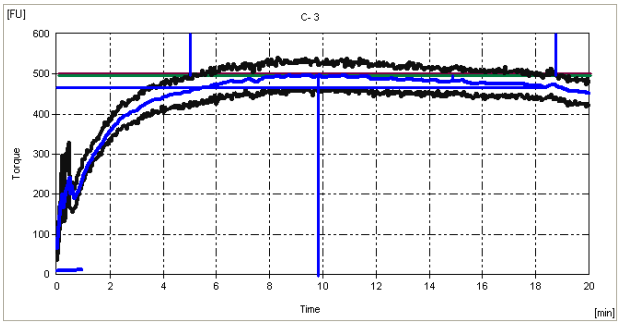
Casselton, ND (Group C)



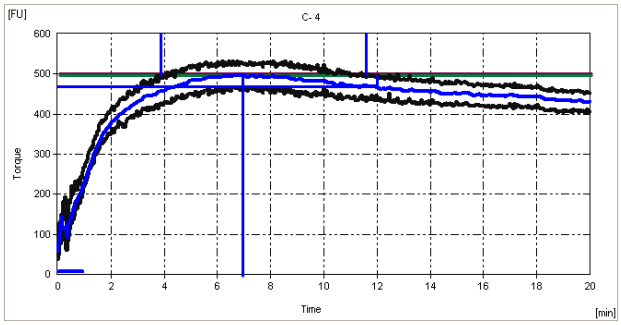
BR0202W



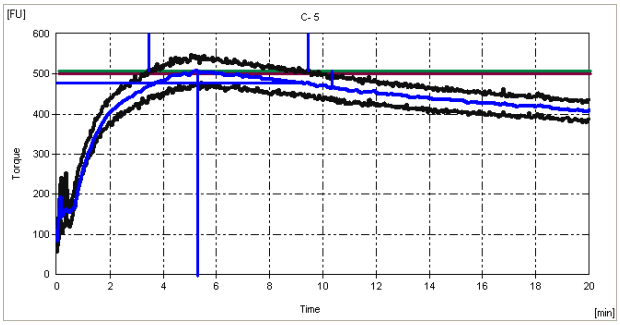
MN08165-8



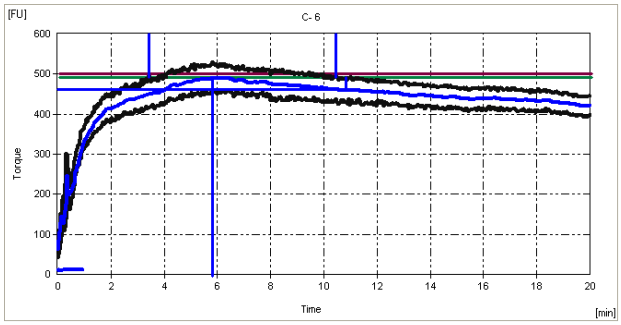
Glenn



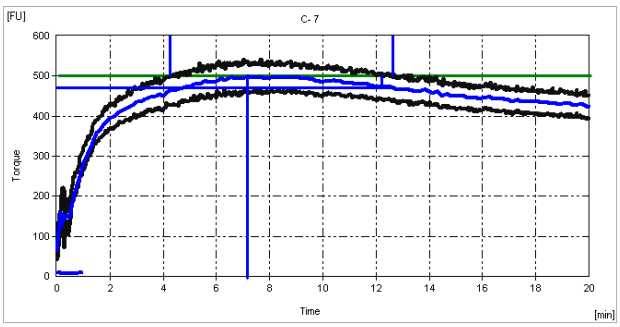
Elgin-ND



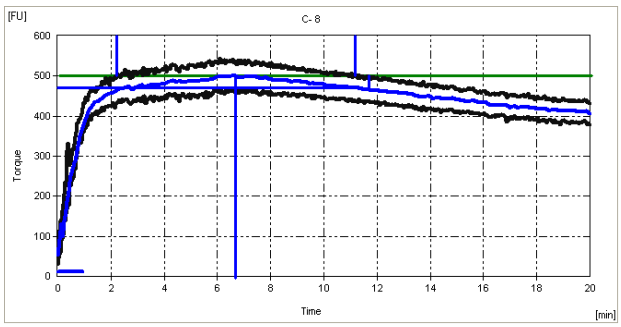
ND 816



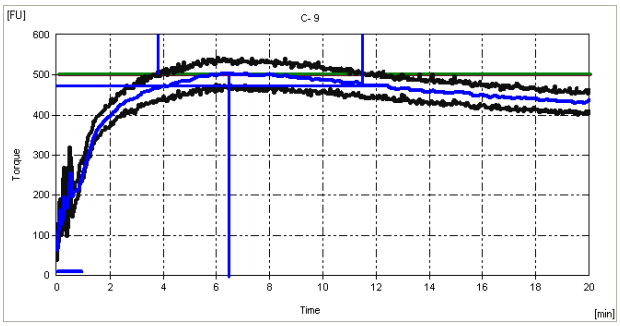
COI565W



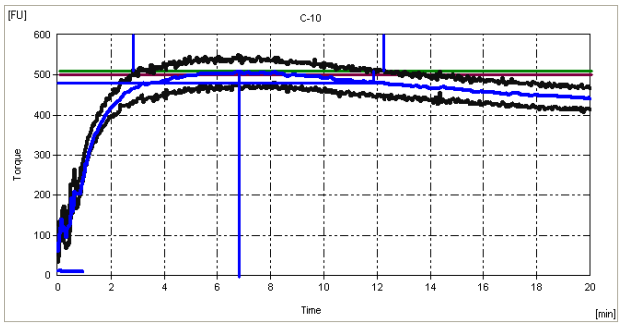
SD4189



CHBR1481W

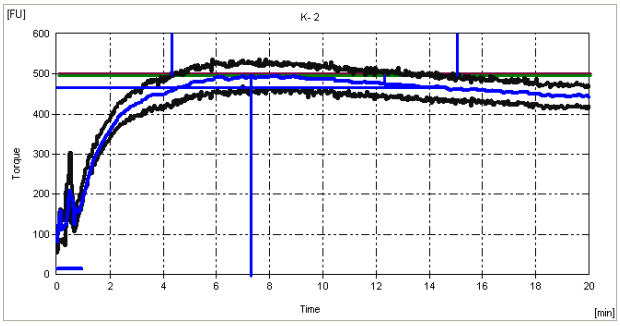


ND 819



WB9507

Crookston, MN (Group K)



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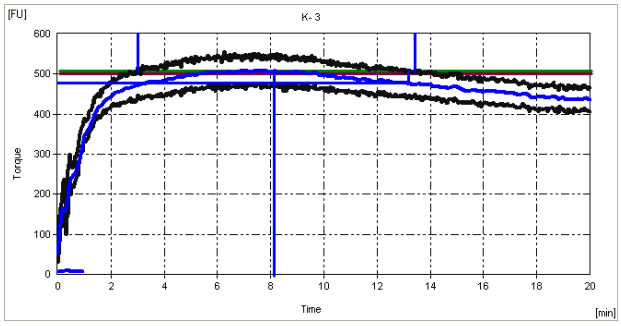
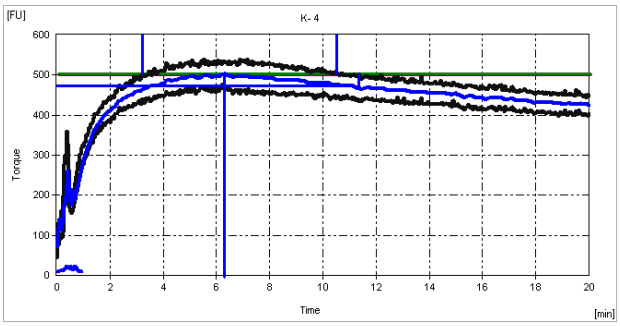
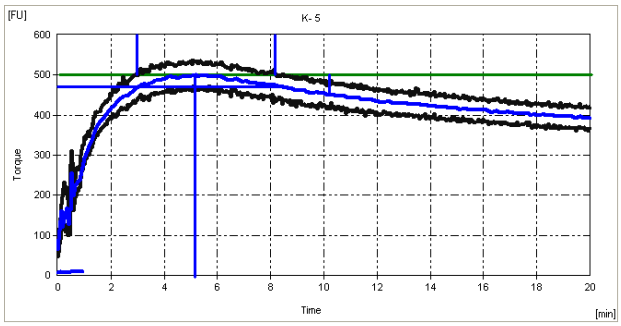


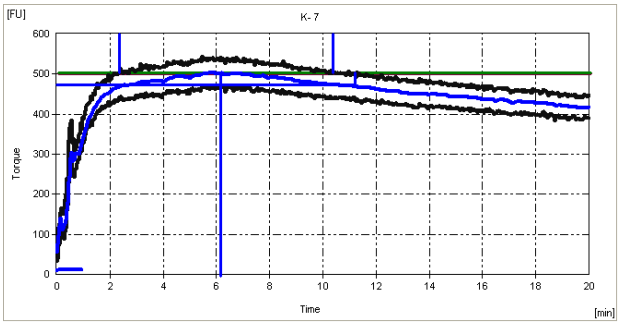
Glenn



Elgin-ND



ND 816



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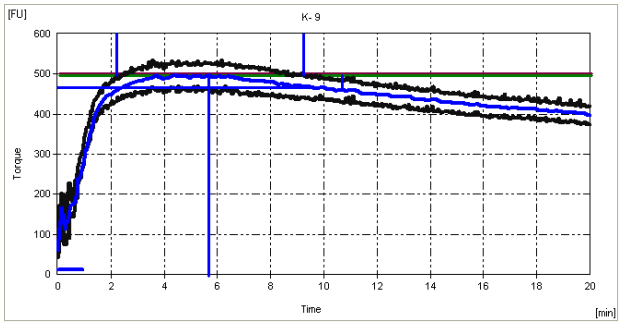
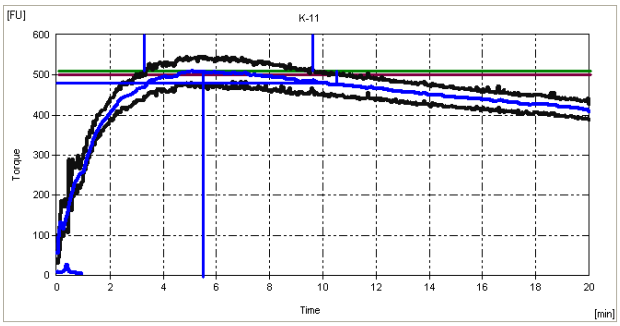
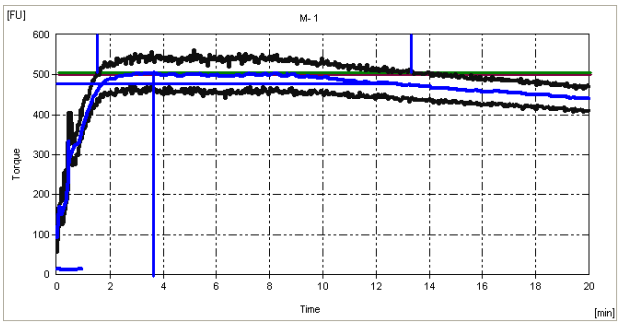


