Arkansas Wheat Promotion Board
Final Report for Pathology Projects in 2005
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The 2005 season was a difficult year for wheat disease research. Soilborne virus plots at Keiser, Clay County, and Jackson County were not planted because of wet conditions during the optimum planting time. It may have been possible to plant the plots in November, but the probability of getting useful data on soilborne viruses from late-planted plots is very low. Leaf rust, leaf blotch, and tan spot plots were planted at Kibler in mid November but had very poor stands because of more than six inches of rain between planting and emergence. Stripe rust and germplasm enhancement plots were planted at Fayetteville in late October and developed normally. The technician hired in August 2004 to assist with wheat disease research was slow to complete tasks and made a lot of mistakes, and consequently, her employment was terminated in May 2005.

Entries in the Arkansas Variety Test were evaluated for stripe rust resistance in Variety Test plots at Lewisville and Marianna that were naturally infected and in the stripe rust nursery at Fayetteville that was inoculated with spores collected from AGS 2000 in the same field as the Lewisville plots. Entries had similar responses to stripe rust at the three locations (Table 1). Extensive sampling of the stripe rust population by graduate student, Sam Markell, at Lewisville, Miller County, Van Buren, and Walnut Ridge indicated that only one race, PST-100, was present at all locations. Differences in stripe rust severity among the three locations are most likely due to when epidemics began and when notes were taken rather than different races. The stripe rust ratings (Table 1) that were developed from data at the three locations should be an accurate indication of their relative resistance/susceptibility to the contemporary population of the stripe rust fungus. Of the 100 entries in the Variety Test, 71 rated resistant or moderately resistant, indicating that many cultivars and advanced breeding lines have effective resistance to stripe rust. However, little is known about the genetic basis for the resistance. Only one entry, Croplan Genetics 514W, was very susceptible, and FFR Cooperative agreed not to market this cultivar in Arkansas.

Septoria leaf blotch developed late in the season in the stripe rust nursery at Fayetteville. However, on entries with both stripe rust and leaf blotch, it was not possible to accurately determine the reaction to leaf blotch, so the total leaf disease severity was recorded (Table 1). For entries that were at least moderately resistant to stripe rust, the total leaf disease severity estimated the leaf blotch severity. Although powdery mildew is not a serious disease in Arkansas, there was enough disease in plots at Lewisville and Marianna to rate some entries (Table 1). Leaf rust developed early in the season at Lewisville (Table 1), but then disappeared as the season progressed which was highly unusual.

Stripe rust and total leaf disease (leaf blotch) data were obtained from one replication of the stripe rust nursery at Fayetteville for the Southern (Table 2), Eastern (Table 3), Gulf-Atlantic, (Table 4), Arkansas Advanced (Table 5), and Arkansas Elite Wheat Nurseries (Table 6). For comparison, the reactions for the nearest plot of Hickory, a very susceptible check cultivar, was included at the bottom of each table. Very few entries were as susceptible as Hickory. Five ARGE lines from the Germplasm Enhancement Program were included in the Elite Nursery (Table 6) and had a high level of stripe rust resistance. Dr. Bacon's head rows also were inoculated with stripe rust, and the resulting epidemic allowed him to select resistant lines.

Sam Markell's grad student research on the inheritance of stripe rust resistance on leaves

and heads of three soft red winter wheat lines was unaffected by weather or technician screw-ups, and useful data were obtained in growth chamber and field tests. Two lines have adult-plant foliar resistance (seedlings are susceptible) that appears to be controlled by two recessive genes, and heads of these two lines have intermediate levels of head resistance that is controlled by at least one recessive gene. The third line has all-stage foliar resistance that is controlled by one dominant gene and a high level of head resistance that may be controlled by the same gene. Results to data indicated that all of these resistances are effective against current races of the stripe rust fungus. The foliar resistances appear to be highly heritable, indicating that they can be selected rather easily in breeding programs. However, heritability of head resistance is low to moderate, and this may be due to the difficulty of rating heads for resistance. One possible benefit of this study may be the development of better methods to evaluate for head resistance. Sam's research on population genetics of the stripe rust fungus resulted in a relatively large collection of single-pustule isolates that were collected in a hierarchal sampling pattern. Spores of these isolates have been increased on plants in growth chambers, identified to race, and are ready for molecular analysis during the next several months. Sam plans to graduate in December 2006.

