Fertilizer Management For Rice Economic Considerations

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Introduction

In recent years, nitrogen (N) has become one of the major inputs with respect to dollar spent per acre of rice produced. Since 2000, N fertilizer and fuel inputs have increased the cost of production by approximately $100 per acre. Growers have been forced to ask the question, "How much can I reduce N-fertilization without losing yield?" Nitrogen fertilizer studies that have been conducted on farms and experiment stations can help address growers concerns of rising N costs.

In Mississippi, as is the case for other rice growing states in the Midsouthern USA, N response studies are conducted each year for experimental breeding lines and newly-released cultivars on soils representative of the rice growing region of the particular state. Recommendations are published by the experiment station and/or extension service upon entry of the cultivar into the public sector. Various means of determining recommendations are employed and factors other than grain yield are considered. Some of the other factors include a cultivar's lodging potential and/or disease resistance, because both are often affected by N fertilization.

The objective of this research was to evaluate the various means of determining N recommendations and to address the aforementioned question, "Can I reduce N fertilization without losing grain yield?"

Materials and Methods

A newly released cultivar, 'CL171AR', was evaluated three site years each on Sharkey clay and Forestdale silt loam soil. Seven N rates ranging from 0 to 256 lb N/a on clay soils and 0 to 226 lb N/a on silt loam soils were applied to 4- to 5-leaf rice immediately prior to flooding. Rice plots were managed according to recommendations from the Mississippi State University Extension Service for drill-seeded, delayed-flood rice culture. Upon maturity, plots were harvested with a small-plot combine and grain yields were standardized to 12% grain moisture.

The data were subjected to three analysis procedures to evaluate different methods of determining N recommendations. First of all, data were subjected to standard analysis of variance procedures where mean separation was determined using the Least Significant Difference method. Secondly, the data were plotted and the derivative of a two-factor polynomial regression equation was used to determine the N rate that would provide 95% of the maximum yield. Finally, two ratios of N price ($/lb N) to rice price ($/lb rice) were determined and used to solve for the N rate that would give the greatest economic return. The first ratio simulated a high N price of $0.54/lb (equivalent to urea at $500/ton) plus $0.13/lb application cost and a low rice price of $0.10/lb (equivalent to $10/cwt). The second ratio assumed the same N price as the first, but included a higher price of rice ($0.13/lb).

Results and Discussion

CL171AR, regardless of the method used for recommending N fertilizer rates, required 17 to 23% less N when produced on clay soils compared to clay soils. Recommendations based on 95% of maximum yield were similar to recommendations based on LSD mean separation procedures; however, both of these methods were approximately 20% less than what would be recommended when considering economic returns. Experiment station and extension service scientists typically employ the more conservative approaches when recommendations are made because economic recommendations often lead to plant lodging and disease problems that ultimately cost producers in harvest efficiency, fungicide applications and grain quality. These data suggest that growers should not apply N at rates less than what is recommended by the land-grant institutions, even when rice prices are low and N prices are high. Before applying N rates based on economic return, growers should consult the source of the recommendations to gain more information about the cultivars of interest so that lodging and disease issues can be fully considered.

Table 1. Nitrogen rate recommendations for CL171AR on silt loam and clay soils based on Least Significant Difference, 95% maximum yield and economic N rate for high N price and low rice price, and high N price and high rice price. Δ

Soil Type	N Recommendation Method			
	Economic N Rate			
	LSD	95% of Max Yield	High N/Low Rice	High N/High Rice
	lb N/a			
Sharkey clay	180-210	180	211	220
Forestdale silt loam	150-180	139	173	181