# Analysis of Factors Influencing Farmers' Knowledge on Resource Conservation Technologies (RCTs) in Rice (*Oryza sativa* L.) Cultivation

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**ABSTRACT** This study to analyse the factors affecting farmers' knowledge towards RCTs 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. Data collection from the selected respondents was made with the help of pre-tested structured schedule through personal interview method. The study reveals that over half of the respondents had medium level of knowledge about resource conservation practices in rice cultivation followed by low and high levels. Except the practices like seed selection, sowing and transplanting, soil fertility and nutrient management and water management, majority respondents had no knowledge on the various recommendations of the remaining five practices related to resource conservation in rice cultivation. The study further shows that out of 11 independent variables under study, except age all the variables were found having positively significant relationship with the knowledge level of the respondents. While four variables namely, annual income, extension contact, mass media exposure and innovation proneness had emerged as the most dominant factors influencing to the increase of knowledge level of farmers towards resource conservation technologies in rice.

## INTRODUCTION

Agriculture in India, during the recent years, 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. India has a large and diverse agricultural sector, with growth of agriculture in GDP is estimated to be 5.4%. The overall GDP has grown by an average of 8.62 % during 2004-05 to 2010-11, 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, lead to degradation of soil, water and genetic resources. The modern farming systems aim at maximizing production through the use of increased quantities of external inputs such as fertilizers and plant protection chemicals without due consideration to their ill effects. 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. While reviewing the changing scenario of Indian agriculture, Malathi and Bangarusamy (2001) explored that indiscriminate use of chemical fertilizers has caused several problems on farm as well as outside farm leaving plants become more susceptible to pests and diseases which calls higher dose of poisonous chemicals to control them.

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. The North Eastern Region of India is widely recognised with high adoption of intensive and conventional agricultural practices which 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 pro-

vide 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. RCTs are generally cost reducing and efficient inputs-use without yield loss, thereby enhancing farmers' income higher than conventional practices (Singh et al. 2011; Singh et al. 2012).

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. In the past, often, farmers were not considered important actors in the sustainable resource management. Their practical activities were usually seen as contributory factors to the degradation of the resources. Of late, however, attention has been directed towards the crucial role farmers can play in the sustainable management of resources through resource conservation technologies. Their key environmental and socio-economic factors have significant influence towards adoption and diffusion of conservation agriculture (Lestrelin et al. 2012). 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 unique knowledge behaviour or ways of using and managing their resource conservation technologies in agriculture. This may include comprehending their perception, actions or behaviour towards RCTs in agriculture. The study, therefore, was undertaken in the North Eastern state of Manipur, India with the following specific objectives.

## Purpose and Objectives

- To study the level of knowledge of farmers towards resource conservation technologies (RCTs) in rice cultivation
- To analyse the various factors influencing the level of knowledge of the farmers towards RCTs in rice cultivation

## METHODOLOGY

### Study Area and Population

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. The Imphal West district is one of the four valley districts of Manipur, which is surrounded by Senapati district on the North, on the East by Imphal East and Thoubal districts, on the South by Thoubal and Bishnupur districts, and on the West by Senapati and Bishnupur districts. The valley area of Imphal West district is fertile land and is mainly made up of alluvial soil of recent origin. However, the soils are acidic with pH ranging between 4.5 to 6.8, rich in organic carbon. Availability of N is medium to high, P is low to medium and K is medium to high. The texture of soil varies from sandy to loam to clayey. Rice is the staple food of Manipuri and is cultivated extensively across the state followed by rabi oil seeds like rapeseed and mustard.

### Sampling Design

A total of 120 respondents were selected with 60 respondents from each sub-division by using proportionate random sampling. For selection of villages, first of all, a list of villages where farmers were commonly in use of resource conservation technologies in rice cultivation from each sub-division was prepared separately in consultation with available literature, office records/reports, through PRA, different NGOs, progressive farmers as well as extension personnel of Department of Agriculture, Government of Manipur. These villages were ranked separately for each sub-division based on number of adopted farmers and area coverage under RCT through participatory methods. Finally, 5 (five) villages according to their rank orders were selected from each of the sub-division for the study. A total of 60 respondents of 5 selected villages from each sub-division were selected through proportionate random sampling method. This makes a total of 120 respondents as the final size of sample.

