Arkansas Wheat Promotion Board
Final Report on Wheat Pathology Research Project, 2006-2007
December 2007

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OBJECTIVES (as listed in proposal)

1. To characterize varieties and Arkansas breeding lines for resistance to stripe rust and soilborne viruses.
2. To develop adapted lines with resistance to stripe rust, leaf rust, and/or barley yellow dwarf.
3. To complete a graduate student research project on the inheritance of stripe rust resistance.
4. To characterize old (before 2000) and new (since 2000) isolates of the stripe rust fungus for traits that may explain why stripe rust has been a consistent problem since 2000.

PRELIMINARY REPORT BY OBJECTIVE

1. Characterize varieties and Arkansas breeding lines for resistance. Despite freeze damage to heads, useful foliar stripe rust ratings were obtained for entries in the Arkansas Variety Test and Dr. Bacon's Elite, Advanced and Observation Nurseries. These data were used to update disease reactions in the Wheat Update for 2007 and to make selections for advancement. No data were obtained from soilborne virus plots established in known infested fields in Jackson and Crittenden counties because insufficient disease symptoms developed.

2. Develop adapted lines with resistance. Lines in the barley yellow dwarf nursery were evaluated on the day before the freeze, and 87 of the most adapted and resistant lines were selected. Remnant seed of these selections were be planted this fall along with resistant varieties developed by the Purdue breeding program working with a USDA virologist.

Of the lines developed for resistance to leaf and stripe rusts, 57 were selected based on plant type and stripe rust reaction. These selections were replanted from remnant seed this fall for further evaluation and generation advancement.

3. Complete a graduate student research project. Sam Markell graduated in Spring 2007, started an Extension job at North Dakota State University on April 1, and submitted two papers on his research to professional journals. The freeze killed wheat heads and precluded getting the necessary head infection data needed for a third paper. Remnant seed of the most important lines were planted this fall in another attempt to get enough data for the third paper.

4. Characterize old and new stripe rust isolates. Two old and 2 new isolates of the stripe rust fungus were evaluated at Fayetteville for ability to survive over winter in the field and to

spread to adjacent wheat plants. Plants of the susceptible variety ‘Croplan Genetics 514W’ were grow outside in pots. In November, plants in 12 pots (replications) were inoculated lightly with each isolate, incubated in at dew chamber for 24 hours to allow infection, and then transplanted among susceptible plants in the field. In March, the number of sporulating stripe rust infections were counted on the inoculated plants and on adjacent plants within an 18-inch radius around the inoculated plants. Results for the two old isolates were similar, but results for the two new isolates were different (Table 1). There is an indication that the new isolate, AR00-02, survives better and spreads faster than the old isolates, but the poor performance of the other new isolate, AR03-33, limits the conclusions that can be made.

The same two old and new isolates were evaluated to determine if new isolates were adapted to infect wheat plants at warmer temperatures than old isolates. Twelve pots with six Croplan Genetics 514W seedlings per pot were inoculated lightly and as uniformly as possible with spores of the four isolates. For pots of each isolate were placed for 24 hours in each of three dew chambers set at different temperatures. One dew chamber always was set at 52°F that is favorable for infection, and the other two were set at higher temperatures. The actual temperature inside the each chamber was recorded every 15 minutes, and the average temperature over the 24 hours was calculated. The experiment was done seven times. Some temperatures were used two or three times. The number of successful infections on the six plants per pot were counted when symptoms became visible. The number of infections per pot at 52°F was considered the maximum possible number of infections for each isolate in each experiment, and the ability of each isolate to infect at a higher temperature was estimated by dividing the number of successful infections at the high temperature by the number at 52°F. For example, if an isolate average 10 infections per pot at 52°F and 5 infections per pot at 62°F, the relative ability to infect at 62°F is 50%. Results were similar for the two old and the two new isolates, so results were averaged across the two isolates in the old and new groups.

The results indicate that old and new isolates have similar relative abilities to infect at the higher temperatures used in this study (Table 2). Furthermore, both types of isolates had no successful infections when temperature averaged 67.6°F or higher over the 24-hour dew period. Dew periods almost always are shorter than 24 hours in the field, and therefore there should be no successful infections under field conditions at overnight low temperatures considerably less than 67°F. A rule-of thumb is that stripe rust epidemics cease when overnight lows are 65°F or higher for several days, and the inability of the stripe rust fungus to infect at these temperatures appears to be important for ending the epidemic.

Table 1. Comparison of two old and two new isolates of the stripe rust fungus to survive overwinter and to spread to adjacent plants in the field at Fayetteville.

Isolate	Type	Frequency of survival on transplanted inoculated plants	Frequency of spread to adjacent plants	Average number of infections on adjacent plants
AR90-01	old	2 of 12	9 of 12	1.9
AR97-01	old	3 of 12	7 of 12	1.6
AR00-02	new	6 of 12	12 of 12	14.6
AR03-33	new	0 of 12	2 of 12	0.3

Table 2. Relative ability of old and new isolates of the stripe rust fungus to establish successful infections on a susceptible variety at various temperatures averaged over a 24-hour dew period. Values were averaged across two old and two new isolates that had similar results and.are relative to the ability to infect at 52°F.

	Relative ability to infect wheat seedlings at various average temperatures							
Type	60.8°F	61.3°F	61.9°F	66.2°F	66.7°F	67.6°F	68.9°F	71.2°F
Old	37%	43%	32%	21%	15%	0%	0%	0%
New	42%	50%	38%	19%	4%	0%	0%	0%