

# Selecting Nebraska Wheat for Processing Needs of Domestic and Foreign Markets

**To:** Nebraska Wheat Board  
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**Annual Report:** FY 2008-2009

In this financial year, the wheat quality lab has analyzed 1909 wheat samples in various quality characterizations.

## 1. 2008 S4R8

In 2008 S4R8 study, 404 wheat samples were analyzed in milling properties, protein content and rheological dough strength. Mixograph tolerance range of 2008 S4R8 with mean value of characterization was given in **Table 1.1**.

**Table 1.1 Tolerance Range in 2008 S4R8 with Mean Value**

Tolerance Range	Dough Strength Class	Tolerance	Peak Time, min	Peak Value, %TQ	Area, %TQ*min	Protein, %	Sample
Tolerance < 3	Weak	2.29	3.73	43.42	93.62	11.25	39.11%
3 ≤ Tolerance < 4	Medium	3.46	4.35	44.04	111.39	11.44	33.91%
4 ≤ Tolerance < 5	Strong	4.32	4.64	46.34	128.06	11.55	24.01%
Tolerance > 5	Very Strong	5.15	5.65	45.93	141.55	11.71	2.97%

## 2. 2008 Poom

In 2008 Poom study, 90 wheat samples in three locations (Lincoln, Mead and North Platte), and total 270 wheat samples were analyzed in milling properties, protein content and rheological dough strength. The mean value of characterization by location was summarized in **Table 2.1**. Mixograph tolerance range of 2008 Poom with mean value of characterization was given in **Table 2.2**.

**Table 2.1 Tolerance Range in 2008 Poom with Mean Value**

Location	Yield, %	Bran Clean-up	Protein (14%mb), %	Tolerance	Midline Peak Time, min	Midline Peak Value, %	Band Area in 8 min, %TQ*min
Lincoln	65.9	3.2	12.64	3.51	3.13	54.16	148.35
Mead	60.1	2.3	13.67	3.42	3.14	55.23	155.27
NP	69.5	4.0	12.02	3.39	3.03	52.83	147.55

**Talbe 2.2 Tolerance Range in 2008 Poom with Mean Value of Characterizations**

Location	Tolerance Range	Dough Strength Class	Tolerance	Peak Time, min	Peak Value, %TQ	Area, %TQ*min	Protein, %	Sample
<b>Lincoln</b>	Tolerance < 3	Weak	1.90	2.40	54.63	114.21	12.78	26.67%
	3 ≤ Tolerance < 4	Medium	3.58	2.97	54.87	156.38	12.62	30.00%
	4 ≤ Tolerance < 5	Strong	4.41	3.65	53.23	162.28	12.57	41.11%
	Tolerance ≥ 5	Very Strong	5.13	4.45	56.08	191.99	12.52	2.22%
<b>Mead</b>	Tolerance < 3	Weak	1.96	2.49	56.86	129.65	13.99	31.11%
	3 ≤ Tolerance < 4	Medium	3.55	3.01	55.06	162.25	13.52	31.11%
	4 ≤ Tolerance < 5	Strong	4.35	3.70	53.64	164.33	13.51	32.22%
	Tolerance ≥ 5	Very Strong	5.40	4.27	56.30	207.12	13.61	5.56%
<b>North Platte</b>	Tolerance < 3	Weak	1.87	2.29	53.79	114.36	12.15	25.56%
	3 ≤ Tolerance < 4	Medium	3.45	2.88	53.38	153.86	12.13	36.67%
	4 ≤ Tolerance < 5	Strong	4.25	3.61	51.08	157.31	11.67	34.44%
	Tolerance ≥ 5	Very Strong	5.58	4.25	57.67	231.79	13.42	3.33%

### 3. 2008 Organic Wheat

In 2008 Organic Wheat study, Our approach will be to conduct wheat state variety trials at 4 organic locations (Sidney, Mead, HAL (Concord), Clay Center) and target organic breeding effort at 2 locations (Sidney, Mead) complete with end-use quality and nutrient quality evaluations, soil fertility trials at two locations, and cover crop research at one location. After wheat was harvested, the grain composited organic wheat was composited by four locations and two locations. There were 22 composited organic wheat from 4 Locations and 68 composited organic wheat from 2 Locations. The total ninety composited organic wheat quality was characterized in single kernel, milling properties, sedimentation, protein content, ash content, rheological dough strength, and bread production.

