

ANNUAL REPORT
WHEAT RESEARCH AND PROMOTION BOARD
November, 2008

TITLE: Breeding for Improved Wheat Cultivars

PRIORITY AREA: Variety Development, Test Weight, and Disease Control

INVESTIGATORS: Robert Bacon and John Kelly

COOPERATORS: Gene Milus and Scott Monfort, Plant Pathology
Jason Kelley, Cooperative Extension Service
Ed Souza-USDA Soft Wheat Quality Lab
Steve Harrison - Louisiana State University
Paul Murphy - North Carolina University
Ron Barnett - University of Florida
Jerry Johnson - University of Georgia
Ben Edge - Clemson University

OBJECTIVES:

- 1). Develop and release wheat varieties with high yield potential, high test weights, straw strength, winterhardiness, and resistance to diseases common to Arkansas using a combination of pedigree and bulk breeding methods.
- 2). Develop herbicide-tolerant (Imidazloinone tolerant) wheat varieties adapted to Arkansas by backcrossing current lines and by developing tolerant populations.
- 3). Develop speciality soft wheat varieties to enhance the market opportunities for Arkansas farmers, including strong gluten (protein) wheats, white-seeded, and waxy grain wheats adapted to Arkansas.
- 4). Evaluate lines from the germplasm enhancement program for agronomic characteristics in order to facilitate the use of this material in the region for disease control.

ABSTRACT:

The planting season was normal for wheat last fall with most locations having adequate soil moisture during the optimum planting period. The breeding trails and Cultivar Performance test were planted at Keiser on October 10 with the head-row material (F₄ and F₅ lines) being planted at Fayetteville on October 22. The breeding yield trails and variety test were planted at Marianna on November 1 and the Cultivar Performance test at Rohwer was planted on November 1.

The planting of the Cultivar Performance test and breeding trials in Stuttgart were planted on November 5 and 6. The variety test at Kilber was planted on October 26 and the variety test at Hope was planted on November 1. All of these planting dates were optimum. Head-row material (F_4 and F_5) lines which were planted in Fayetteville were inoculated with stripe rust. An appropriate infection allowed for good evaluation of resistance to the disease. Of the more than 20,000 lines planted, approximately 400 resistant F_5 lines were advanced for further testing. Approximately 7,000 individual plants were also selected to be used to produce F_5 lines for selection in 2008-09. Selection pressure for both stripe, leaf rust and maturity were at an appropriate level for good advancement of experimental lines.

The first N application was applied on February 20 at Marianna and concluded at Kibler on February 29. The second application began on March 5 and concluded at Fayetteville on March 26. Plant establishments were optimum at all locations. Harvest of the Cultivar Performance Trails and the breeding nurseries began on June 6 at Stuttgart and concluded on June 23 at Kibler. The F_6 head rows at Fayetteville were harvested and 334 lines were advanced to the Wheat Observation trial for the 2008-09 growing season to be grown at Keiser and Stuttgart. Two hundred-twenty lines were also selected for Fusarium Head Blight and advanced to an observation nursery as well. The results of 2007-08 from the most advanced nursery (Elite Wheat) are given in Table 1. Table 2 gives the performance of lines in the Advanced Wheat Strains (AWS). The yield results for the Fusarium Head Blight Nursery are presented in Table 3. Since the Wheat Observation test were not planted this year due to the late freeze the previous growing season a Wheat Strains test was established and the data is presented in Table 4. Data for the Wheat Observation II nursery are presented in Table 5. A White Wheat test was also established to evaluate some high yielding white-seeded lines; results are listed in Table 6.

During the winter the crossing program to produce future lines was expanded. There were 127 successful crosses in four efforts: 1) standard variety development, 2) scab-resistant varieties, 3) stripe rust and leaf rust resistant varieties, 4) specialty types (white wheats). The objective of the crossing efforts are to stress yield potential, test weight, value-added traits, and disease resistance.

INTRODUCTION:

In Arkansas, wheat yields have increased at a rate of about 0.5 bu/A per year since 1924. Yield increases in wheat and other crops are due to improved cultural practices as well as genetic improvement. Studies in other regions have estimated that improved wheat cultivars are responsible for somewhere between 28% to 55% of the yield increases. Pathogens are also under genetic control and will select races which will attack prevalent cultivars. The absence of aggressive breeding programs would not only stop yield increases due to new cultivars but also the yield of cultivars currently grown would decrease since pests would develop which would overcome resistance.

The University of Arkansas' breeding program has stressed cultivar development through the use of adapted crosses to maximize efficiency but has continued to broaden the genetic base of the program to guard against genetic vulnerability and limited genetic improvement. The program uses a combination of the bulk and pedigree methods to minimize cost. In order to obtain high

yielding, adapted cultivars, increased emphasis will be given to disease resistance. The Arkansas program unlike other programs is putting major emphasis on the development of high test weight genotypes since a substantial component of test weight is under genetic control.

MATERIALS AND METHODS:

Parents are chosen for their high-yield potential and adaptation to Arkansas conditions. Crosses are being made between genotypes with complementary traits in the greenhouse at Fayetteville. The F₁ generation is also grown in the greenhouse. Beginning with the F₂ generation, a combination of pedigree and bulk breeding methods are followed until sufficient homozygosity is reached to increase seed for yield testing.

Selected lines are then tested and re-selected in replicated yield plots. Lines selected move in a step-wise progression through the following nurseries: Wheat Observation (2 locations with one replication per location), Advanced Wheat Strains (2 locations), and Elite Wheat Lines (3 locations). Locations include Kibler, Stuttgart, Keiser, Marianna, and Rohwer. Numerous locations are used to help ensure selection of genotypes that are adapted to a number of soil types and environments. All lines in the nurseries are harvested for yield, and data is taken on test weight, lodging, maturity date, plant height, and winterhardiness. Reaction type and level of severity of diseases present is also recorded each spring. Lines that appear to have potential as cultivars are entered in the Arkansas Cultivar Performance Trial. The seed of each line in the Elite Wheat nursery is sent to the USDA Soft Wheat Quality Lab to be tested for baking and milling quality to ensure that the lines released from the program meet industry standards.

