# Wheat Quality Council

# Hard Spring Wheat Technical Committee

# 2008 Crop



February 17 – 19, 2009

Kansas City, MO

## Wheat Quality Council

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2008 Crop



Sponsored by the Wheat Quality Council February 17-19, 2009 Ben Hancock, Executive Vice President Wheat Quality Council P.O. Box 966 Pierre, SD 57501-0966 605-224-5187

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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.

Eleven experimental lines of hard spring wheat were grown at up to five locations in 2008 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 2008 crop year. Test results from other crop years may differ from those reported herein.

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

Trait       Glenn       00S029         1       Wheat Protein (12%mb)       14.7       13.7         2       Flour Protein (12%mb)       14.0       13.0         3       Market Value (Score 1-6)       4.8       4.3         4       Market Value (Score 1-10)       10.0       8.2         5       Test Weight (lb/bu)       65.3       62.2         6       1000 Kernel Weight (g)       36.8       36.5         7       Kernel Size % Large       82       76	
1       Wheat Protein (12%mb)       14.7       13.7         2       Flour Protein (12%mb)       14.0       13.0         3       Market Value (Score 1-6)       4.8       4.3         4       Market Value (Score 1-10)       10.0       8.2         5       Test Weight (lb/bu)       65.3       62.2         6       1000 Kernel Weight (g)       36.8       36.5         7       Kernel Size % Large       82       76	1-3
2       Flour Protein (12%mb)       14.0       13.0         3       Market Value (Score 1-6)       4.8       4.3         4       Market Value (Score 1-10)       10.0       8.2         5       Test Weight (lb/bu)       65.3       62.2         6       1000 Kernel Weight (g)       36.8       36.5         7       Kernel Size % Large       82       76	
3       Market Value (Score 1-6)       4.8       4.3         4       Market Value (Score 1-10)       10.0       8.2         5       Test Weight (Ib/bu)       65.3       62.2         6       1000 Kernel Weight (g)       36.8       36.5         7       Kernel Size % Large       82       76	
3       Market Value (Score 1-6)       4.8       4.3         4       Market Value (Score 1-10)       10.0       8.2         5       Test Weight (Ib/bu)       65.3       62.2         6       1000 Kernel Weight (g)       36.8       36.5         7       Kernel Size % Large       82       76	
4       Market Value (Score 1-10)       10.0       8.2         5       Test Weight (lb/bu)       65.3       62.2         6       1000 Kernel Weight (g)       36.8       36.5         7       Kernel Size % Large       82       76	
5         Test Weight (lb/bu)         65.3         62.2           6         1000 Kernel Weight (g)         36.8         36.5           7         Kernel Size % Large         82         76	
6 1000 Kernel Weight (g) 36.8 36.5 7 Kernel Size % Large 82 76	
7 Kernel Size % Large 82 76	
8 Kernel Size % Small 2 3	
9 Wheat Moisture (%) 10.7 11.3	
10 Wheat Ash (14%mb) 1.37 1.36	
11 Wheat Falling Number (sec) 400 400	
12 SKCS - Hardness Index 85.9 78.1	
13 Vitreous Kernels (%) 96.6 80.7	
Flour Extraction (%)	
14 Tempered Wheat Basis (%) 70.7 73.5	
15 Total Product Basis (%) 74.2 77.5	
16	
17 Flour Color Brightness (L*) 90.9 90.5	
18 Flour Color Yellowness (b*) 8.5 9.8	
19 Flour Moisture (%) 13.3 13.0	
20 Flour Ash (14%mb) 0.403 0.47	1
21 Flour Falling Number (Malted) (sec) 257 247	
Farinograph	
22 Water Absorption (500bu) 65.1 65.4	
23 Water Absorption (14%mb) 64.3 64.9	
24 Arrival Time (min) 3.2 3.8	
25 Peak Time (min) 9.0 6.7	
26 Dough Stability (min) 12.1 6.7	
27 MTI (bu) 25.0 33.0	
28 TTB (min) 14.8 10.9	
II. Cooperator Results/Evaluation	

29	Bake Absorption (Avg %)	<b>63.6</b> ±2.4	63.4±2.6
30	Loaf Volume (% of Check)		<b>96.0</b> ±8.1

Quality		Cr	ookston
Trait	II Cooperator Results/Evaluation	Glenn	00\$0291-3
31	Mixing Requirement	3.7±0.9	2.4±1.1
	5 Very Long		
	4 Long		
	3 Medium		
	2 Short		
	1 Very Short		
32	Dough Characteristics	3.8±1.0	2.6±0.9
	5 Bucky-Tough		
	4 Strong-Elastic		
	3 Medium-Pliable		
	Menow-very Pliable     Meak-Short or Sticky		
22	Mixing Tolerance		<b>2 1</b> +1 2
- 33	5 Much More Tolerance Than Check		<b>2.1</b> ± 1.2
	4 More Tolerance Than Check		
	3 Tolerance Equivalent To Check		
	2 Less Tolerance Than Check		
	1 Much Less Tolerance Than Check		
34	Internal Crumb Color		2.7±0.5
	5 Much Brighter Than Check		
	4 Brighter Than Check		
	3 Equivalent To Check		
	2 Poorer Than Check		
	1 Much Poorer Than Check		
35	Internal Grain and Texture		3.2±0.8
	5 Much Better Than Check		
	4 Better Than Check		
	3 Equivalent To Check		
	2 Poorer Than Check		
	1 Much Poorer Than Check		
III. Coc	operator Quality Assessment		24.55
	Quality Trait 1-2: Protein		<b>2.4</b> ±0.5
	5 Much Better Than Check		
	- Detter Indir Check		
	2 Poorer Than Check		
	1 Much Poorer Than Check		
	Quality Trait 3-21 Milling		<b>3</b> , <b>1</b> +1,1
	5 Much Better Than Check		
	4 Better Than Check		
	3 Equivalent To Check		
	2 Poorer Than Check		
	1 Much Poorer Than Check		
	Quality Trait 22-35: Baking		2.4±0.9
	5 Much Better Than Check		
	4 Better Than Check		
	3 Equivalent To Check		
	2 Poorer Than Check		
	1 Much Poorer Than Check		
	Quality Trait 1-35: Overall Compariso	n	2.2±0.8
	5 Much Better Than Check		
	4 Better Than Check		
	3 Equivalent To Check		
	2 Poorer Than Check		
	1 Much Poorer Than Check		

#### I. USDA/ARS WQL Results/Evaluation

Quality		W	illiston
Trait		Glenn	NDSW0449
1	Wheat Protein (12%mb)	16.9	17.4
2	Flour Protein (12%mb)	16.2	17.1
3	Market Value (Score 1-6)	4.4	3.9
4	Market Value (Score 1-10)	10.0	8.0
5	Test Weight (Ib/bu)	61.7	57.8
6	1000 Kernel Weight (g)	24.8	22.3
7	Kernel Size % Large	5	3
8	Kernel Size % Small	18	31
9	Wheat Moisture (%)	9.4	9.5
10	Wheat Ash (14%mb)	1.14	1.36
11	Wheat Falling Number (sec)	400	400
12	SKCS - Hardness Index	69.5	62.7
13	Vitreous Kernels (%)	94.9	88.2
	Flour Extraction (%)		
14	Tempered Wheat Basis (%)	70.0	70.2
15	Total Product Basis (%)	73.6	74.5
16	Flour /Bu Wheat (Ibs)	45.8	43.2
17	Flour Color Brightness (L*)	90.6	90.0
18	Flour Color Yellowness (b*)	9.7	10.6
19	Flour Moisture (%)	12.8	12.3
20	Flour Ash (14%mb)	0.405	0.418
21	Flour Falling Number (Malted) (sec)	249	238
	Farinograph		
22	Water Absorption (500bu)	64.5	65.7
23	Water Absorption (14%mb)	63.1	64.0
24	Arrival Time (min)	5.0	5.0
25	Peak Time (min)	12.9	7.5
26	Dough Stability (min)	15.0	9.7
27	MTI (bu)	14.0	21.0
28	TTB (min)	20.0	14.8
	orator Dosults /Evaluation		

# II. Cooperator Results/Evaluation29 Bake Absorption (Avg %)

- 30 Loaf Volume (% of Check)
- 63.4±3.4 64.0±2.6 98.2±7.4

Quality		v	Villiston
Trait	II. Cooperator Results/Evaluation	Glenn	NDSW0449
31	Mixing Requirement	4.2±0.8	3.4±1.3
	5 Very Long		
	4 Long		
	3 Medium		
	2 Short		
	1 Very Short		
32	Dough Characteristics	4.2±0.8	<b>4.0</b> ±0.7
	5 Bucky-Tough		
	4 Strong-Elastic		
	3 Medium-Pliable		
	2 Mellow-Very Pliable		
	1 Weak-Short or Sticky		
33	Mixing Tolerance		<b>2.9</b> ±1.3
	5 Much More Tolerance Than Check		
	4 More Tolerance Than Check		
	<b>3</b> Tolerance Equivalent To Check		
	2 Less Tolerance Than Check		
	1 Much Less Tolerance Than Check		
34	Internal Crumb Color		<b>2.7</b> ±1.0
	5 Much Brighter Than Check		
	4 Brighter Than Check		
	3 Equivalent To Check		
	2 Poorer Than Check		
	1 Much Poorer Than Check		
35	Internal Grain and Texture		<b>2.7</b> +1.2
00	5 Much Better Than Check		
	4 Retter Than Check		
	3 Equivalent To Check		
	2 Poorer Than Check		
	1 Much Dooror Than Check		
	nerator Quality Assessment		
III. COC	Quality Trait 1-2: Protein		3 2+1 1
	5 Much Ratter Than Check		J.ZII.I
	A Rattar Than Check		
	2 Equivalent To Check		
	2 Decree Then Check		
	Poorer Than Check     Much Dearer Than Check		
	Quality Trait 2, 21, Milling		28.07
	E Much Pottor Than Check		<b>2.0</b> ±0./
	4 Detter Inan Uneck		
	2 Poorer Than Check		
	1 Much Poorer Than Check		
	Quality Trait 22-35: Baking		2.9±1.2
	5 Much Better Than Check		
	4 Better Than Check		
	3 Equivalent To Check		
	2 Poorer Than Check		
	1 Much Poorer Than Check		
	Quality Trait 1-35: Overall Compariso	n	2.9±1.1
	5 Much Better Than Check		
	4 Better Than Check		
	3 Equivalent To Check		
	2 Poorer Than Check		
	1 Much Poorer Than Check		

## SD3851

Quality		Broo	kings	Cass	elton	Crool	kston
Trait		Glenn	SD3851	Glenn	SD3851	Glenn	SD3851
1	Wheat Protein (12%mb)	13.3	11.3	14.3	13.8	14.7	13.5
2	Flour Protein (12%mb)	12.4	10.9	13.4	12.9	14.0	13.0
3	Market Value (Score 1-6)	4.1	3.6	4.3	4.2	4.8	4.4
4	Market Value (Score 1-10)	10.0	7.8	10.0	9.0	10.0	8.4
5	Test Weight (Ib/bu)	65.4	63.8	65.2	63.9	65.3	64.1
6	1000 Kernel Weight (g)	33.2	37.2	35.6	34.2	36.8	36.5
7	Kernel Size % Large	77	70	80	72	82	68
8	Kernel Size % Small	5	4	2	4	2	5
9	Wheat Moisture (%)	10.6	10.7	12.1	10.6	10.7	10.5
10	Wheat Ash (14%mb)	1.67	1.60	1.72	1.48	1.37	1.21
11	Wheat Falling Number (sec)	400	388	400	400	400	387
12	SKCS - Hardness Index	87.5	81.9	88.5	80.4	85.9	85.9
13	Vitreous Kernels (%)	87.0	46.9	95.6	73.2	96.6	79.3
	Flour Extraction (%)						
14	Tempered Wheat Basis (%)	68.3	71.8	67.6	72.0	70.7	72.3
15	Total Product Basis (%)	71.7	75.3	70.6	75.8	74.2	75.7
16	Flour /Bu Wheat (lbs)	46.8	47.9	46.2	48.2	48.4	48.5
17	Flour Color Brightness (L*)	90.8	90.9	90.7	90.4	90.9	90.4
18	Flour Color Yellowness (b*)	8.9	10.5	8.7	10.0	8.5	10.1
19	Flour Moisture (%)	12.4	13.0	12.6	12.2	13.3	12.3
20	Flour Ash (14%mb)	0.473	0.493	0.418	0.496	0.403	0.458
21	Flour Falling Number (Malted) (sec)	249	250	249	245	257	252
	Farinograph						
22	Water Absorption (500bu)	65.4	62.1	67.0	65.6	65.1	63.3
23	Water Absorption (14%mb)	63.9	61.2	66.0	64.4	64.3	62.3
24	Arrival Time (min)	1.9	1.3	3.0	3.3	3.2	2.0
25	Peak Time (min)	3.3	1.8	5.8	6.7	9.0	6.7
26	Dough Stability (min)	7.2	5.4	7.6	6.2	12.1	10.1
27	MTI (bu)	24.0	34.0	37.0	51.0	25.0	23.0
28	TTB (min)	8.8	6.2	10.7	9.5	14.8	12.1
II. Coo	perator Results/Evaluation						
29	Bake Absorption (Avg %)	63.1±2.3	61.0±2.5	64.4±2.6	62.9±2.4	63.6±2.4	61.5±1.9
30	Loaf Volume (% of Check)		95.6±8.2		<b>99.4</b> ±7.5		94.7±5.3

Quality		Broo	kings	Cass	elton	Croo	kston
Trait	II. Cooperator Results/Evaluation	Glenn	SD3851	Glenn	SD3851	Glenn	SD3851
31	Mixing Requirement	3.7±1.0	3.6±1.2	3.3±0.9	3.2±0.8	3.7±0.9	3.3±0.9
	5 Very Long						
	4 Long						
	2 Medium						
	3 Medidin						
	2 Short 1 Vorus Short						
	I very short		0.4				
32	Dough Characteristics	<b>3.8</b> ±1.1	<b>3.4</b> ±1.1	<b>3.9</b> ±0.9	3.0±1.2	<b>3.8</b> ±1.0	<b>3.2</b> ±1.0
	5 Bucky-Tough						
	4 Strong-Elastic						
	3 Medium-Pliable						
	2 Mellow-Very Pliable						
	1 Weak-Short or Sticky						
33	Mixing Tolerance		<b>2.6</b> ±0.5		<b>2.6</b> ±0.5		<b>2.8</b> ±0.7
	5 Much More Tolerance Than Check						
	4 More Tolerance Than Check						
	3 Tolerance Equivalent To Check						
	2 Less Tolerance Than Check						
	1 Much Loss Tolorance Than Check						
24	I Much Less Tolerance Than Check		2.0.07		2.0.07		2.0.00
34	Internal Crumb Color		<b>2.8</b> ±0.7		<b>2.8</b> ±0.7		<b>2.8</b> ±2.8
	5 Much Brighter Than Check						
	4 Brighter Than Check						
	3 Equivalent To Check						
	2 Poorer Than Check						
	1 Much Poorer Than Check						
35	Internal Grain and Texture		<b>3.6</b> ±0.9		<b>3.1</b> ±0.8		<b>3.4</b> ±1.0
	5 Much Better Than Check						
	4 Better Than Check						
	3 Equivalent To Check						
	2 Poorer Than Check						
	1 Much Poorer Than Check						
	nerator Quality Assessment						
	Quality Trait 1 2: Protoin		10+00		2 2 + 0 5		22+04
	5 Much Bottor Than Chock		1.7±0.9		<b>2.3</b> ±0.5		2.2±0.4
	Much Better Than Check						
	3 Equivalent To Check						
	2 Poorer Than Check						
	1 Much Poorer Than Check						
	Quality Trait 3-21: Milling		3.6±0.9		3.6±1.1		3.1±0.8
	5 Much Better Than Check						
	4 Better Than Check						
	3 Equivalent To Check						
	2 Poorer Than Check						
	1 Much Poorer Than Check						
	Quality Trait 22-35: Baking		2.7±1.3		<b>2.9</b> ±0.8		2.8±0.8
	5 Much Better Than Check						
	4 Retter Than Check						
	3 Fauivalant To Check						
	2 Pooror Than Chask						
	I WUCH POOPER I NAN CHECK		0.4		0.0		0 /
	Quality Trait 1-35: Overall Compariso	n	<b>2.4</b> ±1.0		<b>2.9</b> ±0.8		<b>2.6</b> ±0.7
	5 Much Better Than Check						
	4 Better Than Check						
	3 Equivalent To Check						
	2 Poorer Than Check						
	1 Much Poorer Than Check						

## ND806

Quality		Broo	kings	Cass	elton	Willi	ston
Trait		Glenn	ND806	Glenn	ND806	Glenn	ND806
1	Wheat Protein (12%mb)	13.3	12.4	14.3	12.2	16.9	17.3
2	Flour Protein (12%mb)	12.4	11.3	13.4	11.1	16.2	16.5
3	Market Value (Score 1-6)	4.1	3.6	4.3	3.7	4.4	3.9
4	Market Value (Score 1-10)	10.0	8.2	10.0	5.6	10.0	8.4
5	Test Weight (lb/bu)	65.4	62.2	65.2	62.6	61.7	58.1
6	1000 Kernel Weight (g)	33.2	33.6	35.6	28.0	24.8	22.5
7	Kernel Size % Large	77	72	80	22	5	9
8	Kernel Size % Small	5	4	2	13	18	19
9	Wheat Moisture (%)	10.6	10.6	12.1	10.6	9.4	9.5
10	Wheat Ash (14%mb)	1.67	1.65	1.72	1.42	1.14	1.21
11	Wheat Falling Number (sec)	400	400	400	400	400	400
12	SKCS - Hardness Index	87.5	84.6	88.5	79.4	69.5	71.4
13	Vitreous Kernels (%)	87.0	65.8	95.6	49.2	94.9	98.2
	Flour Extraction (%)						
14	Tempered Wheat Basis (%)	68.3	70.9	67.6	71.4	70.0	70.7
15	Total Product Basis (%)	71.7	75	70.6	75	73.6	74.7
16	Flour /Bu Wheat (lbs)	46.8	46.1	46.2	46.8	45.8	43.8
17	Flour Color Brightness (L*)	90.8	90.7	90.7	90.7	90.6	90.5
18	Flour Color Yellowness (b*)	8.9	9.5	8.7	10.4	9.7	9.5
19	Flour Moisture (%)	12.4	12.3	12.6	12.5	12.8	12.9
20	Flour Ash (14%mb)	0.473	0.529	0.418	0.445	0.405	0.438
21	Flour Falling Number (Malted) (sec)	249	244	249	253	249	239
	Farinograph						
22	Water Absorption (500bu)	65.4	62.5	67.0	59.8	64.5	64.7
23	Water Absorption (14%mb)	63.9	61.2	66.0	59.0	63.1	63.0
24	Arrival Time (min)	1.9	1.8	3.0	2.0	5.0	4.5
25	Peak Time (min)	3.3	3.0	5.8	4.3	12.9	9.5
26	Dough Stability (min)	7.2	6.1	7.6	4.9	15.0	10.5
27	MTI (bu)	24.0	33.0	37.0	59.0	14.0	28.0
28	TTB (min)	8.8	7.9	10.7	7.0	20.0	15.1
II. Coo	perator Results/Evaluation						
29	Bake Absorption (Avg %)	63.1±2.3	60.7±1.9	64.4±2.6	58.7±2.3	63.4±3.4	63.8±3.5
30	Loaf Volume (% of Check)		98.5±6.1		94.3±11.5		<b>99.9</b> ±9.4

Quality		Broo	kings	Cass	elton	Will	iston
Trait	II. Cooperator Results/Evaluation	Glenn	ND806	Glenn	ND806	Glenn	ND806
31	Mixing Requirement	<b>3.7</b> ±1.0	3.8±1.1	3.3±0.9	<b>2.2</b> ±0.7	4.2±0.8	<b>4.0</b> ±0.7
	5 Very Long						
	4 Long						
	3 Medium						
	2 Short						
	1 Very Short						
32	Dough Characteristics	3.8±1.1	<b>3.6</b> ±0.9	3.9±0.9	<b>2.0</b> ±0.7	4.2±0.8	<b>4.0</b> ±1.0
	5 Bucky-Tough						
	4 Strong-Elastic						
	3 Medium-Pliable						
	2 Mellow-Very Pliable						
	1 Weak-Short or Sticky						
33	Mixing Tolerance		2.8±0.7		<b>1.9</b> ±1.6		<b>2.7</b> ±0.9
	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						
34	Internal Crumb Color		<b>3.0</b> ±0.5		2.4±0.5		<b>2.8</b> ±0.4
	5 Much Brighter Than Check						
	4 Brighter Than Check						
	3 Equivalent To Check						
	2 Poorer Than Check						
	1 Much Poorer Than Check						
35	Internal Grain and Texture		3.3±1.1		2.6±1.3		<b>2.6</b> ±0.9
	5 Much Better Than Check						
	4 Better Than Check						
	3 Equivalent To Check						
	2 Poorer Than Check						
	1 Much Poorer Than Check						
	nerator Quality Assessment						
	Quality Trait 1-2: Protein		$2.2 \pm 0.4$		1.6+0.5		$3.3 \pm 0.5$
	5 Much Better Than Check						010-2010
	4 Better Than Check						
	3 Equivalent To Check						
	2 Poorer Than Check						
	1 Much Poorer Than Check						
	Quality Trait 3-21: Milling		3.0+1.1		<b>3.1</b> +1 3		2.7+0.7
	5 Much Better Than Check				0.121.0		
	4 Better Than Check						
	3 Equivalent To Check						
	2 Poorer Than Check						
	1 Much Poorer Than Check						
	Quality Trait 22-35: Baking		30+11		<b>2 0</b> +0 9		31+06
	5 Much Better Than Check		0.011.1		2.010.7		0.110.0
	4 Better Than Check						
	3 Equivalent To Check						
	2 Poorer Than Check						
	1 Much Poorer Than Check						
	Quality Trait 1-35: Overall Compariso	n	<b>2.8</b> +0.8		<b>2.1</b> +0.9		<b>3.0</b> +0.5
	5 Much Better Than Check		2.0±0.0				0.0±0.3
	4 Retter Than Check						
	3 Fauivalent To Check						
	2 Poorer Than Check						
	1 Much Poorer Than Check						

## 06MSP18

Quality		Brookings		Cas	selton	Crookston	
Trait		Glenn	06MSP18	Glenn	06MSP18	Glenn	06MSP18
1	Wheat Protein (12%mb)	13.3	11.4	14.3	14.0	14.7	12.1
2	Flour Protein (12%mb)	12.4	10.4	13.4	12.8	14.0	11.1
3	Market Value (Score 1-6)	4.1	3.2	4.3	3.2	4.8	3.5
4	Market Value (Score 1-10)	10.0	7.0	10.0	8.8	10.0	4.2
5	Test Weight (Ib/bu)	65.4	62.7	65.2	62.2	65.3	62.4
6	1000 Kernel Weight (g)	33.2	30.2	35.6	35.8	36.8	24.3
7	Kernel Size % Large	77	37	80	71	82	18
8	Kernel Size % Small	5	8	2	4	2	16
9	Wheat Moisture (%)	10.6	10.7	12.1	10.3	10.7	10.4
10	Wheat Ash (14%mb)	1.67	1.59	1.72	1.66	1.37	1.23
11	Wheat Falling Number (sec)	400	400	400	400	400	400
12	SKCS - Hardness Index	87.5	75.0	88.5	86.3	85.9	81.9
13	Vitreous Kernels (%)	87.0	27.1	95.6	79.7	96.6	78.0
	Flour Extraction (%)						
14	Tempered Wheat Basis (%)	68.3	70.8	67.6	69.2	70.7	72.1
15	Total Product Basis (%)	71.7	74.9	70.6	72.8	74.2	75.5
16	Flour /Bu Wheat (Ibs)	46.8	46.4	46.2	45.1	48.4	47.0
17	Flour Color Brightness (L*)	90.8	91.1	90.7	90.3	90.9	91.0
18	Flour Color Yellowness (b*)	8.9	10.1	8.7	9.9	8.5	10.3
19	Flour Moisture (%)	12.4	12.3	12.6	12.3	13.3	13.1
20	Flour Ash (14%mb)	0.473	0.432	0.418	0.543	0.403	0.384
21	Flour Falling Number (Malted) (sec)	249	252	249	245	257	250
	Farinograph						
22	Water Absorption (500bu)	65.4	58.8	67.0	65.2	65.1	58.9
23	Water Absorption (14%mb)	63.9	57.9	66.0	63.9	64.3	57.6
24	Arrival Time (min)	1.9	1.5	3.0	2.3	3.2	1.9
25	Peak Time (min)	3.3	2.5	5.8	4.8	9.0	4.9
26	Dough Stability (min)	7.2	5.5	7.6	7.3	12.1	6.2
27	MTI (bu)	24.0	35.0	37.0	28.0	25.0	41.0
28	TTB (min)	8.8	6.8	10.7	10.1	14.8	8.1
II. Coo	perator Results/Evaluation						
29	Bake Absorption (Avg %)	63.1±2.3	58.8±3.8	64.4±2.6	62.6±2.2	63.6±2.4	58.9±3.4
30	Loaf Volume (% of Check)		96.0±12.6		97.9±11.9		<b>90.1</b> ±10.4

Quality		Bro	okings	Cas	selton	Cro	okston
Trait	II. Cooperator Results/Evaluation	Glenn	06MSP18	Glenn	06MSP18	Glenn	06MSP18
31	Mixing Requirement	3.7±1.0	<b>3.1</b> ±0.8	3.3±0.9	<b>2.6</b> ±0.9	3.7±0.9	2.7±1.1
	5 Very Long						
	4 Long						
	3 Medium						
	2 Short						
	1 Verv Short						
32	Dough Characteristics	3.8±1.1	3.3±0.9	3.9±0.9	<b>2.9</b> ±0.9	3.8±1.0	2.8±1.1
	5 Bucky-Tough						
	4 Strong-Elastic						
	3 Medium-Pliable						
	2 Mellow-Very Pliable						
	1 Weak-Short or Sticky						
22	Mixing Tolerance		<b>2 2</b> +0 4		28+07		<b>2 3</b> +1 3
00	5 Much More Tolerance Than Check		L.L.20.4		2.010.7		2.021.0
	4 More Tolerance Than Check						
	3 Tolerance Equivalent To Check						
	2 Loss Toloranco Than Chock						
	1 Much Loss Tolorance Than Check						
24	Internel Crumb Color		20.07		26.05		22.00
34	F. Much Brightor Than Chock		2.7±0.0		<b>2.0</b> ±0.5		<b>2.2</b> ±0.8
	5 Much Brighter Than Check						
	4 Brighter Han Check						
	3 Equivalent To Check						
	2 Poorer Than Check						
	1 Much Poorer Than Check						
35	Internal Grain and Texture		<b>3.2</b> ±1.2		3.0±1.2		<b>2.8</b> ±1.1
	5 Much Better Than Check						
	4 Better Than Check						
	3 Equivalent To Check						
	2 Poorer Than Check						
	1 Much Poorer Than Check						
III. Coo	perator Quality Assessment						
	Quality Trait 1-2: Protein		<b>1.9</b> ±1.3		<b>2.6</b> ±0.5		<b>1.7</b> ±1.0
	5 Much Better Than Check						
	4 Better Than Check						
	3 Equivalent To Check						
	2 Poorer Than Check						
	1 Much Poorer Than Check						
	Quality Trait 3-21: Milling		<b>3.4</b> ±1.1		<b>2.8</b> ±1.0		<b>3.0</b> ±1.1
	5 Much Better Than Check						
	4 Better Than Check						
	3 Equivalent To Check						
	2 Poorer Than Check						
	1 Much Poorer Than Check						
	Quality Trait 22-35: Baking		<b>2.6</b> ±1.0		<b>2.9</b> ±1.1		<b>1.8</b> ±0.7
	5 Much Better Than Check						
	4 Better Than Check						
	3 Equivalent To Check						
	2 Poorer Than Check						
	1 Much Poorer Than Check						
	Quality Trait 1-35: Overall Compariso	n	<b>2.6</b> ±1.2		<b>2.7</b> ±0.7		<b>1.9</b> ±0.6
	5 Much Better Than Check						
	4 Better Than Check						
	3 Equivalent To Check						
	2 Poorer Than Check						
	1 Much Poorer Than Check						

