IMPROVING WHEAT VARIETIES FOR NEBRASKA

1998 STATE BREEDING AND QUALITY EVALUATION REPORT

Report to the

NEBRASKA WHEAT DEVELOPMENT, UTILIZATION
AND MARKETING BOARD

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I. INTRODUCTION

Wheat variety development research in Nebraska is 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, hybrid parent, 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. The basic project is located in the Department of Agronomy 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 1997-98 NEBRASKA WHEAT CROP

1. Growing Conditions

The 1998 crop was planted into relatively dry soils most of Nebraska with the soils becoming progressively wetter to the east. Planting was generally on time, but some producers delayed their planting to wait for rain. The winter was exceptionally mild and there was no winterkilling due to cold temperatures anywhere in the normal winter wheat production areas. In the spring, moisture was adequate throughout the state and a good crop was generally produced though pockets of drought (i.e. near McCook) and areas of excessive rainfall leading to lodging did exist. In general, there was no winterkilling and sufficient moisture that most lines were able to finish with little stress. Hence in some environments, winter tender wheats which often are winterkilled and later wheats which are often “pinched” by dry weather did well. The adequate moisture led to conditions that were ideal for foliar diseases (i.e. leaf blotches) in eastern Nebraska and lodging throughout the state. Hence strong-strawed semi-dwarf lines with good disease resistance were favored in many locations. Alliance and 2137 performed well across the state, as did the newly released Culver. The newly released Wesley performed well in those environments where 2137 excelled. In different areas, Jagger (eastern NE) and Windstar (western NE) performed well.

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2. Diseases

Foliar diseases are highly dependent on moisture, hence foliar diseases were important on the southeastern wheat crop. In 1998, the main diseases were foliar leaf blotches. Leaf rust, wheat soilborne mosaic virus, and wheat streak mosaic virus were present, but caused little damage. Stem rust was barely present, and below

economic loss levels. A new disease to the United States, karnal bunt, was not found in Nebraska in 1995, 1996, 1997, or 1998, though it was found in Texas in 1997.

Many 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, as will the survey for karnal bunt. 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 1998. 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, are important insect pests because they can carry devastating diseases.

4. Wheat Production

The 1998 Nebraska Wheat Crop was estimated at 84,600,000 bu, which represented a 47 bu/a state average yield on 1,800,000 harvested acres. 1,900,000 acres were planted to winter wheat. This crop was larger than 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), but smaller than the 1995 crop of 86,100,000 bu (41 bu/a). Despite continued genetic improvement (see above comparisons of Turkey to Arapahoe, Alliance, and Windstar), the main determinant in wheat production seems to be acres harvested and weather. It may also be that corn or other crops are moving increasingly into the better wheat production areas and the relatively stable state average wheat yield represents the loss of these higher production acres.

The following quality determinations were done by CII Laboratory Services on samples collected from the 1998 harvest:

Nebraska District	Average Test Weight (lbs/bu)		Average Wheat Protein Content (%, 12 % mb)	
	1998	1997	1998	1997
Southwest	60.4	59.4	12.0	12.9
Southeast	59.5	58.7	12.0	12.7
Panhandle	61.3	60.2	11.6	11.9
North Central	60.4	59.1	11.6	13.5
Northeast	59.2	58.2	11.8	13.6

The end-use quality of the 1998 Nebraska hard red winter wheat crop was good and reflected the variety selection made by the producer and growing conditions. Average test weights were higher than last year while average wheat protein contents were lower. The predominant breadmaking procedure used in the United States is the sponge and dough process. The method requires strong gluten proteins during dough mixing and fermentation. The selection of wheat lines with the quality characteristics of medium-strong mixing properties, superior crumb grain and texture, and increased water absorption are the current priorities of the Nebraska Wheat Quality Lab. The focus on these properties will insure that the superior reputation of Nebraska wheats will be maintained in the marketplace.

5. Cultivar Distribution

Arapahoe continues to be the most popular and widely grown variety (28.3% of the state) in 1998. To put Arapahoe's acceptance in perspective, it was grown on more acres than varieties developed by other states and by commercial seed companies combined in Nebraska. Alliance was the second most widely grown variety followed by Centura and Niobrara.

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 78.5% of the state acreage. Other public varieties occupied 9.5% and private varieties occupied 12.0% of the state acreage.

NEBRASKA—WHEAT VARIETIES
ESTIMATED PERCENTAGES PLANTED TO EACH VARIETY, 1993-1998

				Percent		
Variety	1993	1994	1995	1996	1997	1998
2137	-----	-----	-----	-----	-----	1.4
Agripro Abilene	6.2	3	4.1	4.2	2.2	2.4
Agripro Laredo	-----	-----	1.2	1.1	-----	-----
Agripro Ogallala	-----	-----	-----	2.2	1.5	1.6
Agripro Thunderbird	12.4	10	7.8	5.9	5.7	3.5
Agripro Tomahawk	1	3.9	3.1	2.9	2.5	2.6
Agripro Victory	1.3	-----	1	1.2	-----	-----
Alliance	-----	-----	-----	2.7	7.3	8.4
Arapahoe	28.6	32.9	33.6	31.7	30.1	28.3
Buckskin	4.7	5.5	4	5.8	6	6.5
Centura	8.5	11.1	8	9.2	9.8	7.7
Centurk & Centurk 78	1.6	-----	1.3	-----	-----	-----
Cody	-----	-----	-----	-----	-----	-----
Ike	-----	-----	-----	1.6	1.3	1.5

Karl/Karl 92	2.1	3.8	6.9	7.3	6.9	6.6
Lamar	-----	-----	-----	1.2	-----	-----
Niobrara	-----	-----	-----	1.4	6.5	7.5
Pronghorn	-----	-----	-----	-----	-----	4.6
Rawhide	2.1	2	1	-----	-----	1.2
Redland	7.9	6.3	4.3	3.4	1.2	1.0
Scout & Scout 66	2.8	1.6	3.4	2.4	1.6	2.3
Siouxland	8.2	6.4	4	4.7	3.2	1.2
All TAM wheats	3.4	2.8	2.5	2.1	1.1	-----
Vista	-----	-----	4.6	3.6	4.6	3.9
Other Public Varieties	4.2	6	5.9	4.9	5.4	5.9
Other Private Varieties	1.9	3.3	1.9	0.8	3.1	1.9

6. New Cultivars

Two cultivars, Culver and Wesley, were formally recommended for release in 1998. Culver is a hard red winter wheat (*Triticum aestivum* L.) developed cooperatively by the Nebraska Agricultural Experiment Station and the USDA-ARS. It was jointly released to seed producers in 1998 by the developing institutions. Culver was selected from the cross NE82419/Arapahoe, which was made in 1987. The pedigree of NE82419 is Trapper//CMN/OT/3/CIMMYT /Scout/4/ Buckskin sib/Homestead. Culver is an F3-derived line that was selected in the F4 generation. Culver was released primarily for its superior adaptation to dryland agriculture in southcentral and southwestern Nebraska.

Culver is an awned, white-glumed cultivar. Its field appearance is most similar to 'Alliance'. The canopy is moderately open and upright. The flag leaf is erect and twisted at the boot stage. The foliage is green with a waxy bloom at anthesis. The leaf is glaborous. The spike is tapering in shape, moderately long to long, and middense. The glume is midlong and midwide to wide, and the glume shoulder is sloping to square. The beak is short in length with an acuminate tip. The spike is usually nodding at maturity. Kernels are red colored, hard textured, and ovate to elliptical in shape. The kernel has no collar, a large brush of medium length, rounded cheeks, midsize to large germ, and a narrow and shallow crease.

Culver was tested as NE93554 in Nebraska yield nurseries starting in 1994 and in the Northern Regional Performance Nursery in 1996 and 1997, and in state cultivar trials in Nebraska in 1997 to 1998. In two years of testing in the state cultivar trials, it has performed extremely well in the south central and southwest districts, while doing well in the southeast and Panhandle districts. In the south central district (4 environments), Culver was the highest yielding line (4690 kg/ha; 69.8 bu/a) in the last two years. For comparison, Jagger yielded 4610 kg/ha (68.5 bu/a), Alliance yielded 4510 kg/ha (67.0 bu/a) and Arapahoe yielded 4300 kg/ha (64.0 bu/a). In the southwest district (12 environments), Quantum 7406 (4730 kg/ha; 70.3 bu/a) was the highest yielding line averaged over the past two years followed by Jules (4390 kg/ha; 65.3 bu/a) and Culver (4310 kg/ha; 64.1 bu/a). For comparison, the yields of Jagger, Windstar, Alliance, Niobrara, and Arapahoe were 4260 (63.3), 4240 (63.1), 4160 (61.9), 4160 (61.9), and 4120 kg/ha (61.3 bu/a). In the southeast district, Culver yielded similarly to Niobrara and less than 2137 and Nekota. In the Panhandle district, Culver yielded similarly to Arapahoe and less than Alliance, Akron, 2137, Niobrara and Windstar. Culver was grown in the Northern Regional

Performance Nursery in 1996 and 1997. The main advantage that Culver has when compared to other available wheat varieties is its high grain yield and superior leaf rust resistance in dryland production in its area of adaptation.

Culver is medium in maturity, about 0.5 d later than Arapahoe and 2 d later than Alliance. It has a medium length coleoptile, similar to TAM 107, but shorter than Arapahoe and Pronghorn. Culver (83 cm) is similar to Arapahoe for plant height, but 2 cm taller than Alliance. Culver has moderately strong straw strength, similar to Windstar and better than Alliance, Arapahoe, and Pronghorn. The winterhardiness of Culver is similar to Abilene and comparable to other winter wheat cultivars adapted and commonly grown in Nebraska.

Culver is moderately resistant to stem rust (caused by *Puccinia graminis Pers. : Pers.*; contains *Sr6* and *Sr24*, and other unnamed resistance genes) and leaf rust (caused *by P. recondita* Roberge ex Desmaz.; similar to Arapahoe and most likely contains *Lr16*), and susceptible to wheat soilborne mosaic virus, Hessian fly (*Mayetiola destructor* Say), barley yellow dwarf virus, and wheat streak mosaic virus. Culver has a moderately low grain volume weight, better than Alliance, but less than Arapahoe, Pronghorn, and Rawhide. The milling and baking properties of Culver (NE93554) were determined for five years by the Nebraska Wheat Quality Laboratory. The results of these tests were compared with Arapahoe and Scout 66 as check cultivars. The average wheat protein content of Culver was similar to Arapahoe and Scout 66. The average flour extraction on the Buhler Laboratory Mill for the Culver was similar to Arapahoe, but less than Scout 66. The flour ash content was similar to the check varieties. The average flour protein content was less than the check varieties. Dough mixing properties of Culver were similar to Arapahoe and stronger than Scout 66. Average baking absorption was similar to the check varieties. The average loaf volume of Culver was less than the check cultivars. The scores for the internal crumb grain and texture were good or very good, which were superior to Arapahoe and Scout 66. In comparison to Alliance, Culver has a higher average wheat protein content, baking absorption, and crumb grain and texture scores. Other milling and baking properties are similar to Alliance. The overall end-use quality characteristics for Culver should be acceptable to the milling and baking industries.

In targeting Culver, based on current data, it should be grown in the south central and southwest Nebraska. In these areas, it is a good replacement for Alliance as it has a longer coleoptile, and better leaf rust resistance, grain protein content, and grain volume weight. It is genetically complementary to 2137, Alliance, Jagger, Niobrara, Pronghorn, Vista, and Windstar. It is genetically similar to Arapahoe, one of its parents. Like Arapahoe, Culver also seems to have a growth pattern where early spring drought can lower its performance.

The name Culver was chosen in recognition of Moses M. Culver whose farm was purchased on June 25, 1874 to become the current site of East Campus of the University of Nebraska which will celebrate its 125th anniversary in 1999 when certified seed will be available to wheat producers. The East Campus is the home for the Institute of Agriculture and Natural Resources, which is celebrating its 25th anniversary.

Culver has been uniform and stable since 1997. Less than 1.0% of the plants were rogued from the Breeder's seed increase in 1997. All of the rogued variant plants were taller in height (10 - 25 cm). Up to 2% (20:1000) taller, variant plants may be encountered in subsequent generations. The Nebraska Foundation Seed Division, Department of Agronomy, University of Nebraska-Lincoln, Lincoln, NE 68583 had foundation seed available to qualified certified seed producers in 1998. The Nebraska Crop Improvement Association provided technical assistance in describing the cultivar characteristics and accomplishing technology transfer. 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. Culver will be submitted for registration and plant variety protection under P. L. 10577 with the certification option.