### Measurement of Variables

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 sched-

ules 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 variable, attitude towards resource conservation technologies (RCTs). Knowledge level of the respondents towards RCTs in rice cultivation was considered as the dependent variable under the study, which was measured by developing a knowledge test schedule on the 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 the respondents based on the scores obtained under each major practice namely; "Full Knowledge", "Partial Knowledge" and "No Knowledge" were made for each of the practices in the present study. A farmer is considered having "Full Knowledge" on a practice when he fully understood with the recommendations for that practice, deviation from recommendations was considered as "Partial Knowledge" and when the respondent did not at all know the recommendation, he was put in the "No Knowledge" category for that practice. For the purpose of analysis, the mean knowledge scores were calculated separately for each of the practice as well as for all the practices. On the basis of the scores, the respondents were grouped into 3 categories by applying cumulative cube root method ($\sqrt[3]{F}$).

## Data Collection

Data collection from the selected respondents was made during January-March 2012 with the help of pre-tested structured schedule through personal interview method. In this study, both primary and secondary data were collected to attain the stated objectives of the study. Every effort was made to elucidate the questions by repeating in the local language to get accurate and authentic data from the selected respondents. The secondary data were collected from documents, records and published reports of Department of Agriculture, Manipur, NGOs, ICAR Manipur Centre, KVK and from other potential sources.

## Statistical Analysis

The collected data were coded, tabulated and analysed in accordance with the objectives of the study using appropriate statistical tests. The rank order correlation of coefficients were calculated to see the strength of association between the rankings produced by dependent and independent variables by using the formula given.

$$rs = 1 - \frac{6\Sigma d^2}{n(-n^2-1)}$$

Where, $r_s$ = Spearman's rank order correlation coefficients

$d^2$ = square of the difference of corresponding rank

While mathematical measure like regression analysis was used to ascertain the contribution of independent variables on dependent variable. The formula is given below.

$$Y = a + b_1 x_1 + b_2 x_2 + b_3 x_3 + b_4 x_4 + b_5 x_5 + b_6 x_6 + b_7 x_7 + b_8 x_8 + b_9 x_9 + b_{10} x_{10} + b_{11} x_{11} + b_{12} x_{12}$$

Where,

Y = dependent variable (knowledge level towards RCTs in rice cultivation)

a = constant, b = regression co-efficient

$x_1$ =age , $x_2$ = education , $x_3$ = size of operational land holding, $x_4$ = annual income, $x_5$ = social participation, $x_6$ = extension contact, $x_7$ = mass media exposure, $x_8$ = economic motivation, $x_9$ = risk orientation, $x_{10}$ = innovation proneness, $x_{11}$ = attitude towards RCTs,. The calculated value of 't' were compared with the table value of 't' at 0.05 and 0.01 level of probability.

Fisher 't' test, $t = r \sqrt{\frac{n-2}{1-r^2}}$ with (n-2) d. f.

Where, r = observed co-efficient of correlation, n=number of observation

d. f. =degree of freedom, and $t = \frac{B}{\hat{s}}$ with (n-k) d.f.

Where, B=regression co-efficient, $\hat{s}$= standard error, n=number of observation, K= number of independent variables were applied to respective rank order correlation coefficients and multiple regression to identify the significant cause effect relationship, that is, to ascertain the role of independent variables on the dependent variable.

