

Wheat Quality Council

Hard Spring Wheat Technical Committee

2006 Crop



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Kansas City, MO

Hard Spring Wheat Technical Committee

2006 Crop



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Wheat Quality Council

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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 to provide high quality wheat for commercial production and processing.

Twelve experimental lines of hard spring wheat were grown at up to four locations in 2006 and evaluated for kernel, milling, and bread baking quality against the check variety Glenn. To avoid any bias in the test procedures, code numbers were assigned to the experimental lines and maintained throughout the growing and harvesting of the plots and the milling and baking trials. Samples of wheat were milled at the USDA Hard Red Spring and Durum Wheat Quality Laboratory (WQL), Fargo, ND. Flour samples were shipped to independent laboratories and tested for bread baking quality.

From this report:

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

The results relate only to test samples that were volunteered for testing in the 2006 crop year. Test results from additional experimentation in 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.

I. USDA/ARS WQL Results/Evaluation

Quality Trait

		Crookston		Minot	
		Glenn Check	BR0061	Glenn Check	BR0061
1	Wheat Protein (12%mb)	13.9	11.8	15.8	14.8
2	Flour Protein (12%mb)	13.0	10.6	15.6	14.3

3	Market Value (Score 1-6)	4.4	3.4	4.6	3.3
4	Market Value (Score 1-10)	10.0	5.2	10.0	7.6
5	Test Weight (lb/bu)	65.4	60.1	62.6	58.2
6	1000 Kernel Weight (g)	33.9	34.8	32.2	31.3
7	Kernel Size % Large	72	70	56	55
8	Kernel Size % Small	3	6	4	7
9	Wheat Moisture (%)	12.6	12.3	12.5	12.2
10	NIR Hardness	78.9	66.4	70.1	71.1
11	Wheat Ash (14%mb)	1.36	1.59	1.51	1.49
12	Wheat Falling Number (sec)	424	444	406	347
13	Vitreous Kernels (%)	99.1	75.9	85.2	76.8

Patent Flour Extraction (%)

14	Tempered Wheat Basis (%)	70.4	70.9	72.0	72.8
15	Total Product Basis (%)	74.3	75.3	76.1	77.2
16	Patent Flour /Bu Wheat (lbs)	46.0	42.6	45.0	42.3
17	Flour Color (L/b Hunter Lab)	87.6/9.1	87.8/9.3	86.5/8.5	87.2/8.9
18	Flour Moisture (%)	12.5	11.8	12.1	12.0
19	Flour Ash (14%mb)	0.628	0.761	0.581	0.658
20	Wheat PPO Activity (Abs @ 475)	0.799	0.541	0.783	0.490

Farinograph

21	Water Absorption (500bu)	68.7	64.5	69.8	66.2
22	Water Absorption (14%mb)	67.0	62.0	67.6	63.9
23	Arrival Time (min)	2.4	1.2	4.6	3.8
24	Peak Time (min)	4.7	2.7	7.5	6.7
25	Dough Stability (min)	7.7	5.9	6.8	7.6
26	MTI (bu)	27	29	34	34
27	TTB (min)	10.1	7.4	11.8	10.9

28	Bake Absorption (%) - average	65.3±2.5	61.6±2.4	66.5±2.7	63.7±2.1
29	Average Loaf Volume (% of Check)		86.8±8.4		96.6±7.1

II. Cooperator Results/Evaluation

Quality Trait		Crookston		Minot	
		Glenn Check	BR0061	Glenn Check	BR0061
30	Mixing Requirement				
	5 Very Long				
	4 Long	_____	_____	_____	_____
	3 Medium				
	2 Short				
	1 Very Short				
		3.8±0.9	3.4±1.3	3.7±0.8	3.6±0.7
31	Dough Characteristics				
	5 Bucky-Tough				
	4 Strong-Elastic	_____	_____	_____	_____
	3 Medium-Pliable				
	2 Mellow-Very Pliable				
	1 Weak-Short or Sticky				
		3.8±0.9	3.2±1.1	3.5±1.0	3.5±0.8
32	Mixing Tolerance				
	5 Much More Tolerance Than Check				
	4 More Tolerance Than Check				
	3 Tolerance Equivalent To Check			_____	
	2 Less Tolerance Than Check				
	1 Much Less Tolerance Than Check				
			2.0±0.8		3.4±0.5
33	Internal Crumb Color				
	5 Much Brighter Than Check				
	4 Brighter Than Check				
	3 Equivalent To Check			_____	
	2 Poorer Than Check		_____		
	1 Much Poorer Than Check				
			2.6±0.8		2.9±0.9
34	Internal Grain and Texture				
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check		_____		_____
	2 Poorer Than Check				
	1 Much Poorer Than Check				
			3.0±1.1		3.6±1.0

III. Cooperator Quality Assessment

Quality Trait 1-2: Protein					
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check				
	2 Poorer Than Check		1.4±0.7		_____
	1 Much Poorer Than Check		_____		2.4±0.7
Quality Trait 3-20: Milling					
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check				
	2 Poorer Than Check		_____		_____
	1 Much Poorer Than Check		2.2±0.4		2.6±0.9
Quality Trait 21-34: Baking					
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check				_____
	2 Poorer Than Check				
	1 Much Poorer Than Check		1.9±0.7		3.2±0.8
Quality Trait 1-34: Overall Comparison					
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check				_____
	2 Poorer Than Check		1.8±0.6		
	1 Much Poorer Than Check		_____		3.0±0.9

I. USDA/ARS WQL Results/Evaluation

Quality Trait

		Casselton		Crookston	
		Glenn Check	MN01311-A	Glenn Check	MN01311-A
1	Wheat Protein (12%mb)	14.8	14.5	13.9	12.2
2	Flour Protein (12%mb)	14.1	14.1	13.0	11.0

3	Market Value (Score 1-6)	4.4	4.6	4.4	4.5
4	Market Value (Score 1-10)	10.0	9.6	10.0	7.4
5	Test Weight (lb/bu)	62.9	62.0	65.4	63.5
6	1000 Kernel Weight (g)	31.9	36.9	33.9	38.6
7	Kernel Size % Large	64	75	72	82
8	Kernel Size % Small	4	3	3	2
9	Wheat Moisture (%)	13.0	13.2	12.6	12.6
10	NIR Hardness	80.2	84.3	78.9	79.2
11	Wheat Ash (14%mb)	1.57	1.56	1.36	1.41
12	Wheat Falling Number (sec)	466	491	424	478
13	Vitreous Kernels (%)	94.0	77.0	99.1	79.8

Patent Flour Extraction (%)

14	Tempered Wheat Basis (%)	71.3	75.4	70.4	73.9
15	Total Product Basis (%)	74.7	78.9	74.3	77.7
16	Patent Flour /Bu Wheat (lbs)	44.9	46.7	46.0	46.9
17	Flour Color (L/b Hunter Lab)	87.2/8.7	85.8/10.5	87.6/9.1	87.2/11.2
18	Flour Moisture (%)	12.9	13.1	12.5	12.6
19	Flour Ash (14%mb)	0.679	0.707	0.628	0.559
20	Wheat PPO Activity (Abs @ 475)	0.918	0.850	0.799	0.738

Farinograph

21	Water Absorption (500bu)	66.9	64.5	68.7	64.9
22	Water Absorption (14%mb)	65.6	63.5	67.0	63.3
23	Arrival Time (min)	2.4	3.9	2.4	1.8
24	Peak Time (min)	7.2	5.5	4.7	6.5
25	Dough Stability (min)	10.0	6.6	7.7	7.7
26	MTI (bu)	31	29	27	48
27	TTB (min)	12.1	10.6	10.1	9.7

28	Bake Absorption (%) - average	65.2±2.5	62.7±1.3	65.3±2.5	62.3±2.2
29	Average Loaf Volume (% of Check)		95.5±9.9		88.5±5.8

II. Cooperator Results/Evaluation

Quality Trait		Casselton		Crookston	
		Glenn Check	MN01311-A	Glenn Check	MN01311-A
30	Mixing Requirement				
	5 Very Long				
	4 Long				
	3 Medium	_____	_____	_____	_____
	2 Short				
	1 Very Short				
		3.7±0.7	2.4±0.5	3.8±0.9	3.3±0.8
31	Dough Characteristics				
	5 Bucky-Tough				
	4 Strong-Elastic				
	3 Medium-Pliable	_____	_____	_____	_____
	2 Mellow-Very Pliable				
	1 Weak-Short or Sticky				
		3.9±0.9	2.7±0.7	3.8±0.9	3.0±0.9
32	Mixing Tolerance				
	5 Much More Tolerance Than Check				
	4 More Tolerance Than Check				
	3 Tolerance Equivalent To Check				
	2 Less Tolerance Than Check				
	1 Much Less Tolerance Than Check		_____		_____
			2.1±1.1		2.8±0.9
33	Internal Crumb Color				
	5 Much Brighter Than Check				
	4 Brighter Than Check				
	3 Equivalent To Check				
	2 Poorer Than Check		_____		_____
	1 Much Poorer Than Check				
			2.7±0.8		2.4±0.5
34	Internal Grain and Texture				
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check				
	2 Poorer Than Check		_____		_____
	1 Much Poorer Than Check				
			2.9±1.0		3.0±0.8

III. Cooperator Quality Assessment

Quality Trait 1-2: Protein					
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check		_____		
	2 Poorer Than Check				
	1 Much Poorer Than Check				
			3.1±0.6		1.7±0.9
Quality Trait 3-20: Milling					
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check		_____		_____
	2 Poorer Than Check				
	1 Much Poorer Than Check				
			3.6±0.9		3.3±0.9
Quality Trait 21-34: Baking					
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check				
	2 Poorer Than Check		_____		_____
	1 Much Poorer Than Check				
			2.6±1.1		1.9±0.7
Quality Trait 1-34: Overall Comparison					
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check				
	2 Poorer Than Check		_____		_____
	1 Much Poorer Than Check				
			2.7±1.1		2.1±0.6

I. USDA/ARS WQL Results/Evaluation

Quality Trait

		Casselton		Minot	
		Glenn Check	ND803	Glenn Check	ND803
1	Wheat Protein (12%mb)	14.8	14.3	15.8	15.5
2	Flour Protein (12%mb)	14.1	13.5	15.6	14.9
3	Market Value (Score 1-6)	4.4	4.4	4.6	4.8
4	Market Value (Score 1-10)	10.0	10.0	10.0	9.6
5	Test Weight (lb/bu)	62.9	62.2	62.6	60.6
6	1000 Kernel Weight (g)	31.9	35	32.2	36
7	Kernel Size % Large	64	70	56	75
8	Kernel Size % Small	4	3	4	2
9	Wheat Moisture (%)	13.0	13.2	12.5	12.9
10	NIR Hardness	80.2	76.8	70.1	69.0
11	Wheat Ash (14%mb)	1.57	1.57	1.51	1.59
12	Wheat Falling Number (sec)	466	489	406	411
13	Vitreous Kernels (%)	94.0	60.0	85.2	63.1
Patent Flour Extraction (%)					
14	Tempered Wheat Basis (%)	71.3	73.9	72.0	74.0
15	Total Product Basis (%)	74.7	77.8	76.1	77.8
16	Patent Flour /Bu Wheat (lbs)	44.9	46.0	45.0	44.8
17	Flour Color (L/b Hunter Lab)	87.2/8.7	86.9/9.1	86.5/8.5	87.1/8.3
18	Flour Moisture (%)	12.9	12.8	12.1	13.1
19	Flour Ash (14%mb)	0.679	0.699	0.581	0.608
20	Wheat PPO Activity (Abs @ 475)	0.918	0.772	0.783	0.838
Farinograph					
21	Water Absorption (500bu)	66.9	68.7	69.8	68.9
22	Water Absorption (14%mb)	65.6	67.3	67.6	67.9
23	Arrival Time (min)	2.4	2.9	4.6	4.2
24	Peak Time (min)	7.2	6.8	7.5	6.8
25	Dough Stability (min)	10.0	7.1	6.8	7.0
26	MTI (bu)	31	39	34	33
27	TTB (min)	12.1	10.5	11.8	11.4
28	Bake Absorption (%) - average	65.2±2.5	65.3±2.4	66.5±2.7	66.3±3.0
29	Average Loaf Volume (% of Check)		97.2±5.7		96.2±7.4

II. Cooperator Results/Evaluation

Quality Trait		Casselton		Minot	
		Glenn Check	ND803	Glenn Check	ND803
30	Mixing Requirement				
	5 Very Long				
	4 Long				
	3 Medium	_____	_____	_____	_____
	2 Short				
	1 Very Short				
		3.7±0.7	2.8±0.4	3.7±0.8	3.0±0.9
31	Dough Characteristics				
	5 Bucky-Tough				
	4 Strong-Elastic				
	3 Medium-Pliable	_____	_____	_____	_____
	2 Mellow-Very Pliable				
	1 Weak-Short or Sticky				
		3.9±0.9	2.7±0.5	3.5±1.0	3.5±0.7
32	Mixing Tolerance				
	5 Much More Tolerance Than Check				
	4 More Tolerance Than Check				
	3 Tolerance Equivalent To Check				
	2 Less Tolerance Than Check				
	1 Much Less Tolerance Than Check				
			2.1±0.9		2.8±0.6
33	Internal Crumb Color				
	5 Much Brighter Than Check				
	4 Brighter Than Check				
	3 Equivalent To Check				
	2 Poorer Than Check				
	1 Much Poorer Than Check				
			3.0±0.7		3.0±0.5
34	Internal Grain and Texture				
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check				
	2 Poorer Than Check				
	1 Much Poorer Than Check				
			3.0±0.9		3.0±1.0

III. Cooperator Quality Assessment

Quality Trait 1-2: Protein					
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check				
	2 Poorer Than Check				
	1 Much Poorer Than Check				
			2.6±1.0		2.9±0.3
Quality Trait 3-20: Milling					
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check				
	2 Poorer Than Check				
	1 Much Poorer Than Check				
			3.6±0.7		3.3±0.9
Quality Trait 21-34: Baking					
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check				
	2 Poorer Than Check				
	1 Much Poorer Than Check				
			3.0±1.1		2.6±0.7
Quality Trait 1-34: Overall Comparison					
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check				
	2 Poorer Than Check				
	1 Much Poorer Than Check				
			2.9±1.0		3.0±0.9

I. USDA/ARS WQL Results/Evaluation

Quality Trait

		Brookings		Casselton		Minot	
		Glenn Check	SD3851	Glenn Check	SD3851	Glenn Check	SD3851
1	Wheat Protein (12%mb)	14.3	14.2	14.8	14.0	15.8	14.6
2	Flour Protein (12%mb)	13.8	13.1	14.1	13.0	15.6	13.9
3	Market Value (Score 1-6)	4.1	3.6	4.4	3.6	4.6	3.7
4	Market Value (Score 1-10)	10.0	8.0	10.0	7.8	10.0	6.8
5	Test Weight (lb/bu)	65.0	57.5	62.9	58.3	62.6	57.1
6	1000 Kernel Weight (g)	32.9	36.2	31.9	33.1	32.2	34.8
7	Kernel Size % Large	71	75	64	63	56	67
8	Kernel Size % Small	4	4	4	6	4	4
9	Wheat Moisture (%)	12.9	13.0	13.0	13.0	12.5	12.7
10	NIR Hardness	80.2	87.2	80.2	83.4	70.1	81.3
11	Wheat Ash (14%mb)	1.69	1.53	1.57	1.57	1.51	1.31
12	Wheat Falling Number (sec)	409	419	466	496	406	409
13	Vitreous Kernels (%)	83.1	14.5	94.0	28.9	85.2	11.9
Patent Flour Extraction (%)							
14	Tempered Wheat Basis (%)	70.4	71.7	71.3	74.3	72.0	73.8
15	Total Product Basis (%)	74.3	75.2	74.7	78.7	76.1	77.8
16	Patent Flour /Bu Wheat (lbs)	45.8	41.2	44.9	43.3	45.0	42.2
17	Flour Color (L/b Hunter Lab)	86.5/8.7	86.0/9.9	87.2/8.7	86.7/9.7	86.5/8.5	86.2/9.3
18	Flour Moisture (%)	12.6	12.3	12.9	12.5	12.1	13.1
19	Flour Ash (14%mb)	0.699	0.704	0.679	0.700	0.581	0.627
20	Wheat PPO Activity (Abs @ 475)	0.852	0.683	0.918	0.961	0.783	0.805
Farinograph							
21	Water Absorption (500bu)	68.4	66.6	66.9	65.1	69.8	65.3
22	Water Absorption (14%mb)	66.8	64.5	65.6	63.4	67.6	64.3
23	Arrival Time (min)	2.4	3.0	2.4	3.2	4.6	2.8
24	Peak Time (min)	6.5	5.3	7.2	5.4	7.5	4.2
25	Dough Stability (min)	8.7	4.3	10.0	4.6	6.8	2.8
26	MTI (bu)	34	58	31	44.0	34	73
27	TTB (min)	11.1	7.8	12.1	8.7	11.8	6.1
28	Bake Absorption (%) - average	66.3±2.8	64.0±4.1	65.2±2.5	62.8±1.8	66.5±2.7	63.2±1.7
29	Average Loaf Volume (% of Check)		87.3±6.5		86.1±10.0		78.5±8.8

II. Cooperator Results/Evaluation

Quality Trait		Brookings		Casselton		Minot	
		Glenn Check	SD3851	Glenn Check	SD3851	Glenn Check	SD3851
30	Mixing Requirement						
	5 Very Long						
	4 Long	_____	_____	_____	_____	_____	
	3 Medium						
	2 Short						
	1 Very Short	3.9±0.9	2.1±1.0	3.7±0.7	2.0±0.7	3.7±0.8	1.4±0.5
31	Dough Characteristics						
	5 Bucky-Tough						
	4 Strong-Elastic	_____	_____	_____	_____	_____	
	3 Medium-Pliable						
	2 Mellow-Very Pliable						
	1 Weak-Short or Sticky	3.7±1.2	1.9±0.7	3.9±0.9	2.1±1.0	3.5±1.0	1.7±0.8
32	Mixing Tolerance						
	5 Much More Tolerance Than Check						
	4 More Tolerance Than Check						
	3 Tolerance Equivalent To Check						
	2 Less Tolerance Than Check		1.8±0.8		1.8±1.2		1.3±0.7
	1 Much Less Tolerance Than Check						
33	Internal Crumb Color						
	5 Much Brighter Than Check						
	4 Brighter Than Check						
	3 Equivalent To Check						
	2 Poorer Than Check		_____		_____		1.3±0.5
	1 Much Poorer Than Check		2.6±0.7		2.1±1.1		
34	Internal Grain and Texture						
	5 Much Better Than Check						
	4 Better Than Check						
	3 Equivalent To Check						
	2 Poorer Than Check		_____		_____		1.7±0.7
	1 Much Poorer Than Check		2.6±1.2		2.6±1.1		
III. Cooperator Quality Assessment							
Quality Trait 1-2: Protein							
	5 Much Better Than Check						
	4 Better Than Check						
	3 Equivalent To Check						
	2 Poorer Than Check		_____		_____		
	1 Much Poorer Than Check		2.7±0.7		2.2±0.4		1.9±0.3
Quality Trait 3-20: Milling							
	5 Much Better Than Check						
	4 Better Than Check						
	3 Equivalent To Check		_____		_____		
	2 Poorer Than Check						
	1 Much Poorer Than Check		3.0±1.0		2.8±1.3		2.2±1.2
Quality Trait 21-34: Baking							
	5 Much Better Than Check						
	4 Better Than Check						
	3 Equivalent To Check						
	2 Poorer Than Check				1.8±1.2		1.5±0.7
	1 Much Poorer Than Check		1.9±1.0				
Quality Trait 1-34: Overall Comparison							
	5 Much Better Than Check						
	4 Better Than Check						
	3 Equivalent To Check						
	2 Poorer Than Check		_____		_____		1.4±0.5
	1 Much Poorer Than Check		2.0±0.9		1.9±1.2		

