IMPROVING WHEAT VARIETIES FOR NEBRASKA

2012 STATE BREEDING AND QUALITY EVALUATION REPORT

Report to the

NEBRASKA WHEAT DEVELOPMENT, UTILIZATION
AND MARKETING BOARD

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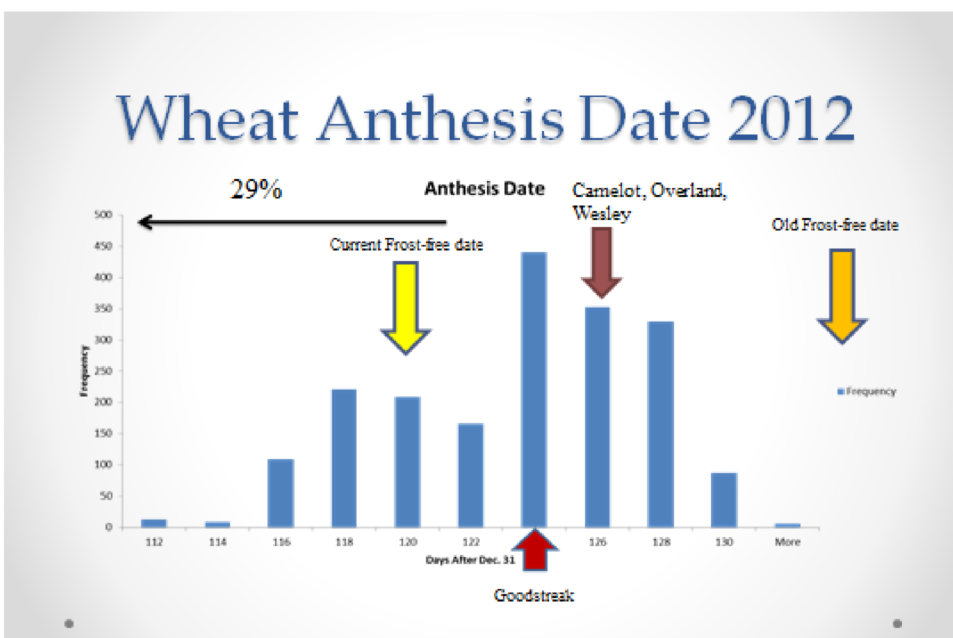
I. INTRODUCTION

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 2011-2012 NEBRASKA WHEAT CROP

1. <u>Growing Conditions</u>

The 2011-2012 growing season was generally one of average to good moisture in the west at planting with dry conditions in the east. The crop generally was planted on time, but some of the crop was not planted due the prior crop not coming off in time for the wheat planting. Everything emerged well. The winter was exceptionally mild and spring season was unusually early (the earliest in the past 26 years) and dry. Where there was sufficient stored moisture, the crop did well due to many sunny days. However, drought affected much of the western Nebraska and definitely reduced grain yields. Flowering and harvest were the earliest in the last 26 years. The **adjacent figure** shows the flowering date of 1780 observation lines grown at Lincoln, NE. Twenty-nine percent of the lines flowered before the normal frost-free date. All of our previously released lines flowered after the frost-free date. The data indicate that a larger percentage of our program is becoming photo-period insensitive. Photoperiod sensitivity



(meaning the plants flower by day length and not by temperature) is associated with superior winter survival, hence care must be taken when selecting lines that photoperiod insensitive that may be grown in a year with a harsh winter.

2. <u>Diseases</u>

The predominant diseases in 2012 were barley yellow dwarf virus, wheat soilborne mosaic virus, leaf rust, and stripe rust in eastern NE. In western NE, barley yellow dwarf virus, wheat streak mosaic and related viruses, and stripe rust were the predominant diseases. Other diseases observed in 2012 but at low levels due to dry weather as the growing season progressed were leaf spot diseases (mainly tan spot and *Septoria tritici* blotch) and powdery mildew in fields with thick stands. Trace levels of Fusarium head blight (scab) (less than 0.5%) were observed in low lying areas in a few fields in southeast Nebraska. Due to dry weather, scab did not develop to damaging levels in 2012. Other head diseases/disorders observed at low or trace levels throughout the state were loose smut and stem maggot damage. One grower from south central Nebraska submitted a wheat grain sample that tested positive for common bunt. Drs. Stephen Wegulo, Jeff Bradshaw and Gary Hein (entomologists monitoring insect vectors of disease), and Roy French continue to be invaluable in disease identification, survey, and understanding.

3. <u>Insects</u>

Isolated presence of severe wheat streak and related viruses indicated sporadic presence of wheat curl mites the previous season. Due to the very dry conditions after harvest and into the fall, over-summering hosts and the presence of wheat curl mites were limited so minimal wheat streak and related virus presence is expected next spring.

Wheat Stem Sawfly Survey

The survey was conducted to document the prevalence and abundance of the wheat stem sawfly (Fig. 1, image of cut stem and larva within stem) and its parasitoids in the wheat growing region of western Nebraska and eastern Wyoming. The fields were sampled for insect damage and the presence of parasitoids, which can impact sawfly populations. The survey also provided information about wheat management practices, helping to understand the management and environmental variables that might be contributing to the spread of this sawfly.

Survey Protocol

- Pre-harvest stem collections. Ten handfuls of wheat/field (approximately a total of 200 stems) were collected, placed into emergence tubes at senescence, and mailed/delivered to PREC. Back in the lab, collected stems were stored in the tubes in a growth chamber to allow stems to dry down and insects to complete development. A collection device was installed onto the tubes to collect emerging parasitoids. One hundred stems per sample were split to record infestation rates.
- Post-harvest stem counts. A 1 square foot card was placed at 5 points along a transect approximately 5-10 feet from the field edge. At each point, total number of stems and number of sawfly cut stems were recorded.
- Field Information. A form describing field history and agricultural practices was requested for each field.

Figure 1. Sawfly-cut tiller above. Sawfly larva within cut tiller below.

2012 Survey

The 2012 survey group was comprised of 10 cooperators, consisting of

Extension agents, specialists, growers, and crop consultants. Twenty-four growers participated throughout the region extending from eastern Wyoming to central Nebraska and two counties in northeast Colorado. A total of nine counties were included in the 2011 survey. An additional six counties were surveyed in 2012 for a total of thirty-one fields in fifteen counties, representing various locations and farming practices. The field stem counts were recorded and parasitoids were collected and tallied from the emergence tubes. We also manually split 100 stems from each tube sample from 2012 and 2011 (over 6,000 stems). We recorded evidence of sawfly feeding, larval presence, whether the larvae were dead or alive and larval position within the stem. The more data we collect, the more questions are raised. Unbelievably, some of the larvae from the 2011 samples were still alive. These tube samples, collected in July of 2011, were kept in a growth chamber for several months, moved to an unheated outdoor greenhouse throughout the winter and most the summer of 2012, exposing these larvae to temperatures of well below freezing to over 120 degrees F and total desiccation! Some of them were still alive! They are tough insects!

Infested tillers:

One hundred tillers were randomly separated from the approximately 200 tillers collected in each tube. Figure 2 represents the percent tillers infested or cut out of the 100 tiller subsample from each tube. As indicated, it was a very good year for sawflies throughout the Panhandle. No sawflies were detected in the samples from the eastern counties, however, infestation rates for the Panhandle and eastern Wyoming ranged from 0 - 86% of the split stems. It is important to note, that there were fewer cut stems than infested stems. Many of the larvae had not completed development at the time of sampling and were still positioned high in the tiller. The early growing season may have been a factor. Some were alive and some had become desiccated, especially from locations that were particularly drought stressed. Although lodging due to cutting is the major damaging factor; in wheat, larval feeding alone (without cutting) has been documented to lower yield, protein content, and reduce kernel number.

Parasitoids

Parasitoid numbers were low this year. These low numbers included all parasitoids, not just the species associated with sawflies. Unfavorable environmental factors (early wheat crop) may have been contributing factors.

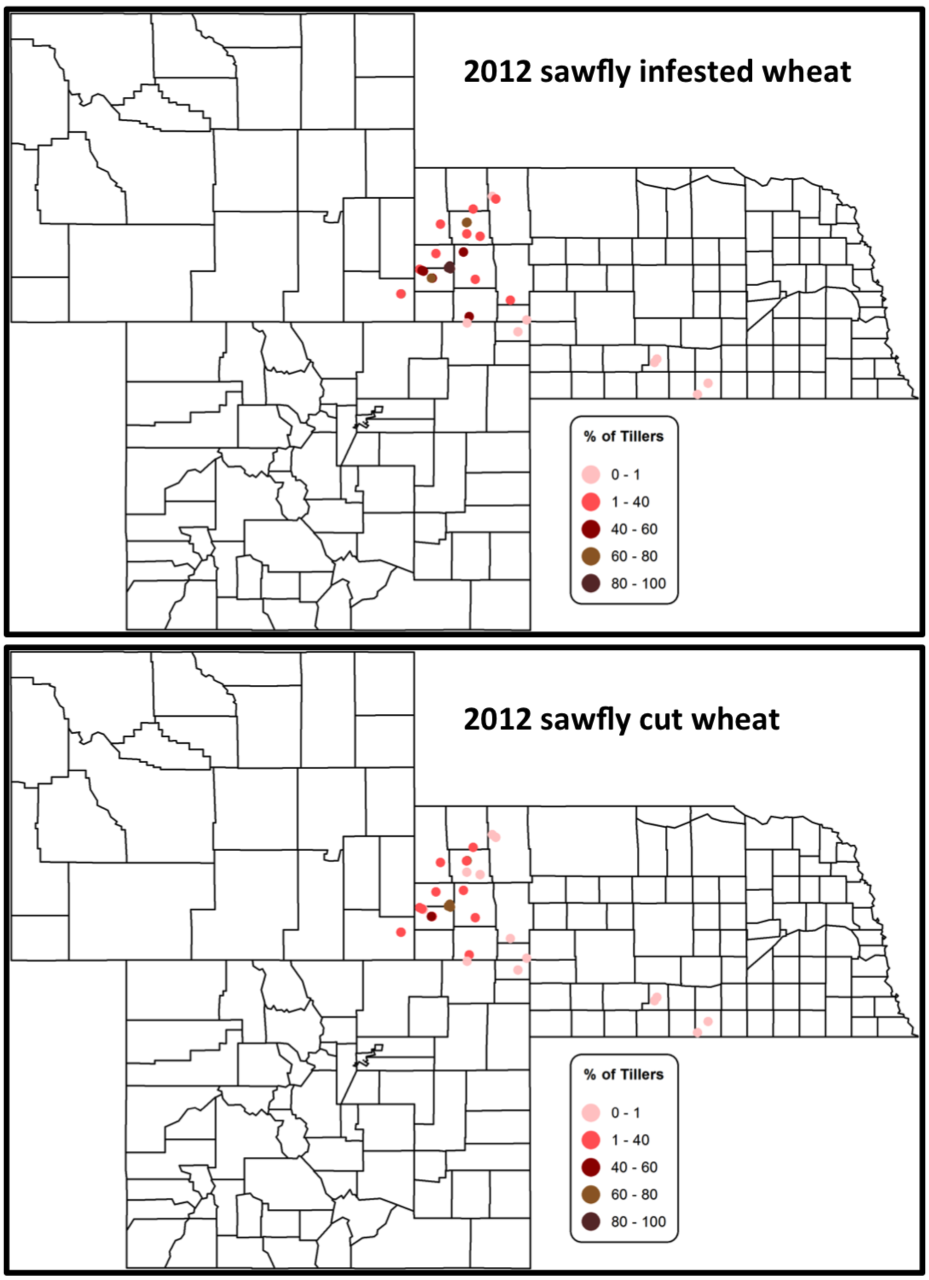
Wheat Stem Sawfly Seasonal Emergence Patterns, 1995-97; 2012

	1995	1996	1997	2012
First fly emergence	Pre-May 30	May 20	May 20	May 15
50% fly emergence	June 8	May 29	May 31	May 18
Peak fly emergence	June 7	May 31	May 30	May 22
Wheat stage at peak	Heads emerged 25%	Heads just fully emerged	Heads just fully emerged	Heads fully emerged

Emergence Traps

A total of 20 emergence traps were set out in a field with a history of heavy sawfly pressure on 18 April 2012 through 12 June 2012. Five traps at three separate field locations were placed on the east edge of a corn field over wheat stubble from the previous year. Five additional traps were placed over a section of brome grass adjacent to the field. Adult emergence dates, total number of sawflies/cage, and numbers of males and females were recorded on a weekly basis. These field data were added to data from prior years as indicated by the following chart. One adult sawfly was recorded in a trap placed over downy brome grass, downy brome could act as one source for sawflies. Overall, the emergence data indicates validates some of our field findings that a number of sawflies may not have completed development. This is because sawfly numbers peaked at a time when wheat head were fully emerged – sawflies are much less likely to survive if they infest wheat at anthesis.

Figure 2. Wheat stem sawfly infested (top) and cut (bottom) wheat throughout the sample region.



Chemical Trial

A chemical trial was conducted in a heavily infested wheat field in Scotts Bluff County. The foliar treatments included pyrethroids and plant growth regulators. The results did not show any significant control for WSS using the treatments. As indicated in previous data, chemical control of WSS adults is relatively unsuccessful due to several factors. The adult stage of this insect does not feed and their emergence occurs over a long period of time. Feeding larvae are well protected within the stem. Current seed treatment products do not have a long enough residual (at least in winter wheat) to affect sawfly larvae.

Overview

The Wheat stem sawfly is a native pest and well adapted to this region and climate. We also know that it is continually evolving, expanding its host range from spring to winter wheat. It is assumed populations could continue to expand throughout the winter wheat region. Some farming practices can positively impact the survival rate of the sawfly. Rotations such as wheat on wheat or wheat-fallow-wheat allow overwintering sawflies close proximity to the new wheat crop the following spring. Sawflies tend to move in from the edge of a field causing narrower strips to incur more damage. Previous data concluded that less tillage equals more sawflies; most likely due to the difficulty adult sawflies have navigating through soil upon emergence. However, no-till systems conserve water and beneficial insects, so there is reason to understand best practices in these systems for suppressing sawfly numbers. Greater cropping system diversity by rotating with non-host crops, for example, could suppress sawfly numbers in no-till systems. Due to the habits and timing of the life cycle of the WSS, chemical treatments have not proven very effective or economical. If the sawfly continues to gain a stronghold in this region, it could possibly have a substantial impact on wheat.

Summary points:

- Not every infested stem is cut, and not every cut stem lodges.
- Local environmental conditions have a tremendous effect on the annual losses due to. sawfly infestation; therefore, continued population monitoring is essential.
- The amount of yield and protein loss due to larval feeding alone may still be in question for winter wheat.
- The impact of parasitoids in this area needs further assessment.
- Resistant varieties of winter wheat need to be developed and tested.
- Secondary effects, resulting from lodged wheat could potentially create a "green bridge" for wheat curl mite and aphid populations.

4. Wheat Production

In 2012, 1,380,000 acres of wheat were planted in Nebraska and 1,300,000 were harvested with an average yield of 41 bu/a for a total production of 53,300,000 bu. In 2011, 1,500,000 acres of wheat were planted in Nebraska and 1,400,000 were harvested with an average yield of 45 bu/a for a total production of 63,000,000 bu. In 2010, 1,600,000 acres of wheat were planted in Nebraska and 1,490,000 were harvested with an average yield of 43 bu/a for a total production of 64,070,000 bu. 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. Despite continued genetic improvement, the main determinant in wheat production seems to be acres harvested, government programs, the price of corn, and weather (which also affects disease pressure and sprouting). This is an economic reality in understanding wheat yields and productivity in NE.

5. <u>Cultivar Distribution</u>

In 2012, TAM 111 (12.8%) inched ahead of Overland (12.7%) as the most widely grown wheat cultivar in Nebraska, followed by Pronghorn (9.6%). Pronghorn and Goodstreak (5.1%) are tall (conventional height) wheat varieties that have consistently done well in the drought prone areas of western Nebraska. Buckskin (4.7%) decreased slightly, indicating that tall wheats, which are adapted to drought in the west, remain very popular (19.4% of the total state acreage). Settler CL acreage (4.7%) increased rapidly in 2012.

While no wheat listed below has all of the characteristics of an ideal wheat, the diverse wheat varieties provide the grower an opportunity to choose high yielding, high quality wheat varieties that have resistance or tolerance to the diseases or insects prevalent in his or her region. Cultivars developed by the University of Nebraska wheat improvement program occupied 65.6% of the state acreage. Other public varieties occupied 17.4% (largely due to TAM 111) and private varieties occupied 17.0% (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. What is interesting is that no variety dominated the acreage. Variety diversity is useful as it should reduce genetic vulnerability to disease and insect pests.

	----------Percent----------									
Variety	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
2137	10.3	7.8	4.3	**3.5**	1.4	2.1	1.7			
2145				**1.0**	1.2	2.2				
Above				**1.3**						
Agripro Abilene	1.4	1.7	1.7		1.0					
Agripro Art								2.4	4.3	3.6
AgriPro AAP503 CL										1.1
AgriPro Dumas					1.4	1.2				
Agripro Hawken							1.2	2.1		
Agripro Jagalene		4.5	16.8	**23.8**	33.4	20.9	13.8	8.5	5.4	2.4
Agripro Ogallala	3.6	2.4	2.0	**1.4**	1.0	1.1				
Agripro Postrock						1.1	4.1	4.4	3.3	2.4
Agripro Thunderbird	1.8									
Agripro Thunderbird								1.1		
Agripro Thunderbolt	2.0	3.0	1.9	**1.9**	2.0	2.4	1.6	1.5	2.2	
Akron	1.2									
Alliance	11.5	13.6	10.1	**10.1**	7.2	6.1	6.1	6.0	3.9	3.7
Arapahoe	8.7	6.8	5.2	**2.9**	2.0	3.4	2.2	2.1	1.5	
Armour									1	2.6
Bond CL										1.1
Buckskin	7.3	4.9	3.7	**5.0**	3.5	3.4	3.3	4.5	5.9	4.7
Camelot									1.1	2.3
Centura	1.8	2.1	2.4	**1.9**	1.3	1.0				
Culver	2.5									
Goodstreak			1.7	**3.7**	3.6	5.1	5.0	6.5	4.4	5.1
Hatcher							1.2	1.5	1.8	2.1
Hawken									1.5	
Infinity CL						2.3	3.5	3.7	3.3	4.3
Jagger	3.9	2.8	3.1	**2.5**	1.7	1.5	1.1			
Karl/Karl 92	3.8	3.3	2.7	**2.7**	1.6	2.9	2.5	1.6	2.1	1.4
Millennium	6.1	11.1	10.7	**9.5**	7.2	9.4	13.2	11.9	7.6	5.9
Niobrara	5.4	3.5	2.2							

Overland							3.4	5.6	10.8	12.7
Overly					1.0	1.1				
Platte	1.0	1.3	1.6							
Pronghorn	10.3	10.4	11.4	**10.1**	12.2	10.6	12.1	13.7	10.4	9.6
Scout & Scout 66	1.1									
Settler CL										4.7
Siouxland	1.4									
TAM 111				**1.2**	1.6	3.2	6.5	7.4	8.1	12.8
TAM 112									1.2	
Vista	1.2									
Wahoo	1.8	1.7	1.8	**1.8**	1.1	1.5	1.1			
Wesley	3.6	5.9	5.5	**5.8**	7.2	7.7	4.8	4.1	4.2	2.0
Winterhawk									1.3	3
Z Other Private Varieties	3.4	4.4	4.0	**3.8**	2.8	4.1	5.0	3.6	5.4	4.5
Z Other Public Varieties	4.9	8.8	7.2	**6.1**	4.6	5.7	6.6	7.8	9.3	8.0
Total	100	100	100	**100**	100	100	100	100	100	100

6. New Cultivars

In 2012, NE06545 was recommended for release and formally released on January 30, 2013. NE06545 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 2013 by the developing institutions. It was released primarily for its superior adaptation to rainfed wheat production systems throughout Nebraska and in states north and west of Nebraska. NE06545 will be marketed as Husker Genetics Brand Freeman Hard Red Winter Wheat in honor of Daniel Freeman, who is recognized as the first person to file for a homestead under the Homestead Act of 1862 which celebrated its 150th anniversary in 2012.

NE06545 was selected from the cross KS92-946-B-15-1/Alliance where the pedigree of KS92-946-B-15-1 is ABI86*3414/Jagger/Karl 92. That cross was made in 2000. The F_1 generation was grown in the greenhouse in 2001 and the F_2 to F_3 generations were advanced using the bulk breeding method in the field at Mead, NE in 2002 to 2003. In 2004, single F_3-derived F_4 rows were planted for selection. There was no further selection thereafter. The $F_{3:5}$ was evaluated as a single four row plot at Lincoln, NE and a single row at Mead, NE. NE06545 was identified in 2006 as the experimental line, and selected for further testing.

NE06545 was evaluated in Nebraska replicated yield nurseries starting in 2007, in the Southern Regional Performance Nursery in 2009 and 2010, in the Northern Regional Performance Nursery in 2011, and in Nebraska cultivar performance trials in 2010, 2011 and 2012. In the Nebraska Intrastate Nursery (2008 to 2012, Table 1), NE06545 performed well across Nebraska and was not significantly different from Husker Genetics Brand Overland, the most widely grown cultivar in Nebraska. These data are supported by the 2009 and 2010 USDA-ARS Southern Regional Performance Nursery where NE06545 ranked 2 and 34 region-wide of the 46 and 48 entries tested in those years (data available at http://www.ars.usda.gov/Research/docs.htm?docid=11932). NE06545 was also tested in the Northern Regional Performance Nursery in 2011 where it ranked second out of 29 entries tested region-wide in that year. In the three years that it has been tested in the Nebraska State Variety Trials (Table 2, full data available at http://cropwatch.unl.edu/web/varietytest/wheat), NE06545 was among the highest yielding lines across the state and was the highest yielding line in western NE. Based upon these data, NE06545 is adapted to all of Nebraska, but particularly to rainfed western NE wheat production.

Other measurements of performance from comparison trials indicate that NE06545 is moderately early in maturity (146.6 d after Jan.1, data from 8 observations in eastern NE), about 2 d earlier flowering than Wesley and Goodstreak and 3 days earlier flowering than 'Overland'. NE06545 is a semi-dwarf wheat cultivar and contains the *RhtB1b* (formerly *Rht1*, data provided by Dr. Guihua Bai). The mature plant height of NE06545 (85 cm) is 5 cm shorter than Overland and 4 cm taller than Wesley. NE06545 has moderate straw strength (6% lodged), similar to Camelot (6%) and McGill (8%), but higher than Wesley (3%) and Overland (3%). The winter hardiness of NE06545 is good and comparable to other winter wheat cultivars adapted and commonly grown in Nebraska.

NE06545 is resistant to soilborne wheat mosaic virus. 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 (RCRSC, QFCSC, QTHJC, RKQQC, and TPMKC) at St. Paul, MN. and using field stem rust races, in Kenya. In greenhouse seedling tests, it is resistant to races QFCSC, QTHJC, MCCFC, SCCSC, QCCSM, heterogeneous to RCRSC and RKQQC, but susceptible to race TMPKC and TTKSK (data provided by Y. Jin at the USDA Cereal Disease Laboratory). It is moderately resistant to moderately susceptible to leaf rust (caused by *P. triticina* Eriks, data provided by J. Kolmer at the USDA Cereal Disease Laboratory) and to stripe rust (caused by *P. striiformis* Westendorp f. sp. t*ritici*, data obtained from field observations in the Great Plains). It is moderately susceptible to Fusarium head blight (caused by *Fusarium graminearum*, data from greenhouse and field observations in Nebraska). NE06545 is moderately susceptible to 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 and field observations in NE).

