Program 9R-2

▸ N-ST*R: Improving The Profitability And Long-Term Substantiability Of Mid-South Rice Production

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Producer profitability is closely tied to commodity prices and production costs, which are in a constant state of flux. In recent years, market volatility, technology costs and input costs have pressured producers to make critical decisions concerning where to "cut" unneeded expenditures. Increasing nitrogen (N) fertilizer prices threaten the long-term sustainability of US rice production and the implementation of a soil-based N test will result in better management of N fertilizer and more profitable rice production, while lowering the potential environmental impact. Soil fertility specialists have searched for a soil-based testing method to manage N fertilization in crop production for decades. Current practices rely on soil type, residual inorganic-N (NO3- and NH4+), yield goal and/or previous crop to determine N fertilizer recommendations (Blackmer et al. 1997). Many crops, such as corn and rice, require large amounts of N fertilizer when utilizing either a yield based or soil texture based fertilizer recommendation. These methods do not take into account the soil N that may become mineralized during the growing season and have no predictive value (Mulvaney et al. 2006). Conventional rice production has relied on yield goal estimates for determining N fertilizer needs, which can often lead to over-fertilization of crops and potentially higher impacts on the surrounding environment. Understanding the amount of N that can be supplied by the soil may significantly reduce the amount of N fertilizer required in many fields to obtain maximum rice yields. Implementation of a soil-based N test for rice production will allow N fertilizer recommendations on a field specific basis and ensure more profitable rice yields while lowering environmental impact due to excess N.

Researchers at the University of Arkansas have been working diligently over the past eight years to develop N-ST*R: a soil-based N test for rice that will provide the first field-specific N rates for rice produced in the Mid-south USA. The basis of this research was to develop an analytical procedure that quantifies the amount of N the soil could provide to the rice crop during the growing season. A direct steam distillation procedure was developed to index the availability of soil N and was correlated and calibrated to rice response parameters on silt loam soils (Roberts et al., 2011). A unique aspect of N-ST*R is that it measures a pool of potentially available soil N that is not prone to loss mechanisms such as NO3-. In order to properly correlate and calibrate N-ST*R for silt loam soils, the entire rooting depth of the rice was soil sampled. The best relationship between N-ST*R values and N calibration rates were found when the soil was sampled 45 cm deep, which was later determined to be the effective rooting depth of rice produced on silt loam soils.

Research with N-ST*R has shown that in most situations the standard N recommendation results in over-fertilization and some producers planting rice after continuous soybean, catfish or fallow may be able to eliminate or at least drastically reduce the N fertilizer rate while maximizing yields. Work on the N-ST*R recommendations has lead to the development of three calibration curves; Economic Optimum (90% Relative Grain Yield), Optimum (95% Relative Grain Yield) and Above Optimum (100% Relative Grain Yield). Utilization of the three N-ST*R calibration curves will allow producers to make management decisions based on their production philosophy and current production costs. Implementation of a soil-based N test will allow site-specific N fertilizer recommendations, thereby avoiding excess N applications and lowering potential environmental impacts, while decreasing the incidence of lodging and disease. Small-plot validation of N-ST*R has been completed with N-ST*R Optimum and Above Optimum predicted N rates producing similar or higher yields in almost all of the 14 sites included in the study. This research has been promising, but has not been fully tested and must be implemented on a large scale to determine the robustness of the calibration curves and the ability of N-ST*R to capture field N availability and variability.

A series of field-scale strip trials were conducted in the summer of 2011 to validate the N-ST*R calibration and soil sampling protocol and educate producers, consultants and county agents on the new technology. Prior to planting, 10 soil samples were taken to a depth of 45 cm from each field and analyzed by N-ST*R to determine the N rate and degree of variability in soil N availability. All of the sites sampled and included in the study resulted in N rate recommendations that were significantly lower than the producer's practice and the standard recommendation of 165 kg N ha-1 for rice produced on silt loam soils. Nitrogen rates in the strip trials for the N-ST*R treatments ranged from 40-151 kg N ha-1 and at all sites the N-ST*R predicted N rate was less than both the producer practice as well as the standard recommendation. Results obtained from these trials indicate that N rates can be significantly reduced with little to no impact on rice yields. Incorporation of this research will not only increase producer profitability while maintaining current production levels, but decrease potential for environmental impacts due to over fertilization.

References:

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Mulvaney, R.L., S.A. Khan and T.R. Ellsworth. 2006. Need for a soil-based approach in managing nitrogen fertilizers for profitable corn production. Soil Sci. Soc. Am. J. 70:172-182.

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Program 13R-2

"Effect Of Seeding Rate On RiceTec Hybrid Rice Yield And Milling Quality"

Presented by Greg Simpson

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Field studies have been conducted from 2004 to 2011 in Arkansas, Louisiana, Mississippi, Texas, and Missouri in multiple locations using RiceTec commercial rice hybrid seed. The purpose of these tests has been to observe the effect of seeding rate on emergence and resulting plant populations on yield and milling yield of RiceTec hybrid rice in an on farm setting. In every test RiceTec hybrid rice seed was compared side by side with locally recommended varieties. Seeding rate treatments of 200,000, 400,000, 600,000, and 800,000 seeds per acre were directly compared using a randomized strip plot design or randomized complete block design depending on the local field conditions. RiceTec hybrid genotypes included in the tests were XL723, CLEARFIELD XL729, and CLEARFIELD XL745. Variety checks were CL161, CL151, WELLS, and CHENIERE depending on the location and year. In each location tests were harvested using a 'Wintersteiger Delta plot combine' with 'Harvest Master' digital plot weigh system. Grain samples were collected at harvest and milled immediately after air drying. In individual location tests and in combined analysis over locations and years grain yield and milling yields from seeding rates from 400,000 seeds per acre to 600,000 seeds per acre were not significantly different . To achieve an acceptable rice plant stand the theme should be good seed to soil contact of the correct seeding rate. The top risk factors are: Improper Planting Date, Poor Seedbed Preparation, Poor Planter Adjustment / Maintenance, and Poor Surface drainage. If these risks are avoided the probability of acceptable stand establishment will be greatly increased.

Independent of seeding rate USDA standard grain quality grades are routinely achieved commercially using RiceTec hybrid rice seed if the common risk factors that reduce rice milling yield are avoided. The most common issue with rice grade and milling scores are: