Effect of Water Management Practices on Nitrogen Uptake, Nitrogen Use Efficiency and Rice Grain Yield

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ABSTRACT

Rice production is dependent upon an adequate water supply which is becoming a limited resource. Producing one kilogram of irrigated rough rice is estimated to require between 600 to 2,000 liters of water, depending on the local climate, soil type, and rice variety. A field experiment was conducted to compare nitrogen uptake, nitrogen use efficiency, and grain yield under three water management practices. The water management practices included conventional flooding (delayed flooding), alternate wetting and drying (AWD), and aerobic rice systems. Four nitrogen rates of 0, 100, 135, and 170 kg N ha^{-1} were split applied one day before flooding and at panicle initiation. Plant tissue samples were collected at 50% heading for determining dry mater weight, nitrogen uptake, and nitrogen use efficiency. Grain yield and yield components were obtained at harvest.

INTRODUCTION

Water availability is a major limiting factor for all crop production (Bouman and Aureus, 2009; Belder et al., 2004). Rice is a staple crop that highly depends on water resources. Water scarcity has been observed in many rice producing countries and is expected to increase in acreage (Bouman, 2009). Water use efficiency, as related to nitrogen fertilization, will be required for maintaining future rice production.

Water saving technologies for rice production have been developed for various rice production systems. Alternate wetting and drying (AWD), saturated soil, and aerobic rice cultural practices can potentially be effective in reducing water use. The best water management practice adopted in one area may not correlate to other areas. Thus, there are still arguments on whether these water management practices decrease or increase rice yields.

MATERIAL AND METHODS

Drill-seeded cultivation

Water management practices:

- Conventional flooding (delayed flooding)
- Alternate wetting and drying (AWD)
- Aerobic irrigation

Nitrogen rates:

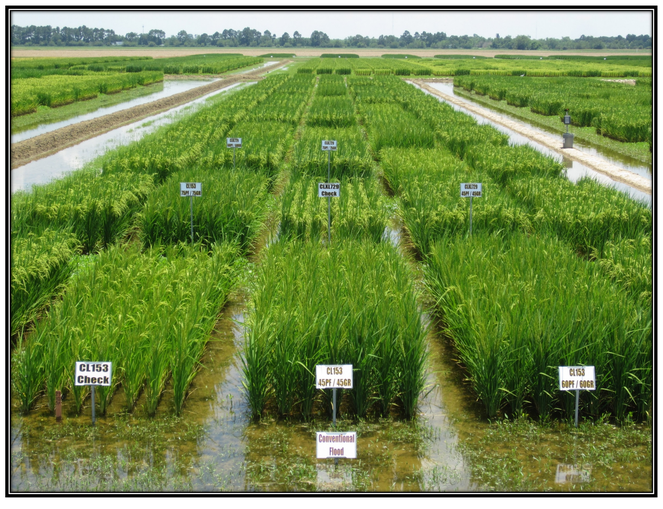
- 0, 100, 135, and 170 kg N ha^{-1}
- 50% before flooding
- 50% at panicle initiation

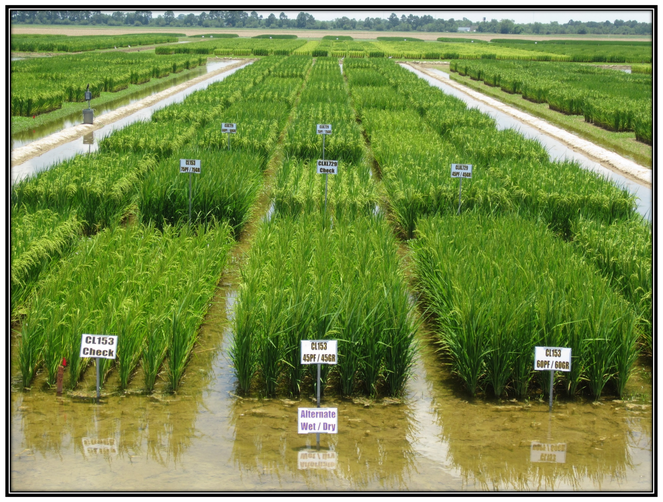
Rice variety:

