IMPROVING WHEAT VARIETIES FOR NEBRASKA

2002 STATE BREEDING AND QUALITY EVALUATION REPORT

Report to the

NEBRASKA WHEAT DEVELOPMENT, UTILIZATION
AND MARKETING BOARD

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January 2003

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I. INTRODUCTION

Wheat variety development research in Nebraska is 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 2001-2002 NEBRASKA WHEAT CROP

1. Growing Conditions

The 2001-2002 crop was planted into generally moist soils. Planting was generally on time and the fall was generally milder than normal. The mild fall lead to a higher than normal incidence of wheat soilborne mosaic virus (early planting or mild fall weather promotes the disease, our normal planting date tends to prevent the disease). The winter was mild and there was little winterkilling. In the spring, moisture was adequate to below average in most of Nebraska. However in western Nebraska a severe drought settled in and extended to eastern Nebraska, though subsoil moisture allowed the crop to finish in eastern Nebraska. The drought proceeded through harvest, which tended to be earlier than normal. IN the areas of severe drought, wheat streak mosaic virus was often present leading to an even greater crop loss. Overall, this was a season that favored early, drought tolerant lines with some wheat streak or soilborne mosaic virus tolerance depending upon where the wheat was grown. As opposed to last year, stripe rust (or any other rust) was not a problem. There were few other diseases or insect problems in the state. In general, Jagalene (a new Agripro wheat), Millennium, and Pronghorn performed well across or in specific sections of the state.

2. Diseases

Foliar diseases are highly dependent on moisture and somewhat on temperature. The dry spring and summer prevented their becoming a problem. In eastern Nebraska, wheat soilborne mosaic virus was the main disease due to the warm fall. In the west, wheat streak mosaic virus was the main disease due to the drought and mild fall. Diseases (wheat streak mosaic virus, barley yellow dwarf virus, leaf rust, stem rust, and various leaf blotches) can be extremely destructive under the appropriate conditions and will continue to

need close monitoring. Fortunately, karnal bunt was not found in Nebraska and we will continue to monitor this situation. Drs. John Watkins and Roy French continue to be invaluable in disease identification, survey, and understanding.

3. Insects

In general, most insect pests were at low levels on wheat in 2001. Russian wheat aphid damage was small and required little spraying. Chinch bugs and Hessian fly were generally minor. Wheat curl mite, the vector for wheat streak mosaic virus, and aphids, the vectors for barley yellow dwarf virus, were generally unimportant insect pests though they can carry devastating diseases.

4. Wheat Production

The 2002 Nebraska Wheat Crop was estimated at 48,600,000 bu, which represented a 32 bu/a state average yield on 1,520,000 harvested acres. 1,650,000 acres were planted to winter wheat. The 2002 crop was the smallest crop since 1944 and had the lowest yield since 1991. The 2001 crop was similar to the 2000 crop (59,400,000 bu harvested from 1,650,000 acres with a 36.0 bu/a state average yield). Both the 2000 and 2001 crops were much lower than the 1999 crop (86,400,000 bu from 1,800,000 harvested acres with a 48 bu/a state average yield), 1998 crop (82,800,000 bu harvested from 1,800,000 acres with a 46 bu/a yield average), the 1997 crop (70,300,000 bu harvested from 1,900,000 acres with a 37.0 bu/a yield average), and the 1996 crop (73,100,000 bu harvested from 2,150,000 acres with a 34 bu/a yield average). Despite continued genetic improvement, the main determinant in wheat production seems to be acres harvested, government programs, and weather (which also affects disease pressure).

5. Cultivar Distribution

The variety survey is being summarized at the time this report is being written. As such, 2002 is the most current data available. With our newer releases, Alliance (16.6% of the state) replaced Arapahoe (13.0%) as the most popular variety in Nebraska. Pronghorn is the third most widely grown variety followed by 2137 and Niobrara. Alliance is the variety having the greatest impact since the release of Arapahoe, but its impact is more localized, as Alliance does not have the broad adaptation in eastern Nebraska that Arapahoe had. It is expected that the former Arapahoe acreage will eventually be divided by three modern releases, Millennium, Culver, and Wahoo.

While no wheat listed below has all of the characteristics of an ideal wheat, the diverse wheats provide the grower an opportunity to choose high yielding, high quality wheats that have resistance or tolerance to the diseases or insects prevalent in his or her region. Cultivars developed by the cooperative USDA-University of Nebraska wheat improvement program occupied 75% of the state acreage. Other public varieties occupied 17% and private varieties occupied 8% of the state acreage.

NEBRASKA—WHEAT VARIETIES Estimated acreage

	Percent						
Variety	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**
2137	-----	-----	1.4	3.6	8.2	10.4	8.0
Agripro Abilene	4.2	2.2	2.4	2.7	2.7	2.5	1.3
Agripro Hondo						1.2	0.0

Agripro Ogallala	2.2	1.5	1.6	1.2	1.4	2.2	1.5
Agripro Thunderbird	5.9	5.7	3.5	3.9	2.8	1.9	0.0
Agripro Thunderbolt							
Agripro Tomahawk	2.9	2.5	2.6	1.6	1.0	0.0	1.8
Akron	-----	-----	-----	1.6	1.5	0.0	1.8
Alliance	2.7	7.3	8.4	10.4	15.1	16.0	16.6
Arapahoe	31.7	30.1	28.3	25.0	19.8	13.4	13.0
Buckskin	5.8	6.0	6.5	5.0	2.9	4.7	6.2
Centura	9.2	9.8	7.7	7.7	6.9	3.7	3.4
Culver						3.1	2.8
Jagger	-----	-----	-----	1.1	2.9	2.4	3.4
Karl/Karl 92	7.3	6.9	6.6	5.5	4.4	4.1	3.3
Millennium							3.5
Niobrara	1.4	6.5	7.5	11.4	10.3	9.3	6.9
Platte							
Pronghorn	-----	-----	4.6	7.8	6.9	10.9	10.8
Scout & Scout 66	2.4	1.6	2.3	1.0	-----	0.0	0.0
Siouxland	4.7	3.2	1.2	1.1	1.5	0.0	0.0
Vista	3.6	4.6	3.9	2.1	2.7	1.7	3.1
Wahoo							
Wesley						1.1	2.2
Windstar	-----	-----	-----	1.3	1.6	1.6	0.0
Other Public Varieties	4.9	5.4	5.9	4.1	5.4	7.6	6.5
Other Private Varieties	0.8	3.1	1.9	1.9	2.0	2.2	3.9

6. New Cultivars

In 2002, Harry and Goodstreak were recommended for release with foundation seed distributed in 2002. In addition, NE97638 (a sister line to Harry) and NE97426 (an awnless line) were recommended for licensing with seed available in 2002. All of the lines will be sold with a research and development fee assessed at $0.01/pound of seed sold. In the case of Harry and Goodstreak, the research and development fee will be assessed on certified seed sold. For licensed lines, certified and quality assured seed may be sold, hence the assessment may be slightly different. Under the leadership of USDA-ARS from the cooperative USDA-ARS & University of Nebraska white wheat efforts, Arrowsmith and Antelope were recommended for release with foundation seed available in 2003.

Goodstreak 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 2002 by the developing institutions and the Wyoming Agricultural Experiment Station. Goodstreak was released primarily for its superior adaptation to rainfed wheat production systems in western Nebraska where conventional height wheat cultivars with long coleoptiles are needed for good emergence and harvest in low moisture conditions. The name was chosen because the area in which it will most likely be grown is know as “Goodstreak” because the grasslands were better than the surrounding areas. In this area, drought is common and “Goodstreak” is an indication that water use efficient annual crops, such as wheat can be grown.

Goodstreak was selected from the cross SD3055/KS88H164//NE89646 that was made in 1991.

The pedigree of SD3055 is ND604/SD2971 where ND604 is Len//Butte/ND526 and SD2971 is Agent/3/ND441// Waldron/Bluebird/4/Butte/5/Len. The pedigree of KS88H164 is Dular/Eagle//2*Cheney/Larned /3/TAM107. The pedigree of NE89646 is Colt *2/Patrizanka. The F_1 to F_3 generations were advanced using the bulk breeding method. Goodstreak is an F_3-derived line that was selected in the F_4 generation.

Goodstreak was evaluated as NE97465 in Nebraska yield nurseries starting in 1997, in the Southern Regional Performance Nursery in 2000 and 20001, and in Nebraska cultivar performance trials in 2001 and 2002. In the Nebraska cultivar performance trials, it has performed extremely well throughout most of Nebraska but is best adapted to western Nebraska. The average Nebraska rainfed yield of Goodstreak of 3280 kg/ha (28 environments) was less than the grain yields of Millennium (3440 kg ha^{-1}), Wahoo (3430 kg ha^{-1}) and Alliance (3380 kg ha^{-1}), but greater than Culver (3230 kg ha^{-1}), Wesley (3160 kg ha^{-1}), and Arapahoe (3180 kg ha^{-1}). In western NE and WY (12 environments), Goodstreak (2690 kg ha^{-1}) was similar in yield to Pronghorn (2710 kg ha^{-1}) and superior to Buckskin (2500 kg ha^{-1}). Goodstreak, Pronghorn, and Buckskin are conventional height wheat cultivars. Goodstreak was tested in the Southern Regional Performance Nursery in 2000 and 2001. It ranked 38th of 45 entries in 2000 (32 environments) and 15th of 43 entries in 2001 (32 environments) and averaged 40 kg ha^{-1} less grain yield than TAM 107. Goodstreak has not performed well under irrigation and is not recommended for use in irrigated productions systems.

Other measurements of performance from comparison trials show that Goodstreak is medium in maturity (142 d after Jan.1, data from observations in NE), about 1 d earlier flowering than Buckskin and 1.5 d later flowering than Pronghorn. Goodstreak has a long coleoptile (62 mm), as expected for a conventional height wheat cultivar, and is similar in length to Pronghorn (64 mm) and slightly shorter than Buckskin (70 mm), but longer than semi-dwarf wheat cultivars such as Arapahoe (45 mm), and Millennium (44 mm). The mature plant height of Goodstreak (94 cm) is 7 cm taller than Millennium and 21 cm taller than Wesley. Goodstreak has good straw strength (9% lodged), which is better than Arapahoe (25% lodged), but lower than Wesley (2% lodged). The winter hardiness of Goodstreak is good to very good, and comparable to other winter wheat cultivars adapted and commonly grown in Nebraska.

Goodstreak is moderately resistant to stem rust (caused by *Puccinia graminis Pers.: Pers. f. sp. tritici* Eriks & E. Henn; most likely containing *Sr6* and an unknown gene; data provided by D. McVey at the USDA Cereal Disease Laboratory), and Hessian fly (*Mayetiola destructor* Say, superior to Arapahoe, data provided by J. Hatchett and Ming-Shun Chen, USDA and Kansas State University). Goodstreak is susceptible to leaf rust (caused by *P. triticina* Eriks.; may contain an unknown gene; data provided by D. McVey at the USDA Cereal Disease Laboratory), wheat soilborne mosaic virus, wheat streak mosaic virus, and barley yellow dwarf virus (data obtained from the Uniform Winter Wheat Southern Regional Performance Nursery, 2000-2001 and field observations in NE).

Goodstreak has good grain volume weight (76.7 kg hl^{-1}) similar to Pronghorn and Millennium, and is superior to Arapahoe (75.0 kg hl^{-1}) and Wesley (74.8 kg hl^{-1}). The milling and baking properties of Goodstreak were determined for five years by the Nebraska Wheat Quality Laboratory. In these tests, Arapahoe was used as a check cultivar. The average wheat and flour protein content of Goodstreak (137 and 118 g kg^{-1}) was lower than Arapahoe (143 and 131 g kg^{-1}). In the low rainfed environments of western NE and WY the average wheat protein content of Goodstreak (135 g kg^{-1}) was higher than Pronghorn (130 g kg^{-1}) and Buckskin (130 g kg^{-1}). The average flour extraction on the Buhler Laboratory Mill for Goodstreak (708 g kg^{-1}) was similar to Arapahoe (712 g kg^{-1}). The flour ash content (43 g kg^{-1}) was similar to Arapahoe (43 g kg^{-1}). Dough mixing properties of Goodstreak are

acceptable, but weaker than Arapahoe. Average baking absorption was slightly better than Arapahoe. The average loaf volume of Goodstreak (912 cm^3) was less than Arapahoe (937 cm^3). The scores for the internal crumb grain and texture were good, which was similar to Arapahoe. The overall end-use quality characteristics for Goodstreak should be acceptable to the milling and baking industries.

In positioning Goodstreak, based on performance data to date, it is best adapted to low rainfed wheat production systems where conventional height wheat cultivars are grown. Where it is adapted, Goodstreak should be a good replacement for Buckskin as it has higher yield potential, similar straw strength, and superior disease and insect resistances. Goodstreak is genetically complementary to 2137, Alliance, Buckskin, Culver, Jagger, Millennium, Niobrara, Pronghorn, Vista, and Windstar.

Goodstreak is an awned, white-glumed cultivar. Its field appearance is most similar to Buckskin. After heading, the canopy is moderately closed and upright. The flag leaf is erect and twisted at the boot stage. The foliage is light green to yellow green with a light waxy bloom at anthesis. The leaves are glaborous. The spike is tapering in shape, narrow, and midlong. The glume is glabrous, midlong and narrow, and the glume shoulder is midwide to wide and square to oblique. The beak is medium in length with an acuminate to acute tip. The spike is usually inclined to nodding at maturity. Kernels are red colored, hard textured, short to midlong, and elliptical in shape. The kernel has no collar, a large brush of medium length, rounded cheeks, large germ, and a narrow and shallow crease.

Goodstreak has been uniform and stable since 2000. Less than 0.5 % of the plants were rogued from the Breeder's seed increase in 2000. The rogued variant plants were taller in height (7 - 15 cm) or were awnless with red chaff. Up to 1% (10:1000) variant plants may be encountered in subsequent generations. The Nebraska Crop Improvement Association and Mr. Roger Hammons 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 had foundation seed available to qualified certified seed enterprises in 2002. The U.S. Department of Agriculture will not have seed for distribution. The seed classes will be Breeder, Foundation, Registered, and Certified. The Registered seed class will be a nonsalable seed class. Goodstreak will be submitted for registration and plant variety protection under P. L. 10577 with the certification option. A research and development fee will be assessed on all certified seed sales. Small quantities of seed for research purposes may be obtained from the corresponding author and the Department of Agronomy and Horticulture, University of Nebraska-Lincoln for at least 5 yr from the date of release. Goodstreak was developed with partial financial support from the Nebraska Wheat Development, Utilization, and Marketing Board.

Harry is a hard red winter wheat cultivar developed cooperatively by the Nebraska Agricultural Experiment Station and the USDA-ARS and released in 2002 by the developing institutions. Harry was released primarily for its superior adaptation to rainfed wheat production systems in western Nebraska. The name Harry was chosen to honor Mr. Harry Cullan, deceased, who was a proponent of well adapted cultivars and certified seed production in western Nebraska.

Harry was selected from the cross NE90614/NE87612 which was made in 1991. The pedigree of NE90614 is Brule/4/Parker*4/Agent//Beloterkovskaia 198/Lancer /3/Newton/Brule. The pedigree of NE87612 is Newton//Warrior*5/Agent/3/Agate sib. The F_1 to F_3 generations were advanced using the bulk breeding method. Harry is an F_3-derived line that was selected in the F_4 generation.

Harry was evaluated as NE97689 in Nebraska yield nurseries starting in 1998, in the Northern Regional Performance Nursery in 2000 and 2001, and in Nebraska cultivar performance trials in 2000 to 2002. In the Nebraska cultivar performance trials, it has performed well throughout most of Nebraska but is best adapted to western Nebraska. The average Nebraska rainfed yield of Harry of 3310 kg ha^{-1}

(28 environments from 2001 to 2002) was greater than the yields of Wesley (3160 kg ha^{-1}), and Culver (3230 kg ha^{-1}), but was lower than Millennium (3440 kg ha^{-1}), Wahoo (3430 kg ha^{-1}), and Alliance (3380 kg ha^{-1}). In its primary area of adaptation (western NE), Harry (17 environments from 2000 to 2002) has yielded 3000 kg ha^{-1}, which was greater than Wesley (2650 kg ha^{-1}), Culver (2770 kg ha^{-1}), Millennium (2890 kg ha^{-1}), Wahoo (2910 kg ha^{-1}), and Alliance (2880 kg ha^{-1}). Harry was tested in the Northern Regional Performance Nursery in 2000 and 2001. It ranked first of 33 entries in 2000 (12 environments) and 4th of 30 entries in 2001 (12 environments) and averaged 520 kg ha^{-1} more grain yield than 'Abilene' and 750 kg ha^{-1} more grain yield than Nekota. Harry has acceptable performance under irrigation, but other wheat cultivars with superior performance, especially with better straw strength (described below), would be recommended.