Other Universities in the soft wheat region have variety development programs. Evaluation of public lines initially takes place in regional uniform nurseries and then through the Cultivar Performance Trial. Released lines adapted to Arkansas will be introduced through the foundation seed program to seedsmen.

RESULTS AND DISCUSSION:

Results from this year's research are found on the following pages. The information is divided into three basic sections: 1) New and future releases, 2) Yield nurseries and 3) Early generations.

1) NEW AND FUTURE RELEASES:

Recent releases continue to perform well. AR850-1-1 now marketed as Buck Harvest was licensed through an agreement with Petrus Seed Company which has exclusive rights to market the variety in Arkansas. It is a full-season maturing variety and has good resistance to stripe rust and Fusarium Head Blight. All available foundation seed of Pat was sold this year. Certified seed sales of both have been good. The breeding program also released a germplasm line with leaf rust resistance (AR93005) in 2006.

AR97044-10-1 will be tested in the Arkansas Variety Trials for the first time in 2008-09 but has performed well in yield trials throughout the state. Forage trials in Northern Alabama indicated that AR97044-10-1 would make an excellent forage wheat.

The program has been devoting an immense effort in the development of lines with resistance to Fusarium Head Blight (FHB) and several lines have shown good FHB index values. Three sister lines AR97124-4-2, AR97124-4-1, and AR124-4-3 have both good FHB resistance and grain yield. AR97124-4-3 will be tested in both the Uniform Eastern and Southern Nurseries for the 2007-08 growing season.

Data from regional yield trials in the Gulf-Atlantic region has AR98001-5-1 ranking 3rd and AR98105-4-1 ranking 19th out of 80 entries. Both of these lines have good disease resistance and will be evaluated at Keiser, Marianna and Stuttgart in the Elite Wheat Nursery this year.

The wheat breeding program has been developing white-seeded lines for several years and will be testing AR99110W-13-1 for the first time in 2008-09. This line has performed well in the Advanced Wheat Strains test and in regional trials.

2) YIELD NURSERIES

The most advanced experimental lines were planted in the Elite Wheat Lines (EWL) nursery at Keiser, Stuttgart, and Marianna. The performance of the experimental lines averaged across the Stuttgart and Marianna locations are presented in Table 1. Yields were low and those that did yield well may be later maturing cultivars and were less affected by the late freeze. AR 97044-10-2 was entered in the USDA Eastern Regional yield nursery and performed well Wisconsin and Northern Illinois and was entered in the cultivar performance trials in Wisconsin. This line has excellent yield potential and stripe rust resistance. Three sister lines AR97124-4-1, AR97124-4-2, and AR97124-4-3 which all have good Fusarium Head Blight resistance and also have comparable grain yields with Pat are also being tested in cooperative regional trials.

The results of Advanced Wheat Strains nursery averaged over the Keiser, Marianna and Stuttgart locations are presented in Table 2. Several of these lines that appeared promising were advanced to the Elite test for further testing in 2008-09.

To enhance disease resistant to Fusarium Head Blight (Scab) a special nursery is conducted to screen experimental lines for agronomic traits as well as scab resistance. The results of this nursery are presented in Table 3. Several lines possess the same level of resistance as the resistant check 'Ernie' but have yields similar to 'Pat'. AR 97002-2-1 was found to have an FBH index and severity similar to Ernie which is considered the standard for resistance to Fusarium Head Blight. It also has very good milling and baking properties. Wheat Strains was initiated this year due to the poor seed quality that was obtained from the previous growing season and the data is presented in Table 4. Wheat Observation II was a new nursery this year due to the effects of the late freeze the results of this test are presented in Table 5. The breeding program has for several years be involved in selecting white wheat lines that perform as well as red-seeded lines. The results of this nursery are presented in Table 6.

Table 1. 2007-2008 Elite Wheat Nursery averaged over Keiser, Marianna and Stuttgart.

Obs	entry	name	yield	tw	head	mat	ht	lodg	pm	sep	stripe
1	34	AG 2581	102.127	58.1000	422.000	526.667	39.00	7.5	0	15	2
2	9	AR96052-4-3	91.348	56.2250	420.667	525.000	38.50	7.5	0	15	15
3	20	AR98022-19-3	89.082	57.8333	423.333	526.667	46.50	0.0	0	7	7
4	5	ARTX02D5406	86.727	57.8250	419.667	525.333	36.50	12.5	0	15	0
5	16	AR98088-1-2	86.672	58.0750	417.667	548.000	39.50	7.5	0	7	0
6	35	TERRAL TV8558	86.653	54.9333	421.000	525.667	39.00	22.5	0	15	2
7	15	AR98023-5-1	84.548	54.6083	424.333	551.667	39.50	10.0	0	7	0
8	14	AR98068-4-1	82.676	57.3667	425.000	526.667	43.50	12.5	0	7	7
9	24	AR98088-1-1	82.175	57.4917	422.667	528.667	40.00	27.5	0	15	2
10	17	AR98152-4-1	82.154	55.8917	417.667	523.000	41.00	7.5	0	15	0
11	22	AR98097-4-1	80.818	57.4000	420.333	526.000	37.00	0.0	0	7	2
12	2	AR97044-10-1	80.532	55.4750	419.000	523.000	41.00	3.5	0	15	7
13	1	AR97044-10-2	80.213	55.3364	419.000	523.333	40.50	6.0	0	30	30
14	36	DELTA GROW 1600	80.048	52.3417	423.000	526.333	39.00	17.5	0	30	0
15	4	AR97124-4-2	79.830	56.4167	423.333	552.667	41.50	25.0	7	15	0
16	11	AR96077-10-1	79.638	55.3250	420.333	524.667	38.75	5.0	0	30	0
17	8	AR97124-4-3	79.574	56.7083	424.333	551.333	41.75	12.5	2	15	0
18	10	AR96077-7-2	78.958	55.3500	420.333	525.667	35.50	0.0	0	15	15
19	12	AR850	78.431	54.5833	449.333	552.667	41.00	0.0	15	15	0
20	18	AR98096-3-1	77.654	52.4750	418.667	524.333	35.00	37.5	0	7	7
21	3	AR97143-7-1	77.421	55.3083	420.667	525.667	43.00	2.5	2	7	2
22	30	AR98159-8-1	77.071	57.3083	418.667	523.333	41.25	17.5	0	30	2
23	23	AR98084-4-1	76.581	56.6167	419.667	525.000	36.75	10.0	0	7	0
24	28	AR98072-3-1	76.009	57.1000	414.000	524.333	36.00	5.0	0	15	2
25	26	AR98152-9-2	74.889	56.4700	422.333	550.667	39.00	47.5	0	30	0
26	29	AR98093-3-1	74.887	57.3750	415.667	524.000	37.75	17.5	0	30	2
27	25	AR98083-1-1	74.559	58.0500	420.667	526.333	39.50	5.0	0	7	2
28	33	DELETE	74.492	50.9917	419.333	525.333	34.50	0.0	0	15	15
29	13	AR98001-5-1	74.466	55.5273	419.000	525.000	37.50	10.0	0	7	0
30	7	AR96077-7-3	74.025	53.5333	420.667	524.667	35.00	0.0	2	15	15
31	19	AR98105-4-1	72.149	57.3417	420.000	523.000	42.50	7.5	0	7	0
32	6	AR97139-11-2	70.885	57.0750	422.333	525.667	39.75	5.0	2	7	0
33	32	AR98172-6-1	68.625	49.7000	421.000	527.000	39.25	25.0	0	15	2
34	31	AR98083-1-3	68.372	57.9000	419.000	525.667	41.00	20.0	0	7	0
35	27	AR98003-7-1	64.885	57.6750	417.333	525.333	39.50	2.5	0	15	0
36	21	AR98172-1-1	57.846	51.8667	422.667	550.000	40.00	10.0	0	15	0
		\bar{x}	78.5	55.9							
		LSD (0.05)	11.9	2.1							
		C.V.	17.5	4.6							

