J Hum Ecol, 35(3): 167-172 (2011)
PRINT: ISSN 0970-9274 ONLINE: ISSN 2456-6608
DOI: 10.31901/24566608.2011/35.03.04

Farmers' Adoption Behaviour in Rice Technology: An Analysis of Adoption Behaviour of Farmers in Rice Technology under Different Farming Systems in Assam

A.K. Singha and M.J. Baruah*

Zonal Project Directorate, Zone-III, ICAR, Barapani-793103, Meghalaya, India
E-mail: arunkumar_singha@yahoo.co.in
**Agricultural Development Officer, Jorhat, Assam, India*

KEYWORDS Socio-economic. Psychological. Dairy. Poultry. Fishery. Correlation. Regression.

ABSTRACT The study to ascertain different adoption behaviour of farmers was conducted in Sonitpur district of Assam with 135 farmer respondents selected by using proportionate cum random sampling. The results indicated that majority of the respondents had medium level of adoption of improved rice cultivation practices under the selected three farming systems that is, Paddy+Vegetable+Dairy+Fishery (FS_1) (44.44%), Paddy+Vegetable+Dairy+Poultry (FS_2) (51.11%) and Paddy+Dairy+Fishery+Poultry (FS_3) (44.44%), respectively. The study further reveals that farmers were poor in adoption of recommendations of those relatively complex practices in nature such as seed treatment, application of manure and fertilizers and plant protection measures under different farming systems. Among the selected independent variables, extension contact, annual income, innovation proneness and positive attitude towards farm diversification of farmers had positively significant relationships with the extent of adoption of improved rice cultivation practices under different farming systems.

I. INTRODUCTION

Agriculture in Assam is essentially subsistence with the vast majority of farming community being small and marginal farmers (83.30% as per 2000-01 Census) with their uneconomic and unviable farm size. The state has a gross cropped area of 40 lakh hectares (estimated) of which rice alone covers 26 lakh hectares. It occupies about 63% and 91% of the gross and net cropped area respectively during 1997-98 (Anonymous 2000). Although the state has enormous potential for good crop production, the average productivity of rice remains very low, that is, 1.435t/ha in 2000-01 which is well below the National average of 1.938 t/ha during the same year. The primary reasons for such low rice productivity could be among others ignorance of farmers about latest improved technologies and their reluctance to change their traditional farming practices, since the prospect of obtaining a marginal surplus depends largely on weather conditions in the state and the fear of possible crop failure certainly discourages the farmers to accept the advanced technologies.

It is widely acknowledged that the risk and uncertainties associated with farming at best, can be controlled by adoption of different diversified farming systems in which crop production is combined with any livestock raising such as dairy, poultry, piggery, fishery etc., to ensure balanced production system (Sivanarayana and Reddy 1993). Realizing this, the spate of diversification of agriculture with allied non-crop enterprises has been gaining momentum in the state in the process of agro-rural development. However, various studies indicated that there is a wide gap between available technology and its adoption especially in rice cultivation under different farming situations. Considering the importance of ascertaining the dominant factors which governed the adoption of improved rice cultivation practices under different farming systems, the present study was undertaken with the following specific objectives.

i. To study the extent of adoption of improved rice cultivation practices by the farmers under different farming systems.
ii. To determine the relationship and contributory influence of selected socio-economic and psychological characteristics of the respondents and their extent of adoption of improved rice cultivation practices under different farming systems.

II. METHODOLOGY

The study was conducted in Sonitpur district of Assam, which consists of 3 Agricultural subdivisions. A total of 135 farmers respondents with 45 from each sub – division (15 respondents from each of 9 selected villages) were selected by us-

ing proportionate random sampling technique. In the present study, 3 out of 25 identified farming systems were selected as the most common and important farming systems which the farmers in the district mostly used to adopt in their farming situations in combination with rice cultivation as primary sources of income in the study area and were considered for the present study in relation to the extent of adoption of recommended practices of rice cultivation. These Farming Systems (FSs) were respectively Paddy+ Vegetable+Dairy+Fishery (FS_1), Paddy+ Vegetable+Dairy+Poultry (FS_2) and Paddy+ Dairy+Fishery+Poultry (FS_3). Respondents in the present study were those who had been practicing either one of the selected three farming systems. Data collection from the selected respondents was made with the help of personal interview methods by using pre-tested structured schedule.