ND 819



ND 812

Minot (Group M)



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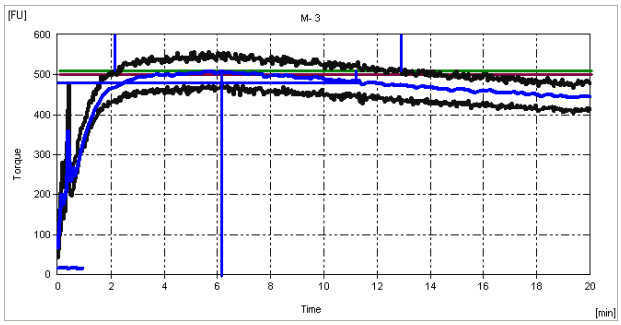
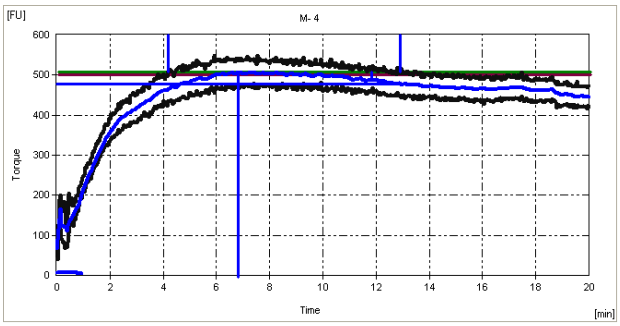
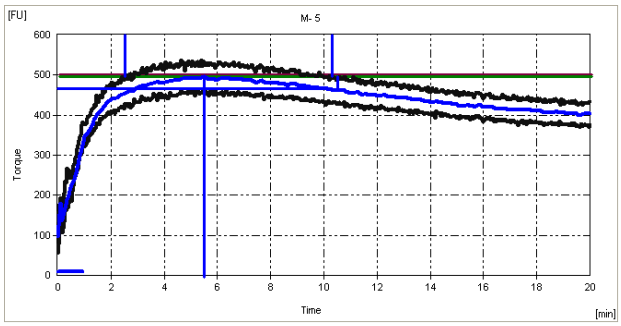


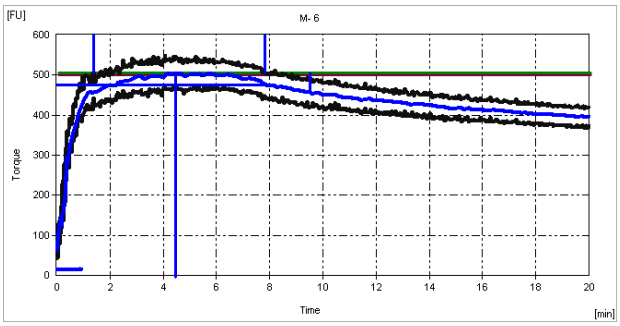
Glenn



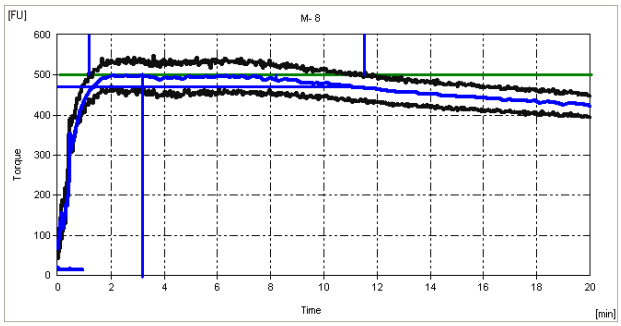
Elgin-ND



ND 816



COI565W



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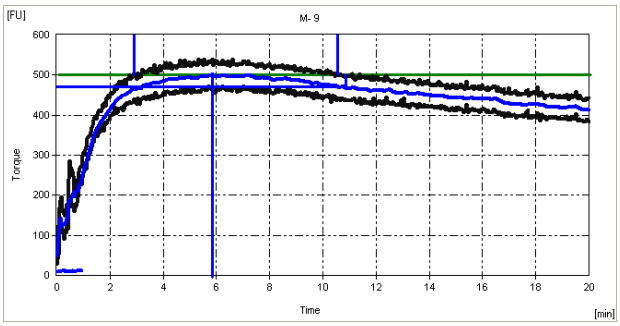
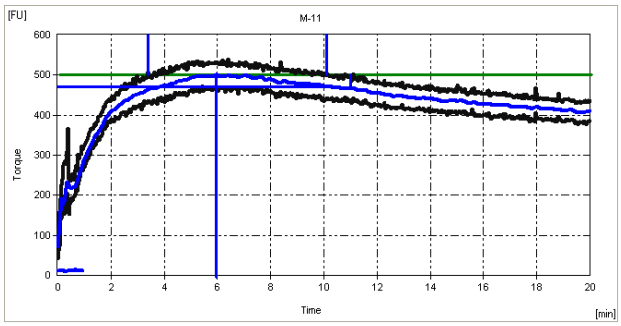
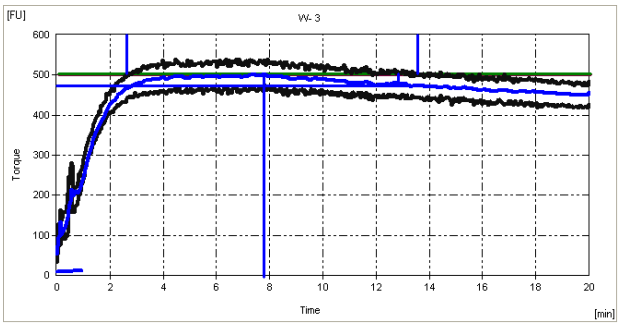


ND 819

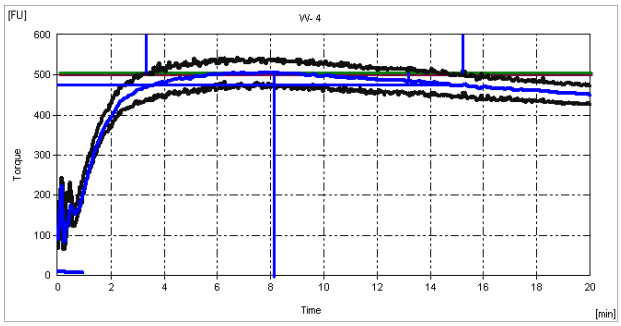


ND 812

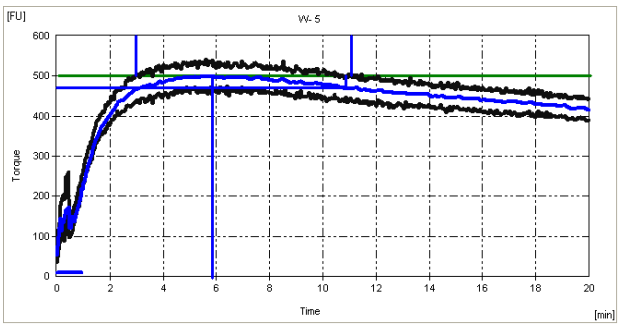
Williston (Group W)



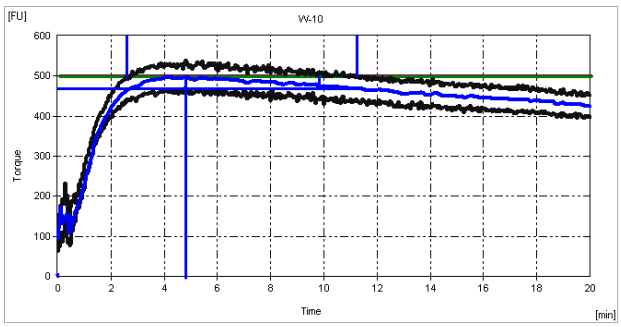
Glenn



Elgin-ND



ND 816



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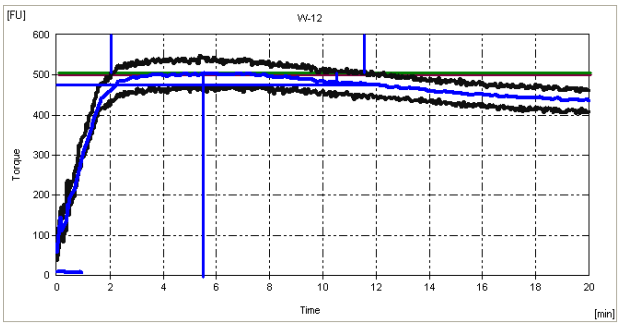
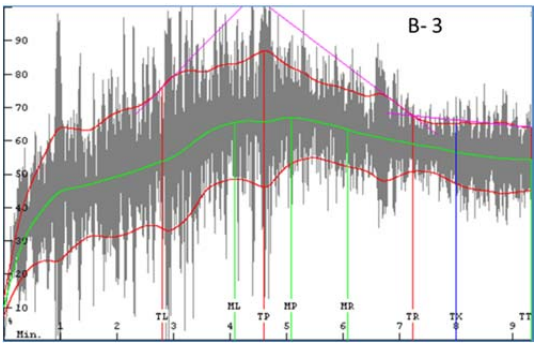


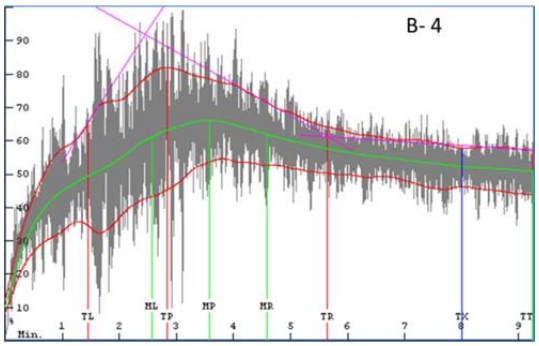
MT0832 (Duclair)

Mixograms

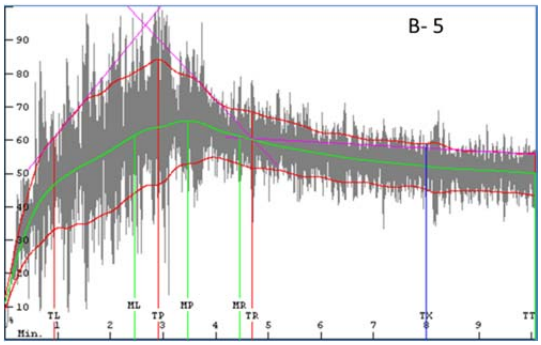
Watertown, SD (Group B)



