Arkansas Wheat Promotion Board
2003 Annual Report

TITLE: Germplasm Enhancement for Disease Resistance

INVESTIGATOR: Gene Milus

COOPERATORS: Robert Bacon, Rick Cartwright, Roger Gipson (Clay County), Randy Chlapecka (Jackson County), and Justin Hensley (St. Francis County)

OBJECTIVES

To incorporate new genes for disease resistance into soft red winter wheat

To characterize varieties and breeding lines for resistance to important diseases

INTRODUCTION

Diseases are a major limitation to profitable and stable wheat production in Arkansas. Resistant varieties have been the most cost effective means of managing several of these diseases to avoid yield and test weight losses. Many current varieties of soft red winter wheat lack effective resistance to contemporary races of leaf rust, stripe rust, and Septoria leaf blotch. None of the varieties have high levels of resistance to scab or barley yellow dwarf. New races of pathogens tend to develop on previously resistant varieties, necessitating continuous efforts to develop new varieties or use more durable types of resistance. Tan spot is a relatively new disease in Arkansas and seems to develop to epidemic levels wherever wheat is grown using reduced tillage for three or more consecutive years. As more growers switch to reduced tillage to lower production costs, tan spot likely will become a more important disease. This project provides the most comprehensive disease evaluations for varieties and breeding lines of soft red winter wheat and will benefit growers in the short to intermediate term by providing reliable disease ratings for varieties and breeding lines. In the long term, growers will benefit from new varieties with disease resistance that would not have been possible without this project.

A graduate student's research on stripe rust is included with this project because the stripe rust project was not funded. Stripe rust has been of more concern in Arkansas since the epidemics in 2000, 2002, and 2003. One possible explanation for the recent epidemics is that new races of the stripe rust fungus are more aggressive than older races. This research will evaluate several old and new races to determine if differences in aggressiveness contribute to recent epidemics.

MATERIALS AND METHODS

Disease evaluations. To evaluate varieties and breeding lines for resistance to important diseases, seed of entries from the Arkansas Variety Test, Uniform Eastern and Southern Soft Red Winter Wheat, Arkansas Elite, Advanced, Rust, and Observation Nurseries, LSU Elite Nursery, and Gulf-Atlantic Breeders Nursery were obtained from the appropriate sources. Approximately 50 grams of seed of each entry were treated with Gaucho insecticide (4 fl oz / cwt) to suppress aphids and barley yellow dwarf and Dividend

fungicide (1 fl oz / cwt) to control loose smut and Stagonospora blotch. Except for the Arkansas Observation Nursery which was planted only at Kibler, entries of all nurseries were assembled into one Disease Evaluation Nursery with three replications of each entry plus resistant and susceptible checks for each disease to be evaluated. Individual plots were one row approximately 5 feet long. Disease Evaluation Nurseries were planted at Fayetteville for stripe rust, Kibler for leaf rust, Pine Tree for tan spot, Clay County for spindle streak mosaic, and Jackson and St. Francis Counties for soilborne plus spindle streak mosaic.

The Disease Evaluation Nurseries were sprayed for aphids and weeds and fertilized as needed. Nurseries for evaluating resistance to soilborne mosaic and spindle streak mosaic were planted in fields with a history of these soilborne diseases. Nurseries for evaluating resistance to tan spot, leaf rust, and stripe rust were inoculated and irrigated to promote high disease pressure. Data were recorded at an appropriate time for each disease, and data for each nursery within the Disease Evaluation Nursery were analyzed separately. Results were provided to the Arkansas Cooperative Extension Service, breeders, and seed companies.

Germplasm enhancement. The process of incorporating new genes for disease resistance into soft red winter wheat adapted to Arkansas involves several steps. Sources of resistance are identified, seed of these sources are obtained (often from outside of the United States), sources are crossed to an adapted variety and then usually backcrossed to the adapted variety to improve the probability of recovering adapted lines, populations from crosses and backcrosses are advanced in bulk and selected for agronomic traits for several generations, and then selected for resistance to particular diseases in later generations. Resistant lines are evaluated for yield and resistance to other diseases, and the best lines are provided to breeders.

Aggressiveness of stripe rust races. To determine if new races are more aggressive than old races, several old and new races will be evaluated for latent period (time from inoculation until sporulation) on five susceptible varieties and spore germination rate on agar media. Both evaluations will be conducted at 54°F (favorable temperature) and 64°F (near upper limit for stripe rust). Races that germinate faster, sporulate sooner, or are able to germinate or sporulate better at the higher temperature will be considered more aggressive.

RESULTS AND DISCUSSION

Disease evaluations. Reliable data were obtained for stripe rust, leaf rust, and tan spot. Insufficient symptoms developed at all three locations planted specifically for wheat spindle streak mosaic and soilborne wheat mosaic, and no data were obtained for these diseases. For entries in the Arkansas Variety Test, disease data were converted to disease reactions and combined with disease reactions obtained in previous years (Table 1). These disease reactions were disseminated as part of a yearly Wheat Update published by the Extension Service. Actual disease data for entries in individual nurseries that were part of the Disease Evaluation Nursery are listed in Tables 2 through 10.

In general, most of the entries in the Arkansas Variety test were at least moderately resistant to the races of leaf rust and stripe rust used to inoculate the field plots. This likely is due to a stable leaf rust population (no important new races for several years) and breeders' long-term attention to leaf rust resistance and quick discarding of lines susceptible to recent races of stripe rust. More research needs to be done to evaluate varieties and lines for resistance to other races in the field, to determine which seedling and adult-plant genes

for stripe rust resistance are in soft red winter wheats, and to determine the source of initial stripe rust inoculum.

Results reported here are the most comprehensive evaluation of soft red winter wheats for tan spot resistance. Of the 90 entries in the Variety Test, 15 were moderately resistant to tan spot despite never being selected for resistance. Other nurseries evaluated also had a low proportion of moderately resistant lines. Tan spot resistance is highly desirable when wheat is grown under no till or minimum till cropping systems. If the wheat acreage under these cropping systems continues to increase, tan spot will become more important. Currently, there is a limited selection of varieties with moderate resistance to tan spot, but there appears to be ample resistance among advanced lines. With a moderate effort by breeders, tan spot resistance probably could be incorporated into varieties along with other good characteristics. The tan spot nursery will be maintained for at least several years to assist breeders with the development of resistant varieties.

Reliable data were obtained for resistance to spindle streak mosaic and soilborne mosaic in 2002 but not in 2003. The blanks for spindle streak and soilborne data (Table 1) reflect both the rapid turn over and proprietary numbering of experimental lines. It has been difficult to obtain complete disease resistance evaluations on many new varieties before they are released because they are tested as lines in accessible nurseries for only one or two years before release and proprietary numbering allows no connection to data that may have been obtained on the line in previous years.

A concerted effort will be made to obtain Septoria leaf blotch evaluations in 2004 to compensate for no new data during the past two seasons. Bacterial streak, powdery mildew, and Fusarium root and crown rot have been infrequent during the past several years, but data will be collected if these diseases occur naturally in nurseries.