NE06545 is lower in grain volume weight (72.5 kg/hl), which is similar to Camelot (73.2 kg/hl) and Wesley (73.0 lbs/bu) and lower than Overland (75.0 kg/hl). The milling and baking properties of NE06545 were determined for five 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 NE06545 (134 and 109 g kg^{-1}) were lower than Wesley (142 and 121 g kg^{-1}) for the corresponding years. The lower grain protein content was confirmed by the Nebraska State Variety Trials (Table 2) where NE06545 had 120 g protein kg^{-1} compared to Wesley with a value of 128 g kg^{-1}. The average flour extraction on the Buhler Laboratory Mill for NE06545 (722 g kg^{-1}) was lower than Wesley (747 g kg^{-1}). The flour ash content (3.9 g kg^{-1}) was lower than Wesley (4.5 g kg^{-1}) as well. Dough mixing properties of NE06545 were acceptable (mixtime peak was 5.34 minutes and mixtime tolerance was scored as 4.2 on a scale of 1 to 7 with 1 being very low tolerance and 7 being high tolerance to mixing) which were stronger than Wesley (mixtime peak of 4.40 minutes and mixtime tolerance scored as 3.90). Average baking absorption (611 H_2O g kg^{-1}) was similar to Wesley (610 H_2Og kg^{-1}) for the corresponding years. The average loaf volume of NE06545 (799 cm^3) was lower than Wesley (849 cm^3). The scores for the internal crumb grain and texture ranged were 3.6 and 3.8 which were lower than Wesley (4.4 and 4.7, respectively). The overall end-use quality characteristics for NE06545 (scored as 3.8, where 3 is fair, 4 is good and 7 is excellent) was lower than Wesley (4.6) and similar to many commonly grown wheat cultivars. NE06545 should be acceptable to the milling and baking industries.

In positioning NE06545, based on performance data to date, it should be well adapted to most rainfed wheat production systems in southeastern, south-central, west-central, and western Nebraska and in adjacent areas of the Great Plains. NE06565 is not recommended for irrigated wheat production due to its average straw strength and does not have the yield potential of the best available irrigated wheat cultivars (data not shown). NE06545 has an excellent grain yield record in organic production systems in eastern NE (highest yielding line using the average of three years for the 22 lines tested in all three years). However, NE06545 is not recommended for organic production due to its quality characteristics. Where it is adapted, NE06545 should be a replacement for Camelot, Millennium, and Wesley (for rainfed production), though Wesley has better straw strength. For the lines listed in Table 2, only NE06545, McGill, 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. NE06545 is genetically complementary to virtually all wheat cultivars grown in Nebraska except for Alliance and Karl 92.

NE06545 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 erect. The flag leaf is erect and twisted at the boot stage. The foliage is green with a light waxy bloom on the leaf sheath, with a little waxy bloom on the spike at anthesis and on the leaves. The leaves are glaborous. The spike is tapering, narrow, mid-long, and middense. The glume is long and wide, and the glume shoulder is oblique to rounded. The beak is long in length with an acuminate tip. Kernels are red colored, hard textured, and mainly ovate in shape. The kernel has no collar, a large brush of long length, rounded cheeks, mid-size germ, and a wide and mid-deep crease.

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 2013. The U.S. Department of Agriculture will not have commercial seed for distribution. The seed classes will be Breeder, Foundation, Registered, and Certified. NE06545 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 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. In addition, a seed sample has been deposited in the USDA-ARS National Small Grains Collection, Aberdeen, ID and seed is freely available to interested researchers.

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Two other lines were given to certified seed producers to see if they like the lines in their commercial fields. If they like the line, they will be released. The first line is NE05496 and it was given to three producers in southwestern Nebraska. The pedigree of NE05496 is KS95HW62-6/Hallam where the pedigree of KS95HW62-6 is KS87H325/RIO BLANCO and the pedigree of Hallam is BRULE/BENNETT// NIOBRARA. It is a medium early maturity, short to medium height semi-dwarf wheat with good winter hardiness, good straw strength and moderately long coleoptile. In our tests, it is resistant to stem rust and Wheat soilborne mosaic virus, moderately resistant to Hessian fly, moderately susceptible to moderately resistant to leaf rust, moderately susceptible to susceptible to yellow (stripe) rust, and susceptible to the Russian wheat aphid. NE05496 appears to have a higher level of resistance to an emerging disease, wheat blast, in the greenhouse than many other lines. Compared to Wesley (moderately susceptible to susceptible for scab reaction and susceptible for DON accumulation) and Overland (moderately resistant to scab reaction and moderately resistant for DON accumulation), NE05496 is considered moderately susceptible to scab reaction and susceptible for DON accumulation. Based upon the data we have collected so far, NE05496 seems to be best suited for production in southwestern NE and adjacent areas in Kansas and Colorado. It was tested in the SRPN in 2008 and 2009 (data available at http://www.ars.usda.gov/Research/docs.htm?docid=11932) and in the Nebraska State Variety Trials (data available at: http://cropwatch.unl.edu/web/varietytest/wheat). Based upon our end-use quality data to date, NE05496 would have similar to slightly less end-use quality to McGill. Release of NE05496 will be determined upon whether NE05496 is sufficiently superior to McGill (which is more broadly adapted in NE, but also more susceptible to stripe rust) to warrant release.

The second lines is NE05548**.** The pedigree of NE05548 is NE97426/NE98574 where the pedigree of NE97426 is BRIGANTINA/2*ARAPAHOE and the pedigree of NE98574 is CO850267/RAWHIDE. NE05548 is a medium late maturity, tall wheat with good winter hardiness, and fair straw strength. In our tests, it is moderately resistant to stem rust, yellow (stripe) rust, and Hessian fly, moderately susceptible to leaf rust, and susceptible to soilborne mosaic virus, and Russian wheat aphid. Compared to Wesley (moderately susceptible to susceptible for scab reaction and susceptible for DON accumulation) and Overland (moderately resistant to scab reaction and moderately resistant for DON accumulation), NE05548 is moderately susceptible to scab reaction and moderately resistant for DON accumulation. Based upon the data we have collected so far, NE05548 would be considered as a new 'tall" wheat by its plant height (very similar to Goodstreak), but it has a short coleoptile and the molecular markers alleles indicative of Rht1 (the major semidwarfing and shorter coleoptile allele in the Great Plains). NE05548 seems to have better grain yield than the tall wheats, is similar in height where height is needed, but is a short coleoptile wheat. It may complement Goodstreak, Pronghorn, and Buckskin in the regions where tall wheats are grown if the shorter coleoptile is not a limitation. It was tested in the NRPN in 2008 and 2009 (data available at http://www.ars.usda.gov/Research/docs.htm?docid=11932) and in the Nebraska State Variety Trials (data available at: http://cropwatch.unl.edu/web/varietytest/wheat). Based upon our end-use quality data to date, NE055548 would have slightly lower end-use quality than McGill.

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 being available in August for certified seed producers, we have two new lines were under increase for possible release in 2014. The first is NE06607. The pedigree of NE06607 is NE98466/Wesley where the pedigree of NE98466 is KS89H50-4/3/Brule//Siouxland/Bennet. NE06607 is a medium early, medium height semi-dwarf wheat with good winter hardiness and average straw strength. It is resistant to wheat soilborne mosaic virus and stem rust (races QFCS and TPMK); moderately susceptible to moderately resistant yellow (stripe) rust; moderately susceptible to susceptible to leaf rust and; and susceptible to Russian wheat aphid, Hessian fly, and wheat streak mosaic virus. It was tested in the NRPN in 2010 and in the SRPN in 2011 (data available at http://www.ars.usda.gov/Research/docs.htm?docid=11932) and in the Nebraska State Variety Trials (data available at: http://cropwatch.unl.edu/web/varietytest/wheat). Based upon the data we have collected so far, NE06607 seems to be fairly narrowly adapted and best suited for production in southwest Nebraska. Based upon our end-use quality data to date, NE06607 would be similar to slightly better in end-use quality to McGill. Compared to Wesley (moderately susceptible to susceptible for scab reaction and susceptible for DON accumulation) and Overland (moderately resistance to scab reaction and moderately resistant for DON accumulation), NE06607is considered as being moderately resistant for scab reaction and moderately resistant to DON accumulation.

The second line is NI08708. The pedigree of NI08708 is CO980829/Wesley where the pedigree of CO980829 is Yuma/T-57//CO850034/3/4*Yuma/4/NEWS1). NI08708 is a medium early, medium height semi-dwarf wheat with good winter hardiness, and average straw strength. It also grows well vegetatively and could be used as a dual purpose grazing and grain wheat cultivar. In our tests, it is moderately resistant to resistant to Hessian fly, moderately susceptible to moderately resistant to stem rust and leaf rust. It is susceptible to the recent race of yellow (stripe) rust, Russian wheat aphid and wheat soilborne mosaic virus. Compared to Wesley (moderately susceptible to susceptible for scab reaction and susceptible for DON accumulation) and Overland (moderately resistant to scab reaction and moderately resistant for DON accumulation), NI08708 is considered susceptible to scab reaction and moderately susceptible for DON accumulation. Based upon the data we have collected so far, NI08708 seems to be fairly broadly adapted and best suited for production in southwestern and western NE and adjacent areas in Kansas, Wyoming, and Colorado. It was tested in the SRPN in 2010 and 2011 (data available at http://www.ars.usda.gov/Research/docs.htm?docid=11932) and in the Nebraska State Variety Trials (data available at: http://cropwatch.unl.edu/web/varietytest/wheat). Based upon our end-use quality data to date, NI08708 would have superior end-use quality to McGill. Five lines have begun their initial increase for release in 2015.

With the release of new varieties Overland, Camelot, Goodstreak, McGill, Robidoux, Settler CL, and Freeman 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 2012. Twelve dryland, two dryland organic, and three irrigated locations (note Hemingford was partially damaged by hail which may affect the averaged results) in Nebraska were harvested for yield data.

In 2012, the top ten entries for dryland production were:

	Yield		Yield
Entry	bu/a	Entry	bu/a
NE06545	59.31	WB Armour	55.38
SY Wolf	58.60	NI08708	55.13
McGill	56.44	NW0366	55.08
Overland	55.78	NE08659	55.06
Mattern	55.53	Settler CL	54.96

As would be expected the two lowest yielding lines were Scout 66 (40.21 bu/a) and Turkey (34.12 bu/a) which were 15% and 28% lower yielding, respectively, than the next lowest yielding cultivar tested in the trial. Scout 66 was 32% lower yielding than NE06545. Turkey was 42% lower yielding than NE06545.

In 2011, the top ten entries for dryland production were:

	Yield		Yield
Entry	bu/a	Entry	bu/a
McGill	68.79	WB-Stout	66.43
NI08708	68.68	NW03666	66.00
Overland	68.23	Expedition	65.95
Robidoux	67.49	NE05496	65.45
NE02558	67.26	Infinity CL	65.00

In 2010, the top ten entries for dryland production were:

	Yield		Yield
Entry	bu/a	Entry	bu/a
Armour	57.95	Infinity CL	54.66
Overland	57.79	NE01481 (McGill)	54.05
Settler CL	55.66	Wesley	54.05
Millennium	54.87	Expedition	53.36
NE06607	54.84	Camelot	53.35

3. <u>Irrigated Wheat Trials:</u>

In 2011, three irrigated environments in NE and WY were grown to evaluate irrigated wheat production. The top ten lines in 2012 were:

	Yield		Yield
Entry	bu/a	Entry	bu/a
WB-Aspen	86.87	NI07703	77.80
Brawl CL Plus	85.10	NE06430	77.80
Anton	82.63	SY-Wolf	76.57
WB- Armour	79.17	Byrd	76.47
Mattern	78.13	Settler CL	75.73

The irrigated data this year continue to show the benefits of having a dedicated irrigated wheat development nursery to select lines which have excellent performance (e.g NI07703).

The top ten lines in 2011 were:

	Yield		Yield
Entry	bu/a	Entry	bu/a
SY-Wolf	99.47	NE06607	94.73
SY-Post Rock	97.03	NE06545	94.70
WB-Hitch	95.50	Wesley	94.53
WB-Cedar	95.33	NI07703	93.87
Expedition	95.00	Armour	93.83

In 2010, the top ten lines were:

	Yield		Yield
Entry	bu/a	Entry	bu/a
NI08708	82.1	NE06545	75.5
Settler CL	80.4	Wesley	75.4
Armour	80.0	Bond CL	75.0
NI07703	78.1	Expedition	75.0
NE06607	76.6	Camelot	74.3

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. In

2012 (next page) , we were able to harvest all of the dryland sites and, in collaboration, had a testing site in Kansas. Unfortunately, we lost the irrigated site. We have made considerable progress in reducing height and lodging, but additional disease resistance is needed. The data is color coded with dark green having the greatest values and red having the lowest values. It should be noted that the earliest wheats will be coded red, while the highest yielding and test weights will be in dark green.

	Lincoln	N. Platte	Alliance	Kansas	**Average**	**Rank**	**NE. Avg.**	**NE-Rank**	Height	Anthesis	TestWT
name	bu/a	bu/a	bu/a	bu/a	bu/a		bu/a		(in)	(Julian day	lbs/bu
Antelope	44.70	46.10	48.20	60.00	**49.75**	**33**	**46.33**	**30**	36.44	125.5	63.98
TAM111	50.20	52.30	51.70	71.10	**56.33**	**10**	**51.40**	**13**	24.80	118.9	52.23
WESLEY	52.20	45.90	52.90	61.60	**53.15**	**21**	**50.33**	**16**	29.11	128.5	57.87
NI04421	61.30	56.80	55.00	71.00	**61.03**	**1**	**57.70**	**3**	20.57	123.1	48.89
NI06736W	39.90	52.20	44.60	79.30	**54.00**	**19**	**45.57**	**33**	32.52	117.4	60.97
NI06737W	41.00	41.60	46.00	74.40	**50.75**	**29**	**42.87**	**37**	36.29	117.2	63.50
NI07703	45.50	49.70	48.00	82.10	**56.33**	**10**	**47.73**	**24**	27.24	117.9	56.38
NI08707	56.40	41.20	50.30	75.50	**55.85**	**13**	**49.30**	**20**	27.43	117.8	55.08
NI08708	54.80	51.00	54.30	74.40	**58.63**	**6**	**53.37**	**8**	22.46	119.1	49.85
NI08714	38.20	34.30	52.20	61.60	**46.58**	**40**	**41.57**	**40**	40.52	117.3	65.94
NI09703	57.90	41.60	52.50	58.50	**52.63**	**23**	**50.67**	**15**	29.56	125.1	56.55
NI09707	49.20	44.30	48.40	69.80	**52.93**	**22**	**47.30**	**26**	31.77	116.1	57.96
NI09710H	58.10	48.60	50.30	72.90	**57.48**	**8**	**52.33**	**10**	23.44	122.7	52.05
NI10703	50.80	40.90	41.00	59.30	**48.00**	**37**	**44.23**	**35**	38.74	123.2	65.65
NI10705	50.50	34.10	51.40	50.90	**46.73**	**39**	**45.33**	**34**	39.44	129.6	67.68
NI10707	48.30	42.90	48.80	69.10	**52.28**	**24**	**46.67**	**28**	32.89	118.6	59.83
NI10712	51.30	46.20	49.10	73.60	**55.05**	**16**	**48.87**	**21**	28.62	124.4	58.01
NI10718W	60.20	51.70	51.70	69.30	**58.23**	**7**	**54.53**	**6**	22.51	124	50.84
NI10720W	52.10	43.20	49.00	62.90	**51.80**	**27**	**48.10**	**22**	32.37	127.5	60.62
Settler C	54.60	49.10	51.80	81.80	**59.33**	**3**	**51.83**	**12**	22.28	121.4	51.89
NE08402	51.70	31.80	42.00	73.50	**49.75**	**33**	**41.83**	**39**	37.94	118.8	65.25
NE08410	49.00	32.20	44.90	64.30	**47.60**	**38**	**42.03**	**38**	39.34	119.9	65.75
NE08509	59.20	46.70	52.20	58.20	**54.08**	**18**	**52.70**	**9**	26.57	124	53.19
NE09481	55.40	45.30	55.90	80.60	**59.30**	**4**	**52.20**	**11**	22.40	116.2	49.87
NE09499	57.10	37.20	49.30	65.20	**52.20**	**25**	**47.87**	**23**	31.96	119.7	58.22
NW07534	66.80	57.20	50.80	69.20	**61.00**	**2**	**58.27**	**2**	20.76	123.8	48.85
NI12701	56.50	45.70	47.60	57.30	**51.78**	**28**	**49.93**	**17**	31.64	124.5	57.71
NI12702	65.70	60.20	50.20	60.50	**59.15**	**5**	**58.70**	**1**	21.57	127.9	50.16
NI12703	71.20	46.10	43.90	61.30	**55.63**	**14**	**53.73**	**7**	24.91	124.7	52.20
NI12704	50.00	44.40	43.90	61.10	**49.85**	**32**	**46.10**	**31**	36.37	124.3	63.89
NI12705	59.20	50.70	54.30	50.00	**53.55**	**20**	**54.73**	**5**	26.58	127.2	52.93
NI12706	50.50	50.50	52.20	76.60	**57.45**	**9**	**51.07**	**14**	24.69	116.9	51.86
NI12707	45.00	45.60	50.80	65.90	**51.83**	**26**	**47.13**	**27**	33.38	120	60.13
NI12708	48.60	38.00	44.60	70.80	**50.50**	**30**	**43.73**	**36**	36.58	122.5	65.03
NI12709	49.50	47.80	51.40	76.40	**56.28**	**12**	**49.57**	**19**	26.86	121.8	55.89
NI12710	53.60	37.60	48.50	57.50	**49.30**	**35**	**46.57**	**29**	36.86	124.7	63.52
NI12711	69.50	45.20	53.60	52.70	**55.25**	**15**	**56.10**	**4**	25.03	126.7	51.91
NI12712	54.10	40.10	48.50	58.10	**50.20**	**31**	**47.57**	**25**	34.52	126.1	61.87
NI12713	57.30	46.30	45.60	69.00	**54.55**	**17**	**49.73**	**18**	28.24	118.3	54.85
NI12714	42.00	41.70	53.50	59.40	**49.15**	**36**	**45.73**	**32**	37.91	122.3	64.07
GRAND M	**53.23**	**45.10**	**49.52**	**66.67**	**53.63**		**49.28**		**30.08**	**122.14**	**57.57**

The 2011 yield data are (lines highlighted in yellow are released lines):

	Linc.	N.Platte	Alliance	Dryland Average	**Dryland Rank**	Kansas-IRR	**Alliance IRR**	**Irrigated Ave**	**IRR Rank**
	bu/a	bu/a	bu/a	**bu/a**		bu/a	bu/a	bu/a	
NI08707	63.53	41.15	70.75	**58.48**	**3**	96.82	72.94	84.88	**1**
Settler CL	55.34	47.54	62.26	**55.05**	**9**	92.27	76.56	84.42	**2**
NE03490	47.60	39.20	58.71	**48.50**	**33**	88.53	75.73	82.13	**3**
NI09710	65.66	48.36	61.87	**58.63**	**2**	87.48	76.39	81.94	**4**

NI09709	63.13	37.23	68.18	**56.18**	**6**	92.24	71.44	81.84	**5**
NI10702	47.06	41.18	58.81	**49.02**	**30**	84.16	79.20	81.68	**6**
NI10708	52.22	41.59	60.32	**51.38**	**20**	89.37	72.39	80.88	**7**
NI09715	55.84	39.64	66.29	**53.92**	**11**	84.58	74.59	79.59	**8**
NI10701	54.41	43.47	65.17	**54.35**	**10**	85.05	73.27	79.16	**9**
TAM111	57.57	45.53	63.43	**55.51**	**7**	92.43	65.02	78.73	**10**
NI08708	65.41	46.55	67.53	**59.83**	**1**	87.24	69.47	78.36	**11**
NI07703	53.85	33.01	58.89	**48.58**	**32**	88.15	68.28	78.22	**12**
NI10704	42.77	45.67	61.82	**50.09**	**26**	75.96	78.44	77.20	**13**
NI08714	49.12	42.16	63.41	**51.56**	**18**	81.27	72.30	76.79	**14**
NI10707	55.65	38.39	59.87	**51.30**	**21**	80.34	72.95	76.65	**15**
NI08715	54.14	48.30	53.60	**52.01**	**15**	87.18	66.09	76.64	**16**
NI10713	58.69	46.47	69.55	**58.24**	**4**	86.02	66.65	76.34	**17**
NI03427	49.47	40.76	58.75	**49.66**	**27**	78.79	72.99	75.89	**18**
NI09707	50.91	45.25	58.21	**51.46**	**19**	81.65	69.21	75.43	**19**
NI09714	44.43	47.95	63.72	**52.03**	**14**	87.23	63.58	75.41	**20**
NI10718	48.65	43.28	63.31	**51.75**	**17**	75.28	75.23	75.26	**21**
NI06737	46.10	41.65	54.52	**47.42**	**34**	85.00	63.33	74.17	**22**
NI10720	47.04	50.84	55.67	**51.18**	**22**	78.04	69.97	74.01	**23**
NI10717	44.93	37.86	63.29	**48.69**	**31**	85.80	60.46	73.13	**24**
WESLEY	43.83	40.53	62.73	**49.03**	**29**	77.65	67.90	72.78	**25**
NI09703	56.79	42.50	57.78	**52.36**	**13**	75.65	68.75	72.20	**26**
NI09706	56.06	40.43	69.97	**55.49**	**8**	75.98	67.99	71.99	**27**
NI06736	53.42	38.79	49.05	**47.09**	**36**	73.77	68.76	71.27	**28**
Antelope	46.42	31.49	54.57	**44.16**	**39**	73.00	67.53	70.27	**29**
NI10712	41.60	43.42	63.71	**49.58**	**28**	75.96	63.60	69.78	**30**
NI04421	58.04	47.82	68.12	**57.99**	**5**	79.40	60.04	69.72	**31**
NI10716	54.94	40.39	64.55	**53.29**	**12**	68.21	69.48	68.85	**32**
NI10705	52.80	41.23	61.86	**51.96**	**16**	74.96	62.21	68.59	**33**
NI10709	45.97	39.92	55.84	**47.24**	**35**	73.70	61.60	67.65	**34**
NE04490	52.13	41.60	58.66	**50.80**	**24**	71.57	63.64	67.61	**35**
Anton	41.14	34.78	55.62	**43.85**	**40**	68.38	65.93	67.16	**36**
NI06731	54.36	37.81	60.00	**50.72**	**25**	69.79	64.06	66.93	**37**
NI10711	53.57	40.30	58.76	**50.88**	**23**	73.78	57.65	65.72	**38**
NI10706	47.60	32.45	52.83	**44.29**	**38**	55.75	75.62	65.69	**39**
NI10703	42.09	41.13	56.10	**46.44**	**37**	59.57	69.68	64.63	**40**
AVERAGE	51.86	41.69	60.95			79.95	69.02	74.49	
LSD	7.63	6.34	8.43			16.29	16.23		
CV	7.53	7.78	7.08			10.42	12.03		

The 2010 data from rainfed sites are:

Variety	Yield Linc.	Lodg. Linc.	Hdate Linc	Dis. Linc.	Yield NP	Yield AL	State Avg	Rank	Linc. All. Avg	Rank	Height
	bu/a	score	May	score	bu/a	bu/a	bu/a		bu/a		in
NI09709	74.88	1.0	22.30	6.0	35.33	52.25	54.15	1	63.57	1	32.23
NI10713	70.79	2.0	23.81	4.0	34.65	47.88	51.11	2	59.34	2	35.30
TAM111	68.44	1.3	23.08	5.0	35.95	48.77	51.05	3	58.61	3	34.40
NI09714	61.25	1.3	24.35	6.0	34.81	53.34	49.80	5	57.30	4	31.87
NI10716	69.22	1.7	25.12	3.0	38.15	41.51	49.63	7	55.37	5	37.47
NI10707	60.80	1.3	24.47	5.0	29.58	48.74	46.37	16	54.77	6	33.83
NI09703	63.42	2.7	24.42	5.0	40.65	44.87	49.65	6	54.15	7	35.50
NI09706	53.35	1.3	23.25	8.0	39.12	54.72	49.06	9	54.04	8	32.93
NI10709	63.05	1.9	24.58	4.0	34.73	44.78	47.52	12	53.92	9	34.40
NI06731	60.17	1.7	23.95	7.0	29.98	46.63	45.59	18	53.40	10	33.13
NI08707	61.93	1.7	24.45	7.0	45.61	44.67	50.74	4	53.30	11	32.10
NI10717	59.10	1.4	24.36	7.0	34.40	46.59	46.70	15	52.85	12	33.13
NI10711	66.15	2.7	24.08	5.0	30.45	38.53	45.04	20	52.34	13	35.77
NI10718	59.46	1.3	24.19	5.0	37.97	44.77	47.40	13	52.12	14	33.07
NI10701	62.72	1.7	23.97	7.0	30.37	41.48	44.86	22	52.10	15	33.27
NI10706	56.64	1.2	24.62	4.0	42.46	46.91	48.67	10	51.78	16	34.43
NI09715	59.87	2.1	24.16	7.0	36.82	43.48	46.72	14	51.68	17	33.80
NI07703	58.46	2.0	23.65	7.0	24.04	44.34	42.28	28	51.40	18	33.80
NI04421	52.20	1.7	24.52	8.0	32.04	48.70	44.31	25	50.45	19	34.67
NI06736	64.53	2.3	22.47	6.0	26.01	36.04	42.19	29	50.29	20	30.90
NI10720	60.28	2.0	25.03	3.0	42.52	40.14	47.65	11	50.21	21	34.43
NI10714	57.85	2.0	23.49	5.0	31.79	41.84	43.83	27	49.85	22	33.70
NI10705	42.40	0.7	27.00	7.0	25.15	56.67	41.41	32	49.54	23	31.77
NI10704	49.10	2.3	24.36	8.0	36.13	49.78	45.00	21	49.44	24	33.97
NI08708	63.28	1.3	23.92	6.0	49.51	35.22	49.34	8	49.25	25	33.33
NI09710	55.95	1.7	24.01	6.0	21.82	41.94	39.90	33	48.95	26	33.03
NI10708	59.34	1.6	24.86	4.0	39.79	38.16	45.76	17	48.75	27	30.87
NI10702	53.10	1.3	24.93	6.0	37.87	44.31	45.09	19	48.71	28	33.60
NI10712	49.33	1.0	24.77	6.0	28.54	46.73	41.53	31	48.03	29	35.17
NI03427	55.94	1.7	23.56	5.0	38.31	38.96	44.40	24	47.45	30	33.57
NI06737	59.40	2.0	22.16	5.0	20.55	33.29	37.75	36	46.35	31	31.93
NI08715	49.91	1.4	23.73	7.0	42.67	41.92	44.83	23	45.92	32	33.00
WESLEY	55.22	1.3	25.21	5.0	41.65	35.49	44.12	26	45.36	33	32.30
NI10710	56.32	3.0	25.58	3.0	25.11	34.11	38.51	34	45.22	34	32.97
Antelope	61.62	1.0	24.08	6.0	34.68	28.81	41.70	30	45.22	35	32.20
NI08714	49.05	1.3	22.37	7.0	26.13	40.08	38.42	35	44.57	36	32.50
NI10719	46.52	2.0	25.69	7.0	25.42	39.48	37.14	39	43.00	37	34.60
NI10715	42.06	1.3	25.26	6.0	25.79	43.08	36.98	40	42.57	38	31.60
NI09707	43.73	0.7	21.18	8.0	30.05	39.18	37.65	37	41.46	39	31.70
NI10703	46.39	1.3	25.00	6.0	32.96	32.18	37.18	38	39.29	40	34.10
Average	**57.58**	**1.63**	**24.15**	**5.80**	**33.74**	**43.01**	**44.78**		**50.29**		**33.41**

4. Nebraska Intrastate Nursery:

The 2012 Nebraska Intrastate Nursery (NIN) was planted at seven locations (Lincoln, Mead, Clay Center, McCook (added due to generous support from ConAgra), North Platte, Sidney, and Hemingford, NE). A collaborative site was in Kansas. The data from Hemingford was damaged by drought and volunteer wheat which cannot be readily controlled in dry years. Sidney and North Platte were excellent sites until drought limited their overall grain yield. The averages are given for all locations and for the Nebraska

name	Kansas	Mead	Linc.	Clay Cen.	N. Platte	McCook	Sidney	Heming.	Avg.	NE Avg.	Rank	NE Rank
	bu/a	bu/a	bu/a	bu/a	bu/a	bu/a	bu/a	bu/a	bu/a	bu/a	bu/a	bu/a
WESLEY	56.2	66.3	50.1	42.4	42.1	71.9	62.3	26.5	52.23	51.66	38	41
Overland	61.9	78.6	57.6	63.3	47.0	76.6	66.4	22.4	59.23	58.84	7	6
NE05496	62.4	57.6	50.0	48.6	38.6	77.3	69.9	25.3	53.71	52.47	29	36
NE05548	41.1	60.0	47.6	50.5	36.7	59.4	63.0	23.6	47.74	48.69	55	54
NE06430	59.8	63.0	49.6	51.6	45.1	79.3	65.6	25.5	54.94	54.24	21	23
NE06545	62.1	72.0	59.8	64.5	54.2	82.0	60.5	26.6	60.21	59.94	5	3
NE06607	57.5	65.8	51.9	54.4	44.0	75.4	60.0	25.2	54.28	53.81	25	26
NE07486	79.0	67.0	51.3	60.8	52.1	79.8	67.3	24.7	60.25	57.57	4	11
NE07531	55.7	60.6	50.7	51.7	42.2	79.9	60.5	26.1	53.43	53.10	32	30
NE07627	45.4	66.9	51.0	54.4	44.2	69.9	61.9	25.5	52.40	53.40	36	28
NE08457	55.2	57.4	50.5	49.2	40.6	58.3	49.9	24.4	48.19	47.19	53	56
NE08476	50.3	62.9	51.7	61.5	38.5	54.7	61.9	23.7	50.65	50.70	45	45
NE08499	61.1	66.7	51.3	54.4	46.8	75.3	66.7	26.4	56.09	55.37	15	14
NE08527	49.7	68.5	54.7	55.1	32.9	62.0	52.2	25.3	50.05	50.10	48	48
NE08555	63.6	62.3	50.4	59.2	42.8	65.9	56.2	26.6	53.38	51.91	33	38
NE08659	41.1	64.2	55.1	60.1	27.4	64.2	61.5	25.1	49.84	51.09	49	43
NE09491	49.6	64.6	45.2	53.4	37.9	65.4	59.3	26.5	50.24	50.33	47	46
NE09495	28.2	69.3	56.0	26.3	47.0	73.6	61.6	21.7	47.96	50.79	54	44
NE09499	53.2	64.2	55.0	43.7	36.7	67.4	59.2	23.3	50.34	49.93	46	50
NE01481	51.7	78.9	63.0	57.1	47.7	73.4	63.2	25.0	57.50	58.33	11	9
NE09517	67.0	63.3	49.2	64.6	50.5	74.9	46.7	25.8	55.25	53.57	20	27
NE09521	61.6	73.8	51.0	61.4	54.8	75.5	65.1	27.2	58.80	58.40	9	8
NE09637	34.9	62.8	52.4	39.3	29.3	68.3	53.3	25.4	45.71	47.26	58	55
NE10418	60.8	62.1	43.5	50.5	47.7	75.9	63.9	24.4	53.60	52.57	31	34
NE10431	54.5	65.4	54.4	55.5	46.0	79.2	58.1	25.2	54.79	54.83	22	18
NE10442	72.2	60.6	42.2	55.8	48.6	79.5	58.2	25.3	55.30	52.89	19	32
NE10449	46.2	60.8	53.3	56.9	34.1	61.6	53.8	24.2	48.86	49.24	51	52
NE10478	81.6	67.9	48.4	61.1	51.7	87.2	65.8	30.7	61.80	58.97	1	5
NE10507	67.3	72.5	62.1	71.3	49.1	81.5	62.7	25.8	61.54	60.71	3	2
NI04421	59.6	68.8	59.3	64.4	54.9	76.7	64.9	26.0	59.33	59.29	6	4
Camelot	48.0	58.8	47.4	50.4	40.8	61.7	62.4	23.3	49.10	49.26	50	51
NE10509	44.9	71.1	63.6	49.8	42.6	66.9	62.9	28.3	53.76	55.03	28	16
NE10514	49.0	61.9	47.9	57.8	42.8	72.2	59.2	30.8	52.70	53.23	35	29
NE10517	56.6	67.6	44.6	54.8	41.1	63.3	58.1	28.1	51.78	51.09	42	42
NE10522	46.3	58.4	41.0	48.3	42.9	64.3	61.2	27.1	48.69	49.03	52	53
NE10529	50.4	75.2	60.6	64.6	48.3	65.8	61.2	27.9	56.75	57.66	13	10
NE10559	60.6	61.8	43.5	51.5	41.2	63.4	64.7	26.0	51.59	50.30	43	47
NE10589	59.0	74.4	64.8	71.0	53.4	81.0	61.9	27.7	61.65	62.03	2	1
NE10609	40.0	58.4	56.8	52.6	39.7	74.7	58.1	26.6	50.86	52.41	44	37
Settler CL	70.5	64.9	52.1	45.4	45.5	81.6	69.9	24.9	56.85	54.90	12	17
NE10625	49.7	72.2	45.1	52.0	44.5	77.5	65.3	26.4	54.09	54.71	27	21
NE10628	53.7	65.4	49.7	56.0	45.3	64.6	57.9	23.5	52.01	51.77	40	40
NE10638	54.1	54.7	43.9	50.4	37.2	52.1	53.9	23.8	46.26	45.14	57	58
NE10683	50.4	59.8	66.0	58.2	42.5	74.3	58.8	24.0	54.25	54.80	26	19
NH09563	58.2	62.1	47.6	56.9	45.2	76.6	65.2	26.0	54.73	54.23	23	25
NH10665	61.3	69.9	55.1	68.5	51.0	70.9	70.0	24.6	58.91	58.57	8	7
NHH09655	57.1	62.2	50.8	54.7	50.1	69.7	65.7	26.5	54.60	54.24	24	24
NI04420	65.7	66.9	49.1	61.8	51.0	75.9	63.2	31.1	58.09	57.00	10	12
NI08708	63.1	59.2	46.6	52.2	44.9	75.0	60.2	25.3	53.31	51.91	34	39
NI09706	51.6	51.1	42.7	37.4	34.7	74.6	58.4	25.0	46.94	46.27	56	57
NI09709	69.7	62.3	47.8	55.6	47.6	72.4	69.5	28.2	56.64	54.77	14	20
NI09714W	66.3	64.1	53.1	67.0	46.3	62.4	61.1	26.2	55.81	54.31	17	22
NW03666	58.1	64.9	49.2	55.6	37.4	74.2	65.6	24.0	53.63	52.99	30	31
NW07505	55.3	71.0	54.3	61.4	39.1	72.1	62.5	27.8	55.44	55.46	18	13
NW09627	65.7	51.0	45.7	51.0	40.9	70.5	62.5	27.9	51.90	49.93	41	49
NW10401	60.4	70.1	50.7	59.1	43.4	73.8	64.7	25.2	55.93	55.29	16	15
NW10487	48.8	65.2	51.4	49.3	39.2	73.7	62.5	27.0	52.14	52.61	39	33
GOODSTREAK	43.9	50.6	46.6	45.3	38.1	47.8	53.0	24.5	43.73	43.70	59	59
SCOUT66	43.5	38.8	31.2	33.3	32.4	56.2	49.5	19.6	38.06	37.29	60	60
CHEYENNE	50.6	59.0	54.4	53.1	42.1	73.1	58.4	27.5	52.28	52.51	37	35
GRAND MEAN	**55.71**	**64.12**	**51.2**	**54.46**	**43.38**	**70.9**	**61.15**	**25.73**	**53.33**	**52.99**		

the five conventional locations and one organic location. The nursery means ranged from 43.38 bu/a at North Platte to 70.9 bu/a at McCook which was sprayed with fungicides to control disease and very well managed despite the drought. As in the past, the correlation between sites ranged from r= -0.06 n.s. (n= 60, Lincoln and Kansa) to a high of r =0.66** (n=60, Lincoln with Mead). Within Nebraska, the lowest correlation was between Lincoln and Hemingford (r=0.12, n.s.) However, even the highest correlation did not explain more than 44% 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, Freeman (NE06545), Robidoux (NI04421), Overland, McGill (NE01481), and Settler CL did well. Our newer experimental lines have performed very well compared to the previously released lines, as we would hope if continual progress were being made. Cheyenne was a misplant and not correct in this nursery explaining its better than expected performance.

Fifty-seven wheat samples in 2011 NIN were analyzed were analyzed for wheat milling and breadmaking end-user quality after harvesting in 2012. There were significant differences in single kernel characteristics. The single kernel hardness indexes, diameters and weights were 62.7±10.7, 2.3±0.1 mm, and 29.0±1.8 mg, respectively. One sample was classified as SOFT, nine samples were mixed, and the rest of samples were hard. Most samples including Overland check had reduced kernel size and weight. Only 26.3% samples including Wesley and Camelot checks had kernel diameters ≥ 2.4 mm, and 35.1% samples including Wesley, Camelot and Settler CL checks had kernel weights ≥ 30.0 mg. Many samples had kernel diameters and weights that were lower than Wesley and Camelot checks. The kernel weights were significantly positively correlated with diameters.

The flour yields were 73.6±1.9%. Only two samples produced flour yields <70%. The brans scores were 3.4±0.7. Fourteen percent samples including SetlerCL check had bran scores < 3.0 (fair). The yields and bran scores were significantly positively correlated with kernel hardness. The yields were also significantly positively correlated with bran scores.

There were significant differences in protein and ash contents. The whole wheat protein contents at 12% mb were 12.9±1.1% and the white flour protein contents at 14% mb were 11.1±0.9%. After milling, the protein losses were 1.5±0.7%. Nineteen percent samples including Camelot and Settler CL checks had flour protein contents ≥ 12.0%, only 2 samples had flour protein contents <10.0%, other samples' protein contents were in a normal range. The flour ash contents at 14% mb were 0.44±0.04%. Three samples including Wesley check had ash >0.50% and the rest of samples had ash between 0.38% and 0.50%. The proteins in flour were significantly correlated with dough rheological properties. As expected, protein concentration was significantly positively correlated with mixograph water absorption, tolerance, peak value, and area.

There were significant differences in dough rheological properties. The water absorptions at 14% mb were 63.0±1.1%. Only 3 samples had water absorptions <62.0%. The mixograph peak times (PT) were 4.66±1.10 min. Fourteen percent samples had PT >6.0 min (higher dough extensibility) and the rest of samples had PT between 3.0 and 6.0 min. The mixograph peak values (PV) were 48.0±3.0 %TQ. No samples had PV <42.0%TQ (low dough strength). The mixograph areas in 8 min were 124±25 %TQ·min. Twelve percent samples including Overland check had areas <100%TQ·min (low resistance to dough extension). The tolerances to mixing were rated as 3.7±0.8. Twelve percent samples including Overland check had tolerances <3 (fair), two samples had tolerances >5.0 (very strong), and the rest of samples had tolerances between 3.0 and 5.0. Therefore, most samples had good dough rheological properties. The dough rheological properties were significantly correlated with breadmaking characteristics. Especially the tolerances were significantly correlated with cell number and bread scores positively and texture hardness and cell diameters negatively. The PT were significantly correlated with mixing times, slice areas, cell number and bread scores positively and cell diameter negatively.

Without adding oxidant in baking, the baking water absorptions for optimum dough development at 14% mb were 61.6±1.5%. Only 42.1% samples including Overland and Camelot as well as control had water absorptions ≥62.0%. The mixing times (MT) were 4.84±1.16 min. Sixteen percent samples including Wesley and Settler CL had MT >6.0 min; others were between 3.0 and 6.0 min. The proofing times (PRF) were 61±9 min. 7.0% samples had PRF >75 min. There were significant differences in bread quality characteristics. The loaf volumes were 794±46 cc. Five samples had volumes <750 cc. The crumb texture firmness was 3510±871 Pa. Few samples received either very hard or soft crumb texture. The slice areas were 95.5±6.0 cm^2. Only 9 samples including Settler CL check had slice areas <90 cm^2. The slice brightness was 144±7. 29.8% samples had brightness <140. The cell number was 5000±795. 29.8% samples including Settler CL check had cell number less than 4500. The cell diameters were 2.23±0.28. 22.8% samples including Overland and Settler CL checks had diameters >2.50 mm. The bread scores were 3.5±0.9. 31.6% samples including Overland and SetlerCL checks had scores <3.0 (fair).

Samples that had bread scores <3 were re-baked with 5 ppm oxidant in the standard formula. The breadmaking properties were significantly improved. Only Overland, NE09637 and NI09706 samples again received unacceptable bread quality.

Data for the 2011 NIN are:

	Linc.	C. Center	N. Platte	Alliance	McCook	**NE Avg. (including Mead Org.)**		Mead Org.	Sidney Org.	**Org. Avg.**		Kansas
name	Yield	Yield	Yield	Yield	Yield	**Yield**	Rank	Yield	Yield	**Yield**	Rank	Yield
	(bu/a)	(bu/a)	(bu/a)	(bu/a)	(bu/a)	**(bu/a)**		(bu/a)	(bu/a)	**(bu/a)**		(bu/a)
NE07531	74.4	60.4	40.1	71.6	81.8	**64.5**	**1**	58.8	55.7	57.2	**11**	93.0
NI08708	66.4	58.3	44.9	65.5	96.6	**64.3**	**2**	54.3	26.0	60.1	**1**	92.4
NE09499	62.7	61.3	41.1	73.2	84.3	**62.8**	**3**	54.1	51.8	51.1	**40**	73.5
NI04421	66.9	62.8	42.3	68.2	83.9	**62.7**	**4**	52.0	51.8	53.1	**28**	79.8
NE06545	66.5	57.8	45.1	76.5	69.4	**62.6**	**5**	60.3	47.0	58.5	**7**	84.7
NI04420	70.4	58.4	39.7	79.9	74.3	**62.4**	**6**	51.5	46.0	51.0	**42**	76.2
NE09517	71.9	55.3	39.0	74.9	79.8	**61.3**	**7**	47.0	54.3	50.5	**45**	76.3
Overland	61.8	58.3	40.6	71.9	76.7	**61.1**	**8**	57.3	50.8	59.5	**3**	81.5
NE06607	66.0	51.6	40.9	71.5	79.3	**61.1**	**9**	57.1	49.7	54.0	**24**	78.8
NE09521	64.3	56.1	44.5	70.4	77.2	**60.8**	**10**	52.5	52.6	59.1	**5**	92.3
NH09563	63.2	57.7	40.5	66.8	77.5	**60.7**	**11**	58.5	54.5	55.2	**17**	85.9
NHH09655	55.1	53.1	46.9	62.2	81.6	**60.0**	**12**	61.4	57.5	60.0	**2**	78.3
NE07486	75.8	56.3	38.4	61.9	74.2	**60.0**	**13**	53.5	56.7	55.9	**14**	95.8
NE09637	67.9	67.3	47.7	65.8	64.2	**59.7**	**14**	45.3	50.9	45.1	**52**	62.7
NE09495	66.8	59.3	42.7	64.1	72.0	**59.3**	**15**	51.0	65.5	53.8	**25**	78.2
NE09417	70.9	54.5	41.0	65.5	69.9	**58.8**	**16**	50.7	50.4	48.4	**48**	77.3
NE01481	68.4	55.7	38.2	61.4	78.6	**58.7**	**17**	49.8	58.3	50.8	**43**	83.3
NE06430	60.5	52.7	39.3	69.7	82.4	**58.6**	**18**	46.9	54.8	50.7	**44**	89.5
WESLEY	76.3	47.2	35.4	62.5	77.6	**58.6**	**19**	52.4	55.1	57.2	**12**	79.5
NE09491	59.7	53.2	38.2	63.0	82.9	**58.2**	**20**	52.3	55.7	59.3	**4**	65.8
NW09627	60.0	57.5	42.4	73.3	62.0	**58.2**	**21**	53.9	55.4	54.1	**22**	78.8
NE08499	66.2	55.7	41.2	66.9	68.4	**58.1**	**22**	50.4	51.5	51.3	**34**	75.1
NE06469	63.7	56.4	37.5	64.5	69.7	**58.1**	**23**	56.6	55.2	57.0	**13**	77.1
NE09498	59.5	56.5	42.4	64.9	70.9	**58.0**	**24**	54.0	60.9	51.2	**38**	72.8
NE08509	62.1	56.9	39.1	64.8	67.7	**57.9**	**25**	56.6	42.9	54.4	**19**	74.9
NW07534	60.2	53.4	40.6	60.8	80.7	**57.8**	**26**	51.0	50.6	53.8	**25**	73.0
NE09527	73.6	57.1	40.8	67.8	61.4	**57.7**	**27**	45.4	52.3	41.6	**57**	65.8
NE08659	60.2	57.2	42.9	57.1	77.3	**57.6**	**28**	50.8	52.2	51.1	**39**	75.1
NE07627	59.6	49.4	41.8	66.7	68.2	**57.5**	**29**	59.2	57.7	57.3	**10**	84.9
NE08402	67.7	48.5	36.2	63.4	71.5	**57.5**	**30**	57.4	55.4	54.4	**18**	79.5
NE07520	63.1	54.1	36.7	63.0	77.5	**57.5**	**31**	50.3	51.5	52.7	**29**	81.1
NE09426	68.0	56.7	31.3	68.6	66.2	**57.4**	**32**	53.4	46.0	51.2	**37**	91.0
NW07505	64.4	58.2	37.0	67.9	64.7	**57.3**	**33**	51.3	49.0	55.3	**16**	83.7
NE08457	69.9	52.4	38.2	67.8	63.2	**57.2**	**34**	51.7	53.4	47.3	**51**	79.9
NE05548	58.1	53.4	39.0	66.7	75.8	**57.2**	**35**	49.9	47.9	51.3	**35**	69.3

NW03666	62.9	51.8	34.4	63.4	81.8	**57.0**	**36**	47.9	47.3	48.9	**47**	77.7
Settler CL	62.2	52.1	42.0	61.4	69.1	**56.9**	**37**	54.4	54.1	58.9	**6**	87.8
NE09481	73.4	52.7	34.2	70.9	73.8	**56.7**	**38**	35.4	46.0	41.4	**58**	100.2
GOODSTREAK	62.5	53.0	36.6	63.7	66.0	**56.5**	**39**	57.0	66.4	54.4	**19**	66.3
NE08410	69.6	50.7	37.4	60.3	66.8	**56.3**	**40**	53.2	56.6	54.2	**21**	79.6
NE09482	65.8	51.3	34.0	60.1	74.2	**56.3**	**41**	52.5	48.4	53.3	**27**	89.0
NE02558	56.1	50.2	39.3	64.3	77.3	**56.1**	**42**	49.4	48.1	48.2	**49**	79.2
NE08452	62.2	53.3	31.9	65.2	69.4	**56.1**	**43**	54.5	53.9	57.7	**9**	78.8
NE08527	65.0	54.4	42.4	61.7	66.6	**56.0**	**44**	45.7	65.7	51.7	**32**	53.2
NE08555	65.6	52.2	43.3	60.2	64.4	**55.9**	**45**	49.4	37.7	52.4	**30**	77.6
NE05496	53.1	45.5	38.5	65.0	77.2	**55.7**	**46**	54.9	44.9	52.3	**31**	84.5
NE09437	56.6	51.1	38.6	67.3	70.8	**55.5**	**47**	48.7	47.8	51.1	**41**	86.0
NE09684	56.1	54.8	39.9	65.5	68.1	**55.4**	**48**	48.2	52.0	48.0	**50**	71.9
NE07409	58.7	53.5	38.6	57.1	73.7	**55.3**	**49**	50.1	58.6	57.8	**8**	78.1
NE08476	53.5	55.6	35.4	64.0	70.2	**55.2**	**50**	52.3	50.5	51.4	**33**	77.3
NE05426	55.8	52.6	36.4	68.2	66.8	**54.7**	**51**	48.2	54.1	51.3	**36**	73.7
NE05430	68.6	51.3	40.0	60.4	67.2	**54.5**	**52**	39.3	65.9	45.0	**53**	68.1
NE09483	60.6	51.5	30.7	62.9	78.2	**54.3**	**53**	42.1	49.8	44.1	**56**	78.1
NE07487	50.3	47.3	38.9	60.8	70.4	**53.9**	**54**	56.0	59.4	55.4	**15**	77.4
NE07444	62.2	48.7	34.2	66.3	61.0	**53.5**	**55**	48.8	56.6	49.6	**46**	79.6
NE09477	55.2	47.5	34.8	63.9	76.6	**53.2**	**56**	41.1	54.4	44.5	**55**	68.8
NE04490	58.6	43.8	38.8	65.2	67.2	**52.9**	**57**	43.7	61.8	44.8	**54**	69.9
Camelot	56.6	47.6	32.0	58.8	59.4	**51.2**	**58**	52.6	30.4	54.1	**22**	77.7
SCOUT66	40.2	39.7	27.1	50.9	58.3	**41.9**	**59**	35.4	63.3	32.9	**59**	61.0
CHEYENNE	34.0	31.6	33.4	50.0	66.6	**41.8**	**60**	35.5	61.9	30.7	**60**	50.6
AVERAGE	**62.3**	**53.4**	**38.8**	**65.1**	**72.5**			**50.9**	**52.8**			**78.0**
LSD	**8.27**	**6.33**	**5.99**	**8.75**	**16.91**			**8.80**	**11.65**			**15.04**
CV	**9.49**	**6.13**	**7.98**	**6.94**	**9.59**			**8.93**	**16.26**			**9.96**
HERITABILITY	**0.99**	**0.99**	**0.99**	**0.99**	**0.99**			**0.99**				**0.99**