I. USDA/ARS WQL Results/Evaluation

Quality Trait

		Casselton		Minot	
		Glenn Check	CS 3100Q	Glenn Check	CS 3100Q
1	Wheat Protein (12%mb)	14.8	14.6	15.8	14.0
2	Flour Protein (12%mb)	14.1	14.1	15.6	13.4
3	Market Value (Score 1-6)	4.4	3.7	4.6	2.7
4	Market Value (Score 1-10)	10.0	8.6	10.0	5.4
5	Test Weight (lb/bu)	62.9	60.1	62.6	59.4
6	1000 Kernel Weight (g)	31.9	29.2	32.2	30.9
7	Kernel Size % Large	64	45	56	54
8	Kernel Size % Small	4	7	4	6
9	Wheat Moisture (%)	13.0	13.2	12.5	12.8
10	NIR Hardness	80.2	71.0	70.1	61.4
11	Wheat Ash (14%mb)	1.57	1.76	1.51	1.53
12	Wheat Falling Number (sec)	466	465	406	334
13	Vitreous Kernels (%)	94.0	43.6	85.2	18.9
Patent Flour Extraction (%)					
14	Tempered Wheat Basis (%)	71.3	74.1	72.0	74.2
15	Total Pproduct Basis (%)	74.7	78.5	76.1	78.4
16	Patent Flour /Bu Wheat (lbs)	44.9	44.5	45.0	44.1
17	Flour Color (L/b Hunter Lab)	87.2/8.7	87.7/8.0	86.5/8.5	87.7/8.2
18	Flour Moisture (%)	12.9	12.5	12.1	12.3
19	Flour Ash (14%mb)	0.679	0.742	0.581	0.665
20	Wheat PPO Activity (Abs @ 475)	0.918	0.888	0.783	0.903
Farinograph					
21	Water Absorption (500bu)	66.9	63.0	69.8	64.0
22	Water Absorption (14%mb)	65.6	61.3	67.6	62.1
23	Arrival Time (min)	2.4	3.4	4.6	3.2
24	Peak Time (min)	7.2	6.7	7.5	5.5
25	Dough Stability (min)	10.0	8.4	6.8	6.2
26	MTI (bu)	31	27	34	35
27	TTB (min)	12.1	11.9	11.8	9.8
28	Bake Absorption (%) - average	65.2±2.5	62.0±2.0	66.5±2.7	61.9±1.6
29	Average Loaf Volume (% of Check)		100.6±7.4		91.4±8.1

II. Cooperator Results/Evaluation

Quality Trait		Casselton		Minot	
		Glenn Check	CS 3100Q	Glenn Check	CS 3100Q
30	Mixing Requirement				
	5 Very Long				
	4 Long				
	3 Medium	_____	_____	_____	_____
	2 Short				
	1 Very Short				
		3.7±0.7	3.5±0.8	3.7±0.8	3.0±0.5
31	Dough Characteristics				
	5 Bucky-Tough				
	4 Strong-Elastic				
	3 Medium-Pliable	_____	_____	_____	_____
	2 Mellow-Very Pliable				
	1 Weak-Short or Sticky				
		3.9±0.9	3.5±0.7	3.5±1.0	2.6±1.1
32	Mixing Tolerance				
	5 Much More Tolerance Than Check				
	4 More Tolerance Than Check				
	3 Tolerance Equivalent To Check				
	2 Less Tolerance Than Check				
	1 Much Less Tolerance Than Check				
			2.8±0.6		2.5±0.5
33	Internal Crumb Color				
	5 Much Brighter Than Check				
	4 Brighter Than Check				
	3 Equivalent To Check		_____		_____
	2 Poorer Than Check				
	1 Much Poorer Than Check				
			3.8±0.6		2.8±1.0
34	Internal Grain and Texture				
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check		_____		_____
	2 Poorer Than Check				
	1 Much Poorer Than Check				
			3.4±0.8		3.1±1.2

III. Cooperator Quality Assessment

Quality Trait 1-2: Protein					
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check		_____		_____
	2 Poorer Than Check				
	1 Much Poorer Than Check				
			3.2±0.6		2.1±0.6
Quality Trait 3-20: Milling					
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check		_____		_____
	2 Poorer Than Check				
	1 Much Poorer Than Check				
			2.8±1.1		2.4±1.0
Quality Trait 21-34: Baking					
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check		_____		_____
	2 Poorer Than Check				
	1 Much Poorer Than Check				
			3.4±1.1		2.2±0.9
Quality Trait 1-34: Overall Comparison					
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check		_____		_____
	2 Poorer Than Check				
	1 Much Poorer Than Check				
			3.1±1.0		2.2±0.9

I. USDA/ARS WQL Results/Evaluation

Quality Trait

		Casselton		Crookston		Minot	
		Glenn Check	Bigg Red	Glenn Check	Bigg Red	Glenn Check	Bigg Red
1	Wheat Protein (12%mb)	14.8	14.1	13.9	12.7	15.8	13.5
2	Flour Protein (12%mb)	14.1	13.7	13.0	11.4	15.6	12.8
3	Market Value (Score 1-6)	4.4	4.0	4.4	4.5	4.6	3.1
4	Market Value (Score 1-10)	10.0	8.6	10.0	8.8	10.0	6.0
5	Test Weight (lb/bu)	62.9	62.6	65.4	64.6	62.6	61.3
6	1000 Kernel Weight (g)	31.9	31.5	33.9	35.3	32.2	30.2
7	Kernel Size % Large	64	52	72	65	56	36
8	Kernel Size % Small	4	8	3	5	4	9
9	Wheat Moisture (%)	13.0	12.5	12.6	12.0	12.5	12.6
10	NIR Hardness	80.2	75.0	78.9	77.4	70.1	63.4
11	Wheat Ash (14%mb)	1.57	1.58	1.36	1.40	1.51	1.37
12	Wheat Falling Number (sec)	466	412	424	434	406	313
13	Vitreous Kernels (%)	94.0	65.3	99.1	67.2	85.2	44.6
Patent Flour Extraction (%)							
14	Tempered Wheat Basis (%)	71.3	74.5	70.4	72.3	72.0	73.2
15	Total Product Basis (%)	74.7	78.5	74.3	76.6	76.1	76.8
16	Patent Flour /Bu Wheat (lbs)	44.9	46.6	46.0	46.7	45.0	44.9
17	Flour Color (L/b Hunter Lab)	87.2/8.7	86.4/8.8	87.6/9.1	87.1/9.4	86.5/8.5	87.0/8.9
18	Flour Moisture (%)	12.9	12.1	12.5	11.8	12.1	12.5
19	Flour Ash (14%mb)	0.679	0.734	0.628	0.595	0.581	0.578
20	Wheat PPO Activity (Abs @ 475)	0.918	0.749	0.799	0.685	0.783	0.903
Farinograph							
21	Water Absorption (500bu)	66.9	69.0	68.7	69.1	69.8	65.9
22	Water Absorption (14%mb)	65.6	66.8	67.0	66.6	67.6	64.2
23	Arrival Time (min)	2.4	3.5	2.4	2.2	4.6	3.2
24	Peak Time (min)	7.2	5.2	4.7	3.4	7.5	6.5
25	Dough Stability (min)	10.0	6.0	7.7	4.8	6.8	6.0
26	MTI (bu)	31	32	27	42	34	47
27	TTB (min)	12.1	10.1	10.1	7.5	11.8	8.9
28	Bake Absorption (%) - average	65.2±2.5	64.8±2.6	65.3±2.5	64.3±3.2	66.5±2.7	63.3±1.8
29	Average Loaf Volume (% of Check)		88.7±7.1		86.4±4.8		85.9±8.2

II. Cooperator Results/Evaluation

Quality Trait		Casselton		Crookston		Minot	
		Glenn Check	Bigg Red	Glenn Check	Bigg Red	Glenn Check	Bigg Red
30	Mixing Requirement						
	5 Very Long						
	4 Long						
	3 Medium	_____		_____		_____	
	2 Short		_____		_____		_____
	1 Very Short						
		3.7±0.7	2.4±0.7	3.8±0.9	2.0±0.8	3.7±0.8	2.7±0.5
31	Dough Characteristics						
	5 Bucky-Tough						
	4 Strong-Elastic	_____		_____		_____	
	3 Medium-Pliable						
	2 Mellow-Very Pliable		_____		1.6±0.7		_____
	1 Weak-Short or Sticky						
		3.9±0.9	2.3±1.1	3.8±0.9	1.6±0.7	3.5±1.0	2.7±0.7
32	Mixing Tolerance						
	5 Much More Tolerance Than Check						
	4 More Tolerance Than Check						
	3 Tolerance Equivalent To Check						
	2 Less Tolerance Than Check						
	1 Much Less Tolerance Than Check		2.0±0.9		1.9±1.0		2.2±0.6
33	Internal Crumb Color						
	5 Much Brighter Than Check						
	4 Brighter Than Check						
	3 Equivalent To Check						
	2 Poorer Than Check		_____		_____		_____
	1 Much Poorer Than Check						
			2.5±1.1		2.2±0.9		2.3±0.7
34	Internal Grain and Texture						
	5 Much Better Than Check						
	4 Better Than Check						
	3 Equivalent To Check						
	2 Poorer Than Check		_____		_____		_____
	1 Much Poorer Than Check						
			2.8±0.8		2.4±1.1		2.7±0.7

III. Cooperator Quality Assessment

Quality Trait 1-2: Protein							
	5 Much Better Than Check						
	4 Better Than Check						
	3 Equivalent To Check						
	2 Poorer Than Check		_____		_____		1.6±0.5
	1 Much Poorer Than Check						
			2.4±0.5		1.9±0.9		
Quality Trait 3-20: Milling							
	5 Much Better Than Check						
	4 Better Than Check						
	3 Equivalent To Check		_____		_____		_____
	2 Poorer Than Check						
	1 Much Poorer Than Check						
			3.0±1.0		3.2±0.7		3.0±0.9
Quality Trait 21-34: Baking							
	5 Much Better Than Check						
	4 Better Than Check						
	3 Equivalent To Check						
	2 Poorer Than Check				1.8±1.2		_____
	1 Much Poorer Than Check						
			2.0±0.9				2.1±0.9
Quality Trait 1-34: Overall Comparison							
	5 Much Better Than Check						
	4 Better Than Check						
	3 Equivalent To Check						
	2 Poorer Than Check		_____		1.7±1.1		_____
	1 Much Poorer Than Check						
			2.1±0.1				2.3±1.1

I. USDA/ARS WQL Results/Evaluation

Quality Trait

		Brookings		Casselton		Minot	
		Glenn Check	98S0127-06	Glenn Check	98S0127-06	Glenn Check	98S0127-06
1	Wheat Protein (12%mb)	14.3	13.6	14.8	13.8	15.8	13.7
	Flour Protein (12%mb)	13.8	12.7	14.1	12.9	15.6	13.1
3	Market Value (Score 1-6)	4.1	3.7	4.4	3.4	4.6	3.3
4	Market Value (Score 1-10)	10.0	7.8	10.0	8.4	10.0	6.4
5	Test Weight (lb/bu)	65.0	60.5	62.9	60.2	62.6	59.6
6	1000 Kernel Weight (g)	32.9	32.9	31.9	31.3	32.2	28.4
7	Kernel Size % Large	71	67	64	49	56	41
8	Kernel Size % Small	4	5	4	10	4	8
9	Wheat Moisture (%)	12.9	13.1	13.0	13.1	12.5	12.2
10	NIR Hardness	80.2	87.2	80.2	88.4	70.1	77.9
11	Wheat Ash (14%mb)	1.69	1.54	1.57	1.71	1.51	1.39
12	Wheat Falling Number (sec)	409	471	466	509	406	381
13	Vitreous Kernels (%)	83.1	19.7	94.0	29.6	85.2	20.7
Patent Flour Extraction (%)							
14	Tempered Wheat Basis (%)	70.4	72.9	71.3	74.1	72.0	74.4
15	Total Pproduct Basis (%)	74.3	77.1	74.7	78.2	76.1	77.3
16	Patent Flour /Bu Wheat (lbs)	45.8	44.1	44.9	44.6	45.0	44.3
17	Flour Color (L/b Hunter Lab)	86.5/8.7	85.8/10.4	87.2/8.7	86.0/10.2	86.5/8.5	86.6/9.7
18	Flour Moisture (%)	12.6	12.6	12.9	12.5	12.1	12.7
19	Flour Ash (14%mb)	0.699	0.722	0.679	0.759	0.581	0.608
20	Wheat PPO Activity (Abs @ 475)	0.852	0.780	0.918	0.801	0.783	0.769
Farinograph							
21	Water Absorption (500bu)	68.4	65.7	66.9	65.2	69.8	65.6
22	Water Absorption (14%mb)	66.8	64.1	65.6	63.5	67.6	64.1
23	Arrival Time (min)	2.4	3.2	2.4	3.0	4.6	3.2
24	Peak Time (min)	6.5	6.0	7.2	6.7	7.5	5.4
25	Dough Stability (min)	8.7	6.7	10.0	8.1	6.8	6.6
26	MTI (bu)	34	40	31	37	34	37
27	TTB (min)	11.1	10.2	12.1	10.8	11.8	10.0
28	Bake Absorption (%) - average	66.3±2.8	64.1±2.4	65.2±2.5	63.2±1.8	66.5±2.7	63.6±2.0
29	Average Loaf Volume (% of Check)		95.9±4.3		94.1±6.2		89.0±9.9

II. Cooperator Results/Evaluation

Quality Trait		Brookings		Casselton		Minot	
		Glenn Check	98S0127-06	Glenn Check	98S0127-06	Glenn Check	98S0127-06
30	Mixing Requirement						
	5 Very Long						
	4 Long						
	3 Medium	_____	_____	_____	_____	_____	_____
	2 Short						
	1 Very Short	3.9±0.9	3.5±0.7	3.7±0.7	4.0±0.8	3.7±0.8	3.1±0.7
31	Dough Characteristics						
	5 Bucky-Tough						
	4 Strong-Elastic						
	3 Medium-Pliable	_____	_____	_____	_____	_____	_____
	2 Mellow-Very Pliable						
	1 Weak-Short or Sticky	3.7±1.2	3.5±1.0	3.9±0.9	3.2±0.6	3.5±1.0	2.9±0.6
32	Mixing Tolerance						
	5 Much More Tolerance Than Check						
	4 More Tolerance Than Check						
	3 Tolerance Equivalent To Check						
	2 Less Tolerance Than Check						
	1 Much Less Tolerance Than Check		2.9±0.9		2.8±0.6		2.7±0.5
33	Internal Crumb Color						
	5 Much Brighter Than Check						
	4 Brighter Than Check						
	3 Equivalent To Check						
	2 Poorer Than Check						
	1 Much Poorer Than Check		3.3±0.7		2.6±1.0		2.6±0.8
34	Internal Grain and Texture						
	5 Much Better Than Check						
	4 Better Than Check						
	3 Equivalent To Check						
	2 Poorer Than Check						
	1 Much Poorer Than Check		3.5±0.8		2.9±1.1		2.9±0.9

III. Cooperator Quality Assessment

Quality Trait 1-2: Protein							
	5 Much Better Than Check						
	4 Better Than Check						
	3 Equivalent To Check						
	2 Poorer Than Check						
	1 Much Poorer Than Check		2.2±0.6		2.0±0.8		1.5±0.7
Quality Trait 3-20: Milling							
	5 Much Better Than Check						
	4 Better Than Check						
	3 Equivalent To Check						
	2 Poorer Than Check						
	1 Much Poorer Than Check		3.3±1.1		2.7±1.1		2.9±1.3
Quality Trait 21-34: Baking							
	5 Much Better Than Check						
	4 Better Than Check						
	3 Equivalent To Check						
	2 Poorer Than Check						
	1 Much Poorer Than Check		3.0±0.7		2.8±1.0		2.4±0.8
Quality Trait 1-34: Overall Comparison							
	5 Much Better Than Check						
	4 Better Than Check						
	3 Equivalent To Check						
	2 Poorer Than Check						
	1 Much Poorer Than Check		2.8±0.6		2.6±1.0		2.4±1.0

I. USDA/ARS WQL Results/Evaluation

Quality Trait

		Casselton		Crookston	
		Glenn Check	MN01333-A-2	Glenn Check	MN01333-A-2
1	Wheat Protein (12%mb)	14.8	13.7	13.9	12.5
2	Flour Protein (12%mb)	14.1	12.8	13.0	11.4
3	Market Value (Score 1-6)	4.4	4.4	4.4	4.2
4	Market Value (Score 1-10)	10.0	8.8	10.0	8.4
5	Test Weight (lb/bu)	62.9	63.3	65.4	63.5
6	1000 Kernel Weight (g)	31.9	34.5	33.9	32.3
7	Kernel Size % Large	64	65	72	70
8	Kernel Size % Small	4	4	3	4
9	Wheat Moisture (%)	13.0	12.3	12.6	12.3
10	NIR Hardness	80.2	68.7	78.9	70.8
11	Wheat Ash (14%mb)	1.57	1.52	1.36	1.34
12	Wheat Falling Number (sec)	466	483	424	475
13	Vitreous Kernels (%)	94.0	56.8	99.1	77.1
Patent Flour Extraction (%)					
14	Tempered Wheat Basis (%)	71.3	74.4	70.4	74.5
15	Total Product Basis (%)	74.7	78.0	74.3	78.4
16	Patent Flour /Bu Wheat (lbs)	44.9	47.1	46.0	47.3
17	Flour Color (L/b Hunter Lab)	87.2/8.7	86.6/9.4	87.6/9.1	87.3/9.8
18	Flour Moisture (%)	12.9	13.1	12.5	12.6
19	Flour Ash (14%mb)	0.679	0.632	0.628	0.630
20	Wheat PPO Activity (Abs @ 475)	0.918	1.026	0.799	0.794
Farinograph					
21	Water Absorption (500bu)	66.9	62.6	68.7	64.7
22	Water Absorption (14%mb)	65.6	61.6	67.0	63.1
23	Arrival Time (min)	2.4	2.5	2.4	1.4
24	Peak Time (min)	7.2	5.9	4.7	5.2
25	Dough Stability (min)	10.0	10.6	7.7	8.2
26	MTI (bu)	31	20	27	33
27	TTB (min)	12.1	13.2	10.1	10.0
28	Bake Absorption (%) - average	65.2±2.5	61.7±2.0	65.3±2.5	62.2±2.2
29	Average Loaf Volume (% of Check)		95.7±5.9		93.8±6.3

II. Cooperator Results/Evaluation

Quality Trait		Casselton		Crookston	
		Glenn Check	MN01333-A-2	Glenn Check	MN01333-A-2
30	Mixing Requirement				
	5 Very Long				
	4 Long				
	3 Medium	_____	_____	_____	_____
	2 Short				
	1 Very Short				
		3.7±0.7	3.1±0.9	3.8±0.9	3.0±0.7
31	Dough Characteristics				
	5 Bucky-Tough				
	4 Strong-Elastic	_____		_____	
	3 Medium-Pliable		_____		_____
	2 Mellow-Very Pliable				
	1 Weak-Short or Sticky				
		3.9±0.9	3.0±0.7	3.8±0.9	2.6±0.7
32	Mixing Tolerance				
	5 Much More Tolerance Than Check				
	4 More Tolerance Than Check				
	3 Tolerance Equivalent To Check				
	2 Less Tolerance Than Check				
	1 Much Less Tolerance Than Check		_____		_____
			2.5±0.5		2.8±0.9
33	Internal Crumb Color				
	5 Much Brighter Than Check				
	4 Brighter Than Check				
	3 Equivalent To Check				
	2 Poorer Than Check		_____		_____
	1 Much Poorer Than Check				
			2.4±0.7		2.3±0.5
34	Internal Grain and Texture				
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check		_____		_____
	2 Poorer Than Check				
	1 Much Poorer Than Check				
			3.1±0.9		2.8±0.8