Other measurements of performance from comparison trials show that Harry is late in maturity (147 d after Jan.1, data from observations in NE), about 2.2 d and 3.6 d later flowering than Arapahoe and 'Wesley', respectively. Harry is a semi-dwarf wheat cultivar and has a short coleoptile (41 mm) similar to Arapahoe (45 mm), Millennium (44 mm), and Wahoo (47 mm); but shorter than Cougar (67 mm), a semi-dwarf line with a different semi-dwarfing gene that does not affect coleoptile length, and Pronghorn (64 mm), a conventional height wheat cultivar. The mature plant height of Harry (79 cm) is 6 cm shorter than Arapahoe and 6 cm taller than Wesley. Harry has moderate straw strength (25% lodged), similar to Arapahoe (25% lodged), but lower than Wesley (2% lodged). The winter hardiness of Harry is good to very good, similar to Abilene and comparable to other winter wheat cultivars adapted and commonly grown in Nebraska.

Harry is moderately resistant to stem rust (caused by *Puccinia graminis Pers.: Pers. f. sp. tritici* Eriks & E. Henn; most likely containing *Sr6, Sr17,* and *Sr24*; data provided by D. McVey at the USDA Cereal Disease Laboratory). It is also moderately resistant to leaf rust (caused by *P. triticina* Eriks.; most likely contains *Lr24,* and possibly other leaf rust resistance genes; data provided by D. McVey at the USDA Cereal Disease Laboratory), and Hessian fly (*Mayetiola destructor* Say, similar to Arapahoe, and most likely contains the Marquillo-Kawvale genes for resistance; data provided by J. Hatchett and Ming-Shun Chen, USDA and Kansas State University). It is susceptible to wheat soilborne mosaic virus and wheat streak mosaic virus, but may contain a low level of tolerance to barley yellow dwarf virus (data obtained from the Uniform Winter Wheat Northern Regional Performance Nursery, 2000-2001 and field observations in NE).

Harry is a genetically lower in grain volume weight (72.0 kg hl^{-1}), which is lower than Arapahoe (75.0 kg hl^{-1}) and Wesley (74.7 kg hl^{-1}), Culver (74.3 kg hl^{-1}), Millennium (76.3 kg hl^{-1}), and Alliance (74.5 kg hl^{-1}). The milling and baking properties of Harry were determined for six years by the Nebraska Wheat Quality Laboratory. In these tests, Arapahoe was used as a check cultivar. The average wheat and flour protein content of Harry (130 and 119g kg^{-1}) was lower than Arapahoe (143 and 131g kg^{-1}). The average flour extraction on the Buhler Laboratory Mill for Harry (687 g kg^{-1}) was lower than Arapahoe (712 g kg^{-1}). The flour ash content (42 g kg^{-1}) was lower than Arapahoe (43 g kg^{-1}). Dough mixing properties of Harry were acceptable, but slightly weaker than Arapahoe. Average baking absorption was slightly less than Arapahoe. The average loaf volume of Harry (885 cm^3) was less than Arapahoe (937 cm^3). The scores for the internal crumb grain and texture were good, which was slightly better than Arapahoe. The overall end-use quality characteristics for Harry should be acceptable to the milling and baking industries.

In positioning Harry, based on performance data to date, it should be well adapted to most rainfed wheat production systems in western Nebraska and in adjacent states with similar growing seasons where its later maturity and full season grain filling capabilities are favored except in times of

drought. Being a later maturity wheat may explain its exceptional performance in the Northern Regional Performance Nursery where later wheat genotypes (by Nebraska standards) are preferred Where it is adapted, Harry should be a good replacement for Arapahoe, Windstar, and 2137 as it has a higher yield potential and similar or superior disease and insect resistances. Harry is genetically complementary to 2137, Alliance, Buckskin, Jagger, Pronghorn, Windstar. It is non-complementary to Arapahoe, Culver, Millennium, Niobrara, and Vista.

Harry is an awned, white-glumed cultivar. Its field appearance is most similar to Alliance. After heading, the canopy is moderately open and upright. The flag leaf is erect and twisted at the boot stage. The foliage is green to yellow green with a waxy bloom on the lag leaf, leaf sheath, and a light waxy bloom on the spike at anthesis. The leaves are pubescent. The spike is tapering to oblong in shape, narrow, mid-long, and middense. The glume is midlong and midwide, and the glume shoulder is midwide and square to rounded. The beak is medium long to long in length with an acuminate tip. The spike is erect to inclined at maturity. Kernels are red colored, hard textured, midlong, and elliptical in shape. The kernel has no collar, a large brush of short length, rounded cheeks, large germ**,** and a midwide and middeep crease.

Harry has been uniform and stable since 2000**.** Less than 0.5 % of the plants were rogued from the Breeder's seed increase in 2000. The rogued variant plants were taller in height (10 - 15 cm) or were awnless with red chaff. Up to 1% (10:1000) variant plants may be encountered in subsequent generations. The Nebraska Crop Improvement Association and Mr. Roger Hammons 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 had foundation seed available to qualified certified seed enterprises in 2002. The U.S. Department of Agriculture will not have seed for distribution. The seed classes will be Breeder, Foundation, Registered, and Certified. The Registered seed class will be a nonsalable seed class. Harry will be submitted for registration and trade marking. A research and development fee will be assessed on all certified seed sales. Small quantities of seed for research purposes may be obtained from the corresponding author and the Department of Agronomy and Horticulture, University of Nebraska-Lincoln for at least 5 yr from the date of this release. Harry was developed with partial financial support from the Nebraska Wheat Development, Utilization, and Marketing Board.

NE97638 (NE90614 (=BRL/4/PKR*4/AGT//BEL.198/LCR/3/NWT/BRL)/NE87612 (=NWT//WRR*5/AGT/3/NE69441) and NE97426 (BRIGANTINA/2*ARAPAHOE) have good winterhardiness, stem rust resistance, agronomic performance and in our trials acceptable end-use quality. NE97426 is an awnless, semi-dwarf wheat that may have potential in grazing/haying and grain systems. NE97638 is a semi-dwarf that tends to be genetically lower in test weight.

Antelope (NW97S278) hard white winter wheat was jointly developed by the USDA-ARS, Wheat Sorghum and Forages Unit and the University of Nebraska Department of Agronomy & Horticulture. Antelope was descended from the cross Pronghorn/Arlin. Pronghorn is a Nebraska developed hard red winter wheat, while Arlin is a hard white winter wheat developed by Kansas State University. Antelope was tested in the University of Nebraska Fall-Sown Small Grain Variety Tests in 2000-2002. Average grain yield of Antelope in these trials was 51.5 bushels per acre, slightly higher than that of Arapahoe (49.7 bu/ac) and Nuplains (50.0 bu/ac) but less than that of Alliance (53.0 bu/ac) and Millennium (54.8 bu/ac). Over this three-year period, grain yield of Antelope was identical to Arapahoe in the Southeast, South Central, West Central and Panhandle dryland districts, while it was at least 5 bu/ac higher than Arapahoe in the Southeast and Panhandle irrigated trials. Antelope seems especially well adapted to

western Nebraska irrigated production. It had the highest three-year average in Panhandle irrigated trials over the years 2000-2002, and also performed well under irrigation in Colorado and Wyoming trials. Antelope also was tested in the USDA-ARS Northern Regional Performance Nursery in 2000 and 2001. Grain yield from 17 locations per year averaged 59 bu/ac, nearly identical to that of Abilene (60 bu/ac) and higher than that of Nekota (56 bu/ac).

Antelope has excellent resistance to lodging, especially under irrigation. Average plant height is approximately 2 inches taller than Abilene and Nekota. Coleoptile length is medium. Test weights generally are similar to those of Abilene and Nekota, and Antelope generally reached heading one day later than Abilene and two days later than Nekota. Antelope is resistant to stem and stripe rusts, but is susceptible to leaf rust, wheat streak mosaic virus and to preharvest sprouting. Antelope has good breadmaking quality, with average grain and flour protein contents. Antelope is a strong gluten wheat, with dough strengths similar to that of Wesley and Alliance.

Arrowsmith (NW97S182) hard white winter wheat was jointly developed by the USDA-ARS, Wheat Sorghum and Forages Unit and the University of Nebraska Department of Agronomy & Horticulture. Arrowsmith was descended from the cross KS87809-10/Arapahoe). KS87809-10 was a Kansas experimental hard winter wheat with the pedigree is KS831374-141B/YE1110. KS8321374-141B was a reselection out of Karl, while YE1110 was descended from Gerek 79, a winter wheat from Turkey, and Aurora, a winter wheat from the former Soviet Union. Arapahoe is a well known Nebraska-bred hard red winter wheat. Arrowsmith was tested in the University of Nebraska Fall-Sown Small Grain Variety Tests in 2000-2002. Average grain yield of Arrowsmith in these trials was 50.5 bushels per acre, slightly higher than that of Arapahoe (49.7 bu/ac) and Nuplains (50.0 bu/ac) but less than that of Alliance (53.0 bu/ac) and Millennium (54.8 bu/ac). Arrowsmith also was tested in the USDA-ARS Northern Regional Performance Nursery in 2000 and 2001. Grain yield from 17 locations per year averaged 59 bu/ac, nearly identical to that of Abilene (60 bu/ac) and higher than that of Nekota (56 bu/ac).

In Nebraska, Arrowsmith is best adapted to dryland sites in the Panhandle district. Arrowsmith is a tall wheat, similar in height to Pronghorn and Millennium. Coleoptile length is moderately long. Test weights generally are similar to those of Abilene and Nekota, and Arrowsmith generally reached heading three days later than Nekota and two days later than Abilene. Arrowsmith is resistant to stem and stripe rusts, but is susceptible to leaf rust, wheat streak mosaic virus and to preharvest sprouting. Arrowsmith has very good breadmaking quality, with above average grain and flour protein contents. Arrowsmith is a medium-strong gluten wheat, with dough strengths similar to that of Nuplains and Arapahoe.

III. FIELD RESEARCH

1. Increase of New Experimental Lines

Based on last year's results and our recent releases, we have decided to "slow down" the release process by one year. The feeling was that our seed producers were having trouble knowing which lines to produce and in what quantity. An additional year of testing should greatly help them identify the best lines for production, while minimizing their risk. The new plan will be for us to test lines in the state variety trial for two years and then make the release decision (as was done before), but that the seed increase will not be made until after the line is released. Hence, one year before foundation seed is available, the seed producers will know which lines are tracking for release and can adjust their seed

inventories accordingly.

Five lines were advanced for intermediate scale increase (goal is to have 30 bu of breeder seed) at the Nebraska Foundation Seed Division for possible release in 2004. Five lines were advanced to small-scale increases at the Nebraska Foundation Seed Division. They are:

NE97V121	N87V106/OK88767
NE98471	NE90461/NIOBRARA
NE98632	NIOBRARA/NE91525
NI98439	NE90476/(10Ax88-1643)X10927 592-1-5
NE98466	KS89H50-4/NE90518

As state experiment stations expand their focus on regional efforts, we will need to discuss how best to release lines that were initially developed in one state, but have utility in other states or niche markets. Currently, this is not a problem because many state experiment stations have compatible release procedures for hard red winter wheat. However, there are different marketing mechanisms for hard white wheat (i.e. grower organizations, or contract production via seed companies and milling companies). The market place will continue to diversify and regionalize especially for niche market wheats (purple, blue, organic, etc.), hence it should be expected that new relationships will be developed which may include marketing publicly varieties outside the state of origin in small multistate niche areas

With the release of new varieties Cougar, Culver, Goodstreak, Harry, Millennium, Nuplains, Wahoo, and Wesley many of the most advanced current breeding lines are not expected to be released.

2. Nebraska Variety Testing

Numerous entries and three seed treatments were included in some or all of the locations in the Fall Sown Small Grain Variety Tests in 2002. Fourteen dryland (including one ecofallow) and two irrigated, were harvested for yield data. In 2002, the top ten entries for dryland production were:

Entry	**Yield bu/a**	Entry	**Yield bu/a**
Jagalene	**50.65**	NE98439	**46.85**
Trego	**48.07**	2137	**46.50**
NE97426	**47.49**	NE97638	**45.84**
Millennium	**47.28**	Alliance	**45.70**
NE98471	**47.03**	Wahoo	**45.45**

In 2001, the top ten entries for dryland production were:

	Average Yield bu/a		Average Yield bu/a
Wahoo	**56.4**	**NE97689**	**53.5**
Millennium	**55.2**	**NE97638**	**53.2**
Alliance	**54.9**	**NW97S182**	**53.1**
NE97669	**54.5**	**NE97426**	**52.4**
NE97465	**53.9**	**Arapahoe**	**51.7**

In 2000, the top ten entries for dryland production were:

Entry	Average Yield	Entry	Average Yield
	bu/a		**bu/a**
Wahoo	**48.8**	**Culver**	**47.0**
Trego	**48.3**	**NUPLAINS**	**46.9**
Alliance	**48.0**	**NW97S343**	**46.9**
NIOBRARA	**47.2**	**2137**	**46.8**
Millennium	**47.1**	**NW97S154**	**46.5**

Of the released lines tested in all dryland locations, Golden Spike (34.65 bu/a), Turkey (35.59 bu/a), as expected, and Heyne (36.05 bu/a) had the lowest grain yields. These yield levels are higher than the state average yield indicating our nurseries tend to be on better production areas than many parts of the state.

3. Irrigated Wheat Trials:

A major improvement in our irrigated trials occurred in 1999 with the coordination of irrigated testing between Nebraska and Wyoming (thanks to Drs. D. Baltensperger and J. Krall). The top ten lines for 2002 were:

Entry	Yield	Entry	Yield
	bu/a		bu/a
Dumas	98	Yumar	93
NW97S278	97	Lakin	93
Jagalene	96	NE97V121	92
NI01824	94	Wesley	92
NI01808	94	NI01823	92

The top ten lines for grain yield in 2001 were:

Entry	Average Yield	Entry	Average Yield
	bu/a		**bu/a**

Millennium	**84**	**Jagger**	**79**
NI98438	**83**	**NE97669**	**79**
NuFrontier	**82**	**NW97S278**	**79**
Wahoo	**81**	**Betty**	**78**
NE97638	**80**	**Wesley**	**77**

The top ten lines for grain yield in 2000 were:

Entry	Average Yield	Entry	Average Yield
	bu/a		**bu/a**
XH9801	**108**	**GM1002**	**104**
AP7510	**107**	**QT7406**	**104**
XH3207	**107**	**QT7588**	**103**
XH7463	**105**	**NW97S278**	**102**
XH9815	**105**	**XH9806**	**102**

The irrigated data this year showed the benefits of having a dedicated irrigated wheat development nursery. Three of the top ten lines came directly from the irrigated wheat development nursery.

As in the past, we have an experimental line irrigated nursery. The nursery 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. As in the past Wesley performed very well. 2137 was not hurt by the winter this year and did well also. A number of experimental lines also performed well. The results for 2002 are:

VARIETY	Linc.	N.Platte	Alliance	Dryland	Dryland	Sidney IR	Test Wt.	State. Avg.	State
	bu/a	bu/a	bu/a	bu/a	rank	bu/a	lbs/bu	bu/a	Rank
NI02401	76.15	50.68	27.03	51.29	18	116.23	59.50	67.52	2
NI02402	95.26	57.77	19.71	57.58	1	108.96	59.00	70.43	1
NI02403	78.99	51.36	18.91	49.75	28	101.70	58.00	62.74	24
NI02404	72.05	46.32	18.47	45.61	46	94.99	61.00	57.96	44
NI02405	74.71	44.90	26.80	48.80	34	100.02	57.50	61.61	31
NI02406	72.53	51.09	28.57	50.73	22	97.23	59.00	62.36	28
NI02407	77.14	48.30	17.42	47.62	39	108.40	60.50	62.82	23
NI02408	77.75	45.85	20.66	48.09	37	107.84	61.50	63.03	20
NI02409	87.44	51.45	17.58	52.16	13	98.90	59.50	63.84	16
NI02410	80.92	44.22	21.27	48.80	35	102.26	58.00	62.17	29
NI02411	75.60	44.56	22.23	47.46	40	99.46	59.50	60.46	39
NI02412	82.95	48.90	24.12	51.99	14	101.70	61.50	64.42	12
NI02413	69.74	38.32	17.90	41.99	49	94.44	59.00	55.10	48
NI02414	79.73	45.47	25.35	50.18	25	105.05	60.00	63.90	15
WESLEY	84.53	53.13	23.65	53.77	6	102.82	59.50	66.03	7
NI02415	82.94	48.04	25.74	52.24	10	84.93	60.00	60.41	41
NI02416	85.90	49.94	23.04	52.96	9	108.41	60.00	66.82	3
NI02417	81.35	50.87	19.61	50.61	24	91.64	59.00	60.87	35

NI02418	86.73	42.15	21.01	49.96	26	105.05	59.50	63.74	17
NI02419	84.99	56.16	11.39	50.85	20	107.28	59.00	64.96	10
NI02420	91.15	46.51	21.79	53.15	8	106.17	59.00	66.41	5
NI02421	86.83	48.99	16.99	50.94	19	96.67	59.00	62.37	27
NI02422	78.14	41.80	25.80	48.58	36	103.94	61.50	62.42	26
NI02423	84.85	52.20	19.49	52.18	12	94.99	60.50	62.88	22
NI02424	64.19	43.60	9.37	39.05	50	92.76	60.00	52.48	50
NI02425	90.55	54.35	23.03	55.98	2	98.35	60.50	66.57	4
NI02426	78.61	57.72	19.03	51.79	16	104.49	56.50	64.96	11
NI02427	88.79	53.66	21.08	54.51	3	79.91	57.00	60.86	36
NI02428	83.44	47.04	19.12	49.87	27	95.55	59.50	61.29	32
ABILENE	83.50	44.85	19.77	49.37	32	102.26	62.00	62.60	25
NI02429	78.29	46.84	15.64	46.92	41	106.17	58.50	61.74	30
NI02430	80.12	51.60	14.77	48.83	33	84.38	61.50	57.72	45
NI02431	84.43	42.43	22.04	49.63	29	92.76	62.00	60.42	40
NI02432	60.62	45.07	22.78	42.82	48	85.49	60.00	53.49	49
NI02433	77.14	40.93	21.89	46.65	42	104.49	58.00	61.11	34
NI02434	79.85	54.61	26.02	53.49	7	93.32	59.00	63.45	19
NI02435	73.37	46.04	16.21	45.21	47	98.35	61.50	58.49	43
NI02436	77.17	46.94	30.94	51.68	17	100.58	58.00	63.91	14
NI02437	79.71	45.06	14.82	46.53	43	99.46	59.50	59.76	42
NI02438	69.69	43.35	24.24	45.76	45	85.50	56.50	55.70	47
NI02439	76.38	46.64	19.89	47.64	38	87.17	62.00	57.52	46
NI01808	84.71	53.73	24.15	54.20	4	93.32	55.50	63.98	13
NI01828	82.48	46.71	23.14	50.78	21	110.64	61.00	65.74	9
NI01803	75.74	41.84	21.02	46.20	44	104.49	60.00	60.77	38
2137	83.93	53.19	24.88	54.00	5	103.37	59.50	66.34	6
NI01812	77.85	57.17	17.00	50.67	23	100.02	57.00	63.01	21
NI01823	75.40	47.23	25.48	49.37	31	94.99	60.00	60.78	37
NI01824	84.55	49.03	22.13	51.90	15	107.84	62.00	65.89	8
NI99416	76.22	51.43	28.92	52.19	11	97.79	59.00	63.59	18
NI98436	78.30	47.84	22.07	49.40	30	96.67	58.50	61.22	33
CV	6.14	5.97	15.72			7.22	1.51		
LSD	8.23	4.84	5.61			12.00	1.51		

The results of the irrigated nursery in 2001 were:

Entry	Variety	Wsurv.	Linc.	Rank L	Allianc.	Rank A	Sidney Irr	Rank S Irr	Test Wt Irr	Dryland Avg.	RankDr	State Avg.	RankST
			bu/a		bu/a		bu/a		lbs/bu	bu/a		bu/a	
1	**NI00413**	**8.46**	**74.45**	**20**	**34.82**	**26**	**93.11**	**21**	**55.10**	**54.64**	**20**	**67.46**	**20**
2	**NI00416**	**9.93**	**87.58**	**1**	**41.15**	**12**	**86.51**	**34**	**54.95**	**64.37**	**4**	**71.75**	**9**
3	**NI00432**	**9.88**	**75.69**	**16**	**28.12**	**41**	**91.13**	**24**	**55.80**	**51.91**	**28**	**64.98**	**30**
4	**NI00438**	**9.37**	**63.62**	**39**	**24.78**	**45**	**95.75**	**17**	**55.85**	**44.20**	**44**	**61.38**	**34**
5	**NI00439**	**7.93**	**57.78**	**47**	**26.01**	**44**	**86.51**	**32**	**53.75**	**41.90**	**48**	**56.77**	**45**

6	NI99416	8.72	64.93	36	42.41	8	89.81	28	56.10	53.67	23	65.72	28
7	NI98438	9.12	77.04	14	40.34	16	99.06	10	56.75	58.69	12	72.15	7
8	NI00433	9.49	70.63	24	41.85	9	90.47	26	54.55	56.24	16	67.65	19
9	NI00436	9.25	57.31	48	29.04	38	91.13	25	54.50	43.18	46	59.16	37
10	NI00437	9.61	63.54	40	37.82	23	74.62	44	54.60	50.68	30	58.66	38
11	NI01801	7.26	68.12	27	21.50	48	72.64	46	55.75	44.81	43	54.09	47
12	NI01802	7.59	63.37	41	24.69	46	73.96	45	53.50	44.03	45	54.01	48
13	NI01803	10.89	65.92	33	28.20	40	103.68	5	55.25	47.06	39	65.93	26
14	NI01804	10.36	74.45	19	38.97	19	96.41	15	53.45	56.71	14	69.94	15
15	WESLEY	10.05	86.12	2	46.04	4	105.66	3	54.20	66.08	1	79.27	2
16	NI01805	9.50	75.47	17	33.86	28	88.49	31	55.65	54.67	19	65.94	25
17	NI01806	9.10	78.77	9	41.51	11	97.73	11	52.90	60.14	8	72.67	6
18	NI01807	9.60	80.88	6	42.62	7	91.79	22	54.90	61.75	7	71.76	8
19	NI01808	9.79	82.71	3	48.83	3	106.32	1	54.40	65.77	2	79.29	1
20	NI01809	3.05	43.74	50	7.34	50	0.20	50	54.30	25.54	50	17.09	50
21	NI01810	8.82	78.83	8	30.96	34	99.06	9	54.25	54.90	18	69.62	16
22	NI01811	10.10	79.07	7	29.75	36	90.47	27	53.15	54.41	21	66.43	24
23	NI01812	10.83	78.72	10	40.83	13	101.70	7	53.95	59.78	10	73.75	5
24	NI01813	11.15	72.65	21	40.43	15	97.08	13	51.55	56.54	15	70.05	14
25	NI01814	9.96	74.86	18	40.63	14	95.75	16	54.20	57.75	13	70.41	13
26	NI01815	9.37	77.88	12	51.61	1	84.53	36	52.95	64.75	3	71.34	10
27	NI01816	9.50	67.75	28	28.59	39	78.59	42	56.10	48.17	36	58.31	40
28	NI01817	8.82	81.78	4	36.14	25	93.78	20	54.65	58.96	11	70.57	12
29	NI01818	10.40	69.87	26	33.95	27	82.55	37	55.25	51.91	27	62.12	31
30	2137	10.79	64.97	35	39.76	18	79.90	39	54.35	52.37	25	61.54	33
31	NI01819	9.83	54.01	49	32.19	31	88.49	29	50.35	43.10	47	58.23	41
32	NI01820	8.69	70.53	25	40.13	17	95.09	18	55.50	55.33	17	68.58	18
33	NI01821	7.66	66.20	32	30.04	35	85.85	35	54.90	48.12	37	60.70	36
34	NI01822	5.82	63.76	38	31.45	32	79.24	41	56.20	47.61	38	58.15	42
35	NI01823	9.78	77.69	13	18.90	49	105.00	4	56.05	48.30	35	67.20	22
36	NI01824	3.04	60.60	44	29.53	37	105.66	2	55.60	45.07	42	65.26	29
37	NI01825	7.88	72.39	22	36.24	24	91.79	23	57.10	54.32	22	66.81	23
38	NI01826	8.52	61.51	43	38.86	20	97.07	14	56.55	50.19	32	65.81	27
39	NI01827	4.96	62.08	42	38.33	21	82.55	38	54.90	50.21	31	60.99	35
40	NI01828	9.98	78.29	11	41.77	10	101.70	6	55.70	60.03	9	73.92	3
41	NI01829	9.92	81.31	5	45.00	6	95.09	19	56.30	63.16	6	73.80	4
42	NI01830	7.74	65.44	34	38.19	22	71.98	47	52.40	51.82	29	58.54	39
43	NI00831	9.29	67.03	29	27.02	42	77.26	43	55.20	47.03	40	57.10	44
44	NI01832	9.40	66.71	30	26.81	43	79.25	40	54.25	46.76	41	57.59	43
45	ABILENE	9.27	76.96	15	49.99	2	86.51	33	56.55	63.48	5	71.15	11
46	NI01833	5.86	58.31	46	23.24	47	67.36	49	52.85	40.78	49	49.64	49
47	NI01834	7.45	58.45	45	45.66	5	97.73	12	55.10	52.06	26	67.28	21
48	NI01835	8.26	66.61	31	31.22	33	67.36	48	54.85	48.92	33	55.06	46
49	NI01836	7.32	71.77	23	33.50	29	101.70	8	56.45	52.64	24	68.99	17
50	NI01837	8.65	64.23	37	33.10	30	88.49	30	56.00	48.67	34	61.94	32
	Mean	8.76	70.05		34.87		88.07		54.79	52.46		64.33	

	CV	10.85	6.25		16.36		8.06		4.26			
	LSD	1.59	7.34		9.57		11.90		3.92			

The results of the irrigated nursery in 2000 are:

Entry	VARIETY	Lincoln	Alliance	Dryland Avg	Rank	SidneyIRR	RankS	Test weight	State Avg.	Rank
		bu/a	bu/a	bu/a		bu/a		lbs/bu	bu/a	
1	NI00401	43.45	52.04	47.75	45	98.59	19	57.40	64.69	29
2	NI00402	42.85	54.02	48.44	43	86.36	30	54.40	61.08	39
3	NI00403	46.03	63.10	54.57	27	58.84	49	59.15	55.99	47
4	NI00404	58.60	61.64	60.12	4	73.37	43	57.60	64.54	30
5	NI00405	40.20	45.59	42.90	49	68.78	47	53.15	51.52	50
6	NI00406	53.38	45.22	49.30	41	100.12	18	56.10	66.24	24
7	NI00407	46.16	51.62	48.89	42	84.07	33	59.40	60.62	41
8	NI00408	57.77	55.43	56.60	17	80.25	34	50.75	64.48	31
9	NI00409	53.71	52.05	52.88	33	76.42	38	53.80	60.73	40
10	NI00410	54.75	61.94	58.35	8	90.18	28	55.60	68.96	16
11	NI00411	50.16	62.99	56.58	18	77.19	36	54.10	63.45	34
12	NI00412	56.12	52.36	54.24	28	56.56	50	55.40	55.01	49
13	NI00413	48.09	47.42	47.76	44	110.05	7	61.65	68.52	19
14	NI00414	59.32	65.10	62.21	2	93.23	21	55.20	72.55	10
15	NI00415	39.56	51.15	45.36	48	100.88	15	57.05	63.86	33
16	NI00416	55.64	55.81	55.73	23	100.88	17	55.15	70.78	12
17	NI00417	54.70	60.86	57.78	10	89.41	29	58.15	68.32	20
18	NI00418	43.11	48.63	45.87	47	74.89	39	56.00	55.54	48
19	NI00419	48.62	57.62	53.12	32	92.47	22	58.10	66.24	25
20	NI00420	52.29	49.02	50.66	39	90.94	26	57.60	64.08	32
21	NI00421	58.80	64.44	61.62	3	100.88	16	54.05	74.71	4
22	NI00422	52.78	59.26	56.02	20	90.95	24	56.05	67.66	21
23	NI00423	57.09	50.94	54.02	29	62.67	48	54.30	56.90	46
24	NI00424	51.63	56.07	53.85	30	90.18	27	52.70	65.96	26
25	NI00425	56.21	54.40	55.31	25	76.43	37	52.85	62.35	37
26	NI00426	55.12	43.89	49.51	40	73.37	42	56.75	57.46	45
27	NI00427	58.91	56.43	57.67	11	72.60	44	47.70	62.65	35
28	NI00428	57.05	44.55	50.80	38	71.84	45	54.35	57.81	44
29	NI00429	54.92	59.78	57.35	14	90.95	25	51.35	68.55	18
30	NI00430	61.59	55.60	58.60	7	80.25	35	47.60	65.81	27
31	NI00431	47.63	46.42	47.03	46	104.70	10	53.10	66.25	23
32	NI00432	39.63	35.41	37.52	50	108.52	8	58.65	61.19	38
33	NI00433	54.76	64.00	59.38	6	114.64	2	57.55	77.80	2
34	NI00434	61.39	58.31	59.85	5	101.64	14	55.80	73.78	7
35	NI00435	52.70	61.61	57.16	15	91.71	23	55.55	68.67	17
36	NI00436	72.30	62.49	67.40	1	101.64	13	59.00	78.81	1
37	NI00437	57.97	57.17	57.57	12	112.34	4	56.95	75.83	3
38	NI00438	55.84	48.91	52.38	34	102.40	12	59.85	69.05	15

39	**NI00439**	**55.87**	**47.41**	**51.64**	**36**	**114.64**	**1**	**54.85**	**72.64**	**9**
40	**NI99410**	**66.41**	**48.73**	**57.57**	**13**	**85.59**	**31**	**55.50**	**66.91**	**22**
41	**NI99411**	**59.50**	**53.06**	**56.28**	**19**	**102.41**	**11**	**53.65**	**71.66**	**11**
42	**NI99416**	**42.50**	**64.92**	**53.71**	**31**	**104.70**	**9**	**58.30**	**70.71**	**13**
43	**NI99428**	**57.23**	**59.04**	**58.14**	**9**	**71.07**	**46**	**53.40**	**62.45**	**36**
44	**NI99429**	**53.75**	**58.18**	**55.97**	**21**	**84.07**	**32**	**52.95**	**65.33**	**28**
45	**NI99432**	**47.71**	**54.58**	**51.15**	**37**	**74.13**	**41**	**54.30**	**58.81**	**43**
46	**NI98427**	**51.98**	**51.94**	**51.96**	**35**	**74.13**	**40**	**54.25**	**59.35**	**42**
47	**NI98438**	**44.63**	**69.43**	**57.03**	**16**	**96.30**	**20**	**55.40**	**70.12**	**14**
48	**WESLEY**	**62.41**	**48.59**	**55.50**	**24**	**113.10**	**3**	**59.95**	**74.70**	**5**
49	**2137**	**52.74**	**58.73**	**55.74**	**22**	**110.81**	**5**	**56.80**	**74.09**	**6**
50	**ABILENE**	**56.53**	**53.06**	**54.80**	**26**	**110.81**	**6**	**60.95**	**73.47**	**8**
	Average	**53.24**	**54.82**			**89.86**		**55.60**		
	CV	**7.83**	**7.84**			**13.79**		**3.47**		
	LSD	**7.00**	**7.21**			**16.10**		**2.51**		

In 2002, twelve lines were continued for further testing in the irrigated nursery and four lines were advanced to the Nebraska Triplicate Nursery (NTN). In 2001, eight lines were continued for further testing in the irrigated nursery and 2 lines were advanced to the NTN. In 2000, ten lines were continued for further testing in the irrigated nursery, and five lines were advanced to the NTN. One concern that we have is that relatively few lines seem to perform well for two consecutive years in the irrigated trials. As such, we have decided to be slightly less stringent on our selection strategy because the year-to-year variation may reflect the limited number of replications we have in this trial and field position effects. We have also changed to alpha-lattices to help remove field variation. Progress continues to be made in developing germplasm adapted irrigated production for Nebraska.

4. Nebraska Intrastate Nursery:

The Nebraska Intrastate Nursery (NIN) was planted at eight locations (Lincoln, Clay Center, North Platte, McCook, Grant, Sidney, Alliance, and Mead) and harvested at seven locations. Sidney was lost to drought and wheat streak mosaic virus. Most trials had four replications, but McCook, Grant, and Mead had two replications.

Data for 2002 is given below.

NIN 2002			Yield (bu/a)						
VARIETY	Linc.	ClayCen	N.Platte	McCook	Grant	Mead	Alliance	STAVG	STRANK
WESLEY	90.51	78.61	43.56	42.40	25.86	63.15	28.59	53.240	2
ALLIANCE	87.32	67.97	38.92	45.70	28.99	47.44	28.71	49.293	23
NE96737	72.54	71.24	43.07	49.10	24.46	52.86	27.17	48.634	33
GOODSTREAK	84.32	63.27	37.99	46.00	24.43	46.15	26.96	47.017	47
NE98425	84.94	63.73	43.01	47.25	24.89	55.28	26.09	49.313	22
NE97638	85.42	79.48	40.67	41.18	27.75	36.62	28.54	48.523	36

NE97669	83.06	65.24	44.44	44.35	29.25	39.50	26.27	47.444	43
HARRY	85.69	72.02	41.36	35.88	23.40	42.67	26.86	46.840	48
N97V121	96.54	68.61	42.59	35.18	31.66	49.38	27.42	50.197	13
NE97426	88.67	66.13	43.07	39.53	29.69	63.34	27.56	51.141	8
NE98466	82.79	72.26	41.01	37.28	21.37	61.77	25.45	48.847	31
NE98471	85.29	60.07	47.85	37.10	28.30	52.06	24.83	47.929	40
NE98503	70.99	63.87	39.11	39.30	29.39	51.97	29.94	46.367	52
NE98589	86.49	68.46	37.96	39.08	21.45	43.95	26.96	46.336	53
CULVER	79.35	71.86	43.38	46.35	21.06	43.56	26.46	47.431	44
MILLENNIUM	83.32	67.30	43.47	43.23	27.87	50.22	29.57	49.283	24
WAHOO	90.26	69.17	48.47	41.93	26.46	41.52	26.37	49.169	26
ARAPAHOE	77.34	72.77	42.74	43.45	23.07	41.87	28.03	47.039	46
NE98632	89.62	65.69	37.98	50.98	28.06	45.78	25.54	49.093	29
NE98692	89.63	48.31	35.86	49.00	23.99	41.58	26.31	44.954	56
NI98439	86.56	70.62	35.61	49.40	28.90	50.21	24.74	49.434	18
NI98414	81.36	74.56	38.28	40.05	23.48	42.18	26.25	46.594	50
NE99445	78.92	69.26	35.39	48.20	27.73	49.05	27.06	47.944	39
NE99464	81.40	61.09	36.04	46.20	29.49	56.11	33.84	49.167	27
NE99469	86.07	71.26	40.15	46.60	28.18	46.74	19.68	48.383	37
NE99489	85.81	77.76	40.33	42.88	26.28	49.08	25.56	49.671	17
NE99495	86.67	66.21	47.91	45.98	28.72	58.53	23.27	51.041	11
NE99533	83.31	74.86	51.66	47.38	25.19	58.40	27.25	52.579	4
NE99543	84.95	75.10	41.57	38.85	26.94	62.71	27.54	51.094	10
NIOBRARA	81.46	68.78	42.90	43.83	28.05	53.62	27.08	49.389	20
NUPLAINS	88.26	78.94	38.68	36.65	27.64	57.44	21.26	49.839	16
NE99554	89.26	64.53	42.27	38.38	29.96	32.46	26.44	46.186	54
NE99579	79.12	76.48	40.71	49.50	25.20	57.15	23.07	50.176	14
NE99656	89.64	61.91	52.55	46.43	29.51	58.99	24.82	51.979	6
NE00403	85.55	80.99	49.00	47.18	32.20	66.40	29.63	55.850	1
NE00429	92.44	73.51	49.32	46.95	32.54	40.50	25.02	51.469	7
NE00435	88.71	67.92	48.96	50.48	25.76	61.58	26.93	52.906	3
NE00439	78.23	63.28	44.41	46.73	25.40	75.18	24.67	51.129	9
NE00456	77.50	61.22	42.64	43.55	26.36	63.34	30.16	49.253	25
PRONGHORN	78.88	63.69	37.42	42.10	27.86	56.35	26.25	47.507	42
SCOUT66	69.21	51.89	29.52	43.75	20.82	45.27	27.93	41.199	60
NE00469	78.41	56.37	40.20	46.43	26.20	51.01	27.74	46.623	49
NE00479	75.22	79.34	40.66	47.85	19.34	59.61	23.54	49.366	21
NE00481	87.28	64.99	37.34	51.10	25.83	54.61	22.54	49.099	28
NE00507	88.71	72.23	45.16	56.50	28.18	41.70	23.65	50.876	12
NE00525	83.79	67.53	34.65	59.33	24.00	50.33	23.00	48.947	30
NE00544	71.07	60.65	36.52	56.83	24.88	57.80	25.17	47.560	41
NE00556	87.20	71.16	36.16	46.85	19.44	55.44	24.32	48.653	32
NE00564	86.22	65.91	46.10	36.65	30.21	50.09	30.82	49.429	19
NE00611	92.71	60.12	42.99	47.78	28.74	43.57	23.94	48.550	35
NE00616	87.69	67.15	39.50	37.70	25.79	47.86	24.32	47.144	45

NE00624	78.97	71.31	38.89	40.45	29.58	27.32	21.47	43.999	57
NE00633	85.71	66.28	41.33	57.95	28.51	60.70	24.19	52.096	5
NE00639	71.18	67.94	46.25	48.43	25.52	39.89	26.04	46.464	51
NE00658	82.09	65.14	43.11	47.63	23.50	61.63	26.09	49.884	15
NE00679	82.86	59.59	48.09	47.55	28.68	46.43	27.06	48.609	34
NE00687	78.36	56.51	37.27	41.73	28.60	53.58	27.08	46.161	55
NE00698	84.27	66.16	42.62	48.53	20.43	52.29	21.84	48.020	38
CHEYENNE	70.06	44.28	40.49	49.80	22.55	46.38	26.31	42.839	58
BUCKSKIN	68.17	42.23	40.98	44.03	25.41	50.14	26.77	42.533	59
GRAND MEAN	83.12	66.91	41.67	45.14	26.38	51.04	26.13	48.629	

With the exception of Alliance and Grant where drought was severe, most nurseries would be considered as being average to above average. In particular, the nurseries at Lincoln and Clay Center were very good. Wesley, Alliance, Nuplains, Niobrara and Millennium, and Wahoo performed very well among the released varieties, but a number of excellent experimental lines are progressing well towards future release.

Thirty-nine entries were submitted for large-scale analysis in the Nebraska Wheat Quality Laboratory from the 2001 NIN. This includes the 2001 NTN) Nine varieties were grown as checks. On a 14% moisture base, the flour protein values ranged from 12.5% (NI98439) to 14.8%(Wesley and Buckskin). Six entries were noted to have very good to exceptionally good quality characteristics. NE98439 had scores of: Very good- and Good+ for external, crumb grain, and texture. Additionally it was noted the crumb color was “Bright white”. NE99543 had outstanding baking scores for all characteristics; plus very good loaf volume of 1000cc. The flour protein for this entry was 13.6%. Another outstanding entry for quality was NE00544. It received very good bread scores for all quality characteristics and excellent protein content of 14%. Additionally, NE99489 was noted to have good dough strength, and NE00479 and NE00658 received very good scores for baking characteristics.

There was one entry noted to have less than desirable baking characteristics. NE00429 received lower than average bake scores. All other entries were considered acceptable. The water absorption of all entries was acceptable or above.

Twenty-three experimental lines and two reselected lines were retained for continued testing in the 2002 NIN. Thirteen released varieties were also retained to represent the primary varieties grown in Nebraska.

The data for the 2001 NIN are:

		----------bu/a----------									bu/a	
Entry	**Variety**	**Linc.**	**Mead**	**ClayC**	**McCook**	**Grant**	**Sidney**	**Allian.**	**St. Avg.**	**St. Rank**	**Akron**	**Rank**
1	**WESLEY**	**78.8**	**71.8**	**84.2**	**31.1**	**38.6**	**45.5**	**54.4**	**57.75**	**2**	**31.6**	**14**
2	**ALLIANCE**	**71.5**	**68.4**	**82.7**	**23.8**	**31.2**	**44.9**	**62.8**	**55.06**	**11**	**32.9**	**12**
3	**NE96579**	**70.8**	**59.4**	**65.2**	**36.8**	**25.6**	**40.9**	**50.4**	**49.88**	**42**	**21.2**	**49**
4	**NE96737**	**70.7**	**57.7**	**69.7**	**40.6**	**28.4**	**44.7**	**57.5**	**52.76**	**28**	**42.2**	**1**
5	**NE97465**	**74.4**	**69.2**	**71.0**	**37.3**	**26.6**	**42.9**	**53.0**	**53.48**	**22**	**35.6**	**9**
6	**NE98425**	**70.9**	**58.3**	**54.0**	**41.2**	**33.7**	**45.7**	**52.3**	**50.87**	**39**	**27.4**	**27**
7	**NE97638**	**81.8**	**69.6**	**74.3**	**26.4**	**28.9**	**41.2**	**54.2**	**53.78**	**20**	**19.5**	**52**
8	**NE97669**	**79.9**	**55.8**	**76.1**	**28.6**	**26.8**	**47.5**	**47.4**	**51.74**	**35**	**35.8**	**8**

9	NE98530	72.1	54.6	71.8	33.2	24.9	41.9	45.2	49.10	46	25.9	33
10	WINDSTAR	73.0	69.4	71.3	37.8	27.0	44.1	58.6	54.45	15	24.4	41
11	NE97689	76.6	67.7	75.0	36.0	16.8	46.9	54.9	53.39	23	15.0	58
12	N97V121	79.1	55.5	70.9	39.1	37.9	44.9	54.7	54.58	14	23.0	45
13	NE98424	75.9	50.7	51.0	35.1	27.7	44.7	51.7	48.12	49	33.0	11
14	NE97426	75.6	65.7	71.0	44.9	27.0	42.0	54.8	54.42	16	25.1	38
15	NE98466	74.8	60.8	79.6	39.1	33.3	40.1	52.6	54.33	17	25.8	34
16	NE98471	76.5	68.0	68.5	30.1	27.1	39.9	49.4	51.37	36	28.9	20
17	NE98503	76.6	62.9	75.9	28.2	21.7	43.1	58.1	52.35	30	23.0	46
18	NE98564	74.3	59.1	64.0	29.9	31.9	44.2	52.8	50.89	38	20.9	50
19	NE98589	77.5	64.4	78.1	33.2	20.6	41.9	52.9	52.66	29	29.1	19
20	CULVER	76.8	65.1	68.9	32.0	28.2	44.0	54.7	52.81	27	26.2	32
21	MILLENNIUM	79.3	70.3	78.5	39.0	31.2	41.4	52.4	56.02	5	36.5	5
22	WAHOO	73.2	64.8	79.9	42.0	20.8	47.2	59.4	55.34	10	35.1	10
23	ARAPAHOE	75.0	65.1	72.3	33.3	28.2	45.3	53.6	53.26	24	28.0	23
24	NE98632	74.3	64.7	66.1	29.8	29.2	43.9	54.3	51.75	33	23.5	44
25	NE98684	70.4	67.0	73.8	38.1	24.4	45.0	58.5	53.90	19	24.5	40
26	NE98692	79.7	69.9	76.8	34.9	20.8	40.8	59.9	54.69	12	21.7	48
27	NI98418	65.7	42.5	50.9	35.5	24.4	37.4	47.1	43.34	59	15.3	57
28	NI98439	71.9	70.1	81.2	36.5	24.0	40.7	47.4	53.10	25	25.5	37
29	NI99412	67.3	43.1	49.6	36.6	25.2	41.7	53.2	45.25	56	25.7	35
30	NI99416	75.8	64.9	72.4	36.7	28.7	41.8	54.5	53.55	21	24.6	39
31	NI98414	82.0	74.3	81.6	38.0	26.4	45.1	50.3	56.82	4	31.4	15
32	NE99410	68.8	67.0	69.5	34.6	22.3	36.6	54.2	50.42	41	27.0	28
33	NE99424	77.5	56.2	51.8	35.9	29.6	43.2	40.9	47.87	51	28.4	21
34	NE99445	74.8	52.3	44.7	31.3	33.3	44.9	54.6	47.99	50	39.4	2
35	NE99464	80.9	71.3	80.9	35.5	32.0	45.6	57.0	57.61	3	37.0	4
36	NE99469	77.8	65.9	63.5	39.5	35.2	43.0	53.2	54.02	18	28.4	22
37	NE99489	76.3	67.5	76.5	36.8	29.0	45.7	59.4	55.90	7	26.3	31
38	NE99495	83.0	59.9	75.5	39.0	30.3	46.8	55.0	55.64	8	36.1	6
39	NE99510	73.7	55.8	58.3	35.1	25.9	44.2	53.6	49.50	44	17.5	55
40	NIOBRARA	74.7	59.9	57.9	29.2	24.9	39.8	46.7	47.58	52	17.7	54
41	COUGAR	69.7	56.6	75.6	32.6	24.1	38.0	50.7	49.60	43	24.3	42
42	NE99513	73.6	53.9	57.5	32.6	22.4	40.4	44.8	46.47	54	18.0	53
43	NE99529	82.0	54.7	64.6	34.9	21.8	40.9	46.9	49.41	45	26.9	29
44	NE99533	81.2	61.8	78.6	40.3	30.6	44.5	54.6	55.95	6	26.5	30
45	NE99542	76.6	57.4	78.8	37.4	27.0	42.4	46.1	52.23	31	13.0	59
46	NE99543	78.2	76.7	79.1	41.6	16.0	42.6	54.6	55.54	9	20.5	51
47	NE99552	76.2	51.2	64.1	39.8	14.7	41.6	52.3	48.55	47	25.6	36
48	NE99554	74.1	61.4	68.0	41.4	26.6	46.9	51.7	52.86	26	27.9	25
49	NE99575	66.4	53.8	51.0	41.8	23.9	36.8	51.7	46.49	53	13.0	60
50	PRONGHORN	64.4	63.7	66.7	36.7	23.4	43.3	55.1	50.46	40	31.2	16
51	SCOUT66	63.5	51.9	62.8	27.6	19.6	38.4	50.2	44.83	57	38.2	3
52	NE99578	68.2	30.3	24.3	34.9	23.8	40.9	48.1	38.64	60	29.7	18
53	NE99579	90.6	64.7	80.8	38.1	28.6	47.9	56.0	58.09	1	27.9	24
54	NE99585	65.2	46.6	47.7	33.9	24.3	46.0	49.6	44.76	58	36.0	7

55	**NE99656**	**83.9**	**68.3**	**74.6**	**37.9**	**25.3**	**42.2**	**50.3**	**54.64**	**13**	**15.6**	**56**
56	**NE99675**	**76.5**	**55.9**	**47.3**	**36.3**	**25.2**	**38.8**	**45.3**	**46.45**	**55**	**23.8**	**43**
57	**N99L012**	**79.3**	**63.4**	**69.7**	**36.3**	**24.5**	**39.9**	**49.0**	**51.74**	**34**	**27.7**	**26**
58	**N99L033**	**78.5**	**57.1**	**68.2**	**37.6**	**25.6**	**37.9**	**51.7**	**50.96**	**37**	**21.9**	**47**
59	**CHEYENNE**	**62.9**	**67.3**	**61.7**	**30.1**	**24.8**	**38.6**	**54.3**	**48.52**	**48**	**30.8**	**17**
60	**BUCKSKIN**	**74.6**	**72.3**	**67.0**	**27.9**	**24.3**	**41.9**	**54.4**	**51.75**	**32**	**32.0**	**13**
	GRAND MEAN	**74.92**	**61.26**	**67.89**	**35.35**	**26.44**	**42.67**	**52.58**	**51.59**		**26.8**	
	CV	**7.84**	**6.19**	**8.56**	**10.04**	**14.56**	**8.28**	**9.43**			**18.8**	
	LSD	**6.87**	**6.34**	**6.79**	**5.93**	**6.44**	**4.13**	**5.80**			**8.4**	

The results for the 2000 NIN are:

Yield (bu/a)

ENTRY	VARIETY	Lincoln	Mead	ClayCen	McCook	Sidney	Alliance	State Avg.	St. Rank
1	**ARAPAHOE**	**52.6**	**62.5**	**37.6**	**14.7**	**57.9**	**58.3**	**47.26**	**56**
2	**NIOBRARA**	**60.1**	**69.2**	**48.3**	**20.9**	**62.0**	**64.6**	**54.17**	**22**
3	**NE94654**	**66.8**	**78.7**	**46.0**	**26.2**	**66.7**	**60.6**	**57.48**	**5**
4	**NE95473**	**62.2**	**68.7**	**46.5**	**33.9**	**63.4**	**58.2**	**55.48**	**12**
5	**NE95510**	**58.4**	**64.8**	**49.7**	**27.3**	**59.3**	**67.5**	**54.49**	**19**
6	**NE95553**	**59.0**	**61.9**	**39.4**	**21.1**	**53.3**	**49.1**	**47.29**	**55**
7	**NE96579**	**67.7**	**72.2**	**45.7**	**20.0**	**61.2**	**56.7**	**53.90**	**24**
8	NE96649	54.2	61.4	39.8	15.8	59.1	62.5	**48.79**	**51**
9	NE96654	56.1	58.8	42.1	19.9	51.5	55.5	**47.32**	**54**
10	NE96737	58.2	67.3	44.5	30.5	62.6	63.0	**54.35**	**20**
11	**ALLIANCE**	**56.4**	**62.7**	**41.3**	**32.7**	**67.1**	**69.4**	**54.93**	**16**
12	**WINDSTAR**	**53.5**	**59.6**	**47.1**	**22.6**	**57.4**	**65.6**	**50.95**	**37**
13	NE97426	62.2	62.3	46.7	20.2	61.7	64.8	**52.98**	**28**
14	NE97465	63.7	68.0	43.4	19.3	54.6	59.2	**51.36**	**34**
15	NE97489	58.4	57.8	42.1	24.8	54.8	59.5	**49.57**	**45**
16	NE97558	43.6	61.7	46.5	27.1	53.4	60.9	**48.85**	**50**
17	NE97612	63.6	63.6	45.4	28.3	51.7	47.1	**49.94**	**42**
18	NE97638	61.2	67.8	47.6	35.5	65.1	70.7	**57.99**	**4**
19	NE97669	53.9	64.9	42.7	30.9	67.8	60.5	**53.45**	**25**
20	NE97670	56.0	58.1	48.2	23.7	60.2	55.4	**50.26**	**41**
21	**COUGAR**	**48.1**	**56.0**	**45.0**	**19.4**	**50.5**	**55.5**	**45.74**	**57**
22	**PRONGHORN**	**57.5**	**53.1**	**38.6**	**22.8**	**56.1**	**58.4**	**47.75**	**52**
23	SCOUT66	51.2	47.7	36.8	23.9	52.8	54.6	**44.49**	**59**
24	NE97675	50.9	69.5	44.3	26.7	55.1	51.5	**49.66**	**44**
25	NE97689	51.8	79.3	48.4	39.7	72.7	70.3	**60.37**	**1**
26	NI97423	51.5	66.2	46.6	18.3	59.2	54.8	**49.42**	**47**
27	N97V121	60.2	69.8	52.5	36.2	61.7	64.4	**57.47**	**6**
28	NE98410	54.2	64.9	41.2	27.0	54.9	56.6	**49.81**	**43**
29	NE98416	59.4	61.9	40.8	30.8	60.4	54.8	**51.35**	**35**
30	**WESLEY**	**67.8**	**65.7**	**52.4**	**32.1**	**57.8**	**60.5**	**56.05**	**8**
31	**CULVER**	**61.1**	**67.8**	**43.5**	**33.3**	**64.2**	**61.2**	**55.18**	**14**

32	**MILLENNIUM**	**57.2**	**69.6**	**50.1**	**23.2**	**62.7**	**62.3**	**54.18**	**21**
33	NE98424	67.8	65.8	47.0	23.0	63.6	60.9	**54.68**	**18**
34	NE98425	57.7	60.4	51.2	29.7	59.7	58.3	**52.82**	**29**
35	NE98445	59.9	68.4	45.4	34.6	57.5	46.7	**52.07**	**32**
36	NE98466	63.1	72.4	44.2	30.3	65.2	54.6	**54.94**	**15**
37	NE98471	63.0	70.6	49.4	38.8	62.9	70.9	**59.24**	**2**
38	NE98476	49.9	63.7	40.5	27.2	57.2	57.4	**49.33**	**48**
39	NE98502	48.9	52.7	38.6	29.7	54.2	62.1	**47.68**	**53**
40	NE98503	63.7	67.1	45.4	28.4	66.9	63.3	**55.80**	**9**
41	NE98530	52.8	71.4	43.0	17.7	61.0	51.6	**49.56**	**46**
42	NE98564	55.2	69.3	46.0	25.0	60.1	64.8	**53.39**	**26**
43	NE98574	59.8	64.8	40.9	31.0	59.3	48.9	**50.79**	**38**
44	NE98589	53.9	70.4	45.8	32.6	64.0	65.5	**55.36**	**13**
45	NE98594	52.8	67.8	48.3	24.1	57.5	60.1	**51.75**	**33**
46	NE98602	53.5	64.9	46.0	23.7	60.6	56.0	**50.78**	**39**
47	NE98632	69.7	76.7	51.1	21.2	63.3	68.0	**58.33**	**3**
48	NE98646	60.8	65.0	45.3	24.8	63.7	59.7	**53.23**	**27**
49	**BUCKSKIN**	**39.5**	**47.7**	**36.3**	**20.6**	**49.7**	**53.0**	**41.13**	**60**
50	**CHEYENNE**	**52.7**	**59.2**	**33.2**	**23.1**	**49.1**	**51.0**	**44.70**	**58**
51	NE98684	50.7	64.8	43.7	37.0	67.8	69.7	**55.60**	**11**
52	NE98691	55.5	65.4	45.3	18.0	57.4	53.2	**49.15**	**49**
53	NE98692	58.7	72.2	49.4	26.9	61.7	65.5	**55.73**	**10**
54	NE98714	55.6	61.0	50.1	19.6	69.1	59.1	**52.41**	**30**
55	NI98418	56.2	58.1	47.3	31.0	67.8	69.1	**54.92**	**17**
56	NI98438	54.3	64.1	43.7	18.8	63.7	57.5	**50.35**	**40**
57	NI98439	60.2	69.1	51.4	28.5	68.7	62.1	**56.66**	**7**
58	NI97405	63.4	64.1	45.0	28.7	59.8	62.7	**53.96**	**23**
59	NI97435	46.0	67.2	44.4	22.0	62.4	65.0	**51.16**	**36**
60	NI99412	59.6	72.3	49.6	17.6	60.4	54.9	**52.40**	**31**
	Average	57.05	64.99	44.97	26.03	60.22	59.76	52.17	
	CV	17.18	8.33	12.34	20.94	8.68	10.32	13.49	
	LSD	11.46	9.05	6.49	9.11	6.11	7.21	8.44	

5. Nebraska Triplicate Nursery:

The same comments about the NIN data apply to the Nebraska Triplicate Nursery (NTN) with the exception that Sidney was harvested.

----------yield (bu/a)----------

VARIETY	Linc.	Mead	Clay C.	N.Platte	McCook	Sidney	Alliance	Grant	STAVG	STRANK
NE01417	63.58	44.09	58.32	17.70	42.40	20.52	18.86	28.81	36.785	59
NE01422	74.34	65.25	78.15	35.66	45.70	30.34	22.75	27.42	47.451	4
NE01431	73.26	63.75	74.50	26.29	49.10	21.26	20.05	27.61	44.478	22
NE01434	63.92	60.35	65.72	37.84	46.00	20.50	19.26	22.61	42.025	36
NE01435	64.07	67.17	66.17	36.68	47.25	23.82	28.79	27.26	45.151	17
NE01453	62.46	67.01	52.01	36.26	41.18	13.42	21.84	12.97	38.394	54

NE01458	58.00	55.17	74.90	34.09	44.35	16.05	23.18	26.91	41.581	40
NE01459	65.47	53.88	75.42	36.05	35.88	18.11	20.70	25.36	41.359	41
NE01463	64.76	46.11	62.68	34.27	35.18	17.04	18.50	22.96	37.688	58
NE01466	66.61	51.29	65.59	34.12	39.53	18.74	18.57	18.73	39.148	53
NE01468	61.84	45.81	63.75	33.58	37.28	16.89	20.38	23.54	37.884	56
NE01469	66.43	39.55	62.52	38.60	37.10	18.71	20.10	21.65	38.083	55
NE01472	66.30	50.15	61.42	34.27	39.30	18.24	18.69	24.95	39.165	52
NE01473	66.49	51.35	63.71	35.43	39.08	17.54	19.76	25.65	39.876	50
ALLIANCE	76.82	67.72	66.64	33.27	46.35	21.76	22.95	25.74	45.156	16
NE01474	69.22	53.27	66.07	34.62	43.23	19.46	18.88	21.65	40.800	46
NE01475	68.39	59.42	53.98	35.06	41.93	20.05	16.47	27.22	40.315	47
NE01479	60.18	53.09	61.79	18.98	43.45	21.21	20.76	23.15	37.826	57
NE01481	75.51	70.84	71.53	36.36	50.98	25.60	24.12	22.49	47.179	6
NE01482	70.79	63.49	58.00	25.12	49.00	22.56	23.39	23.69	42.005	37
NE01483	68.02	63.23	56.57	26.79	49.40	20.78	24.24	28.56	42.199	35
NE01484	72.40	48.92	64.64	31.20	40.05	18.89	18.95	25.95	40.125	49
NE01485	75.93	68.81	57.56	20.03	48.20	25.11	24.51	27.58	43.466	26
NE01490	73.38	54.90	61.05	35.86	46.20	19.01	24.62	26.37	42.674	30
NE01502	58.72	62.21	73.00	23.35	46.60	11.52	18.54	21.87	39.476	51
NE01504	74.12	64.21	49.06	30.68	42.88	21.47	28.20	28.13	42.344	34
NE01506	69.33	69.73	64.94	30.69	45.98	27.98	20.41	28.01	44.634	21
NE01507	72.41	65.21	75.61	25.11	47.38	27.00	19.99	27.15	44.983	20
NE01508	72.63	75.16	80.29	31.15	38.85	15.57	22.46	24.18	45.036	19
PRONGHOR	66.81	55.01	58.12	25.45	43.83	28.73	21.64	28.54	41.016	43
NE01509	84.77	57.03	68.57	34.58	36.65	13.85	22.35	26.43	43.029	28
NE01532	68.11	70.51	60.62	24.65	38.38	15.91	19.18	24.19	40.194	48
NE01533	68.34	77.09	73.35	24.93	49.50	23.61	15.92	29.78	45.315	15
NE01534	79.65	70.63	71.96	33.24	46.43	18.34	19.30	29.13	46.085	13
NE01550	66.74	71.83	71.10	42.80	47.18	22.15	24.72	33.02	47.443	5
NE01551	77.20	67.17	62.18	32.90	46.95	21.39	19.88	23.79	43.933	24
NE01552	61.04	59.37	78.18	36.64	50.48	19.76	24.07	31.35	45.111	18
NE01553	62.16	60.35	64.99	30.76	46.73	15.22	21.98	25.22	40.926	44
NE01564	77.32	67.06	75.30	39.58	43.55	25.75	20.04	26.89	46.936	8
NE01581	64.01	69.46	64.13	27.77	42.10	19.27	22.10	26.36	41.900	38
NE01582	63.76	62.33	72.06	24.93	43.75	29.07	20.59	22.58	42.384	33
NE01583	70.24	58.56	65.64	22.27	46.43	30.27	22.56	27.08	42.881	29
NE01584	63.23	65.01	64.29	21.73	47.85	23.50	24.81	28.77	42.399	31
NE01601	66.72	68.23	78.49	36.35	51.10	16.38	25.25	27.24	46.220	12
WESLEY	74.73	75.16	62.70	40.24	56.50	14.97	21.92	24.85	46.384	11
NE01602	67.18	65.23	80.53	28.68	59.33	28.19	19.69	28.24	47.134	7
NE01603	73.35	72.51	80.00	42.94	56.83	23.45	22.10	26.68	49.733	2
NE01604	73.76	63.73	70.69	34.58	46.85	20.97	25.86	29.85	45.786	14
NE01609	71.23	61.48	56.26	30.63	36.65	20.14	21.04	29.61	40.880	45
NE01617	74.33	63.77	69.33	32.21	47.78	17.65	23.67	24.40	44.143	23
NE01638	74.52	63.93	66.42	27.00	37.70	17.27	19.11	22.33	41.035	42

NE01639	52.31	52.17	53.59	20.18	40.45	15.33	20.30	22.23	34.570	60
NE01643	80.23	76.95	75.09	41.19	57.95	28.09	23.22	31.50	51.778	1
NE01681	70.35	70.40	64.65	25.30	48.43	20.26	20.73	18.98	42.388	32
NE01704	74.85	55.37	73.46	17.50	47.63	19.64	23.60	33.31	43.170	27
NE01709	68.17	74.18	70.70	42.95	47.55	18.74	22.90	26.99	46.523	9
NE01712	60.26	76.35	41.14	40.98	41.73	23.18	23.58	27.40	41.828	39
NI01808	77.86	68.79	65.89	36.45	48.53	26.82	20.48	27.04	46.483	10
NI01828	75.53	72.54	76.40	41.10	49.80	21.63	22.29	23.24	47.816	3
NE01578	61.89	68.12	66.60	32.80	44.03	26.54	25.62	25.41	43.876	25
GRAND MEAN	69.10	62.69	66.47	31.71	45.14	20.92	21.67	25.84	42.943	
CV	7.24	5.46	9.86	12.38	5.22	9.17	11.56	6.01		
LSD	6.77	5.72	8.87	6.56	3.94	2.60	3.39	2.59		

Fifty-eight entries were submitted to the Nebraska Wheat Quality Laboratory for large-scale quality testing from the 2001 Duplicate Nursery. This is the first year that large-scale analyses is completed on this group. Three varieties: Pronghorn, Wesley, and Alliance were included as checks. The flour protein (on a 14% moisture base) ranged from 11.6%(NE01417) to 14.9%(NE01712). The majority of entries flour protein ranged between 13% and 14%. Three samples were noted to have very good quality characteristics. NE01553 received Very Good bread scores, with the crumb color noted as "Bright White." NE01609 also had very good scores for all bread characteristics. NE01458 milled very well and had an outstanding flour yield of 74.4%. Two entries had results of less acceptable quality. NE01639 milled very poorly and plugged the reduction side of the Buhler Mill. A kernel hardness test on the Single Kernel Hardness System verified that this is a soft wheat. Additionally, NE01506 had less desirable baking characteristics with the crumb texture noted as weak. All other entries had acceptable or above evaluations. Nineteen lines were advanced for further testing in the 2002 NIN.

