A Study on Knowledge Level of Rice Growers on Green Technologies in Rice Based Ecosystem for Sustainable Agriculture in Madurai and Trichy District of Tamil Nadu

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The present study was conducted in Trichy and Madurai district of Tamil Nadu. From each district two blocks were selected. Thus, the total sample size of 240 were selected for the present investigation. that higher percentage of the Trichy farmers had high level of knowledge towards green technologies (43.33%) followed by low (36.67%) and medium (20.00%) level of knowledge towards green technologies. Meanwhile, half of the Madurai farmers had high level of knowledge

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(50.00%) followed by low (36.67%) and medium (13.33%) level of knowledge towards green technologies.The R^2 value indicated that all the variables contributed 59.60% and 66.90% variation in the knowledge level among the respondents of Trichy and Madurai district respectively.

1. INTRODUCTION

An eco-friendly technology otherwise also known as green technology can be defined as the use of knowledge and resources in a systematic way to produce desired output without harming the environment. The world population is expected to increase over 10 billion by 2050. Such a growth in population has created and would create unprecedented pressures on the limited natural resources base to produce additional food, fiber, fuel and raw materials.The development and the transfer of eco-friendly technologies is interlinked with government extension agencies. Hence, it becomes necessary to study the efforts of the major promoters of agriculture in promoting eco-friendly technologies. Considerable attention is being paid to the eco-friendly technologies in different parts of the world. As the onus for promoting agricultural technologies is with the extension agencies, they must adapt themselves to the new environmental imperatives. In this point of view, agricultural extension is the educational process of advising and assisting farm women in getting the best use of agricultural land and other natural resources in their care in the context of prevailing economical, technical, social and institutional conditions. The present study was undertaken to study the extent of knowledge level of recommended green technologies for paddy cultivation.

2. MATERIALS AND METHODS

The study was conducted in Trichy and Madurai districts of Tamil Nadu. From Madurai district two blocks namely Melur and Madurai east, from Trichy, Lalgudi and Thiruverambur blocks were selected and from each block three villages were identified for the study. A total of sample size of 240 farmers were selected from each village by using proportionate random sampling. For measuring knowledge, a Teacher made knowledge test was developed. A list of 25 knowledge items was constructed by using pertinent literature as well as extensive consultations with scientists and specialists. Judges opinion were obtained. The responses were binary in nature, such as 'Yes' and 'No'.

Each accurate response received a score of 2 and each incorrect responses received a score of 1. By using cumulative frequency method, knowledge level of respondents were categorized into low, medium and high. Correlation and regression analysis was carried out to study the association and contribution of each variable on knowledge level for both the districts.

3. RESULTS AND DISCUSSION

3.1 Knowledge Level of Farmers Utilizing Green Technologies in Rice-based Ecosystem

The knowledge level of farmers utilizing green technologies in rice-based ecosystem in Madurai and Trichy district is studied and presented in Table 1.

From Table 1, it was observed that among the Trichy district farmers, most of them had knowledge on Azospirillum seed treatment in rice cultivation and its quantity to be used in seed treatment (90.00%). In the case of Madurai district farmers, 83.33 per cent of the paddy farmers had knowledge on azospirillum seed treatment. Majority of the farmers of Trichy district had knowledge on the recommended water level after panicle initiation to before maturation (3.33%) whereas more than half of the rice growers of Madurai district had knowledge (53.33%) on recommended water level in paddy cultivation.

Further examination of the table reveals that 83.33 and 90 per cent of Trichy district and Madurai district farmers were found to be knowledgeable on FYM required for paddy cultivation respectively. Meanwhile, it was found that 10.00 per cent of the farmers of Trichy district had knowledge on the crops which can be grown as a green manure in paddy cultivation. Among Madurai district farmers, 83.33 per cent knowledge towards usage of green manure in paddy cultivation. Around 13.33 per cent of the farmers of Trichy district had knowledge on the quantity of green manure to be incorporated in

Table 1. Knowledge level of Madurai and Trichy district farmers utilizing green technologies in rice-based ecosystem (n = 240)