III. Cooperator Quality Assessment

Quality Trait 1-2: Protein					
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check				
	2 Poorer Than Check		_____		_____
	1 Much Poorer Than Check				
			2.2±0.6		1.9±0.9
Quality Trait 3-20: Milling					
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check		_____		_____
	2 Poorer Than Check				
	1 Much Poorer Than Check				
			3.3±1.0		3.1±0.9
Quality Trait 21-34: Baking					
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check		_____		_____
	2 Poorer Than Check				
	1 Much Poorer Than Check				
			2.7±1.1		2.3±0.7
Quality Trait 1-34: Overall Comparison					
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check		_____		_____
	2 Poorer Than Check				
	1 Much Poorer Than Check				
			2.5±1.0		2.2±0.8

I. USDA/ARS WQL Results/Evaluation

Quality Trait

		Casselton		Minot	
		Glenn Check	ND805	Glenn Check	ND805
1	Wheat Protein (12%mb)	14.8	13.8	15.8	15.0
2	Flour Protein (12%mb)	14.1	12.8	15.6	14.4
3	Market Value (Score 1-6)	4.4	4.2	4.6	4.0
4	Market Value (Score 1-10)	10.0	8.6	10.0	8.6
5	Test Weight (lb/bu)	62.9	61.6	62.6	59.9
6	1000 Kernel Weight (g)	31.9	34.8	32.2	34.1
7	Kernel Size % Large	64	77	56	72
8	Kernel Size % Small	4	4	4	4
9	Wheat Moisture (%)	13.0	12.8	12.5	12.6
10	NIR Hardness	80.2	90.3	70.1	88.3
11	Wheat Ash (14%mb)	1.57	1.54	1.51	1.44
12	Wheat Falling Number (sec)	466	440	406	375
13	Vitreous Kernels (%)	94.0	51.9	85.2	53.5
Patent Flour Extraction (%)					
14	Tempered Wheat Basis (%)	71.3	74.3	72.0	74.2
15	Total Product Basis (%)	74.7	77.5	76.1	78.5
16	Patent Flour /Bu Wheat (lbs)	44.9	45.8	45.0	44.5
17	Flour Color (L/b Hunter Lab)	87.2/8.7	86.2/7.7	86.5/8.5	86.9/8.1
18	Flour Moisture (%)	12.9	12.8	12.1	13.1
19	Flour Ash (14%mb)	0.679	0.648	0.581	0.624
20	Wheat PPO Activity (Abs @ 475)	0.918	0.912	0.783	0.757
Farinograph					
21	Water Absorption (500bu)	66.9	65.1	69.8	67.0
22	Water Absorption (14%mb)	65.6	63.7	67.6	66.0
23	Arrival Time (min)	2.4	2.5	4.6	4.2
24	Peak Time (min)	7.2	6.2	7.5	6.7
25	Dough Stability (min)	10.0	7.1	6.8	6.3
26	MTI (bu)	31	41	34	38
27	TTB (min)	12.1	9.7	11.8	10.5
28	Bake Absorption (%) - average	65.2±2.5	62.9±1.6	66.5±2.7	65.0±2.0
29	Average Loaf Volume (% of Check)		98.8±6.3		96.3±5.8

II. Cooperator Results/Evaluation

Quality Trait		Casselton		Minot	
		Glenn Check	ND805	Glenn Check	ND805
30	Mixing Requirement				
	5 Very Long				
	4 Long				
	3 Medium	_____	_____	_____	_____
	2 Short				
	1 Very Short				
		3.7±0.7	3.1±0.6	3.7±0.8	3.5±0.7
31	Dough Characteristics				
	5 Bucky-Tough				
	4 Strong-Elastic				
	3 Medium-Pliable	_____	_____	_____	_____
	2 Mellow-Very Pliable				
	1 Weak-Short or Sticky				
		3.9±0.9	3.1±0.9	3.5±1.0	3.4±1.1
32	Mixing Tolerance				
	5 Much More Tolerance Than Check				
	4 More Tolerance Than Check				
	3 Tolerance Equivalent To Check				
	2 Less Tolerance Than Check				
	1 Much Less Tolerance Than Check				
			2.3±0.9		2.8±0.4
33	Internal Crumb Color				
	5 Much Brighter Than Check				
	4 Brighter Than Check				
	3 Equivalent To Check		_____		_____
	2 Poorer Than Check				
	1 Much Poorer Than Check				
			3.7±0.9		3.0±0.8
34	Internal Grain and Texture				
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check		_____		_____
	2 Poorer Than Check				
	1 Much Poorer Than Check				
			3.1±0.9		3.1±1.1

III. Cooperator Quality Assessment

Quality Trait 1-2: Protein					
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check		_____		_____
	2 Poorer Than Check				
	1 Much Poorer Than Check				
			2.2±0.6		2.3±0.5
Quality Trait 3-20: Milling					
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check		_____		_____
	2 Poorer Than Check				
	1 Much Poorer Than Check				
			3.0±1.0		3.0±1.0
Quality Trait 21-34: Baking					
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check		_____		_____
	2 Poorer Than Check				
	1 Much Poorer Than Check				
			3.1±0.9		2.8±0.6
Quality Trait 1-34: Overall Comparison					
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check		_____		_____
	2 Poorer Than Check				
	1 Much Poorer Than Check				
			2.8±0.8		2.7±0.8

I. USDA/ARS WQL Results/Evaluation

Quality Trait

		Casselton		Crookston		Minot	
		Glenn Check	BR6843	Glenn Check	BR6843	Glenn Check	BR6843
1	Wheat Protein (12%mb)	14.8	13.3	13.9	11.3	15.8	15.0
2	Flour Protein (12%mb)	14.1	12.7	13.0	10.3	15.6	14.2
3	Market Value (Score 1-6)	4.4	3.0	4.4	2.7	4.6	3.5
4	Market Value (Score 1-10)	10.0	6.0	10.0	3.8	10.0	7.4
5	Test Weight (lb/bu)	62.9	58.5	65.4	60.8	62.6	59.9
6	1000 Kernel Weight (g)	31.9	29.3	33.9	28.7	32.2	29.5
7	Kernel Size % Large	64	35	72	47	56	42
8	Kernel Size % Small	4	10	3	8	4	6
9	Wheat Moisture (%)	13.0	12.7	12.6	12.2	12.5	12.7
10	NIR Hardness	80.2	71.4	78.9	66.8	70.1	63.5
11	Wheat Ash (14%mb)	1.57	1.63	1.36	1.41	1.51	1.48
12	Wheat Falling Number (sec)	466	401	424	368	406	295
13	Vitreous Kernels (%)	94.0	17.6	99.1	18.8	85.2	30.3
Patent Flour Extraction (%)							
14	Tempered Wheat Basis (%)	71.3	74.9	70.4	74.7	72.0	73.5
15	Total Product Basis (%)	74.7	78.7	74.3	78.4	76.1	77.6
16	Patent Flour /Bu Wheat (lbs)	44.9	43.8	46.0	45.4	45.0	44.0
17	Flour Color (L/b Hunter Lab)	87.2/8.7	87.0/8.9	87.6/9.1	87.6/9.4	86.5/8.5	86.4/8.6
18	Flour Moisture (%)	12.9	13.2	12.5	13.0	12.1	11.9
19	Flour Ash (14%mb)	0.679	0.742	0.628	0.613	0.581	0.645
20	Wheat PPO Activity (Abs @ 475)	0.918	0.925	0.799	0.747	0.783	0.631
Farinograph							
21	Water Absorption (500bu)	66.9	61.6	68.7	60.3	69.8	66.0
22	Water Absorption (14%mb)	65.6	60.7	67.0	59.1	67.6	63.6
23	Arrival Time (min)	2.4	3.0	2.4	1.2	4.6	4.6
24	Peak Time (min)	7.2	7.7	4.7	2.2	7.5	7.5
25	Dough Stability (min)	10.0	9.6	7.7	8.3	6.8	7.8
26	MTI (bu)	31	28	27	11	34	30
27	TTB (min)	12.1	13.0	10.1	9.7	11.8	12.1
28	Bake Absorption (%) - average	65.2±2.5	61.1±2.1	65.3±2.5	59.2±2.0	66.5±2.7	63.8±2.5
29	Average Loaf Volume (% of Check)		97.0±9.0		90.3±8.7		92.9±8.0

II. Cooperator Results/Evaluation

Quality Trait		Casselton		Crookston		Minot	
		Glenn Check	BR6843	Glenn Check	BR6843	Glenn Check	BR6843
30	Mixing Requirement						
	5 Very Long						
	4 Long						
	3 Medium	_____	_____	_____	_____	_____	_____
	2 Short						
	1 Very Short						
		3.7±0.7	3.6±0.7	3.8±0.9	3.2±1.0	3.7±0.8	3.5±0.7
31	Dough Characteristics						
	5 Bucky-Tough						
	4 Strong-Elastic						
	3 Medium-Pliable	_____	_____	_____	_____	_____	_____
	2 Mellow-Very Pliable						
	1 Weak-Short or Sticky						
		3.9±0.9	3.2±0.6	3.8±0.9	2.9±1.0	3.5±1.0	3.2±1.1
32	Mixing Tolerance						
	5 Much More Tolerance Than Check						
	4 More Tolerance Than Check						
	3 Tolerance Equivalent To Check						_____
	2 Less Tolerance Than Check						
	1 Much Less Tolerance Than Check						
			2.6±0.7		2.4±1.1		3.3±0.7
33	Internal Crumb Color						
	5 Much Brighter Than Check						
	4 Brighter Than Check						
	3 Equivalent To Check						
	2 Poorer Than Check						_____
	1 Much Poorer Than Check						
			2.9±0.9		2.8±0.6		2.3±0.9
34	Internal Grain and Texture						
	5 Much Better Than Check						
	4 Better Than Check						
	3 Equivalent To Check						_____
	2 Poorer Than Check						
	1 Much Poorer Than Check						
			3.4±0.8		3.2±0.9		3.0±1.0

III. Cooperator Quality Assessment

Quality Trait 1-2: Protein							
	5 Much Better Than Check						
	4 Better Than Check						
	3 Equivalent To Check						
	2 Poorer Than Check						
	1 Much Poorer Than Check						
			1.9±0.9		1.4±0.7		2.3±0.5
Quality Trait 3-20: Milling							
	5 Much Better Than Check						
	4 Better Than Check						
	3 Equivalent To Check						
	2 Poorer Than Check						_____
	1 Much Poorer Than Check						
			2.7±1.1		2.8±1.3		2.3±0.7
Quality Trait 21-34: Baking							
	5 Much Better Than Check						
	4 Better Than Check						
	3 Equivalent To Check						
	2 Poorer Than Check						_____
	1 Much Poorer Than Check						
			2.8±1.2		2.1±1.3		2.5±1.2
Quality Trait 1-34: Overall Comparison							
	5 Much Better Than Check						
	4 Better Than Check						
	3 Equivalent To Check						
	2 Poorer Than Check						_____
	1 Much Poorer Than Check						
			2.6±1.2		2.0±0.9		2.7±1.1

I. USDA/ARS WQL Results/Evaluation

Quality Trait

		Casselton		Crookston		Minot	
		Glenn Check	CS 3100L	Glenn Check	CS 3100L	Glenn Check	CS 3100L
1	Wheat Protein (12%mb)	14.8	12.7	13.9	11.7	15.8	14.3
2	Flour Protein (12%mb)	14.1	11.8	13.0	10.8	15.6	13.7
3	Market Value (Score 1-6)	4.4	3.2	4.4	3.5	4.6	2.9
4	Market Value (Score 1-10)	10.0	6.0	10.0	5.6	10.0	6.4
5	Test Weight (lb/bu)	62.9	60.8	65.4	61.5	62.6	59.4
6	1000 Kernel Weight (g)	31.9	29.9	33.9	28.9	32.2	28.4
7	Kernel Size % Large	64	30	72	43	56	25
8	Kernel Size % Small	4	13	3	12	4	12
9	Wheat Moisture (%)	13.0	13.0	12.6	13.3	12.5	12.3
10	NIR Hardness	80.2	62.6	78.9	70.9	70.1	77.5
11	Wheat Ash (14%mb)	1.57	1.65	1.36	1.46	1.51	1.46
12	Wheat Falling Number (sec)	466	405	424	443	406	401
13	Vitreous Kernels (%)	94.0	13.0	99.1	65.0	85.2	24.1
Patent Flour Extraction (%)							
14	Tempered Wheat Basis (%)	71.3	75.7	70.4	76.2	72.0	75.5
15	Total Product Basis (%)	74.7	79.3	74.3	79.8	76.1	78.9
16	Patent Flour /Bu Wheat (lbs)	44.9	46.0	46.0	46.9	45.0	44.8
17	Flour Color (L/b Hunter Lab)	87.2/8.7	87.3/9.7	87.6/9.1	88.1/10.0	86.5/8.5	87.0/9.3
18	Flour Moisture (%)	12.9	12.7	12.5	12.5	12.1	12.6
19	Flour Ash (14%mb)	0.679	0.636	0.628	0.694	0.581	0.649
20	Wheat PPO Activity (Abs @ 475)	0.918	0.934	0.799	0.865	0.783	0.841
Farinograph							
21	Water Absorption (500bu)	66.9	57.2	68.7	59.6	69.8	61.7
22	Water Absorption (14%mb)	65.6	55.7	67.0	57.9	67.6	60.1
23	Arrival Time (min)	2.4	1.8	2.4	1.6	4.6	3.6
24	Peak Time (min)	7.2	5.0	4.7	5.3	7.5	5.8
25	Dough Stability (min)	10.0	8.1	7.7	7.4	6.8	5.6
26	MTI (bu)	31	31	27	40	34	41
27	TTB (min)	12.1	9.6	10.1	9.2	11.8	9.1
28	Bake Absorption (%) - average	65.2±2.5	58.0±3.0	65.3±2.5	58.9±2.5	66.5±2.7	60.9±2.2
29	Average Loaf Volume (% of Check)		90.8±9.6		89.8±10.1		89.7±8.0

II. Cooperator Results/Evaluation

Quality Trait		Casselton		Crookston		Minot	
		Glenn Check	CS 3100L	Glenn Check	CS 3100L	Glenn Check	CS 3100L
30	Mixing Requirement						
	5 Very Long						
	4 Long	_____	_____	_____	_____	_____	_____
	3 Medium						
	2 Short						
	1 Very Short						
		3.7±0.7	2.9±0.9	3.8±0.9	3.4±0.8	3.7±0.9	2.8±0.9
31	Dough Characteristics						
	5 Bucky-Tough						
	4 Strong-Elastic	_____	_____	_____	_____	_____	_____
	3 Medium-Pliable						
	2 Mellow-Very Pliable						
	1 Weak-Short or Sticky						
		3.9±0.9	3.0±0.7	3.8±0.9	2.8±1.1	3.4±1.0	2.8±0.9
32	Mixing Tolerance						
	5 Much More Tolerance Than Check						
	4 More Tolerance Than Check						
	3 Tolerance Equivalent To Check						
	2 Less Tolerance Than Check						
	1 Much Less Tolerance Than Check						
			2.5±1.1		2.6±0.8		2.0±0.7
33	Internal Crumb Color						
	5 Much Brighter Than Check						
	4 Brighter Than Check						
	3 Equivalent To Check	_____	_____	_____	_____	_____	_____
	2 Poorer Than Check						
	1 Much Poorer Than Check						
			3.1±1.0		2.5±0.7		2.4±1.0
34	Internal Grain and Texture						
	5 Much Better Than Check						
	4 Better Than Check						
	3 Equivalent To Check	_____	_____	_____	_____	_____	_____
	2 Poorer Than Check						
	1 Much Poorer Than Check						
			3.4±1.1		3.0±1.2		3.2±1.1

III. Cooperator Quality Assessment

Quality Trait 1-2: Protein							
	5 Much Better Than Check						
	4 Better Than Check						
	3 Equivalent To Check						
	2 Poorer Than Check						
	1 Much Poorer Than Check						
			1.4±1.0		1.6±1.3		2.1±0.7
Quality Trait 3-20: Milling							
	5 Much Better Than Check						
	4 Better Than Check						
	3 Equivalent To Check	_____	_____	_____	_____	_____	_____
	2 Poorer Than Check						
	1 Much Poorer Than Check						
			2.7±1.4		2.7±1.2		2.8±1.3
Quality Trait 21-34: Baking							
	5 Much Better Than Check						
	4 Better Than Check						
	3 Equivalent To Check	_____	_____	_____	_____	_____	_____
	2 Poorer Than Check						
	1 Much Poorer Than Check						
			2.3±1.3		2.3±1.3		2.3±1.3
Quality Trait 1-34: Overall Comparison							
	5 Much Better Than Check						
	4 Better Than Check						
	3 Equivalent To Check	_____	_____	_____	_____	_____	_____
	2 Poorer Than Check						
	1 Much Poorer Than Check						
			2.1±1.2		1.9±1.4		2.4±1.2

I. USDA/ARS WQL Results/Evaluation

Quality Trait

		Casselton		Minot	
		Glenn Check	ND804	Glenn Check	ND804
1	Wheat Protein (12%mb)	14.8	13.9	15.8	15.8
2	Flour Protein (12%mb)	14.1	13.0	15.6	15.3
3	Market Value (Score 1-6)	4.4	4.0	4.6	4.1
4	Market Value (Score 1-10)	10.0	9.0	10.0	9.2
5	Test Weight (lb/bu)	62.9	62.6	62.6	60.9
6	1000 Kernel Weight (g)	31.9	31.9	32.2	31.8
7	Kernel Size % Large	64	78	56	69
8	Kernel Size % Small	4	3	4	4
9	Wheat Moisture (%)	13.0	12.8	12.5	12.7
10	NIR Hardness	80.2	88.5	70.1	77.8
11	Wheat Ash (14%mb)	1.57	1.57	1.51	1.42
12	Wheat Falling Number (sec)	466	423	406	460
13	Vitreous Kernels (%)	94.0	69.8	85.2	72.9
Patent Flour Extraction (%)					
14	Tempered Wheat Basis (%)	71.3	69.6	72.0	71.5
15	Total Product Basis (%)	74.7	73.4	76.1	75.5
16	Patent Flour /Bu Wheat (lbs)	44.9	43.6	45.0	43.5
17	Flour Color (L/b Hunter Lab)	87.2/8.7	86.3/9.3	86.5/8.5	86.3/8.8
18	Flour Moisture (%)	12.9	12.5	12.1	12.3
19	Flour Ash (14%mb)	0.679	0.676	0.581	0.595
20	Wheat PPO Activity (Abs @ 475)	0.918	0.686	0.783	0.864
Farinograph					
21	Water Absorption (500bu)	66.9	72.8	69.8	74.3
22	Water Absorption (14%mb)	65.6	71.1	67.6	72.2
23	Arrival Time (min)	2.4	3.2	4.6	4.5
24	Peak Time (min)	7.2	7.0	7.5	8.5
25	Dough Stability (min)	10.0	7.8	6.8	7.1
26	MTI (bu)	31	37	34	36
27	TTB (min)	12.1	11.6	11.8	12.7
28	Bake Absorption (%) - average	65.2±2.5	67.3±4.1	66.7±2.8	68.5±4.0
29	Average Loaf Volume (% of Check)		95.7±7.7		94.4±5.7