Extent of adoption of recommended package of practices of rice cultivation by the farmers was studied by developing a test schedule. Weightage of the practices was decided by the judge's rating. Extent of adoption was measured as "Full adoption", "Partial Adoption" and "No adoption" with scores as 2, 1 and 0 respectively. Final adoption scores were attained by multiplying the weightage of a practice with the corresponding extent of adoption scores. On the basis of scores obtained, the respondents were classified into 3 categories by following the procedure as adopted by Dasgupta (1989).

The study took into account 10 socio-economic and psychological variables. These were age, education, extension contact, annual income, operational and holding, economic motivation, innovation proneness, risk orientation, decision making ability and attitude toward farm diversification. Socio-Economic Status Scale-Rural (Trivedi and Pareek 1964) was used to measure education. Chronological age was taken into account for age and for extension contact, annual income and operational land holding, respective schedules were developed. Measurement scales developed by Singha (1991) were used for economic motivation, risk orientation and decision making ability with slight modification. Innovation proneness was tested by Innovation Proneness Scale (Moulik and Rao 1965). While the variable attitude towards farm diversification was measured with the help of the scale developed of the scale developed by Anand Kumar et al. (1997).

III. RESULTS AND DISCUSSION

Data in Table 1 shows that more than two-fifth of (44.44%) the respondents had medium level of adoption of improved practices of rice cultivation. This was followed by low (31.11%) and high (24.44%) level in case of FS_1. In case of FS_2 it was also found that majority (51.11%) of the respondents were seen in medium and respondents with 33.33% and 15.56% were found to have low and high extent of adoption respectively. Similar findings were observed in case FS_3 with percentage distribution of 44.44%, 37.78% and 17.78% were observed in medium, low and high extent of adoption of improved rice cultivation practices, respectively. Similar findings were also reported by Thyagarajan and Vasanthakumar (2000) in adoption of recommended rice technology. From the Table, it is seen that in all the selected farming systems, majority of the farmers could not adopt the full recommended practices in rice cultivation, because by and large, they were poor in education and economic conditions in the study area accompanied by other associated factors.

The Chi-square (χ^2=97.51**) value indicated that there was significant difference among the farmers of different farming systems in regard to the extent of adoption of improved rice cultivation practices.

Practice-wise extent of adoption of Rice Technology

Seed Selection

It is seen from Table 2 that in all the three categories of the farming systems, over half proportion of the farmer respondents of each farming system were found to have full adoption of the recommendations of seed selection practice, that is, 53.33%, 64.44% and 57.78% respectively. Remaining other respondents of the selected farming systems had not adopted any recommendation of seed selection at all and they used their own traditional methods of seed selection of paddy cultivation.

Seed Treatment

In general, farmers had little/no adoption of seed treatment practice in rice cultivation in all the three farming systems. A less proportion of the respondents were observed to have adopted

Table 1: Distribution of respondents according to their extent of adoption of improved rice cultivation practices under different farming systems

S.No.	*Category*	*Score range*	*Frequency (F)*	*Percentage (%)*	*Mean*	*S.D.*
FS_1					$N_1=45$	
1.	Low	25-29	14	31.11	33.04	3.99
2.	Middle	30-36	20	44.44	33.04	3.99
3.	High	37-43	11	24.44		
	Total		45	99.99		
FS_2					$N_2=45$	
1.	Low	11-27	15	33.33	33.51	6.56
2.	Middle	28-40	23	51.11		
3.	High	41-51	7	15.56		
	Total		45	100.00		
FS_3					$N_3=45$	
1.	Low	17-24	17	37.78		
2.	Middle	25-36	20	44.44	30.55	6.14
3.	High	37-42	8	17.78		
	Total		45	100.00		

$\chi^2 = 97.52^{**}$ (at 0.01 level of probability)

seed treatment with full recommendations with 4.44% (FS_1) and 2.22% (FS_2) and 8.89% partial adoption in FS_3. Lack of knowledge and non-availability of quality chemicals were some of the probable reasons for poor adoption of the practice in identified farming systems in the study area.

