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Evaluation of different organic nutrients on growth and yield of traditional rice – Mapillai Samba (*Oryza sativa* L.) under SRI method

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Abstract
A field investigation was conducted during Rabi season 2021-2022 at Krishna College of Agriculture and Technology, Affiliated to TNAU, Coimbatore-3, Tamil Nadu, India. To study the Evaluation of different organic nutrients on growth and yield of Traditional Rice (*Oryza sativa* L.), under SRI method. The experiment was laid out in RBD design with three replications. Seven different treatments are consisted of T_1- Absolute Control, T_2- Azolla @ 5t ha^{-1}, T_3- E-FYM @ 750 kg ha^{-1}, T_4- Vermicompost (2.5 t ha^{-1}), T_5- Azospirillum + Phosphobacteria (600g ha^{-1}), T_6- Panchagavya (3%) & T_7- Neem cake (400 kg ha^{-1}). The results of the experiment revealed that application of E-FYM @ 750 kg ha^{-1} (T_3) was recorded the highest growth and yield parameters, plant height (150.67 cm), LAI (17.07), DMP (7705 kg/ha) on 90 DAP & harvest, no of tillers/hill (27), no of grains /panicle (176), grain yield (3135 kg/ha), straw yield (6650 kg/ha) and harvest index (48.26) percentage.

Keywords: Traditional rice, mapillai samba, organic nutrients, growth and yield

1. Introduction
Rice (*Oryza sativa*) is one of the most ancient crops being cultivated in 117 countries, hence called as "Global Grain". Rice is the staple food for two thirds of the world's population (Kumari *et al.*, 2014) [6]. In India, it is grown over an area of 44 million hectares with a total production of 105 million tonnes and the productivity of 2.4 t ha^{-1} (Directorate of Economics and Statistics, 2017-2018). In Tamil Nadu, rice is grown in an area of 1.93 million hectare with the production of 7.63 million tonnes and the productivity is 3.9 t ha-1 (Annual report on Agriculture 2016-2017) [1]. The traditional rice varieties in India and across Asia are under serious threat of extinction due to arrival of modern rice varieties, like the so-called high yielding varieties (HYV).

Among the various methods of rice cultivation, the SRI (System of Rice Intensification) method is gaining great popularity in recent days. Farmers in several parts of Tamil Nadu have adopted this method on a trial basis. SRI is a method that has been introduced in agriculture to increase productivity. In this method of cultivation, techniques like transplanting of very young seedlings, transplanting seedlings with sufficient spacing, use of welders to manage weeds etc., are adopted to increase the yield. Moreover, use of inputs like seeds, irrigation water, manures is lessened. In general SRI is recommended along with the use of chemical fertilizers and the focus is to increase productivity (Balasubramanian *et al.*, 2019) [2]. Tamil Nadu has been through the ages, recognized as a centre with very high biodiversity of the rice crop. Tamil literature that goes by the name of – "Pallu" literature is having very large number of traditional rice varieties. In 233 Traditional Rice Varieties and their properties and uses have been described in Siddha medical literature.

Recent trend illustrates remarkable expansion in market size of organic produce from US15.2 billion in 1999 to 63.9 billion in 2012 and is anticipated to grow at higher growth rate in the coming years (IFOAM 2013). In general, countries with higher income have greater demands for organic foods. For instance, the USA has the largest market size (US$ 29 billion) followed by Germany (US$ 9.2 billion) and France (US$ 5.2 billion). Meanwhile, the developing countries particularly South Asian countries have also witnessed significant growth in organic food market in recent years. The growing concern about the ill effects of intensive use of chemicals in agriculture has paved the way to embrace organic farming worldwide (Prasad 2005) [10].

Also, the demand for organic rice has also increased in recent years that have eventually created a considerable gap between demand and supply. Therefore, to harness the global organic rice market, the area coverage and productivity of organic rice urgently need a dramatic increase.

2. Materials and Methods

Field investigation was conducted during 2021-2022 at Krishna College of Agriculture and Technology, usilampatti. The experimental field was clay loamy soil with pH 6.5, available nitrogen (231 kg ha^{-1}), available phosphorus (16 kg ha^{-1}) and available potassium (293 kg ha^{-1}). The experimental farm located at 9º 58' N latitude, 77º 48' E longitudes at an altitude of 218m above mean sea level. The experiment was laid out in RBD design with three replications. The levels of treatment were compared by critical difference at 5% level of probability. Seven different treatments consisted of T_1- Absolute Control, T_2- Azolla @ 5t ha^{-1}, T_3- E-FYM @ 750 kg ha^{-1}, T_4- Vermicompost (2.5 t ha^{-1}), T_5- Azospirillum + Phosphobacteria (600 g ha^{-1}), T_6- Panchagavya (3%), T_7- Neem Cake (400 kg ha^{-1}). The planting of Traditional rice variety was done at 25 x 25 cm spacing. Observations recorded on plant height (cm), LAI, DMP (kg/ha), no of tillers/hill, no of grains /panicle, grain yield (kg/ha), straw yield (kg/ha) and harvest index percentage. The data were subjected to statistical analysis as prescribed by Gomez and Gomez, (2010) [4].