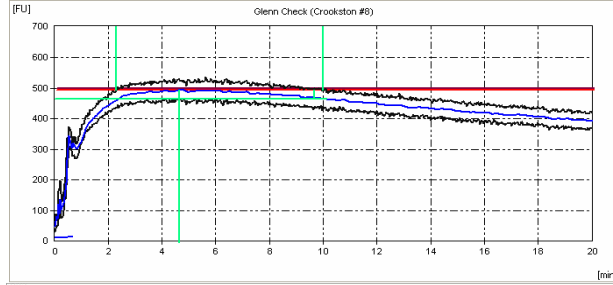
II. Cooperator Results/Evaluation

Quality Trait		Casselton		Minot	
		Glenn Check	ND804	Glenn Check	ND804
30	Mixing Requirement				
	5 Very Long				
	4 Long				
	3 Medium	_____	_____	_____	_____
	2 Short				
	1 Very Short				
		3.7±0.7	2.8±0.6	3.7±0.9	3.3±0.8
31	Dough Characteristics				
	5 Bucky-Tough				
	4 Strong-Elastic				
	3 Medium-Pliable	_____	_____	_____	_____
	2 Mellow-Very Pliable				
	1 Weak-Short or Sticky				
		3.9±0.9	2.7±1.2	3.4±1.0	3.0±0.9
32	Mixing Tolerance				
	5 Much More Tolerance Than Check				
	4 More Tolerance Than Check				
	3 Tolerance Equivalent To Check				
	2 Less Tolerance Than Check				
	1 Much Less Tolerance Than Check				
			2.2±0.8		2.6±0.5
33	Internal Crumb Color				
	5 Much Brighter Than Check				
	4 Brighter Than Check				
	3 Equivalent To Check				
	2 Poorer Than Check				
	1 Much Poorer Than Check				
			2.8±0.9		2.4±0.8
34	Internal Grain and Texture				
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check				
	2 Poorer Than Check				
	1 Much Poorer Than Check				
			2.8±1.1		2.4±0.7

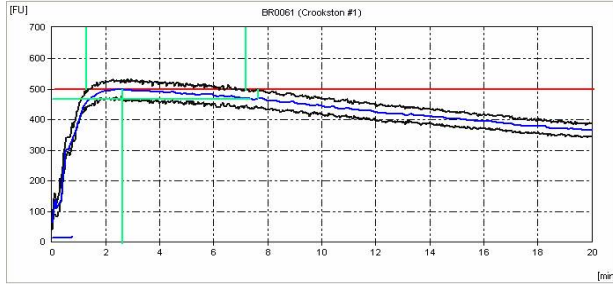
III. Cooperator Quality Assessment

Quality Trait 1-2: Protein					
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check				
	2 Poorer Than Check				
	1 Much Poorer Than Check				
			2.2±0.4		2.9±0.3
Quality Trait 3-20: Milling					
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check				
	2 Poorer Than Check				
	1 Much Poorer Than Check				
			2.7±0.5		2.9±0.3
Quality Trait 21-34: Baking					
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check				
	2 Poorer Than Check				
	1 Much Poorer Than Check				
			2.7±0.8		2.5±0.7
Quality Trait 1-34: Overall Comparison					
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check				
	2 Poorer Than Check				
	1 Much Poorer Than Check				
			2.5±1.0		2.6±0.7

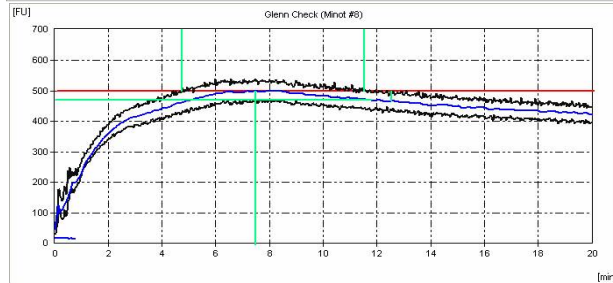
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KCK8



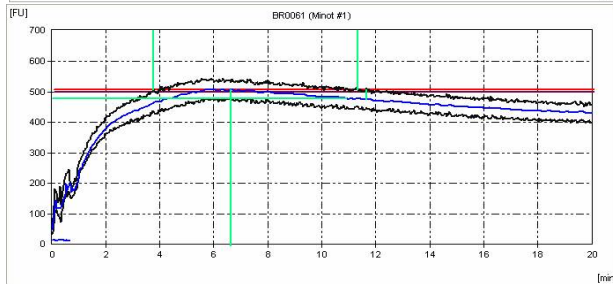
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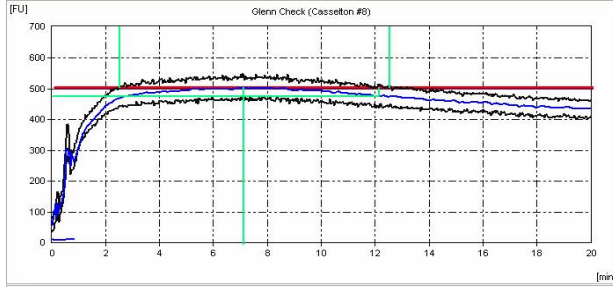
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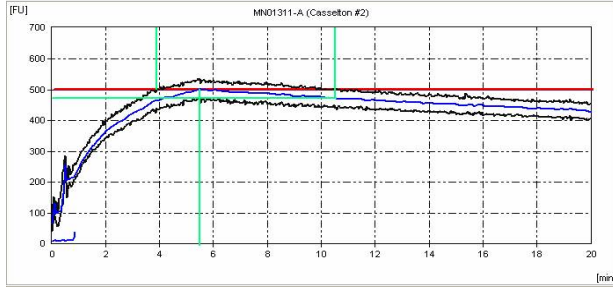
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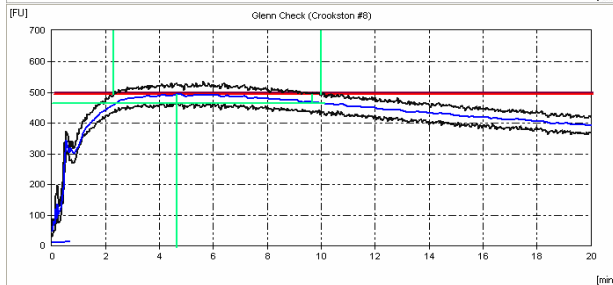
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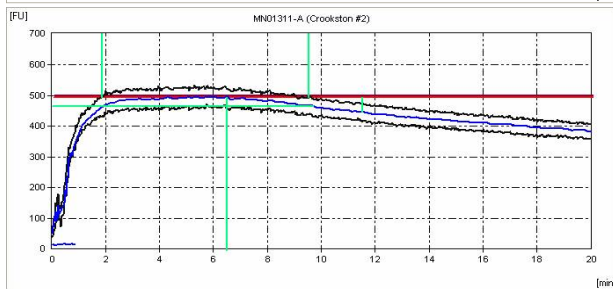
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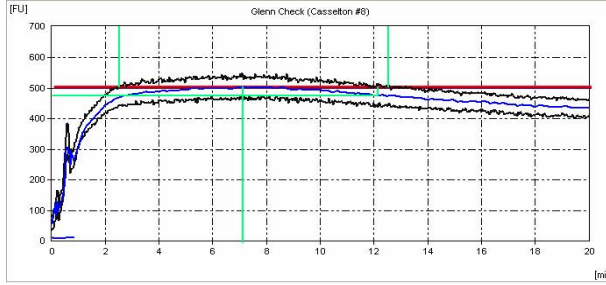
Glenn Check
KCK8



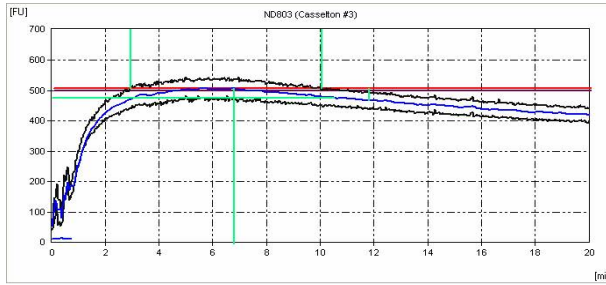
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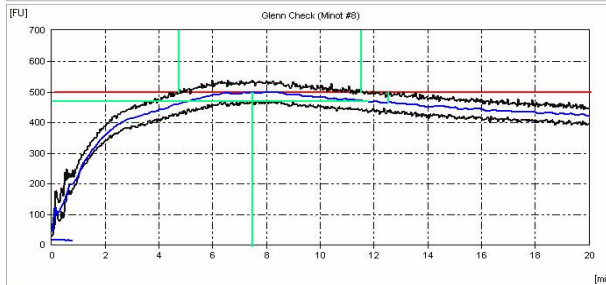
Glenn Check
CCK8



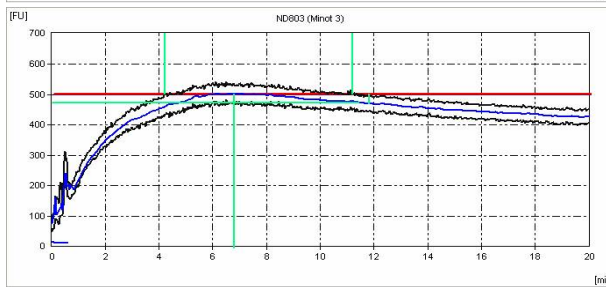
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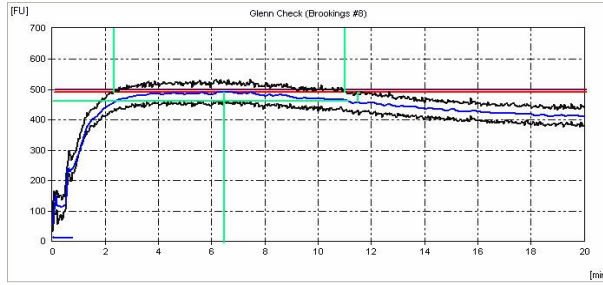
Glenn Check
MCK8



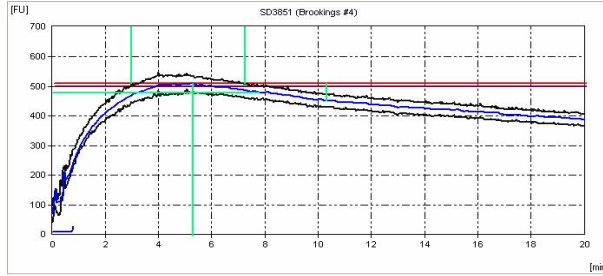
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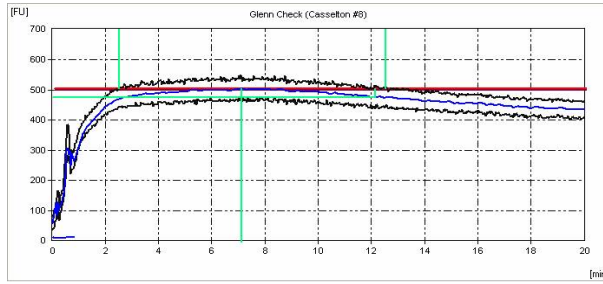
Glenn Check
BCK8



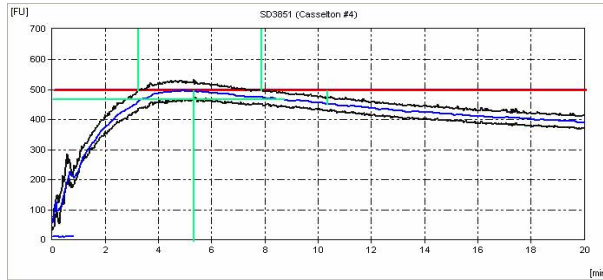
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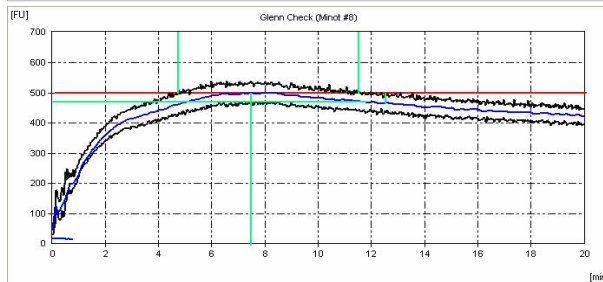
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CCK8



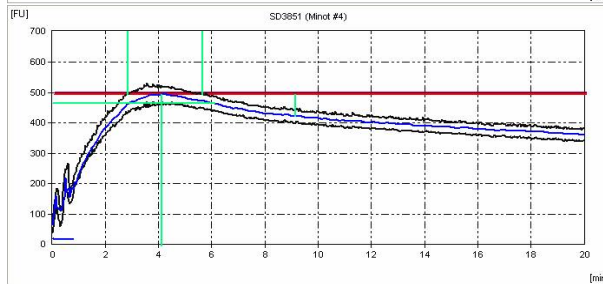
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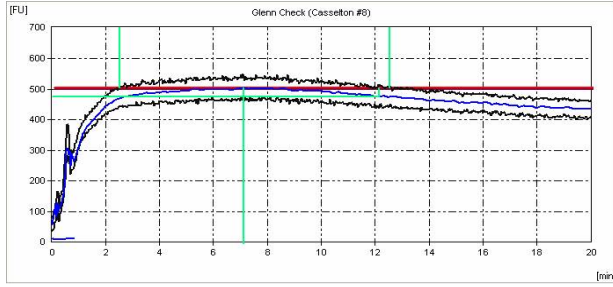
Glenn Check
MCK8



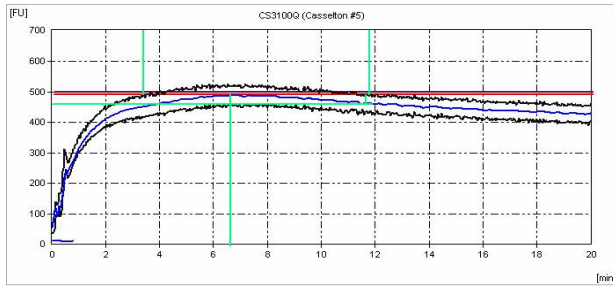
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M4



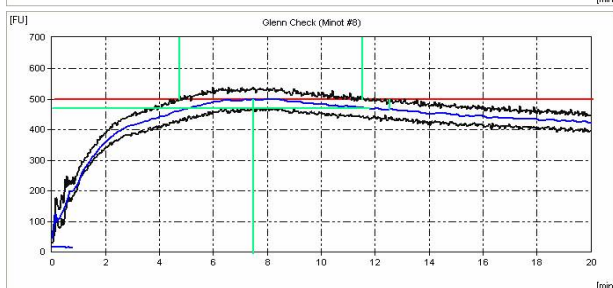
Glenn Check
CCK8



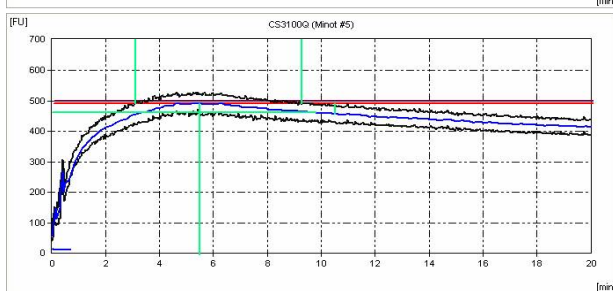
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C5



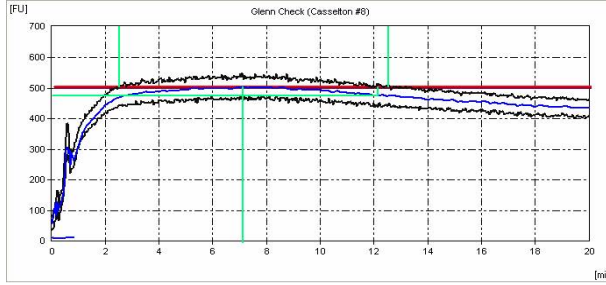
Glenn Check
MCK8



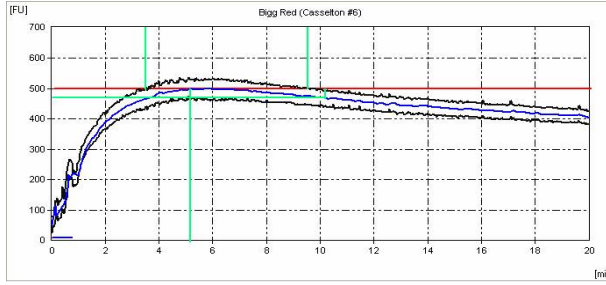
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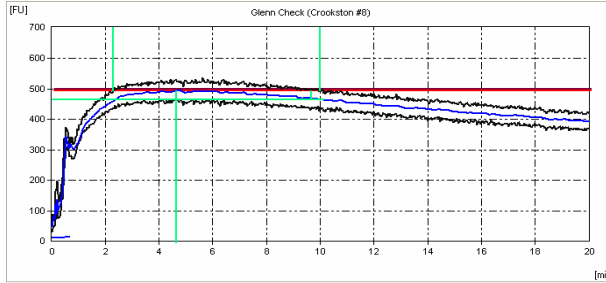
Glenn Check
CCK8