Wesley is a hard red winter wheat developed by the USDA-ARS (Dr. C. J. Peterson's leadership) and the Nebraska Agricultural Experiment Station. It will be co-released with South Dakota Agricultural Experiment Station. It is a high yielding semi-dwarf wheat with adaptation characteristics similar to 2137, and is particularly well suited for production in southeast Nebraska and under irrigation. The formal release description is currently being developed by the USDA-ARS. The name was chosen to honor Dr. John Wesley Schmidt, former wheat breeder at the University of Nebraska.

III. FIELD RESEARCH

1. Increase of New Experimental Lines

Four experimental lines (NuPlains, NE93496, NE93613, and NE 94479) are under large-scale increase for possible release in 1999. In addition, NE93405 has been held over for a third year of testing before possible release in 1999. **NE93405** and **NE93496** (NE85707/Thunderbird) are sister lines and are Thunderbird derivatives with a long coleoptile, good winterhardiness, good testweight, large kernels, and very strong straw strength (**NE93496** having the better standability). The pedigree of NE85707 is Wrr*5/Agent//Kavkaz/4/NE63218/KY58/3/ NTH/2*CMTH//PNC/*2 CNN. They are white chaffed, awned, hard red winter wheat. They are medium early in maturity and medium tall in plant height (probably has a semi-dwarfing gene that does not affect coleoptile length). The best performance area seems to higher moisture areas of Nebraska similar to Thunderbird. The relatively lower statewide performance of **NE93405** and **NE93496** compared to many widely grown varieties probably represents its narrower adaptation and many of the testing sites are outside of their adapted area. **NE93405** and **NE93496** are moderately resistant to stem rust (contains Sr5 and Sr31 or Sr24), moderately susceptible to leaf rust, and susceptible to Russian wheat aphid, Hessian fly, barley yellow dwarf virus, wheat soilborne mosaic virus, and wheat streak mosaic virus. Both **NE93405** and **NE93496** have the 1B.1R translocation, but have adequate end-use quality.

NE93613 is a sister line to Culver and was derived from the cross NE82419/Arapahoe. The pedigree of NE82419 is Trapper//CMN/OT/3/CIMMYT /Scout/4/ Buckskin sib/Homestead. **NE93613** is an Arapahoe derivative with a medium length coleoptile, good winterhardiness, average testweight, medium kernels, and moderately strong straw strength. It is a white chaffed, awned, hard red winter wheat. It is medium to late in maturity and medium tall in plant height (probably a taller, semi-dwarf). **NE93613** is later than Culver and while Culver seems particularly well suited to southcentral and southwest Nebraska, NE93613 has performed very well in western Nebraska. **NE93613** is moderately resistant to stem rust (contains Sr6, Sr10, and Sr24) and leaf rust (similar to Arapahoe and Culver), moderately susceptible to wheat soilborne mosaic virus and Hessian fly (better than Culver), and susceptible to Russian wheat aphid, barley yellow dwarf virus, and wheat streak mosaic virus.

NE94479 was derived from the cross Arapahoe/Abilene//NE86488. The pedigree of NE8648 is Colt/3/WRR 5*/Agent//Kavkaz. NE94479 has good winterhardiness, average test weight, medium kernels, and moderately strong straw strength. It is a white chaffed, awned, hard red winter wheat. It is medium in maturity and medium tall in plant height (probably a taller, semi-dwarf). **NE94479 is** slightly later than Arapahoe and seems broadly adapted in Nebraska. It is moderately resistant to stem rust (contains Sr6, and Sr24) and Hessian fly. It is moderately susceptible to leaf rust and susceptible to wheat soilborne mosaic virus, Russian wheat aphid, barley yellow dwarf virus, and wheat streak mosaic virus. As

opposed to Arapahoe and Culver, it seems to perform well despite spring droughts.

NuPlains is a hard white winter wheat developed by the USDA-ARS (Dr. C. J. Peterson's leadership) and the Nebraska Agricultural Experiment Station. It is derived from the cross Abilene/KS831872 where the pedigree of KS831872 is Plainsman V//Newton/Arthur 71 high protein selection. It is an awned, white glumed, short coleoptile, semidwarf cultivar with good straw strength. It is moderately resistant to stem rust, moderately susceptible to leaf rust, and susceptible to wheat soilborne mosaic virus, wheat streak mosaic virus, Russian wheat aphid, and Hessian fly. It is currently targeted for dryland production in southcentral and southwest Nebraska and possibly for irrigated production. **NuPlains** is a dual-purpose wheat, suitable for both breadmaking and noodle making.

One line, **NE93427** was dropped from further consideration for release. Two lines are under small-scale increase: **NE94654** (Arapahoe 2*/Abilene) and **NE95473** (Russian selection/ Arapahoe).

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 Culver, Wesley, Windstar, Pronghorn, Niobrara, and Alliance, many of the most advanced current breeding lines are not expected to be released.

2. Nebraska Variety Testing

Sixty-one entries and three seed treatments were included in some or all of the locations in the Fall Sown Small Grain Variety Tests in 1998. Fifteen dryland, one irrigated, and one ecofallow nurseries were harvested for yield data.

In 1998, the top ten entries for dryland production were:

Entry	Av. Yield bu/a	Entry	Av. Yield bu/a
2137	68.8	NE94479	66.6
NE93613	68.1	Alliance	66.6
Wesley	68.0	Windstar	64.5
NE94653	67.6	Niobrara	64.4
Culver	67.5	N94L205	63.9

In 1997, the top ten entries for dryland production were:

Entry	Av. Yield bu/a	Entry	Av. Yield Bu/a
Alliance-D*	51.6	Arapahoe-D*	48.5
2137	50.2	Nekota	48.1
Alliance	49.7	Pronghorn	48.0
NE93554	49.3	Arapahoe	47.8
Windstar	49.3	Niobrara	47.4

*"-D" denotes the seed was treated with Dividend seed treatment.

The top ten lines in 1996 for dryland production were:

Entry	Av. Yield bu/a	Entry	Av. Yield Bu/a
Alliance	56.5	Windstar	52.7
2137	56.0	Niobrara	51.5
NE92662	54.0	Vista	51.5
Arapahoe	53.0	Pronghorn	51.4
NE91648	52.9	Nekota	51.3

Of the lines tested in all locations except the irrigated test, Turkey had the lowest grain yield (47.2 bu/a) which was as expected when winterkilling is relatively minor. It is interesting to note the average yield of Turkey across the dryland and ecofallow sites was the same as the state yield average indicating our testing sites represent above average production site. Jagger (46.3 bu/a), a Kansas wheat that can be hurt by late freezes, performed well which indicated a relatively mild winter or good snow cover during cold temperatures.

Hybrid wheat lines, which have performed extremely well in the test in the past, had an above average year, but do best under high management production efforts. All hybrids and many varieties were not tested in allocations, hence some high yielding hybrids and varieties may be overlooked when using statewide averages.

3. Irrigated Wheat Trials:

The irrigated wheat nursery was planted in Cheyenne County on a commercial farm by Dr. D. Baltensperger. The top ten lines for grain yield were in 1998:

Entry	Av. Yield	Entry	Av. Yield

	bu/a		bu/a
AP7510	125	NE94482	106
Laredo	114	Jagger	103
Ogallala	108	Wesley	103
N96L1229	107	N96S031	102
H1881	106	Coronado	102

The irrigated wheat nursery was planted in Cheyenne County on a commercial farm by Dr. D. Baltensperger. The top ten lines for grain yield were in 1997:

AP 7510	98 bu/a	2137	88
Jagger	94	Laredo	88
Coronado	89	AP 7501	87
N95L159	88	Karl 92	84
Wesley	88	Ogallala	83

The irrigated data this year was quite interesting as lines previously recommended for irrigation (Rawhide, Yuma) generally performed poorly. It is not known what caused this reduced performance, but high yielding lines that consistently perform well under irrigation remain a definite need for this high production area. One of the concerns with the irrigated wheat trials is that many high yielding lines were not specifically developed for irrigated production and we have not developed a truly adapted irrigated wheat.

In 1996, a change in irrigated wheat development was undertaken. We began testing early generation (F5, equivalent to our preliminary dryland observation nursery), short, semi-dwarf lines at the Sidney High Plains Agricultural Laboratory using an augmented design in cooperation with Dr. Baltensperger. In 1997, the 45 best lines, based on height, grain yield, and standability, from this test were advanced to a second year of irrigated and dryland testing (data below). An additional 262 early generation lines were planted this year in the preliminary irrigated observation nursery. A major goal of this program will be to develop high yielding, irrigated wheat varieties with and without straw for bailing. For some irrigated producers the straw is a salable by-product of their production, hence they like Rawhide. For other irrigated producers, excessive straw causes difficulties with their rotational practices and they do not like Rawhide. One of the interesting aspects of this research is that many scientists think the best way to select for lower yielding environments is to select high yielding lines in high yielding environments. The assumption is that yield genes are expressed best (most easily identified) in high yielding environments and these genes are also necessary for yield in low yielding environments. Our preliminary review of the data suggests this is not the case and that for dryland or irrigated wheat production, selection must be done under dryland or irrigated production systems. The yield of irrigated wheat is not correlated with the yield of dryland wheat.

ENTRY	VARIETY	Lincoln	N.Platte	Alliance	Dryland Avg.	Rank	Irrigated-Sidney	Rank
		bu/a	bu/a	bu/a	bu/a	Dryland	bu/a	Irrigated
1	NI98401	83.8	42.5	64.5	63.6	41	97.6	29

2	NI98402	76.9	56.9	79.1	70.9	19	98.7	26
3	NI98403	76.9	57.4	65.1	66.5	32	101.9	23
4	NI98404	71.6	58.5	77.7	69.2	24	84.6	47
5	NI98405	68.1	48.6	77.8	64.8	36	85.1	45
6	NI98406	72.0	47.1	64.7	61.2	48	96.9	31
7	NI98407	81.1	47.1	89.3	72.5	16	61.8	50
8	NI98408	71.4	50.5	60.1	60.7	49	78.1	49
9	NI98409	78.9	44.0	61.8	61.6	47	110.1	11
10	NI98410	79.4	63.2	68.4	70.3	21	105.7	19
11	NI98411	75.3	57.6	72.1	68.3	27	119.3	1
12	NI98412	75.5	54.1	92.1	73.9	12	92.6	38
13	NI98413	70.8	57.5	81.6	70.0	22	115.7	5
14	NI98414	78.4	52.4	107.6	79.5	3	110.2	10
15	NI98415	68.5	64.7	67.6	66.9	30	109.5	13
16	NI98416	74.8	60.8	63.0	66.2	33	92.8	37
17	NI98417	75.3	44.6	69.0	63.0	44	105.6	20
18	NI98418	81.7	48.7	99.0	76.5	9	109.0	14
19	NI98419	71.1	74.7	76.3	74.0	11	103.6	21
20	NI98420	69.9	62.8	85.0	72.6	15	96.0	34
21	NI98421	71.3	61.6	57.2	63.4	42	111.1	8
22	NI98422	67.5	52.8	71.6	64.0	39	84.7	46
23	NI98423	77.6	52.2	78.4	69.4	23	97.6	30
24	NI98424	76.2	58.2	70.3	68.2	29	106.8	18
25	NI98425	76.2	50.8	64.3	63.8	40	98.7	27
26	NI98426	70.4	41.6	69.6	60.5	50	81.3	48
27	NI98427	76.4	62.3	67.9	68.9	25	117.8	2
28	NI98428	80.6	46.3	72.8	66.6	31	109.6	12
29	NI98429	78.1	49.6	67.1	64.9	35	112.3	6
30	NI98430	77.5	55.3	56.1	63.0	43	100.5	24
31	NI98431	75.5	55.4	74.0	68.3	28	95.0	35
32	NI98432	73.4	47.0	75.8	65.4	34	91.7	39
33	NI98433	82.0	51.4	60.4	64.6	37	108.7	15
34	NI98434	84.6	48.6	81.7	71.6	18	102.5	22
35	NI98435	88.3	58.1	73.4	73.2	13	96.0	33
36	NI98436	79.3	53.9	54.6	62.6	45	110.4	9
37	NI98437	82.6	56.3	72.1	70.3	20	111.9	7
38	NI98438	83.6	68.9	70.8	74.4	10	117.4	3
39	NI98439	88.1	64.8	81.9	78.2	5	99.1	25
40	NI97405	71.4	79.8	79.6	76.9	7	108.5	16
41	NI97409	73.1	43.1	69.0	61.7	46	88.1	42
42	NI97410	74.8	50.4	67.7	64.3	38	108.2	17
43	NI97435	80.3	65.6	92.1	79.3	4	85.6	44
44	NI97442	75.9	66.5	72.9	71.8	17	90.8	40
45	NI97444	79.2	69.2	81.1	76.5	8	93.3	36
46	YUMA	68.6	72.8	93.1	78.2	6	116.0	4
47	RAWHIDE	69.6	58.0	78.1	68.6	26	87.0	43
48	2137	82.8	76.8	81.7	80.4	1	98.0	28
49	ABILENE	79.5	81.2	80.5	80.4	2	96.8	32

50	VISTA	79.9	61.1	77.9	73.0	14	90.0	41
	GRAND MEAN	76.5	57.1	74.3			99.8	

Yuma was the only released line that performed both under dryland and irrigated conditions in 1998. In the past 2137 has performed well under both conditions also. As irrigated nurseries are amply watered and fertilized, it is hoped it will be a very good nursery to identify strong strawed cultivars needed both for irrigation and for high rainfall conditions of southeastern Nebraska. It is interested to note the very high yield of the dryland tests in 1998 (essentially irrigated wheat yields) and that Abilene and 2137 had exceptional yield potential under these conditions.

