RICE RESEARCH & PROMOTION BOARD 2005 SUMMARY PROGRESS REPORT

TITLE: Discovery, Definition and Utilization of Resistance Genes for Arkansas Rice Disease Control.

INVESTIGATORS: F.N. Lee, R.D. Cartwright and J.C. Correll with assistance from cooperators.

OVERALL GOAL: Maintain and enhance disease control options through discovery, definition and utilization of host resistance genes.

PROGRESS REPORT: (Year 2 of 3 year project for 2004-2007)
Annual inoculated blast and sheath blight nurseries at the RREC and the Pine Tree Experiment Station were completed. Greenhouse tests evaluating advanced breeding lines (URRN & others) for reaction to specific blast races have been completed and other germplasm is now being assayed. Selected entries from the now defunct anther culture program are being evaluated for reaction to blast races IE-1k, IE-1k-Banks, IB-33 and others.

Research efforts have identified germplasm with novel blast resistance genes. The search for novel blast resistance genes is has proven successful. Potentially novel blast resistance genes have been detected through a combined field-greenhouse-molecular assay for known R genes. Approximately thirteen germplasm sources exhibit resistance to all known blast races including the IE-1k-Banks variant and the even more virulent race IB-33. Red rice entries resistant to Pi-ta virulent races are identified. Approximately 1500 core collection entries from the U.S. rice germplasm collection are being evaluated in inoculated greenhouse blast tests and in the inoculated field blast and sheath blight nurseries. Rice germplasm of interest to all research programs are processed through the UA-APC rice quarantine greenhouse in Fayetteville, AR.

We are exploring pathogen, environmental and host resistance interactions which brought about severe rice blast in the Banks variety. Blast race IE-1k, or a closely related variant (IE-1k-Banks), and adverse environmental conditions collectively compromised the Pi-ta R gene in Banks during 2004 and again in 2005. Multiple germplasm sources were resistant these races. See details in UA Research Series 529: B.R. Wells Rice Research Studies 2004, pages 103-110.

We continued research into the flood-induced field resistance phenomenon where flooded plants become blast resistant. Conversely, drought stress increases blast susceptibility as occurred with Banks in 2004 & 2005.. All blast susceptible rice plants tested to date have exhibited some degree of altered blast field resistance when growing under flooded or drought stressed environments which suggests flood-induced field resistance is universal in rice germplasm. Flood-induced resistance is cumulative and in select varieties approaches that expressed by major resistance genes such as Pi-ta.

During 2005, as suspected in 2004, we observed severe drought stress render Banks rice plants blast susceptible. This is a common response which has been duplicated experimentally in other *Pi-ta*-varieties using *Pi-ta* virulent blast races IE-1K, IB-33 and others. Tests are underway to understand blast field resistance, to identify and quantify this extremely valuable resistance mechanism in genetic breeding lines, and to define its economic impact in Arkansas rice. See details in UA Research Series 529: B.R. Wells Rice Research Studies 2004, pages 96-102.