## RESULTS AND DISCUSSION

### Knowledge Towards RCTs

The findings related to farmers' knowledge level indicate that over half of the respondents (51.67%) had medium level of knowledge towards resource conservation technologies in rice cultivation. While 42.50% and 5.83% respondents had low and high level of knowledge of resource conservation practices in rice cultivation (see Table 1). The mean value of 46.63 indicates that by and large, farmers in the study area had low to medium level of knowledge on resource conservation technologies in rice cultivation. It is reported that the concept of resource conservation technologies in agriculture despite gaining its popularity among the farmers, its systematic and scientific application were not properly trained under different farming situations. This calls for hand-on training programmes for farmers by the experts in this field to improve their knowledge and skills towards RCTs. The findings of the study were in agreement with the results obtained by Naik (2005), Thippeswamy (2007) and Kumar (2009). Sidram (2008) also reported similar findings with majority respondents belonged to medium level of knowledge in improved cultivation practices of pigeon pea in Gularga district of Karnataka, India.

**Table 1: Distribution of respondents according to their level of knowledge towards RCTs in rice cultivation (n=120)**

| Category | Frequency (f) | Percentage (%) | Mean | S.D. |
|---|---|---|---|---|
| Low (30-45) | 51 | 42.50 | 46.625 | 5.14 |
| Medium (45-55) | 62 | 51.67 | | |
| High (55-60) | 7 | 5.83 | | |
| Total | 120 | 100 | | |

### Practice- wise Knowledge Level of RCTs by the Farmers

Out of the nine selected practices (Table 2) 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, majority (55.83%) of the respondents were found having full knowledge of all the water management recommendations/ practices such as rain water conservation, withdrawing water/ draining water after grain filling stage, drainage at maximum tillering stage and irrigation at a depth of 5cm when water from ponds disappears. Whereas, in case of practices like seed treatment, land preparation/soil tillage practices, weed management, plant protection measures and harvesting, all the respondents had reported their partial knowledge level in rice cultivation.

The table also shows that none of the respondents were found in the no knowledge category towards RCTs in rice cultivation. The study further reveals that farmers, by and large, had partial knowledge of all the selected RCT practices in rice cultivation except water management where majority of them were found in full knowledge category of the recommendations. Extension efforts therefore, may be strengthened through different capacity building programmes for the farmers for strengthening the knowledge of the farmers towards RCTs in rice cultivation.

### Relationship and Influence of Socio-economic and Psychological Characteristics of Respondents with and on their Knowledge Level on RCTs in Rice Cultivation

In order to study the nature of relationship between socio-economic and psychological

**Table 2: Practice wise level of knowledge of respondents towards RCTs in rice cultivation  (n=120)**

| Practices | Full knowledge | | Partial knowledge | | No knowledge | |
|---|---|---|---|---|---|---|
| | f | % | f | % | f | % |
| Seed selection | 49 | 40.83 | 71 | 59.17 | 0 | 0 |
| Seed treatment | 0 | 0.00 | 120 | 100.00 | 0 | 0 |
| Land preparation /Soil tillage practices | 0 | 0.00 | 120 | 100.00 | 0 | 0 |
| Sowing and transplanting | 42 | 35.00 | 78 | 65.00 | o | O |
| Weed management | 0 | 0.00 | 120 | 100.00 | 0 | 0 |
| Soil fertility and nutrient management | 35 | 29.16 | 85 | 70.83 | 0 | 0 |
| Water management | 67 | 55.83 | 53 | 44.17 | 0 | 0 |
| Plant protection measures | 0 | 0.00 | 120 | 100.00 | 0 | 0 |
| Harvesting | 0 | 0.00 | 120 | 100.00 | 0 | 0 |

characteristics and level of knowledge of RCTs in rice cultivation, the rank order correlation co-efficients were calculated with the help of computer software SAS 9.2. The results are given in Table 3. From the table, it is seen that out of 11 independent variables under study namely; age, education, size of operational land holding, annual income, social participation, extension contact, mass media exposure, economic motivation, risk orientation, innovation proneness and attitude towards RCTs, except age, all the variables were found with positively significant correlation with the level of knowledge of RCTs in rice cultivation as evident from their corresponding 'r' values having significant at 0.01 and 0.05 levels of probability.

