IMPROVING WHEAT VARIETIES FOR NEBRASKA

2008 STATE BREEDING AND QUALITY EVALUATION REPORT

Report to the

NEBRASKA WHEAT DEVELOPMENT, UTILIZATION
AND MARKETING BOARD

P. S. Baenziger and Lan Xu

Key Support Staff:
Mitch Montgomery, Gregory Dorn, Richard Little, Carol Speth, Karen Kreider, Julie Breathnach, Janelle Counsels, and Glenn Frickel

Graduate Students and Postdoctoral Scientists:
Zakaria Aj-Alouni, Anyamanee Auvuchanon, Ali Bakhsh, Nick Crowley, Neway Mengistu, Somrudee Onto, Kayse Onweller, and Javed Sidiqi.

Key University of Nebraska Cooperators:
Kent Eskridge, Stephen Wegulo, Ismail Dweikat, Tom Clemente, Shirley Sato, Gary Hein, Drew Lyon, Amit Mitra, Al Weiss, Dipak Santra, and Bob Klein

Key Cooperators:
USDA-ARS
Robert Graybosch, Vern Hansen, Lori Divis, Ming Chen, Mike Pumphrey, Ken Vogel, Yue Jin, and Guihua Bai, and Roy French

Public Universities:
Kulvinder Gill (WSU), Amir Ibrahim (SDSU, TAMU), Scott Haley (CSU), Brett Carver (OSU), Joe Martin and Alan Fritz (KSU), J. Krall (U. of WY), and Lance Gibson (ISU)

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I. INTRODUCTION

Wheat variety development research in Nebraska is a cooperative effort between the Agricultural Research Division, IANR of the University of Nebraska-Lincoln, and the Agricultural Research Service/USDA, Northern Plains Area. Winter wheat breeding, which includes variety, line, and germplasm development, is a major component of the state wheat improvement research. This report will deal only with the state portion of the total wheat breeding effort (located in the Department of Agronomy and Horticulture at the University of Nebraska-Lincoln). Very important contributions come from state, and federal researchers in the department and at the Nebraska research and extension centers, from state and private researchers in South Dakota, Wyoming, Kansas, Oklahoma, Texas, and Colorado, from researchers in the Department of Plant Pathology (both state and federal), from plant pathologists located at the USDA Cereal Disease Laboratory, St. Paul, Minnesota, and USDA entomologists at Manhattan, Kansas and Stillwater, Oklahoma. All of these programs invest time and funds in this program. Grants from the Nebraska Wheat Development, Utilization and Marketing Board provide key financial support for this research. Without the Wheat Board's support, much of the state breeding efforts would be curtailed and many of the wheat quality analyses to evaluate our breeding material would not be available.

II. THE 2007-2008 NEBRASKA WHEAT CROP

1. Growing Conditions

The 2007-2008 crop was planted into generally good conditions with adequate moisture in western and central Nebraska. Planting was completed in a timely manner. The fall was generally conducive to good emergence in these parts of the state. Planting in eastern Nebraska was subject to heavy rains which delayed planting and hurt emergence after planting. Hence the eastern wheat crop got off to a bad start that unfortunately carried forward through the rest of the growing season. The winter was relatively mild and winterkilling was minor. The spring growing season began and stayed on the dry side in parts of western NE, thus reducing diseases other than viruses, but did cause concerns for drought damage. However, much of eastern NE had ample moisture during flowering and grainfill leading to leaf diseases, and Fusarium head blight, which again was a major concern. Where the fall planting and emergence were good, high yields were also possible. At harvest, much of the rains stopped and the harvest seed quality was good in central and western Nebraska, but poor in fields where scab damaged the crop. In general, NE01643 (Husker Genetics Brand Overland), Westbred Smokey Hill, 2137, Camelot, Millennium, and Settler CL and Infinity CL performed well across or in specific sections of the state. In areas of extreme scab infection, some of the later lines may have avoided some of the effects of the disease. However, all of the above lines have the reputation of being broadly adapted, which was again born out this year.

2. Diseases

Disease development was favored by excessively wet weather during the growing season. As mentioned above, in the east, there was severe damage due to foliar diseases and Fusarium head blight. The main economic disease in eastern NE was Fusarium head blight because not only did it affect grain yield and test weight, but also high levels of DON (vomitoxin) were found in some samples, which led to significant dockage at elevators.

Hence the growers lost twice (lower yield and lower price). In the south central and eastern parts of the state, early season diseases included powdery mildew, tan spot, and Septoria leaf blotch. The predominant leaf disease during the growing season was Septoria leaf blotch. Despite the wetness, leaf rust did not develop to damaging levels (except in some susceptible lines or varieties) because the inoculum (rust spores) blown into Nebraska from southern states was limited. Stripe rust also occurred, but at trace, almost negligible levels – it was observed in a few fields in southwestern part of the state and in the Panhandle. In western NE, wheat streak mosaic virus was present as was loose smut and common bunt (syn. stinking smut). Common bunt is probably in every soil throughout NE, but the conditions have to be right for its spread. One experimental line, NI04421 was very susceptible and will need either to be dropped or recommended for fungicide seed treatments. One grower's field in south central Nebraska had so much common bunt that 100% of the grain was rejected at the elevator. Seed treatments are effective ways of reducing seed borne smuts. For the first time, Triticum mosaic virus was confirmed in Nebraska. This new virus was discovered in 2006 in Kansas and is, like wheat streak mosaic virus and the high plains virus, transmitted by wheat curl mites. Drs. Stephen Wegulo, Gary Hein (entomologist monitoring insects vectors of disease and the disease), and Roy French continue to be invaluable in disease identification, survey, and understanding.

3. Insects

In general, most insect pests were seen primarily at low levels on wheat in 2007-2008. Wheat stem sawfly in the panhandle continued to expand its presence with severe infestations being found for the first time in central Box Butte county. This insect was also problematic in some isolated areas where it has been seen before. All of the instances of severe infestations of wheat stem sawfly occur in no-till wheat-fallow situations. Cereal aphids presence was lower across the state with few economic instances noted. In the panhandle, black grass bug infestations spilling over from serious infestations in adjoining wheatgrasses were seen, but this was always restricted to slight border infestations. We also saw an increase in grasshopper numbers through the season with some serious infestations and damage occurring later in the season. Dr. Gary Hein continues to be invaluable in insect and disease vector identification, survey, and understanding.

4. Wheat Production

In 2008, 1,750,000 acres of wheat were planted in Nebraska and 1,670,000 were harvested with an average yield of 44 bu/a for a total production of 73,500,000 bu. In 2007, 2,050,000 acres of wheat were planted in Nebraska and 1,960,000 were harvested with an average yield of 43 bu/a for a total production of 84,280,00 bu. The 2006 Nebraska Wheat Crop was estimated at 61,200,000 bu, which represented a 36 bu/a state average yield on 1,700,000 harvested acres. The 2008 crop was 13% lower than the 2007 crop, but 20% higher than the 2006 crop. Despite continued genetic improvement, the main determinant in wheat production seems to be acres harvested, government programs, and weather (which also affects disease pressure and sprouting). This is an economic reality in understanding wheat yields and productivity in NE.

5. Cultivar Distribution

In 2009, the most popular wheat was Agripro Jagalene (13.8% of the state) was the most widely grown cultivar followed by Millennium (13.2%), Pronghorn (12.1%), TAM 111 (6.5%), Alliance (6.1%), Goodstreak (5.0%), and Wesley (4.8%). The rise of Jagalene was very rapid, going from 4.5% in 2004 to 33.4% in 2007 and then dropping off in to 13.8% in 2009 due to its being hurt by the diseases. Pronghorn and Goodstreak are

tall (conventional height) wheat varieties that have consistently done well in the drought prone areas of western Nebraska. Interestingly, the Buckskin acreage remained virtually constant, indicating that the drought in the west is causing more tall wheat varieties to be planted. Millennium is an excellent wheat that is the replacement for Arapahoe with its broad adaptability, excellent disease resistance, and good end-use quality. Alliance is a semi-dwarf the variety having the greatest impact since the release of Arapahoe, but its impact is more localized, as Alliance does not have the broad adaptation in eastern Nebraska that Arapahoe had.

While no wheat listed below has all of the characteristics of an ideal wheat, the diverse wheat varieties provide the grower an opportunity to choose high yielding, high quality wheat varieties that have resistance or tolerance to the diseases or insects prevalent in his or her region. Cultivars developed by the University of Nebraska wheat improvement program occupied 61.3% of the state acreage. Other public varieties occupied 13.0% and private varieties occupied 25.7% (note the private cultivars does not include TAM 111 that was developed by Texas A&M but is marketed by Agripro) of the state acreage.

Variety	2001	2002	2003	2004	2005	2006	2007	2008	2009
2137	10.4	8.0	10.3	7.8	4.3	3.5	1.4	2.1	1.7
2145						1.0	1.2	2.2	
Agripro Abilene	2.5	1.3	1.4	1.7	1.7		1.0		
AgriPro Dumas							1.4	1.2	
Agripro Ogallala	2.2	1.5	3.6	2.4	2.0	1.4	1.0	1.1	
Agripro Postrock								1.1	4.1
Agripro Thunderbolt			2.0	3.0	1.9	1.9	2.0	2.4	1.6
Agripro Tomahawk	0.0	1.8							
Agripro Jagalene				4.5	16.8	23.8	33.4	20.9	13.8
Agripro Hawken									1.2
Above						1.3			
Akron	0.0	1.8	1.2						
Alliance	**16.0**	**16.6**	**11.5**	**13.6**	**10.1**	**10.1**	**7.2**	**6.1**	**6.1**
Arapahoe	**13.4**	**13.0**	**8.7**	**6.8**	**5.2**	**2.9**	**2.0**	**3.4**	**2.2**
Buckskin	**4.7**	**6.2**	**7.3**	**4.9**	**3.7**	**5.0**	**3.5**	**3.4**	**3.3**
Centura	**3.7**	**3.4**	**1.8**	**2.1**	**2.4**	**1.9**	**1.3**	**1.0**	
Culver	**3.1**	**2.8**	**2.5**						
Goodstreak		**0.0**			**1.7**	**3.7**	**3.6**	**5.1**	**5.0**
Infinity CL								**2.3**	**3.5**
Jagger	2.4	3.4	3.9	2.8	3.1	2.5	1.7	1.5	1.1
Karl/Karl 92	4.1	3.3	3.8	3.3	2.7	2.7	1.6	2.9	2.5
Millennium		**3.5**	**6.1**	**11.1**	**10.7**	**9.5**	**7.2**	**9.4**	**13.2**
Niobrara	**9.3**	**6.9**	**5.4**	**3.5**	**2.2**				
Overly							1.0	1.1	
Overland									**3.4**
Platte		0.0	1.0	1.3	1.6				
Pronghorn	**10.9**	**10.8**	**10.3**	**10.4**	**11.4**	**10.1**	**12.2**	**10.6**	**12.1**
Scout & Scout 66	0.0	0.0	1.1						
Siouxland	0.0	0.0	1.4						
TAM 111						1.2	1.6	3.2	6.5
Vista	1.7	3.1	1.2						
Hatcher									1.2
Wahoo		**0.0**	**1.8**	**1.7**	**1.8**	**1.8**	**1.1**	**1.5**	**1.1**

Wesley	**1.1**	**2.2**	**3.6**	**5.9**	**5.5**	**5.8**	**7.2**	**7.7**	**4.8**
Windstar	**1.6**	**0.0**							
Other Public Varieties	**7.6**	**6.5**	**4.9**	**8.8**	**7.2**	**6.1**	**4.6**	**5.7**	**6.6**
Other Private Varieties	2.2	3.9	3.4	4.4	4.0	3.8	2.8	4.1	5.0

6. New Cultivars

NE01604 and NH03614 CL (a herbicide tolerant wheat) were released in 2008. NE01604 will be licensed to NuPride Genetics Network and marketed as Camelot. NH03614 was co-released with the University of Wyoming and South Dakota State University and will be marketed as Settler CL. Forms for the American Organization of State Certifying Agencies (AOSCA) have been approved, which will allow both lines to be sold with certification in adjacent states for both lines. In addition, both PVP applications have been submitted. Information on both lines can be found at our website (http://agronomy.unl.edu/grain/) or in our previous annual report (http://agronomy.unl.edu/grain/WHTANN0732708.PDF).

III. FIELD RESEARCH

1. Increase of New Experimental Lines

With our new release procedures of determining which lines will be released in January (will be delayed until March this year) with the seed begin available in August for certified seed producers, two lines are under increase NE01481 and NI04421. NE01481 is being evaluated for the Southeastern NE and the organic market. It has superior end use quality, soilborne wheat mosaic virus resistance (a rarity among our lines), and very high grain yield for Southeast NE. We view it as an excellent new wheat with a trait that is valuable to a part of our state that we have had difficulty finding good new varieties with the right disease resistances. NI04421 is targeted for irrigated production systems where it has preformed extremely well. It has acceptable end-use quality and disease resistance with one exception. It is **very** susceptible to stinking smut. As this disease is easily controlled by seed treatments, if this line is released we will need an educational campaign to make sure growers purchase and grow treated seed. It will not be recommended for production without seed treatment. A number of lines are under small-scale increase for possible release in 2010.

With the release of new varieties Antelope, Anton, Camelot, Goodstreak, Infinity CL, and Settler CL, many of the most advanced current breeding lines are not expected to be released.

2. Nebraska Variety Testing

Numerous entries were included in some or all of the locations in the Fall Sown Small Grain Variety Tests in 2008. Eleven dryland, four dryland organic, and three irrigated locations were harvested for yield data. In 2008, the top ten entries for dryland production were:

Entry	Yield (bu/a)	Entry	Yield (bu/a)
Overland (NE01643)	61.71	2137	59.09

Smokey Hill	60.71	NI04420	58.37
NE04490	59.96	Camelot	58.06
NE01481	59.26	Millennium	58.00
NE04424	59.17	NE03490	57.85

Of the released lines tested in all dryland locations, Turkey (44.49 bu/a) and Scout 66 (47.48 bu/a) as expected were the lowest yielding lines. Even the lowest yielding lines in these trials were on average higher yielding than the state average production value indicating our nurseries are on better production ground than many parts of the state. The highest average trial yield occurred in Furnas County (90.61 bu/a) indicating moisture was not limited at that trial and production was very good.

In 2007, the top ten entries for dryland production were:

Entry	**Yield (bu/a)**	**Entry**	**Yield (bu/a)**
Overland (NE01643)	62.65	2137	59.10
NH03614	60.35	NE02584	58.58
NI04420	59.95	Arapahoe	58.43
Camelot	59.70	Agripro Postrock	58.23
Millennium	59.53	Infinity CL	58.20

In 2006, the top ten entries for dryland production were:

Entry	**Yield (bu/a)**	**Entry**	**Yield (bu/a)**
Jagalene	52.57	NE02584	50.80
NE01643	52.85	Harry	52.82
Infinity CL	52.14	Expedition	51.06
Trego	50.70	2137	49.70
NE01481	50.51	Wahoo	51.72

3. Irrigated Wheat Trials:

In 2008, three irrigated environments (three in NE and one in WY) were used to evaluate irrigated wheat production. The top ten lines in 2008 were:

Variety	**Yield bu/a**	**Variety**	**Yield bu/a**
Anton (W)	76.13	Bond CL	73.33
Overland	74.90	Camelot	72.73
NI04421	73.90	Settler CL	72.20
NI04436	73.70	Hawken	72.17
NI04420	73.63	NI05714	71.03

In 2007, four irrigated environments (three in NE and one in WY) were used to evaluate irrigated wheat production. The top ten lines in 2007 were:

Variety	Yield bu/a	Variety	Yield bu/a
CO01385-A1	93.90	NH03614	87.75
Bond CL	91.65	NE02584	87.48
NE01604	91.63	Hatcher	87.08
NI04421	90.95	Wesley	87.03
Overland (NE01643)	88.58	RonL	86.50

The top ten lines in 2006 were:

Variety	Yield bu/a	Variety	Yield bu/a
TAM 111	102	NE01422	99
Bond CL	102	NuDakota	99
NI04421	100	2137	98
NuFrontier (W)	99	Jagalene	97
Blend #10	99	Wesley	97

The irrigated data this year continue to show the benefits of having a dedicated irrigated wheat development nursery. NI04421, NI04436, and NI04420 came directly from the irrigated wheat development nursery. In addition, it is good to see a number of experimental lines in the best lines group. We hope that with the three to four locations there will be more consistent performance among the irrigated wheat lines. Currently there is a yearly shuffle among the top lines and it is hard for growers to choose the most consistent performer.

As in the past, we have an experimental line irrigated nursery, which is grown under irrigation in western Nebraska and under dryland conditions throughout the state. The goal of this nursery is to identify higher yielding lines under irrigation and under higher rainfall conditions, which periodically occur in Nebraska. What was interesting about this nursery was the exceptional growing conditions at North Platte and the tough irrigated conditions at Sidney. While commonly grown varieties did well in this trial, advanced experimental line NI04421 did exceptionally well in both dryland and irrigated conditions. This line are exactly the type of lines that we hope this nursery can identify. We correlated the yield data from Lincoln, North Platte, Sidney Irrigated, and Alliance. Only North Platte was positively (albeit weakly) correlated with Alliance for grain yield. Sidney Irrigated was not correlated with any other location. That the four sites are generally not correlated indicates that they represent four different environments and that each is needed to evaluate our lines.