Germplasm enhancement. From populations developed for resistance to leaf rust, 15 F_7, backcross F_6, or topcross F_6 lines from 10 sources of resistance were resistant to leaf rust and stripe rust and two were moderately resistant to tan spot (Table 11). These lines also were tested for yield by Dr. Bacon, and five lines were among the top 10 for yield among 54 entries in the Arkansas Rust Nursery. Three of these lines were highly resistant to Karnal bunt in tests conducted in Mexico and India during 2003 and may be useful sources of Karnal bunt resistance. Additional lines have been submitted for Karnal bunt evaluation. Three F_2 and three BCF_2 populations utilizing a CIMMYT soft red spring wheat with several genes for adult-plant resistance have been developed. The spring wheat has a very high level of adult-plant resistance that appears to be effective against all races of leaf rust.

From populations developed for resistance to barley yellow dwarf, 12 backcross F_5 lines from four sources of resistance were resistant to barley yellow dwarf in early-planted, naturally-infected plots at Fayetteville and Kibler (Table 12). All of the lines have reasonable agronomic characteristics and will be retested in 2004. Three of these lines from different sources of resistance are being crossed with Roane and Coker 9663, which also have resistance to barley yellow dwarf, in an attempt to combine different genes for resistance and develop adapted lines with higher levels of resistance. Backcrosses to a CIMMYT spring wheat line with a major gene for barley yellow dwarf resistance and four BCF_2 populations are being advanced.

Several lines with resistance to leaf rust, stripe rust, or leaf blotch from international wheat nurseries and miscellaneous wheat lines (Table 13) were selected in the field and

appear to have reasonable adaptation to Arkansas. These will be evaluated in all disease nurseries in 2004, and the best lines will be selected for crossing. Two international nurseries will be evaluated in 2004 to identify new sources of resistance. Wheat pathologists in the eastern United States assembled a nursery of lines with resistance to Stagonospora blotch (glume blotch), and this nursery will be evaluated in an inoculated, irrigated plot at Kibler.

Aggressiveness of stripe rust races. Five races have been evaluated so far, and there were differences in latent period and germination rate among the races. About 15 additional races will be tested during the next six months. The student should complete her thesis and graduate in August 2004.

Table 1. Disease Reactions of Selected Wheat Varieties and Lines Evaluated in Arkansas, 2003.

VARIETY	LEAF RUST	SEPTORIA LEAF BLOTCH	STRIPE RUST	SOILBORNE WHEAT MOSAIC	WHEAT SPINDLE STREAK MOSAIC	BACTERIAL STREAK	POWDERY MILDEW	FUSARIUM ROOT AND CROWN ROT	TAN SPOT
AGRIPRO D98-9762	MR		S						VS
AGRIPRO D99-5261	R		R						S
AGRIPRO M98-1661	MR		MS						MS
AGRIPRO NATCHEZ	R	MR	R	R	MR			R	S
AGRIPRO Savage	R		MR						S
AGRIPRO SHELBY	MS	S	S	MS	S		MR	R	S
AGS 2000	R	MR	S	S	VS		R	R	S
AGS 485	R		S						MS
AR 839-25-8-2	MR	MS	R	MR	R			R	MS
AR 839-28-1-2	MS	MS	R	R	R			R	MS
AR 910-9-1	R		R	MR	VS				MS
ARMOR 3035	MS*	MS	MR	MR	MS		S	R	MS
ARMOR 4045	MS	S	MR	R	MS		S	MR	MS
ARMOR X 5111	MS		R						S
ARMOR X 5222	MS		R	MS	S				S
ARMOR X 5333	MS		MR	MR	MS				S
ARMOR X 5777	MR		R						
ARMOR X 5888	MS		R						S
COYOTE	MR		MS						MS
CROPLAN GENET. 514W	.		VS						S
CROPLAN GENET. 554W	MR		S	R	R				MS
DELTA GROW 4200	MR		R	MS	S				S
DELTA GROW 4500	MR		R						S
DELTA GROW 4888	MR*	MS	R	MR	MS			R	MS
DELTA GROW 5300	MR	MR	R	MS	VS			MR	S
DELTA KING 1551W	MR	S	R	S	S		MS	MR	S
DELTA KING 7777	MS		R	R	R				S
DELTA KING 7900	MS		R	MR	MS				MS

Table 1. (continued)

VARIETY	LEAF RUST	SEPTORIA LEAF BLOTCH	STRIPE RUST	SOILBORNE WHEAT MOSAIC	WHEAT SPINDLE STREAK MOSAIC	BACTERIAL STREAK	POWDERY MILDEW	FUSARIUM ROOT AND CROWN ROT	TAN SPOT
DELTA KING 9027	MR	S	MR	R	MS	MR	MR	S	S
DELTA KING 9121	MR	MR	MS	R	R		R	S	MR
DELTA KING 9216	MR*	S	MR	MS	S			MR	S
DELTA KING 9410	MS		R	R	S				S
DIXIE 900	MS*	MR	R	MS	S			R	S
DIXIE 922	MS*	MS	R	MR	S			R	S
DIXIE 933	S		R						MS
DIXIE X9013	S		R						MS
DIXIE X9113	S		MS						MR
DIXIE X9512	MS		R	MS	MS				S
DIXIE X9712	MS		R						S
DIXIE X9812	S		R						S
EK EXP 110	MR		R						MS
EK EXP 138	MR		R						S
EK EXP 180	S		MR						MR
FFR 510	R	MS	VS	MS	MR		R	S	MS
FFR 556	MS		S	R	R				MR
GA 931241E16	R		MR						MR
GENESIS M86	MR		R						S
GENESIS R023	MS		R	MS	MS				VS
GENESIS R024	MS		MR	MR	S				VS
GENESIS RO33	S		R						S
GENESIS RO43	S		R						VS
GENESIS VENTURE	MR		VS						
HBK 3030	R	S	MR	MR	VS			MS	VS
HBK X3106	R		MS						S
LA 90185G3-1-3-4-2	MS	MR	VS	VS	S			R	
McCORMICK	MR		R	MR	MR				MR

Table 1. (continued)

VARIETY	LEAF RUST	SEPTORIA LEAF BLOTCH	STRIPE RUST	SOILBORNE WHEAT MOSAIC	WHEAT SPINDLE STREAK MOSAIC	BACTERIAL STREAK	POWDERY MILDEW	FUSARIUM ROOT AND CROWN ROT	TAN SPOT
NC 96-13156	R		VS						MR
NK B960457	R		R						MR
NK COKER 9152	R	MS	MS	R	R			MR	VS
NK COKER 9663	MS	MR	S	S	VS	MR	R	R	MS
PAT	MS	MS	R	R	R		S	R	MS
PIONEER 26R12	MS		MS						MS
PIONEER 26R24	R	S	S	MS	S		MR	MR	MR
PIONEER 26R38	MS*	MS	VS	MR	MR			R	S
PIONEER 26R46	MR*	MR	MS	MS	MS		R	R	S
PIONEER 26R58	MR		MS						MR
PROGENY 145	MS		R						S
PROGENY 156	MR	MS	R	MS	S		MR	MS	MR
PROGENY 166	MR		MR						S
ROANE	MR	S	MR	R	MS		R	MR	MR
SABBE	S	MR	R	MR	S		R	R	S
SOUTH. STATES SS 520	R		VS	MS	MR				S
SOUTH. STATES SS 522	R	MR	VS	VS	VS		MS	MS	MR
SOUTH. STATES SS 524	R		MS	R	S				VS
SOUTH. STATES SS 535	R	MS	S	MS	S		R	R	MS
SOUTH. STATES SS 560	S		MS						MR
TERRAL LA841	R		R						VS
TERRAL TV 8450	MS		MR	MR	MS				S
TERRAL TV 8466	MR		R						VS
TERRAL TV 8555	MR	MS	R	MR	R	S	R	R	S
TERRAL TV 8565	MS		R	MR	MS				MS
TERRAL TVX81HO4	MS		R						S
TERRAL TVX82HO1	S		R						S
TERRAL TVX82HO2	MS		R						MS