The overall score of bread was scored from 1.90 to 4.98 (average 3.78) for 4 Locations composited organic wheat, and 1.20 to 5.60 (average 3.58) for 2 Locations composited organic wheat. The bread overall score of 4 Locations was slightly better than of 2 Locations composited organic wheat by 0.20 in average. In general, the end-use wheat quality of 4 Locations was slightly better than of 2 Locations composited organic wheat in average.

In overview, the top twelve varieties of 4 Locations composited organic wheat that had best baking properties were as following. Their overall score was from 4.0 to 5.0.

HARRY (683) ≥ PRONGHORN (677) > WESLEY (684) > NW03681 (693) > ALICE (688) > CAMELOT (696) > DARRELL (689) > ANTELOPE (687) > HATCHER (685) > ARROWSMITH (686) > MILLENNIUM (679) > NE04490 (698).

They had good milling property (average 74.8% flour yield). They had average protein content 12.3% and 0.454% ash content. They had fair to good strong dough strength (average 3.77 tolerance and 128.41% TQ\*min). They had relatively longer mixing times (average 6.8 min) and average water absorption (60.6%). They had good to very good exterior (average 4.57), and good crumb grain (average 4.25). They had good to very good smoothness (average 4.43) and good resilient texture (average 94.54 g). They had higher loaf volume (average 879 mL). They had higher slice brightness (average 142.8) and better distributed cells (average 5.706). They had higher slice area (average 9526 mm<sup>2</sup>) and number of cells (average 4963). They had medium cell diameter (average 2.387 mm) and cell elongated (average 1.47).

In overview, the top thirty varieties of 2 Locations composited organic wheat that had best baking properties were as following. Their overall score was from 4.0 to 5.6.

NE05426 (713) > NE07457 (732) > NE07410 (730) > NE06430 (722) > NE05418 (712) > NE02558 (704) > NW07505 (743) > NE02533 (703) > Darrell (763) > NE07490 (742) > NE06607 (728) > Wesley (699) > NW06630 (766) > NE07520 (744) > NE06548 (726) > NE07486 (740) > NI04427 (710) > NE07487 (741) > NE07484 (739) > HARRY (737) > NE06471 (724) > NE05496 (715) > Alice (762) ≥ NE07444 (731) > NE07531 (746) ≥ NE06545 (725) > Pronghorn (758) ≥ NE07477 (735) > NE07569 (749) > NH03614 (718).

They had good milling property (average 74.2% flour yield). They had average protein content 13.8% and 0.452% ash content. They had good to excellent strong dough strength (average 4.64 tolerance and 169.38%TQ\*min). They had relatively longer mixing times (average 6.8 min) and average water absorption (60.9%). They had good to very good exterior (average 4.34) and crumb grain (average 4.41). They had good to excellent smoothness (average 4.51) and average resilient texture (average 94.54 g). They had higher loaf volume (average 829 mL). They had higher slice brightness (average 145.1) and better distributed cells (average 5.264). They had higher slice area (average 9340 mm<sup>2</sup>) and number of cells (average 4916). They had medium cell diameter (average 2.358 mm) and cell elongated.

Mean value of characterization by location in 2008 Organic Wheat was indicated in **Table 3.1**. Overall ranking by location composites of 2008 Organic Wheat with mean value of characterization was given in **Table 3.2**. Some breadcrumb images of 2008 Organic Wheat varieties with overall baking scores were shown in **Table 3.3**.

These results highlight the importance of studying different organic variety wheat quality across different environments. It also highlights why it is important to have numerous cultivars available and widely grown throughout Nebraska so that on average our end-use quality remains highly desired in the marketplace.




