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Farmers' Preferences on Acceptance and Adoption of Traditional Rice Production under Organic Farming

V Dhanushkodi[1], Noorjehan AKA Hanif[2], S Sangeetha[3], R Nageswari[4] and R Jagadeesan[5]

Anbil Dharmalingam Agricultural College and Research Institute, Tiruchirappalli-620027, Tamil Nadu

ABSTRACT

Persistent nutrient depletion is posing a greater threat to organic farming. Therefore, it becomes imperative to explore the most effective organic nutrient sources for sustaining soil fertility and producing quality products. Hence, the present investigation was carried out to promote organic farming through TNAU released liquid biofertilizers *viz., Azospirillum*, Phosphate solubilizing bacteria, K Solubilizer, Zn solubilizers, PPFM application in traditional rice under organic farming. The knowledge level of the traditional rice growers in improved technologies was medium (36.0 %) to low (42.0 %) in before implement of the demonstration. The knowledge level was increased from medium (36.0 %) to high (56.0 %) after implementation of the programme. More than 68 per cent of the traditional rice growers practice panchagavya seedling dip, liquid biofertilizer seedling dip, liquid biofertilizer foliar application, foliar application of humic acid, foliar application of panchagavya in four critical stages etc. The results show that the applications of liquid biofertilizers positively increased more productive tillers (17.1 numbers), additional grain yield (18%) and straw yield (22%) compared to farmers' practice. It was observed wide variations in grain yield (3950 kg/ha) and durations (180 d duration) according to varieties. The majority of the respondents indicated that organic farming grants effective utilization of natural resources for income generation (95%) followed by nutritional security (88%). The appropriate reason for a medium to higher level of knowledge about improved production technologies of traditional rice growers might be due to KVK interventions such as awareness programme, demonstrations, training and field days.

Key Words: Adoption, Humic acid, Liquid biofertilizers, Panchagavya, Traditional rice, Yield.

INTRODUCTION

Rice is one of the most important staple cereals for more than half of the world's population, particularly in Asia. On account of the continuous world energy crisis with increasing prices of chemical fertilizer, the use of organic manures as renewable source of plant nutrients is gaining importance. Although inorganic fertilizers are a good source of nutrients for plants, they have a long-lasting and adverse effect on soil and the environment. Therefore, to minimize these adverse effects, standardization of suitable organic sources of nutrients is required Shivani *et al* (2022).

Sustaining soil and crop productivity is a challenging issue in organic farming. To encourage increasing crop yield and soil health in organic farming, beneficial bacteria has been discovered which can provide essential elements such as nitrogen, phosphorus and potash Verma *et al* (2018). Biofertilizers are an environment-friendly non-bulky and low-cost agricultural input containing a specific micro-organism in concentrated form which is derived either from the plant roots or from the soil

Corresponding Author's Email:dhanushselgi@yahoo.com.au

[1&5] Anbil Dharmalingam Agricultural College and Research Institute, Tiruchirappalli-620027, Tamil Nadu

[2]Agricultural College and Research Institute, Karur-639 001, Tamil Nadu

[3] Horticultural College and Research Institute for Women, Trichy-620 027, Tamil Nadu

[4] Tamil Nadu Rice Research Institute, Aduthurai-612 101, Tamil Nadu

Table 1. Effect of liquid biofertilizers on growth and yield of traditional rice.

Treatment	Treatment Detail	Plant height (cm)	No of productive tillers	No. of grains / panicle	Grain yield (kg/ ha)	Straw yield (kg/ha)
T_1	Farmers' practice (without liquid biofertilizer)	137.9	14.9	135.4	3460	6540
T_2	Farmers practice + Application of *Azospirillum* and *Phosphobacteria* (each 2 kg/ha)	140.5	15.6	138.7	3598	6760
T_3	Farmers practice + Liquid biofertilizer application (seed treatment (@each 125ml/ha), seedling dipping (@each 125ml/ha and main field application (@each 500ml/ha)	141.6	16.7	143.4	3757	7090
T_4	Farmers practice + Panchagavya (3%) and Humic acid (0.4%)	139.7	16.8	145.9	3680	6850
T_5	Farmers practice + Liquid biofertilizer application(seed treatment (@each 125ml/ha), seedling dipping (@each 125ml/ha and main field application (@each 500ml/ha)+ Panchagavya (3%)and Humic acid (0.4%)	146.2	17.1	150.7	3950	7250
	SEd	5.86	0.68	5.98	154.08	288.83
	CD(p=0.05)	13.52	1.59	13.79	355.32	666.05

