IMPROVING WHEAT VARIETIES FOR NEBRASKA

2009 STATE BREEDING AND QUALITY EVALUATION REPORT

Report to the

NEBRASKA WHEAT DEVELOPMENT, UTILIZATION
AND MARKETING BOARD

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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 2008-2009 NEBRASKA WHEAT CROP

1. Growing Conditions

The 2008-2009 growing season was generally one of abundant moisture. In western NE we planted on time and the rains came after we planted. In central and eastern NE, we planted in between rains. The winter was normal, but the spring and fall were wetter and cooler than normal. Initially we thought the crop season would be about 7 to 10 days later than normal, but a warm spring advanced he crop so that it was later than normal, but not more like 4 to 7 days later than normal. Due to the cool temperature moisture requiring disease were a little less sever than normal but extremely widespread. For example, Fusarium head blight (FHB) was found in low levels in eastern NE, higher levels in central NE, and the main epidemic was probably in southwest NE. This is the first time FHB was found in that part of NE is recent history. Furthermore, FHB was found as far west as Chimney Rock. In general, NE01643 (Husker Genetics Brand Overland), NE01481, Hitch, Wesley, Settler CL, Camelot, Art, Alliance, Westbred Winterhawk, Bond CL, and NI04421 performed well across or in specific sections of the state.

2. Diseases

Disease development was favored by a warm fall and excessively wet weather during the growing season. In the east, there was damage due to wheat soilborne mosaic virus (WSBMV), foliar diseases, stem and leaf rust, and Fusarium head blight. The main economic disease in eastern NE was mostly WSBMV, though this disease can be prevented by late planting and resistant varieties. As mentioned above, FHB was found across the state in areas where we had not found it before, including the northern Panhandle. Economically damaging levels of FHB occurred in southwestern NE where heavy rains coincided with flowering. Loose smut was observed in most fields scouted, but at low levels (trace to about 1% incidence). At least one wheat sample brought to the Pathology Extension office had common bunt. As a result of the prolonged rainfall in June, the

incidence of black point was higher than normal in 2009. Triticum mosaic virus, a new virus discovered in 2006 in Kansas and which is, like wheat streak mosaic virus and the high plains virus, transmitted by wheat curl mites, continued to be a threat. Black chaff, a bacterial disease, occurred mainly in southwestern Nebraska and was favored by June rains. Some irrigated fields planted with highly susceptible cultivars had severe levels of black chaff which resulted in significant economic loss. There were reports of as much as 30% yield loss in these fields. This yield loss was most likely due to a combination of black chaff and other diseases such as scab, leaf rust, and leaf spots. Drs. Stephen Wegulo, Gary Hein (entomologist monitoring insect vectors of disease), and Roy French continue to be invaluable in disease identification, survey, and understanding.

3. Insects

In general, most insect pests were seen at low levels on wheat in 2008-2009. Wheat stem sawfly in the panhandle continued to expand its presence. All instances of severe infestations of wheat stem sawfly continue to occur in no-till wheat-fallow situations. Also in the panhandle, Russian wheat aphids were readily found, but they primarily remained at low levels. The presence of other cereal aphids was low across the state with few economic situations noted and little barley yellow dwarf noted. Grasshoppers again increased and threatened emerging wheat in some areas of the western half of the state. Dr. Gary Hein continues to be invaluable in insect and disease vector identification, survey, and understanding.

4. Wheat Production

In 2009, 1,700,000 acres of wheat were planted in Nebraska and 1,600,000 were harvested with an average yield of 48 bu/a for a total production of 76,800,000 bu. 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 2009 crop was 5% higher than the 2008 crop, but 9% lower than the 2007 crop. Despite continued genetic improvement, the main determinant in wheat production seems to be acres harvested, government programs, and weather (which also affect 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 8.5% in 2009 due to its being hurt by the diseases. In 2010, Pronghorn was the most widely grown wheat in Nebraska (13.7%). It 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 increased slightly, indicating that tall wheats, which are adapted to drought in the west, remain very popular. Overland continues to increase in its acreage.

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 (data presented in red)occupied 65.9% of the state acreage. Other public varieties occupied 10.5% and private varieties occupied 23.6% (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.

	Percent									
Variety	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
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 Art										**2.4**
AgriPro Dumas							1.4	1.2		
Agripro Hawken									1.2	**2.1**
Agripro Hondo	1.2	0.0								
Agripro Laredo	0.0	0.0								
Agripro Ogallala	2.2	1.5	3.6	2.4	2.0	1.4	1.0	1.1		
Agripro Postrock								1.1	4.1	**4.4**
Agripro Thunderbird	1.9	0.0	1.8							
Agripro Thunderbolt			2.0	3.0	1.9	1.9	2.0	2.4	1.6	**1.5**
Agripro Thunderbird										**1.1**
Agripro Tomahawk	0.0	1.8								
Agripro Jagalene				4.5	16.8	23.8	33.4	20.9	13.8	**8.5**
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	**6.0**
Arapahoe	13.4	13.0	8.7	6.8	5.2	2.9	2.0	3.4	2.2	**2.1**
Buckskin	4.7	6.2	7.3	4.9	3.7	5.0	3.5	3.4	3.3	**4.5**
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	**6.5**
Infinity CL								2.3	3.5	**3.7**
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	**1.6**
Millennium		3.5	6.1	11.1	10.7	9.5	7.2	9.4	13.2	**11.9**
Niobrara	9.3	6.9	5.4	3.5	2.2					
Overley							1.0	1.1		
Overland									3.4	**5.6**
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	**13.7**
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	**7.4**
Vista	1.7	3.1	1.2							
Hatcher									1.2	**1.5**
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	**4.1**
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	**7.8**
Other Private Varieties	2.2	3.9	3.4	4.4	4.0	3.8	2.8	4.1	5.0	**3.6**

6. New Cultivars

Two new cultivars were increased and recommended for release in 2010. They are NE01481 and NI04421. NE01481 is a hard red winter wheat (*Triticum aestivum* L.) cultivar developed cooperatively by the Nebraska Agricultural Experiment Station and the USDA-ARS and released in 2010 by the developing institutions. It was released primarily for its superior adaptation to rainfed wheat production systems in eastern and west central Nebraska and its excellent resistance to wheat soilborne mosaic virus, a trait that is very rare in recent Nebraska released cultivars and is needed in southeastern and south central NE where the disease is present in early plantings of wheat. NE01481 was selected from the cross NE92458/Ike that was made in 1995. The pedigree of NE92458 is OK83201/REDLAND and the pedigree of OK83201, an experimental line developed by Oklahoma State University is Vona//Chisholm/Plainsman V. The F_1 generation was grown in the greenhouse in 1996 and the F_2 to F_3 generations were advanced using the bulk breeding method in the field at Mead, NE in 1997 to 1998. In 1999, single F_3-derived F_4 rows were planted for the selection. There was no further selection thereafter. Ne01481 was identified in 2001 as the experimental line, NE01481, and selected for further testing.

NE01481 was evaluated in Nebraska replicated yield nurseries starting in 2002, in the Southern Regional Performance Nursery in 2005 and 2006, and in Nebraska cultivar performance trials in 2005 to 2009. In the Nebraska Intrastate Nursery (2003 to 2009), NE01481 performed well in eastern NE (Lincoln and Mead), central and west central NE (Clay Center and North Platte). In western NE other cultivars have a better performance record. These data are supported by the 2004 and 2005 USDA-ARS Southern Regional Performance Nursery where NE01481 ranked 27 and 19 of the 50 and 48 entries tested in those years, but ranked 4 and 6 in the in the North Central Plains zone (eastern NE and KS and central NE, data available at http://www.ars.usda.gov/Research/docs.htm?docid=11932). In the five years that it has been tested in the Nebraska State Variety Trials (Table 2, full data available athttp://cropwatch.unl.edu/web/varietytest/wheat), NE01481 (68.4 bu/a and 62.9 bu/a) was lower yielding than Overland (70.4 bu/a and 64.1 bu/a) in southeastern NE and west central NE. However in south central NE (data provided only from Clay Center) NE01481 (52.0 bu/a) was lower yielding than Millennium (57.0bu/a), Overland (60.0 bu/a) and Wesley (57.0bu/a). Based upon these data, NE01481 is adapted to eastern, central, and west central NE.

Other measurements of performance from comparison trials show that NE01481 is moderately early in maturity (142.4 d after Jan.1, data from 14 observations in eastern NE), about 1 d earlier flowering than Wesley and 2 days earlier flowering than 'Camelot' and 'Overland'. NE01481 is a semi-dwarf wheat cultivar and contains the *RhtB1b* (formerly *Rht1*, data provided by Dr. Guihua Bai). The mature plant height of NE01481(34.3 in) is 0.5 in shorter than Millennium and 3 in taller than Wesley. NE01481 has moderate straw strength (9% lodged), similar to Infinity CL (11%), but higher than Wesley (4%) and Millennium (4%). The winter hardiness of NE01481 is good and comparable to other winter wheat cultivars adapted and commonly grown in Nebraska.

NE01481 is resistant to soilborne wheat mosaic virus. It is moderately resistant to moderate susceptible to stem rust (caused by *Puccinia graminis Pers.: Pers. f. sp. tritici* Eriks & E. Henn.) in field nursery tests inoculated with a composite of stem rust races (RCRS, QFCS, QTHJ, RKQQ, and TPMK). In greenhouse tests, it is resistant to races TPMK, QFCS, and RCRS, but susceptible to race TTTT and RKQQ (data provided by Y. Jin at the USDA Cereal Disease Laboratory). It is moderately resistant to moderate susceptible to leaf rust (caused by *P. triticina* Eriks, data provided by J. Kolmer at the USDA Cereal Disease Laboratory), and moderately susceptible to susceptible to stripe rust (caused by *P. striiformis* Westendorp f. sp. t*ritici*, data obtained from field observations in the Great Plains), Ne01481 is susceptible to Hessian fly (*Mayetiola destructor* Say, data provided by Ming-Shun Chen, USDA and Kansas State University). It is susceptible to barley yellow dwarf virus, and wheat streak mosaic virus (data obtained from the Southern Regional Performance Nursery, 2005 and field observations in NE).

NE01481 is a genetically intermediate in grain volume weight (57.0 lbs/bu), which is lower than Millennium (58.3 lbs/bu) and Overland (58.2 lbs/bu), similar to Camelot (57.3 lbs/bu), and higher than Wesley (56.0 lbs/bu). The milling and baking properties of NE01481 determined for seven years by the Nebraska Wheat Quality Laboratory. In these tests, Wesley, an excellent milling and baking wheat, was used for comparison. The average wheat and flour protein content of NE01481 (142 and 125 g kg^{-1}) were similar to lower than Wesley (143 and 130 g kg^{-1}) for the corresponding years. The similar to lower grain protein content was confirmed by the Nebraska State Variety Trials where NE01481 had 115 g protein kg^{-1} compared to Wesley with a value of 120 g kg^{-1}. The average flour extraction on the Buhler Laboratory Mill for NE01481 (708 g kg^{-1}) was lower than Wesley (739 g kg^{-1}). The flour ash content (46 g kg^{-1}) was higher than Wesley (44 g kg^{-1}). Dough mixing properties of NE01481 were acceptable (mixtime peak was 3.4 minutes and mixtime tolerance was scored as 3.6), but weaker than Wesley (mixtime peak of 4.7 minutes and mixtime tolerance scored as 4.5). Average baking absorption (602 H_2O g kg^{-1}) was lower than Wesley (611 H_2Og kg^{-1}) for the corresponding years. The average loaf volume of NE01481 (864 cm^3) was lower than Wesley (947 cm^3). The scores for the internal crumb grain and texture ranged from fair to good, which was lower than Wesley which ranged from good to slightly above good. The overall end-use quality characteristics for NE01481 (scored as 3.7, where 3 is fair, 4 is good and 7 is excellent) was lower than Wesley (4.3) and similar to many commonly grown wheat cultivars. NE01481 should be acceptable to the milling and baking industries.

In positioning NE01481, based on performance data to date, it should be well adapted to most rainfed wheat production systems in southeastern, south-central, and west central Nebraska and in adjacent areas of the Great Plains. Where it is adapted, NE01481 should be a replacement for 2137, Millennium, Wahoo, and Wesley (for rainfed production), though Wesley has better straw strength. Of the lines listed in for comparison, only NE01481 and Wesley have excellent wheat soilborne mosaic virus resistance which is needed in southeastern and south central NE for early planted wheat or wheat that is planted at the recommended seeding date followed by a warm fall. NE01481 is genetically complementary to virtually all wheat cultivars grown in Nebraska.