Six lines from this nursery were advanced to the Nebraska Triplicate Nursery (NTN) and seven lines were retained for further testing in the irrigated nursery (one line for the third year of testing).

The data for the 1997 irrigated-dry nursery is listed below:

Entry	Linc.	ClayC.	N.Plat bu/a	Cheyn. Irr.	Avg.	Rank	DryAvg. bu/a	DryRank
NI97401	37.55	19.65	38.00	66.75	42.85	42	34.88	48
NI97402	35.55	12.25	45.03	72.10	40.30	48	29.70	49
NI97403	45.25	32.25	42.03	55.93	44.00	39	40.02	34
NI97404	42.05	25.33	44.80	73.32	48.67	22	40.45	32
NI97405ϕ	47.60	29.53	60.40	85.46	54.28	6	43.89	14
NI97406	49.80	44.15	40.88	46.78	47.46	25	47.68	3
NI97407	39.80	39.68	45.88	62.84	48.33	24	43.50	16
NI97408	38.40	36.88	33.25	44.02	38.03	50	36.04	43
NI97409ϕ	39.05	42.43	48.28	83.98	52.24	10	41.66	25
NI97410*ϕ	54.75	50.03	40.28	79.72	54.75	4	46.42	7
NI97411	47.35	46.73	42.23	63.26	49.35	20	44.71	11
NI97412	41.50	34.40	40.05	77.36	46.85	31	36.68	40
NI97413	43.25	46.78	49.03	68.32	49.76	18	43.57	15
NI97414	37.60	28.85	49.63	59.44	42.35	44	36.66	42
NI97415	44.55	38.00	41.93	77.68	50.98	13	42.08	22
NI97416	42.45	37.88	44.45	65.44	47.02	29	40.88	30
NI97417	44.65	33.15	48.55	66.04	46.46	32	39.94	35
NI97418*	50.90	51.53	46.03	76.82	56.61	3	49.87	2
NI97419	39.15	45.38	39.38	49.95	44.38	36	42.53	20
NI97420	33.30	35.25	45.63	65.13	42.96	41	35.56	46
NI97421	36.15	25.30	47.63	59.77	41.92	45	35.96	44
NI97422	44.35	48.98	33.48	72.23	50.46	17	43.20	17
NI97423*	51.35	56.70	50.88	75.56	57.64	2	51.67	1
NI97424*	47.30	43.03	50.90	74.53	53.72	7	46.79	6
NI97425	42.45	35.63	38.33	77.44	50.77	15	41.88	23
NI97426	35.50	31.58	33.58	55.19	40.45	47	35.54	47
NI97427	37.90	32.45	36.93	56.45	41.62	46	36.67	41
NI97428	39.25	31.85	50.65	64.00	47.30	26	41.74	24
NI97429	40.55	50.48	46.10	51.23	48.39	23	47.44	4
NI97430	37.45	44.60	41.98	60.70	47.21	27	42.71	18
NI97431	39.50	35.70	44.78	63.98	45.72	35	39.63	36
NI97432	42.25	48.93	44.50	64.43	50.88	14	46.36	8
NI97433	45.70	40.30	48.40	73.80	49.41	19	41.28	29
NI97434	45.60	47.13	31.35	77.68	50.57	16	41.53	28
NI97435ϕ	44.35	40.83	39.38	81.96	51.65	11	41.55	27

NI97436	45.85	33.70	43.80	53.58	43.86	40	40.62	31
NI97437	46.70	34.73	46.65	66.41	46.92	30	40.43	33
NI97438	49.40	23.05	44.63	63.97	42.77	43	35.70	45
NI97439	45.10	53.75	35.80	52.10	46.24	33	44.29	13
NI97440	39.10	45.98	37.88	50.62	44.36	37	42.27	21
NI97441	48.20	39.18	36.65	77.55	51.30	12	42.54	19
NI97442ϕ	38.15	51.98	47.58	78.23	53.20	8	44.85	10
NI97443	40.50	30.55	38.93	63.67	44.14	38	37.63	38
NI97444ϕ	40.85	49.38	38.03	80.03	54.57	5	46.09	9
NI97445	40.25	38.93	44.00	70.11	48.69	21	41.55	26
2137	53.95	36.83	47.18	90.06	57.70	1	46.92	5
ABILENE	39.40	35.10	45.38	69.56	46.02	34	38.17	37
RAWHIDE	44.15	32.00	35.10	78.38	47.19	28	36.79	39
VISTA	38.70	52.58	36.93	77.40	52.65	9	44.40	12
YUMA	41.90	4.33	33.58	72.61	38.08	49	26.57	50
Mean	42.73	38.11	42.73	67.87	47.86		41.19	
CV	12.39	16.15	16.43	12.36				
LSD	8.88	10.32	11.77	14.07				

*Advanced to NTN

ϕAdvanced to Replicated Irrigated Trial

4. Nebraska Intrastate Nursery:

The Nebraska Intrastate Nursery (NIN) was planted at seven locations and harvested at six locations. Most trials had four replications, but Mead (not harvested) and McCook had two replications. With the exception of McCook, all of the nurseries were outstanding (yields ranging from 60-70 bu/a). McCook was average (37 bu/a). While these yield were excellent for producers, they did not really allow much selection as five of six harvested nurseries were similar. Selection is based upon differences, hence a greater diversity of yields would have been more useful. Niobrara and Alliance performed extremely well in this nursery. The data for 1998 is listed below:

VARIETY	LINCOLN	RANK	CLAY CT	RANK	N.PLATTE	RANK	MCCOOK	RANK	SIDNEY	RANK	ALLIANCE	RANK	Avg.	RANK
ARAPAHOE	71.3	17	63.1	31	60.9	28	41.4	11	70.5	26	72.7	31	63.31	23
NIOBRARA	76.6	3	68.5	10	60.1	32	50.5	3	77.9	7	82.3	6	69.29	2
NE92652	71.4	16	65.7	15	60.7	29	42.1	10	71.7	19	68.8	38	63.40	21
NE93405	70.3	28	63.2	28	58.5	42	35.8	39	67.9	34	67.5	44	60.54	38
NE93496	68.1	37	63.1	30	56.6	47	32.7	48	66.2	40	67.1	45	58.95	47
NE93554	71.4	15	66.5	13	58.2	44	40.2	15	69.8	30	73.3	28	63.23	24
NE93613	70.8	21	72.7	4	70.6	1	38.2	23	73.1	14	80.2	7	67.58	6
NE94445	70.3	29	64.5	21	61.3	25	33.9	42	65.6	42	84.6	3	63.36	22
NE94479	75.5	4	75.6	1	62.3	17	50.6	2	71.1	23	74.0	23	68.19	5
NE94482	70.7	22	73.7	3	61.0	27	35.9	37	71.4	20	77.3	13	64.99	11
NE94589	65.0	50	63.9	24	67.0	4	42.8	8	73.2	11	78.4	11	65.03	10
NE94632	68.6	35	60.3	42	59.1	36	39.2	20	61.7	53	76.9	16	60.96	34
NE94653	67.2	43	70.3	6	62.0	21	42.9	7	70.0	29	77.5	12	64.97	12
NE94654	73.7	8	65.2	17	68.4	2	53.5	1	80.3	4	83.9	4	70.82	1
ALLIANCE	75.1	5	64.3	22	64.3	12	40.1	16	81.5	1	85.0	2	68.38	4
KARL92	68.7	34	53.7	57	49.0	60	31.7	53	65.0	44	51.9	60	53.34	59
NE94655	71.5	14	66.4	14	58.0	46	42.3	9	70.9	25	72.9	30	63.67	19
NE95473	74.8	6	72.4	5	62.3	18	47.9	4	73.6	10	80.2	8	68.52	3
NE95489	70.4	26	63.2	29	55.7	49	38.2	24	72.4	17	58.7	56	59.74	40
NE95510	70.4	24	65.3	16	59.3	35	40.6	13	70.9	24	72.1	34	63.09	25

NE95546	74.0	7	57.8	51	68.2	3	33.8	44	72.8	16	90.3	1	66.16	7
NE95553	67.3	42	64.3	23	66.6	7	37.9	27	59.6	56	71.7	35	61.23	31
NE95593	71.6	13	52.6	59	62.0	20	34.2	41	67.1	37	68.5	40	59.36	42
NE95656	61.8	53	63.3	27	66.9	6	40.0	17	69.6	31	79.9	10	63.56	20
NE96435	66.1	47	62.1	35	58.8	39	39.4	18	73.1	12	74.3	22	62.29	28
NE96461	81.6	1	63.8	25	62.1	19	33.4	47	80.0	5	68.7	39	64.92	13
NE96515	69.3	32	59.3	45	58.8	40	32.2	49	71.3	21	63.7	50	59.10	46
NE96573	72.4	12	65.0	19	59.0	37	38.0	25	72.8	15	76.4	19	63.94	17
VISTA	70.5	23	58.5	48	63.0	14	36.5	34	81.0	2	73.0	29	63.78	18
WINDSTAR	65.4	48	62.1	34	66.1	8	39.1	22	74.5	8	76.9	15	64.01	16
NE96579	70.3	27	74.5	2	54.8	51	31.3	54	62.0	52	56.0	57	58.13	49
NE96580	60.9	54	66.8	12	54.7	52	38.0	26	63.1	48	55.2	58	56.42	53
NE96584	73.5	9	59.9	43	58.0	45	37.5	30	62.5	50	63.3	51	59.12	44
NE96585	70.4	25	61.1	39	53.8	54	33.4	46	57.2	58	54.6	59	55.07	57
NE96605	66.3	45	55.7	53	58.8	41	31.2	55	63.4	47	64.0	49	56.55	52
NE96607	60.7	56	65.2	18	54.2	53	30.2	59	73.9	9	62.2	53	57.75	51
NE96618	66.9	44	53.4	58	65.0	9	37.5	29	78.5	6	83.2	5	64.08	15
NE96622	70.1	30	59.4	44	61.9	22	36.2	35	61.6	54	74.6	21	60.63	36
NE96623	71.0	20	56.6	52	63.9	13	37.0	33	66.7	39	76.5	18	61.94	29
NE96625	63.0	52	61.9	36	59.7	33	36.2	36	70.2	27	72.2	32	60.55	37
NE96628	60.8	55	54.1	56	56.6	48	41.1	12	57.1	59	67.6	43	56.21	55
NE96630	71.0	19	68.5	9	61.7	23	30.3	58	67.3	36	66.4	46	60.86	35
NE96632	71.3	18	63.7	26	66.9	5	44.1	6	67.5	35	73.3	27	64.47	14
NE96638	68.2	36	62.9	33	53.3	57	32.0	52	57.8	57	60.5	54	55.77	56
BUCKSKIN	60.4	57	58.4	49	58.9	38	39.4	19	65.5	43	72.1	33	59.11	45
CHEYENNE	53.5	60	59.3	46	53.7	55	37.1	32	64.8	45	68.9	37	56.22	54
NE96641	67.7	40	58.2	50	59.5	34	33.5	45	71.2	22	76.8	17	61.15	32
NE96644	65.3	49	54.4	55	61.0	26	27.4	60	71.9	18	70.8	36	58.47	48
NE96649	72.7	11	64.6	20	62.8	15	37.2	31	80.6	3	75.3	20	65.52	9
NE96652	65.0	51	63.0	32	60.5	30	33.8	43	62.4	51	64.1	48	58.12	50
NE96654	68.0	38	61.2	38	64.9	10	37.5	28	62.8	49	73.7	25	61.36	30
NE96676	69.7	31	61.0	40	62.4	16	34.7	40	73.1	13	73.8	24	62.44	26
NE96677	68.8	33	61.8	37	58.2	43	30.4	57	66.1	41	73.7	26	59.82	39
NE96690	67.7	39	67.7	11	53.7	56	35.8	38	68.3	33	62.6	52	59.31	43
NE96737	67.4	41	69.9	7	60.4	31	40.4	14	68.5	32	67.6	42	62.37	27
NE96744	66.3	46	54.9	54	50.8	59	31.1	56	63.6	46	60.3	55	54.48	58
NE96747	73.4	10	60.3	41	55.3	50	32.1	51	70.0	28	65.2	47	59.38	41
NE93427	78.1	2	69.7	8	64.8	11	39.2	21	66.7	38	77.0	14	65.92	8
PRONGHORN	60.1	58	58.6	47	61.6	24	44.3	5	61.3	55	80.0	9	60.97	33
SCOUT66	59.4	59	52.0	60	52.2	58	32.1	50	51.5	60	68.0	41	52.52	60
GRAND ME	68.8		62.8		60.2		37.4		68.7		71.5		61.57	

The Nebraska Wheat Quality Lab analyzed the milling and baking characteristics of advanced experimental lines and check varieties from the NIN. After Buhler milling and baking these samples, four lines (NE94479, NE96605, NE96623, and NE96737) were found to have superior end-use performance. One line (NE96461) was found to be less than satisfactory because of weak dough mixing properties and a very yellow crumb color.