Table 2. 2007-2008 Advanced Wheat Strains averaged over Keiser, Marianna, and Stuttgart.

Obs	entry	name	yield	tw	head	mat	ht	lodg	pm	sep	stripe
1	26	AR99174-5-1	90.5998	58.7889	423.667	528	38.50	0.5	2	7	0
2	39	AR99044-3-1	89.6515	58.1222	423.667	528	36.00	12.5	7	7	0
3	6	AR99110W-13-1	88.2264	54.1333	450.333	530	40.00	3.5	0	30	0
4	3	AR99016-1-1	86.6586	59.1444	421.667	526	36.50	2.5	0	15	2
5	64	TERRAL TV8558	85.9071	55.6778	422.667	528	37.75	12.5	0	30	15
6	1	AR99015-3-3	85.6860	56.8500	418.000	524	39.00	3.5	0	15	2
7	8	AR99110W-12-2	85.5919	55.3667	449.000	528	36.50	2.5	0	30	0
8	25	AR99015-2-1	85.5390	57.3333	419.667	528	35.75	7.5	0	15	0
9	5	AR99016-1-2	85.0380	59.0333	420.667	528	39.50	17.5	0	30	2
10	61	DELTA GROW 1600	84.2197	53.9333	423.000	530	37.50	35.0	0	30	2
11	2	AR99110W-12-1	84.0746	55.8750	425.333	528	37.25	5.5	0	30	0
12	19	AR99015-3-1	83.4284	56.4222	420.000	522	39.25	7.5	0	15	2
13	10	AR99110-11-3	80.8188	55.8222	454.333	530	39.25	7.5	0	7	0
14	21	AR99015-5-1	80.4902	52.8111	427.000	530	40.00	45.0	0	7	0
15	18	AR99110-3-2	80.2145	58.0333	420.000	528	39.00	10.0	0	7	0
16	7	AR99110-11-4	80.0800	55.7875	451.333	530	38.50	0.5	0	7	0
17	55	AR99009-3-2	79.8835	54.4778	422.667	528	38.50	17.5	0	15	0
18	16	AR99039-2-1	79.8174	57.9111	421.333	528	36.75	17.5	0	7	0
19	63	PAT	79.4624	56.4556	450.667	528	40.75	0.0	15	15	0
20	46	AR99238-4-1	79.2511	56.5111	419.667	528	35.75	18.5	0	15	0
21	11	AR99015-3-2	78.0237	55.5111	418.333	526	38.25	40.0	0	15	0
22	4	AR99122W-5-1	77.6434	56.3000	421.667	526	38.00	22.5	0	15	0
23	27	AR99138-7-1	77.2196	58.0556	421.667	528	34.00	12.5	0	15	0
24	41	AR99136-13-2	77.2053	55.5333	449.667	528	40.75	15.0	2	7	0
25	9	AR99138-12-1	76.9028	55.3500	423.000	528	40.00	50.0	0	7	0
26	24	AR99033-6-2	76.3907	57.7000	451.667	530	40.00	5.0	0	7	0
27	57	AR99012W-1-3	75.9285	58.0000	449.000	528	38.50	15.0	15	30	0
28	62	PIONEER 26R22	75.8224	56.1889	424.000	528	37.00	42.5	0	15	0
29	40	AR99114-2-1	75.6250	58.5444	426.667	528	45.00	10.0	0	7	0
30	17	AR99122S-4-1	75.4816	56.1500	449.667	528	44.00	40.0	0	7	0
31	28	AR99174-14-1	75.4805	53.4778	423.667	530	38.75	10.0	0	30	0
32	20	AR99033-6-3	75.1377	58.0222	450.333	526	39.25	2.5	0	15	0
33	37	AR99138-3-1	74.9938	56.7111	422.667	528	35.75	20.0	0	30	0
34	51	AR99138-12-2	74.7676	55.5500	422.667	528	37.50	41.0	0	7	0
35	48	AR99174-6-1	74.1355	54.4500	421.000	528	38.50	0.0	0	15	0
36	47	AR99110-11-1	73.9510	56.8111	454.667	528	42.00	5.0	0	2	0
37	59	AR99129-10-1	73.4891	57.0556	449.667	528	40.50	50.0	15	7	2
38	14	AR99015-5-2	72.6072	51.7750	426.000	528	39.50	72.5	0	7	0
39	50	AR99095-10-2	72.4486	58.8222	450.000	528	40.00	45.0	30	15	0
40	23	AR99033-6-1	72.3816	56.4889	452.333	530	38.50	7.5	0	7	0
41	58	AR99095-18-1	72.2517	57.4889	451.333	528	45.50	17.5	0	7	0
42	36	AR99127-2-1	71.3283	52.1222	424.000	528	43.50	67.5	0	15	0
43	42	AR99174-21-3	71.3015	54.5500	422.667	520	39.50	17.5	0	15	0
44	49	AR99127-9-1	71.1042	57.8000	421.333	528	42.00	13.5	2	15	0
45	30	AR99033-5-3	70.8922	58.0889	420.000	528	39.50	7.5	0	15	0
46	35	AR99081-3-1	70.1558	57.2444	423.000	530	39.00	15.5	0	15	0
47	33	AR99174-8-1	70.1422	53.7875	424.333	528	39.00	0.0	0	15	0
48	29	AR99110-11-2	69.9452	57.0667	420.333	528	38.25	10.0	0	50	7
49	54	AR99174-21-1	69.3115	55.1667	425.000	528	41.50	55.0	0	15	0
50	45	AR99033-5-1	68.9960	52.3125	454.333	528	38.25	32.5	0	15	0
51	52	AR99009-3-1	68.8898	55.6000	450.667	530	41.50	77.5	0	15	0
52	38	AR99174-21-2	68.7844	54.2556	423.000	528	35.50	15.0	0	15	0
53	43	AR99174-25-1	67.4782	56.9250	449.000	520	37.50	10.0	0	15	0
54	56	AR99093-1-1	66.9915	55.6625	454.667	528	40.50	25.0	7	7	0
55	15	AR99081-3-2	66.5821	56.0889	448.000	528	40.50	5.5	0	7	0
56	31	AR99110-3-1	66.5699	58.6000	421.667	528	40.25	0.5	0	7	0
57	34	AR99097W-11-1	66.2801	55.9444	425.000	528	35.00	20.0	15	15	2
58	22	AR99174-6-2	65.1329	54.1500	421.667	528	38.50	17.5	0	7	0
59	12	AR99033-5-2	64.6580	52.7000	456.000	530	38.00	17.5	0	7	0
60	44	AR99099-5-1	63.8946	57.0571	449.333	528	41.75	8.5	0	15	0
61	53	AR99037-3-1	63.8156	54.1444	452.000	528	39.50	87.5	0	7	0
62	32	AR99081-3-3	62.8270	52.1714	422.333	528	37.75	12.5	0	15	0
63	60	AR99097-5-3	61.6649	54.8875	448.333	528	36.00	31.0	30	15	0
64	13	AR99097W-11-2	61.5743	55.4000	423.000	528	37.75	10.0	15	30	2
		\bar{x}	74.9	56.1			38.9				
		LSD (0.05)	9.7	2.2			7.1				
		C.V.	13.9	4.0			9.2				

Table 3. 2007-2008 Fusarium Head Blight Nursery averaged over Stuttgart and Marianna.

Obs	entry	name	yield	tw	head	mat	ht	lodg	fayfhb	kibfhb	pm
1	1	99028-1-1	88.5113	56.7338	419.5	523.5	35	0.0	5	43	0
2	24	99263-7-1	87.4013	55.5732	422.0	524.5	41	2.0	2	25	8
3	7	99071-7-2	85.9007	59.8233	423.5	527.0	40	0.0	1	20	0
4	20	99254-10-1	85.8282	59.2887	420.5	526.0	39	2.0	4	30	3
5	6	99071-7-1	83.9173	58.9415	423.0	527.5	41	2.4	3	22	0
6	10	99092-7-1	83.7742	59.0968	423.5	529.5	42	0.0	3	35	13
7	23	99258-2-1	83.6507	54.5239	422.5	527.5	40	0.0	2	27	0
8	12	99102-5-2	81.9319	56.2515	420.0	522.0	40	1.8	5	40	0
9	31	97124-4-3	80.3594	56.3978	421.0	527.5	44	8.4	3	30	3
10	21	99257-12-1	79.8446	53.7264	423.0	526.5	40	0.0	2	28	1
11	29	97124-4-1	79.6473	56.9221	420.5	526.5	44	8.2	2	30	1
12	19	99254-7-1	79.6349	59.8187	423.5	527.0	45	1.0	2	20	0
13	30	97124-4-2	79.6055	57.1719	421.0	526.5	45	8.8	3	30	1
14	39	BESS	79.4984	55.5976	422.5	525.5	41	6.8	2	40	1
15	18	99248-3-1	79.1371	57.6113	420.0	526.0	47	1.0	2	35	0
16	34	98127-1-1	78.6164	60.6953	418.0	522.5	44	0.0	5	33	0
17	26	99311-12-1	78.3401	57.5533	422.5	525.5	37	32.0	10	53	1
18	16	99183-4-1	78.2865	57.3022	422.5	526.0	41	3.0	6	42	0
19	38	PAT	77.9194	56.9608	424.5	529.0	41	0.0	3	38	5
20	27	99311-12-2	77.0805	58.0324	422.0	527.0	38	18.4	12	55	1
21	4	99039-9-1	77.0740	55.7555	424.0	529.0	40	5.0	5	38	0
22	33	97002-2-1	74.8776	57.5206	418.0	525.5	39	4.8	.	40	12
23	40	ERNIE	73.0079	57.0956	418.5	526.0	35	17.0	.	.	3
24	13	99160-1-1	72.9138	57.4731	423.0	528.5	49	0.0	1	17	1
25	15	99183-1-1	71.8313	56.3000	423.0	527.0	43	2.0	4	43	1
26	11	99102-4-1	71.2747	56.4024	418.0	523.5	41	0.4	2	33	0
27	36	AR857-1-2	70.8951	56.9893	417.0	524.5	44	1.8	.	45	1
28	25	99264-8-1	70.0053	58.4948	422.5	526.0	49	18.4	2	28	0
29	22	99257-14-1	69.5075	54.5664	422.5	525.0	39	0.0	2	22	0
30	28	99311-14-2	68.7536	55.6546	422.0	525.0	46	0.0	4	42	0
31	2	99039-5-2	67.4771	54.7210	423.5	528.0	38	1.0	2	23	0
32	32	97002-10-2	64.8658	56.6558	420.5	528.0	39	8.8	4	33	32
33	9	99092-6-1	62.3807	55.5254	424.0	526.5	42	2.0	2	40	1
34	17	99183-9-1	61.4400	58.0792	420.5	525.0	43	11.2	3	33	3
35	14	99160-4-1	60.5678	58.9849	421.5	525.5	51	0.0	1	13	0
36	8	99092-4-1	60.1504	60.3465	422.5	527.5	50	4.0	2	22	1
37	3	99039-6-1	59.1861	55.8511	423.5	527.5	38	2.4	2	27	1
38	5	99054-4-1	55.2395	58.2608	424.0	527.5	43	0.0	1	25	0
39	35	AR957-1-1	55.1546	54.8476	417.5	522.0	45	0.0	.	50	20
40	37	TRUMAN	54.1910	52.8156	464.0	565.5	42	10.0	0	7	15
		\bar{x}	73.7	57.0							
		LSD (0.05)	10.4	3.0							
		C.V.	14.4	5.2							