of the root zone. Biofertilizers are one of the best modern tools and a gift of our modern agricultural science Mishra *et al* (2013). Now, biofertilizers are introduced in the form of liquid for the benefit of the farming community through sustaining soil health. Liquid biofertilizers are the specific beneficial bio-inoculants that promote the growth and yield of crops by converting the unavailable form of soil nutrients into an available form for better crop growth. Recently liquid biofertilizers like *Azospirillum*, *Phosphate solubilizing bacteria*, K solubilizer, Zn solubilizer, PPFM are gaining importance among rice growers under normal rice cultivation Poorniammal *et al* (2020). Besides, liquid-biofertilizers also induce resistance against biotic and abiotic stress in plants through biological activity on the root surface Sivasakthivelan and Saranraj (2013).

Currently, 162 countries are engaged in organic cultivation involving 37.2 million ha Yadav (2013). Asia covers thirty four percent of the world's organic producers, where India ranks 33rd in terms of total land under organic cultivation. The Green Revolution (1960s) focused on developing high-rice yielding varieties with increased yields, reducing the cropping period and increased cropping intensity with the cultivation of 2–3 crops in the same year. One of the major ecological consequences of the introduction of new high-yielding varieties through the green revolution was the depletion in the number of traditional rice varieties Ashraf and Lokanadan, (2017). Now in the face of climate change, farmers are gradually realizing that traditional rice cultivars inherently possess a valuable gene pool to adapt to climate change Krishnakutti *et al* (2021). Recently,

Table 2. Distribution of respondents based on their knowledge level . (n = 50)

Sr. No.	Category	Before Demonstration		After Demonstration	
		Number	Per cent	Number	Per cent
1	Low	21	42	6	12
2	Medium	18	36	16	32
3	High	11	22	28	56

the adoption of traditional rice for organic farming is increasing day by day. The objective of this study was to create awareness of a suitable combination of organic with locally available nutrient sources in traditional rice production and the acceptance under organic farming conditions.

MATERIALS AND METHODS

A study was carried out by the Indian Council of Agricultural Research-Krishi Vigyan Kendra, Tiruchirappalli district with traditional rice growing areas of Tiruhchirappalli district in Tamil Nadu. In this study, effect of liquid biofertilizers on sustainable soil health and yield enhancement in traditional rice' variety under organic farming was compared with farmers' practices and normal biofertilizers during *Rabi* 2020 Thooyamalli traditional rice cultivar. *Azospirillum lipoferum,*

Table 3. Knowledge level of the traditional rice growers in organic rice cultivation techniques. (n=50)

Sr. No.	Technology	Before Demonstration		After Demonstration	
		Number	Percentage	Number	Percentage
1	Use of biofertilizers @2kg/ha for seed treatment	27	52	45	90
2	Use of Panchagavya (3%) as seed treatment	22	44	41	82
3	Use of Humic acid (0.5%) as seed treatment	15	30	43	86
4	Seed treatment (Trichoderma viride @ 4g and Pseudomonas fluorescens @ 10 g/kg of seeds)	28	56	39	78
5	Foliar application of panchagavya (3%) at four critical stages	19	38	46	92
6	Foliar application of Humic acid (0.5%) at four critical stages	22	44	43	86
7	Seed treatment with liquid biofertilizers *Azospirillum lipoferum, Phosphate solubilizing bacteria Basillum megatherium, K Solubilizer Basillus mucilaginosus and Zn solubilizers* (@each 125ml/ha)	6	12	28	56
8	Foliar application of *PPFM* (@each 500ml/ ha) along with Panchagavya (3%), Humic acid (0.5%)	15	30	42	84

