Organic Rice Ratoon Production Experience for Young Scholars through Internship Program

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Introduction

Organic ratoon rice production in Texas represents a sustainable approach to farming. It prioritizes sustainability by avoiding synthetic agrochemicals, emphasizing organic inputs, and improving soil health. Employing techniques such as cover cropping and organic amendments, farmers aim to improve soil fertility, farm productivity and biodiversity. Despite a nearly six-fold increase in US organic rice acreage since 1995, predominantly in Texas and California, constituting over 76% of the nation's total, existing production falls short of meeting escalating market demand. Leveraging improved ratoon cropping presents a pivotal opportunity to mitigate dependence on imports, fostering economic prosperity for US rice farmers. Thus, this project aims to establish resilient organic ratoon rice production systems in the Southern US by integrating cover crops, organic soil amendments, and rice varieties to augment crop productivity, economic returns, and soil health. Additionally, it seeks to enhance the educational experiences of undergraduate STEM students, with a specific emphasis on encouraging women to actively participate in scientific endeavors.

Objectives

- Assessing the effects of varieties, cover crops and organic soil amendments on ratoon rice yields
- Enhancing the knowledge and research experiences of undergraduate STEM students with a specific focus on fostering interest and participation among women in science

Material and Method

A field trial was initiated at The Texas A&M AgriLife Research Center near Beaumont, Texas, USA, encompassing two rice variety (inbred - Presidio and hybrid - XP753), and two cover crop treatments [cover crop (CC) and winter fallow (WF)]. Additionally, five nitrogen (N) rates (0, 30, 60, 90, 120 lb/acre) were applied to the ratoon crop, supplied through Nature Safe (13-0-0). All treatments were replicated four times. Because of unsuccessful attempts to establish cover crops in the fall of 2022, alfalfa hay was subsequently applied to mimic the leguminous cover crop effect at a rate of 5500 lb/acre. In 2023, rice was planted on March 31st, flushed on April 1st, and a permanent flood was established on April 25th. On May 4th, all plots of the main crop received 145 lb/acre of nitrogen through Nature Safe. The main crop was harvested on July 27-28th. Nitrogen treatment for the ratoon crop was applied on August 7th, and reflooding was established on August 8th. The ratoon crop was harvested on October 25th, with grain weight measured, and moisture content assessed to calculate ratoon rice yield per unit area at 12% whole grain moisture content.

Fig. 1: Field activities during the experiment. A- Alfalfa hay application; B- Seed drilling of the rice, C- A rice plot representing main crop; D and E- Student interns hand harvesting rice main crop; F- A ratoon crop plot and G- Machine harvesting of ratoon crop.

Result and Summary

Table 1: Generalized mix model analysis of variance showing effects of cover crop, variety and ratoon crop N rate on ratoon rice yield

Source	DF	F value	Probability	Source	DF	F value	Probability
Cover crop (CC)	1	11.87	**0.0011**	CC x V	1	0.04	0.8417
Variety (V)	1	60.96	**<0.0001**	CC x N	4	0.28	0.8871
Nitrogen rate (N)	4	2.33	**0.0666**	V x N	4	0.40	0.8076
				CC x V x N	4	0.54	0.7069

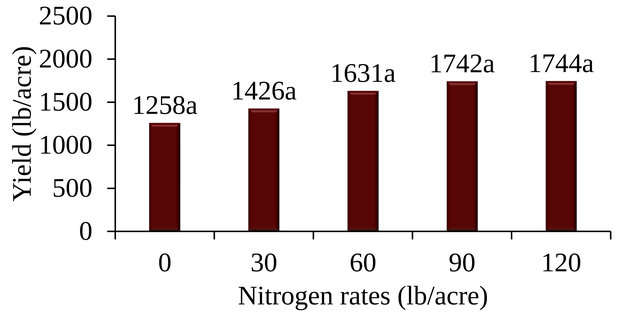

Fig. 2. Effect of ratoon rice nitrogen rates on ratoon rice yield.

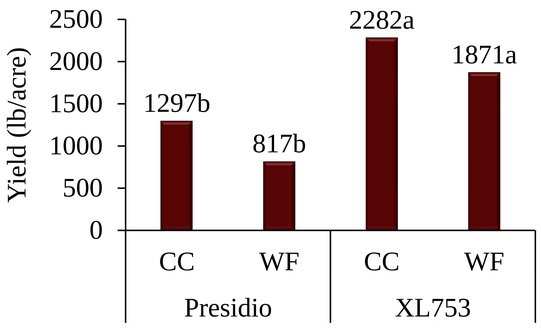

Fig. 3. Interactive effect of variety and cover treatments on ratoon rice yield. CC- cover crop; WF- winter fallow

- Ratoon rice yield exhibited significant variations based on cover crop treatments and rice varieties (Table 1). Nitrogen treatment were not significant. Moreover, no significant interaction effects were observed (Table 1).
- On average, the hybrid variety XP753 demonstrated a 96% higher yield compared to the inbred variety Presidio. Likewise, the application of a cover crop (alfalfa hay application) resulted in a 32% higher ratoon rice yield than winter fallow.
- Although no significant impact of N rates on ratoon rice yield was observed, a noticeable trend of increasing grain yield with increasing N rates, up to 90 lb/acre, suggests an optimal N rate near 90 lb/acre (Fig. 2).
- Analyzing further, it was observed that with a cover crop, the hybrid variety XP753 demonstrated a 22% increase in ratoon rice production, while the inbred variety Presidio, under similar conditions, exhibited a significant 59% yield enhancement compared to winter fallow, as illustrated in Fig 3.
- Student interns acquired skills in various aspects of sustainable organic ratoon rice production, encompassing rice planting, harvesting, plant and grain sampling, as well as grain weight and moisture measurement.

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