S. No.	Statements	Response							
		Trichy (n=120)				Madurai (n=120)			
		Yes		No		Yes		No	
		No.	%	No.	%	No.	%	No.	%
1	The quantity of Azosprillum used per kg of seeds for seed treatment	108	90.00	12	10.00	100	83.33	20	16.67
2	Mention the ideal spacing of paddy cultivation	100	83.33	20	16.67	92	76.67	28	23.33
3	The recommended nursery area for one hectare of rice cultivation .	100	83.33	20	16.67	108	90.00	12	10.00
4	The recommended water level after panicle initiation to before maturation	4	3.33	116	96.67	64	53.33	56	46.67
5	How much quantity of FYM is required for paddy cultivation	100	83.33	20	16.67	108	90.00	12	10.00
6	Name any one crop that is used as green manure in paddy cultivation ?	12	10.00	108	90.00	100	83.33	20	16.67
7	What is the quantity of incorporation of green manure in paddy cultivation / ha?	16	13.33	104	86.67	76	63.33	44	36.67
8	Name one purpose of wood ash	28	23.33	92	76.67	28	23.33	92	76.67
9	Azolla is incorporated in the paddy field during which stage	12	10.00	108	90.00	40	33.33	80	66.67
10	Mention the quantity of azospirillum that can be broadcastin paddy field	84	70.00	36	30.00	32	26.67	88	73.33
11	Mention one purpose of leaf colour chart	24	20.00	96	80.00	60	50.00	60	50.00
12	Mention one advantage of SRI technique	32	26.67	88	73.33	24	20.00	96	80.00
13	Name one method that is used to test the nutrients in the soil	40	33.33	80	66.67	28	23.33	92	76.67
14	Name one purpose of cono weeder	36	30.00	84	70.00	32	26.23	88	76.67
15	What is the proportion of raw materials in panchakavya and amirdhakaraisal?	60	50.00	60	50.00	84	70.00	36	30.00
16	How can be egg masses of stem borer be eliminated	32	26.67	88	73.33	28	23.33	92	76.67
17	Mention the stage at which clipping off rice seedling tips can be done	32	26.67	88	73.33	36	30.00	84	70.00

S. No.	Statements	Response							
		Trichy (n=120)				Madurai (n=120)			
		Yes		No		Yes		No	
		No.	%	No.	%	No.	%	No.	%
18	Trap effective against the infestation of yellow stem borer	28	23.33	92	76.67	32	26.67	88	73.33
19	During which stage paddyegg parasitoids is released	76	63.33	44	36.67	76	63.33	44	36.67
20	Mention the quantity of neem oil that can be sprayed /ha	80	66.67	40	33.33	88	73.33	32	26.67
21	The purpose of light trap installation	8	6.67	112	93.33	76	63.33	44	36.67
22	The number of bird perches that can be set up/ha	12	10.00	108	90.00	88	73.33	32	26.67
23	Name the purpose of bunding in paddy cultivation	80	66.67	40	33.33	80	66.67	40	33.33
24	The quantityof *Pseudomonasfluroscens* used as foliar spray	12	10.00	108	90.00	36	30.00	84	70.00
25	Mention the disadvantage of burning of crop residues in paddy field	32	26.67	88	73.33	32	26.67	88	73.33

paddy cultivation. Less than two-third of the Madurai rice growers (63.33%) were found to be knowledgeable on incorporation of green manure in paddy cultivation.

Similarly, majority of the Trichy farmers had no knowledge (90%) and knowledge (10%) of the azolla usage as a biofertilizer; whereas, among Madurai farmers, two-third of the farmers had no knowledge (66.67%) on azolla as biofertilizer. Higher percentage of the farmers of Trichy district had knowledge (70.00%) and no knowledge (30%) on azospirillum usage as biofertilizer respectively. Two-third of the Trichy paddy farmers (66.67%) and three-fourth of the paddy farmers in Madurai district had no knowledge (76.67%) on soil health card management.

