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Determinants of Resource Conservation Technologies (RCTs) Adoption in Rice (*Oryza Sativa* L.) Cultivation under Rainfed Farming Condition

Sony Devi[1], A.K. Singha[2#], R. Bordoloi[3] and P.C. Jat[2*]

[1] College of Post Graduate Studies, Central Agricultural, University, Barapani 793 103, Meghalaya, India
[2] Zonal Project Directorate, Zone-III, ICAR, Barapani 793 103, Meghalaya, India
[3] KVK Ribhoi, Meghalaya, India
Mobile: [2#]<9436349584>, [2]<8414028001>, [3]<9436337276>,*
E-mail: [1]<sonykshetri@gmail.com>, [2]<arunkumar_singha@yahoo.co.in>,*
[2#]<jat4pc@gmail.com>,[3]<rmbshl@rediffmail.com>

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ABSTRACT The study for assessing the determinants of adoption of resource conservation technologies in rice (*Oryza sativa* L.) cultivation was conducted in Imphal West district of Manipur state, India with 120 sample size selected through proportionate random sampling from 10 villages in the district during January-March, 2012. Data collection from the selected respondents was made with the help of pre-tested structured schedule through personal interview method. The study reveals that nearly half of the respondents had medium level of adoption of resource conservation technologies in rice cultivation followed by low and high. Investigation reveals that a formidable proportion of farmers in the study area although had good knowledge on resource conservation technologies in agriculture, could not adopt them with full recommendations. Except the practices like seed selection and water management, all other practices were with partial adoption by almost every respondents in rice cultivation The study further shows that out of 12 selected independent variables under study, except age and size of operational land holding, all the variables were found having positively significant relationship with the adoption level of the respondents. While three variables namely; innovation proneness, attitude towards RCTs and knowledge towards RCTs had emerged as the most dominant factors influencing to the adoption level of farmers of resource conservation technologies in rice cultivation.

INTRODUCTION

The growing concern over sustainability in agriculture is one of the most important phenomena during the recent years, which in simplest term focuses on sustainability of production and productivity over an extended scale of time and space. Indian agriculture has witnessed spectacular advances in the food grain production and productivity, which plays a significant role in the overall socio-economic fabric of the nation. The overall GDP has grown by an average of 8.62 % during 2004-05 to 2010-11 in which, agricultural sector GDP has increased by only 3.46 % during the same period (Economic Survey 2010-11). Intensive agriculture and excessive use of external inputs among others, contribute to this significant growth, which in turn, however, lead to the degradation of soil, water and genetic resources. These adverse effects are manifested through shortage of water, degradation of soil health, deterioration of water quality, emission of greenhouse gases (GHGs) such as methane causing global warming and pollution.

In view of overriding concerns for ensuring food security through sustainable agriculture and growing resource degradation problems worldwide, conservation agriculture (CA) has emerged as an alternative strategy to sustain agricultural production. Conservation agriculture is based on the principle of enhancing natural biological process in such a way and quantity that mechanical soil tillage and use of external inputs are reduced to an absolute minimum to avoid interference with or disrupt the biological processes. It has been widely recognized that intensive and conventional agricultural practices in North Eastern Region of India cause continuous degradation of natural resources, posing a serious threat to the sustainability of agriculture. Resource conservation technologies (RCTs) using locally available resources encompass practices that enhance resource and inputs use efficiency and thus provide immediate, identifiable and demonstrable

economic benefits such as reduction in production costs, water saving, fuel, labour requirements and timely establishment of crops resulting in improved yields. Singh et al. (2011) highlighted superiority of RCTs over the conventional practices in terms of cost saving and efficient inputs-use.

It is, therefore imperative to consider suitable resource conservation technologies in agronomic practices, which are not only economical and helpful for better growth and development but also, enable to utilize valuable resources efficiently and conserve them for future generations. Of late, however, attention has been directed towards the crucial role that farmers can play in the sustainable management of resources. The question is how to involve the farmers in the sustainable development of agriculture through RCTs management activities. One way is to start understanding their adoption behaviour or ways of using and managing their resource conservation technologies in agriculture. The study, therefore, is designed to explore the farmers' adoption behavior towards RCTs in rice cultivation and to better understand the dominant factors responsible for increasing their adoption level.