3. Results and Discussion

3.1. Effect of Growth attributes

Plant height is an important character of the vegetative phase and indirectly influences the yield components (Table 1). Plant height as a measure of crop growth was recorded at successive stages of crop growth, Plant height, LAI and DMP i.e. 30, 60, 90 DAP. The analysed data is presented in Table1. Application of different organic manures influenced plant height, LAI & DMP significantly over control. All the treatments were significantly superior to untreated control. Nitrogen has been widely accepted as dominant growth promoter. The significant increase of plant height was due to the no of tillers and the vigorous root growth. The highest plant height (74.67, 108.33 & 150.67 cm), LAI (0.67, 3.4 & 17.07) & DMP (9295, 9405 & 7705 kg) was recorded at 30, 60, 90 DAP in respect of T_3-E-FYM @ 750 kg ha^{-1}. This result was in close conformity with the findings of Manjunath *et al*. (2012) [7].

Table 1: Effect of different treatments on Plant heights (cm), LAI and DMP (kg/ha)

Treatments	Plant height (cm)				LAI			DMP (kg/ha)		
	30 DAP	60 DAP	90 DAP	AT Harvest	30 DAP	60 DAP	90 DAP	30 DAP	60 DAP	90 DAP
T_1- Absolute Control	59.33	56.33	123.33	131.67	0.33	1.71	7.93	7650	8740	6805
T_2- Azolla @ 5t ha^{-1}	65.00	81.67	123.67	133.00	0.62	2.49	13.01	8390	8550	6900
T_3- E-FYM @ 750 kg ha^{-1}	74.67	108.33	138.33	150.67	0.67	3.44	17.07	9295	9405	7705
T_4- Vermicompost (2.5 t ha^{-1})	63.67	88.67	132.00	145.00	0.36	2.05	13.12	9205	9205	7060
T_5- Azospirillum + Phosphobacteria (600 g ha^{-1})	65.50	81.67	125.33	134.00	0.56	2.61	10.93	8940	8665	7100
T_6- Panchagavya (3%)	62.33	76.33	134.67	136.67	0.47	2.06	13.46	9045	8870	7110
T_7- Neem Cake (400 kg ha^{-1})	68.33	107.33	131.67	151.67	0.65	3.01	13.10	8785	8935	7135
S.E.D	0.46	1.71	0.55	0.81	0.01	0.06	0.26	53.92	28.58	27.02
C.D at 5%	1.01	3.72	1.20	1.76	0.03	0.12	0.57	117.48	62.27	58.87

3.2 Effect of yield attributes

The number of tillers per plant, no of panicles per plant, no of grains per panicle, grain yield and straw yield was recorded from randomly selected five plants of each plot at harvesting. The analysed data is presented in (Table 2).

The panicles were cut from randomly selected five plants of each plot, threshed carefully by hand. The recorded highest Number of tillers $hill^{-1}$ (27), no of panicles $hill^{-1}$(5), no of seeds $panicle^{-1}$(176), seed yield and straw yield (3135 & 6650 kg/ha) in respect of T_3-E-FYM @ 750 kg ha^{-1}. This might be due to beneficial effect of nutrients in combination with microorganisms, which resulted in higher yield as reported Miah *et al.* (2006) [8]. Followed by T_7- Neem cake @ 400 kg/ha recorded grain yield and straw yield (2715 & 5500 kg/ha) respectively.

This might be due to better absorption of nutrients applied through soil leading to better activity of functional root nodules resulting in more uptakes of nutrients. The higher nutrient application might have increased nutrient content in soil solution, which reflected in terms of increased nutrient content in grain and straw (Parvez *et al.,* 2008) [9].

Table 2: Effect of different N treatments on yield attributes, no of tillers $plant^{-1}$, no of panicles per hill, no of grains/panicle, grain yield & straw yield (kg ha^{-1}) and harvest index percentage

Treatments	Yield attributing characters						
	No of tillers $plant^{-1}$	No of panicles $plant^{-1}$	No of grains $panicle^{-1}$	1000 grain weight (g)	Grain yield (kg/ha)	Straw yield (kg/ha)	Harvest index (%)
T_1-Absolute Control	19.00	3.33	131.67	22.50	990.00	2050.00	40.67
T_2- Azolla @ 5t ha^{-1}	25.00	3.67	160.00	27.67	1825.00	3750.00	43.07
T_3- E-FYM @ 750 kg ha^{-1}	27.00	5.00	176.00	33.53	3135.00	6650.00	48.26
T_4-Vermicompost (2.5 t ha^{-1})	24.67	4.00	157.33	31.33	1790.00	3400.00	41.10
T_5- Azospirillum + Phosphobacteria (600 g ha^{-1})	21.33	3.67	133.33	29.00	2115.00	4085.00	41.33
T_6- Panchagavya (3%)	20.33	3.67	138.33	27.33	1865.00	3500.00	41.67
T_7- Neem Cake (400 kg ha^{-1})	22.67	4.33	171.67	32.00	2715.00	5500.00	44.33
S.E.D	0.27	0.05	1.72	0.35	65.45	141.92	0.25
C.D at 5%	0.59	0.12	3.75	0.76	142.60	309.22	0.55

3.3 Harvest index
The analysis of variance for harvest index reveals that the effect of soil application of nutrients on harvest index was found significant. The maximum harvest index was recorded (48.26 %) with the application of EFYM @ 750kg/ha (T_3).

4. Conclusion
From this study it is concluded that different treatments have positive effect on higher yield and nutrient uptake of rice under SRI - system of rice intensification. Application of organic nutrients recorded (T_3) highest grain yield (3135 kg /ha), straw yield (6650 kg/ha) and harvest index (48.26%). The least grain & straw yield (2715 & 5500 kg/ha) was recorded in control treatment (T_1).

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