Table 1. (continued)

VARIETY	LEAF RUST	SEPTORIA LEAF BLOTCH	STRIPE RUST	SOILBORNE WHEAT MOSAIC	WHEAT SPINDLE STREAK MOSAIC	BACTERIAL STREAK	POWDERY MILDEW	FUSARIUM ROOT AND CROWN ROT	TAN SPOT
TRIBUTE	S	MS	MS	S	S			MR	MR
USG 3209	MR	MS	MR	MS	S		R	MR	MR
USG 3350	MR		R						S
USG 3430	S		R						VS
USG 3709	S	MR	S	MR	R		MR	MR	S
VA 98w 706	R		R						MS

* Other races of the fungus able to attack this variety are known, but have not been common in Arkansas recently.
R = Resistant; **MR** - Moderately Resistant; **MS** = Moderately Susceptible; **S** = Susceptible; **VS** = Very Susceptible.
Ratings are based on the latest data and may therefore differ from previous years.
Acknowledgments: Peter Rohman, Charles Parsons, Dr. Robert Bacon, Dr. John Kelly, Roger Gipson, Randy Chlapecka, Lance Blythe, Claude Kennedy, Dr. Fred Bourland, Ronnie Sherman, J.D. Barham, Terry Kirkpatrick, Joe Vestal and all Arkansas Wheat growers whose checkoff contributions through the Arkansas Wheat Promotion Board helped support this work.

Table 2. Disease evaluations for the Arkansas Variety Test, 2003.

Genotype	% Stripe Rust			% Tan Spot	Leaf Rust at Kibler	
	Kibler[1]	Lewisville[2]	Fayetteville[3]	Pine Tree[4]	%[5]	IT[6]
Delta Grow 4200	0	0	3	63	5	3
Delta Grow 4500	0	0	10	70	27	4
Delta Grow 4888	0	0	5	37	29	3
Delta Grow 5300	0	0	5	57	10	3
Croplan Genetics 514w	91	67	88	55	.	.
Croplan Genetics 554w	45	20	57	43	29	3
Mc Cormick	0	1	4	32	15	3
VA 98w 706	0	0	1	38	2	2
NK Coker 9663	5	2	32	43	37	3
NK Coker 9152	13	8	20	80	2	2
NK B960457	0	1	8	32	8	2
Coyote	0	7	25	43	13	3
Delta King 155w	0	1	14	68	5	2
Delta King 7777	0	0	7	63	43	4
Delta King 7900	0	0	7	50	38	4
Delta King 9027	0	1	10	57	0	.
Delta King 9121	2	7	38	27	1	2
Delta King 9216	0	9	10	57	16	3
Delta King 9410	0	0	7	63	50	4
GA 931241E16	0	8	20	15	0	.
USG 3209	4	2	15	32	11	2
USG 3709	4	8	68	70	40	4
USG 3430	0	1	7	75	43	4
Agripro Shelby	4	23	43	57	1	2
Agripro Natchez	0	1	4	63	6	2
Agripro Savage	1	0	17	63	2	3
Agripro D99-5261	0	1	10	63	2	2
Agripro D98 9762	17	8	50	90	26	3
Agripro M98-1661	0	2	27	43	29	3
Pioneer 26R24	4	35	63	27	1	1
Pioneer 26R46	0	2	20	68	0	.
Pioneer 26R38	13	28	75	68	42	4
Pioneer 26R58	3	4	27	15	29	3
Pioneer 26R12	1	4	55	33	38	4
Progeny 145	0	0	11	70	38	4
Progeny 156	0	1	12	30	20	3
Progeny 166	0	0	25	57	12	3
Ek Exp 110	0	1	7	50	29	4
Ek Exp 138	0	1	11	63	17	3
Ek Exp 180	0	6	15	32	43	4
Dixie X9013	0	2	8	37	43	4
Armor 3035	0	0	28	43	43	4
Armor 4045	0	0	26	50	38	4
Dixie X9113	0	10	28	30	43	4
Armor X 5222	0	0	2	57	43	4
Armor X 5333	0	0	5	70	50	4
NC 96-13156	9	78	80	12	3	3
HBK 3030	0	2	20	83	0	.
HBK X3106	8	14	50	57	0	.
FFR 556	18	12	50	25	38	4
Sabbe	0	0	8	70	57	4
Pat	0	0	4	38	37	4
AR 839-25-8-2	0	0	4	50	24	3

Table 2. (continued)

Genotype	% Stripe Rust			% Tan Spot	Leaf Rust at Kibler	
	Kibler[1]	Lewisville[2]	Fayetteville[3]	Pine Tree[4]	%[5]	IT[6]
AR 910-9-1	0	0	3	43	8	2
Terral TV8450	0	1	13	63	32	3
Terral TV8466	0	1	12	88	16	3
Terral TV 8555	0	2	10	63	23	3
Terral TV8565	0	0	4	50	45	4
Terral LA841	0	0	1	85	0	.
AGS 2000	2	10	32	70	0	.
AGS 485	55	34	62	43	6	2
Dixie 900	0	0	2	63	32	4
Dixie 922	0	0	5	63	45	3
Dixie 933	0	1	1	43	43	4
Dixie X9512	0	0	8	70	38	3
Dixie X9712	0	0	4	70	36	4
Dixie X9812	0	0	7	70	50	4
Terral TVX81HO4	0	0	5	70	34	3
Terral TVX82HO1	0	0	7	70	50	4
Terral TVX82HO2	0	0	2	50	38	4
Armor X 5111	0	1	7	57	34	3
Armor X 5888	0	1	2	70	32	3
USG 3350	0	1	2	70	27	3
Armor X 5777	0	1	11	.	29	3
LA 90185G3-1-3-4-2	5	50	57	.	50	4
Vigoro Tribute	2	8	45	32	49	3
Genesis RO23	0	1	10	75	34	3
Genesis M86	0	0	5	63	29	3
Genesis RO24	0	2	11	90	38	4
Genesis RO33	0	0	2	57	40	4
Genesis RO43	0	0	10	75	50	4
Genesis Venture	14	19	85	.	29	3
AR 839-28-1-2	.	.	8	50	32	3
South States SS 522	1	50	83	30	1	2
South States SS 535	1	27	45	37	0	.
South States SS 520	91	75	90	63	0	.
South States SS 524	10	12	27	75	0	.
South States SS 560	10	12	43	32	40	4
Roane	3	3	15	24	19	3
FFR 510	83	75	90	45	0	.
LSD (0.05)	9	14	21	20	27	

[1]Percentage of flag leaf area diseased at late soft dough stage in the Arkansas Variety Test plots.
[2]Percentage of leaf area diseased at flowering stage in the Arkansas Variety Test plots.
[3]Percentage of the flag leaf area with sporulating pustules on May 5 at soft dough stage. Plot was inoculated with isolate that was supposed to be race PST-78 (virulent on Lemhi, HeinesVII, Lee, Fielder, Express, Yr8, Yr9, Clement, and Compair), but the isolate was virulent only on Lemhi, Lee, Fielder, Express, and Yr-9.
[4]Percentage of the flag leaf area with tan spot symptoms on May 9 at soft dough stage. Plot was inoculated with infested straw from two locations and irrigated frequently.
[5]Percentage of the flag leaf are with leaf rust on May 21 at late soft dough stage. Plot was inoculated with race TNRL, virulent on Lr 1, 2a, 2c, 3, 9, 24, 3ka, 11, 30, and 10.
[6]Infection type,0-4 scale, 4 is most susceptible.