Data for 2008 are:

	LINC	N.PLATTE	ALLIANCE	Dryland	Dryland	Rank	**Sidney Irr.**	**Irrigated**	St.avg	St. Avg.
Variety	Yield	Yield	Yield	Yield	Height		**Yield**	**Height**	Yield	Height
	bu/a	bu/a	bu/a	bu/a	in		**bu/a**	**in**	bu/a	in
WESLEY	40.1	102.0	62.3	68.10	33.07	13	**51.9**	**24.6**	64.0	31.0
Antelope	51.2	96.2	57.0	68.12	34.40	12	**50.6**	**27.2**	63.7	32.6

TAM111	47.6	99.0	60.3	68.96	35.67	9	**64.2**	**28.6**	67.8	33.9
NI04421	**52.3**	**106.2**	**63.0**	**73.86**	**34.97**	**1**	**68.6**	**27.6**	**72.6**	**33.1**
NI04436	49.4	105.1	59.6	71.37	34.17	3	**44.4**	**27.3**	64.6	32.5
NI05714	48.0	98.5	59.7	68.75	34.87	11	**56.3**	**30.1**	65.6	33.7
NI04427	61.5	94.4	53.8	69.93	32.23	5	**54.6**	**24.1**	66.1	30.2
NI03427	40.4	95.7	56.3	64.12	34.07	24	**58.8**	**26.3**	62.8	32.1
NI06721	51.9	86.7	57.2	65.24	29.87	20	**29.4**	**25.7**	56.3	28.8
NI06724	49.6	86.9	60.2	65.58	34.03	17	**58.2**	**28.6**	63.7	32.7
NI06726	53.7	77.1	54.0	61.55	33.50	29	**47.9**	**28.9**	58.1	32.4
NI06731	38.5	101.7	55.7	65.32	33.70	19	**61.2**	**25.1**	64.3	31.6
NI06736	56.4	96.8	54.0	69.08	32.33	8	**54.0**	**25.4**	65.3	30.6
NI06737	52.8	96.2	53.0	67.34	32.23	16	**63.7**	**24.7**	66.4	30.4
NI07701	47.2	90.5	57.8	65.13	30.50	21	**64.2**	**25.1**	64.9	29.2
NI07703	53.4	93.9	56.5	67.94	34.27	14	**61.9**	**27.3**	66.4	32.5
NI07710	45.0	81.9	46.6	57.80	34.07	35	**68.1**	**27.9**	60.4	32.5
NI07712	38.6	85.3	46.4	56.78	34.00	36	**49.1**	**27.2**	54.9	32.3
NI07713	35.8	78.5	51.6	55.30	31.70	38	**51.4**	**24.2**	54.3	29.8
NI07714	45.9	93.9	51.7	63.83	34.47	26	**58.4**	**24.7**	62.5	32.0
NI07717	36.8	92.9	64.8	64.79	34.90	22	**74.7**	**28.0**	67.3	33.2
NI08701	10.1	85.7	54.7	50.20	34.70	40	**47.8**	**28.7**	49.6	33.2
NI08702	34.1	95.2	59.0	62.79	34.23	28	**45.2**	**29.6**	58.4	33.1
NI08703	34.1	94.2	53.3	60.51	33.07	31	**73.8**	**29.1**	63.8	32.1
NI08704	27.8	98.6	50.5	58.97	32.03	33	**42.1**	**26.3**	54.7	30.6
NI08705	44.3	80.3	56.6	60.40	32.43	32	**56.3**	**26.7**	59.4	31.0
NI08706	42.2	74.6	52.1	56.29	32.33	37	**42.9**	**27.1**	52.9	31.0
NI08707	37.0	94.9	70.4	67.39	33.10	15	**67.1**	**27.4**	67.3	31.7
NI08708	39.4	105.4	63.1	69.29	34.23	7	**67.4**	**29.0**	68.8	32.9
NI08709	51.4	94.5	50.7	65.56	32.17	18	**61.5**	**24.7**	64.5	30.3
NI08710	37.7	100.5	54.8	64.33	34.47	23	**63.2**	**28.7**	64.1	33.0
NI08711	48.8	88.4	51.4	62.85	33.93	27	**54.4**	**27.4**	60.7	32.3
NI08712	49.4	78.7	53.5	60.55	33.50	30	**57.8**	**27.0**	59.9	31.9
NI08713	40.9	73.7	51.2	55.24	33.53	39	**59.3**	**28.4**	56.2	32.3
NI08714	47.4	101.9	57.5	68.95	32.73	10	**66.8**	**29.3**	68.4	31.9
NI08715	55.5	98.6	55.1	69.71	33.10	6	**63.5**	**26.3**	68.2	31.4
NI08716	55.9	100.9	58.8	71.87	33.80	2	**68.6**	**27.4**	71.1	32.2
NI08717	53.0	104.1	55.5	70.87	33.27	4	**49.4**	**26.1**	65.5	31.5
NI08718	43.4	87.4	61.0	63.91	33.00	25	**53.2**	**28.4**	61.2	31.9
NI08719	33.4	81.1	59.7	58.06	34.43	34	**67.4**	**28.1**	60.4	32.9
Mean	**44.6**	**92.5**	**56.3**	**64.42**	**33.43**		**57.5**	**27.1**	**62.68**	**31.85**

In 2008, 19 lines were continued for further testing in the irrigated nursery and no lines were advanced to the Nebraska Triplicate Nursery (NTN). The low number of lines advanced to the NTN was probably due to a late harvest for wheat, especially for the irrigated site, which delayed our data analysis. In 2007, 18 lines were continued for further testing in the irrigated nursery and 4 lines were advanced to the Nebraska Triplicate Nursery (NTN). In 2006, 16 lines were continued for further testing in the irrigated nursery and 1 line was advanced to the Nebraska Triplicate Nursery (NTN). Currently in the NIN there are 5 lines from this nursery.

In the 2008, one IRR/DRY lines was advanced for large-scale foundation seed increase (NE04421). ***In 2008 IRDR nursery***, fifteen lines, which were included two check Wesley and Antelope, were analyzed in SKCS, Buhler milling, protein content, ash, Mixograph for dough strength, and baking properties. Most

varieties kernels were HARD with average diameter (23 mm) and weight (32.8 mg). The flour yield was in normal range (average 74%). The bran and short can be separated well generally. The protein and ash content were in good range, too. The average flour protein content was 11.8%. The average flour ash content was 0.417%. The wheat flour had from good to very good dough strength with medium peak time. In general, the baking properties distributed narrowly from good to very good in these varieties of this nursery. They had medium long mixing times (5.2 to 7.8 min), higher loaf volume (810 to 915 mL), good to very good exterior, and very good crumb grain. They had smooth and resilient texture. They had higher slice area (average 10473 mm^2), slice brightness (average 145.4) and better distributed cells. They had average number of cells, cell diameter, and cell elongated. The top five varieties that had best baking properties were NI07713, NI06724, NI07714, NI06736, and NI07703, respectively.

Data for 2007 are:

2007			Rainfed	Rainfed	Rainfed	Rainfed	Rainfed	**Irri.**	**Irri.**		
name	Heading	Height	Lincoln	North. Platte	Alliance	Average		**Sidney**		State Avg.	
	Date	in	bu/a	bu/a	bu/a	bu/a	Rank	**bu/a**	**Rank**	bu/a	Rank
Jagalene	17	33.6	53.63	76.60	49.33	59.85	18	**102.48**	**37**	70.51	21
WESLEY	20	33.5	48.82	80.08	51.83	60.24	16	**103.46**	**36**	71.05	18
Antelope	18	35.1	50.83	77.97	46.52	58.44	20	**100.44**	**39**	68.94	25
NI04421	20	36.0	61.47	73.98	51.17	62.21	11	**118.74**	**4**	76.34	8
NI04428	18	32.2	63.27	88.72	51.78	67.92	1	**107.89**	**26**	77.92	2
NI04436	21	36.3	48.50	72.17	45.82	55.50	25	**109.46**	**22**	68.99	24
NE03486	20	35.2	66.23	71.13	47.20	61.52	13	**108.64**	**23**	73.30	12
NI05714	22	36.2	42.22	62.82	48.57	51.20	32	**110.57**	**17**	66.05	30
NI05718W	20	38.3	41.02	72.35	41.98	51.78	30	**100.57**	**38**	63.98	34
NI05720W	23	36.5	37.58	54.18	43.63	45.13	39	**105.31**	**30**	60.18	40
NI04427	18	33.3	55.32	77.63	50.02	60.99	15	**105.06**	**32**	72.01	15
NI03427	21	37.7	59.07	81.45	49.73	63.42	8	**110.22**	**18**	75.12	10
NI06721	16	34.3	62.23	78.85	49.47	63.52	7	**116.48**	**7**	76.76	7
NI06724	17	35.4	51.18	78.60	48.07	59.28	19	**109.87**	**19**	71.93	16
NI06726	17	35.8	48.52	78.73	44.05	57.10	22	**112.23**	**13**	70.88	19
NI06731	16	34.0	63.47	80.00	47.75	63.74	6	**119.9**	**1**	77.78	3
NI06732	22	36.7	56.93	78.10	48.93	61.32	14	**106.73**	**28**	72.67	14
NI06736	17	33.9	62.13	85.67	48.80	65.53	4	**113.58**	**11**	77.55	4
NI06737	17	32.1	56.03	84.97	47.60	62.87	10	**119.62**	**2**	77.06	5
NI07701	17	29.3	40.77	68.23	50.93	53.31	28	**118.61**	**5**	69.64	23
NI07702	18	33.1	72.58	65.90	46.78	61.75	12	**99.75**	**40**	71.25	17
NI07703	18	32.2	61.88	84.67	52.77	66.44	2	**116.96**	**6**	79.07	1
NI07704	18	34.5	50.37	71.87	44.50	55.58	24	**107.54**	**27**	68.57	27
NI07705	18	34.6	69.92	74.55	49.82	64.76	5	**104.46**	**33**	74.69	11
NI07706	18	33.9	45.02	79.40	48.37	57.60	21	**109.68**	**20**	70.62	20
NI07707	21	36.3	64.23	85.10	49.22	66.18	3	**109.62**	**21**	77.04	6
NI07708	21	35.8	47.88	66.33	43.27	52.49	29	**103.52**	**35**	65.25	33
NI07709	21	34.9	35.28	54.82	51.60	47.23	37	**112.61**	**12**	63.58	35
NI07710	21	35.5	45.43	57.25	43.67	48.78	34	**114.81**	**9**	65.29	32
NI07711	18	32.4	56.82	80.67	51.55	63.01	9	**114.18**	**10**	75.81	9
NI07712	20	35.6	36.93	72.88	51.35	53.72	27	**118.96**	**3**	70.03	22

NI07713	21	32.0	38.50	60.97	51.98	50.48	33	**110.78**	**15**	65.56	31
NI07714	20	35.8	55.42	73.97	50.70	60.03	17	**111.85**	**14**	72.99	13
NI07715	21	33.2	52.07	61.20	55.25	56.17	23	**106.6**	**29**	68.78	26
NI07716	20	34.4	50.68	62.48	51.57	54.91	26	**103.68**	**34**	67.10	29
NI07717	21	36.4	44.50	53.48	56.13	51.37	31	**115.75**	**8**	67.47	28
NI07718	18	31.3	39.08	61.68	43.67	48.14	36	**105.19**	**31**	62.41	38
NI07719	22	35.9	34.90	59.48	50.52	48.30	35	**108.39**	**25**	63.32	36
NI07720	20	33.5	35.43	55.52	50.17	47.04	38	**108.61**	**24**	62.43	37
NI07721	17	32.0	34.73	61.18	38.40	44.77	40	**110.71**	**16**	61.26	39
Average	**19.23**	**34.5**	**51.02**	**71.64**	**48.61**	**57.09**		**109.84**		**70.28**	

The data for 2006 are:

VARIETY	Flowering date	Height (in)	Linc. bu/a	N. Platte bu/a	Allian. bu/a	Rainfed Avg. bu/a	Rank	Sidney Irr **bu/a**	Rank	Avg. bu/a	Rank
Jagalene	22.2	31.2	83.69	41.25	43.67	56.20	36	**74.32**	**37**	60.73	39
Wesley	21.1	31.6	92.12	43.69	42.79	59.53	23	**83.83**	**16**	65.61	18
Antelope	21.5	31.2	75.48	49.55	41.02	55.35	38	**87.71**	**6**	63.44	32
NI04414	21.8	31.5	92.05	45.56	39.66	59.09	27	**69.39**	**40**	61.67	37
NI04421	21.9	31.8	97.20	53.89	40.84	63.98	8	**78.90**	**31**	67.71	14
NI04428	21.4	31.1	104.93	59.52	40.89	68.45	4	**75.02**	**36**	70.09	6
NI04430	20.0	31.7	84.52	46.95	42.61	58.03	31	**80.31**	**27**	63.60	30
NI04436	20.9	32.4	104.01	43.59	42.82	63.47	10	**92.64**	**1**	70.77	4
NE03486	20.5	32.6	94.22	45.12	41.32	60.22	19	**81.01**	**23**	65.42	20
NI05706	22.4	32.7	103.25	47.70	42.32	64.42	6	**80.31**	**26**	68.40	10
NI05711	22.5	31.5	99.20	46.45	45.00	63.55	9	**82.07**	**21**	68.18	12
NI05713	22.9	33.1	93.02	42.13	44.27	59.81	21	**78.19**	**32**	64.40	25
NI05714	22.4	31.9	78.58	51.38	44.49	58.15	30	**87.35**	**8**	65.45	19
NI05718W	21.7	32.7	87.94	52.81	46.94	62.56	13	**70.44**	**39**	64.53	24
NI05720W	21.8	33.3	95.94	49.66	49.06	64.89	5	**79.60**	**29**	68.57	9
NI05722W	20.8	31.9	82.21	38.94	42.72	54.62	40	**73.97**	**38**	59.46	40
NI04427	21.3	31.3	111.32	51.98	43.86	69.05	3	**87.35**	**7**	73.63	2
NI03427	21.3	31.7	89.59	47.82	45.12	60.84	18	**90.17**	**3**	68.18	13
NI06719	22.3	31.9	91.88	43.31	42.52	59.24	25	**77.49**	**33**	63.80	28
NI06720	21.6	32.0	80.60	48.19	46.08	58.29	29	**79.95**	**28**	63.71	29
NI06721	22.0	31.7	82.54	54.97	49.30	62.27	14	**83.48**	**17**	67.57	15
NI06722	21.1	32.2	84.61	46.75	46.19	59.18	26	**75.38**	**35**	63.23	33
NI06723	21.6	32.4	77.43	52.10	43.95	57.83	32	**82.07**	**20**	63.89	27
NI06724	21.1	32.6	97.20	52.27	40.63	63.37	11	**84.88**	**14**	68.75	7
NI06725	21.7	32.6	87.40	37.63	44.58	56.54	35	**82.42**	**19**	63.01	36
NI06726	22.3	32.4	100.29	49.16	40.06	63.17	12	**85.24**	**13**	68.69	8

NI06727	22.1	30.6	81.65	46.32	41.81	56.59	34	**83.12**	**18**	63.23	34
NI06728	22.9	32.0	85.81	46.91	39.26	57.33	33	**85.24**	**12**	64.31	26
NI06729	22.3	32.6	96.18	46.83	40.37	61.13	16	**89.47**	**4**	68.21	11
NI06730	22.7	31.1	91.04	48.96	38.99	59.66	22	**84.53**	**15**	65.88	17
NI06731	20.7	31.2	92.31	49.71	40.70	60.91	17	**86.65**	**9**	67.34	16
NI06732	21.9	31.5	88.89	52.42	44.34	61.88	15	**75.73**	**34**	65.35	21
NI06733	20.5	32.0	75.44	52.98	46.66	58.36	28	**79.25**	**30**	63.58	31
NI06734	22.7	31.7	76.19	43.60	45.77	55.19	39	**81.01**	**22**	61.64	38
NI06735	21.7	31.6	82.34	43.00	42.10	55.81	37	**85.24**	**11**	63.17	35
NI06736	22.3	31.2	113.01	50.45	43.82	69.09	2	**85.94**	**10**	73.31	3
NI06737	20.5	32.0	107.74	43.46	41.51	64.24	7	**88.06**	**5**	70.19	5
NI06738	21.5	30.5	120.27	50.04	39.02	69.78	1	**90.87**	**2**	75.05	1
NI06739	22.3	31.4	88.57	46.44	44.82	59.94	20	**80.66**	**25**	65.12	22
NI06740	21.3	31.5	91.09	45.38	41.29	59.25	24	**80.66**	**24**	64.61	23
Average	**21.7**	**31.8**	**91.54**	**47.72**	**43.08**	**60.78**		**82.00**		**66.09**	

4. Nebraska Intrastate Nursery:

The 2008 Nebraska Intrastate Nursery (NIN) was planted at six locations (Lincoln, Clay Center, North Platte, Sidney, Hemingford, and Mead, NE). Unfortunately, Mead and Lincoln were damage by rain at planting, Lincoln by soilborne wheat mosaic virus, and Mead by hail at harvest. Scab (Fusarium head blight) was present at Lincoln, Mead, and Clay Center. The state averages are given for all six locations and for the four locations (Clay Center, North Platte, Sidney, and Mead; highlighted by the *) with the better data. In reviewing the data, the locations nearest to each other tended to have the highest correlations with a gradual decrease as the locations were separated further apart. Though all the correlations were positive, the correlations were much higher than in 2007 and sometimes one location's data explained 50% of the variation in another location. This result was quite surprising in that it suggests that fewer testing locations might be possible. Of course it is never possible to predict years when the correlation would be high enough (2008) to reduce testing locations vs. when the correlations would be low (2007) and all testing locations are needed. In correlating flowering date at Lincoln (the best location for this trait) with grain yield, the correlations were generally positive (meaning later lines tended to have higher grain yields) or non-significant where water and disease were not problems. Of the released lines, Overland (NE01643) did well, as did, Camelot. However, Settler CL and Infinity CL both had relatively tough years. Our newer lines have performed very well compared to the previously released lines as would be hoped if continual progress were being made. Any line with a coloring is under increase for possible release.

NIN	MEAD	LINC.	Clay Center	North Platte	Sidney	Alliance	State Avg.	State Avg.*	Height	Flowering	Rank	Rank *
2008	Yield	Yield	Yield	Yield	Yield	Yield	Yield	Yield		(Days	6	4
name	bu/a	bu/a	bu/a	bu/a	bu/a	bu/a	bu/a	bu/a	(in)	after 4/30)		
WESLEY	34.3	49.0	37.7	82.8	49.9	51.6	48.85	54.18	36.76	31.97	55	47
ALLIANCE	28.7	42.5	40.4	89.0	55.1	54.6	51.02	58.01	40.36	31.9	45	21
Overland	36.8	49.7	52.9	82.6	53.1	56.4	52.04	59.38	40.38	34.4	38	10

NE01481	27.6	77.1	43.1	90.8	50.3	52.2	56.50	58.56	40.52	32.2	5	16
Camelot	32.9	58.4	43.2	88.7	53.8	51.4	53.97	58.23	40.17	32.1	22	19
NE02533	28.1	72.8	33.0	87.5	55.7	51.8	55.77	56.74	40.86	32.4	10	34
NE02558	29.7	71.8	33.7	90.1	60.6	55.1	57.67	59.42	41.61	31.4	3	9
NE02584	34.4	65.0	47.9	82.7	45.5	53.7	52.85	56.53	38.53	31.2	33	35
NE03490	28.9	47.9	36.0	85.9	56.3	55.6	51.22	56.98	39.49	33.2	43	33
Settler CL	29.8	65.7	39.0	77.7	47.8	54.7	51.78	54.21	38.98	31.8	41	46
NW03654	36.9	63.4	42.7	86.4	57.5	54.2	56.10	59.38	41.49	31.3	7	11
NW03666	29.5	70.6	36.4	89.1	57.5	51.4	55.90	58.06	41.07	31.3	9	20
NW03681	35.4	65.9	42.6	74.2	53.9	45.5	52.05	53.64	40.86	32.3	37	50
NE04424	38.3	73.6	45.8	73.6	54.9	58.4	55.94	57.75	40.69	31.8	8	23
NE04490	44.9	72.2	41.0	81.0	57.7	54.1	57.69	58.30	40.60	30.9	2	18
NI04420	40.2	68.5	49.7	72.3	53.8	57.2	54.89	57.57	40.59	31.8	14	28
NI04421	34.1	65.6	41.5	77.5	52.0	62.4	54.50	57.58	39.86	32.4	16	26
NI04427	34.1	63.2	57.6	81.4	50.0	54.1	52.98	59.22	39.03	31.4	30	13
NE05403	35.9	70.6	53.0	81.0	47.9	53.0	54.03	57.79	38.53	31.9	19	22
HARRY	22.0	46.7	29.3	77.1	55.6	52.1	48.03	52.39	39.18	34.8	58	55
MILLENNIUM	31.3	46.5	40.9	73.1	49.5	53.2	48.51	53.05	39.80	33.8	56	54
NE05418	31.6	75.4	42.0	84.1	42.3	50.9	54.26	54.72	34.31	30.5	18	43
NE05425	36.0	68.2	49.0	84.2	52.3	55.2	55.73	59.28	40.16	30.8	11	12
NE05426	36.3	70.0	52.6	87.7	54.9	52.2	56.44	60.78	40.35	31.1	6	3
NE05430	29.1	68.3	36.3	79.4	47.1	55.1	52.88	54.16	39.21	32.7	31	48
NE05496	26.3	65.5	45.3	82.4	55.5	56.4	53.82	58.66	40.13	31.2	24	15
NE05548	26.8	74.4	50.7	88.5	50.2	58.4	56.54	60.86	41.07	32.0	4	1
NE05549	26.8	73.1	37.9	80.3	55.4	52.4	54.41	56.08	40.51	32.3	17	38
NE05459	32.9	66.9	45.9	76.0	45.7	50.6	51.83	54.02	39.86	31.8	40	49
NE05569	24.8	63.2	38.9	93.1	55.6	56.1	54.85	59.70	39.82	32.1	15	8
NE06430	34.6	68.4	45.8	83.8	55.8	52.2	55.12	58.54	40.35	30.8	12	17
NE06432	32.4	41.5	46.7	88.8	59.2	53.5	51.65	59.96	42.08	32.7	42	6
NE06436	40.4	67.2	37.4	77.3	54.7	48.3	53.72	54.28	38.45	31.5	25	45
NW06452	24.8	41.7	29.7	84.2	51.3	53.0	48.32	53.29	39.23	32.1	57	51
NE06460	21.6	72.9	29.1	80.3	52.4	51.8	52.87	53.28	39.66	31.1	32	52
NE06462	32.9	66.9	44.2	76.7	48.5	59.0	53.99	56.46	40.24	31.2	21	36
NE06469	33.0	49.4	49.6	90.3	56.1	52.3	52.60	60.18	40.29	32.4	35	5
NE06471	36.5	39.3	56.2	87.8	56.4	49.1	50.35	59.95	40.73	32.9	48	7
NE06472	34.2	50.6	41.3	87.9	53.5	52.9	52.76	57.66	40.23	32.0	34	25
NE06474	36.1	38.3	42.4	81.8	57.2	56.5	50.52	57.68	40.75	31.4	47	24
Infinity	32.0	47.2	34.7	78.8	52.2	50.8	49.06	53.10	39.78	33.8	52	53
WAHOO	21.8	50.1	21.7	80.9	55.1	53.3	49.42	52.09	40.37	34.0	50	56
NE06499	29.0	65.2	32.3	80.1	56.8	52.2	53.06	54.89	39.01	30.4	29	42
NE06537	29.4	67.5	43.8	84.5	48.9	54.3	53.93	57.09	39.80	32.1	23	32
NE06545	39.0	84.3	43.5	90.0	55.7	52.4	59.83	60.30	39.86	30.5	1	4
NE06548	40.4	59.5	40.2	81.9	57.7	53.0	55.09	57.57	41.04	31.7	13	27
NE06549	41.7	38.7	43.1	90.9	57.7	51.8	52.04	59.09	39.23	32.4	39	14
NE06552	36.1	63.4	41.6	79.7	55.1	55.1	54.03	57.10	39.23	31.2	20	31
NE06607	39.3	42.5	45.2	94.8	56.5	54.3	53.38	60.83	39.58	32.1	28	2
NE06619	39.2	61.9	40.3	81.7	53.3	48.9	53.39	55.53	40.17	32.0	27	40
NE06622	43.6	49.0	43.0	82.8	52.2	46.5	51.06	55.12	38.05	31.1	44	41

