Development of disease resistant rice is one of the most important achievements rice breeders attempt to accomplish. The plant pathology group assists with this goal by providing screening tests in the greenhouse and the field. Blast [Magnaporthe grisea (T.T.Hebert) M.E. Barr], sheath blight (Rhizoctonia solani Kuhn), and bacterial panicle blight [Burkholderia glumae (Kurita and Tabei)] are the diseases currently being screened at the University of Arkansas System Division of Agriculture Rice Research and Extension Center (RREC). Artificial inoculation of these pathogens on rice is key to collecting disease severity data for rice breeders. The pathology group screens lines for rice blast, sheath blight, and bacterial panicle blight. Inocula are prepared in the lab and applied to the appropriate test. Blast and bacterial panicle blight screening is conducted in the greenhouse and the field. Sheath blight is screened only in the field. Data from these tests are used to determine which lines in the breeding program will be advanced to the next stage of testing.

INTRODUCTION

Plant breeders working in cooperation with the plant pathologists develop disease resistant and high yielding cultivars. Early and advanced breeding lines need to be evaluated and screened at the seedling stage in the greenhouse. Rice blast screening is more successful in the greenhouse than in the field. The inocula preparation for blast usually suffers contamination unless it is done carefully by trained technicians. Field sheath blight inoculation also requires massive inocula preparation that takes months of careful handling. To decrease expenses, a person trained for greenhouse blast screening would also be trained for bacterial panicle blight screening. Bacterial inocula preparation and the inoculation require careful handling of inocula preservation, media preparation, and keeping the laboratory utensils and equipment clean.
Breeding for disease resistance is the major area of emphasis in any breeding program. Rice breeders at the Rice Research and Extension Center, near Stuttgart, Ark., work together with rice pathologists to develop varieties having good agronomic qualities and resistance to major diseases. Cultivars are evaluated and selected for desirable characteristics, disease resistance being one of the important traits. Screening early generation material for the most problematic diseases is important for a successful breeding program. Lines which have good yield, quality, or disease resistance, but require further improvement for one or more traits can be utilized as parents in future crosses. Rice blast and sheath blight still remain as major diseases of rice and can result in a significant yield loss under favorable environments unless they are managed properly. Bacterial panicle blight, once considered minor and sporadic, is emerging as the top priority disease particularly in the growing seasons with hot temperatures. This disease requires answers for several unknowns about the bacterial complexity, host pathogen interactions, and disease spreading mechanisms. Tackling the problems in laboratory, greenhouse, and field tests and deriving sound management strategies for this disease requires several coworkers.

**PROCEDURES**

Greenhouse testing is conducted for blast and bacteria panicle blight. Greenhouse blast testing is uses a spore suspension sprayed directly on the rice plants grown to a 4-If stage (approximately 21 d). The suspension consists of six different blast races either applied in a bulk or individually. The blast cultures are grown on a specific agar medium for seven days, after which the petri dishes are rinsed with a xanthan gum suspension to provide the inoculum needed to spray the plants. Artificially inoculated plants are placed in a dew chamber for approximately 14 h. Disease data is then collected 7-10 days after the plants are removed from the dew chamber. One cycle of seedling greenhouse testing for blast takes approximately 28 d. Over 300 entries of the Uniform Regional Rice Nursery (URRN) and Arkansas Rice Performance Trial (ARPT) were tested and evaluated using individual races in 2012. Testing bacterial panicle blight in the greenhouse is used to develop various methods to artificially inoculate plants at both the seedling and adult developmental stages. Methods include treating seed with a bacterial suspension before planting, spray inoculation, stem “pricking” with a syringe containing a bacterial suspension, and cutting leaves with scissor tips dipped in inoculum.

Field testing is done for blast, sheath blight, and bacterial panicle blight. Inoculum for blast and sheath blight consists of sterilizing several hundred gallons of cracked corn (corn chops) and rye grass seed. The sterilization process takes three days to accomplish for approximately 16 gallons of sheath blight and approximately 12 gallons of blast. The cultures are grown on a specific medium for 7 days and are mixed in the sterile chops/rye grass. Sterility must be maintained throughout the entire process to ensure contaminate-free inocula. Field tests are inoculated with dried inoculum at the tillering stage for blast and before boot split for sheath blight. Artificial inoculation for bacterial panicle blight is currently made by two separate methods. One is inoculation
using pressure to force the bacteria into seeds and the other is spraying plants between
the boot-split to flowering stage with the bacteria suspension. Seeds were inoculated
with the bacterial suspension for 256 plots in 2012. Foliar inoculation was used for the
ARPT and URRN. Both methods were found effective after review of the collected
data from the 300 combined test entries in 2012.

Disease data are collected from ongoing inoculated disease plots, including in-
oculated sheath blight and blast. General observation tests planted in problem disease
fields along with general observations made during the agronomic testing of entries
provide additional disease assessments.

RESULTS AND DISCUSSION

A total of nearly 2,100 entries were replicated four times and tested for each
pathogen group in 2012. The data were provided to the rice breeders for use in selecting
material to advance or utilize (those having good level of disease resistance) as parents
in their crossing programs.

SIGNIFICANCE OF FINDINGS

The goal of the rice breeding program is to develop maximum yielding cultivars
with good levels of disease resistance for release to Arkansas rice producers. Plant pathol-
ogy will continue to provide support to the breeding group and the extension program
for the above listed diseases, as well as any other pathogens that become problematic.
Assisting the breeders to select resistant rice varieties and helping commercial/private
growers will be a continuous effort by the plant pathology group.

ACKNOWLEDGMENTS

The authors gratefully acknowledge the cooperation of the Arkansas rice produc-
ers, and the support of the Arkansas Rice Research and Promotion Board through their
continued interest and funding. Thanks also go to the USDA-ARS for their cooperation,
interest, and evaluation of materials, and to the other University of Arkansas System
Division of Agriculture Research Stations located throughout Arkansas for their con-
tinued support.