

Tillage, Seeding And N Rate Effects On Rice Emergence, Yield And Yield Components

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Rice (*Oryza sativa* L.) is an important agricultural commodity in Louisiana with an average of 471,000 acres grown in 2008 and 2009. A variety of tillage regimes are practiced by producers to prepare seedbeds prior to planting in drill-seeded delayed flood rice production. Conventional tillage is currently the most common tillage system used in drill-seeded Louisiana rice however; reduced tillage systems have become more common over the last decade. In fact, estimates from the 2008 season suggest that over 142,000 acres of rice planted in Louisiana used some form of conservation tillage practice, with a fall-stale seedbed being the predominant form. Conventional tillage has the advantage of destroying weedy vegetation and improved soil-to-seed contact. However, fall-stale seedbed advantages include reducing seedbed preparation time thus speeding planting of drill seeding during the spring, increased soil moisture at planting and reduced nutrient losses associated with draining rice fields. In both instances, a weed free and uniform seedbed is paramount for rice seedling survival. The fall-stale seedbed tillage system requires seedbeds to be prepared initially in the fall followed by burning down winter vegetation using herbicides in the spring. However, a potential disadvantage of the fall-stale seedbed would include reduced soil temperatures in early spring which could potentially reduce rice seed germination and seedling survival. Numerous studies have been conducted to individually analyze various tillage methods, seeding, or N rates; however, few have evaluated the three-way interactions between these factors as they affect rice density, grain yield and yield components. A clear understanding of the interrelationships between tillage, seeding, and N rate can aid producers in making sound decisions if less than optimum conditions are experienced at seeding that result in low stand densities. The objective of this research was to evaluate the main effects of tillage, seeding and N rate and their interactions on rice density, rough rice grain yield and yield components.

Experiments were conducted in 2007 and 2008 at the Louisiana State University Agricultural Center's Rice Research Station near Crowley, LA to evaluate agronomic responses 'Jupiter' and 'Cheniere' to variable tillage, seeding and N rates. Experiments were conducted on a Crowley silt loam (fine, smectitic, thermic Typic Albaqualfs) with an initial pH of 7.4. The experimental design for both experiments was a randomized complete block with four replications. Two tillage systems (conventional and fall-stale seedbed), four targeted seeding rates (15, 30, 45 and 60 seed ft⁻²) and four N rates (90, 120, 150 and 180 lb A-1) were used in the experiments. Winter vegetation of all plots was controlled using glyphosate plus 2,4-D approximately 4 weeks prior to seeding. Seeding was done immediately following conventional tillage treatment. An additional glyphosate application was made to all plots 1 d post seeding.

When data was evaluated across all seeding and N rates, the conventional tillage system reduced rice density of Jupiter by 25% and Cheniere by 16%. The reduction in stand achieved in the conventional tillage system can be explained by crusting of silt loam rice soils which can often occur after a heavy rainfall or flush irrigation event. When evaluated across all seeding and N rates, stale seedbed tillage increased grain yields over conventional tillage by 6 and 10% for Jupiter and Cheniere cultivars, respectively.

Jupiter rough rice yields increased with each increasing rate of N, with a maximum yield (9804 lb A-1) occurring at the 180 lb A-1 rate. Cheniere rough rice grain yield was increased by 4% when N rate was increased from 90 to 120 lb A-1, and increased another 4% when increasing N from 120 to 150 lb A-1. However, there was no additional increase in yield with further additions of N. The lack of a significant interaction between N rate and tillage in this study suggests that in a rice-fallow rotation, the optimum rate of N fertilization is similar between the fall stale seedbed and conventional tillage in drill-seeded delayed flood rice. The lack of a seeding rate by N rate interaction in this study suggests that poor rice densities as a function of low seeding rates cannot be compensated for by increasing N fertilization.

The stale seedbed tillage practice had 16 and 18% more panicles as compared to the conventional tillage practice in Jupiter and Cheniere, respectively. Conversely, the stale seedbed tillage practice produced 7 and 13% less filled grain panicle-1 as compared with the conventional tillage system in Jupiter and Cheniere, respectively. Grain weight was slightly heavier in the stale seedbed as compared with the conventional tillage system for Jupiter rice however this was not observed for Cheniere. Jupiter and Cheniere panicle density increased numerically with increasing seeding rates. However, the 45 seed ft⁻² seeding rate produced a statistically equivalent number of panicle as compared with the 60 seed ft⁻² seeding rate in both cultivars. Filled grain panicle-1 tended to decline with increasing seeding rates and was maximized for both cultivars at the lowest seeding rate of 15 seed ft⁻². Grain weights were lower at the higher seeding rates (45 and 60 seed ft⁻²) as compared to the lower seeding rates (15 and 30 seed ft⁻²) for Cheniere. Similarly, grain weight was numerically lower at the 15 seed ft⁻² seeding rate as compared with all higher seeding rates. While all yield components tentatively influence rough rice grain yield, single linear regression analysis identified panicle density as the single most influential yield component. Panicle density could explain 49 and 51% of the variation in yield for Jupiter and Cheniere, respectively. Δ