Additionally, each wheat sample was evaluated on the Single Kernel Characterization System 4100, which determined individual kernel moisture content, weight, diameter, and hardness. Results for each characteristic were expressed as an average of 300 kernels and as a distribution. Four experimental wheat lines (NE94445, NE94632, NE95546, and NE96607) were scored as Mixed Wheat. Results from the SKCS 4100 may be used to make selections for advancement in the future. This device may be adopted by the Federal Grain Inspection

Service as part of the grain grading system. Also this device has the potential to select wheat lines that have uniform seed size.

The data for 1997 was:

VARIETY	Yield (bu/a)								State
	Linc	Mead	Clay C.	N.Plat	McCook	Sidney	Allianc	Avg.	Rank
ARAPAHOE	45.48	28.60	54.58	51.25	73.11	34.46	46.96	47.774	21
NIOBRARA	47.12	24.58	38.78	57.76	69.62	37.87	44.32	45.722	33
PRONGHORN	48.26	29.64	49.29	59.04	71.05	34.09	48.60	48.566	18
WINDSTAR	47.71	30.20	61.38	59.79	69.96	33.59	46.83	49.923	12
NE91518	50.50	25.47	38.01	61.66	65.94	38.12	46.80	46.641	28
NE91631	43.94	31.34	38.10	52.39	70.40	43.08	39.85	45.586	36
NE92628	43.87	21.20	50.62	56.72	69.87	39.39	41.68	46.190	32
NE92646	49.20	25.02	46.64	52.07	75.09	36.54	44.65	47.030	26
NE92662	46.92	34.94	39.94	57.86	74.57	44.93	46.32	49.355	15
ALLIANCE	42.38	30.38	55.95	58.34	69.77	45.19	54.88	50.983	5
VISTA	40.51	26.05	45.17	52.91	70.69	41.83	48.24	46.484	30
NE93405	49.69	32.79	54.64	56.48	68.86	39.70	46.65	49.829	14
NE93496*	46.59	32.60	60.51	57.25	67.58	34.40	50.02	49.849	13
NE93522	43.70	27.38	46.81	50.97	63.16	26.61	46.12	43.534	46
NE93554*	47.77	30.62	51.42	53.96	79.26	41.70	50.67	50.772	8
NE93613	41.57	24.33	57.53	60.64	80.88	44.42	42.80	50.309	10
NE94445	50.80	26.96	40.30	57.37	67.03	41.25	47.33	47.289	24
NE94479*	57.73	33.74	57.86	58.03	73.70	53.39	51.00	55.063	1
NE94482*	50.38	27.56	54.60	59.22	69.54	52.23	50.91	52.062	3
REDLAND	43.14	28.90	52.55	51.06	72.74	46.04	45.54	48.566	17
TAM107	44.26	22.10	22.34	51.71	71.58	35.62	43.34	41.566	58
NE94489	44.33	22.81	47.39	53.02	64.57	31.93	47.76	44.545	40
NE94567	39.01	22.40	24.93	60.12	68.57	39.80	44.07	42.697	52
NE94588	41.71	25.03	36.65	61.35	70.32	26.95	40.79	43.257	48
NE94589	42.80	25.89	47.21	63.33	68.63	39.90	37.70	46.494	29
NE94632*	47.24	19.26	52.87	52.48	69.87	33.86	43.81	45.625	35
NE94653*	48.55	30.91	56.10	61.84	72.19	37.49	50.32	51.058	4
NE94654	43.58	30.82	48.01	59.37	81.70	44.19	47.98	50.807	7
NE94655*	44.85	29.44	52.44	52.83	67.92	34.88	44.29	46.665	27
NEKOTA	41.84	26.16	45.85	63.26	65.12	44.41	46.71	47.621	23
KARL92	38.81	24.70	17.30	43.65	67.20	30.10	45.49	38.178	59
NE95417	48.38	23.84	25.95	53.34	67.30	35.01	48.57	43.196	49
NE95473	50.69	28.77	49.84	53.80	71.56	50.01	51.67	50.906	6
NE95482	49.05	28.91	54.32	57.53	78.69	53.41	48.66	52.937	2
NE95489	46.66	26.90	53.61	52.37	67.39	37.20	46.78	47.271	25
NE95509	40.45	29.52	20.82	36.90	61.39	32.47	45.09	38.091	60
NE95510	44.29	27.19	48.62	52.84	75.98	52.26	50.07	50.179	11
NE95536	44.01	28.66	40.20	56.83	71.24	37.67	40.89	45.640	34
NE95537	48.94	25.95	48.72	53.31	69.83	26.77	45.00	45.503	37
SCOUT66	36.86	26.93	41.40	57.30	56.10	36.94	41.56	42.440	55
CENTURA	33.87	28.14	42.02	55.62	66.15	35.78	39.34	42.989	50
NE95546	40.54	29.86	28.58	57.70	71.92	39.66	36.99	43.606	45
NE95553	45.06	27.84	47.87	66.35	78.84	34.66	44.45	49.295	16
NE95587	42.88	24.84	47.09	52.94	68.95	41.81	45.68	46.313	31
NE95593	47.30	25.00	52.33	60.73	77.79	32.60	43.94	48.528	19
NE95632*	36.63	23.88	38.85	50.62	55.81	46.36	45.74	42.555	54
NE95656	41.72	23.88	30.09	56.83	67.81	29.06	41.78	41.595	57
NE95686	48.74	26.73	49.94	58.83	61.87	45.38	43.43	47.845	20
N94L212	48.87	27.20	47.46	50.24	66.02	30.84	46.58	45.315	38
CHEYENNE	39.86	26.94	39.67	61.95	55.83	39.45	34.77	42.637	53
BUCKSKIN	39.44	34.33	39.55	57.11	63.16	31.89	39.78	43.609	44
NE93549	36.43	22.57	45.81	48.33	72.12	27.17	46.46	42.699	51
NE94481	45.90	28.16	51.41	58.49	74.17	44.78	51.16	50.582	9

NE95518	38.54	24.88	38.29	57.34	64.31	35.38	38.02	42.393	56
NE95683	36.76	27.29	35.81	56.06	68.02	43.22	48.82	45.141	39
NE94507	41.29	32.19	41.59	59.29	64.71	25.19	43.52	43.969	42
NE95451	45.05	27.94	34.18	52.93	67.89	38.01	42.28	44.040	41
NE95508	42.27	28.51	45.68	55.99	60.12	34.93	39.79	43.896	43
NE95520	39.57	32.39	47.82	57.52	60.25	32.65	33.06	43.322	47
NE92652*	49.69	29.07	44.61	55.62	68.67	40.15	45.70	47.644	22
GRAND MEAN	44.40	27.50	44.63	55.87	69.07	38.31	45.03		
CV	11.38	13.26	14.20	8.40	5.98	17.63	8.78		
LSD	5.91	6.09	7.41	5.49	6.90	7.90	4.62		

*Advanced to USDA regional nurseries

The 1996 NIN yield data are given below. NEAVG is the yield average across all locations. NERANK is the rank of this mean. NEMODRNK is the rank of NEAVG_NM which is the yield average of all the locations except Nelson and Mead. One experimental line deserves particular notice, NE93554. It was the highest yielding line at Lincoln, Sidney, and McCook, and among the top four lines at Hemmingford and Mead (unreplicated trial).

1996 Nebraska Intrastate Nursery:

VARIETY	NEAVG bu/a	NERANK	NEMODRNK	NEAVG_NM	Hemming.	Lincoln	Mead bu/a	Sidney	Nelson	McCook
ARAPAHOE	41.786	25	29	52.00	64.92	41.79	27.80	55.10	14.93	46.18
NIOBRARA	40.780	34	11	54.34	62.68	30.58	20.10	61.91	7.22	62.19
PRONGHORN	42.866	18	10	54.37	70.65	31.81	30.20	50.96	9.51	64.07
NE90476	41.171	31	14	54.02	66.20	28.96	19.80	58.44	11.13	62.50
NE90479	39.258	45	49	49.03	58.52	26.24	30.20	49.31	9.21	62.07
WINDSTAR	43.342	16	16	53.82	63.52	33.25	33.90	60.72	10.88	57.78
NE91518	43.991	10	9	54.70	64.38	33.15	32.80	63.14	12.33	58.14
NE91631	42.166	22	23	53.01	58.74	39.05	26.80	59.77	14.16	54.48
NE91648	40.030	41	39	50.32	59.91	19.45	30.20	54.83	8.70	67.09
NE92456	38.915	49	48	49.10	58.92	28.25	26.70	49.15	10.40	60.07
NE92458	37.455	53	51	48.32	61.48	30.13	24.20	43.36	7.27	58.29
ALLIANCE	44.839	8	2	59.29	67.83	42.20	25.50	62.56	6.38	64.57
RAWHIDE	42.169	21	13	54.12	65.56	34.43	28.40	55.18	8.13	61.31
VISTA	40.333	40	33	51.30	59.52	27.40	26.00	57.76	10.80	60.52
NE92603	41.683	27	40	50.21	62.38	27.28	37.10	49.50	12.14	61.70
NE92608	40.613	35	28	52.12	66.23	12.51	25.90	65.11	9.29	64.64
NE92628	41.317	30	36	50.83	65.73	18.19	34.00	57.91	10.59	61.48
NE92646	39.937	42	38	50.67	65.84	21.69	28.20	59.86	8.74	55.29
NE92662	42.015	23	26	52.26	65.94	24.73	30.30	57.01	12.74	61.37
NE93405*	41.677	28	27	52.17	62.97	35.32	29.60	47.70	11.77	62.70
NE93427*	39.033	47	50	48.90	63.39	34.64	31.00	55.47	7.60	42.10
NE93496*	44.012	9	19	53.36	64.45	37.69	34.90	51.04	15.73	60.26
NE93522	43.482	14	20	53.34	62.28	41.51	36.70	50.06	10.84	59.50
REDLAND	40.906	32	42	50.11	63.15	24.76	34.70	48.97	10.28	63.57
TAM107	35.389	58	57	44.13	56.72	21.07	32.30	51.85	3.50	46.90
NE93549	43.721	13	22	53.17	67.18	37.13	36.30	53.02	13.34	55.36
NE93554*	50.208	1	1	63.42	68.97	47.49	38.60	68.94	8.98	68.27
NE93613*	45.776	6	5	56.99	67.54	30.64	34.10	64.44	12.61	65.33
NE93649	43.782	12	21	53.18	62.69	40.13	35.70	50.48	14.27	59.42
NE94407	35.509	57	59	43.71	61.09	15.60	29.90	50.78	8.33	47.35
NE94413	39.690	44	46	49.81	62.16	28.10	32.40	53.02	6.51	55.95
NE94445	42.857	19	18	53.61	68.65	30.46	36.30	54.58	6.39	60.76
NE94479*	42.638	20	15	53.84	63.08	34.97	27.10	57.83	13.36	59.49
NE94481*	43.377	15	17	53.71	67.22	27.60	28.70	60.30	16.74	59.70
NEKOTA	40.573	36	47	49.43	56.73	37.30	37.30	56.66	8.43	47.02
KARL92	38.001	52	54	45.92	56.76	26.49	36.90	51.46	7.42	48.97
NE94482*	41.344	29	37	50.70	68.64	29.44	32.50	55.87	12.76	48.86
NE94489*	40.483	37	43	49.98	63.17	21.80	33.60	57.84	9.40	57.09
NE94507	40.470	38	45	49.88	65.69	32.23	36.40	46.64	6.92	54.94
NE94512	43.252	17	30	51.79	66.01	27.38	38.90	50.74	13.46	63.02
NE94518	38.965	48	24	52.57	67.32	30.01	11.90	55.31	11.61	57.64
NE94567*	40.442	39	35	50.90	63.40	27.28	32.00	55.35	7.04	57.58
NE94577	41.766	26	31	51.65	61.95	34.54	36.10	54.64	7.88	55.49
NE94585	38.748	50	32	51.58	61.54	28.75	18.10	62.22	8.07	53.81