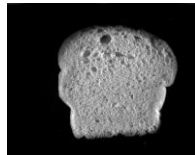







**Table 3.1 Mean Value of Characterization by Location in 2008 Organic Wheat**

Composite	Kernel Hardness	Kernel d, mm	Kernel wt, mg	Flour Yield, %	Bran	Short	Wheat, %	Flour, %
4 Loc	59.2	2.4	31.2	74.5	2.8	3.5	13.19	10.11
2 Loc	64.0	2.3	30.0	74.2	3.5	3.5	14.27	11.31
Composite	Ash, %	Sed, min	Peak Time, min	Tolerance	Peak Time, min	Peak Value, %	Left Slope, %TQ/min	Band Area, %TQ*min
4 Loc	0.454	78.9	4.7	3.77	5.31	43.23	1.46	128.27
2 Loc	0.453	87.8	4.4	4.34	4.85	48.65	3.51	166.40
Composite	Water Abs, %	Mix Time, min	Loaf Vol, mL	Loaf Density, g/mL	Exterior	Crumb	Crumb Hand Texture	Overall
4 Loc	60.2	6.5	857	0.167	3.86	3.61	3.85	3.78
2 Loc	60.7	6.0	791	0.183	3.47	3.61	3.61	3.58
Composite	Crumb Texture, g	Stiffness, g/sec	Slice Area, mm <sup>2</sup>	Slice Brightness	Num. Cells	Cell d, mm	Non-uniform	Cell Elong
4 Loc	75.2	29.5	9306	140	4713	2.466	4.606	1.47
2 Loc	74.9	21.8	8968	143	4570	2.421	3.836	1.46

**Table 3.2 Overall Ranking of 2008 Organic Wheat with Mean Value of Characterization**

Composite	Ranking	Kernel Hardness	Flour Yield, %	Flour Protein (14% mb), %	Ash (14%mb), %	Tolerance	Midline Peak Time, min	Midline Peak Value, %	Band Area in 8 min, %TQ*min	Water Abs (14% mb) , %	Mixing Time, min
4 Locations	Poorest	61.2	74.2	12.19	0.484	3.67	4.1	44.11	131.47	59.50	5.5
	Fair	56.8	74.4	12.11	0.443	3.75	5.2	42.88	124.53	59.71	6.5
	Best	60.1	74.7	12.33	0.454	3.81	5.7	43.21	129.66	60.67	6.7
2 Locations	Poorest	64.1	74.7	14.28	0.460	3.93	4.2	49.09	163.41	60.59	5.2
	Fair	63.6	74.0	13.97	0.450	4.25	4.6	48.95	164.58	60.59	5.7
	Best	64.2	74.1	13.77	0.452	4.64	5.5	48.20	169.38	60.86	6.8
Composite	Ranking	Loaf Vol, mL	Loaf Density, g/mL	Texture Hardness, g	Slice Area, mm2	Slice Brightness	Cells Num.	Cell d, mm	Uniformity	Cell Elongation	Bread Overall
4 Locations	Poorest	833	0.172	53.90	8769	112	4080	2.70	2.68	1.462	2.23
	Fair	835	0.170	56.03	9202	137	4567	2.51	3.81	1.465	3.45
	Best	876	0.164	91.74	9501	142	4957	2.38	5.55	1.467	4.37
2 Locations	Poorest	737	0.197	75.92	8330	139	3958	2.58	2.85	1.449	2.20
	Fair	781	0.185	74.37	8952	142	4570	2.38	2.59	1.454	3.46
	Best	829	0.175	74.76	9340	145	4916	2.36	5.26	1.473	4.45

**Table 3.3 Breadcrumb Images with Overall Scores in 2008 Organic Wheat**

CONTROL	BUCKSKIN	ALICE	DARRELL	NE04424	NE99495
<u>4 Locations:</u>					
5.00	3.83	4.28	4.23	3.60	3.60
					
<u>2 Locations:</u>					
5.00		4.08	4.53	3.70	3.58
					

#### 4. 2008 NIN

In 2008 NIN, thirty-one varieties were analyzed in single kernel, milling properties, protein content, ash content, rheological dough strength, and bread production.

In overview, the top 11 varieties of 2008 NIN wheat that had best baking properties were as following. Their overall score was from 4.0 to 5.5. Their average protein content was about 12.7%. They had good to excellent dough strength with longer mixing times. They had higher loaf volume, good to very good exterior, and very good crumb grain. They had smooth and resilient texture. They had higher slice area, slice brightness and better distributed cells. They had average cell diameter and cell elongation.

INFINITY < NW03666 < NE05418 < NE02533 < NE06430 < NI04427 < NE06548 < NI04421 < NE06607 < NE05426 ≤ WESLEY

Overall bread ranking of 2008 NIN with mean value of characterization was given in **Table 4.1**. After added 5 ppm antioxidant ascorbic acid in baking, the bread quality of wheat varieties, which were ranked from 1.0 to 3.1 in not adding antioxidant baking, was improved significantly. Some bread with and without oxidant ranking of 2008 Triplicate with mean value of characterization was given in **Table 4.2**.