NE01481 is an awned, ivory-glumed cultivar. Its field appearance is most similar to Wesley, but can be easily separated from Wesley because Wesley has a bronze chaff. After heading, the canopy is moderately closed and inclined to nodding. The flag leaf is recurved and not twisted at the boot stage. The foliage is green with a light waxy bloom on the leaf sheath and spike at anthesis, but not on the leaves. The leaves are glaborous. The spike is tapering, narrow, mid-long, and middense. The glume is long and midwide, and the glume shoulder is square. The beak is moderately long in length with an acuminate tip. The spike is predominantly nodding at maturity with some spikes inclined. Kernels are red colored, hard textured, and mainly ovate in shape. The kernel has no to a very small collar, a large brush of long length, rounded cheeks, large germ, and a narrow and shallow crease.

NE01481 has been uniform and stable since 2007. Less than 0.5 % of the plants were rogued from the Breeder's seed increase in 2007-9. The rogued variant plants were taller in height (5 - 15 cm) or were awnless and/or with red chaff. Up to 1% (10:1000) variant plants may be` encountered in subsequent generations. The Nebraska Crop Improvement Association provided technical assistance in describing the cultivar characteristics and accomplishing technology transfer. The Nebraska Foundation Seed Division, Department of Agronomy and Horticulture, University of Nebraska-Lincoln, Lincoln, NE 68583 will have foundation seed available to qualified certified seed enterprises in 2010. The U.S. Department of Agriculture will not have seed for distribution. The seed classes will be Breeder, Foundation, Registered, and Certified. NE01481 will be submitted for plant variety protection under P.L. 10577 with the certification option. A research and development fee will be assessed on all certified seed sales. Small quantities of seed for

research purposes may be obtained from the Dr. P. S. Baenziger and the Department of Agronomy and Horticulture, University of Nebraska-Lincoln for at least 5 yr from the date of this release.

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NI04421 is a hard red winter wheat (*Triticum aestivum* L.) cultivar developed cooperatively by the Nebraska Agricultural Experiment Station and the USDA-ARS and released in 2010 by the developing institutions and the Wyoming Agricultural Experiment Station. NI04421 was released primarily for its superior performance under irrigation and rainfed conditions in western Nebraska. Additionally, in eastern Wyoming NI04421 has demonstrated superior performance under irrigated and limited irrigated conditions.

NI04421 was selected from the cross NE96644/Wahoo (sib) where the pedigree of NE96644 is Odesskaya P/ Cody//Pavon 76/*3 Scout 66. The cross was made in the spring of 1998. The F_1 generation was grown in the greenhouse in 1999 and the F_2 to F_3 generations were advanced using the bulk breeding method in the field at Mead, NE in 2000 to 2001. In 2001, single F_3-derived F_4 rows were planted for harvest and selection in 2002. Using visual selection for shorter plant height with good straw strength the row (later named NI04421) was identified as possibly having potential for rainfed and irrigated production. Harvested seed of this row was split, planted, and evaluated in 2003 in a single 4 row observation plot at Lincoln, NE and in a two row observation plot under irrigation near Gurley western NE. Based upon its performance in 2003 under irrigation, the line was advanced to the Irrigated-Rainfed Nursery which has one irrigated testing site in western NE and three rainfed sites (Hemmingford, North Platte, and Lincoln, NE) in 2004 with the belief that some irrigated wheat lines may perform well in eastern NE where there is higher rainfall and that it may be possible to develop lines that perform well under both irrigation and rainfed conditions. It was the 21st new entry in 2004 and was given the experimental line name of NI04421 where the NI recognizes that it came from our irrigation-breeding program. Based upon its performance in 2004 under both irrigation and dryland production, NI04421 was continued in the Irrigated-Rainfed Nursery and in the intermediate rainfed nursery (grown in 6 environments in NE in 2005). From 2006 on, NI04421 was grown in both Irrigated-Rainfed Nursery and the Nebraska Intrastate Nursery (NIN, elite trial, 6 locations per year). Once the line was identified in 2004, the only selection thereafter was roguing to remove obvious off-types (plants that were too tall, bronze chaffed, awnless, etc.).

NI04421 was evaluated in Nebraska replicated yield nurseries from 2004 to 2009 in the irrigated rainfed nursery, from 2007 to 2009 in the Nebraska Intrastate Nursery, and from 2007 to 2009 in Nebraska State Variety Trials in rainfed and irrigated testing sites. Based upon accumulated data, NI04421 is superior in western rainfed (west of North Platte, where drought is common) and irrigated production sites to many currently grown cultivars. It seems to have good drought tolerance and does best in irrigated environments in the drier areas. Across all nine Wyoming environments NI04421 averaged 85.6 bu/a, 11.1 % protein, 60.7 lbs/bu, and 24 inches in height. It exceed Wesley by 7.3 bu/a, 0.3% protein, 0.9 lb/bu, and 1 inch in height. As opposed to some irrigated wheat cultivars that have excellent potential when conditions are

optimal, NI04421 does best in high yielding irrigated environments where some stress tolerance is beneficial, but not as well in extremely high yielding irrigated environments.

Other measurements of performance from comparison trials show that NI04421 is moderately late in maturity (143.1 d after Jan.1) which is very similar to Wesley (143.2 after Jan. 1), about 0.5 d later flowering than 'Antelope' (142.69 d after Jan. 1). NI04421 is a semi-dwarf wheat cultivar and contains *RhtB1b* (formerly *Rht1*, data provided by Dr. Guihua Bai). The mature plant height of NI0441 (33.3 in) is 1.6 in taller than Wesley and 2.2 in shorter than Millennium. Using data from the 2007-2009 irrigated locations in Nebraska State Variety Trials where lodging tends to be the most severe, NI04421 has moderate straw strength (7 % lodged), which is similar to Bond CL (7%) and less than Wesley (0%). The winter hardiness of NI04421 is good to very good and comparable to other winter wheat cultivars adapted and commonly grown in Nebraska.

NI04421 is moderately resistant to stripe rust (caused by *P. striiformis* Westendorp f. sp. t*ritici*, data obtained from field observations in the Great Plains). It is moderately resistant to moderately susceptible to stem rust (caused by *Puccinia graminis Pers.: Pers. f. sp. tritici* Eriks & E. Henn.) in field nursery tests inoculated with a composite of stem rust races (data from the 2006 and 2007 Southern Regional Performance Nursery) and to wheat soilborne mosaic virus**.** In greenhouse tests, it has heterogeneous reactions (e.g. some plants are resistant and others are susceptible) to many races of stem rust (data provided by Y. Jin at the USDA Cereal Disease Laboratory). It is moderately susceptible to leaf rust (caused by *P. triticina* Eriks, data from the 2006 and 2007 Southern Regional Performance Nursery). NI04421 is susceptible to Hessian fly (*Mayetiola destructor* Say, data provided by Ming-Shun Chen, USDA and Kansas State University and wheat streak mosaic virus (data obtained from the Southern Regional Performance Nursery, 2006 and field observations in NE). It is susceptible to common bunt (syn. stinking smut, caused by *Tilletia spp*.) and seed treatments are recommended.

NI04421 is genetically lower for test weight in rain fed conditions (56.0lbs/bu), but is similar to Wesley (56.0 lbs/bu) and lower than Millennium (58.3 lbs/bu). In irrigated trials, the test weight of NI04421 (60.3 lbs/bu) was greater than Bond CL (59.0 lbs/bu) and Wesley (59.8 lbs/bu), but less than TAM 111 (61.1 lbs/bu). The milling and baking properties of NI04421 were determined for four years by the Nebraska Wheat Quality Laboratory. In these tests, Wesley, an excellent milling and baking wheat, was used for comparison. The average wheat and flour protein content of NI04421 (14.6 and 11.8%) were similar to less than Wesley (14.7% and 12.6%) for the corresponding years. The slightly lower grain protein content was confirmed by the Nebraska cultivar performance trials where NI04221 had 11.6% compared to Wesley with a value of 12.0%. The average flour extraction on the Buhler Laboratory Mill for NI04421 (72.3%) was lower than Wesley (74.1%). The flour ash content (0.435%) was lower than Wesley (0.464%). Dough mixing properties of NI04421 were strong (mixtime peak was 4.4 minutes and mixtime tolerance was scored as 4.8) which was similar to Wesley (mixtime peak of 4.2 minutes and mixtime tolerance scored as 4.7). Average baking absorption (60.8%) was slightly higher than Wesley (60.0%) for the corresponding years. The average loaf volume of NI04421 (813 ml) was lower than Wesley (861 ml). The scores for the internal crumb grain and texture ranged from 4.4 to 4.9, which are good, but were slightly less than Wesley that ranged from 4.5 to 5.3). The overall end-use quality characteristics for NI04421 are acceptable and similar to many commonly grown wheat cultivars that are well received by the milling and baking industries.

In positioning NI04421, based on performance data to date, it should be well adapted to most rainfed and irrigated wheat production systems in western Nebraska and eastern Wyoming. Where it is adapted, NI04421 should provide growers with an additional choice to Camelot, Millennium, Overland, and Wesley for their rainfed production systems and to Bond CL, TAM 111, NuDakota, and Wesley for their irrigated production systems. Because NI04421 has Wahoo as a parent, NI04421, Wahoo, and Millennium would be

considered non-complementary. NI04421 is complementary to Bond CL, Settler CL, Infinity CL, TAM 111, NuDakota, Wesley, Alliance, Buckskin, Goodstreak, and Pronghorn.

NI04421 is an awned, ivory-glumed cultivar. After heading, the canopy is moderately closed and nodding. The flag leaf is recurved and twisted at the boot stage. The foliage is green with a light waxy bloom on the leaf sheath and spike at anthesis, but not on the leaves. The leaves are generally glaborous. The spike is tapering, narrow, mid-long, and middense. The glume is long and narrow, and the glume shoulder is wanting. The beak is moderately long in length with an acuminate tip. The spike is predominantly nodding at maturity with some spikes inclined. Kernels are red colored, hard textured, and mainly ovate in shape. The kernel has no to a very small collar, a midsized brush of medium length, rounded cheeks, large germ, and a narrow and shallow crease.

NI04421 has been uniform and stable since 2007. Less than 1 % of the plants were rogued from the Breeder's seed increase in 2007. The rogued variant plants were taller in height (8 - 15 cm), had larger beak length, or bronze chaff. Up to 2% (20:1000) variant plants may be encountered in subsequent generations. The Nebraska Crop Improvement Association provided technical assistance in describing the cultivar characteristics and accomplishing technology transfer. The Nebraska Foundation Seed Division, Department of Agronomy and Horticulture, University of Nebraska-Lincoln, Lincoln, NE 68583 has Foundation seed available to qualified certified seed enterprises in 2010. The U.S. Department of Agriculture will not have seed for distribution. The seed classes will be Breeder, Foundation, Registered, and Certified. NI04421 will be submitted for U.S. Plant Variety Protection under P. L. 10577 with the certification option. A research and development fee will be assessed on all certified seed sales. The Nebraska Foundation Seed Division, Department of Agronomy and Horticulture, University of Nebraska-Lincoln, Lincoln, NE 68583 will have foundation seed.

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III. FIELD RESEARCH

1. Increase of New Experimental Lines

With our new release procedures of determining which lines will be released in January with the seed begin available in August for certified seed producers, two lines are under increase NE03490 and NE04490. NE03490 is a bright chaff wheat with the pedigree of WI90-540W/*2 Culver that based upon current data is best suited for production in western NE in rainfed and irrigated conditions. NE04490 is a bronze chaff wheat with the pedigree of NE95589/NE94632//Abilene/Arapahoe where NE95589 has the pedigree of NE87457/Vista and NE94632 has the pedigree of Abliene/Norkan//Rawhide. It has soilborne mosaic virus

resistance and seems broadly adapted to Nebraska. Both lines have acceptable end-use quality. A number of lines are under small-scale increase for possible release in 2010.

With the release of new varieties Anton, Camelot, Goodstreak, Infinity CL, NE01481, NI04421, 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 2009. Twelve dryland, four dryland organic, and three irrigated locations in Nebraska were harvested for yield data. In 2009, the top ten entries for dryland production were:

Entry	Yield (bu/a)	Entry	Yield (bu/a)
NE01481	63.9	Overland	62.2
Settler CL	63.5	Infinity CL	61.9
Westbred Armour	62.7	NE04490	61.7
NI04421	62.6	Millennium	61.6
Nupride Camelot	62.5	NE03490	61.4

Of the released lines tested in all dryland locations, Turkey (45.1 bu/a) and Scout 66 (47.7 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 Box Butte County (80.9 bu/a) indicating moisture was not limited at that trial and production was very good. Note due to the small plot size used in this trial, any deviation in measurement of he plots will make a large difference on the calculated yield (e.g. if the row width varied between plots).