NW06630	31.2	68.7	40.9	81.4	49.5	47.2	52.58	54.30	38.68	30.8	36	44
NW06635	30.4	62.0	26.8	76.7	45.8	49.3	49.95	49.70	37.96	31.9	49	58
NW06649	24.0	64.5	32.6	77.0	48.9	43.7	49.02	50.25	38.82	32.0	53	57
NW06655	31.2	64.8	45.1	88.3	48.5	50.6	53.40	57.18	40.11	31.8	26	29
NE06672	25.3	40.3	36.6	88.1	55.2	52.5	49.31	56.33	39.51	34.2	51	37
NE06683	23.3	38.7	41.2	94.0	49.3	52.2	48.99	57.11	39.46	34.7	54	30
GOODSTREAK	26.2	46.6	34.8	83.7	54.0	56.4	50.79	55.94	41.64	34.1	46	39
SCOUT66	20.2	33.8	21.1	68.3	48.5	46.8	42.68	45.47	40.50	33.4	60	60
CHEYENNE	14.6	34.5	22.4	69.3	48.9	51.8	42.75	47.02	40.75	35.0	59	59
Mean	**31.8**	**59.2**	**40.6**	**82.9**	**52.9**	**52.9**	**52.6**	**56.4**	**39.8**	**32.1**		
CV	**14.86**	**12.7**	**13.98**	**6.71**	**9.28**	**8.05**						

* Data and rank from data at Clay Center, North Platte, Sidney, and Alliance to avoid the difficulties at Lincoln and Mead.

In 2008 NIN nursery, sixty-one lines, which included nine checks, were analyzed in SKCS, Buhler milling, protein content, ash, Mixograph for dough strength, and baking properties. Most varieties kernels were HARD wheat with average diameter (23 mm) and weight (28.8 mg). The flour yield was in normal range (average 72%). The bran and short can be separated fairly well. The protein and ash content were in good range, too. The average flour protein content was 12.5%. The average flour ash content was 0.433%. Most wheat flour (89%) samples had from good to very good dough strength with medium to long peak time. In general, the baking properties distributed widely from very poor to very good in these varieties of this nursery, but more than half varieties (66%) had good to very good baking properties. The top twenty-one varieties that had best baking properties was NE06436 ≤ NE06548 = NE06619 < NE05569 < NE06622 < NE02558 ≤ WESLEY < NI04421 < NW03666 < NH03614 < NE06607 < NE04490, NW03681 < NE06430 < NE05496 < NE05425 < NE02533 < NE05418 < NI04427 < NW06655 < NE05426. They had an average protein content of 12.6%, and medium to very strong dough strength. They had relatively longer mixing times, higher loaf volume, good to very good exterior, and very good crumb grain. They had very smooth and resilient texture. They had higher slice brightness (creamy to white crumb) and better distributed cells. They higher slice area, number of cells. They had average cell diameter, and cell elongated. The bottom eight varieties that had worst baking properties were SCOUT66 < NE05548 < GOODSTREAK < NE06683 < NE06545 ≤ NE06545 < NW03654 < NE06537. They had an average protein content of 12.7%, but low to medium dough strength. They had shorter mixing times, very lower loaf volume, poor exterior and crumb grain. They had harsh texture. They had lower slice brightness (yellow crumb) and denser cells. They lower slice area and irregular cell shape. In baking with adding oxidant, the quality of bread was improved significantly in some varieties.

Data for the NIN 2007 are:

Name	Mead	Lincoln	Clay Cen.	N. Platte	Sidney	Alliance	St.Avg.	Rank	State-CC	Rank
	bu/a	bu/a	bu/a	bu/a	bu/a	bu/a			Avg.	
WESLEY	53.13	60.81	29.13	73.25	38.77	44.68	**49.96**	51	**54.13**	50
ALLIANCE	52.38	59.7	28.08	80.57	54.98	54.42	**55.02**	29	**60.41**	19
NE01643	68.05	70.49	47.08	78.25	53.12	43.03	**60.00**	5	**62.59**	5
NE01481	60.75	77.01	44.68	76.47	55.03	39.17	**58.85**	7	**61.69**	11
Camelot	**55.93**	**69.63**	**30.63**	**88.73**	**54.4**	**55.68**	**59.17**	**6**	**64.87**	**1**
NE02513	56.98	65.84	42.27	83.93	52.17	49.78	**58.50**	10	**61.74**	10
NE02533	53.43	59.04	38.3	72.2	57.32	50.58	**55.15**	27	**58.51**	33

NE02558	49.5	65.14	31.97	81.15	49.47	50.98	**54.70**	32	**59.25**	26
NE02584	52.45	61.2	42.78	77.23	55.93	53.98	**57.26**	18	**60.16**	21
NE03458	46.37	62.65	28.87	60.45	51.77	56.2	**51.05**	45	**55.49**	45
NE03488	56.22	73.24	39.7	63.95	44.23	48.17	**54.25**	35	**57.16**	39
NE03490	49.08	70.08	35.42	85.95	53.68	53.83	**58.01**	12	**62.52**	6
NH03614	**57.55**	**69.88**	**49.48**	**85.4**	**46.32**	**57.98**	**61.10**	**2**	**63.43**	**3**
NI03427	53.6	59.93	35.35	69	49.1	53.1	**53.35**	41	**56.95**	40
NW03654	60.32	67.71	50.95	74.57	54.6	55.23	**60.56**	4	**62.49**	7
NW03666	51.62	63.98	29.67	75.9	54.45	48.52	**54.02**	38	**58.89**	30
NW03670	42.38	62.38	39.53	58.62	53.13	47.63	**50.61**	47	**52.83**	54
NW03681	53.12	65.38	32.57	68.65	51.63	48.25	**53.27**	42	**57.41**	38
NE04424	55.62	69.66	48.52	79.73	57.6	54.65	**60.96**	3	**63.45**	2
NE04449	51.57	64.88	38.25	68	43	50.37	**52.68**	44	**55.56**	43
NE04490	50.85	60.45	44.15	67.2	46.82	57.75	**54.54**	33	**56.61**	41
NE04550	39.42	65.26	32.95	54.45	46.9	34.65	**45.61**	57	**48.14**	58
NE04653	50.55	63.83	41.12	68.63	46.02	48.47	**53.10**	43	**55.50**	44
NI04420	51.8	70.35	41.83	81.25	48.53	52.97	**57.79**	14	**60.98**	13
NI04421	52.55	67.91	33.3	66.1	53.4	56.83	**55.02**	30	**59.36**	25
NI04427	49.85	61.3	36.57	71.1	55.18	51.62	**54.27**	34	**57.81**	35
NE03457	42.55	60.85	39.9	56.38	53.48	48.97	**50.36**	49	**52.45**	55
NE05403	62.82	77.33	44.45	67.95	48.47	47.9	**58.15**	11	**60.89**	15
HARRY	46.5	63.33	36.22	63.17	40.13	54	**50.56**	48	**53.43**	53
MILLENNIUM	59	70.69	45.88	61.58	48.97	48.68	**55.80**	23	**57.78**	36
Hallam	49.45	72.6	38.62	68.55	50.52	51.58	**55.22**	25	**58.54**	32
Infinity	58.18	72.79	41.12	67.27	51.8	54.75	**57.65**	16	**60.96**	14
WAHOO	60.15	67.44	31.93	70.02	53.28	57.5	**56.72**	21	**61.68**	12
NE05418	60.43	75.93	52.12	68.37	43.45	52.7	**58.83**	8	**60.18**	20
NE05425	56.27	74.43	41.85	77.27	47.43	48.93	**57.70**	15	**60.87**	16
NE05426	55	71.88	37.58	76.15	48.4	51.45	**56.74**	20	**60.58**	17
NE05427	51.95	70.73	34.5	77.03	43.93	46.1	**54.04**	37	**57.95**	34
NE05430	65.6	84.36	55.2	76.58	45.58	41.87	**61.53**	1	**62.80**	4
NE05495	48.83	63.64	40.58	65.72	50.45	53.62	**53.81**	40	**56.45**	42
NE05496	51.08	73.36	42.4	70.17	53.97	54.03	**57.50**	17	**60.52**	18
NW05518	40.05	58.55	27.68	60.13	45.88	51.4	**47.28**	56	**51.20**	56
NE05523	40.78	61.1	28.3	72.78	49.88	47.25	**50.02**	50	**54.36**	48
NE05537	51.9	65.28	28.87	79.05	52.18	47.52	**54.13**	36	**59.19**	28
NE05548	56.5	75.54	41.3	72.38	51.37	55.73	**58.80**	9	**62.30**	8
NE05549	44.33	71.15	31.12	82	58.95	43.37	**55.15**	26	**59.96**	23
NE05558	50.65	69.98	36.48	69.38	54.63	50.23	**55.23**	24	**58.97**	29
NE05578	47.15	65.66	30.5	62.02	46.25	47.3	**49.81**	52	**53.68**	52
NW05589	62.9	68.15	29.27	72.92	44.93	45.15	**53.89**	39	**58.81**	31
NW05643	45.3	65.51	17.97	61.48	45.3	56.55	**48.69**	55	**54.83**	47
NE05699	38.35	45.31	13.13	56.62	42.33	38.05	**38.97**	60	**44.13**	60
NI05713	51.95	62.85	25.02	67.5	39.78	46.68	**48.96**	54	**53.75**	51
NE05453	58.58	72.11	35.18	79.42	42.05	47.73	**55.85**	22	**59.98**	22
NE05459	52.03	70.16	50.88	73.32	53.52	47.13	**57.84**	13	**59.23**	27
NE05567	49.98	58.09	25.63	63.75	49.27	49.67	**49.40**	53	**54.15**	49
NE05568	53.58	59.36	41.53	74.42	49.88	51.2	**55.00**	31	**57.69**	37

NE05569	52.18	64.35	32.87	72.4	58.08	50.3	**55.03**	28	**59.46**	24
Millennium-27 CL	56.48	60.09	27.45	65.27	49.55	45.3	**50.69**	46	**55.34**	46
GOODSTREAK	61.35	70.51	32.12	82.02	50.3	46.48	**57.13**	19	**62.13**	9
SCOUT66	47.97	51.74	13	53.3	47.02	47.68	**43.45**	58	**49.54**	57
CHEYENNE	41.22	50.44	20.8	52.22	42.1	45.35	**42.02**	59	**46.27**	59
	52.44	**66.22**	**36.08**	**70.82**	**49.68**	**49.84**	**54.18**		**57.80**	

The 2006 data are:

VARIETY	Lincoln Yield bu/a	Rank	Mead Yield bu/a	Rank	Clay Yield bu/a	Center Rank	North Yield bu/a	Platte Rank	Alliance Yield bu/a	Rank	**State Yield bu/a**	**Rank**
WESLEY	**79.72**	**25**	68.80	47	**80.06**	**15**	42.35	10	**44.41**	**44**	63.07	29
ALLIANCE	**75.43**	**44**	70.55	42	**70.19**	**48**	41.73	14	**47.45**	**34**	61.07	39
NE00403	**71.87**	**53**	67.29	55	**78.21**	**20**	41.87	12	**51.86**	**11**	62.22	32
NE01422	**73.29**	**48**	63.17	56	**73.20**	**38**	37.02	40	**40.43**	**55**	57.42	54
NE01481	**87.31**	**3**	78.78	13	**73.75**	**35**	39.52	22	**49.39**	**25**	65.75	11
NE01481-1	**70.09**	**55**	58.17	58	**71.22**	**44**	29.21	59	**44.61**	**43**	54.66	58
NE01604	**78.62**	**27**	69.75	45	**75.39**	**28**	37.90	32	**46.63**	**36**	61.66	35
NE01643	**80.78**	**21**	**84.31**	**2**	**83.82**	**7**	**39.47**	**23**	**50.34**	**15**	**67.74**	**4**
NE02465	**78.63**	**26**	73.77	31	**70.67**	**46**	35.35	47	**30.93**	**60**	57.87	52
NE02513	**72.44**	**52**	69.27	46	**81.74**	**10**	27.87	60	**42.51**	**49**	58.77	50
NE02528	**75.94**	**41**	76.80	18	**74.23**	**32**	32.88	56	**43.89**	**46**	60.75	42
NE02532	**76.14**	**39**	81.62	7	**79.53**	**18**	34.85	50	**43.03**	**48**	63.03	30
NE02533	**86.11**	**5**	76.37	20	**86.95**	**1**	37.48	37	**49.66**	**21**	67.31	5
NE02549	**77.30**	**36**	67.55	50	**72.27**	**41**	40.46	18	**47.48**	**32**	61.01	40
NE02558	**83.28**	**13**	72.26	38	**77.38**	**23**	40.99	17	**54.46**	**3**	65.67	12
NE02584	**82.43**	**16**	79.39	11	**77.54**	**22**	35.39	46	**50.26**	**18**	65.00	17
NE02588	**72.50**	**51**	76.09	23	**67.80**	**52**	37.87	33	**44.64**	**42**	59.78	47
NE02592-1	**74.59**	**46**	80.51	9	**62.01**	**57**	33.24	54	**38.50**	**59**	57.77	53
NI02425	**83.89**	**9**	77.29	16	**81.10**	**13**	36.18	43	**41.68**	**53**	64.03	22
NI02425-1	**77.89**	**29**	82.60	5	**74.56**	**30**	35.23	49	**39.85**	**57**	62.03	34
NE03457	**69.36**	**57**	60.70	57	**69.88**	**49**	34.43	52	**46.41**	**37**	56.16	55
NE03458	**79.90**	**23**	74.02	29	**41.97**	**60**	37.92	**31**	**41.95**	**52**	55.15	57
NE03488	**75.97**	**40**	72.84	34	**79.08**	**19**	37.51	**36**	**49.98**	**20**	63.08	28
NE03490	**85.95**	**7**	67.47	52	**70.64**	**47**	44.39	**3**	**59.83**	**1**	65.66	13
NH03609	**81.16**	**20**	76.20	22	**85.63**	**4**	38.10	**29**	**42.40**	**50**	64.70	18
NH03614	**83.55**	**10**	74.64	27	**79.65**	**17**	41.51	**16**	**49.65**	**22**	65.80	10
NI03418	**75.78**	**42**	67.37	53	**70.72**	**45**	35.64	**44**	**43.51**	**47**	58.60	51
HARRY	**77.64**	**32**	73.93	30	**67.96**	**51**	37.70	**34**	**48.32**	**29**	61.11	38
MILLENNIUM	**69.87**	**56**	75.15	25	**72.24**	**42**	38.92	**25**	**47.47**	**33**	60.73	43
Hallam	**77.48**	**35**	78.38	14	**65.44**	**55**	42.71	**8**	**52.18**	**9**	63.24	27
Infinity	**80.45**	**22**	81.20	8	**74.60**	**29**	38.85	**26**	**47.39**	**35**	64.50	20
WAHOO	**74.89**	**45**	67.50	51	**71.42**	**43**	42.07	**11**	**50.31**	**16**	61.24	37
NI03427	**84.66**	**8**	79.99	10	**81.57**	**12**	36.94	**41**	**42.07**	**51**	65.05	16
NW03638	**70.28**	**54**	77.12	17	**73.58**	**36**	36.24	**42**	**50.78**	**14**	61.60	36
NW03654	**77.58**	**33**	76.21	21	**73.78**	**34**	43.94	**4**	**49.62**	**23**	64.23	21
NW03666	**77.28**	**37**	79.33	12	**81.81**	**9**	43.45	**6**	**52.89**	**6**	66.95	6

NW03670	**72.90**	**50**	69.87	44	**73.36**	**37**	35.48	**45**	**51.45**	**12**	60.61	44
NW03681	**77.85**	**30**	67.71	49	**80.37**	**14**	40.32	**19**	**44.24**	**45**	62.10	33
NE04424	**87.04**	**4**	71.16	40	**79.80**	**16**	45.83	**2**	**50.30**	**17**	66.83	7
NE04435	**73.52**	**47**	69.91	43	**72.76**	**39**	34.79	**51**	**48.20**	**31**	59.84	46
NE04449	**82.59**	**15**	73.50	32	**86.34**	**3**	38.19	**28**	**45.78**	**39**	65.28	15
NE04466	**81.28**	**19**	72.62	36	**75.46**	**27**	42.51	**9**	**45.20**	**41**	63.41	25
NE04475	**76.99**	**38**	67.89	48	**67.52**	**53**	37.46	**38**	**48.88**	**26**	59.75	48
NE04490	**77.55**	**34**	83.02	4	**86.70**	**2**	43.39	**7**	**52.90**	**5**	68.71	3
NE04537	**73.23**	**49**	72.79	35	**65.61**	**54**	38.05	**30**	**52.52**	**7**	60.44	45
NE04550	**86.05**	**6**	74.61	28	**77.97**	**21**	41.72	**15**	**48.65**	**28**	65.80	9
NE04465	**83.10**	**14**	76.59	19	**69.61**	**50**	39.09	**24**	**50.19**	**19**	63.72	23
NE04653	**81.54**	**18**	76.01	24	**82.15**	**8**	37.64	**35**	**50.84**	**13**	65.64	14
NE04662	**75.70**	**43**	72.56	37	**53.56**	**59**	32.67	**57**	**45.53**	**40**	56.00	56
NE04665	**81.74**	**17**	77.59	15	**76.13**	**26**	38.85	**27**	**38.73**	**58**	62.61	31
NW04673	**83.48**	**11**	73.23	33	**74.36**	**31**	40.17	**20**	**46.06**	**38**	63.46	24
NW04685	**78.22**	**28**	70.76	41	**81.71**	**11**	33.43	**53**	**40.35**	**56**	60.89	41
NI04411	**77.72**	**31**	74.66	26	**76.38**	**25**	39.88	**21**	**48.28**	**30**	63.38	26
NI04416	**83.40**	**12**	83.09	3	**74.13**	**33**	32.53	**58**	**49.54**	**24**	64.54	19
NI04420	**89.33**	**2**	85.23	1	**77.28**	**24**	43.63	**5**	**48.71**	**27**	68.84	2
NI04421	**90.01**	**1**	81.63	6	**84.21**	**5**	53.00	**1**	**52.04**	**10**	72.18	1
NI04427	**79.75**	**24**	71.87	39	**83.84**	**6**	41.84	**13**	**53.27**	**4**	66.11	8
GOODSTREAK	**62.31**	**59**	67.37	54	**72.63**	**40**	37.18	**39**	**55.72**	**2**	59.04	49
SCOUT66	**55.92**	**60**	51.86	60	**57.86**	**58**	35.34	**48**	**40.82**	**54**	48.36	60
CHEYENNE	**64.52**	**58**	57.20	59	**62.07**	**56**	33.23	**55**	**52.29**	**8**	53.86	59
GRAND MEAN	**77.93**		**73.32**		**74.39**		**38.39**		**47.29**		**62.26**	
CV	4.94		5.31		9.80		7.54		9.89			
LSD	4.50		5.27		9.87		3.92		6.33			