**Table 4.1 Overall Ranking of 2008 NIN Varieties with Mean Value of Characterization**

Ranking	Kernel Hardness	Flour Yield, %	Flour Protein (14% mb), %	Ash (14%mb), %	Tolerance	Midline Peak Time, min	Midline Peak Value, %	Band Area in 8 min, %TQ*min	Water Abs (14% mb) , %	Mixing Time, min
Poorest	66.4	74.2	12.65	0.428	4.02	3.59	50.79	158.69	61.2	4.91
Fair	68.9	73.4	12.24	0.426	4.61	4.28	50.28	170.34	61.4	5.87
Best	67.5	74.2	12.65	0.484	5.00	5.10	50.25	178.40	61.3	6.83
Ranking	Loaf Vol, mL	Loaf Density, g/mL	Texture Hardness, g	Slice Area, mm <sup>2</sup>	Slice Brightness	Cells Num.	Cell d, mm	Uniformity	Cell Elongation	Bread Overall
Poorest	701	0.211	124.1	8182	138.19	3532	2.76	2.51	1.46	1.98
Fair	790	0.185	105.4	9344	142.56	4360	2.43	3.36	1.46	3.59
Best	803	0.181	97.2	9622	145.08	4774	2.32	2.49	1.47	4.58

**Table 4.2 Some Bread (0 and 5 ppm Oxidant) Overall Ranking of 2008 NIN Varieties with Mean Value**

Oxidant	Water Abs (14% mb) , %	Mixing Time, min	Loaf Vol, mL	Loaf Density, g/mL	Texture Hardness, g	Slice Area, mm <sup>2</sup>	Slice Brightness	Cells Num.	Cell d, mm	Uniformity	Cell Elongation	Bread Overall
0ppm	61.2	4.88	705	0.209	123.4	8241	138.14	3567	2.76	2.42	1.46	2.05
5ppm	62.0	4.84	770	0.191	92.5	9366	150.54	4517	2.38	2.29	1.47	3.79

## 5. 2008 Triplicate

In 2008 Triplicate, twenty-four varieties were analyzed in single kernel, milling properties, protein content, ash content, rheological dough strength, and bread production.

In overview, the top 13 varieties of 2008 Triplicate wheat that had best baking properties were as following. Their overall score was from 4.0 to 5.0. The average protein content was about 12.2%. They had good to excellent dough strength with longer mixing times. They had higher loaf volume, good to very good exterior, and very good crumb grain. They had smooth and resilient texture. They had higher slice area, slice brightness and better distributed cells. They had average cell diameter and cell elongation.

NE07458 < NE07490 < NE07695 < NE07487 < NE07484 < NE07520 < NE07457 < NW07534 < NE07569 < NE07410 ≤ NE07668 < NW07539 < NW07505

Overall bread ranking of 2008 Triplicate with mean value of characterization was given in **Table 5.1**. After added 5 ppm antioxidant ascorbic acid in baking, the bread quality of wheat varieties, which were ranked from 1.0 to 3.1 in not adding antioxidant baking, was improved significantly. Some bread with and without oxidant ranking of 2008 Triplicate with mean value of characterization was given in **Table 5.2**.

**Table 5.1 Bread Overall Ranking of 2008 Triplicate Varieties with Mean Value**

Bread Ranking	Kernel Hardness	Flour Yield, %	Flour Protein (14% mb), %	Ash (14%mb), %	Tolerance	Midline Peak Time, min	Midline Peak Value, %	Band Area in 8 min, %TQ*min	Water Abs (14% mb), %	Mixing Time, min
Poorest	70.2	71.6	13.55	0.808	4.00	2.73	67.35	208.74	62.0	4.12
Fair	63.4	73.5	12.32	0.444	4.17	3.97	53.79	174.44	61.6	5.23
Best	73.1	72.5	12.24	0.481	4.48	4.49	51.38	168.22	62.2	6.08
Ranking	Loaf Vol, mL	Loaf Density, g/mL	Texture Hardness, g	Slice Area, mm <sup>2</sup>	Slice Brightness	Cells Num.	Cell d, mm	Uniformity	Cell Elongation	Bread Overall
Poorest	608	0.247	66.73	7069	137.9	3272	2.44	1.26	1.48	1.00
Fair	755	0.194	99.71	9118	141.9	3872	2.75	2.71	1.47	3.20
Best	774	0.190	88.98	9240	144.9	4418	2.40	3.30	1.48	4.19

**Table 5.2 Some Bread (0 and 5 ppm Oxidant) Overall Ranking of 2008 Triplicate Varieties with Mean Value**

Oxidant	Water Abs (14% mb), %	Mixing Time, min	Loaf Vol, mL	Loaf Density, g/mL	Texture Hardness, g	Slice Area, mm <sup>2</sup>	Slice Brightness	Cells Num.	Cell d, mm	Uniformity	Cell Elongation	Bread Overall
0ppm	62.5	4.86	708	0.210	86.61	8508	141.1	3533	2.80	2.66	1.48	2.39
5ppm	62.8	5.15	737	0.203	86.86	8999	140.0	4197	2.51	2.80	1.45	3.35

## 6. 2008 IRDR

In 2008 IRDR, fourteen varieties were analyzed in single kernel, milling properties, protein content, ash content, rheological dough strength, and bread production.