SIOUXLAND	45.419	7	6	56.57	65.44	38.52	34.90	60.98	11.33	61.34
SCOUT66	39.812	43	44	49.90	62.35	37.82	32.30	47.64	6.99	51.77
NE94588	43.943	11	12	54.21	66.56	37.01	37.60	55.89	9.22	57.38
NE94589	46.725	2	3	58.29	70.48	37.74	37.90	64.84	9.31	60.08
NE94632*	41.906	24	25	52.43	65.50	32.17	30.50	56.72	11.23	55.31
NE94653*	45.830	4	7	56.18	61.91	47.34	34.70	52.07	15.56	63.40
NE94654*	45.779	5	4	57.01	65.58	34.74	32.00	62.33	14.65	65.38
NE94655	46.193	3	8	55.44	61.69	48.17	39.20	52.58	16.19	59.33
NE94661	34.634	59	56	44.24	60.73	15.09	26.70	48.50	4.15	52.63
NE94665	37.052	54	58	43.80	59.48	24.53	39.20	42.68	7.91	48.51
NE94666	35.857	56	55	44.67	56.56	23.23	27.70	43.92	8.76	54.97
NE94673	40.788	33	34	50.97	57.82	35.67	29.10	47.62	11.74	62.78
NE94685	39.188	46	41	50.18	64.55	30.27	26.10	52.01	8.31	53.89
CENTURA	36.139	55	53	47.11	60.10	31.28	18.20	44.43	10.18	52.64
CHEYENNE	38.084	51	52	48.16	58.85	25.27	26.90	52.48	8.96	56.05
BUCKSKIN	33.520	60	60	41.91	52.98	25.71	25.50	51.61	7.99	37.33
GRAND MEAN	0.000				63.20	30.9	7	54.55	10.17	57.46
LSD	0.000				4.89	16.6	2	5.70	3.57	20.70

* Advanced to USDA regional nurseries.

5. Nebraska Triplicate Nursery:

The same comments about the NIN data apply to the Nebraska Triplicate Nursery (NTN). Again, 2137 and Alliance had very good years. Data for the 1998 NTN follow:

VARIETY	LINC.		CLAYCE		N.PLATTE		MCCOOK		SIDNEY		ALLIANCE		AVG.	
	bu/a		bu/a		bu/a		bu/a		bu/a		bu/a		bu/a	
NE97407	66.4	44	61.2	46	73.8	7	41.6	10	60.7	46	66.5	41	61.70	31
NE97415	72.1	18	65.5	21	61.5	53	28.1	59	59.2	51	68.9	34	59.23	51
NE97419	72.4	16	68.1	12	62.0	50	33.5	44	59.1	52	57.0	58	58.67	54
NE97421	66.7	42	64.9	22	67.9	21	37.0	32	69.1	13	69.1	32	62.46	24
NE97425	66.4	45	62.7	37	63.6	42	32.7	50	65.9	28	70.0	30	60.20	44
NE97426	65.9	49	60.8	48	62.8	46	38.0	25	68.9	14	83.9	3	63.36	20
NE97434	68.7	34	63.5	29	64.8	38	38.4	23	61.7	42	73.6	18	61.75	29
NE97436	66.1	48	59.6	52	65.5	33	35.4	40	63.0	37	77.9	8	61.27	36
NE97444	68.8	33	57.6	55	74.2	4	33.3	46	50.7	60	70.6	25	59.21	52
NE97465	71.3	22	66.8	18	72.2	10	45.3	3	58.5	54	93.4	1	67.91	1
NE97478	68.0	36	56.5	58	56.1	60	35.9	39	59.7	49	71.2	23	57.90	58
NE97481	65.1	51	59.3	53	63.6	44	42.3	8	61.0	45	61.1	52	58.71	53
NE97483	72.2	17	68.7	9	67.4	24	44.6	4	70.6	8	67.8	38	65.21	7
NE97487	69.9	29	67.6	15	60.1	55	33.2	48	55.8	57	61.8	50	58.06	57
ALLIANCE	71.9	19	61.7	42	67.5	23	47.3	2	67.2	17	79.8	5	65.91	6
NE97489	75.7	8	68.9	8	67.2	29	37.9	26	55.0	58	79.6	6	64.05	14
NE97491	66.8	41	63.5	30	65.4	34	37.1	31	61.5	43	66.6	40	60.15	45
NE97492	65.8	50	62.3	40	63.0	45	39.9	16	58.6	53	68.0	37	59.61	50
NE97494	68.1	35	62.6	38	66.4	30	38.9	20	56.0	56	74.1	16	61.00	39
NE97495	71.6	21	70.5	3	67.4	27	41.6	9	72.9	4	72.8	19	66.13	5
NE97496	72.9	14	64.4	26	64.4	40	38.9	19	63.6	35	59.0	57	60.54	41
NE97497	70.2	27	68.3	11	62.6	49	39.2	18	66.7	22	76.7	11	63.94	15
NE97498	64.2	54	58.4	54	63.6	43	41.0	11	57.2	55	77.5	10	60.31	42
NE97518	74.4	11	64.7	25	60.1	56	33.5	45	72.3	5	65.6	43	61.77	28
NE97519	70.5	26	69.0	7	64.5	39	40.3	14	61.0	44	60.8	53	61.00	38
NE97521	67.2	37	57.5	56	65.2	36	37.7	28	64.1	32	60.3	54	58.64	55
NE97531	66.1	46	69.5	4	68.8	18	39.7	17	66.6	23	68.7	35	63.23	21
NE97547	63.2	57	57.3	57	76.9	2	36.9	34	66.8	19	76.3	12	62.91	23
NE97548	63.7	56	63.4	31	63.8	41	38.7	22	65.9	27	62.6	48	59.68	48
ARAPAHOE	69.2	32	61.5	44	61.5	52	35.0	41	69.5	10	61.2	51	59.65	49
NE97553	69.4	31	69.2	5	73.0	9	36.4	36	68.5	15	70.4	29	64.48	12

NE97558	70.6	25	65.8	20	67.4	26	36.2	38	62.5	41	87.7	2	65.03	8
NE97559	73.5	13	66.6	19	70.9	13	44.2	6	63.9	34	69.3	31	64.75	10
NE97569	64.9	52	60.3	49	67.3	28	34.6	43	59.3	50	60.3	55	57.77	59
NE97592	63.0	60	67.9	14	68.5	19	40.5	13	62.7	39	68.6	36	61.85	27
NE97596	67.1	38	61.1	47	61.5	54	37.0	33	68.3	16	72.7	21	61.27	35
NE97612	75.1	9	71.3	1	67.5	22	40.9	12	66.1	26	63.5	45	64.07	13
NE97614	78.3	7	64.2	28	65.9	32	38.8	21	72.3	6	77.6	9	66.18	4
NE97619	79.2	6	61.5	43	61.7	51	32.6	51	62.8	38	66.9	39	60.78	40
NE97635	66.8	40	64.8	24	65.2	35	32.5	52	63.4	36	65.5	44	59.70	47
NE97637	63.2	58	62.9	36	68.4	20	34.6	42	66.4	24	74.9	15	61.71	30
NE97638	71.9	20	69.2	6	69.5	16	36.6	35	59.8	48	75.9	13	63.80	17
NE97664	63.0	59	64.3	27	73.7	8	40.0	15	53.6	59	72.7	22	61.20	37
NE97669	70.9	23	61.3	45	73.9	6	33.2	47	69.1	12	70.5	28	63.15	22
JAGGER	80.4	4	56.1	59	70.6	15	31.5	53	66.8	18	78.0	7	63.89	16
NE97670	70.7	24	67.4	16	65.1	37	37.5	30	60.4	47	70.6	26	61.96	26
NE97675	74.7	10	70.6	2	68.9	17	36.3	37	64.0	33	66.3	42	63.48	19
NE97676	70.1	28	62.4	39	62.8	47	37.5	29	66.7	21	62.3	49	60.31	43
NE97688	64.2	55	53.1	60	73.9	5	31.0	55	73.9	2	73.6	17	61.61	33
NE97689	73.8	12	67.9	13	74.6	3	37.9	27	64.4	31	80.2	4	66.47	3
NE97693	64.6	53	59.7	50	71.1	12	44.2	5	66.2	25	75.9	14	63.61	18
NE97698	69.8	30	63.0	33	70.9	14	47.7	1	65.3	29	70.6	27	64.54	11
NE97710	89.0	1	63.1	32	71.3	11	33.2	49	62.5	40	70.8	24	64.98	9
NE97713	67.0	39	63.0	34	66.3	31	30.4	56	73.7	3	69.0	33	61.56	34
NE97716	66.1	47	59.6	51	62.8	48	43.7	7	77.4	1	63.2	46	62.12	25
NI97410	72.5	15	67.1	17	57.1	59	28.4	58	69.2	11	55.4	60	58.27	56
NI97418	79.5	5	62.9	35	67.4	25	30.3	57	66.8	20	63.1	47	61.65	32
NI97423	81.1	3	68.6	10	57.9	58	26.7	60	70.0	9	55.7	59	60.02	46
NI97424	66.5	43	62.2	41	60.0	57	31.2	54	65.2	30	60.2	56	57.53	60
2137	82.4	2	64.9	23	77.9	1	38.0	24	71.4	7	72.8	20	67.88	2
GRAND ME	70.2		63.8		66.6		37.1		64.5		69.8		62.00	
LSD	9.86		9.91		7.93		10.18		12.44		10.35			

The Nebraska Wheat Quality Laboratory has evaluated these lines for milling and baking properties. Seven samples were evaluated as having notable baking characteristics: NE97481, NE97489, NE97491, NE97492, NE97521, NE97548, NE97553, and NE97638. These experimental lines had high loaf volumes. Additionally, the external appearance and internal characteristics of these experimental lines were scored in at least one category as good or very good. One exceptional experimental line, NE97492, had very good baking properties and strong dough mixing properties.

The overall baking evaluation of four lines (NE97483, NE97496, and NE97619, and NE97713) was less satisfactory. Specifically, the dough handling properties of NE97483, NE97497, and NE97713 were rated as sticky out of the mixer.

Each wheat sample from this nursery was evaluated at two locations (Alliance and McCook) on the Single Kernel Characterization System 4100. Five samples from Alliance (NE97492, NE97558, NE97614, NE97669, and NE97713) were scored as Mixed Wheat. These lines from McCook scored as Hard Wheat.