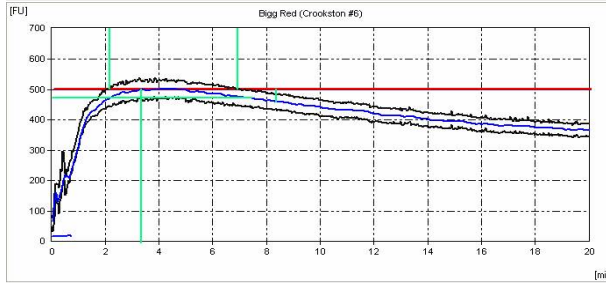
Bigg Red
C6



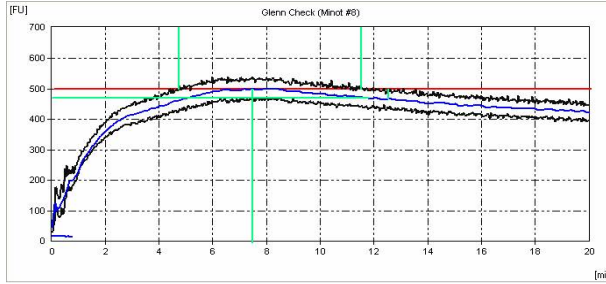
Glenn Check
KCK8



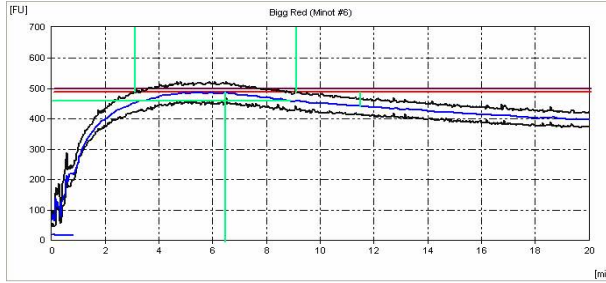
Bigg Red
K6



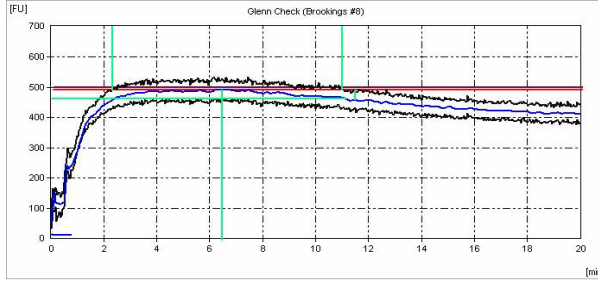
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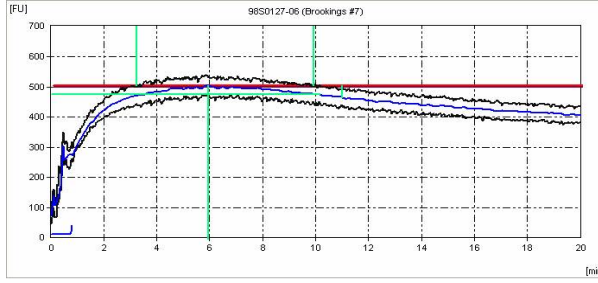
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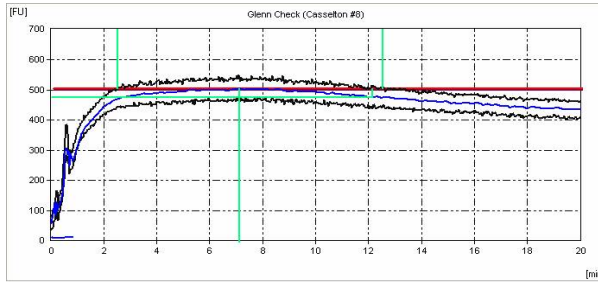
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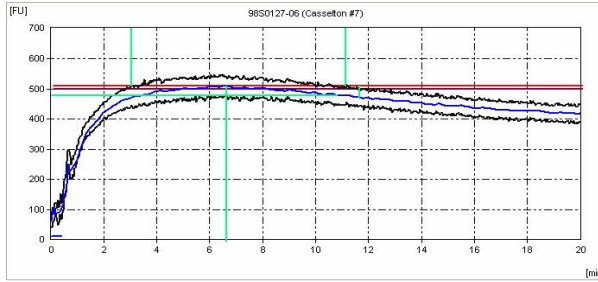
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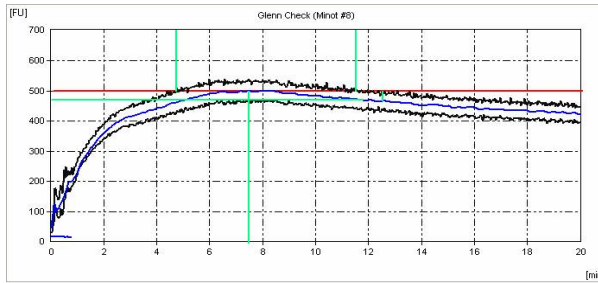
Glenn Check
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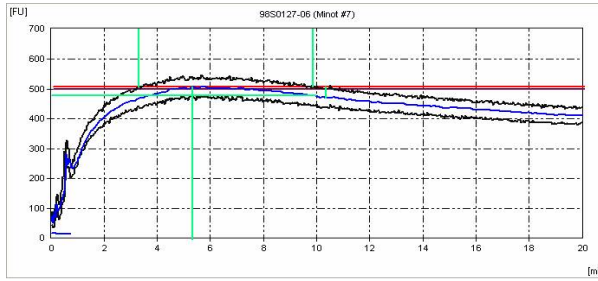
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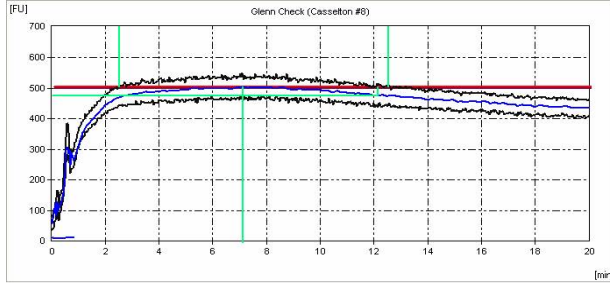
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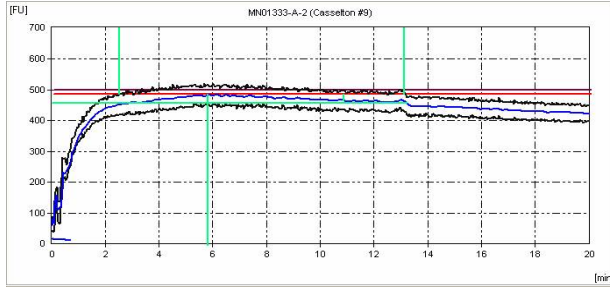
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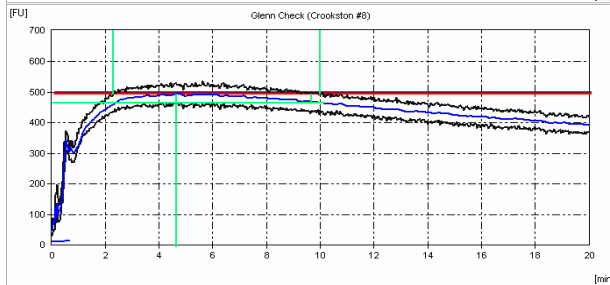
Glenn Check
CCK8



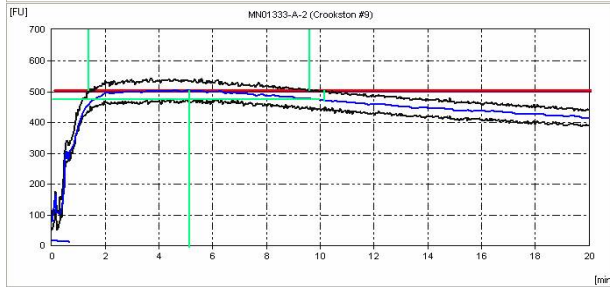
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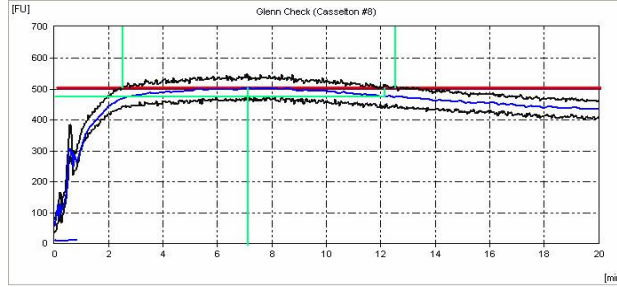
Glenn Check
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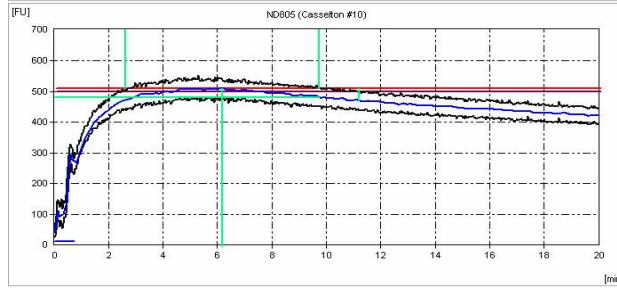
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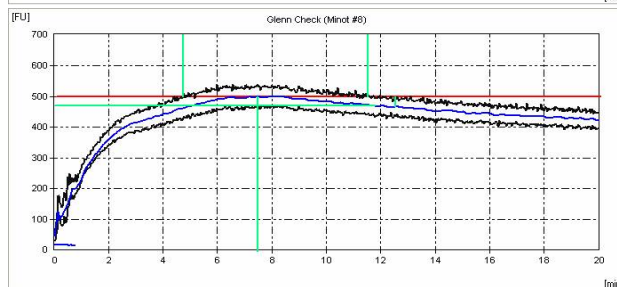
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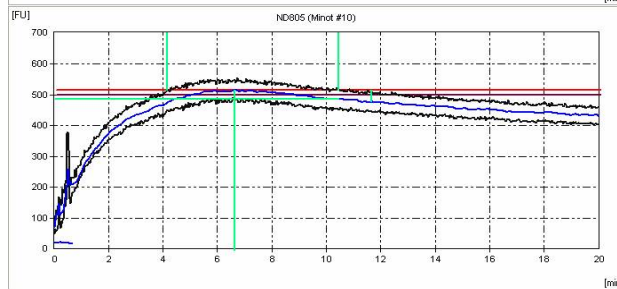
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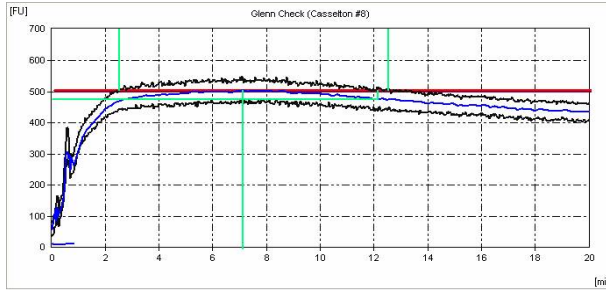
Glenn Check
MCK8



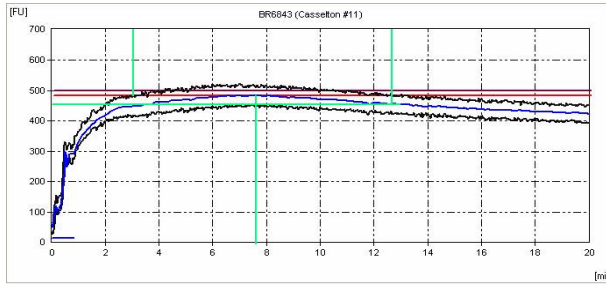
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M10



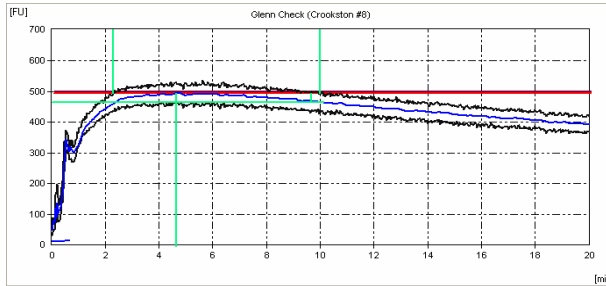
Glenn Check
CCK8



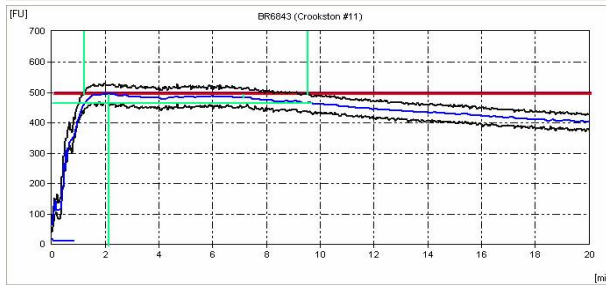
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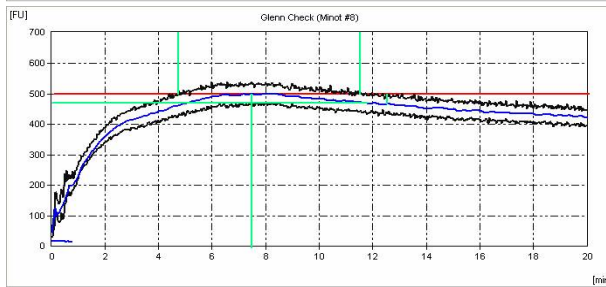
Glenn Check
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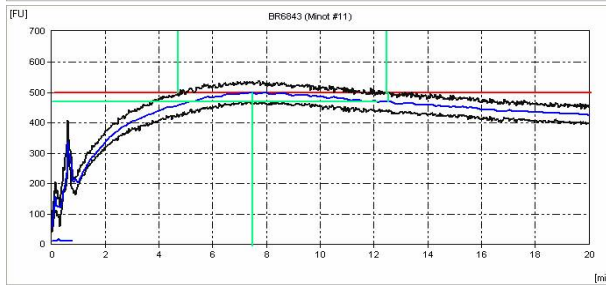
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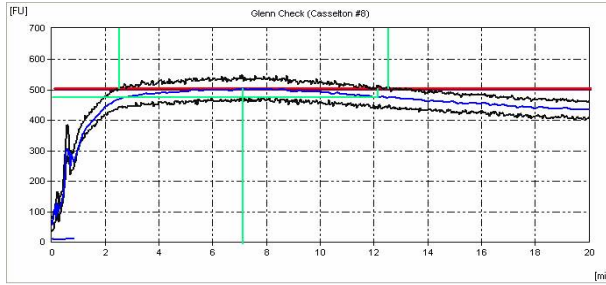
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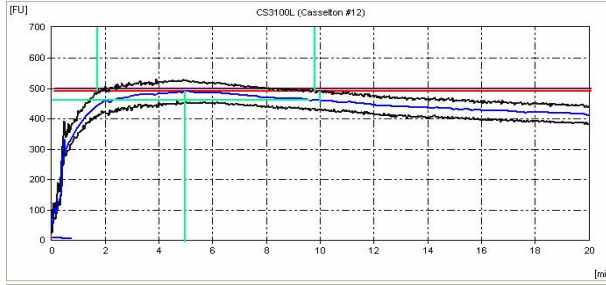
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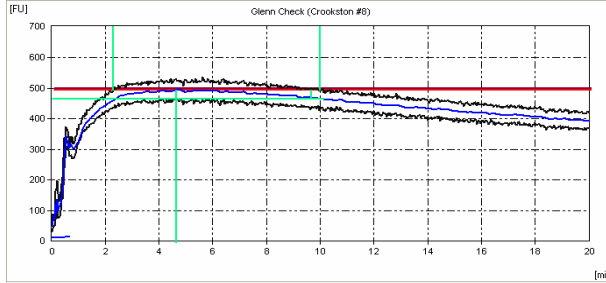
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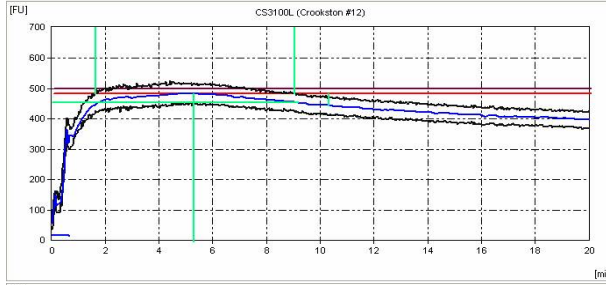
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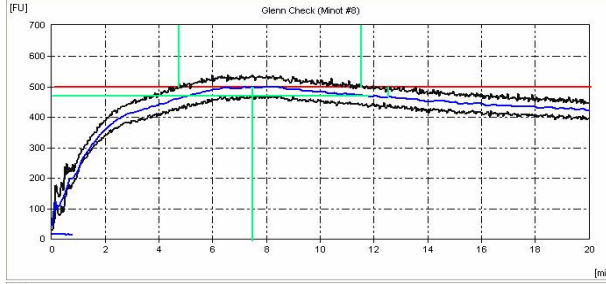
Glenn Check
KCK8



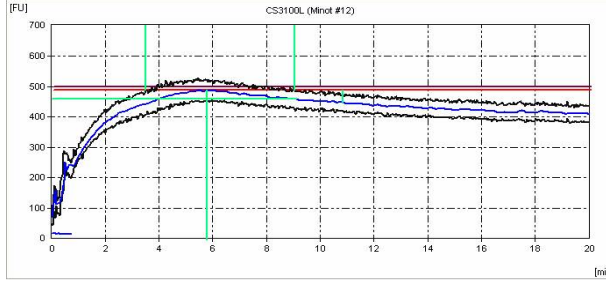
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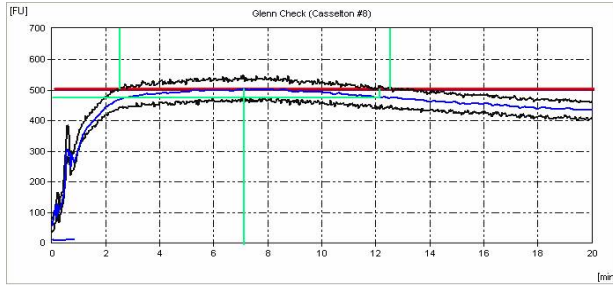
Glenn Check
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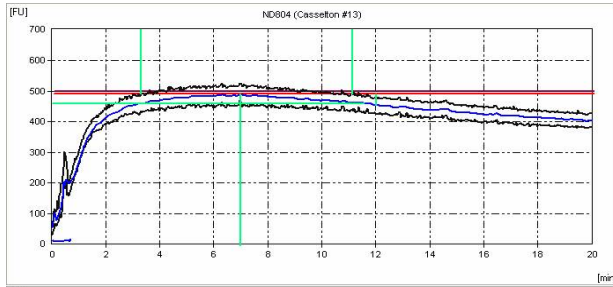
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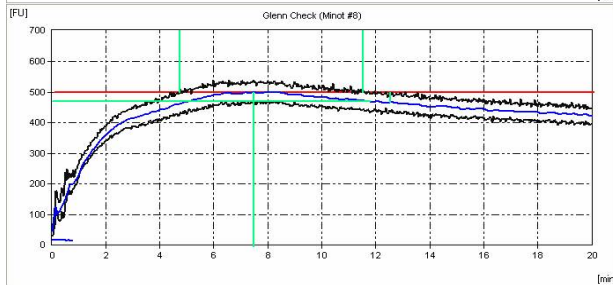
Glenn Check
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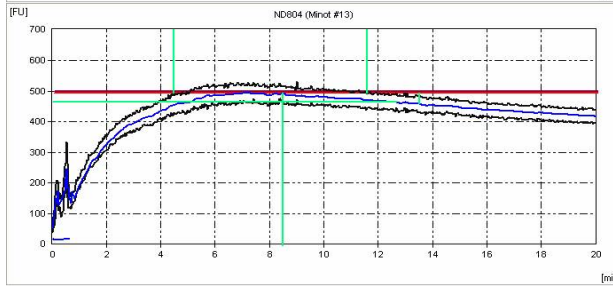
ND804
C13



Glenn Check
MCK8



ND804
M13



Comparative Results Among Bake Cooperators

Glenn Check

Brookings		Bake	Bake	Loaf	Mixing	Dough
Cooperator	Method	Absorption	Volume	Requirement	Characteristic	
1	Sponge/Dough	61	2850	3	3	
2	Straight Dough -lb	64.3	3050	3	2	
3	Sponge/Dough	64	993	5	5	
4	Sponge/Dough	66	3015	5	5	
5	Straight Dough	69.7	2900	4	3	
6	Straight Dough	66	2800	4	3	
7	Straight Dough	65.3	1070	4	5	
8	Straight Dough	70.7	895	5	5	
9	Sponge/Dough	66.9	710	3	3	
10	Straight Dough	67.9	800	3	3	
Average		66.2		3.9	3.7	
± 1 Std Dev		2.8		0.9	1.2	

Casselton		Bake	Bake	Loaf	Mixing	Dough
Cooperator	Method	Absorption	Volume	Requirement	Characteristic	
1	Sponge/Dough	61	2700	4	5	
2	Straight Dough -lb	63.6	2950	4	3	
3	Sponge/Dough	64	993	4	4	
4	Sponge/Dough	66	2986	5	4	
5	Straight Dough	67.6	2950	3	3	
6	Straight Dough	64	2800	4	4	
7	Straight Dough	64.1	1060	3	5	
8	Straight Dough	69.9	878	4	5	
9	Sponge/Dough	65.4	710	3	3	
10	Straight Dough	66.6	845	3	3	
Average		65.2		3.7	3.9	
± 1 Std Dev		2.5		0.7	0.9	

Crookston		Bake	Bake	Loaf	Mixing	Dough
Cooperator	Method	Absorption	Volume	Requirement	Characteristic	
1	Sponge/Dough	60	2700	3	3	
2	Straight Dough -lb	65	3200	4	3	
3	Sponge/Dough	63	918	5	5	
4	Sponge/Dough	66	3045	5	5	
5	Straight Dough	69	3050	3	3	
6	Straight Dough	64	2700	3	4	
7	Straight Dough	65.5	980	4	5	
8	Straight Dough	66.8	810	5	4	
9	Sponge/Dough	67.2	610	3	3	
10	Straight Dough	66.7	775	3	3	
Average		65.3		3.8	3.8	
± 1 Std Dev		2.5		0.9	0.9	

Minot		Bake	Bake	Loaf	Mixing	Dough
Cooperator	Method	Absorption	Volume	Requirement	Characteristic	
1	Sponge/Dough	62	2800	4	5	
2	Straight Dough -lb	65.7	3000	4	2	
3	Sponge/Dough	64	988	5	4	
4	Sponge/Dough	66	3074	5	5	
5	Straight Dough	68.7	2900	3	3	
6	Straight Dough	65	2700	3	3	
7	Straight Dough	66.1	1250	3	3	
8	Straight Dough	71.8	1043	4	4	
9	Sponge/Dough	68.3	720	3	3	
10	Straight Dough	67	960	3	3	
Average		66.5		3.7	3.5	
± 1 Std Dev		2.7		0.8	1.0	