# NDSW0601

#### I. USDA/ARS WQL Results/Evaluation

Quality		Ca	sselton	Wi	lliston				
Trait		Glenn	NDSW0601	Glenn	NDSW0601				
1	Wheat Protein (12%mb)	14.3	13.0	16.9	18.1				
2	Flour Protein (12%mb)	13.4	12.4	16.2	17.8				
3	Market Value (Score 1-6)	4.3	3.2	4.4	4.1				
4	Market Value (Score 1-10)	10.0	6.8	10.0	8.4				
5	Test Weight (Ib/bu)	65.2	61.2	61.7	58.0				
6	1000 Kernel Weight (g)	35.6	34.8	24.8	26.9				
7	Kernel Size % Large	80	76	5	15				
8	Kernel Size % Small	2	3	18	15				
9	Wheat Moisture (%)	12.1	10.3	9.4	9.5				
10	Wheat Ash (14%mb)	1.72	1.66	1.14	1.35				
11	Wheat Falling Number (sec)	400	344	400	400				
12	SKCS - Hardness Index	88.5	82.0	69.5	68.3				
13	Vitreous Kernels (%)	95.6	77.6	94.9	92.0				
	Flour Extraction (%)								
14	Tempered Wheat Basis (%)	67.6	70.5	70.0	70.5				
15	Total Product Basis (%)	70.6	74.7	73.6	75.1				
16	Flour /Bu Wheat (lbs)	46.2	45.2	45.8	43.7				
17	Flour Color Brightness (L*)	90.7	90.7	90.6	89.6				
18	Flour Color Yellowness (b*)	8.7	11.0	9.7	11.1				
19	Flour Moisture (%)	12.6	12.5	12.8	12.4				
20	Flour Ash (14%mb)	0.418	0.637	0.405	0.529				
21	Flour Falling Number (Malted) (sec)	249	270	249	250				
	Farinograph								
22	Water Absorption (500bu)	67.0	64.5	64.5	69.2				
23	Water Absorption (14%mb)	66.0	63.7	63.1	67.4				
24	Arrival Time (min)	3.0	3.5	5.0	6.9				
25	Peak Time (min)	5.8	6.2	12.9	11.4				
26	Dough Stability (min)	7.6	8.5	15.0	13.0				
27	MTI (bu)	37.0	27.0	14.0	14.0				
28	TTB (min)	10.7	9.8	20.0	20.0				
II. Coop	II. Cooperator Results/Evaluation								

29	Bake Absorption (Avg %)	64.4±2.6	
20	Loof Valuma (9/ of Cheale)		

30 Loaf Volume (% of Check)

±2.6 62.0±2.3 63.4±3.4 66.6±3.4 98.1±11.5 101.9±6.6

Quality		Ca	sselton	Williston	
Trait	II. Cooperator Results/Evaluation	Glenn	NDSW0601	Glenn	NDSW0601
31	Mixing Requirement	3.3±0.9	<b>2.6</b> ±0.7	4.2±0.8	<b>4.2</b> ±1.0
	5 Very Long				
	4 Long				
	3 Medium				
	2 Short				
	1 Very Short				
32	Dough Characteristics	3.9±0.9	<b>2.7</b> ±1.0	4.2±0.8	4.2±0.8
	5 Bucky-Tough				
	4 Strong-Elastic				
	3 Medium-Pliable				
	2 Mellow-Very Pliable				
	1 Weak-Short or Sticky				
33	Mixing Tolerance		<b>2.8</b> ±1.0		<b>3.2</b> ±1.0
	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				
34	Internal Crumb Color		20+05		<b>27</b> +07
	5 Much Brighter Than Check		2.010.3		2.7 ±0.7
	4 Brighter Than Check				
	3 Fauivalant To Check				
	2 Dooror Than Chask				
	2 Poorer Than Check				
25	Internal Crain and Taxture		20.40		24.00
30	F Much Bottor Than Chock		<b>2.0</b> ±1.3		<b>2.4</b> ±0.9
	4 Rottor Than Check				
	4 Detter Hall Check				
	2 Poorer Than Check				
	I WUCH POORER I han Check				
III. Coo	perator Quality Assessment		0.0		0.7
	Quality Trait 1-2: Protein		<b>2.0</b> ±0.7		<b>3. /</b> ±1.2
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check				
	2 Poorer Than Check				
	1 Much Poorer Than Check				
	Quality Trait 3-21: Milling		2.7±1.4		2.8±1.3
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check				
	2 Poorer Than Check				
	1 Much Poorer Than Check				
	Quality Trait 22-35: Baking		<b>2.6</b> ±1.0		3.1±1.1
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check				
	2 Poorer Than Check				
	1 Much Poorer Than Check				
	Quality Trait 1-35: Overall Compariso	n	2.3±0.9		3.1±1.1
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check				
	2 Poorer Than Check				
	1 Much Poorer Than Check				

## I. USDA/ARS WQL Results/Evaluation

Quality		Cass	elton	Williston	
Trait		Glenn	Samson	Glenn	Samson
1	Wheat Protein (12%mb)	14.3	13.1	16.9	17.5
2	Flour Protein (12%mb)	13.4	12.8	16.2	17.1
3	Market Value (Score 1-6)	4.3	3.5	4.4	3.7
4	Market Value (Score 1-10)	10.0	6.4	10.0	8.2
5	Test Weight (Ib/bu)	65.2	61.0	61.7	57.4
6	1000 Kernel Weight (g)	35.6	31.0	24.8	23.6
7	Kernel Size % Large	80	54	5	10
8	Kernel Size % Small	2	6	18	22
9	Wheat Moisture (%)	12.1	10.5	9.4	9.3
10	Wheat Ash (14%mb)	1.72	1.68	1.14	1.30
11	Wheat Falling Number (sec)	400	400	400	400
12	SKCS - Hardness Index	88.5	77.2	69.5	63.9
13	Vitreous Kernels (%)	95.6	48.8	94.9	95.6
	Flour Extraction (%)				
14	Tempered Wheat Basis (%)	67.6	72.5	70.0	70.7
15	Total Product Basis (%)	70.6	76.5	73.6	75.2
16	Flour /Bu Wheat (lbs)	46.2	46.3	45.8	43.4
17	Flour Color Brightness (L*)	90.7	90.2	90.6	90.4
18	Flour Color Yellowness (b*)	8.7	11.7	9.7	11.6
19	Flour Moisture (%)	12.6	12.1	12.8	12.3
20	Flour Ash (14%mb)	0.418	0.537	0.405	0.471
21	Flour Falling Number (Malted) (sec)	249	256	249	250
	Farinograph				
22	Water Absorption (500bu)	67.0	63.9	64.5	63.3
23	Water Absorption (14%mb)	66.0	62.4	63.1	61.4
24	Arrival Time (min)	3.0	2.1	5.0	4.5
25	Peak Time (min)	5.8	3.8	12.9	10.2
26	Dough Stability (min)	7.6	5.8	15.0	14.9
27	MTI (bu)	37.0	40.0	14.0	23.0
28	TTB (min)	10.7	7.9	20.0	17.6

## II. Cooperator Results/Evaluation

29	Bake Absorption (Avg %)	64.4±2.6	62.4±3.1	$63.4 \pm 3.4$	<b>62.6</b> ±3.5
30	Loaf Volume (% of Check)		102.4±9.0		100.8±4.9

## Samson

Quality		Cass	elton	Will	iston
Trait	II. Cooperator Results/Evaluation	Glenn	Samson	Glenn	Samson
31	Mixing Requirement	3.3±0.9	<b>2.8</b> ±1.0	4.2±0.8	4.8±0.7
	5 Very Long				
	4 Long				
	3 Medium				
	2 Short				
	1 Very Short				
22	Dough Characteristics	30+00	3 2+10	4 2+0 8	<u>4 0+1 2</u>
JZ	5 Bucky-Tough	<b>J</b> . <b>7</b> ±0.7	<b>J.Z</b> ±1.0	<b>4.2</b> ±0.0	4.011.3
	4 Strong Elastic				
	4 Stiong-Elastic				
	2 Mellow-Very Pliable				
	1 Weak-Short or Sticky				
33	Mixing Tolerance		<b>2.9</b> ±0.6		<b>3.6</b> ±0.7
	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				
34	Internal Crumb Color		2.3±1.2		2.2±0.8
	5 Much Brighter Than Check				
	4 Brighter Than Check				
	3 Equivalent To Check				
	2 Poorer Than Check				
	Foorer Than Check     Much Dearer Than Check				
25	Internal Crain and Taxture		22.40		26.00
30	Internal Grain and Texture		3.3±1.2		<b>2.0</b> ±0.9
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check				
	2 Poorer Than Check				
	1 Much Poorer Than Check				
III. Coo	perator Quality Assessment				
	Quality Trait 1-2: Protein		<b>2.6</b> ±1.0		3.6±0.7
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check				
	2 Poorer Than Check				
	1 Much Poorer Than Check				
	Quality Trait 3-21: Milling		<b>2.9</b> ±1.5		<b>2.9</b> ±0.9
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check				
	2 Poorer Than Check				
	1 Much Poorer Than Check				
	Quality Trait 22, 25, Paking		20.11		20.10
	Cuality Halt 22-35. Baking		3.0±1.1		3.0±1.0
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check				
	2 Poorer Than Check				
	1 Much Poorer Than Check				
	Quality Trait 1-35: Overall Compariso	n	<b>2.9</b> ±1.2		2.9±1.1
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check				
	2 Poorer Than Check				
	1 Much Poorer Than Check				

I

Quality		Ca	sselton	Crookston		
Trait		Glenn	MN03358-4	Glenn	MN03358-4	
1	Wheat Protein (12%mb)	14.3	14.1	14.7	13.6	
2	Flour Protein (12%mb)	13.4	13.2	14.0	13.1	
3	Market Value (Score 1-6)	4.3	3.9	4.8	4.0	
4	Market Value (Score 1-10)	10.0	8.8	10.0	6.8	
5	Test Weight (Ib/bu)	65.2	62.4	65.3	62.4	
6	1000 Kernel Weight (g)	35.6	33.0	36.8	30.7	
7	Kernel Size % Large	80	61	82	56	
8	Kernel Size % Small	2	5	2	5	
9	Wheat Moisture (%)	12.1	10.4	10.7	10.3	
10	Wheat Ash (14%mb)	1.72	1.80	1.37	1.31	
11	Wheat Falling Number (sec)	400	400	400	400	
12	SKCS - Hardness Index	88.5	95.3	85.9	95.3	
13	Vitreous Kernels (%)	95.6	93.4	96.6	96.1	
	Flour Extraction (%)					
14	Tempered Wheat Basis (%)	67.6	67.1	70.7	68.7	
15	Total Product Basis (%)	70.6	70.6	74.2	72.5	
16	Flour /Bu Wheat (lbs)	46.2	43.9	48.4	45.0	
17	Flour Color Brightness (L*)	90.7	90.1	90.9	90.0	
18	Flour Color Yellowness (b*)	8.7	10.1	8.5	10.2	
19	Flour Moisture (%)	12.6	12.6	13.3	12.5	
20	Flour Ash (14%mb)	0.418	0.603	0.403	0.474	
21	Flour Falling Number (Malted) (sec)	249	261	257	251	
	Farinograph					
22	Water Absorption (500bu)	67.0	67.6	65.1	66.9	
23	Water Absorption (14%mb)	66.0	65.9	64.3	65.1	
24	Arrival Time (min)	3.0	1.9	3.2	2.8	
25	Peak Time (min)	5.8	3.8	9.0	5.8	
26	Dough Stability (min)	7.6	5.1	12.1	6.4	
27	MTI (bu)	37.0	46.0	25.0	37.0	
28	TTB (min)	10.7	7.3	14.8	9.6	
II. Coo	perator Results/Evaluation					

29	Bake Absorption (Avg %)	64.4±2.6	64.4±2.9	<b>63.6</b> ±2.4	<b>63.9</b> ±3.0
30	Loaf Volume (% of Check)		<b>98.2</b> ±7.3		91.9±9.3

Quality		C	asselton	Crookston		
Trait	II. Cooperator Results/Evaluation	Glenn	MN03358-4	Glenn	MN03358-4	
31	Mixing Requirement	$3.3 \pm 0.9$	3.0+1.1	3.7±0.9	3.6+1.1	
	5 Very Long 4 Long 3 Medium 2 Short					
	1 Very Short					
32	Dough Characteristics	3.9±0.9	<b>3.8</b> ±1.0	<b>3.8</b> ±1.0	<b>3.7</b> ±1.4	
	5 Bucky-Tough					
	4 Strong-Elastic					
	3 Medium-Pliable					
	2 Mollow Vory Diable					
	2 Menlow-Very Pilable					
0.0	Weak-Short of Sticky		07.00		2 (	
33	Mixing Tolerance		<b>2.1</b> ±0.9		<b>2.6</b> ±0.9	
	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					
34	Internal Crumb Color		<b>3.0</b> ±1.0		2.8±0.7	
	5 Much Brighter Than Check					
	4 Brighter Than Check					
	3 Equivalent To Check					
	2 Poorer Than Check					
	1 Much Poorer Than Check					
35	Internal Grain and Texture		<b>2.8</b> ±1.4		<b>3.0</b> ±1.0	
	5 Much Better Than Check					
	4 Better Than Check					
	3 Equivalent To Check					
	2 Poorer Than Check					
	1 Much Dearar Than Check					
III. COO	Overline Trait 4, 0, Protein		0.4		07.5	
	Quality Trait 1-2: Protein		<b>3.1</b> ±0.6		<b>2.1</b> ±0.1	
	5 Much Better Than Check					
	4 Better Than Check					
	3 Equivalent To Check					
	2 Poorer Than Check					
	1 Much Poorer Than Check					
	Quality Trait 3-21: Milling		2.3±0.9		2.1±0.3	
	5 Much Better Than Check					
	4 Better Than Check					
	3 Equivalent To Check					
	2 Poorer Than Check					
	1 Much Poorer Than Check					
	Quality Trait 22-35: Baking		<b>2.7</b> ±0.7		2.7±0.7	
	5 Much Better Than Check					
	4 Better Than Check					
	3 Equivalent To Check					
	2 Poorer Than Check					
	1 Much Poorer Than Check					
	Quality Trait 1-25: Overall Comparing	n	27+07		28+07	
	5 Much Pottor Than Chook		<b>2.7</b> ±0.7		2.0±0.7	
	Dettor Thom Check					
	4 Better Inan Check					
	2 Poorer Than Check					
	1 Much Poorer Than Check					