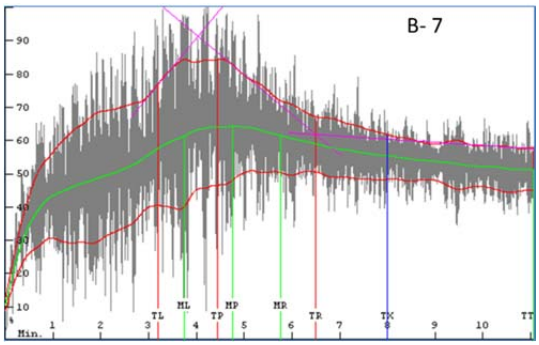
Glenn



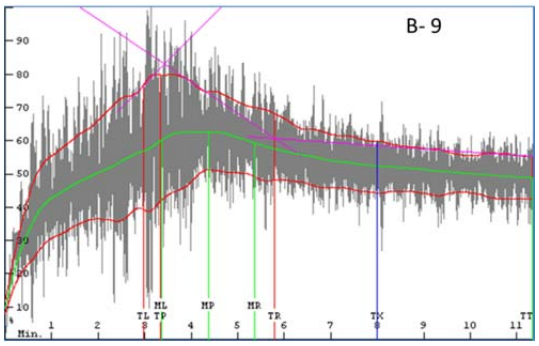
Elgin-ND



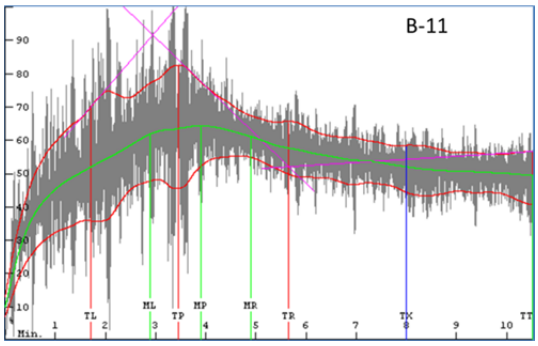
ND 816



SD4189

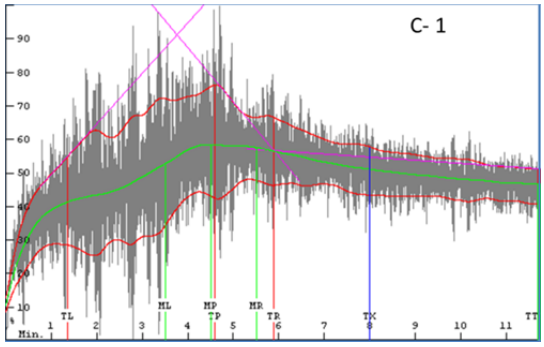


ND 819

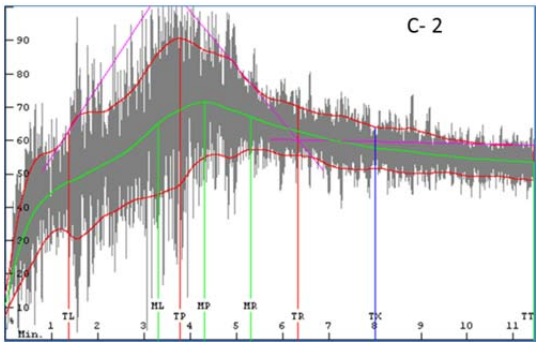


ND 812

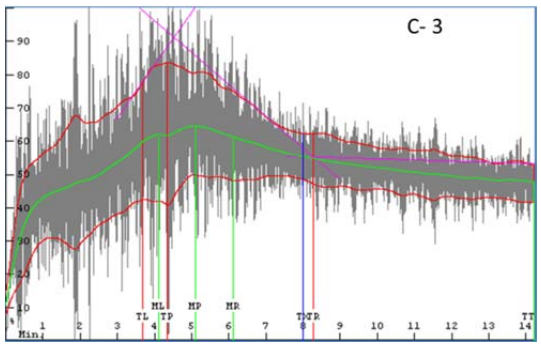
Casselton, ND (Group C)



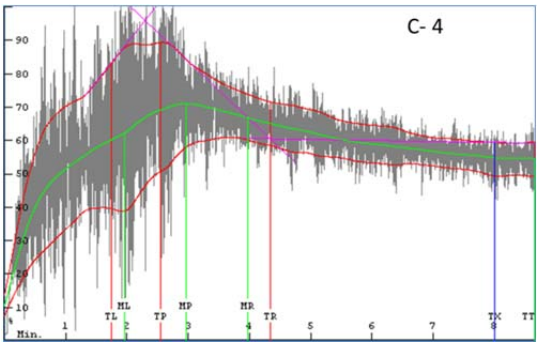
BR0202W



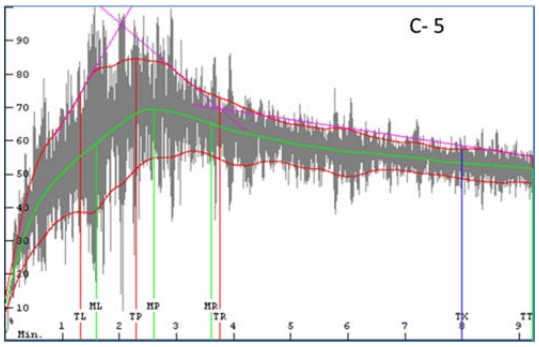
MN08165-8



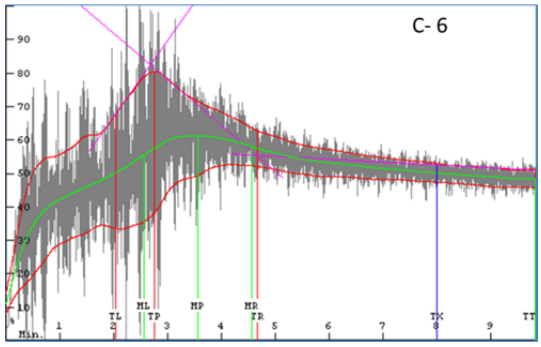
Glenn



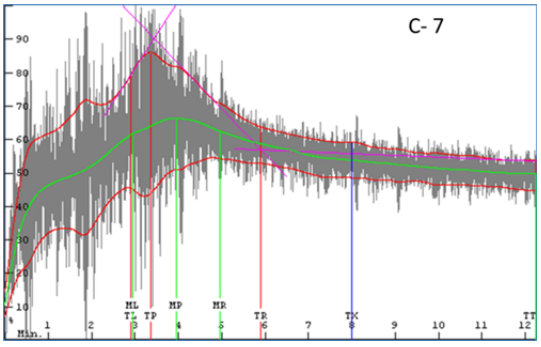
Elgin-ND



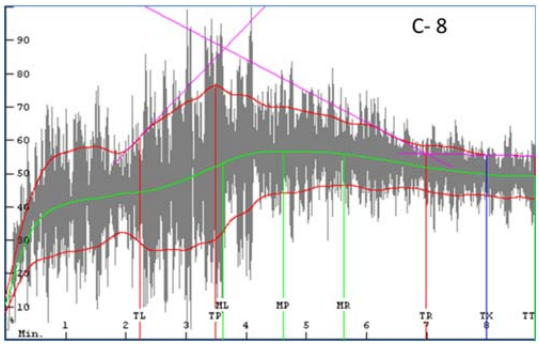
ND 816



COI565W



SD4189



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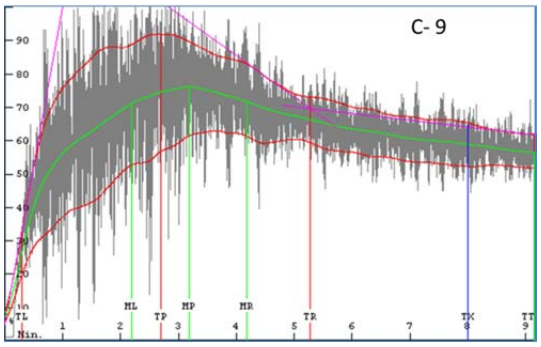
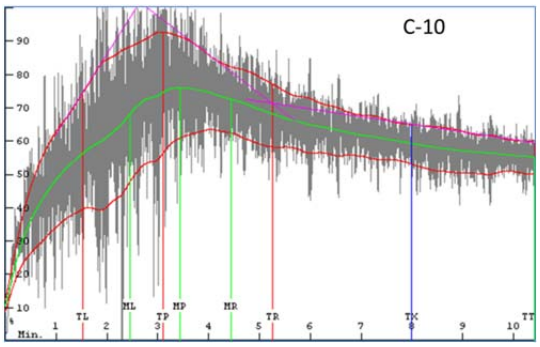
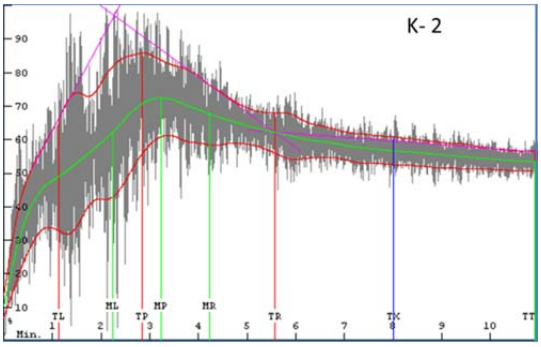


ND 819

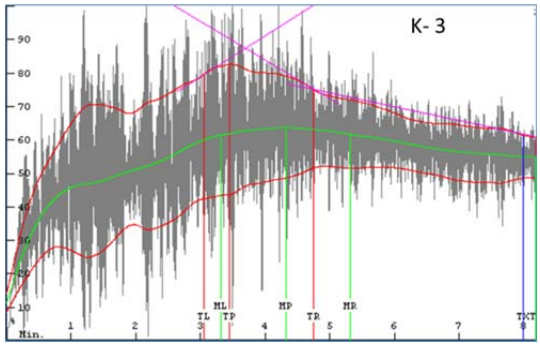


WB9507

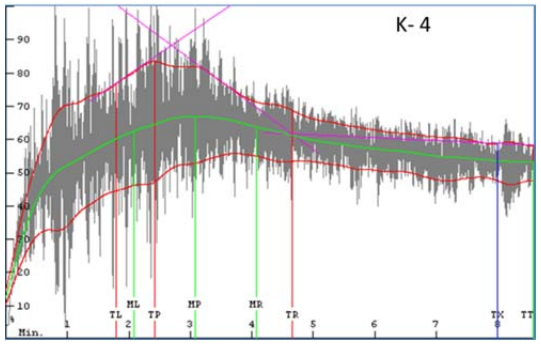
Crookston, MN (Group K)