Objectives

1. To determine the extent of adoption of Resource Conservation Technologies (RCTs) in rice cultivation by the respondents.
2. To analyze the relationship and influence of socio-economic and psychological characteristics of respondents with and on their extent of adoption of RCTs in rice cultivation.

MATERIAL AND METHODS

The present study was carried out in Imphal West district of Manipur state of India, which comprises of two agricultural sub-division namely; Imphal West-I and Imphal West-II. A total of 120 respondents were selected with 60 respondents from 5 selected villages of each subdivision by using proportionate random sampling. Data collection from the selected respondents was made with the help of pre-tested structured schedule through personal interview method during the period of January-March 2012.

The independent variables *viz.*, age, education, social participation were measured with the help of scales developed by Trivedi and Pareek (1964) with little modification. The variables- size of operational land holding, annual income, extension contact and mass media exposure were measured with the help of schedules structured for the study. The psychological variables namely; economic motivation, risk orientation and innovative proneness were measured with the help of scales developed by Parani Kumar (1999), Supe (1969) and Moulik and Rao (1965) with slight modification. Scale was constructed by judges' rating to measure the variables, attitude towards resource conservation technologies (RCTs) and knowledge towards resource conservation technologies (RCTs).

The dependent variable selected for this investigation was the extent of adoption of selected resource conservation practices in rice cultivation. The extent of adoption of the respondents was measured with a set of questions prepared on various aspects of adoption of selected resource conservation practices in rice cultivation. For this purpose, a list of resource conservation practices in rice cultivation was prepared in consultation with different literatures and discussion with experts in the field of resource conservation in agriculture ranging from seed selection to harvesting of rice. A schedule consisting of questions against each selected practices was administered to the intended respondents by assigning the answer Yes/ No with 1 score for 'Yes' and 0 for 'No' response. Three categories of respondents namely; "Full adoption", "Partial adoption" and "No adoption" were made for each of the practices in the present study. A farmer is considered having "Full adoption" on a practice when he fully complied with the recommendations for that practice, deviation from recommendations was considered as "Partial adoption" and when the respondent did not at all adopt the recommendation, he was put in the "No adoption" category for that practice. Finally, on the basis of the scores obtained, the respondents were classified into three categories of the level of adoption by applying cumulative cube root method ($3\sqrt{}$ F).

RESULTS AND DISCUSSION

Extent of adoption of RCTs

The results presented in the Table 1 indicate that nearly half (48.33%) of the respondents had

medium level of adoption of resource conservation technologies in rice cultivation followed by low (45.83 %) and only 5.84% of the respondent were found in high adoption category of resource conservation practices in rice cultivation. Further investigation reveals that a formidable proportion of farmers in the study area although with good knowledge on resource conservation technologies in agriculture, could not adopt them in full due to their poor nature of short term/ immediate returns in small farming situation coupled with poor economic conditions of the farmers. This by and large, attributed to the medium level of adoption of RCTs in rice cultivation by majority of farmers. The findings are in conformity with the findings of Raghavendra (2005), Marradi (2006), and Singh et al. (2010).

Table 1: Distribution of respondents according to their extent of adoption of RCTs in rice cultivation (n=120)

Category	*Score range*	*Frequency (f)*	*Percentage (%)*	*Mean*	*S.D.*
Low	20-35	55	45.83	36.15	6.31
Medium	35-45	58	48.33		
High	45-50	7	5.84		
Total		120	100.00		

Practice-wise Adoption Level of RCTs

The information pertaining to the practice-wise extent of adoption of RCTs in rice cultivation is given in Table 2.

From the Table 2, it can be clearly seen that out of the nine selected practices namely; seed selection, seed treatment, land preparation/ soil tillage practices, sowing and transplanting, weed management, soil fertility and nutrient management, water management, plant protection measures and harvesting, over half (55.00%) of the respondents were found full adoption of all the water management recommendations/ practices such as rain water conservation, withdrawing water/ draining out water after grain filling stage, drainage at maximum tillering stage and irrigation at a depth of 5cm when ponded water disappears.

Whereas, in case of practices like land preparation/soil tillage practices, sowing and transplanting, weed management, soil fertility and nutrient management, plant protection measures and harvesting, all the respondents had reported their partial adoption in rice cultivation. The table also shows that 4.17% and 0.83% respondents had no adoption of seed treatment and seed selection respectively.