Wesley, Alliance, and number of experimental lines had very good years. Data for the 2001 NTN follow:

		----------bu/a----------									
Entry	Variety	Winsur	McCook	Linc.	ClayC.	Mead	Grant	Allian.	Sidn.	St. Avg.	St. Rank
1	NE00403	8.42	41.6	76.8	62.9	65.6	39.2	56.7	36.4	**54.17**	**15**
2	NE00429	9.72	34.3	74.5	74.4	74.2	39.1	62.4	37.9	**56.67**	**8**
3	NE00435	8.78	32.6	70.4	64.1	72.2	39.4	63.6	37.7	**54.28**	**14**
4	NE00436	8.07	31.0	66.2	63.5	66.5	38.2	54.2	37.9	**51.08**	**30**
5	NE00439	7.90	33.7	87.1	60.5	60.9	41.1	46.2	37.9	**52.48**	**24**
6	NE00443	7.69	24.0	65.6	45.4	53.5	35.9	45.6	31.9	**43.13**	**50**
7	NE00446	6.37	23.9	60.6	32.7	49.5	29.4	54.2	39.0	**41.32**	**54**
8	NE00447	9.42	31.9	68.0	66.0	65.4	37.7	64.3	47.6	**54.42**	**12**
9	NE00452	8.69	34.1	65.5	67.3	62.8	26.6	51.5	40.7	**49.77**	**34**
10	NE00456	8.95	35.4	72.4	68.8	64.5	35.9	58.6	42.8	**54.06**	**16**
11	NE00469	8.43	32.0	68.5	71.6	67.6	30.9	57.9	38.9	**52.49**	**23**
12	NE00479	8.11	23.7	81.2	73.7	70.8	34.2	52.8	36.8	**53.31**	**20**
13	NE00480	6.39	28.0	58.4	56.2	47.8	35.0	45.5	38.5	**44.19**	**46**
14	NE00481	8.24	23.4	80.5	66.2	75.0	32.4	50.3	39.7	**52.50**	**22**
15	Alliance	8.51	34.7	70.9	79.8	68.8	41.2	58.4	39.9	**56.25**	**9**
16	NE00485	4.58	33.4	66.9	16.7	27.3	32.9	51.7	33.1	**37.43**	**60**

17	NE00488	8.35	30.8	76.0	62.2	68.5	34.1	51.6	36.4	**51.38**	**29**
18	NE00493	6.61	24.9	61.7	36.6	38.9	25.2	51.3	32.3	**38.70**	**59**
19	NE00495	7.06	26.9	65.9	42.5	54.2	30.0	46.9	37.4	**43.43**	**49**
20	NE00500	8.72	26.0	67.1	62.1	65.9	29.6	47.9	36.3	**47.82**	**40**
21	NE00507	9.19	33.1	69.0	58.0	66.6	38.0	55.7	41.4	**51.69**	**27**
22	NE00525	8.07	33.8	56.5	61.6	57.3	41.3	64.0	39.2	**50.52**	**32**
23	NE00532	4.17	20.7	69.9	34.9	40.2	37.5	42.9	34.4	**40.07**	**58**
24	NE00540	6.64	36.8	76.5	33.2	62.2	38.3	54.7	34.1	**47.98**	**38**
25	NE00544	8.89	35.4	77.1	72.6	72.9	40.2	61.2	43.6	**57.59**	**5**
26	NE00548	8.54	30.1	62.4	58.1	66.0	38.0	52.2	34.2	**48.70**	**36**
27	NE00556	7.63	31.9	69.7	61.2	65.7	41.6	53.0	41.3	**52.05**	**26**
28	NE00559	8.02	36.7	68.7	59.6	58.3	29.0	45.5	37.9	**47.96**	**39**
29	NE00564	9.37	36.0	81.3	83.1	82.3	33.5	52.7	37.8	**58.10**	**4**
30	Pronghorn	8.78	30.3	59.2	72.0	84.4	30.0	56.3	40.9	**53.30**	**21**
31	NE00566	8.19	28.5	68.6	68.7	70.5	32.5	57.9	40.1	**52.39**	**25**
32	NE00571	8.58	29.5	73.8	56.8	55.5	39.2	52.7	41.0	**49.79**	**33**
33	NE00578	8.35	28.5	69.0	81.0	77.0	41.0	55.6	40.2	**56.03**	**10**
34	NE00597	7.05	25.8	62.4	45.6	50.8	33.0	49.1	33.9	**42.95**	**51**
35	NE00606	6.85	23.2	53.7	58.2	57.8	35.6	58.5	36.2	**46.20**	**44**
36	NE00609	8.10	34.4	83.1	69.3	68.1	36.5	52.9	42.2	**55.22**	**11**
37	NE00611	8.66	30.2	66.7	71.8	76.6	38.5	54.8	37.1	**53.69**	**19**
38	NE00616	8.55	24.1	79.2	80.0	77.0	34.3	47.1	36.7	**54.03**	**17**
39	NE00624	7.14	34.8	66.9	68.2	57.4	39.6	55.5	34.3	**50.96**	**31**
40	NE00627	5.90	28.9	71.4	53.4	53.7	32.4	54.8	36.9	**47.36**	**42**
41	NE00633	7.29	32.6	74.1	60.6	68.7	40.2	60.7	39.7	**53.79**	**18**
42	NE00636	6.60	33.9	81.4	58.4	63.9	31.0	55.9	36.3	**51.53**	**28**
43	NE00638	7.75	31.5	75.6	58.2	58.0	33.0	56.0	35.0	**49.60**	**35**
44	NE00639	8.88	32.4	77.2	77.4	80.9	35.4	50.1	44.0	**56.77**	**7**
45	Wesley	8.99	28.5	90.9	90.4	69.6	30.1	62.4	36.9	**58.41**	**3**
46	NE00642	6.41	24.5	56.7	42.3	45.7	28.6	54.5	35.5	**41.13**	**55**
47	NE00645	6.90	26.5	63.8	52.5	41.5	23.8	48.7	37.6	**42.04**	**53**
48	NE00649	7.96	29.5	77.1	69.4	56.2	25.1	45.4	35.2	**48.26**	**37**
49	NE00658	8.94	32.7	87.3	89.5	79.8	34.6	50.1	41.7	**59.37**	**1**
50	NE00665	7.41	28.0	58.2	52.9	53.5	22.3	55.8	37.3	**43.98**	**48**
51	NE00669	8.61	26.4	62.7	57.8	60.2	27.8	59.2	38.3	**47.49**	**41**
52	NE00679	8.91	27.5	76.9	82.7	83.4	33.4	57.7	37.0	**56.94**	**6**
53	NE00687	8.87	27.7	89.7	86.0	77.3	30.4	63.6	38.6	**59.03**	**2**
54	NE00691	4.82	27.0	64.7	40.4	34.6	34.4	48.7	32.2	**40.28**	**57**
55	NE00698	8.43	28.8	76.0	83.0	72.4	30.0	53.1	36.7	**54.30**	**13**
56	NI00414	6.09	29.1	75.0	48.8	54.3	33.5	53.8	31.5	**46.56**	**43**
57	NI00434	6.48	30.9	61.5	44.2	47.4	29.5	52.2	33.6	**42.77**	**52**
58	NI00433	6.83	30.5	65.7	46.0	57.6	36.3	43.8	41.8	**45.96**	**45**
59	NI00436	5.80	25.9	69.7	36.2	47.4	30.8	41.7	32.9	**40.67**	**56**
60	NI00437	7.06	29.2	69.2	39.4	51.3	35.1	46.2	38.7	**44.15**	**47**
	Avg.	7.74	30.03	70.71	60.61	62.07	34.05	53.47	37.72	**49.81**	

	CV		10.848	8.693	12.320	9.975	6.446	10.71	7.819		
	LSD		5.446	8.321	10.109	10.349	3.668	7.75	3.992		

Data for the 2000 NTN follow:

		---------- Yield (bu/a)----------							
ENTRY	VARIETY	Lincoln	Mead	Clay Cen	McCook	Sidney	Alliance	Average	**Rank**
1	NI99412	64.5	93.2	44.3	26.9	78.9	57.2	60.82	**5**
2	NI99416	58.1	69.9	46.4	34.7	89.9	61.0	60.02	**6**
3	NI98414	51.4	78.0	45.7	28.6	89.4	57.3	58.40	**18**
4	NE99404	50.9	69.3	40.1	34.9	68.3	55.3	53.14	**49**
5	NE99405	55.8	64.8	42.1	33.0	70.3	40.5	51.07	**56**
6	NE99406	55.6	68.4	43.5	38.7	82.6	45.6	55.72	**36**
7	NE99407	48.6	54.1	43.7	35.5	85.8	58.0	54.28	**43**
8	NE99410	56.7	65.1	45.0	38.4	87.7	67.1	60.01	**7**
9	NE99411	51.7	67.9	43.8	29.7	71.6	49.7	52.40	**54**
10	NE99413	48.5	66.6	44.2	22.3	72.6	49.7	50.65	**57**
11	NE99417	47.0	60.4	35.5	31.1	74.2	47.1	49.23	**60**
12	NE99418	56.4	70.5	38.7	35.9	73.8	57.9	55.54	**37**
13	NE99424	52.7	81.1	46.4	35.8	82.9	50.7	58.26	**21**
14	NE99428	58.1	71.6	39.8	30.5	80.3	52.4	55.45	**39**
15	ALLIANCE	58.2	74.9	44.2	35.4	89.1	55.1	59.48	**9**
16	NE99430	43.0	74.4	40.7	29.0	84.2	51.5	53.78	**47**
17	NE99431	55.3	74.7	37.8	34.8	71.8	54.4	54.79	**42**
18	NE99437	43.9	68.0	43.9	36.8	74.7	57.8	54.17	**45**
19	NE99441	64.2	60.4	36.1	32.7	76.1	48.9	53.06	**51**
20	NE99443	48.4	68.5	40.3	33.6	87.9	60.1	56.46	**33**
21	NE99445	57.1	76.8	50.0	34.5	91.0	57.2	61.08	**4**
22	NE99464	63.9	60.5	47.7	37.9	78.7	52.0	56.78	**31**
23	NE99469	61.6	66.5	44.7	34.3	85.6	63.5	59.37	**11**
24	NE99471	54.1	67.7	38.1	29.3	77.3	59.0	54.25	**44**
25	NE99489	60.9	68.1	46.7	33.1	85.3	61.5	59.27	**13**
26	NE99495	55.7	78.3	45.8	38.7	87.7	50.4	59.43	**10**
27	NE99496	51.6	69.5	39.8	39.1	81.1	56.3	56.23	**35**
28	NE99504	50.8	77.5	37.0	35.4	80.5	58.2	56.57	**32**
29	NE99508	55.3	68.3	45.2	34.3	76.5	58.5	56.37	**34**
30	PRONGHORN	49.7	63.9	38.8	27.0	75.0	62.2	52.77	**52**
31	NE99510	65.2	77.8	42.8	34.3	81.8	55.7	59.59	**8**
32	NE99512	54.9	71.8	41.8	28.1	72.0	55.9	54.10	**46**
33	NE99513	60.3	69.7	42.5	40.5	78.2	60.6	58.64	**17**
34	NE99521	53.6	71.1	52.3	28.6	78.8	56.5	56.82	**30**
35	NE99529	57.0	81.5	46.3	31.7	79.2	49.0	57.44	**27**
36	NE99533	57.4	86.4	54.6	46.7	85.1	60.2	65.06	**1**
37	NE99534	47.4	72.7	36.9	34.3	68.1	53.8	52.19	**55**
38	NE99541	59.0	67.6	38.6	31.2	82.3	53.0	55.29	**40**
39	NE99542	53.5	71.6	40.0	37.7	87.6	59.9	58.39	**19**

40	NE99543	60.2	76.4	43.3	37.9	87.4	64.0	61.54	**3**
41	NE99552	61.3	73.9	44.0	24.3	84.7	61.5	58.29	**20**
42	NE99554	54.0	80.2	44.2	34.4	75.6	58.9	57.88	**23**
43	NE99555	45.6	74.9	40.3	30.1	81.0	48.2	53.35	**48**
44	NE99559	56.3	75.6	45.1	23.8	80.7	51.2	55.45	**38**
45	2137	59.2	77.8	46.1	36.0	84.1	51.5	59.13	**14**
46	NE99575	55.9	67.5	38.6	34.2	97.3	62.2	59.28	**12**
47	NE99578	57.9	65.2	46.0	35.3	88.4	55.7	58.07	**22**
48	NE99579	57.4	81.7	44.2	27.9	82.3	52.3	57.64	**24**
49	NE99585	51.2	87.1	52.2	31.7	78.1	45.4	57.60	**25**
50	NE99604	55.8	65.5	41.3	20.8	66.3	49.8	49.91	**59**
51	NE99617	56.3	70.6	37.4	28.6	85.6	64.9	57.23	**28**
52	NE99626	53.7	70.9	36.8	18.8	68.7	55.1	50.65	**58**
53	NE99636	53.6	67.4	39.1	27.9	79.6	51.1	53.13	**50**
54	NE99656	49.8	72.0	43.9	30.6	87.9	61.1	57.56	**26**
55	NE99669	56.2	71.7	44.1	28.5	75.2	56.0	55.28	**41**
56	NE99675	67.8	82.9	39.5	22.4	86.1	53.8	58.73	**15**
57	N99L011	51.3	73.8	43.4	34.9	80.9	56.9	56.86	**29**
58	N99L012	69.6	78.1	41.0	36.9	89.1	55.0	61.63	**2**
59	N99L031	48.5	71.2	40.4	19.5	89.4	46.6	52.59	**53**
60	N99L033	64.8	76.2	47.1	35.4	68.5	60.0	58.67	**16**
	Average	55.4	72.2	42.8	32.3	80.7	55.4		
	CV	10.2	6.5	7.5	11.4	7.0	9.4		
	LSD	7.7	7.8	4.4	6.2	7.6	7.1		

6. Regional Nurseries

In 2002, we made a major change in how we handle our regional nurseries. We combined into one larger nursery the Southern Regional Performance Nursery (SRPN), the Northern Regional Performance Nursery (NRPN), and our elite herbicide tolerant lines, which were planted at Lincoln, North Platte, Sidney, and Alliance. At Clay Center, only the SRPN was planted. Using our advanced statistical analytical procedures, we are able to analyze complex trials. The benefit of combining the trials is that we are able to directly compare all the advanced lines in one trial. Trial to trial variation is common in our diverse locations. Yields were as follows:

		----------bu/a----------				----------bu/a----------	
ENTRY	VARIETY	Linc.	N. Platte	STAVG	STRANK	Clay C.	STAVG
1	Kharkof	44.500	41.401	42.95	95	41.33	42.41
2	Roughrider	52.393	37.699	45.05	94		
3	Nuplains	85.935	43.171	64.55	43		
4	Nekota	75.175	52.733	63.95	46		
5	G970252W	81.781	44.939	63.36	51		
6	SD97457	87.239	49.952	68.60	10		
7	SD92107-3	66.373	45.306	55.84	87		
8	SD92107-5	66.213	45.424	55.82	88		
9	SD97049	78.669	52.895	65.78	33		
10	SD97250	71.804	56.081	63.94	47		

11	SD97W609	73.305	56.370	64.84	40		
12	NW97S277	80.828	52.058	66.44	23		
13	NW98S078	78.892	56.477	67.68	15		
14	NW99L7042	70.333	45.638	57.99	81		
15	NW99L7068	80.175	49.013	64.59	42		
16	NW99L7083	79.957	51.219	65.59	36		
17	NW99L7171	72.109	50.326	61.22	65		
18	NE98471	88.472	55.767	72.12	3		
19	NE98503	70.690	43.966	57.33	83		
20	NE96737	80.795	50.637	65.72	35		
21	NI98418	83.742	56.655	70.20	7		
22	NE99445	73.365	46.757	60.06	72		
23	NE99469	80.526	50.148	65.34	38		
24	NE99495	81.920	49.743	65.83	32		
25	NE99533	78.205	53.884	66.04	30		
26	Scout 66	62.118	44.608	53.36	92	49.14	51.96
27	TAM-107	76.304	56.050	66.18	27	60.99	64.45
28	Trego	84.808	56.335	70.57	6	74.02	71.72
29	T003X	76.578	54.314	65.45	37	76.22	69.04
30	T004X	71.593	53.505	62.55	56	68.14	64.41
31	T128	69.361	48.226	58.79	79	63.24	60.28
32	T129	86.632	56.548	71.59	4	68.31	70.50
33	G970246	80.987	45.482	63.23	52	76.49	67.65
34	G970019	71.693	48.148	59.92	74	61.87	60.57
35	G970447	80.522	49.379	64.95	39	67.53	65.81
36	G970466	81.436	46.859	64.15	45	74.39	67.56
37	G970454	63.586	50.582	57.08	85	66.96	60.38
38	G970343	67.105	46.240	56.67	86	64.08	59.14
39	SD97457	83.319	50.606	66.96	20	69.51	67.81
40	NE97V121	89.034	47.543	68.29	12	64.25	66.94
41	NE98632	91.861	47.273	69.57	8	44.51	61.21
42	NE98466	84.269	50.869	67.57	16	67.75	67.63
43	NI98439	80.564	52.281	66.42	24	59.41	64.09
44	NE99543	83.300	53.644	68.47	11	59.03	65.32
45	KS940786-6-7	77.544	49.634	63.59	49	50.24	59.14
46	KS940786-17-2	79.294	52.242	65.77	34	67.00	66.18
47	KS940748-2-2	69.941	41.379	55.66	90	58.38	56.57
48	OK96717-99-6756	74.907	43.149	59.03	78	63.97	60.68
49	OK96705-99-6738	82.923	51.517	67.22	17	72.72	69.05
50	OK95548-98-6654	69.738	48.547	59.14	77	78.13	65.47
51	OK98697	71.647	45.323	58.49	80	61.99	59.65
52	OK98699	74.511	44.850	59.68	75	64.81	61.39
53	OK95616-98-6756	80.067	44.535	62.30	60	62.59	62.40
54	TX98D1170	86.861	55.027	70.94	5	78.67	73.52
55	TX98D2423	70.366	40.455	55.41	91	55.74	55.52