Germplasm enhancement efforts focused on stripe rust and barley yellow dwarf. Thirteen populations with what appears to be adult-plant resistance to stripe rust were selected during 2005, and 80 head rows from each population will be evaluated in 2006. Twenty-one advanced lines resistant to stripe rust and leaf rust and having a source of resistance gene *Yr29/Lr46* in their parentage have been developed. This gene appears to confer adult-plant resistance to all know races of stripe rust and leaf rust. These lines were sent to a USDA Genotyping Lab to determine if their molecular markers for this gene could identify lines with Yr29/Lr46, but the molecular markers did not work for these lines. The best of these lines will be considered for release as resistant germplasm.

Fifty-two advanced lines developed from crosses with two sources of resistance to barley yellow dwarf were selected during 2005 and will be evaluated again in 2006. The best of these lines will be considered for release as resistant germplasm. Approximately 600 F_3 lines from intercrosses among resistant lines will be evaluated in 2006 to determine if higher levels of resistance can be identified in good agronomic backgrounds.

Table 1. Disease reactions of the 2005 Arkansas Wheat Variety Test.

Entry	Stripe rust severity (%)[1] Lewisville 14 April	Marianna 25 April	Fayetteville 4 May	Stripe rust rating[2]	Leaf disease[3] Fayetteville 19 May	Powdery mildew rating[4]	Leaf rust (%)[1] Lewisville 10 March
AGRIPRO/COKER APW742	0	0	0	R	50		0
AGRIPRO/COKER APW749	0	0	0	R	50		1
AGRIPRO/COKER B980582	69	5	15	MS	85		0
AGRIPRO/COKER B980696	0	0	0	R	30		1
AGRIPRO/COKER BERETTA	2	0	0	R	50	R	0
AGRIPRO/COKER COKER9152	83	2	15	S	93	R	1
AGRIPRO/COKER COKER9375	11	1	2	R	70	R	0
AGRIPRO/COKER COKER9663	93	5	50	S	93	MR	1
AGRIPRO/COKER COOPER	90	20	50	S	93	MR	1
AGRIPRO/COKER NATCHEZ	1	0	0	R	30	R	0
AGRIPRO/COKER PANOLA	0	0	0	R	50	R	1
AGRIPRO/COKER SAVAGE	12	1	0	R	50	R	1
AGS 2000	83	17	50	S	98	R	1
AGS 2050	83	3	30	S	93		2
AR93027-5-1	11	8	30	MR	93	MR	0
ARMOR 2010	6	1	2	R	50	MS	4
ARMOR 3035	2	0	0	R	50	S	1
ARMOR 3330	1	0	0	R	30	MS	5
ARX 5099	4	2	2	R	50		1
ARX 5109	0	0	0	R	50		4
ARX 5299	49	15	30	S	85		0
ARX 5667	3	1	0	R	50		1
CHOPTANK	88	10	30	S	85		0
CROPLAN GENET. 514W	98	85	93	VS	98	R	0
CROPLAN GENET. 554W	90	43	50	S	93	R	2
CROPLAN GENET. 8302	29	0	0	R	50		1
DELTA GROW 4100	0	0	0	R	30		5
DELTA GROW 4200	2	0	0	R	50	MS	4
DELTA GROW 4500	1	1	0	R	50	S	5
DELTA KING 1551	6	1	0	R	50	MR	1
DELTA KING 7710	0	0	0	R	30		2
DELTA KING 7830	1	1	0	R	50	S	8
DELTA KING 7900	1	0	0	R	50	S	4
DELTA KING 9216	78	11	2	MS	50	R	2
DELTA KING 9410	3	10	0	R	50	S	10
DELTA KING 9577	1	1	2	R	30		5
DELTA KING 9650	88	22	50	S	85		1
DELTA KING GR9108	1	1	0	R	30	R	1
DELTA KING XTJ321	7	1	2	R	50		2
DELTA KING XTJ322	0	0	0	R	30		0
DELTA KING XTJ323	80	43	30	S	93		1
DIXIE 357	1	0	0	R	50	MS	4
DIXIE 500	31	1	7	MR	50		4
DIXIE 900	2	0	0	R	50	MS	4
DIXIE 922	3	1	0	R	50	S	2
DIXIE 9512	1	0	0	R	50	S	2
DIXIE 9812	5	1	0	R	50	S	2
DIXIE BELL DB1170	7	1	0	R	30	S	5
DIXIE BELL DB2125	0	0	0	R	30		2
DIXIE BELL DB2150	2	1	2	R	70	S	4
EK EXP 125	85	21	70	S	98		1

continued

Table 1. Continued.

