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A SOIL NITROGEN TEST FOR RICE PRODUCTION

The long-term sustainability of Midsouth rice production depends on efficient management of N fertilizer. Nitrogen fertilizer recommendations for rice in the Midsouth are typically based on grain yield potential of a particular variety or hybrid. However, research has demonstrated that optimum N rates could vary as much as five-fold for comparable varieties grown on similar soil types due largely to site-specific variability in soil N mineralization. The development of a simple soil test for available N can improve the efficiency of rice production.

Various testing methods such as inorganic soil N, biological incubation, and hydrolyzable N [the Illinois Soil N Test (ISNT)] have been evaluated for several crops, but none have been calibrated for use in rice. Some work with incubation tests has shown some promise for rice; however, the test is untimely and the results were highly variable. A better understanding of N availability and how it affects Midsouth rice yield is needed. The development and adoption of a soil N test for rice will help ensure continued improvements in profitability and environmental sustainability of Midsouth rice production.

The rice research team at the University of Arkansas has completed 28 site-years of studies evaluating soil N testing methods for rice. They conducted replicated N response trials on several silt loam soils at experiment stations and in farmer fields across Arkansas. They evaluated the relationship between grain yield and soil N measured using either the ISNT or direct steam distillation (DSD). Good correlation was found between both the ISNT and DSD with relative grain yield across locations.

Results were best using a soil sample collected from an 18 in. depth. The ability of the ISNT and DSD to predict relative grain yield improved with each 6-in. increment down to 18 in., then decreased using a 24-in. sample. This result conflicts with traditional thought that a 6-in. sample is appropriate for assessing available soil N. Relative grain yield in rice appears to be highly dependent on soil N mineralization potential as well as subsoil N availability.

Calibration of a soil-based N test is the most critical step in determining its potential to affect production. The researchers in Arkansas found a strong relationship between soil test N using the two methods and N fertilizer need for their study sites. Similar to their results with grain yield, the best relationship existed at the 18 in. depth. Comparing N rate recommendations based on soil analysis with the standard recommendation for Arkansas rice production, they found deviations in optimum N rate ranging from zero (the standard recommendation was accurate) to 150 lb N/A (the field was non-responsive to N fertilizer), with the average deviation being 81 lb N/A.

These results indicate the strong need for a soil-based N test for fertilizer recommendations in Midsouth rice production; however, more research is necessary. The work in Arkansas was only conducted on silt loam soils with low variability in total N and C and inorganic N. Additional research has been established in Louisiana, Mississippi, and Texas to evaluate soil N testing methods on other soil textures and in different yielding environments.

Site-specific N management is a goal for producers of many crops and identifying the “right rate” for Midsouth rice growers may become easier in the near future.

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Abbreviations for this article: N = nitrogen; C = carbon.