Data for the 1997 NTN follow:

VARIETY	LINC.	CLAYC.	N.PLAT	MCCOOK	SIDNEY	ALL.	AVG.	Rank
				Yield (bu/a)				

NE96435	40.10	52.02	50.28	75.05	36.51	50.49	50.74	1
NE96455	34.97	28.99	38.53	64.93	33.61	44.66	40.95	54
NE96458	38.58	21.93	44.17	65.70	36.71	46.04	42.19	48
NE96461	48.50	39.76	53.07	76.53	30.20	45.88	48.99	5
NE96462	35.99	34.72	31.30	67.30	41.37	42.54	42.20	47
NE96473	39.43	48.90	42.64	59.33	26.95	45.48	43.79	37
NE96476	42.07	30.12	24.63	62.19	29.21	38.26	37.75	59
NE96510	43.76	53.87	40.25	65.85	43.27	40.71	47.95	10
NE96515	43.37	40.82	36.41	62.40	32.94	47.26	43.87	36
NE96518	36.59	28.46	27.41	69.98	39.84	42.12	40.73	55
NE96520	40.04	41.42	42.00	62.78	17.14	47.87	41.87	51
NE96526	42.22	38.85	33.68	63.75	38.09	39.12	42.62	45
NE96566	32.29	37.05	30.09	70.32	23.13	47.42	40.05	56
NE96573	37.71	54.35	53.69	74.04	34.44	48.13	50.39	2
ALLIANCE	43.63	43.88	39.92	65.43	42.43	49.86	47.52	14
NE96577	40.83	40.55	38.09	65.87	35.96	43.12	44.07	33
NE96579	42.22	38.63	44.01	68.31	37.63	45.37	46.03	17
NE96580	38.22	41.89	44.97	62.84	36.82	44.70	44.91	27
NE96584	36.04	37.32	48.60	60.50	19.25	51.38	42.18	49
NE96585	42.72	27.97	42.38	60.13	31.74	44.28	41.54	52
NE96605	38.13	42.74	55.67	66.25	40.95	47.81	48.59	6
NE96607	46.13	46.16	51.51	62.13	36.99	42.94	47.64	12
NE96618	41.18	37.51	47.47	71.35	30.05	45.43	45.50	21
NE96621	34.75	44.43	38.93	69.41	37.34	42.50	44.56	30
NE96622	36.60	44.29	36.45	73.96	33.90	42.43	44.60	29
NE96623	36.92	47.50	40.72	67.43	34.21	45.01	45.30	22
NE96625	38.74	45.49	32.16	70.38	37.57	45.38	44.95	26
NE96627	37.02	47.19	44.41	72.36	46.00	41.99	48.16	7
NE96628	38.34	48.97	48.42	59.45	34.55	45.22	45.83	19
ARAPAHOE	41.52	55.57	43.56	70.99	48.03	41.55	50.20	3
NE96630	43.73	34.47	38.58	69.30	37.96	42.25	44.38	31
N396632	39.76	52.51	38.84	64.27	37.40	49.93	47.12	15
N396638	39.71	42.80	33.19	69.31	39.22	41.61	44.31	32
N396641	45.01	37.13	45.49	69.31	24.88	46.08	44.65	28
NE96644	38.65	41.49	46.02	69.28	28.00	46.76	45.03	24
NE96647	35.49	37.39	43.84	70.46	28.41	45.84	43.57	38
NE96649	35.44	41.81	40.39	72.13	49.49	45.98	47.54	13
NE96650	32.63	46.63	38.26	59.41	37.73	43.62	43.05	43
NE96652	40.25	52.96	45.57	71.35	36.40	41.31	47.97	9
NE96654	42.47	46.76	50.62	68.19	26.12	43.55	46.29	16
NE96658	40.48	42.50	36.43	62.34	34.28	42.56	43.10	42
NE96659	29.77	35.80	33.72	67.58	33.52	37.58	39.66	58
NE96661	32.47	55.54	38.88	51.52	36.49	39.92	42.47	46
NE96676	42.04	51.94	45.05	59.66	33.61	37.72	45.00	25
KARL92	39.18	29.51	33.87	59.41	29.98	46.72	39.78	57
NE96677	31.94	55.48	46.05	64.92	32.69	44.16	45.87	18
NE96679	37.21	41.72	35.12	63.41	37.88	42.09	42.90	44
NE96682	37.07	56.47	40.21	48.23	25.74	45.22	42.16	50
NE96690	42.29	48.53	40.54	61.35	43.00	35.95	45.28	23
NE96697	36.46	50.35	44.40	57.81	33.90	37.10	43.34	41
NE96700	28.89	34.19	44.23	62.93	49.88	40.64	43.46	40
NE96704	38.00	18.50	38.37	60.91	24.20	37.70	36.28	60
NE96722	42.45	21.71	42.52	67.12	43.72	46.77	44.05	34
NE96723	41.76	38.92	40.67	64.80	30.79	44.16	43.52	39
NE96727	35.76	38.49	36.86	59.52	49.52	43.40	43.93	35
NE96737	48.90	45.21	41.65	68.50	36.28	46.81	47.89	11
NE96740	41.76	19.01	36.66	60.25	47.32	43.42	41.40	53
NE96744	35.58	39.36	52.81	55.26	49.24	41.72	45.66	20
NE96747	37.35	45.61	52.43	66.15	40.55	46.20	48.05	8
PRONGHORN	38.29	48.40	45.88	69.83	45.71	50.92	49.84	4
GRAND MEAN	38.99	41.54	41.54	65.36	35.84	44.04	44.55	

CV	10.63	12.80	22.84	6.72	16.20	7.99			
LSD	5.61	7.20	12.85	7.34	7.86	4.76			

Nineteen lines were advanced to the Nebraska Intrastate Nursery which is slightly below normal for advancement from this nursery. The low number is in part due to a more normal year for grain protein quality and some lines which previously appeared to be adequate for quality were considered as being deficient.

6. Regional Nurseries

The Southern Regional Performance Nursery (SRPN) and Northern Regional Performance Nursery (NRPN) were harvested at Lincoln, Clay Center (SRPN only), North Platte, Sidney, and Alliance. Yields were as follows:

SRPN:

VARIETY	Yield (bu/a)					Rank					AVG.	Rank
	Linc.	Clay C.	N. Plat.	Sidn.	Allia.	Linc.	Clay C.	N. P.	Sidn.	All.		
1 KHARKOF	44.0	50.6	30.3	45.8	60.5	45	44	45	40	38	46.25	45
2 SCOUT66	56.5	56.9	40.8	44.0	65.9	44	36	44	42	28	52.81	44
3 TAM-107	73.3	62.3	61.5	63.7	84.2	20	27	28	12	2	68.97	12
4 OK94P549	79.0	65.5	65.1	69.6	71.2	5	19	22	4	16	70.08	9
5 OK95548	74.9	74.6	82.6	58.7	63.3	17	3	3	21	33	70.82	8
6 OK95571	82.1	65.6	64.3	68.0	83.8	2	18	24	5	3	72.72	2
7 OK95593	72.6	72.2	59.5	54.3	58.4	23	5	29	30	43	63.41	32
8 OK95G701	70.3	56.3	49.8	57.6	68.6	29	40	43	25	18	60.51	39
9 TX91D6825	62.9	71.2	79.1	49.2	59.8	41	7	6	37	40	64.44	29
10 TX91D6856	82.3	76.6	70.1	58.6	60.0	1	1	17	22	39	69.50	10
11 TX94V2327	68.4	68.0	56.4	63.8	66.7	32	12	36	11	26	64.67	28
12 TX95V4926	72.3	67.0	64.8	42.8	83.4	25	15	23	44	4	66.06	22
13 TX95V4933	66.9	70.3	58.6	53.5	77.3	37	8	31	32	8	65.33	24
14 TX95V5332	67.8	69.8	55.2	37.7	58.8	33	9	38	45	42	57.84	43
15 TX94V2130	57.8	51.3	63.1	50.6	68.5	43	43	27	35	20	58.26	42
16 CO940700	77.4	61.7	72.5	51.6	67.8	9	30	14	33	21	66.19	21
17 KS95HW62-6	75.1	62.2	57.9	59.0	56.2	16	28	34	20	45	62.08	36
18 KS95H165-3	69.3	63.7	55.1	60.7	75.2	31	23	40	17	10	64.79	26
19 KS95H176-1	65.5	65.0	58.5	63.9	59.3	39	20	32	10	41	62.44	35
20 KS90175-3	70.4	62.9	78.0	62.3	67.7	28	25	7	15	22	68.26	15
21 KS89180B-2-1	75.7	72.1	91.3	43.5	80.7	15	6	1	43	7	72.64	3
22 KS97P0630-4-5	73.4	73.9	79.6	46.4	82.2	19	4	5	39	5	71.08	7
23 KS97W0935-29-15	73.6	66.5	77.6	57.7	68.6	18	16	8	24	19	68.78	13
24 KS91W009-6-1	70.1	56.7	74.2	67.6	65.2	30	38	10	6	31	66.74	19
25 NE95L158	79.6	46.6	90.7	54.6	70.9	4	45	2	29	17	68.45	14
26 NE93496	67.7	58.8	69.2	60.5	63.0	34	34	18	19	34	63.82	30
27 NE94632	77.1	67.4	50.9	54.7	65.2	11	14	42	27	30	63.06	33
28 W95-210	66.9	56.4	72.5	58.2	60.9	36	39	13	23	36	62.98	34
29 W95-188	58.3	63.6	57.1	44.7	75.6	42	24	35	41	9	59.84	40
30 W94-244-132	72.8	69.6	73.4	50.4	74.2	22	10	11	36	13	68.06	17

31	W95-301	66.9	66.1	55.7	54.1	64.5	35	17	37	31	32	61.45	37
32	W95-221	78.4	51.9	71.5	60.6	71.4	7	42	15	18	15	66.75	18
33	WX94-3504	77.7	75.7	77.5	65.7	61.6	8	2	9	8	35	71.63	4
34	XH1881	76.9	68.1	67.4	82.1	91.3	12	11	20	2	1	77.15	1
35	XH1875	80.1	67.9	69.1	64.8	74.3	3	13	19	9	12	71.23	5
36	XH1872	78.9	62.6	66.1	82.2	66.2	6	26	21	1	27	71.19	6
37	T99	71.7	61.5	59.2	67.2	66.9	26	31	30	7	25	65.29	25
38	T100	65.0	60.7	54.8	51.2	67.1	40	32	41	34	23	59.73	41
39	T101	72.6	56.8	55.1	60.9	57.7	24	37	39	16	44	60.60	38
40	T102	73.1	57.7	72.9	49.2	65.5	21	35	12	38	29	63.66	31
41	G14264	76.1	61.9	64.2	54.6	67.0	14	29	26	28	24	64.74	27
42	G15048	76.5	63.7	70.3	62.5	72.9	13	22	16	14	14	69.18	11
43	G15011	77.2	59.0	58.5	71.7	74.7	10	33	33	3	11	68.22	16
44	G15458	70.7	64.7	81.8	54.9	60.6	27	21	4	26	37	66.54	20
45	G15111	65.9	54.4	64.2	62.9	81.3	38	41	25	13	6	65.72	23
	GRAND MEAN	71.4	63.5	65.5	57.7	69.0						65.42	
	CV	11.00	12.97	16.87	20.00	21.73							
	LSD	12.74	13.37	17.93	18.74	24.33							

Data for the NRPN:

		Yield (bu/a)				Rank					
										Aver.	Rank
	VARIETY	Linc.	N.Pla.	Sidn.	Alli.	Linc	N.Pla	Sidn	Alli		
1	KHARKOV	36.2	38.9	53.8	51.5	30	30	30	27	45.11	30
2	ROUGHRIDER	44.3	45.3	58.9	50.2	29	28	28	28	49.67	29
3	ABILENE	72.3	47.4	66.4	45.7	13	27	16	30	57.93	27
4	SD92107	57.6	42.3	63.5	54.4	27	29	24	26	54.45	28
5	SD93267	61.6	51.6	62.4	78.3	23	25	26	10	63.47	23
6	SD93380	69.8	58.2	64.8	70.2	15	16	22	19	65.74	19
7	SD93338	77.0	59.4	65.7	59.5	6	13	19	25	65.41	20
8	SD93528	66.7	52.7	65.2	68.3	19	22	21	21	63.21	24
9	SD94149	77.7	56.1	67.0	69.4	5	17	14	20	67.53	13
10	SD94227	62.8	63.3	60.9	80.5	22	8	27	8	66.88	15
11	SD94241	66.7	60.2	65.5	49.1	18	12	20	29	60.39	26
12	NE94479	76.0	78.1	68.3	74.5	8	1	13	16	74.23	6
13	NE94482	85.0	58.7	74.0	83.8	1	14	4	6	75.39	5
14	NE94653	67.0	69.4	68.8	76.2	17	5	11	14	70.33	7
15	NE94655	73.9	61.2	66.7	65.4	10	10	15	22	66.83	16
16	NE94654	76.6	54.7	71.6	77.3	7	19	8	13	70.06	8
17	NE94589	56.9	50.1	70.0	84.0	28	26	10	5	65.25	21
18	NE95473	77.9	53.1	66.2	79.2	4	21	17	9	69.08	9
19	NE95553	60.3	51.9	66.0	77.7	25	24	18	12	63.94	22
20	NE95656	81.9	58.5	54.6	76.0	2	15	29	15	67.73	12
21	N95L189	63.8	64.5	72.1	72.3	21	7	7	17	68.17	11
22	N95L1224	73.0	60.7	68.7	64.2	12	11	12	23	66.66	17
23	N95L1226	70.5	62.5	73.3	62.9	14	9	6	24	67.28	14

24	N95L1229	64.7	64.8	74.7	70.7	20	6	2	18	68.73	10
25	XNH1824	69.5	75.6	74.0	82.6	16	2	5	7	75.42	4
26	XH1881	75.1	73.2	76.9	107.7	9	4	1	1	83.26	1
27	XH1872	81.4	73.8	71.4	86.8	3	3	9	4	78.35	2
28	XNH1778	73.1	55.9	74.3	102.1	11	18	3	2	76.33	3
29	NE95518	60.6	53.5	64.3	87.8	24	20	23	3	66.56	18
30	NE95632	57.9	52.1	63.4	78.1	26	23	25	11	62.86	25
	GRAND MEAN	67.9	58.3	67.1	72.9					66.54	
	CV	11.27	15.59	10.18	14.15						
	LSD	12.51	14.84	11.16	16.85						

In these regional nurseries, the hybrids (XH, XNH, and WX lines) continue to perform well. In the SRPN, few Nebraska experimental lines are entered because they tend to be too late for that nursery. The better experimental lines for Nebraska tend to be entered in the NRPN where they perform well. However, high yielding early lines are a need for Nebraska and increased efforts in selecting these types are needed.