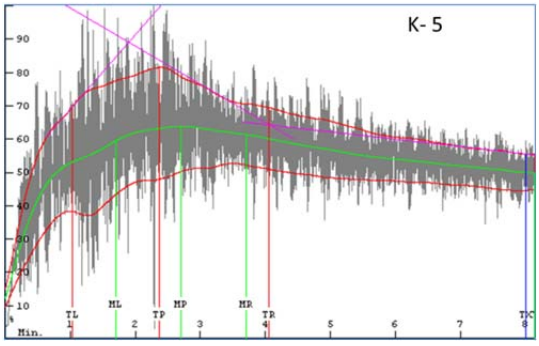
MN08165-8



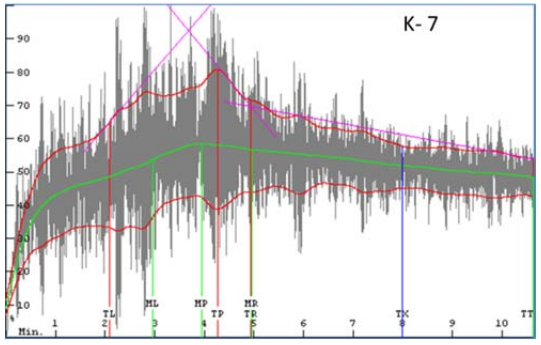
Glenn



Elgin-ND



ND 816



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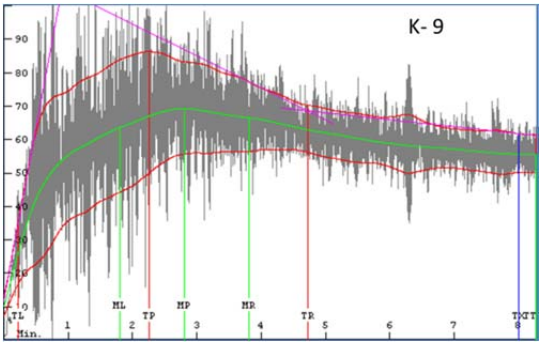
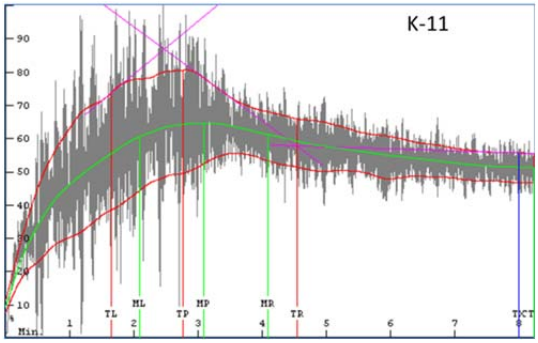
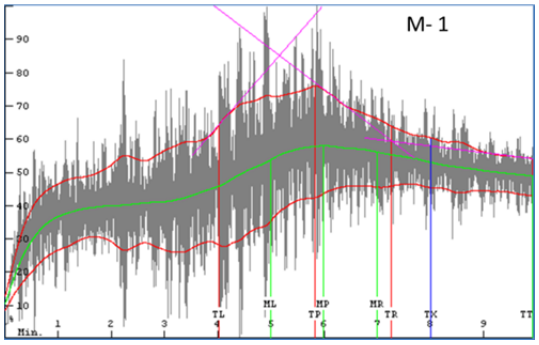


ND 819

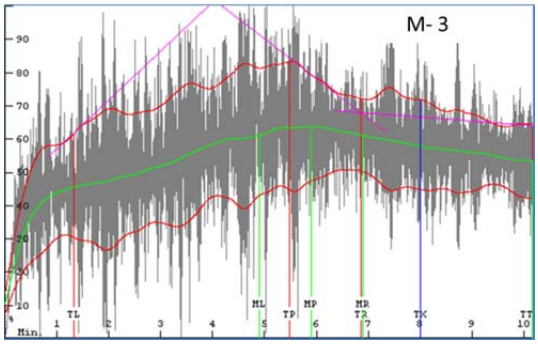


ND 812

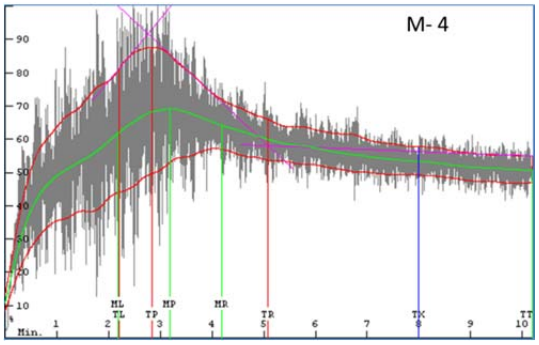
Minot, ND (Group M)



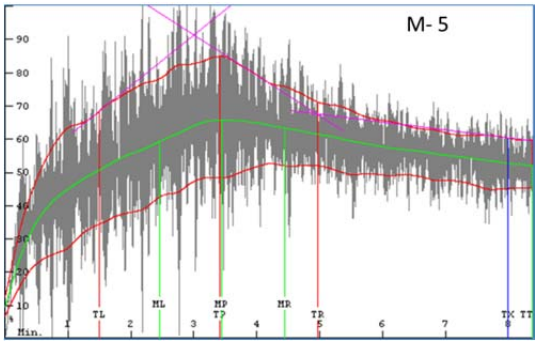
BR0202W



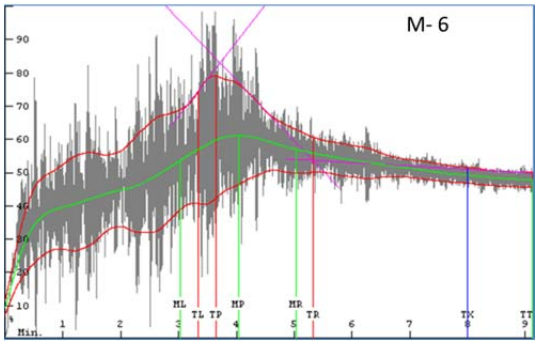
Glenn



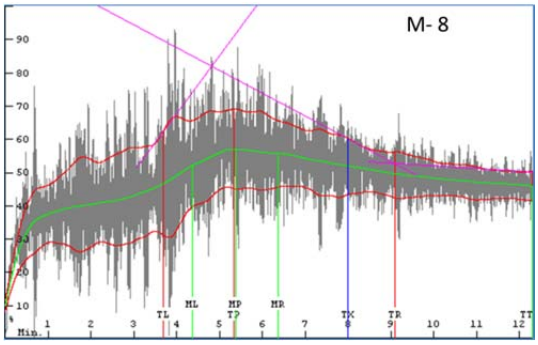
Elgin-ND



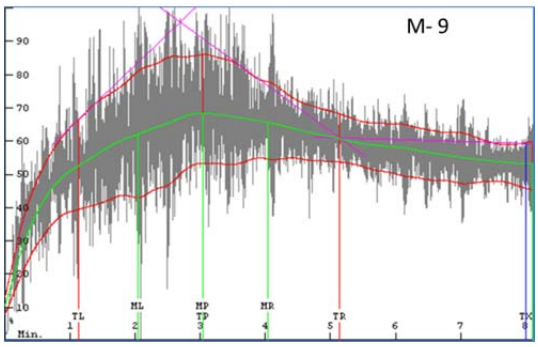
ND 816



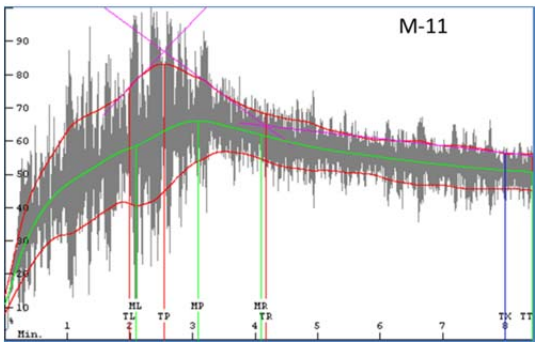
COI565W



CHBR1481W

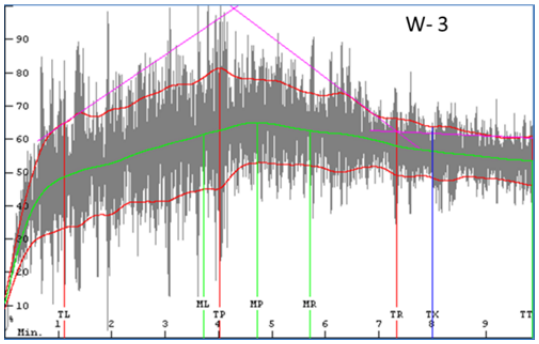


ND 819

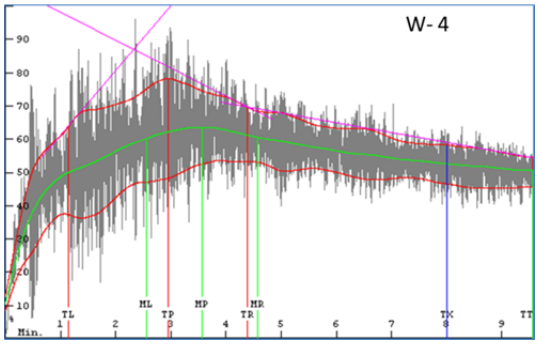


ND 812

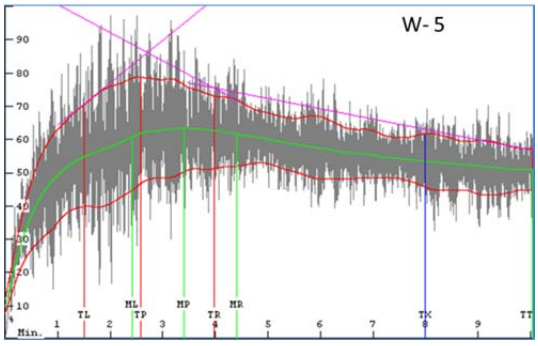
Williston, ND (Group W)



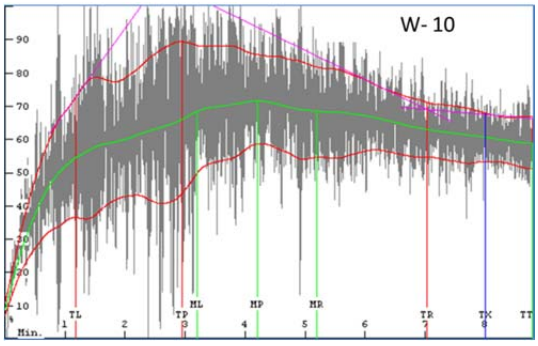
Glenn



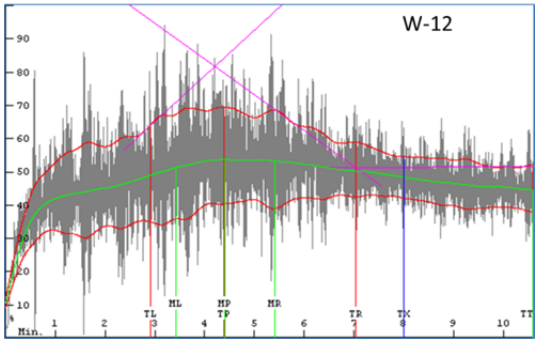
Elgin-ND



ND 816



WB9507



MT0832 (Duclair)