Data from 2006 to 2008 from the Nebraska Intrastate Nursery for Grain Yield (bu/a)

name	Mead		Lincoln		Clay Cen.		N. Platte		Sidney		Alliance		St.Avg.	Rank
	bu/a		bu/a		bu/a		bu/a		bu/a		bu/a		bu/a	
NE04490	61.17	1	73.12	6	58.72	2	68.04	7	57.66	2	53.89	8	61.70	1
NI04420	61.01	2	75.89	4	58.80	1	67.12	13	50.04	20	54.64	4	61.25	2
NI04421	55.83	6	75.30	5	55.84	5	70.60	1	50.24	18	55.81	2	60.58	3
NW03666	56.38	5	71.87	7	56.40	4	69.05	5	56.05	5	53.17	11	60.47	4
NE04424	52.84	16	76.91	2	53.68	11	68.47	6	54.30	9	54.19	5	60.10	5
NE02533	57.50	4	76.48	3	55.68	7	67.74	9	54.40	8	48.15	22	59.85	6
Overland	**59.00**	**3**	**66.70**	**15**	**55.77**	**6**	**70.25**	**2**	**53.74**	**11**	**54.14**	**6**	**59.30**	**7**
NI04427	52.84	15	70.28	11	58.24	3	63.13	18	51.69	14	54.75	3	58.74	8
NE01481	55.13	8	78.38	1	54.23	10	63.96	16	49.64	21	50.08	21	58.49	9
NE02558	51.80	17	71.37	8	49.80	17	67.75	8	58.95	1	53.37	10	58.28	10
NW03654	54.32	13	67.41	14	51.03	14	67.15	12	56.32	3	51.80	13	57.97	11
NE03490	49.62	20	65.00	18	49.79	18	69.16	4	56.12	4	56.45	1	57.95	12
Camelot	54.48	10	71.34	9	54.42	8	67.70	10	54.43	7	45.74	24	57.85	13
Settler CL	51.77	18	69.89	12	54.28	9	62.14	19	47.30	23	54.05	7	57.29	14
NE02584	54.44	11	70.87	10	52.48	12	66.40	14	47.47	22	51.66	15	57.26	15
GOODSTREA	55.32	7	64.85	19	44.11	21	69.48	3	52.16	13	51.70	14	56.61	16

K														
WESLEY	54.40	12	65.39	17	49.89	16	65.07	15	51.58	15	51.18	16	56.51	17
NW03681	51.57	19	69.23	13	50.86	15	63.47	17	54.16	10	46.10	23	55.75	18
MILLENNIUM	54.86	9	63.06	21	51.43	13	59.75	22	50.66	17	51.81	12	55.06	19
Infinity	53.22	14	63.65	20	48.50	19	60.27	21	46.15	24	50.72	18	54.77	20
HARRY	48.45	21	65.65	16	45.28	20	61.10	20	53.05	12	50.65	19	54.10	21
ALLIANCE	46.09	22	55.57	23	43.50	22	67.61	11	55.02	6	53.76	9	52.93	22
WAHOO	45.76	23	58.91	22	35.38	25	58.75	23	51.06	16	50.44	20	50.22	23
CHEYENNE	41.05	25	49.07	25	38.62	23	52.89	25	45.51	25	50.94	17	46.64	24
SCOUT66	41.74	24	51.70	24	37.19	24	57.41	24	50.06	19	45.30	25	46.64	25

As can be seen the excellent three-year yields of Overland, there are some line with similar, excellent broad adaptability, as well as, many lines with excellent grain yields in the east, central, or west parts of Nebraska. Both broadly and more narrowly adapted lines have value in wheat production.

5. Nebraska Triplicate Nursery (NTN):

The same comments about the NIN data apply to the NTN. In this nursery, the check lines performed reasonably well compared to the experimental lines, but clearly based upon this year's data there are a number of lines that have promise continued testing for new cultivar releases. The lines in the NTN have less performance history, so it is expected that some experimental lines will out yield the checks, but that most lines will have poorer performance. As in the NIN, it was quite surprising that the locations were generally positively correlated, though in many cases the variation in one location could not explain one-half the variation in the other location. The 2008 data are:

2008	MEAD	LINC.	C.CENTER	N.PLATTE	SIDNEY	ALLIANCE	**ST.YIELD**	**ST.RANK**
name	(bu/a)	(bu/a)	(bu/a)	(bu/a)	(bu/a)	(bu/a)	(bu/a)	
Goodstreak	34.0	45.7	37.6	83.7	67.8	79.1	57.97	**48**
Overland	51.6	50.2	58.5	79.4	69.2	76.7	64.26	**23**
WESLEY	47.9	72.9	45.9	87.9	66.3	72.5	65.56	**15**
NE07402	52.8	41.8	50.0	81.3	67.0	69.0	60.30	**40**
NE07408	56.1	49.7	55.6	81.8	73.5	75.1	65.31	**18**
NE07409	38.3	53.7	48.1	78.9	81.9	73.8	62.46	**30**
NE07410	44.8	65.2	54.0	77.5	67.0	61.3	61.62	**35**
NE07424	40.4	40.5	33.6	81.2	74.3	72.2	57.03	**52**
NE07426	40.4	57.3	36.4	78.8	69.8	70.2	58.82	**46**
NE07435	48.6	50.7	44.1	83.6	80.3	67.3	62.43	**31**
NE07436	35.7	34.1	38.8	77.9	65.3	74.5	54.37	**58**
NE07444	46.6	81.5	54.3	83.1	65.0	72.6	67.17	**8**
NE07457	37.7	54.4	32.5	93.8	77.3	74.4	61.70	**34**
NE07458	49.9	75.7	59.6	71.9	74.2	70.2	66.92	**9**
NE07463	46.7	81.1	51.0	81.4	64.3	80.1	67.43	**7**
NE07465	52.0	65.9	42.4	79.6	72.5	65.9	63.04	**27**
NE07466	44.3	40.8	52.8	84.1	70.3	75.6	61.31	**36**
NE07469	43.9	79.2	39.7	82.6	70.2	71.1	64.44	**21**
NE07474	49.6	75.4	45.4	88.8	63.6	69.9	65.44	**16**
NE07477	41.7	68.1	51.6	88.0	65.2	72.7	64.55	**20**

NE07479	51.7	83.7	54.6	75.2	72.8	60.4	66.40	**10**
NE07480	33.9	79.0	39.0	82.5	65.8	62.5	60.44	**38**
NE07483	30.6	53.5	36.8	85.6	68.1	78.4	58.83	**45**
NE07484	48.5	41.6	59.3	80.3	66.0	70.6	61.05	**37**
NE07486	50.6	84.8	60.6	92.3	77.7	76.1	73.70	**1**
NE07487	48.1	76.6	52.0	80.4	68.4	66.3	65.30	**19**
NE07488	57.8	76.7	61.9	80.7	69.7	73.3	70.02	**3**
NE07490	54.4	43.5	53.2	90.5	75.9	77.2	65.78	**13**
NE07498	60.2	40.8	55.6	82.3	68.9	68.1	62.64	**28**
NW07505	41.7	76.2	57.7	92.4	68.2	73.8	68.35	**4**
NE07511	35.3	34.8	22.8	82.1	73.9	77.9	54.47	**57**
NE07517	42.4	48.6	44.7	76.3	63.4	68.7	57.35	**50**
NE07520	41.8	69.2	49.7	78.2	74.4	71.5	64.13	**24**
NE07521	48.8	48.0	58.0	94.2	75.8	80.3	67.52	**6**
NE07531	54.4	46.4	65.8	92.7	68.0	79.2	67.74	**5**
NW07534	51.9	77.0	63.4	91.9	79.3	74.0	72.90	**2**
NW07539	45.3	69.4	55.6	84.6	69.8	72.9	66.27	**11**
NE07561	41.8	43.7	45.2	84.5	67.0	70.3	58.73	**47**
NE07567	43.4	39.3	54.6	85.2	68.0	71.5	60.31	**39**
NE07569	41.2	54.4	38.3	88.1	77.6	76.2	62.63	**29**
NE07570	43.6	70.9	48.3	75.0	67.9	67.7	62.23	**32**
NE07572	50.6	50.7	59.1	87.3	71.7	77.0	66.06	**12**
NE07577	33.0	45.0	40.3	76.4	66.3	71.4	55.38	**54**
NE07604	41.2	39.0	39.3	85.3	70.5	70.8	57.68	**49**
NE07614	44.5	61.1	47.1	72.6	67.4	68.2	60.13	**41**
NE07616	30.3	71.7	32.9	67.6	74.1	76.6	58.87	**44**
NE07617	34.7	66.3	35.7	64.1	70.6	66.6	56.33	**53**
NE07619	40.9	63.6	50.7	79.1	65.1	60.6	60.01	**42**
NE07622	40.0	68.1	48.0	82.8	74.4	73.2	64.40	**22**
NE07627	41.5	80.6	44.5	87.9	69.9	67.9	65.36	**17**
NE07628	37.8	70.1	45.7	68.6	60.3	60.9	57.23	**51**
NE07663	44.2	60.4	51.0	88.8	76.5	72.7	65.59	**14**
NE07665	32.7	36.9	40.0	81.0	68.7	68.7	54.67	**55**
NE07668	33.7	68.4	48.4	88.0	77.5	65.4	63.56	**25**
NE07670	34.1	49.8	39.0	77.2	59.6	67.5	54.52	**56**
NE07695	44.0	62.6	52.7	80.3	64.7	68.6	62.14	**33**
NI07703	43.7	68.2	39.6	82.6	69.6	76.5	63.36	**26**
NI07705	37.3	37.9	46.7	78.9	57.7	61.5	53.34	**59**
NI07707	48.5	51.8	45.9	78.1	70.1	61.3	59.30	**43**
NI07711	27.2	40.0	37.5	75.4	74.8	57.2	52.01	**60**
Mean	**43.50**	**58.90**	**47.55**	**82.03**	**70.02**	**70.89**	**62.15**	
CV	21.22	17.36	14.31	7.41	8.39	6.75		
LSD	12.53	13.88	9.24	8.25	7.97	6.5		

In 2008 Triplicate nursery, fifty-three lines, which included nine checks, were analyzed in SKCS, Buhler milling, protein content, ash, Mixograph for dough strength, and baking properties. Most varieties kernels were HARD wheat with average diameter (23 mm) and weight (29.1 mg). The flour yield was in normal range (average 71%). Most bran and short can be separated fairly, but some bran and short were poorly separated. The protein and ash content were in good range, too. The average flour protein content

was 12.2%. The average flour ash content was 0.419%. Most wheat flour (89% samples) had from good to very good dough strength with medium long peak time. In general, the baking properties distributed widely from poor to very good in these varieties of this nursery, but most varieties (81%) had good to very good baking properties. The top twenty-six varieties that had best baking properties were NE07410 ≤ NE07409 < NE07424 < NE07695 < NE07670 < NE07488 < NE07457 < NE07408 < NE07517 < NW07539 < NE07628 < NE07511 < NE07665 < NE07480 < NE07486 < NE07668 < NE07435 < NE07577 < NE07484 < NE07614 < NE07426 < NE07490 < NW07534 < NE07487 < NE07619 < NW07505. They had average protein content 12.6%, and medium to very strong dough strength. They had relatively longer mixing times, higher loaf volume, good to very good exterior, and very good crumb grain. They had very smooth and resilient texture. They had higher slice area and slice brightness (creamy to white crumb) and better distributed cells. They had average cell diameter, and cell elongated. The bottom three varieties that had worst baking properties was NE07572 < NE07498 < NE07521. They had average protein content 12.4%, but medium dough strength and mixing times. They had very low loaf volume, poor exterior and crumb grain. They had harsh texture. They had lower slice brightness (yellow crumb) and denser cells. They lower slice area and irregular cell shape. In baking with adding oxidant, the quality of bread was improved significantly in some varieties.

The 2007 data are:

Name	Mead	Lincoln	Clay Cen.	N.Platte	Sidney	Alliance	St.Avg	St.Avg-CC	**St. Avg. Rank**	**St. Avg-CC Rank**
	bu/a	bu/a	bu/a	bu/a	bu/a	Bu/a	bu/a	bu/a		
Jagalene	44.58	52.43	34.28	57.97	60.08	48.75	49.68	52.76	**55**	**56**
WESLEY	53.48	57.65	34.75	84.22	62.87	45.42	56.40	60.73	**22**	**17**
GOODSTREAK	53.08	63.83	30.77	87.15	56.72	44.13	55.95	60.98	**26**	**14**
NE06404	48.18	62.20	26.35	83.02	63.60	47.00	55.06	60.80	**32**	**16**
NE06415	47.83	64.25	40.32	77.02	59.40	50.35	56.53	59.77	**20**	**25**
NE06430	49.00	59.65	39.45	87.22	63.63	45.23	57.36	60.95	**14**	**15**
NE06431	40.47	61.10	34.25	78.70	62.57	40.05	52.86	56.58	**42**	**42**
NE06432	57.27	61.05	31.67	77.17	67.17	47.73	57.01	62.08	**15**	**7**
NE06433	44.00	60.07	36.70	76.67	63.75	51.32	55.42	59.16	**30**	**28**
NE06436	54.05	66.27	41.95	84.97	64.52	48.47	60.04	63.66	**4**	**6**
NE06441	52.62	56.67	33.32	73.52	58.70	44.20	53.17	57.14	**41**	**36**
NW06452	48.62	63.17	41.55	75.98	64.55	46.77	56.77	59.82	**18**	**24**
NE06454	42.55	57.35	26.18	64.38	60.88	45.90	49.54	54.21	**56**	**54**
NE06460	51.32	60.12	40.67	77.30	57.60	46.98	55.67	58.66	**28**	**29**
NE06462	55.95	67.47	43.52	86.90	62.47	48.68	60.83	64.29	**2**	**2**
NE06469	51.68	64.00	39.08	76.35	72.05	45.00	58.03	61.82	**10**	**9**
NE06471	53.10	60.15	42.83	74.55	68.02	45.95	57.43	60.35	**13**	**20**
NE06472	50.58	57.78	43.08	67.48	64.38	50.88	55.70	58.22	**27**	**33**
NE06474	48.57	69.38	40.75	74.07	61.95	45.92	56.77	59.98	**19**	**22**
NW06476	40.30	62.95	36.80	73.70	59.80	54.73	54.71	58.30	**33**	**32**
NW06477	41.63	66.05	33.98	65.13	61.98	50.85	53.27	57.13	**40**	**38**
NW06479	46.20	59.12	32.85	62.57	66.93	39.95	51.27	54.95	**47**	**50**
NE06497	47.38	59.22	36.73	65.65	63.52	49.90	53.73	57.13	**37**	**37**
NE06499	45.80	63.65	42.58	68.18	68.33	49.87	56.40	59.17	**21**	**27**
NE06507	46.88	59.58	32.38	59.80	61.78	44.95	50.90	54.60	**50**	**53**
NE06537	47.43	69.48	43.72	78.75	65.05	48.93	58.89	61.93	**7**	**8**
NE06543	50.80	56.90	29.02	67.22	59.55	43.55	51.17	55.60	**48**	**47**

NE06544	53.57	51.37	30.58	67.65	68.43	52.03	53.94	58.61	**35**	**30**
NE06545	54.63	61.23	33.63	81.25	71.50	50.62	58.81	63.85	**8**	**4**
NE06547	43.15	49.60	24.30	56.57	57.50	51.28	47.07	51.62	**57**	**57**
NE06548	48.95	62.88	40.78	72.15	64.77	48.53	56.34	59.46	**24**	**26**
NE06549	47.18	59.88	40.57	82.75	61.58	49.98	56.99	60.27	**17**	**21**
NE06552	47.23	61.58	39.70	77.13	67.43	48.97	57.01	60.47	**16**	**19**
NH06558	39.48	50.72	25.30	52.75	63.00	48.30	46.59	50.85	**58**	**58**
NH06559	39.60	50.02	19.70	53.80	57.73	29.92	41.80	46.21	**60**	**60**
NE06580	43.67	53.52	35.62	76.63	57.00	48.30	52.46	55.82	**44**	**44**
NE06591	46.83	49.95	38.43	83.72	45.03	47.93	51.98	54.69	**46**	**52**
NE06599	47.23	57.00	38.60	67.60	57.40	46.22	52.34	55.09	**45**	**48**
NE06602	51.42	47.05	31.33	75.80	61.75	49.50	52.81	57.10	**43**	**39**
NE06607	56.87	69.92	42.25	82.82	55.80	55.18	60.47	64.12	**3**	**3**
NE06619	58.67	76.30	43.05	88.50	63.48	53.47	63.91	68.08	**1**	**1**
NE06622	54.80	62.22	34.42	76.92	58.08	51.60	56.34	60.72	**25**	**18**
NW06630	51.58	70.97	41.33	76.65	62.05	46.88	58.24	61.63	**9**	**10**
NW06631	44.80	50.50	27.70	63.17	67.00	48.07	50.21	54.71	**52**	**51**
NW06635	55.60	65.62	36.90	77.03	58.40	51.25	57.47	61.58	**12**	**11**
NW06641	52.57	50.82	21.05	71.10	54.97	48.70	49.87	55.63	**54**	**46**
NW06649	56.45	60.12	38.73	70.37	61.52	50.97	56.36	59.89	**23**	**23**
NW06652	61.25	61.52	43.37	76.48	51.38	39.40	55.57	58.01	**29**	**35**
NW06653	48.77	55.10	27.23	70.83	59.93	44.23	51.02	55.77	**49**	**45**
NW06654	57.68	65.75	49.48	75.70	56.75	49.25	59.10	61.03	**6**	**13**
NW06655	59.45	67.32	36.73	79.07	59.60	53.38	59.26	63.76	**5**	**5**
NE06658	46.67	59.28	40.28	71.23	68.57	45.80	55.31	58.31	**31**	**31**
NW06666	38.87	42.73	28.75	54.58	57.82	56.05	46.47	50.01	**59**	**59**
NE06672	46.73	61.20	37.53	65.28	65.23	45.70	53.61	56.83	**38**	**40**
NI06436	53.42	58.97	32.92	78.88	58.68	40.77	53.94	58.14	**34**	**34**
NE06683	55.55	60.58	39.70	83.37	60.97	46.23	57.73	61.34	**11**	**12**
NE06687	49.88	54.45	27.85	72.93	58.52	39.52	50.53	55.06	**51**	**49**
NW06691	55.87	63.72	37.48	63.98	65.02	34.50	53.43	56.62	**39**	**41**
NW06693	48.92	55.68	41.80	59.72	73.43	43.20	53.79	56.19	**36**	**43**
NW06694	38.42	54.37	31.42	66.67	65.38	43.62	49.98	53.69	**53**	**55**
	49.49	**59.72**	**35.80**	**72.98**	**61.96**	**47.18**	**54.52**	**58.27**		