Entry	Stripe rust severity (%)[1] Lewisville 14 April	Marianna 25 April	Fayetteville 4 May	Stripe rust rating[2]	Leaf disease[3] Fayetteville 19 May	Powdery mildew rating[4]	Leaf rust (%)[1] Lewisville 10 March
EK EXP 155	63	62	70	S	98		0
EXP SABRE	83	34	50	S	93		0
EXP SENNA	38	5	2	MR	70		1
FFR 556	90	31	15	S	70	R	2
FFR 8302	1	0	0	R	50		1
GENESIS M86	1	0	0	R	50	MS	2
GENESIS R073	1	0	2	R	50	MS	4
GENESIS RO47	2	0	0	R	30	R	1
GENESIS RO63	5	1	0	R	50	S	2
HBK 3266	84	30	30	S	85	MR	0
LA95125BUB73-2-2-B	20	10	50	MS	93		0
LA95135D54-2-3-C	1	0	0	R	50		0
LA95181BUB40-1	0	0	0	R	50		0
LA95283CA78-1-2-B	0	0	2	R	50		0
LA952D3-1-3-C	0	0	0	R	50		1
LA9560CA22-1	5	2	2	R	50		0
LA96140BUA70-2	0	0	0	R	50		0
LA97113UC-124-B	2	0	2	R	30		1
McCORMICK	57	2	15	MS	50	R	2
MVS-46	25	45	50	S	93		0
PAT	2	1	2	R	30	MS	1
PIONEER 26R12	38	4	30	MS	93	R	1
PIONEER 26R15	15	2	30	MR	70	MR	1
PIONEER 26R58	57	5	7	MS	70	MR	0
PIONEER XW03X	0	1	0	R	50		2
PROGENY 110	2	1	2	R	50	MS	2
PROGENY 133	1	0	2	R	30	MS	4
PROGENY 145	4	1	7	R	70	S	2
PROGENY 156	6	1	2	R	70	MR	2
PROGENY 166	1	0	2	R	50	MS	2
PROGENY 185	70	8	50	S	85		2
ROANE	25	11	15	MR	70	R	0
SABBE	4	2	0	R	50	R	2
SOUTH. STATES SS560	90	15	50	S	93	MR	2
TERRAL LA841	0	0	0	R	30	R	0
TERRAL TV8450	24	1	0	R	50	S	5
TERRAL TV8466	0	2	0	R	30	MR	0
TERRAL TV8502	1	0	0	R	50	S	2
TERRAL TV8565	3	0	0	R	50	MS	7
TERRAL TVX83W479	2	1	2	R	30		1
TERRAL TVX84W451	88	27	30	S	93		1
UGA 951079-2E31	0	1	0	R	30		0
UGA 951216-2E26	0	0	0	R	30		0
USG 3209	12	5	15	MR	70	MR	1
USG 3350	1	0	2	R	50	MS	2
USG 3592	83	27	7	S	85		1
USG EXP 910	83	34	50	S	98		1
VA00W-526	20	0	0	R	50		1
VAN98W-342	65	32	70	S	98		0

[1] Percentage of leaf area with sporulating pustules.
[2] R = resistant, MR = moderately resistant, MS = moderately susceptible, S = susceptible, and VS = very susceptible.
[3] Percentage of leaf area diseased for stripe rust and septoria leaf blotch.

Table 2. Disease reactions for one replication of the 2005 Uniorm Southern Soft Red Winter Wheat Nursery at Fayetteville.

	Stripe rust severity[1]		Leaf area diseased[2]
Entry	27 April	4 May	19 May
AGS 2000	30	30	85
USG 3209	2	15	30
Pioneer 26R61	0	0	30
McCormick	2	15	50
TN04-01	30	50	85
NC00-15332	2	2	50
MV 5-46	30	70	98
SC996284	0	0	50
SC996289	0	0	70
961526-3E15	30	70	98
961176-3A48	0	0	50
96229-3A41	0	0	30
951395-3A31	0	0	50
B990081	2	2	50
B990133	2	2	50
B990399	2	15	70
B990816	7	50	85
LA95181BUB40-1	0	2,70	50
LA96140BUA70-2	0	0	50
LA95135D54-2-3	0	0	30
AR 850-1-1	0	0	30
AR 93027-5-1	30	50	93
FL9547-B15-C1-D3	0	2	70
FL95345-A10-C5	0	0	70
FL99089-D35	50	85	98
D00*6874-9	0	0	30
D00*6874-2	0	0	30
D01-7017	0	0,70	30
D01*7759	2	2	30
VA01W-21	50	70	98
VA02W-513	0	7	50
VA02W-555	0	0	30
VA02W-370	2	2,70	50
981543A1-1-9-3	0	0	50
99751RA1-6-3	0,50	2,70	30,98
NC01-27750	30	50	98
NC00-15371	30	50	85
NC01-28087	50	70	98
G20412	30	50	85
G20921	50	85	98
G20922	50	93	98
Hickory (very susceptible check)	70	98	98

[1] Percentage of leaf area with sporulating pustules.