Protein, Wheat Quality Parameters, and Market Score

Entry ID	Protein (12% mb)		Test Weight (lb/bu)	1000 Kernel Weight (g)	Wheat Ash (14% mb) (%)	Wheat Falling No (sec)	Market Score	
	Wheat (%)	Flour (%)					M1 (1 to 6)	M2 (1 to 10)
Watertown, SD								
Glenn (B 3, Check)	14.8	14.7	64.7	31.6	1.62	441	4.7	10.0
Elgin-ND (B 4)	14.5	14.0	61.2	29.4	1.59	454	4.2	8.4
ND 816 (B 5)	14.4	13.7	60.1	33.2	1.62	484	4.1	8.4
SD4189 (B 7)	14.0	13.2	60.1	31.0	1.64	518	3.8	7.8
ND 819 (B 9)	14.8	14.1	61.2	28.4	1.58	465	4.2	8.4
ND 812 (B11)	14.3	13.9	63.4	28.4	1.48	444	4.5	8.6
Casselton, ND								
BR0202W (C 1)	14.4	13.0	62.0	32.7	1.47	401	4.4	7.6
MN08165-8 (C 2)	15.9	15.4	63.1	34.0	1.46	437	5.4	9.2
Glenn (C 3, Check)	15.4	14.5	65.4	30.2	1.46	421	4.9	10.0
Elgin-ND (C 4)	14.4	13.8	62.6	27.1	1.40	404	4.3	8.2
ND 816 (C 5)	15.1	14.1	63.0	32.7	1.46	407	4.9	9.2
COI565W (C 6)	13.6	12.7	63.3	40.7	1.32	340	4.4	5.4
SD4189 (C 7)	14.0	13.1	62.4	32.4	1.47	410	4.4	7.6
CHBR1481W (C 8)	13.2	12.3	61.8	31.1	1.35	384	3.9	6.0
ND 819 (C 9)	14.6	13.7	63.0	28.8	1.43	400	4.5	8.6
WB9507 (C10)	14.1	13.1	61.4	35.7	1.44	400	4.4	7.2
Crookston, MN								
MN08165-8 (K 2)	14.1	13.6	63.7	34.4	1.35	456	5.0	9.0
Glenn (K 3, Check)	13.1	12.5	66.1	30.7	1.20	404	4.3	10.0
Elgin-ND (K 4)	13.1	12.3	63.0	29.6	1.24	433	4.3	8.8
ND 816 (K 5)	12.3	11.6	63.8	34.0	1.31	467	4.4	8.4
SD4189 (K 7)	11.7	11.0	63.5	30.9	1.40	441	4.0	7.6
ND 819 (K 9)	12.2	11.4	64.5	31.3	1.32	408	4.0	8.8
ND 812 (K11)	13.0	12.1	65.4	31.2	1.18	421	4.4	10.0
Minot, ND								
BR0202W (M 1)	14.7	14.0	54.5	28.9	1.64	150	2.1	6.4
Glenn (M 3, Check)	15.0	14.7	62.0	25.2	1.56	271	3.1	10.0
Elgin-ND (M 4)	15.6	14.9	59.1	31.0	1.42	347	3.7	8.8
ND 816 (M 5)	13.9	13.4	61.3	32.9	1.39	367	4.0	8.4
COI565W (M 6)	12.7	12.2	57.2	40.3	1.66	165	2.2	3.2
CHBR1481W (M 8)	14.0	13.0	56.6	29.4	1.48	224	2.1	6.0
ND 819 (M 9)	14.4	13.6	59.7	30.0	1.62	304	2.9	8.2
ND 812 (M11)	14.8	14.0	61.3	28.1	1.45	387	4.0	10.0
Williston, ND								
Glenn (W 3, Check)	13.7	13.4	64.2	29.2	1.58	405	4.1	10.0
Elgin-ND (W 4)	13.8	13.0	61.8	28.9	1.51	457	4.1	9.2
ND 816 (W 5)	14.2	13.3	62.6	34.2	1.55	528	4.7	9.2
WB9507 (W10)	13.1	12.5	60.1	39.1	1.57	486	4.2	7.0
Duclair (W12)	12.9	12.7	60.1	28.7	1.35	495	3.7	7.8

Wheat Vitreous Kernel, Kernel Size, and Single Kernel Characteristics

Entry ID	Vitreous Kernel	Kernel Size		Single Kernel Characteristics[1]					
		Large	Small	Hardness Index		Weight (mg)		Diameter (mm)	
	(%)	(%)	(%)	Mean	SD	Mean	SD	Mean	SD
Watertown, SD									
Glenn (B 3, Check)	100	68	9	87.3	19.1	34.3	10.7	2.81	0.35
Elgin-ND (B 4)	93	60	12	90.0	19.9	29.5	8.7	2.56	0.35
ND 816 (B 5)	66	69	8	94.2	18.3	34.4	8.4	2.70	0.33
SD4189 (B 7)	68	63	10	86.7	19.5	32.0	10.0	2.71	0.36
ND 819 (B 9)	84	56	14	95.7	18.3	30.9	9.7	2.62	0.36
ND 812 (B11)	88	55	12	99.1	18.2	30.8	9.3	2.59	0.31
Casselton, ND									
BR0202W (C 1)	4	50	12	86.2	17.7	32.2	8.9	2.55	0.30
MN08165-8 (C 2)	90	80	5	90.0	17.3	35.5	9.1	2.80	0.36
Glenn (C 3, Check)	98	66	9	92.0	18.1	32.7	9.6	2.76	0.34
Elgin-ND (C 4)	97	61	11	92.3	16.8	29.9	8.1	2.57	0.33
ND 816 (C 5)	94	70	9	94.4	18.7	32.3	8.9	2.61	0.34
COI565W (C 6)	11	87	3	63.1	19.8	39.1	11.3	2.74	0.39
SD4189 (C 7)	70	75	4	92.6	16.2	32.1	8.7	2.75	0.33
CHBR1481W (C 8)	38	52	13	85.3	18.0	31.7	8.4	2.55	0.34
ND 819 (C 9)	89	63	10	104.2	19.9	29.6	9.2	2.59	0.35
WB9507 (C10)	92	63	11	93.1	16.7	36.1	9.3	2.81	0.34
Crookston, MN									
MN08165-8 (K 2)	87	73	6	88.6	18.0	36.4	9.8	2.83	0.34
Glenn (K 3, Check)	97	56	10	90.3	17.9	32.6	8.9	2.74	0.30
Elgin-ND (K 4)	84	57	12	86.5	17.5	31.6	9.1	2.59	0.33
ND 816 (K 5)	77	69	8	85.3	21.3	35.1	9.5	2.72	0.35
SD4189 (K 7)	86	64	9	89.3	17.5	31.6	8.8	2.69	0.29
ND 819 (K 9)	89	75	5	90.7	17.8	33.7	8.0	2.73	0.32
ND 812 (K11)	97	69	8	93.5	17.7	32.5	7.8	2.69	0.32
Minot, ND									
BR0202W (M 1)	8	37	18	58.9	20.0	30.4	9.8	2.39	0.31
Glenn (M 3, Check)	100	68	9	84.1	17.2	33.3	9.9	2.75	0.34
Elgin-ND (M 4)	81	69	7	75.1	17.4	31.7	7.9	2.64	0.33
ND 816 (M 5)	55	76	7	76.3	21.2	33.5	9.3	2.62	0.34
COI565W (M 6)	15	68	3	53.2	18.9	40.9	9.6	2.85	0.36
CHBR1481W (M 8)	12	51	15	65.3	21.1	32.8	9.2	2.50	0.35
ND 819 (M 9)	48	71	9	85.4	19.8	31.3	9.6	2.65	0.37
ND 812 (M11)	86	75	6	94.7	18.8	31.2	8.7	2.62	0.31
Williston, ND									
Glenn (W 3, Check)	91	47	12	87.6	15.5	31.2	8.3	2.71	0.31
Elgin-ND (W 4)	89	44	13	78.1	17.7	31.1	8.6	2.59	0.31
ND 816 (W 5)	88	63	8	79.0	16.2	35.7	9.7	2.70	0.33
WB9507 (W10)	48	82	3	73.0	16.5	38.7	8.3	2.87	0.33
Duclair (W12)	90	24	19	65.2	17.1	29.5	9.6	2.49	0.29

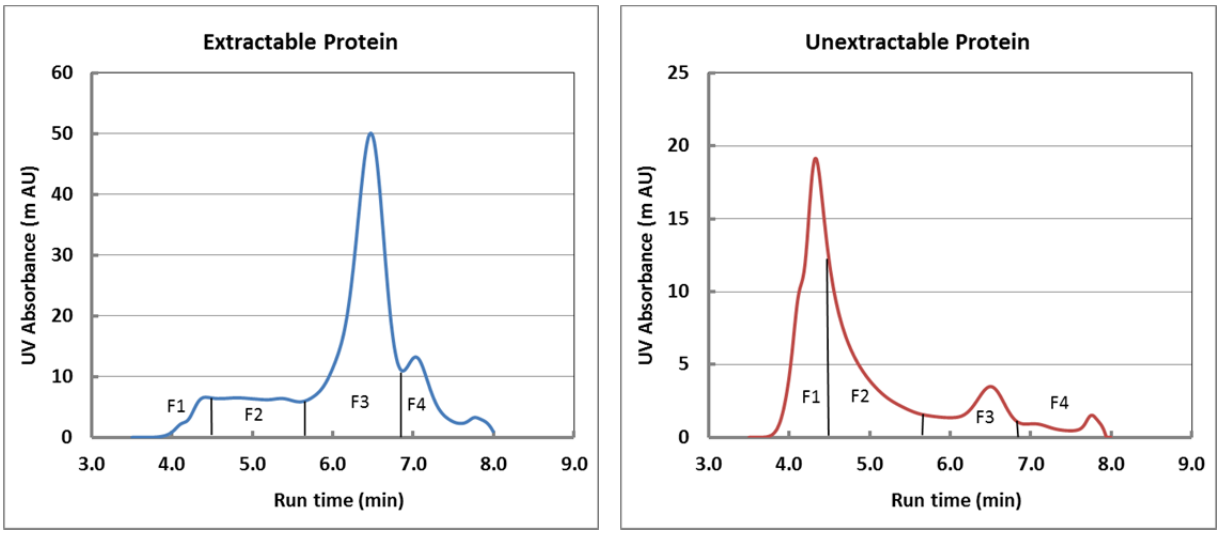
[1]Mean and standard deviation (SD) values were calculated from data of 300 kernels.