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

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

3. Irrigated Wheat Trials:

In 2009, two irrigated environments in NE were used to evaluate irrigated wheat production. The top ten lines in 2009 were:

Variety	Yield bu/a	Variety	Yield bu/a
Settler CL	94.1	NI04420	89.4
Anton (W)	93.9	NX04Y2107	89.1
Wesley	93.0	Bond CL	86.5
NE02584	90.5	NE05426	85.5
NI04436	89.6	Bill Brown	85.1

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 irrigated data this year continue to show the benefits of having a dedicated irrigated wheat development nursery to both select lines which have excellent performance (e.g NI04420, NI04436) and to identify lines from the rainfed breeding program that do well under irrigation (settler CL, Anton (W), and Wesley). This year's data needs to be taken with a grain of salt in that the data is from Holt Co. (which is a different irrigated environment than the western and southwestern environments), Chase Co (which was hurt by Fusarium head blight this year and excessive rain), and Box Butte Co. where the yields were spectacular. Hence the data may not be "normal",

but useful for developing a long-term data package.

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 Lincoln and North Platte and under irrigation at Alliance. Interesting, only the data at Lincoln was correlated with the irrigated data at Alliance. The rainfed and irrigated data at Alliance, though closer were not correlated, indicating the need to have testing sites across the state and also that even within the "same" location, different management practices require specific testing. That the sites are generally not correlated indicates that they represent four different environments and that each is needed to evaluate our lines.

Data for 2009 are:

name	Lincoln bu/a	N.Platte bu/a	Alliance bu/a	**St. AVG. Dry bu/a**	**Alliance Irr bu/a**	St. Avg. All bu/a	Flowering d after Jan. 1	Height in.	Test Wt. lbs/bu
Antelope	72.3	48.7	75.8	**65.6**	**119.0**	78.9	141.6	32.7	59.2
TAM111	71.9	67.5	83.4	**74.3**	**132.6**	88.8	143.1	35.1	59.5
WESLEY	77.3	59.4	82.7	**73.1**	**127.9**	86.8	143.9	31.5	58.0
NI03427	82.5	59.1	81.8	**74.5**	**126.3**	87.4	142.9	33.4	58.9
NI04421	75.7	71.1	89.4	**78.7**	**105.9**	85.5	144.0	34.7	57.5
NI06731	81.2	47.0	79.0	**69.0**	**122.5**	82.4	139.9	33.5	57.3
NI06736	85.9	55.3	74.1	**71.8**	**126.4**	85.4	141.1	31.8	57.5
NI06737	78.4	57.7	74.0	**70.0**	**125.1**	83.8	140.1	31.9	58.7
NI07701	62.3	54.6	73.8	**63.6**	**130.3**	80.2	141.2	29.0	57.0
NI07703	80.0	53.6	77.4	**70.3**	**124.0**	83.7	141.2	33.7	57.4
NI07710	49.3	37.4	85.0	**57.2**	**97.4**	67.3	147.4	34.1	54.1
NI07712	49.1	40.5	82.7	**57.4**	**100.5**	68.2	145.0	33.8	54.8
NI07714	71.0	46.6	72.5	**63.4**	**117.3**	76.9	144.9	33.2	57.4
NI07717	73.2	57.3	88.3	**72.9**	**111.1**	82.5	147.3	35.3	56.1
NI08703	71.7	54.3	75.4	**67.1**	**108.7**	77.5	146.2	34.2	57.1
NI08707	88.1	64.5	94.3	**82.3**	**124.4**	92.8	141.1	32.4	57.6
NI08708	95.4	66.4	81.6	**81.1**	**116.1**	89.9	140.5	34.4	58.6
NI08714	84.7	62.8	87.6	**78.4**	**131.2**	91.6	139.9	33.2	57.8
NI08715	70.4	55.0	73.0	**66.1**	**117.1**	78.9	142.5	31.8	58.4
NI08716	71.2	55.5	79.2	**68.6**	**106.9**	78.2	142.5	32.9	58.3
NI08717	76.4	59.9	76.2	**70.8**	**110.2**	80.7	140.2	33.2	59.4
NI08719	53.9	53.5	68.1	**58.5**	**111.0**	71.6	145.1	32.3	56.3
NI09701	73.8	48.0	89.6	**70.5**	**119.0**	82.6	143.2	34.7	56.8
NI09702	78.6	51.6	77.0	**69.1**	**116.4**	80.9	143.4	34.6	58.2
NI09703	60.4	66.7	84.6	**70.6**	**126.9**	84.7	147.8	34.9	60.3
NI09704	91.9	57.0	84.3	**77.7**	**109.9**	85.8	145.7	38.2	57.2
NI09705	57.7	63.3	91.3	**70.8**	**113.3**	81.4	144.8	37.2	59.9
NI09706	78.8	53.6	79.0	**70.5**	**116.6**	82.0	141.3	32.0	58.2
NI09707	71.2	65.3	73.3	**69.9**	**121.4**	82.8	140.0	31.4	57.8
NI09708	80.4	57.1	72.9	**70.1**	**118.3**	82.2	141.1	32.8	59.2
NI09709	87.4	65.3	85.8	**79.5**	**116.7**	88.8	140.0	32.0	60.1
NI09710	87.8	58.3	76.0	**74.1**	**128.6**	87.7	142.3	32.8	56.7
NI09711	78.1	59.4	74.7	**70.7**	**116.0**	82.0	145.1	34.6	58.0

NI09712	75.7	56.7	85.7	**72.7**	**115.3**	83.3	139.5	33.0	56.9
NI09713	73.6	54.6	82.0	**70.1**	**114.0**	81.1	141.8	33.5	55.5
NI09714	68.8	54.2	93.5	**72.2**	**122.8**	84.8	143.2	33.2	55.8
NI09715	66.3	60.5	75.5	**67.4**	**118.8**	80.3	143.9	33.4	58.4
NI09716	82.1	51.1	80.4	**71.2**	**119.3**	83.2	144.0	34.0	56.3
NI09717	77.5	58.8	86.4	**74.2**	**119.1**	85.4	140.9	32.6	56.2
NI09718	74.0	51.9	92.7	**72.9**	**107.6**	81.5	141.2	35.9	54.3
Average	**74.64**	**56.52**	**81**	**70.7**	**117.8**	**82.5**	**22.77**	**33.5**	**57.6**
LSD	12.45	9.13	8.08		**11.2**	10.2	2.37	1.8	1.7

In 2009, 17 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 2008, 19 lines were continued for further testing in the irrigated nursery and no lines were advanced to the Nebraska Triplicate Nursery (NTN). 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 the 2009, one IRR/DRY lines was advanced for large-scale foundation seed increase (NE04421). The quality samples for this nursery come from the previous year nursery. In 2008 IRDR, fourteen lines were analyzed in single kernel, milling properties, protein content, ash content, rheological dough strength, and bread production. The top four wheat varieties had good baking performance without adding antioxidant. They were NI07701, NI06737, Antelope and NI06731 in increasing order. The average protein and ash were 12.0% and 0.347%, respectively. They were HARD (average 66.1 hard index) wheat. Their average flour yield was had 75.3%. They had good rheological dough strength. They needed longer mixing times (average 6.7 min) to get optimal dough when water absorption was 62.1% in average. They had good exterior and crumb grain. They had smooth and resilient texture. They had high loaf volume (average 791 mL). Nine wheat varieties had very poor to fair in baking performance without adding antioxidant. After adding 5 ppm antioxidant ascorbic acid in baking for these wheat samples, the bread quality was not improved significantly. Irrigated wheat production has unique challenges because it affects end-use quality. Wesley usually possesses excellent baking quality.

Data for 2008 are:

	LIN C	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**

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**	

4. Nebraska Intrastate Nursery:

The 2009 Nebraska Intrastate Nursery (NIN) was planted at eight locations (Lincoln, Mead, Mead Organic, Clay Center, North Platte, Sidney, Sidney Organic, and Hemingford, NE). Unfortunately, Sidney Organic was lost due to excessive rain and Lincoln and Clay Center were damaged by soilborne wheat mosaic virus. The state averages are given for the seven harvested locations. This year can be characterized as having sufficient rainfall across Nebraska to allow virtually every location to be excellent. The nursery means went from 56.0 bu/a (low due to wheat soilborne mosaic virus) to over 80 bu/a. Because all the locations had ample rainfall, the correlations between sites were better. In general, the locations nearest to each other tended to have the highest correlations with a gradual decrease as the locations were separated further apart. For example the highest correlation was between Sidney and North Platte (r= 0.625**), but there were a few surprises (Mead Organic and Alliance were correlated at r=0.295*). Again this appears to be due to the generally excellent moisture across the state. However, event he highest correlation did not explain more than 40% of the variation between the two sites and generally less than 20% was explained. As such, it is important to continue testing at all of our sites to represent the possible growing areas for our advanced lines. Of the released lines, Goodstreak and Overland (NE01643) did well, as did, Settler CL. The two newest lines, NE01481 performed well, but is narrowly adapted. NI04421 is adapted to irrigated conditions and did well across the state due to the high moisture conditions. Our newer experimental lines have performed very well compared to the previously released lines as would be hoped if continual progress

were being made.

NIN 2009	Linc.	Mead	Mead Org.	Clay Cen.	N. Platte	Sidney	Alliance	**State Avg**	St. Rank	Flowering	Height
name	bu/a	bu/a	bu/a	bu/a	bu/a	bu/a	bu/a	**bu/a**		d after 1/1	in
WESLEY	77.4	66.0	71.8	63.5	74.1	72.5	87.3	**73.2**	37	145.0	30.8
ALLIANCE	78.2	61.5	68.2	41.6	74.8	83.5	90.6	**71.2**	49	144.7	33.6
OVERLAND	94.4	69.2	88.8	53.0	72.3	79.1	82.3	**77.0**	9	145.7	34.3
NE01481	79.3	74.3	83.4	60.6	74.5	79.9	74.5	**75.2**	23	144.0	34.7
NE02533	80.3	57.6	73.9	51.0	73.0	78.9	81.2	**70.9**	50	144.3	35.5
NE02558	82.8	60.0	75.1	67.2	77.6	81.4	87.4	**75.9**	15	144.7	34.6
NE02584	81.0	70.3	64.1	60.6	69.6	79.0	69.8	**70.6**	53	144.7	32.6
NE03490	72.1	64.3	79.8	28.1	72.2	91.9	87.3	**70.8**	52	145.0	30.9
NW03666	80.2	70.0	78.1	57.9	75.2	89.0	79.9	**75.7**	18	145.0	33.9
NE04490	75.0	69.1	65.1	63.3	82.1	78.5	80.5	**73.4**	34	143.3	31.3
NI04420	82.4	72.2	72.5	54.7	78.3	79.5	83.4	**74.7**	25	144.7	33.7
NI04421	82.8	67.3	70.3	66.2	76.6	87.2	86.9	**76.8**	10	144.7	33.9
NI04427	76.8	69.5	68.4	58.9	77.8	74.9	90.3	**73.8**	30	144.0	31.2
NE05403	69.3	70.5	74.7	64.0	69.4	70.9	84.0	**71.8**	46	143.3	31.7
NE05418	79.2	64.5	72.3	53.1	72.1	71.1	69.3	**68.8**	56	143.3	35.9
NE05426	78.5	73.0	74.0	54.8	68.6	80.5	73.9	**71.9**	45	144.0	33.6
NE05430	84.8	81.2	78.2	68.1	77.2	76.4	77.9	**77.7**	7	142.7	33.8
NE05496	89.1	78.0	83.8	66.7	72.7	82.6	95.7	**81.2**	2	142.7	33.3
NE05548	85.3	75.8	74.4	50.4	74.3	81.3	87.3	**75.6**	21	145.0	38.6
CAMELOT	84.2	71.5	77.1	43.9	76.7	83.4	84.9	**74.5**	26	145.3	35.0
SETTLER CL	77.2	66.8	73.1	74.6	71.3	77.0	94.9	**76.4**	13	144.0	31.8
Infinity	78.8	67.9	75.9	47.4	70.9	83.4	85.7	**72.9**	39	144.3	34.5
NE05549	78.9	64.3	78.8	64.7	85.7	87.1	96.0	**79.4**	5	145.0	34.8
NE05459	71.5	71.9	73.3	58.2	67.8	79.1	88.3	**72.9**	38	144.0	34.2
NE06430	67.9	78.3	74.5	55.5	75.1	96.1	80.4	**75.4**	22	141.0	32.1
NE06469	71.5	72.9	76.0	47.7	73.6	85.1	86.0	**73.2**	36	141.7	33.8
NE06471	70.2	81.2	74.9	37.2	67.2	85.9	85.7	**71.7**	47	143.0	33.1
NE06545	82.8	79.2	86.0	70.4	87.7	97.8	87.3	**84.5**	1	142.7	32.6
NE06548	70.3	68.4	73.0	57.7	74.3	84.3	78.2	**72.3**	44	144.7	32.9
NE06552	68.0	56.4	70.9	59.9	73.5	80.9	84.3	**70.6**	54	144.3	30.6
NE06607	74.8	73.3	78.8	38.8	78.3	85.8	84.2	**73.4**	32	143.7	32.6
NE07409	79.2	77.9	78.3	44.9	70.5	82.2	80.1	**73.3**	35	143.0	32.3
NE07410	73.2	61.7	68.7	48.8	59.2	77.5	77.7	**66.7**	57	143.3	31.6
NE07444	87.4	83.6	81.4	45.4	73.1	76.8	87.1	**76.4**	14	142.3	34.6
NE07457	72.5	67.3	69.5	61.2	76.2	87.1	80.1	**73.4**	33	145.0	30.0
NE07458	86.7	70.0	72.0	59.0	64.6	76.3	80.6	**72.7**	41	144.7	33.4
NE07469	74.2	76.1	72.8	57.9	65.7	73.1	73.8	**70.5**	55	144.7	33.8
NE07477	80.2	75.9	72.6	58.1	74.6	76.2	80.5	**74.0**	28	143.0	33.5
NE07479	80.5	73.8	68.7	70.4	66.5	77.3	77.0	**73.4**	31	142.7	31.0
HARRY	70.6	76.0	77.8	45.4	75.7	89.0	96.0	**75.8**	17	146.3	32.1
MILLENNIUM	66.1	71.0	79.8	49.5	69.3	76.9	83.5	**70.8**	51	144.3	34.6
NE07484	55.6	81.0	70.4	47.9	62.9	69.0	79.6	**66.6**	58	144.3	32.7
NE07486	78.2	73.4	73.0	60.8	75.8	83.8	79.1	**74.9**	24	142.7	32.0
NE07487	76.9	70.3	75.4	64.2	72.5	86.8	83.4	**75.6**	19	143.7	33.6