The 2006 data are:

	Lincoln	Mead	Clay Center	N. Platte	Alliance	Average	Rank
VARIETY	bu/a	bu/a	bu/a	bu/a	bu/a	bu/a	
Goodstreak	**73.58**	**62.32**	**69.19**	**38.54**	**49.04**	**58.53**	**40**
Jagalene	**86.29**	**71.62**	**91.66**	**39.12**	**48.40**	**67.42**	**3**
Wesley	**84.42**	**61.89**	**93.96**	**43.21**	**44.78**	**65.65**	**11**
NE05403	89.94	75.95	80.70	38.07	41.35	65.20	15
NE05418	74.56	71.47	84.58	35.03	42.65	61.66	25
NE05425	86.45	65.51	93.14	37.76	48.30	66.23	9
NE05426	90.03	73.61	89.04	37.10	45.20	67.00	5
NE05427	78.23	70.42	101.44	34.77	46.56	66.28	6
NE05430	86.92	81.56	81.00	45.38	42.76	67.52	2
NE05434	82.64	69.69	90.22	33.76	40.79	63.42	19
NE05435	70.56	60.16	65.17	26.27	34.12	51.26	59
NE05442	80.09	66.14	55.96	33.61	47.98	56.76	50
NE05443	81.11	62.28	66.59	38.35	44.26	58.52	41
NE05453	88.56	71.72	81.13	36.36	50.93	65.74	10
NE05454	79.63	65.50	61.76	31.08	44.01	56.40	53
NE05458	85.93	75.17	82.67	40.27	47.22	66.25	7
NE05459	82.32	69.02	89.62	42.54	47.71	66.24	8
NE05462	74.13	59.91	64.62	38.62	49.47	57.35	46
NE05463	81.70	58.26	80.24	35.60	42.57	59.67	35
NE05468	81.11	69.01	68.61	41.59	44.23	60.91	28
NE05481	65.22	59.42	73.90	36.41	47.35	56.46	52
NE05489	74.60	64.68	81.78	36.95	42.61	60.12	32
NE05495	84.70	68.14	81.96	42.21	50.65	65.53	12
NE05496	89.03	66.83	88.73	49.26	50.31	68.83	1
NW05502	71.34	58.53	80.86	38.13	35.73	56.92	49
NW05517	86.80	63.59	95.05	35.73	46.38	65.51	13
NW05518	82.70	61.45	84.76	40.05	46.10	63.01	21
NE05523	83.13	57.24	74.12	36.51	47.21	59.64	36
NE05529	84.82	75.70	60.69	35.48	46.57	60.65	30
NE05532	79.52	60.93	80.14	39.07	36.80	59.29	37
NE05537	75.12	61.81	91.70	27.55	42.87	59.81	34
NE05538	82.55	63.92	83.17	33.82	37.90	60.27	31
NE05548	81.01	62.67	87.10	36.59	48.68	63.21	20
NE05549	82.11	64.20	81.85	39.54	45.84	62.71	22
NE05558	81.83	64.62	88.80	44.37	41.39	64.20	17
NE05564	80.83	65.88	69.04	43.84	47.06	61.33	27
NE05566	71.58	64.59	64.49	42.13	44.00	57.36	45
NE05567	87.30	72.06	74.35	34.00	41.88	61.92	24
NE05568	77.19	66.54	73.37	40.04	46.67	60.76	29
NE05569	82.56	62.80	92.21	40.24	49.56	65.47	14
NE05572	73.49	49.71	73.71	27.85	42.25	53.40	58
NE05578	69.64	66.45	85.10	32.47	42.04	59.14	38

NW05584	70.18	48.81	83.14	40.94	46.30	57.87	43
NW05589	71.71	61.31	97.61	35.06	26.33	58.40	42
NW05601	73.03	60.43	77.09	32.85	42.22	57.12	48
NW05605	78.76	59.46	72.64	30.93	38.81	56.12	54
NW05608	78.85	57.38	77.96	31.81	40.55	57.31	47
NW05617	90.69	57.50	91.78	35.29	46.00	64.25	16
NE05625	72.24	54.42	76.82	38.49	46.59	57.71	44
NE05627	82.88	62.89	54.24	35.07	47.80	56.58	51
NE05629	79.46	70.65	90.51	43.97	50.50	67.02	4
NE05631	66.13	51.60	81.60	38.41	41.26	55.80	55
NE05638	78.38	67.78	78.59	35.67	47.03	61.49	26
NW05643	83.39	61.27	79.59	44.77	50.76	63.96	18
NE05652	88.78	70.31	69.95	31.09	39.89	60.00	33
NE05674	71.55	74.24	87.23	35.39	42.35	62.15	23
NE05699	57.64	56.44	60.75	35.57	40.69	50.22	60
NI05713	72.59	58.59	81.56	37.27	45.19	59.04	39
NI05714	79.00	62.39	53.17	33.76	43.73	54.41	57
NI05722W	78.21	52.96	55.55	38.41	51.35	55.30	56
GRAND MEAN	**79.31**	**64.19**	**78.80**	**37.23**	**44.49**	**60.81**	
CV	6.95	6.47	8.49	8.23	7.52		
LSD	7.47	5.62	9.05	4.15	4.53		

5. Regional Nurseries

In 2008, we continued to combine into one larger nursery the Southern Regional Performance Nursery (SRPN), the Northern Regional Performance Nursery (NRPN), which were planted at Lincoln, North Platte, Sidney, and Alliance. At Clay Center, only the SRPN was planted. To fill out the nursery, we added a few other lines mainly to compare selections out of lines to see if the selection (often for disease or end-use quality) was an improvement agronomically compared to original line. The data for 2008 are:

2008	Lincoln	N. Platte	Sidney	Alliance	St. Avg.	State	Clay Cen.
	Yield	Yield	Yield	Yield	Yield	Rank	Yield
Name	(bu/a)	(bu/a)	(bu/a)	(bu/a)	(bu/a)		(bu/a)
Kharkov	13.39	49.67	51.12	45.22	39.85	**90**	23.11
Scout 66	25.13	59.92	60.18	46.22	47.86	**89**	27.43
TAM-107	42.48	73.06	60.99	46.64	55.79	**81**	52.22
Trego	62.62	76.49	64.56	43.9	61.89	**68**	46.63
OK00514-05806	80.22	86.85	63.74	44.23	68.76	**37**	56.55
OK05737W	76.31	74.65	57.93	48.49	64.35	**59**	40.91
OK03522	85.56	79.63	61.23	44.99	67.85	**43**	66.94
OK03305	75.11	62.47	67.05	49.79	63.61	**61**	53.06
OK04505	70.17	92.45	71.06	51.69	71.34	**22**	55.12
AP04T8211	85.17	89.23	68.14	51.5	73.51	**9**	59.57
AP05T2413	56.51	75.62	55.55	45.49	58.29	**76**	45.33
AP05TW2821	74.91	86.27	76.25	54.41	72.96	**12**	50.74

AP06T3832	74.95	100.15	72.08	52.4	74.90	**5**	55.12
KS05HW15-2	89.14	90.55	66.14	47.3	73.28	**10**	60.39
KS05HW121-2	76.84	91.76	66.48	55	72.52	**16**	47.98
KS05HW122-5	79.26	78.97	69.83	53.63	70.42	**25**	46.86
KS05HW136-3	56.73	85.2	56.09	48.24	61.57	**70**	47.63
HV9W96-1271R-1	93.99	79.11	70.38	57.71	75.30	**3**	62.26
HV9W03-539R	93.83	88.38	65.16	47.91	73.82	**7**	75.12
HV9W03-696R-1	83.59	85.31	63.14	50.79	70.71	**24**	80.29
HV9W02-942R	69.17	75.12	64.15	43.58	63.01	**65**	57.89
T151	89.77	72.15	63.27	49.22	68.60	**39**	65.18
T153	93.94	78.79	60.76	50.23	70.93	**23**	79.12
T154	95.34	80.88	65.19	51.66	73.27	**11**	82.53
T158	90.03	72.69	65.4	45.87	68.50	**40**	62.22
NE04424	84.64	86.57	65.61	53.87	72.67	**15**	62.35
NE05425	74.57	92.18	65.23	46.16	69.54	**33**	69.05
NE05426	78.52	95.25	62.89	55.1	72.94	**13**	65.06
NE05430	68.12	93.33	62	46.08	67.38	**44**	54.36
KS970093-8-9-#1	86.57	95.2	69.83	52.54	76.04	**2**	71.00
KS970187-1-10	89.26	85.18	61.65	51.74	71.96	**19**	71.16
KS980512-11-22	84.32	80.11	68.99	46.67	70.02	**29**	52.67
KS980554-12-~9	77.43	81.1	69.98	52.52	70.26	**27**	66.05
CO02W237	66.23	79.23	61.36	47.15	63.49	**62**	58.09
CO03064	20.06	74.23	64.13	49.33	51.94	**87**	48.66
CO03W054	40.79	87.2	67.55	52.28	61.96	**67**	54.11
CO03W139	81.91	78.58	64.39	50.41	68.82	**36**	49.94
CO03W239	26.91	84.6	64.06	49.18	56.19	**79**	39.36
CO03W043	74.01	76.16	69.52	49.15	67.21	**45**	42.69
NE05496	81.14	85.62	63.77	42.11	68.16	**42**	59.75
KS980512-2-2	86.72	86.54	66.61	46.49	71.59	**21**	69.76
OK03825-5403-6	47.61	75.18	60.11	38.07	55.24	**82**	63.35
TX02A0252	37.91	78.72	74.92	53.11	61.17	**72**	43.43
TX03A0148	27.23	69.56	72.25	50.2	54.81	**83**	48.95
TX03A0563	69.25	75.84	62.85	55.26	65.80	**54**	51.70
TX04A001246	73.68	68.18	54.18	50.15	61.55	**71**	65.44
TX01V5134RC-3	84.33	84.62	57.58	52.76	69.82	**30**	65.07
TX04M410164	42.15	83.9	65.96	50.22	60.56	**74**	60.01
TX04M410211	72.15	85.78	62.91	45.72	66.64	**49**	61.73
TX04V075080	75.91	78.05	61.66	51.44	66.77	**48**	44.54
Antelope	61.15	79.39	64.44	50.53	63.88	**60**	
WESLEY	68.18	84.65	67.98	45.72	66.63	**50**	
Jerry	23.46	77.08	60.54	45.97	51.76	**88**	
SD06W117	71.91	77.12	60.61	48.89	64.63	**58**	
SD06069	38.91	94.01	66.53	52.11	62.89	**66**	
SD06163	47.33	84.21	63.28	47.86	60.67	**73**	
SD06165	67.66	84.47	60.73	49.59	65.61	**55**	
SD06173	50.32	86.29	68.74	54.09	64.86	**56**	
SD03164-1	88.31	83.56	59.7	47.03	69.65	**32**	
SD03164-2	78.71	83.23	56.78	44.94	65.92	**53**	

SD05118	40.62	100.36	62.42	50.45	63.46	64	
SD05210	70.63	80.35	61.87	46.51	64.84	57	
SD05W030	77.95	82.36	75.02	53.67	72.25	18	
N98L20040-44	27.95	74.36	63.07	46.74	53.03	86	
NX03Y2489	41.78	75.68	58.14	52.66	57.07	78	
NX04Y2107	51.74	83.84	59.84	51.36	61.70	69	
NW04Y2188	42.33	84.64	64.51	49.34	60.21	75	
HV9W03-1379R	70.32	76.99	67.74	51.2	66.56	51	
NE02533	82.8	84.12	70.07	54.43	72.86	14	
NE02558	78.39	81	68.86	48.7	69.24	34	
NW03666	68.97	82.16	66.02	50.8	66.99	46	
NE04490	**91.08**	**97.22**	**67.27**	**53.48**	**77.26**	**1**	
NI04420	**80.45**	**88.32**	**70.27**	**55.25**	**73.57**	**8**	
NI04427	72.82	89.44	67.03	50.82	70.03	28	
NE05548	80.7	90.62	63.65	51.59	71.64	20	
NE05549	**83.68**	**93.34**	**65.13**	**57.12**	**74.82**	**6**	
NE05569	69.3	89.13	61.49	54.53	68.61	38	
MT0495	27.01	71.9	65.52	52.97	54.35	84	
MTS0531	41.77	72.92	62.66	39.92	54.32	85	
MT0552	27.46	77.07	61.59	57.06	55.80	80	
NE01643	56.07	88.27	68.57	54.18	66.77	47	
NI03427	85.18	76.63	64.86	54.95	70.41	26	
NE05699	58.65	67.62	61.55	44.14	57.99	77	
NE04424	**82.63**	**91.97**	**71.23**	**54.43**	**75.07**	**4**	
NE04490	76.19	97.07	68.44	48.01	72.43	17	
NE03486	81.89	75.52	66.5	48.93	68.21	41	
NI05718W	76.7	73.61	63.18	51.86	66.34	52	
NI03427	68.57	85.75	67.93	54.2	69.11	35	
Infinity	60.6	80.32	63.88	49.09	63.47	63	
NE02584	70.81	78.92	77.08	52.23	69.76	31	
Mean	**66.96**	**81.91**	**64.78**	**49.90**	**65.89**		**56.77**

One of the pleasant surprises with this nursery is that four of the top 10 lines were developed in Nebraska, particularly as the very high yielding site of Lincoln was severely infected with soilborne wheat mosaic virus (SBWMV). It is always pleasant to see some of the Nebraska wheat experimental lines have resistance to this virus, as in the past they were very rare. Hence, we are now developing lines that can do well in southeast NE when planted early. The risk of SBWMV decreases with later planting, so most growers who are planting wheat after soybeans avoid this disease. An example of the effect of SBWMV is that Overland (NE01643) is ranked 47th out of 90 entries when Lincoln is included, but when Lincoln is excluded its rank became 15th. In considering how our germplasm compares to the region's, the Nebraska early germplasm needs better straw strength so it can complete better in the south central region (e.g. Clay Center) where yields are often very high. Our irrigated wheat breeding efforts will help here. We may need to increase the fertility level at Lincoln to identify stronger strawed wheat lines. If this were done, then Mead will become the selection nursery for the later and taller lines that are well adapted to the longer season of western Nebraska. In addition, the regional white wheat efforts continue to expand, thus increasing the germplasm available for parent use in creating new white wheat lines.

7. Multiple-Location Observation Nursery

Six replications (locations) in Nebraska (Lincoln, Mead, Clay Center, North Platte, Sidney, and Hemingford) were harvested and used for selection. A nursery in Kansas was also harvested and used for information, but seed was limited and the plot size was smaller than normal. The table below gives the grain yields for all of the locations, the line average, and the rank of the top 20 highest yielding lines, only one line was an Overland check, indicating we have very competitive new lines in development. Fifty-seven lines were advanced for further testing.

NAME	St. Yield bu/a	RANK	Mead bu/a	Lincoln bu/a	Clay Cen. bu/a	N.Platte bu/a	Sidney bu/a	Alliance bu/a
NE08452	72.21	1	66.75	103.70	62.60	89.96	53.48	56.76
NE08407	71.49	2	66.60	107.65	78.10	74.48	50.20	51.92
NE08402	71.40	3	70.85	106.40	75.30	84.48	47.00	44.36
NE08523	67.13	4	63.55	83.45	54.25	94.04	54.64	52.84
NE08438	66.35	5	43.35	94.25	63.50	88.12	49.52	59.36
NE08659	66.32	6	35.15	79.20	58.00	97.80	62.60	65.16
NE08457	66.03	7	47.80	96.10	60.65	85.44	51.84	54.32
NE08435	65.55	8	28.55	110.10	55.45	86.48	54.36	58.36
NE08530	64.89	9	42.75	75.60	59.85	92.52	54.88	63.76
NE08592	64.75	10	36.75	96.75	64.40	103.96	47.88	38.76
NE08417	64.33	11	56.55	82.30	68.55	90.24	48.52	39.84
NE08527	64.15	12	50.45	72.05	65.00	94.04	53.80	49.56
NE08449	63.94	13	43.70	77.10	50.50	89.28	58.80	64.24
NE08447	63.88	14	48.85	70.45	70.70	87.76	55.08	50.44
NE08531	63.88	15	39.30	77.45	62.95	92.60	55.80	55.16
NE08459	63.84	16	37.60	91.30	64.80	88.12	45.80	55.44
Overland	63.71	17	41.60	68.15	62.40	95.48	56.44	58.20
NE08470	63.53	18	37.75	74.30	55.15	90.00	56.92	67.08
NE08469	63.50	19	41.05	69.35	49.35	95.48	55.52	70.24
NE08448	63.03	20	47.15	72.05	57.05	85.56	58.12	58.24
Nur. Ave.	54.11		31.01	58.78	49.82	83.12	51.17	50.75

8. Early Generation Nurseries

a. Single-plot Observation Nursery

Sixteen hundred and eighty-one lines were evaluated at Lincoln in 2008. Of the 1681 lines and checks, 1374 where red or mixed red and white seeded (including 85 one gene herbicide and 48 two gene herbicide tolerant lines) and 317 where white seeded. Of this group, 410 were harvested and 360 samples were submitted for Quadrumat Junior milling, flour protein content, and dough mixing properties. As in the past, the turn-around time in the Wheat Quality Laboratory was excellent (all quality evaluations completed by the end of August). The above numbers are fewer than in the past, but we decided to try to make the program more efficient, be more rigorous in our field selections so that there would be fewer, but better lines to harvest and fewer for end-use quality assays. Based on agronomic and quality performance, 272 red and 16 white lines were selected for further testing. In future more white lines will need to be selected; however, they will

continue to be selected on agronomic and quality performance.

b. Headrow Nursery

In 2007-08, 39,600 headrows were planted at Lincoln. In general, the headrow nursery was better than expected considering the conditions at Lincoln. In many cases the headrows were planted with a gentle slope that did not lead to erosion or compaction due to heavy rains. In addition, they tended to be planted after the worst of the hard rains. Rains at harvest did lodge many of the rows and make field selections problematical. We harvested over 1725 lines and planted 1714 (1233 red or segregating red and white; 316 white wheat; 50 lines for wheat streak mosaic virus testing, and 115 herbicide tolerant lines). Of the red and white wheat lines, 362 where sent to Scottsbluff for planting at in our irrigated observation nursery, and 50 lines to Gary Hein to test for wheat steak mosaic virus tolerance.

c. F_3 bulk hybrids

The F_3 bulk hybrid nursery contained 741 red, red and white segregating, or white seeded bulks. All plots were planted at Mead (our main and best winter killing site) and most were planted at Sidney. At Mead there was erosion due to heavy rains at planting and lodging due to heavy rains and some hail during grain filling and harvest. It was difficult to select for bulks with tall plants that should do well in western NE where straw strength is less important. These bulks were most likely lost due to lodging and some hail. In addition, there were 42 bulks with one gene for herbicide tolerance and 68 bulks with two genes for herbicide tolerance planted at Lincoln and sprayed with the herbicide to kill susceptible plants. The number of F_3 bulks is above normal. Over 38,800 head rows were selected for fall planting in 2009. The headrows were planted on time on one large field due to due to having the space in one field. In general, their emergence and stands were very good in the fall. The project goal remains to have sufficiently good segregating F_3 material to select about 40 - 45,000 headrows.

b. F_2 bulk hybrids

The F_2 bulk hybrid nursery contained 770 bulks and check plots that were planted at Mead NE. An additional, 41 F_2 bulks with one gene for herbicide resistance and 44 F_2 bulks with two genes for herbicide resistance were planted at Lincoln for herbicide selection. The bulks generally survived the winter, but some were winterkilled (those involving wintertender parents) and others were severely affected by Fusarium head blight. Finally, severe winds at harvest lead to the combine being "plugged" (the grain feeder pipe was filled with chaff because the wind was stronger than the fan to push the chaff out) which led to greatly reduced grain yields and probably grain mixtures. As in the past, we continue to share our bulks with other programs and receive bulks from other programs. Due to the large number of bulks, about 770 bulks (including 110 herbicide tolerant bulks) were advanced as individual bulks for further consideration in 2008-09 from our program.