Phosphate solubilizing bacteria Basillum megatherium, K Solubilizer Basillus mucilaginosus and Zn solubilizers Pseudomonas chlororaphis was used for seed treatment (@each 125ml/ha), seedling dipping (@each 125ml/ha before planting and main field application (@each 500ml/ha) and foliar spray during tillering and panicle initiation stage (@each 500ml/ha) sprinkled over the crop. PPFM (*Methylobacterium aminovorans*) spray (@each 500ml/ha) was done during tillering and panicle initiation to mitigate drought. The farmer's practice of incorporation of green manure and foliar application of panchagavya (3%) was considered as a check plot. Initial and post-harvest soil samples were collected from the demonstration plot and check for analyzing soil nutrient status. Rice yield and income were recorded to interpret the trial. The responses on reasons for adoption and constraints in adoption were scored on 4 point scales fitting to the statements as very much (4), much (3) not so much (2) and not at all (1) important.

Further, the knowledge level of FLD farmers with liquid bio fertilizer application technologies of traditional rice growers before and after the interventions of KVK was measured by adopting knowledge tests Singh (1986). The knowledge level of the respondents was calculated as reported by Madhan (2002). The respondents were classified into three categories such as low, medium and high using mean and standard deviation.

RESULTS AND DISCUSSION

Yield and Income of Rice

The data (Table 1) expresses that the use of liquid biofertilizers panchagavya (3%) and humic acid (0.5%) has positively produced more grain yield in the traditional cultivar when compared to that of the check plot. The average yield data obtained from T5 liquid biofertilizers, panchagavya (3%) and humic acid (0.5%) treated plot revealed that the grain yield in traditional rice *viz.,* 3950 kg/ha increased substantially, high in the demonstration plot compared to the T1 control plot (3115 kg/ha) and the average increase in grain yield was 14.16 per cent. The increased grain yield might be due to increased nutrient status and the overall positive effect of liquid biofertilizer on soil health and ecosystem in and around the rhizosphere of the crop. A similar trend in straw yield (7250 kg/ha) also observed under T5 liquid biofertilizers panchagavya (3%) and humic acid (0.5%) treated plot. These findings were in agreement with the

Table 4. Reasons for the adoption of traditional rice under organic farming.

Sr. No.	Developmental strategies	Farmers response			
		M.F* M.S	S.F* M.S	B.F* M.S	Average M.S
1.	Soil suitability	2.7	3.3	3.5	2.7
2.	Climatic condition	2.9	3.9	3.0	2.9
3.	Reduced input cost	3.0	3.9	3.7	3.0
4.	Nutritional security	2.7	3.3	3.5	2.7
5.	Effect utilization of farm outputs	2.9	3.9	3.0	2.9
6.	Entrepreneurship development	3.0	3.4	3.6	3.0
7.	Income security	3.5	3.9	3.5	3.5
8.	Traditional practices	3.5	3.6	3.5	3.5
9.	Easy for marketing	2.3	2.3	2.4	2.3
10.	Less pest and disease incidence	3.2	3.0	3.3	3.2

**Where MF-Marginal farmer, SF-Small farmer, BF-Big farmer and M.S-Mean score.*

results obtained by Singh *et al* (2018) in groundnut and Sherpa *et al* (2019) in brinjal. Chaudhary *et al* (2015), Rahevar *et al* (2015) and Madhu Bala and Kedar Nath (2015) also found the same trend in the application of multi-strain biofertilizer on growth, pod and haulm yield of groundnut.

Economics

The application of liquid-biofertilizers, panchagavya (3%) and humic acid (0.5%) favourably increased the net return and benefit-cost ratio in traditional rice cultivation (Figure 1). The net return of Rs.157350 /ha in Thooyamalli with the liquid biofertilizer, panchagavya (3%) and humic acid (0.5%) application, which might be due to the highest grain yield and market preferred qualities (appearance & aroma) of traditional rice. From the present investigation, it can be concluded that inoculation of liquid-biofertilizer granted positive improvement in physiological traits, the productivity and the profitability of traditional rice. A similar trend was observed by Singh *et al* (2018) in the application of liquid NPK formulation along with Zn solubilizing bacteria in groundnut.