Trait       Glenn       01S0042-10       Glenn       01S0042-10         1       Wheat Protein (12%mb)       13.3       13.0       14.3       13.7         2       Flour Protein (12%mb)       12.4       12.2       13.4       13.2         3       Market Value (Score 1-6)       4.1       3.7       4.3       4.0         4       Market Value (Score 1-6)       4.1       3.7       4.3       4.0         5       Test Weight (Ib/bu)       65.4       63.9       65.2       63.4         6       1000 Kernel Weight (g)       33.2       28.8       35.6       31.8         7       Kernel Size % Small       5       4       2       4         9       Wheat Moisture (%)       10.6       10.3       12.1       11.0         10       Wheat Falling Number (sec)       400       400       400         2       SKCS - Hardness Index       87.5       81.3       88.5       81.2         11       Wheat Falling Number (sec)       400       46.1       46.2       46.7         12       SKCS - Hardness Index       87.5       81.3       88.5       81.2         13       Vitreous Kernels (%)       71.7       7	Quality		Brookings Casselton			
1       Wheat Protein (12%mb)       13.3       13.0       14.3       13.7         2       Flour Protein (12%mb)       12.4       12.2       13.4       13.2         3       Market Value (Score 1-6)       4.1       3.7       4.3       4.0         4       Market Value (Score 1-10)       10.0       8.8       10.0       8.6         5       Test Weight (b/bu)       65.4       63.9       65.2       63.4         6       1000 Kernel Weight (g)       33.2       28.8       35.6       31.8         7       Kernel Size % Large       77       73       80       69         8       Kernel Size % Small       5       4       2       4         9       Wheat Moisture (%)       10.6       10.3       12.1       11.0         10       Wheat Falling Number (sec)       400       400       400       400         11       Wheat Kernels (%)       87.5       81.3       88.5       81.2         13       Vitreous Kernels (%)       71.7       72.2       70.6       73.5         14       Tempered Wheat Basis (%)       68.3       68.7       67.6       70.3         15       Total Product Basis (%)	Trait		Glenn	01S0042-10	Glenn	01S0042-10
2       Flour Protein (12%mb)       12.4       12.2       13.4       13.2         3       Market Value (Score 1-6)       4.1       3.7       4.3       4.0         4       Market Value (Score 1-10)       10.0       8.8       10.0       8.6         5       Test Weight (Ib/bu)       65.4       63.9       65.2       63.4         6       1000 Kernel Weight (g)       33.2       28.8       35.6       31.8         7       Kernel Size % Large       77       73       80       69         8       Kernel Size % Large       77       73       80       69         8       Kernel Size % Small       5       4       2       4         9       Wheat Moisture (%)       10.6       10.3       12.1       11.0         10       Wheat Ash (14%mb)       1.67       1.58       1.72       1.67         11       Wheat Falling Number (sec)       400       400       400       400         12       SKCS - Hardness Index       87.5       81.3       88.5       81.2         13       Vitreous Kernels (%)       71.7       72.2       70.6       73.5         14       Tempered Wheat Basis (%)       68.3<	1	Wheat Protein (12%mb)	13.3	13.0	14.3	13.7
3Market Value (Score 1-6)4.13.74.34.04Market Value (Score 1-10)10.08.810.08.65Test Weight (b/bu)65.463.965.263.461000 Kernel Weight (g)33.228.835.631.87Kernel Size % Large777380698Kernel Size % Small54249Wheat Moisture (%)10.610.312.111.010Wheat Ash (14%mb)1.671.581.721.6711Wheat Ash (14%mb)1.671.581.721.6712SKCS - Hardness Index87.581.388.581.213Vitreous Kernels (%)87.072.795.662.2Flour Extraction (%)87.072.795.662.214Tempered Wheat Basis (%)68.368.767.670.315Total Product Basis (%)71.772.270.673.516Flour Color Brightness (t*)90.891.090.790.819Flour Color Brightness (t*)8.910.78.710.819Flour Ash (14%mb)0.4730.4700.4180.47121Flour Ash (14%mb)0.4730.4700.4180.47123Water Absorption (500bu)65.464.267.066.124Arrival Time (min)3.35.55.85.226Dough Stability (min) </td <td>2</td> <td>Flour Protein (12%mb)</td> <td>12.4</td> <td>12.2</td> <td>13.4</td> <td>13.2</td>	2	Flour Protein (12%mb)	12.4	12.2	13.4	13.2
3Market Value (Score 1-6)4.13.74.34.04Market Value (Score 1-10)10.08.810.08.65Test Weight (lb/bu)65.463.965.263.461000 Kernel Weight (g)33.228.835.631.87Kernel Size % Large777380698Kernel Size % Small54249Wheat Moisture (%)10.610.312.111.010Wheat Ash (14%mb)1.671.581.721.6711Wheat Falling Number (sec)40040040040012SKCS - Hardness Index87.581.388.581.213Vitreous Kernels (%)87.072.795.662.2Flour Extraction (%)71.772.270.673.516Flour Ash (14%mb)0.4730.47090.790.818Flour Color Brightness (L*)90.891.090.790.819Flour Color Yellowness (b*)8.910.78.710.819Flour Ash (14%mb)0.4730.4700.4180.47121Flour Falling Number (Malted) (sec)249252249251Farinograph22Water Absorption (14%mb)63.963.366.065.424Arrival Time (min)3.35.55.85.226Dough Stability (min)7.26.07.66.4<						
4       Market Value (Score 1-10)       10.0       8.8       10.0       8.6         5       Test Weight (lb/bu)       65.4       63.9       65.2       63.4         6       1000 Kernel Weight (g)       33.2       28.8       35.6       31.8         7       Kernel Size % Large       77       73       80       69         8       Kernel Size % Small       5       4       2       4         9       Wheat Moisture (%)       10.6       10.3       12.1       11.0         10       Wheat Ash (14%mb)       1.67       1.58       1.72       1.67         11       Wheat Falling Number (sec)       400       400       400       400         12       SKCS - Hardness Index       87.5       81.3       88.5       81.2         13       Vitreous Kernels (%)       87.0       72.7       95.6       62.2         Flour Extraction (%)       11.7       72.2       70.6       73.5         14       Tempered Wheat Basis (%)       68.3       68.7       67.6       70.3         15       Total Product Basis (%)       90.7       90.8       89       10.7       8.7       10.8         18       Flour C	3	Market Value (Score 1-6)	4.1	3.7	4.3	4.0
5       Test Weight (lb/bu)       65.4       63.9       65.2       63.4         6       1000 Kernel Weight (g)       33.2       28.8       35.6       31.8         7       Kernel Size % Large       77       73       80       69         8       Kernel Size % Small       5       4       2       4         9       Wheat Moisture (%)       10.6       10.3       12.1       11.0         10       Wheat Ash (14%mb)       1.67       1.58       1.72       1.67         11       Wheat Falling Number (sec)       400       400       400       400         12       SKCS - Hardness Index       87.5       81.3       88.5       81.2         13       Vitreous Kernels (%)       87.0       72.7       95.6       62.2         Flour Extraction (%)       71.7       72.2       70.6       73.5         14       Tempered Wheat Basis (%)       68.3       68.7       67.6       70.3         15       Total Product Basis (%)       71.7       72.2       70.6       73.5         16       Flour /Bu Wheat (L*)       90.8       91.0       90.7       90.8         17       Flour Color Brightness (L*)       90.	4	Market Value (Score 1-10)	10.0	8.8	10.0	8.6
6       1000 Kernel Weight (g)       33.2       28.8       35.6       31.8         7       Kernel Size % Large       77       73       80       69         8       Kernel Size % Small       5       4       2       4         9       Wheat Moisture (%)       10.6       10.3       12.1       11.0         10       Wheat Ash (14%mb)       1.67       1.58       1.72       1.67         11       Wheat Falling Number (sec)       400       400       400       400         12       SKCS - Hardness Index       87.5       81.3       88.5       81.2         13       Vitreous Kernels (%)       87.0       72.7       9.6       62.2         Flour Extraction (%)       71.7       72.2       70.6       73.5         14       Tempered Wheat Basis (%)       68.3       68.7       67.6       70.3         15       Total Product Basis (%)       71.7       72.2       70.6       73.5         16       Flour Color Brightness (L*)       90.8       91.0       90.7       90.8         19       Flour Color Yellowness (b*)       8.9       10.7       8.7       10.8         20       Flour Ash (14%mb)	5	Test Weight (Ib/bu)	65.4	63.9	65.2	63.4
7       Kernel Size % Large       77       73       80       69         8       Kernel Size % Small       5       4       2       4         9       Wheat Moisture (%)       10.6       10.3       12.1       11.0         10       Wheat Ash (14%mb)       1.67       1.58       1.72       1.67         11       Wheat Falling Number (sec)       400       400       400       400         12       SKCS - Hardness Index       87.5       81.3       88.5       81.2         13       Vitreous Kernels (%)       87.0       72.7       95.6       62.2         Flour Extraction (%)       71.7       72.2       70.6       73.5         14       Tempered Wheat Basis (%)       68.3       68.7       67.6       70.3         15       Total Product Basis (%)       71.7       72.2       70.6       73.5         16       Flour Color Brightness (L*)       90.8       91.0       90.7       90.8         19       Flour Moisture (%)       12.4       13.3       12.6       13.6         20       Flour Ash (14%mb)       0.4713       0.4700       0.418       0.471         21       Flour Ash (14%mb)       63.9<	6	1000 Kernel Weight (g)	33.2	28.8	35.6	31.8
8       Kernel Size % Small       5       4       2       4         9       Wheat Moisture (%)       10.6       10.3       12.1       11.0         10       Wheat Ash (14%mb)       1.67       1.58       1.72       1.67         11       Wheat Falling Number (sec)       400       400       400       400         12       SKCS - Hardness Index       87.5       81.3       88.5       81.2         13       Vitreous Kernels (%)       87.0       72.7       95.6       62.2         Flour Extraction (%)       68.3       68.7       67.6       70.3         14       Tempered Wheat Basis (%)       68.3       68.7       67.6       73.5         16       Flour /Bu Wheat (lbs)       46.8       46.1       46.2       46.7         17       Flour Color Brightness (L*)       90.8       91.0       90.7       90.8         18       Flour Color Yellowness (b*)       8.9       10.7       8.7       10.8         19       Flour Moisture (%)       0.473       0.470       0.418       0.4711         21       Flour Falling Number (Malted) (sec)       249       252       249       251          Peak T	7	Kernel Size % Large	77	73	80	69
9       Wheat Moisture (%)       10.6       10.3       12.1       11.0         10       Wheat Ash (14%mb)       1.67       1.58       1.72       1.67         11       Wheat Falling Number (sec)       400       400       400       400         12       SKCS - Hardness Index       87.5       81.3       88.5       81.2         13       Witreous Kernels (%)       87.0       72.7       95.6       62.2         Flour Extraction (%)       71.7       72.2       70.6       73.5         14       Tempered Wheat Basis (%)       68.3       68.7       67.6       70.3         15       Total Product Basis (%)       71.7       72.2       70.6       73.5         16       Flour /Bu Wheat (lbs)       46.8       46.1       46.2       46.7         17       Flour Color Brightness (L*)       90.8       91.0       90.7       90.8         19       Flour Moisture (%)       12.4       13.3       12.6       13.6         20       Flour Ash (14%mb)       0.473       0.470       0.418       0.471         21       Flour Falling Number (Malted) (sec)       249       252       249       251         Farinograp	8	Kernel Size % Small	5	4	2	4
10       Wheat Ash (14%mb)       1.67       1.58       1.72       1.67         11       Wheat Falling Number (sec)       400       400       400       400         12       SKCS - Hardness Index       87.5       81.3       88.5       81.2         13       Vitreous Kernels (%)       87.0       72.7       95.6       62.2         Flour Extraction (%)       71.7       72.2       70.6       73.5         14       Tempered Wheat Basis (%)       68.3       68.7       67.6       70.3         15       Total Product Basis (%)       71.7       72.2       70.6       73.5         16       Flour /Bu Wheat (lbs)       46.8       46.1       46.2       46.7         17       Flour Color Brightness (L*)       90.8       91.0       90.7       90.8         18       Flour Color Yellowness (b*)       8.9       10.7       8.7       10.8         20       Flour Ash (14%mb)       0.470       0.418       0.471         21       Flour Falling Number (Malted) (sec)       249       252       249       251         Farinograph         22       Water Absorption (500bu)       65.4       64.2       67.0       66.1	9	Wheat Moisture (%)	10.6	10.3	12.1	11.0
11       Wheat Falling Number (sec)       400       400       400       400         12       SKCS - Hardness Index       87.5       81.3       88.5       81.2         13       Vitreous Kernels (%)       87.0       72.7       95.6       62.2         Flour Extraction (%)       87.0       72.7       95.6       62.2         14       Tempered Wheat Basis (%)       68.3       68.7       67.6       70.3         15       Total Product Basis (%)       71.7       72.2       70.6       73.5         16       Flour /Bu Wheat (lbs)       46.8       46.1       46.2       46.7         17       Flour Color Brightness (L*)       90.8       91.0       90.7       90.8         18       Flour Color Yellowness (b*)       8.9       10.7       8.7       10.8         19       Flour Moisture (%)       0.473       0.470       0.418       0.471         21       Flour Falling Number (Malted) (sec)       249       252       249       251         Farinograph         22       Water Absorption (14%mb)       63.9       63.3       66.0       65.4         24       Arrival Time (min)       3.3       5.5       5.8	10	Wheat Ash (14%mb)	1.67	1.58	1.72	1.67
12       SKCS - Hardness Index       87.5       81.3       88.5       81.2         13       Vitreous Kernels (%) Flour Extraction (%)       87.0       72.7       95.6       62.2         14       Tempered Wheat Basis (%)       68.3       68.7       67.6       70.3         15       Total Product Basis (%)       71.7       72.2       70.6       73.5         16       Flour /Bu Wheat (lbs)       46.8       46.1       46.2       46.7         17       Flour Color Brightness (L*)       90.8       91.0       90.7       90.8         18       Flour Color Yellowness (b*)       8.9       10.7       8.7       10.8         19       Flour Moisture (%)       12.4       13.3       12.6       13.6         20       Flour Ash (14%mb)       0.473       0.470       0.418       0.471         21       Flour Falling Number (Malted) (sec)       249       252       249       251         Farinograph         22       Water Absorption (500bu)       65.4       64.2       67.0       66.1         23       Water Absorption (14%mb)       63.9       63.3       66.0       65.4         24       Arrival Time (min)       3.3	11	Wheat Falling Number (sec)	400	400	400	400
13       Vitreous Kernels (%) Flour Extraction (%)       87.0       72.7       95.6       62.2         14       Tempered Wheat Basis (%)       68.3       68.7       67.6       70.3         15       Total Product Basis (%)       71.7       72.2       70.6       73.5         16       Flour /Bu Wheat (lbs)       46.8       46.1       46.2       46.7         17       Flour Color Brightness (L*)       90.8       91.0       90.7       90.8         18       Flour Color Yellowness (b*)       8.9       10.7       8.7       10.8         19       Flour Moisture (%)       12.4       13.3       12.6       13.6         20       Flour Ash (14%mb)       0.473       0.470       0.418       0.471         21       Flour Falling Number (Malted) (sec)       249       252       249       251         Farinograph         22       Water Absorption (500bu)       65.4       64.2       67.0       66.1         23       Water Absorption (500bu)       65.4       64.2       67.0       66.1         24       Arrival Time (min)       1.9       3.2       3.0       2.8         25       Peak Time (min)       3.3	12	SKCS - Hardness Index	87.5	81.3	88.5	81.2
Flour Extraction (%)       68.3       68.7       67.6       70.3         14       Tempered Wheat Basis (%)       71.7       72.2       70.6       73.5         15       Total Product Basis (%)       71.7       72.2       70.6       73.5         16       Flour /Bu Wheat (lbs)       46.8       46.1       46.2       46.7         17       Flour Color Brightness (L*)       90.8       91.0       90.7       90.8         18       Flour Color Yellowness (b*)       8.9       10.7       8.7       10.8         19       Flour Moisture (%)       12.4       13.3       12.6       13.6         20       Flour Ash (14%mb)       0.473       0.470       0.418       0.471         21       Flour Falling Number (Malted) (sec)       249       252       249       251         Farinograph         22       Water Absorption (500bu)       65.4       64.2       67.0       66.1         23       Water Absorption (500bu)       63.9       63.3       66.0       65.4         24       Arrival Time (min)       1.9       3.2       3.0       2.8         25       Peak Time (min)       3.3       5.5       5.8       5	13	Vitreous Kernels (%)	87.0	72.7	95.6	62.2
14       Tempered Wheat Basis (%)       68.3       68.7       67.6       70.3         15       Total Product Basis (%)       71.7       72.2       70.6       73.5         16       Flour /Bu Wheat (lbs)       46.8       46.1       46.2       46.7         17       Flour Color Brightness (L*)       90.8       91.0       90.7       90.8         18       Flour Color Yellowness (b*)       8.9       10.7       8.7       10.8         19       Flour Moisture (%)       12.4       13.3       12.6       13.6         20       Flour Ash (14%mb)       0.473       0.470       0.418       0.471         21       Flour Falling Number (Malted) (sec)       249       252       249       251         Farinograph         Example and the absorption (500bu)         65.4       64.2       67.0       66.1         23       Water Absorption (14%mb)       63.9       63.3       66.0       65.4         24       Arrival Time (min)       1.9       3.2       3.0       2.8         25       Peak Time (min)       3.3       5.5       5.8       5.2         26       Dough Stability (min)       7.2       6		Flour Extraction (%)				
15       Total Product Basis (%)       71.7       72.2       70.6       73.5         16       Flour /Bu Wheat (lbs)       46.8       46.1       46.2       46.7         17       Flour Color Brightness (L*)       90.8       91.0       90.7       90.8         18       Flour Color Yellowness (b*)       8.9       10.7       8.7       10.8         19       Flour Moisture (%)       12.4       13.3       12.6       13.6         20       Flour Ash (14%mb)       0.473       0.470       0.418       0.471         21       Flour Falling Number (Malted) (sec)       249       252       249       251         Farinograph         Exprime results/Evaluation (14%mb)         22       Water Absorption (500bu)       65.4       64.2       67.0       66.1         23       Water Absorption (14%mb)       63.9       63.3       66.0       65.4         24       Arrival Time (min)       1.9       3.2       3.0       2.8         25       Peak Time (min)       3.3       5.5       5.8       5.2         26       Dough Stability (min)       7.2       6.0       7.6       6.4         27       MTI (b	14	Tempered Wheat Basis (%)	68.3	68.7	67.6	70.3
16       Flour /Bu Wheat (lbs)       46.8       46.1       46.2       46.7         17       Flour Color Brightness (L*)       90.8       91.0       90.7       90.8         18       Flour Color Yellowness (b*)       8.9       10.7       8.7       10.8         19       Flour Moisture (%)       12.4       13.3       12.6       13.6         20       Flour Ash (14%mb)       0.473       0.470       0.418       0.471         21       Flour Falling Number (Malted) (sec)       249       252       249       251         Farinograph         Farinograph         Gene Kater Absorption (14%mb)         63.9       63.3       66.0       65.4         24       Arrival Time (min)       1.9       3.2       3.0       2.8         25       Peak Time (min)       3.3       5.5       5.8       5.2         26       Dough Stability (min)       7.2       6.0       7.6       6.4         27       MTI (bu)       24.0       50.0       37.0       41.0         28       TTB (min)       8.8       9.0       10.7       9.2          Filenencols       63.1±2	15	Total Product Basis (%)	71.7	72.2	70.6	73.5
17       Flour Color Brightness (L*)       90.8       91.0       90.7       90.8         18       Flour Color Yellowness (b*)       8.9       10.7       8.7       10.8         19       Flour Moisture (%)       12.4       13.3       12.6       13.6         20       Flour Ash (14%mb)       0.473       0.470       0.418       0.471         21       Flour Falling Number (Malted) (sec)       249       252       249       251         Farinograph         Erainograph         22       Water Absorption (500bu)       65.4       64.2       67.0       66.1         23       Water Absorption (14%mb)       63.9       63.3       66.0       65.4         24       Arrival Time (min)       1.9       3.2       3.0       2.8         25       Peak Time (min)       3.3       5.5       5.8       5.2         26       Dough Stability (min)       7.2       6.0       7.6       6.4         27       MTI (bu)       24.0       50.0       37.0       41.0         28       TTB (min)       8.8       9.0       10.7       9.2         11.       Cooperator Results/Evaluation       22	16	Flour /Bu Wheat (Ibs)	46.8	46.1	46.2	46.7
18       Flour Color Yellowness (b*)       8.9       10.7       8.7       10.8         19       Flour Moisture (%)       12.4       13.3       12.6       13.6         20       Flour Ash (14%mb)       0.473       0.470       0.418       0.471         21       Flour Falling Number (Malted) (sec)       249       252       249       251         Farinograph         22       Water Absorption (500bu)       65.4       64.2       67.0       66.1         23       Water Absorption (14%mb)       63.9       63.3       66.0       65.4         24       Arrival Time (min)       1.9       3.2       3.0       2.8         25       Peak Time (min)       3.3       5.5       5.8       5.2         26       Dough Stability (min)       7.2       6.0       7.6       6.4         27       MTI (bu)       24.0       50.0       37.0       41.0         28       TTB (min)       8.8       9.0       10.7       9.2         III. Cooperator Results/Evaluation         29       Bake Absorption (Avg %)       63.1±2.3       62.2±2.3       64.4±2.6       63.8±2.8         30       Loaf Volume	17	Flour Color Brightness (L*)	90.8	91.0	90.7	90.8
19       Flour Moisture (%)       12.4       13.3       12.6       13.6         20       Flour Ash (14%mb)       0.473       0.470       0.418       0.471         21       Flour Falling Number (Malted) (sec)       249       252       249       251         Farinograph         22       Water Absorption (500bu)       65.4       64.2       67.0       66.1         23       Water Absorption (14%mb)       63.9       63.3       66.0       65.4         24       Arrival Time (min)       1.9       3.2       3.0       2.8         25       Peak Time (min)       3.3       5.5       5.8       5.2         26       Dough Stability (min)       7.2       6.0       7.6       6.4         27       MTI (bu)       24.0       50.0       37.0       41.0         28       TTB (min)       8.8       9.0       10.7       9.2         II. Cooperator Results/Evaluation         29       Bake Absorption (Avg %)       63.1±2.3       62.2±2.3       64.4±2.6       63.8±2.8         30       Loaf Volume (% of Check)       97.7±8.9       97.7±8.9       97.7±8.9	18	Flour Color Yellowness (b*)	8.9	10.7	8.7	10.8
20       Flour Ash (14%mb)       0.473       0.470       0.418       0.471         21       Flour Falling Number (Malted) (sec)       249       252       249       251         Farinograph         22       Water Absorption (500bu)       65.4       64.2       67.0       66.1         23       Water Absorption (14%mb)       63.9       63.3       66.0       65.4         24       Arrival Time (min)       1.9       3.2       3.0       2.8         25       Peak Time (min)       3.3       5.5       5.8       5.2         26       Dough Stability (min)       7.2       6.0       7.6       6.4         27       MTI (bu)       24.0       50.0       37.0       41.0         28       TTB (min)       8.8       9.0       10.7       9.2         II. Cooperator Results/Evaluation         29       Bake Absorption (Avg %)       63.1±2.3       62.2±2.3       64.4±2.6       63.8±2.8         30       Loaf Volume (% of Check)       97.7±8.9       97.7±8.8       97.7±8.8	19	Flour Moisture (%)	12.4	13.3	12.6	13.6
21       Flour Falling Number (Malted) (sec)       249       252       249       251         Farinograph         22       Water Absorption (500bu)       65.4       64.2       67.0       66.1         23       Water Absorption (14%mb)       63.9       63.3       66.0       65.4         24       Arrival Time (min)       1.9       3.2       3.0       2.8         25       Peak Time (min)       3.3       5.5       5.8       5.2         26       Dough Stability (min)       7.2       6.0       7.6       6.4         27       MTI (bu)       24.0       50.0       37.0       41.0         28       TTB (min)       8.8       9.0       10.7       9.2         11. Cooperator Results/Evaluation       29       Bake Absorption (Avg %)       63.1±2.3       62.2±2.3       64.4±2.6       63.8±2.8         30       Loaf Volume (% of Check)       97.7±8.9       97.7±8.9       97.7±8.8	20	Flour Ash (14%mb)	0.473	0.470	0.418	0.471
FarinographImage: Second system22Water Absorption (500bu) $65.4$ $64.2$ $67.0$ $66.1$ 23Water Absorption (14%mb) $63.9$ $63.3$ $66.0$ $65.4$ 24Arrival Time (min) $1.9$ $3.2$ $3.0$ $2.8$ 25Peak Time (min) $3.3$ $5.5$ $5.8$ $5.2$ 26Dough Stability (min) $7.2$ $6.0$ $7.6$ $6.4$ 27MTI (bu) $24.0$ $50.0$ $37.0$ $41.0$ 28TTB (min) $8.8$ $9.0$ $10.7$ $9.2$ II. Cooperator Results/Evaluation29Bake Absorption (Avg %) $63.1\pm 2.3$ $62.2\pm 2.3$ $64.4\pm 2.6$ $63.8\pm 2.8$ 30Loaf Volume (% of Check) $97.7\pm 8.9$ $97.7\pm 8.8$ $97.7\pm 8.8$	21	Flour Falling Number (Malted) (sec)	249	252	249	251
Farinograph       Farinograph						
22       Water Absorption (500bu)       65.4       64.2       67.0       66.1         23       Water Absorption (14%mb)       63.9       63.3       66.0       65.4         24       Arrival Time (min)       1.9       3.2       3.0       2.8         25       Peak Time (min)       3.3       5.5       5.8       5.2         26       Dough Stability (min)       7.2       6.0       7.6       6.4         27       MTI (bu)       24.0       50.0       37.0       41.0         28       TTB (min)       8.8       9.0       10.7       9.2         II. Cooperator Results/Evaluation         29       Bake Absorption (Avg %)       63.1±2.3       62.2±2.3       64.4±2.6       63.8±2.8         30       Loaf Volume (% of Check)       97.7±9.9       97.7±8.8		Farinograph				
23       Water Absorption (14%mb)       63.9       63.3       66.0       65.4         24       Arrival Time (min)       1.9       3.2       3.0       2.8         25       Peak Time (min)       3.3       5.5       5.8       5.2         26       Dough Stability (min)       7.2       6.0       7.6       6.4         27       MTI (bu)       24.0       50.0       37.0       41.0         28       TTB (min)       8.8       9.0       10.7       9.2         II. Cooperator Results/Evaluation         29       Bake Absorption (Avg %)       63.1±2.3       62.2±2.3       64.4±2.6       63.8±2.8         30       Loaf Volume (% of Check)       97.7±9.9       97.7±9.9       97.7±8.8	22	Water Absorption (500bu)	65.4	64.2	67.0	66.1
24       Arrival Time (min)       1.9       3.2       3.0       2.8         25       Peak Time (min)       3.3       5.5       5.8       5.2         26       Dough Stability (min)       7.2       6.0       7.6       6.4         27       MTI (bu)       24.0       50.0       37.0       41.0         28       TTB (min)       8.8       9.0       10.7       9.2         II. Cooperator Results/Evaluation         29       Bake Absorption (Avg %)       63.1±2.3       62.2±2.3       64.4±2.6       63.8±2.8         30       Loaf Volume (% of Check)       97.7±9.9       97.7±9.9       97.7±8.8	23	Water Absorption (14%mb)	63.9	63.3	66.0	65.4
25       Peak Time (min)       3.3       5.5       5.8       5.2         26       Dough Stability (min)       7.2       6.0       7.6       6.4         27       MTI (bu)       24.0       50.0       37.0       41.0         28       TTB (min)       8.8       9.0       10.7       9.2         II. Cooperator Results/Evaluation         29       Bake Absorption (Avg %)       63.1±2.3       62.2±2.3       64.4±2.6       63.8±2.8         30       Loaf Volume (% of Check)       97.7±9.9       97.7±9.9       97.7±8.8	24	Arrival Time (min)	1.9	3.2	3.0	2.8
26       Dough Stability (min)       7.2       6.0       7.6       6.4         27       MTI (bu)       24.0       50.0       37.0       41.0         28       TTB (min)       8.8       9.0       10.7       9.2         II. Cooperator Results/Evaluation         29       Bake Absorption (Avg %)       63.1±2.3       62.2±2.3       64.4±2.6       63.8±2.8         30       Loaf Volume (% of Check)       97.7±9.9       97.7±8.8	25	Peak Time (min)	3.3	5.5	5.8	5.2
27       MTI (bu)       24.0       50.0       37.0       41.0         28       TTB (min)       8.8       9.0       10.7       9.2         II. Cooperator Results/Evaluation         29       Bake Absorption (Avg %)       63.1±2.3       62.2±2.3       64.4±2.6       63.8±2.8         30       Loaf Volume (% of Check)       97.7±9.9       97.7±9.9       97.7±8.8	26	Dough Stability (min)	7.2	6.0	7.6	6.4
28       TTB (min)       8.8       9.0       10.7       9.2         II. Cooperator Results/Evaluation       29       Bake Absorption (Avg %)       63.1±2.3       62.2±2.3       64.4±2.6       63.8±2.8         30       Loaf Volume (% of Check)       97.7±9.9       97.7±9.9       97.7±8.8	27	MTI (bu)	24.0	50.0	37.0	41.0
II. Cooperator Results/Evaluation         29       Bake Absorption (Avg %)         30       Loaf Volume (% of Check)	28	TTB (min)	8.8	9.0	10.7	9.2
11. Cooperator Results/ Evaluation         29       Bake Absorption (Avg %) $63.1\pm2.3$ $62.2\pm2.3$ $64.4\pm2.6$ $63.8\pm2.8$ 30       Loaf Volume (% of Check) $97.7\pm9.9$ $97.7\pm9.9$		ocrator Doculto (Evoluction				
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	20	Pake Absorption (Avg %)	63 1+2 2	62 2	61 1+26	63 8+20
	30	Loaf Volume (% of Check)	00.1±2.3	97.7+9.9	07.7±2.0	97.7+8.8

- 30 Loaf Volume (% of Check)
- 97.7±9.9

Quality		Bi	rookings	Casselton	
Trait	II. Cooperator Results/Evaluation	Glenn	0150042-10	Glenn	01S0042-10
31	Mixing Requirement	3.7±1.0	3.3±1.2	3.3±0.9	3.0±1.0
	5 Very Long				
	4 Long				
	3 Medium				
	2 Short				
	1 Very Short				
20	Dough Characteristics	3 8+1 1	<b>4</b> 0+1 0	30+00	2 9+1 2
52	5 Bucky-Tough	5.0±1.1	4.011.0	<b>J</b> .7±0.7	2.711.2
	4 Strong-Elastic				
	2 Modium Bliable				
	3 Mediani-Filable				
	2 Mellow-very Pliable				
2.2	Niving Televenee		2.0.07		27.05
33	Mixing Tolerance		3.0±0.7		<b>2</b> .7±0.5
	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				
34	Internal Crumb Color		<b>2.6</b> ±0.7		2.2±1.0
	5 Much Brighter Than Check				
	4 Brighter Than Check				
	3 Equivalent To Check				
	2 Poorer Than Check				
	1 Much Poorer Than Check				
35	Internal Grain and Texture		<b>2.9</b> ±0.9		2.8±1.1
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check				
	2 Poorer Than Check				
	1 Much Poorer Than Check				
III. Coo	perator Quality Assessment				
	Quality Trait 1-2: Protein		<b>2.9</b> ±0.6		<b>2.8</b> ±0.7
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check				
	2 Poorer Than Check				
	1 Much Poorer Than Check				
	Quality Trait 3-21: Milling		3 0+0 7		3 2+0 9
	5 Much Ratter Than Check		<b>J.U</b> ±0.7		J.2 10.0
	A Rattar Than Chack				
	3 Fauivalant To Chock				
	2 Degrar Than Check				
	2 POOLET Mail Check				
	Ouglity Trait 22, 25, Baking		26.00		27.07
	Quality Irait 22-35: Baking		<b>2.0</b> ±0.9		<b>2</b> ./±0./
	5 Much Better Than Check				
	4 Better Than Check				
	2 Poorer Than Check				
	1 Much Poorer Than Check				
	Quality Trait 1-35: Overall Compariso	n	2.8±1.1		2.6±0.5
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check				
	2 Poorer Than Check				
	1 Much Poorer Than Check				

## ND809

Quality		Cass	elton	Croo	kston	Will	iston
Trait		Glenn	ND809	Glenn	ND809	Glenn	ND809
1	Wheat Protein (12%mb)	14.3	13.8	14.7	13.8	16.9	17.8
2	Flour Protein (12%mb)	13.4	13.1	14.0	13.1	16.2	17.0
3	Market Value (Score 1-6)	4.3	4.0	4.8	4.7	4.4	4.4
4	Market Value (Score 1-10)	10.0	8.6	10.0	9.0	10.0	9.4
5	Test Weight (lb/bu)	65.2	63.2	65.3	63.8	61.7	60.5
6	1000 Kernel Weight (g)	35.6	31.6	36.8	40.3	24.8	24.9
7	Kernel Size % Large	80	75	82	82	5	9
8	Kernel Size % Small	2	3	2	2	18	18
9	Wheat Moisture (%)	12.1	10.5	10.7	10.5	9.4	9.8
10	Wheat Ash (14%mb)	1.72	1.70	1.37	1.39	1.14	1.28
11	Wheat Falling Number (sec)	400	400	400	400	400	400
12	SKCS - Hardness Index	88.5	88.2	85.9	90.2	69.5	79.4
13	Vitreous Kernels (%)	95.6	78.5	96.6	92.6	94.9	97.6
	Flour Extraction (%)						
14	Tempered Wheat Basis (%)	67.6	68.5	70.7	71.8	70.0	70.3
15	Total Product Basis (%)	70.6	72.2	74.2	75.8	73.6	74.2
16	Flour /Bu Wheat (lbs)	46.2	45.2	48.4	47.8	45.8	45.2
17	Flour Color Brightness (L*)	90.7	90.5	90.9	90.4	90.6	90.3
18	Flour Color Yellowness (b*)	8.7	9.5	8.5	9.4	9.7	10.1
19	Flour Moisture (%)	12.6	12.6	13.3	12.5	12.8	12.7
20	Flour Ash (14%mb)	0.418	0.471	0.403	0.411	0.405	0.414
21	Flour Falling Number (Malted) (sec)	249	249	257	246	249	234
	Farinograph						
22	Water Absorption (500bu)	67.0	68.0	65.1	69.3	64.5	68.1
23	Water Absorption (14%mb)	66.0	67.0	64.3	68.3	63.1	66.8
24	Arrival Time (min)	3.0	2.8	3.2	3.0	5.0	6.3
25	Peak Time (min)	5.8	5.9	9.0	5.3	12.9	10.8
26	Dough Stability (min)	7.6	6.4	12.1	7.5	15.0	13.6
27	MTI (bu)	37.0	43.0	25.0	30.0	14.0	11.0
28	TTB (min)	10.7	8.9	14.8	10.5	20.0	20.0
II. Coo	perator Results/Evaluation						
29	Bake Absorption (Avg %)	64.4±2.6	<b>64.7</b> ±2.9	63.6±2.4	64.8±3.7	63.4±3.4	65.8±3.6
30	Loaf Volume (% of Check)		100.0±9.7		<b>92.8</b> ±8.5		102.9±7.1

Quality		Cass	elton	Croo	kston	Will	iston
Trait	II. Cooperator Results/Evaluation	Glenn	ND809	Glenn	ND809	Glenn	ND809
31	Mixing Requirement	3.3±0.9	<b>2.9</b> ±0.9	3.7±0.9	<b>2.8</b> ±1.0	4.2±0.8	4.4±1.0
	5 Very Long						
	4 Long						
	3 Medium						
	2 Short						
	2 Short 1 Vory Short						
	Provense Observational States	20.00	24.40	20.44	2.0.4.4	10.00	4.4
32		3.9±0.9	<b>3.4</b> ±1.0	3.8±1.0	<b>2.9</b> ±1.1	4.2±0.8	<b>4.1</b> ±0.8
	5 Bucky-Tough						
	4 Strong-Elastic						
	3 Medium-Pliable						
	2 Mellow-Very Pliable						
	1 Weak-Short or Sticky						
33	Mixing Tolerance		<b>2.6</b> ±0.5		2.3±0.9		3.3±0.9
	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						
24	Internal Crumb Color		20.00		26.05		21.04
34	F Much Brightor Than Chock		<b>2.7</b> ±0.8		<b>2.0</b> ±0.5		<b>3.1</b> ±0.0
	5 Wuch Brighter Than Check						
	4 Brighter Than Check						
	3 Equivalent To Check						
	2 Poorer Than Check						
	1 Much Poorer Than Check						
35	Internal Grain and Texture		2.8±1.1		<b>2.9</b> ±0.6		<b>2.7</b> ±0.9
	5 Much Better Than Check						
	4 Better Than Check						
	3 Equivalent To Check						
	2 Poorer Than Check						
	1 Much Poorer Than Check						
	nerator Quality Assessment						
	Quality Trait 1-2: Protein		28+07		23+05		36+09
	5 Much Better Than Check		2.0±0.7		2.0 ± 0.5		0.0±0.7
	A Bottor Than Check						
	4 Better man check						
	3 Equivalent To Check						
	2 Poorer Than Check						
	1 Much Poorer Than Check						
	Quality Trait 3-21: Milling		<b>2.9</b> ±0.8		<b>3.2</b> ±0.7		<b>3.0</b> ±0.5
	5 Much Better Than Check						
	4 Better Than Check						
	3 Equivalent To Check						
	2 Poorer Than Check						
	1 Much Poorer Than Check						
	Quality Trait 22-35: Baking		3.0±1.0		2.3±0.7		3.4±0.7
	5 Much Better Than Check						
	4 Better Than Check						
	3 Equivalent To Check						
	2 Poorer Than Check						
	1 Much Poorer Than Check						
	Quality Trait 1 25: Quarall Comparing	n	20.00		27.00		24.07
	E Much Pottor Than Charle	11	<b>2.7±0.9</b>		<b>2.7</b> ±0.9		3.4±0.7
	4 Better Inan Check						
	3 Equivalent To Check						
	2 Poorer Than Check						
	1 Much Poorer Than Check						

#### I. USDA/ARS WQL Results/Evaluation

Quality		Williston			
Trait		Glenn	COI320W		
1	Wheat Protein (12%mb)	16.9	17.0		
2	Flour Protein (12%mb)	16.2	16.6		
3	Market Value (Score 1-6)	4.4	3.8		
4	Market Value (Score 1-10)	10.0	8.0		
5	Test Weight (Ib/bu)	61.7	57.5		
6	1000 Kernel Weight (g)	24.8	24.5		
7	Kernel Size % Large	5	14		
8	Kernel Size % Small	18	17		
9	Wheat Moisture (%)	9.4	9.5		
10	Wheat Ash (14%mb)	1.14	1.41		
11	Wheat Falling Number (sec)	400	400		
12	SKCS - Hardness Index	69.5	63.3		
13	Vitreous Kernels (%)	94.9	98.2		
	Flour Extraction (%)				
14	Tempered Wheat Basis (%)	70.0	69.7		
15	Total Product Basis (%)	73.6	74.2		
16	Flour /Bu Wheat (lbs)	45.8	42.7		
17	Flour Color Brightness (L*)	90.6	90.7		
18	Flour Color Yellowness (b*)	9.7	7.9		
19	Flour Moisture (%)	12.8	12.4		
20	Flour Ash (14%mb)	0.405	0.446		
21	Flour Falling Number (Malted) (sec)	249	251		
	Farinograph				
22	Water Absorption (500bu)	64.5	63.8		
23	Water Absorption (14%mb)	63.1	61.9		
24	Arrival Time (min)	5.0	5.0		
25	Peak Time (min)	12.9	9.5		
26	Dough Stability (min)	15.0	14.9		
27	MTI (bu)	14.0	11.0		
28	TTB (min)	20.0	20.0		

## II. Cooperator Results/Evaluation

29	Bake Absorption (Avg %)	<b>63.4</b> ±3.4	<b>62.9</b> ±3.9
30	Loaf Volume (% of Check)		102.7±5.2

Quality		Williston		
Trait	II. Cooperator Results/Evaluation	Glenn	COI320W	
31	Mixing Requirement	4.2±0.8	4.2±1.4	
	5 Very Long			
	4 Long			
	3 Medium			
	2 Short			
	1 Very Short			
32	Dough Characteristics	4.2+0.8	4.3+0.7	
32	5 Rucky-Tough	r. <b>∠</b> ⊥0.0	4.010.7	
	A Strong-Electic			
	4 SUUNY-EIASUC			
	viellow-very Pliable			
	1 Weak-Short or Sticky			
33	Mixing Tolerance		3.1±0.8	
	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			
34	Internal Crumb Color		3.8±0.7	
	5 Much Brighter Than Check			
	4 Brighter Than Check			
	3 Equivalent To Check			
	2 Doorer Than Check			
	Pooler man check     Much Dooror Than Check			
25			27.40	
35	Internal Grain and Texture		<b>2.7</b> ±1.0	
	5 Wuch Better Than Check			
	4 Better Than Check			
	<b>3</b> Equivalent To Check			
	2 Poorer Than Check			
	1 Much Poorer Than Check			
III. Coo	perator Quality Assessment			
	Quality Trait 1-2: Protein		3.1±0.6	
	5 Much Better Than Check			
	4 Better Than Check			
	3 Equivalent To Check			
	2 Poorer Than Check			
	1 Much Poorer Than Check			
	Quality Trait 3-21 Milling		2.7+0.9	
	5 Much Retter Than Check			
	A Rattar Than Chack			
	• Detter Hall Check			
	2 Poorer Than Check			
	1 Much Poorer Than Check			
	Quality Trait 22-35: Baking		3.3±1.0	
	5 Much Better Than Check			
	4 Better Than Check			
	3 Equivalent To Check			
	2 Poorer Than Check			
	1 Much Poorer Than Check			
	Quality Trait 1-35: Overall Comparison	n	3.2±1.1	
	5 Much Better Than Check			
	4 Retter Than Check			
	2 Equivalant To Chack			
	2 Poorer Than Check			
	1 Much Poorer Than Check			

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## **Source of Wheat**

<u> Source – Breeding Program</u>	Code#	<b>Identification</b>
AgriPro	1	00S0291-3
North Dakota State University (B)	2	NDSW0449 *
South Dakota State University	3	SD3851
North Dakota State University (M)	4	ND806
Trigen	5	06MSP18
North Dakota State University (B)	6	NDSW0601
Westbred	7	Sampson
University of Minnesota	9	MN03358-4
AgriPro	10	01S0042-10
North Dakota State University (M)	11	ND809 *
WWW	12	CO1320W
North Dakota State University	8	Glenn Check

\*Second year of testing in WQC trials

## **Field Plot Locations and Procedures**

The experimental lines and Glenn check cultivar 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 Williston Agricultural Experiment Station, Williston, ND

Wheat was seeded in large-scale plots of  $\frac{1}{2}$  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.