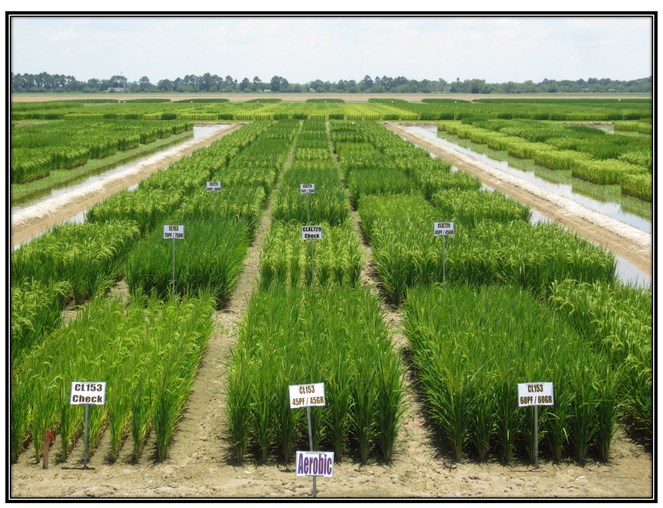
- CL153
- CLXL729

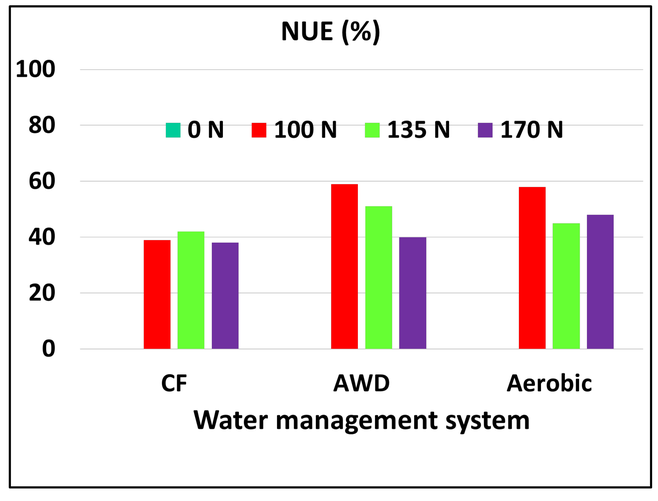
Data collection:

- Plant biomass
- Nitrogen uptake
- Nitrogen use efficiency
- Grain yield



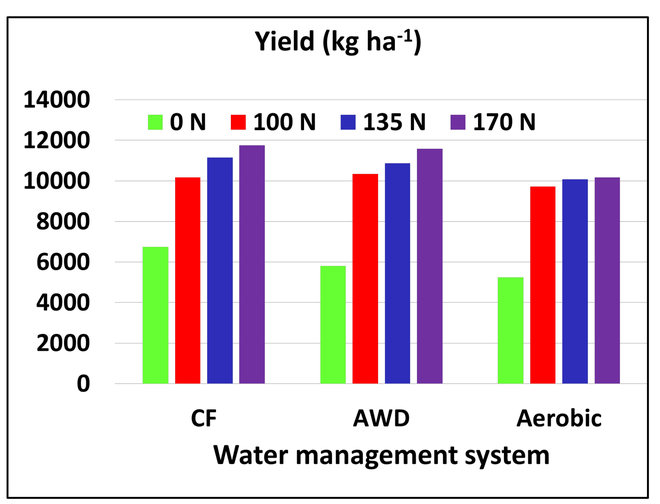






RESULTS

- No difference between water systems, when averaged over varieties and N rates.
- CLXL729 (101 kg N ha^{-1}) had higher N uptake than CL153 (91 kg N ha^{-1}) in all water systems.
- N application rates significantly influenced N uptake when averaged over water systems.
- No significant differences were observed between NUE for each N rates as compared to 0 N treatment.
- Average grain yield was highest in CF (9950 kg N ha^{-1}), AWD (9650 kg N ha^{-1}), and aerobic (8801 kg N ha^{-1}).
- Average yield of CLXL729 (9911 kg N ha^{-1}) was significantly higher than CL153 (9023 kg N ha^{-1}).



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