56	TX99D4151	81.273	50.944	66.11	28	66.28	66.17
57	TX99D4572	74.714	46.059	60.39	70	59.81	60.19
58	CO970547	78.439	42.690	60.56	68	55.20	58.78
59	CO99508	69.386	55.449	62.42	58	63.06	62.63
60	CO99534	66.724	56.910	61.82	62	65.16	62.93
61	TX97A0122	71.820	49.978	60.90	66	72.10	64.63
62	TX97A0244	74.745	58.404	66.57	21	63.58	65.58
63	TX97A0169	82.036	50.530	66.28	26	65.08	65.88
64	TX99A0155	79.809	43.236	61.52	64	52.96	58.67
65	TX97V2838	89.212	46.432	67.82	14	62.47	66.04
66	TX98V9628	94.277	51.982	73.13	2	71.48	72.58
67	TX98V9437	91.156	38.354	64.76	41	53.91	61.14
68	W98-362	91.245	59.423	75.33	1	70.89	73.85
69	W99-331	78.663	41.424	60.04	73	74.77	64.95
70	W99-259-8	70.490	36.016	53.25	93	64.20	56.90
71	NH01004	79.664	41.808	60.74	67		
72	NH01009	69.968	41.434	55.70	89		
73	NH01017	73.373	51.482	62.43	57		
74	NH01018	70.396	48.293	59.34	76		
75	NH01021	72.753	50.746	61.75	63		
76	NH01022	73.475	47.490	60.48	69		
77	NH01023	81.213	54.919	68.07	13		
78	NH01024	79.459	52.405	65.93	31		
79	NH01025	73.229	51.534	62.38	59		
80	NH01026	64.451	50.883	57.67	82		
81	NH01028	77.622	48.087	62.85	54		
82	NH01029	73.367	51.762	62.56	55		
83	NH01031	81.983	50.834	66.41	25		
84	NH01034	75.259	50.478	62.87	53		
85	NH01036	81.810	51.107	66.46	22		
86	NH01037	77.015	50.363	63.69	48		
87	NH01038	66.408	58.193	62.30	61		
88	NH01039	71.417	55.610	63.51	50		
89	NH01042	78.752	55.317	67.03	19		
90	NH01045	78.737	53.378	66.06	29		
91	NH01046	79.362	59.470	69.42	9		
92	NH01048	82.842	45.565	64.20	44		
93	NH01049	79.142	55.009	67.08	18		
94	NH01068	64.220	56.185	60.20	71		
95	NH01072	69.782	44.685	57.23	84		
	GRAND MEAN	76.589	49.666			64.18	
	CV	6.782	6.253			11.57	
	LSD	7.011	4.192			10.08	

In reviewing the 2002 data, the early lines which tended to avoid the late season drought tended to do

very well.

7. Multiple-Location Observation Nursery

Five replications (locations) in Nebraska (Lincoln, Mead, Clay Center, McCook, and Grant) of this nursery were harvested and used for selection. Sidney and Alliance were lost to drought hence selections were made without data from western Nebraska. Due to budget cuts in 2002-2003 we dropped the McCook and Grant sites, so we hope that all of our locations will be harvestable in 2003. Fifty-one lines were advanced for further testing.

8. Early Generation Nurseries

a. Single-plot Observation Nursery

Seventeen hundred ninety-three lines including checks were evaluated at Lincoln in 2002. Of the 1793 lines and checks, 1463 where red seeded and 330 where white seeded. Most of the white seeded lines were pure white, while any segregating red and white line was grown among the red lines. Of this group, 473 were harvested and 445 samples were submitted for Quadrumat Junior milling, flour protein content, and dough mixing properties. As in the past, the turn-around time in the Wheat Quality Laboratory was excellent (all quality evaluations completed by the end of August). On the basis of agronomic and quality performance, 202 red, 15 herbicide tolerant, and 74 white wheat lines were selected for further testing. In 2001, 260 red wheat and 30 white wheat lines were selected for further testing; hence our white wheat efforts continue to expand.

b. Headrow Nursery

Over 43,000 headrows were planted at Mead. In general, the headrow nursery had an excellent start due to early planting (our two plating crew effort) and adequate moisture with little winter injury. We harvested over 1700 lines and planted 1646 (1488 red or segregating red and white; and 157 white wheat lines). Of the red and white wheat lines, 345 where sent to Dr. Baltensperger for planting at Scottsbluff in our irrigated observation nursery, 43 to Cheryl Baker (USDA-ARS, Stillwater OK) for Russian Wheat Aphid testing, and 53 lines to Gary Hein to test for wheat steak mosaic virus tolerance.

a. F3 bulk hybrids

The F3 bulk hybrid nursery contained 668 red or red and white segregating bulks (includes 50 bulks shared by Colorado State University) and 173 white bulks. All plots were planted at Mead and most were planted at Sidney. Most bulks survived the winter and were above average for selection. Heads were selected from the Mead bulks and the seed quality would be considered as above average. The number of F3 bulks is large. Over 40,000 head rows were selected for fall planting (of which approximately one fourth are white seeded). The headrows were planted early into good moisture while we were planting our western nurseries. Their emergence and stand was excellent. The project goal remains to have

sufficiently good segregating F3 material to select about 40 - 45,000 headrows.

b. F2 bulk hybrids

The F2 bulk hybrid nursery contained 818 red (including segregating red and white) and 120 white bulks and check plots. These bulks generally survived the winter, but some were winterkilled (those involving wintertender parents) and some were damaged by rodents and birds. As in the past, we continue to share our bulks with other programs and receive bulks from other programs. Due to the large number of bulks, about 589 red and 100 white bulks were advanced as individual bulks for further consideration in 2003 from our program.

9. Winter Triticale Nursery

In 2002, no new triticale lines were released for commercial sale. Our previous releases have done well and slightly over $12,000 in research and development fees were collected by Dec. 1, 2002. There is a 20% collection fee that cannot exceed $4,000 for all lines (wheat, triticale, soybeans, etc.) sold through the Nebraska Crop Improvement Association (our released lines and those purchased by Nupride Genetics,) and a 20% collection fee for lines sold through the Nebraska Foundation Seed Division (NFSD; the lines licensed through NSFD). We expect about $9500 to come to the University of Nebraska. There is some debate as to how that money will be divided within the university. The Vice Chancellor of Research would like to assess a 15% indirect cost to all research and development fees. The Department of Agronomy and Horticulture will assess a 10% handling charge for keeping the research and development fee accounts. Hence, the triticale-breeding program should receive about $7000 this year. These funds will be extremely important in developing a sustainable triticale-breeding program. In 2003, we expect our acreage to increase for both triticale cultivars. One new line, NE95T426 which has exceptional grain yield and good fall forage characteristics (determined by Dr. Carlyle Thompson of Kansas State University, Hays, KS whose help and interest in fostering triticale production is invaluable) is under increase. Our goal will be to develop triticale blends involving NE95T426 with our forage triticales (which are haying or spring forage types), so that the blend will have good fall and spring forage potential and will have less costly to produce. Excellent collaborations were established with a team of triticale researchers at Iowa State University (the breeder is Dr. Jean Luc Jannick) who are interested in grain triticale to diversify their cropping systems. While the future is always uncertain, triticale is being given a careful look to determine if it can aid producers.

Visual selection was used to select early generation lines and head rows for advancement. The key to improved triticale varieties remains access to improved triticale germplasm and efforts continue to increase germplasm diversity.

The triticale nurseries this year were average at Lincoln, above average at Mead, and below average due to drought at Sidney (though it should be noted that triticale yields were quite good compared to Arapahoe, presumably due to triticale having better drought tolerance and tolerance to wheat streak mosaic virus). The yields in Iowa were phenomenal and may be inflated due to edge effects (the plots are not “tightly” planted), but they are exceptional by Nebraska standards.

Data for 2002 are:

VARIETY	TYPE	Linc.	Mead	Sidney	NE.AVG	NE. Rank	IA. AVG	IA. Rank	AVG.
		lbs/a	lbs/a	lbs/a	lbs/a		lbs/a		lbs/a

PRESTO	GR	2956	3304	1904	2721	17	5308	18	4015
NE95T426	GR	3823	4445	1960	3409	2	6358	3	4883
NE95T427	GR	3626	4500	1542	3223	6	6344	4	4784
NE96T422	FO	2679	3059	1594	2444	23	4838	26	3641
NE96T441	FO	2620	2835	1487	2314	25	4913	25	3613
NE98T424	GR	3959	4259	1589	3269	5	6115	6	4692
NE98T425	FO/GR	3196	3913	1619	2909	11	5629	9	4269
NE99T440	GR/FO	3598	3277	1969	2948	9	5396	14	4172
NE99T441	FO	3038	3845	1476	2787	14	5380	15	4083
NEWCALE	GR	3112	3419	1645	2725	16	5618	10	4172
NE99T448	FO	2358	2491	1663	2171	27	5015	24	3593
NT00418	GR	2473	3873	1462	2603	21	5375	16	3989
NT00419	GR	3065	3139	1269	2491	22	5667	8	4079
NT00421	A-/FO	2379	3348	941	2223	26	5446	12	3835
NT00428	GR	3428	3987	1444	2953	8	6517	1	4735
NT00449	FO	3220	3519	1887	2875	12	5158	22	4017
NT01402	0	3132	3530	1611	2758	15	5217	21	3987
NT01410	GR	3388	3710	1727	2941	10	5742	7	4342
NT01411	GR	3216	3240	1640	2699	18	5364	17	4031
ARAPAHOE	GR	2285	2959	1010	2085	28	4753	27	3419
NT01417	0	3128	3503	1328	2653	20	5265	19	3959
NT01421	F0	2019	2437	1262	1906	30	4729	28	3317
NT01422	0	1626	2991	1294	1970	29	4412	30	3191
NT01435	F/G	3691	4498	1940	3376	3	6378	2	4877
NT01443	0	3196	3385	1480	2687	19	5157	23	3922
NT01444	0	3797	3032	1630	2820	13	5230	20	4025
NT01446	0	4212	3604	1461	3092	7	5504	11	4298
NT01451	GR	3933	4811	1925	3556	1	6189	5	4873
NT01456	GR	3755	4367	1751	3291	4	5443	13	4367
TRICAL	FO	2592	3259	1135	2328	24	4594	29	3461
GRAND MEAN		3117	3551	1555					
CV		24.06	7.98	14.96					
LSD		1024	482	317					

Data for 2001 are:

			---------bu/a using 60 lbs/bu----------						(in)
ENTRY	**VARIETY**	**TYPE***	**Linc.**	**Sidn.**	**Mead**	**St. Avg.**	**St. Rank**	**Avg. HD****	**Avg. HT*****
1	PRESTO	G	79.2	38.0	55.2	**57.46**	**9**	22.17	42.55
2	NE95T426	G	80.4	34.2	52.0	**55.54**	**13**	23.00	40.61
3	NE95T427	G	101.6	34.9	55.6	**64.02**	**2**	23.00	42.11
4	NE96T420	G	73.7	30.6	50.4	**51.56**	**20**	23.84	43.80
5	NE422T	F	68.1	32.1	52.8	**51.00**	**23**	29.84	53.78
6	NE96T431	G	58.6	32.4	32.9	**41.31**	**30**	23.50	40.65
7	Gro-Green	F	65.6	29.8	69.3	**54.92**	**15**	29.84	50.92

	Plus								
8	NE98T413	G	69.7	27.1	42.2	**46.35**	**27**	21.50	43.08
9	NE98T424	G	84.8	38.0	58.2	**60.33**	**4**	22.84	42.72
10	NEWCALE	G	89.8	21.6	42.6	**51.32**	**21**	21.34	40.46
11	NE98T425	FO/G	97.1	25.8	53.1	**58.64**	**6**	23.17	43.04
12	NE98T428	G	77.3	24.4	49.9	**50.54**	**25**	23.75	44.81
13	NE98T448	G	81.0	28.9	65.0	**58.29**	**8**	23.42	45.34
14	NE99T404	G	71.9	34.5	47.5	**51.31**	**22**	23.84	39.69
15	NE99T440	G/F	74.6	31.0	59.8	**55.13**	**14**	20.84	42.21
16	NE99T441	F	74.8	24.4	58.7	**52.62**	**18**	24.59	45.54
17	NE99T448	F	88.6	38.7	61.9	**63.08**	**3**	20.92	44.83
18	NT00409	G	84.0	37.7	50.2	**57.29**	**11**	22.34	40.58
19	NT00410	G	89.5	31.5	54.5	**58.52**	**7**	22.25	40.46
20	ARAPAHOE	CG	60.6	43.1	58.9	**54.19**	**16**	23.17	35.55
21	NT00418	G	95.4	31.0	54.1	**60.16**	**5**	22.34	39.98
22	NT00419	G	90.0	30.5	51.6	**57.37**	**10**	22.34	39.71
23	NT00421	A-/FO	76.0	32.2	48.3	**52.18**	**19**	25.25	45.96
24	NT00427	G	64.8	25.2	38.2	**42.75**	**29**	25.59	44.86
25	NT00428	G	89.6	39.6	64.4	**64.52**	**1**	23.75	41.21
26	NT00432	G	86.3	33.5	48.1	**55.95**	**12**	23.34	42.35
27	NT00436	G	73.9	33.9	50.2	**52.65**	**17**	22.84	39.75
28	NT00449	FO	70.1	36.0	45.5	**50.55**	**24**	22.50	44.80
29	NT00459	FO	61.0	19.5	49.0	**43.20**	**28**	24.84	48.64
30	TRICAL	CF	60.5	24.4	58.8	**47.89**	**26**	30.09	50.51
	Average		77.95	31.48	52.63	54.02		23.73	43.35
	CV		12.30	19.15	8.63				
	LSD		13.09	8.23	7.73				

* Type: Forage (F) or Grain (G); A- is awnletted
** Anthesis date, Days after April 30 (data from Lincoln and Mead)
*** Plant Height in inches (data from Lincoln, Mead, and Sidney)

The data from the 2000 Triticale Variety Trial are:

			----------Yield (bu/a)*----------						
ENTRY	VARIETY	TYPE	Lincoln	Sidney	Mead	Average	Rank	HDL	HTL
1	PRESTO	G**	68.74	76.01	53.19	65.98	4	11.1	41.2
2	NE95T426	G	83.93	73.00	65.13	74.02	2	12.3	41.6
3	NE95T427	G	77.12	69.85	76.90	74.62	1	13.3	42.4
4	NE96T420	G	56.73	92.87	53.71	67.77	3	14.2	41.5
5	NE96T422	F	54.10	65.60	41.79	53.83	22	21.8	48.1
6	NE96T431	G	58.90	71.99	55.57	62.15	7	12.5	40.7
7	NE96T441	F	69.08	61.55	43.06	57.90	16	20.8	45.2
8	NE98T413	G	61.62	64.93	61.35	62.63	6	11.0	43.5
9	NE98T424	G	68.28	57.74	65.17	63.73	5	11.4	42.8
10	NEWCALE	G	60.65	58.06	49.08	55.93	21	12.2	41.8
11	NE98T425	FO/G	54.28	61.20	63.82	59.77	10	11.8	42.5
12	NE98T428	G	57.28	68.43	53.63	59.78	9	12.0	41.8

13	NE98T448	G	64.03	59.86	55.02	59.64	11	12.8	41.9
14	NE99T404	G	59.55	67.02	54.98	60.52	8	12.7	41.1
15	NE99T440	G/F	59.82	67.10	48.97	58.63	14	12.7	42.1
16	NE99T441	F	69.43	57.70	51.53	59.55	12	16.0	43.2
17	NE99T448	F	57.93	73.78	39.72	57.14	17	15.4	40.8
18	NT00409	G	71.10	73.30	64.96	69.79	9	13.0	43.0
19	NT00410	G	68.85	69.90	63.01	67.25	12	11.0	44.0
20	ARAPAHOE	CG	47.84	45.72	51.20	48.25	27	13.2	32.4
21	NT00418	G	78.20	82.85	63.00	74.68	3	11.0	43.0
22	NT00419	G	69.50	89.20	62.83	73.84	4	12.0	41.0
23	NT00421	A-/FO	70.25	34.50	70.40	58.38	33	15.0	43.0
24	NT00427	G	82.30	70.65	68.03	73.66	5	12.0	47.0
25	NT00428	G	99.80	68.80	55.56	74.72	2	12.0	44.0
26	NT00432	G	101.45	47.95	66.98	72.13	6	12.0	35.0
27	NT00436	G	73.65	60.00	81.52	71.72	8	13.0	44.0
28	NT00449	FO	78.05	34.00	56.63	56.23	39	14.0	49.0
29	NT00459	FO	68.70	48.60	57.78	58.36	34	17.0	48.0
30	TRICAL	CF	60.29	23.88	42.93	42.37	29	23.5	44.0

* The bushel used in these calculations is 60 lbs/bu so the measurements are directly comparable to wheat. The official triticale bu is 48 lbs/bu.