Entry #	Entry	Reference	Brookings	Casselton	Crookston	Minot	Williston
1	00S0291-3	AgriPro			х	na	
2	NDSW0449	NDSU (B)				na	х
3	SD3851	SDSU	х	х	х	na	
4	ND806	NDSU (M)	х	Х		na	х
5	06MSP18	Trigen	х	х	х		
6	NDSW0601	NDSU (B)		х		na	х
7	Samson	Westbred		х		na	х
8	Glenn	Check	х	х	х	na	х
9	MN03358-4	Un of MN		Х	х		
10	01S0042-10	AgriPro	х	х			
11	ND809	NDSU (M)		х	х	na	х
12	CO1320W	www				na	Х

## 2008 Hard Spring Wheat Production Sites\*

\*WQC entries from Minot were sprout-damaged and not harvested. Quality test results are not available (na).

## **Description of 2008 Hard Spring Wheat Lines**

#### 00S0291-3 – SWQAC 1

00S0291-3 is a hard red spring wheat developed by AgriPro of Syngenta Seeds. It was named and released as "Jenna" to AgriPro Associates for planting in the spring of 2009. Limited quantities of certified seed will be available for growers in 2010. Jenna was derived from the cross "N98-0178/97S0212-08". Varieties in its parentage include Krona, Bergen, Dalen and Amidon. It has med-late maturity and good test weight. It is a semidwarf with height slightly taller than Kuntz. Straw strength is good, between Knudson and Kuntz. It is resistant to stem rust and moderately resistant to leaf rust. Protection to foliar diseases has been very good. Tolerance to FHB has been intermediate. Protein has been med-high, similar to Freyr. Jenna is best adapted for the northern areas of the spring wheat growing region of the Northern Plains.

## NDSW0449 - SWQAC 2

NDSW0449 was selected from the cross (Ernest//ND622/Keene /3/\*2//SD3310/SD3414). It is a hard red spring wheat developed primarily for its resistance to the wheat stem sawfly. It is medium-tall height, awned, and matures approximately 2 days later than Reeder. NDSW0449 is susceptible to FHB, moderately susceptible to leaf rust, and resistant to moderately resistant to stem rust. It has excellent resistance to wheat stem sawfly infestation despite exhibiting less stem-solidity compared with the variety Choteau. NDSW0449 has exhibited excellent milling and baking characteristics, with generally better than average grain protein content, higher loaf volume, and stronger mix characteristics compared with other hard red spring wheat varieties.

### **SD3851 – SWQAC 3**

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  $F_4$  plant population created in the spring of 1999. It has been tested within South Dakota State University Advanced Yield Trials (AYT) from 2004 - 2008. SD3851 was tested in both the Uniform Regional Spring Wheat Nursery (URSWN) in 2005 and 2006 as well as the South Dakota Crop Performance Testing trials in 2005 through 2008. In addition, SD3851 was evaluated by the Wheat Quality Council in 2008. Pending approval of the SDSU Variety Review and Release Committee, SD3851 should be made available to Registered seed producers in spring 2009. Coverage under the United States Plant Variety Protection Act will be sought.

Points of note associated with SD3851 include: Good yield potential; Exceptionally heavy test weight; Early heading date; Possesses Fhb1 QTL which confers good level of Fusarium Head Blight resistance; and Moderate to highly resistant ratings for both leaf and stem rust.

### **ND806 – SWQAC 4**

ND 806 is selected from a 3-way cross involving the NDSU cultivar 'Reeder' and experimental line ND 721 that traces its parentage to the high protein NDSU cultivar 'Glupro"; and the SDSU cultivar 'Walworth' (SD3348). ND 806 has been tested in the ND Variety trials and the regional trials since 2005. It is a medium early line similar to Faller with medium straw strength and semi-dwarf comparable to Parshall. ND 806 has high grain yield, superior to Alsen and Glenn, similar to Reeder particularly in the Western parts of the State.

ND 806 has excellent resistance to foliar diseases particularly, leaf and stem rusts. It is medium susceptible to scab or Fusarium head blight.

ND 806 has good test weight and grain protein content. Overall, ND 806 has good milling and baking qualities similar to Reeder. In Western regions however, ND 806 is in general, comparable to most of NDSU checks such as Alsen and Steele-ND.

#### **06MSP18 – SWQAC 5**

O6 MSP 18 is the experimental designation for a hard red spring wheat line developed by Trigen seed LLC derived from a cross Alsen//Buck Antorcha/Norm. The objective of this cross was to combine the tolerance to Fusarium Head Blight and other characteristics from the NDSU Alsen (50%) with desirable traits from the Argentine variety Buck Antorcha and the UMN variety Norm. This selection has a medium-early maturity, and a yield potential similar to that of Faller with better resistance to lodging. It has shown strong flour rheological properties and good bread-making characteristics in small plot samples. We have named this wheat Albany and will have production in 2009.

## NDSW0601 – SWQAC 6

NDSW0601 was selected from the cross N97-0117//MT9420/3/971//IDO533/9747. It is a hard white spring wheat developed for high yield potential and bread making applications. NDSW0601 is a semi-dwarf and awned breeding line, and it matures on average 2 days later than Alpine, a hard white spring wheat, and 3 days later than Glenn, a hard red spring wheat. It has good straw strength, but is more adapted to western North Dakota production conditions due to the potential for more pre-harvest sprouting and disease in the east. NDSW0601 is susceptible to FHB, moderately susceptible to moderately resistant to prevalent races of leaf rust, and resistant to very resistant to prevalent races of stem rust. NDSW0601 does not exhibit low PPO, but at 15.4% protein, a 70/30 flour blend of NDSW0601 with soft white wheat was considered to provide acceptable quality for Taiwan raw noodles (2008 Asian Products Collaborative Project Summary).

### Samson – SWQAC 7

"Samson" HRSW is derived from the cross "Express" X "Knudson". Samson is a medium height, medium early maturing semi-dwarf. Standability and yield potential are excellent. Samson is moderately resistant-moderately susceptible to leaf rust and foliar disease (Tan Spot and Septoria tritici). Samson is resistant to the prevalent races of stem rust. However, Samson is susceptible to scab (Fusarium Head Blight) so fungicide application at heading is a must. Samson produces medium protein, medium test weight seed, with SDS Sedimentation values averaging about 115 mm.

### MN03358-4 – SWQAC 9

MN03358-4 is a mid-maturity hard red spring wheat with high grain yields and good scab resistance. The pedigree of MN03358-4 is MN98389/MN97518. MN03358-4 has been a consistently high yielder in Minnesota and the hard red spring wheat region, performing well in the 2006 and 2007 regional performance nurseries. Grain protein and test weight are average compared to other cultivars. MN03358-4 is moderately resistant to pre-harvest sprouting with good falling numbers. Straw strength is below average. MN03358-4 is resistant to stem rust and moderately resistant to prevalent races of leaf rust and other leaf diseases. MN03358-4 has moderate resistance to Fusarium head blight (scab), comparable to 'Tom' and better than 'RB07'.

### 01S0042-10 - SWQAC 10

01S0042-10 is a hard red spring wheat developed by AgriPro of Syngenta Seeds. It was named and released as "Brennan" to AgriPro associates for planting in spring of 2009. Limited quantities of certified seed will be available for growers in 2010. Brennan was derived from the cross "Reeder//CHISCAB#140/N90-0190". Other varieties in its parentage include Amidon, Norseman and Coteau. It has early maturity and very good test weight. It is a short semidwarf with height similar to Kelby. Straw strength is very good. It is resistant to stem rust and moderately resistant to leaf rust. Protection to foliar diseases has been very good. Tolerance to FHB has been intermediate. Protein levels have been high, slightly lower than Kelby. Brennan is best adapted for the southern areas of the spring wheat growing region of the Northern Plains.

## ND809 – SWQAC 11

ND 809 was selected from a 3-way cross involving an NDSU experimental line (ND 2831) that is derived from "Sumai 3", a major source of resistance to Fusarium head blight (FHB) or scab. Therefore, ND 809 has medium resistance to FHB. It has very good resistance to other foliar diseases including stem and leaf rusts. It is an early line with medium straw strength and semi-dwarf. ND 809 has high grain yield comparable to Faller but superior to Alsen, Reeder, and Parshall. It has high test weight and grain protein content compared to Alsen. ND 809 has high protein and very good milling and baking characteristics.

## **COI320W – SWQAC 12**

COI320W is an early-maturing hard white spring wheat, developed by World Wide Wheat LLC (W<sup>3</sup>), using male sterile facilitated recurrent selection (MSFRS) population breeding. A hard white variety from Pakistan, Sonalika, with large hard white seed and superior protein quality was used for recurrent topcrossing in a W<sup>3</sup> low input population.

COI320W originated as an  $F_2$  head selection. A single  $F_2$  head selection from this continuing population was increased in Moscow, Idaho with a sever Hessian fly infestation. A single  $F_3$  head tolerant to Hessian Fly was harvested. Single head selection continued through the F4 generation.

COI320W has been evaluated for yield and quality at several global locations for several years with much success. The line possesses a high-yielding potential under adequate moisture conditions. COI320W is tolerant to Hessian fly and moderately resistant to stripe rust.

## **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. Sixty pounds of cleaned wheat was tempered to 16.5% 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 three reduction (R1, R2, R3) sections of the mill were combined to straight grade flour. Prior to milling the experimental lines, the Buhler Experimental Mill was adjusted to optimize mill extraction of the Glenn check that was grown at Crookston, which represented the highest quality check among the 5 growing locations. No further adjustments were made to optimize mill extraction for the

experimental lines, thus, flour extraction of individual samples was relative to flour extraction of the Crookston Glenn check.

## **Methods of Analyses**

Wheat Market Value Score

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)

Wheat Falling Number (Perten Falling Number Instrument)

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

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

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

Farinograph

Water Absorption (Brabender Computerized Farinograph w/50 g bowl) – 14%mb and 500 bu.

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

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

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

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

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

Mixograph

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

## **C-Cell Bread Descriptors**

#### Cell

This displays the individual cells within the product slice. Each one is colour coded according to its prominence. This is based on a combination of its area and depth. Small cells are colored in dark blue and larger ones are shown in lighter shades of blue, green and yellow. Cells large enough to be classified as holes are outlined in red.

#### Volume contours

This displays contours of the coarseness of the texture, based on volume measurements of cells. The coarsest 50% of the slice area is shaded in red and the finest regions are shaded in blue. The range of values displayed in this image is used for calculation of cell size measurements on the Coarse/Fine Clustering. The shape of the red and blue regions is used for calculation of the Circularity measurement.

#### **Brightness correction**

This image shows a view of the slice, corrected to remove any differences in overall product reflectance. The image is shaded in brown to avoid confusion with the raw image.

#### Elongation

This image represents the orientation and elongation of cells. Short red lines are drawn parallel to the long axis of cells at each point in the slice. The length of the lines indicates the degree of elongation of the cells. For regions that show some curvature, green lines are also drawn that point towards the centre of the curvature. The length of the green lines indicates the degree of local curvature. Yellow lines are also shown that divide regions of the slice that show curvature in opposite directions. Regions of the slice that show a complete 360 degree rotational structure are shaded in bright blue. Those that show a rotational structure that turns through 180 degrees are shaded in pale blue. Those showing no full rotation are left in grey.

#### Shape

This shows a view of the slice with particular shape features shown in color. A white rectangular box is shown enclosing the slice. The corners of the slice are also identified and are connected by white lines to each other and to the centre of the slice. Concavities in the sides of the slice are shown in blue for the bottom, green for the sides and red for the top. Where oven spring is detected, this is shown in yellow. The points used for measuring the slice height are marked as yellow points on the top edge. High points are identified at either side of the top edge and the lowest point between them is

also marked. Where there is no clear dip in the top, some of these points may coincide and it may not be possible to see three distinct points.

#### Raw Image

A raw image of a slice selected for analysis

## **Test Bake Procedures**

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

## **Bake Cooperators\***

ADM Milling	Olathe, Kansas
Bay State Milling Company	Winona, Minnesota
Cargill (Horizon Milling)	Minnetonka, Minnesota
Cereal Food Processors, Inc.	Wichita, Kansas
General Mills, Inc	Minneapolis, Minnesota
North Dakota State Mill	Grand Forks, North Dakota
North Dakota State University	
Department of Cereal Science	Fargo, North Dakota
USDA/ARS Grain Marketing &	
Production Research Center	Manhattan, Kansas
USDA/ARS Hard Red Spring & Durum	
Wheat Quality Laboratory	Fargo, North Dakota

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

# Production: Climate, Disease, and Field Conditions

Brookings	Casselton	Crookston	Minot	Williston
		At Planting		
Ideal Conditions planted on well drained soils with an excellent seed bed	Moist seed bed following light showers provided a nearly ideal seedbed, but a .33 inch rainfall interrupted seeding after the first 3 entries. Seeding resumed 2 days later and emergence of all entries was uniform and quick. (6-7 days)	The 2008 Spring Wheat Quality Trial was planted into some of our lighter soil. The soil conditions were moist at planting and made for an excellent seed bed.	Soil conditions for the Wheat Quality Trial were adequate at the time of planting.	Planted in extremely dry soil and cool conditions. The soil is average for what is here at the center.
		During Growth		
Excess moisture and cool throughout June	Although monthly rainfall totals look adequate, most of Junes rainfall was early and July's was mid month which gave us a three week period that was on the verge of stressing the plants. Cooler than normal temps gave an overall excellent vegetative period, promoting above average tillering.	The spring wheat trial continued to develop with no apparent problems observed.	The growing conditions for the trial in Minot for the most part were favorable. The rains were spaced out leading to some plant stress.	Cool growing conditions and extremely dry during the growing season.
		At Flowering		
No rain for five weeks from June 12-July 17	Relatively dry weather and low humidity promoted low FHB and leaf diseases.	The plants progressed rapidly and the environment at flowering and previous to that time, was not conducive to the development of leaf diseases or Fusarium head blight.	Minot location had dry conditions at flowering, very little disease present at flowering.	Crops were stressed do to extensive drought conditions.
		During Maturation		
Dry, Free of Diseases except for a bacterial blight caused by early winds and excess moisture	Mostly dry weather except for two 1.5 inch rains as the crop was just beginning to dry down.	Some lodging due to strong wind and rain.	Intermitant rainfall which cause slow maturation.	Dry, disease free, and dried down quickly.
		At Harvest		
Harvested dry and cooled by aeration.	Swathed and combined the same afternoon. No lodged lines, good yields and quality. Moisture content was under 13.5 on all lines except OVA 20, the seed of which came in 2 weeks after the others were seeded.	There were no apparent problems at harvest and the trial was taken off in a timely manner to ensure the best possible grain quality.	Excessive wet period at harvest time caused severe seed damage. Hand threshed heads were showing visible sprout damage averaging between 25-30%. At that time the decision was made to abandon harvest due to the low seed quality.	Dry harvest conditions, thin stand, low test weight, thin kernels, and poorer grain quality.

## 2008 Spring Wheat Field Production Data

Location						
Variable	Brookings	Casselton	Crookston	Williston	Minot	
Planting Date	4/22/2008	5/6 to 5/8, 2008	5/5/2008	5/14/2008	5/16/2008	
Harvest Date	8/8/2008	8/25/2008	8/20/2008	8/21/2008	No Harvest**	
Fertilizer (lb/A)						
Ν	110	100	16 + 140	100	100	
Р	80	40	10	0	30	
К	50	0	254	0	0	
Herbicide/rate						
Broadleaf	Brox M Ultra/12.8 oz.	Bison Adv/0.8 pt.	Bronate/1 pt/A	Bison Advance/1.2pt/A	1pt Widematch, 2/10oz Harmony GT	
Grass	Puma/10.5 oz.	Puma/0.6 pt.	Puma/1/2 pt/A	Puma/1/2ptA	.66 pt/ac.	
Fungicide	Quilt/4 oz., Folicur-Proline 3+3 oz.	*	*	None	*	
* = No Application	on, **No harvest was made due to rain during	harvest time and quality	loss including sprouting ir	n the head.		
		Clima	tologic Data			
Month	Average Temperature ( <sup>0</sup> F)/Precipitation (in)					
	Brookings	Casselton	Crookston	Williston	Minot	
April	40/0.83 (4/22-30)	40.20/1.72	40.2/1.02	44.2/0.28	40.4/.49	
May	53/3.04	53.0/2.10	51.2/0.90	55.9/1.40	51.5/2.64	
June	65/5.96	63.3/6.03	62.7/3.87	63.2/2.31	60.5/5.53	
July	71/1.89	69.0/3.44	67.9/2.14	74.1/0.84	68.2/2.64	
August	76/0.05 (8/1-8)	68.5/3.34	68.3/3.6	73.1/1.40	68.1/3.20	
* = Not Applicat	ble					
		Yi	eld Data			
Cultivar	Cultivar Vield (bu/acre) / Test Wt / % Moisture					
	Brookings	Casselton	Crookston	Williston (yield)	Minot	
SWQAC 1	*	*	60.1/61/14.52	*	*	
SWQAC 2	*	*	*	18.3	**	
SWQAC 3	58.25/62.4 /12.7	84.21/62.0/13.0	67.3/62.3/12.88	*	**	
SWQAC 4	55.17/59.3/12.2	68.47/61.0/13.2	*	8.1	**	
SWQAC 5	72.33/61.3 /12.9	77.99/61.0/12.5	67.2/60.5/13.08	7.8	*	
SWQAC 6	*	68.08/58.0/13.2	*	17.6	**	
SWQAC 7	*	78.78/58.5/13.0	*	12.4	**	
SWQAC 8	63.00/62.8/12.7	78.70/63.0/12.2	63.2/64.3/12.78	**	**	
SWQAC 9	*	79.56/61.5/12.7	68.9/60.4/12.67	*	*	
SWQAC 10	63.67/62.1/12.2	83.58/61.0/13.1	*	6.9	**	
SWQAC 11	*	76.65/62.0/12.7	71.1/61.9/14.11	5.2	**	
SWQAC 12	*	*	*	**	**	

\* Not Increased at this site \*\* = No data available \*\*\*Planted late on 5/20/2008
## 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:	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%					

Wheat Marketing Score = (TW\*2) + (1000KWT\*2) + (FN\*2) + (Protein\*3) + (Ash\*1)/10

# Wheat Marketing Score – Method #2

### Rules for Score Calculation

Weight of each Factor		Weighting								
Protein		0.3	5							
Test Weight (TW)		0.2								
Falling Number		0.2								
Thousand Kernel Weight (TKW)	0.2									
Wheat Ash		0.1								
		Entered Line minus	s Check value equ	als difference (D	iff)					
Component Score	0	2	4	6	8					
Protein	Diff<-2.5	-2.501 <diff<-2< td=""><td>-2.001<diff<-1.5< td=""><td>-1.501<diff<-1< td=""><td>-1.001<diff<-0.5< td=""><td></td><td></td></diff<-0.5<></td></diff<-1<></td></diff<-1.5<></td></diff<-2<>	-2.001 <diff<-1.5< td=""><td>-1.501<diff<-1< td=""><td>-1.001<diff<-0.5< td=""><td></td><td></td></diff<-0.5<></td></diff<-1<></td></diff<-1.5<>	-1.501 <diff<-1< td=""><td>-1.001<diff<-0.5< td=""><td></td><td></td></diff<-0.5<></td></diff<-1<>	-1.001 <diff<-0.5< td=""><td></td><td></td></diff<-0.5<>					
TestWeight	Diff<-5	-5.001 <diff<-4< td=""><td>-4.001<diff<-3< td=""><td>-3.001<diff<-2< td=""><td>-2.001<diff<-1< td=""><td></td><td></td></diff<-1<></td></diff<-2<></td></diff<-3<></td></diff<-4<>	-4.001 <diff<-3< td=""><td>-3.001<diff<-2< td=""><td>-2.001<diff<-1< td=""><td></td><td></td></diff<-1<></td></diff<-2<></td></diff<-3<>	-3.001 <diff<-2< td=""><td>-2.001<diff<-1< td=""><td></td><td></td></diff<-1<></td></diff<-2<>	-2.001 <diff<-1< td=""><td></td><td></td></diff<-1<>					
Falling Number	Diff<-125	-125.01 <diff<-100< td=""><td>-100.01<diff<75< td=""><td>-75.01<diff<50< td=""><td>-50.01<diff<-25< td=""><td></td><td></td></diff<-25<></td></diff<50<></td></diff<75<></td></diff<-100<>	-100.01 <diff<75< td=""><td>-75.01<diff<50< td=""><td>-50.01<diff<-25< td=""><td></td><td></td></diff<-25<></td></diff<50<></td></diff<75<>	-75.01 <diff<50< td=""><td>-50.01<diff<-25< td=""><td></td><td></td></diff<-25<></td></diff<50<>	-50.01 <diff<-25< td=""><td></td><td></td></diff<-25<>					
Thousand Kernel Weight	Diff<-10	-10.001 <diff<-8< td=""><td>-8.001<diff<-6< td=""><td>-6.001<diff<-4< td=""><td>-4.001<diff<-2< td=""><td></td><td></td></diff<-2<></td></diff<-4<></td></diff<-6<></td></diff<-8<>	-8.001 <diff<-6< td=""><td>-6.001<diff<-4< td=""><td>-4.001<diff<-2< td=""><td></td><td></td></diff<-2<></td></diff<-4<></td></diff<-6<>	-6.001 <diff<-4< td=""><td>-4.001<diff<-2< td=""><td></td><td></td></diff<-2<></td></diff<-4<>	-4.001 <diff<-2< td=""><td></td><td></td></diff<-2<>					
Wheat Ash										
Component Score	10	8	6	4	2		0			
Protein	-0.501 <di< td=""><td>2<diff<3.001< td=""><td>3<diff<4.001< td=""><td>4<diff<5.001< td=""><td>5<diff<6.001< td=""><td>Diff&gt;6</td><td></td></diff<6.001<></td></diff<5.001<></td></diff<4.001<></td></diff<3.001<></td></di<>	2 <diff<3.001< td=""><td>3<diff<4.001< td=""><td>4<diff<5.001< td=""><td>5<diff<6.001< td=""><td>Diff&gt;6</td><td></td></diff<6.001<></td></diff<5.001<></td></diff<4.001<></td></diff<3.001<>	3 <diff<4.001< td=""><td>4<diff<5.001< td=""><td>5<diff<6.001< td=""><td>Diff&gt;6</td><td></td></diff<6.001<></td></diff<5.001<></td></diff<4.001<>	4 <diff<5.001< td=""><td>5<diff<6.001< td=""><td>Diff&gt;6</td><td></td></diff<6.001<></td></diff<5.001<>	5 <diff<6.001< td=""><td>Diff&gt;6</td><td></td></diff<6.001<>	Diff>6				
TestWeight	-1.001 <di< td=""><td>2<diff<4.001< td=""><td>4<diff<6.001< td=""><td>6<diff<8.001< td=""><td>8<diff<10.001< td=""><td>Diff&gt;10</td><td></td></diff<10.001<></td></diff<8.001<></td></diff<6.001<></td></diff<4.001<></td></di<>	2 <diff<4.001< td=""><td>4<diff<6.001< td=""><td>6<diff<8.001< td=""><td>8<diff<10.001< td=""><td>Diff&gt;10</td><td></td></diff<10.001<></td></diff<8.001<></td></diff<6.001<></td></diff<4.001<>	4 <diff<6.001< td=""><td>6<diff<8.001< td=""><td>8<diff<10.001< td=""><td>Diff&gt;10</td><td></td></diff<10.001<></td></diff<8.001<></td></diff<6.001<>	6 <diff<8.001< td=""><td>8<diff<10.001< td=""><td>Diff&gt;10</td><td></td></diff<10.001<></td></diff<8.001<>	8 <diff<10.001< td=""><td>Diff&gt;10</td><td></td></diff<10.001<>	Diff>10				
Falling Number	-25.01 <di< td=""><td>ff</td><td></td><td></td><td></td><td></td><td></td></di<>	ff								
Thousand Kernel Weight	-2.001 <di< td=""><td>4<diff<8.001< td=""><td>8<diff<12.001< td=""><td>12<diff<16.001< td=""><td>16<diff<20.001< td=""><td>Diff&gt;20</td><td></td></diff<20.001<></td></diff<16.001<></td></diff<12.001<></td></diff<8.001<></td></di<>	4 <diff<8.001< td=""><td>8<diff<12.001< td=""><td>12<diff<16.001< td=""><td>16<diff<20.001< td=""><td>Diff&gt;20</td><td></td></diff<20.001<></td></diff<16.001<></td></diff<12.001<></td></diff<8.001<>	8 <diff<12.001< td=""><td>12<diff<16.001< td=""><td>16<diff<20.001< td=""><td>Diff&gt;20</td><td></td></diff<20.001<></td></diff<16.001<></td></diff<12.001<>	12 <diff<16.001< td=""><td>16<diff<20.001< td=""><td>Diff&gt;20</td><td></td></diff<20.001<></td></diff<16.001<>	16 <diff<20.001< td=""><td>Diff&gt;20</td><td></td></diff<20.001<>	Diff>20				
Wheat Ash	Diff<0.10	10.1 <diff<0.201< td=""><td>0.2<diff<0.301< td=""><td>0.3<diff<0.401< td=""><td>0.4<diff<0.501< td=""><td>Diff&gt;0.5</td><td></td></diff<0.501<></td></diff<0.401<></td></diff<0.301<></td></diff<0.201<>	0.2 <diff<0.301< td=""><td>0.3<diff<0.401< td=""><td>0.4<diff<0.501< td=""><td>Diff&gt;0.5</td><td></td></diff<0.501<></td></diff<0.401<></td></diff<0.301<>	0.3 <diff<0.401< td=""><td>0.4<diff<0.501< td=""><td>Diff&gt;0.5</td><td></td></diff<0.501<></td></diff<0.401<>	0.4 <diff<0.501< td=""><td>Diff&gt;0.5</td><td></td></diff<0.501<>	Diff>0.5				