Table 3. Disease evaluations for the Uniform Southern Soft Red Winter Wheat Nursery, 2003.

Genotype	% Stripe Rust Fayetteville[1]	% Tan Spot Pine Tree[2]	Leaf Rust at Kibler	
			%[3]	IT[4]
Coker 9663	45	57	7	3
AGS 2000	50	75	1	2
USG 3209	27	32	11	3
Pioneer 26R61	1	37	10	4
SC 960057	17	12	10	4
G/F 931241E16	17	22	0	.
G/F 93052E42	57	75	0	.
F/G 931470E62	57	20	17	3
F/G 931233E17	1	63	0	.
AR 910-9-1	2	63	1	2
NC 98-26143	85	37	33	4
NC 99-13022	12	50	0	.
NC 98-24182	1	63	27	4
VA 00W-526	3	20	36	3
VA 98W-335	62	63	0	.
VAN98W-342	83	63	0	.
VA98W-631	5	63	1	2
LA9330D11-1	37	70	0	.
LA9560CA22-1	15	57	0	.
AW D99-5261	29	37	4	2
AW L96*9266-1	27	50	0	.
AW D99*5725	20	70	42	4
AW M96*3978-4	17	75	29	3
AR 93035-4-1	31	43	37	3
G/F 94261E7	25	75	50	4
G 96195	18	43	32	4
G 96226	38	27	38	4
G 19844	8	30	43	4
F/G 931630E48	8	37	13	2
MO 002001	62	43	27	4
SC 980890	43	83	25	3
B 980582	50	57	20	3
B 980696	6	20	10	3
B 980954	43	63	50	4
B 980416	68	20	2	2
MD 71-5	85	38	.	.
TX 00D1626	64	15	0	.
LSD (0.05)	21	20	27	.

[1]Percentage of the flag leaf area with sporulating pustules on May 5 at soft dough stage. Plot was inoculated with isolate that was supposed to be race PST-78 (virulent on Lemhi, HeinesVII, Lee, Fielder, Express, Yr8, Yr9, Clement, and Compair), but the isolate was virulent only on Lemhi, Lee, Fielder, Express, and Yr-9.

[2]Percentage of the flag leaf area with tan spot symptoms on May 9 at soft dough stage. Plot was inoculated with infested straw from two locations and irrigated frequently.

[3]Percentage of the flag leaf are with leaf rust on May 21 at late soft dough stage. Plot was inoculated with race TNRL, virulent on Lr 1, 2a, 2c, 3, 9, 24, 3ka, 11, 30, and 10.

[4]Infection type, 0-4 scale, 4 is most susceptible.

Table 4. Disease evaluations for the Uniform Eastern Soft Red Winter Wheat Nursery, 2003.

Genotype	% Stripe Rust Fayetteville[1]	% Tan Spot Pine Tree[2]	Leaf Rust at Kibler	
			%[3]	IT[4]
Caldwell	43	37	12	3
Foster	75	20	40	4
Patton	68	32	22	3
Roane	12	12	20	3
OH 669	13	38	63	4
MO 980725	8	63	50	4
TW 044-094	38	22	68	4
Daisy exp.	32	32	63	4
Husky exp.	30	37	57	4
Y98-912	1	43	43	3
AR 910-9-1	1	62	4	2
T 126	36	57	32	3
T 127	8	75	7	3
VA 00W-526	6	15	32	3
VA 97W-375WS	32	45	0	.
VAN 98W-170WS	17	62	5	3
T 143	17	79	16	3
9712C1-4	38	12	5	2
97395B1-4-2-4	55	27	4	2
97395B1-4-3-8	55	22	25	3
KY 93C-0876-66	43	20	50	4
KY 92C-0010-17	4	68	43	4
Z00-5018	17	30	37	4
S00-0495	4	57	57	4
Darby exp.	8	70	50	4
M98-1661	17	43	37	4
M99*3098	11	20	25	3
M99-2418	36	57	37	4
OH 708	38	5	7	2
OH 712	4	20	37	3
G96055	1	50	37	4
G96226	42	32	43	4
G19835	41	25	20	3
MO 981020	17	63	50	4
MO 980829	8	37	25	3
B980203	11	85	36	3
B980582	32	63	36	4
B980696	0	25	30	3
IL 97-3632	22	30	38	3
IL 97-4915	62	57	27	3
G/F 9312233A24	1	25	0	.
LSD (0.05)	21	20	27	.

[1]Percentage of the flag leaf area with sporulating pustules on May 5 at soft dough stage. Plot was inoculated with isolate that was supposed to be race PST-78 (virulent on Lemhi, HeinesVII, Lee, Fielder, Express, Yr8, Yr9, Clement, and Compair), but the isolate was virulent only on Lemhi, Lee, Fielder, Express, and Yr-9.

[2]Percentage of the flag leaf area with tan spot symptoms on May 9 at soft dough stage. Plot was inoculated with infested straw from two locations and irrigated frequently.

[3]Percentage of the flag leaf are with leaf rust on May 21 at late soft dough stage. Plot was inoculated with race TNRL, virulent on Lr 1, 2a, 2c, 3, 9, 24, 3ka, 11, 30, and 10.

[4]Infection type, 0-4 scale, 4 is most susceptible.

Table 5. Disease evaluations for the Arkansas Elite Nursery, 2003.

Genotype	% Stripe Rust Fayetteville[1]	% Tan Spot Pine Tree[2]	Leaf Rust at Kibler	
			%[3]	IT[4]
AR 839-28-1-2	2	15	1	2
AR 93035-4-2	20	43	43	4
AR 93027-5-1	32	20	15	2
AR 910-9-1	4	68	10	2
AR 839-25-8-2	6	57	21	3
AR 93027-3-2	38	20	24	3
AR 93035-4-1	31	37	25	3
AR 800-1-3-1	8	57	10	4
AR 93005-6-5	4	83	0	.
AR 93002-3-3	15	57	10	3
AR 93173-3-3	1	50	21	3
AR 93005-6-1	1	80	0	.
AR 94071-3-1	7	70	5	3
AR 94112-7-1	12	70	0	.
AR 94047-5-1	5	37	2	2
AR 94123-1-1	11	70	7	3
AR 94060-4-1	8	57	20	3
AR 94168-2-1	16	70	6	3
AR 94150-5-1	32	63	1	2
PAT	10	38	15	4
COKER 9663	38	43	32	4
AGS 2000	38	75	0	.
SABBE	15	70	36	3
SHELBY	43	63	2	2
LSD (0.05)	21	20	27	.

