Conservation Tillage Practices for Water-seeded Rice

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INTRODUCTION

Rice currently ranks third in total acreage behind soybean and cotton in Louisiana with over 518,000 acres being grown in 1991 (L.S.U. Agricultural Center, 1992). The majority of this acreage is located in southwest and northeast Louisiana. These distinctly different regions have unique cultural management system due to differences in soil type, environment, weather, and tradition. In southwest Louisiana, most water-seeded rice is planted into completely tilled seedbeds. Numerous field operations are required to destroy weedy vegetation and establish a firm and level seedbed. Proper seedbed preparation is considered essential since water management in water-seeded rice is critical to fertilizer efficiency and stand establishment. Wet springs compromise conventional seedbed preparation. Additional field operations are generally required, and planting is delayed. These situations increase production costs, and delays in planting can result in significant yield reductions.

Two alternatives to conventional seedbed preparation are no-till or stale seedbed preparation. These conservation tillage practices have been used in other crops for many years and are increasing in popularity. The advantage in no-till rice establishment is the reduction or elimination of field operations required for conventional seedbed preparation. Stale seedbed systems provide more flexibility in land preparation and allow the producer to take advantage of favorable weather conditions for seedbed preparation weeks or months prior to planting. Conservation tillage is also very effective in reducing soil erosion and conserving soil moisture.

Information on water-seeded rice production in conservation tillage systems is limited. Preliminary studies conducted in Crowley, Louisiana, have shown conservation tillage has potential in rice production (Bollich et al., 1987, 1988, 1989). The objective of this study was to evaluate the performance of water-seeded rice grown in no-till and stale seedbeds as alternatives to planting rice into conventionally prepared seedbeds.

MATERIALS AND METHODS

The experiment was conducted at the Rice Research Station in Crowley, Louisiana, on a Crowley silt loam (fine, montmorillonitic, thermic, Typic Albaqualf)previously cropped to soybeans. Seedbed preparation in the conventional and stale seedbeds consisted of disking, vibrashanking, and conditioning with a roller harrow until a uniform, level, weed-free seedbed was formed. Rice establishment consisted of 1) no-till planting into soybean residue, 2) planting into a stale seedbed tilled in the spring 4 to 6 weeks prior to planting, 3) planting into a stale seedbed tilled 5 to 6 months prior to planting, and 4) planting into a conventionally tilled seedbed. Treatments were arranged in a randomized complete block design with four replications.

Glyphosate (1 Ib ai/acre) was applid to the conservation tillage treatments 7 and 23 days preplant in 1989 and 1990, respectively, to destroy existing vegetation. A no-till grain-fertilizer drill was used to apply preplant fertilizer in a 7-in band to a shallow depth 2 days prior to flooding. Approximately 450 Ib/acre of 20-10-10 fertilizer were applied each year. Pregerminated rice (cv. Lemont) was water seeded by aerial application after floodup.

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The study was drained 3 days after planting to encourage seedling anchorage. A shallow, permanent flood was established 3 to 5 days later. This type of management is typical of water-seeded, pinpoint flood rice culture in Louisiana (L.S.U. Agricultural Center, 1987).

A midseason fertilizer application of urea (45 and 55 lb N/acre in 1989 and 1990, respectively) was applied at the panicle initiation growth stage. In addition, the herbicides propanil, bentazoa, molinate, and bensulfuron-methylwere used for postemergence weed control as required.

Stand density for each planting method was determined at the 4- to 5-leaf growth stage each year. Individual whole plots (3250 ft^2) were combine-harvested and grain yields were adjusted to 12% moisture.

RESULTS AND DISCUSSION

Stand densities for each tillage practice are shown in Table 1. A significant interaction occurred between year and tillage method. Density was significantly influenced by tillage practice in 1989. Densities were lower in the no-till and stale seedbed treatments when compared with conventional seedbed preparation. In 1990, tillage practice had no influence on stand density, and densities were also higher. Difficulty in establishing a rice stand occurred in 1989 and appeared to be due to the elapsed time between glyphosate application and seeding. Flooding followed glyphosate application by 4 days in 1989, and much of the collapse and decay of existing vegetation occurred during rice emergence and stand establishment. Seed to soil contact and seedling anchorage were affected and some

Table 1 Effect of seedbed tillage method on stand density and grain yield of water seeded Lemont rice at Crowley, LA, 1989 and 1990.

	Stand Density			Grain Yield		
Tillage	1989	1990	Avg.	1989	1990	Avg.
	plants ft^{-2}			lb A^{-1}		
Conventional	15	15	15	5549	5851	5700
Stale-spring	12	18	15	5539	6125	5832
Stale-fall	10	19	15	5118	5839	5478
No-till	8	21	14	4539	5754	5146
LSD (0.05)	3	ns	ns	511	ns	315
Source of Variation	df					
Year (Y)	1		*			**
Tillage (T)	3		ns			**
Y x T	3		*			*

*, ** Significant at P = 0.05, P = 0.01 respectively.

seedling loss occurred due to fungal diseases that were more prevalent in the stale and no-till treatments. Inclement weather delayed planting in 1990, and the test area was not flooded until 3 weeks after glyphosate application. The vegetation was completely dessicated and partially collapsed at the time of flooding, and this condition resulted in better seedling anchorage and more rapid stand establishment. The problems associated with stand establishment in this study also occurred in a drill-seeded conservation tillage study conducted during the same time (Bollich, 1991). Stand establishment appears to be more difficult in a water-seeded system, and either excessive vegetation or significant decomposition of vegetation after flooding is a concern.

A significant year x tillage interaction also occurred for grain yield. Yield was significantly reduced in the no-till seedbed in 1989 and was probably related to low stand density. A stand of 15 to 20 plants/ft^2 is considered optimum in Louisiana, although successful yields have occurred at lower densities (L.S.U. Agricultural Center, 1987). The nonuniformity of the no-till stand, incomplete canopy closure, and competition from aquatic weeds may have contributed to low yields. Tillage practice had no influence on grain yield in 1990. Yield in 1990 was significantly higher than in 1989.

Conservation tillage practices in water-seeded rice have potential in Louisiana. Stand establishment is critical, however, especially in no-till rice. Additional research is needed to determine the required time interval between application of burndown herbicides and flooding in order to minimize detrimental effects on stand establishment. If burndown of vegetation prior to planting into a conservation tillage seedbed is successful and stand establishment difficulties are minimized, rice culture in a water-seeded, pinpoint flood system is very similar to that in a conventional system.

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