Flour Protein Content and Composition

Entry ID	Protein Content (%) (14 % mb)	Composition (% flour, 14% mb)								Ratio[1]
		SDS Buffer Extractable				SDS Buffer Unextractable				
		F1	F2	F3	F4	F1	F2	F3	F4	UPP/EPP
Watertown, SD										
Glenn (B 3, Check)	14.3	0.61	1.61	6.51	1.77	1.65	1.34	0.60	0.23	1.35
Elgin-ND (B 4)	13.7	0.60	1.58	6.12	1.70	1.71	1.19	0.58	0.22	1.32
ND 816 (B 5)	13.4	0.55	1.52	6.40	1.58	1.52	1.12	0.52	0.19	1.27
SD4189 (B 7)	12.9	0.56	1.49	5.59	1.64	1.73	1.12	0.55	0.21	1.39
ND 819 (B 9)	13.8	0.55	1.47	6.67	1.63	1.58	1.08	0.57	0.20	1.32
ND 812 (B11)	13.5	0.56	1.49	6.47	1.63	1.62	1.06	0.52	0.19	1.31
Casselton, ND										
BR0202W (C 1)	12.7	0.54	1.49	5.52	1.67	1.72	1.05	0.53	0.18	1.36
MN08165-8 (C 2)	15.1	0.58	1.65	6.67	1.77	2.12	1.36	0.67	0.24	1.56
Glenn (C 3, Check)	14.2	0.55	1.57	6.36	1.73	1.96	1.24	0.58	0.21	1.51
Elgin-ND (C 4)	13.4	0.57	1.57	5.98	1.71	1.80	1.11	0.51	0.19	1.36
ND 816 (C 5)	13.8	0.56	1.56	6.79	1.67	1.64	0.97	0.45	0.17	1.23
COI565W (C 6)	12.4	0.56	1.51	5.35	1.72	1.61	1.06	0.43	0.17	1.29
SD4189 (C 7)	12.8	0.72	1.64	5.62	1.65	1.48	1.08	0.46	0.19	1.08
CHBR1481W (C 8)	12.0	0.60	1.49	5.17	1.59	1.53	0.95	0.51	0.20	1.18
ND 819 (C 9)	13.4	0.60	1.52	6.58	1.63	1.42	0.92	0.55	0.19	1.10
WB9507 (C10)	12.8	0.63	1.62	5.72	1.66	1.48	1.01	0.49	0.19	1.11
Crookston, MN										
MN08165-8 (K 2)	13.3	0.72	1.75	5.45	1.92	1.64	1.19	0.46	0.19	1.14
Glenn (K 3, Check)	12.2	0.59	1.50	5.14	1.69	1.68	1.02	0.44	0.18	1.29
Elgin-ND (K 4)	12.0	0.60	1.49	5.19	1.66	1.54	0.97	0.41	0.17	1.20
ND 816 (K 5)	11.4	0.54	1.41	5.09	1.63	1.30	0.84	0.40	0.17	1.10
SD4189 (K 7)	10.7	0.52	1.33	4.32	1.55	1.47	0.96	0.41	0.17	1.32
ND 819 (K 9)	11.1	0.50	1.30	5.15	1.50	1.23	0.84	0.42	0.17	1.15
ND 812 (K11)	11.8	0.55	1.42	5.41	1.58	1.41	0.84	0.40	0.16	1.15
Minot, ND										
BR0202W (M 1)	13.7	0.64	1.66	5.95	1.79	1.77	1.11	0.55	0.21	1.25
Glenn (M 3, Check)	14.3	0.60	1.60	6.19	1.76	1.91	1.46	0.62	0.22	1.53
Elgin-ND (M 4)	14.6	0.66	1.76	6.31	1.87	1.91	1.31	0.57	0.21	1.32
ND 816 (M 5)	13.1	0.55	1.45	6.10	1.59	1.51	1.09	0.57	0.20	1.30
COI565W (M 6)	12.0	0.58	1.50	4.80	1.75	1.45	1.16	0.53	0.21	1.25
CHBR1481W (M 8)	12.7	0.57	1.52	5.19	1.72	1.75	1.18	0.59	0.22	1.40
ND 819 (M 9)	13.3	0.56	1.48	6.21	1.64	1.56	1.02	0.59	0.21	1.27
ND 812 (M11)	13.7	0.61	1.63	6.25	1.77	1.70	1.05	0.48	0.18	1.23
Williston, ND										
Glenn (W 3, Check)	13.1	0.59	1.56	5.63	1.64	1.84	1.14	0.54	0.20	1.39
Elgin-ND (W 4)	12.7	0.60	1.56	5.50	1.61	1.64	1.09	0.47	0.18	1.27
ND 816 (W 5)	13.0	0.57	1.50	6.06	1.60	1.44	1.05	0.58	0.20	1.20
WB9507 (W10)	12.2	0.56	1.49	5.36	1.61	1.51	1.06	0.45	0.17	1.25
Duclair (W12)	12.4	0.58	1.54	5.38	1.70	1.60	1.01	0.42	0.17	1.23

[1]UPP/EPP= SDS buffer unextractable polymeric proteints (F1 + F2)/extractable polymeric proteins (F1 + F2)

Interpreting Protein Composition Data



Size exclusion HPLC chromatograms of SDS buffer extractable and unextractable proteins

Native (unreduced) proteins extracted from wheat flour were analyzed by size-exclusion high performance liquid chromatography (SE-HPLC) to evaluate variation in protein composition in wheat genotypes (Gupta et al. 1993; Ohm et al. 2009).

The SE-HPLC chromatograms are shown above for sodium-dodecyl sulfate (SDS) buffer extractable and unextractable proteins. Main protein components of individual fractions (F1-F4) shown in the figures have been reported to be high molecular weight polymeric proteins for F1; low molecular weight polymeric proteins for F2; gliadins for F3; and albumin and globulins for F4.

Researches using SE-HPLC have found that polymeric proteins (F1 + F2) in SDS buffer unextractable fraction (UPP) have positive effect while polymeric proteins (F1 + F2) in extractable fraction (EPP) have negative effect on dough strength (Gupta et al. 1993; Ohm et al. 2009). High molecular weight fractions (F1) of UPP have been specifically identified to have more pronounced effect on dough strength parameters (Ohm et al. 2009).

In summary, wheat genotypes that have greater ratio of UPP to EPP might have greater gluten strength.

References

Gupta, R. B., Khan, K., and MacRitchie, F. 1993. Biochemical basis of flour properties in bread wheats. I. Effect of variation in the quality and size distribution of polymeric protein. J. Cereal Sci. 18:23-41.

Ohm, J. B., Hareland, G., Simsek, S., and Seabourn, B. 2009. Size exclusion HPLC of protein using narrow-bore column for evaluation of breadmaking quality of hard spring wheat flours. Cereal Chem. 86:463-469.

Flour Characteristics

Entry ID	Flour Extraction[1]			Damaged Starch (%)	Flour Color				Ash (%) (14% mb)	Falling Number	
	TWB (%)	TPB (%)	FBW (lbs)		L*	b*	L	b		(No Malt) (sec)	(Malted) (sec)
Watertown, SD											
Glenn (B 3, Check)	73.8	75.6	45.6	5.0	90.4	7.2	87.9	6.9	0.51	426	252
Elgin-ND (B 4)	74.6	75.7	45.7	5.8	90.8	7.9	88.4	7.7	0.50	434	257
ND 816 (B 5)	73.2	74.3	44.8	6.1	90.8	8.1	88.3	7.8	0.55	453	256
SD4189 (B 7)	74.5	75.8	45.8	6.2	91.0	8.2	88.6	7.9	0.55	508	260
ND 819 (B 9)	71.0	74.3	44.8	6.3	90.2	7.9	87.6	7.6	0.53	438	248
ND 812 (B11)	75.1	75.5	45.5	5.8	90.3	8.0	87.7	7.7	0.53	448	249
Casselton, ND											
BR0202W (C 1)	74.8	75.1	45.3	5.8	90.5	6.8	87.9	6.6	0.51	393	246
MN08165-8 (C 2)	73.7	74.5	44.9	6.0	90.4	7.8	87.8	7.5	0.46	487	248
Glenn (C 3, Check)	72.6	74.0	44.6	5.9	90.8	7.4	88.3	7.2	0.43	422	249
Elgin-ND (C 4)	74.1	75.5	45.6	5.9	90.6	8.7	88.0	8.4	0.41	453	246
ND 816 (C 5)	73.4	75.7	45.7	6.3	90.5	8.6	87.9	8.2	0.46	413	252
COI565W (C 6)	75.7	76.5	46.2	5.6	90.7	8.0	88.3	7.7	0.47	390	257
SD4189 (C 7)	73.1	74.5	44.9	6.3	91.0	8.5	88.6	8.2	0.44	450	250
CHBR1481W (C 8)	74.1	76.5	46.1	6.0	90.9	7.7	88.4	7.4	0.44	396	254
ND 819 (C 9)	72.1	73.7	44.5	6.6	90.4	8.2	87.9	7.9	0.46	401	252
WB9507 (C10)	73.4	73.5	44.3	6.9	90.5	7.4	88.0	7.1	0.47	373	265
Crookston, MN											
MN08165-8 (K 2)	73.0	74.4	44.9	6.4	91.1	8.5	88.7	8.2	0.52	529	252
Glenn (K 3, Check)	72.7	73.5	44.4	5.8	91.3	7.4	89.0	7.2	0.47	436	252
Elgin-ND (K 4)	74.6	76.8	46.3	6.6	91.2	7.9	88.9	7.7	0.48	428	257
ND 816 (K 5)	77.7	77.8	46.9	6.3	91.0	8.6	88.6	8.3	0.50	427	252
SD4189 (K 7)	75.9	77.1	46.5	6.4	91.3	8.1	89.0	7.9	0.49	452	257
ND 819 (K 9)	75.5	75.3	45.4	6.8	90.3	8.0	87.8	7.7	0.49	420	249
ND 812 (K11)	75.7	75.9	45.8	6.2	91.0	8.1	88.5	7.8	0.48	397	257
Minot, ND											
BR0202W (M 1)	70.5	73.5	44.4	5.3	90.9	7.1	88.5	6.9	0.50	229	229*
Glenn (M 3, Check)	71.9	73.6	44.4	5.4	90.9	7.2	88.4	7.0	0.52	325	252
Elgin-ND (M 4)	72.8	75.4	45.5	5.4	90.3	9.0	87.7	8.6	0.42	393	251
ND 816 (M 5)	75.4	76.8	46.3	5.7	90.7	8.8	88.2	8.5	0.48	395	265
COI565W (M 6)	71.2	74.8	45.2	5.3	90.3	8.1	87.7	7.8	0.59	194	194*
CHBR1481W (M 8)	74.2	75.9	45.8	5.9	90.6	7.7	88.1	7.4	0.53	245	245*
ND 819 (M 9)	71.9	74.2	44.8	6.2	90.5	8.2	88.0	7.9	0.56	320	252
ND 812 (M11)	75.0	75.8	45.8	5.7	90.9	8.5	88.5	8.1	0.49	374	254
Williston, ND											
Glenn (W 3, Check)	72.2	74.6	45.0	6.1	90.9	7.6	88.5	7.4	0.55	405	259
Elgin-ND (W 4)	72.1	74.3	44.8	5.9	91.0	8.9	88.6	8.5	0.49	427	257
ND 816 (W 5)	74.4	75.7	45.7	6.5	91.2	8.8	88.8	8.5	0.51	486	255
WB9507 (W10)	72.8	72.8	43.9	6.7	91.4	6.9	89.1	6.7	0.57	439	262
Duclair (W12)	73.7	74.4	44.9	5.2	91.0	7.8	88.6	7.6	0.50	447	260

[1]TWB= Tempered wheat basis; TPB=total product basis; and FPB= flour/standard bushel of wheat.

