

On-Farm Variety Trials

On-farm varietal evaluation is a vital step in the variety development process for many crops including rice. Conducting variety trials under producers' field conditions helps identify the released varieties or hybrids as well as elite experimental breeding lines that are best suited to specific growing environments, including niche markets. It also helps determine which specific entries are widely adapted to and/or have consistent performance across varying growing conditions. This information not only helps in future breeding but also is important for proper deployment of released varieties.

It is typical in on-farm variety trials for standard varieties, hybrids, new releases, and elite experimental lines to be evaluated in their target growing environments. In the case of elite breeding lines, based on their performance in these multi-environment tests, the most promising are selected for possible release as new varieties. The information collected on these lines include yield and milling performance, insect and disease susceptibility, tolerance to environmental stresses, vigor, and lodging scores. However, apart from using the data generated for line advancement decisions, they could also be used to recycle yet-imperfect lines back into the hybridization program.

With the inclusion of released varieties from Mississippi and the US Mid-South as entries in the on-farm trials, the testing process also helps local rice producers to determine the most suitable released variety to plant on their respective farms based on the test locations. By placing these trials at multiple key locations throughout the Mississippi Delta, varieties, hybrids, and elite lines are exposed to the prevalent growing conditions and practices that are commonly used in commercial production in Mississippi. Many of these growing conditions and management practices cannot be reproduced at the Mississippi State University's Delta Research and Extension Center, Stoneville, thus there is a great value to on-farm evaluations from a research and development perspective. In return, growers are afforded the opportunity to evaluate the current varieties and hybrids in commercial circulation, side-by-side under their own management conditions. Ultimately, this process helps them in deciding which variety or hybrid to use on their farms the following year and in placing advanced seed orders for their chosen varieties or hybrids accordingly.

Variety selection is one of the most important decisions a grower makes in crop production planning. Growers should attempt to select varieties that offer the best combination of yield and quality factors while also considering the variety's tolerance or susceptibility to both biological and environmental factors that could limit yield potential. As grain quality is becoming more important for improving US rice global competitiveness, producers will benefit from having grain quality data for the commercial varieties evaluated in the variety trials. Millers, consolidators, and traders may also use this grain quality data for implementing 'identity preserved'-related strategies that are gaining importance for improving overall rice grain quality. Rice research and extension specialists can use variety trials as an educational platform for demonstrating the merits of on-farm evaluation to other scientific or technical staff, growers, private consultants, rice industry personnel, students, policy makers, and the general public. Through these trials, interested parties are afforded a "first look" at new or potential releases from Mississippi State University and other participating rice breeding programs, including from the private industry.

Test Procedures

For 2021, the rice On-Farm Variety Trials consisted of 34 entries including five hybrids/FullPage® herbicide technology-based materials, 16 Clearfield® or Provisia® purelines (7 released varieties and 9 elite experimental lines) and 13 conventional purelines (4 released varieties and 9 elite experimental lines). All hybrids/Full Page® materials were provided by RiceTec, HorizonAg provided all the Clearfield® and Provisia® herbicide technology-based purelines, and the conventional pureline released varieties came from the public breeding programs of

Mississippi (2), Arkansas (1), and Louisiana (1). The trials were conducted in seven locations from North to South of the Mississippi Delta, namely, in Tunica, Clarksdale, Pace, Shaw, Choctaw, Stoneville, and Hollandale (**Figure 1**). Individual plots consisted of eight drilled rows that were 15 feet in length and spaced 8 inches apart. Varieties and experimental lines were planted at a seeding rate of 85 pounds of seed per acre while the hybrids were planted at 25 pounds of seed per acre. Seeds were mechanically drilled approximately 1.25 inches deep into stale seedbeds at all locations. All entries were replicated three times at each location using a randomized complete block experimental design. Crop management practices for each location, as well as the stresses encountered, are presented in **Tables 3-9**. [For more information on pesticide formulations and application rates, please refer to the pesticide product label information available on the internet or to the 2015 Weed Control Guidelines for Mississippi booklet that is available both in print and online (MSU-ES/MAFES Pub. No. 1532; <http://msucares.com/pubs/publications/p1532.pdf>)].

Agronomic and crop phenology data were collected at appropriate times during the growing season. Lodging ratings were obtained on a plot-by-plot basis. The entire plot was harvested with a Wintersteiger Delta plot combine equipped with a computerized weighing system and a moisture meter. Due to differences in maturity, most of the entries at each location were required to have achieved the appropriate harvest moisture level prior to the test being harvested. Average harvest grain moisture levels for each entry are reported in **Tables 3-9**. Subsamples of each entry were collected at harvest and these were used for measuring milling-related traits, chalkiness, bushel weight, and 1,000-seed weight parameters. *For yield, previous replicated research has shown that the border effect common in small-plot research could result in increases in grain yield estimates of 10% for inbred varieties and 15% for hybrids. Therefore, the plot yields reported for the test entries should be compared in a relative manner rather than just through the absolute values for the reported yield potential.*

Analysis of variance procedure was conducted for all relevant data gathered from the trials using SAS version 9.4 statistical software. The Least Significant Difference (LSD) test at the 5% significance level may be used to determine significant differences between entries. If the value of the yield difference between any two trial entries at a location, as computed from the yields reported in **Tables 3-9**, is greater than the LSD value for that particular location, the entries are deemed to be statistically different from each other. In addition, a coefficient of variation (CV) was calculated for each test. This measure is an indication of the variability or 'noise' in the trial, and thus the level of precision of each test. Lower CV values indicate greater reliability of the test. Coefficient of variation values of 10% or less are generally considered to be optimum for plant breeding trials and CV values above 25% are considered unacceptable. The LSD and CV values for yield in these tests are reported in the footnotes of **Tables 3-9** and are included for the other measured variables in **Table 11**.