

RICE BREEDING

YIELD OF HYBRIDS AND PURELINE VARIETIES IN MISSISSIPPI RICE VARIETY TRIALS

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"RICE PRODUCERS EACH YEAR MUST SELECT WHETHER TO PLANT HYBRIDS OR PURELINE VARIETIES IN THEIR RESPECTIVE FARMS. THE AVERAGE YIELD ADVANTAGE OF HYBRIDS OVER THE PURELINES, BOTH CLEARFIELD® AND CONVENTIONAL TYPES, WAS ABOUT 21 PERCENT OR 46 BUSHELS PER ACRE BASED ON RECENT VARIETY TRIALS."

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Mississippi rice producers each year must choose among different varietal options to use for maximizing farm production and profitability. For decades, the yield performance of rice entries in the Mississippi Official Variety Trials (<http://www.mafes.msstate.edu/variety-trials/includes/crops/rice.asp>) conducted on-farm each year by the Mississippi Agricultural and Forestry Experiment Station (MAFES) at MSU has been indispensable to the state's rice producers as the primary basis for making their seed selections and planting decisions.

For over a decade, three main varietal types have been included as entries in the Mississippi Official Variety Trials for rice. These are: (1) proprietary F1 hybrids developed by private companies such as RiceTec® Inc. and Bayer CropScience®; (2) herbicide tolerant inbred or pureline varieties developed by public universities under a licensing agreement with BASF® and commercialized exclusively by HorizonAg®; and (3) convention-

al pureline varieties developed by breeding programs of public universities whose foundation seeds in Mississippi are produced by MAFES for dissemination to and use by the Mississippi rice seed industry in certified seed production.

Conventional pureline varieties and elite breeding lines have been the principal type of entries in the on-farm trials historically, accounting for 53% of the entries, on average, from 2011 to 2016 (Table 1). During this period, the number of trial entries averaged 34 and ranged from 29 to 38 per year for a total of 206 entry by year combinations. The Clearfield® technology based purelines, which remain highly vigorous even with Newpath®, Clearpath®, and Beyond® herbicide applications due to their tolerance to imidazolinone, accounted for 31% of the test entries. Meanwhile, rice hybrids, that offer higher yield potential due to the genetic phenomenon of hybrid vigor or heterosis, have comprised only about 16% of entries in the trials to date.

Varietal Type	2011	2012	2013	2014	2015	2016	Total	Average
Hybrids (both conventional and Clearfield®)	8	6	6	4	4	5	33	6
Clearfield® purelines	10	10	13	13	7	10	63	11
Conventional purelines	13	22	19	19	18	19	110	18
All Entries	31	38	38	36	29	34	206	34

Table 1. Entries in the MAFES Rice Variety Trials by varietal type, 2011-2016.

Rice producers each year must select which varietal type to plant in their farms and, within each type, the specific pureline variety or hybrid to order from seed industry distributors, usually in advance. Pureline varieties such as Lemont and Cocodrie were the dominant varieties in Mississippi from 2000 to 2008, the Clearfield® variety CL151

was the most planted from 2009 to 2010, and the Clearfield® hybrid CLXL745 was dominant from 2011 to 2013. Conventional pureline varieties will have the lowest seed cost per acre, the Clearfield® purelines will provide opportunities for better weed

management and red rice control, and the hybrids, both Clearfield® and conventional types, will offer the highest yield potential. The decision on what type(s) to use varies from grower to grower, depending on their individual circumstances and preferences, with many growers choosing a mix of varietal options.

Information on the relative yield advantage of each varietal type can assist in the seed selection decisions made annually by Mississippi rice growers. Traditionally, entries in the Mississippi Official Variety Trials for rice were compared relative to each other, without regard to varietal type. The data generated for the trials from 2011 to 2016 was, therefore, summarized on a per varietal type basis (Figure 1). Yields across all varietal types ranged from 205 bushels per acre in 2016 to 238 bushels per acre both in 2011 and 2014 and averaged 225 bushels per acre across the six growing seasons. On

average, hybrids yielded 265 bushels per acre across years while the yield averages of Clearfield® purelines and conventional purelines were very similar at 220 and 219 bushels per acre, respectively, across years.

Based on this data set, the average yield advantage of hybrids over the pureline varieties, both Clearfield® and

conventional types, was about 46 bushels per acre or 21%. Similar levels of yield superiority of hybrids over purelines has been widely documented for rice in the U.S. and in different countries. Hybrid superiority is generally attributed to heterosis or the observed vigor in hybrids relative to their

parents or check cultivars, the genetic basis of which still remains unclear. As varietal groups, no substantial differences in terms of yield could be observed between Clearfield purelines and conventional purelines.

For making seed selections, due to specific adaptation, individual hybrids or purelines may be expected to excel in a specific environment compared to other entries within the same or different varietal group. Rice growers would thus benefit by examining results of variety trials in specific and across locations for guidance on entry-specific yield performance. Also, other practical considerations such as intrinsic farm conditions, management practices to be applied, disease and environmental stresses expected, and target markets should be considered when making decisions on what varietal types or combinations thereof to best use in individual rice farms for maximizing profitability.