NE07490	79.5	68.3	74.0	32.1	75.3	88.9	89.6	**72.5**	42	144.0	32.2
NW07505	82.8	76.6	77.4	66.6	78.7	85.5	88.6	**79.5**	4	144.0	34.9
NE07520	85.2	58.5	70.2	72.4	76.4	82.4	86.4	**75.9**	16	144.3	32.9
NE07521	78.3	72.6	72.0	46.6	81.4	86.9	83.1	**74.4**	27	144.7	31.2
NE07531	74.6	84.0	81.5	35.5	82.8	89.1	88.1	**76.5**	12	144.0	32.1
NW07534	81.7	71.1	79.6	77.1	76.8	84.1	79.5	**78.6**	6	145.3	30.1
NW07539	79.8	59.2	70.8	66.2	72.5	78.5	79.8	**72.4**	43	144.7	33.3
NE07569	81.9	71.2	75.3	72.4	69.6	76.4	70.7	**73.9**	29	146.0	30.4
NE07627	83.6	77.7	80.8	76.0	75.5	82.8	86.3	**80.4**	3	144.3	33.0
NE07663	79.2	60.7	73.7	54.4	72.9	79.9	89.2	**72.8**	40	144.3	33.5
NE07668	85.3	55.5	76.0	69.2	79.3	85.9	85.8	**76.7**	11	146.0	32.8
NE07695	80.6	68.3	74.6	69.3	73.0	67.1	66.8	**71.4**	48	144.3	30.7
NI07703	84.8	66.7	76.6	54.9	74.8	91.6	79.8	**75.6**	20	143.7	31.3
GOODSTREAK	87.8	82.0	80.9	47.8	73.3	80.0	90.4	**77.5**	8	144.7	39.0
SCOUT66	54.7	51.9	69.9	29.1	51.7	61.7	66.5	**55.1**	60	144.0	39.5
CHEYENNE	76.0	62.1	70.4	34.9	62.4	71.0	77.3	**64.9**	59	145.0	39.1
Average	**78.0**	**70.2**	**74.9**	**56.0**	**73.3**	**81.1**	**82.9**	**73.8**			
LSD	9.6	10.0	6.6	3.3	7.0	7.1	8.4				

The 2009 NIN consists of lines advanced from the 2008 NIN and 2008 Triplicate (NTN). Our quality samples come from those nurseries as they can only be analyzed after they have been harvested for the previous year. In the 2008 NIN, thirty-one wheat lines were analyzed in single kernel, milling properties, protein content, ash content, rheological dough strength, and bread production. The top eleven wheat varieties had good baking performance without adding antioxidant. They were INFINITY, NW03666, NE05418, NE02533, NE06430, NI04427, NE06548, NI04421, NE06609, NE05426, and WESLEY in increasing order. Their average protein and ash content was 12.7% and 0.484%, respectively. They were HARD (average 67.5 hard index) wheat. Their average flour yield was had 74.2%. Their rheological dough strength was strong. They needed longer mixing times (average 6.8 min) to get optimal dough when water absorption was 61.3% in average. They had good exterior and very good crumb grain. They had smooth and resilient texture. They had high loaf volume (average 803 mL). Fourteen wheat varieties had very poor to fair in baking performance without adding antioxidant. After added 5 ppm antioxidant ascorbic acid in baking for these wheat samples, the bread quality was improved significantly, though water absorption and mixing time were not changed significantly. Therefore, only NE05548, NE01643, and NE05496 were considered unacceptable in bread quality.

In 2008 Triplicate, twenty-four lines were analyzed in single kernel, milling properties, protein content, ash content, rheological dough strength, and bread production. The top thirteen wheat varieties had good baking performance without adding antioxidant. They were NE07458, NE07490, NE07695, NE07487, NE07484, NE07520, NE07457, NW07534, NE07569, NE07410, NE07668, NW07539 and NW07505 in increasing order. The average protein and ash content were 12.2% and 0.446%, respectively. They were HARD (73.1 hard index) wheat. Their average flour yield was had 71.0%. They had good rheological dough strength. They needed longer mixing times (average 6.1 min) to get optimal dough when water absorption was 62.4% in average. They had good exterior and very good crumb grain. They had smooth and resilient texture. They had high loaf volume (778 mL in average). Five wheat varieties had poor to fair in baking performance without adding antioxidant. After added 5 ppm antioxidant ascorbic acid in baking for these wheat samples, the bread quality of wheat varieties was improved significantly, though water absorption and mixing time were not changed significantly. Therefore, only NE07469 and NE07663 were considered unacceptable in bread quality.

Data for 2008 are:

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.

Data for the NIN 2007 are:

Name	Mead	Lincoln	Clay Cen.	N. Platte	Sidney	Alliance	St. Avg.	Rank	State-CC Avg.	Rank
	bu/a	bu/a	bu/a	bu/a	bu/a	bu/a				
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**	

Data from 2007 to 2009 from the Nebraska Intrastate Nursery for Grain Yield (bu/a)

	name	Mead	Lincoln	Clay Cen.	N. Platte	Sidney	Alliance	St. Avg.	Rank	Mead Org.
		bu/a	bu/a	bu/a	bu/a	bu/a	bu/a	bu/a		bu/a
2007-2009	NE05496	57.69	75.97	51.47	75.09	64.01	68.70	63.97	1	68.19
2007-2009	NE05430	63.50	79.15	53.19	77.73	56.34	58.29	63.47	2	77.11

2007-2009	NE05548	56.92	78.40	47.48	78.41	60.95	67.12	63.30	3	70.36
2007-2009	SETTLER CL	56.80	70.90	54.37	78.14	57.04	69.22	63.20	4	80.93
2007-2009	NE05549	51.47	74.38	44.59	82.66	67.14	63.92	62.57	5	77.77
2007-2009	NI04420	52.98	73.72	48.71	77.30	60.59	64.53	62.22	6	75.86
2007-2009	NE01481	57.18	77.80	49.46	80.58	61.76	55.26	62.21	7	79.76
2007-2009	CAMELOT	56.76	70.73	39.25	84.72	63.86	63.99	62.10	8	83.40
2007-2009	OVERLAND	54.27	71.51	50.96	77.71	61.75	60.57	62.00	9	73.93
2007-2009	NE02558	48.87	73.24	44.30	82.92	63.83	64.47	61.59	10	75.08
2007-2009	NE04490	52.38	69.21	49.46	76.76	61.00	64.14	61.57	11	64.07
2007-2009	NI04421	49.74	72.10	46.99	73.40	64.19	68.71	61.54	12	79.76
2007-2009	NE05403	58.71	72.40	53.84	72.78	55.75	61.65	61.47	13	65.11
2007-2009	NI04427	54.90	67.10	51.02	76.79	60.02	65.35	61.36	14	74.68
2007-2009	NE05426	53.61	73.46	48.33	77.48	61.25	59.17	61.17	15	72.29
2007-2009	GOODSTREAK	62.63	68.29	38.24	79.69	61.44	64.43	61.16	16	74.01
2007-2009	NW03666	54.77	71.59	41.32	80.07	66.98	59.94	61.09	17	78.19
2007-2009	NE05459	54.33	69.50	51.65	72.37	59.45	62.02	60.55	18	73.32
2007-2009	NE02584	52.69	69.08	50.45	76.50	60.13	59.18	60.36	19	83.82
2007-2009	Infinity	58.41	66.26	41.06	72.32	62.45	63.75	59.75	20	74.44
2007-2009	NE05418	54.05	76.83	49.07	74.86	52.26	57.63	59.65	21	78.79
2007-2009	NE03490	53.18	63.33	33.16	81.33	67.29	65.55	59.42	22	72.51
2007-2009	NE02533	49.25	70.71	40.77	77.57	63.98	61.19	59.24	23	70.31
2007-2009	ALLIANCE	51.04	60.15	36.68	81.48	64.50	66.53	58.88	24	68.36
2007-2009	WESLEY	53.97	62.39	43.44	76.74	53.70	61.22	57.72	25	78.09
2007-2009	HARRY	53.88	60.23	36.96	71.97	61.58	67.36	57.33	26	88.84
2007-2009	MILLENNIUM	54.32	61.09	45.43	67.98	58.47	61.79	57.32	27	69.87
2007-2009	CHEYENNE	44.67	53.63	26.04	61.30	53.99	58.15	48.28	28	73.07
2007-2009	SCOUT66	43.06	46.76	21.08	57.75	52.40	53.66	44.78	29	71.82
	Average	**54.00**	**68.96**	**44.44**	**76.01**	**60.62**	**62.67**	**59.97**		**74.96**

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, there was low but positive correlations among the closer locations, but in all cases the variation in one location could not explain one-fifth of the variation in the other location, again indicating the value of extensive testing in NE.