		Quality Factors Compared to Glenn Check											
Cooperator	Bake Method	Bake Absorption	Loaf Volume	LV % of CK	Mixing Requirement	Dough Characteristic	Mix	Crumb	Grain &	Protein	Milling	Baking	Overall
							Tolerance	Color	Texture				
1	Sponge/Dough	57	2700	100.0	2	3	3	3	3	2		3	3
2	Straight Dough -lb	60	2600	81.3	5	5	2	3	4	1	2	2	2
3	Sponge/Dough	60	828	90.2	3	3	2	3	3	1	2	2	2
4	Sponge/Dough	61	2986	98.1	4	2	1	3	4	1	2	2	2
5	Straight Dough	64	2525	82.8	2	4	3	2	4	2	2	2	2
6	Straight Dough	62	2250	83.3	2	2	1	2	2	1	3	1	1
7	Straight Dough	60.5	715	73.0	5	5	1	1	1	1	3	1	1
8	Straight Dough	64.5	713	88.0	5	3	3	4	4	3	2	2	2
9	Sponge/Dough	63.0	560	91.8	3	3	2	3	2	1	2	3	2
10	Straight Dough	64.3	620	80.0	3	2	2	2	3	1	2	1	1
	Average	61.6		86.8	3.4	3.2	2.0	2.6	3.0	1.4	2.2	1.9	1.8
	± 1 Std Dev	2.4		8.4	1.3	1.1	0.8	0.8	1.1	0.7	0.4	0.7	0.6

		Quality Factors Compared to Glenn Check											
Cooperator	Bake Method	Bake Absorption	Loaf Volume	LV % of CK	Mixing Requirement	Dough Characteristic	Mix	Crumb	Grain &	Protein	Milling	Baking	Overall
							Tolerance	Color	Texture				
1	Sponge/Dough	61	2800	100.0	4	5	3	3	3	2		3	3
2	Straight Dough -lb	61.4	3100	103.3	4	3	3	3	3	2	2	4	5
3	Sponge/Dough	64	1027	103.9	4	4	4	4	5	4	2	4	3
4	Sponge/Dough	63	2956	96.2	5	5	3	2	4	2	2	4	3
5	Straight Dough	65.9	2525	87.1	3	3	3	4	3	2	4	2	3
6	Straight Dough	63	2650	98.1	3	3	3	2		3	3	3	3
7	Straight Dough	62.4	1250	100.0	3	3	4	2	2	2	4	3	2
8	Straight Dough	68	1033	99.0	4	3	3	4	5	3	2	4	4
9	Straight Dough	64.7	700	97.2	3	3	4	3	3	2	2	3	2
10	Straight Dough	63.7	780	81.3	3	3	4	2	4	2	2	2	2
	Average	63.7		96.6	3.6	3.5	3.4	2.9	3.6	2.4	2.6	3.2	3.0
	± 1 Std Dev	2.1		7.1	0.7	0.8	0.5	0.9	1.0	0.7	0.9	0.8	0.9

		Quality Factors Compared to Glenn Check											
Casselton Cooperator	Bake Method	Bake Absorption	Loaf Volume	LV % of CK	Mixing Requirement	Dough Characteristic	Mix	Crumb	Grain &	Protein	Milling	Baking	Overall
							Tolerance	Color	Texture				
1	Sponge/Dough	61	2900	107.4	2	3	2	3	3	3		2	2
2	Straight Dough -lb	61.4	3150	106.8	3	3	4	4	4	3	3	4	4
3	Sponge/Dough	64	910	91.6	2	2	2	3	2	3	4	2	2
4	Sponge/Dough	63	2897	97.0	3	2	1	2	2	2	2	2	2
5	Straight Dough	65.5	2950	100.0	2	4	4	4	2	4	4	3	2
6	Straight Dough	62	2600	92.9	2	2	1	2	3	3	4	2	2
7	Straight Dough	62.0	980	92.5	2	3	1	2	2	3	5	2	2
8	Straight Dough	62.1	910	103.6	3	3	2	3	5	4	4	5	5
9	Sponge/Dough	63	635	89.4	2	2	2	2	3	3	3	2	3
10	Straight Dough	63	625	74.0	3	3	2	2	3	3	3	2	3
	Average	62.7		95.5	2.4	2.7	2.1	2.7	2.9	3.1	3.6	2.6	2.7
	± 1 Std Dev	1.3		9.9	0.5	0.7	1.1	0.8	1.0	0.6	0.9	1.1	1.1

		Quality Factors Compared to Glenn Check											
Crookston Cooperator	Bake Method	Bake Absorption	Loaf Volume	LV % of CK	Mixing Requirement	Dough Characteristic	Mix	Crumb	Grain &	Protein	Milling	Baking	Overall
							Tolerance	Color	Texture				
1	Sponge/Dough	58	2650	98.1	2	3	3	3	4	2		2	2
2	Straight Dough -lb	61.4	2850	89.1	3	3	4	3	3	1	4	3	3
3	Sponge/Dough	60	812	88.5	3	3	2	3	3	1	3	2	2
4	Sponge/Dough	63	2927	96.1	4	4	2	2	3	1	2	2	2
5	Straight Dough	65.3	2675	87.7	3	2	4	2	4	2	3	2	2
6	Straight Dough	62	2200	81.5	3	2	1	2	2	1	4	1	2
7	Straight Dough	61.8	835	85.2	4	3	3	2	2	1	5	1	1
8	Straight Dough	64.4	700	86.4	5	5	3	3	4	4	3	2	3
9	Sponge/Dough	63.4	565	92.6	3	3	3	2	2	2	3	3	2
10	Straight Dough	63.9	620	80.0	3	2	3	2	3	2	3	1	2
	Average	62.3		88.5	3.3	3.0	2.8	2.4	3.0	1.7	3.3	1.9	2.1
	± 1 Std Dev	2.2		5.8	0.8	0.9	0.9	0.5	0.8	0.9	0.9	0.7	0.6

		Quality Factors Compared to Glenn Check											
Casselton Cooperator	Bake Method	Bake Absorption	Loaf Volume	LV % of CK	Mixing Requirement	Dough Characteristic	Mix	Crumb	Grain &	Protein	Milling	Baking	Overall
							Tolerance	Color	Texture				
1	Sponge/Dough	60	2800	103.7	3	3	2	3	3	2		2	2
2	Straight Dough -lb	65	2800	94.9	3	3	4	4	4	3	3	4	3
3	Sponge/Dough	64	908	91.4	3	3	2	3	3	2	4	2	2
4	Sponge/Dough	66	2883	96.6	2	2	1	3	2	2	3	2	2
5	Straight Dough	69.3	3025	102.5	3	3	3	4	3	2	3	4	4
6	Straight Dough	64	2600	92.9	2	2	2	3	3	2	4	2	2
7	Straight Dough	65.8	1030	97.2	3	3	1	2	2	2	5	3	3
8	Straight Dough	65.4	940	107.1	3	3	2	3	5	5	4	5	5
9	Sponge/Dough	67.2	690	97.2	3	2	2	3	3	3	3	3	3
10	Straight Dough	66.7	750	88.8	3	3	2	2	2	3	3	3	3
	Average	65.3		97.2	2.8	2.7	2.1	3.0	3.0	2.6	3.6	3.0	2.9
	± 1 Std Dev	2.4		5.7	0.4	0.5	0.9	0.7	0.9	1.0	0.7	1.1	1.0

		Quality Factors Compared to Glenn Check											
Minot Cooperator	Bake Method	Bake Absorption	Loaf Volume	LV % of CK	Mixing Requirement	Dough Characteristic	Mix	Crumb	Grain &	Protein	Milling	Baking	Overall
							Tolerance	Color	Texture				
1	Sponge/Dough	62	2850	101.8	2	4	2	3	3	3		2	2
2	Straight Dough -lb	65.7	3200	106.7	4	3	4	3	3	3	3	4	5
3	Sponge/Dough	64	937	94.8	3	4	2	4	4	3	3	2	2
4	Sponge/Dough	66	2986	97.1	5	5	3	3	2	3	3	2	2
5	Straight Dough	69.9	2550	87.9	3	3	3	3	2	2	4	2	3
6	Straight Dough	64	2800	103.7	3	3	3	3		3	4	3	3
7	Straight Dough	66.4	1155	92.4	2	3	3	2	2	3	5	3	3
8	Straight Dough	72.4	1018	97.6	3	4	2	3	5	3	2	3	4
9	Sponge/Dough	67.4	710	98.6	3	3	3	3	3	3	3	3	3
10	Straight Dough	65.4	785	81.8	2	3	3	3	3	3	3	2	3
	Average	66.3		96.2	3.0	3.5	2.8	3.0	3.0	2.9	3.3	2.6	3.0
	± 1 Std Dev	3.0		7.4	0.9	0.7	0.6	0.5	1.0	0.3	0.9	0.7	0.9

							Quality Factors Compared to Glenn Check						
Cooperator	Bake	Bake	Loaf	LV	Mixing	Dough	Mix	Crumb	Grain &	Protein	Milling	Baking	Overall
	Method	Absorption	Volume	% of CK	Requirement	Characteristic	Tolerance	Color	Texture				
1	Sponge/Dough	60	2725	95.6	2	3	2	2	2	2	3	3	3
2	Straight Dough -lb	62.1	2700	88.5	3	3	3	3	3	2	4	2	2
3	Sponge/Dough	63	775	78.0	1	1	1	1	1	3	3	1	1
4	Sponge/Dough	65	2515	83.4	1	1	1	2	1	2	2	1	1
5	Straight Dough	74.2	2725	94.0	4	2	3	3	2	4	4	2	2
6	Straight Dough	63	2300	82.1	1	1	1	3	2	3	4	1	1
7	Straight Dough	63.0	925	86.4	2	2	1	3	4	3	4	1	2
8	Straight Dough	59.4	843	94.2	3	2	2	3	4	2	2	4	4
9	Sponge/Dough	65.1	650	91.5	2	2	2	3	3	3	2	2	2
10	Straight Dough	65.1	630	78.8	2	2	2	3	4	3	2	2	2
	Average	64.0		87.3	2.1	1.9	1.8	2.6	2.6	2.7	3.0	1.9	2.0
	± 1 Std Dev	4.1		6.5	1.0	0.7	0.8	0.7	1.2	0.7	1.0	1.0	0.9

							Quality Factors Compared to Glenn Check						
Cooperator	Bake	Bake	Loaf	LV	Mixing	Dough	Mix	Crumb	Grain &	Protein	Milling	Baking	Overall
	Method	Absorption	Volume	% of CK	Requirement	Characteristic	Tolerance	Color	Texture				
1	Sponge/Dough	60.0	2450	90.7	2	3	1	1	3	2		1	1
2	Straight Dough -lb	64.4	2650	89.8	3	3	4	4	4	2	3	4	2
3	Sponge/Dough	63.0	768	77.3	1	1	1	2	1	2	2	1	1
4	Sponge/Dough	63.0	2397	80.3	1	1	1	1	1	2	1	1	1
5	Straight Dough	65.4	3000	101.7	3	1	4	3	3	2	4	4	5
6	Straight Dough	63.0	2400	85.7	2	2	1	3	2	2	4	1	2
7	Straight Dough	61.9	960	90.6	2	2	1	1	2	2	5	1	1
8	Straight Dough	59.9	830.0	94.5	2	4	1	3	4	2	2	2	2
9	Sponge/Dough	63.6	600	84.5	2	2	2	2	3	3	2	2	2
10	Straight Dough	63.6	555	65.7	2	2	2	1	3	3	2	1	2
	Average	62.8		86.1	2.0	2.1	1.8	2.1	2.6	2.2	2.8	1.8	1.9
	± 1 Std Dev	1.8		10.0	0.7	1.0	1.2	1.1	1.1	0.4	1.3	1.2	1.2

							Quality Factors Compared to Glenn Check						
Cooperator	Bake	Bake	Loaf	LV	Mixing	Dough	Mix	Crumb	Grain &	Protein	Milling	Baking	Overall
	Method	Absorption	Volume	% of CK	Requirement	Characteristic	Tolerance	Color	Texture				
1	Sponge/Dough	61.0	2600	92.9	1	3	1	2	3	2		1	1
2	Straight Dough -lb	62.1	2500	83.3	2	3	3	2	2	2	2	2	2
3	Sponge/Dough	64	690	69.8	1	1	1	1	1	1	2	1	1
4	Sponge/Dough	65.0	2574	83.7	1	1	1	1	1	2	1	1	1
5	Straight Dough	66.3	2100	72.4	1	1	1	1	1	2	3	2	2
6	Straight Dough	63	2250	83.3	1	1	1	1	1	2	4	1	1
7	Straight Dough	62.8	915	73.2	1	1	1	1	1	2	4	1	1
8	Straight Dough	61.1	783	75.1	2	2	2	2	2	2	2	3	2
9	Sponge/Dough	63.8	625	86.8	2	2	1	1	2	2	1	2	2
10	Straight Dough	62.8	620	64.6	2	2	1	1	2	2	1	1	1
	Average	63.2		78.5	1.4	1.7	1.3	1.3	1.7	1.9	2.2	1.5	1.4
	± 1 Std Dev	1.7		8.8	0.5	0.8	0.7	0.5	0.7	0.3	1.2	0.7	0.5

		Quality Factors Compared to Glenn Check											
Casselton Cooperator	Bake Method	Bake Absorption	Loaf Volume	LV % of CK	Mixing Requirement	Dough Characteristic	Mix	Crumb	Grain &	Protein	Milling	Baking	Overall
							Tolerance	Color	Texture				
1	Sponge/Dough	61	2900	107.4	3	4	2	4	3	3		2	2
2	Straight Dough -lb	59.3	3150	106.8	3	3	4	4	4	3	3	4	3
3	Sponge/Dough	64	1005	101.2	4	4	3	5	4	3	2	4	4
4	Sponge/Dough	61	2927	98.0	5	5	3	4	2	3	2	3	3
5	Straight Dough	63.3	3125	105.9	3	3	2	4	3	3	3	5	4
6	Straight Dough	61	2800	100.0	3	3	3	3	3	3	4	3	3
7	Straight Dough	59.8	1080	101.9	3	4	2	4	3	3	5	3	2
8	Straight Dough	65.9	950	108.2	5	3	3	4	5	5	2	5	5
9	Sponge/Dough	61.5	650	91.5	3	3	3	3	3	3	2	3	3
10	Straight Dough	63	720	85.2	3	3	3	3	4	3	2	2	2
	Average	62.0		100.6	3.5	3.5	2.8	3.8	3.4	3.2	2.8	3.4	3.1
	± 1 Std Dev	2.0		7.4	0.8	0.7	0.6	0.6	0.8	0.6	1.1	1.1	1.0

		Quality Factors Compared to Glenn Check											
Minot Cooperator	Bake Method	Bake Absorption	Loaf Volume	LV % of CK	Mixing Requirement	Dough Characteristic	Mix	Crumb	Grain &	Protein	Milling	Baking	Overall
							Tolerance	Color	Texture				
1	Sponge/Dough	60	2700	96.4	3	4	2	2	4	2		3	3
2	Straight Dough -lb	60	3100	103.3	3	1	3	4	3	2	2	3	1
3	Sponge/Dough	63	952	96.4	3	3	2	4	4	3	2	2	2
4	Sponge/Dough	61	2927	95.2	4	4	2	3	2	2	2	2	2
5	Straight Dough	64.1	2575	88.8	3	1	3	3	3	2	2	2	3
6	Straight Dough	62	2500	92.6	3	3	3	1		2	3	2	2
7	Straight Dough	60.6	1040	83.2	3	3	2	2	1	1	5	1	1
8	Straight Dough	64.6	983	94.2	3	3	2	4	5	3	2	4	4
9	Sponge/Dough	62.5	650	90.3	2	2	3	3	3	2	2	2	2
10	Straight Dough	61.5	710	74.0	3	2	3	2	3	2	2	1	2
	Average	61.9		91.4	3.0	2.6	2.5	2.8	3.1	2.1	2.4	2.2	2.2
	± 1 Std Dev	1.6		8.1	0.5	1.1	0.5	1.0	1.2	0.6	1.0	0.9	0.9

							Quality Factors Compared to Glenn Check						
Casselton		Bake	Bake	Loaf	LV	Mixing	Dough	Mix	Crumb	Grain &			
Cooperator	Method	Absorption	Volume	% of CK	Requirement	Characteristic	Tolerance	Color	Texture	Protein	Milling	Baking	Overall
1	Sponge/Dough	61	2700	100.0	2	4	2	2	3	3		1	1
2	Straight Dough -lb	64.3	2750	93.2	3	3	4	4	4	3	2	4	3
3	Sponge/Dough	63	828	83.4	2	2	1	3	2	2	3	2	1
4	Sponge/Dough	66	2721	91.1	1	1	1	1		2	2	1	1
5	Straight Dough	68.8	2825	95.8	3	1	3	4	2	2	3	3	4
6	Straight Dough	65	2300	82.1	2	2	2	3	3	2	4	2	2
7	Straight Dough	65.3	900	84.9	2	2	1	1	2	2	5	2	2
8	Straight Dough	60.9	818	93.2	3	4	2	3	4	2	2	2	2
9	Sponge/Dough	67.5	610	85.9	3	2	2	2	3	3	3	2	3
10	Straight Dough	66.5	650	76.9	3	2	2	2	2	3	3	1	2
	Average	64.8		88.7	2.4	2.3	2.0	2.5	2.8	2.4	3.0	2.0	2.1
	± 1 Std Dev	2.6		7.1	0.7	1.1	0.9	1.1	0.8	0.5	1.0	0.9	1.0

							Quality Factors Compared to Glenn Check						
Crookston		Bake	Bake	Loaf	LV	Mixing	Dough	Mix	Crumb	Grain &			
Cooperator	Method	Absorption	Volume	% of CK	Requirement	Characteristic	Tolerance	Color	Texture	Protein	Milling	Baking	Overall
1	Sponge/Dough	58	2500	92.6	2	2	2	2	2	2		2	2
2	Straight Dough -lb	64.3	2800	87.5	3	3	3	4	3	1	4	4	4
3	Sponge/Dough	61	767	83.6	1	1	1	1	1	2	3	1	1
4	Sponge/Dough	65	2662	87.4	1	1	1	3	1	1	2	1	1
5	Straight Dough	68.6			2	1	4	2	4	2	3	1	1
6	Straight Dough	65	2100	77.8	1	1	1	2	2	1	4	1	1
7	Straight Dough	65.1	800	81.6	2	2	1	1	2	2	4	1	1
8	Straight Dough	61.5	725	89.5	3	2	2	3	4	4	3	4	3
9	Sponge/Dough	67.6	560	91.8	3	1	2	2	2	2	3	1	1
10	Straight Dough	66.6	665	85.8	2	2	2	2	3	2	3	2	2
	Average	64.3		86.4	2.0	1.6	1.9	2.2	2.4	1.9	3.2	1.8	1.7
	± 1 Std Dev	3.2		4.8	0.8	0.7	1.0	0.9	1.1	0.9	0.7	1.2	1.1