# Wheat Quality by Location

		-										Wheat		
		Wheat	Flour				Kernel	Kerne	el Size	Wheat	Wheat	Falling	SKCS	Vitreous
		Protein	Protein	Wheat Ma	rket Score	Test Weight	Weight	large	small	Moisture	Ash	Number	Hardness	Kernels
Entry	ID	12%mb	12%mb	1 to 6	1 to 10	lb/bu	g/1000	(g)	(g)	%	14%mb	sec	HI	%
SD3851	B3	11.3	10.9	3.6	7.8	63.8	37.2	70	4	10.7	1.60	388	81.9	46.9
ND806	B4	12.4	11.3	3.6	8.2	62.2	33.6	72	4	10.6	1.65	400	84.6	65.8
06MSP18	B5	11.4	10.4	3.2	7.0	62.7	30.2	37	8	10.7	1.59	400	75.0	27.1
Glenn	B8	13.3	12.4	4.1	10.0	65.4	33.2	77	5	10.6	1.67	400	87.5	87.0
01S0042-10	B10	13.0	12.2	3.7	8.8	63.9	28.8	73	4	10.3	1.58	400	81.3	72.7
SD3851	C3	13.8	12.9	4.2	9.0	63.9	34.2	72	4	10.6	1.48	400	80.4	73.2
ND806	C4	12.2	11.1	3.7	5.6	62.6	28.0	22	13	10.6	1.42	400	79.4	49.2
06MSP18	C5	14.0	12.8	3.2	8.8	62.2	35.8	71	4	10.3	1.66	400	86.3	79.7
NDSW0601	C6	13.0	12.4	3.2	6.8	61.2	34.8	76	3	10.3	1.66	344	82.0	77.6
Samson	C7	13.1	12.8	3.5	6.4	61.0	31.0	54	6	10.5	1.68	400	77.2	48.8
Glenn	C8	14.3	13.4	4.3	10.0	65.2	35.6	80	2	12.1	1.72	400	88.5	95.6
MN03358-4	C9	14.1	13.2	3.9	8.8	62.4	33.0	61	5	10.4	1.80	400	95.3	93.4
01S0042-10	C10	13.7	13.2	4.0	8.6	63.4	31.8	69	4	11.0	1.67	400	81.2	62.2
ND809	C11	13.8	13.1	4.0	8.6	63.2	31.6	75	3	10.5	1.70	400	88.2	78.5
00\$0291-3	K1	13.7	13.0	4.3	8.2	62.2	36.5	76	3	11.3	1.36	400	78.1	80.7
SD3851	K3	13.5	13.0	4.4	8.4	64.1	36.5	68	5	10.5	1.21	387	85.9	79.3
06MSP18	K5	12.1	11.1	3.5	4.2	62.4	24.3	18	16	10.4	1.23	400	81.9	78.0
Glenn	К8	14.7	14.0	4.8	10.0	65.3	36.8	82	2	10.7	1.37	400	85.9	96.6
MN03358-4	K9	13.6	13.1	4.0	6.8	62.4	30.7	56	5	10.3	1.31	400	95.3	96.1
ND809	K11	13.8	13.1	4.7	9.0	63.8	40.3	82	2	10.5	1.39	400	90.2	92.6
NDSW0449	W2	17.4	17.1	3.9	8.0	57.8	22.3	3	31	9.5	1.36	400	62.7	88.2
ND806	W4	17.3	16.5	3.9	8.4	58.1	22.5	9	19	9.5	1.21	400	71.4	98.2
NDSW0601	W6	18.1	17.8	4.1	8.4	58.0	26.9	15	15	9.5	1.35	400	68.3	92.0
Samson	W7	17.5	17.1	3.7	8.2	57.4	23.6	10	22	9.3	1.30	400	63.9	95.6
Glenn	W8	16.9	16.2	4.4	10.0	61.7	24.8	5	18	9.4	1.14	400	69.5	94.9
ND809	W11	17.8	17.0	4.4	9.4	60.5	24.9	9	18	9.8	1.28	400	79.4	97.6
CO1320W	W12	17.0	16.6	3.8	8.0	57.5	24.5	14	17	9.5	1.41	400	63.3	98.2

		Flour Extraction			- Flour	Color	Flour	Flour	Flour FN
E a tau c		IWB	IPB	FIOUR/DU Wheat	FIOU	L0101	Moisture	ASN 1.407 mala	Mailed
Entry	ID	%	%	LDS	L"	D.	%	14%mD	sec
SD3851	B3	71.8	75.3	47.9	90.9	10.5	13.0	0.493	250
ND806	B4	70.9	75.0	46.1	90.7	9.5	12.3	0.529	244
06MSP18	B5	70.8	74.9	46.4	91.1	10.1	12.3	0.432	252
Glenn	B8	68.3	71.7	46.8	90.8	8.9	12.4	0.473	249
01S0042-10	B10	68.7	72.2	46.1	91.0	10.7	13.3	0.470	252
SD3851	C3	72.0	75.8	48.2	90.4	10.0	12.2	0.496	245
ND806	C4	71.4	75.0	46.8	90.7	10.4	12.5	0.445	253
06MSP18	C5	69.2	72.8	45.1	90.3	9.9	12.3	0.543	245
NDSW0601	C6	70.5	74.7	45.2	90.7	11.0	12.5	0.637	270
Samson	C7	72.5	76.5	46.3	90.2	11.7	12.1	0.537	256
Glenn	C8	67.6	70.6	46.2	90.7	8.7	12.6	0.418	249
MN03358-4	C9	67.1	70.6	43.9	90.1	10.1	12.6	0.603	261
01S0042-10	C10	70.3	73.5	46.7	90.8	10.8	13.6	0.471	251
ND809	C11	68.5	72.2	45.2	90.5	9.5	12.6	0.471	249
00S0291-3	K1	73.5	77.5	47.8	90.5	9.8	13.0	0.474	247
SD3851	K3	72.3	75.7	48.5	90.4	10.1	12.3	0.458	252
06MSP18	K5	72.1	75.5	47.0	91.0	10.3	13.1	0.384	250
Glenn	K8	70.7	74.2	48.4	90.9	8.5	13.3	0.403	257
MN03358-4	K9	68.7	72.5	45.0	90.0	10.2	12.5	0.474	251
ND809	K11	71.8	75.8	47.8	90.4	9.4	12.5	0.411	246
NDSW0449	W2	70.2	74.5	43.2	90.0	10.6	12.3	0.418	238
ND806	W4	70.7	74.7	43.8	90.5	9.5	12.9	0.438	239
NDSW0601	W6	70.5	75.1	43.7	89.6	11.1	12.4	0.529	250
Samson	W7	70.7	75.2	43.4	90.4	11.6	12.3	0.471	250
Glenn	W8	70.0	73.6	45.8	90.6	9.7	12.8	0.405	249
ND809	W11	70.3	74.2	45.2	90.3	10.1	12.7	0.414	234
CO1320W	W12	69.7	74.2	42.7	90.7	7.9	12.4	0.446	251

		Farinograph								
		Water Abs	Water Abs							
		500 bu	14%mb	Arrival Time	Peak Time	Dough Stability	MTI	TTB		
Entry	ID	%	%	min	min	min	bu	min		
SD3851	B3	62.1	61.2	1.3	1.8	5.4	34.0	6.2		
ND806	B4	62.5	61.2	1.8	3.0	6.1	33.0	7.9		
06MSP18	B5	58.8	57.9	1.5	2.5	5.5	35.0	6.8		
Glenn	<b>B8</b>	65.4	63.9	1.9	3.3	7.2	24.0	8.8		
01S0042-10	B10	64.2	63.3	3.2	5.5	6.0	50.0	9.0		
SD3851	C3	65.6	64.4	3.3	6.7	6.2	51.0	9.5		
ND806	C4	59.8	59.0	2.0	4.3	4.9	59.0	7.0		
06MSP18	C5	65.2	63.9	2.3	4.8	7.3	28.0	10.1		
NDSW0601	C6	64.5	63.7	3.5	6.2	8.5	27.0	9.8		
Samson	C7	63.9	62.4	2.1	3.8	5.8	40.0	7.9		
Glenn	C8	67.0	66.0	3.0	5.8	7.6	37.0	10.7		
MN03358-4	C9	67.6	65.9	1.9	3.8	5.1	46.0	7.3		
01S0042-10	C10	66.1	65.4	2.8	5.2	6.4	41.0	9.2		
ND809	C11	68.0	67.0	2.8	5.9	6.4	43.0	8.9		
000001.0	144		( ) 0		<i>,</i> 7	<i>(</i> <b>-</b>		10.0		
0050291-3	K1	65.4	64.9	3.8	6.7	6.7	33.0	10.9		
SD3851	K3	63.3	62.3	2.0	6.7	10.1	23.0	12.1		
06MSP18	K5	58.9	57.6	1.9	4.9	6.2	41.0	8.1		
Glenn	K8	65.1	64.3	3.2	9.0	12.1	25.0	14.8		
MN03358-4	K9	66.9	65.1	2.8	5.8	6.4	37.0	9.6		
ND809	K11	69.3	68.3	3.0	5.3	7.5	30.0	10.5		
NDSW0449	W2	65.7	64.0	5.0	7.5	9.7	21.0	14.8		
ND806	W4	64 7	63.0	4 5	9.5	10.5	28.0	15.1		
NDSW0601	W/6	69.2	67.4	6.9	11 4	13.0	14 N	20.0		
Samson	W7	63.3	61.4	4 5	10.2	14.9	23.0	17.6		
Glenn	W/8	64 5	63 1	50	12 9	15.0	14 0	20.0		
	W/11	68.1	66.8	63	10.8	13.0	11 0	20.0		
CO1320W/	W12	63.8	61.9	5.0	95	14.9	11.0	20.0		
Glenn 01S0042-10 SD3851 ND806 06MSP18 NDSW0601 Samson Glenn MN03358-4 01S0042-10 ND809 00S0291-3 SD3851 06MSP18 Glenn MN03358-4 ND809 NDSW0449 ND806 NDSW0601 Samson Glenn ND809 CO1320W	<b>B8</b> B10 C3 C4 C5 C6 C7 <b>C8</b> C9 C10 C11 K1 K3 K5 <b>K8</b> K9 K11 W2 W4 W6 W7 W4 W6 W7 <b>W8</b> W11 W12	<b>65.4</b> 64.2 65.6 59.8 65.2 64.5 63.9 <b>67.0</b> 67.6 66.1 68.0 <b>65.4</b> 63.3 58.9 <b>65.1</b> 66.9 69.3 65.7 64.7 69.2 63.3 64.5 68.1 63.8	63.9 63.3 64.4 59.0 63.9 63.7 62.4 66.0 65.9 65.4 67.0 64.9 62.3 57.6 64.3 65.1 68.3 65.1 68.3 64.0 63.0 67.4 61.4 63.1 66.8 61.9	1.9 3.2 3.3 2.0 2.3 3.5 2.1 <b>3.0</b> 1.9 2.8 2.8 3.8 2.0 1.9 <b>3.2</b> 2.8 3.0 <b>5.0</b> 4.5 <b>6.9</b> 4.5 <b>5.0</b> 6.3 5.0	3.3 5.5 6.7 4.3 4.8 6.2 3.8 5.8 3.8 5.2 5.9 6.7 6.7 4.9 9.0 5.8 5.3 7.5 9.5 11.4 10.2 12.9 10.8 9.5	<b>7.2</b> 6.0 6.2 4.9 7.3 8.5 5.8 <b>7.6</b> 5.1 6.4 6.4 6.7 10.1 6.2 <b>12.1</b> 6.4 7.5 9.7 10.5 13.0 14.9 <b>15.0</b> 13.6 14.9	24.0 50.0 51.0 59.0 28.0 27.0 40.0 <b>37.0</b> 46.0 41.0 43.0 33.0 23.0 41.0 <b>25.0</b> 37.0 30.0 21.0 28.0 14.0 23.0 14.0 23.0 11.0 11.0	<ul> <li>8.8</li> <li>9.0</li> <li>9.5</li> <li>7.0</li> <li>10.1</li> <li>9.8</li> <li>7.9</li> <li>10.7</li> <li>7.3</li> <li>9.2</li> <li>8.9</li> <li>10.9</li> <li>12.1</li> <li>8.1</li> <li>14.8</li> <li>9.6</li> <li>10.5</li> <li>14.8</li> <li>15.1</li> <li>20.0</li> <li>17.6</li> <li>20.0</li> <li>20.0</li> <li>20.0</li> <li>20.0</li> </ul>		

		Mixograph									
		Envelop	Envelop	Envelop	Midline	Midline	Midline	Midline			
		Peak Time	Peak Value	Peak Width	Peak Time	Peak Value	Peak Width	Peak Integral			
Entry	ID	Min	%	%	Min	%	%	%tq*min			
SD3851	B3	5.5	67.6	29.7	5.4	52.7	29.7	237.6			
ND806	B4	4.3	59.6	20.2	4.9	49.5	17.2	202.9			
06MSP18	B5	3.8	56.8	21.1	4.3	47.1	16.3	172.7			
Glenn	<b>B8</b>	4.9	65.7	26.0	5.9	53.4	21.7	273.4			
01S0042-10	B10	3.4	69.1	24.8	3.7	56.5	21.5	174.4			
SD3851	C3	3.1	78.2	28.3	3.3	64.3	24.9	159.0			
ND806	C4	2.6	64.9	24.4	3.2	53.2	17.6	135.1			
06MSP18	C5	2.7	63.8	19.6	3.1	54.6	15.6	134.3			
NDSW0601	C6	2.8	65.2	16.8	3.0	56.8	16.1	133.6			
Samson	C7	3.0	62.1	23.1	3.5	51.6	16.6	150.9			
Glenn	<b>C8</b>	4.3	68.3	24.3	4.6	55.7	23.0	212.5			
MN03358-4	C9	3.2	65.3	21.4	3.0	54.3	20.2	134.8			
01S0042-10	C10	2.7	75.5	26.8	2.7	61.2	26.8	128.0			
ND809	C11	2.7	80.3	28.7	2.8	66.2	27.7	145.6			
00S0291-3	K1	2.3	74.7	28.9	2.6	61.6	22.6	122.4			
SD3851	K3	4.5	70.9	30.8	4.9	55.1	20.3	219.3			
06MSP18	K5	2.9	61.2	22.2	3.4	50.9	18.0	146.0			
Glenn	K8	3.7	73.2	34.9	4.8	59.6	20.2	228.5			
MN03358-4	K9	2.2	68.0	29.6	3.6	56.0	18.2	171.0			
ND809	K11	3.1	68.2	16.9	3.1	59.1	16.9	148.1			
NDSW0449	W2	3.1	76.6	25.5	3.4	64.7	22.5	160.8			
ND806	W4	4.6	74.0	23.7	4.6	61.3	23.5	211.2			
NDSW0601	W6	3.9	89.2	32.9	4.2	73.9	27.7	213.9			
Samson	W7	8.4	69.9	30.5	8.6	54.6	30.1	363.1			
Glenn	W8	5.2	74.2	26.9	5.6	61.0	23.7	243.9			
ND809	W11	4.4	86.0	32.7	4.4	68.9	32.6	214.6			
COI320W	W12	5.2	73.8	21.4	5.1	63.0	21.4	222.5			



