RED RICE DIVERSITY AND PLANTING DATE EFFECTS ON RISK OF GENE FLOW. Nilda R. Burgos, Vinod K. Shivrain, David R. Gealy, Kenneth L. Smith, and Robert C. Scott, Associate Professor, Graduate Assistant, Department of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR 72704, Plant Physiologist, Dale Bumpers National Rice Research Center, Stuttgart, AR 72160, Professor, University of Arkansas Cooperative Extension Service, Monticello, AR 71656, and Associate Professor, University of Arkansas Cooperative Extension Service, Lonoke, AR 72086.

Red rice (*Oryza sativa* L.) is a problematic weed in rice production worldwide. Red rice control is difficult with conventional herbicides due to its similar biology and physiology as cultivated rice. Herbicide-resistant (HR) rice provides a valuable tool for red rice management, but with a risk of transferring HR gene to red rice populations. Diversity in red rice populations mainly in flowering time, plant height, and sexual compatibility with cultivated rice and the wide window of planting time can affect the rate of HR gene transfer from rice to red rice. Thus, experiments were conducted to understand the effect of: a) red rice biotype, b) rice cultivar, and c) sexual compatibility of rice and red rice on outcrossing rate.

Small plot experiments were conducted at the Rice Research Extension Center, Stuttgart; and Southeast Research and Extension Center, Rowher, AR from 2005 to 2007. Experimental design was a split-split plot with 3-4 replications, with planting date as main plot, Clearfield (CL) rice cultivar as subplot, and red rice biotype as sub-subplot. Rice and red rice were planted from early April to late May at 2-week intervals. CL161, CL hybrid and 12 red rice accessions were used. Red rice was planted in the middle row of each plot, flanked by four CL161 or CL hybrid rice on each side. Emergence, flowering, and plant height of red rice and CL rice were recorded. Red rice seed was harvested and a sub-sample of 100 g was planted in the field in subsequent years. Red rice seedlings were sprayed twice with imazethapyr at 0.14 kg ai/ha. Red rice plants which survived imazethapyr applications were counted and confirmed as outcrosses by DNA analysis. Manual crosses also were performed between the 12 red rice accessions and CL161 to determine their sexual compatibility.

The red rice accessions were 100 to 160 cm tall, with a flowering period ranging from 88 to 128, 87 to 117, 79 to 118, and 71 to 116 days after planting in the first, second, third, and fourth planting, respectively. Outcrossing rate differed between locations, but trends of outcrossing rate affected by red rice biotypes, CL rice, and planting dates were similar at both locations. At any given planting date, outcrossing rates differed between red rice accessions due to differences in flowering time. Planting date by CL cultivar and planting date by red rice accession interactions were significant ($p < 0.05$) for outcrossing rate. The outcrossing rate in different red rice accessions ranged from 0 to 0.3% across planting dates. Brownhull red rice had the highest outcrossing rate regardless of the CL rice cultivar pollen donor, and strawhull had the lowest outcrossing rate in general. Averaged over planting dates, the outcrossing rate between CL hybrid rice and red rice accessions was 0.3% compared with 0.06% in CL161. In experiments related to compatibility, brownhull, blackhull, and strawhull had 91, 78, and 71% seed set, respectively, which corroborate the results of field experiments. The data suggest that the interaction of planting date, red rice biotype, and rice cultivar can result in no gene transfer in some cases to significantly high risk of gene transfer in others. Hence, these factors need to be considered in planning HR gene transfer mitigation strategies for rice.