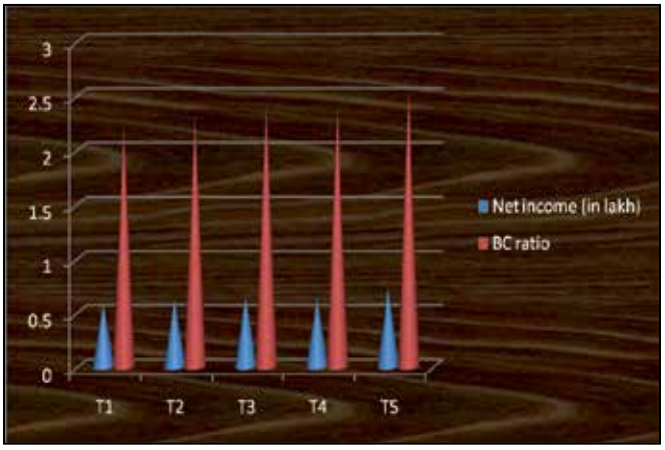

Figure 1. Effect of liquid-biofertilizers on net return and benefit-cost ratio in traditional rice cultivation

Knowledge level of the Traditional rice growers farmers

It could be inferred (Table 2) that the knowledge level of the traditional rice growers from newly released technologies was medium (36.0 %) to low (42.0 %) in before implement of the demonstration programme. The knowledge level was increased from medium (36.0 %) to high (56.0 %) after implementation of the programme. This might be due to the fact that KVK conducted the demonstration programme and extended activities such as training programmes and field day.

It can be observed from the above Table 3, that before implementation of the demonstration programme only around twenty seven percent of the respondents had knowledge of improved traditional rice cultivation practices and foliar application of liquid bio fertilizers, but after implementation of the programme it has been increased to 92 per cent. More than 90 percent of the respondents had knowledge of foliar application of panchagavya (3%) at four critical stages.

According to the pest management, 6 per cent of the respondent had knowledge on the seed treatment with liquid biofertilizers before implementation of the programme. This has been increased to 56 per cent. The probable reason for this increased level of knowledge might be due to the resulting demonstration of the liquid-biofertilizers, panchagavya (3%) and humic acid (0.5%) and which resulted in more yield and profit. Similarly, Asiwal *et al* (2005) also reported that an increase in productivity and income gain under demonstration over traditional practices of blackgram cultivation.

Reasons for the adoption of traditional rice under organic farming

The majority of the respondents indicated that organic farming grants effective utilization of natural resources for income security (3.5%) and traditional practices (3.5%) followed by less pest and disease incidence (3.2%). Traditional rice is being used by traditional healers and local farmers in ayurveda for curing of various kinds of treatment in improving immunity, strengthening bone, curing stroke, joint pain, diabetics, high blood pressure and skin disease, protect from cancer and kidney problems and improve digestion as they are abundant

in antioxidants, antiviral properties, vitamins and minerals etc.,. Farmers also expressed that some of the traditional paddy varieties are resistant to biotic and abiotic stress (Table 4).

CONCLUSION

Proficient nutrient management is essential through organics for enhancing crop yield and improving soil health for long-term sustainability. The success of organic agriculture can be greatly influenced by the adoption of advanced technologies like liquid bio-fertilizers and PGPRs for crop growth and soil fertility. Use of organic and green manures along with liquid biofertilizers fertilizers viz., *Azospirillum lipoferum, Phosphate solubilizing bacteria, Basillum megatherium, K Solubilizer Basillus mucilaginosus and Zn solubilizers and PPFM* has been found effective in paddy cultivation under organic farming play a vital role to obtain maximum grain yield, income and improving soil fertility. From the study, it can be concluded that obtaining more yield in traditional rice as well as profit will be possible with liquid bio-fertilizers and needs to be promoted among the farmers to achieve success in organic farming. Therefore, the integration of liquid biofertilizers is the most important biological resource.

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