[1]Percentage of the flag leaf area with sporulating pustules on May 5 at soft dough stage. Plot was inoculated with isolate that was supposed to be race PST-78 (virulent on Lemhi, HeinesVII, Lee, Fielder, Express, Yr8, Yr9, Clement, and Compair), but the isolate was virulent only on Lemhi, Lee, Fielder, Express, and Yr-9.

[2]Percentage of the flag leaf area with tan spot symptoms on May 9 at soft dough stage. Plot was inoculated with infested straw from two locations and irrigated frequently.

[3]Percentage of the flag leaf are with leaf rust on May 21 at late soft dough stage. Plot was inoculated with race TNRL, virulent on Lr 1, 2a, 2c, 3, 9, 24, 3ka, 11, 30, and 10.

[4]Infection type, 0-4 scale, 4 is most susceptible.

Table 6. Disease evaluations for the Arkansas Advanced Nursery, 2003.

Genotype	% Stripe Rust Fayetteville[1]	% Tan Spot Pine Tree[2]	Leaf Rust at Kibler	
			%[3]	IT[4]
AR 95003-1-1	5	50	1	2
AR 95003-4-1	5	70	0	.
AR 95003-5-1	10	68	0	.
AR 95003-5-2	32	70	0	.
AR 95009-3-1	12	17	2	3
AR 95009-6-1	38	57	6	3
AR 95021-1-1	27	88	15	4
AR 95023-4-2	43	15	5	3
AR 95023-6-1	32	68	27	3
AR 95023-6-3	20	63	27	3
AR 95023-7-2	38	63	24	3
AR 95024-1-1	37	70	24	3
AR 95024-5-1	32	63	25	4
AR 95024-7-2	45	57	32	3
AR 95029-4-1	50	22	55	4
AR 95030-3-1	1	57	25	2
AR 95031-6-1	32	96	.	.
AR 95047-2-2	32	32	32	3
AR 95047-6-1	29	50	0	.
AR 95047-8-1	22	57	0	.
AR 95048-1-2	57	11	1	2
AR 95049-3-1	22	75	1	2
AR 95049-4-1	25	83	1	2
AR 95049-5-1	78	8	0	.
AR 95052-1-2	8	50	0	.
AR 95053-5-1	68	38	17	4
AR 95060-3-1	50	57	5	2
AR 95060-5-1	57	42	12	3
AR 95071-4-1	45	70	17	4
AR 95071-5-1	22	63	19	3
AR 95071-6-1	25	15	10	2
AR 95071-7-1	25	38	5	2
AR 95073-2-1	50	22	4	2
AR 95077-3-2	68	36	0	.
AR 95079-1-1	38	25	0	.
AR 95079-1-3	38	29	0	.
AR 95085-4-1	50	25	22	3
AR 95108-5-2	1	80	1	2
AR 95108-5-3	5	57	1	2
AR 95121-4-1	2	75	21	3
AR 95125-1-1	1	94	1	2
AR 95182-2-1	1	85	2	2
PAT	5	29	25	3
COKER 9663	43	50	27	4
AGS 2000	32	80	1	2
SABBE	8	63	75	4
SHELBY	43	68	43	4
LSD (0.05)	21	20	27	.

[1]Percentage of the flag leaf area with sporulating pustules on May 5 at soft dough stage. Plot was inoculated with isolate that was supposed to be race PST-78 (virulent on Lemhi, HeinesVII, Lee, Fielder, Express, Yr8, Yr9, Clement, and Compair), but the isolate was virulent only on Lemhi, Lee, Fielder, Express, and Yr-9.

[2]Percentage of the flag leaf area with tan spot symptoms on May 9 at soft dough stage. Plot was inoculated with infested straw from two locations and irrigated frequently.

[3]Percentage of the flag leaf are with leaf rust on May 21 at late soft dough stage. Plot was inoculated with race TNRL, virulent on Lr 1, 2a, 2c, 3, 9, 24, 3ka, 11, 30, and 10.

[4]Infection type, 0-4 scale, 4 is most susceptible.

Table 7. Disease evaluations for the Arkansas Rust Nursery, 2003.

Genotype	% Stripe Rust Fayetteville[1]	% Tan Spot Pine Tree[2]	Leaf Rust at Kibler	
			%[3]	IT[4]
AR 93005-6-4	4	75	0	.
AR 93005-6-1	3	75	1	2
AR 93005-6-2	1	78	0	0
AR 908-8-2	5	12	2	2
AR 93039-6-1	4	38	2	2
AR 908-8-1	5	10	0	.
AR 93110-9-4	11	32	10	11
AR 93127-3-1	2	68	0	.
AR 93039-1-1	5	17	0	.
ARGE97-1058-4-2	4	27	0	.
ARGE97-3004-22A-3	1	43	17	2
ARGE97-3003-1-5	22	12	0	.
ARGE97-3002-2-1	4	63	0	.
ARGE97-3005-17-1	4	50	0	.
ARGE97-0006-6-5	2	90	0	.
ARGE97-0001-11-5	13	25	1	2
ARGE97-0002-3-4	13	78	0	.
ARGE97-0031-2-6	2	63	1	2
ARGE97-0021-1-4	10	15	0	.
ARGE97-0030-3-3	1	38	1	2
ARGE97-0016-5-6	4	80	1	2
ARGE97-0027-3-3	5	75	0	.
ARGE97-1016-3-2	1	32	16	3
ARGE97-1017-4-1	4	63	0	.
AR 96071-32	22	25	0	.
AR 96068-47	45	70	10	4
AR 96071-23	45	38	40	4
AR 96001-72	31	88	57	4
AR 96068-10	62	75	11	3
AR 96068-27	62	80	0	.
AR 96068-11	64	75	27	4
AR 96068-44	17	57	15	3
AR 96068-69	75	80	19	3
AR 96071-29	57	20	2	2
AR 96071-35	57	37	1	2
AR 96001-18	4	63	15	3
AR 96001-13	15	83	10	4
AR 96071-76	57	12	20	3
AR 96071-25	50	43	27	3
AR 96071-13	52	57	38	4
AR 96001-38	38	70	50	4
AR 96068-6	67	80	2	2
AR 96068-28	62	85	7	3
AR 96001-54	5	62	0	.
AR 96001-35	38	62	17	4
AR 96068-8	50	80	25	3
AR 96005-38	29	75	6	3

Table 7. (continued)

	% Stripe Rust	% Tan Spot	Leaf Rust at Kibler

Genotype	Fayetteville[1]	Pine Tree[2]	%[3]	IT[4]
AR 96001-17	4	78	1	2
AR 96001-79	50	63	7	3
AR 96071-26	55	57	11	3
AR 96001-61	38	63	50	4
SABBE	11	68	63	4
HAZEN	45	71	16	3
ARLA 85411	2	71	0	.
LSD (0.05)	21	20	27	.