*Flour was not malted due to low falling number.

Farinograph Parameters

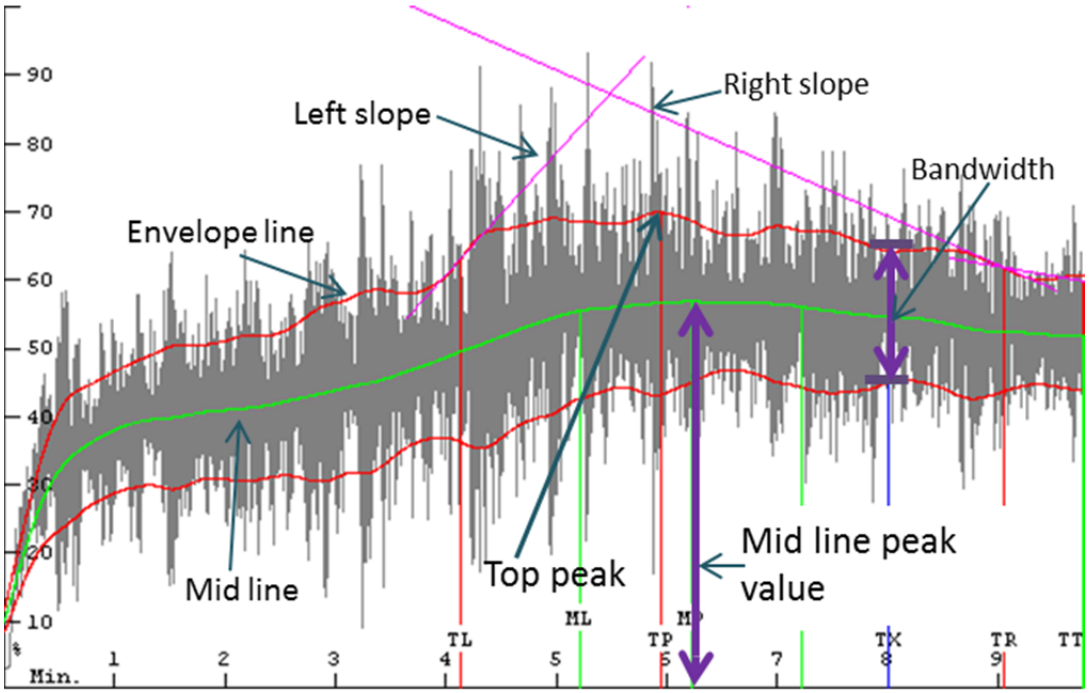
Entry ID	Water Absorption (%, 500 FU)	Water Absorption (%, 14% mb)	Arrival Time (min)	Peak Time (min)	Dough Stability (min)	Mixing Tolerance Index (FU)	Time To Breakdown (min)
Watertown, SD							
Glenn (B 3, Check)	65.4	64.8	3.5	7.9	9.6	32	12.7
Elgin-ND (B 4)	68.2	66.6	3.5	7.2	7.9	31	11.3
ND 816 (B 5)	68.3	66.9	3.0	7.0	8.4	37	10.8
SD4189 (B 7)	64.7	63.7	4.1	7.6	9.2	24	13.3
ND 819 (B 9)	68.5	67.5	3.9	7.9	8.6	33	12.1
ND 812 (B11)	67.5	66.8	3.1	7.5	8.2	36	11.1
Casselton, ND							
BR0202W (C 1)	62.4	61.6	2.1	6.9	9.3	32	11.1
MN08165-8 (C 2)	68.7	67.2	4.7	11.0	17.0	14	20.4
Glenn (C 3, Check)	68.4	67.4	5.0	9.9	13.8	15	18.3
Elgin-ND (C 4)	69.2	68.1	3.9	7.0	7.7	31	12.0
ND 816 (C 5)	69.2	68.9	3.5	5.4	6.0	42	9.3
COI565W (C 6)	63.3	62.5	3.5	5.9	7.0	32	10.6
SD4189 (C 7)	65.2	64.5	4.3	7.2	8.4	26	12.7
CHBR1481W (C 8)	61.0	60.2	2.2	6.7	9.0	34	11.3
ND 819 (C 9)	70.5	70.1	3.8	6.5	7.7	28	11.6
WB9507 (C10)	69.8	69.3	2.9	6.9	9.4	28	12.3
Crookston, MN							
MN08165-8 (K 2)	67.3	66.0	4.4	7.4	10.7	19	14.6
Glenn (K 3, Check)	64.8	64.4	3.0	8.2	10.4	33	12.6
Elgin-ND (K 4)	69.0	68.5	3.3	6.4	7.3	35	10.8
ND 816 (K 5)	65.7	64.4	3.0	5.2	5.2	50	8.3
SD4189 (K 7)	63.8	63.0	2.4	6.2	8.0	34	10.5
ND 819 (K 9)	70.6	69.1	2.2	5.7	7.0	37	9.6
ND 812 (K11)	68.2	67.5	3.3	5.6	6.3	33	10.2
Minot, ND							
BR0202W (M 1)	59.2	58.9	1.6	3.7	11.8	9	12.8
Glenn (M 3, Check)	64.3	63.9	2.2	6.2	10.8	24	11.4
Elgin-ND (M 4)	67.0	66.3	4.2	6.9	8.7	20	12.9
ND 816 (M 5)	65.0	64.0	2.6	5.6	7.8	34	10.1
COI565W (M 6)	59.0	58.7	1.4	4.5	6.4	48	7.9
CHBR1481W (M 8)	59.6	59.2	1.2	3.2	10.4	12	11.1
ND 819 (M 9)	69.3	68.4	2.9	5.9	7.7	33	10.6
ND 812 (M11)	68.3	67.3	3.4	6.0	6.7	35	10.1
Williston, ND							
Glenn (W 3, Check)	68.6	68.2	2.7	7.9	10.9	25	13.3
Elgin-ND (W 4)	68.2	67.1	3.4	8.2	11.9	22	14.7
ND 816 (W 5)	69.3	68.6	3.0	5.9	8.1	31	10.8
WB9507 (W10)	68.5	67.6	2.6	4.9	8.6	25	11.5
Duclair (W12)	61.1	60.5	2.1	5.6	9.5	25	12.0

Mixograph Parameters

Entry ID	Water Absorption[1] (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, SD								
Glenn (B 3, Check)	65.1	4.6	86.9	40.9	5.1	66.9	28.8	264.0
Elgin-ND (B 4)	64.2	2.9	82.0	36.6	3.6	66.0	25.0	180.2
ND 816 (B 5)	63.7	2.9	84.1	37.6	3.5	65.8	26.5	177.9
SD4189 (B 7)	62.9	4.4	84.4	37.7	4.8	64.2	34.7	238.3
ND 819 (B 9)	64.2	3.3	80.1	38.1	4.4	62.8	23.5	214.7
ND 812 (B11)	63.9	3.5	82.6	36.9	3.9	64.4	25.4	198.5
Casselton, ND								
BR0202W (C 1)	62.7	4.6	76.2	33.7	4.5	58.5	32.6	198.3
MN08165-8 (C 2)	66.2	3.8	90.6	43.7	4.3	71.5	32.1	225.4
Glenn (C 3, Check)	64.9	4.4	83.5	42.8	5.1	64.5	30.8	255.4
Elgin-ND (C 4)	63.8	2.6	89.4	38.8	3.0	71.0	26.3	159.9
ND 816 (C 5)	64.3	2.3	84.6	33.4	2.6	69.5	29.0	134.3
COI565W (C 6)	62.2	2.8	80.4	42.2	3.6	61.1	22.0	167.4
SD4189 (C 7)	62.8	3.4	86.0	42.1	4.0	66.3	30.8	202.9
CHBR1481W (C 8)	61.7	3.5	76.3	46.1	4.6	56.7	25.9	206.7
ND 819 (C 9)	63.7	2.7	92.0	35.1	3.2	76.1	28.1	186.7
WB9507 (C10)	62.8	3.1	92.7	36.3	3.5	76.1	30.4	191.1
Crookston, MN								
MN08165-8 (K 2)	63.6	2.8	85.8	30.0	3.2	72.4	22.8	170.9
Glenn (K 3, Check)	61.9	3.5	82.6	38.9	4.3	63.7	30.5	219.0
Elgin-ND (K 4)	61.7	2.4	83.5	36.2	3.1	67.0	29.1	166.0
ND 816 (K 5)	60.7	2.4	81.5	33.5	2.7	63.8	28.3	140.4
SD4189 (K 7)	59.7	4.3	80.6	41.9	4.0	58.5	34.2	182.5
ND 819 (K 9)	60.3	2.3	86.3	36.3	2.8	69.2	27.6	153.7
ND 812 (K11)	61.3	2.8	80.7	31.0	3.1	64.7	25.9	153.8
Minot, ND								
BR0202W (M 1)	64.1	5.8	75.9	33.6	6.0	58.0	31.2	256.0
Glenn (M 3, Check)	65.1	5.5	83.4	38.7	5.9	63.8	31.9	301.1
Elgin-ND (M 4)	65.5	2.9	87.6	38.0	3.2	69.1	32.2	167.4
ND 816 (M 5)	63.2	3.4	84.9	36.5	3.5	65.8	36.5	172.0
COI565W (M 6)	61.6	3.7	79.1	36.7	4.0	61.1	30.3	181.5
CHBR1481W (M 8)	62.7	5.3	69.1	24.0	5.4	57.0	24.1	229.8
ND 819 (M 9)	63.5	3.0	86.0	32.7	3.0	68.4	32.7	160.9
ND 812 (M11)	64.1	2.5	83.1	38.3	3.1	66.0	25.0	154.9
Williston, ND								
Glenn (W 3, Check)	63.3	4.0	81.2	36.2	4.7	64.9	25.1	247.7
Elgin-ND (W 4)	62.6	3.0	78.2	30.1	3.6	63.6	22.0	183.2
ND 816 (W 5)	63.1	2.6	78.8	31.9	3.4	63.4	26.0	175.7
WB9507 (W10)	61.9	3.0	89.4	45.7	4.2	71.6	26.9	239.0
Duclair (W12)	62.2	4.4	69.4	29.0	4.4	53.7	28.9	196.2

[1] 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 peak. Units are the vertical axis (% torque) multiplied by the horizontal axis (minutes). These values represent the work put into the flour and water in order to develop the dough.