9. Winter Triticale Nursery

In 2008, no new triticale lines were recommended for release; however, we selected nine lines for

increase (5 small and 4 large) as possible replacements or to complement NE426GT and NE422T which continue to perform well. Because triticale is a small market crop, we are carefully deciding how best to release new triticale cultivars so as to not cause inventory problems with the previously released cultivars. We are now beginning to move to higher and more consistent grain yield levels, but identifying excellent forage types requires forage harvesting which is expensive and difficult for widespread trials. Though the markets for biofuels fluctuate with the price of oil and other geologically based fuels, we believe that there is a future for triticale in a biobased energy system. Triticale can be grown over the winter as forage or grain crop in areas where maize cannot be grown successfully. The grain will substitute for maize in animal rations and the forage can be used as forage, cellulosic ethanol feed stocks, or as a ground cover. Cooperation with Iowa State University continues to provide excellent efforts in the grain yield evaluation and potentially in the future bioenergy uses of triticale. The forage data for the 2007 triticale variety trial was provided by Dr. Ken Vogel and the USDA-ARS. Again NE426GT and NE422T performed well, but other experimental lines are equal or better to these lines. Jagger, as an early, representative winter wheat variety, does not have the biomass of winter triticale.

The triticale-breeding program received about very little in research and development fees for 2008. Last year we received $6265.09, and in 2007 we received $8,589.20 that is less than the $10,000, which was received in 2004. These funds will be extremely important in developing a sustainable triticale-breeding program. A growing concern is that some producers are saving seed and replanting it on their farms or selling it to others. This practice will hinder the development of new triticale varieties and an ethical seed business. The practice of brown bagging is historically common in triticale and the University needs to protect its intellectual property rights. WE may begin marketing blended triticale cultivars to lessen farmer saved seed. Marketing in nearby states will become increasingly important if triticale emergences as an important alternative small grains crop. The results of the 2008 triticale variety grain and forage trial were:

2008						Lincoln	Lincoln	Sidney	**State**	**State**
			Forage	**Forage**	Variety	Winter	Grain	Grain	**Grain**	**Rank**
VARIETY	Flowering Date	Height	Yield Dry	**Rank**		Survival	Yield	Yield	**Yield**	
	d after May 31	(in)	lbs/a			9=Good	(lbs/a)	(lbs/a)	**(lbs/a)**	
JAGGER	2.00	34.0	4726	**30**	JAGGER	7.9	2087	3762	**2925**	**22**
NE03T416	4.75	39.8	5751	**23**	NE03T416	5.6	2696	4470	**3583**	**4**
NE03T449	6.00	41.3	6684	**6**	NE03T449	6.4	2894	2647	**2771**	**26**
NE422T	5.75	42.0	6506	**9**	NE422T	6	1877	3451	**2664**	**28**
NE426GT	4.00	41.0	6182	**16**	NE426GT	5.1	1998	3113	**2556**	**30**
NT01435	2.75	39.5	5256	**27**	NT01435	7.4	2155	3900	**3028**	**18**
NT01451	5.00	38.3	6196	**15**	NT01451	6.8	2373	3976	**3175**	**12**
NT02421	3.75	42.0	6296	**12**	NT02421	5.7	2413	3694	**3054**	**16**
NT04424	4.25	40.0	6330	**11**	NT04424	5.9	2509	4099	**3304**	**10**
NT04432	3.50	40.3	6795	**3**	NT04432	6.4	2336	4309	**3323**	**8**
NT05421	4.00	45.0	7137	**1**	NT05421	6.3	3011	3618	**3315**	**9**
NT05429	3.00	39.8	5552	**24**	NT05429	6.3	3941	3611	**3776**	**3**
NT05442	4.75	40.0	6179	**18**	NT05442	5	1723	3833	**2778**	**25**
NT05443	4.50	38.8	5844	**22**	NT05443	3.6	2032	3864	**2948**	**21**
NT05444	4.25	41.0	6224	**14**	NT05444	6	1605	3832	**2719**	**27**
NT06422	3.25	42.0	6718	**5**	NT06422	8.3	3599	4255	**3927**	**2**

NT06423	4.00	41.0	6518	**8**	NT06423	5.9	2903	4099	**3501**	**5**
NT06426	3.00	37.8	5436	**25**	NT06426	4.7	2116	3181	**2649**	**29**
NT06427	4.00	41.8	7083	**2**	NT06427	7	2722	4226	**3474**	**6**
NT06429	3.50	40.3	5015	**28**	NT06429	7.8	3176	3023	**3100**	**15**
NT06434	4.00	40.5	5406	**26**	NT06434	4.2	2443	3237	**2840**	**23**
NT07403	2.00	42.0	6753	**4**	NT07403	7.5	3778	4153	**3966**	**1**
NT07410	3.25	40.5	6181	**17**	NT07410	4.5	2026	4326	**3176**	**11**
NT07411	3.50	38.8	4969	**29**	NT07411	5.2	1965	4364	**3165**	**13**
NT07413	4.50	39.5	4577	**31**	NT07413	5	1613	3970	**2792**	**24**
NT07415	2.75	41.0	6088	**19**	NT07415	5.7	2282	3646	**2964**	**20**
NT07427	4.00	41.0	5890	**21**	NT07427	4.9	2419	3656	**3038**	**17**
NT07433	4.00	42.8	6044	**20**	NT07433	5.1	1938	4085	**3012**	**19**
NT07434	3.50	42.5	6270	**13**	NT07434	7.4	2426	4242	**3334**	**7**
NT07438	5.50	40.0	6669	**7**	NT07438	5.3	2123	4146	**3135**	**14**
Pika	8.00	39.5	6406	**10**						
CV	11.80	6.0	13.98		CV	23.44	21.83	12.54		
Grand Mean	4.03	40.4	6054.1		Grand Mean	5.97	2439.3	3826.2		
LSD	0.56	2.8	994.79		LSD	1.91	727.03	655.25		

The colored lines indicate their being released or under increase.

The results of the 2007 triticale variety grain and forage trial were:

2007	Lincoln	Average	Average	Lincoln	Mead	Sidney	State Avg.	State	Mead
	Winter Survival	Heading	Height	Grain Yield	Grain Yield	Grain Yield	Grain Yield	Rank	Forage Yield
Variety	%	Date	in	lbs/a	lbs/a	lbs/a	lbs/a		lbs/a
NE426GT	**100.0**	**20.0**	**42.1**	**4398**	**2765**	**3233**	**3465**	**2**	**9253**
NE422T	**100.0**	**25.5**	**58.1**	**4171**	**1828**	**1899**	**2633**	**25**	**7383**
JAGGER	90.0	16.5	31.3	2995	1594	2465	2351	28	6811
NT01451	100.0	21.0	42.6	4557	1734	3085	3125	11	7743
NT02421	96.7	20.5	44.4	4109	2923	3134	3389	4	7534
NE03T416	96.7	18.5	42.2	4653	2806	3519	3659	1	7263
NT02458	100.0	21.0	44.1	4582	2245	1328	2718	22	7459
NT01435	100.0	21.5	47.2	4040	2413	2489	2981	17	7103
NT02435	86.7	21.0	45.7	4274	2504	2325	3034	15	6277
NE03T449	100.0	26.0	59.8	3669	1579	769	2006	30	7723
NT04432	83.3	21.0	43.9	4598	2118	2410	3042	14	7611
NE03T407	93.3	19.0	43.7	4313	2405	3046	3255	8	7390
NT04424	100.0	20.0	44.4	4299	2276	3507	3361	6	7529
NT05414	100.0	21.5	51.9	3872	1558	2317	2582	27	7395
NT05421	100.0	19.5	49.9	4755	2242	2273	3090	12	8006
NT05429	86.7	18.5	41.3	4464	2062	3291	3272	7	7894
NT05433	80.0	20.5	43.0	4640	2067	3391	3366	5	6790
NT05442	96.7	20.5	40.9	4568	2833	2937	3446	3	8073
NT05443	100.0	21.0	41.8	4416	2731	2429	3192	10	6369
NT05444	96.7	21.0	42.4	3969	2169	3028	3055	13	7720
NT06419	100.0	18.5	42.1	4109	1951	2517	2859	20	5593

NT06422	80.0	18.5	42.6	4584	2212	2300	3032	16	7394
NT06423	90.0	20.5	45.5	4015	1606	2505	2709	23	7656
NT06424	80.0	19.0	43.2	3658	2043	3937	3213	9	7133
NT06425	83.3	19.0	39.0	3654	1914	3018	2862	19	6693
NT06426	66.7	17.5	36.7	3332	1379	3282	2664	24	7845
NT06427	83.3	19.5	40.7	4204	1692	2785	2894	18	7568
NT06429	63.3	18.0	38.6	3174	1635	3022	2610	26	7497
NT06433	80.0	19.0	42.8	3861	2031	2271	2721	21	7085
NT06434	93.3	20.5	44.6	3341	1057	2633	2344	29	8269
Mean	**90.9**	**20.1**	**43.9**	**4109.1**	**2079.1**	**2704.8**	**2964.3**		**7402**
LSD	**21**			**770**	**1516**	**964**			**710**

The results of the 2006 triticale variety grain and forage trial were:

VARIETY	Flowering	Height	Lincoln	Mead	Average	Grain	Dry Forage	IVDMD	Forage
	May	in	lbs/a	lbs/a	lbs/a	Rank	lbs/a	%	Rank
NE426GT	**23.2**	**52.5**	**5665**	**4817**	**5241.0**	**4**	5766	59.8	12
NE422T	**26.8**	**57.8**	**4179**	**3671**	**3925.0**	**29**	5372	65.3	24
JAGGER	19.0	41.9	5006	3412	4209.0	28	4610	55.4	30
NT01451	23.5	52.0	5793	4635	5214.0	6	5826	61.3	8
NT02421	23.0	54.7	5482	4605	5043.5	9	5333	58.9	25
NT02431	22.8	52.4	5028	3774	4401.0	21	5557	60.4	18
NE03T416	21.2	54.0	5830	4818	5324.0	1	5467	58.5	22
NT02458	23.4	50.9	5285	4600	4942.5	13	5744	58.8	13
NT00421	24.2	54.3	5151	3567	4359.0	22	5324	61.9	27
NT01435	24.8	52.9	5099	4350	4724.5	17	6510	61.6	1
NT02435	23.2	56.9	5614	3744	4679.0	18	5796	59.0	10
NE03T449	25.7	60.3	3688	3615	3651.5	30	5671	63.2	14
NT02456	24.5	56.3	4547	3934	4240.5	26	5591	62.9	16
NT04417	23.7	51.4	5027	4793	4910.0	14	5598	61.9	15
NT04432	23.5	50.4	5256	4518	4887.0	15	5917	60.8	5
NE03T407	21.5	55.8	5732	4683	5207.5	7	5888	58.8	6
NT04403	24.0	55.9	4801	3832	4316.5	23	5814	61.5	9
NT04424	22.2	55.0	5693	4304	4998.5	10	5329	60.5	26
NT05414	24.0	58.7	4472	4129	4300.5	25	6150	62.7	3
NT05417	24.7	58.5	4864	3590	4227.0	27	5783	61.4	11
NT05421	22.8	58.2	5028	4113	4570.5	19	6175	62.1	2
NT05425	25.5	58.3	4730	3897	4313.5	24	5383	62.7	23
NT05426	19.3	49.0	5724	4210	4967.0	11	5300	59.0	28
NT05429	20.9	51.9	6072	4489	5280.5	2	5298	59.7	29
NT05433	23.2	51.7	5737	4773	5255.0	3	6133	57.4	4
NT05434	21.9	53.2	5625	4291	4958.0	12	5577	57.2	17
NT05442	24.0	52.4	5631	4562	5096.5	8	5479	60.2	21
NT05443	23.7	52.2	5717	4711	5214.0	5	5552	61.1	19
NT05444	23.5	49.9	5292	4249	4770.5	16	5853	58.6	7
NT05448	25.0	58.3	4771	4068	4419.5	20	5523	63.5	20

GRAND MEAN	**5217.97**	**4225.13**	**4721.55**	**5643.91**	**60.54**
CV	8.63	9.74		8.0	3.629
LSD	614.91	561.85		528.7	2.583

The three year grain and forage data summary for locations where we were able to harvest trials is presented below:

		Linc	Mead	Sidney	State Ave	Region Ave.		Mead	
		Grain	Grain	Grain	Grain	Grain		Forage	
		Yield	Yield	Yield	Yield	Yield	**Grain**	Yield	**Forage**
		lbs/a	lbs/a	lbs/a	lbs/a	lbs/a	**Rank**	lbs/a	**Rank**
2006-8	JAGGER	3363	2503	3114	3162	2993	**13**	5382	**15**
2006-8	NE03T416	4393	3812	3995	4189	4067	**1**	6160	**13**
2006-8	NE03T449	3417	2597	1708	2809	2574	**15**	6692	**4**
2006-8	NE422T	3409	2750	2675	3074	2945	**14**	6420	**8**
2006-8	NE426GT	4020	3791	3173	3754	3661	**6**	7067	**2**
2006-8	NT01435	3765	3382	3195	3578	3447	**11**	6290	**11**
2006-8	NT01451	4241	3185	3531	3838	3652	**7**	6588	**6**
2006-8	NT02421	4001	3764	3414	3829	3726	**4**	6388	**10**
2006-8	NT04424	4167	3290	3803	3888	3753	**3**	6396	**9**
2006-8	NT04432	4063	3318	3360	3751	3580	**9**	6774	**3**
2006-8	NT05421	4265	3178	2946	3658	3463	**10**	7106	**1**
2006-8	NT05429	4826	3276	3451	4110	3851	**2**	6248	**12**
2006-8	NT05442	3974	3698	3385	3774	3686	**5**	6577	**7**
2006-8	NT05443	4055	3721	3147	3785	3641	**8**	5922	**14**
2006-8	NT05444	3622	3209	3430	3515	3420	**12**	6599	**5**

It is clear that it will be difficult to find better forage cultivars than NE426GT which has excellent grain yield and forage potential (at least in eastern NE).

10. Wheat Transformation and Tissue Culture Studies

Wheat transformation continues to be a key strategic effort in the wheat improvement overall effort. It is a technology that is too important not to be included in the breeders' tool kit, especially for adding genetic variation. Mr. Neway Mengistu, a graduate student on the project, is genetically characterizing and evaluating some lines with possible Fusarium head blight (FHB) resistance genes in collaboration with Dr. T. Clemente and Ms. S. Sato of the Transformation Core facility (they do our wheat transformation), Dr. S. Wegulo and Ms. J. Counsell of the Department of Plant Pathology (they do the screening of conventionally bred and transgenic wheat lines with FHB). In addition, Dr. Clemente is adding some new transgenes with novel sweetener and fiber characteristics that may enhance end-use quality as a potential value added trait.

11. Chromosome Substitution Lines

This research was undertaken with the expectation as we learn more about the wheat genome; we would be

able to develop better breeding strategies. It is done in collaboration with Drs. Kent Eskridge, Kulvinder Gill (now the Vogel Chair at Washington State University), and Ismail Dweikat. In 2005, 2006, and 2007, we evaluated 230 recombinant inbred chromosome lines in a Cheyenne background for chromosome 3A (CNN(RICL3A)) in a four-replicated trial in three environments (Lincoln, Mead, and Sidney). Unfortunately, Sidney, 2006 was lost to hail. Currently we have six good trials (Mead, 2005, 2006, and 2007; Sidney, 2005; Lincoln, 2006, North Platte, 2007). Dr. Md. Liakat Ali is currently summarizing this research. We continue testing in replicated trials recombinant chromosome lines involving both chromosomes 3A and 6A in a Cheyenne background (CNN(RICL3A+6A)) to study epistasis (lead by Mr. Ali Bakhsh, a new student in our project). We planted and harvested in replicated trials at Lincoln, Mead, and North Platte, 90 WI(RICL3A)s to compare to our CNN(RICL3A)s and CNN(RICL3A+6A)s. Mr. Neway Mengistu is leading the WI(RICL3A)s research as part of his Ph.D. dissertation. The trial at North Platte was excellent, but the trials at Lincoln and Mead were hurt as described before. Preliminary results suggest that the yield reducing QTL from CNN in the WI background maps to the same location and the yield increasing QTL from WI mapped in the CNN background. Dr. Mujeeb Kazi created these lines for us using doubled haploid techniques and we are very appreciative of his efforts. We will continue our large field tests to identify where the genes affecting agronomic performance are found on chromosome 3A.

12. White Wheat

Dr. Bob Graybosch, USDA-ARS and I continue our orderly transfer of white wheat germplasm to the state wheat breeding. The cooperation has been excellent and the goal will be to continue the University of Nebraska wheat improvement effort, while building a unified cultivar release program. Nuplains, Antelope, Arrowsmith, and Anton (a niche wheat variety) have been release and are available to growers. The first white wheat developed from this program was entered into the Nebraska State Variety Trials in 2005. However the line did not have sufficient end-use quality or agronomic performance to continue its testing. Additional lines are currently being tested. The progress on this front has been slower than we would like. However approximately one fifth of the new early generation lines are white which indicates that we are building a foundation. Interestingly many of our colleagues seem to be losing interest in or patience in white wheat, which means that we may have the possibility of creating a value added new market with less competition. We continue to screen all of the lines advanced in 2005 for low polyphenol oxidase, an enzyme that is believed to discolor wet noodles and other wheat products, such as frozen dough products.

To enhance the percentage of lines that may have low PPO, Ms. Laura Teihen, an undergraduate student supported by a UCARE (undergraduate creative activities and research experience) scholarship, has developing a system where we can determine on a single kernel basis the PPO level. The selected low PPO seed is vernalized and we have transplanted many of the selected seed in greenhouse to determine if this selection practice will allow us to select for low PPO plants. We will need to confirm this system, but it seems to work best with field-grown seed. The idea will be to select for low PPO seeds in F_2 or F_3 populations to enrich the subsequent generations for low PPO.

The results were as follows:

	Total			Low PPO
Nursery	Number of	Low PPO	Higher PPO	Percent of Lines
2009	Lines	Lines	Lines	
NIN	60	0	34	0%
Triplicate	60	3	43	7%
Duplicate	300	32	212	13%

Irrigated-Dry	40	5	35	13%
S4R8	1714	184	1348	12%
Triticale Variety	30	11	19	37%

* Low PPO is scored on a 0-5 scale with 0 having no discoloration and 5 being virtually black in the assay. Lines with scores of 3 or below were considered as being low PPO for this summary. Some lines were not scored and not included in this table.