[1]Percentage of the flag leaf area with sporulating pustules on May 5 at soft dough stage. Plot was inoculated with isolate that was supposed to be race PST-78 (virulent on Lemhi, HeinesVII, Lee, Fielder, Express, Yr8, Yr9, Clement, and Compair), but the isolate was virulent only on Lemhi, Lee, Fielder, Express, and Yr-9.

[2]Percentage of the flag leaf area with tan spot symptoms on May 9 at soft dough stage. Plot was inoculated with infested straw from two locations and irrigated frequently.

[3]Percentage of the flag leaf are with leaf rust on May 21 at late soft dough stage. Plot was inoculated with race TNRL, virulent on Lr 1, 2a, 2c, 3, 9, 24, 3ka, 11, 30, and 10.

[4]Infection type, 0-4 scale, 4 is most susceptible.

Table 8. Disease evaluations for the Arkansas Wheat Observation Nursery, 2003.

Genotype	Leaf Rust at Kibler	
	%[1]	IT[2]
JAYPEE	.	.
AR 96001-2-1	30	3
AR 96001-2-2	.	.
AR 96001-5-1	50	4
AR 96001-6-1	30	3
AR 96003-1-1	2	2
AR 96003-4-1	30	3
AR 96003-5-1	30	3
AR 96003-5-2	30	3
AR 96003-6-1	50	4
PAT	15	2
AR 96003-7-1	70	4
AR 96003-7-2	70	4
AR 96004-1-1	70	4
AR 96004-5-1	.	.
AR 96004-6-1	15	2
AR 96004-6-2	15	3
AR 96004-7-1	2	2
AR 96004-9-1	.	.
AR 96004-13-1	.	.
AR 96004-13-2	.	.
SABBE	70	4
AR 96005-2-1	.	.
AR 96005-4-1	.	.
AR 96007-1-1	0	.
AR 96007-3-1	50	4
AR 96007-4-1	0	.
AR 96007-4-2	0	.
AR 96007-5-1	50	4
AR 96008-3-1	.	.
AR 96010-4-1	.	.
AR 96010-4-2	0	.
JAYPEE	.	.
AR 96010-4-3	.	.
AR 96010-6-1	0	.
AR 96012-1-1	.	.
AR 96012-3-1	0	.
AR 96015-1-1	7	2
AR 96015-1-2	0	.
AR 96015-2-1	0	.
AR 96015-2-2	0	.
AR 96015-6-1	.	.
AR 96015-7-1	.	.
PAT	30	4
AR 96015-7-2	.	.
AR 96016-8-1	.	.
AR 96018-1-1	0	.
AR 96018-1-2	30	4
AR 96024-4-1	.	.
AR 96024-4-2	0	.
AR 96024-4-3	0	.
AR 96026-2-1	50	4
AR 96026-4-1	0	.
AR 96026-4-2	2	2
SABBE	70	4
AR 96027-8-1	50	4
AR 96028-1-1	50	4
AR 96028-4-1	0	.
AR 96031-1-1	.	.
AR 96031-1-2	.	.
AR 96042-5-1	.	.
AR 96046-2-1	0	.
AR 96046-2-2	.	.
AR 96049-2-1	7	3
AR 96052-2-1	0	.
JAYPEE	.	.
AR 96052-4-1	0	.
AR 96052-4-2	0	.
AR 96052-4-3	0	.
AR 96052-6-1	0	.
AR 96052-6-2	.	.
AR 96054-4-1	0	.
AR 96056-1-1	0	.
AR 96056-4-1	0	.
AR 96056-5-1	.	.
AR 96056-5-2	.	.
PAT	30	4
AR 96056-6-1	0	.
AR 96062-6-1	0	.
AR 96062-8-1	0	.
AR 96068-1-1	15	2
AR 96068-2-1	.	.
AR 96068-2-2	.	.
AR 96068-3-1	0	.
AR 96071-6-1	7	3
AR 96072-3-1	0	.
AR 96072-3-2	0	.
SABBE	85	4
AR 96072-4-1	.	.
AR 96072-5-1	0	.

Table 8. (continued)

Genotype	Leaf Rust at Kibler	
	%[1]	IT[2]

Genotype	%[1]	IT[2]
AR 96073-2-1	0	.
AR 96073-4-1	7	2
AR 96075-1-1	30	3
AR 96075-1-2	30	3
AR 96075-3-1	.	.
AR 96075-5-1	0	.
AR 96075-5-2	30	3
AR 96075-6-1	7	3
JAYPEE	.	.
AR 96075-8-1	30	3
AR 96075-8-2	50	4
AR 96075-9-1	0	.
AR 96075-9-2	.	.
AR 96075-9-3	0	.
AR 96077-1-1	.	.
AR 96077-1-2	.	.
AR 96077-2-1	0	.
AR 96077-3-1	0	.
AR 96077-5-1	0	.
AR 96077-7-1	0	.
PAT	50	4
AR 96077-7-2	0	.
AR 96077-7-3	30	3
AR 96077-10-1	0	.
AR 96077-11-1	0	.
AR 96077-11-2	0	.
AR 96081-1-1	0	.
AR 96081-1-2	0	.
AR 96081-3-1	0	.
AR 96081-3-2	0	.
AR 96081-3-3	0	.
SABBE	70	4
AR 96081-3-4	0	.
AR 96081-6-1	0	.
AR 96081-7-1	0	.
AR 96081-7-2	0	.
AR 96082-2-1	0	.
AR 96082-3-1	0	.
AR 96082-3-2	0	.
AR 96086-1-1	0	.
AR 96086-1-2	0	.
AR 96086-2-1	15	3
JAYPEE	.	.
AR 96086-6-1	7	2
AR 96120-3-1	0	.

Genotype	%[1]	IT[2]
AR 96131-5-1	0	.
AR 96131-10-1	2	2
AR 96132-1-1	0	.
AR 96133-1-1	0	.
AR 96133-1-2	0	.
AR 96133-1-3	0	.
AR 96133-3-1	0	.
AR 96134-1-1	0	.
PAT	0	.
AR 96134-5-1	0	.
AR 96134-5-2	.	.
AR 96134-5-3	0	.
AR 96134-5-4	0	.
AR 96135-2-1	.	.
AR 96135-3-1	.	.
AR 96135-3-2	.	.
AR 96135-3-3	.	.
AR 96135-4-1	.	.
AR 96135-7-1	0	.
SABBE	50	4
AR 96135-7-2	0	.
AR 96135-7-3	0	.
AR 96136-4-1	.	.
AR 96136-5-1	0	.
AR 96136-5-2	0	.
AR 96136-8-1	.	.
AR 96136-8-2	0	.
AR 96138-1-1	0	.
AR 96138-6-1	0	.
AR 96138-6-2	0	.
JAYPEE	.	.
AR 96138-7-1	0	.
AR 96139-3-1	0	.
AR 96139-4-1	0	.
AR 96140-3-1	0	.
AR 96140-8-1	0	.
AR 96141-4-1	30	4
AR 96141-5-1	30	3
AR 96142-1-1	0	.
AR 96142-2-1	30	4
AR 96142-3-1	0	.
PAT	30	2
AR 96142-7-1	.	.
AR 96142-8-1	0	.
AR 96143-1-1	0	.

Table 8. (continued)

	Leaf Rust at Kibler	
Genotype	%[1]	IT[2]
AR 96143-3-1	0	.
AR 96143-3-2	0	.