The 2009 data are:

	Linc.	Mead	Mead Org.	Clay Cen.	N. Platte	Sidney	Alliance	State Avg	Rank	Flowering	Height
Variety	bu/a	bu/a	bu/a	bu/a	bu/a	bu/a	bu/a	bu/a		d after 1/1	in

GOODSTREAK	96.8	77.9	96.3	44.5	68.5	76.1	89.8	**78.6**	**6**	144.3	40.2
Overland	97.8	77.8	81.4	48.1	70.4	77.9	90.4	**77.7**	**8**	145.3	35.3
WESLEY	84.6	61.3	76.4	52.0	75.7	71.1	89.6	**73.0**	**34**	144.3	31.5
NE08402	98.2	72.7	90.2	54.5	64.2	77.0	85.0	**77.4**	**9**	143.3	31.6
NE08404	84.3	78.7	87.7	29.0	67.2	59.9	87.7	**70.6**	**48**	144.0	32.5
NE08405	81.2	70.2	75.2	57.9	67.6	66.7	75.8	**70.6**	**49**	142.0	32.3
NE08406	75.5	65.9	77.7	47.3	69.7	65.7	79.3	**68.7**	**52**	143.7	31.4
NE08407	92.9	76.8	95.1	59.0	66.8	84.2	86.8	**80.2**	**2**	143.0	32.0
NE08408	72.9	72.9	79.8	42.0	59.1	63.8	74.1	**66.4**	**59**	142.3	34.1
NE08410	91.5	76.3	93.5	59.4	64.8	85.4	79.5	**78.6**	**5**	143.0	32.1
NE08414	84.5	71.8	84.0	52.4	68.1	84.7	79.0	**74.9**	**24**	141.7	29.9
NE08417	88.7	68.5	81.9	63.5	66.6	76.9	79.2	**75.0**	**23**	142.3	31.5
NE08418	73.3	58.9	84.9	40.3	73.4	78.3	87.3	**70.9**	**47**	144.3	34.5
NE08435	95.7	83.0	85.5	58.6	65.7	83.1	89.0	**80.1**	**3**	142.7	32.4
NE08438	97.1	66.8	87.7	56.2	60.1	83.8	82.7	**76.3**	**14**	142.3	31.9
NE08440	92.0	64.5	86.5	55.5	75.0	81.5	85.0	**77.2**	**11**	143.7	34.7
NE08443	85.5	57.1	76.8	57.5	69.6	73.5	82.8	**71.8**	**44**	144.0	33.3
NE08445	69.3	76.6	79.4	40.2	59.4	74.9	75.9	**68.0**	**58**	142.7	34.0
NE08446	86.9	58.2	79.8	59.4	72.4	77.4	83.9	**74.0**	**29**	144.0	33.5
NE08447	86.9	69.2	79.1	58.8	68.6	66.8	78.8	**72.6**	**39**	144.0	34.1
NE08448	80.8	53.3	76.1	66.5	66.6	76.7	88.6	**72.6**	**38**	143.0	31.9
NE08449	90.8	66.5	79.8	64.8	63.1	77.6	85.7	**75.5**	**19**	144.3	36.8
NE08451	67.5	57.4	74.3	36.8	64.9	80.7	80.7	**66.0**	**60**	143.3	32.8
NE08452	95.0	72.5	82.3	74.8	66.8	84.5	78.6	**79.2**	**4**	142.7	32.6
NE08454	81.1	71.3	81.7	52.2	60.2	86.3	72.1	**72.1**	**42**	142.0	31.4
NE08457	87.8	75.5	90.1	69.0	74.7	74.6	90.2	**80.3**	**1**	143.7	33.6
NE08459	84.4	62.4	81.3	67.8	70.1	72.4	87.2	**75.1**	**22**	143.3	31.2
NW08460	87.5	75.7	83.5	68.5	62.2	86.6	77.0	**77.3**	**10**	143.3	33.4
NE08462	80.1	71.6	87.2	45.7	76.7	85.8	86.7	**76.3**	**15**	144.0	35.0
NW08463	81.0	60.9	85.1	53.7	78.4	80.3	80.8	**74.3**	**28**	143.3	32.1
NE08465	80.6	68.7	81.8	34.1	66.6	84.8	87.9	**72.1**	**43**	144.3	35.1
NE08466	71.3	63.8	86.1	37.7	71.8	87.6	84.5	**71.8**	**45**	142.7	32.2
NE08467	85.6	71.0	82.3	39.2	66.5	60.7	86.4	**70.2**	**51**	144.3	32.1
NE08468	82.8	51.2	85.5	56.2	67.4	75.5	75.5	**70.6**	**50**	143.3	33.3
NE08469	86.3	43.1	74.0	66.6	71.3	80.8	89.3	**73.1**	**33**	144.7	32.6
NE08470	87.1	66.2	78.8	47.1	71.0	82.9	87.9	**74.4**	**27**	143.7	32.1
NE08472	87.0	67.0	78.8	48.6	69.1	81.4	80.3	**73.2**	**32**	143.7	30.5
NE08476	95.0	71.2	84.1	59.5	63.3	71.0	85.9	**75.7**	**18**	144.0	33.3
NE08495	83.7	54.8	77.4	69.5	71.2	74.0	84.1	**73.5**	**31**	143.0	30.8
NE08499	85.9	79.6	88.7	43.4	67.2	77.3	89.4	**75.9**	**16**	143.7	34.2
NE08507	86.0	60.2	79.1	49.9	61.8	61.8	80.4	**68.4**	**54**	143.3	32.9
NE08509	87.3	56.6	80.4	55.2	72.2	75.2	94.2	**74.4**	**26**	144.7	31.7
NE08523	91.6	78.5	79.9	46.0	65.3	67.0	81.5	**72.8**	**36**	143.3	39.7
NE08527	88.3	69.7	80.7	57.8	67.3	75.7	90.5	**75.7**	**17**	144.7	36.4
NE08530	82.1	52.7	71.9	47.3	67.3	89.0	96.2	**72.4**	**40**	144.7	34.6
NE08531	88.6	63.8	86.3	61.7	69.2	72.7	85.7	**75.4**	**20**	144.3	35.7
NE08535	80.0	71.2	77.1	41.3	61.1	65.6	80.5	**68.1**	**55**	144.7	33.9
NE08555	90.0	64.3	80.0	67.5	71.4	72.9	79.9	**75.2**	**21**	144.3	35.6

NE08559	84.7	61.2	82.0	37.0	68.5	67.5	75.3	**68.0**	**57**	146.7	37.8
NE08578	86.5	61.1	93.7	45.5	70.4	77.3	87.1	**74.5**	**25**	145.0	35.8
NE08592	94.2	59.2	81.1	70.0	72.3	77.3	82.1	**76.6**	**12**	144.7	33.5
NE08622	82.6	52.8	77.6	67.9	69.3	79.8	86.6	**73.8**	**30**	145.0	35.5
NE08634	84.4	54.8	85.8	63.6	70.7	71.8	79.6	**72.9**	**35**	144.7	36.6
NE08643	86.7	62.2	75.1	56.4	67.9	72.6	85.5	**72.3**	**41**	145.0	37.5
NW08645	76.9	63.9	78.8	38.1	61.6	73.3	84.1	**68.1**	**56**	144.7	36.1
NE08646	86.0	59.2	93.1	39.8	69.4	71.8	89.7	**72.7**	**37**	144.7	36.9
NE08648	86.4	54.1	77.7	54.0	64.8	77.8	85.6	**71.5**	**46**	144.7	35.8
NE08651	94.0	61.9	85.5	43.9	78.0	81.7	89.8	**76.4**	**13**	145.7	33.0
NE08655	86.0	48.6	81.6	62.3	67.6	59.5	75.2	**68.7**	**53**	146.3	37.2
NE08659	95.3	59.0	81.8	70.5	70.0	77.5	93.0	**78.1**	**7**	145.7	37.1
Average	**85.9**	**65.4**	**82.5**	**53.6**	**68.1**	**76.0**	**84.0**	**73.6**		**143.9**	**33.9**
LSD	9.66	11.64	7.57	3.35	8.21	7.39	6.84				
CV	8.28	13.11	6.76	4.60	8.87	7.17	6.00				

The 2008 data are:

2008 name	MEAD (bu/a)	LINC. (bu/a)	C.CENTER (bu/a)	N.PLATTE (bu/a)	SIDNEY (bu/a)	ALLIANCE (bu/a)	**ST.YIELD** (bu/a)	**ST.RANK**
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		

The 2007 data are:

Name	Mead	Lincoln	Clay Cen.	N.Platte	Sidney	Alliance	St. Avg	St. Avg-CC	**St. Avg.**	**St. Avg-CC**
	bu/a	bu/a	bu/a	bu/a	bu/a	Bu/a	bu/a	bu/a	**Rank**	**Rank**
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**
Average	**49.49**	**59.72**	**35.80**	**72.98**	**61.96**	**47.18**	**54.52**	**58.27**		

Regional Nurseries

In 2009, 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 determine if they had merit. In general our Nebraska developed lines did well, but many lines from other states were favored by the mild winter and above average rainfall. At Lincoln and Clay Center there was severe wheat soilborne mosaic virus (WSBMV) infections which hurt line that are susceptible. Note WSBMV susceptibility also manifested itself as winterkilling.

RPN09	Linc.	N.Platte	Sidney	Alliance	**State Avg.**	**Rank**	Clay Cen.	**Avg.**	**Rank**
Variety	bu/a	bu/a	bu/a	bu/a	**bu/a**		bu/a	**bu/a**	
Kharkof	39.1	37.8	45.1	59.8	**45.5**	**90**	28.7	**42.1**	**50**
Scout 66	41.2	44.8	55.8	70.9	**53.2**	**89**	36.8	**49.9**	**48**
TAM-107	44.9	70.8	77.3	71.8	**66.2**	**79**	42.3	**61.4**	**46**
Trego	76.9	73.4	66.9	66.4	**70.9**	**71**	44.8	**65.7**	**40**
KS05HW136-3	84.0	65.5	73.1	82.6	**76.3**	**48**	57.6	**72.5**	**23**
KS06HW46-3	101.2	81.7	85.6	82.2	**87.7**	**4**	47.1	**79.6**	**7**
T163	78.1	68.2	77.8	77.5	**75.4**	**57**	56.4	**71.6**	**28**
T164	82.0	68.9	80.3	77.5	**77.2**	**43**	60.5	**73.9**	**19**
T165	51.4	68.1	88.1	85.4	**73.3**	**65**	34.4	**65.5**	**41**
T166	90.0	75.1	91.1	85.8	**85.5**	**8**	59.4	**80.3**	**4**
KS970093-8-9-#1-1	95.8	79.2	82.0	90.0	**86.8**	**5**	64.5	**82.3**	**3**
KS06O3A~57-3	91.8	67.8	75.1	72.7	**76.9**	**45**	55.9	**72.7**	**22**
KS06O3A~58-1	100.4	70.2	59.5	80.2	**77.6**	**39**	56.4	**73.4**	**21**
KS020056TM~4-1	98.1	77.6	74.4	77.8	**82.0**	**20**	62.1	**78.0**	**10**
OK05128	88.0	70.7	68.0	72.5	**74.8**	**59**	45.8	**69.0**	**31**
OK04525	88.0	76.0	79.0	82.8	**81.5**	**21**	58.4	**76.9**	**13**
OK04111	73.4	76.2	72.8	83.2	**76.4**	**47**	53.3	**71.8**	**27**
OK04315	90.1	69.1	64.8	80.1	**76.0**	**50**	39.4	**68.7**	**33**
OK05212	88.0	76.5	76.9	82.9	**81.1**	**24**	62.9	**77.4**	**12**
NE05403	74.8	71.4	70.1	85.9	**75.5**	**54**	65.9	**73.6**	**20**
NE05426	88.4	66.4	75.0	72.5	**75.6**	**53**	38.2	**68.1**	**35**
NE05496	90.9	77.1	85.5	83.9	**84.4**	**13**	55.3	**78.5**	**8**
NE06545	63.1	83.7	87.8	93.7	**82.1**	**19**	70.1	**79.7**	**5**
NE05430	88.5	70.6	65.1	79.2	**75.9**	**51**	67.9	**74.3**	**17**
CO03W054-2	47.3	76.4	91.6	94.6	**77.5**	**41**	38.5	**69.7**	**30**
CO03064-2	15.3	59.7	81.3	68.9	**56.3**	**88**	22.4	**49.5**	**49**
TX01V5134RC-3	81.1	63.9	67.3	76.2	**72.1**	**69**	38.5	**65.4**	**42**
TX04V075080	89.4	61.9	66.0	80.0	**74.3**	**60**	57.3	**70.9**	**29**
TX05A001614	53.4	84.0	82.7	99.2	**79.8**	**27**	52.9	**74.4**	**16**