Around thirty per cent of the farmers of Trichy district were found to be knowledgeable on useconoweeder for weeding in rice field. Among Madurai farmers, 26.23 per cent had knowledge on weeding in rice field. Exactly half of the Trichy district farmers had knowledge (50%) on the usage of Panchakavya and Amirdhakaraisal as plant growth regulators whereas, 70 per cent and 30 per cent of the Madurai district farmers had knowledge and no knowledge on usage of plant growth regulators. Similarly, 26.67 per cent of

them had knowledge on the clipping of tip of the seedlings for elimination of stem borer egg mass remaining three-fourth of the farmers of Trichy district had no knowledge on this practice.

Regarding the effective trap for yellow stem borer, 76.67 and 26.67 per cent of Trichy and Madurai rice growers were found to be knowledgeable. With reference to the farmer's knowledge level regarding the egg parasitoids, 63.33 per cent and 36.67 per cent of Trichy and Madurai district farmers had knowledge and no knowledge on it.

Eventually, 10.00 per cent of the Trichy farmers had knowledge and no knowledge on the installation of bird perches for destruction of leaf folder respectively; 73.33 per cent of the Madurai farmers had knowledge. Most of the farmers had no knowledge (90.00%) and knowledge (10.00%) on the usage of *Pseudomonas fluroscens*as foliar spray. Similarly, a little less than three-fourth of the Madurai farmers had no knowledge (70.00%) and knowledge (30.00%) on usage of *Pseudomonas fluroscens*as foliar spray.

Based on the findings, it can be observed that farmers were found to have high level of knowledge on organic farming, increased social

and environmental concern regarding good and healthy food motivate the farmers to adopt organic and eco-friendly practices. Simultaneously, increased level of information sources, higher level of extension participation and extension contact inspired the farmers to adopt eco-friendly practices; which in turn increased their knowledge level towards green technologies in paddy cultivation. Further, contrary findings were reported by Rathod et al. [1], Suji et al. [2], Rahaman et al. [3] and Balamurugan et al. [4].

3.2 Overall Knowledge Level of Farmers Utilizing Green Technologies

The overall knowledge level of farmers utilizing green technologies in rice-based ecosystem in Madurai and Trichy district is studied and presented in Table 2.

From Table 2, it was revealed that higher percentage of the Trichy farmers had high level of knowledge towards green technologies (43.33%) followed by low (36.67%) and medium (20.00%) level of knowledge towards green technologies. Meanwhile, half of the Madurai farmers had high level of knowledge (50.00%)

followed by low (36.67%) and medium (13.33%) level of knowledge towards green technologies.

On contrary to findings of Rathod et al. [1], Suji et al. [2], Rahaman et al. [3] and Balamurugan et al. [4], from the present study, the farmers of Madurai and Trichy district were found to have high level of knowledge towards green technologies. Meanwhile, similar findings were reported by Suji et al. [2] and Upadhyay et al. [5]. Eventually, Singh et al. (2013) identified higher level of knowledge gap among the farmers and Masso and Man [6] & Rahaman et al. [3] suggested to intensify the awareness and knowledge level of farmers towards green technology practices.

3.3 Relationship between the Profile Characteristics of Trichy and Madurai Farmers and their Knowledge Level on Green Technologies

To find out the relationship between the dependent variable knowledge and the selected independent variables, simple correlation and multiple regression analysis were worked out separately for Trichy and Madurai and the results are presented in Table 3.

Table 2. Overall knowledge level of madurai and trichy district farmers utilizing green technologies in rice-based ecosystem n=240

S. No.	Overall knowledge level of green technologies	Respondents – Farmers					
		Trichy		Madurai		Total	
		F	%	F	F	%	F
1	Low	44	36.67	44	36.67	88	36.67
2	Medium	24	20.00	16	13.33	40	16.66
3	High	52	43.33	60	50.00	112	46.67
Total		120	100.00	120	100.00	240	100.00

Table 3. Correlation analysis of profile characteristics of Trichy and Madurai farmers with their knowledge level on green technologies

Sl. No.	Characteristics	'r' value Trichy farmers	'r' value Madurai farmers
X_1	Age	-0.350**	0.087
X_2	Education	0.240**	0.097
X_3	Occupation	-0.169	0.222*
X_4	Farm size	0.022	-0.165
X_5	Farming experience	-0.241**	-0.037
X_6	Annual income	-0.128	-0.061
X_7	Information seeking behavior	-0.227*	-0.224*
X_8	Extension participation	-0.015	-0.161
X_9	Social participation	-0.681**	-0.673**
X_{10}	Innovativeness	-0.011	-0.171
X_{11}	Economic motivation	-0.045	-0.149