[2] Percentage of leaf area diseased for stripe rust and septoria leaf blotch.

Table 3. Disease reactions for one replication of the 2005 Uniform Eastern Soft Red Winter Wheat Nursery at Fayetteville.

	Stripe rust severity[1]		Leaf area diseased[2]
Entry	27 April	4 May	19 May
Caldwell	15	50	93
Foster	30	50	98
Patton	15	50	98
Roane	2	7	50
MO980829	0	0	50
T141	0	0,50	30
AR 93027-3-2	2	15	93
MV 5-46	7	30	98
MSU Line E1007	2	15	93
IL99-15867	7	30	93
OH751	2	15	93
M00-3701	0	0	70
X00-1079	0	7	85
96229-3E39	0	0	30
961395-3E25	0	0	70
B990081	0	2	50
B990133	0	0	30
B990399	2	0	50
MSU Line D8006-R	2	2	70
AR 850-1-1	0	0	30
M01-4377	0	0	30
M01*1019	0	0	50
Y00*3067	7	50	98
X00-1056	0	2	50
93C-0004-22-1	0	0	30
97C-0232-2	0	0	30
VA02W-398	7	15	93
VA02W-513	0	0	50
VA02W-555	0	0	30
Nomad exp.	30	70	98
Samco exp.	0	0	50
Bingo exp.	30	50	98
97397J1-4-1-4-7	7	15	85
97462A1-21-1-5-2	30	70	93
981312A1-6-2-2	7	7	50
T148	0	0	50
OH776	2	7	70
OH768	15	30	85
IL99-26442	0	0	30
IL00-8061	2	15	93
G20412	2	7	85
G20536	15	15	85
G20433	50	70	98
Hickory (very susceptible check)	70	98	98

[1] Percentage of leaf area with sporulating pustules.

[2] Percentage of leaf area diseased for stripe rust and Septoria leaf blotch.

Table 4. Disease reactions for one replication of the 2005 Gulf-Atlantic Wheat Nursery at Fayetteville.

	Stripe rust severity[1]		Leaf area		Stripe rust severity[1]		Leaf area
Entry	27 April	4 May	diseased[2]	Entry	27 April	4 May	diseased[2]
NC01-27753	7	15	98	GA971541-4E37	0	0	50
NC01-27764	0	0	30	GA98186-4A32	0	0	50
NC02-2178	2	2	70	GA961567-4A35	0	0	50
NC02-2179	15	2,15	70	GA951231-4A15	0	0	50
NC02-2276	0	0	50	GA961171-4A9	0	0	50
NC02-4518	15	30	98	GA96693-4E16	0	2	50
NC02-4660	7	15	50	LA95171CA58-3-2-C	0	0	50
NC02-4661	2	0	50	LA9554D68-3-2-C	0	0	50
NC02-4662	2	0,30	70	LA98094BUB-58-5-B	0	0	50
AR96077-7-2	2	2	70	LA96408D-89-3-2-B	0	0	30
AR96052-4-2	7	30	98	LA952D3-1-3-C	0	0	30
AR96024-4-1	0	2	15	LA95181BUB40-2-2-C	0	0	50
AR96141-4-1	30	70	98	SC013623	0	0	50
AR96052-4-3	7	15	98	SC013787	0	0	50
AR96077-7-3	2	15	98,50	SC013810	30	70	98
AR96031-1-1	15	15	98	SC013824	7	30	98
AR96077-10-1	0	0	30	SC013916	0	0	93
AR96150-2-1	2	15	93	SC014033	0	0	30
VA01W-243	0	0	30	SC019908	7	50	98
VA03W-235	0	0	15	SC019915	7	30	85
VA03W-249	7	30	50,98	SC110329	7	30	98
VA03W-409	7	30	98	FL9547-B4-C2-	0	0	50
VA03W-412	2	0	50	FL91226A-X4-Y11-	0	0	30
VA03W-415	50	70	98,50	FL99044D-E60	0	2	70
VA03W-434	0	7	85	FL99077D-E47	0	15	70
VA03W-436	2	7	85	FL9547-B15-C1-	0	0	70
VA03W-445	7	30	98	FL98202-D27-E2	2	2	50
VA03W-453	0	2	85	FL99053D-E69	7	50	98
GA96693-4E15	0	2	50	FL99003-D39	0	0	50
GA961171-4E21	2	0	50	FL95138-A3-B15-	0	0	50
GA951231-4E25	0	0	30				
GA951231-4E26	0	0	50	Hickory (very susceptible)	50	70	98

[1] Percentage of leaf area with sporulating pustules.