TX05A001639	56.9	73.0	76.7	81.0	**71.9**	**70**	41.3	**65.8**	**39**
TX05A001828	53.2	73.4	87.2	92.0	**76.4**	**46**	38.8	**68.9**	**32**
TX05A001822	101.9	77.5	78.8	94.7	**88.2**	**3**	67.5	**84.0**	**1**
TX06A001263	74.2	77.1	74.8	89.6	**78.9**	**34**	46.7	**72.5**	**24**
TX05A001398	71.8	69.2	77.0	73.7	**72.9**	**66**	51.6	**68.6**	**34**
CO04393	76.0	77.1	80.7	75.4	**77.3**	**42**	52.8	**72.4**	**26**
CO04499	58.9	74.1	77.3	84.6	**73.7**	**62**	35.9	**66.1**	**37**
AP00x0100-51	108.2	77.6	82.3	86.7	**88.7**	**2**	59.4	**82.8**	**2**
Jackpot	83.9	75.6	82.7	82.5	**81.1**	**23**	45.7	**74.0**	**18**
AP05T2413	71.6	69.1	61.6	78.4	**70.2**	**73**	37.9	**63.7**	**44**
AP06TA4520	80.7	64.0	63.2	72.8	**70.2**	**72**	48.6	**65.9**	**38**
AP06T3832	97.2	70.6	74.7	82.1	**81.2**	**22**	67.3	**78.4**	**9**
NW04Y2188	61.3	67.9	60.6	68.2	**64.5**	**82**	37.5	**59.1**	**47**
HV9W04-1186W	88.1	68.6	94.7	83.0	**83.6**	**16**	54.1	**77.7**	**11**
HV9W04-1594R	95.8	75.2	79.3	88.0	**84.6**	**12**	44.2	**76.5**	**14**
HV9W03-1596R	85.6	75.4	75.8	81.5	**79.6**	**29**	55.1	**74.7**	**15**
HV9W05-1125R	94.0	80.4	79.1	87.3	**85.2**	**10**	57.1	**79.6**	**6**
Antelope	65.7	71.2	77.5	79.1	**73.4**	**63**	45.3	**67.8**	**36**
WESLEY	83.9	69.3	70.1	78.7	**75.5**	**56**	60.1	**72.4**	**25**
Jerry	60.3	55.1	69.0	81.9	**66.6**	**77**	49.0	**63.0**	**45**
NX05M4180-6	40.6	57.6	70.6	85.2	**63.5**	**85**	67.0	**64.2**	**43**
NX05M4499-1	87.8	66.5	77.4	87.5	**79.8**	**28**			
AP00x0100-51	103.3	79.2	85.9	91.4	**90.0**	**1**			
NW04Y2188	56.1	68.1	63.0	69.7	**64.2**	**83**			
LE1911	46.0	47.0	72.8	76.6	**60.6**	**87**			
NE04490	105.0	73.6	74.9	82.6	**84.0**	**14**			
NE05548	98.1	70.3	76.3	84.8	**82.3**	**17**			
NE05549	82.6	78.2	86.0	92.0	**84.7**	**11**			
NE06469	57.3	78.5	85.4	81.6	**75.7**	**52**			
NE06607	44.9	81.3	80.1	85.4	**72.9**	**67**			
NI04420	73.6	82.3	73.3	82.1	**77.8**	**37**			
NI04427	72.9	77.2	75.3	84.5	**77.5**	**40**			
SD07W053	51.8	70.0	69.4	80.6	**68.0**	**75**			
SD07126	90.1	73.8	78.7	98.3	**85.2**	**9**			
SD07W084	69.3	73.0	71.7	79.1	**73.3**	**64**			
SD07165	94.7	74.1	87.1	91.1	**86.7**	**6**			
SD05118-1	60.9	78.5	77.3	99.9	**79.2**	**32**			
CA9W07-817	48.1	57.7	69.1	90.6	**66.4**	**78**			
CA9W07-818	50.8	58.1	59.7	84.2	**63.2**	**86**			
CA9W07-819	54.9	59.9	65.5	95.7	**69.0**	**74**			
NE06436	81.3	72.2	72.7	93.1	**79.8**	**26**			
TA001	75.7	70.4	97.0	79.1	**80.5**	**25**			
TA024	67.1	75.7	93.1	80.7	**79.1**	**33**			
TA030	50.8	72.8	93.5	97.9	**78.7**	**35**			
TA103	65.2	73.8	85.9	79.6	**76.1**	**49**			
TA111	73.4	53.8	77.1	66.7	**67.7**	**76**			
TA157	68.7	64.0	84.3	83.6	**75.1**	**58**			
TA163	39.1	65.8	81.3	73.4	**64.9**	**81**			

TA171	67.8	72.9	91.8	75.7	**77.0**	**44**			
TA173	66.7	51.2	75.6	62.9	**64.1**	**84**			
TA064	63.4	68.6	81.7	76.3	**72.5**	**68**			
MACE	60.8	66.2	71.4	66.2	**66.2**	**80**			
NE01643	79.4	68.1	80.5	89.1	**79.3**	**31**			
NE04424	82.5	87.9	81.9	91.4	**85.9**	**7**			
NE05425	86.5	69.6	71.8	86.1	**78.5**	**36**			
NE05569	82.8	74.7	80.6	96.7	**83.7**	**15**			
NI04436	85.9	72.0	82.5	88.1	**82.1**	**18**			
NI06721	74.1	76.3	80.7	80.0	**77.8**	**38**			
NI06724	76.8	70.1	76.7	78.5	**75.5**	**55**			
NI08717	68.1	72.6	76.9	78.6	**74.0**	**61**			
NW06630	79.9	72.5	83.8	82.0	**79.5**	**30**			
Average	**73.9**	**70.6**	**76.8**	**82.1**	**75.8**				
CV	13.1	9.4	7.9	8.8					
LSD	13.0	9.0	8.3	9.8					

In considering how our germplasm compares to the region's, the Nebraska early germplasm needs better resistance to WSBMV and straw strength so it can complete better in the south central region (e.g. Lincoln and 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 are extremely useful for 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. The table below gives the grain yields for all of the locations, the line average, and the rank of the top 10 highest yielding lines. The highest yielding check was an Overland check (ranked 23, 26, and 57) indicating we have very competitive new lines in development. Fifty-seven lines were advanced for further testing.

	Linc.	Mead	Mead Org.	Clay Cen.	N. Platte	Sidney	Allianc e	**St. Avg.**	Flowerin g	Height	Test Wt.
Name	bu/a	bu/a	bu/a	bu/a	bu/a	bu/a	bu/a	**bu/a**	d after 1/1	in	lbs/bu
NE09481	99.5	53.0	83.0	70.5	100.3	79.3	91.6	**82.5**	143.3	29.9	59.9
NE09476	93.1	70.5	84.0	46.8	87.3	82.4	92.9	**79.5**	144.7	31.7	58.1
NE09586	95.2	70.1	88.4	56.0	87.3	81.5	73.2	**78.8**	142.0	32.0	58.9
NE09627	83.3	51.4	83.7	72.4	79.9	87.1	83.5	**77.3**	143.0	31.3	57.1
NE09517	97.4	60.2	79.4	55.9	94.5	56.5	93.7	**76.8**	144.3	34.1	60.6
NE09482	98.0	53.9	82.2	65.2	88.9	70.3	78.8	**76.7**	144.0	32.4	59.8
NE09477	81.6	73.4	81.4	43.0	85.4	72.8	98.9	**76.6**	143.3	32.4	58.8
NE09601	99.9	69.7	68.2	62.8	75.7	64.2	95.3	**76.5**	142.7	33.0	59.0
NE09417	90.5	82.8	87.3	62.2	64.8	73.1	73.6	**76.3**	143.3	32.6	59.4
NE09636	90.1	71.2	88.8	76.4	72.3	65.3	67.6	**75.9**	144.7	32.0	58.3
Overland	92.3	80.4	88.2	48.4	70.0	66.3	74.3	**74.3**	145.3	33.9	59.7

Goodstreak	80.3	73.0	97.1	41.0	67.9	79.7	80.7	74.2	144.7	35.4	60.8
Overland	69.1	76.3	92.9	37.5	74.0	73.7	94.6	74.0	146.3	32.7	59.6
NuDakota	86.8	71.5	48.8	56.7	83.0	80.5	81.6	72.7	145.0	29.4	54.5
Overland	78.8	43.3	83.8	42.3	100.1	64.0	85.7	71.2	145.3	33.4	60.1
average	**71.8**	**52.3**	**75.5**	**44.7**	**70.8**	**64.6**	**74.4**	**64.9**	**144.5**	**33.2**	**59.0**

8. Early Generation Nurseries

a. Single-plot Observation Nursery

Seventeen and fourteen lines were evaluated at Lincoln in 2009. Of the 1714 lines and checks, 1387 where red or mixed red and white seeded (including 117 one and two gene herbicide tolerant lines and 153 Hessian fly tolerant lines) and 327 where white seeded. Of this group, 410 were harvested and 410 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 higher 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, 225 red, 17 herbicide tolerant lines, and 38 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 -d

In 2008-09, 338,800 headrows were planted at Lincoln. In general, the headrow nursery was considered as average at Lincoln. As is usual, the headrows were planted on time, grew well, and were generally difficult to separate, especially for semidwarf lines with good straw that should be sent to our irrigated observation nurseries. However, many good types were identified. We harvested over 1850 lines and planted 1840 (1510 red or segregating red and white; 336 white wheat; 104 lines for wheat streak mosaic virus testing, and 225 herbicide tolerant lines—note the total will be higher than 1840 due some wheats are red and wheat streak mosaic virus tolerant and herbicide tolerant). Of the red and white wheat lines, 245 where sent to Scottsbluff for planting at in our irrigated observation nursery, and 104 lines to Gary Hein to test for wheat steak mosaic virus tolerance.

c. F_3 bulk hybrids

The F_3 bulk hybrid nursery contained 660 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 the plots were good, though it appeared they were not as well tillered as expected which may be due to our using a considerable amount of diverse germplasm, which may not be adapted to our conditions. It is always difficult to select for bulks with tall plants that should do well in western NE where straw strength is less important. These bulks were often lost due to lodging. 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, 50 yielding bulks from our sorting experiments were planted at Mead. Fifty-four F_2 bulks with one or two genes for herbicide resistance planted at Lincoln for selection. The bulks generally survived the winter, but some were winterkilled (those involving wintertender parents) and others were severely affected by Fusarium head blight. 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 935 bulks (including 50 herbicide tolerant bulks) were advanced as individual bulks for further consideration in 2009-10 from our program.

9. Winter Triticale Nursery

In 2009, no new triticale lines were recommended for release; however, we selected nine lines for increase 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. Our current thoughts are that we will most likely partner with a triticale seed supplier to merchandise our next release. Jeff Noel handles our licensing arrangements and has contacted a number of companies.

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. Due to personnel changes and emphasis on other crops, cooperation with Iowa State University has considerably lessened. The forage data for the 2009 triticale variety trial will be provided by Dr. Ken Vogel and the USDA-ARS.

The triticale-breeding program received $8829.00 research and development fees for 2009. Last year we no R&D funds, but received $6265.09 in 2008, and $8,589.20in 2007. We believe that new merchandising arrangements can improve the impact of these varieties. 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 for the 2009 triticale variety grain trials are:

	Linc.	Mead	Sidney	St. Avg.	State	Linc.	Mead	Avg.	Linc.	Sidney	Avg
Variety	lbs/a	lbs/a	lbs/a	lbs/a	Rank	Hdate	hdate	hdate	height	height	height
								May			in
NE422T	4484	3343	4963	4263	20	24.7	26.3	25.5	40.7	39.6	40.2
NE426GT	3367	2806	4194	3456	29	28.7	30.0	29.3	53.9	53.5	53.7
JAGGER	2855	3120	4054	3343	30	20.3	23.8	22.1	33.4	31.8	32.6
NT01451	5354	3601	5090	4682	4	25.3	26.3	25.8	41.2	37.9	39.6
NT02421	5401	3532	4914	4616	7	23.0	27.0	25.0	43.6	41.7	42.7
NE03T416	5008	3521	5075	4535	9	21.3	25.9	23.6	40.7	38.4	39.6
NT04424	5006	2921	5132	4353	15	25.3	26.3	25.8	43.1	40.5	41.8
NT04432	4211	3407	5131	4250	21	25.3	27.7	26.5	40.0	38.9	39.5
NT05421	5178	3952	4214	4448	12	25.0	26.5	25.7	46.9	42.8	44.9
NT05429	5044	4047	5032	4708	3	22.7	25.5	24.1	39.2	36.8	38.0
NT05442	4383	3628	4786	4266	19	25.7	26.6	26.1	39.4	36.9	38.2
NT05444	4498	3558	4962	4339	16	24.7	27.7	26.2	41.6	38.9	40.3
NT06422	5619	4122	5066	4936	2	21.3	25.5	23.4	42.7	38.7	40.7
NT06423	4341	3241	4663	4082	24	24.7	27.1	25.9	44.3	41.6	43.0
NT06427	4304	3790	4884	4326	17	25.7	25.3	25.5	41.4	35.2	38.3
NT07403	5170	4312	5420	4967	1	23.7	24.6	24.1	42.5	38.1	40.3
NT07410	4971	3662	4686	4440	13	22.7	25.7	24.2	41.1	40.3	40.7
NT07434	3831	3843	4461	4045	26	25.3	25.9	25.6	39.9	38.5	39.2
NT07438	3060	3129	4285	3491	28	26.3	28.7	27.5	44.2	45.6	44.9
NT08402	4201	4008	5373	4527	10	24.7	25.9	25.3	40.8	36.3	38.6
NT08408	4110	3793	3840	3914	27	26.0	27.5	26.7	45.1	46.2	45.7
NT08411	4078	3746	4479	4101	23	26.3	25.9	26.1	35.9	38.5	37.2
NT08414	5414	3438	5170	4674	5	24.7	26.2	25.4	38.8	36.3	37.6
NT08421	4514	3011	4924	4150	22	26.3	25.8	26.0	42.4	37.8	40.1
NT08425	5128	3675	5081	4628	6	24.3	26.1	25.2	41.9	39.9	40.9
NT08426	4684	3071	5216	4324	18	25.3	25.9	25.6	39.1	37.6	38.4
NT08428	4843	3889	5042	4591	8	23.3	26.0	24.7	41.5	39.0	40.3
NT08430	4801	3332	4047	4060	25	25.0	26.6	25.8	45.9	43.0	44.5
NT08432	5315	4025	3726	4355	14	24.7	25.5	25.1	41.6	37.2	39.4
NT08450	5056	3653	4693	4467	11	26.0	27.0	26.5	43.9	41.9	42.9
Average	**4608**	**3573**	**4753**	4311		**24.6**	**26.4**	25.5	**41.9**	**39.6**	40.8