** Grain or forage type.

10. Wheat Transformation and Tissue Culture Studies

Wheat transformation continues to be a key strategic effort in the wheat improvement overall effort. In our current research, we are emphasizing trying to develop wheat lines with improved Fusarium head blight (FHB) resistance as part of the US Wheat and Barely Scab Initiative. This is a collaborative effort between Dr. T. Clemente and Ms. S. Sato of the Transformation Core facility (does our wheat transformation), Dr. J. Watkins and Ms. J. Schimelfenig of the Department of Plant Pathology (does the screening of conventionally bred and transgenic wheat lines with FHB) and Drs. A. Mitra and M. Dickman, also of the Department of Plant Pathology who are studying new concepts in disease resistance. Ms. S. Mitra has been very helpful in maintaining the plants and doing much of the transgene analysis. So far, we have concentrated on putting in the following genes: a) inhibitors of apoptosis (programmed cell death): ced9, IAP, and BCL X(L), b) lactoferrin and a related derived protein, lactoferricin, and c) related antifungal proteins that have been derived based on similar protein structures. Based on our screening data, it appears that inhibitors of apoptosis, and lactoferrin and lactoferricin inhibit FHB. The level of inhibition in our transgenic lines is less than that of Alsen (an elite FHB tolerant spring wheat with resistance derived from Sumai 3). However, the tolerance indicates our concept is good. We did our first field test this summer. Although it was very dry and our results were difficult to interpret, we learned the regulatory procedure for field-testing.

11. Chromosome Substitution Lines

This research was undertaken with the expectation as we learn more about the wheat genome, we would be able to develop better breeding strategies. It is done in collaboration with Drs. Kent Eskridge, Kulvinder Gill (now the Vogel Chair at Washington State University), and Ismail Dweikat. Dr. Mustafa Erayman, a former graduate student, has continued as a postdoc. Mustafa is "binning" the known probes for chromosome 3A (including the recently developed ESTs) using deletion stocks developed at Kansas State University. His research is helping us understand the recombinational map and the physical map for chromosome 3A. This effort is needed to fill in the gaps in our map and to determine the physical size of the critical chromosome regions. Todd Campbell, completed his Ph.D. and evaluated evaluation of 95 recombinant inbred chromosome lines (RICLs) for Cheyenne (CNN)-Wichita (WI) chromosome 3A lines [e.g. CNN(RICLs3A)] in the field. Because Todd had more replications in each testing location than we have had in the past, he was able to more tightly link markers to traits of interest and to thoroughly study genotype x environmental interactions. In Nebraska genotype x environmental interactions are very important. Mr. Hikmet Budak, had to abandon his study on WI(RICLs3A) because when markers were put on chromosome 3A, he discovered a univalent shift had occurred and the population structure was unsuitable for mapping. Thanks to excellent collaborations with Mr. Mujeeb-Kazi of CIMMYT we have created a larger population of CNN(RICLs3A), which will greatly assist our fine mapping of traits on chromosome 3A and in the future chromosome 6A.

Hikmet Budak studied a series of D-chromosome substitution lines in Presto triticale. The goal of this research was to determine if the genomic constitution of triticale (AABBRR) could be improved by replacing some of the chromosomes from the D-genome of common wheat (genomic constitution is AABBDD). As expected, group 1 and 6 D chromosomes greatly improved end-use quality (these chromosomes contain major glutenin and gliadin genes). No D chromosome substitution improved agronomic performance. Hence it appears, at least with the limited substitutions that were tested, that the D chromosomes do not have promise for agronomically improving triticale. Perhaps translocations involving D chromosome segments would be more successful.

In a very sad note, Mr. Yehia Mater died in a car accident. He, in collaboration with Dr. Ismail Dweikat and Bob Graybosch was developing a new 1A.1R chromosome in which he hoped to combine the best attributes of 1A.1R from Amigo with 1B.1R from Kavkaz. This research is possible due to the elegant cytogenetic manipulations of Dr. Adam Lukaszewski (Univ. of California—Riverside) who created 1A.1R lines where the 1R was previously on 1B in Kavkaz. We have trying to reconstruct his data and are continuing to evaluate his lines.

12. White Wheat

Dr. Bob Graybosch, USDA-ARS and I continue our orderly transfer of white wheat germplasm to the state wheat breeding. The cooperation has been excellent and the goal will be to continue the cooperative USDA-University of Nebraska wheat improvement effort, while building a unified cultivar release program. As mentioned previously, Antelope and Arrowsmith were recommended for release with foundation seed available in the fall of 2003.

Three new white wheat experimental lines were advanced from regional trials to the Nebraska Statewide Small Grains Variety trial for 2003. These are: NW99L7068 and NW99L7083, sister lines from the cross KS84HW1968*RioBlanco/HBY762A//Halt, and NW99L7171 (VH09553-753/N91L019//AP-WI89-163). NW99L7068 and NW99L7083 are both high yield potential, medium (Nuplains height) wheats, with some tolerance to prehavest sprouting, and a medium strength gluten that will make them suitable for both bread and noodles. NW99L7171 has

excellent breadmaking quality, is tolerant to preharvest sprouting, and is a tall (Scout height) long coleoptile wheat, which might be well suited for western Nebraska. These lines also were re-entered in the 2003 USDA-ARS Northern Regional Performance Nursery (NRPN).

Additional experimental white wheats were entered for the first time in the NRPN. These are:

NW97S412-1	(KS87809-10/ARAPAHOE)
NW97S142-1	(KSSB-192-3/NE89529)
NW97S139-1	(KSSB-192-3/NE89529)
NW97S139-2	(KSSB-192-3/NE89529)
NW97S218-lt	[NW97S218 (KS85W663-1-1/KARL92) selection]
NW98S097	(WA691213-27/N86L177//AP-WI89-163)

This group all were re-selections from previously tested hard white wheats. They were reselected for purity of grain color and plant height. NW97S412-1 is a sister line of Arrowsmith. NW97S218-lt is a later maturing selection from NW97S218, a high quality, sprout tolerant (but less than optimal yielding white wheat) formerly tested in the Nebraska Statewide Variety trial. NW98S097 is an excellent breadmaking wheat with low levels of polyphenol oxidase (PPO), and attractive feature for noodle making.

13. Collaborative Research on Wheat Diseases

Dr. John Watkins, 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. What and Barley Scab Initiative), and as time permits with wheat leaf rust. The greenhouse tests were good for stem rust with Ms. Julie Schimelfenig (works with Dr. Watkins) being somewhat harder on our lines than previous evaluators. In her screens, anything that is good, is really very good, so we are erring to the conservative side. In the field, drought prevented a successful stem rust field inoculation and screen. John's efforts to determine the virulence patterns of leaf rust in Nebraska have greatly helped understand this important disease and why some previously resistant lines became susceptible and other previously susceptible lines are becoming for resistant. His efforts are closely coordinated with Dr. Don McVey, USDA-ARS, Cereal Disease Lab, who provides stem rust inoculum and who also tests our lines with a set of stem rust races to identify the resistance genes in those lines. With Dr. McVey's retirement, we are extraordinarily fortunate that he continues to screen our lines. At this moment, it is not clear if the USDA will continue to support stem rust screening which seems extremely short sighted considering the potential devastation caused by the disease. Dr. Watkins and his staff will also take leadership for screening lines in our transgenic lines for FHB in the greenhouse and our breeding lines for FHB in the field.

Work continues on introgressing the resistance from *Agropyron* (the first real resistance/tolerance to wheat streak mosaic virus developed by Dr. Joe Martin, Kansas State University at Hays, Kansas and his co-workers) into adapted wheat varieties. A number of lines that may have this source of resistance were given to Gary Hein who is testing them in the field in Scottsbluff, NE.

14. Considerations on Nursery Sites

Due to reduced funding, we made the decision to drop our testing sites at Grant and McCook. Both sites will be missed as Grant provides a useful back up site for western Nebraska and McCook was an ideal

southwestern Nebraska site to complement North Platte. In the future as we develop sustainable funding sources (e.g. our research and development fees to augment our other sources of funding), we hope to return to McCook. Using our incomplete block designs, we have decided to use three replications at all of our sites except Lincoln, which continues to be our main early generation seed increase site. We (Dr. Kent Eskridge and I) believe that alpha-lattices with very small incomplete blocks (2 to 4 entries per block) will greatly help our data evaluation. This research is ongoing and will require years of data before we can be sure we are analyzing our data in the best possible fashion.

15. Global Change Research

Our global change efforts continue to evolve. Dr. R. Graybosch has taken leadership of he field efforts and for the first time we had a very successful field experiment using covered chambers (tunnels) that provide a temperature gradients. Our chambers are the first "field chambers" in the Great Plains to study warming scenarios and we continue to improve their operation. While we are currently studying elevated temperature, they could be modified to study elevated CO_2 levels. We also developed smaller and more durable chambers which were highly successful, but expensive to operate. The active research group currently includes Drs. Graybosch, B. Beecher, A. Weiss, Madhavan, and S. Baenziger. Now that the bugs have been worked out in how to handle the global change chambers, we expect to collaborate with USDA genomics efforts in Albany, CA who are interesting in studying how the environment affects end-use quality. The goal of this group will be to develop experimental techniques that will allow us to predict what may occur under various global change scenarios (e.g. global warming, elevated CO_2, etc.) and to identify germplasm that may ameliorate these changes. The benefit of this research is that it allows the breeding program to work with a highly interdisciplinary team who can provide insight into future breeding objectives. This work is future oriented, but with the variable climate of Nebraska, many of the possible scenarios (e.g. drought or heat stress, or rapid weather change) occur annually in one or another part of Nebraska, hence has immediate impact. The work of Al Weiss is providing extremely useful information on wheat growth and development and how plants respond to the environment.

16. Diversity in Wheat

In any breeding program, new sources of germplasm (genetic variation) is critical to develop new lines. As part of our understanding genetic variation in Nebraska wheat, Mr. Fufa Birru, in collaboration with Drs. Ismail Dweikat and Kent Eskridge and as part of his Ph.D. studies, is using three different approaches to estimate the genetic diversity of our historic and current lines. One of his goals will be to see if over time, our breeding program has consistently selected certain groups of genes (basically what parts of the genome are selected for and held constant and what parts of the genome are quite flexible depending upon parentage). Ms. Chatuporn Kuleung, in collaboration with Dr. Ismail Dweikat and as part of her Ph.D. studies, is determining how transferable molecular markers are from one genus to another genus. The goal of her research is to determine if the considerable molecular genetic resources in one crop (for example, wheat) can be used to study a crop with less developed molecular genetic resources (for example, triticale).

IV. GREENHOUSE RESEARCH

In 2002, the majority of F_1 wheat populations were grown at Yuma, AZ. We gratefully acknowledge

the support of the Nebraska Foundation Seed Division for financially supporting this effort. Only populations needing additional crosses are being grown in the Lincoln Greenhouses. Based on the results from Arizona, we will continue to increase all of the populations that did not need further crossing in Arizona. This change reduced our greenhouse space and greenhouse labor, and provided much greater quantities of F_2 seed. In future, it is hoped that only parents and those F_1 plants that need additional crosses, and research projects will be grown in the greenhouse.

V. PROPRIETARY RESEARCH

With the advent of plant biotechnology, the necessity and desirability of interacting with commercial companies has increased. We continue to breed herbicide tolerant wheat with one company and with a second company, have negotiated their having access to our germplasm for developing herbicide (different chemistry) tolerant wheat. Dr. Soleman Al-Otayk completed his Ph.D. studying how best to select for herbicide tolerance in wheat. By spraying segregating populations with 2 times the recommended rate of herbicide, 98% of the surviving plants were homozygous and 2% were heterozygous for the tolerance genes. He recommended spraying the segregating populations with at twice the recommended rate in two different years to create populations, which should be 100% homozygous for the tolerance trait.

We received our third year of research and development fees from are agreement with a commercial seed company for the exclusive release of our winter barley germplasm. A number of new barley lines were sent to the company as possible new products. 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. Spring-Sown Wheat Research

A small spring-sown wheat breeding effort was initiated in 1997 and due to lack of funds was greatly scaled back in 2002-2003. Dr. D. Baltensperger coordinates the spring wheat trials at Sidney, and is considering additional trials at other Nebraska sites. He works closely with Dr. D. Lyon on intensified cropping systems as it is expected that spring wheat will be used in new cropping systems. A few crosses will continue to be made at Lincoln mainly between winter and spring wheats to enlarge the winter wheat gene pool. Spring wheat segregants can be easily extracted if desired.

VI. ALLIED RESEARCH

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

The program also depends on interactions and collaborations with the Wheat Board, Nebraska Wheat Growers Association, regional advisory boards, Foundation Seeds Division, Nebraska Crop Improvement Association, the milling and baking industry, and other interested groups and individuals. The Nebraska Wheat Quality Laboratory cooperates closely with the Wheat Quality Council and baked the large-scale

cooperator samples. Numerous groups have visited the laboratory and participated in discussions on quality and marketing. Through these interactions, the program is able to remain focused and dedicated to being a premier provider of quality varieties, information, and technologies to help maintain the Nebraska Wheat Industry.

Summary

The 2002 Nebraska Wheat Crop was estimated at 48,600,000 bu, which represented a 32 bu/a state average yield on 1,520,000 harvested acres. 1,650,000 acres were planted to winter wheat. The 2002 crop was the smallest crop since 1944 and had the lowest yield since 1991. The 2001 crop was similar to the 2000 crop (59,400,000 bu harvested from 1,650,000 acres with a 36.0 bu/a state average yield). Both the 2000 and 2001 crops were much lower than the 1999 crop (86,400,000 bu from 1,800,000 harvested acres with a 48 bu/a state average yield), 1998 crop (82,800,000 bu harvested from 1,800,000 acres with a 46 bu/a yield average), the 1997 crop (70,300,000 bu harvested from 1,900,000 acres with a 37.0 bu/a yield average), and the 1996 crop (73,100,000 bu harvested from 2,150,000 acres with a 34 bu/a yield average). Despite continued genetic improvement, the main determinant in wheat production seems to be acres harvested, government programs, and weather (which also affects disease pressure).

The variety survey has not been updated for 2002. In 2001, Alliance (16.0% of the state) replaced Arapahoe (13.4%) as the most popular variety in Nebraska. Pronghorn is the third most widely grown variety followed by 2137 and Niobrara. Alliance is the variety having the greatest impact since the release of Arapahoe, but its impact is more localized, as Alliance does not have the broad adaptation in eastern Nebraska that Arapahoe had. It is expected that the former Arapahoe acreage will eventually be divided by three modern releases, Millennium, Culver, and Wahoo.

In 2002, two new hard red winter wheat varieties, Goodstreak (a modern, tall wheat) and Harry (a high yielding, semi-dwarf wheat), were recommended for release with foundation seed being allocated in fall 2002. In addition, two new hard white wheat varieties, Antelope (a high yielding semi-dwarf with excellent production potential under irrigation) and Arrowsmith (a taller, dryland wheat), were recommended for release with foundation seed being available in fall, 2003. In addition, two hard red winter wheats, NE97638 (a sister line of Harry that is a little earlier and tends to do well in southern Nebraska) and NE97426 (an awnless semi-dwarf wheat that may have potential for grazing/haying and grain production) were recommended for licensing.

The two forage triticale varieties that were released for commercial sale (NE422T [formerly NE96T422] to Nupride Genetics Network and Gro-Green Plus [formerly NE96T441] to Star Seed Inc. of Kansas) in 2001 had good sales years in 2002. One experimental triticale line (NE95T426, a line that produced good fall forage and has tremendous grain yield potential) is under increase for release in 2003.

Basic research studies continue in developing transgenic wheat, herbicide tolerant wheat, disease and insect resistant wheat, superior data analytical techniques, and how to better understand wheat grain yield and agronomic traits in global climate change.

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