In overview, the top 4 varieties of 2008 IRDR wheat that had best baking properties were as following. Their overall score was from 4.0 to 4.3. Their average protein content was about 12.0%. They had good to good dough strength with longer mixing times. They had higher loaf volume, good exterior and crumb grain. They had smooth and resilient texture. They had higher slice area, slice brightness and better distributed cells. They had average cell diameter and cell elongation.

$$NI07701 \leq NI06737 < \text{Antelope} \leq NI06731$$

Overall bread ranking of 2008 IRDR with mean value of characterization was given in **Table 6.1**. After added 5 ppm antioxidant ascorbic acid in baking, the bread quality of wheat varieties, which were ranked from 0.6 to 3.4 in not adding antioxidant baking, was improved slightly. Some bread with and without oxidant ranking of 2008 IRDR with mean value of characterization was given in **Table 6.2**.

**Table 6.1 Bread Overall Ranking of 2008 IRDR Varieties with Mean Value**

Bread Ranking	Kernel Hardness	Flour Yield, %	Flour Protein (14% mb), %	Ash (14%mb), %	Tolerance	Midline Peak Time, min	Midline Peak Value, %	Band Area in 8 min, %TQ*min	Water Abs (14% mb), %	Mixing Time, min
Poorest	53.9	73.3	11.4	0.364	4.1	4.0	49.5	154.3	61.3	5.6
Fair	63.0	73.8	11.2	0.356	4.1	4.8	46.4	144.6	62.1	6.2
Best	66.1	75.3	12.0	0.347	4.4	4.9	49.1	154.9	62.1	6.7
Ranking	Loaf Vol, mL	Loaf Density, g/mL	Texture Hardness, g	Slice Area, mm <sup>2</sup>	Slice Brightness	Cells Num.	Cell d, mm	Uni-formity	Cell Elongation	Bread Overall
Poorest	654	0.224	141.2	7697	138.9	3249	3.0	3.3	1.5	1.4
Fair	742	0.197	80.6	8849	134.5	3715	2.9	2.8	1.4	3.3
Best	791	0.186	74.5	9470	137.8	4165	2.8	2.8	1.4	4.2

**Table 6.2 Some Bread (0 and 5 ppm Oxidant) Overall Ranking of 2008 IRDR Varieties with Mean Value**

Oxidant	Water Abs (14% mb), %	Mixing Time, min	Loaf Vol, mL	Loaf Density, g/mL	Texture Hardness, g	Slice Area, mm <sup>2</sup>	Slice Brightness	Cells Num.	Cell d, mm	Uni-formity	Cell Elongation	Bread Overall
0ppm	61.6	5.8	686	0.215	118.4	8083	137.1	3381	3.02	3.17	1.45	2.0
5ppm	61.0	5.6	688	0.214	108.9	8222	138.8	3445	3.04	2.34	1.44	2.5

## 7. 2008 WQC

In 2008 WQC, eighteen varieties were analyzed in bread production. USDA/ARS/NPA/GMPRC Hard Winter Wheat Quality Lab had provided flour protein, mixograph and farinograph as well as other quality data. Our average NIR protein content was 11.28% for 2008 WQC samples. There was only 0.4% difference between HWWQL and our lab in average of protein content.

In overview, the top 4 varieties of 2008 WQC wheat that had best baking properties were as following. Their overall score was from 4.5 to 5.1. Their average protein content was about 12.4%. They had good to excellent dough strength with longer mixing times. They had higher loaf volume, very good exterior and crumb grain. They had smooth and resilient texture.

$$2403 < 2411 \leq 2410 < 2406$$

Overall bread ranking of 2008 WQC with mean value of characterization was given in **Table 8.1**. We presented our results in 2009 WQC Annual Conference in Hard Winter Wheat section. Our results were consistent with the results of the most cooperated labs.