The data for the 2010 NIN were:

	Conventional									**Organic**			
	Mead	Linc.	CC	NP	Sidney	Alliance	McCook	**Avg**	**Rank**	Sidney	Mead	**Avg.**	**Rank**
	Yield	Yield	Yield	Yield	Yield	Yield	Yield			Yield	Yield		
	bu/a	bu/a	bu/a	bu/a	bu/a	bu/a	bu/a	**bu/a**		bu/a	bu/a	**bu/a**	
WESLEY	37.5	52.9	43.3	34.3	52.0	47.2	76.7	**44.5**	**55**	32.8	35.7	**34.2**	**49**
ALLIANCE	31.2	53.2	45.8	48.7	60.9	58.7	80.4	**49.8**	**19**	27.4	42.5	**34.9**	**46**
Overland	45.5	56.5	52.5	37.0	54.8	58.8	92.8	**50.8**	**10**	36.2	40.6	**38.4**	**29**
NE01481	37.0	61.3	52.0	34.5	57.3	50.6	91.7	**48.8**	**25**	39.1	40.2	**39.6**	**18**
NE02558	43.1	53.4	47.9	44.0	58.3	53.2	83.7	**50.0**	**17**	35.8	45.6	**40.7**	**8**
NE03490	33.3	57.4	52.8	33.2	53.5	49.3	81.1	**46.6**	**42**	29.6	38.4	**34.0**	**50**
NW03666	43.7	60.7	49.0	36.0	53.6	57.8	87.6	**50.1**	**16**	30.7	43.4	**37.0**	**35**
NE04490	35.4	57.1	39.5	37.5	50.0	58.2	77.1	**46.3**	**44**	33.9	46.5	**40.2**	**13**
NI04420	45.3	60.2	53.7	34.9	65.1	53.1	89.8	**52.0**	**6**	38.2	41.1	**39.6**	**19**
NI04421	41.2	56.4	46.3	35.3	63.9	58.7	89.8	**50.3**	**15**	37.3	40.8	**39.0**	**23**
NE05426	38.4	63.8	40.6	32.6	50.4	48.5	82.5	**45.7**	**49**	27.7	40.6	**34.2**	**49**
NE05430	38.4	59.2	47.9	26.9	57.2	45.6	85.9	**45.9**	**48**	29.3	41.5	**35.4**	**43**

NE05496	38.5	54.5	47.0	46.0	58.0	52.5	87.0	**49.4**	**22**	42.5	34.3	**38.4**	**28**
NE05548	28.2	56.0	45.1	41.3	61.7	58.6	80.3	**48.5**	**26**	32.0	40.3	**36.1**	**40**
NE06430	33.0	55.7	48.0	40.0	64.2	52.7	88.7	**48.9**	**24**	32.5	45.0	**38.7**	**24**
NE06469	39.7	58.7	48.1	46.7	53.1	47.4	84.2	**49.0**	**23**	38.4	50.9	**44.7**	**3**
NE06545	31.8	59.0	40.0	39.1	51.9	61.4	91.0	**47.2**	**37**	31.5	43.9	**37.7**	**32**
NE06607	43.7	58.9	54.2	44.5	63.4	58.9	88.6	**53.9**	**1**	54.6	47.9	**51.2**	**1**
NE07444	33.6	55.2	49.5	37.9	53.3	54.7	85.5	**47.4**	**35**	22.6	43.3	**33.0**	**56**
NE07486	40.0	66.3	54.4	34.5	60.2	62.7	88.5	**53.0**	**3**	31.8	45.5	**38.6**	**26**
NE07487	30.4	55.5	48.9	31.3	60.1	63.7	83.3	**48.3**	**27**	31.8	47.7	**39.8**	**16**
NW07505	40.7	59.5	55.5	43.6	63.1	59.4	78.7	**53.6**	**2**	30.3	42.5	**36.4**	**38**
NE07520	30.8	57.9	48.4	32.8	61.9	57.0	88.5	**48.1**	**29**	25.0	39.8	**32.4**	**58**
NE07521	39.7	56.8	47.5	35.5	50.8	50.7	85.6	**46.8**	**41**	20.0	42.0	**31.0**	**61**
NE07531	31.8	49.9	42.3	45.1	52.1	51.9	92.1	**45.5**	**51**	31.3	44.4	**37.8**	**31**
NW07534	35.5	55.4	38.4	34.1	44.4	46.9	81.7	**42.5**	**58**	22.1	41.3	**31.7**	**59**
NE07627	36.4	49.5	37.4	35.8	55.5	57.3	91.8	**45.3**	**52**	25.0	48.0	**36.5**	**37**
NE07668	31.4	56.5	43.7	34.3	56.2	48.9	82.3	**45.2**	**53**	32.5	34.6	**33.5**	**52**
NI07703	37.7	46.6	36.4	24.8	58.6	54.2	83.8	**43.1**	**57**	30.5	35.0	**32.7**	**57**
Camelot	43.7	57.4	49.9	39.1	64.9	53.2	81.7	**51.3**	**8**	35.4	52.5	**44.0**	**4**
Settler CL	38.5	56.9	43.9	45.5	61.1	57.5	83.2	**50.6**	**11**	25.9	42.7	**34.3**	**47**
Infinity CL	34.1	56.5	48.8	31.2	60.7	57.3	80.9	**48.1**	**30**	32.3	38.0	**35.2**	**44**
MILLENNIUM	39.1	54.1	49.5	30.5	58.8	57.4	82.0	**48.2**	**28**	31.4	38.9	**35.1**	**45**
NE08402	41.5	64.2	48.6	22.7	54.8	50.5	81.3	**47.0**	**39**	48.9	47.2	**48.1**	**2**
NE08407	46.1	63.2	46.3	29.2	52.8	47.8	82.7	**47.6**	**32**	28.6	48.6	**38.6**	**27**
NE08410	41.3	63.7	43.8	27.6	54.5	52.5	84.8	**47.2**	**36**	35.4	45.1	**40.2**	**12**
NE08435	39.1	60.8	44.3	23.2	55.9	49.8	85.2	**45.5**	**50**	32.2	45.2	**38.7**	**25**
NE08452	27.2	55.7	45.3	35.2	63.4	60.7	84.8	**47.9**	**31**	31.7	42.6	**37.1**	**34**
NE08457	42.6	60.1	44.1	40.9	55.9	54.6	84.5	**49.7**	**20**	30.9	42.4	**36.6**	**36**
NE08459	38.8	57.9	38.2	33.3	55.1	54.0	79.7	**46.2**	**46**	36.6	41.6	**39.1**	**22**
NE08470	35.2	51.8	43.0	32.7	58.8	46.1	83.8	**44.6**	**54**	31.0	35.2	**33.1**	**55**
NE08476	37.5	59.3	54.3	43.1	62.5	59.6	82.6	**52.7**	**4**	38.0	40.2	**39.1**	**21**
NE08499	33.3	61.9	52.7	38.4	61.8	60.9	83.3	**51.5**	**7**	33.3	39.4	**36.3**	**39**
NE08509	30.7	47.9	45.9	41.5	58.7	58.1	85.6	**47.1**	**38**	39.7	41.2	**40.4**	**10**
NE08523	31.4	59.4	62.6	37.2	60.5	50.7	76.2	**50.3**	**14**	37.3	43.6	**40.4**	**11**
NE08527	31.1	58.5	57.8	36.6	62.1	57.1	81.5	**50.5**	**12**	40.3	39.3	**39.8**	**15**
NE08531	36.1	54.0	53.5	40.8	55.7	44.2	79.8	**47.4**	**34**	40.8	40.5	**40.7**	**9**
NE08555	39.3	55.9	49.6	38.9	57.5	56.0	84.1	**49.5**	**21**	47.7	36.0	**41.9**	**7**
NE08651	35.3	51.8	43.6	43.4	56.2	50.9	81.6	**46.9**	**40**	37.5	47.3	**42.4**	**6**
NE08659	38.8	54.7	54.1	47.4	65.8	55.4	74.6	**52.7**	**5**	34.0	42.4	**38.2**	**30**
NW08460	29.8	58.9	42.2	30.7	60.8	56.8	85.0	**46.5**	**43**	31.9	35.8	**33.8**	**51**
NW08463	38.7	59.1	38.2	39.3	50.4	50.9	85.5	**46.1**	**47**	40.8	38.7	**39.8**	**17**
NI06731	36.8	60.0	45.3	33.0	56.1	54.0	78.8	**47.5**	**33**	32.6	39.0	**35.8**	**42**
NI06736	38.8	60.2	47.9	31.4	50.8	48.2	76.7	**46.2**	**45**	24.2	42.1	**33.1**	**54**
NI06737	31.8	62.4	45.8	29.1	50.4	45.5	74.8	**44.1**	**56**	27.3	39.6	**33.4**	**53**
NE07409	39.4	62.3	54.2	33.4	58.1	51.7	89.0	**49.9**	**18**	34.2	45.9	**40.0**	**14**
NI08708	38.2	61.2	51.5	41.9	62.0	47.6	90.0	**50.4**	**13**	38.4	48.3	**43.3**	**5**

GOODSTREAK	43.8	49.4	50.4	40.5	62.4	60.3	69.8	51.1	9	34.9	43.7	39.3	20
SCOUT66	28.7	40.8	37.3	29.7	50.3	40.5	57.6	37.9	59	40.5	22.5	31.5	60
CHEYENNE	27.7	23.6	33.1	37.0	47.1	44.2	52.0	35.4	60	42.4	29.8	36.1	41
AVERAGE	**36.8**	**56.5**	**47.0**	**36.4**	**57.2**	**53.5**	**82.7**	**47.9**		**33.8**	**41.6**	**37.7**	
LSD	**9.1**	**4.7**	**4.1**	**7.1**	**6.0**	**5.5**	**7.4**			**11.2**	**8.8**		
CV	**18.2**	**7.1**	**6.4**	**14.3**	**7.7**	**7.6**	**5.3**			**24.4**	**15.6**		

Data from 2010 to 2012 (three year average) from the Nebraska Intrastate Nursery for Grain Yield (bu/a)

	Yield MD	Yield LN	Yield CC	Yield NP	Yield SD	Yield All.	Yield MC	State AVG	Rank
	bu/a	bu/a	bu/a	bu/a	bu/a	bu/a	bu/a	bu/a	
Camelot	51.2	53.8	49.3	37.3	63.7	45.1	67.6	50.5	24
CHEYENNE	43.3	37.3	39.3	37.5	52.7	40.6	63.9	43.7	26
GOODSTREAK	47.2	52.8	49.5	38.4	57.7	49.5	61.2	50.4	25
NE01481	57.9	64.2	55.0	40.1	60.3	45.6	81.2	55.8	9
NE05496	48.1	52.5	47.1	41.0	64.0	47.6	80.5	52.6	19
NE05548	44.1	53.9	49.7	39.0	62.4	49.6	71.8	51.9	22
NE06430	48.0	55.3	50.8	41.5	64.9	49.3	83.5	54.7	12
NE06545	51.9	61.8	54.1	46.1	56.2	54.9	80.8	56.7	5
NE06607	54.8	58.9	53.4	43.1	61.7	51.9	81.1	56.5	6
NE07486	53.5	64.5	57.2	41.7	63.8	49.8	80.9	57.3	3
NE07531	46.2	58.3	51.5	42.4	56.3	49.9	84.6	54.8	11
NE07627	51.6	53.4	47.1	40.6	58.7	49.8	76.6	52.0	21
NE08457	50.0	60.2	48.6	39.9	52.9	48.9	68.7	51.7	23
NE08476	50.2	54.8	57.1	39.0	62.2	49.1	69.2	53.0	16
NE08499	50.0	59.8	54.3	42.1	64.2	51.4	75.7	55.5	10
NE08527	49.8	59.4	55.8	37.3	57.2	48.0	70.0	52.9	17
NE08555	50.8	57.3	53.7	41.7	56.8	47.6	71.5	52.9	18
NE08659	51.5	56.7	57.1	39.2	63.6	45.9	72.1	54.2	14
NI04420	56.1	59.9	58.0	41.9	64.2	54.7	80.0	57.9	2
NI04421	55.0	60.9	57.8	44.2	64.4	51.0	83.5	58.1	1
NI08708	48.7	58.1	54.0	43.9	61.1	46.1	87.2	56.2	7
NW03666	54.3	57.6	52.2	35.9	59.6	48.4	81.2	54.0	15
NW07505	55.9	59.4	58.4	39.9	62.8	51.7	71.9	55.9	8
Overland	62.0	58.6	58.0	41.5	60.6	51.0	82.0	57.2	4
SCOUT66	33.7	37.4	36.8	29.7	49.9	37.0	57.4	39.5	27
Settler CL	51.7	57.1	47.1	44.4	65.5	47.9	78.0	54.3	13
WESLEY	51.9	59.8	44.3	37.2	57.2	45.4	75.4	52.0	20
Mean	**50.7**	**56.4**	**51.7**	**40.2**	**60.2**	**48.4**	**75.5**	**53.4**	

As can be seen from the excellent three-year yields of released lines (NI04421= Robidoux, NE06545 = Freeman, and Overland) our released lines continue to do well, but we have many experimental lines with excellent grain yields in the east, central, or west parts of Nebraska. Robidoux continues to build its reputation as being a drought tolerant wheat under rainfed conditions that can respond well to moisture under irrigation. Both broadly and more narrowly adapted lines have value in wheat production.

5. <u>Nebraska Triplicate Nursery (NTN):</u>

The same comments about the NIN data apply to the NTN. In this nursery, the check lines performed well (Overland) to very poorly (Camelot and Goodstreak) compared to the experimental lines. Goodstreak was a disappointment (especially considering its better performance in previous years) due to the early season and being very badly hurt by stripe rust in eastern NE. Despite the early season, Overland continued to do well. There are a number of lines that have promise for continued testing toward 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 were low but positive correlations among the closer locations, but in all cases the variation in one location could explain at most 35% of the variation in the other location (McCook with North Platte), again indicating the value of extensive testing in NE. In 2013 we will be able to evaluate the protein concentration in grain samples harvested from this early screening nursery due to the high throughput of the new NIR instrument we have added to the seed house.

The data for the 2012 TRP:

name	KS (bu/a)	Mead (bu/a)	Linc. (bu/a)	Clay C. (bu/a)	N. Platte (bu/a)	McCoo (bu/a)	Sid (bu/a)	Allian. (bu/a)	Mean (bu/a)	Rank	Flower date
Camelot	41.3	58.0	48.2	50.7	37.7	63.2	63.7	46.0	51.1	52	**125.7**
GOODSTREAK	36.4	49.4	43.2	39.2	31.7	51.5	57.1	48.8	44.7	60	**125.4**
Overland	47.8	76.6	52.0	64.5	42.7	75.4	65.6	51.6	59.5	6	**129.0**
NE11415	66.9	51.7	41.9	51.9	43.4	82.6	63.1	49.6	56.4	16	**117.7**
NE11423	64.0	53.3	42.1	46.4	39.5	66.4	58.4	45.4	51.9	46	**123.1**
NE11426	45.4	65.2	49.7	51.9	41.9	72.4	57.6	47.1	53.9	30	**117.6**
NE11440	61.2	60.7	39.4	55.2	37.0	64.7	60.8	49.2	53.5	36	**122.0**
NE11443	51.9	59.2	46.2	51.4	38.3	60.1	61.4	38.8	50.9	54	**117.6**
NE11455	64.0	63.5	45.4	46.2	39.4	82.2	65.8	40.9	55.9	20	**119.3**
NE11461	60.9	54.8	52.1	47.8	43.3	66.2	62.9	47.7	54.5	25	**122.0**
NE11464	52.7	55.3	49.5	47.1	38.3	77.9	54.2	45.9	52.6	42	**119.7**
NE11470	58.9	55.2	46.5	55.0	44.5	72.2	63.4	51.2	55.9	21	**117.7**
NE11472	62.1	60.6	50.2	58.6	44.1	78.6	60.4	47.2	57.7	12	**119.7**
NE11480	55.1	56.5	47.4	45.7	39.2	68.7	59.6	43.3	51.9	46	**121.5**
NE11482	48.9	59.3	47.7	53.2	43.7	72.7	66.6	52.2	55.5	22	**126.3**
NH11489	60.4	57.7	50.3	55.4	43.7	88.2	64.8	47.1	58.5	9	**123.1**
NH11490	48.2	63.6	49.1	52.5	41.6	75.2	64.6	44.7	54.9	24	**123.7**
NE11499	62.4	67.5	52.4	54.8	40.8	77.9	65.7	46.1	58.5	8	**121.3**
NW11510	67.0	51.1	38.8	49.7	41.6	85.9	57.6	38.4	53.8	32	**117.7**
NW11511	68.1	53.1	48.1	55.3	50.3	88.8	59.1	41.4	58.0	11	**116.1**
NW11514	57.6	61.7	38.0	50.6	40.3	75.0	62.8	45.2	53.9	31	**119.1**
NE11522	52.6	64.1	44.6	48.3	36.9	63.9	55.0	45.1	51.3	49	**121.6**
NE11527	52.2	64.6	51.5	51.4	40.0	69.0	64.3	47.1	55.0	23	**124.4**
NE11530	45.9	63.7	52.6	50.3	35.8	60.8	56.3	49.3	51.8	48	**124.1**
NE11536	41.2	65.9	49.1	61.0	48.6	69.5	65.2	50.6	56.4	16	**127.7**
NE11543	41.2	61.1	50.1	40.8	38.6	67.9	59.0	50.8	51.2	50	**126.7**
NE11560	69.3	60.8	56.8	59.6	53.5	83.3	70.0	48.4	62.7	1	**120.6**
NH11563	56.6	64.4	52.0	51.4	51.1	77.5	65.9	42.6	57.7	13	**126.0**
NH11565	62.6	63.7	57.9	59.5	44.3	85.8	60.0	51.1	60.6	2	**122.7**
NHH11569	56.3	59.0	45.3	54.3	39.6	63.4	58.2	44.9	52.6	41	**122.4**
NE11581	51.7	61.9	48.2	44.9	39.2	64.1	59.8	53.3	52.9	39	**122.0**
NW11588	34.3	62.1	55.3	52.4	41.4	65.4	60.7	50.4	52.8	40	**126.3**
NW11589	33.0	54.1	48.7	45.7	31.4	53.8	57.4	41.2	45.7	59	**124.7**
NW11590	58.8	67.4	54.7	60.0	48.1	81.9	64.6	48.3	60.5	3	**121.9**
NW11593	49.0	55.5	40.9	47.5	39.4	71.9	59.3	45.9	51.2	51	**119.3**
NW11598	61.2	57.2	53.5	57.4	47.0	78.6	68.6	43.3	58.4	10	**123.7**
NE11607	45.9	75.0	59.9	71.6	46.9	73.4	53.9	51.6	59.8	5	**129.4**

NE11608	40.7	65.7	54.3	51.4	40.5	65.9	56.6	50.0	53.1	38	**129.3**
NE11610	32.1	62.0	51.0	57.1	43.9	67.1	62.7	52.2	53.5	37	**127.7**
NE11612	35.7	59.9	56.0	62.9	43.5	64.6	59.8	46.9	53.7	33	**130.0**
NE11613	39.6	59.3	50.7	60.6	41.4	65.0	59.0	43.5	52.4	43	**125.7**
NH11631	44.5	71.0	58.9	47.9	39.8	84.6	59.2	41.5	55.9	19	**129.3**
NHH11638	34.6	71.3	59.6	54.4	47.9	90.0	57.4	46.1	57.7	14	**127.6**
NHH11639	34.6	65.9	56.7	53.6	44.9	83.2	64.8	43.9	56.0	18	**128.9**
NE11642	37.6	66.1	47.2	52.0	37.0	59.6	56.5	51.5	50.9	53	**130.0**
NE11643	40.0	62.5	47.2	67.3	36.9	59.0	59.0	46.5	52.3	44	**129.6**
NW11645	43.8	63.4	52.5	53.8	33.0	66.3	50.3	53.9	52.1	45	**129.0**
NE11652	45.3	69.1	51.1	59.6	39.9	59.6	60.4	49.6	54.3	26	**129.6**
NE11653	27.3	74.4	56.0	60.1	36.7	67.4	62.6	48.9	54.2	29	**128.7**
NE11654	46.6	68.0	63.1	64.9	43.2	71.9	65.4	51.6	59.3	7	**129.2**
NE11655	31.9	65.2	51.9	47.1	38.3	67.9	55.7	44.8	50.4	55	**129.9**
NH11663	37.1	71.3	56.6	50.5	35.4	73.8	63.1	46.4	54.3	27	**130.6**
NH11664	40.0	75.1	52.6	49.9	38.4	72.7	59.5	40.5	53.6	34	**130.4**
NH11668	41.3	73.6	57.9	52.3	39.4	78.8	61.6	47.4	56.5	15	**129.4**
NE11684	32.1	69.6	55.1	64.1	43.2	67.7	54.2	42.6	53.6	35	**130.9**
NE11688	41.6	73.7	61.9	73.3	49.9	70.1	65.4	46.7	60.3	4	**128.3**
NE11690	27.8	60.2	49.1	43.7	33.9	69.1	59.9	42.2	48.2	58	**128.6**
NH11691	35.1	54.4	54.1	45.8	40.1	79.3	46.1	46.3	50.2	56	**130.6**
NW11696	33.4	61.9	46.3	47.4	36.2	63.5	59.0	47.0	49.3	57	**127.6**
NE11697	60.7	56.0	42.8	50.2	44.8	62.7	62.7	54.3	54.3	27	**120.0**
Mean	47.9	62.6	50.5	53.5	41.2	71.4	60.6	46.9	54.3		**124.8**

The 2011 data are:

	Conventional								**Organic**		
	Linc.	Clay Center	McCook	N. Platte	Alliance	**Avg (with Mead Org.)**		Sidney	Mead	**Avg.**	
	Yield	Yield	Yield	Yield	Yield	**Yield**	Rank	Yield	Yield	Yield	Rank
	bu/a	bu/a	bu/a	bu/a	bu/a	**bu/a**		bu/a	bu/a	**bu/a**	
Camelot	42.0	48.0	68.1	29.3	64.6	**50.6**	**55**	59.9	51.7	**55.8**	**13**
Goodstreak	49.8	53.6	66.5	35.8	66.5	**54.7**	**30**	56.0	56.2	**56.1**	**10**
NE10415	60.4	54.6	57.4	28.8	60.5	**51.7**	**51**	44.9	48.5	**46.7**	**50**
NE10418	59.9	54.3	73.7	32.6	64.6	**56.7**	**11**	45.7	55.0	**50.4**	**34**
NE10431	59.6	55.9	77.9	37.9	72.7	**59.1**	**5**	34.3	50.3	**42.3**	**55**
NE10433	55.2	47.7	65.2	39.9	58.8	**52.5**	**45**	42.1	48.3	**45.2**	**53**
NE10442	68.4	53.8	69.1	33.0	63.0	**56.7**	**10**	41.6	52.9	**47.3**	**48**
NE10449	54.4	56.8	70.1	37.7	63.8	**56.2**	**15**	50.6	54.5	**52.5**	**22**
NE10451	45.7	45.4	65.8	30.5	66.7	**50.2**	**57**	50.5	47.1	**48.8**	**39**
NE10456	67.9	51.7	60.3	34.3	62.2	**55.2**	**26**	41.9	55.1	**48.5**	**42**
NE10460	56.0	60.3	69.5	39.5	60.9	**55.4**	**24**	50.2	46.1	**48.1**	**45**
NE10464	60.7	46.9	55.3	33.9	61.7	**50.2**	**56**	38.3	42.9	**40.6**	**58**
NE10466	66.0	56.2	57.1	31.9	65.6	**53.8**	**38**	32.1	46.1	**39.1**	**60**
NE10467	60.7	49.8	60.4	37.4	67.4	**53.2**	**42**	34.8	43.5	**39.2**	**59**

NE10474	50.1	50.2	70.1	36.1	58.0	**52.2**	49	33.3	48.7	**41.0**	57
NE10475	53.7	48.9	36.0	34.9	65.0	**49.0**	60	48.7	55.8	52.2	25
NE10478	67.3	62.1	74.0	33.9	64.1	**59.3**	4	41.4	54.3	**47.8**	47
NE10506	48.6	50.2	66.5	35.3	61.0	**51.3**	53	50.1	46.2	**48.1**	46
NE10510	53.3	54.2	69.8	40.1	65.7	**55.9**	19	44.6	52.6	**48.6**	41
NE10513	60.1	53.9	65.3	31.4	60.1	**53.4**	39	37.2	49.7	**43.5**	54
NE10514	52.1	52.5	75.1	39.4	68.0	**56.2**	16	47.2	50.2	**48.7**	40
NE10517	50.3	54.0	75.2	38.0	62.1	**56.1**	18	61.9	56.7	**59.3**	3
NE10522	55.4	51.9	70.3	40.0	70.5	**55.9**	20	44.5	47.2	**45.9**	52
NE10527	51.8	47.6	43.8	31.4	65.3	**49.8**	58	50.6	59.1	**54.9**	15
NE10528	48.7	53.3	66.9	33.6	59.7	**52.5**	46	51.3	52.7	**52.0**	26
NE10529	58.4	60.3	87.8	39.6	65.2	**62.2**	2	57.8	61.7	**59.8**	2
NE10535	55.1	54.5	78.1	35.6	59.6	**55.8**	21	40.4	51.9	**46.1**	51
NE10536	55.9	48.5	68.6	36.7	59.1	**54.6**	31	47.0	58.7	**52.9**	21
NE10549	55.6	48.3	66.7	39.2	55.2	**53.3**	41	55.4	54.6	**55.0**	14
NE10558	52.1	53.4	68.3	35.8	66.1	**55.0**	27	50.6	54.5	**52.5**	23
NE10559	53.2	50.0	78.3	33.1	63.2	**56.1**	17	55.8	58.5	**57.1**	5
NE10574	53.9	53.4	66.8	35.8	63.7	**55.0**	28	44.2	56.5	**50.4**	35
NE10575	50.7	52.6	70.2	30.7	64.6	**54.4**	35	44.4	57.4	**50.9**	32
NE10577	47.6	53.1	73.4	33.1	59.1	**53.3**	40	53.1	53.7	**53.4**	18
NE10582	53.5	52.5	72.2	38.5	60.6	**54.9**	29	42.3	51.7	**47.0**	49
NE10586	49.0	48.1	69.4	34.8	74.1	**55.7**	22	53.5	58.9	**56.2**	9
NE10589	73.6	65.1	60.6	36.9	71.0	**61.8**	3	50.3	63.9	**57.1**	6
NE10609	62.9	62.1	83.0	35.2	65.2	**62.2**	1	40.9	65.0	**53.0**	19
NE10610	55.3	53.0	67.2	37.5	64.4	**55.5**	23	52.2	55.8	**54.0**	17
NE10614	62.4	49.6	56.0	39.1	58.4	**53.8**	37	55.3	57.6	**56.4**	7
NE10615	41.9	47.3	69.4	39.5	61.4	**51.9**	50	47.6	51.9	**49.7**	37
NE10625	47.5	51.8	90.6	33.7	61.7	**56.5**	13	49.6	53.9	**51.8**	28
NE10628	67.9	60.1	62.1	37.7	62.3	**57.1**	6	47.0	52.5	**49.8**	36
NE10638	56.5	55.0	67.7	43.3	63.7	**56.3**	14	45.9	51.8	**48.8**	38
NE10642	51.6	51.6	58.6	35.5	63.9	**52.8**	44	47.3	55.8	**51.6**	30
NE10645	51.9	48.8	66.1	36.4	68.2	**54.5**	32	49.2	55.6	**52.4**	24
NE10671	42.6	48.9	63.9	36.0	54.2	**49.4**	59	46.1	50.8	**48.4**	43
NE10676	41.4	49.2	68.6	35.5	63.8	**52.5**	47	58.2	56.2	**57.2**	4
NE10677	43.5	48.3	68.3	37.0	57.4	**51.4**	52	49.2	53.5	**51.3**	31
NE10684	57.7	49.8	73.3	39.1	56.4	**54.4**	34	53.4	50.1	**51.8**	28
NH10665	52.2	53.9	68.3	38.3	63.8	**57.0**	7	47.3	65.5	**56.4**	8
NH10669	45.7	50.9	77.3	41.0	54.9	**54.5**	33	51.7	57.3	**54.5**	16
NW10401	63.2	51.2	58.0	32.0	66.5	**55.3**	25	63.7	61.1	**62.4**	1
NW10487	54.1	54.7	72.4	33.4	64.6	**56.8**	9	50.4	61.5	**55.9**	11
NW10498	45.0	52.8	60.8	35.4	66.8	**52.3**	48	50.9	52.9	**51.9**	27
NW10499	51.9	51.6	74.1	38.2	68.2	**56.9**	8	54.6	57.1	**55.8**	12
NW10500	51.8	52.2	68.5	34.3	63.6	**54.3**	36	50.7	55.1	**52.9**	20
NW10501	58.1	52.1	52.5	35.9	65.5	**51.0**	54	40.0	42.1	**41.1**	56
NW10566	42.9	55.3	68.5	38.0	60.0	**53.0**	43	47.9	53.4	**50.7**	33
Overland	49.5	58.7	73.7	38.5	69.4	**56.7**	12	46.0	50.4	**48.2**	44
AVERAGE	**54.23**	**52.71**	**67.64**	**35.94**	**63.40**			**47.9**	**53.67**		
LSD	**8.95**	**5.40**	**20.83**	**5.16**	**6.42**			**10.6**	**7.51**		
CV	**8.52**	**5.32**	**12.88**	**7.42**	**7.46**			**16.30**	**7.23**		

The 2010 data are:

	Conventional Yield									Organic Yield				State Averages		
	Mead	Linc	CC	NP	Sid	Alli	McC	**Avg**	Rank	Mead	Sid	**Avg**	Rank	Avg HT	Avg HD	Linc Lod
	bu/a	bu/a	bu/a	bu/a	bu/a	Bu/a	bu/a	**bu/a**		bu/a	bu/a	**bu/a**		inch	May	%
Camelot	40.1	58.6	50.0	38.3	53.9	54.5	71.8	**52.4**	**34**	36.8	20.7	**28.7**	**60**	36	26	3
Goodstreak	39.6	50.2	45.5	40.4	61.6	63.3	75.1	**53.7**	**17**	37.5	76.9	**57.2**	**4**	41	26	6
Overland	39.9	60.1	56.3	31.3	49.7	67.3	86.7	**55.9**	**11**	41.5	77.4	**59.5**	**2**	36	26	3
NE09406	31.8	55.6	45.4	35.5	44.7	65.3	83.3	**51.6**	**37**	42.1	49.5	**45.8**	**36**	34	26	2
NE09417	45.9	61.7	49.7	33.3	48.6	54.6	84.5	**54.0**	**16**	44.8	44.7	**44.8**	**42**	35	25	5
NE09422	36.3	58.8	40.9	26.6	49.3	50.3	74.0	**48.0**	**55**	36.8	63.4	**50.1**	**23**	34	24	3
NE09426	42.0	65.9	43.3	23.8	53.5	58.8	88.2	**53.6**	**18**	45.1	61.5	**53.3**	**12**	33	22	2
NE09429	37.8	49.6	40.2	35.7	49.1	50.2	78.9	**48.8**	**53**	42.6	62.7	**52.7**	**13**	38	25	2
NE09437	39.4	60.8	48.0	41.7	61.7	68.3	81.8	**57.4**	**6**	40.4	67.7	**54.0**	**10**	36	25	2
NE09460	27.2	51.1	43.4	35.9	50.3	61.8	78.1	**49.7**	**49**	36.5	53.8	**45.2**	**39**	35	25	3
NE09462	36.9	52.4	36.9	33.2	53.6	59.7	85.4	**51.2**	**39**	36.7	52.0	**44.3**	**43**	35	25	2
NE09470	26.4	45.2	41.5	30.2	58.2	62.4	83.0	**49.5**	**50**	38.5	49.7	**44.1**	**44**	33	24	2
NE09474	38.3	62.7	40.7	23.7	59.9	55.1	80.8	**51.6**	**38**	42.8	47.9	**45.4**	**37**	32	24	2
NE09476	38.8	61.2	44.1	36.0	56.6	59.8	75.3	**53.1**	**25**	46.0	38.3	**42.1**	**52**	34	25	5
NE09477	43.1	61.1	51.5	37.5	65.9	62.3	83.7	**57.9**	**3**	42.2	41.3	**41.7**	**55**	37	25	1
NE09478	45.7	50.3	36.0	34.1	47.1	58.7	79.2	**50.2**	**43**	41.2	49.1	**45.1**	**40**	35	24	2
NE09480	38.2	56.7	46.3	25.9	58.1	62.5	82.5	**52.9**	**28**	38.7	48.0	**43.4**	**50**	36	24	3
NE09481	41.7	66.9	48.4	29.5	63.5	64.5	92.2	**58.1**	**2**	43.0	47.7	**45.3**	**38**	33	24	2
NE09482	41.5	64.7	55.0	29.3	57.2	59.9	79.8	**55.3**	**12**	40.9	59.7	**50.3**	**21**	34	25	2
NE09483	37.2	56.9	49.4	31.1	60.1	62.8	83.8	**54.5**	**13**	42.0	60.2	**51.1**	**19**	34	23	2
NE09484	35.3	56.6	49.0	33.1	56.7	57.1	83.8	**53.1**	**26**	42.3	59.2	**50.8**	**20**	36	24	3
NE09487	39.5	47.9	35.0	38.4	50.4	52.1	64.4	**46.8**	**57**	39.9	57.5	**48.7**	**27**	40	26	4
NE09491	41.7	53.5	44.3	31.1	59.6	64.2	79.8	**53.5**	**20**	43.6	67.8	**55.7**	**7**	38	26	3
NE09495	46.2	54.4	51.5	41.3	72.1	65.7	82.7	**59.1**	**1**	47.7	71.2	**59.5**	**1**	36	26	3
NE09498	32.7	66.9	51.5	32.9	62.4	52.2	82.9	**54.5**	**14**	45.8	68.6	**57.2**	**5**	36	26	1
NE09499	31.5	63.5	47.9	35.9	60.1	61.9	90.6	**55.9**	**10**	48.2	61.6	**54.9**	**8**	36	26	2
NE09515	43.5	41.7	37.9	33.2	54.5	54.5	85.7	**50.1**	**44**	44.3	45.5	**44.9**	**41**	37	26	2
NE09517	41.7	60.1	48.4	29.6	61.9	64.8	88.8	**56.5**	**9**	35.6	52.5	**44.0**	**45**	36	25	2
NE09521	42.4	63.6	55.4	31.6	67.4	59.7	83.0	**57.6**	**4**	44.3	72.3	**58.3**	**3**	36	25	5
NE09527	47.1	63.4	52.7	43.3	49.6	44.4	74.7	**53.6**	**19**	42.4	60.9	**51.6**	**15**	38	23	3
NE09537	37.2	55.2	40.2	25.0	59.0	66.5	86.9	**52.8**	**30**	41.1	54.0	**47.6**	**32**	35	26	3
NE09540	38.8	49.4	40.4	27.3	52.7	62.9	78.8	**50.0**	**45**	41.9	61.2	**51.5**	**16**	36	27	5
NE09547	52.3	57.6	44.9	40.9	55.3	62.4	82.0	**56.5**	**8**	53.0	38.7	**45.8**	**35**	37	25	4
NE09559	45.8	58.6	46.3	40.2	62.4	66.2	83.5	**57.6**	**5**	46.1	49.0	**47.6**	**33**	37	26	1
NE09563	39.7	41.2	36.8	38.6	59.0	66.2	92.4	**53.4**	**21**	35.3	61.7	**48.5**	**28**	36	25	4
NE09582	36.7	51.3	41.8	32.2	50.0	48.3	64.8	**46.4**	**58**	35.2	48.3	**41.7**	**54**	37	25	4
NE09583	40.1	56.3	43.0	24.0	52.8	61.3	76.5	**50.6**	**42**	49.8	50.2	**50.0**	**24**	36	25	4
NE09584	34.1	42.4	35.5	34.3	51.8	65.2	86.1	**49.9**	**46**	38.4	48.7	**43.6**	**48**	33	24	3
NE09586	39.0	57.3	51.4	24.5	53.5	62.7	83.6	**53.1**	**24**	24.2	53.0	**38.6**	**57**	34	24	2
NE09587	33.5	49.8	45.9	28.1	53.5	57.3	77.5	**49.4**	**51**	44.4	60.2	**52.3**	**14**	34	25	3
NH09591	44.5	47.0	34.6	29.8	48.7	58.0	79.2	**48.8**	**52**	31.8	38.6	**35.2**	**58**	34	25	3
NE09599	41.4	62.8	52.5	22.2	53.4	58.2	78.9	**52.8**	**31**	39.3	70.2	**54.8**	**9**	35	24	3
NE09601	35.9	68.4	56.4	27.9	48.2	54.5	78.8	**52.9**	**29**	39.5	56.9	**48.2**	**30**	35	24	3
NW09615	39.1	33.1	28.5	30.5	48.2	59.8	82.4	**45.9**	**59**	31.0	31.2	**31.1**	**59**	33	24	6
NW09617	27.4	53.4	42.9	33.4	59.9	59.3	80.7	**51.0**	**40**	44.9	50.7	**47.8**	**31**	35	25	2
NW09618	27.3	62.7	52.7	28.6	48.9	54.4	81.8	**50.9**	**41**	35.2	56.8	**46.0**	**34**	34	24	3
NW09622	34.5	46.9	36.1	29.6	46.1	55.8	82.4	**47.3**	**56**	45.3	42.7	**44.0**	**46**	34	23	3
NW09627	30.9	54.4	36.8	29.6	61.8	70.7	88.0	**53.2**	**23**	34.3	43.5	**38.9**	**56**	34	24	3

NW09632	36.5	53.0	43.2	34.8	52.6	65.9	80.0	**52.3**	35	35.4	48.7	**42.0**	53	35	25	3
NE09636	46.8	57.3	43.0	27.4	54.1	61.8	80.5	**53.0**	27	38.7	63.9	**51.3**	17	35	25	2
NE09637	26.7	53.6	36.0	37.0	55.6	71.6	82.5	**51.9**	36	46.7	55.6	**51.2**	18	38	27	2
NE09638	40.2	45.0	43.3	48.8	54.6	57.8	78.0	**52.5**	33	48.7	63.4	**56.0**	6	39	27	3
NE09641	28.0	36.8	38.4	31.3	59.2	67.1	80.0	**48.7**	54	40.6	45.7	**43.1**	51	36	25	4
NE09680	26.0	47.5	50.3	29.5	51.1	57.9	86.9	**49.9**	47	44.8	55.0	**49.9**	25	35	25	4
NE09684	38.7	56.5	51.4	36.8	62.5	66.7	83.9	**56.6**	7	49.3	58.1	**53.7**	11	36	26	2
NE09506	25.8	46.0	37.6	33.3	52.3	46.9	68.7	**44.4**	60	37.4	59.1	**48.2**	29	39	26	5
NE09522	28.4	55.5	49.6	37.8	61.8	55.5	80.1	**52.7**	32	39.1	61.2	**50.2**	22	36	25	4
NW09532	31.4	47.5	41.5	33.2	51.7	61.5	81.7	**49.8**	48	33.2	53.9	**43.6**	49	35	25	3
NE09560	44.1	56.8	46.6	39.2	55.6	56.0	82.3	**54.4**	15	37.8	60.8	**49.3**	26	39	26	4
NHH09655	35.2	46.5	42.7	37.2	57.0	65.5	88.8	**53.3**	22	33.4	54.5	**43.9**	47	34	26	1
AVERAGE	**37.6**	**54.5**	**44.6**	**32.9**	**55.5**	**60.0**	**81.4**	**52.4**		**40.8**	**54.7**			**36**	**25**	**3**
LSD (0.1)	**6.5**	**6.5**	**4.6**	**7.2**	**6.1**	**5.7**	**5.8**			**10.2**	**14.6**				**1**	**2**
CV	**12.7**	**8.8**	**7.7**	**16.2**	**8.2**	**7.0**	**4.3**			**18.4**	**19.6**				**3**	**36**

Regional Nurseries

In 2012, we continued to combine into one larger nursery the Southern Regional Performance Nursery (SRPN) and the Northern Regional Performance Nursery (NRPN), which were planted at Lincoln, North Platte, Sidney, and Alliance (lost to volunteer wheat and no data reported). 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 research for scab tolerance or drought tolerance to determine if they had merit. The Bakhsh lines contain *Fhb1* (a gene known to confer scab tolerance and they did well). The drought tolerant Goodstreak derived lines were severely damaged by stripe rust and performed very poorly, consistent with the year that Goodstreak had throughout NE. In general our Nebraska developed lines did well, but many lines from other states were favored by the early season, the drought, and the above average temperatures. The winter in Minneapolis/St. Paul in 2012 was similar to the historical average winter for Omaha, NE. Similarly, the winter 2012 in Nebraska would be considered as being more like one much to our south. In considering how our germplasm compares to the region's, the Nebraska early germplasm is improving its resistance to WSBMV, but continues to need better 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. It was useful to see Kharkof and Scout 66, older wheat cultivars, continue to be very low yielding indicating that breeding progress has been made.

The 2012 data are:

	Lincoln	**N. Platte**	**Sidney**	**Clay Cen.**	**SRPN**	**SRPN**	**NRPN**	**NRPN**
	Yield	**Yield**	**Yield**	**Yield**	**Yield**	**Rank**	**Yield**	**Rank**
name	**bu/a**	**bu/a**	**bu/a**	**bu/a**	**bu/a**		**bu/a**	
Kharkof	19.9	23.1	27.6	27.0	**24.4**	**49**		
Scout 66	25.9	29.7	52.1	37.3	**36.3**	**48**		
TAM 107	29.1	38.0	66.6	38.4	**43.0**	**43**		
FULLER	33.6	49.9	68.9	53.1	**51.4**	**36**		
KS07HW5-1-1-3	24.3	41.0	62.0	38.2	**41.4**	**46**		

KS07HW5-1-1-4	26.8	35.1	64.6	43.7	**42.6**	**44**		
KS07HW5-1-1-5	17.4	37.3	65.1	43.5	**40.8**	**47**		
OK07214	51.3	55.3	74.3	63.1	**61.0**	**4**		
OK08328	50.8	45.5	71.5	70.1	**59.5**	**10**		
OK08229	42.8	41.2	77.1	63.2	**56.1**	**21**		
OK09634	51.4	52.7	71.6	62.6	**59.6**	**9**		
OK08707W	35.9	49.6	73.3	57.0	**54.0**	**27**		
OCW00S063S-1B	51.9	45.9	64.1	69.6	**57.9**	**15**		
BL11001	42.2	39.6	68.5	38.6	**47.2**	**42**		
BL11002	55.2	52.3	70.7	58.2	**59.1**	**11**		
CO05W111	40.0	44.2	70.3	54.2	**52.2**	**32**		
CO07W245	47.5	57.5	78.8	69.1	**63.2**	**3**		
CO07W722-F5	58.6	56.3	75.1	74.8	**66.2**	**1**		
HV9W07-1784	38.3	54.1	66.0	49.9	**52.1**	**33**		
HV9W07-1942	53.1	47.6	69.2	60.2	**57.5**	**16**		
HV9W07-1028	55.2	46.6	71.4	68.7	**60.5**	**5**		
TX07A001505	37.2	58.2	80.4	64.6	**60.1**	**8**		
TX03A0563-07AZHR247	45.4	41.6	75.8	65.1	**57.0**	**19**		
TX06V7266	52.6	50.4	75.7	62.3	**60.3**	**6**		
TX08A001128	49.1	51.2	68.8	71.3	**60.1**	**7**		
TX08A001249	53.8	45.3	73.7	56.6	**57.4**	**17**		
TX07V7327	34.5	46.2	69.9	61.7	**53.1**	**30**		
TX08V7173	36.9	46.8	67.6	51.1	**50.6**	**38**		
TX08V7313	43.5	49.4	70.9	60.5	**56.1**	**22**		
NE06430	51.5	42.5	66.7	55.6	**54.1**	**25**		
NE09517	46.4	47.5	43.5	69.4	**51.7**	**35**		
NE09521	47.3	49.9	70.8	65.6	**58.4**	**13**		
NE08499	47.5	42.3	61.2	62.2	**53.3**	**29**		
NW09627	46.1	41.3	59.7	51.1	**49.6**	**39**		
T175	56.2	44.7	66.9	60.7	**57.1**	**18**		
T185	52.2	44.1	63.0	56.1	**53.9**	**28**		
T179	56.6	47.7	63.9	66.1	**58.6**	**12**		
LCH08-80	53.0	44.6	62.0	61.4	**55.3**	**24**		
LCH08-12	47.1	47.6	71.8	57.5	**56.0**	**23**		
KS020319-7-3	53.9	48.2	61.6	69.3	**58.3**	**14**		
KS020638-M-5	33.2	42.8	73.3	59.9	**52.3**	**31**		
KS020665-M-3	54.2	51.0	70.9	76.9	**63.3**	**2**		
KS030975-CF-3	40.1	42.3	72.0	52.6	**51.8**	**34**		
T167	46.2	49.3	68.0	63.2	**56.7**	**20**		
Overland	53.5	47.1	65.3				**55.3**	**2**
WESLEY	51.9	41.4	67.0				**53.4**	**9**
Jerry	42.6	23.8	43.4				**36.6**	**37**
Lyman	48.8	34.0	55.4				**46.1**	**27**
NW05M6011-10-2	42.2	33.8	56.1				**44.0**	**34**
NW05M6011-22-3	45.5	39.9	56.3				**47.2**	**26**
NE09495	54.5	37.1	54.9				**48.8**	**20**
NE09499	54.3	36.3	54.3				**48.3**	**23**
NE09637	49.7	28.9	55.7				**44.8**	**33**
NH09655	40.5	41.4	63.7				**48.5**	**22**

NE08476	50.5	39.9	56.4				48.9	19
NE08659	53.8	47.6	57.6				53.0	10
NW07505	54.4	45.5	64.4				54.8	4
NE08527	55.9	34.5	45.3				45.2	31
MTS0808	28.4	38.2	50.0				38.9	35
MTS0819	41.4	37.5	57.5				45.5	28
MTS0826	25.2	26.6	53.4				35.1	38
MT0871	33.5	41.0	61.2				45.2	32
T180	59.2	43.0	53.7				52.0	12
T179	54.9	49.7	65.1				56.6	1
LCH08-80	57.0	43.0	64.9				55.0	3
LCH08-12	48.0	48.9	67.3				54.7	5
LCH10-13	58.4	42.3	60.5				53.7	6
SD05085-1	32.3	40.0	63.7				45.3	29
SD06158	53.1	46.6	60.7				53.5	8
SD07184	45.1	43.6	57.4				48.7	21
SD07W083-4	48.3	43.5	58.1				50.0	17
SD08080	45.8	40.8	63.6				50.1	16
SD08200	50.1	47.6	62.8				53.5	7
SD09113	48.2	46.8	57.6				50.9	14
SD09192	45.5	50.3	60.5				52.1	11
SD09227	48.6	46.7	56.0				50.4	15
SD09138	52.3	43.9	58.7				51.6	13
GSYN46	31.3	29.0	39.9				33.4	40
GSYN48	33.1	30.5	40.7				34.8	39
GSYN55	31.9	22.8	19.0				24.6	41
GSYN57	31.7	31.7	53.0				38.8	36
NE11504	55.6	33.4	55.5				48.2	24
NE11548	56.3	34.2	45.4				45.3	30
NH11669	52.5	37.4	58.6				49.5	18
GOODSTREAK	42.1	34.4	48.6	41.7	41.7	45		
Camelot	41.1	38.9	61.8	49.7	47.9	40		
NE11451	41.6	41.1	60.9				47.9	25
Bakhsh24	59.8	35.2	48.2	60.3	50.9	37		
Bakhsh33	52.5	34.7	62.2	40.9	47.6	41		
Bakhsh35	52.2	39.1	61.2	63.4	54.0	26		
GRAND MEAN	**45.5**	**42.4**	**61.7**	**57.5**				
LSD	**8.0**	**7.0**	**6.4**	**7.0**				
CV	**9.1**	**8.6**	**6.4**	**7.5**				

7. Multiple-Location Observation Nursery

Seven replications (locations) in Nebraska (Lincoln, Mead, Clay Center, North Platte, McCook, Sidney, and Alliance) were harvested and used for selection. An irrigated nursery in Kansas also was harvested and used for selection. The table below gives the grain yields for all of the harvested locations, the line average, and the rank of the top 10 highest yielding lines**.** In this nursery, we continued to use marker-assisted selection for line advancement. Eventually, we hope to develop a training population so that we can have multiyear values for each marker and its estimated breeding value. One concern with this approach is that we are constantly changing markers due to technological advancement. This year we used genotyping by sequencing (GBS) and in the previous years, we used DArT molecular markers. Genotyping by sequencing was done in collaboration with Dr. Jesse Poland, USDA-ARS, because it is much less costly (less than 1/3 of the cost of other marker systems). We will continue to do to this for as long as we can afford as it is allowing us to better understand our germplasm in this gateway nursery. Of note, was the top ten lines were all relatively early lines, again indicating that this season selected for early maturing lines. One advantage of genomic selection is that we may be able to select using training populations from more "normal" years to avoid too heavily weighting extreme or unusual selection seasons. We hope in a more normal year that this year's selections will continue to perform well. In addition, in 2013 we will be able to evaluate the protein concentration and grain hardness in grain samples harvested from this early screening nursery due to the high throughput of the new NIR instrument we have added to the seed house.