Table 2: Practice-wise extent of adoption of respondents of RCTs in rice cultivation (n=120)

Practice	*Full adoption*		*Partial adoption*		*No adoption*	
	f	*%*	*f*	*%*	*f*	*%*
Seed selection	36	30.00	83	69.17	1	0.83
Seed treatment	0	0.00	115	95.83	5	4.17
Land preparation / Soil tillage practices	0	0.00	120	100.00	0	0.00
Sowing and transplanting	0	0.00	120	100.00	0	0.00
Weed management	0	0.00	120	100.00	0	0.00
Soil fertility and nutrient management	0	0.00	120	100.00	0	0.00
Water management	66	55.00	54	45.00	0	0.00
Plant protection measures	0	0.00	120	100.00	0	0.00
Harvesting	0	0.00	120	100.00	0	0.00

The study indicates that farmers, by and large, had partial adoption of all the selected RCT practices in rice cultivation except water management where majority of them were found in full adoption category of the recommendations. Extension efforts therefore, may be strengthened through different capacity building programmes for the farmers for full adoption of RCTs in rice cultivation.

Relationship of Socio-economic and Psychological Characteristics of Respondents with Their Extent of Adoption of RCTs in Rice Cultivation

In order to study the nature of relationship between the selected socio-economic and psychological characteristics and extent of adoption of RCTs in rice cultivation, rank order correlation coefficients were calculated with the help of computer software SAS 9.2. The results are given in Table 3.

Table 3: Spearman's rank order correlation coefficients of socio-economic and psychological characteristics of the respondents with extent of adoption of RCTs in rice cultivation

Independent variables	*Rank order correlation ('r)*	*coefficients 'p' value*
Age	-0.0717	0.4362
Education	0.2662**	0.0033
Size of operational land holding	-0.0104	0.9103
Annual income	0.2783**	0.0021
Social participation	0.3137**	0.0005
Extension contact	0.5499**	<.0001
Mass media exposure	0.3861**	<.0001
Economic motivation	0.2765**	0.0022
Risk orientation	0.4362**	<.0001
Innovation proneness	0.7299**	<.0001
Attitude towards RCTs	0.72184**	<.0001
Knowledge towards RCTs	0.7145**	<.0001

**Significant at 0.01 level of probability

From the Table 3, it is seen that out of 12 independent variables namely; age, education, size of operational land holding, annual income, social participation, extension contact, mass media exposure, economic motivation, risk orientation, innovation proneness, attitude towards RCTs and knowledge towards RCTs, except two variables - age and size of operational land holding, other variables were found with positively significant correlation with the extent of adoption of RCTs in rice cultivation as evident from their corresponding 'r' values having significant at 0.01 level of probability. This indicates that higher the level of those positively significant variables of the respondents higher would be their level of adoption of RCTs in rice cultivation. Hence, the concerned stakeholders in the district should pay higher emphasis to improve and develop these variables through different capacity building programmes supported by the provision for infra- structure facilities and inputs. The findings are in conformity with those of Das (1991) and Reddy (2006) in case of knowledge level, innovation proneness and attitude of farmers towards sustainable cultivation practices. In contrary to the results, Shashidhara (2006) and Venkatesh et al. (2008) reported non-significant association between economic motivation and innovation proneness with adoption of eco-friendly practices of vegetables and integrated pest in tomato.

Relative Influence of Selected Socio-economic and Psychological Characteristics of the Respondents on Their Extent of Adoption of RCTs in Rice Cultivation

The multiple regression analysis was employed to determine the relative influence of each independent variable in explaining the variation in the dependent variable. The twelve independent variables namely; age, education, size of operational land holding, annual income, social participation, extension contact, mass media exposure, economic motivation, risk orientation, innovation proneness, attitude towards RCTs and knowledge towards RCTs were included for the purpose of this study. The predictive power of each multiple regression was estimated by working out the value of co-efficient of determination (R^2).

To test the statistical significant of the regression co-efficients, the 't' values were also calculated. The results of this analysis are given in Table 4.