**Table 7.1 Bread Overall Ranking of 2008 WQC Varieties with Mean Value**

Bread Ranking	Flour Protein (14% mb), %	Peak Time, min	Tolerance	Water Abs (14% mb), %	Mixing Time, min	Loaf Vol, mL	Loaf Density, g/mL	Bread Overall
<b>Poorest</b>	11.32	2.73	2	60.5	4.86	795	0.181	2.7
<b>Fair</b>	11.61	4.47	3	60.8	6.62	822	0.175	4.1
<b>Best</b>	12.38	5.91	5	60.6	8.59	874	0.164	4.8



## 8. 2008 Nick

In 2008 Nick, 960 samples were analyzed in milling properties, protein content, and rheological dough strength by Mixograph. Table 1.1 is Data by EXPT in 2008 Nick. Table 1.2 is Protein Range in 2008 Nick with Mean Value. The dough strength was NICK08M > NICK08NP > NICK08L in average.

**Table 8.1 Data by EXPT in 2008 Nick**

EXPT	Yield, %	Bran	Flour Protein (14%mb), %	Tolerance	Midline Peak Time, min	Midline Peak Value, %TQ	Band Area in 8 min, %TQ*min
<i>NICK08L</i>							
Mean	67.9	3.55	10.19	4.39	4.12	50.11	146.99
STDev	2.305	0.630	0.838	1.099	1.150	4.833	29.616
Max	74.7	4.50	15.32	7.00	8.00	70.08	256.12
Min	59.8	1.50	8.05	2.00	1.76	39.56	87.76
<i>NICK08M</i>							
Mean	68.1	3.27	13.59	4.09	3.69	61.16	204.19
STDev	2.846	0.806	0.938	1.218	1.032	4.864	38.747
Max	75.2	4.50	17.10	7.00	7.21	79.52	339.98
Min	57.7	0.50	11.48	1.00	1.52	48.38	78.16
<i>NICK08NP</i>							
Mean	68.6	3.53	12.21	3.90	3.74	55.92	184.39
STDev	2.558	0.794	0.816	1.286	1.312	4.062	41.845
Max	76.2	4.50	15.36	7.00	8.00	67.78	351.03
Min	61.1	1.00	10.34	0.75	0.00	46.29	80.53

a. 160 samples with two duplication in each EXPT

**Table 8.2 Protein Range in 2008 Nick with Mean Value**

EXPT	Protein, %	Tolerance	Peak Time, min	Peak Value, %TQ	Area, %TQ*min	Sample, %
<b>NICK08L</b>	< 10.0	4.42	4.42	47.30	135.80	40.3
	10.0-12.0	4.42	3.98	51.63	154.73	57.5
	> 12.0	3.07	2.56	62.00	149.70	2.2
<b>NICK08M</b>	< 10.0					
	10.0-12.0	4.50	4.21	58.14	192.25	1.6
	> 12.0	4.08	3.68	61.21	204.38	98.4
<b>NICK08NP</b>	< 10.0					
	10.0-12.0	4.00	3.66	55.00	176.42	43.4
	> 12.0	3.83	3.81	56.64	190.51	56.6

## **9. 2005-2008 Noodle**

The twenty-eight hard white winter wheat grain samples in FY 2005 to 2008 were analyzed for noodle quality characterizations in Polyphenol Oxidase (PPO), dough color change by L, a and b values, noodle cooking lost and water uptake of noodle as well as noodle texture by using TA-XTplus Texture Analyzer. The PPO value of flour was obtained in 475 nm absorbance. Most (60% varieties in 2005-2008 HWWW can be made good noodle. The top five varieties with good noodle quality were NW05517 (2005 Duplicate, 9.6% protein), NW05589 (2005 Duplicate, 11.0% protein), Trego, Sidney (2007 NIC213, 9.4% protein), NW07505 (2008 Triplicate, 11.7% protein), NW07534 (2008 Triplicate, 12.5% protein) in good noodle texture, insignificantly color change, medium PPO value, normal cooking lost and water uptake.

## **10. Others**

- USDA/ARS/NPA/GMPRC HWWQL had sent check samples to test flour protein content, ash content and mixograph. Our test results was not significant different from other lab's results.
- Service egg shell strength and egg yolk membrane strength test from animal science department.
- Purchase Beckman Coulter DU 800 UV/Visible Spectrophotometer with computer.
- Wheat lab tour to Nebraska Wheat Grower Association group and other organization.