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 data summary for locations where we were able to harvest trials is presented below:

		Linc.	Mead	Sidney	St. Avg.	State
	name	lbs/a	lbs/a	lbs/a	lbs/a	Rank
2007-2009	NT06422	4601	3167	3874	3965	**1**
2007-2009	NE03T416	4119	3164	4355	3926	**2**
2007-2009	NT05429	4483	3055	3978	3919	**3**
2007-2009	NT02421	3974	3228	3914	3686	**4**
2007-2009	NT04424	3938	2599	4246	3673	**5**
2007-2009	NT01451	4095	2668	4050	3661	**6**
2007-2009	NT05421	4315	3097	3368	3618	**7**
2007-2009	NT04432	3715	2763	3950	3538	**8**
2007-2009	NT05442	3558	3231	3852	3497	**9**
2007-2009	NT06423	3753	2424	3756	3430	**10**
2007-2009	**NE426GT**	**3627**	**3054**	**3770**	**3428**	**11**
2007-2009	NT05444	3357	2864	3941	3371	**12**
2007-2009	**NE422T**	**3138**	**2317**	**3181**	**2917**	**13**
2007-2009	JAGGER	2646	2357	3427	2873	**14**
Average		**3808**	**2856**	**3833**	**3536**	

It is clear that we have made great progress in grain yields in triticale. Marketing remains the major limitation to improving triticale's impact in modern agriculture.

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 continues to summarize this research. Using more lines, we are able to map the QTLs with greater precision and also indentify QTLs with smaller effects. We planted and harvested in replicated trials at Lincoln, Mead, North Platte, and Sidney, 90 WI(RICL3A)s to compare to our CNN(RICL3A)s. Mr. Neway Mengistu is leading the WI(RICL3A)s research as part of his Ph.D. dissertation. The trial at North Platte and Sidney were very good, but the trials at Lincoln and Mead were hurt by disease and herbicide drift. 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, but we expect to enhance our efforts by purchasing a new very fast kernel sorting (red from white) machine—due to arrive in June 2010. 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 for low polyphenol oxidase, an enzyme that is believed to discolor wet noodles and other wheat products, such as frozen dough products.

The results were as follows:

	Total			Low PPO
Nursery	Number of	Low PPO	Higher PPO	Percent of Lines
2009	Lines	Lines	Lines	
NIN	60	7	53	12%
Triplicate	60	5	52	9%
Duplicate	280	20	260	7%
Irrigated-Dry	40	8	32	20%
S4R8	1841	128	1713	7%

* 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 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. In breeding wheat it takes 12 years to create a new cultivar, so it is very difficult to stay ahead of disease virulence changes. 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.

Work continues on introgressing the resistance from *Agropyron* (the first real resistance/tolerance to wheat streak mosaic virus [WSMV] 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) and WSMV 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 continued screening all three way cross F1 seed to identify those carrying FHB and WSMV 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). 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. We are also designing crosses with known FHB QTLs so as to create populations with a high frequency of genotypes that have FHB QTLs, thus making selection easier. 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. Drs. Ismail Dweikat and Guihua Bai (for marker research) and Floyd Dowell (for optical sorting) are key collaborators in these efforts.

14. Coordinated Agriculture Project: Applied Wheat Genomics

Our Wheat CAP RIL population (CAP 70/71), TAM 107-R7 by Arlin is currently on track and complete with the grant timeline. We submitted our final marker data set in June 2008. The data set includes 436 markers, a mixture of SSR, DArT, Glutenin, and morphological markers, totaling 67,144 data points. Our linkage map is complete and will be submitted to the CAP database in December 2008. The linkage map covers approximately 2120 cM, with a density of 6.44 cM/marker. The QTL data was submitted to the database in October 2009. We identified QTLs for 8 traits, totaling 40 QTL from individual and combined environments. The most significant QTL was for Soilborne Wheat Mosaic Virus. The remaining trait QTLs were for heading, anthesis, maturity, grain fill duration, plant height, test weight, and grain yield data.

We have conducted RIL integrity using ten SSR markers on our population using seed from our seed increases from the greenhouse and in Yuma, AZ. From the random samples of each line we identified no deviation or errors from one generation to the next. Visual analysis of glume color (bronze vs. white) and seed color (red vs. white) gave us the ability to check RIL integrity in the field before harvest of our plots.

C) QTL testing

We completed our two-year six environment testing of our RIL population throughout Nebraska. Our population was grown in the field using replicated (3 replications) trials at 3 locations (Lincoln, Mead, and North Platte, NE). Additional locations (2) in Texas have been conducted (2008-2009) but not included in the submitted data, but will be added to the publication. We have also tested our population on the basis of end-use quality. Currently we only have one year's data, while the current 2009 study is still being screened in the lab with then anticipated finish date of April 2010. We will investigate microquality analyses among the $1A_S.1A_L$ lines and among the $1R_S.1A_L$ lines) and red vs. white wheat. Post harvest quality QTL for 2009 will not be available until early 2010 and will be included in subsequent publications.

During the spring of 2008 and 2009 at Lincoln, NE, a severe infection of Soilborne Wheat Mosaic Virus (SBWMV) occurred. Our parental lines differ in their resistance levels and therefore we had the chance to evaluate the population using quantitative data (ELISA) and visual phenotyping to identify a SBWMV resistance QTL. We have identified a very significant region on linkage group 5D for SBWMV resistance and a closely linked marker. End-use quality data from our SBWMV environments (Lincoln 2008 and 2009) will be conducted to determine the potential negative effects this pathogen has on the population. Our population was sprayed with fungicides to remove the confounding factor of plant disease fungal pathogens, so only this disease was present.

We will likely share our end-use quality data from two of our locations (Mead, NE and North Platte, NE) with wheat breeders at Colorado State University (Dr. Patrick Byrne and Dr. Scott Haley) for two reasons 1) because they developed the population and will be able to help us through analysis and interpretations and 2) because they have already grown the population in multiple environments so that we may conduct a combined analysis statistically and then for end-use quality QTL across Colorado and Nebraska.

Fungal disease trait data from greenhouse assays are also being obtained from Dr. Harbans Bariana in Australia and will be used to screen putative QTL in our population or identify single resistance loci. We are planning to screen the parental material and the population with SSR markers to identify if our parents and population carry the *Triticum ventricosum* 2NS segment that confers *Lr37, Yr17* and *Sr38* resistance.

15. Genetic Diversity in Turkish and Nebraska Cultivars

Ms. Anyamanee Auvuchanon (who is supported by a scholarship from the government of Thailand) completed

her study of the relationship between U.S. and Turkish wheat lines. In her study, she evaluated 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 in 2008 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 suggested 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 based on molecular markers and phenotypic data 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 (based upon molecular markers) 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. We have begun crossing the elite Turkish wheat lines with our adapted germplasm.

16. 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 phenotypically and with molecular markers. She is also studying the origin of the variation in PPO activity and dough discoloration. Her preliminary results indicate one of the published markers in not very useful and that both the genotype and environment x genotype affects the expression of PPO activity. 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.

17. Introgressing traits from Synthetic Wheat Lines

In collaboration with Drs. Pat Byrne and Scott Haley of Colorado State University, we backcrossed six synthetic wheat lines into Goodstreak. The synthetic wheat lines are crosses of durum wheat (AABB) to the D-genome donor (*T. tauschii*, DD). The resultant wheat is AABBDD which is similar to common or bread wheat in its genome structure. The synthetic wheats were chosen on the basis of apparent drought tolerance. To determine if they may have other useful genes, Ms. Kayse Onweller has screened the lines in collaboration with others for numerous disease and insect pests. It appears the lines have useful genes for greenbug and stem rust resistance.

18. Organic Wheat Breeding

a. Yield and Agronomic Traits

Organic State Variety yield trials, with 19 varieties and 11 experimental lines, were conducted at Mead, Clay Center, Sidney and Dixon County. NIN, Triplicate and Duplicate nurseries, with the same entries as in the conventional trials, were conducted at Mead and Sidney. Clay Center and Mead were planted after soybeans in October on the 5th and 20th respectively. Sidney was planted after fallow on September 17. Concord was planted after oats/clover on September 18.

The five top-yielding lines in the state variety trial for 2009 at Sidney were as follows:

	2007-2009				2008-2009						2009				
	yield	YRank	TW	HT	yield	YRank	TW	HD	HT	Cover Index	Yield	TW	HD	HT	Cover Index
NE03490					44	8	59.6	153	25	6.1	44	58.9	150	24	5.6

HATCHER	61	1	58.9	28	52	1	59.7	154	24	3.8	42	58.0	151	21	2.5
WAHOO	52	6	56.9	29	45	6	57.5	153	25	5.8	42	54.7	150	24	5.8
NE06469											42	58.6	150	26	5.1
ANTELOPE	54	3	59.7	29	48	5	60.3	154	26	5.9	42	59.2	151	24	2.8
Mean	51		59	30	42		60	153	25		38	58	151	24	
CV	16		2	9	22		1	1	12		13	2	3	10	
LSD	NS		2	4	NS		NS	NS	4		6	2	1	3	

The ten top-yielding lines in the state variety trial for 2009 in the eastern locations were as follows:

	2008- 2009			2009					Mead			Dixon			Clay Center		
	Yield	Yield rank	TW	Yield	TW	Rel HD	HT	Cover Index	Yield	Yield rank	TW	Yield	Yield rank	TW	Yield	Yield rank	TW
NE03490	60	5	56	70	59	1	30	3	86	11	58	58	1	58	65	2	60
WAHOO	57	8	56	68	58	3	33	6	90	3	58	51	5	57	63	6	59
SD05118				68	59	5	31	5	87	8	59	51	7	58	65	3	61
CAMELOT	56	9	57	68	59	1	33	5	94	1	59	42	23	59	67	1	61
NE99495	56	9	58	66	60	2	31	5	89	4	59	48	13	58	60	11	62
NW03666				66	59	2	33	4	89	4	58	47	14	57	61	8	60
GOODSTREAK	62	2	58	65	60	2	38	6	86	10	60	51	6	59	59	14	62
NE05548				65	59	2	36	6	85	15	59	52	2	58	59	13	60
NE01481	56	9	57	65	59	3	33	3	86	9	59	51	8	58	57	16	60
HARRY	59	6	55	64	57	4	31	4	85	12	56	48	11	56	60	12	59
Mean	57		57	65	59		33		82		59	46		58	58		60
C.V.	13		2	10	1		4		8		1	14		1	10		1
LSD.05	6		1	8	1		2		8		1	9		1	8		1

Despite its good yield performance, Harry was removed from further testing because of its consistently low test weight. Buyers of organic wheat do not accept grain with a test weight lower than 57 lbs./bu.

Analysis of 2008 Triplicate lines that were also in 2009 NIN revealed significant genotype x environment interaction for yield (System * Sasentry in the following table) between conventional and organic systems at Mead and Sidney.