13. Collaborative Research on Wheat Diseases

Dr. Stephen Wegulo, Department of Plant Pathology, and their staff continue to inoculate our experimental lines with wheat stem rust and Fusarium head blight (FHB, research funded by the U.S. What and Barley Scab Initiative), and as time permits with wheat leaf rust. We continue to improve the greenhouse tests for stem rust, as we seem to be using a slightly more virulent race of the disease than in the past. The major event in stem rust research is the emergence of a new race Ug99 (Ug 99---for its being first found in Uganda in 1999) that can overcome some of the previously very durable resistance genes in wheat which were the main genes used in our program, hence this is a huge potential loss for our breeding efforts. In addition, *Sr36* (found in Vista and possibly the new Colorado line Ripper), and Sr_{amigo} (associated with Amigo derived lines) were genes that we were rapidly incorporating as they were effective until this 2008. It appears that *Sr2* (found in Scout 66 but is associated with false or pseudo black chaff), is one of the few commonly used genes available. We are rapidly incorporating new stem rust genes (*Sr25* and *Sr26*), but the rapid loss of so many resistance genes in unprecedented in my lifetime. Interestingly Sr_{Tmp}, which is found in many of our lines, including NE01643 is resistant to Ug99, but not to some of the races found in the United States. Much of the world is very concerned about Ug99 because it has moved from Africa to the Arabian Peninsula and recently to Iran as was expected. Virtually all of the wheat varieties in this area are susceptible and the consequences would be dire for small, barely self-sufficient farmers. Mr. Javed Sidiqi, a Fulbright scholar from Afghanistan, screened 505 lines from Central Asia (430 from Afghanistan, 25 from Pakistan, 25 from Iran, 25 from Tajikistan) and only 2 modern lines from Afghanistan were resistant to stem rust race TPMK (a surrogate race that is present in the U.S.). We do not use race Ug99 because it might escape our testing confines, a risk that is too great to try. Working with Dr. Yue Jin, the four most resistant lines were screened to Ug99 in his carefully confined testing facility and all were found to be susceptible to Ug99. This result confirms the extreme vulnerability of the Central Asian wheat crop to this new race.

Work continues on introgressing the resistance from *Agropyron* (the first real resistance/tolerance to wheat streak mosaic virus developed by Dr. Joe Martin, Kansas State University at Hays, Kansas and his co-workers) into adapted wheat varieties. A number of lines that may have this source of resistance were given to Gary Hein who is testing them in the field in Scottsbluff, NE. The frequency of lines carrying virus resistance remains lower than expected and it is our hope that molecular marker will be used to enrich our populations and enhance our frequency of elite lines with resistance.

Molecular markers are becoming an important aspect of our research on developing Fusarium head blight (FHB, syn. scab) resistant lines. Working with FHB is hard because the disease assay must be done when the plants are at flowering (hence it is a very long assay) and it is very environmentally sensitive. Hence, anything that can be done to select for plants in the seedling stages (as molecular markers would allow you to do) is very important. This year we began screening all three way cross F1 seed to identify those carrying FHB QTLs so as to enhance the frequency of the QTLs in our populations. In the F2 and possibly F3 bulk generations, we are using optical sorting to enrich the populations for kernel hardness (remove the soft kernel genotypes). Currently experiments to determine the efficacy of optical sorting for hardness and protein content are underway with Dr. Floyd Dowell of the USDA-ARS, Manhattan, KS. In

this approach, minimally we should create populations that are fixed for the 3BS QTL (*Fhb1*), enriched for other FHB QTLs, and selected for hardness prior to visual selection for plant type. Mr. Neway Mengistu (who received a partial scholarship from Pioneer HiBred International) coordinates our FHB breeding research. The scab research is supported by a grand from the USDA-National Wheat and Barley Scab Initiative program, which also funds part of Mr. Mengistu's research.

14. Plant Height and Diversity in Wheat

Mr. Zakaria Aj-Ajlouni worked with Dr. Guihua Bai (USDA-ARS, Genotyping Center) and Dr. Dweikat to determine the frequency or semi-dwarfing genes in our breeding lines. We are interested in knowing if Rht_1 or Rht_2 may have better height characteristics in our tall and short plant height environments. Rht are "reduced height" genes that are the basis of the Green Revolution. Virtually all of our lines have the Rht_1 gene and only two lines may have had Rht_2. The most surprising result was that while many of lines have markers associated major dwarfing genes, the gene effects were missing (hence the markers were not diagnostic of the gene in our populations). None was more surprising than Cheyenne having the marker for Rht8, a gibberellic sensitive dwarfing gene. However, even Norin 10, which had had the Rht_1 and Rht_2 alleles, had the marker for Rht_8 but did not have the Rht_8 gene. Basically, in our germplasm, the Rht_8 marker is not linked to the Rht_8 gene. There are many different responses to the environment for lines with Rht_1, which we believe, can best be explained by unknown modifier genes in the background that affect of Rht_1.

15. Coordinated Agriculture Project: Applied Wheat Genomics

As part of a large multistate project, we are genotyping and phenotyping a mapping population of 154 F6-derived recombinant inbred lines (RILs) of TAM 107-R7 x Arlin in collaboration with Pat Byrne and Scott Haley of Colorado State University. We have submitted our final marker data set in June 2008. The data set includes 436 markers, a mixture of SSR, DArT, HMW and LMW glutenins, and morphological markers, totaling 67,144 data points. Our linkage map is complete and was submitted to the CAP database in the fall of 2008. The linkage map covers approximately 2120 cM, with a density of 6.44 cM/marker. The population has been submitted into the National Small Grains Collection with the accession numbers in GRIN: GSTR 11601 – 11756 and is available upon request. We harvested our first field trails in 2008 and have repeated the field experiments in 2008-2009, which includes two sites in Texas. The population is under evaluation for over 15 traits for agronomic and end-use quality QTL. Nick also identified a strong QTL providing resistance to SBWMV in the parent TAM 107-R7. The resistance QTL is currently being investigated in the lab and this coming year in a second nursery, that was planted early, in hopes of achieving a second year infection. Top RILs identified by Nick for yield and resistance to SBWMV were selected for crossing in our winter greenhouse. Backcross populations have also been developed to further dissect, define, and incorporate the QTL for SBWMV resistance in a current grant proposal for the Wheat CAP II. Additionally, ten RILs were selected and placed in the RPN for 2009. Mr. Nick Crowley, formerly working on his M.S. changed his degree emphasis to his Ph.D., which reflects the scope of his research and his maturity. This research is supported by a grand from the USDA-CSREES-NRI (Proj. No. 2006-55606-16629) competitive grants program.

16. Genetic Diversity in Turkish and Nebraska Cultivars

Ms. Anyamanee Auvuchanon (who is supported by a scholarship from the government of Thailand) is studying the relationship between U.S. and Turkish wheat lines. In her study, she is evaluating 23 U.S. Great

Plains wheat and 22 Turkish wheat lines (sent to us by a former visiting scientist, Dr. Sahin Dere who tragically died this year in a car accident). In 1874, Turkey red winter wheat was brought to the Great Plains and became the most widely grown wheat in the United States. Since then the Turkish and U.S. breeding programs have interacted, but often used different germplasm. This study suggests that modern Great Plains wheat cultivars diverged from Turkish wheat cultivars by breeding for adaptation since only historic Great Plains wheat cultivars had a close relationship with Turkish wheat cultivars using the various clustering programs to determine similarity. For Great Plains wheat improvement, it may be possible to use those Turkish wheat cultivars that have agronomic merit and are most closely related to the Great Plains wheat cultivars as parents to add new alleles without adding so much genetic diversity as to make it hard to find the useful alleles.

17. Genetics of White Flour and Noodle Color in Wheat

In a collaborative study with Dr. Bob Graybosch, Ms. Somrudee Onto is studying the genetics of white flour and noodle color. This research is important because white flour and noodle color is an important end-use quality criteria in our export markets and may give us a competitive edge in frozen dough products that may discolor over time in the processing and storage.

18. Organic Wheat Breeding

Wheat breeding research for organic systems was initiated in 2008 through a USDA/CSEERS grant on certified organic land at four Nebraska research stations. An additional component of this project is to develop production systems utilizing cover crops and winter wheat in organic systems.

Testing in organic environments at UNL begins at the F6 generation with unreplicated yield trials. The F6 nursery plus F7 (early replicated yield trial) and F8-F12 (Nebraska interstate Nursery—NIN) nurseries are grown on organic land at only two locations, Mead and Sidney. The F10-F12 (Organic State Variety Trial) nursery is grown at four locations of which three also have conventional State Variety Trials for comparison: Mead, Clay Center, and Sidney. Concord (Haskell) has only an organic variety trial.

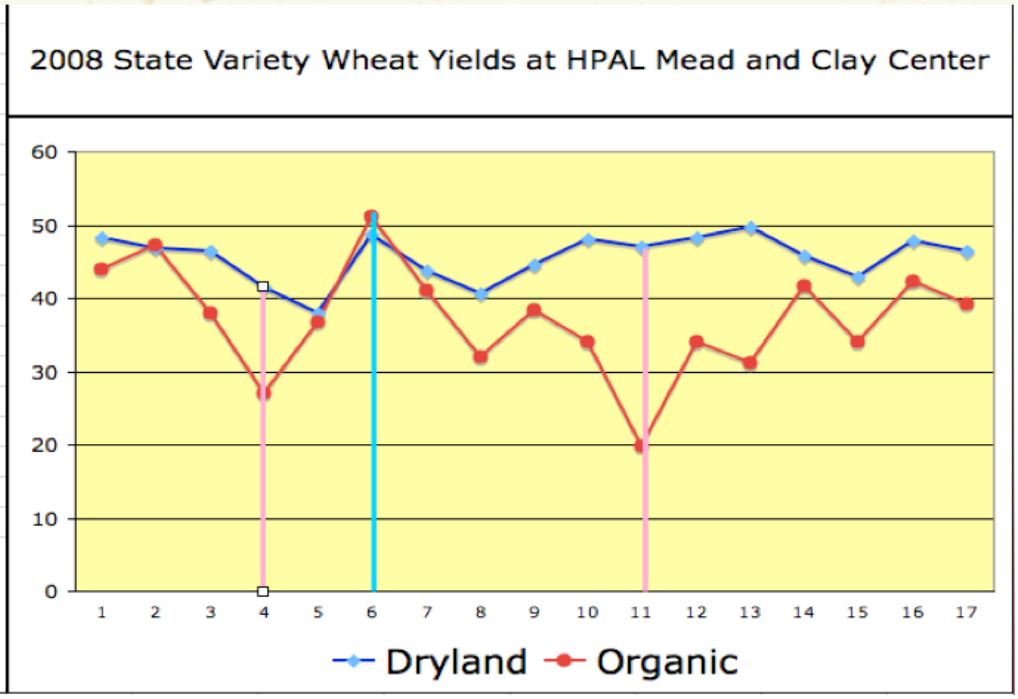
Based on discussions with organic small grains producers, an initial list of ideal winter wheat cultivar traits was used as the basis for screening in 2008: 1.) competitive grain yield; 2.) excellent end use quality; 3.) the ability to extract soil nutrients; 4.) excellent disease and insect resistance; and 5.) the ability to provide early season ground cover to suppress or tolerate weeds.

a. Yield

Many yield rank changes were expressed between organic and conventional lines in the NIN trials. This is important, because the NIN was not plagued by inconsistent results as in the variety trials at Sidney. Ironically, the line that did best in our elite trial grown in organic conditions was NH03614 (released as Settler CL), an herbicide-resistant wheat that is unlikely to be used in organic production.

Three-location yield rank differences

		Dryland	Organic
1	2137	48	44
2	MILLENNIUM	47	47
3	WESLEY	46	38
4	2145	41	27
5	ANTON	38	37
6	OVERLAND	49	51
7	NE01481	44	41
8	MACE	41	32
9	CAMELOT	45	38
10	NE02584	48	34
11	NI04421	47	20
12	NI04420	48	34
13	NX04Y2107	50	31
14	NE03490	46	42
15	NW03681	43	34
16	NE04424	48	42
17	NE04490	46	39



For the three locations with both organic and conventional plots, '2145' and NI04421 (most likely due to its being very susceptible to common bunt (syn. stinking smut) yielded much lower in organic plots than in conventional plots, while Overland was consistently high in both systems. This change of ranks is reflected in a highly significant system by entry interaction ($P < .0001$).

Sidney had little rain, justifying keeping its data separate from the other locations that had ample moisture. The Organic State variety trial in Sidney had inconsistent yields. The only significant difference, even though the yield range was 19 bushels per acre, was between Hatcher (51 bu/acre) and Wesley (32 bu/acre). In comparison, Wesley in the conventional environment yielded better than the average. Two other lines showed dramatic yield rank changes, with NI04421 being low in the organic environment and high in the conventional environment. The opposite is true for Pronghorn. In 2006, yields were also inconsistent, resulting in a lack of significant differences. Therefore the best data we have is from 2007. Trends for 2007 showed similar yield ranks for organic and conventional environments. This lack of difference in ranks is reflected in an insignificant system by entry interaction ($P = .5102$). Hatcher and Overland were the most stable varieties for yield and highest in adjusted rank for 2006 - 2008.

Organic Wheat Variety Trials--Yield Results

Western Nebraska -- Yield Ranks are opposite of Eastern Nebraska

Cultivar	Adjusted Rank for Yield*	2006 Averages					2007 Averages					2008 Averages				
		Grain Yield bu/a	Yield rank	Bushel Weight lb/bu	Grain Protein percent	Plant Height inches	Grain Yield bu/a	Yield rank	Bushel Weight lb/bu	Grain Protein percent	Plant Height inches	Grain Yield bu/a	Yield rank	Bushel Weight lb/bu	Grain Protein percent	Plant Height inches
HATCHER	1	52	5	54	10	27	73	2	57	11	36	51	1	61	11	19
NI04420	2						71	4	59	12	36	48	5	61	12	19
OVERLAND	2	53	3	56	11	30	69	5	60	12	37	47	9	60	12	21
ALICE (W)	4						72	3	60	12	34	44	12	61	13	17
CAMELOT	4	53	3	54	12	30	65	7	57	12	40	42	18	61	12	20
NE02584	6	46	16	56	12	29	74	1	62	12	34	40	22	62	12	18
MILLENNIUM	6	50	7	56	11	30	65	9	60	12	39	48	5	61	12	20
WAHOO	6	54	1	54	10	29	64	12	56	12	37	50	2	60	12	19
ANTELOPE (W)	9	52	6	54	10	28	64	10	58	12	34	43	14	61	12	20
HARRY	10	50	8	49	11	29	64	11	54	12	36	49	3	60	11	20
PRONGHORN	11	53	2	56	12	34	59	19	60	12	43	48	7	61	12	20
WESLEY	12	48	14	53	11	27	65	8	57	12	33	32	29	60	12	21
NI04421	13						66	6	56	12	36	36	28	59	11	21
DARRELL	14						60	15	59	13	37	46	11	61	12	19
2137	15	50	9	53	11	28	62	14	57	12	34	39	25	61	12	18
ALLIANCE	15	49	11	54	11	30	58	20	56	12	37	46	10	61	12	20
ARROWSMITH (W)	17	49	12	54	12	31	60	17	60	13	38	43	14	61	12	20
MACE	18	48	13	53	12	28	59	18	57	13	35	41	19	60	11	17
ANTON (W)	18	42	17	53	12	27	60	16	60	13	33	38	27	62	12	17
GOODSTREAK	20	46	15	55	12	32	55	21	59	13	43	49	4	61	12	21
BUCKSKIN	21	50	9	56	11	33	52	22	59	13	43	40	23	61	12	18
NE03490	∫											47	8	60	11	18
NE04424	∫											43	13	62	12	20
NE01481	∫											43	16	60	12	20
NW03681	∫											43	16	61	12	19
NX04Y2107	∫											41	20	61	12	20
NE04490	∫											41	21	61	12	20
2145	∫											39	24	61	12	20
NE99495	∫											38	26	61	12	21
Mean		50		54	29	11	63		58	37	12	43		61	12	19
C.V.*		15		3	8	9	8		2	3	7	30		1	8	12
LSD (P=.05)†		18	(NS)	2	4	3	7		2	3	1	20	(NS)	1	1	2

* Ranks are adjusted to give more weight to data that is most consistent among replications (with lower coefficients of variation or 'C.V.'), and with significant differences among entries, thus giving more weight to 2007 data and to combined analyses over years.

∫ One year data from 2008 with non-significant differences does not justify ranking of these entries.

In the three eastern locations, the long cool early summer seemed to favor tall varieties including Goodstreak and Pronghorn. Goodstreak consistently out-yielded all other cultivars at all three locations.

Darrell was the most consistent in yield rank next to Goodstreak and performed the best for canopy cover (light bar readings) at jointing stage across locations. One new line with an excellent yield record in eastern Nebraska, NE01481, that also has great baking quality (yet poor milling quality) and very good disease resistance (including soilborne mosaic virus resistance--rare in our releases), is being increased for conventional and organic production.

Organic Wheat Variety Trials--Yield Results

Eastern Nebraska

Highlighted varieties are tall

	Three Location Averages		Mead			Clay Center			Dixon County	
	Organic		Conv.	Organic		Conv.	Organic		Organic	
Cultivar	Grain Yield bu/a	Yield Rank Sum	Grain Yield bu/a		Yield Rank	Grain Yield bu/a		Yield Rank	Grain Yield bu/a	Yield Rank
GOODSTREAK	59	3		58	1		48	1	71	1
DARRELL	50	16		53	4		34	7	68	5
NE03490	51	18	27	52	7	53	30	9	71	2
OVERLAND	53	18	29	52	5	61	36	4	66	9
PRONGHORN	53	20		51	10		41	2	67	8
HARRY	50	26		51	9		28	10	68	7
NE99495	46	26		52	6		26	14	68	6
ALLIANCE	47	29		52	7		35	6	62	16
BUCKSKIN	47	33		43	25		35	5	69	3
MILLENNIUM	50	35	23	48	18	59	37	3	62	14
NE01481	47	35	23	50	11	53	26	12	63	12
CAMELOT	45	37	25	54	3	48	16	24	65	10
WAHOO	45	38	22	49	16	49	23	18	68	4
ALICE (W)	43	40		49	14		26	13	63	13
NE04424	44	40	26	55	2	60	21	20	60	18
2137	50	44	25	49	15	60	31	8	59	21
WESLEY	44	47	24	48	19	55	23	17	64	11
ARROWSMITH (W)	45	49		49	17		25	15	61	17
ANTELOPE (W)	42	51		50	11		25	16	55	24
NW03681 (W)	43	53	22	44	24	57	28	11	60	18
NE04490	41	54	26	50	13	57	15	26	62	15
ANTON (W)	42	65	20	46	21	44	19	22	58	22
NE02584	39	67	28	45	22	59	15	25	59	20
MACE	40	68	26	41	26	44	22	19	57	23
NX04Y2107	38	71	23	46	20	66	15	26	53	25
NI04420	41	72	28	45	22	57	19	21	51	29
HATCHER	39	76		39	27		18	23	52	26
2145	30	84	22	34	28	58	2	28	51	28
NI04421	23	85	28	15	29	50	2	29	51	27
Mean	44			47			25		62	
C.V.	17			12			29		15	
LSD (.05)	6			8			12		13	

b. Quality

Good USDA/ARS milling, mixing and baking ratings from previous years were supported in 2008 for Pronghorn, Wesley, Alice and Millennium. Poor USDA milling of Antelope was repeated in the 2008 UNL tests. The promising USDA milling and baking quality for three experimental lines (NW03681, NE04424 and NE04490) was supported. High protein content was responsible for all good mixing and baking lines, except for NE04490. NE04490 baked well and Hatcher, Harry, Alliance and NE03490 had acceptable baking quality in 2008 despite low protein, which indicates good protein quality.

IV. GREENHOUSE RESEARCH

In 2008, the majority of F_1 wheat populations were grown at Yuma, AZ. Only populations needing additional crosses are being grown in the Lincoln Greenhouses. This change reduced our greenhouse space and greenhouse labor, and provided much greater quantities of F_2 seed. We made 91 triticale crosses, 94 barley crosses and 955 Wheat crosses in last year's winter greenhouse. In addition, we made 45 synthetic wheat x Goodstreak crosses and 70 wheat crosses in the fall greenhouse.