							Quality Factors Compared to Glenn Check						
Minot		Bake	Bake	Loaf	LV	Mixing	Dough	Mix	Crumb	Grain &			
Cooperator	Method	Absorption	Volume	% of CK	Requirement	Characteristic	Tolerance	Color	Texture	Protein	Milling	Baking	Overall
1	Sponge/Dough	60	2600	92.9	3	3	2	2	3	1		2	2
2	Straight Dough -lb	62.1	2900	96.7	3	3	3	3	3	1	4	3	4
3	Sponge/Dough	62	842	85.2	2	2	1	2	3	2	2	1	2
4	Sponge/Dough	65	2750	89.5	3	3	2	2	3	2	2	2	2
5	Straight Dough	66.2	2525	87.1	3	1	3	4	3	2	3	3	4
6	Straight Dough	63	2300	85.2	3	3	3	2	2	1	4	1	1
7	Straight Dough	62.7	910	72.8	2	3	2	2	1	1	4	1	1
8	Straight Dough	63.8	863	82.7	3	3	2	2	3	2	2	3	2
9	Sponge/Dough	64.4	680	94.4	3	3	2	2	3	2	3	3	3
10	Straight Dough	63.9	700	72.9	2	3	2	2	2	2	3	2	2
	Average	63.3		85.9	2.7	2.7	2.2	2.3	2.7	1.6	3.0	2.1	2.3
	± 1 Std Dev	1.8		8.2	0.5	0.7	0.6	0.7	0.7	0.5	0.9	0.9	1.1

		Quality Factors Compared to Glenn Check											
Cooperator	Bake Method	Bake Absorption	Loaf Volume	LV % of CK	Mixing Requirement	Dough Characteristic	Mix Tolerance	Crumb Color	Grain & Texture	Protein	Milling	Baking	Overall
	1	Sponge/Dough	60	2850	100.0	3	3	3	3	4	2	3	3
2	Straight Dough -lb	62.1	3000	98.4	3	3	3	4	4	2	4	3	3
3	Sponge/Dough	63	925	93.2	4	4	2	4	4	2	2	3	2
4	Sponge/Dough	65	3044	101.0	5	5	5	3	2	2	3	4	3
5	Straight Dough	68	2925	100.9	3	2	3	4	4	2	3	3	3
6	Straight Dough	63	2600	92.9	3	3	2	2	2	2	5	2	2
7	Straight Dough	62.6	955	89.3	4	5	2	3	4	2	5	2	2
8	Straight Dough	67.2	883	98.7	4	4	3	4	4	4	2	4	4
9	Sponge/Dough	64.2	650	91.5	3	3	3	3	4	2	3	3	3
10	Straight Dough	65.7	745	93.1	3	3	3	3	3	2	3	3	3
	Average	64.1		95.9	3.5	3.5	2.9	3.3	3.5	2.2	3.3	3.0	2.8
	± 1 Std Dev	2.4		4.3	0.7	1.0	0.9	0.7	0.8	0.6	1.1	0.7	0.6

		Quality Factors Compared to Glenn Check											
Cooperator	Bake Method	Bake Absorption	Loaf Volume	LV % of CK	Mixing Requirement	Dough Characteristic	Mix Tolerance	Crumb Color	Grain & Texture	Protein	Milling	Baking	Overall
	1	Sponge/Dough	60	2800	103.7	4	3	2	2	2	2	3	3
2	Straight Dough -lb	61.4	2800	94.9	4	3	4	4	4	2	2	4	3
3	Sponge/Dough	63	937	94.4	4	4	3	3	3	2	2	3	3
4	Sponge/Dough	63	2750	92.1	5	4	3	2	1	2	2	2	2
5	Straight Dough	65.5	3000	101.7	5	2	3	4	3	1	3	4	4
6	Straight Dough	63	2600	92.9	3	3	2	3	3	2	4	2	2
7	Straight Dough	62	945	89.2	4	3	2	1	2	1	5	1	1
8	Straight Dough	65.6	873	99.4	5	4	3	3	5	4	2	4	4
9	Sponge/Dough	63.7	635	89.4	3	3	3	2	3	2	2	3	2
10	Straight Dough	64.7	705	83.4	3	3	3	2	3	2	2	2	2
	Average	63.2		94.1	4.0	3.2	2.8	2.6	2.9	2.0	2.7	2.8	2.6
	± 1 Std Dev	1.8		6.2	0.8	0.6	0.6	1.0	1.1	0.8	1.1	1.0	1.0

		Quality Factors Compared to Glenn Check											
Cooperator	Bake Method	Bake Absorption	Loaf Volume	LV % of CK	Mixing Requirement	Dough Characteristic	Mix Tolerance	Crumb Color	Grain & Texture	Protein	Milling	Baking	Overall
	1	Sponge/Dough	60	2700	96.4	3	3	2	2	4	1	2	2
2	Straight Dough -lb	62.1	2800	93.3	3	3	3	3	3	1	3	3	4
3	Sponge/Dough	63	892	90.3	3	2	2	4	4	2	2	2	2
4	Sponge/Dough	65	2986	97.1	5	4	2	2	2	2	2	2	2
5	Straight Dough	66.1	2925	100.9	3	2	3	4	3	2	3	3	4
6	Straight Dough	63	2350	87.0	3	3	3	3	3	1	5	2	2
7	Straight Dough	62.6	925	74.0	3	3	3	2	1	1	5	1	1
8	Straight Dough	66.8	908	87.1	3	3	3	2	3	3	2	4	3
9	Sponge/Dough	64.1	675	93.8	3	3	3	2	3	1	2	3	2
10	Straight Dough	63.5	675	70.3	2	3	3	2	3	1	2	2	2
	Average	63.6		89.0	3.1	2.9	2.7	2.6	2.9	1.5	2.9	2.4	2.4
	± 1 Std Dev	2.0		9.9	0.7	0.6	0.5	0.8	0.9	0.7	1.3	0.8	1.0

		Quality Factors Compared to Glenn Check											
Casselton Cooperator	Bake Method	Bake Absorption	Loaf Volume	LV % of CK	Mixing Requirement	Dough Characteristic	Mix	Crumb	Grain &	Protein	Milling	Baking	Overall
							Tolerance	Color	Texture				
1	Sponge/Dough	60	2700	100.0	2	3	2	2	3	2		2	2
2	Straight Dough -lb	59.3	3000	101.7	3	3	3	4	4	2	3	4	2
3	Sponge/Dough	63	930	93.7	2	2	2	2	2	2	4	2	2
4	Sponge/Dough	61	2868	96.0	5	3	2	2	2	2	2	2	2
5	Straight Dough	63.6	2875	97.5	3	4	2	2	3	2	2	3	3
6	Straight Dough	60	2600	92.9	3	3	2	2	3	2	4	2	2
7	Straight Dough	60.1	1010	95.3	3	3	3	2	3	2	5	2	2
8	Straight Dough	65.3	925	105.4	4	4	3	3	5	4	4	5	5
9	Sponge/Dough	61.1	635	89.4	3	3	3	2	3	2	3	3	3
10	Straight Dough	63.1	720	85.2	3	2	3	3	3	2	3	2	2
	Average	61.7		95.7	3.1	3.0	2.5	2.4	3.1	2.2	3.3	2.7	2.5
	± 1 Std Dev	2.0		5.9	0.9	0.7	0.5	0.7	0.9	0.6	1.0	1.1	1.0

		Quality Factors Compared to Glenn Check											
Crookston Cooperator	Bake Method	Bake Absorption	Loaf Volume	LV % of CK	Mixing Requirement	Dough Characteristic	Mix	Crumb	Grain &	Protein	Milling	Baking	Overall
							Tolerance	Color	Texture				
1	Sponge/Dough	58	2650	98.1	2	3	3	2	3	2		2	2
2	Straight Dough -lb	60.7	2900	90.6	3	3	4	3	3	1	3	3	3
3	Sponge/Dough	60	842	91.7	2	2	2	2	2	2	3	2	2
4	Sponge/Dough	63	2839	93.2	3	2	1	2	2	1	2	2	2
5	Straight Dough	65.1	2900	95.1	4	2	3	2	4	2	2	2	2
6	Straight Dough	62	2350	87.0	3	3	2	2	2	1	4	2	2
7	Straight Dough	61.6	890	90.8	3	3	4	2	3	2	5	2	2
8	Straight Dough	64.6	860	106.2	4	4	3	3	4	4	3	4	4
9	Sponge/Dough	63.2	610	100.0	3	2	3	3	2	2	3	2	1
10	Straight Dough	63.7	660	85.2	3	2	3	2	3	2	3	2	2
	Average	62.2		93.8	3.0	2.6	2.8	2.3	2.8	1.9	3.1	2.3	2.2
	± 1 Std Dev	2.2		6.3	0.7	0.7	0.9	0.5	0.8	0.9	0.9	0.7	0.8

		Quality Factors Compared to Glenn Check											
Casselton Cooperator	Bake Method	Bake Absorption	Loaf Volume	LV % of CK	Mixing Requirement	Dough Characteristic	Mix	Crumb	Grain &	Protein	Milling	Baking	Overall
							Tolerance	Color	Texture				
1	Sponge/Dough	60	2800	103.7	3	4	2	2	3	2		3	3
2	Straight Dough -lb	61.4	3000	101.7	4	4	4	4	4	2	3	4	3
3	Sponge/Dough	63	927	93.4	3	2	2	4	3	2	3	2	2
4	Sponge/Dough	63	3015	101.0	4	4	2	5	4	2	2	4	3
5	Straight Dough	65.7	3100	105.1	3	2	4	5	3	2	2	4	4
6	Straight Dough	62	2900	103.6	2	2	2	3	3	2	4	3	2
7	Straight Dough	62.2	990	93.4	3	3	1	3	1	2	5	2	2
8	Straight Dough	63.8	913	104.0	3	4	2	3	4	4	2	4	4
9	Sponge/Dough	63.6	685	96.5	3	3	2	4	3	2	3	3	3
10	Straight Dough	64.1	725	85.8	3	3	2	4	3	2	3	2	2
	Average	62.9		98.8	3.1	3.1	2.3	3.7	3.1	2.2	3.0	3.1	2.8
	± 1 Std Dev	1.6		6.3	0.6	0.9	0.9	0.9	0.9	0.6	1.0	0.9	0.8

		Quality Factors Compared to Glenn Check											
Minot Cooperator	Bake Method	Bake Absorption	Loaf Volume	LV % of CK	Mixing Requirement	Dough Characteristic	Mix	Crumb	Grain &	Protein	Milling	Baking	Overall
							Tolerance	Color	Texture				
1	Sponge/Dough	61	2800	100.0	4	5	3	3	3	2		3	3
2	Straight Dough -lb	64.3	2800	93.3	4	2	3	4	4	2	3	3	2
3	Sponge/Dough	64	968	98.0	4	4	2	3	4	3	3	2	2
4	Sponge/Dough	66	2986	97.1	5	5	3	3	2	2	3	2	2
5	Straight Dough	68	2925	100.9	3	2	3	3	2	2	3	3	4
6	Straight Dough	64	2700	100.0	3	3	3	2		3	4	3	3
7	Straight Dough	64.6	1195	95.6	3	3	2	2	2	2	5	3	3
8	Straight Dough	67.8	1013	97.1	3	4	3	4	5	3	2	4	4
9	Sponge/Dough	65.5	720	100.0	3	3	3	4	3	2	2	3	2
10	Straight Dough	64.5	780	81.3	3	3	3	2	3	2	2	2	2
	Average	65.0		96.3	3.5	3.4	2.8	3.0	3.1	2.3	3.0	2.8	2.7
	± 1 Std Dev	2.0		5.8	0.7	1.1	0.4	0.8	1.1	0.5	1.0	0.6	0.8

							Quality Factors Compared to Glenn Check						
Casselton	Bake	Bake	Loaf	LV	Mixing	Dough	Mix	Crumb	Grain &	Protein	Milling	Baking	Overall
Cooperator	Method	Absorption	Volume	% of CK	Requirement	Characteristic	Tolerance	Color	Texture				
1	Sponge/Dough	60	2800	103.7	3	4	2	4	4	2	2	3	3
2	Straight Dough -lb	58.6	3000	101.7	4	3	4	4	4	2	2	4	3
3	Sponge/Dough	62	975	98.2	3	3	2	3	3	2	2	2	2
4	Sponge/Dough	61	2927	98.0	4	4	2	3	4	2	2	3	2
5	Straight Dough	62.7	3100	105.1	4	2	2	4	3	1	3	4	5
6	Straight Dough	60	2800	100.0	3	3	2	3	3	1	4	2	2
7	Straight Dough	59.2	960	90.6	4	3	3	2	2	1	5	1	1
8	Straight Dough	65.8	940	107.1	5	4	3	4	5	4	2	5	4
9	Sponge/Dough	60.1	620	87.3	3	3	3	2	3	2	2	2	2
10	Straight Dough	61.9	660	78.1	3	3	3	2	3	2	2	2	2
	Average	61.1		97.0	3.6	3.2	2.6	2.9	3.4	1.9	2.7	2.8	2.6
	± 1 Std Dev	2.1		9.0	0.7	0.6	0.7	0.9	0.8	0.9	1.1	1.2	1.2

							Quality Factors Compared to Glenn Check						
Crookston	Bake	Bake	Loaf	LV	Mixing	Dough	Mix	Crumb	Grain &	Protein	Milling	Baking	Overall
Cooperator	Method	Absorption	Volume	% of CK	Requirement	Characteristic	Tolerance	Color	Texture				
1	Sponge/Dough	57	2800	103.7	2	3	3	3	4	2	2	3	3
2	Straight Dough -lb	57.1	2900	90.6	4	4	3	4	4	1	4	4	2
3	Sponge/Dough	60	842	91.7	2	2	1	3	2	1	1	1	2
4	Sponge/Dough	59	2927	96.1	2	3	1	3	4	1	2	2	2
5	Straight Dough	61.1	2400	78.7	4	2	2	3	4	2	3	1	1
6	Straight Dough	58	2200	81.5	3	2	1	2	2	1	4	1	1
7	Straight Dough	57.3	865	88.3	4	3	4	2	2	1	5	1	2
8	Straight Dough	63.3	813	100.4	5	5	3	3	4	3	2	4	4
9	Sponge/Dough	58.8	570	93.4	3	3	3	3	3	1	2	3	2
10	Straight Dough	60.3	610	78.7	3	2	3	2	3	1	2	1	1
	Average	59.2		90.3	3.2	2.9	2.4	2.8	3.2	1.4	2.8	2.1	2.0
	± 1 Std Dev	2.0		8.7	1.0	1.0	1.1	0.6	0.9	0.7	1.3	1.3	0.9

							Quality Factors Compared to Glenn Check						
Mnot	Bake	Bake	Loaf	LV	Mixing	Dough	Mix	Crumb	Grain &	Protein	Milling	Baking	Overall
Cooperator	Method	Absorption	Volume	% of CK	Requirement	Characteristic	Tolerance	Color	Texture				
1	Sponge/Dough	61	2650	94.6	4	5	3	2	3	2	2	2	2
2	Straight Dough -lb	61.4	3100	103.3	4	2	4	3	4	2	2	4	5
3	Sponge/Dough	64	957	96.9	3	3	2	3	4	3	2	3	3
4	Sponge/Dough	63	2868	93.3	5	5	3	1	1	2	2	1	2
5	Straight Dough	65.6	2800	96.6	3	2	3	3	3	2	2	2	3
6	Straight Dough	63	2600	96.3	3	3	3	1		3	3	2	2
7	Straight Dough	62.1	1105	88.4	3	3	4	2	2	2	4	2	2
8	Straight Dough	69.7	1020	97.8	4	4	3	4	4	3	2	5	4
9	Sponge/Dough	64.5	635	88.2	3	2	4	2	3	2	2	2	2
10	Straight Dough	63.5	710	74.0	3	3	4	2	3	2	2	2	2
	Average	63.8		92.9	3.5	3.2	3.3	2.3	3.0	2.3	2.3	2.5	2.7
	± 1 Std Dev	2.5		8.0	0.7	1.1	0.7	0.9	1.0	0.5	0.7	1.2	1.1

							Quality Factors Compared to Glenn Check						
Casselton Cooperator	Bake	Bake	Loaf	LV	Mixing	Dough	Mix	Crumb	Grain &	Protein	Milling	Baking	Overall
	Method	Absorption	Volume	% of CK	Requirement	Characteristic	Tolerance	Color	Texture				
1	Sponge/Dough	59	2500	92.6	3	4	2	2	5	2	2	2	2
2	Straight Dough -lb	53.6	2700	91.5	3	4	5	4	4	1	3	4	1
3	Sponge/Dough	61	885	89.1	2	3	2	3	2	1	2	1	2
4	Sponge/Dough	59	3045	102.0	1	2	1	3	4	1	1	2	2
5	Straight Dough	57.7	2975	100.8	4	3	3	5	3	1	2	3	3
6	Straight Dough	58	2700	96.4	3	3	2	3	3	1	5	2	2
7	Straight Dough	54.2	925	87.3	3	2	2	3	2	1	5	1	1
8	Straight Dough	63.5	833	94.9	4	3	2	4	5	4	2	5	5
9	Sponge/Dough	55.7	600	84.5	3	3	3	2	3	1	2	2	2
10	Straight Dough	58.2	580	68.6	3	3	3	2	3	1	2	1	1
	Average	58.0		90.8	2.9	3.0	2.5	3.1	3.4	1.4	2.7	2.3	2.1
	± 1 Std Dev	3.0		9.6	0.9	0.7	1.1	1.0	1.1	1.0	1.4	1.3	1.2

							Quality Factors Compared to Glenn Check						
Crookston Cooperator	Bake	Bake	Loaf	LV	Mixing	Dough	Mix	Crumb	Grain &	Protein	Milling	Baking	Overall
	Method	Absorption	Volume	% of CK	Requirement	Characteristic	Tolerance	Color	Texture				
1	Sponge/Dough	58	2850	105.6	2	3	3	3	4	2	3	3	3
2	Straight Dough -lb	55.7	2700	84.4	3	4	3	3	4	1	3	3	1
3	Sponge/Dough	60	872	95.0	3	4	2	3	2	1	2	2	2
4	Sponge/Dough	59	2956	97.1	4	4	2	1	2	1	1	1	1
5	Straight Dough	59.9	2425	79.5	4	1	4	2	4	2	3	3	3
6	Straight Dough	58	2250	83.3	3	1	1	2	2	1	4	1	1
7	Straight Dough	56.4	870	88.8	4	3	2	3	2	1	5	1	1
8	Straight Dough	64.9	815	100.6	5	3	3	3	5	5	2	5	5
9	Sponge/Dough	58.1	555	91.0	3	3	3	3	2	1	2	3	1
10	Straight Dough	58.6	565	72.9	3	2	3	2	3	1	2	1	1
	Average	58.9		89.8	3.4	2.8	2.6	2.5	3.0	1.6	2.7	2.3	1.9
	± 1 Std Dev	2.5		10.1	0.8	1.1	0.8	0.7	1.2	1.3	1.2	1.3	1.4

							Quality Factors Compared to Glenn Check						
Minot Cooperator	Bake	Bake	Loaf	LV	Mixing	Dough	Mix	Crumb	Grain &	Protein	Milling	Baking	Overall
	Method	Absorption	Volume	% of CK	Requirement	Characteristic	Tolerance	Color	Texture				
1	Sponge/Dough	61	2700	96.4	3	4	2	2	4	2	2	2	2
2	Straight Dough -lb	57.9	2700	90.0	3	3	3	4	4	2	2	4	4
3	Sponge/Dough	64	868	87.9	2	3	1	2	3	2	2	2	2
4	Sponge/Dough	61	2986	97.1	5	4	2	2	3	2	2	2	2
5	Straight Dough	62.1	2775	95.7	2	2	3	3	3	2	3	3	4
6	Straight Dough	60	2500	92.6	2	1	1	1	1	2	5	1	1
7	Straight Dough	58.6	1040	83.2	3	3	2	2	1	1	5	1	1
8	Straight Dough	64.9	958	91.9	3	3	2	4	5	4	2	5	4
9	Sponge/Dough	60.2	660	91.7	2	3	2	2	3	2	2	2	2
10	Straight Dough	59.7	675	70.3	3	2	2	2	3	2	2	1	2
	Average	60.9		89.7	2.8	2.8	2.0	2.4	3.2	2.1	2.8	2.3	2.4
	± 1 Std Dev	2.2		8.0	0.9	0.9	0.7	1.0	1.1	0.7	1.3	1.3	1.2