Dependent Variable: GY

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	433	525216.7325	1212.9717	23.99	<.0001
Error	821	41513.2654	50.5643		
Corrected Total	1254	566729.9979			

R-Square	Coeff Var	Root MSE	GY Mean
0.926749	12.61587	7.110856	56.36438

Source	DF	Type I SS	Mean Square	F Value	Pr > F
SASentry	59	19819.2568	335.9196	6.64	<.0001
locyear	3	360311.9418	120103.9806	2375.27	<.0001
System	1	16310.3302	16310.3302	322.57	<.0001
BLOC(locyear*System)	16	75341.4402	4708.8400	93.13	<.0001
locyear*System	0	0.0000	.	.	.
System*SASentry	59	10548.9297	178.7954	3.54	<.0001
locyear*SASentry	177	28017.0039	158.2882	3.13	<.0001
locyea*System*SASent	118	14867.8299	125.9986	2.49	<.0001

b. Milling and Bread Baking Quality

Thirty-seven organic wheat varieties, composited from Mead and Sidney locations, were analyzed in single kernel, milling properties, protein content, ash content, rheological dough strength, and bread production in the UNL Wheat Quality Lab. The top fourteen organic wheat composites had good baking performance without adding oxidants. They were NW03666, NE01481, KARL92, NE05496, PRONGHORN, NE07444, NE06469, NE04424, NE02558 , NW03681, NE07569, SD05118, NW07505 and NE05425 in increasing order. Their average flour protein and ash contents were 10.6% and 0.455%, respectively. They had strong dough. They needed long mixing times (average 6.6 min) to get optimal dough when water absorption was 62.2% on average. They had good exterior and crumb grain and smooth and resilient texture. Loaf volume was high (average 784 mL). Baking quality of the remaining 27 poorer quality lines was significantly improved by adding 7.5 ppm oxidant. However, approved oxidants are not available for organic bread making. Only OVERLAND was evaluated as having poor baking quality with the added oxidants.

Twenty-five organic wheat varieties, which were composited from Lincoln, Mead, North Platte and Sidney locations, were characterized in milling properties, protein and ash contents, falling number, farinograph, and bread production by Baystate Milling and Chopin alveograph by Heartland Mills. In general, the wheat from the two-location composites possessed superior baking quality compared with those from the four-location composites possibly because of the higher ash content of flour from two locations, despite the higher flour protein from four locations.

Of the 25 varieties that were tested as both 2-location and 4-location composites, Karl 92 excelled for bread quality. Overland, Goodstreak and Arrowsmith were unacceptable. Darrell, Wesley, NE04424, NE01481 and NE05548 were at least marginally acceptable. Two of these lines stand out as having good protein quality despite lower protein content: NE04424 and NE01481. Alliance was alone in having a very low protein content, which explains its nominal bread quality. One experimental line with very strong gluten and an excellent bread score in UNL tests, NE05425, performed poorly in Baystate's farinograph and baking tests and was therefore deemed unacceptable to Baystate.

When comparing 2009 results with 2008 Organic results and multiple years of data from conventional trials in regional nurseries (USDA tests), the rejection of Goodstreak, Danby and Overland for the organic bread market is supported. The poor baking and milling in 2009 is supported for Goodstreak, but not for Arrowsmith. Heartland and UNL's favorable bread results for Hatcher, Camelot, Pronghorn, Buckskin, Darrell and Wesley in 2009 are supported by 2008 Organic data and USDA tests. The long-term poor milling of NE01481 and Antelope is a concern that is supported by 2008 and 2009 organic data.

c. Nutritional Quality

Kelloggs Company tested 37 lines from Sidney for digestible fiber. Sixteen lines exceeded the checks for total digestible fiber in the following descending order: NE06469, Darrell, NEne06607, Camelot, NE07444, Clarks Cream, NW03666, NW07505, Buckskin, Millennium, Hatcher, Alliance, Karl92, Wahoo, Overland, and NE06545. The top line, NE06469 was well above the others.

Antioxidant tests revealed that the hard white wheat lines, Arrowsmith, Antelope and Anton had levels of total phenols and total flavonoids that were well below the levels for all tested hard red wheat lines except for Darrell.

IV. GREENHOUSE RESEARCH

In 2009, the majority of F_1 wheat populations were grown at Yuma, AZ. Mainly 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 79 triticale crosses, 107 barley crosses and 921 wheat crosses in last year's winter greenhouse. In addition, we made numerous crosses to the of the synthetic wheat x Goodstreak crosses and about 50 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 have continued our fee for service contracting and panted a trial for a commercial seed company at Mead, NE.

We received our eighth 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 try 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 2009 and with the interest in feed grains due to the ethanol market. We are increasing a number of barley lines for further testing and as possible new products. The 2009 Barley Variety Trial data are:

VARIETY	Mead		Sidney	Colby	Colby	Over All Average			
	Yield	WinSur	Yield	Test weight	Yield	Yield	Rank	Flowering Date	Height
	lbs/a	*%*	*lbs/a*	lbs/bushel	*lbs/a*	***Lbs/a***		***(after May 1)***	***Inch***
P-713	2282	92	3326	47.1	3331	**2980**	**12**	**23.2**	**28.0**
P-721	2094	72	3121	47.2	2923	**2713**	**23**	**23.3**	**25.8**
P-954	2388	73	3111	45.9	2838	**2779**	**22**	**24.4**	**27.2**
TAMBAR 501	1377	72	2456	46.9	2984	**2272**	**40**	**22.1**	**27.8**
NB018187	2136	67	3768	48.4	3050	**2985**	**11**	**23.7**	**27.0**
NB018199	2381	77	3810	47.8	2978	**3056**	**7**	**26.5**	**27.2**
NB03437	2397	75	3012	48.3	3253	**2887**	**15**	**25.0**	**27.4**
NB99845	2241	80	3267	45.2	3078	**2862**	**17**	**22.3**	**25.9**
NB99875	3406	80	3129	46.8	2926	**3154**	**3**	**23.0**	**27.5**
NB03429	2649	78	2982	47.9	2922	**2851**	**18**	**24.6**	**25.8**
NB05419	1702	77	2422	45.8	2996	**2373**	**38**	**21.3**	**27.9**
NB05420	2274	77	1814	45.6	3047	**2378**	**37**	**22.0**	**27.2**
NB06417	1982	72	2369	45.3	3127	**2493**	**33**	**20.3**	**27.7**
NB06444	2029	68	2664	47.9	3178	**2624**	**27**	**22.7**	**26.0**
NB07407	2734	68	3049	49.6	2748	**2844**	**20**	**24.1**	**27.6**
NB07410	2798	73	3057	48.3	2890	**2915**	**13**	**23.1**	**30.8**
NB07411	3220	82	4746	47.8	2841	**3602**	**1**	**25.0**	**29.1**
NB07412	3244	75	3752	48.8	3147	**3381**	**2**	**24.0**	**27.6**
NB07416	2080	62	2924	49.2	3070	**2691**	**24**	**22.9**	**28.5**
NB07442	2466	65	2116	48.9	3229	**2604**	**30**	**23.3**	**28.9**
NB07443	2504	77	2272	47.6	2769	**2515**	**31**	**22.0**	**28.7**
NB08402	3188	70	2961	48.8	3005	**3051**	**8**	**23.4**	**28.5**
NB08403	3414	80	2558	50.1	3098	**3023**	**9**	**22.5**	**28.9**
NB08405	3150	83	2403	50.4	3059	**2871**	**16**	**24.6**	**29.2**
NB08409	3229	85	3164	49.6	2992	**3128**	**4**	**24.1**	**29.6**
NB08410	3631	73	2608	49.0	3056	**3098**	**6**	**23.3**	**28.9**
NB08411	3334	72	2673	49.7	2949	**2985**	**10**	**23.3**	**28.9**
NB08412	2429	55	2723	48.9	3188	**2780**	**21**	**24.4**	**28.2**
NB08413	3062	75	3290	49.2	2957	**3103**	**5**	**24.8**	**28.2**
NB08414	2757	73	3003	47.8	2788	**2849**	**19**	**23.8**	**29.1**
NB08419	2993	70	1502	49.6	2748	**2414**	**35**	**21.9**	**30.0**
NB08423	2255	78	2473	46.3	3101	**2610**	**29**	**21.8**	**26.2**
NB08428	2450	78	2375	48.5	3068	**2631**	**26**	**23.7**	**26.9**
NB08430	1836	78	3481	49.3	2521	**2613**	**28**	**24.6**	**31.7**
NB08436	2505	78	2115	47.4	2897	**2506**	**32**	**23.5**	**28.0**
NB08437	1791	65	2501	47.1	2867	**2386**	**36**	**21.9**	**26.6**
NB08438	2235	85	2135	46.2	2574	**2315**	**39**	**22.7**	**27.1**
NB08440	2422	77	2836	46.3	2781	**2680**	**25**	**22.1**	**27.9**
NB08441	2444	78	2203	46.9	2812	**2486**	**34**	**21.7**	**27.3**
NB08444	3258	75	2747	47.4	2696	**2900**	**14**	**24.0**	**27.5**
Mean	**2569.2**	**74.8**	**2823.0**	**47.9**	**2962.0**	**2940**		**23.6**	**27.7**
CV	**13.7**	**13.4**	**20.1**	**1.6**	**6.9**				

LSD (p=0.05)	**572.4**		**924.0**	**1.1**	**284.1**					

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		

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. ConAgra also provides excellent milling and large loaf baking data to support our small loaf testing procedures. 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. Dr. Anyamanee Auvuchanon successfully completed her Ph.D.degree. We welcome Mr. Ibrahim Salah El-Baysoni (who will be working on association mapping) and Mr. Tadele Tadessa (who will be working on stem rust and pyramiding genes for resistance), new Ph.D. students to our program. Three visiting scientists from China (Drs. X. Chen, X. Song and W. Liu) were invaluable in helping us this year and in sharing germplasm.

Summary

In 2009, 1,700,000 acres of wheat were planted in Nebraska and 1,600,000 were harvested with an average yield of 48 bu/a for a total production of 76,800,000 bu. 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 2009 crop was 5% higher than the 2008 crop, but 9% lower than the 2007 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.

Two new cultivars were increased and recommended for release in 2010. They are NE01481 and NI04421. NE01481 is a hard red winter wheat (*Triticum aestivum* L.) cultivar developed cooperatively by the Nebraska Agricultural Experiment Station and the USDA-ARS and released in 2010 by the developing institutions. It was released primarily for its superior adaptation to rainfed wheat production systems in eastern and west central Nebraska and its excellent resistance to wheat soilborne mosaic virus, a trait that is very rare in recent Nebraska released cultivars and is needed in southeastern and south central NE where the disease is present in early plantings of wheat. NE01481 was selected from the cross NE92458/Ike that was made in 1995. The pedigree of NE92458 is OK83201/REDLAND and the pedigree of OK83201, an experimental line developed by Oklahoma State University is Vona//Chisholm/Plainsman V. In the Nebraska Intrastate Nursery (2003 to 2009), NE01481 performed well in eastern NE (Lincoln and Mead), central and west central NE (Clay Center and North Platte). In western NE other cultivars have a better performance record. These data are supported by the 2004 and 2005 USDA-ARS Southern Regional Performance Nursery where NE01481 ranked 27 and 19 of the 50 and 48 entries tested in those years, but ranked 4 and 6 in the in the North Central Plains zone (eastern NE and KS and central NE, data available at http://www.ars.usda.gov/Research/docs.htm?docid=11932). In the five years that it has been tested in the Nebraska State Variety Trials (Table 2, full data available athttp://cropwatch.unl.edu/web/varietytest/wheat), NE01481 (68.4 bu/a and 62.9 bu/a) was lower yielding than Overland (70.4 bu/a and 64.1 bu/a) in southeastern NE and west central NE. However in south central NE (data provided only from Clay Center) NE01481 (52.0 bu/a) was lower yielding than Millennium (57.0bu/a), Overland (60.0 bu/a) and Wesley (57.0bu/a). Based upon these data, NE01481 is adapted to eastern, central, and west central NE.

NI04421 is a hard red winter wheat (*Triticum aestivum* L.) cultivar developed cooperatively by the Nebraska Agricultural Experiment Station and the USDA-ARS and released in 2010 by the developing institutions and the Wyoming Agricultural Experiment Station. NI04421 was released primarily for its superior performance under irrigation and rainfed conditions in western Nebraska. Additionally, in eastern Wyoming NI04421 has demonstrated superior performance under irrigated and limited irrigated conditions. NI04421 was selected from the cross NE96644/Wahoo (sib) where the pedigree of NE96644 is Odesskaya P/ Cody//Pavon 76/*3 Scout 66. Based upon accumulated data, NI04421 is superior in western rainfed (west of North Platte, where drought is common) and irrigated production sites to many currently grown cultivars. It seems to have good drought tolerance and does best in irrigated environments in the drier areas. Across all nine Wyoming environments NI04421 averaged 85.6 bu/a, 11.1 % protein, 60.7 lbs/bu, and 24 inches in height. It exceed Wesley by 7.3 bu/a, 0.3% protein, 0.9 lb/bu, and 1 inch in height. As opposed to some irrigated wheat cultivars that have excellent potential when conditions are optimal, NI04421 does best in high yielding irrigated environments where some stress tolerance is beneficial, but not as well in extremely high yielding irrigated environments.

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