Table 4. 2007-2008 Wheat Strains Nursery averaged over Keiser, Marianna, and Stuttgart.

Obs	entry	name	yield	tw	head	mat	ht	lodg	pm	sep	stripe	
1	21	00120-11-1	96.0083	55.9583	423.333	527.333	41.25	11.0	0	15	2	
2	61	ARMOR 6202	95.3250	54.7833	424.667	551.000	38.00	18.5	0	7	2	
3	37	00039-5-2	94.9802	60.1000	423.333	524.667	40.50	0.0	2	15	0	
4	63	Delta King 7710	94.8400	56.8667	421.667	524.000	42.00	17.5	0	15	0	
5	8	00082-13-2	92.2123	55.7273	422.667	527.000	39.50	10.0	0	15	2	
6	60	00159-8-1	91.6090	55.0667	421.000	525.667	38.25	17.5	0	15	0	
7	30	00120-11-2	91.3111	55.8333	422.667	548.667	38.75	17.5	2	15	0	
8	64	Pioneer 26R22	91.2226	54.5750	420.333	549.667	38.00	21.0	0	7	0	
9	62	ARMOR 260Z	90.4619	54.4667	419.667	525.000	38.00	18.5	0	7	7	
10	17	00030-11-2	89.6607	55.8083	424.000	552.333	41.00	12.5	7	7	0	
11	55	00039-4-1	88.7516	54.1750	422.333	525.333	34.00	25.0	2	7	0	
12	15	00012-13-1	87.9614	56.2000	422.000	550.333	39.25	10.0	0	7	0	
13	48	00012-16-1	87.6448	56.2000	425.000	525.333	41.00	7.5	2	15	0	
14	2	00039-6-1	86.4339	57.0750	425.333	551.333	39.00	0.0	0	15	0	
15	35	00006-11-1	86.1110	56.9917	424.667	552.333	38.50	7.5	2	15	0	
16	14	00134-3-1	85.7115	55.1250	423.667	527.667	38.00	5.0	30	30	7	
17	26	00082-1-1	85.7062	55.3273	450.000	552.000	41.00	0.0	7	7	0	
18	3	00053-5-1	85.6875	54.8273	424.333	527.667	33.25	10.0	0	30	0	
19	13	00086-2-1	85.6869	52.9545	421.333	527.333	35.50	17.5	15	30	0	
20	20	00250-14-2	85.4701	56.0167	426.000	529.333	40.00	5.5	15	7	0	
21	56	00082-13-1	85.4400	55.1636	424.667	551.667	40.00	5.0	0	15	2	
22	53	00082-4-1	84.7179	55.6667	449.000	551.333	39.00	0.0	2	7	2	
23	44	00082-9-1	84.6485	56.0917	450.000	550.000	40.00	0.0	15	15	0	
24	51	00030-11-1	84.3323	55.3833	424.333	549.000	40.00	15.0	30	15	7	
25	23	00047-4-1	84.0859	56.8091	420.667	524.667	40.75	7.5	0	30	0	
26	5	00006-11-2	83.5023	54.2000	424.667	551.000	40.00	25.0	0	7	0	
27	18	00272-18-1	83.4225	52.9545	424.667	552.333	35.00	10.0	7	7	0	
28	45	00250-3-1	83.2439	58.0833	426.000	550.000	41.00	7.5	50	7	0	
29	38	00082-11-1	82.4929	55.7417	449.667	550.667	41.75	0.0	15	7	0	
30	25	00082-10-2	82.4728	55.7333	450.000	551.000	39.50	0.0	2	7	0	
31	22	00066-7-1	82.4041	56.3167	422.000	551.333	37.00	12.5	0	30	0	
32	32	00052-1-1	82.3459	57.1364	422.333	526.000	40.25	2.5	2	15	0	
33	6	00012-9-2	81.8503	56.2417	425.667	551.667	41.50	17.5	0	7	0	
34	12	00012-9-1	81.5253	57.2167	426.333	529.000	40.50	25.0	0	15	0	
35	24	00052-1-2	81.4759	55.9818	419.667	525.667	39.50	7.5	2	15	0	
36	40	00082-6-1	80.6847	55.7833	449.333	549.667	42.00	0.0	7	15	0	
37	28	00082-8-2	80.6523	56.2667	449.667	551.333	41.25	0.0	15	15	0	
38	47	00003-15-2	80.4955	50.7917	424.667	526.000	36.00	8.5	2	7	0	
39	52	00066-7-2	80.3678	56.2273	422.000	550.000	38.00	2.5	7	30	15	
40	19	00053-1-2	79.4049	54.7600	421.667	528.000	29.75	25.0	0	7	0	
41	31	00085-2-2	79.3105	53.8833	423.667	549.667	41.00	5.0	2	15	2	
42	9	00035-1-1	79.1723	55.9000	424.667	529.000	47.00	6.0	0	7	0	
43	58	00115-9-1	78.4988	53.4583	425.333	550.667	41.00	7.5	0	7	2	
44	42	00003-7-1	78.4208	45.5091	423.667	549.667	36.25	5.0	0	7	0	
45	10	00006-6-1	78.1228	51.3000	425.333	550.667	42.00	30.0	15	7	0	
46	50	00148-11-2	78.0737	53.7167	449.333	550.667	36.50	0.0	30	15	15	
47	34	00085-2-1	77.8869	54.3667	423.667	526.667	41.00	5.0	0	30	0	
48	46	00001-8-1-	77.6789	53.9000	422.333	526.333	39.25	5.0	30	7	0	
49	59	00170-1-1	77.5409	50.6900	454.000	554.333	37.50	32.5	0	7	0	
50	16	00003-6-1	76.3632	42.9700	424.333	552.000	36.75	15.0	2	15	0	
51	7	00134-7-1	76.2845	54.3000	424.333	550.667	38.00	17.5	0	30	0	
52	29	00053-1-1	76.0867	52.5100	422.333	550.333	30.00	41.0	0	15	0	
53	1	00074-5-1	75.6649	57.1154	424.000	527.333	44.00	12.5	7	15	0	
54	4	00053-5-2	75.2772	54.6600	424.000	526.000	34.75	20.0	0	15	0	
55	11	00250-14-1	74.6137	54.0778	450.667	553.000	36.50	55.0	30	7	0	
56	49	00082-10-1	74.5538	56.0273	450.333	548.000	38.25	0.0	15	15	2	
57	54	00256-3-1	73.9423	54.1000	448.667	550.667	39.75	15.0	0	7	2	
58	33	00006-2-1	73.9211	52.7400	424.333	527.667	41.50	37.5	7	15	0	
59	27	00012-7-1	72.6564	55.0091	450.667	552.333	39.50	15.0	2	7	0	
60	57	00256-15-1	67.1981	54.8800	424.667	551.000	37.50	55.0	0	15	0	
61	36	00046-2-1	56.5994	50.8111	423.000	525.667	33.00	25.0	2	50	0	
62	43	00046-3-2	54.2085	51.4286	421.667	525.333	32.50	11.0	0	30	0	
63	41	00005-3-3-1	52.4374	52.4778	424.333	550.667	32.50	5.0	2	30	2	
64	39	00046-3-1	50.0265	51.2429	421.000	525.667	29.50	11.0	2	50	0	
			\bar{x}	80.86	54.7		13.0					
			LSD (0.05)	10.1	2.8		35.1					
			C.V.	15.5	6.2		134.2					