	Leaf Rust at Kibler	
Genotype	%[1]	IT[2]
AR 96153-3-2	50	3
SABBE	70	4

AR 96143-3-3	0	.
AR 96143-8-1	0	.
AR 96143-8-2	0	.
AR 96144-4-1	0	.
AR 96144-5-1	2	2
SABBE	85	4
AR 96144-7-1	0	.
AR 96146-2-1	.	.
AR 96146-2-2	0	.
AR 96146-2-3	0	.
AR 96146-3-1	.	.
AR 96146-4-1	0	.
AR 96147-1-1	0	.
AR 96147-4-1	0	.
AR 96147-4-2	0	.
AR 96147-5-1	30	3
JAYPEE	.	.
AR 96148-1-1	30	4
AR 96148-1-2	2	2
AR 96148-1-3	2	2
AR 96150-1-1	30	3
AR 96150-2-1	.	.
AR 96150-2-2	15	3
AR 96150-2-3	2	2
AR 96151-3-1	0	.
AR 96151-6-1	.	.
AR 96151-6-2	15	3
AR 96151-7-1	50	4
PAT	50	4
AR 96152-1-1	50	4
AR 96152-2-1	0	.
AR 96152-2-2	0	.
AR 96152-5-1	0	.
AR 96153-1-1	50	4
AR 96153-1-2	50	4
AR 96153-2-1	50	4
AR 96153-2-2	30	3
AR 96153-3-1	30	3
AR 96154-2-1	0	.
AR 96154-5-1	0	.
AR 96154-6-1	0	.
AR 96156-7-1	.	.
AR 96158-1-1	0	.
AR 96158-1-2	0	.
AR 96158-2-1	0	.
AR 96158-5-1	0	.
AR 96158-6-1	0	.
AR 96161-3-1	0	.
JAYPEE	50	4
AR 96161-4-1	30	3
AR 96161-4-2	7	3
AR 96161-5-1	2	2
AR 96161-5-2	0	.
AR 96162-2-1	2	2
AR 96162-2-2	15	2
AR 96163-1-1	0	.
AR 96163-3-1	.	.
AR 96163-4-1	30	4
AR 96164-1-1	50	4
PAT	7	2
AR 96164-3-1	50	4

[1]Percentage of the flag leaf are with leaf rust on May 21 at late soft dough stage. Plot was inoculated with race TNRL, virulent on Lr 1, 2a, 2c, 3, 9, 24, 3ka, 11, 30, and 10.
[2]Infection type, 0-4 scale, 4 is most susceptible.

Table 9. Disease evaluations for the LSU Elite Nursery, 2003.

Genotype	% Stripe Rust Fayetteville[1]	% Tan Spot Pine Tree[2]	Leaf Rust at Kibler	
			%[3]	IT[4]
LA925C104-2	45	38	0	.
LA9319D5-1-2-B-2	17	57	20	3
LA9319D5-1-2-B-3	17	57	29	4
LA9361D35-2-1-B-1	55	80	29	4
LA9415D104-5-2	8	88	16	3
LA95102D18-2	62	80	13	2
LA95125BUB73-2-2-B	25	88	0	.
LA95176D56-2	68	90	0	.
LA95181BUB6-1	6	17	0	.
LA95187BUB8-3	71	70	0	.
LA95283CA78-1-2-B	4	57	0	.
LA95298BUA22-1	71	68	0	.
LA9544D11-1	68	37	1	2
LA9546D5-1-3-B	57	43	12	3
LA9560CA22-1	36	30	17	4
LA9560CA22-2-1-B	57	25	32	4
LA9560CA4-1	76	79	7	3
LA9560D52-2	62	75	0	.
LA9585D17-2	38	32	0	.
LA9585D17-3-3-B	41	68	7	3
LA959D2-1	57	70	1	2
LA96140D-38-B	38	90	1	2
LA96501D-6-2-B	31	80	0	.
LA96601D-80-2-B	41	68	5	3
LA97113UC-124-3-B	1	50	3	2
LA9721UC-18-1-B	41	90	2	2
LA9759UC-29-2-B	36	85	0	.
LA9778UC-115-2-B	59	80	0	.
LA9786UC-57-3-B	73	57	20	4
AGS2000	32	70	0	.
USG3209	17	25	0	.
TERRAL LA841	2	85	0	.
PIO26R38	71	76	34	3
LSD (0.05)	21	20	27	.

[1]Percentage of the flag leaf area with sporulating pustules on May 5 at soft dough stage. Plot was inoculated with isolate that was supposed to be race PST-78 (virulent on Lemhi, HeinesVII, Lee, Fielder, Express, Yr8, Yr9, Clement, and Compair), but the isolate was virulent only on Lemhi, Lee, Fielder, Express, and Yr-9.

[2]Percentage of the flag leaf area with tan spot symptoms on May 9 at soft dough stage. Plot was inoculated with infested straw from two locations and irrigated frequently.

[3]Percentage of the flag leaf are with leaf rust on May 21 at late soft dough stage. Plot was inoculated with race TNRL, virulent on Lr 1, 2a, 2c, 3, 9, 24, 3ka, 11, 30, and 10.

[4]Infection type, 0-4 scale, 4 is most susceptible.

Table 10. Disease evaluations for the Gulf Atlantic Nursery, 2003.

Genotype	% Stripe Rust Fayetteville[1]	% Tan Spot Pine Tree[2]	Leaf Rust at Kibler	
			%[3]	IT[4]
AR93035-4-2	54	50	22	3
AR93027-5-1	45	38	27	3
AR93027-3-2	45	22	28	4
AR93035-4-1	22	32	36	3
AR800-1-3-1	7	43	17	4
AR93005-6-5	1	80	19	3
AR93002-3-3	10	63	1	2
AR93173-3-3	1	57	10	4
AR93005-6-1	1	71	17	4
FL89250	12	75	7	2
FL95195	8	57	17	4
FL9547	8	63	8	2
FL9567	6	37	0	.
FL95138	41	70	0	.
FL95A331	28	50	0	.
FL95IN1384	57	57	2	2
FL95IN2830	5	75	0	.
FL95342	43	75	1	2
GA 941208 E35	3	50	0	.
AGS 2000	25	75	0	.
GA 951395 E19	10	45	0	.
GA 961662 E22	1	50	0	.
GA 951079 E31	2	50	1	1
GA 95652 E56	4	8	0	.
GA 951216 E14	5	12	0	.
GA 931233 E7	4	43	1	2
GA 961565 E46	3	37	10	3
GA 951216 E26	4	25	0	.
GA 951079 A25	4	32	0	.
LA925C104-2	45	37	1	2
LA9415D104-5-2	11	88	1	2
LA95283CA78-1-2-B	5	70	2	2
LA95298BUA22-1	73	94	0	.
LA9560CA4-1	73	85	.	.
LA9585D17-2	68	32	0	.
LA959D2-1	67	75	0	.
LA96140D38-B	32	95	0	.
LA9778UC115-2-B	72	80	2	3
NC00-15426	62	75	1	1
USG 3209	38	32	5	3
NC00-15428	57	63	0	.
NC00-15546	17	63	0	.
NC00-16419	29	75	1	1
NC00-15543	12	68	0	.
NC00-15332	10	83	29	4
NC00-15385	45	68	0	.
NC00-16203	5	50	0	.