Table 4: Multiple regression analysis of independent variables with extent of adoption of RCTs in rice cultivation

Independent variables	*'b' value*	*'t' value*	*Pr>F*
Age	-0.0112	-0.2808	0.7794
Education	0.2349	0.7000	0.4854
Size of operational land holding	-0.4366	-1.9228	0.0572
Annual income	0.0000	0.6162	0.5391
Social participation	0.1087	0.6429	0.5216
Extension contact	0.1860	1.2691	0.2071
Mass media exposure	0.2368	0.8609	0.3912
Economic motivation	0.1635	1.0599	0.2915
Risk orientation	0.1521	1.0006	0.3193
Innovation proneness	0.4377	2.5529*	0.0121
Attitude towards RCTs	0.3936	2.4767*	0.0148
Knowledge towards RCTs	0.4743	4.4688**	<.0001

F- Value = 19.90** R^2 =0.6906

**Significant at 0.01 level of probability
*Significant at 0.05 level of probability

A close look at the regression co-efficient given in Table 4 reveals that 3 (three) out of 12 (twelve) independent variables *viz.*, innovation proneness, attitude towards RCTs and knowledge towards RCTs, as shown by their signifi-

cant 't' values, had significant contribution to their extent of adoption of RCTs in rice cultivation. This means that those positively significant variables had significant contribution to the level of adoption of RCTs in rice cultivation.

The R^2 value of 0.6906 clearly signifies that all the twelve independent variables taken together helped in explaining about 69.06% of the total variation in respondents' extent of adoption of RCTs in rice cultivation.

F' ratio value of 19.90 was found significant at 0.01 level of probability, indicating that all the 12 (twelve) independent variables contributed significantly in the variation of respondents on their extent of adoption of RCTs in rice cultivation.

CONCLUSION

The findings reveal that the majority of the farmers had low to medium level of adoption of selected RCTs in rice cultivation. Some of the specific practices under different major practices although very much relevant with RCTs in rice cultivation were not adopted by any of the farmer. It is important for the technologies to continue being promoted since demand for resource conserving technologies among the farmers increases in the changing agricultural concern. Without knowledge of the existing technologies, farmers cannot adopt them, even though they are appropriate for their particular situations. This implies that extension workers and the concerned stakeholders should gear up and continue their efforts in intensifying the awareness programmes on the significant role of RCTs in sustainable agriculture. Necessary technical guidance through specific training programmes followed by other extension efforts may be taken up by the concerned line departments / organisations including Krishi Vigyan Kendras (KVKs) in the state on such no adoption practices. The findings also indicate that the variables such as innovation proneness, attitude towards RCTs and knowledge towards RCTs of the respondents had significant impacts on the extent of adoption of RCTs in rice cultivation as evident by their corresponding significant 't' values of multiple regression coefficients. There is a call for extension agencies and other allied departments to manipulate these crucial factors in order to bring about desirable changes in the present RCTs adoption behaviour of farmers in agriculture through different extension efforts and programmes.

RECOMMENDATIONS

The major findings of the present study have a measure of implications for extension workers, agricultural scientists, planners, policy makers and administrators. Some of the important recommendations are given below.

- The findings on extent of adoption reveal that the majority of the farmers had low to medium level of adoption of selected RCTs in rice cultivation. This implies that extension workers and the concerned stakeholders should gear up and continue their efforts in intensifying the awareness programmes on the significant role of RCTs in sustainable agriculture.
- It is seen that 3 (three) out of 12 (twelve) independent variables *viz.*, innovation proneness, attitude towards RCTs and knowledge towards RCTs, as shown by their significant 't' values, had significant contribution to their extent of adoption of RCTs in rice cultivation. This means that those positively significant variables had significant contribution to the level of adoption of RCTs in rice cultivation. There is a call for extension agencies and other departments to manipulate these crucial factors in order to bring about desirable changes in the knowledge behaviour of farmers towards RCTs in agriculture through different extension efforts and programmes.
- Farmers should be encouraged to make use of all the improved resource conservation and management practices to achieve the desired result of sustainability in agriculture and boosting rice production in the region.
- Furthermore, there should be research focus on resource conserving technologies which have been developed on the basis of external knowledge and research, with the participation of farmers for there is a great potential for their large scale adoption and bring about sustainability in agriculture in the region.

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