		Quality Factors Compared to Glenn Check											
Casselton Cooperator	Bake Method	Bake Absorption	Loaf Volume	LV % of CK	Mixing Requirement	Dough Characteristic	Mix	Crumb	Grain &	Protein	Milling	Baking	Overall
							Tolerance	Color	Texture				
1	Sponge/Dough	60	2800	103.7	3	3	2	2	2	2		2	2
2	Straight Dough -lb	69.3	3100	105.1	3	3	4	4	5	2	3	4	4
3	Sponge/Dough	63	873	87.9	2	5	2	3	3	2	3	2	2
4	Sponge/Dough	66	2868	96.0	3	2	1	1	2	2	2	2	2
5	Straight Dough	73.1	2775	94.1	2	1	3	4	2	3	3	2	1
6	Straight Dough	64	2250	80.4	2	2	2	3	3	2	2	2	2
7	Straight Dough	69.6	1000	94.3	3	2	2	2	1	2	2	3	2
8	Straight Dough	66.6	880	100.2	4	4	2	3	4	3	3	3	4
9	Sponge/Dough	71.3	730	102.8	3	2	2	3	3	2	3	4	3
10	Straight Dough	69.8	785	92.9	3	3	2	3	3	2	3	3	3
	Average	67.3		95.7	2.8	2.7	2.2	2.8	2.8	2.2	2.7	2.7	2.5
	± 1 Std Dev	4.1		7.7	0.6	1.2	0.8	0.9	1.1	0.4	0.5	0.8	1.0

		Quality Factors Compared to Glenn Check											
Minot Cooperator	Bake Method	Bake Absorption	Loaf Volume	LV % of CK	Mixing Requirement	Dough Characteristic	Mix	Crumb	Grain &	Protein	Milling	Baking	Overall
							Tolerance	Color	Texture				
1	Sponge/Dough	62	2800	100.0	2	4	2	2	3	3		2	2
2	Straight Dough -lb	70	3150	105.0	4	2	3	4	3	3	3	3	3
3	Sponge/Dough	64	935	94.6	4	4	2	3	3	3	3	2	2
4	Sponge/Dough	66	2809	91.4	5	4	2	2	1	3	3	2	2
5	Straight Dough	74.2	2725	94.0	3	2	3	3	3	3	3	3	4
6	Straight Dough	65	2350	87.0	3	3	3	2		3	3	2	2
7	Straight Dough	70.7	1070	85.6	3	2	3	1	2	3	3	2	3
8	Straight Dough	70.4	1020	97.8	3	4	2	3	3	2	2	4	3
9	Sponge/Dough	72.8	685	95.1	3	2	3	2	2	3	3	2	2
10	Straight Dough	69.8	900	93.8	3	3	3	2	2	3	3	3	3
	Average	68.5		94.4	3.3	3.0	2.6	2.4	2.4	2.9	2.9	2.5	2.6
	± 1 Std Dev	4.0		5.7	0.8	0.9	0.5	0.8	0.7	0.3	0.3	0.7	0.7

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The 2006 Wheat Quality Testing Program

Source of Wheat

<u>Source – Breeding Program</u>	<u>Code#</u>	<u>Identification</u>
WWW	1	BR0061
University of Minnesota	2	MN01311-A
North Dakota State University	3	ND803 *
South Dakota State University	4	SD3851
Meridian	5	CS 3100Q
Westbred	6	Bigg Red
AgriPro	7	98S0127-06
University of Minnesota	9	MN01333-A-2
North Dakota State University	10	ND805 *
WWW	11	BR6843
Meridian	12	CS 3100L
North Dakota State University	13	ND804
Glenn Check	8	

*Second year of testing in WQC trials

Field Plot Locations and Procedures

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

South Dakota State University, Brookings, SD – Jack Ingmanson
 Northwest Experiment Station, Crookston, MN – John Wiersma
 Agronomy Seed Farm, Casselton, ND – Tom Teigen
 North Central Agricultural Experiment Station, Minot, ND – Jay Fisher

Wheat was seeded in large-scale plots of ½ acre in size to approximate commercial production. Cultural practices such as tillage and weed control common to each area were used. Consideration was also given to germination, seed size, and planting depth to provide stand uniformity. Based on soil test results from each 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.

2006 Hard Spring Wheat Production Sites

Entry #	Entry	Reference	Production Sites			
			Brookings	Casselton	Crookston	Minot
1	BR0061	WWW			X	X
2	MN01311-A	Un of MN		X	X	
3	ND803	NDSU		X		X
4	SD3851	SDSU	X	X		X
5	CS 3100Q	Meridian		X		X
6	Bigg Red	Westbred		X	X	X
7	98S0127-06	AgriPro	X	X		X
8	Glenn	Check	X	X	X	X
9	MN01333-A-2	Un of MN		X	X	
10	ND805	NDSU		X		X
11	BR6843	WWW		X	X	X
12	CS 3100L	Meridian		X	X	X
13	ND804	NDSU		X		X

Description of 2006 Experimental Lines

BR0061 – SWQAC 1

BR0061 is a tall and moderately late hard red spring wheat developed by World Wide Wheat L.L.C. (W3) with male sterile facilitated recurrent selection (MSFRS) population breeding. The cultivar was derived from a single F2 plant selected at Eloy, Arizona in 2000. Lax spikes are white with white awns. BR0061 was evaluated for yield and screened for quality 2003-2005. Yield was competitive with Cavalier and Brook. Average grain protein at 8% moisture base was 14.9% with a mini-sed rate of 13.5. A subsequent end user flour evaluation with a 14% moisture base reported .410 ash, 12.6% protein, absorption of 65.1 with a high loaf volume of 3225 cc. Interior rating was good to good. BR0061 has exhibited resistance to stripe rust, leaf rust and Septoria tritici in California. BR0061 has not been evaluated for FHB.

MN01311-A – SWQAC 2

MN01311-A (97T-1003/VERDE) has medium maturity, height, and straw strength. MN01311-A-1 has shown consistently high grain yields, especially in northern locations, good leaf rust resistance, and Fusarium head blight resistance comparable to Alsen. MN01311-A-1 has above average test weight and grain protein content, and very good resistance to preharvest sprouting.

ND803 – SWQAC 3

ND 803 hard red spring wheat (HRSW) was selected from the “ND2831/FO.2808” cross. ND 2831 is a NDSU HRSW experimental line derived from ‘Sumai 3’ wheat, a Chinese main source of resistance to Fusarium Head Scab (FHB) or scab disease. It is a medium

early line with good straw strength and semi dwarf (comparable to 'Alsen'). ND 803 has very good grain yield potential with test weight comparable to 'Parshall'. Grain protein content is similar to Alsen. Milling and baking parameters of ND 803 are good. ND 803 has good level of resistance to FHB, at least equal to Alsen. The reaction of ND 803 to leaf rust and stem rust is resistant.

SD3851 – SWQAC 4

SD3851 (ND2897/SD3219//SD3414) is an experimental hard red spring wheat breeding line developed by the South Dakota Agricultural Experiment Station. It was originally derived as a single plant from within an F₄ plant population created in the spring of 1999. It has been tested within South Dakota State University Advanced Yield Trials (AYT) from 2004 - 2006. SD3851 was tested in both the Uniform Regional Spring Wheat Nursery (URSWN) and South Dakota Crop Performance Testing trials in 2005 and 2006. In addition, SD3851 was evaluated by the Wheat Quality Council in 2006. Pending approval of the SDSU Variety Review and Release Committee, SD3851 should be made available to Registered seed producers in 2008. Coverage under the United States Plant Variety Protection Act will be sought.

Points of note associated with SD3851 include:

- 1 High yield potential
- 2 Exceptionally heavy test weight
- 3 Early heading date
- 4 Highest level of Fusarium Head Blight resistance when compared with other SDSU varieties
- 5 Moderate to highly resistant ratings for both leaf and stem rust

CS 3100Q – SWQAC 5

CS3100Q hard white spring wheat was bred and developed by New Zealand Crop and found and has been extensively tested in the USA by Meridian Seeds LLC. It will be released in 2007. CS 3100Q is a medium-tall variety with intermediate straw strength. The variety has early-medium maturity and good test weight with good protein concentration. Suitable for milling for hard white wheat programs.

Bigg Red – SWQAC 6

Bigg Red (FA-900-720) is a hard red spring wheat developed by WestBred LLC for scab impacted regions of the Northern Great Plains. It has a moderate to high tillering habit and produces extremely high test weight seed with high yield potential, medium levels of protein and acceptable bread wheat quality. Bigg Red is a medium tall variety, 1 to 2 inches taller than 2375 but with slightly better standability. It is medium maturity, 1-2 days later to head than 2375. Bigg Red has a MS-S reaction to leaf rust, R-MR to stem rust, and MS to foliar disease. It's shattering resistance is a little better than 2375. Bigg Red has a vigorous moderately resistant reaction to Fusarium Head Blight (scab).

98S0127-06 – SWQAC 7

98S0127-06 is a hard red spring wheat developed by AgriPro. It is a tentative release to AgriPro associates for planting in the spring of 2007. Limited quantities of certified seed will be available for growers in 2008. 98S0127-06 was derived from the cross “N97-0214/3/N93-0338//SUMAI#3/DALEN”. It has medium maturity and very good test weight. It is a semidwarf with height similar to Norpro. It is resistant to stem rust and moderately resistant to leaf rust. 98S0127-06 has exhibited very good protection to other leaf spotting diseases such as tan spot and septoria. Tolerance to FHB has been intermediate. 98S0127-06 is broadly adapted to the Northern Plains.

MN01333-A-2 – SWQAC 9

MN01333-A-2 (MN97008/MN97695) is relatively early maturing and short, and has good lodging resistance. MN01333-A-2 has yielded very well in Minnesota, but is not well-adapted to other environments in the spring wheat region. This line has good leaf rust resistance, but is moderately susceptible to Fusarium head blight. MN01333-A-2 has above average test weight and average grain protein content.

ND805 - SWQAC 10

ND 805 hard red spring wheat (HRSW) a selection from the “ND2857/3/KITT/AMIDON//GR/STOA SIB” cross. ND 2875 is a NDSU HRSW experimental line derived from a cross involving the ‘Sumai 3’ wheat, a Chinese main source of resistance to Fusarium Head Scab (FHB) or scab disease. Therefore, ND 805 is medium susceptible to FHB, slightly less than ‘Alsen’ resistance level. ND 805 is a medium early line with medium straw strength and semi dwarf, similar to Alsen. It is a very high yielding line with good straw strength; good test weight (similar to ‘Parshall’); and high grain protein content (comparable to Alsen). Milling and baking parameters of ND 805 are good. ND 805 is very resistant to leaf and stem rusts.

BR6843 – SWQAC 11

BR6843 is a hard red spring wheat cultivar developed by World Wide Wheat L.L.C. (W3) with male sterile facilitated recurrent selection (MSFRS) population breeding. The cultivar originated from a single F2 head selection at Maricopa, Arizona in 1996. BR6843 is a moderately tall, very sturdy, with minimal lodging susceptibility and has white middense spikes with tinted awns. BR6843 has been evaluated for yield and screened for quality 2001-2005. Yield is very competitive. Average grain protein at 8% moisture base was 14.8% with a mini-sed rate of 13.0. A subsequent end user flour evaluation with a 14% moisture base, reported 0.425 ash, 12.3% protein, 64.9 absorption and a loaf volume of 2875CC, interior rating good to slightly open. BR6843 exhibited a moderate susceptibility to stripe rust in California with no apparent effect on yield. BR6843 has not been evaluated for FHB.

CS 3100L – SWQAC 12

CS 3100L – CS 3100L hard white spring wheat was bred and developed by New Zealand Crop and has been extensively tested in the USA by Meridian Seeds LLC. It will be

released in 2007. CS 3100L has short-intermediate height and intermediate straw strength. The variety has full season maturity and good test weight with intermediate protein concentration. Suitable for milling for hard white wheat programs.

ND804 – SWQAC 13

Not available

Grain Cleaning and Milling Procedures

Wheat (approximately 6 bu/variety) was cleaned in a Carter-Day Bulldog seed cleaner that was equipped with two rotating indent cylinders (#24 – coarse and #16 fine), a sizer cylinder (#5), vibrator, and air aspiration. For milling purposes, approximately 75 lb of the cleaned wheat was scoured to remove beeswax and other extraneous matter. The scoured wheat was tempered to 16% moisture basis and conditioned 16-18 hours. The tempered wheat was milled in a Buhler Experimental Mill, MLU, at an average feed rate of 175 g/min. Flour from three break (B1, B2, B3) and two reduction (R1, R2) sections of the mill were combined to patent flour. R3 flour was not included in the patent flour due to high ash content, but was included in calculating straight grade flour yield.

Methods of Analyses

Test Weight (AACC Method 55-10)

Wheat and Flour Protein (AACC46-30 – combustion method)

Wheat and Flour Ash (AACC Method 08-01)

Kernel Size (Sieving according to USDA/ARS WQL)

NIR Kernel Hardness (AACC Method 39-70A)

Wheat Falling Number (Perten Falling Number Instrument)

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

Flour Color (Minolta Colorimeter Hunter Lab L b values)

Polyphenol oxidase (PPO) activity of wheat based on absorbance at 475 (high values indicate higher PPO activity).

Flour Extraction: % Total Product Basis (TPB), % Tempered Wheat Basis (TWB), and Pounds Patent Flour Per Bushel Wheat.

Farinograph

Water Absorption (Brabender Computerized Farinograph w/50 g bowl) – 14%mb

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

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

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

Mechanical Tolerance Index (MTI): difference in BU between the top of the curve at the peak and the top of the curve measured 5 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.

Bake Cooperator Results/Evaluation:

- Bake Absorption (Actual - %)
- Loaf Volume (% of Check)
- Mixing Requirement
- Dough Characteristics
- Mixing Tolerance
- Internal Crumb Color
- Internal Crumb Grain and Texture

Bake Cooperator Quality Assessment:

- Protein Content
- Milling
- Baking
- Overall Comparison

Test Bake Procedures

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

Bake Cooperators

ADM Milling

Bay State Milling Company

Cargill (Horizon Milling)

Cereal Food Processors, Inc.

General Mills, Inc

North Dakota State Mill

North Dakota State University

Department of Cereal Science

USDA/ARS Grain Marketing &

Production Research Center

USDA/ARS Hard Red Spring & Durum

Wheat Quality Laboratory

(2 sets of data provided)

Olathe, Kansas

Winona, Minnesota

Minnetonka, Minnesota

Wichita, Kansas

Minneapolis, Minnesota

Grand Forks, North Dakota

Fargo, North Dakota

Manhattan, Kansas

Fargo, North Dakota

2006 Spring Wheat Field Production Data

Location				
Variable	Brookings	Casselton	Crookston	Minot
Planting Date	5/4/2006	5/5/2006	4/27/2006	5/16/2006
Harvest Date	8/7/2006	8/16/2006	8/3/2006	8/22/2006
Fertilizer (lb/A)				
N	110	100# NH3= 15# urea	40 + 120	181
P	70	40 #	18	21
K	125	45#	320	340
Herbicide/rate				
Broadleaf	Bronate Advanced/0.8 pt	bronate advanced/.8pt.	Bronate/1 pt/A	3/4pt widematch/.25oz Harmony GT
Grass	/	puma/.4 pt	Puma/1/2 pt/A	Puma .5 pt/ac
Fungicide	Quilt/7oz.-Folicur 4 oz.	none	Tilt/4 oz/A	/
* = No Application				
Climatologic Data				
Month	Average Temperature (^o F)/Precipitation (in)			
	Brookings	Casselton	Crookston	Minot
April	*/*	43/1.17	48.8/1.31	49.7/1.41
May	56.5/1.0	56.5/2.16	57.0/2.44	55.6/.93
June	66.0/2.4	65.5/1.94	67.2/1.06	65.4/2.25
July	71.0/0	70.5/2.22	72.5/1.03	73.2/2.59
August	*/1.1 by 8/7/06	/	68.0/3.50	70/1.76
* = Not Applicable				
Yield Data				
Cultivar	Yield (bu/acre) / Test Wt / % Moisture			
	Brookings	Casselton - Yield	Crookston	Minot
SWQAC 1	*	*	53.0/64.3/13.61	6 bu/ac
SWQAC 2	*	64.05	74.2/61.1/12.22	*
SWQAC 3	*	66.09	*	17.4 bu/ac
SWQAC 4	No Data	79.91	*	17.7 bu/ac
SWQAC 5	*	63.09	*	12.9 bu/ac
SWQAC 6	*	72.19	71.5/62.1/13.01	14.8 bu/ac
SWQAC 7	No Data	75.14	*	9.5 bu/ac
SWQAC 8	No Data	71.21	76.5/64.3/12.42	17.0 bu/ac
SWQAC 9	*	78.8	84.1/61.0/11.82	*
SWQAC 10	*	78.23	*	18.0 bu/ac
SWQAC 11	*	74.28	81.5/58.7/11.62	11.0 bu/ac
SWQAC 12	*	75.95	76.0/61.8/13.21	9.7 bu/ac
SWQAC 13	*	72.6	*	18.1 bu/ac

Wheat Marketing Score

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

Wheat Marketing Score – Method #1

WHEAT MARKETING SCORE or EXPORT MARKETING SCORE						
		Test Weight	1000 KWT	Falling Number	Wheat Protein	Wheat Ash
Variation(+/-) from Target Value:	SCORE	1lb/bu	3 g up, 4 g down	25 sec	1.0%	0.1%
	6	63 lb/bu	39 g	425 sec	16.5%	1.35%
	5	62 lb/bu	36 g	400 sec	15.5%	1.45%
	4	61 lb/bu	33g	375 sec	14.5%	1.55%
TARGET VALUE:	3	60 lb/bu	30 g	350 sec	13.5%	1.65%
	2	59 lb/bu	26 g	325 sec	12.5%	1.75%
	1	58 lb/bu	22 g	300 sec	11.5%	1.85%
	0	57 lb/bu	18 g	275 sec	10.5%	1.95%

$$\text{Wheat Marketing Score} = (\text{TW} \times 2) + (1000\text{KWT} \times 2) + (\text{FN} \times 2) + (\text{Protein} \times 3) + (\text{Ash} \times 1) / 10$$

Wheat Marketing Score – Method #2

Rules for Score Calculation

Weight of each Factor	Weighting					
Protein	0.3					
Test Weight (TW)	0.2					
Falling Number	0.2					
Thousand Kernel Weight (TKW)	0.2					
Wheat Ash	0.1					
	Entered Line minus Check value equals difference (Diff)					
Component Score	0	2	4	6	8	
Protein	Diff<-2.5	-2.501<Diff<-2	-2.001<Diff<-1.5	-1.501<Diff<-1	-1.001<Diff<-0.5	
TestWeight	Diff<-5	-5.001<Diff<-4	-4.001<Diff<-3	-3.001<Diff<-2	-2.001<Diff<-1	
Falling Number	Diff<-125	-125.01<Diff<-100	-100.01<Diff<75	-75.01<Diff<50	-50.01<Diff<-25	
Thousand Kernel Weight	Diff<-10	-10.001<Diff<-8	-8.001<Diff<-6	-6.001<Diff<-4	-4.001<Diff<-2	
Wheat Ash						
Component Score	10	8	6	4	2	0
Protein	-0.501<Di 2<Diff<3.001		3<Diff<4.001	4<Diff<5.001	5<Diff<6.001	Diff>6
TestWeight	-1.001<Di 2<Diff<4.001		4<Diff<6.001	6<Diff<8.001	8<Diff<10.001	Diff>10
Falling Number	-25.01<Diff					
Thousand Kernel Weight	-2.001<Di 4<Diff<8.001		8<Diff<12.001	12<Diff<16.001	16<Diff<20.001	Diff>20
Wheat Ash	Diff<0.1010.1<Diff<0.201		0.2<Diff<0.301	0.3<Diff<0.401	0.4<Diff<0.501	Diff>0.5