V. PROPRIETARY RESEARCH

With the advent of plant biotechnology, the necessity and desirability of interacting with commercial companies has increased. We continue to breed herbicide tolerant wheat with one company as can be seen by the release of Infinity CL and Settler CL wheat (formerly NH03614), and the development of two-gene Clearfield wheat lines. Historically, the University of Nebraska has been reticent to enforce aggressively its intellectual property rights under the Plant Variety Protection Act, but this will have to change. Non-enforcement or weak enforcement will jeopardize all future collaborations with companies who have the reasonable expectation that their intellectual property will be handled in accordance to the material transfer agreements, the law, and in an ethical manner.

We received our seventh year of research and development fees from an agreement with Paramount Seed Farms (a commercial seed company) for the exclusive release of our winter barley germplasm. They continue to build a viable market for our germplasm and we are fortunate that they took the initial risk of building a market when no one else was interested. Barley performed well in 2008 and with the interest in feed grains due to the ethanol market, Paramount did an excellent job of marketing our barley lines for 2007-2008. Unfortunately drought and weather related damage affect seed production for 2008 sales. We are increasing a number of barley lines for further testing and as possible new products. The 2008 Barley Variety Trial data are:

The 2008 Barley Variety Trial was:

	Lincoln				Sydney	Colby			State Average	
VARIETY	Anthesis	Plant height	Grain yield	Winter survival	Grain yield	Anthesis	Grain yield	Test weight	Grain yield	Rank
	(after May)	cm	lbs/a	%	lbs/a	(after May)	lbs/a	lbs/bu	Lbs/a	
P-713	23	33	2569	83	4463	23	2939	47	3323	17
P-721	24	33	2485	80	4631	24	2628	48	3248	18
P-954	24	31	3114	81	4541	24	2756	49	3470	11
TAMBAR 501	20	33	2780	79	3641	23	2114	44	2845	29
NB018187	22	33	2830	80	4647	23	2955	49	3477	10
NB018199	25	34	3186	85	4937	27	3397	47	3840	3

NB03437	25	33	2595	73	4846	24	2893	49	3445	13
NB99845	22	32	2824	75	4685	23	2885	47	3465	12
NB99875	24	32	3040	76	4546	22	2968	49	3518	8
NB03429	24	30	3344	73	4968	23	2723	50	3678	7
NB05419	20	34	3833	81	5022	21	2651	49	3835	4
NB05420	20	32	3708	88	4151	22	2443	46	3434	15
NB06419	20	32	2595	81	3906	23	2569	48	3023	26
NB06403	24	32	2516	73	4297	25	2424	43	3079	24
NB06410	23	32	2807	79	4040	22	2552	49	3133	22
NB06417	20	33	3273	86	3815	20	2622	46	3236	19
NB06425	21	33	2201	75	3792	22	2114	48	2703	30
NB06432	21	33	2609	70	3976	24	2074	48	2886	28
NB06444	21	30	2997	75	3848	22	2609	48	3151	21
NB07404	24	33	2246	76	3828	24	3058	44	3044	25
NB07405	23	32	2189	83	4444	22	2729	47	3121	23
NB07407	21	33	3170	91	5132	22	2905	51	3736	6
NB07410	22	34	3840	84	4835	21	3200	51	3958	2
NB07411	27	33	3362	86	5379	24	3315	47	4019	1
NB07412	24	33	3419	80	4910	23	3172	48	3834	5
NB07416	22	33	3622	85	4173	23	2508	50	3434	14
NB07420	20	31	3438	75	3778	22	2306	47	3174	20
NB07426	22	25	2627	58	4541	26	1705	47	2958	27
NB07442	23	35	2912	78	4500	23	2566	48	3326	16
NB07443	20	32	4010	94	4046	20	2427	47	3494	9
Mean	22	32	3005	79	4411	23	2674	48		
CV	4.29	4.14	22.91	15.08	13.12	5.19	14.81	5.02		
LSD	0.95	1.33	688.39	11.96	578.82	1.18	395.88	2.39		

Color shaded lines are under increase for possible release.

The 2007 data for the Barley Variety Trial were:

	Anthesis		Colby	Colby	Colby	Colby	Lincoln	Lin. Winter	Mead	Sidney	Average	
VARIETY	Date	Height	Lodging	Yield	Moisture	Test Wt.	Yield	Survival	Yield	Yield	Yield	
	in May	in	%	lbs/a	%	lbs/bu	lbs/a	%	lbs/a	lbs/a	Lbs/a	
NB99845	16.3	28.3	7.50	5836.3	14.00	46.50	4378.5	91.3	3010.5	2178.0	**3850.8**	**2**
NB018199	18.9	29.8	17.50	4890.7	13.25	46.75	4084.5	96.3	3108.0	2356.0	**3609.8**	**9**
NB99874	20.8	27.9	26.25	4488.5	13.25	46.25	3639.8	53.8	2955.0	2267.0	**3337.6**	**16**
NB99875	17.3	29.1	11.25	4654.6	13.25	48.00	4373.3	97.5	3133.5	1704.0	**3466.4**	**14**
NB04427	17.4	29.1	10.00	5007.8	13.00	48.25	3971.3	67.5	2620.5	2781.0	**3595.2**	**10**
NB018131	16.5	27.3	18.75	4774.1	13.50	48.75	3615.0	77.5	2238.0	1435.0	**3015.5**	**33**
NB018187	17.7	27.6	8.75	4871.0	13.00	48.75	4361.3	93.8	3156.0	2741.0	**3782.3**	**5**
NB03439	18.4	27.7	15.00	4390.1	13.00	50.25	2835.0	46.3	2851.5	2183.0	**3064.9**	**31**
NB04436	17.9	28.2	17.50	4595.0	13.00	49.00	3291.0	100.0	2428.5	2227.0	**3135.4**	**26**
P-713	**17.5**	**26.9**	**16.25**	**5413.9**	**12.00**	**46.50**	**3457.5**	**66.3**	**2839.5**	**2646.0**	**3589.2**	**11**
NB03440	17.6	28.5	15.00	4140.5	13.00	48.50	4101.8	85.0	2484.0	2596.0	**3330.6**	**17**
NB04418	17.9	29.1	32.50	4217.3	12.00	47.75	2478.8	26.3	2092.5	1450.0	**2559.7**	**38**
NB04428	17.6	28.6	6.25	4730.9	11.75	44.50	3227.3	70.0	2754.0	2358.0	**3267.6**	**21**
NB018163	17.2	26.5	11.25	4589.3	12.25	49.00	4020.8	95.0	2622.0	1918.0	**3287.5**	**20**
NB03402	16.5	29.1	12.50	5313.6	12.50	48.75	3918.0	90.0	2899.5	678.0	**3202.3**	**24**
NB03437	17.8	26.8	7.50	5720.6	12.75	49.25	5211.8	98.8	2755.5	2526.0	**4053.5**	**1**
NB03429	17.4	27.0	18.75	5113.0	12.50	49.00	4410.0	97.5	3235.5	2260.0	**3754.6**	**7**
TAMBAR 501	16.6	25.7	13.75	5369.3	11.75	45.75	2592.0	46.3	1515.0	1782.0	**2814.6**	**36**
NB05417	17.3	26.9	23.75	4799.5	11.75	45.00	1256.3	21.3	1375.5	1717.0	**2287.1**	**40**
P-954	**17.6**	**25.5**	**10.00**	**5156.2**	**12.25**	**48.00**	**4412.3**	**83.8**	**3526.5**	**2070.0**	**3791.3**	**4**
NB05420	16.4	27.1	5.00	6236.2	11.50	47.00	2176.5	21.3	2920.5	1935.0	**3317.1**	**19**
NB05418	17.3	25.8	26.25	4722.2	12.00	46.25	999.8	13.8	2254.5	1611.0	**2396.9**	**39**
NB05419	17.8	26.1	17.50	5858.4	12.00	47.50	2296.0	36.8	1884.0	1542.0	**2895.1**	**35**
NB05410	16.5	25.3	8.75	5446.1	12.00	47.00	3855.0	77.5	2661.0	1318.0	**3320.0**	**18**
NB06403	17.4	25.4	6.25	6260.2	12.00	47.75	3225.0	42.5	2842.5	1676.0	**3500.9**	**13**
NB06410	17.7	26.8	6.25	6141.6	12.75	49.50	2045.0	22.8	2320.5	1821.0	**3082.0**	**28**
NB06411	17.4	28.8	72.50	5118.7	13.00	48.00	1963.5	43.8	2671.5	2060.0	**2953.4**	**34**
NB06414	16.9	27.6	23.75	5191.7	12.00	46.50	1070.0	11.3	1716.0	2523.0	**2625.2**	**37**
NB06417	16.6	26.2	13.75	5919.4	11.75	45.25	2382.0	23.0	2695.5	1776.0	**3193.2**	**25**
P-721	**17.1**	**22.9**	**11.25**	**5287.2**	**12.50**	**47.50**	**4449.0**	**87.5**	**2892.0**	**2606.0**	**3808.6**	**3**
NB06419	16.0	30.0	12.50	5275.7	12.25	45.75	2479.5	52.5	2490.0	2112.0	**3089.3**	**27**
NB06420	16.4	26.9	15.00	5492.6	12.50	48.50	2734.5	62.5	2557.5	1532.0	**3079.2**	**29**
NB06423	16.7	27.3	11.25	5310.7	12.25	45.00	2940.8	60.0	3105.0	2490.0	**3461.6**	**15**
NB06425	17.0	28.6	8.75	5906.9	12.25	47.75	3655.5	48.8	3805.5	1759.0	**3781.7**	**6**
NB06426	19.2	27.4	12.50	5198.9	13.25	49.00	3102.0	50.0	2583.0	2182.0	**3266.5**	**22**
NB06427	17.4	25.2	11.25	5425.9	13.00	49.50	2214.8	32.5	2439.0	2210.0	**3072.4**	**30**
NB06432	16.4	28.3	7.50	5842.1	12.00	46.50	1430.0	10.0	3460.5	2282.0	**3253.7**	**23**
NB06435	17.6	27.8	13.75	5353.0	12.75	48.25	1949.3	28.8	2839.5	2014.0	**3039.0**	**32**
NB06437	16.7	25.4	13.75	5604.0	12.75	48.50	3734.3	50.0	2884.5	1964.0	**3546.7**	**12**
NB06444	14.9	25.4	3.75	6587.0	13.00	48.00	2812.5	45.0	3600.0	2007.0	**3751.6**	**8**
Mean	**17.3**	**27.3**	**15.0**	**5256.3**	**12.5**	**47.6**	**3128.8**	**58.1**	**2705.6**	**2032.3**	**3280.7**	
CV			62.62	11.3	6.03	2.03	20.4	32.7	22.1	27.0		

LSD			8.58	542.6	0.69	0.88	581.4	17.3	780.5	578.2	
REPS			4.00	4.0	4.00	4.00	4.0	4.0	2.0	3.0	

The 2006 data for the Barley Variety Trial were:

VARIETY	Heading Date May	Height (in)	Colby Yield lbs/a	Colby Moist. %	Colby Test Wt lbs/bu	Linc. Yield lbs/a	Mead Yield lbs/a)	**Average Yield Lbs/a**	Rank
NB99845	11.3	32.4	3728	10.0	44.0	4795	4349	**4290**	25
NB018199	13.8	35.0	3350	10.3	43.5	4874	5262	**4495**	8
NB99874	18.5	35.4	3335	10.3	38.8	4706	4773	**4271**	26
NB99875	14.2	34.7	3602	10.8	43.3	4505	4976	**4361**	19
NB04427	12.8	35.3	3574	10.5	45.0	4902	4248	**4241**	27
NB018131	10.4	34.7	3283	10.0	44.5	4864	4778	**4308**	24
NB018211	10.9	34.0	3314	10.5	46.8	4517	3255	**3695**	40
NB97891	12.1	33.6	3520	10.0	44.8	5039	4397	**4319**	23
NB018187	11.8	33.6	3979	10.5	45.5	5195	4652	**4608**	4
NB03439	13.8	35.8	3643	11.0	48.3	4607	4920	**4390**	17
P-713	9.9	34.9	4034	10.3	43.8	5505	4893	**4811**	1
NB04436	13.2	35.0	4262	10.5	47.8	4331	4829	**4474**	9
NB03440	13.6	35.8	3743	11.0	47.0	4715	4770	**4409**	13
NB04442	13.5	37.5	3498	10.3	43.3	4113	3876	**3829**	38
NB018180	10.9	36.4	3505	10.5	46.5	4427	4215	**4049**	33
NB04418	10.6	36.0	3740	10.0	44.8	5222	4392	**4451**	11
NB04428	12.2	36.0	3293	10.3	43.5	5135	4760	**4396**	16
NB018163	11.2	36.5	3745	10.8	47.0	5183	4851	**4593**	5
P-954	13.3	33.6	3537	10.8	44.3	5170	4707	**4471**	10
NB03402	10.6	32.4	3889	10.5	46.3	5336	4755	**4660**	3
NB04412	14.4	36.9	3417	10.3	45.5	4241	4323	**3994**	35
NB03437	14.9	34.3	3584	10.3	44.8	5108	4893	**4528**	6
NB03403	9.9	34.9	3301	10.8	47.8	5015	4080	**4132**	30
NB03429	14.0	31.9	4014	10.3	45.5	5055	5063	**4711**	2
P-721	12.8	33.8	3814	10.8	45.3	4301	4203	**4106**	32
TAMBAR 501	9.5	35.3	2546	9.0	35.5	4136	4575	**3752**	39
NB04439	15.4	37.0	3841	11.0	47.0	4535	4752	**4376**	18
NB03435	13.6	34.2	3712	10.3	43.8	4891	4587	**4397**	15
NB99881	13.7	34.4	3562	11.5	45.8	4731	4917	**4403**	14
NB05417	9.7	34.6	3743	10.0	45.8	4386	4947	**4359**	20
NB05432	11.3	34.8	3834	10.8	46.3	5018	3275	**4042**	34
NB05420	11.3	31.6	2947	10.0	44.5	5262	4848	**4352**	21
NB05418	9.8	34.6	4013	10.3	45.3	5127	4367	**4502**	7
NB05428	11.7	35.8	3523	10.0	44.0	4621	4197	**4114**	31
NB05419	8.8	34.0	3743	10.0	46.3	4964	4295	**4334**	22
NB05423	7.8	34.3	3459	9.5	42.0	4862	4337	**4219**	28
NB05412	17.0	32.8	3872	10.8	45.0	4046	4574	**4164**	29
NB05407	12.8	34.0	3346	10.3	46.8	4064	4088	**3833**	37

NB05409	9.9	34.0	2845	10.3	43.5	4519	4365	**3910**	36
NB05410	10.0	33.9	3176	9.8	45.8	5240	4902	**4440**	12
GRAND MEAN			**3572**	**10.4**	**44.9**	**4781**	**4531**	**4295**	
CV			9.0	4.7	2.8	9.74	13.1		
LSD			376.1	0.6	1.5	545.91	1003		

With the current level of private sector investments in research, additional public-private interactions are to be expected. A key goal will be to develop working relationships that benefit the producer, the customer, and the public good.

VI. ALLIED RESEARCH

The wheat breeding or variety development project is only one phase of wheat improvement research at the University of Nebraska-Lincoln. The project interacts and depends on research in wheat germplasm development, wheat quality, wheat nutritional improvement, wheat cytogenetics, plant physiology and production practices, and variety testing. Much of the production research is located at the research and extension centers. All components are important in maintaining a competitive and improving wheat industry in Nebraska. The allied research is particularly necessary as grain classification and quality standards change and as growers try to reduce their production costs.

The program also depends on interactions and collaborations with the Wheat Board, Nebraska Wheat Growers Association, regional advisory boards, Foundation Seeds Division, Nebraska Crop Improvement Association, the milling and baking industry, and other interested groups and individuals. The Nebraska Seed Quality Laboratory cooperates closely with the Wheat Quality Council and baked the large-scale cooperator samples. Numerous groups have visited the laboratory and participated in discussions on quality and marketing. Through these interactions, the program is able to remain focused and dedicated to being a premier provider of quality varieties, information, and technologies to help maintain the Nebraska Wheat Industry.

VII. Comings and Goings

All projects are more than crosses, selections, evaluations, data, and seed. At its heart, it is the people that make this research possible. Mr. Javed Sidiqi successfully completed his M.S. degree. Mr. Zakaria Aj-Alouni successfully completed his Ph.D. degree. We welcome Ms. Kayse Onweller as a new graduate student to our program. Finally, we welcome Dr. Dipak Santra, who is the new proso millet breeder in western NE and who will be invaluable cooperator on wheat research.

Summary

In 2008, 1,750,000 acres of wheat were planted in Nebraska and 1,670,000 were harvested with an average yield of 44 bu/a for a total production of 73,500,000 bu. In 2007, 2,050,000 acres of wheat were planted in Nebraska and 1,960,000 were harvested with an average yield of 43 bu/a for a total production of 84,280,00 bu. The 2008 crop was 13% lower than the 2007 crop. Despite continued genetic improvement, the main determinant in wheat production seems to be acres harvested, government programs relating to commodity prices, and weather (which also affects disease pressure and sprouting).

Disease development was favored by excessively wet weather during the growing season. In the east, there was severe damage due to foliar diseases and Fusarium head blight. The main economic disease in eastern NE was Fusarium head blight because not only did it affect grain yield and test weight, but also high levels of DON (vomitoxin) were found in some samples that led to significant dockage at elevators. Hence the growers lost twice (lower yield and lower price). In the south central and eastern parts of the state, early season diseases included powdery mildew, tan spot, and Septoria leaf blotch. The predominant leaf disease during the growing season was Septoria leaf blotch. Despite the wetness, leaf rust did not develop to damaging levels (except in some susceptible lines or varieties) because the inoculum (rust spores) blown into Nebraska from southern states was limited. Stripe rust also occurred, but at trace, almost negligible levels – it was observed in a few fields in southwestern part of the state and in the Panhandle. In general, most insect pests were seen primarily at low levels on wheat in 2007-2008. Wheat stem sawfly in the panhandle continued to expand its presence with severe infestations being found for the first time in central Box Butte county. All of the instances of severe infestations of wheat stem sawfly occur in no-till wheat-fallow situations. Cereal aphids presence was lower across the state with few economic instances noted. In the panhandle, black grass bug infestations spilling over from serious infestations in adjoining wheatgrasses were seen, but this was always restricted to slight border infestations. We also saw an increase in grasshopper numbers through the season with some serious infestations and damage occurring later in the season.

In 2008, NE01604 and NH03614 CL (a herbicide tolerant wheat) were formally released. NE01604 was licensed to NuPride Genetics Network and marketed as Camelot. NH03614 CL will have as its legal name of NH03614 CL and will be marketed as Husker Genetics Brand Settler CL. Camelot will be an excellent complementary wheat variety to Overland because Camelot has better stem rust resistance and end-use quality. Settler CL will be an excellent complementary wheat variety to Infinity CL and Bond CL because it seems to do better western NE and the northern Great Plains. Two additional lines are under increase for possible release in 2009, NI04421 (a new irrigated wheat which unfortunately is very susceptible to stinking smut (syn. common bunt), and NE01481 (a soilborne wheat mosaic virus resistant line with good quality that would ideally be suited for southeastern and southcentral wheat production and in organic production). Of the previously released lines, Overland (NE01643) continues to perform well across the state.

Research continue on understanding grain yield, genetic diversity in the Great Plains, and breeding for disease and insect resistance, as well as superior end-use quality. Much of this research involves using new technologies in the areas of statistics and software, molecular biology and markers, and improved equipment to allow us to become more efficient and provide a better return on the considerable investment made by the State of Nebraska and the grower community. Our goal is to continue to be a major provider of improved wheat germplasm to the Nebraska wheat producer and the industry that depends on having a supply of high quality wheat grain. The University of Nebraska is known as the People's University and we continue to support the organic wheat market and the use of modern technologies such as transgenic wheat. In our organic research we are beginning to identify cultivar x system responses (e.g. conventional vs. organic systems), hence we seeing the benefit of having a dedicated organic breeding effort.

The generous support of the Nebraska Wheat Board is gratefully acknowledged.