7. Multiple-Location Observation Nursery

Seven replications (locations) of this nursery were harvested and used for selection. Due tot he size of this nursery, spatial variation continues to be a concern at many locations. Enhanced statistical analyses for these trials continue to be sought. Fifty lines (including four lines from Dr. C. J. Peterson's breeding efforts) were advanced to the Nebraska Triplicate Nursery. An additional six lines from the irrigated wheat efforts were advanced to the Nebraska Triplicate Nursery. In reviewing the pedigrees of the lines in this nursery, it is apparent that most of the elite germplasm involves very narrow crosses (e.g. Nebraska x Nebraska lines or Nebraska x regional lines x Nebraska lines). The effective use of germplasm introductions seems to require at least two cycles of selection (the first selections from crosses involving introductions lead to parents and crosses with those parents may lead to varieties).

8. Early Generation Nurseries

a. Single-plot Observation Nursery

Seventeen hundred twenty lines including checks were evaluated at Lincoln in 1998. Of this group, 403 lines were harvested and most were submitted for Quadrumat Junior milling, flour protein content, and dough mixing properties. Frankly, this nursery was a disappointment. In 1997, our headrow nursery was planted into extremely droughty soils and there was insufficient moisture throughout the growing season to develop vigorous plants. All the headrows were short, and generally lacked vigor. The headrow selections planted in the 1998 observation nursery grew under excellent conditions and generally were extremely tall. In some ways, it was fortunate that there were 400 lines worthy of selection. Few if any of the selections could be considered short semi-dwarfs needed to high input agriculture. 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, 285 lines were selected for further testing. In the past, additional lines from Dr. Peterson would be added to this nursery, however, with his accepting a position in Oregon, a separate, replicated nursery was developed for his material. Thirty-eight red grain experimental lines were entered into that nursery.

b. Headrow Nursery

Over 40,000 headrows were planted at Mead. In general, the headrow nursery was above average. We were able to plant the nursery in early September (while another crew was planting North Platte and Clay Center). This was a tremendous benefit as the lines were planted following spring oats, into good moisture and had excellent fall growth. Over 1650 rows were selected and 16565 lines were advanced to the observation nursery. In addition, about 40 lines to Dr. Joe Martin (Kansas State University at Hays, Kansas) for wheat steak mosaic field testing and 331 strong strawed semi-dwarf lines were directly advanced to an irrigated observation nursery in cooperation with Dr. David Baltensperger.

a. F3 bulk hybrids

The F3 bulk hybrid nursery contained 876 bulks and check plots and were planted at Mead and Sidney. Most bulks survived the winter and were good for selection. Heads were selected from the Mead bulks and the seed quality would be considered as average. The number of F3 bulks is larger than normal due to our planting segregating red and white F3 and F4 bulks. The frequency of white segregants should be higher in F4 bulks than in F3 bulks. Over 40,000 head rows were selected for fall planting. The headrows were planted very 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 918 bulks and check plots. These bulks generally survived the winter, but some were winterkilled (those involved spring wheat parents) and some were damaged by rodents. As in the past, we continue to share our bulks with other programs (Colorado State University and South Dakota State University) and receive bulks from other programs (Colorado State University, Kansas State University, Texas A&M University, and South Dakota State University). This germplasm sharing should continue as many more crosses are made among breeding programs than can be fully evaluated (i.e. my crosses are evaluated in Nebraska, but could have utility elsewhere if they were evaluated). An additional 60+ bulks were received from Scott Haley

Due to the large number of bulks, only 600 were advanced as individual bulks for further consideration. Those bulks that were not advanced were combined to form a large bulk that was planted in hopes we wold not lose any valuable germplasm. This is a departure from our past breeding system, but was implemented to insure more resources are being used for those populations having the greatest potential. Bulks that segregating for red and white seed types, had the white seeds had selected and planted in the greenhouse to add to our white wheat populations.

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

The triticale nurseries this year were above average at Lincoln and Sidney. Mead was abandoned due to excessive rain at harvest. 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. Triticales with high grain and forage yield potential are available and may be useful as a feed grain or forage crop. Triticale research has replaced our research on feed wheat. Dr. Ken Vogel (USDA-ARS, forage grass geneticist) has begun evaluating some of the forage triticales for forage potential and preliminary data indicate some lines may be commercially competitive with the best available forage triticale varieties. Dr. Jim Peterson also makes a valuable contribution to this project by planting and harvesting for grain, the forage triticale trials at McCook and Sidney. Two lines NE96T422 and E96T441 are under small scale increase for possible release as forage triticale.

VARIETY	Lincoln				Sidney	Avg.	Rank		
	Ht (in)	HD	Yld (bu/a)*	Lodg	Yld (bu/a)*	bu/a*	State	Linc.	Sidn.
1 PRESTO	47.5	19.5	66.2	0	63.2	64.68	5	4	8
2 TSW250783	46.5	21.0	71.9	0	75.6	73.71	1	1	1
3 NE92T422	47.5	20.0	60.8	0	60.1	60.47	12	11	12
4 NE94T416	48.5	23.5	37.6	0	41.1	39.36	29	29	27
5 NE95T423	47.5	20.0	63.5	0	62.8	63.15	8	6	9
6 NE95T424	48.5	20.0	62.7	0	59.2	60.95	11	8	13
7 NE95T426	44.5	19.5	63.1	4	68.1	65.60	4	7	4
8 NE95T427	46.5	19.0	57.0	1	67.1	62.03	10	15	6
9 NE95T436	48.5	23.0	51.6	0	58.4	55.00	18	21	15
10 NE96T404	46.5	22.5	53.7	0	54.1	53.93	20	20	19
11 NE96T413	49.5	20.5	68.5	0	67.3	67.87	3	3	5
12 NE96T420	46.5	21.0	54.1	0	74.3	64.17	6	19	2
13 NE96T422	60.5	25.0	42.8	2	38.1	40.45	28	28	29
14 NE96T431	46.5	19.5	71.1	0	66.7	68.87	2	2	7
15 NEWCALE	44.0	19.0	51.0	2	46.5	48.75	25	24	23
16 NE96T440	47.0	21.5	49.0	0	47.6	48.29	26	26	21
17 NE96T441	56.5	25.0	44.8	1	38.4	41.58	27	27	28
18 NE97T404	48.5	19.0	54.2	2	44.2	49.21	24	18	25
19 NE97T407	44.0	18.0	61.9	1	43.8	52.80	21	9	26
20 NE97T416	48.0	22.0	58.3	2	54.5	56.40	16	14	18
21 NE97T425	48.5	19.5	61.3	3	53.9	57.57	14	10	20
22 NE97T426	46.0	20.0	51.1	1	59.0	55.05	17	23	14
23 NE97T432	45.5	20.5	59.3	3	68.4	63.83	7	12	3
24 NE97T433	46.0	21.0	63.7	2	60.9	62.31	9	5	10
25 NE97T435	47.0	21.0	50.9	2	47.6	49.25	23	25	22
26 NE97T452	45.5	19.5	55.4	0	57.9	56.67	15	17	17
27 NE97T454	47.5	20.0	58.5	0	60.3	59.37	13	13	11
28 NE97T457	53.0	20.0	55.9	6	44.3	50.13	22	16	24
29 ARAPAHOE	40.0	21.0	51.2	0	58.3	54.76	19	22	16
30 TRICAL	57.5	26.5	28.6	3	15.7	22.14	30	30	30

GRAND MEAN	48.0	20.9	56.0	1	55.2	55.61
CV	3.40	2.30	10.63	0	15.86	
LSD	3.34	0.98	9.73	0	14.32	

* using a 60 lbs/bu for easy comparison to winter wheat yields. The actual standard for triticale is a 48 lbs/bu

1997 Triticale Results:

VARIETY	Linc.	Mead	Sidney	Avg.	Rank
		bu/a*			
PRESTO	37.55	24.00	49.12	36.89	12
NE90T413	37.88	18.03	34.58	30.16	23
TSW250783	37.44	27.55	53.72	39.57	5
NE92T422	37.09	33.95	50.57	40.54	4
NEWCALE	27.83	19.45	43.22	30.17	22
NE94T407	37.44	22.88	50.10	36.81	13
NE94T416	34.66	18.33	62.80	38.60	7
TRICAL	24.82	17.50	32.90	25.07	29
NE95T423	38.76	24.33	48.07	37.05	10
NE95T424	38.98	22.15	51.70	37.61	9
NE95T426	47.59	29.38	48.65	41.87	2
NE95T427	37.62	18.25	61.60	39.16	6
NE95T436	34.61	24.35	55.22	38.06	8
ARAPAHOE	31.74	19.68	42.05	31.15	19
NE96T404	24.61	28.48	50.02	34.37	15
NE96T410	25.97	21.80	47.07	31.61	18
NE96T411	31.06	31.15	27.30	29.84	24
NE96T412	32.16	22.23	38.15	30.85	20
NE96T413	34.92	35.88	58.55	43.12	1
NE96T418	21.55	18.88	40.15	26.86	28
NE96T420	36.40	20.68	53.77	36.95	11
NE96T421	32.47	22.23	42.45	32.38	17
NE96T422	34.80	16.53	30.75	27.36	25
NE96T423	24.01	22.63	34.33	26.99	27
NE96T424	28.09	14.43	20.88	21.13	30
NE96T429	30.77	18.30	50.93	33.34	16
NE96T431	42.74	16.80	49.68	36.40	14
NE96T440	37.95	23.33	61.60	40.96	3
NE96T441	33.75	22.68	25.48	27.30	26
NE96T451	28.96	14.78	47.18	30.30	21
GRAND MEAN	33.47	22.35	45.42	33.75	
CV	9.40	28.75	23.78		
LSD	4.29	10.92	14.74		

* using a 60 lbs/bu for easy comparison to winter wheat yields. The actual standard for triticale is a 48 lbs/bu.

10. Wheat Transformation and Tissue Culture Studies

Due to a successful grant writing efforts (both within the university and for nationally competitive grants; approximate funding is $2,000,000 over five years), a team of scientists (Dr. A. Mitra, Dr. J. van Etten, Dr. R. French, Dr. P. Staswick, Dr. J. Morris, Dr. T. Elthon, Dr. P. Blum, Dr. H. Cerutti, Dr. K. Gill, Dr. T. Clemente, and Dr. Baenziger) at the University of Nebraska has developed a major effort on gene expression in plants with an emphasis on wheat and soybean transformation. In wheat, the key goals for transformation are improved transformation methods and disease and stress (mainly heat) resistance. Dr. Clemente and Ms. Shirley Sato lead the wheat transformation efforts. Numerous transgenic plants have been created using the particle bombardment technique and progress has been made developing an Agrobacterium facilitated method. One of the main disease resistance efforts currently being studied is the 2-5A system, a key research area of Dr. Mitra, which may provide broad-spectrum resistance to RNA virus (such as wheat streak mosaic virus). Mr. Todd Campbell, a graduate student, is genetically characterizing 2-5A transgenic plants. One of his more interesting findings is that that while co-transformation is common (in this research, genes on three plasmids were inserted), co-insertion is less common (i.e. the three plasmid did not always insert at the same site). The importance of this finding is that it may be possible to have genes of interest (there are two main genes in the 2-5A system) co-insert, but have selectable marker genes (often antibiotic resistance genes) insert at different genome locations which can later be bred out of the populations. Some consumers are concerned with antibiotic resistance genes in food.

Our future plans include further genetic characterization of transgenic plants, developing optimized transgenes for expression in wheat, and adding possible fungicidal genes as part of the scab initiative research (cooperative project among Drs. Mitra, M. Dickman, Clemente, and Baenziger). The four genes (which may affect scab disease development), we wish to insert into wheat encode: a) CED9, b) IAP (inhibitor of apoptosis—programmed cell death), c) lactoferrin and a related derived protein, lactoferricin, and d) oxalyl-CoA- decarboxylase. We also wish to insert both lactoferrin and oxalyl-CoA- decarboxylase in hopes the two genes combined may have enhanced antifungal properties. These four genes were chosen because these genes in transgenic tobacco plants have shown potential for combating economically important fungal diseases of crop plants. In addition, these four genes represent distinctly different target specificities (modes of action).