Table 5. 2007-2008 Wheat Observation II Nursery averaged over Keiser, Marianna and Stuttgart.

Obs	entry	name	yield	tw	head	mat	ht	lodg	pm	sep	stripe
1	6	00036-5-2	93.1748	56.6000	419.000	524.667	38.75	1.0	0	7	0
2	50	Delta King 7710	92.1723	58.0917	425.000	528.000	42.25	22.5	2	7	0
3	45	00126-3-1	92.0638	56.2417	422.000	550.333	38.25	32.5	2	7	7
4	41	00036-5-1	91.6087	57.6167	417.667	523.000	37.50	47.5	0	7	0
5	44	00295-1-1	89.2260	55.6917	422.000	526.333	37.50	0.0	2	7	0
6	14	00003-4-1	88.4646	55.9083	419.000	524.333	33.00	10.0	0	7	0
7	35	00054-8-2	87.3078	55.5667	421.000	526.000	34.00	25.0	30	15	2
8	7	00026-11-1	86.6852	55.4167	423.000	526.667	34.00	0.0	0	7	0
9	48	Delta Grow 1600	85.5289	54.3917	449.000	552.000	38.50	13.5	0	7	0
10	28	00026-2-2	85.4396	56.1667	425.000	527.667	35.50	0.0	2	15	0
11	31	00254-7-1	84.8662	53.4250	422.000	527.000	38.00	40.0	0	15	7
12	49	Armor 260Z	83.9174	55.0667	422.667	525.667	37.25	22.5	2	15	0
13	9	00085-11-1	83.6701	56.6833	421.667	522.667	42.00	5.0	2	7	0
14	1	00120-8-2	83.6391	54.3818	422.333	523.667	39.50	6.0	0	15	2
15	4	00255-16-1	82.6519	54.7364	422.333	528.000	35.50	37.5	15	30	0
16	16	00039-1-1	81.8407	56.3333	421.000	524.333	39.50	3.5	0	15	0
17	23	00090-1-1	81.5539	58.4545	420.333	524.333	40.50	3.5	0	15	0
18	47	00196-10-1	80.5345	56.7364	422.333	526.667	38.25	2.5	0	7	0
19	10	00119-11-1	80.3880	55.1000	422.667	526.667	37.50	0.0	0	7	0
20	39	00054-8-1	80.1110	55.6100	422.333	525.667	35.50	22.5	7	7	7
21	33	00012-6-1	79.9223	60.2500	419.333	524.333	40.75	40.0	0	7	0
22	17	00082-11-2	78.1928	57.2364	452.000	578.000	39.50	1.0	2	15	0
23	22	00090-6-1	77.0252	58.6545	424.667	549.667	41.00	0.0	0	15	0
24	15	00168-4-1	75.4343	53.5182	426.667	553.000	39.75	15.0	0	7	0
25	13	00090-4-1	75.0014	57.3083	420.000	524.667	40.50	0.0	7	15	0
26	20	00041-1-1	74.8606	56.8917	423.333	524.667	49.00	75.0	0	7	0
27	32	00257-9-1	74.7521	53.8818	449.333	551.333	30.75	47.5	2	30	0
28	2	00008-3-2	73.7043	55.6667	477.667	577.333	49.50	55.0	0	7	0
29	19	TAM083-2-1	73.0214	58.0333	424.333	526.333	52.00	75.0	0	7	0
30	36	00196-7-1	71.3122	57.1900	449.667	551.667	41.50	12.5	50	15	0
31	8	00053-4-1	71.1140	58.9917	422.333	525.667	36.75	0.0	0	15	0
32	18	00041-8-1	70.8275	54.7600	425.000	553.000	48.00	35.0	0	7	0
33	5	00008-2-1	70.3137	57.3200	421.667	524.333	46.50	80.0	0	7	0
34	30	00069-5-1	70.0463	57.6333	425.333	526.000	43.50	87.5	15	7	0
35	3	00030-10-1	67.8183	52.6700	425.333	553.000	41.75	5.0	0	7	7
36	24	00008-3-1	67.6639	55.8333	478.000	554.667	47.00	80.0	0	7	0
37	26	00027-2-1	67.4728	55.0000	451.667	554.000	42.50	7.5	2	7	0
38	21	00039-5-1	67.3272	58.1583	425.000	552.333	52.00	1.0	0	7	0
39	38	TAM089-3-1	67.2089	50.9000	424.667	551.667	41.25	25.0	30	15	0
40	27	00118-15-2	66.4674	52.2750	478.000	553.667	33.50	13.5	7	7	0
41	11	00148-19-1	64.1149	52.0875	449.333	551.667	38.50	0.0	15	7	0
42	42	00215-2-1	63.3918	54.2500	449.333	551.667	38.00	15.0	0	7	0
43	40	00118-15-1	62.8391	51.5417	452.667	551.667	36.50	42.5	15	7	0
44	43	00082-12-1	61.7224	56.7833	449.667	551.000	48.00	5.0	2	7	0
45	37	00148-14-1	60.3968	52.8667	450.333	551.000	36.50	0.0	30	15	0
46	46	00148-10-2	60.3673	51.8667	452.000	552.667	42.50	5.0	50	7	0
47	29	00148-14-2	59.8036	52.7111	451.667	554.000	36.50	0.0	30	7	0
48	25	00008-1-1	57.5102	52.4143	425.000	553.667	44.00	10.0	0	7	0
49	34	00097-4-1	55.3745	56.9750	450.000	527.333	51.00	45.0	15	7	0
50	12	TAM115-10-1	49.4937	50.6444	420.667	550.667	36.25	43.5	30	30	0
		\bar{x}	75.0	55.8							
		LSD (0.05)	9.8	2.2							
		C.V.	16.3	4.7							

