RICE BREEDING

PERFORMANCE OF MISSISSIPPI RICE BREEDING LINES IN U.S. MID-SOUTH YIELD TRIALS

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"THE COLLABORATIVE UNIFORM RICE RESEARCH NURSERY HELPS DETERMINE NOT ONLY THE ADAPTATION OF A BREEDING LINE OR VARIETY TO MISSISSIPPI, BUT ALSO ITS YIELD STABILITY ACROSS THE US MID-SOUTH. SEVERAL MISSISSIPPI BREEDING PRODUCTS SUCH AS THE NEW VARIETY THAD HAVE PERFORMED VERY WELL IN MULTI-STATE EXPERIMENTS."

Ed Redoña

The only rice breeding program in the state of Mississippi is in the Mississippi Agricultural and Forestry Experiment Station (MAFES) at DREC. Since1986, the program provides access to elite, high-performing varieties to Mississippi rice producers. The breeding program has released eight conventional varieties. The latest releases are 'CL163', a Clearfield®-type conventional variety that has tolerance to imidazolinone herbicide, and 'Thad', a conventional variety, released in 2015 and 2016, respectively.

Before a variety is released, it must undergo a series of performance testing for various traits including yield, grain quality, earliness, disease resistance, and tolerance to environmental stresses. The program provides access to elite, high-performing varieties to Mississippi rice producers. Evaluated each year in several locations, only the most outstanding among several thousand breeding lines under development, that, end up as commercial varieties. In Mississippi, the sequential, multi-stage, and multi-location testing undertaken includes the observational trial, the preliminary yield trial, the statewide yield trial, the Uniform Rice Research Nursery (URRN), and the Official Variety Trials conducted by MAFES (http://www.mafes.msstate.edu/variety-trials/includes/crops/rice.asp).

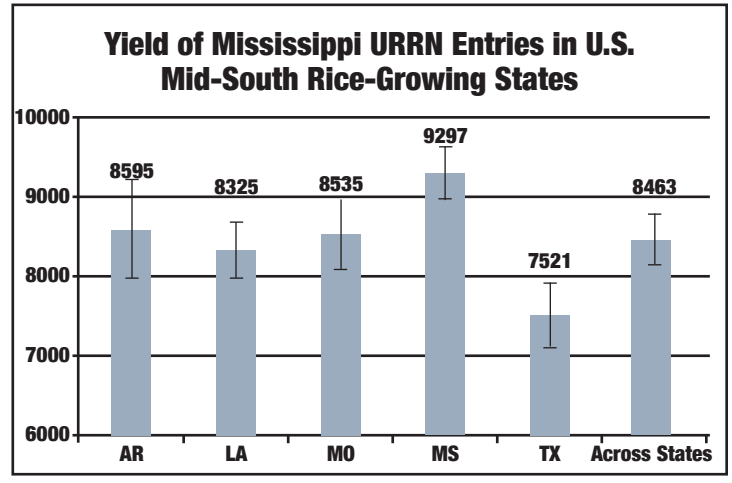
Among these trials, only the URRN allows for the assessment of varietal performance in all states growing rice in the Southern U.S. Thus, the URRN provides an indication not only of the adaptation of a breeding line to a specific environment or rice-growing state per se, but also of the stability of the performance of a line across different environments. The URRN data, therefore, becomes important not only to producers as basis for seed selection, but also to breeders and researchers

Table 1. *Average yield of Mississippi-bred entries (pounds per acre) in the Uniform Rice Research Nursery from 2013 to 2016*

Year	No. of MS Entries	AR	LA	MO	MS	TX	Across States	Standard Deviation	Standard Error
		Average Yield (lb/ac)							
2013	28	9722	9002	8626	9922	7554	8965	848	379
2014	27	9693	9037	9125	9746	8366	9193	504	225
2015	29	8251	7427	9310	8228	6643	7964	894	400
2016	29	6715	7836	7078	9292	-	7730	988	494

for deciding variety release and deployment strategies for the outstanding lines that are advanced further along the breeding pipeline.

The URRN is a decades-old cooperative research effort involving the United States Department of Agriculture (USDA) and the public rice breeding programs of Arkansas, Louisiana, Mississippi, Missouri and Texas. Under the URRN, 200 rice breeding lines in the advanced stage of varietal testing plus commercial check cultivars are nominated by the different breeding programs. Each participating state is allotted a certain number of lines to include in the URRN, with Mississippi nominating about 28 lines each year. Entries are then divided into seven groups, with the most advanced being included in the first four groups that are replicated three times and newer entries included in the last three groups that are replicated twice. The yield trial is conducted at the main rice research station of each state following the optimum management practices for that location.



To determine how well Mississippi breeding lines perform in the rice growing states of the U.S. Mid-South, the yield data recorded in the URRN from 2013 to 2016 was summarized (Table 1). During this four-year period, the number of Mississippi entries ranged from 27 to 29 per year while the number of test locations varied from four to five, for a total of 536 entry by location combinations. Year-wise, the highest yield across entries and locations was obtained in 2014 (9,193 pounds per acre or pounds per acre) and 2013 (8,965 pounds per acre). This mirrored the high average yields across the US of 7,576 and 7,694 pounds per acre, respectively, across all grain types for those years relative to other years as reported by the USDA.

As may be expected, Mississippi-bred entries, as a group, yielded the highest in Mississippi (9,297 pounds per acre) compared to other rice growing states (Figure 1). This indicates the importance of local adaptation and thus the need for developing varieties best suited to local conditions. Mississippi lines yielded the least in Texas (7,521 pounds per acre) while yields in Arkansas, Missouri, and Louisiana were close to the average yield across all states (8,463 pounds per acre). This could be due to similarities and differences in the growing environments in the five states, with the Texas location being the most geographically distant from Stoneville.

Several Mississippi-bred lines performed well both in Mississippi and other states relative to URRN entries from other breeding programs. For example, RU1104077, eventually released as 'Thad', was ranked 4th and 7th in its URRN grouping for 2015 and 2016, respectively, across all states. This further validates the importance of multistate testing via the URRN as one of the cornerstones for making variety release decisions. Stable varieties such as 'Thad' that are adapted to Mississippi conditions would benefit not only the rice growers in Mississippi but potentially also producers from other U.S. mid-Southern states growing rice.