## Cumulative Ash Curve – Brookings, SD













## Cumulative Ash Curve – Casselton, ND











### Cumulative Ash Curve – Crookston, MN





## Cumulative Ash Curve – Williston, ND

























# **Brookings Mixograms**

















# 06MSP18 (B5)



# Glenn Check (B8)









# 06MSP18 (C5)

# NDSW0601 (C6)



# Samson (C7)

# Glenn Check (C8)





# 01S0042-10 (C10)


### ND809 (C11)



## 00S0291-3 (K1)



### 06MSP18 (K5)



### Glenn Check (K8)



### MN03358-4 (K9)



### ND809 (K11)



### NDSW0449 (W2)



### ND806 (W4)



# NDSW0601 (W6)

## Samson (W7)











### Glenn Check (W8)



### ND809 (W11)





### Glenn Check Evaluation (by Cooperator)

		200	8 Hard	Spring Whea	it Crop	200	/ Hard	Spring whea	at Crop
Brookings B8	Bake	Bake	Loaf	Mixing	Dough	Bake	Loaf	Mixing	Dough
Cooperator	Method	Absorption	Volume	Requirement	Characteristic	Absorption	Volume	Requirement	Characteristic
1	Sponge/Dough	58.0	2725	4	3	58.0	2850	5	5
2	Straight Dough	62.0	2900	3	4	60.7	2700	2	3
2	Straight Dough	62.0	2700	3	-	61.0	2700	2	3
3	Sponge/Dough	02.0	907 2015	4 F	5 F	01.0	007	Z F	4 F
4	Sponge/Dougn	65.0	3015	5	5	63.0	3104	5	5
5	Straight Dough	65.9	2950	2	5	64.8	2925	2	3
6	Straight Dough	63.0	3000	3	3	62.0	2450	2	3
7	Straight Dough	63.9	915	4	3	61.3	870	4	4
8	Straight Dough	63.7	710	5	2	65.5	778	4	3
10	Straight Dough	64.4	835	3	4	65.8	725	3	5
Average	0 0	63.1		3.7	3.8	62.5		3.2	3.9
+ 1 Std Dev		23		10	11	2.6		13	0.9
		2.0				2.0			0.7
Cassolton C9	Bako	Rako	Loaf	Mixing	Dough	Rako	Loaf	Mixing	Dough
Cassellon Co	Dake		LUdi	IVIIXII IY	Douyii Ohana ataniatia		LUai	IVIIXII IY	Douyn
Cooperator	Method	Absorption	volume	Requirement	Characteristic	Absorption	volume	Requirement	Characteristic
1	Sponge/Dough	59.0	2725	3	3	62.0	2975	5	5
2	Straight Dough	62.0	3150	4	5	62.9	3400	3	2
3	Sponge/Dough	64.0	975	4	3	64.0	998	4	4
4	Sponge/Dough	66.0	2956	5	5	63.0	2986	5	5
5	Straight Dough	68.0	2675	2	5	66.0	3075	3	3
6	Straight Dough	64.0	2750	3	3	64.0	2850	3	3
7	Straight Dough	65.5	950	3	3	62.5	1005	1	4
, 0	Straight Dough	64.7	015	2	3	67.0	010		2
10	Straight Dough	04.7	710	5	4	07.2	710	5	3
10	Straight Dough	66.0	960	3	4	00.7	800	3	4
Average		64.4		3.3	3.9	64.3		3.9	3.7
± 1 Std Dev		2.6		0.9	0.9	1.9		0.9	1.0
Crookston K8	Bake	Bake	Loaf	Mixing	Dough	Bake	Loaf	Mixing	Dough
Crookston K8 Cooperator	Bake Method	Bake Absorption	Loaf Volume	Mixing Requirement	Dough Characteristic	Bake Absorption	Loaf Volume	Mixing Requirement	Dough Characteristic
Crookston K8 Cooperator	Bake Method Sponge/Dough	Bake Absorption 60.0	Loaf Volume 3000	Mixing Requirement 4	Dough Characteristic 4	Bake Absorption 61.0	Loaf Volume 3000	Mixing Requirement 5	Dough Characteristic 5
Crookston K8 Cooperator 1 2	Bake Method Sponge/Dough Straight Dough	Bake Absorption 60.0 60.0	Loaf Volume 3000 2900	Mixing Requirement 4 4	Dough Characteristic 4 5	Bake Absorption 61.0 64.3	Loaf Volume 3000 3350	Mixing Requirement 5 3	Dough Characteristic 5 3
Crookston K8 Cooperator	Bake Method Sponge/Dough Straight Dough Sponge/Dough	Bake Absorption 60.0 60.0 64.0	Loaf Volume 3000 2900 1075	Mixing Requirement 4 4 4	Dough Characteristic 4 5 4	Bake Absorption 61.0 64.3 62.0	Loaf <u>Volume</u> 3000 3350 923	Mixing Requirement 5 3 3	Dough Characteristic 5 3 4
Crookston K8 Cooperator 1 2 3 4	Bake Method Sponge/Dough Straight Dough Sponge/Dough Sponge/Dough	Bake Absorption 60.0 60.0 64.0 65.0	Loaf Volume 3000 2900 1075 2986	Mixing Requirement 4 4 4 5	Dough Characteristic 4 5 4 5	Bake Absorption 61.0 64.3 62.0 66.0	Loaf Volume 3000 3350 923 2986	Mixing Requirement 5 3 3 5	Dough Characteristic 5 3 4 5
Crookston K8 Cooperator 1 2 3 4 5	Bake Method Sponge/Dough Straight Dough Sponge/Dough Straight Dough	Bake Absorption 60.0 60.0 64.0 65.0 66.2	Loaf Volume 3000 2900 1075 2986 2125	Mixing Requirement 4 4 5	Dough Characteristic 4 5 4 5 2	Bake Absorption 61.0 64.3 62.0 66.0 69.1	Loaf Volume 3000 3350 923 2986 2300	Mixing Requirement 5 3 3 5 5 2	Dough Characteristic 5 3 4 5 4
Crookston K8 Cooperator 1 2 3 4 5	Bake Method Sponge/Dough Straight Dough Sponge/Dough Straight Dough Straight Dough	Bake Absorption 60.0 60.0 64.0 65.0 66.3 62.0	Loaf Volume 3000 2900 1075 2986 3125 2000	Mixing Requirement 4 4 5 4	Dough Characteristic 4 5 4 5 3 4	Bake Absorption 61.0 64.3 62.0 66.0 68.1 64.0	Loaf Volume 3000 3350 923 2986 3300 2450	Mixing Requirement 5 3 3 5 3 4	Dough Characteristic 5 3 4 5 4 4
Crookston K8 Cooperator 1 2 3 4 5 6 6	Bake Method Sponge/Dough Straight Dough Sponge/Dough Straight Dough Straight Dough	Bake Absorption 60.0 64.0 65.0 66.3 66.3 63.0	Loaf Volume 3000 2900 1075 2986 3125 3000	Mixing Requirement 4 4 5 4 4 4	Dough Characteristic 4 5 4 5 3 4 2	Bake Absorption 61.0 64.3 62.0 66.0 68.1 64.0 (41)	Loaf Volume 3000 3350 923 2986 3300 2450	Mixing Requirement 5 3 3 5 3 4	Dough Characteristic 5 3 4 5 4 5 4 4
Crookston K8 Cooperator 1 2 3 4 5 6 7	Bake <u>Method</u> Sponge/Dough Straight Dough Sponge/Dough Straight Dough Straight Dough Straight Dough	Bake Absorption 60.0 64.0 65.0 66.3 63.0 63.6	Loaf Volume 3000 2900 1075 2986 3125 3000 1030	Mixing Requirement 4 4 5 4 4 4 3	Dough Characteristic 4 5 4 5 3 4 4 3	Bake Absorption 61.0 64.3 62.0 66.0 68.1 64.0 64.6	Loaf Volume 3000 3350 923 2986 3300 2450 1045	Mixing Requirement 5 3 5 5 3 4 4 3	Dough Characteristic 5 3 4 5 4 4 4 4 4 4
Crookston K8 Cooperator 1 2 3 4 5 6 7 8	Bake Method Sponge/Dough Straight Dough Sponge/Dough Straight Dough Straight Dough Straight Dough Straight Dough	Bake Absorption 60.0 64.0 65.0 66.3 63.0 63.6 63.6 66.7	Loaf Volume 3000 2900 1075 2986 3125 3000 1030 1020	Mixing Requirement 4 4 5 4 4 4 3 2	Dough Characteristic 4 5 4 5 3 4 3 4 3 2	Bake Absorption 61.0 64.3 62.0 66.0 68.1 64.0 64.6 69.8	Loaf Volume 3000 3350 923 2986 3300 2450 1045 983	Mixing Requirement 5 3 5 5 3 4 3 4 3 4 3 4	Dough Characteristic 5 3 4 5 4 4 4 4 4 5
Crookston K8 Cooperator 1 2 3 4 5 6 7 8 10	Bake Method Sponge/Dough Straight Dough Sponge/Dough Straight Dough Straight Dough Straight Dough Straight Dough Straight Dough	Bake Absorption 60.0 64.0 65.0 66.3 63.0 63.6 66.7 64.1	Loaf Volume 2900 1075 2986 3125 3000 1030 1020 885	Mixing Requirement 4 4 5 4 4 3 2 3	Dough Characteristic 4 5 4 5 3 4 3 4 3 2 4 3 2 4	Bake Absorption 61.0 64.3 62.0 66.0 68.1 64.0 64.6 69.8 68.0	Loaf Volume 3000 3350 923 2986 3300 2450 1045 983 880	Mixing <u>Requirement</u> 5 3 5 3 4 3 4 3 4 3 4 3 4 3	Dough Characteristic 5 3 4 5 4 4 4 4 4 5 4 5 4
Crookston K8 Cooperator 1 2 3 4 5 6 7 8 10 Average	Bake Method Sponge/Dough Sponge/Dough Sponge/Dough Straight Dough Straight Dough Straight Dough Straight Dough	Bake Absorption 60.0 64.0 65.0 66.3 63.0 63.6 66.7 64.1 <b>63.6</b>	Loaf Volume 2900 1075 2986 3125 3000 1030 1020 885	Mixing Requirement 4 4 5 4 4 3 2 3 3 3 3.7	Dough <u>Characteristic</u> 4 5 4 5 3 4 3 4 3 2 4 <b>3</b> 2 4 <b>3</b> 8	Bake Absorption 61.0 64.3 62.0 66.0 68.1 64.0 64.6 69.8 68.0 <b>65.3</b>	Loaf Volume 3000 3350 923 2986 3300 2450 1045 983 880	Mixing <u>Requirement</u> 5 3 5 3 4 3 4 3 4 3 4 3 <b>3</b> . <b>4</b> . 3 <b>4</b> . 3 <b>4</b> . 3 <b>5</b> . <b>3</b> . <b>5</b> . <b>3</b> . <b>4</b> . <b>3</b> . <b>5</b> . <b>3</b> . <b>5</b> . <b>3</b> . <b>5</b> . <b>3</b> . <b>4</b> . <b>3</b> . <b>4</b> . <b>3</b> . <b>4</b> . <b>3</b> . <b>4</b> . <b>3</b> . <b>5</b> . <b>3</b> . <b>4</b> . <b>3</b> . <b>3</b> . <b>4</b> . <b>3</b> . <b>7</b> . <b>1</b> .	Dough <u>Characteristic</u> 5 3 4 5 4 4 4 4 5 4 4 5 4 <b>4.2</b>
Crookston K8 <u>Cooperator</u> 1 2 3 4 5 6 7 8 10 Average ± 1 Std Dev	Bake Method Sponge/Dough Sponge/Dough Sponge/Dough Straight Dough Straight Dough Straight Dough Straight Dough	Bake Absorption 60.0 64.0 65.0 66.3 63.0 63.6 66.7 64.1 63.6 2.4	Loaf Volume 2900 1075 2986 3125 3000 1030 1020 885	Mixing Requirement 4 4 5 4 4 3 2 3 3 3 7 0.9	Dough Characteristic 4 5 4 5 3 4 3 4 3 2 4 3.8 1.0	Bake Absorption 61.0 64.3 62.0 66.0 68.1 64.0 64.6 69.8 68.0 65.3 2.9	Loaf Volume 3000 3350 923 2986 3300 2450 1045 983 880	Mixing Requirement 5 3 5 3 4 3 4 3 4 3 4 3 3 7 0.9	Dough Characteristic 5 3 4 5 4 4 4 4 5 4 5 4 4 2 0.7
Crookston K8 <u>Cooperator</u> 1 2 3 4 5 6 7 8 10 Average ± 1 Std Dev	Bake <u>Method</u> Sponge/Dough Sponge/Dough Straight Dough Straight Dough Straight Dough Straight Dough Straight Dough	Bake Absorption 60.0 64.0 65.0 66.3 63.0 63.6 66.7 64.1 <b>63.6</b> <b>2.4</b>	Loaf Volume 2900 1075 2986 3125 3000 1030 1020 885	Mixing Requirement 4 4 5 4 4 3 2 3 3 3 7 0.9	Dough Characteristic 4 5 4 5 3 4 3 2 4 3.8 1.0	Bake Absorption 61.0 64.3 62.0 66.0 68.1 64.0 64.6 69.8 68.0 <b>65.3</b> <b>2.9</b>	Loaf Volume 3000 3350 923 2986 3300 2450 1045 983 880	Mixing Requirement 5 3 5 3 4 3 4 3 4 3 3 4 3 7 0.9	Dough Characteristic 5 3 4 5 4 4 4 4 5 4 5 4 4 2 0.7
Crookston K8 <u>Cooperator</u> 1 2 3 4 5 6 7 8 10 Average ± 1 Std Dev Williston W8	Bake Method Sponge/Dough Sponge/Dough Straight Dough Straight Dough Straight Dough Straight Dough Straight Dough Straight Dough	Bake <u>Absorption</u> <u>60.0</u> <u>60.0</u> <u>64.0</u> <u>65.0</u> <u>66.3</u> <u>63.6</u> <u>66.7</u> <u>64.1</u> <u>63.6</u> <u>2.4</u> Bake	Loaf <u>Volume</u> <u>3000</u> <u>2900</u> 1075 <u>2986</u> <u>3125</u> <u>3000</u> 1030 <u>1020</u> <u>885</u>	Mixing Requirement 4 4 5 4 4 3 2 3 3 7 0.9 Mixing	Dough Characteristic 4 5 4 5 3 4 3 4 3 2 4 3.8 1.0 Dough	Bake Absorption 61.0 64.3 62.0 66.0 68.1 64.0 64.6 69.8 68.0 <b>65.3</b> <b>2.9</b> Bake	Loaf Volume 3000 3350 923 2986 3300 2450 1045 983 880	Mixing Requirement 5 3 5 3 4 3 4 3 4 3 3 4 3 7 0.9 Mixing	Dough Characteristic 5 3 4 5 4 4 4 4 5 4 5 4 4 2 0.7 Dough
Crookston K8 Cooperator 1 2 3 4 5 6 7 8 10 Average ± 1 Std Dev Williston W8 Cooperator	Bake Method Sponge/Dough Straight Dough Sponge/Dough Straight Dough Straight Dough Straight Dough Straight Dough Straight Dough	Bake <u>Absorption</u> <u>60.0</u> <u>60.0</u> <u>64.0</u> <u>65.0</u> <u>66.3</u> <u>63.6</u> <u>66.7</u> <u>64.1</u> <u>63.6</u> <u>2.4</u> Bake Absorption	Loaf Volume 2900 1075 2986 3125 3000 1030 1020 885	Mixing Requirement 4 4 5 4 4 3 2 3 3 3.7 0.9 Mixing Requirement	Dough Characteristic 4 5 4 5 3 4 3 4 3 2 4 3.8 1.0 Dough Characteristic	Bake Absorption 61.0 64.3 62.0 66.0 68.1 64.0 64.6 69.8 68.0 <b>65.3</b> <b>2.9</b> Bake Absorption	Loaf Volume 3000 3350 923 2986 3300 2450 1045 983 880 Loaf Volume	Mixing Requirement 5 3 5 3 4 3 4 3 4 3 4 3 3 7 0.9 Mixing Requirement	Dough Characteristic 5 3 4 5 4 4 4 4 5 4 5 4 4 2 0.7
Crookston K8 Cooperator  1 2 3 4 5 6 7 8 10 Average ± 1 Std Dev Williston W8 Cooperator 1	Bake Method Sponge/Dough Straight Dough Sponge/Dough Straight Dough Straight Dough Straight Dough Straight Dough Straight Dough Straight Dough Straight Dough	Bake <u>Absorption</u> 60.0 64.0 65.0 66.3 63.0 63.6 66.7 64.1 <b>63.6</b> <b>2.4</b> Bake <u>Absorption</u> 62.0	Loaf Volume 2900 1075 2986 3125 3000 1030 1030 885 Loaf Volume 2850	Mixing Requirement	Dough Characteristic 4 5 4 5 3 4 3 4 3 2 4 3.8 1.0 Dough Characteristic	Bake Absorption 61.0 64.3 62.0 66.0 68.1 64.0 64.6 69.8 68.0 65.3 2.9 Bake Absorption	Loaf Volume 3000 3350 923 2986 3300 2450 1045 983 880 Loaf Volume 2925	Mixing <u>Requirement</u> 5 3 5 3 4 3 4 3 4 3 4 3 4 3 4 3 4 3 4 3 4 3 4 3 4 3 4 3 4 3 4 3 4 3 4 3 5 5 5 5 6 7 6 7 7 7 7 7 7 7 7 7 7 7 7 7	Dough Characteristic 5 3 4 5 4 4 4 5 4 5 4 4 5 4 4 2 0.7 Dough Characteristic
Crookston K8 Cooperator 1 2 3 4 5 6 7 8 10 Average ± 1 Std Dev Williston W8 Cooperator 1 2	Bake Method Sponge/Dough Straight Dough Sponge/Dough Straight Dough Straight Dough Straight Dough Straight Dough Straight Dough Bake Method Sponge/Dough Straight Dough	Bake <u>Absorption</u> 60.0 64.0 65.0 66.3 63.0 63.6 66.7 64.1 <b>63.6</b> <b>2.4</b> Bake <u>Absorption</u> 58.0	Loaf Volume 3000 2900 1075 2986 3125 3000 1030 1020 885 Loaf Volume 2850	Mixing Requirement 4 4 4 5 4 4 3 2 3 3 3.7 0.9 Mixing Requirement 5 4	Dough <u>Characteristic</u> 4 5 4 5 3 4 3 4 3 2 4 3 8 1.0 Dough <u>Characteristic</u> 5	Bake Absorption 61.0 64.3 62.0 66.0 68.1 64.0 64.6 69.8 68.0 65.3 2.9 Bake Absorption 65.0 65.2	Loaf Volume 3000 3350 923 2986 3300 2450 1045 983 880 Loaf Volume 2925 3400	Mixing <u>Requirement</u> 5 3 5 3 4 3 4 3 4 3 4 3 3 7 0.9 Mixing <u>Requirement</u> 5 2	Dough Characteristic 5 3 4 5 4 4 4 4 5 4 4 5 4 4 2 0.7 Dough Characteristic 5 2
Crookston K8 <u>Cooperator</u>	Bake Method Sponge/Dough Straight Dough Sponge/Dough Straight Dough Straight Dough Straight Dough Straight Dough Straight Dough Straight Dough Straight Dough Straight Dough Straight Dough	Bake Absorption 60.0 64.0 65.0 66.3 63.0 63.6 66.7 64.1 <b>63.6</b> <b>2.4</b> Bake Absorption 62.0 58.0	Loaf Volume 3000 2900 1075 2986 3125 3000 1030 1020 885 Loaf Volume 2850 3050	Mixing Requirement 4 4 5 4 4 3 2 3 3 3.7 0.9 Mixing Requirement 5 4	Dough Characteristic 4 5 4 5 3 4 4 3 2 4 3.8 1.0 Dough Characteristic 5 5	Bake Absorption 61.0 64.3 62.0 66.0 68.1 64.0 64.6 69.8 68.0 <b>65.3</b> <b>2.9</b> Bake Absorption 65.0 65.2 65.2	Loaf Volume 3000 3350 923 2986 3300 2450 1045 983 880 Loaf Volume 2925 3400	Mixing <u>Requirement</u> 5 3 5 3 4 3 4 3 4 3 4 3 7 0.9 Mixing <u>Requirement</u> 5 3 4	Dough Characteristic 5 3 4 5 4 4 4 4 5 4 4 5 4 4 2 0.7 Dough Characteristic 5 3 4
Crookston K8 <u>Cooperator</u>	Bake Method Sponge/Dough Straight Dough Sponge/Dough Straight Dough Straight Dough Straight Dough Straight Dough Straight Dough Straight Dough Sponge/Dough Straight Dough Sponge/Dough	Bake Absorption 60.0 64.0 65.0 66.3 63.0 63.6 66.7 64.1 <b>63.6</b> <b>2.4</b> Bake Absorption 62.0 58.0 64.0	Loaf Volume 3000 2900 1075 2986 3125 3000 1030 1020 885 Volume 2850 3050 1125	Mixing Requirement 4 4 5 4 4 3 2 3 3 3.7 0.9 Mixing Requirement 5 4 5	Dough Characteristic 4 5 4 3 3 4 3 2 4 3.8 1.0 Dough Characteristic 5 5 5 5	Bake Absorption 61.0 64.3 62.0 66.0 68.1 64.0 64.6 69.8 68.0 <b>65.3</b> <b>2.9</b> Bake Absorption 65.0 65.2 64.0 (65.2	Loaf <u>Volume</u> 3000 3350 923 2986 3300 2450 1045 983 880 Loaf <u>Volume</u> 2925 3400 1005	Mixing <u>Requirement</u> 5 3 5 3 4 3 4 3 4 3 4 3 <b>3.7</b> 0.9 Mixing <u>Requirement</u> 5 3 4 5 5 5 5 5 5 5 5 5 5 5 5 5	Dough <u>Characteristic</u> 5 3 4 5 4 4 4 5 4 4 5 4 4 <b>4</b> .2 <b>0.7</b> Dough <u>Characteristic</u> 5 3 4 5
Crookston K8 <u>Cooperator</u>	Bake Method Sponge/Dough Straight Dough Sponge/Dough Straight Dough Straight Dough Straight Dough Straight Dough Straight Dough Straight Dough Sponge/Dough Sponge/Dough Sponge/Dough	Bake Absorption 60.0 64.0 65.0 66.3 63.0 63.6 66.7 64.1 <b>63.6</b> <b>2.4</b> Bake Absorption 62.0 58.0 64.0 64.0 63.0	Loaf Volume 3000 2900 1075 2986 3125 3000 1030 885 Loaf Volume 2850 3050 1125 3162	Mixing Requirement 4 4 4 5 4 4 3 2 3 3 3.7 0.9 Mixing Requirement 5 4 5 5 5	Dough <u>Characteristic</u> 4 5 4 5 3 4 3 2 4 3 2 4 3.8 1.0 Dough <u>Characteristic</u> 5 5 5 5 5	Bake Absorption 61.0 64.3 62.0 66.0 68.1 64.0 64.6 69.8 68.0 <b>65.3</b> <b>2.9</b> Bake Absorption 65.0 65.2 64.0 65.0	Loaf <u>Volume</u> 3000 3350 923 2986 3300 2450 1045 983 880 Loaf <u>Volume</u> 2925 3400 1008 3045	Mixing <u>Requirement</u> 5 3 5 3 4 5 5 3 4 5 5 3 4 5 5 5 6 6 6 6 6 6 7 0 9 Mixing <u>Requirement</u> 5 7 6 7 7 0 9 Mixing <u>Requirement</u> 5 7 7 0 9 Mixing <u>Requirement</u> 5 3 4 3 3 7 0 9 Mixing <u>Requirement</u> 5 3 4 5 3 4 5 3 4 5 3 4 5 3 4 5 3 4 5 3 4 5 3 4 5 3 4 5 3 4 5 3 4 5 3 4 5 3 4 5 3 4 5 3 4 5 5 3 4 5 5 3 4 5 5 5 5 5 5 5 5 5 5 5 5 5	Dough <u>Characteristic</u> 5 3 4 5 4 4 4 5 4 4 5 4 4 <b>4</b> .2 <b>0.7</b> Dough <u>Characteristic</u> 5 3 4 5 3 4 5 5 5 5 5 5 5 5 5 5 5 5 5
Crookston K8 <u>Cooperator</u> 1 2 3 4 5 6 7 8 10 Average ± 1 Std Dev Williston W8 Cooperator 1 2 3 4 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	Bake Method Sponge/Dough Straight Dough Sponge/Dough Straight Dough Straight Dough Straight Dough Straight Dough Straight Dough Straight Dough Sponge/Dough Sponge/Dough Sponge/Dough Sponge/Dough Straight Dough	Bake Absorption 60.0 64.0 65.0 66.3 63.0 63.6 66.7 64.1 <b>63.6</b> <b>2.4</b> Bake Absorption 62.0 58.0 64.0 63.0 63.0 65.1	Loaf Volume 2900 1075 2986 3125 3000 1030 1020 885 Volume 2850 3050 1125 3162 2850	Mixing Requirement 4 4 5 4 4 3 2 3 3 2 3 3 7 0.9 Mixing Requirement 5 4 5 4 5 4 5 4 5 4	Dough <u>Characteristic</u> 4 5 4 5 3 4 3 2 4 3.8 1.0 Dough <u>Characteristic</u> 5 5 5 5 5 3 3	Bake Absorption 61.0 64.3 62.0 66.0 68.1 64.0 64.6 69.8 68.0 <b>65.3</b> <b>2.9</b> Bake Absorption 65.0 65.2 64.0 65.0 65.2 64.0 65.0 65.2	Loaf <u>Volume</u> 3000 3350 923 2986 3300 2450 1045 983 880 Loaf <u>Volume</u> 2925 3400 1008 3045 3200	Mixing <u>Requirement</u> 5 3 5 3 4 5 5 3 4 5 5 5 6 7 0.9 Mixing <u>Requirement</u> 5 7 1 1 1 1 1 1 1 1 1 1 1 1 1	Dough Characteristic 5 3 4 5 4 4 4 5 4 4 5 0.7 Dough Characteristic 5 3 4 5 3 4 5 3 4 5 3 4 5 3
Crookston K8 Cooperator	Bake Method Sponge/Dough Straight Dough Straight Dough Straight Dough Straight Dough Straight Dough Straight Dough Straight Dough Sponge/Dough Sponge/Dough Sponge/Dough Sponge/Dough Straight Dough Straight Dough Straight Dough	Bake Absorption 60.0 64.0 65.0 66.3 63.0 63.6 66.7 64.1 63.6 2.4 Bake Absorption 62.0 58.0 64.0 63.0 65.1 62.0	Loaf Volume 2900 1075 2986 3125 3000 1030 1020 885 Volume 2850 3050 1125 3162 2850 2950	Mixing Requirement 4 4 4 5 4 4 3 2 3 3 2 3 3 7 0.9 Mixing Requirement 5 4 5 4 5 5 4 5 5 4 5 5 4 5 5	Dough <u>Characteristic</u> 4 5 4 5 3 4 3 2 4 3.8 1.0 Dough <u>Characteristic</u> 5 5 5 5 5 5 3 4 3 4 3.8 1.0	Bake Absorption 61.0 64.3 62.0 66.0 68.1 64.0 64.6 69.8 68.0 <b>65.3</b> <b>2.9</b> Bake Absorption 65.2 64.0 65.2 64.0 65.2 65.0	Loaf Volume 3000 3350 923 2986 3300 2450 1045 983 880 Loaf Volume 2925 3400 1008 3045 3200 2600	Mixing <u>Requirement</u> 5 3 5 3 4 3 5 5 5 5 6 6 8 8 8 8 8 8 8 8 8 8 8 8 8	Dough Characteristic 5 3 4 5 4 4 4 5 4 4 5 4 4 <b>4</b> .2 0.7 Dough Characteristic 5 3 4 5 3 4 5 3 5
Crookston K8 Cooperator	Bake Method Sponge/Dough Straight Dough Straight Dough Straight Dough Straight Dough Straight Dough Straight Dough Straight Dough Straight Dough Straight Dough Sponge/Dough Sponge/Dough Straight Dough Straight Dough Straight Dough Straight Dough	Bake Absorption 60.0 64.0 65.0 66.3 63.0 63.6 66.7 64.1 63.6 2.4 Bake Absorption 62.0 58.0 64.0 63.0 65.1 62.0 65.1 62.0 63.0	Loaf Volume 2900 1075 2986 3125 3000 1030 1020 885 Loaf Volume 2850 3050 1125 3162 2850 2950 1110	Mixing Requirement 4 4 4 5 4 4 3 2 3 3 2 3 3 7 0.9 Mixing Requirement 5 4 5 5 4 5 5 4 5 5 4 5 5 4 5 5 4 4 5 5 4 4 5 5 4 4 5 5 4 4 5 5 4 4 5 5 4 4 5 5 5 4 5 5 5 6 6 7 6 7 7 7 7 7 8 7 7 7 7 7 7 7 7 7 7	Dough <u>Characteristic</u> 4 5 4 5 3 4 3 2 4 3.8 1.0 Dough <u>Characteristic</u> 5 5 5 5 5 3 4 3 4 3.8 1.0 Dough <u>Characteristic</u> 5 5 5 3 4 5 5 5 5 5 5 5 5 5 5 5 5 5	Bake Absorption 61.0 64.3 62.0 66.0 68.1 64.0 64.6 69.8 68.0 <b>65.3</b> <b>2.9</b> Bake Absorption 65.2 64.0 65.2 64.0 65.2 64.0 65.2 65.0 65.2 65.0 63.7	Loaf Volume 3000 3350 923 2986 3300 2450 1045 983 880 Loaf Volume 2925 3400 1008 3045 3200 2600 1150	Mixing <u>Requirement</u> 5 3 5 3 4 3 4 3 4 3 4 3 4 3 4 3 4 3 4 3 4 3 4 5 3 4 5 3 4 5 3 4 5 3 4 5 3 4 5 5 3 4 5 5 3 4 5 5 3 4 5 5 5 3 4 5 5 5 5 5 5 5 5 5 5 5 5 5	Dough Characteristic 5 3 4 5 4 4 4 5 4 4 4 5 0.7 Dough Characteristic 5 3 4 5 3 4 5 3 4 5 3 3 5 3 3
Crookston K8 Cooperator	Bake Method Sponge/Dough Straight Dough Straight Dough	Bake Absorption 60.0 60.0 64.0 65.0 66.3 63.6 66.7 64.1 <b>63.6</b> <b>2.4</b> Bake Absorption 62.0 58.0 64.0 63.0 65.1 62.0 63.0 65.1 62.0 63.0 70.7	Loaf Volume 2900 1075 2986 3125 3000 1030 1020 885 Loaf Volume 2850 3050 1125 3162 2850 2950 1110 1130	Mixing Requirement 4 4 4 5 4 4 3 2 3 3 7 0.9 Mixing Requirement 5 4 5 5 4 5 5 4 5 5 4 5 5 4 3 5 4 3 5 4 3 5 4 3 5 4 4 3 5 4 4 3 5 4 4 4 3 5 4 4 5 4 4 5 4 4 5 4 4 5 4 4 5 4 4 5 4 4 5 4 4 5 4 4 5 4 4 5 5 4 4 5 5 5 6 6 7 6 7 7 7 0.9 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	Dough <u>Characteristic</u> 4 5 4 5 3 4 3 2 4 3 2 4 3 2 4 3 2 4 3 2 4 3 5 5 5 5 5 5 5 5 3 4 3 4 3 4 3 4 3 4 3 4 3 2 4 3 4 3 4 3 4 3 4 3 4 3 4 3 4 3 4 3 4 3 4 3 4 3 4 5 5 5 5 5 5 5 5 5 5 5 5 5	Bake Absorption 61.0 64.3 62.0 66.0 68.1 64.0 64.6 69.8 68.0 <b>65.3</b> <b>2.9</b> Bake Absorption 65.2 64.0 65.2 64.0 65.2 64.0 65.2 65.0 65.2 65.0 63.7 70.0	Loaf Volume 3000 3350 923 2986 3300 2450 1045 983 880 Loaf Volume 2925 3400 1008 3045 3200 2600 1150 1073	Mixing <u>Requirement</u> 5 3 5 3 4 3 4 3 4 3 4 3 4 3 4 3 4 3 4 3 4 3 4 3 4 5 3 4 5 3 4 5 3 4 5 3 4 5 5 3 4 5 5 3 4 5 5 3 4 5 5 5 3 4 5 5 5 5 5 5 5 5 5 5 5 5 5	Dough Characteristic 5 3 4 5 4 4 4 5 4 4 4 5 0.7 Dough Characteristic 5 3 4 5 3 4 5 3 4 5 3 3 4 5 3 3 4 5 3 3 4 5 3 3 3 3
Crookston K8 Cooperator	Bake Method Sponge/Dough Straight Dough Straight Dough	Bake Absorption 60.0 64.0 65.0 66.3 63.0 63.6 64.1 63.6 2.4 Bake Absorption 62.0 58.0 64.0 63.0 65.1 65.1 65.1 63.0 63.0 70.7 63.0	Loaf Volume 2900 1075 2986 3125 3000 1030 1020 885 Volume 2850 3050 1125 3162 2850 2950 1110 1130 825	Mixing Requirement 4 4 5 4 3 3 2 3 3 7 0.9 Mixing Requirement 5 4 5 4 5 5 4 5 5 4 5 5 4 5 5 4 3 3 3 7 0.9	Dough <u>Characteristic</u> 4 5 3 4 3 2 4 3 2 4 3 2 4 3 2 4 3 2 4 3 2 4 3 5 5 5 5 5 5 3 4 3 4 3 4 3 4 3 4 3 2 4 3 4 3 4 3 4 3 4 3 4 3 4 3 4 3 4 3 4 3 4 3 4 3 4 5 5 5 5 5 5 5 5 5 5 5 5 5	Bake Absorption 61.0 64.3 62.0 66.0 68.1 64.0 64.6 69.8 68.0 <b>65.3</b> <b>2.9</b> Bake Absorption 65.0 65.2 64.0 65.2 64.0 65.0 65.2 64.0 65.0 63.7 70.0 65.6	Loaf Volume 3000 3350 923 2986 3300 2450 1045 983 880 Loaf Volume 2925 3400 1008 3045 3200 2600 1150 1073 890	Mixing <u>Requirement</u> 5 3 5 3 4 3 4 3 4 3 4 3 4 3 4 3 4 3 4 3 4 3 4 3 4 3 4 3 4 3 4 5 3 4 5 3 4 5 3 4 5 3 4 5 3 4 5 3 4 5 3 4 5 5 3 4 5 5 3 4 5 5 3 4 5 5 5 3 4 5 5 5 5 5 5 5 5 5 5 5 5 5	Dough Characteristic 5 3 4 5 4 4 4 4 5 4 4 5 0.7 Dough Characteristic 5 3 4 5 3 4 5 3 4 5 3 4 5 3 4 4 5 3 4 4 5 3 3 4 4 5 3 4 4 5 3 4 4 5 4 4 4 5 4 4 4 5 4 4 4 5 4 4 4 5 4 4 5 4 4 4 5 4 4 5 4 4 5 4 4 5 4 4 5 4 4 5 4 4 5 4 4 5 4 4 5 4 4 4 5 4 4 4 5 4 4 4 5 4 4 4 5 4
Crookston K8 Cooperator	Bake Method Sponge/Dough Straight Dough Straight Dough	Bake Absorption 60.0 64.0 65.0 66.3 63.0 63.6 66.7 64.1 <b>63.6</b> <b>2.4</b> Bake Absorption 62.0 58.0 64.0 65.1 63.0 65.1 62.0 63.0 63.0 63.0 63.0 63.0 63.0 63.0 63	Loaf Volume 2900 1075 2986 3125 3000 1030 1020 885 Volume 2850 3050 1125 3162 28500 2950 1110 1130 825	Mixing Requirement 4 4 4 5 4 3 2 3 3 2 3 3 7 0.9 Mixing Requirement 5 4 5 4 5 4 5 5 4 5 5 4 5 5 4 3 5 4 3 5 4 3 5 4 3 5 4 4 5 5 4 4 3 5 5 4 4 5 5 4 4 5 5 4 4 5 5 4 4 5 5 4 4 5 5 4 4 4 5 5 6 7 6 7 7 7 7 7 8 7 7 7 7 7 7 7 7 7 7 7	Dough <u>Characteristic</u> 4 5 4 5 3 4 3 2 4 3 2 4 3 8 1.0 Dough <u>Characteristic</u> 5 5 5 5 5 3 4 3 4 3 4 4 3 4 4 3 4 4 3 4 4 3 4 4 3 4 4 3 4 4 3 4 4 3 4 4 3 4 4 3 4 4 5 5 5 5 5 5 5 5 5 5 5 5 5	Bake Absorption 61.0 64.3 62.0 66.0 68.1 64.0 64.6 69.8 68.0 <b>65.3</b> <b>2.9</b> Bake Absorption 65.0 65.2 64.0 65.2 64.0 65.2 65.0 65.2 65.0 65.2 65.0 65.2 65.0 65.2 65.0 65.2 65.0 65.5 65.6	Loaf Volume 3000 3350 923 2986 3300 2450 1045 983 880 Loaf Volume 2925 3400 1008 3045 3200 2600 1150 1073 890	Mixing Requirement 5 3 5 3 4 3 4 3 4 3 4 3 4 3 4 5 3 4 5 3 4 5 3 4 5 3 4 5 3 4 5 3 4 5 3 4 5 5 3 4 5 5 3 4 5 5 5 3 4 5 5 5 5 5 5 5 5 5 5 5 5 5	Dough Characteristic 5 3 4 5 4 4 4 4 5 4 4 5 4 4 2 0.7 Dough Characteristic 5 3 4 5 3 4 5 3 4 5 3 3 4 5 3 3 4 5 3 3 4 5 3 3 4 5 3 3 4 5 5 3 3 4 5 5 3 3 4 5 5 5 5
Crookston K8 Cooperator	Bake Method Sponge/Dough Straight Dough Straight Dough	Bake Absorption 60.0 64.0 65.0 66.3 63.0 63.6 66.7 64.1 <b>63.6</b> <b>2.4</b> Bake Absorption 62.0 58.0 64.0 65.1 63.0 65.1 63.0 63.1 63.0 63.0 70.7 63.0 63.4	Loaf Volume 2900 1075 2986 3125 3000 1030 1020 885 Volume 2850 3050 1125 3162 2850 2950 1110 1130 825	Mixing Requirement 4 4 4 5 4 3 2 3 3 2 3 3 7 0.9 8 Mixing Requirement 5 4 5 5 4 5 5 4 5 5 4 5 5 4 5 5 4 5 5 4 5 5 4 5 5 4 5 5 4 5 5 6 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	Dough <u>Characteristic</u> 4 5 4 5 3 4 3 2 4 3 2 4 3 2 4 3 8 1.0 Dough <u>Characteristic</u> 5 5 5 5 5 5 3 4 3 4 4 2 4 4 3 8 1.0 Dough <u>Characteristic</u> 5 5 5 5 5 5 3 4 4 3 8 1.0 0 8 1.0 0 8 1.0 0 8 1.0 0 8 1.0 0 0 0 0 0 0 0 0 0 0 0 0 0	Bake Absorption 61.0 64.3 62.0 66.0 68.1 64.0 64.6 69.8 68.0 <b>65.3</b> <b>2.9</b> Bake Absorption 65.2 64.0 65.2 64.0 65.2 64.0 65.2 64.0 65.2 65.0 65.2 64.0 65.2 65.0 65.6 63.7 70.0 65.6 <b>1.9</b>	Loaf Volume 3000 3350 923 2986 3300 2450 1045 983 880 Loaf Volume 2925 3400 1008 3045 3200 2600 1150 1073 890	Mixing Requirement 5 3 3 4 3 4 3 4 3 4 3 4 3 4 3 4 5 3 4 5 3 4 5 3 4 5 3 4 5 3 4 5 3 4 5 3 4 5 3 4 5 5 3 4 5 5 5 5 5 5 5 5 5 5 5 5 5	Dough Characteristic 5 3 4 5 4 4 4 4 5 4 4 5 4 4 2 0.7 Dough Characteristic 5 3 4 4 5 3 4 5 3 3 4 5 3 3 4 4 5 3 3 4 4 5 3 3 4 4 5 3 3 4 5 3 3 6 5 3 3 4 5 5 3 6 6 7 6 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7

00\$0291-3								Factor	s Compa	red to G	enn Ch	eck	
Crookston - K1	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	59.0	2900	96.7	1	1	1	3	3	3	5	1	1
2	Straight Dough	60.0	3250	112.1	4	4	4	3	4	2	2	4	3
3	Sponge/Dough	63.0	938	87.3	2	2	1	3	3	2	3	2	1
4	Sponge/Dough	65.0	3104	104.0	3	3	2	2	3	2	3	2	2
5	Straight Dough	66.9	3025	96.8	1	2	2	3	3	3	2	3	3
6	Straight Dough	63.0	2700	90.0	2	2	2	3	3	2	4	3	3
7	Straight Dough	63.9	1010	98.1	2	3	1	3	5	2	4	3	2
8	Straight Dough	65.7	905	88.7	4	3	4	2	2	3	2	2	2
10	Straight Dough	64.2	800	90.4	3	3	2	2	3	3	3	2	3
Average		63.4		96.0	2.4	2.6	2.1	2.7	3.2	2.4	3.1	2.4	2.2
± 1 Std Dev		2.6		8.1	1.1	0.9	1.2	0.5	0.8	0.5	1.1	0.9	0.8

### Bake Evaluation (by Cooperator)

NDSW0449								Factor	rs Compa	red to Gl	enn Che	eck	
Williston - W2	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	63.0	2800	98.3	5	5	3	3	1	3	4	3	3
2	Straight Dough	59.0	3350	109.8	4	4	4	4	4	4	3	4	4
3	Sponge/Dough	64.0	1022	90.8	3	4	2	3	2	1	2	1	1
4	Sponge/Dough	64.0	3104	98.2	5	5	4	2	4	4	3	4	3
5	Straight Dough	66.0	3075	107.9	3	4	2	2	3	4	2	4	4
6	Straight Dough	63.0	2750	93.2	4	4	3	4	4	4	3	4	4
7	Straight Dough	64.2	1035	93.2	2	3	1	2	3	4	3	2	2
8	Straight Dough	68.7	1165	103.1	4	4	5	3	2	2	2	2	2
10	Straight Dough	64.2	735	89.1	1	3	2	1	1	3	3	2	3
Average		64.0		<b>98.2</b>	3.4	4.0	2.9	2.7	2.7	3.2	2.8	2.9	2.9
± 1 Std Dev		2.6		7.4	1.3	0.7	1.3	1.0	1.2	1.1	0.7	1.2	1.1