Table 6. 2007-2008 White Wheat Lines Nursery averaged over Stuttgart and Marianna.

Obs	entry	name	yield	tw	head	mat	ht	lodg
1	3	00106-7-1	91.0750	60.2673	427.0	529.5	40.5	0
2	26	Delta King 7710	89.2988	59.8175	425.0	528.5	37.5	0
3	25	Armor 260Z	87.3163	57.6124	424.5	527.0	35.5	2
4	22	AR99110W-12-1	87.0675	57.5634	461.5	529.5	35.0	0
5	24	Delta Grow 1600	85.8300	58.1865	425.0	564.5	36.0	2
6	19	AR99110W-12-2	85.6638	57.7933	425.5	530.5	34.5	0
7	11	00241-6-1	85.4288	56.8583	425.0	565.5	39.0	2
8	7	00222-1-2	85.0825	55.8542	461.5	566.5	34.5	0
9	17	AR99110W-13-1	84.8200	57.1341	463.5	565.0	39.0	2
10	13	00235-13-2	82.0625	57.4435	425.5	563.5	42.5	0
11	20	AR99123W-5-1	80.0138	59.6058	424.0	528.0	31.0	0
12	28	PAT	79.9388	58.4137	463.5	565.0	39.0	0
13	21	AR99098W-11-1	79.7163	58.5142	422.5	528.0	34.5	2
14	6	00222-1-1	79.5975	55.8413	462.0	566.5	33.5	5
15	18	AR99012W-1-3	79.1350	61.5982	426.5	529.0	32.5	0
16	9	00235-11-1	78.8263	57.5933	426.0	563.5	43.0	10
17	27	Pioneer 26R22	78.7538	56.8544	423.5	565.5	37.0	15
18	12	00219-10-1	78.7463	57.5150	426.0	565.5	42.5	2
19	8	00222-9-1	77.8225	55.4879	462.0	567.0	43.0	5
20	10	00235-13-1	76.2775	57.3210	424.5	564.5	35.5	2
21	1	00077-6-1	75.9938	57.6449	463.5	565.5	47.0	5
22	4	00220-14-1	74.3088	58.4396	463.0	565.0	39.5	2
23	23	AR99098W-11-2	73.4963	56.6862	424.0	529.0	37.5	0
24	5	00220-15-1	71.2925	56.5948	464.0	567.0	32.0	2
25	16	00078-8-1	62.6875	59.4110	465.0	565.0	43.0	0
26	2	00078-5-1	62.5988	58.3953	464.5	565.0	39.0	5
27	15	00078-4-2	60.7900	58.7022	465.0	566.0	46.0	2
28	14	00078-7-1	59.5488	58.5565	464.5	566.0	42.5	5
		\bar{x}	78.3	57.9				
		LSD (0.05)	11.7	1.2				
		C.V.	15.1	2.1				

3) EARLY GENERATIONS

During the winter the greenhouse crossing program to produce future lines was continued. There were 127 successful crosses in four efforts: 1) standard variety development, 2) scab-resistant variety development, 3) stripe rust resistant cultivar development, 4) specialty types (white and waxy wheats). The resulting offspring of last year's crosses (170 F₁) were grown in the greenhouse over the winter to increase seed. The next three generations (F₂, F₃, and F₄) were grown as bulk populations in the field at Stuttgart. This year there were 89 F₂ populations, 88 F₃ populations, and 123 F₄ populations. Individual plants were selected from the F₆ generations at Fayetteville to produce experimental lines which will be planted at Stuttgart and Keiser to begin yield testing.

Table 7. List of crosses made in the greenhouse during the winter of 2008.

08001	93005-6-1 / 97002-2-1
08002	93005-6-1 / 99136-13-2
08003	93005-6-1 / 99136-13-2
08004	93005-6-1 / AGS 2020
08005	93005-6-1 / GA971127-14-6-6
08006	97002-2-1 / 93005-6-1
08007	97002-2-1 / 97044-10-2
08008	97002-2-1 / 99093-1-1
08009	97002-2-1 / AGS 2026
08010	97002-2-1 / AGS 2026
08011	97002-2-1 / Bess
08012	97002-2-1 / LA011410-138-4-B
08013	97002-2-1 / LA011410-138-4-B
08014	97002-2-1 / LA011410-138-4-B
08015	97044-10-2 / 93005-6-1
08016	97044-10-2 / 99093-1-1
08017	97044-10-2 / AR910
08018	97044-10-2 / LA011410-138-4-B
08019	97124-4-2 / 98001-5-1
08020	97124-4-2 / Armor 6202
08021	97124-4-2 / Bess
08022	97124-4-3 / 97044-10-2
08023	97124-4-3 / 99110-11-2
08024	97124-4-3 / Armor 6202
08025	97124-4-3 / Bess
08026	97124-4-3 / Bess
08027	97124-4-3 / Bess
08028	97124-4-3 / Delta King XTJ 724
08029	97124-4-3 / GA971127-14-6-6
08030	98105-4-1 / 97002-2-1
08031	98105-4-1 / 97044-10-2
08032	98105-4-1 / Armor 2602
08033	98105-4-1 / Delta Grow 1600
08034	98105-4-1 / Delta Grow 5200
08035	98105-4-1 / Dixie 900
08036	98105-4-1 / LA011410-138-4-B