Sl. No.	Characteristics	'r' value Trichy farmers	'r' value Madurai farmers
X_{12}	Perception on use of green technology	-0.015	-0.312**
X_{13}	Perception on environmental degradation	-0.212*	0.295**
X_{14}	Perception on feasibility of green technology agricultural practices	-0.011	0.075
X_{15}	Perception on use of synthetic fertilizers	0.008	0.224*

In the case of Trichy district, it could be observed from Table 3, that out of fifteen variables analysed, six variables have established significant association with knowledge on green technologies. The variable education(X_2) was found to be significant and positively associated at one percent level of probability. The variables age (X_1), farming experience (X_5) and social participation(X_9) were found to negatively significant and associate with knowledge level on one per cent level of probability. Information seeking behavior (X_7) and perception on environmental degradation innovativeness (X_{13}) have been found to besignificant and negatively associated with knowledge level at five percent level of probability [7-9].

From Table 3, it was reported that education status of the Trichy farmers had positive and significant association with their knowledge level on green technologies at 1 per cent level of probability. Since education status of a farmer increases, they learn new things and their knowledge level increases which significantly increases their knowledge level on green technologies.

From Table 3, it revealed that information seeking behaviour of the Trichy farmers had negative and significant association with their knowledge level on green technologies at 5 per cent level of significance. Since information seeking behaviour of farmers on chemical fertilizers increases, their knowledge on green technologies decreases.

From Table 3, it was evident that social participation of the Trichy farmers had negative and significant association with their knowledge level on green technologies at 1 per cent level of significance. Increased social participation of farmers hinders their participation in agricultural activities; thus, it limits the knowledge level of the farmers on green technologies.

From Table 3, it was observed that perception on environmental degradation of the Trichy farmers had negative and significant association with their knowledge level on green technologies at 5 per cent level of significance. Since the observability of the relative advantage of the green technology is relatively low than chemical fertilizers, farmers were not aware of the harmful effects of chemical fertilizers in deteriorating and polluting the environment.

In the case of Madurai district, it could be observed from Table 3, that out of fifteen variables analysed, six variables have established significant association with knowledge on green technologies. The variable perception on environmental degradation innovativeness (X_{13}) was found to be significant and positively associated at one percent level of probability.

Variables namely occupation(X_3) and Perception on use of synthetic fertilizers(X_{15}) was found to be significant and positively associated at five percent level of probability whereas variables social participation(X_9) and Perception on use of green technology(X_{12}) were found to significant and associated negatively with knowledge level on one per cent level of probability. Information seeking behavior (X_7) have been found to besignificant and negatively associated with knowledge level at five percent level of probability.

The contribution of each characteristic towards knowledge level of Trichy farmers on green technologies was examined using multiple regression analysis and the results are presented in Table 4. It indicated that co-efficient of determination (R^2value) for the farmers was 0.596, which depicts that all the fifteen independent variables chosen for the study together explained for 59.60 per cent of variation in the knowledge level of farmers on green technologies. The prediction equation fitted for

Table 4. Multiple regression analysis of profile characteristics of Trichy and Madurai farmers with their knowledge level on green technologies