SD3851								Factor	s Compa	red to GI	enn Che	eck	
Brookings - B3	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	57.0	2725	100.0	3	2	2	3	3	2	5	2	2
2	Straight Dough	59.0	2800	96.6	3	4	3	4	4	1	3	4	3
3	Sponge/Dough	60.0	882	91.2	5	5	3	3	4	2	4	2	2
4	Sponge/Dough	61.0	3104	103.0	5	5	3	2	3	1	3	2	2
5	Straight Dough	63.2	2500	84.7	2	4	2	2	5	2	3	1	2
6	Straight Dough	61.0	2900	96.7	2	3	2	3	4	2	4	5	4
7	Straight Dough	60.6	790	86.3	5	3	2	2	2	1	4	2	1
8	Straight Dough	65.7	785	110.6	4	2	3	3	4	4	4	4	4
10	Straight Dough	61.1	760	91.0	3	3	3	3	3	2	2	2	2
Average	5 5	61.0		95.6	3.6	3.4	2.6	2.8	3.6	1.9	3.6	2.7	2.4
± 1 Std Dev		2.5		8.2	1.2	1.1	0.5	0.7	0.9	0.9	0.9	1.3	1.0
SD3851								Factor	s Compa	red to Gl	enn Che	eck	
Casselton - C3	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	59.0	2900	106.3	3	3	3	3	3	3	5	3	3
2	Straight Dough	60.0	3000	95.2	4	4	3	2	2	2	2	3	3
3	Sponge/Dough	63.0	938	96.2	3	3	2	3	4	2	3	2	2
4	Sponge/Dough	65.0	3074	104.0	5	5	3	2	4	2	4	4	4
5	Straight Dough	66.4	3025	113.1	2	3	3	2	3	3	2	4	4
6	Straight Dough	63.0	2750	100.0	3	2	2	4	4	2	4	3	3
7	Straight Dough	64.1	940	98.9	3	2	2	3	3	2	5	2	2
8	Straight Dough	61.7	825	90.2	3	1	2	3	2	2	4	2	2
10	Straight Dough	64.1	870	90.6	3	4	3	3	3	3	3	3	3
Average	0 0	62.9		99.4	3.2	3.0	2.6	2.8	3.1	2.3	3.6	2.9	2.9
± 1 Std Dev		2.4		7.5	0.8	1.2	0.5	0.7	0.8	0.5	1.1	0.8	0.8
SD3851								Factor	s Compa	red to Gl	enn Che	eck	
Crookston - K3	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	59.0	2900	96.7	3	3	3	3	3	3	4	3	3
2	Straight Dough	58.0	2800	96.6	4	3	4	2	2	2	2	2	2
3	Sponge/Dough	62.0	985	91.6	3	4	2	3	4	2	3	2	2
4	Sponge/Dough	63.0	3104	104.0	5	5	3	2	4	2	3	3	3
5	Straight Dough	64.3	3050	97.6	2	2	2	4	4	3	2	3	3
6	Straight Dough	61.0	2950	98.3	3	2	3	4	4	2	4	4	4
7	Straight Dough	61.8	945	91.7	4	3	2	3	5	2	4	4	2
8	Straight Dough	61.7	900	88.2	3	3	3	2	2	2	3	2	2
10	Straight Dough	62.3	775	87.6	3	4	3	2	3	2	3	2	2
Average		61.5		94.7	3.3	3.2	2.8	2.8	3.4	2.2	3.1	2.8	2.6
± 1 Std Dev		1.9		5.3	0.9	1.0	0.7	0.8	1.0	0.4	0.8	0.8	0.7

ND806								Factor	rs Compa	red to Gl	enn Ch	eck	
Brookings - B4	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	57.0	2800	102.8	5	5	4	3	3	2	5	3	3
2	Straight Dough	59.0	2850	98.3	3	4	3	4	4	2	2	4	2
3	Sponge/Dough	60.0	922	95.3	4	3	3	3	3	3	3	2	2
4	Sponge/Dough	61.0	3045	101.0	5	5	2	2	1	2	3	2	2
5	Straight Dough	63.2	2750	93.2	2	3	3	3	5	2	2	2	3
6	Straight Dough	61.0	2900	96.7	3	3	3	3	4	2	4	5	4
7	Straight Dough	61.0	840	91.8	5	3	2	3	3	2	4	2	2
8	Straight Dough	62.7	795	112.0	4	3	2	3	4	2	2	4	4
10	Straight Dough	61.5	800	95.8	3	3	3	3	3	3	2	3	3
Average	5 5	60.7		<b>98.5</b>	3.8	3.6	2.8	3.0	3.3	2.2	3.0	3.0	2.8
± 1 Std Dev		1.9		6.1	1.1	0.9	0.7	0.5	1.1	0.4	1.1	1.1	0.8
ND806								Factor	rs Compa	red to Gl	enn Ch	eck	
Casselton - C4	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	57.0	2700	99.0	3	2	3	2	1	2	5	2	1
2	Straight Dough	54.0	3100	98.4	2	1	1	3	1	1	3	2	2
3	Sponge/Dough	60.0	918	94.2	2	2	2	3	2	2	1	1	1
4	Sponge/Dough	59.0	3104	105.0	3	3	2	2	3	1	3	2	2
5	Straight Dough	61.0	2800	104.7	1	2	2	3	3	1	2	4	4
6	Straight Dough	59.0	2350	85.5	2	2	2	2	2	2	4	2	2
7	Straight Dough	58.3	870	91.6	3	2	1	3	5	1	4	2	2
8	Straight Dough	61.7	930	101.6	2	1	2	2	2	2	4	2	3
10	Straight Dough	58.3	660	68.8	2	3	2	2	4	2	2	1	2
Average	5 5	58.7		94.3	2.2	2.0	1.9	2.4	2.6	1.6	3.1	2.0	2.1
± 1 Std Dev		2.3		11.5	0.7	0.7	0.6	0.5	1.3	0.5	1.3	0.9	0.9
ND806								Factor	rs Compa	red to Gl	enn Ch	eck	
Williston - W4	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	63.0	2800	98.3	5	5	3	3	1	3	4	3	3
2	Straight Dough	58.0	3400	111.5	4	4	4	3	2	4	2	3	3
3	Sponge/Dough	64.0	1066	94.8	4	4	2	3	3	3	2	3	3
4	Sponge/Dough	63.0	3045	96.3	5	5	3	3	4	4	3	4	3
5	Straight Dough	65.0	3000	105.3	3	2	2	3	2	3	2	4	4
6	Straight Dough	63.0	2400	81.4	4	4	3	2	3	4	3	3	3
7	Straight Dough	63.2	1105	99.5	4	3	1	3	3	3	3	3	3
8	Straight Dough	71.7	1270	112.4	4	5	3	3	2	3	2	2	2
10	Straight Dough	63.2	820	99.4	3	4	3	2	3	3	3	3	3
Average		63.8		99.9	4.0	4.0	2.7	2.8	2.6	3.3	2.7	3.1	3.0
± 1 Std Dev		3.5		9.4	0.7	1.0	0.9	0.4	0.9	0.5	0.7	0.6	0.5

06MSP18								Factor	s Compa	red to GI	enn Ch	eck	
Brookings - B5	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	56.0	2900	106.4	3	2	2	3	3	2	5	2	2
2	Straight Dough	54.0	2800	96.6	3	4	2	4	4	1	4	4	4
3	Sponge/Dough	60.0	920	95.1	2	3	2	3	3	2	3	1	2
4	Sponge/Dough	59.0	3045	101.0	4	4	2	2	1	1	2	2	1
5	Straight Dough	59.9	2950	100.0	3	5	2	3	5	2	3	3	4
6	Straight Dough	58.0	2200	73.3	2	3	2	3	3	1	3	3	3
7	Straight Dough	57.3	855	93.4	4	3	2	2	2	1	4	2	1
8	Straight Dough	67.7	825	116.2	4	3	3	3	4	5	5	4	4
10	Straight Dough	57.8	685	82.0	3	3	3	3	4	2	2	2	2
Average		<b>58.9</b>		<b>96.0</b>	3.1	3.3	2.2	2.9	3.2	1.9	3.4	2.6	2.6
± 1 Std Dev		3.8		12.6	0.8	0.9	0.4	0.6	1.2	1.3	1.1	1.0	1.2
06MSP18								Factor	s Compa	red to Gl	enn Ch	eck	
Casselton -C5	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	59.0	3000	110.0	3	3	3	3	1	3	4	3	3
2	Straight Dough	60.0	3300	104.8	3	5	4	3	2	3	2	4	3
3	Sponge/Dough	63.0	908	93.1	2	2	2	3	2	2	3	2	2
4	Sponge/Dough	64.0	2986	101.0	4	3	2	2	4	2	3	2	2
5	Straight Dough	65.9	2750	102.8	2	3	3	2	3	3	1	3	3
6	Straight Dough	63.0	2550	92.7	3	3	3	3	3	2	4	3	2
7	Straight Dough	63.7	975	102.6	3	2	3	3	5	3	3	4	3
8	Straight Dough	60.7	955	104.4	2	3	2	2	3	2	2	4	4
10	Straight Dough	63.7	670	69.8	1	2	3	2	4	3	3	1	2
Average		62.6		97.9	2.6	2.9	2.8	2.6	3.0	2.6	2.8	2.9	2.7
± 1 Std Dev		2.2		11.9	0.9	0.9	0.7	0.5	1.2	0.5	1.0	1.1	0.7
0446010								Fasta	Compo	rad to Cl	lonn Ch	ook	
Crockston KE	Pako	Pako	Loaf	1.V	Mixing	Dough	Mix	Crumb	Crain &	leu lo Gi		JUK	
Cooperator	Method	Absorption	Volume	LV % of CK	Pequirement	Characteristic	Toloranco	Color	Toyturo	Drotoin	Milling	Rakina	Overall
1	Sponge/Dough	57.0	2600	26 7	2	2	2	2	2	2	Nining A	2	2
1	Straight Dough	57.0	2000	110.7	3	2	2	2	2	2 1	4	2	2
2	Shanga/Dough	54.0 60.0	0200	05 G	3 1	4	4	2	4 2	1	4	3 1	3 1
3	Sponge/Dough	50.0	920 2056	00.0	1	2	1	2 1	2	1	1 2	ו ר	ו כ
4	Straight Dough	59.0	2900	99.0 07.0	4	3	2	1	2	ו ר	2	2	2
5	Straight Dough	59.0	2725	07.Z Q1 7	ו ס	4	2	4	ა ი	2	3	2	2
0 7	Straight Dough	50.0	2450	01.7	2	2	2	2	2	1	4	2	2
1	Straight Dough	57.4	1005	03.0 00 E	3	Ζ	F	ა ი	ິ ວ	1	4	2	1
8 10	Straight Dough	50./	600	70.0	4	4	ວ ວ	2	2	4	2	2	2
	Straight Dough	58.0	090	70.0 00 1	ى 27	3 2 0	2	22	3 <b>2 0</b>	17	20	10	10
+ 1 Std Dev		34		10.1	2.7 1 1	2.0 1 1	2.3 1 2	0.8	2.0	1.7	11	0.7	0.6
Average ± 1 Std Dev	5 5	58.9 3.4		90.1 10.4	2.7 1.1	2.8 1.1	2.3 1.3	2.2 0.8	2.8 1.1	1.7 1.0	3.0 1.1	1.8 0.7	1.9 0.6

NDSW0601								Factor	rs Compai	red to G	lenn Ch	eck	
Casselton - C6	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	58.0	2750	100.8	2	2	2	3	1	3	5	2	3
2	Straight Dough	60.0	3350	106.3	3	4	3	2	4	2	1	4	2
3	Sponge/Dough	61.0	930	95.4	1	1	1	2	1	1	3	1	1
4	Sponge/Dough	64.0	2780	94.0	3	3	2	1	2	1	2	2	2
5	Straight Dough	65.7	2750	102.8	3	2	4	2	4	3	1	3	3
6	Straight Dough	62.0	2250	81.8	3	3	3	2	2	2	4	2	2
7	Straight Dough	63.0	1075	113.2	3	2	4	2	4	2	4	3	2
8	Straight Dough	61.7	995	108.7	3	4	3	2	3	2	2	4	4
10	Straight Dough	63.0	765	79.7	2	3	3	2	4	2	2	2	2
Average		62.0		98.1	2.6	2.7	2.8	2.0	2.8	2.0	2.7	2.6	2.3
± 1 Std Dev		2.3		11.5	0.7	1.0	1.0	0.5	1.3	0.7	1.4	1.0	0.9
NDSW0601								Factor	rs Compa	red to G	lenn Ch	eck	
NDSW0601 Williston - W6	Bake	Bake	Loaf	LV	Mixing	Dough	Mix	Factor Crumb	rs Compai Grain &	red to G	lenn Ch	eck	
NDSW0601 Williston - W6 Cooperator	Bake Method	Bake Absorption	Loaf Volume	LV % of CK	Mixing Requirement	Dough Characteristic	Mix Tolerance	Factor Crumb Color	rs Compai Grain & Texture	red to G Protein	lenn Ch Milling	eck Baking	Overall
NDSW0601 Williston - W6 Cooperator 1	Bake Method Sponge/Dough	Bake Absorption 64.0	Loaf Volume 2750	LV % of CK 96.5	Mixing Requirement 5	Dough Characteristic 5	Mix Tolerance 3	Factor Crumb Color 3	rs Compai Grain & Texture 1	red to G Protein 3	lenn Ch Milling 5	eck Baking 3	Overall 3
NDSW0601 Williston - W6 Cooperator 1 2	Bake Method Sponge/Dough Straight Dough	Bake Absorption 64.0 60.0	Loaf Volume 2750 3300	LV % of CK 96.5 108.2	Mixing Requirement 5 5	Dough Characteristic 5 5	Mix Tolerance 3 3	Factor Crumb Color 3 3	rs Compai Grain & Texture 1 4	red to G Protein 3 5	lenn Ch Milling 5 1	eck Baking 3 4	Overall 3 4
NDSW0601 Williston - W6 Cooperator 1 2 3	Bake Method Sponge/Dough Straight Dough Sponge/Dough	Bake Absorption 64.0 60.0 64.0	Loaf Volume 2750 3300 1057	LV % of CK 96.5 108.2 94.0	Mixing Requirement 5 5 3	Dough Characteristic 5 5 3	Mix Tolerance 3 3 2	Factor Crumb Color 3 3 3 3	rs Compai Grain & Texture 1 4 2	red to G Protein 3 5 2	lenn Ch Milling 5 1 4	eck Baking 3 4 2	Overall 3 4 2
NDSW0601 Williston - W6 Cooperator 1 2 3 4	Bake Method Sponge/Dough Straight Dough Sponge/Dough Sponge/Dough	Bake Absorption 64.0 60.0 64.0 66.0	Loaf Volume 2750 3300 1057 3162	LV % of CK 96.5 108.2 94.0 100.0	Mixing Requirement 5 5 3 5 5	Dough Characteristic 5 5 3 5	Mix Tolerance 3 3 2 4	Factor Crumb Color 3 3 3 3 2	rs Compai Grain & Texture 1 4 2 3	red to G Protein 3 5 2 4	lenn Ch Milling 5 1 4 3	eck Baking 3 4 2 3	Overall 3 4 2 3
NDSW0601 Williston - W6 Cooperator 1 2 3 4 5	Bake Method Sponge/Dough Straight Dough Sponge/Dough Sponge/Dough Straight Dough	Bake Absorption 64.0 60.0 64.0 66.0 69.4	Loaf Volume 2750 3300 1057 3162 3175	LV % of CK 96.5 108.2 94.0 100.0 111.4	Mixing Requirement 5 5 3 5 5 4	Dough Characteristic 5 5 3 5 5 3 5 3	Mix Tolerance 3 3 2 4 3	Factor Crumb Color 3 3 3 2 3 3 2 3	rs Compar Grain & Texture 1 4 2 3 2 2	Protein 3 5 2 4 4	Milling 5 1 4 3 1	eck Baking 3 4 2 3 4	Overall 3 4 2 3 4
NDSW0601 Williston - W6 Cooperator 1 2 3 4 5 6	Bake Method Sponge/Dough Straight Dough Sponge/Dough Straight Dough Straight Dough	Bake Absorption 64.0 60.0 64.0 66.0 69.4 65.0	Loaf Volume 2750 3300 1057 3162 3175 2800	LV % of CK 96.5 108.2 94.0 100.0 111.4 94.9	Mixing Requirement 5 5 3 5 4 5 4 5	Dough Characteristic 5 5 3 5 3 5 3 5 3 5	Mix Tolerance 3 2 4 3 3 4 3 4	Factor Crumb Color 3 3 3 2 3 2 3 4	rs Compar Grain & Texture 1 4 2 3 2 3 2 3	red to G Protein 3 5 2 4 4 5	Milling 5 1 4 3 1 3	eck Baking 3 4 2 3 4 5	Overall 3 4 2 3 4 5
NDSW0601 Williston - W6 Cooperator 1 2 3 4 5 6 7	Bake Method Sponge/Dough Straight Dough Sponge/Dough Straight Dough Straight Dough Straight Dough	Bake Absorption 64.0 64.0 66.0 69.4 65.0 67.7	Loaf Volume 2750 3300 1057 3162 3175 2800 1115	LV % of CK 96.5 108.2 94.0 100.0 111.4 94.9 100.5	Mixing Requirement 5 5 3 5 4 5 4 5 3	Dough Characteristic 5 5 3 5 3 5 3 5 4	Mix Tolerance 3 3 2 4 3 4 3 4 2	Factor Crumb Color 3 3 3 2 3 4 2 3 4 2	rs Compar Grain & Texture 1 4 2 3 2 3 2 3 2 3 2	red to G Protein 3 5 2 4 4 4 5 5 5	Milling 5 1 4 3 1 3 3	eck Baking 3 4 2 3 4 5 2	Overall 3 4 2 3 4 5 2
NDSW0601 Williston - W6 Cooperator 1 2 3 4 5 6 7 8	Bake Method Sponge/Dough Straight Dough Sponge/Dough Straight Dough Straight Dough Straight Dough Straight Dough	Bake Absorption 64.0 60.0 64.0 66.0 69.4 65.0 67.7 71.7	Loaf Volume 2750 3300 1057 3162 3175 2800 1115 1250	LV % of CK 96.5 108.2 94.0 100.0 111.4 94.9 100.5 110.6	Mixing Requirement 5 5 3 5 4 5 4 5 3 5 5	Dough Characteristic 5 5 3 5 3 5 3 5 4 4 4	Mix Tolerance 3 3 2 4 3 4 3 4 2 5	Factor Crumb Color 3 3 3 2 3 4 2 3 4 2 2	rs Compar Grain & Texture 1 4 2 3 2 3 2 3 2 2 2 2	red to G Protein 3 5 2 4 4 5 5 5 2	Milling 5 1 4 3 1 3 3 2	eck Baking 3 4 2 3 4 5 2 2 2	Overall 3 4 2 3 4 5 2 2 2
NDSW0601 Williston - W6 Cooperator 1 2 3 4 5 6 7 8 10	Bake Method Sponge/Dough Straight Dough Sponge/Dough Straight Dough Straight Dough Straight Dough Straight Dough Straight Dough	Bake Absorption 64.0 64.0 64.0 66.0 69.4 65.0 67.7 71.7 67.7	Loaf Volume 2750 3300 1057 3162 3175 2800 1115 1250 835	LV % of CK 96.5 108.2 94.0 100.0 111.4 94.9 100.5 110.6 101.2	Mixing Requirement 5 5 3 5 4 5 4 5 3 5 3 5 3	Dough Characteristic 5 5 3 5 3 5 3 5 4 4 4 4 4	Mix Tolerance 3 2 4 3 4 2 4 2 5 3	Factor Crumb Color 3 3 3 2 3 4 2 3 4 2 2 2 2	rs Compar Grain & Texture 1 4 2 3 2 3 2 3 2 2 3 2 3 3 2 3 3	red to G Protein 3 5 2 4 4 5 5 5 2 3	lenn Ch Milling 5 1 4 3 1 3 3 2 3 3	eck Baking 3 4 2 3 4 5 2 2 2 3	Overall 3 4 2 3 4 5 2 2 2 3
NDSW0601 Williston - W6 Cooperator 1 2 3 4 5 6 7 8 10 Average	Bake Method Sponge/Dough Straight Dough Sponge/Dough Straight Dough Straight Dough Straight Dough Straight Dough Straight Dough	Bake Absorption 64.0 64.0 66.0 69.4 65.0 67.7 71.7 67.7 <b>66.2</b>	Loaf Volume 2750 3300 1057 3162 3175 2800 1115 1250 835	LV % of CK 96.5 108.2 94.0 100.0 111.4 94.9 100.5 110.6 101.2 <b>101.9</b>	Mixing Requirement 5 5 3 5 4 5 3 5 3 5 3 4 2 8 4.2	Dough Characteristic 5 5 3 5 3 5 3 5 4 4 4 4 4 4 4	Mix Tolerance 3 2 4 3 4 2 4 2 5 3 3 3 2 3 2 3 3	Factor Crumb Color 3 3 2 3 4 2 2 2 2 2 2 2 2.7	rs Compar Grain & Texture 1 4 2 3 2 3 2 3 2 2 3 2 3 2 2 3 2 2 3 2 2 3	red to G Protein 3 5 2 4 4 5 5 5 2 3 3 <b>3.7</b>	Milling 5 1 4 3 1 3 2 3 2 3 <b>2.8</b>	eck Baking 3 4 2 3 4 5 2 2 2 3 3 <b>3.1</b>	Overall 3 4 2 3 4 5 2 2 2 3 3 <b>3.1</b>

Samson								Factor	rs Compa	red to G	enn Ch	eck	
Casselton - C7	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	59.0	2900	106.3	2	3	3	3	1	3	5	3	3
2	Straight Dough	58.0	3150	100.0	3	4	3	1	3	2	2	2	2
3	Sponge/Dough	62.0	1003	102.9	3	3	4	3	4	4	2	4	5
4	Sponge/Dough	63.0	3162	107.0	5	5	3	1	4	1	2	3	2
5	Straight Dough	64.4	2875	107.5	2	3	3	2	3	3	1	4	4
6	Straight Dough	62.0	2900	105.5	2	2	2	5	5	2	4	5	4
7	Straight Dough	62.4	1010	106.3	3	2	2	2	4	2	5	2	2
8	Straight Dough	68.7	980	107.1	3	4	3	2	2	4	3	2	2
10	Straight Dough	62.4	760	79.2	2	3	3	2	4	2	2	2	2
Average		62.4		102.4	2.8	3.2	2.9	2.3	3.3	2.6	2.9	3.0	2.9
± 1 Std Dev		3.1		9.0	1.0	1.0	0.6	1.2	1.2	1.0	1.5	1.1	1.2
Samson								Factor	rs Compa	red to G	enn Ch	eck	
Samson Williston - W7	Bake	Bake	Loaf	LV	Mixing	Dough	Mix	Factor Crumb	rs Compa Grain &	red to G	enn Ch	eck	
Samson Williston - W7 Cooperator	Bake Method	Bake Absorption	Loaf Volume	LV % of CK	Mixing Requirement	Dough Characteristic	Mix Tolerance	Factor Crumb Color	rs Compa Grain & Texture	red to G Protein	lenn Ch Milling	eck Baking	Overall
Samson Williston - W7 Cooperator 1	Bake Method Sponge/Dough	Bake Absorption 63.0	Loaf Volume 2850	LV % of CK 100.0	Mixing Requirement 5	Dough Characteristic 5	Mix Tolerance 3	Factor Crumb Color 2	rs Compa Grain & Texture 1	red to G Protein 3	lenn Ch Milling 5	eck Baking 3	Overall 3
Samson Williston - W7 Cooperator 1 2	Bake Method Sponge/Dough Straight Dough	Bake Absorption 63.0 57.0	Loaf Volume 2850 3350	LV % of CK 100.0 109.8	Mixing Requirement 5 5	Dough Characteristic 5 4	Mix Tolerance 3 4	Factor Crumb Color 2 2	rs Compa Grain & Texture 1 3	red to G Protein 3 4	Milling 5 2	eck Baking 3 2	Overall 3 2
Samson Williston - W7 Cooperator 1 2 3	Bake Method Sponge/Dough Straight Dough Sponge/Dough	Bake Absorption 63.0 57.0 64.0	Loaf Volume 2850 3350 1135	LV % of CK 100.0 109.8 100.9	Mixing Requirement 5 5 5	Dough Characteristic 5 4 5	Mix Tolerance 3 4 3	Factor Crumb Color 2 2 3	rs Compa Grain & Texture 1 3 3	red to G Protein 3 4 4	lenn Chi Milling 5 2 3	eck Baking 3 2 4	Overall 3 2 4
Samson Williston - W7 Cooperator 1 2 3 4	Bake Method Sponge/Dough Straight Dough Sponge/Dough Sponge/Dough	Bake Absorption 63.0 57.0 64.0 61.0	Loaf Volume 2850 3350 1135 3133	LV % of CK 100.0 109.8 100.9 99.1	Mixing Requirement 5 5 5 5 5	Dough Characteristic 5 4 5 5 5	Mix Tolerance 3 4 3 3 3	Factor Crumb Color 2 2 3 1	rs Compa Grain & Texture 1 3 3 2	red to G Protein 3 4 4 4 4	lenn Ch Milling 5 2 3 3	eck Baking 3 2 4 2	Overall 3 2 4 2
Samson Williston - W7 Cooperator 1 2 3 4 5	Bake Method Sponge/Dough Straight Dough Sponge/Dough Sponge/Dough Straight Dough	Bake Absorption 63.0 57.0 64.0 61.0 63.4	Loaf Volume 2850 3350 1135 3133 2850	LV % of CK 100.0 109.8 100.9 99.1 100.0	Mixing Requirement 5 5 5 5 5 5 5 5	Dough Characteristic 5 4 5 5 5 1	Mix Tolerance 3 4 3 3 4 3 4	Factor Crumb Color 2 2 3 1 3 3	rs Compa Grain & Texture 1 3 3 2 3 3	red to G Protein 3 4 4 4 4 4 4	Milling 5 2 3 3 2	eck Baking 3 2 4 2 3	Overall 3 2 4 2 3
Samson Williston - W7 Cooperator 1 2 3 4 5 6	Bake Method Sponge/Dough Straight Dough Sponge/Dough Straight Dough Straight Dough	Bake Absorption 63.0 57.0 64.0 61.0 63.4 61.0	Loaf Volume 2850 3350 1135 3133 2850 2700	LV % of CK 100.0 109.8 100.9 99.1 100.0 91.5	Mixing Requirement 5 5 5 5 5 5 5 5 5 5	Dough Characteristic 5 4 5 5 5 1 5 1 5	Mix Tolerance 3 4 3 3 4 4 4 4	Factor Crumb Color 2 2 3 1 3 3 3	rs Compa Grain & Texture 1 3 3 2 3 4	red to G Protein 3 4 4 4 4 4 4 4 4 4	Milling 5 2 3 3 2 3 3 2 3	eck Baking 3 2 4 2 3 5	Overall 3 2 4 2 3 5
Samson Williston - W7 Cooperator 1 2 3 4 5 6 7	Bake Method Sponge/Dough Straight Dough Sponge/Dough Straight Dough Straight Dough Straight Dough	Bake Absorption 63.0 57.0 64.0 61.0 63.4 61.0 61.7	Loaf Volume 2850 3350 1135 3133 2850 2700 1165	LV % of CK 100.0 109.8 100.9 99.1 100.0 91.5 105.0	Mixing Requirement 5 5 5 5 5 5 5 5 5 5 5 5 5	Dough Characteristic 5 4 5 5 5 1 5 1 5 3	Mix Tolerance 3 4 3 3 4 4 4 3 3	Factor Crumb Color 2 2 3 1 3 3 3 2	rs Compa Grain & Texture 1 3 3 2 3 4 2 3 4 2	red to G Protein 3 4 4 4 4 4 4 4 4 4 4	lenn Ch Milling 5 2 3 3 2 3 2 3 3 3	eck Baking 3 2 4 2 3 5 3 3	Overall 3 2 4 2 3 5 2
Samson Williston - W7 Cooperator 1 2 3 4 5 6 7 8	Bake Method Sponge/Dough Straight Dough Sponge/Dough Straight Dough Straight Dough Straight Dough Straight Dough	Bake Absorption 63.0 57.0 64.0 61.0 63.4 61.0 61.7 70.2	Loaf Volume 2850 3350 1135 3133 2850 2700 1165 1150	LV % of CK 100.0 109.8 100.9 99.1 100.0 91.5 105.0 101.8	Mixing Requirement 5 5 5 5 5 5 5 5 5 5 5 5 5 5	Dough Characteristic 5 4 5 5 5 1 5 3 4	Mix Tolerance 3 4 3 3 4 4 3 4 3 5	Factor Crumb Color 2 2 3 1 3 3 3 2 3 3	rs Compa Grain & Texture 1 3 3 2 3 4 2 3 4 2 2 2	red to G Protein 3 4 4 4 4 4 4 4 4 4 2	lenn Ch Milling 5 2 3 3 2 3 3 2 3 3 2 2 3 2	eck Baking 3 2 4 2 3 5 3 2	Overall 3 2 4 2 3 5 2 2 2
Samson Williston - W7 Cooperator 1 2 3 4 5 6 7 8 10	Bake Method Sponge/Dough Straight Dough Sponge/Dough Straight Dough Straight Dough Straight Dough Straight Dough Straight Dough	Bake Absorption 63.0 57.0 64.0 61.0 63.4 61.0 61.7 70.2 61.8	Loaf Volume 2850 3350 1135 3133 2850 2700 1165 1150 820	LV % of CK 100.0 109.8 100.9 99.1 100.0 91.5 105.0 101.8 99.4	Mixing Requirement 5 5 5 5 5 5 5 5 5 5 5 5 3	Dough Characteristic 5 4 5 5 1 5 1 5 3 4 4 4	Mix Tolerance 3 4 3 4 4 4 3 5 3 3	Factor Crumb Color 2 2 3 1 3 3 2 3 2 3 1	rs Compa Grain & Texture 1 3 2 3 4 2 3 4 2 2 3 3	red to G Protein 3 4 4 4 4 4 4 4 2 3	lenn Ch Milling 5 2 3 3 2 3 3 2 3 3 2 3 3 2 3 3 2 3 3	eck Baking 3 2 4 2 3 5 3 5 3 2 3 2 3	Overall 3 2 4 2 3 5 2 2 2 3
Samson Williston - W7 Cooperator 1 2 3 4 5 6 7 8 10 <b>Average</b>	Bake Method Sponge/Dough Straight Dough Sponge/Dough Straight Dough Straight Dough Straight Dough Straight Dough Straight Dough	Bake Absorption 63.0 57.0 64.0 61.0 63.4 61.0 61.7 70.2 61.8 <b>62.6</b>	Loaf Volume 2850 3350 1135 3133 2850 2700 1165 1150 820	LV % of CK 100.0 109.8 100.9 99.1 100.0 91.5 105.0 101.8 99.4 <b>100.8</b>	Mixing Requirement 5 5 5 5 5 5 5 5 5 5 3 4.8	Dough Characteristic 5 4 5 5 1 5 3 4 4 4 4 4.0	Mix Tolerance 3 4 3 3 4 4 4 3 5 3 5 3 3 <b>3.6</b>	Factor Crumb Color 2 2 3 1 3 3 2 3 2 3 1 2.2	rs Compa Grain & Texture 1 3 3 2 3 4 2 3 4 2 2 3 2 3 2.6	red to G Protein 3 4 4 4 4 4 4 4 2 3 3 <b>3.6</b>	lenn Ch Milling 5 2 3 3 2 3 3 2 3 2 3 2 3 2 3 2 2 3	eck Baking 3 2 4 2 3 5 3 5 3 2 3 2 3 3 0 3.0	Overall 3 2 4 2 3 5 2 2 2 3 2 2 3 2.9