In summary, the 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.)

Extensograph Parameters - 45 min Resting						
Entry ID	Energy [cm²]	Resistance (50 mm) [BU]	Extensibility [mm]	Maximum [BU]	Ratio Number	Ratio Number (Max.)
Watertown, SD						
Glenn (B 3, Check)	170	261	235	575	1.1	2.4
Elgin-ND (B 4)	140	237	240	443	1.0	1.9
ND 816 (B 5)	118	218	223	394	1.0	1.8
SD4189 (B 7)	167	296	216	616	1.4	2.9
ND 819 (B 9)	120	242	204	455	1.2	2.2
ND 812 (B11)	134	280	201	511	1.4	2.5
Casselton, ND						
BR0202W (C 1)	123	257	194	519	1.3	2.7
MN08165-8 (C 2)	168	254	240	550	1.1	2.3
Glenn (C 3, Check)	203	336	223	727	1.5	3.3
Elgin-ND (C 4)	98	213	200	376	1.1	1.9
ND 816 (C 5)	86	174	213	299	0.8	1.4
COI565W (C 6)	113	236	206	414	1.1	2.0
SD4189 (C 7)	169	284	230	568	1.2	2.5
CHBR1481W (C 8)	137	326	185	581	1.8	3.1
ND 819 (C 9)	103	222	197	401	1.1	2.0
WB9507 (C10)	165	260	237	541	1.1	2.3
Crookston, MN						
MN08165-8 (K 2)*	178	355	213	641	1.7	3.0
Glenn (K 3, Check)	172	280	224	616	1.3	2.8
Elgin-ND (K 4)	99	231	187	410	1.2	2.2
ND 816 (K 5)	102	214	208	365	1.0	1.8
SD4189 (K 7)	146	270	211	544	1.3	2.6
ND 819 (K 9)	87	229	181	355	1.3	2.0
ND 812 (K11)	97	204	204	354	1.0	1.7
Minot, ND						
BR0202W (M 1)	206	399	200	852	2.0	4.3
Glenn (M 3, Check)	243	386	224	903	1.7	4.0
Elgin-ND (M 4)	133	207	243	417	0.9	1.7
ND 816 (M 5)	122	220	216	451	1.0	2.1
COI565W (M 6)	140	297	197	566	1.5	2.9
CHBR1481W (M 8)	165	334	200	663	1.7	3.3
ND 819 (M 9)	109	232	199	428	1.2	2.2
ND 812 (M11)	98	220	196	378	1.1	1.9
Williston, ND						
Glenn (W 3, Check)	133	325	177	612	1.8	3.5
Elgin-ND (W 4)	101	268	180	415	1.5	2.3
ND 816 (W 5)	111	272	185	461	1.5	2.5
WB9507 (W10)	138	363	171	649	2.1	3.8
Duclair (W12)	116	258	191	485	1.4	2.5

*Water abosroption was adjusted to farinograph water absorption -2.5 %.

Extensograph Parameters - 90 min Resting

Entry ID	Energy [cm²]	Resistance (50 mm) [BU]	Extensibility [mm]	Maximum Resistance [BU]	Ratio Number	Ratio Number (Max.)
Watertown, SD						
Glenn (B 3, Check)	178	294	224	638	1.3	2.9
Elgin-ND (B 4)	120	236	212	432	1.1	2.0
ND 816 (B 5)	135	219	242	417	0.9	1.7
SD4189 (B 7)	166	295	213	621	1.4	2.9
ND 819 (B 9)	110	282	176	492	1.6	2.8
ND 812 (B11)	102	246	183	436	1.4	2.4
Casselton, ND						
BR0202W (C 1)	130	338	171	615	2.0	3.6
MN08165-8 (C 2)	207	312	236	708	1.3	3.0
Glenn (C 3, Check)	181	342	201	767	1.7	3.8
Elgin-ND (C 4)	108	233	206	394	1.1	1.9
ND 816 (C 5)	90	193	208	322	0.9	1.6
COI565W (C 6)	120	242	208	441	1.2	2.1
SD4189 (C 7)	145	315	193	600	1.6	3.1
CHBR1481W (C 8)	132	385	163	655	2.4	4.0
ND 819 (C 9)	99	253	176	453	1.4	2.6
WB9507 (C10)	158	258	230	534	1.1	2.3
Crookston, MN						
MN08165-8 (K 2)*	190	362	213	696	1.7	3.3
Glenn (K 3, Check)	188	434	184	838	2.4	4.6
Elgin-ND (K 4)	121	269	194	486	1.4	2.5
ND 816 (K 5)	107	224	205	399	1.1	2.0
SD4189 (K 7)	160	376	182	719	2.1	4.0
ND 819 (K 9)	106	240	193	423	1.3	2.2
ND 812 (K11)	98	226	191	400	1.2	2.1
Minot, ND						
BR0202W (M 1)	255	638	190	997	3.4	5.3
Glenn (M 3, Check)	270	607	200	1000	3.0	5.0
Elgin-ND (M 4)	136	216	234	459	0.9	2.0
ND 816 (M 5)	143	257	222	504	1.2	2.3
COI565W (M 6)	202	400	208	770	1.9	3.7
CHBR1481W (M 8)	214	432	201	850	2.2	4.2
ND 819 (M 9)	137	258	216	488	1.2	2.3
ND 812 (M11)	123	192	239	402	0.8	1.7
Williston, ND						
Glenn (W 3, Check)	211	427	202	831	2.1	4.1
Elgin-ND (W 4)	118	289	189	475	1.5	2.5
ND 816 (W 5)	133	273	210	483	1.3	2.3
WB9507 (W10)	141	444	159	704	2.8	4.4
Duclair (W12)	133	298	198	517	1.5	2.6

*Water abosroption was adjusted to farinograph water absorption -2.5 %.

Extensograph Parameters - 135 min Resting

Entry ID	Energy [cm²]	Resistance (50 mm) [BU]	Extensibility [mm]	Maximum [BU]	Ratio Number	Ratio Number (Max.)
Watertown, SD						
Glenn (B 3, Check)	163	263	228	571	1.2	2.5
Elgin-ND (B 4)	128	218	228	427	1.0	1.9
ND 816 (B 5)	116	218	216	415	1.0	1.9
SD4189 (B 7)	178	352	208	672	1.7	3.2
ND 819 (B 9)	108	295	172	483	1.7	2.8
ND 812 (B11)	122	241	211	442	1.1	2.1
Casselton, ND						
BR0202W (C 1)	115	343	162	567	2.1	3.5
MN08165-8 (C 2)	183	351	211	674	1.7	3.2
Glenn (C 3, Check)	238	408	221	858	1.9	3.9
Elgin-ND (C 4)	98	221	191	400	1.2	2.1
ND 816 (C 5)	86	140	231	294	0.6	1.3
COI565W (C 6)	123	252	202	472	1.3	2.3
SD4189 (C 7)	195	302	236	653	1.3	2.8
CHBR1481W (C 8)	158	433	170	747	2.6	4.4
ND 819 (C 9)	116	273	194	456	1.4	2.4
WB9507 (C10)	118	255	195	474	1.3	2.4
Crookston, MN						
MN08165-8 (K 2)*	222	389	220	790	1.8	3.6
Glenn (K 3, Check)	217	526	185	934	2.8	5.1
Elgin-ND (K 4)	122	229	216	437	1.1	2.0
ND 816 (K 5)	88	208	187	366	1.1	2.0
SD4189 (K 7)	151	361	183	655	2.0	3.6
ND 819 (K 9)	100	203	206	382	1.0	1.9
ND 812 (K11)	105	189	223	358	0.9	1.6
Minot, ND						
BR0202W (M 1)	240	600	182	999	3.3	5.5
Glenn (M 3, Check)	204	582	169	958	3.4	5.7
Elgin-ND (M 4)	141	223	238	449	0.9	1.9
ND 816 (M 5)	131	230	218	472	1.1	2.2
COI565W (M 6)	190	442	191	778	2.3	4.1
CHBR1481W (M 8)	205	445	196	831	2.3	4.3
ND 819 (M 9)	115	237	203	441	1.2	2.2
ND 812 (M11)	116	194	240	369	0.8	1.5
Williston, ND						
Glenn (W 3, Check)	166	417	179	750	2.3	4.2
Elgin-ND (W 4)	133	287	206	491	1.4	2.4
ND 816 (W 5)	118	267	195	465	1.4	2.4
WB9507 (W10)	167	460	169	790	2.7	4.7
Duclair (W12)	122	280	189	510	1.5	2.7

*Water abosroption was adjusted to farinograph water absorption -2.5 %.

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.

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Luther Talbert, Montana State University
Growers
Jay Fisher & Chad Anderson, North Central Agricultural Experiment Station, Minot, ND
Jack Ingmanson, Northeast Research Farm (Watertown), South Dakota State Univ.,
Sanford Qvale, Williston Agricultural Experiment Station, Williston, ND-
Tom Teigen, Agronomy Seed Farm, Casselton, ND
John Wiersma, Northwest Experiment Station, Crookston, MN
Dale Williams (Coordinator, NDSU Foundation seed)
Cooperators
ADM Milling, Olathe, Kansas- Vickie Correll and Dave Green
Bay State Milling Company, Winona, Minnesota- Darrel Nelson, Terry A. Selleck and Kenneth A. Ulbrich
Horizon Milling, Minnetonka, Minnesota- Colleen Kuznik and Brian Walker
Cereal Food Processors, Inc., Wichita, Kansas- Rich Kendrick and Tim Aschbrenner
ConAgra Foods, Omaha, Nebraska- Scott Baker and Glen Weaver
General Mills, Inc., Minneapolis, Minnesota
- Steve Cheruvathoor, Jim Wigand and Dave Katzke
Limagrain Cereal Seeds, Fort Collins CO- Hayley Butler
North Dakota State Mill, Grand Forks, North Dakota- Bob Sombke
North Dakota State University, Department of Cereal Science, Fargo, North Dakota
- Kelly McMonagle, DeLane Olsen, and Senay Simsek
USDA/ARS Hard Red Spring & Durum Wheat Quality Laboratory, Fargo, North Dakota
- Michael Edwards, Alyssa Hicks, Sherry Jiang, Mary Valenzuela , and Jadene Wear
Kaitlin Beck, and Brian Sebring (NDSU student worker)
USDA/ARS Hard Winter Wheat Quality Laboratory, Manhattan, Kansas
- Margo Caley, Richard Chen, and Brad Seabourn
USDA/ARS Western Wheat Quality Laboratory, Pullman, Washington
- Doug Engle, and Craig Morris
Wheat Marketing Center, Portland, Oregon- Bon Lee, and Dave Shelton