Locations	KS	Mead	Linc	C. Cen	N. Plat	McCo	Sid.	All.	Avg.Raw	Avg. Adj.	Rank	Rank
genotypes	**bu/a**	**bu/a**	**bu/a**	**bu/a**	**bu/a**	**bu/a**	**bu/a**	**bu/a**	**bu/a**	**bu/a**	raw	adjust
NE12503	**84.7**	75.9	**67.8**	69.8	54.3	**62.0**	**76.5**	60.3	68.34	67.26	1	1
NE12583	**89.3**	77.6	**60.0**	58.3	50.7	**76.4**	**63.1**	53.5	65.18	65.97	7	2
NE12686	**96.7**	68.1	**36.9**	62.0	51.7	**87.3**	**82.5**	53.7	67.90	64.92	2	3
NE12580	**76.3**	71.7	**51.4**	47.9	59.5	**81.4**	**75.8**	52.8	63.11	63.96	25	4
NE12675	**68.2**	75.6	**57.3**	69.8	50.0	**73.6**	**71.9**	63.3	64.91	63.79	10	5
NE12571	**103.1**	63.5	**47.1**	60.4	41.3	**87.3**	**70.3**	59.6	65.41	63.60	5	6
NE12464	**87.1**	57.0	**45.4**	70.7	53.7	**73.7**	**75.8**	57.8	65.56	63.35	4	7
NE12430	**92.7**	61.4	**50.1**	54.8	52.5	**74.9**	**71.7**	66.6	64.46	62.52	13	8
NE12408	**93.1**	60.0	**46.1**	59.4	55.7	**70.6**	**75.6**	49.9	64.90	62.40	11	9
NE12450	**92.6**	62.5	**52.2**	59.3	50.3	**68.1**	**81.3**	55.8	64.15	62.39	15	10

8. <u>Early Generation Nurseries</u>

a. Single-plot Observation Nursery

Nineteen hundred and forty-two lines were evaluated at Lincoln in 2012. Of the 1942 lines and checks, 1768 were red or mixed red and white seeded and 276 where white seeded. The 1982 lines included 32 one and two gene herbicide tolerant lines, 132 possible FHB tolerant lines, 37 possible lines with WSMV tolerance, and 53 Hessian fly tolerant lines. Of this group, 441 were harvested and 431 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). This number is similar to the number harvested and tested in our microquality lab as in the past. Based on agronomic and quality performance, 193 red, 10 herbicide tolerant lines (mainly red), 6 were tolerant to WSMV, and 77 white lines were selected for further testing (this number does not total to 280 as some lines were both virus resistant and red or white). The number of white wheat lines is roughly where we want the program to be as red and white wheat lines are important in Nebraska's wheat marketing strategy. In future we will harvest all of the observation plots (with our modern combines, this is a simple process and requires very little additional time which allows the "human eye/visual selection" error to be removed). In addition, we will be able to evaluate the protein concentration and grain hardness in grain samples from this early screening nursery due to the high throughput of the new NIR instrument we have added to the seed house. Therefore, a combination of visual evaluations, yield data, and protein concentration will be used to identify wheats for which we will conduct microquality evaluations. We believe that this will greatly strengthen our capacity to discriminate among the large number of wheats at this early stage of testing.

b. Headrow Nursery

In 2011-12, 44,400 (41,800 were red or red/white, 8100 were for Fusarium head blight tolerance and diversity, 2600 were white, and 3000 were herbicide tolerant) headrows were planted at Lincoln. In general, the headrow nursery was average in size. In general, the headrown nusery, despite rain at harvest and heat, looked fairly good. We harvested over 1850 lines and planted in 2012-2013, 1772 (1515 red or red/white, 270 for *Fusarium* head blight, 257 white, 101 lines for wheat streak mosaic virus testing, and 71 herbicide tolerant lines—note the total will be higher than 1772 due some wheats are red and wheat streak mosaic virus tolerant and herbicide tolerant). Of the red and white wheat lines, 257 were sent to Scottsbluff for planting in our irrigated observation nursery. The proportion of lines that were white is near our target, but we had fewer herbicide and WSMV tolerant lines than we would like. Our efforts in this area will increase in the future. . In 2013, we will be able to evaluate the protein concentration and grain hardness in grain samples harvested from this early screening nursery due to the high throughput of the new NIR instrument we have added to the seed house. These data will be coupled with visual evaluations of seed characters to identify wheats to advance to the single plot observation nursery.

c. F_3 bulk hybrids

The F_3 bulk hybrid nursery contained 942 red, red and white segregating, or white seeded bulks. In addition, we planted 48 herbicide tolerant bulks (planted at Lincoln). Most bulks were planted at Mead (our main and best winter killing site) and many of those were planted at Sidney. At Mead the plots were good, but the early season affected their growth and the plots were taller than expected leading to lodging. The number of F_3 bulks is our new normal. Over 44,000 head rows were selected for fall planting in 2012. The headrows were planted on time. In general, their emergence and stands were very good in the fall (despite the poor seed quality). The project goal remains to have sufficiently good segregating F_3 material to select about 40 - 45,000 headrows.

d. F_2 bulk hybrids

The F_2 bulk hybrid nursery contained 936 bulks and check plots that were planted at Mead NE. Thirty-three F_2 bulks with one or two genes for herbicide resistance were planted at Lincoln for selection. The bulks generally survived the winter, but some were winter-killed (those involving winter tender parents). We continued not sharing our bulk populations this year as the new Wheat Workers Material Transfer Agreement (WWMTA) require prior approval of bulk sharing for any subsequent segregating generation. There is no approved bulk sharing form attached to the WWMTA and the paperwork will continue to a major hurdle. As such, the path of least resistance is to not share bulks. Our approach had been that once we made the cross, we could share the germplasm because it the genes were scrambled and the crosses were 50% - 75% Nebraska germplasm. While this curtailment of bulk sharing is unfortunate and in many ways a waste of resources (groups making the same crosses or not having access to crosses they wished they had made), the alternative concern is that some programs prefer not to share their segregating germplasm with other institutions and businesses. In the future we may develop an institution to institution bulk sharing agreement where both institutions' lines are the parents of the bulk, but that will remain to be determined. Due to the large number of bulks, about 1012 bulks (including 72 herbicide tolerant bulks) were advanced as individual bulks for further consideration in 2012-13 from our program.

9. <u>Winter Triticale Nursery</u>

In 2012, no new triticale lines were recommended for release; however, we selected seven 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. We also expanded our collaborative testing area into Wisconsin, Kansas, and New Mexico. Jeff Noel handles our licensing arrangements and has contacted a number of companies.

In 2013, 11 lines (including NE426GT and NE422T) we recommended for increase. It appears that NE422T has good forage potential for the Southern Great Plains. We are 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.

The triticale-breeding program received $20250.50 in 2012 compared to $6847.75 in 2011 and $10060.50 in research and development fees for 2010. 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.

The forage results from Wisconsin were:

		Seeding Rate		**Yield**	
Variety		(seeds/packet)		Kg/ha	**Rank**
NE03T416		4400		**4954**	**5**
NT01451		4400		**4813**	**7**
NT05421		4400		**5135**	**4**
NT05429		4400		**5215**	**2**
NT06422		4400		**5465**	**1**
NT06427		4400		**4862**	**6**
NT07403		4400		**5157**	**3**
815		4400		**4558**	**8**

815 is a local check and it is clear that our lines can compete with the local lines in Wisconsin based on this year's data.

The forage data from North Platte in 2012 are (thanks to Dr. Jerry Volesky):

Triticale Plots 2012	
	2012
Entry	**- - - Tons/acre - - -**
Wheat Border	5.07

1010 Triticale	5.39
NT05429	5.97
NE03T416	6.08
Syn Exp	6.20
NT07403	6.21
NT05421	6.23
NT06427	6.23
NT06422	6.39
TriCal 348	6.58
ATR-626	6.59
NE422T	7.17
NT01451	7.29

Again our lines did very well compared to the local check 1010 Triticale.
The results for the 2012 forage trial at Sidney were (thanks to Dr. Dipak Santra):

name	Yield lbs/a	NDF	ADF	Prot	RFV	TDN
GOODSTREAK	6312	54.6	35.6	11.8	104	62
NE422T	6193	52.15	32.8	11.4	113	65.2
NE426GT	6212	53.75	35.6	10.75	106	62
NT01451	6786	53.95	34.2	12.1	108	63.6
NT05421	6863	54.4	34.15	11.15	107	63.6
NT06427	6793	56.8	36.4	11.5	100	61.1
NT07403	6200	54.8	34.55	12.05	105	63.2
NT09404	7114	54.9	35.15	11.4	104	62.5
NT09423	6905	57.2	37.85	11.6	97	59.4
NT10441	7065	56.2	36.7	11.3	100	60.8
NT10418	7016	56.85	36.15	11.5	100	61.3
NT10429	6319	55.3	35.3	11.35	103	62.3
GRAND MEAN	6648.19	55.08	35.37	11.49	103.63	62.23
LSD	1240.4	3.33	2.71	1.52	9.04	3.06

The results for the 2012 forage triticale trial at Mead, NE are (thanks to Dr. Ken Vogel):

Name	Yield Lbs/a	IVDMD	NDF	ADF	ADL	NITROGEN	DM %
OVERLAND	10108	70.22	54.45	31.65	4.39	1.55	0.4
NE422T	12454	68.6	61.44	36.89	5.04	1.36	0.34
NE426GT	12951	70.48	56.05	32.19	4.38	1.47	0.34
NT01451	12521	69.72	58.58	34.56	4.77	1.48	0.33
NE03T416	11809	70.99	54.77	32.69	4.37	1.38	0.35
NT05421	12638	68.59	58.61	34.62	4.81	1.39	0.35
NT05429	11780	70.88	52.51	31.36	4.16	1.39	0.37

NT06422	11863	70.46	53.42	31.72	4.29	1.39	0.38
NT06423	12090	68.26	57.81	34.59	4.8	1.4	0.36
NT06427	12372	69.58	56.72	33.41	4.51	1.44	0.35
NT07403	13075	71.14	52.02	30.42	4.02	1.44	0.4
NT08414	13083	69.22	56.13	33.59	4.48	1.37	0.33
NT08425	12359	70.43	54.79	32.07	4.31	1.47	0.35
NT09404	12892	70.1	56.79	33.36	4.64	1.57	0.34
NT09423	11698	69.67	58.38	34.4	4.63	1.49	0.33
NT10444	12955	70.93	54.49	32.26	4.4	1.44	0.35
NT10441	11509	69.83	55.79	32.37	4.52	1.41	0.35
NT10417	12236	70.32	55.5	33.11	4.44	1.31	0.36
NT10418	12670	69.1	56.56	33.28	4.41	1.37	0.36
NT10429	11199	68.29	59.09	34.93	4.64	1.45	0.36
NT10443	11951	68.24	61.18	37.01	4.87	1.36	0.35
NT11404	12088	70.02	56.46	33.3	4.54	1.5	0.34
NT11406	12924	69.98	57.33	33.68	4.59	1.38	0.33
NT11408	13906	69.67	55.87	33.2	4.51	1.39	0.35
NT11410	12771	70.1	55.73	33.53	4.47	1.36	0.34
NT11419	12596	68.6	57.78	34.15	4.74	1.27	0.35
NT11428	13220	68.73	59.29	34.97	4.62	1.42	0.34
NT11430	13203	70.49	55.66	32.76	4.39	1.32	0.35
NT11438	12609	69.05	57.14	34.3	4.6	1.32	0.35
NT11444	13567	68.18	59.06	35	4.54	1.32	0.35
GRAND MEAN	12437	69.66	56.65	33.51	4.53	1.41	0.35
LSD	1588	1.63	2.54	1.62	0.31	0.19	0.02
CV	9.05	1.65	3.18	3.42	4.9	9.75	4.07

The results for the 2012 grain triticale trials are:

name	Grain Yield (lbs/a) Linc.	Grain Yield (lbs/a) Mead	Grain Yield (lbs/a) Sidney	**State Avg Yield lbs/a**	**Rank**	**State Avg. Hdate (d after Jan.1)**	**State Avg. Height (in)**
Overland	3100	4127	3139	**3455**	**25**	**129.7**	**38.0**
NE422T	3965	3732	1868	**3188**	**28**	**131.0**	**55.0**
NE426GT	4497	4593	3213	**4101**	**4**	**128.2**	**46.3**
NT01451	4312	4152	2785	**3750**	**20**	**129.5**	**44.5**
NE03T416	4520	4327	2708	**3852**	**14**	**122.2**	**46.8**
NT05421	4380	4680	2569	**3876**	**12**	**124.8**	**49.9**
NT05429	4087	4392	2967	**3815**	**17**	**121.2**	**43.4**
NT06422	4421	4794	3061	**4092**	**6**	**121.7**	**48.2**
NT06423	4266	4045	3235	**3849**	**16**	**128.2**	**48.9**
NT06427	4161	3880	2781	**3607**	**23**	**125.2**	**44.5**
NT07403	4482	4200	3372	**4018**	**9**	**119.4**	**45.0**

NT08414	3886	4369	2944	**3733**	**21**	**127.5**	**44.4**
NT08425	4392	4222	3106	**3907**	**11**	**128.0**	**47.2**
NT09404	4334	4392	2865	**3864**	**13**	**129.2**	**48.4**
NT09423	4826	5060	3183	**4356**	**1**	**129.9**	**44.6**
NT10444	4191	3960	3118	**3756**	**18**	**125.5**	**45.0**
NT10441	4516	4551	3086	**4051**	**7**	**129.0**	**45.3**
NT10417	4597	4964	2993	**4185**	**3**	**125.5**	**46.8**
NT10418	4128	3765	2319	**3404**	**27**	**124.0**	**51.3**
NT10429	4154	3695	2377	**3409**	**26**	**129.9**	**52.9**
NT10443	3760	3143	1678	**2860**	**30**	**131.4**	**50.8**
NT11404	4517	4586	2989	**4031**	**8**	**126.5**	**44.7**
NT11406	4747	4956	3075	**4259**	**2**	**129.4**	**46.6**
NT11408	4361	4472	2714	**3849**	**15**	**125.9**	**51.4**
NT11410	4276	4643	2960	**3960**	**10**	**126.5**	**44.3**
NT11419	4354	3575	2926	**3618**	**22**	**129.3**	**50.2**
NT11428	5144	4492	2662	**4099**	**5**	**129.2**	**50.9**
NT11430	4008	4328	2280	**3539**	**24**	**127.2**	**49.7**
NT11438	3595	3901	1544	**3013**	**29**	**129.0**	**52.1**
NT11444	4638	4244	2371	**3751**	**19**	**130.7**	**52.0**
LSD	865.19	678.46	538.78				
CV	10.23	9.64	11.93				
MEAN	**4287**	**4275**	**2763**	**3775**		127.1	47.6

The results for the 2011 grain triticale trial at Lincoln (the only valid location) are:

Entry	**Variety**	**Flowering Date d after April 30**	**Height (in)**	**Grain Yield lbs/a**	**Rank**
1	Overland	29.4	39.7	4040	30
2	NE422T	29.2	58.4	4595	27
3	NE426GT	25.5	50.2	5597	9
4	NT01451	26.8	48.3	5311	17
5	NT02421	24.8	50.7	5315	16
6	NE03T416	23.5	49.7	5517	13
7	NT04424	24.8	51.3	5243	18
8	NT05421	24.2	53.9	5016	22
9	NT05429	23.1	46.1	5660	7
10	NT06422	22.5	49.0	5671	6
11	NT06423	25.9	52.9	5392	14
12	NT06427	25.9	48.5	4965	23
13	NT07403	22.3	45.7	5720	4
14	NT08414	24.3	46.6	5049	21
15	NT08425	24.7	49.1	5602	8
16	NT09404	28.1	51.3	5541	11
17	NT09411	25.1	48.4	5819	3
18	NT09420	27.1	52.6	5132	20
19	NT09423	27.4	48.0	5931	2
20	NT09428	27.5	50.5	5356	15
21	NT10444	24.7	50.2	5531	12
22	NT10441	26.6	47.0	5698	5

23	NT10417	24.8	52.8	6016	1
24	NT10445	29.1	61.6	4284	29
25	NT10418	24.6	57.4	4879	25
26	NT10442	29.8	56.0	5211	19
27	NT10429	28.4	57.1	5596	10
28	NT10443	29.5	57.7	4743	26
29	NT10413	24.4	55.4	4905	24
30	NT10432	30.2	59.7	4353	28
	AVERAGE	**26.1**	**51.5**	**5256**	
	LSD	**1.7**	**2.4**	**616**	
	CV	**3.9**	**2.9**	**7.1**	

The results for the 2010 grain triticale trials are:

	Linc.	Linc.	Sid.	Avg.	Linc.	Sid.	Avg	
Entry	Hdate May	Height	Height	Height	GrainYld	GrainYld	GrainYld	Rank
	d	in	in	in	lbs/a	lbs/a	lbs/a	
JAGGER	21.00	37.70	34.00	35.85	2289	3186	2737.5	30
NE422T	28.33	54.30	58.00	56.15	2981	4160	3570.5	27
NE426GT	24.33	49.70	39.00	44.35	3609	4816	4212.5	7
NT01451	24.33	49.00	44.00	46.50	3532	4884	4208.0	9
NT02421	24.33	52.30	46.00	49.15	3608	4720	4164.0	12
NE03T416	23.67	51.00	43.00	47.00	3332	4805	4068.5	15
NT04424	25.00	52.70	45.00	48.85	3018	4625	3821.5	23
NT05421	23.67	56.30	53.00	54.65	3695	4086	3890.5	22
NT05429	23.00	48.30	41.00	44.65	4296	4657	4476.5	2
NT06422	22.67	52.00	48.00	50.00	3849	4612	4230.5	6
NT06423	23.67	52.70	49.00	50.85	3402	4913	4157.5	13
NT06427	24.33	51.70	44.00	47.85	3105	5306	4205.5	10
NT07403	22.00	48.70	43.00	45.85	3841	4958	4399.5	3
NT07410	23.67	50.00	47.00	48.50	2645	4550	3597.5	26
NT08414	24.67	46.30	39.00	42.65	3216	4703	3959.5	20
NT08425	24.33	45.30	44.00	44.65	3186	4613	3899.5	21
NT09404	24.00	53.00	48.00	50.50	4066	4646	4356.0	4
NT09411	23.33	51.00	45.00	48.00	3673	4903	4288.0	5
NT09414	24.00	60.00	51.00	55.50	2551	3699	3125.0	29
NT09416	24.67	47.00	45.00	46.00	3180	4889	4034.5	17
NT09418	24.00	53.30	44.00	48.65	3679	4508	4093.5	14
NT09419	24.33	54.00	44.00	49.00	3435	3861	3648.0	25
NT09420	25.33	52.30	47.00	49.65	3683	4707	4195.0	11
NT09423	24.67	50.00	44.00	47.00	3694	5549	4621.5	1
NT09426	26.33	50.70	45.00	47.85	3339	4764	4051.5	16
NT09428	24.67	51.70	45.00	48.35	3630	4795	4212.5	8
NT09429	25.67	51.70	44.00	47.85	2810	4652	3731.0	24
NT09435	25.67	53.30	47.00	50.15	3308	4761	4034.5	18
NT09436	24.67	50.00	45.00	47.50	3201	4755	3978.0	19
NT09438	24.67	58.70	58.00	58.35	2867	3504	3185.5	28
AVERAGE	**24.30**	**51.16**			**3357**	**4586**		
CV	**3.59**	**7.95**			**8.95**	**6.02**		
LSD	**1.19**	**5.55**			**413**	**379**		

Results of the 2010 triticale forage trials at Mead NE (done in cooperation with Dr. Ken Vogel, USDA-ARS):