Sl. No.	Characteristics	Trichy			Madurai		
		Regression co-efficient	Standard error	t-value	Regression co-efficient	Standard error	t-value
X_1	Age	-0.112	0.097	-1.153	-0.269	0.186	-1.446
X_2	Education	0.201	0.034	5.890	0.070	0.069	1.018
X_3	Occupation	-0.136	0.052	-2.607	0.189	0.065	2.900
X_4	Farm size	0.750	0.074	10.196	-0.272	0.118	-2.310
X_5	Farming experience	0.055	0.066	0.840	0.145	0.114	1.269
X_6	Annual income	0.149	0.094	1.585	0.124	0.137	0.905
X_7	Information seeking behaviour	-0.404	0.099	-4.100	-0.640	0.147	-4.362
X_8	Extension participation	0.282	0.082	3.428	-0.211	0.122	-1.727
X_9	Social participation	-1.234	0.075	-16.487	-0.831	0.130	-6.410
X_{10}	Innovativeness	0.133	0.064	2.061	-0.200	0.102	-1.955
X_{11}	Economic motivation	-0.566	0.092	-6.163	-0.395	0.132	-3.000
X_{12}	Perception on use of green technology	0.237	0.100	2.363	-0.360	0.123	-2.922
X_{13}	Perception on environmental degradation	-0.170	0.081	-2.104	0.219	0.142	1.538
X_{14}	Perception on feasibility of green technology agricultural practices	0.050	0.082	0.616	0.087	0.124	0.705
X_{15}	Perception on use of synthetic fertilizers	0.295	0.089	3.300	0.231	0.130	1.778

* = Significant at 5% ** = Significant at 1%
Trichy district
R^2 = 0.596 F=32.89 a= 1.838
Madurai district
R^2 = 0.669 F=14.005 a= 5.155

knowledge level of farmers on green technologies is given below.

$Y1 = 1.838 - 0.350^{**} (X_1) + 0.240^{**} (X_2) - 0.169 (X_3) + 0.022 (X_4) - 0.241^{**} (X_5) - 0.128 (X_6) - 0.227^* (X_7) - 0.015 (X_8) - 0.681^{**} (X_9) - 0.011 (X_{10}) - 0.045 (X_{11}) - 0.015 (X_{12}) - 0.212^* (X_{13}) - 0.011 (X_{14}) + 0.008 (X_{15})$

In the case of Madurai district, co-efficient of determination (R^2 value) for the farmers was 0.669, which depicts that all the fifteen independent variables together explained for 66.90 per cent of variation in the knowledge level of the farmers on green technologies. The prediction equation fitted for knowledge level of the farmers on green technologies is given below.

$Y2 = 5.155 + 0.087 (X_1) + 0.097 (X_2) + 0.222^* (X_3) - 0.165 (X_4) - 0.037 (X_5) - 0.061 (X_6) - 0.224^* (X_7) - 0.161 (X_8) - 0.673^{**} (X_9) - 0.171 (X_{10}) - 0.149 (X_{11}) - 0.312^{**} (X_{12}) + 0.295^{**}(X_{13}) + 0.075 (X_{14}) + 0.224^* (X_{15})$

From Table 4, it was observed that occupation of Madurai farmers had positive and significant association with their knowledge level on green technologies at 5 per cent level of significance. Since, occupation of the majority of the farmers is farming alone, they tend to increase their knowledge on improved agricultural practices to keep them updated in their occupation.

From the Table 4, it was observed that information seeking behvaiour of Madurai farmers had negative and significant association with their knowledge level on green technologies at 5 per cent level of significance. As information source of farmers might vary and may prefer the usage of chemical fertilizers, which affects the knowledge level on green technologies in a negative way.

From the Table 4, it was reported that perception on environmental degradation of the Madurai farmers had positive and significant association with their knowledge level on green technologies at 1 per cent level of significance. As farmers were not aware of the harmful effects of synthetic fertilizers, as they concern for increased yield and income; their perception on environmental degradation might not improve their knowledge on green technology.

From the Table 4, it was observed that perception on use of agricultural practices of the Madurai farmers had positive and significant association with their knowledge level on green technologies at 5 per cent level of significance. Though, farmers prefer chemical fertilizers for quicker results, their concern on field fertility and longterm productivity might influence their knowledge level on green technology.

4. CONCLUSION

The study revealed that majority of the respondents of both Trichy and Madurai district came under higher knowledge level on green technologies. The policy makers should arrange training programmes at farm level to increase the knowledge level of farmers on green technologies. Extension professionals may concentrate to impart skill demonstration on various aspect like bio input, use of various traps, encouraging minimal use of chemicals.The green technologies can ensure healthy, culturally compatible and sustainable life. Hence efforts need to be taken by the extension offcials to popularize the importance of these practices.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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