Table 10. (continued)

	% Stripe Rust	% Tan Spot	Leaf Rust at Kibler

Genotype	Fayetteville[1]	Pine Tree[2]	%[3]	IT[4]
NC00-15444	62	43	30	4
VA00W-462	85	32	0	.
VA01W-18	62	43	27	4
VA01W-112	38	25	25	4
VA01W-145	4	27	0	.
VA01W-148	69	12	0	.
VA01W-205	4	70	0	.
VA01W-258	16	50	2	2
VA01W-283	68	30	30	3
VA01W-317	76	70	50	4
VA01W-353	36	63	33	4
SC980649	21	88	0	.
McCormick	4	15	20	3
SC981395	52	84	0	.
SC981730	22	83	5	3
SC9810940	16	88	5	3
SC9810913	10	85	0	.
LSD (0.05)	21	20	27	.

[1]Percentage of the flag leaf area with sporulating pustules on May 5 at soft dough stage. Plot was inoculated with isolate that was supposed to be race PST-78 (virulent on Lemhi, HeinesVII, Lee, Fielder, Express, Yr8, Yr9, Clement, and Compair), but the isolate was virulent only on Lemhi, Lee, Fielder, Express, and Yr-9.

[2]Percentage of the flag leaf area with tan spot symptoms on May 9 at soft dough stage. Plot was inoculated with infested straw from two locations and irrigated frequently.

[3]Percentage of the flag leaf are with leaf rust on May 21 at late soft dough stage. Plot was inoculated with race TNRL, virulent on Lr 1, 2a, 2c, 3, 9, 24, 3ka, 11, 30, and 10.

[4]Infection type, 0-4 scale, 4 is most susceptible.

Table 11. Disease evaluations for the Leaf Rust Germplasm Lines, 2003.

Genotype	% Stripe Rust Fayetteville[1]	% Tan Spot Pine Tree[2]	Leaf Rust at Kibler	
			%[3]	IT[4]
Mason*2/3/Altar 84/Ae.224//2*Yaco	1	43	17	2
Mason/3/Altar84/Ae.191//Opata	22	12	0	.
Mason/4/Altar 84/Ae. (191)//Yaco/3/3*Bau	4	63	0	.
Mason*2/4/Altar 84/Ae. (191)//Yaco/3/3*Bau	4	50	0	.
P2684/Parula	2	90	0	.
Mason/Fasan	13	25	1	2
P2684/Fasan	13	78	0	.
Mason//P2684/Star	2	63	1	2
P2684/Terenzio	10	15	0	.
N895004-1/P2684	4	27	0	.
Mason//P2684/Tonichi	1	38	1	2
P2684/Trap #1R1	4	80	1	2
P2684/3/Mason//Parula/Veery#10	5	75	0	.
Mason/Choix M95	1	32	16	3
P2684/Choix M95	4	63	0	.
LSD (0.05)	21	20	27	.
Checks				
Patton	73			
Mason	5	51	10	2
Hickory	75			
C9663	43		30	3
P2580		76		
P2684		81	3	2
Sabbe		58	76	4
Marion			0	
C9704			0	

[1]Percentage of the flag leaf area with sporulating pustules on May 5 at soft dough stage. Plot was inoculated with isolate that was supposed to be race PST-78 (virulent on Lemhi, HeinesVII, Lee, Fielder, Express, Yr8, Yr9, Clement, and Compair), but the isolate was virulent only on Lemhi, Lee, Fielder, Express, and Yr-9.

[2]Percentage of the flag leaf area with tan spot symptoms on May 9 at soft dough stage. Plot was inoculated with infested straw from two locations and irrigated frequently.

[3]Percentage of the flag leaf are with leaf rust on May 21 at late soft dough stage. Plot was inoculated with race TNRL, virulent on Lr 1, 2a, 2c, 3, 9, 24, 3ka, 11, 30, and 10.

[4]Infection type, 0-4 scale, 4 is most susceptible.

Table 12. Selections for barley yellow dwarf resistance from 96 lines evaluated at Fayetteville, 2003.

Selection	Parentage
99-2020-25-2	P2684*2//THB/CEP7780
99-2022-3-2	P2684*2//MILAN/SHA7
99-2022-3-3	P2684*2//MILAN/SHA7
99-2029-20-1-3	MASON*2//THB/CEP7780
99-2029-20-2-1	MASON*2//THB/CEP7780
99-2029-20-2-2	MASON*2//THB/CEP7780
99-2029-20-2-3	MASON*2//THB/CEP7780
99-2029-20-1	MASON*2//THB/CEP7780
99-2029-20-1	MASON*2//THB/CEP7780
99-2029-26	MASON*2//THB/CEP7780
99-2029-26	MASON*2//THB/CEP7780
99-2036-11	MASON*2/3/KAUZ*2/OPATA//KAUZ

Table 13. Disease data for wheat lines that were selected for further evaluation in 2003

Line	Leaf Rust at Kibler		%Green leaves	Maturity	% Tan spot
	%[1]	IT[2]	Kibler[3]	Kibler[4]	Pine Tree[5]
Burrion	0	.	50	2	30
CHUM18//JUP/BJY	2	1	50	1	93
MILAN/SHA7	0	.	50	2	2
Cimmyt Line 6	0	.	50	2	.
Cimmyt Line 46	7	2	50	1	.
Cimmyt Line 81	30	3	70	2	.
Fawwon 28	2	2	70	3	98
Fawwon 112	0	.	85	4	15
Fawwon 113	7	3	85	4	7
Fawwon 116	7	2	70	3	30
Fawwon 117	0	.	85	4	85
Fawwon 133	7	2	85	4	7
KM 630-84	30	3	70	3	.
Tifcos 35	2	2	85	4	30
Tifcos 55	0	.	85	4	70
Tifcos 77	0	.	70	3	15
Tifcos 127	2	2	85	4	50
Tifcos 129	7	3	85	4	93
Tifcos 136	2	2	50	2	50
Tifcos 137	0	.	70	3	50
Lacos 9	7	2	50	2	15
Lacos 10	2	2	50	2	70
Lacos 17	0	.	50	2	50
Lacos 19	7	3	50	1	50
Lacos 21	0	.	50	2	85
Lacos 32	0	.	50	2	50
Lacos 53	0	.	50	2	93
Lacos 170	0	.	50	2	50
Lacos 176	15	3	50	2	30
Lacos 271	0	.	70	2	50

[1]Percentage of the flag leaf are with leaf rust on May 21 at late soft dough stage. Plot was inoculated with race TNRL, virulent on Lr 1, 2a, 2c, 3, 9, 24, 3ka, 11, 30, and 10.
[2]Infection type, 0-4 scale, 4 is most susceptible.
[3]Rated on May 12. Septoria tritici blotch was the principal leaf disease, but also some stripe rust.
[4]Maturity recorded on April 21. 1=Past flowering, 2=Flowering, 3=Heading, 4=Boot, 5=Preboot.
[5]Percentage of the flag leaf area with tan spot symptoms on May 9 at soft dough stage. Plot was inoculated with infested straw from two locations and irrigated frequently.