	Dry Matter	Dry ForageYld	RANK	NDF	ADL	ADF	IVDMD	Nitrogen
NAME	%	lbs/a		%	%	%	%	%
JAGGER	0.575	5438	30	50.765	4.494	29.376	61.226	1.284
NE422T	0.395	8286	14	58.439	4.757	34.511	60.289	1.160
NE426GT	0.462	7894	20	51.441	4.522	30.918	64.048	1.067
NT01451	0.470	8211	15	52.473	4.608	31.326	62.490	1.060
NT02421	0.456	9292	3	53.723	4.544	31.488	63.095	1.030
NE03T416	0.474	7322	26	52.647	4.517	31.777	62.522	1.019
NT04424	0.473	7797	22	55.386	5.017	32.947	61.523	0.963
NT05421	0.476	8940	6	53.471	4.532	32.016	63.174	0.960
NT05429	0.497	6923	28	52.054	4.317	30.055	63.169	1.025
NT06422	0.510	7620	25	51.949	4.646	31.656	61.434	1.040
NT06423	0.514	8099	17	54.406	4.641	31.217	61.658	1.019
NT06427	0.431	6160	29	52.474	4.469	30.154	63.213	0.985
NT07403	0.503	7032	27	54.719	4.356	30.788	61.174	0.993
NT07410	0.495	8795	7	52.996	4.678	31.13	63.667	1.023
NT08414	0.484	9199	4	54.023	4.694	31.448	63.133	1.068
NT08425	0.456	8043	18	55.021	4.886	32.727	60.952	1.067
NT09404	0.416	9101	5	52.569	4.260	30.698	63.475	1.150
NT09411	0.510	8003	19	52.473	4.281	29.951	62.341	1.032
NT09414	0.594	8164	16	55.225	4.742	32.945	59.257	0.973
NT09416	0.499	7893	21	52.974	4.657	31.551	61.736	0.945
NT09418	0.500	8662	9	50.260	4.316	29.909	64.241	0.951
NT09419	0.440	9597	1	55.050	4.821	33.229	62.153	0.973
NT09420	0.476	7663	24	52.412	4.247	29.741	62.488	1.050
NT09423	0.449	7727	23	53.780	4.324	30.229	61.706	1.027
NT09426	0.459	8650	10	55.549	4.619	31.818	60.820	1.050
NT09428	0.466	8771	8	52.529	4.382	30.686	62.381	1.027
NT09429	0.447	8316	13	54.948	4.882	32.651	61.270	1.043
NT09435	0.476	8418	12	53.697	4.744	31.675	62.120	1.180
NT09436	0.479	9339	2	52.471	4.501	31.088	63.370	0.998
NT09438	0.527	8515	11	55.670	4.733	33.045	59.567	1.071
AVERAGE	**0.480**	**8129**		**53.520**	**4.570**	**31.420**	**62.120**	**1.040**
LSD	**0.05**	**1024**		**1.91**	**0.26**	**2.02**	**1.37**	**0.09**
CV	**8.41**	**11**		**3.04**	**4.85**	**3.84**	**1.88**	**7.12**

The results of the 2010 triticale forage trials at Sidney, NE (done in cooperation with Dr. Dipak Santra and Ward Laboratories) are:

	Height	Wet Forage	Dry Matter	Dry Forage	RANK	ASH	NDF	ADF	PROTEIN
NAME	in	lbs/a		lbs/a		%	%	%	%
NE422T	57.00	23616	0.56	12912	3	7.80	61.50	40.50	7.05
NE426GT	43.50	20156	0.56	11461	10	7.25	51.90	32.40	7.85
NT01451	42.30	21235	0.60	13031	2	7.80	53.60	33.95	7.40
NE03T416	44.70	20053	0.66	12235	7	7.05	48.85	29.90	8.10
NT04424	42.60	20670	0.58	12635	5	8.01	53.05	33.10	8.45
NT05421	46.40	20456	0.54	12049	8	8.17	51.10	32.35	8.30
NT05429	42.20	15828	0.64	10199	12	7.66	50.65	31.40	7.65
NT06422	43.40	19653	0.62	12426	6	7.97	50.00	31.40	7.85

NT06423	46.40	19323	0.66	11912	9	6.83	53.15	33.10	7.20
NT06427	40.60	16691	0.70	11103	11	7.83	51.85	32.55	5.55
NT07403	43.00	21408	0.68	14481	1	8.04	52.75	33.35	7.15
NT07410	42.20	20151	0.59	12698	4	8.39	55.75	34.80	7.15
AVERAGE	**44.52**	**19937**	**0.62**	**12262**		**7.73**	**52.85**	**33.23**	**7.48**
LSD	**1.56**	**32660**	**0.08**	**18810**		**1.45**	**9.10**	**6.49**	**2.87**
CV	**2.91**	**13.7**	**4.57**	**12.8**		**6.28**	**6.33**	**7.18**	**14.15**

These trial results indicate that: 1. triticale produces more biomass and grain yield than wheat; 2. there is considerable GxE for forage yield;and 3. it very difficult to couple grain yield with forage yield. For example, NT07403 ranked 27 at Mead, but first at Sidney. Note this is somewhat of a difficult comparison as we do not have all the lines at Sidney that we had at Mead, however, other lines show similar changes in rank. The comparison likely was affected by different stages of harvest as seen by the different dry matter contents. Of the lines tested in all the grain and forage trials, NT07403 had good grain yield across the state, excellent forage yield in western NE, but poor forage yield in eastern NE. This highlights the need for testing our forage triticale lines in grain and forage trials across and beyond Nebraska.

The three-year (2009-2012) grain yield data summary for locations where we were able to harvest trials is presented below:

	Linc.	Mead	Sidney	St. Avg.	State	Avg.	Avg
Name	lbs/a	lbs/a	lbs/a	lbs/a	Rank	hdate	height
NE03T416	4456	4327	3757	3960	9	122.2	46.83
NE422T	3847	3732	3014	3379	14	131.0	55.00
NE426GT	4568	4593	4015	4157	4	128.2	46.27
NT01451	4385	4152	3835	3979	8	129.5	44.47
NT05421	4364	4680	3328	3883	12	124.8	49.90
NT05429	4681	4392	3812	4146	5	121.2	43.37
NT06422	4647	4794	3837	4161	3	121.7	48.20
NT06423	4353	4045	4074	4003	7	128.2	48.87
NT06427	4077	3880	4044	3906	10	125.2	44.50
NT07403	4681	4200	4165	4209	2	119.4	45.03
NT08414	4050	4369	3824	3846	13	127.5	44.43
NT08425	4393	4222	3860	3903	11	128.0	47.17
NT09404	4647	4392	3756	4110	6	129.2	48.43
NT09423	4817	5060	4366	4489	1	129.9	44.63
Overland	3143	4127	3163	3096	15	129.7	38.03
Average	**4341**	**4331**	**3790**	**3949**		**126.4**	**46.34**

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.

13. Collaborative Research on Wheat Diseases

Dr. Stephen Wegulo, Department of Plant Pathology, and his staff continue to inoculate our experimental lines with wheat stem rust and Fusarium head blight (FHB, research funded by the U.S. Wheat and Barley Scab Initiative), and as time permits with wheat leaf rust. We continue to improve the greenhouse tests for stem rust. With the advent of the new race of stem rust, Ug99, that can overcome some of the previously very durable resistance genes in wheat which were the main genes used in our program, we have greatly increased our efforts to introgress and pyramid new genes with our existing genes (*Sr2, SrAmigo, SrTmp, SrR, Sr6, Sr22, Sr 24, Sr25, Sr26, Sr 36, Sr39,* and *Sr 40*).

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. The frequency of lines carrying virus resistance remains far lower than expected. There appears to be a genetic segregation distortion in heterozygous plants with the progeny often not carrying the gene. However, we continue make numerous crosses as this is a key trait for Nebraska. Our attempt to use molecular markers has proven to be problematic in that linkage between the marker and the gene is often broken (e.g. lines with the marker are susceptible and lines without the marker are tolerant). The field assay is by far the best method to determine the tolerance to this virus. With the continued spreading of wheat soilborne mosaic virus into our Lincoln fields (a key early generation testing site), we are now able to select for wheat soilborne mosaic virus resistant lines and many of lines have this beneficial trait.

14. Understanding the Stem Rust Resistance in 'Gage' Wheat: T. Kumsa, P.S. Baenziger, S. Wegulo, M. Rouse, and Y. Jin.

In this project we are interested in understanding the *Sr2* complex in Gage (a Nebraska hard red winter wheat cultivar, released in 1963 mainly for its excellent field resistance to wheat stem rust (*Puccinia graminis* f.s. *tritici*). Resistance in Gage remains unexplained by breeders and pathologists. The *Sr2* marker phenotype from F_2 plants validated the involvement of adult plant resistance gene. Segregation of seedling resistance to races QFCSC among $F_{2:3}$ families suggested the resistance is conferred by gene/s in addition to *Sr2*. The effectiveness and phenotypic expression of resistance gene Sr_2 is only at the adult plant stage (called Adult Plant Resistance gene) while the phenotypic effect from other resistance genes can be detected at both the seedling and adult plant stages. The adult plant field evaluation on $F_{2:3}$ families in 2012 was not successful due to extreme dry weather. However, $F_{3:4}$ families are growing in the field for adult plant evaluation in summer 2013. The $F_{4:5}$ plants will be assessed in the greenhouse for Adult plant resistance. We are advancing the population using single seed descent to increase the homozygosity. By the end of May 2013 we will obtain F_6 seed which will give RIL after one more generation of selfing. From genetic marker analysis and infection response to several races, the gene/s involved in Gage is most likely different from known major stem rust genes.

15. Association Mapping for Important Biotic & Abiotic Related Traits in a Structured Wheat Breeding Population. I. Salah, D. Wang, K. Eskridge, J. Crossa, and P.S. Baenziger

This research focuses on applying genomic selection methods in our breeding program using different statistical approaches to build new applicable protocols that will be used to improve our selection. We are specifically interested in effectively building the genotype by environment interaction into our models. Our preliminary results indicated that, when factors such as heritability, relative costs of genotyping versus field evaluation, and the number of cycles of selection per year are taken into account, the efficiency of GS becomes favorable in comparison with phenotypic selection. Furthermore, we are comparing the predictability of different markers systems i.e. SNP and GBS in a genomic selection framework. One of the difficulties with genomic selection that we have is that cost effective marker platforms are constantly improving and it is important to be able to compare allele values over time and with different marker platforms.

16. Pre-harvest Sprouting derived from Red / White Wheat (*Triticum aestivum*) mating populations: Juthamas Fakthongphan, R. Graybosch, P. S. Baenziger

Pre-harvest Sprouting (PHS) of wheat (*Triticum spp*.), the premature germination of wheat heads, takes place in a field under conditions of high humidity during senescence. This problem can have large negative economic effects on both farmers and end-users. Wheat breeders have tried to diversify the wheat production system in Nebraska by introducing hard white winter wheat cultivars. The grain yield potential and disease resistance have been increased but hard white winter wheats typically are less tolerant of pre-harvest sprouting than hard red wheats. The adapted hard red winter wheat genepool, however, might serve as a reservoir of genes for tolerance to PHS, independent of genes conditioning seed coat color. To identify red wheat parents capable of donating genes for tolerance to PHS an MXN mating scheme was imployed in which the hard white wheats Nuplains, NW99L7068, RioBlanco, Cayuga, NW97S218, and Peck were mated in all combinations to the hard red wheats Niobrara, Wesley, Arapahoe, NE98466, CO960293-2, Jagalene, NI01812, and Plainsman V. Seed of progeny was sorted to obtain pure hard white populations. Tolerance to PHS was assessed in samples obtained from four Nebrasksa environments, using both a misting chamber assay and falling number determinations of field-grown samples. Among red wheats, Jagalene, and Niobrara were found to be able to donate PHS tolerance which is independent of genes encoding red seed coat. RioBlanco, and Nuplain, were identified as hard white wheats with good GCA for PHS tolerance. Both carry the PHS gene(s) on chromosome 3As. Cayuga and Peck previously described as tolerant, did not display good GCA. This could be due to GxE or gene x genetic background.

17. Fusarium Headblight (FHB) Research: Ali Bakhsh, Stephen Wegulo, Guihua Bai, Bill Berzonsky, P. S. Baenziger

In previous research, we found *Fhb1*, a major gene for scab (syn. Fusaium head blight) tolerance, was not pleiotropic or linked to genes that reduce grain yield. The difficulty with creating high yielding *Fhb1* lines is most likely due to the wide diversity and poor adaptation of many of parents lines used as *Fhb1* sources. In a second study, we evaluated a number of Wesley backcross 2 lines with the *Fhb1* gene. We identified seven high yielding Wesley *Fhb1* lines for use as parents in crossing. We are using high yielding lines from the first and the Wesley study in our crossing block. In addition, Dr. Guihua Bai has created a number of Overland backcross *Fhb1* lines which are also being used in the greenhouse crossing block. Overland has a native tolerance which with the added tolerance conveyed by Fhb1 could be extremely valuable in creating new cultivars with tolerance to scab. Of course, Overland has been a very popular and high yielding cultivar in Nebraska which makes it use as a parent very attractive. These lines have been used heavily as parents in our breeding program.

18. <u>Breeding for Organic Systems: Richard Little, P. S. Baenziger, Dipak Santra, Teshome Regassa</u>

Organic State Winter Wheat Variety yield trials were conducted at Clay Center (SCAL) with 13 cultivars and 23 experimental lines and at Sidney (HPAL) with 15 cultivars and 19 experimental lines. A project funded by CERES Organic Trust entitled "Investigating Nitrogen Use Efficiency for Winter Wheat Quality [NUEQ] in Organic Rotations in Nebraska" funded by CERES Organic Trust was initiated at SCAL with 12 promising lines planted and harvested at two stages of the rotation—after soybeans and after alfalfa. The purpose is to identify lines with excellent bread-making quality at lower protein content, and to determine if soil N not utilized for wheat protein is conserved for future crops.

In the NUEQ trials, protein content was one percent higher (in absolute values) after alfalfa than after soybeans. This appeared to be the effect of drought stress and lower yields. Treatments of manure in a previous year and application of 20 lbs. N per acre of Chilean nitrate increased protein content less dramatically. The purpose of these unreplicated plots was to obtain flour at different protein levels, not to obtain agronomic data. Thom Leonard, a flour quality consultant for Heartland Mill, developed a standard whole-wheat sourdough baking protocol and assembled a group of artisan bakers to test stoneground flour of 12 lines at three protein content levels. Arstisan baking results will be compared with results of white flour baking tests by the UNL Grain Quality Lab, farinograph tests conducted by Baystate Milling, and whole-wheat mixographs performed by project staff.

The top-yielding lines at HPAL were Mace, NE06545, NW07505, Karl92, NW03666, Hatcher, NI08708, and Overland, respectively. Mace excels for yield only when WSMV or TrMV infections are severe. Lines in the top yield group (significantly greater than all other lines) at SCAL were NE08659, NE02558 and NE06545. Yield and protein data are available at http://cropwatch.unl.edu/web/varietytest/wheat.

In the SCAL variety trial, conditions converged—late planting into cool soils– for infection of seedlings with common bunt (*Tilletia sp.*) spores. Three of our most promising experimental lines, NE05425, NE05496 and NW03681, plus Karl 92, had severe common bunt. Common bunt and black point ratings based on the percent of infected kernels is provided in the following table where 1 is resistant/tolerant and 9 is susceptible. Lines that were tested less than three years in organic trials may have escaped infection, because common bunt is a seed-borne disease that is readily controlled by fungicidal seed treatments which are often used in our conventional trials.

ID	Years tested in organic plots	Bunt Count per 10000 seeds	Bunt Severity Score 1-9	Percent Blacktip Seeds	Blacktip Severity Score 1-9	Note
ALLIANCE	5	5	1	2	2	
CAMELOT	5	18	2	1	1	
EXPEDITION	3	9	1	2	1	
KARL 92	4	143	9	4	3	
LYMAN	2	8	1	5	4	
MCGILL	5	17	2	18	9	
MILLENNIUM	5	443	9	2	1	
NE02558	2	16	2	5	4	
NE03490	5	95	6	5	4	
NE04424	5	319	9	4	4	
NE05425	5	181	9	3	3	
NE05496	3	16	2	3	2	Extreme bunt in NUEQ samples
NE05548	4	27	2	2	2	
NE06469	4	12	2	4	4	Extreme bunt in NUEQ samples
NE06545	2	50	4	3	2	
NE06607	3	2	1	4	4	
NE07444	2	36	3	12	9	
NE07531	1	4	1	5	4	
NE08457	2	30	3	5	5	
NE08509	1	12	2	2	2	

NE08659	1	11	2	1	1	
NE99495	5	15	2	4	3	
NI08708	2	13	2	4	4	
NW03666	4	6	1	2	2	
NW03681	5	286	9	3	2	
NW05M6011-10-2	1	22	2	2	1	
NW05M6011-22-3	1	7	1	1	1	
NW07505	3	2	1	10	8	
NX04Y2107	1	0	1	9	8	
OVERLAND	5	65	5	5	4	
PRONGHORN	5	28	3	2	2	
SCOUT 66	1	15	2	9	8	
SD07165	2	76	5	2	2	
TURKEY	1	11	2	2	1	
WAHOO	5	38	3	5	4	
WESLEY	5	67	5	3	3	

19. Nitrogen Use Efficiency (Katherine Frels, Mary Guttieri, Teshome Regassa, Brian Waters, P. Stephen Baenziger, Brian Wardlow, Bryan Leavitt, Richard Perk)

As part of a multistate effort, we began a major experiment on nitrogen use efficiency (NUE) at Mead, NE. The trial includes 300 Great Plains wheat genotypes, from the foundational cultivars to the most recent releases. The genotypes are evaluated at two levels of applied N, a moderate level and very low level. The capacity of wheats to accumulate N in plant tissue and remobilize that N to grain is being evaluated using the new NIR instrument added to our program. In addition, we are measuring the mineral concentration in grain harvested from the trial. The trial performed well in 2012 and is established for 2013. It is too early to report any results, but we have worked very hard to develop an excellent NUE testing site, protocols for canopy spectral reflectance (CSR, high throughput phenotyping), and data collection. In 2012, we also collected high resolution aerial hyperspectral images of the experimental area in cooperation with CALMIT (Center for Agricultural Land Management and Information Technology) at the UNL. We are evaluating the potential of this very high throughput technology to provide useful information about our yield trials. The wheat lines included in the trial also are being genotyped with high density markers so that we can evaluate genetic association with these characteristics. We expect the efficient use of nitrogen and other major inputs in modern agriculture will be important areas for future research in agricultural profitability and sustainability.

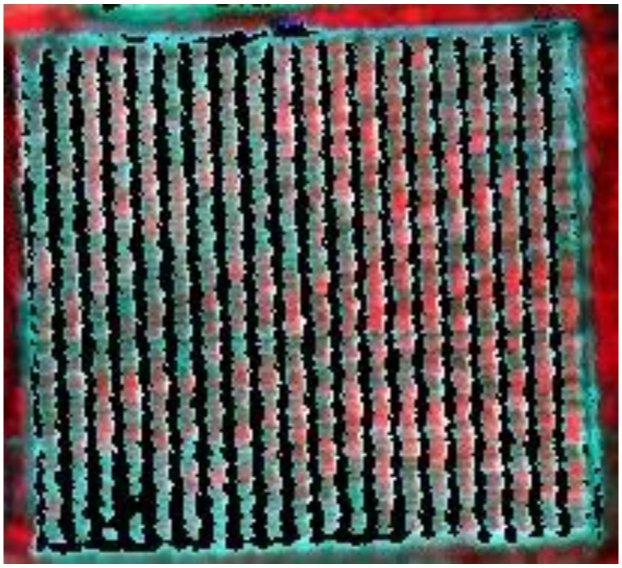

Figure 3. False color composite of 2012 nitrogen use efficiency trial. High resolution aerial image displayed as false color composite with alleys masked. Red areas represent healthiest vegetation.

The advantage of this technology is that we can measure a whole field in literally minutes, hence the throughput is extraordinary and we can measure the field with a minimal effect of clouds or other transient weather changes. This work was done in cooperation with CALMIT who developed and uses this technology routinely.

20. Studying the Role of Roots in Drought in Wheat (Sumardi bin Haji Abdul Hamid, Harkamal Walia, P.S. Baenziger)

In Nebraska, about 75% of the wheat production is in the western half of the state with approximately 92% of the winter wheat acreage is in dryland production. The seed vigor, fall stand establishment, and also the effect of water deficit on three winter wheat cultivars ('Goodstreak', 'Harry' and 'Wesley') specifically chosen due to their superior adaptation to rainfed or irrigated wheat production systems in Nebraska were compared. The results showed that semi-dwarfing allele had an influence on both seed vigor and coleoptile length but did not account for the overall drought tolerance in winter wheat cultivars. The root dry matter, root-to-shoot length ratio and root-to-shoot mass ratio of winter wheat were significantly greater in the water stress than in the well-watered conditions, indicating that root growth had increased under water stress. We speculated that low shoot dry matter might be beneficial in dry environment due to reduction in total leaf area and transpiration. Under drought stress, the root length of Goodstreak was significantly greater than Harry and Wesley, which could possibly contribute to its drought tolerance during the early growth stage. Harry did not have significantly greater root length, root dry matter, shoot length and shoot dry matter than Goodstreak and Wesley. Our results suggested that Harry may be capable of utilizing limited water resource during the seedling growth because of its low shoot dry matter, shallow and intensive root system, and also its ability to conserve stored soil moisture for later use at a later stage of wheat development.

21. **Hybrid Wheat (P. S. Baenziger, MengYuan Wang, and friends)**

In 2010 we began a small hybrid wheat program using two cytoplasmic male sterile systems. The goal of this effort is to provide a system for hybrid wheat. The story of hybrid rice is inspirational where scientists worked very hard to overcome the barriers to hybrid rice (30 years of difficult research) that led to one of the great hybrid crop successes. Hybrid wheat and traits (syn. transgenes, genetically modified wheat) are two of the last great frontiers in wheat research. However, while there is considerable private and public sector research in traits, there is relatively little public sector research in hybrid wheat. Hence we decided to begin a program so that should hybrid wheat become a reality, there would be public sector research looking at heterosis and heterotic pools, hybrid production systems, and pollinators. Currently the *timopheevi* cytoplasmic male sterile looks very good (e.g. the male steriles are fully sterile) and the restorer lines look fully restored. Unfortunately, almost all hybrid sources are spring growth habit, hence we are busy converting the spring male sterile lines into winter male sterile lines (we are currently up to the second backcross). We have selfed out the restorer genes from a hybrid and through extraordinarily generosity have received the restorer line for a commercial hybrid. We are using these restorer lines as parents to create winter wheat restorer lines. So far, the fertility in our *timopheevi* restorer lines looks very good. Hence we are creating the key components of a viable hybrid system. Our second cytoplasmic male sterile system may be under some environmental control. In the winter, the males sterile and restored lines looked excellent. However in our spring greenhouse, the male sterile lines looked "leaky"—more seed set than expected. If the male sterile line is not not leaky, then the outcrossing in the greenhouse was extremely high which would be a valuable trait in hybrid production. The second system, if leaky, may be a good system for recurrent selection. Both hybrid systems are still under evaluation, but it appears that we have made progress. The next step will be to develop strategies to develop heterotic pools to create hybrid vigor. While this research may be criticized because if successful, it will almost assuredly lead to a greatly reduced role for public wheat breeders, the fundamental question of how to create heterotic pools should provide a s more systematic foundation for pure line breeding also.

Though not directly related to hybrid wheat breeding we are creating a dominant male sterile based open pollinated population for possible recurrent selection experiments.

IV. GREENHOUSE RESEARCH

In 2012, 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 over 100 triticale crosses, over 100 barley crosses and over 1000 wheat crosses in last year's fall, winter, and spring greenhouses.

V. PROPRIETARY RESEARCH

Public Private (University of Nebraska) Collaborations:

In 2009, the University of Nebraska decided to sustain the wheat breeding project via enhanced collaborations with commercial companies spanning the value chain. The University of Nebraska-Lincoln (UNL) has had a long-standing arrangement with BASF, providing access to the Clearfield technology. Infinity CL and Settler CL are outcomes of this research. We are now concentrating on two-gene herbicide tolerant wheat cultivars. In 2009 UNL began a collaboration with ConAgra. They support our McCook Nursery and provide valuable information on the end-use quality of our lines at that site which is a key sourcing site for their Colorado mills. In 2010, UNL developed a collaboration with Bayer Crop Science that allows non-exclusive access to UNL germplasm and is in accordance with the principles for collaboration approved by the National Association of Wheat Growers and with the U.S. Wheat Associates Joint Biotechnology Committee. This collaboration has led to extensive collaborations and interactions on genetics, plant breeding, and crop physiology. Having their excellent staff in Lincoln has been very advantageous to our students and their interactions also. In 2012, we evaluated over 900 doubled haploid lines created in collaboration with Limagrain. One hundred lines were selected for further evaluation. We continue to develop germplasm exchange agreement with private companies as their germplasm is becoming increasingly relevant. Our goal continues to be the "People's University" and to work will all public and private wheat researchers in a manner compatible with the landgrant mission.