MN03358-4								Factor	rs Compa	red to G	lenn Ch	eck	
Casselton - C9	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	59.0	2800	102.7	3	3	3	3	1	3	3	3	3
2	Straight Dough	61.0	3300	104.8	4	5	4	3	3	3	1	2	3
3	Sponge/Dough	63.0	937	96.1	4	4	3	3	1	3	3	2	1
4	Sponge/Dough	66.0	3104	105.0	5	5	3	3	2	3	2	3	3
5	Straight Dough	67.9	2525	94.4	2	5	3	1	3	4	1	3	3
6	Straight Dough	64.0	2650	96.4	2	3	3	5	5	2	3	4	3
7	Straight Dough	66.1	940	98.9	3	3	1	3	4	3	3	3	3
8	Straight Dough	66.2	945	103.3	2	3	2	3	2	4	2	2	2
10	Straight Dough	66.6	785	81.8	2	3	2	3	4	3	3	2	3
Average		64.4		<b>98.2</b>	3.0	3.8	2.7	3.0	2.8	3.1	2.3	2.7	2.7
± 1 Std Dev		2.9		7.3	1.1	1.0	0.9	1.0	1.4	0.6	0.9	0.7	0.7
MN03358-4								Factor	rs Compa	red to G	lenn Ch	eck	
MN03358-4 Crookston - K9	Bake	Bake	Loaf	LV	Mixing	Dough	Mix	Factor Crumb	rs Compa Grain &	red to G	lenn Ch	eck	
MN03358-4 Crookston - K9 Cooperator	Bake Method	Bake Absorption	Loaf Volume	LV % of CK	Mixing Requirement	Dough Characteristic	Mix Tolerance	Factor Crumb Color	rs Compa Grain & Texture	red to G Protein	lenn Ch Milling	eck Baking	Overall
MN03358-4 Crookston - K9 Cooperator 1	Bake Method Sponge/Dough	Bake Absorption 59.0	Loaf Volume 2825	LV % of CK 94.2	Mixing Requirement 5	Dough Characteristic 5	Mix Tolerance 3	Factor Crumb Color 3	rs Compa Grain & Texture 3	red to G Protein 3	lenn Ch Milling 2	eck Baking 3	Overall 3
MN03358-4 Crookston - K9 Cooperator 1 2	Bake Method Sponge/Dough Straight Dough	Bake Absorption 59.0 59.0	Loaf Volume 2825 3000	LV % of CK 94.2 103.4	Mixing Requirement 5 3	Dough Characteristic 5 5	Mix Tolerance 3 3	Factor Crumb Color 3 3	rs Compar Grain & Texture 3 5	red to G Protein 3 2	lenn Ch Milling 2 2	eck Baking 3 4	Overall 3 3
MN03358-4 Crookston - K9 Cooperator 1 2 3	Bake Method Sponge/Dough Straight Dough Sponge/Dough	Bake Absorption 59.0 59.0 63.0	Loaf Volume 2825 3000 952	LV % of CK 94.2 103.4 88.6	Mixing Requirement 5 3 4	Dough Characteristic 5 5 4	Mix Tolerance 3 3 3	Factor Crumb Color 3 3 3 3	rs Compa Grain & Texture 3 5 2	red to G Protein 3 2 3	lenn Ch Milling 2 2 2	eck Baking 3 4 3	Overall 3 3 3
MN03358-4 Crookston - K9 Cooperator 1 2 3 4	Bake Method Sponge/Dough Straight Dough Sponge/Dough Sponge/Dough	Bake Absorption 59.0 59.0 63.0 65.0	Loaf Volume 2825 3000 952 3162	LV % of CK 94.2 103.4 88.6 105.9	Mixing Requirement 5 3 4 5	Dough Characteristic 5 5 4 5	Mix Tolerance 3 3 3 3 3	Factor Crumb Color 3 3 3 3 2	rs Compa Grain & Texture 3 5 2 3	red to G Protein 3 2 3 2 2	lenn Ch Milling 2 2 2 2 2	eck Baking 3 4 3 3	Overall 3 3 3 3 3
MN03358-4 Crookston - K9 Cooperator 1 2 3 4 5	Bake Method Sponge/Dough Straight Dough Sponge/Dough Straight Dough	Bake Absorption 59.0 63.0 65.0 67.1	Loaf Volume 2825 3000 952 3162 2600	LV % of CK 94.2 103.4 88.6 105.9 83.2	Mixing Requirement 5 3 4 5 2	Dough Characteristic 5 4 5 1	Mix Tolerance 3 3 3 3 3 2	Factor Crumb Color 3 3 3 2 4	rs Compa Grain & Texture 3 5 2 3 4	red to G Protein 3 2 3 2 3 2 3	lenn Ch Milling 2 2 2 2 2 2 2	eck Baking 3 4 3 3 2	Overall 3 3 3 3 3 2
MN03358-4 Crookston - K9 Cooperator 1 2 3 4 5 6	Bake Method Sponge/Dough Straight Dough Sponge/Dough Straight Dough Straight Dough	Bake Absorption 59.0 63.0 65.0 67.1 64.0	Loaf Volume 2825 3000 952 3162 2600 3000	LV % of CK 94.2 103.4 88.6 105.9 83.2 100.0	Mixing Requirement 5 3 4 5 2 2 2	Dough Characteristic 5 4 5 1 2	Mix Tolerance 3 3 3 3 2 2 2	Factor Crumb Color 3 3 3 2 4 3 3	rs Compai Grain & Texture 3 5 2 3 4 3 4 3	Protein 3 2 3 2 3 2 3 2 3 2	lenn Ch Milling 2 2 2 2 2 2 2 2 2	eck Baking 3 4 3 3 2 3	Overall 3 3 3 3 2 4
MN03358-4 Crookston - K9 Cooperator 1 2 3 4 5 6 7	Bake Method Sponge/Dough Straight Dough Sponge/Dough Straight Dough Straight Dough Straight Dough	Bake Absorption 59.0 63.0 65.0 67.1 64.0 65.4	Loaf Volume 2825 3000 952 3162 2600 3000 905	LV % of CK 94.2 103.4 88.6 105.9 83.2 100.0 87.9	Mixing Requirement 5 3 4 5 2 2 2 2 4	Dough Characteristic 5 4 5 1 2 4	Mix Tolerance 3 3 3 3 3 2 2 2 2 1	Factor Crumb Color 3 3 3 2 4 3 3 3 3	rs Compai Grain & Texture 3 5 2 3 4 3 4 3 3 3	Protein 3 2 3 2 3 2 3 2 2 2 2	lenn Ch Milling 2 2 2 2 2 2 2 2 2 2 2 2	eck Baking 3 4 3 3 2 3 2 3 2 2	Overall 3 3 3 3 2 4 2 2
MN03358-4 Crookston - K9 Cooperator 1 2 3 4 5 6 7 8	Bake Method Sponge/Dough Straight Dough Sponge/Dough Straight Dough Straight Dough Straight Dough Straight Dough	Bake Absorption 59.0 63.0 65.0 67.1 64.0 65.4 66.7	Loaf Volume 2825 3000 952 3162 2600 3000 905 845	LV % of CK 94.2 103.4 88.6 105.9 83.2 100.0 87.9 82.8	Mixing Requirement 5 3 4 5 2 2 2 4 4 4	Dough Characteristic 5 4 5 1 2 4 4 4 4	Mix Tolerance 3 3 3 3 3 2 2 2 1 4	Factor Crumb Color 3 3 3 2 4 3 3 3 2 4 3 3 2	rs Compai Grain & Texture 3 5 2 3 4 3 4 3 3 2	Protein 3 2 3 2 3 2 3 2 2 2 4	lenn Ch Milling 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	eck Baking 3 4 3 3 2 3 2 3 2 2 2	Overall 3 3 3 2 4 2 2 2
MN03358-4 Crookston - K9 Cooperator 1 2 3 4 5 6 7 8 10	Bake Method Sponge/Dough Straight Dough Sponge/Dough Straight Dough Straight Dough Straight Dough Straight Dough Straight Dough	Bake Absorption 59.0 63.0 65.0 67.1 64.0 65.4 66.7 65.9	Loaf Volume 2825 3000 952 3162 2600 3000 905 845 720	LV % of CK 94.2 103.4 88.6 105.9 83.2 100.0 87.9 82.8 81.4	Mixing Requirement 5 3 4 5 2 2 2 4 4 4 3	Dough Characteristic 5 4 5 1 2 4 4 4 4 3	Mix Tolerance 3 3 3 3 2 2 2 1 4 2 2 1 2 2 2 2 2 2 2 2 2 2 2 2	Factor Crumb Color 3 3 2 4 3 2 4 3 3 2 2 2	rs Compai Grain & Texture 3 5 2 3 4 3 4 3 3 2 2 2	red to G Protein 3 2 3 2 3 2 2 2 4 3 3	lenn Ch Milling 2 2 2 2 2 2 2 2 2 2 2 2 3	eck Baking 3 4 3 2 3 2 2 2 2 2	Overall 3 3 3 2 4 2 2 3
MN03358-4 Crookston - K9 Cooperator 1 2 3 4 5 6 7 8 10 Average	Bake Method Sponge/Dough Straight Dough Sponge/Dough Straight Dough Straight Dough Straight Dough Straight Dough Straight Dough	Bake Absorption 59.0 63.0 65.0 67.1 64.0 65.4 66.7 65.9 <b>63.9</b>	Loaf Volume 2825 3000 952 3162 2600 3000 905 845 720	LV % of CK 94.2 103.4 88.6 105.9 83.2 100.0 87.9 82.8 81.4 <b>91.9</b>	Mixing Requirement 5 3 4 5 2 2 2 4 4 4 3 3 3.6	Dough Characteristic 5 4 5 1 2 4 4 4 3 3 3.7	Mix Tolerance 3 3 3 3 2 2 2 1 4 2 2 1 4 2 2 2.6	Factor Crumb Color 3 3 2 4 3 2 4 3 3 2 2 2 2 2 2 8	rs Compai Grain & Texture 3 5 2 3 4 3 4 3 3 2 2 2 2 3.0	red to G Protein 3 2 3 2 3 2 3 2 2 4 3 2 4 3 2.7	lenn Ch Milling 2 2 2 2 2 2 2 2 2 2 2 2 3 3 2.1	eck Baking 3 4 3 2 3 2 2 2 2 2 2 2 2 2 2 2 2 2 2	Overall 3 3 3 2 4 2 2 3 3 <b>2.8</b>

01S0042-10								Factor	rs Compa	red to G	enn Ch	eck	
Brookings - B10	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	58.0	3000	110.1	5	5	4	3	3	3	4	3	3
2	Straight Dough	60.0	2800	96.6	2	3	4	3	3	3	2	3	2
3	Sponge/Dough	61.0	962	99.5	2	3	2	3	3	2	2	1	1
4	Sponge/Dough	63.0	3104	103.0	5	5	3	1	1	2	3	3	3
5	Straight Dough	65.3	2700	91.5	2	5	3	3	4	3	3	2	3
6	Straight Dough	62.0	2500	83.3	3	3	3	3	3	3	3	3	3
7	Straight Dough	62.7	885	96.7	4	3	2	2	2	3	3	2	2
8	Straight Dough	64.7	800	112.7	4	5	3	3	4	4	4	4	5
10	Straight Dough	62.7	720	86.2	3	4	3	2	3	3	3	2	3
Average		62.2		97.7	3.3	4.0	3.0	2.6	2.9	<b>2.9</b>	3.0	2.6	2.8
± 1 Std Dev		2.3		9.9	1.2	1.0	0.7	0.7	0.9	0.6	0.7	0.9	1.1
01S0042-10								Factor	rs Compa	red to G	enn Ch	eck	
01S0042-10 Casselton - C10	Bake	Bake	Loaf	LV	Mixing	Dough	Mix	Factor Crumb	rs Compa Grain &	red to G	enn Ch	eck	
01S0042-10 Casselton - C10 Cooperator	Bake Method	Bake Absorption	Loaf Volume	LV % of CK	Mixing Requirement	Dough Characteristic	Mix Tolerance	Factor Crumb Color	rs Compa Grain & Texture	red to G Protein	lenn Ch Milling	eck Baking	Overall
01S0042-10 Casselton - C10 Cooperator 1	Bake Method Sponge/Dough	Bake Absorption 59.0	Loaf Volume 2825	LV % of CK 103.7	Mixing Requirement 3	Dough Characteristic 3	Mix Tolerance 3	Factor Crumb Color 3	rs Compa Grain & Texture 1	red to G Protein 3	lenn Ch Milling 4	eck Baking 3	Overall 3
01S0042-10 Casselton - C10 Cooperator 1 2	Bake Method Sponge/Dough Straight Dough	Bake Absorption 59.0 60.0	Loaf Volume 2825 3150	LV % of CK 103.7 100.0	Mixing Requirement 3 3	Dough Characteristic 3 4	Mix Tolerance 3 2	Factor Crumb Color 3 2	rs Compa Grain & Texture 1 3	red to G Protein 3 2	Milling 4 2	eck Baking 3 3	Overall 3 3
01S0042-10 Casselton - C10 Cooperator 1 2 3	Bake Method Sponge/Dough Straight Dough Sponge/Dough	Bake Absorption 59.0 60.0 63.0	Loaf Volume 2825 3150 935	LV % of CK 103.7 100.0 95.9	Mixing Requirement 3 3 4	Dough Characteristic 3 4 3	Mix Tolerance 3 2 3	Factor Crumb Color 3 2 3	rs Compa Grain & Texture 1 3 3	red to G Protein 3 2 3	lenn Ch Milling 4 2 2	eck Baking 3 3 3	Overall 3 3 2
01S0042-10 Casselton - C10 Cooperator 1 2 3 4	Bake Method Sponge/Dough Straight Dough Sponge/Dough Sponge/Dough	Bake Absorption 59.0 60.0 63.0 66.0	Loaf Volume 2825 3150 935 3074	LV % of CK 103.7 100.0 95.9 104.0	Mixing Requirement 3 3 4 5	Dough Characteristic 3 4 3 5	Mix Tolerance 3 2 3 3 3	Factor Crumb Color 3 2 3 1	rs Compa Grain & Texture 1 3 3 2	red to G Protein 3 2 3 2 2	lenn Ch Milling 4 2 2 3	eck Baking 3 3 3 2	Overall 3 3 2 2 2
01S0042-10 Casselton - C10 Cooperator 1 2 3 4 5	Bake Method Sponge/Dough Straight Dough Sponge/Dough Sponge/Dough Straight Dough	Bake Absorption 59.0 60.0 63.0 66.0 67.4	Loaf Volume 2825 3150 935 3074 2425	LV % of CK 103.7 100.0 95.9 104.0 90.7	Mixing Requirement 3 3 4 5 2	Dough Characteristic 3 4 3 5 5 1	Mix Tolerance 3 2 3 3 3 3 3	Factor Crumb Color 3 2 3 1 1 1	rs Compar Grain & Texture 1 3 3 2 2 2	Protein 3 2 3 2 4	Milling 4 2 2 3 3 3	eck Baking 3 3 3 2 2 2	Overall 3 3 2 2 2 2
01S0042-10 Casselton - C10 Cooperator 1 2 3 4 5 6	Bake Method Sponge/Dough Straight Dough Sponge/Dough Straight Dough Straight Dough	Bake Absorption 59.0 60.0 63.0 66.0 67.4 64.0	Loaf Volume 2825 3150 935 3074 2425 2700	LV % of CK 103.7 100.0 95.9 104.0 90.7 98.2	Mixing Requirement 3 3 4 5 2 3	Dough Characteristic 3 4 3 5 5 1 3 3	Mix Tolerance 3 2 3 3 3 3 3 3 3 3	Factor Crumb Color 3 2 3 1 1 1 4	rs Compa Grain & Texture 1 3 3 2 2 2 4	red to G Protein 3 2 3 2 4 3 3	Milling 4 2 2 3 3 4	eck Baking 3 3 2 2 2 4	Overall 3 2 2 2 2 3
01S0042-10 Casselton - C10 Cooperator 1 2 3 4 5 6 7	Bake Method Sponge/Dough Straight Dough Sponge/Dough Straight Dough Straight Dough Straight Dough	Bake Absorption 59.0 60.0 63.0 66.0 67.4 64.0 64.6	Loaf Volume 2825 3150 935 3074 2425 2700 975	LV % of CK 103.7 100.0 95.9 104.0 90.7 98.2 102.6	Mixing Requirement 3 3 4 5 2 3 3 3	Dough Characteristic 3 4 3 5 1 3 2	Mix Tolerance 3 2 3 3 3 3 3 3 2	Factor Crumb Color 3 2 3 1 1 1 4 2	rs Compa Grain & Texture 1 3 3 2 2 2 4 4 4	red to G Protein 3 2 3 2 4 3 2 4 3 2 2	lenn Ch Milling 4 2 2 3 3 4 4 4	eck Baking 3 3 2 2 2 4 3	Overall 3 2 2 2 2 3 2 3 2
01S0042-10 Casselton - C10 Cooperator 1 2 3 4 5 6 7 8	Bake Method Sponge/Dough Straight Dough Sponge/Dough Straight Dough Straight Dough Straight Dough Straight Dough	Bake Absorption 59.0 60.0 63.0 66.0 67.4 64.0 64.6 65.7	Loaf Volume 2825 3150 935 3074 2425 2700 975 975	LV % of CK 103.7 100.0 95.9 104.0 90.7 98.2 102.6 106.6	Mixing Requirement 3 3 4 5 2 3 3 3 2 2	Dough Characteristic 3 4 3 5 1 3 2 2 2	Mix Tolerance 3 2 3 3 3 3 3 2 2 2	Factor Crumb Color 3 2 3 1 1 4 2 2 2	rs Compa Grain & Texture 1 3 3 2 2 4 4 4 2	red to G Protein 3 2 3 2 4 3 2 4 3 2 3	lenn Ch Milling 4 2 3 3 4 4 4 4	eck Baking 3 3 2 2 4 3 2 4 3 2	Overall 3 2 2 2 3 2 3 2 3 3 2 3
01S0042-10 Casselton - C10 Cooperator 1 2 3 4 5 6 7 8 10	Bake Method Sponge/Dough Straight Dough Sponge/Dough Straight Dough Straight Dough Straight Dough Straight Dough Straight Dough	Bake Absorption 59.0 60.0 63.0 66.0 67.4 64.0 64.6 65.7 64.6	Loaf Volume 2825 3150 935 3074 2425 2700 975 975 750	LV % of CK 103.7 100.0 95.9 104.0 90.7 98.2 102.6 106.6 78.1	Mixing Requirement 3 4 5 2 3 3 3 2 2 2	Dough Characteristic 3 4 3 5 1 3 2 2 2 3	Mix Tolerance 3 2 3 3 3 3 3 2 2 2 2 3	Factor Crumb Color 3 2 3 1 1 4 2 2 2 2	rs Compa Grain & Texture 1 3 3 2 2 4 4 4 2 4 2 4	red to G Protein 3 2 3 2 4 3 2 4 3 2 3 3 3	Milling 4 2 2 3 3 4 4 4 4 3	eck Baking 3 3 2 2 2 4 3 2 4 3 2 2 2	Overall 3 2 2 2 3 2 3 3 3 3 3
01S0042-10 Casselton - C10 Cooperator 1 2 3 4 5 6 7 8 10 Average	Bake Method Sponge/Dough Straight Dough Sponge/Dough Straight Dough Straight Dough Straight Dough Straight Dough Straight Dough	Bake Absorption 59.0 60.0 63.0 66.0 67.4 64.0 64.6 65.7 64.6 <b>63.8</b>	Loaf Volume 2825 3150 935 3074 2425 2700 975 975 750	LV % of CK 103.7 100.0 95.9 104.0 90.7 98.2 102.6 106.6 78.1 <b>97.7</b>	Mixing Requirement 3 3 4 5 2 3 3 3 2 2 2 2 3.0	Dough Characteristic 3 4 3 5 1 3 2 2 2 3 2 2 3 2.9	Mix Tolerance 3 2 3 3 3 3 3 2 2 2 3 2 3 2 2 3	Factor Crumb Color 3 2 3 1 1 4 2 2 2 2 2 2 2 2.2	rs Compai Grain & Texture 1 3 3 2 2 4 4 4 2 4 2 4 2 8	red to G Protein 3 2 3 2 4 3 2 4 3 2 3 3 2 8	Milling 4 2 2 3 3 4 4 4 4 3 3.2	eck Baking 3 3 2 2 4 3 2 4 3 2 2 2 2 2 2 2.7	Overall 3 2 2 2 3 2 3 3 3 2 2.6

ND809								Factor	s Compa	red to GI	enn Ch	eck	
Casselton - C11	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	59.0	2900	106.3	2	2	2	3	1	3	4	2	3
2	Straight Dough	62.0	3050	96.8	3	4	2	2	2	2	2	2	3
3	Sponge/Dough	63.0	968	99.3	3	4	2	3	4	3	2	3	2
4	Sponge/Dough	66.0	3045	103.0	5	5	3	2	2	2	3	2	2
5	Straight Dough	68.0	3125	116.8	2	4	3	4	3	4	3	5	5
6	Straight Dough	65.0	2350	85.5	3	3	3	2	2	3	4	3	2
7	Straight Dough	66.5	920	96.8	3	3	2	3	4	2	3	4	3
8	Straight Dough	66.7	980	107.1	2	2	3	3	3	3	2	3	3
10	Straight Dough	66.5	850	88.5	3	4	3	4	4	3	3	3	3
Average		64.7		100.0	2.9	3.4	2.6	2.9	2.8	2.8	2.9	3.0	2.9
± 1 Std Dev		2.9		9.7	0.9	1.0	0.5	0.8	1.1	0.7	0.8	1.0	0.9
ND809						<b>.</b> .		Factor	s Compa	red to Gl	enn Ch	eck	
Crookston - K11	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	59.0	2800	93.3	3	2	2	3	3	3	3	2	2
2	Straight Dough	60.0	3150	108.6	3	4	3	2	2	2	3	3	3
3	Sponge/Dough	63.0	950	88.4	3	3	2	3	4	2	4	2	2
4	Sponge/Dough	65.0	3045	102.0	5	4	3	2	3	2	3	3	2
5	Straight Dough	70.3	2475	79.2	2	1	2	3	3	3	3	1	4
6	Straight Dough	64.0	2650	88.3	2	2	2	3	3	2	4	3	4
1	Straight Dough	67.8	960	93.2	3	3	1	3	3	2	4	3	2
8	Straight Dough	66.7	950	93.1	2	3	4	2	2	2	2	2	2
10	Straight Dough	67.8	/90	89.2	2	4	2	2	3	3	3	2	3
Average		64.8		92.8	2.8	2.9	2.3	2.6	2.9	2.3	3.2	2.3	2.7
± 1 Std Dev		3.7		8.5	1.0	1.1	0.9	0.5	0.6	0.5	0.7	0.7	0.9
ND809								Factor	s Compa	red to Gl	enn Ch	≏ck	
Williston - W11	Bake	Bake	Loaf	IV	Mixina	Dough	Mix	Crumb	Grain &			0011	
Cooperator	Method	Absorption	Volume	% of CK	Requirement	Characteristic	Tolerance	Color	Texture	Protein	Millina	Baking	Overall
1	Sponge/Dough	63.0	2800	98.3	5	5	3	3	1	3	4	3	3
2	Straight Dough	60.0	3500	114.8	5	4	4	4	3	5	3	4	4
3	Sponge/Dough	64.0	1135	100.9	5	5	3	3	3	3	3	3	3
4	Sponge/Dough	66.0	3162	100.0	5	5	3	2	2	4	3	3	3
5	Straight Dough	68.8	3200	112.3	5	3	4	3	3	4	2	5	5
6	Straight Dough	65.0	2750	93.2	4	4	3	4	4	4	3	4	4
7	Straight Dough	66.6	1150	103.6	4	3	2	3	2	4	3	3	3
, 8	Straight Dough	72.7	1205	106.6	5	4	5	3	3	2	3	3	3
10	Straight Dough	66.6	800	97.0	2	4	3	3	3	3	3	3	3
Average	ett algitt Dough	65.9	000	103.0	4.4	4.1	3.3	3.1	2.7	3.6	3.0	3.4	3.4
± 1 Std Dev		3.6		7.1	1.0	0.8	0.9	0.6	0.9	0.9	0.5	0.7	0.7

CO1320W								Factor	s Compai	red to Gl	enn Che	eck	
Williston - W12	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	63.0	2875	100.9	5	5	3	3	1	3	4	3	3
2	Straight Dough	57.0	3200	104.9	5	5	4	5	2	3	2	3	3
3	Sponge/Dough	64.0	1120	99.6	4	4	2	3	3	3	3	3	3
4	Sponge/Dough	61.0	3133	99.1	5	5	3	4	3	3	3	2	2
5	Straight Dough	63.9	3225	113.2	5	4	4	4	4	4	1	5	5
6	Straight Dough	61.0	2950	100.0	5	5	4	4	4	4	3	5	5
7	Straight Dough	62.3	1205	108.6	3	3	3	4	2	3	3	3	2
8	Straight Dough	71.7	1095	96.9	5	4	2	3	3	2	2	3	3
10	Straight Dough	62.3	835	101.2	1	4	3	4	2	3	3	3	3
Average		62.9		102.7	4.2	4.3	3.1	3.8	2.7	3.1	2.7	3.3	3.2
± 1 Std Dev		3.9		5.2	1.4	0.7	0.8	0.7	1.0	0.6	0.9	1.0	1.1