This indicates that higher the level of those positively significant variables of the respondents higher would be their level of knowledge towards 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. Raghavendra (1997), Saikrishna (1998) and Bharathamma et al. (2006) also noticed significant relation in case of mass media use with the knowledge level of the farmers.

## Relative Influence of Selected Socio-economic and Psychological Characteristics of the Respondents on their Level of Knowledge 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 eleven 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 and attitude 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. It reveals that 4 (four) out of 11 (eleven)

**Table 3: Spearman's rank order correlation coefficients of socio-economic and psychological attributes of the respondents with Knowledge level of RCTs in rice cultivation**

| Independent variables | Rank order correlation coefficients ('r) | 'p' value |
|---|---|---|
| Age | -0.0514 | 0.5769 |
| Education | 0.2161* | 0.0178 |
| Size of operational land holding | 0.2137* | 0.0191 |
| Annual income | 0.3811** | <.0001 |
| Social participation | 0.3441** | <.0001 |
| Extension contact | 0.6538** | <.0001 |
| Mass media exposure | 0.4739** | <.0001 |
| Economic motivation | 0.2481** | 0.0075 |
| Risk orientation | 0.4033** | <.0001 |
| Innovation proneness | 0.6206** | <.0001 |
| Attitude towards RCTs | 0.5827** | <.0001 |

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

**Table 4: Multiple regression analysis of independent variables with knowledge level of RCTs in rice cultivation**

| Independent variables | 'b' value | 't' value | Pr>F |
|---|---|---|---|
| Age | -0.0359 | -0.9971 | 0.3209 |
| Education | 0.1617 | 0.5321 | 0.5957 |
| Size of operational land holding | 0.3454 | 1.7001 | 0.0919 |
| Annual income | 0.4141 | 2.2356* | 0.3515 |
| Social participation | 0.0031 | 0.0205 | 0.9837 |
| Extension contact | 0.6643 | 5.7019** | 0.4299 |
| Mass media exposure | 0.5099 | 2.0858* | 0.0394 |
| Economic motivation | 0.0827 | 0.5924 | 0.5548 |
| Risk orientation | 0.1764 | 1.2899 | 0.1998 |
| Innovation proneness | 0.4842 | 3.2652** | 0.0001 |
| Attitude towards RCTs | 0.1388 | 0.9677 | 0.3353 |

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

independent variables viz; annual income, extension contact, mass media exposure and innovation proneness of the respondents, as shown by their significant 't' values, had significant contribution to their level of knowledge towards RCTs in rice cultivation and were considered as the most dominant factors affecting the level of knowledge of the farmers towards RCTs in rice cultivation.

This signifies that those positively significant variables had the highest contribution to the knowledge level of the farmers towards RCTs in rice cultivation. The $R^2$ value of 0.6133 clearly indicates that all the eleven independent variables taken together helped in explaining about 61.33% of the total variation in respondents'

level of knowledge towards RCTs in rice cultivation. The 'F' ratio value of 15.57 was found significant at 0.01 level of probability, indicating that all the 11 independent variables contributed significantly in the variation of respondents on their knowledge level of RCTs in rice cultivation.

## CONCLUSION

The study showed that some of the specific practices although very much relevant with RCTs in rice cultivation were not aware 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 farming situations. This calls for conscious consideration and take care on the part of extension workers and other concerned departments for large scale awareness programmes followed by trainings and demonstrations for improving technical knowledge and skills of the farmers on various RCTs in agriculture. Necessary technical guidance through specific training programmes followed by other extension efforts may be taken up by the concerned line departments and other stakeholders including Krishi Vigyan Kendras (KVKs) in the state on such no knowledge practices.

## 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 level of knowledge reveal that the majority of the farmers had low to medium level of knowledge 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.
- The findings also indicate that the variables such as annual income, extension contact, mass media exposure and innovation proneness of the respondents had signi-

ficant impacts on the knowledge level on RCTs in rice cultivation as evident by their corresponding significant 't' values of multiple regression co-efficients. 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

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