[2] Percentage of leaf area diseased for stripe rust and septoria leaf blotch.

Table 5. Disease reactions for one replication of the 2005 Arkansas Advanced Wheat Nursery at Fayetteville.

	Stripe rust severity[1]		Leaf area diseased[2]
Entry	27 April	4 May	19 May
AR97139-9-2	15	30	93
AR97109-9-3	0	2, 70	30
AR97139-15-1	0	7	50
AR97139-10-1	0	0	50
AR97225-4-1	0	0	50
AR97139-15-2	0	15	70
AR97044-10-1	0	2	85
AR97170-2-1	0	2	70
AR97226-1-1	2	15	93
AR97139-19-2	0	0	50
AR97031-1-2	0	0	50
AR97044-10-2	2	7	70
AR97139-14-1	7	7	85
AR97044-10-3	2	2	85
AR97100-4-1	2	2	50
AR97031-8-1	0	0	70
AR97170-1-1	2	2	50
AR97139-11-1	2	2	30
AR97226-1-2	2	2	70
AR97026-8-1	7	7	50
AR97109-9-1	2	2	50
AR97149-9-2	15	30	93
AR97217-1-1	2	30	85
AR97130-4-1	30	50	93
AR97100-3-1	2	2	50
AR97139-9-1	7	7	93
AR97044-12-1	2	2	70
AR97226-6-1	2	2	85
AR97083-1-1	50	70	98
AR97068-5-1	2	2	50
AR97106-2-1	7	50	93
AR97154-2-1	15	30	85
AR97244-4-1	30	50	85
AR97139-18-2	0	2	30
AR97044-12-2	2	2	70
AR97143-7-2	15	30	93
AR97144-5-1	7	7	93
AR97152-3-1	30	50	98
AR97149-8-1	2	7	50
AR97139-5-1	0	0	30
AR97044-12-3	2	2	70
AR97068-5-2	2	30	50
AR97083-1-2	30	70	98
AR97128-2-1	30	70	98
AR93021-1-2-4	2	0	85
AR97128-1-1	0	0	50
AR97120-6-1	0	0	50
AR97026-9-1	30	50	70
AR97243-4-1	50	70	93
AR97139-11-2	0	0	30
AR97068-6-1	30	2, 70	50
AR97128-2-2	30	50	98
AR97168-5-1	30	50	93
AR97044-3-1	7	2	50
AR93021-1-2-3	2	7	50
AR97100-1-1	2	7	30
AR97127-9-1	2	2	50
AR97143-7-1	2	0	30
AR97131-1-3	2	2	30
Hickory (very susceptible check)	70	98	98

[1] Percentage of leaf area with sporulating pustules.

[2] Percentage of leaf area diseased for stripe rust and septoria leaf blotch.

Table 6. Disease reactions for one replication of the 2005 Arkansas Elite Wheat Nursery at Fayetteville.

	Stripe rust severity[1]		Leaf area diseased[2]
Entry	27 April	4 May	19 May
AR910-9-1	0, 30	0, 70	50
AR93027-5-1	50	85	93
AR93035-4-1	2	15	85
AR93027-3-2	85	98	98
AR850-1-1	0	0	30
TX02D5270	0	2	70
AR96077-7-2	7	2, 70	70
AR96052-4-2	50	50	85
AR96024-4-1	2	0	30
AR96141-4-1	70	85	98
AR92024-4-2	0	0	30
AR96052-4-3	0, 30	70, 2	70
AR96077-7-3	0, 30	70, 2	85
AR96031-1-1	50	70	93
AR96077-10-1	0	0	30
AR96150-2-1	30	70	98
AR96141-5-1	50	85	98
AR96077-3-1	2	2, 70	70
AR96086-2-1	0	0	70
ARGE97-3005-17-1	0	0	30
ARGE97-0002-3-4	2	0	50
ARGE97-1017-4-1	0	0	30
ARGE97-0027-3-3	0	2	70
ARGE97-1022-5-1	0	0	30
TX02D5270	7	70	98
TX02D5271	0	0	50
TX95-115	2	30	85
HBB362-7	0	2	70
TX02D5115	2	2	85
TX02D5356	0	0	70
TX02D5406	0	0	50
TX02D6833	2	0	50
TX02D7296	7	15	85
TX02D7307	0	0	50
PAT	2	2	30
SABBE	0	0	5
Hickory (very susceptible check)	50	93	98

[1] Percentage of leaf area with sporulating pustules.

[2] Percentage of leaf area diseased for stripe rust and septoria leaf blotch.