08037 99093-1-1 / 97044-10-2
08038 99093-1-1 / 97124-4-3
08039 99093-1-1 / Armor 6202
08040 99093-1-1 / Armor 6202
08041 99093-1-1 / Bess
08042 99110-11-2 / 07016
08043 99110-11-2 / 97044-10-2
08044 99110-11-2 / 97124-4-3
08045 99110-11-2 / AGS 2024
08046 99110-11-2 / AR910
08047 99110-11-2 / Bess
08048 99110-11-2 / Delta Grow 5200
08049 99136-13-2 / 93005-6-1
08050 99136-13-2 / 97044-10-2
08051 99136-13-2 / 97124-4-3
08052 99136-13-2 / 98105-4-1
08053 99136-13-2 / AR910
08054 99136-13-2 / Delta King XTJ 724
08055 99136-13-2 / Stars 0601W
08056 AGS 2020 / 93005-6-1
08057 AGS 2020 / 97124-4-2
08058 AGS 2020 / 99093-1-1
08059 AGS 2026 / 07016
08060 AGS 2026 / 97002-2-1
08061 AGS 2026 / 97124-4-3
08062 AGS 2026 / 98105-4-1
08063 AGS 2026 / 99093-1-1
08064 AGS 2026 / GA971127-14-6-6
08065 AGS 2060 / 93005-6-1
08066 AR910 / 07016
08067 AR910 / 91124-4-3
08068 AR910 / 97002-2-1
08069 AR910 / 97124-4-3
08070 AR910 / 99093-1-1
08071 AR910 / 99110-11-2
08072 AR910 / 99110-11-2
08073 Armor 6202 / 93005-6-1
08074 Armor 6202 / 97044-10-2
08075 Armor 6202 / 99136-13-2
08076 Armor 6202 / Delta King XTJ 724
08077 Armor 6202 / Delta King XTJ 732
08078 Bess / 97002-2-1
08079 Bess / 97124-4-3
08080 Bess / AGS 2026
08081 Bess / Delta King XTJ 724
08082 Coker 9700 / AR 98001-5-1
08083 Delta Grow 1600 / 97044-10-2
08084 Delta Grow 1600 / 98105-4-1
08085 Delta Grow 5200 / 971224-4-3
08086 Delta Grow 5200 / 98105-4-1
08087 Delta Grow 5200 / 99093-1-1
08088 Delta Grow 5200 / 99136-13-2
08089 Delta Grow 5200 / Armor 6202

08090 Delta King 9577 / Pioneer 26R87
08091 Delta King XTJ 724 / 97002-2-1
08092 Delta King XTJ 724 / 97044-10-2
08093 Delta King XTJ 724 / 99093-1-1
08094 Delta King XTJ 724 / 99093-1-1
08095 Delta King XTJ 732 / 07016
08096 Delta King XTJ 732 / 97002-2-1
08097 Delta King XTJ 732 / 98105-4-1
08098 Delta King XTJ 732 / 98105-4-1
08099 Delta King XTJ 732 / Armor 6202
08100 Delta King XTJ 732 / Dixie 900
08101 Delta King XTJ 732 / LA011620-136-8-13
08102 Delta King XTJ 732 / LA01164D-94-2-B
08103 Dixie 900 / 97002-2-1
08104 GA971127-14-6-6 / 97124-4-3
08105 GA971127-14-6-6 / 97124-4-3
08106 GA971127-14-6-6 / Armor 2602
08107 GA971127-14-6-6 / Armor 6202
08108 GA971127-14-6-6 / LA01164D-94-2-B
08109 LA01141D-138 / 97002-2-1
08110 LA01141D-138-4-B / 97044-10-2
08111 LA01141D-138-4-B / 98105-4-1
08112 LA01141D-138-4-B / 98105-4-1
08113 LA01141D-138-4-B / Armor 2602
08114 LA01141D-138-4-B / Delta Grow 1600
08115 LA01162D-136-8-B / 97124-4-2
08116 LA01162D-136-8-B / 99136-13-2
08117 LA01162D-136-8-B / Armor 2602
08118 LA01162D-136-8-B / Armor 6202
08119 LA01162D-136-8-B / Delta Grow 5200
08120 LA01162D-136-8-B / Truman
08121 LA01164D-94-2-B / 99093-1-1
08122 LA01164D-94-2-B / Delta Grow 5200
08123 Pat / 98001-5-1
08124 Stars 0601W / AR910
08125 Stars 0601W / Delta Grow 1600
08126 Truman / GA971127-14-6-6
08127 Truman / LA01162D-136-8-B

CONCLUSIONS:

The breeding project has made strides in a number of areas. Approximately 1,000 experimental lines were tested throughout the state to determine genetic potential for Arkansas wheat producers. For future testing nearly 20,000 new lines were evaluated in the field. In order to produce new experimental lines, over 1200 genetically segregating populations were grown in the field as well as making approximately 130 crosses in the greenhouse to produce new populations. Some specific highlights from this year's work:

- Foundation seed of Pat and Sabbe still selling well.
- AR 97044-10-1 has performed well in regional trials and is entered in State Performance Trials.
- AR 99110W-13-1 a white wheat has been entered in the State Performance Trials.
- AR 97002-2-1 a line that has an FBH index and severity similar to Ernie also has excellent Milling and Baking Qualities and is continuing to be tested in the Uniform FBH Nursery.
- Four lines advanced to Regional Soft Wheat testing
- Breeding lines of herbicide-tolerant wheat for Hoelon-resistant ryegrass.
- Five scab resistant lines advanced for regional testing.
- Identification of lines resistant to stripe rust.
- Work in developing speciality (white and waxy) wheat for Arkansas.