USDA-ARS projects at the University of Nebraska are not party to these agreements.

We received our eleventh 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. We are fortunate that they took the initial risk of building a market for our germplasm when no one else was interested.

In 2012, P-845 is a winter barley (*Hordeum vulgare* L.) cultivar developed by the Nebraska Agricultural

Experiment Station and will be released in 2013 by the developing institution. It was released primarily for its superior grain yield and adaptation to rainfed small grains production systems in Nebraska and in states south of Nebraska. P-845 was selected from the cross Krasnodar 'K304/2'/NB90701, where the Krasnodar line K304/2 was developed in southern Russia and used as a parent for its diversity and expected winterhardiness and the pedigree of NB90701 is NE80725 sel./OK77422. The pedigree of NE80725 is Sabbaton/Meimi*2/Decatur/3/Dundy//Nebar sel./Dundy. The pedigree of OK77422 is CI 13855/NC 6005-15. The cross was made in 1993. The F_1 generation was grown in the greenhouse in 1994 and the F_2 to F_3 generations were advanced using the bulk breeding method in the field at Mead, NE in 1995 and 1996. In 1996, single F_3-derived F_4 rows were planted for selection in 1997. There was no further selection thereafter. The $F_{3:5}$ was evaluated as a single four row plot at Lincoln, NE in 1998. P-845 was identified in 1999 as the experimental line, NB99845, and selected for further testing.

P-845 was evaluated in Nebraska replicated yield nurseries starting in 2001 to 2011 and in the USDA-ARS Uniform Winter Barley Yield Trial in 2010. In the Nebraska Barley Variety Trial (2004 to 2011, Table 1), P-845 performed well across Nebraska and in western Kansas. Compared to the four commercially available cultivars, P-845 was the highest yielding line at Lincoln, NE and Colby, KS. It was the second and third highest yielding line at Mead and Sidney, NE respectively. These data are supported by the 2010 USDA-ARS Nursery where P-845 ranked 6th region-wide of the 16 entries tested. It was not significantly ($P<0.05$) lower than the highest yielding lines in the nursery. Based upon these data, P-845 is adapted to Nebraska and western Kansas and adjacent areas of the Great Plains.

Other measurements of performance from comparison trials indicate that P-845 is moderately early in maturity (flowering 136.6 d after Jan.1), about 1 d later flowering than TAMBAR 501 and 1 day earlier flowering than P-713, P-721, and P-954. P-845 is a relatively short winter barley cultivar (26.7 in tall) which is similar to P-721 and P-954, but one inch shorter than TAMBAR 501 and 2 inches shorter than P-713. P-845 has moderate straw strength (8% lodged) which was lower than the comparison cultivars. The winter hardiness of P-845 is good and comparable to other winter wheat cultivars adapted and commonly grown in Nebraska and Kansas.

In Nebraska, winter barley is mainly affected by winter injury and there are relatively few diseases on the crop. Based upon data from the USDA-ARS Uniform Winter Barley Yield Trial in 2010 using field races, P-845 is moderately resistant to moderately susceptible to net blotch (incited by *Pyrenophera* Drechs. F. *teres* Smedeg.), moderately susceptible to powdery mildew (*Blumeria graminis* f. sp. *hordei* Speer) and susceptible to stripe rust(incited by *Puccinia striiformis* Westend. f. sp. *hordeii* Eriksson). P-845 has average grain volume weight (44.2 lbs/bu) which is similar to P-713 (44.7 lbs/bu), lower than P-721 (45.1 lbs/bu) and P-954 (45.3 lbs/bu), and higher than TAMBAR 501 (42.8 lbs/bu) in comparison trials.

In positioning P-845, based on performance data to date, it should be well adapted to most rainfed small grains production systems in southeastern, south central, west central, and western Nebraska, in western Kansas, and in adjacent areas of the Great Plains. P-845 has not been tested under irrigation, so its performance in that production system in unknown. P-845 is genetically complementary to virtually all barley cultivars grown in Nebraska and Kansas except for P-721 that also has Dundy as a parent.

P-845 is a straight, tan-glumed winter barley cultivar that has long and rough awns with many teeth. The juvenile growth habit is protrate. The plant color at heading is green and anthrocyanin is absent from the stem and leaf sheath. The leaf is glossy.. The auricle is white. The spike is six-row, square headed, and erect at maturity. The glume is one half of the lemma and has no hairs. The rachis is pubescent. The lemma is long. The seed is slightly wrinkled, hulled or covered, and the rachilla has short hairs. The aleurone is colorless.

P-845 has been uniform and stable since 2010. Less than 0.5 % of the plants were rogued from the Breeder's seed increase in 2010-12. The rogued variant plants were taller in height (5 - 15 cm) or were awnless. Up to 1% (10:1000) variant plants may be encountered in subsequent generations. Paramount Seed Farms, 7682 County Road Z, Quinter, KS 67752 has the exclusive rights to market P-845 and will have seed available to qualified growers in 2013. The Nebraska Foundation Seed Division, Department of Agronomy and Horticulture, University of Nebraska-Lincoln, Lincoln, NE 68583 will not have foundation seed. A research and development fee will be assessed on all seed sales. Small quantities of seed for research purposes may be obtained from the 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. In addition, a seed sample has been deposited in the USDA-ARS National Small Grains Collection, Aberdeen, ID and seed is freely available to interested researchers.

Barley appears to be making a comeback in the Great Plains. Paramount is marketing barley from Texas to Nebraska, mainly for forage, but also for grain. They are very innovative and have created a food barley product line, as well as marketing barley grain for use in hydroponic forage units (one example of hydroponic barley forage production can be seen at: http://www.allseasongreens.com/). In 2012, the trials at Lincoln and Mead were good, but those at Colby were lost to drought and at Sidney due delayed harvest. Part of this research is funded by the American Malting Barley Association which is committed to developing winter malting barley lines (prefer 2-row types). The biggest challenge to barley breeding is timely harvest as the barley crop ripens at Sidney when we are cutting wheat in eastern NE. Barley not cut on time often loses its heads similar to hail damage.

The 2012 data are:

Winter Barley Variety Trial (BVT) 2012 Summary for Lincoln and Mead, NE

	Lincoln				MEAD				Across Locations	
VARIETY	Anthesis	PHT	YLD	Rank *	Anthesis	PHT	YLD	Rank	YLD	Rank
	(after April1)	*Inch*	*lbs/a*		*(after April1)*	*Inch*	*lbs/a*		*Lbs/a*	
P-713	19	35	4784	15	24	35	5563	3	5173	7
P-721	21	31	3908	36	26	32	4786	25	4347	33
P-954	23	32	3218	39	25	32	4564	33	3891	39
TAMBAR 501	16	34	4772	17	21	35	5375	9	5073	11
NB08428	20	33	4332	27	23	34	5385	8	4859	18
NB09404	20	34	4732	18	24	36	5493	5	5113	9
NB09405	16	32	3668	38	22	35	4570	32	4119	36
NB09409	20	32	4608	21	25	35	5254	11	4931	15
NB09410	19	35	5216	5	23	37	5842	2	5529	2
NB09425	19	30	4811	14	25	32	5200	13	5006	13
NB09427	24	32	4185	30	27	35	5253	12	4719	24
NB09430	14	33	4064	32	21	37	4888	21	4476	28
NB09432	22	33	4083	31	26	35	4236	39	4160	35
NB09433	21	32	4242	29	26	34	4627	28	4434	31
NB09434	20	33	4295	28	25	32	4833	24	4564	25
NB09437	20	36	5321	3	24	36	6064	1	5692	1
NB09439	20	32	4636	19	24	33	4886	23	4761	21
NB09440	13	33	3935	34	21	35	4285	37	4110	37
NB09441	18	34	4903	12	21	36	5017	17	4960	14
NB10403	13	34	4951	9	21	38	4740	27	4846	19

NB10404	14	34	4556	22	21	35	4241	38	4399	32
NB10409	15	37	5023	8	22	38	4760	26	4892	16
NB10417	15	31	5077	6	21	35	5177	14	5127	8
NB10420	14	33	4774	16	21	36	5000	18	4887	17
NB10421	18	34	4934	11	24	35	4508	34	4721	23
NB10425	20	37	4951	9	25	35	5075	15	5013	12
NB10440	15	33	4891	13	22	35	5265	10	5078	10
NB10444	16	31	5536	1	21	35	5435	6	5486	3
NB11404	16	34	2848	40	21	35	3200	40	3024	40
NB11405	19	35	4516	23	25	37	4589	29	4552	26
NB11414	19	32	5488	2	23	35	4887	22	5188	6
NB11416	20	34	5035	7	24	35	5543	4	5289	5
NB11418	16	32	4611	20	22	33	4952	20	4782	20
NB11419	19	32	4335	26	22	34	4583	30	4459	29
NB11427	18	31	4033	33	22	33	4983	19	4508	27
NB11429	21	34	3782	37	23	33	4425	36	4104	38
NB11430	17	35	5219	4	21	36	5423	7	5321	4
NB11431	20	31	3911	35	25	31	4582	31	4247	34
NB11432	19	33	4398	25	24	34	4489	35	4443	30
NB11438	17	33	4459	24	22	35	5050	16	4755	22
Mean	**18.18**	**33.22**	**4526.1**		**23.10**	**34.68**	**4925.7**			
Coeff Var	**1.05**	**1.38**	**7.57**		**4.52**	**3.02**	**8.44**			
Root MSE	**1.47**	**1.38**	**342.45**		**1.05**	**1.05**	**415.61**			
R-Square	**0.91**	**0.68**	**0.81**		**0.81**	**0.78**	**0.70**			
LSD (p=0.05)	**1.71**	**2.37**	**556.66**		**1.69**	**1.70**	**675.58**			
P-value	**<0.0001**	**<0.0001**	**<0.0001**		**<0.0001**	**<0.0001**	**<0.0001**			

The 2011 data are:

Winter Barley Variety Trial (BVT) 2011 Summary for Lincoln (NE) and Colby (KS)

ENTRY	VARIETY	Lincoln					Colby			Across Locations	
		Anthesis	PHT	YLD	WinSur	Rank*	PHT	YLD	Rank	YLD	Rank
		(after May	Inch	lbs/a	%		Inch	lbs/a		Lbs/a	
1	P-713	14	34	3498	90	4	21	2282	2	2890	1
2	P-721	15	31	2553	90	33	20	1928	19	2241	28
3	P-954	16	31	2796	83	26	22	2035	11	2415	19
4	TAMBAR 5	15	31	3211	77	13	22	1585	28	2398	20
5	NB03437	19	33	2405	70	38	20	1260	37	1833	39
6	NB99845	20	31	3152	53	15	20	1456	33	2304	23
7	NB99875	19	35	3201	63	14	19	1295	36	2248	25
8	NB07410	16	37	2956	80	22	23	1500	31	2228	29
9	NB07411	19	34	3613	70	3	20	770	40	2192	31
10	NB07412	18	34	2398	60	39	19	1052	39	1725	40
11	NB08428	17	31	3406	83	5	18	1597	27	2501	14
12	NB09404	16	34	2417	73	37	21	1904	21	2161	32
13	NB09405	15	35	2815	73	25	26	1380	35	2098	35
14	NB09409	15	34	2742	93	27	21	1880	23	2311	22
15	NB09410	16	39	2279	83	40	24	1915	20	2097	36
16	NB09425	16	29	2603	90	31	20	1957	16	2280	24
17	NB09427	18	36	3399	87	6	24	2111	8	2755	6
18	NB09430	13	35	2697	87	29	24	1555	30	2126	33
19	NB09432	16	36	2428	90	35	22	1490	32	1959	38
20	NB09433	16	31	3087	87	17	24	1757	26	2422	18
21	NB09434	17	33	3380	83	9	21	2012	12	2696	7
22	NB09437	16	34	3399	87	6	23	2202	4	2801	4
23	NB09439	16	31	2697	90	29	20	2238	3	2468	16
24	NB09440	13	33	2428	83	35	21	2055	9	2242	27
25	NB09441	13	34	3087	87	17	25	1880	24	2483	15
26	NB10403	13	34	3380	80	9	22	1872	25	2626	9
27	NB10404	12	33	3000	87	20	20	1450	34	2225	30
28	NB10406	15	34	2587	80	32	22	1903	22	2245	26
29	NB10409	16	35	3397	80	8	24	1943	17	2670	8
30	NB10410	15	33	2726	73	28	23	1968	14	2347	21
31	NB10417	14	31	3126	77	16	23	2115	7	2621	10
32	NB10419	14	31	2933	73	23	21	1962	15	2447	17
33	NB10420	12	36	3616	93	2	24	1969	13	2793	5
34	NB10421	16	34	3054	70	19	22	1174	38	2114	34
35	NB10425	15	35	3629	93	1	25	2040	10	2834	3
36	NB10434	15	31	2919	77	24	23	2177	5	2548	13
37	NB10437	16	33	2488	70	34	22	1566	29	2027	37
38	NB10439	16	34	2993	87	21	25	2143	6	2568	12
39	NB10440	14	35	3356	83	11	26	2343	1	2850	2
40	NB10444	15	32	3248	73	12	24	1943	17	2596	11
	Mean	15.57	33.33	2959.94	80.25		22.10	1791.68			

The 2010 data are:

	Source			Lincoln					Colby					Across Locations	
VARIETY	Exp't	07Plot#	PEDIGREE	Anthesis	PHT	YLD	WinSur	Rank	HD	PHT	Test weight	YLD	Rank	YLD	Rank
				(after May 1)	*Inch*	*lbs/a*	*%*		*(after Ap*	*Inch*	lbs/bushel	*lbs/a*		*Lbs/a*	
P-713	BVT08L	1	**P-954/Pennco**	22	35	4646	82	**15**	28	34	46	4751	**22**	4698	**17**
P-721	BVT08L	2	**Dundy/OK77559**	21	32	3997	65	**35**	27	32	41	4716	**25**	4357	**34**
P-954	BVT08L	3	**Hitchcock/Maury//Hitchcock**	23	33	4122	67	**32**	28	34	41	4820	**18**	4471	**27**
TAMBAR 501	BVT08L	4		17	36	4422	85	**23**	22	35	44	4746	**24**	4584	**20**
NB018187	BVT08L	5	NB93760/NB94723	21	36	4557	78	**20**	27	34	46	4715	**26**	4636	**19**
NB018199	BVT08L	6	NB94723/NB93727	24	35	4469	78	**21**	31	33	45	4430	**33**	4449	**30**
NB03437	BVT08L	7	NB92711/NB86954	20	34	4600	80	**18**	28	32	46	5035	**12**	4818	**13**
NB99845	BVT08L	8	Krasnodar K304/2//NB90701	18	33	4685	97	**12**	24	32	43	5170	**7**	4927	**8**
NB99875	BVT08L	9	Robust/Perkins//Dundy	19	37	4670	98	**14**	24	37	45	5555	**1**	5112	**2**
NB03429	BVT08L	10	NB92711/NB86954	22	33	4257	83	**29**	29	32	46	4685	**27**	4471	**28**
NB05419	BVT08L	11	NE98890/NE98885	20	33	4141	82	**30**	26	33	44	4448	**32**	4294	**36**
NB07407			NE95711/Legacy	22	34	4303	77	**26**	28	34	46	5152	**8**	4728	**16**
NB07410			NE95711/NE99868	18	36	5047	93	**3**	25	35	48	5220	**5**	5133	**1**
NB07411			NE95713/NE99881	25	36	4712	87	**11**	29	33	45	5151	**9**	4931	**7**
NB07412	BVT08L	22	NE95713/NE99881	21	35	5040	88	**4**	29	34	45	5007	**14**	5024	**3**
NB07442	BVT08L	23	NE98893//TX-15/Hitchcock	21	35	4797	90	**9**	27	35	47	4919	**16**	4858	**11**
NB08402	BVT08L	24	NE95711/Legacy/NE95711	22	35	4356	88	**24**	26	35	47	5266	**3**	4811	**15**
NB08403	BVT08L	25	NE95711/Legacy/NE95711	21	35	4279	82	**27**	27	34	48	4878	**17**	4578	**22**
NB08409	BVT08L	26	NE95711/Legacy/NE95711	24	34	4123	68	**31**	30	35	46	4786	**20**	4454	**29**
NB08410	BVT08L	29	NE95711/Legacy/NE95711	22	34	4273	73	**28**	27	34	48	5070	**11**	4671	**18**
NB08411	BVT08L	30	NE95711/Legacy/NE95711	21	34	4304	80	**25**	25	34	48	5320	**2**	4812	**14**
NB08413	BDUP08L	402	NE95711/Legacy/NE95711	24	35	3974	73	**37**	29	35	47	5188	**6**	4581	**21**
NB08428	BDUP08L	403	NE98888/NE98936	23	34	4840	82	**6**	28	33	45	5072	**10**	4956	**4**
NB09402	BDUP08L	405	NE98890/ NE97891	21	35	4002	78	**34**	29	33	45	4394	**34**	4198	**38**
NB09404	BDUP08L	409	NE98890/ NE97891	21	35	4577	83	**19**	29	36	46	4514	**30**	4546	**23**
NB09405	BDUP08L	410	P-954/ NE94737	20	38	5086	88	**1**	26	38	44	4779	**21**	4933	**6**
NB09409	BDUP08L	411	NE99820/ NE94737	24	35	3993	82	**36**	28	34	48	4959	**15**	4476	**26**
NB09410	BDUP08L	412	NE99820/ NE94737	21	39	4675	87	**13**	29	36	50	5224	**4**	4949	**5**
NB09425	BDUP08L	413	HITCHCOCK/ NE94737	23	33	3744	78	**40**	30	30	49	4266	**35**	4005	**40**
NB09427	BDUP08L	414	Legacy/ P-713	23	35	4817	80	**7**	31	34	44	4036	**39**	4427	**33**
NB09430	BDUP08L	419	94Ab1274/ NE94738	19	36	3892	82	**39**	24	37	45	4749	**23**	4321	**35**
NB09432	BDUP08L	423	NE97891/ P-713	22	36	4806	88	**8**	28	35	45	5023	**13**	4914	**9**
NB09433	BDUP08L	428	NE97891/ P-713	21	35	5059	88	**2**	28	34	47	4611	**28**	4835	**12**
NB09434	BDUP08L	430	P-954/ NE94737	22	34	4944	78	**5**	27	35	47	4800	**19**	4872	**10**
NB09436	BDUP08L	436	VA97B-388/ PERKINS	23	35	4028	78	**33**	30	34	47	3993	**40**	4011	**39**
NB09437	BDUP08L	437	VA97B-388/ PERKINS	21	36	4446	75	**22**	29	33	47	4509	**31**	4477	**25**
NB09439	BDUP08L	438	VA00H-137/ NE94738	22	33	4633	77	**16**	29	31	45	4228	**38**	4431	**31**
NB09440	BDUP08L	440	VA01H-124/ P-919 (NE98919)	15	36	4720	95	**10**	24	31	42	4264	**36**	4492	**24**
NB09441	BDUP08L	441	TX00D525/ NE98936	17	36	4606	92	**17**	23	34	45	4252	**37**	4429	**32**
NB09442	BDUP08L	444	TX00D525/ NE98936	22	35	3920	83	**38**	27	33	45	4609	**29**	4264	**37**
Mean				**21.25**	**34.83**	**4464.00**	**82.30**		**27.30**	**33.73**	**45.56**	**4782.69**			
Coeff Var				**7.63**	**4.96**	**8.83**	**12.10**		**3.85**	**4.45**	**5.78**	**8.27**			
Root MSE				**1.62**	**1.73**	**394.36**	**9.96**		**1.05**	**1.49**	**2.64**	**395.49**			
R-Square				**0.72**	**0.52**	**0.57**	**0.47**		**0.86**	**0.62**	**0.44**	**0.59**			
LSD (p=0.05)				**2.64**	**2.81**	**641.04**	**16.18**		**1.47**	**2.10**	**3.69**	**553.85**			
P-value				**<0.0001**	**0.0029**	**0.0002**	**0.0184**		**<0.0001**	**<0.0001**	**0.0010**	**<0.0001**			

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, the malting and brewing 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. Ali Bakhsh and Dr. Ibrahim Salah El Baysoni completed their Ph.D. degrees. Sumardi bin Haji Abdul Hamid completed his M.S. degree. MengYuan Wang and Marmar El-Siddig returned to their respective home countries after completing their visiting scientist projects. Ms. Rungravee Boontung joined our project as a new Ph.D. student. Dr. Emel Ozer came to our project as a visiting scientist.

Summary:

In 2012, 1,380,000 acres of wheat were planted in Nebraska and 1,300,000 were harvested with an average yield of 41 bu/a for a total production of 53,300,000 bu. In 2011, 1,500,000 acres of wheat were planted in Nebraska and 1,400,000 were harvested with an average yield of 45 bu/a for a total production of 63,000,000 bu. In 2010, 1,600,000 acres of wheat were planted in Nebraska and 1,490,000 were harvested with an average yield of 43 bu/a for a total production of 64,070,000 bu. 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 2012, TAM 111 (12.8%) inched ahead of Overland (12.7%) as the most widely grown wheat cultivar in Nebraska, followed by Pronghorn (9.6%). Pronghorn and Goodstreak (5.1%) are tall (conventional height) wheat varieties that have consistently done well in the drought prone areas of western Nebraska. Buckskin (4.7%) decreased slightly, indicating that tall wheats, which are adapted to drought in the west, remain very popular (19.4% of the total state acreage). Settler CL acreage (4.7%) increased rapidly in 2012. Cultivars developed by the University of Nebraska wheat improvement program occupied 65.6% of the state acreage. Other public varieties occupied 17.4% (largely due to TAM 111) and private varieties occupied 17.0% (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.

In 2012, NE06545 was recoemmended for release and formally released on January 30, 2013. NE06545 is a hard red winter wheat (*Triticum aestivum* L.) cultivar developed cooperatively by the Nebraska Agricultural Experiment Station and the USDA-ARS. It was released primarily for its superior adaptation to rainfed wheat production systems throughout Nebraska and in states north and west of Nebraska. NE06545 will be marketed as Husker Genetics Brand Freeman Hard Red Winter Wheat in honor of Daniel Freeman, who is recognized as the first person to file for a homestead under the Homestead Act of 1862 which celebrated its 150th anniversary in 2012.

NE06545 was selected from the cross KS92-946-B-15-1/Alliance where the pedigree of KS92-946-B-15-1 is ABI86*3414/Jagger/Karl 92. NE06545 performed well across Nebraska and was not significantly different from Husker Genetics Brand Overland, the second most widely grown cultivar in Nebraska. These data are supported by the 2009 and 2010 USDA-ARS Southern Regional Performance Nursery where NE06545 ranked 2 and 34 region-wide of the 46 and 48 entries tested in those years. NE06545 was also tested in the Northern Regional Performance Nursery in 2011 where it ranked second out of 29 entries tested region-wide in that year. Other measurements of performance from comparison trials indicate that NE06545 is moderately early in maturity, about 2 d earlier flowering than Wesley and Goodstreak and 3 days earlier flowering than ‘Overland’. NE06545 is a semi-dwarf wheat cultivar.

NE06545 is resistant to soilborne wheat mosaic virus. It is moderately resistant to moderately susceptible to stem rust. It is moderately resistant to moderately susceptible to leaf rust and to stripe rust. It is moderately susceptible to Fusarium head blight. NE06545 is moderately susceptible to susceptible to Hessian fly, barley yellow dwarf virus and wheat streak mosaic virus.

In 2012, P-845 is a winter barley (*Hordeum vulgare* L.) cultivar developed by the Nebraska Agricultural Experiment Station and will be released in 2013 by the developing institution. It was released primarily for its superior grain yield and adaptation to rainfed small grains production systems in Nebraska and in states south of Nebraska. P-845 was selected from the cross Krasnodar ‘K304/2’/NB90701, where the Krasnodar line K304/2 was developed in southern Russia and used as a parent for its diversity and expected winterhardiness and the pedigree of NB90701 is NE80725 sel./OK77422. The pedigree of NE80725 is Sabbaton/Meimi*2/Decatur/3/Dundy//Nebar sel./Dundy.

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