Mr. Kamil Haliloglu, in cooperation with Ms. Sato, Drs. Clemente and Mitra, is conducting research on improving *Agrobacterium* mediated transformation of wheat using immature embryos. Mr. Kim Kyung-moon is trying to improve our anther culture systems with the intent to transform haploid cells. Plant transformation is considered a key technology for modern crop improvement.

11. Chromosome Substitution Lines

This research was undertaken with the expectation as we learned more about the wheat genome, we would be able to develop better breeding strategies. Dr. Mohammed Maroof Shah, a former graduate student, completed the data analysis of the field evaluations of the recombinant inbred chromosome lines (RICLs) for Cheyenne (CNN)-Wichita (WI) chromosome 3A lines. As in our previous studies, CNN(WI3A) had significantly higher grain yield, and kernel weight CNN. CNN(WI3A) was also significantly earlier flowering than CNN. The parent lines were not different from each other for grain volume weight, which

may reflect the fewer environments in which we have completed our measurements for this trait. Hence the quantitative trait loci (QTLs) for grain yield on chromosome 3A, despite having a significant G x E interaction, have been identified in 8 (Berke et al., 1992a), 4 (Yen et al., 1997), and now in 7 environments.

Significant differences were identified among the RICLs for those traits that the parent lines were significantly different which indicate that the parental QTLs are segregating among the RICLs. Among the RICLs there appeared to be no statistically significant transgressive segregation, which can be interpreted as the parent lines differing by one gene or by genes in coupling phase. The frequency distributions were tested for normality and with the exception of anthesis date, all of the distributions were statistically normal. Anthesis date was bimodal with the peaks being similar the parental values. When grouped by the parental values, a chi-square test indicated 1:1segregation for anthesis date, indicating a single gene segregation. A significant correlation was found between anthesis date, plant height, and 1000 kernel weight. Generally, most of the early flowering and short statured lines were similar to CNN(WI3A) for 1000 kernel weight while most of the late flowering and taller lines were similar to CNN. However, two lines had plant heights similar to CNN(WI3A) but were as late as CNN which we believe indicated crossing over between the gene controlling anthesis date and the gene(s) or QTLs for plant height or one of the traits is controlled by additional genes. Larger GxE effects for yield and its component traits; kernel tiller^{-1} and tiller m^{-2}, and for grain volume weight may be the reasons of not detecting major genes for these traits.

Dr. Shah, in cooperation with Dr. Kulvinder Gill, determined using 51 RFLP probes, that 78% detected polymorphism between CNN and WI with one or more of the seven restriction enzymes, 43% detected polymorphism for chromosome 3A, 66% probes were found polymorphic for chromosomes 3B or 3D. This high level of RFLPs between these cultivars was unexpected and may be somewhat fortuitous. Thirteen RFLPs and a phenotypic locus, anthesis date, were used to develop a genetic linkage map of chromosome 3A and to identify QTLs associated with agronomic traits. The major locus affecting anthesis date was mapped distal to an RFLP marker locus *Xcdo549* on short arm of the chromosome. Individual loci explained from 8.9% to 38% of the total phenotypic variation for the measured traits. Multiple regression models explained 18% to 55% of the phenotypic variation. The anthesis date locus explained 38.2% of the total phenotypic variation for plant height, and 17.4% for kernels/tiller and kernel weight, respectively. Additional QTLs for each of plant height, kernel weight, and kernel/tiller were identified on the chromosome. In addition, a tightly linked QTL for spikes/m^2 to the QTLs for plant height and kernel/tiller was also identified. No QTL(s) for grain yield and grain volume weight were detected. No significant epistasis was detected between markers associated with QTLs.

12. White Wheat

In the past, this project's efforts have emphasized developing hard red winter wheat cultivars, while Dr. Peterson emphasized developing hard white wheat cultivars. With Dr. Peterson accepting a position at Oregon State University, Dr. Bob Graybosch, USDA-ARS and I have begun an orderly transfer of white wheat germplasm to the state wheat breeding effort over the next four years. The current elite lines will continue to be advanced by Dr. Graybosch until they are released or dropped. However, early generation materials and their progeny are being transferred. 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. The goals of the white wheat breeding effort will continue to be those of needed by the market and well recognized by Dr. Peterson. Specifically white wheats need to be truly white, dual purpose (capable of making noodles or bread), and should not discolor in fresh noodle products. NuPlains is an excellent example of a cultivar with these characteristics.

A small effort will continue in developing purple and blue wheats for unique markets. In our program we have identified a high yielding purple, softer wheat. A clearly identified (marked) soft wheat may have utility for organic or conventionally grown soft wheat production in non-traditional production areas. Blue wheat can also be used as a marker for natural and induced outcrossing, and potentially as way of determining the level of stress in a field (the blue color forms late in the seed development and stress may end kernel development before the blue color is completed).

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, wheat leaf rust, and as time permits with wheat streak mosaic virus. The greenhouse tests were excellent. Unfortunately, in the field, the weather was such that we did not have a successful stem rust field inoculation.. 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.

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 which may have this source of resistance were given to Bob Graybosch who in cooperation with Drs. Martin, French, and Stenger are testing them in the field in Lincoln, NE and Hays, KS.

14. Considerations on Nursery Sites

At the recommendation of Dr. Peterson who has had excellent trials at Grant, NE, we added Grant to our testing environments. To avoid greatly increasing our seed requirements and harvest needs, we moved the Multiple-Location Observation Nursery to Grant from North Platte. We also planted two replications of the NIN and NTN at Grant and North Platte. North Platte remains the testing site for the regional nurseries and graduate student research. Hence we have similar sized nurseries at North Platte, McCook, and Grant. The land at McCook and Grant is very uniform and we believe two replication trials should provide excellent performance data. This change will add only 60 additional plots for harvest, but should provide markedly better information on our experimental lines and their adaptation in central Nebraska. Efforts continue to develop better analytical methods for data analysis. With more information becoming available on karnal bunt, it is our hope that the southcentral site will again use a sustainable farm to increase our linkages with these emerging farming groups.

16. Global Change Research

One of the new areas that the project hopes to become involved in is global change scenarios. A large, interdisciplinary effort involving crop modeling (Dr. A. Weiss), crop physiology and production (Dr. T.

Arkebauer, Dr. J. Maranville, Dr. Drew Lyon, Dr. Madhavan), cereal chemistry (Dr. D. Shelton), biometrics (Dr. K. Eskridge), economics (Dr. G. Helmers), and plant breeding (Dr. Baenziger) has been formed. 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. We built at Mead, the first "field chambers" in the Great Plains to study enhanced CO_2 and warming scenarios. Unfortunately, the plastic film, chosen for its durability and light transmission properties, did not survive our first windstorm. Evidently cold weather and wind driven, fine dust particles punctured the film, which then tore in the wind. A heavier plastic sheathing is currently being reviewed as a possible replacement. 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. While this may seem too future oriented, it should be recognized that 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. The National Institute for Global Environmental Change (NIGEC) and the National Science Foundation (NSF) is funding this research.

IV. GREENHOUSE RESEARCH

The F_1 wheat populations were grown only in the Lincoln Greenhouses to avoid possible losses to winterkilling. Over 600 F_1 populations were grown. This is higher than normal and translates to over 650 F_2 plots including checks planted in 1998-1999. An additional 600+ wheat crosses were made for breeding purposes including improving the genetic male sterile population (first planted in 1990). Some crosses were made for genetic studies. In the triticale program, over 70 crosses were made.

V. PROPRIETARY RESEARCH

With the advent of plant biotechnology and hybrid wheat, the necessity and desirability of interacting with commercial has increased. In 1996, the University of Nebraska signed its first agreement to allow a commercial hybrid wheat company to access one of its lines as a hybrid parent. Over 800 unreleased experimental lines have been sent to a hybrid wheat company for evaluation as potential future hybrid wheat parents.

We continue to negotiate with an agricultural chemical company for the commercial use of their herbicide tolerant wheat germplasm. We have received the germplasm and have rapidly introgressed the trait into our germplasm with the expectation that we can come to agreement on the terms of use. This germplasm is potentially quite useful as the herbicides have residual activity and control most grassy weeds (i.e. jointed goat grass, downy brome, cheat grass). Herbicide tolerance will also allow greater flexibility for cropping rotations and will involve our dryland-cropping specialists, particularly Dr. Drew Lyon.

We are also negotiating with a commercial seed company for the exclusive release of our winter barley germplasm with a research fee clause. It is expected our forage triticale germplasm will be released to some form of a consortium on a research fee basis, also. Wheat cultivars will continue to be released without research fee agreements.

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. Approximately 40 spring wheat crosses were made in fall, 1997 with an additional 30-40 winter by spring crosses to be made in spring, 1998 and an additional 40 crossed being made in fall, 1998. Dr. Jackie Rudd of South Dakota State University graciously shared his elite trial and 30 bulks for our evaluation. Unfortunately, the 1998 field harvest was exceptionally poor and relatively little was learned other than we need to know a lot more before we can develop spring wheat cultivars for viable production systems.

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

An excellent crop was harvested in 1998 (estimated to be 84,600,000 bu), which represented a 47 bu/a state average yield on 1,800,000 harvested acres. 1,900,000 acres were planted to winter wheat. The planted acres were down due to the low price for wheat. Most of our normal production stresses, winterkilling, blowing, drought, and heat were minimal in most of the state. The main diseases were foliar blotches and leaf rust in the southern Nebraska. Insects (Russian wheat aphid and Hessian fly) were relatively minor.

Arapahoe continued to be the most widely grown wheat in Nebraska in 1998. Producers are rapidly accepting Alliance and Niobrara. The acreage of tall wheats is increasing. Alliance continued to have excellent yields, as did 2137 and Windstar, Niobrara, and two newly released cultivars: Culver, and Wesley.

Culver is a hard red winter wheat (*Triticum aestivum* L.) developed cooperatively by the Nebraska Agricultural Experiment Station and the USDA-ARS. Culver was selected from the cross NE82419/Arapahoe, which was made in 1987. The pedigree of NE82419 is Trapper//CMN/OT/3/CIMMYT /Scout/4/ Buckskin sib/Homestead. Culver is an F3-derived line that was selected in the F4 generation. Culver was released primarily for its superior adaptation to and good disease resistance package in dryland agriculture production systems in southcentral and southwestern Nebraska. Culver is moderately resistant to stem rust (caused by *Puccinia graminis Pers. : Pers*.; contains *Sr6* and *Sr24*, and other unnamed resistance genes) and leaf rust (caused *by P. recondita* Roberge ex Desmaz.; similar to Arapahoe and most likely contains *Lr16*), and susceptible to wheat soilborne mosaic virus, Hessian fly (*Mayetiola destructor* Say), barley yellow dwarf virus, and wheat streak mosaic virus. Culver has a moderately low grain volume weight, better than Alliance, but less than Arapahoe, Pronghorn, and Rawhide. The overall end-use quality characteristics for Culver should be acceptable to the milling and baking industries. Culver is recommended for growing in southern and west central Nebraska. In these areas, it is a good replacement for Alliance as it has a longer coleoptile, and better leaf rust resistance, grain protein content, and grain volume weight. It is genetically complementary to 2137, Alliance, Jagger, Niobrara, Pronghorn, and Windstar. Culver is not complementary to Arapahoe, Niobrara, and Vista. Like Arapahoe, Culver also seems to have a growth pattern where early spring drought can lower its performance.

Wesley is a hard red winter wheat developed by the USDA-ARS (Dr. C. J. Peterson's leadership) and the Nebraska Agricultural Experiment Station. It will be co-released with South Dakota Agricultural Experiment Station. It is a high yielding semi-dwarf wheat with adaptation characteristics similar to 2137, and is particularly well suited for production in southeast Nebraska and under irrigation. The formal release description is currently being developed by the USDA-ARS. The name was chosen to honor Dr. John Wesley Schmidt, former wheat breeder at the University of Nebraska.

Four experimental lines (NuPlains, NE93496, NE93613, and NE 94479) are under large-scale increase for possible release in 1999. In addition, NE93405 has been held over for a third year of testing before possible release in 1999. NuPlains is a hard white winter wheat developed by the USDA-ARS (Dr. C. J. Peterson's leadership) and the Nebraska Agricultural Experiment Station. NuPlains, if released, will be the first hard white wheat released by the USDA-University of Nebraska wheat improvement efforts.

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