Seed Rate

The data presented in the table shows that farmers, by and large, had adopted recommended seed rate of rice cultivation in the study area. This was reflected by their higher percentage of full adoption with 82.22%, 57.78% and 55.56% in FS_1, FS_2, FS_3, respectively.

Field Preparation

A formidable proportion of the farmer respondents were found to have full adoption of the total field preparation practice, the percentage distribution of which were 71.11%, 64.44% and 75.56% respectively. The remaining other respondents of the three selected farming systems had not adopted all the recommendations of field preparation practice of rice cultivation.

Transplantation

The recommended practices of transplantation of rice seedlings to the main field was followed by majority farmers (93.33%) in FS_1, of which 31.11% and 62.22% were found to have full adoption and partial adoption respectively. Similar findings were also observed in case of FS_2 (84.44%) and FS_3 (82.22%). Their percentage distribution in full adoption and partial adoption were 31.11% and 53.33% in FS_2 and 24.44% and 57.78% in FS_1.

Manure and Fertilizers

As regards manures and fertilizers, farmers normally used to apply/follow this practice the recommendations notwithstanding. It is clear from the percentage of total adoption figures of 73.33%, 64.44% and 57.78% in case of FS_1, FS_2 and FS_3 respectively. A total of only 4.44% respondents in each of the farming system had reported their adoption in full recommendations of the practice.

Intercultural Operations

Respondents in general, used to practice intercultural operations such as weeding, gap filling, thinning etc. in rice cultivation as shown by relatively higher percentage of total participation in the selected three farming systems, the percentage distribution of which were 88.89%, 80.00% and 82.22% respectively. However, it is indicated that majority of the respondents were found to have partial adoption in case of FS_2 (51.11%) and FS_3 (46.67%). While over half (64.44%) of the respondents had reported full adoption in case of FS_1.

Plant Protection Measures

Regarding plant protection measures in rice cultivation, the table reveals that more than half of the respondents had not adopted any recommendation in FS_2 (51.11%) and FS_3 (53.33%) While a little over half (51.11%) of the respondents of FS_1 could manage adoption, of which

Table 2: Frequency and percentage distribution of respondents according to their practice-wise extent of adoption of recommended rice cultivation practices under different farming systems

S. No.	Practice	Distribution of respondents											
		FS_1 (N_1=45)				FS_2 (N_2=45)				FS_3 (N_3=45)			
		FA	PA	NA	TA	FA	PA	NA	TA	FA	PA	NA	TA
1.	Selection of seeds	24 (53.33)	0 (0.00)	21 (46.67)	24 (53.33)	29 (64.44)	0 (0.00)	16 (35.56)	29 (64.44)	26 (57.78)	0 (0.00)	19 (42.22)	26 (57.78)
2.	Seed treatment	2 (4.44)	0 (0.00)	43 (95.56)	2 (4.44)	1 (2.22)	0 (0.00)	44 (97.78)	1 (2.22)	0 (0.00)	4 (8.89)	41 (91.11)	4 (8.89)
3.	Seed rate	37 (82.22)	0 (0.00)	8 (17.78)	37 (82.22)	26 (57.78)	0 (0.00)	19 (42.22)	26 (57.78)	25 (55.56)	0 (0.00)	20 (44.44)	25 (55.56)
4.	Field preparation	32 (71.11)	0 (0.00)	13 (28.89)	32 (71.11)	29 (64.44)	0 (0.00)	16 (35.56)	29 (64.44)	34 (75.56)	0 (0.00)	11 (24.44)	34 (75.56)
5.	Transplantation	14 (31.11)	28 (62.22)	3 (6.67)	42 (93.33)	14 (31.11)	24 (53.33)	7 (15.56)	38 (84.44)	11 (24.44)	26 (57.78)	8 (17.78)	37 (82.22)
6.	Manures and fertilizers	2 (4.44)	31 (68.89)	12 (26.67)	33 (73.33)	2 (4.44)	27 (60.00)	16 (35.56)	29 (64.44)	2 (4.44)	24 (53.33)	19 (42.22)	26 (57.78)
7.	Intercultural operation	29 (64.44)	11 (24.44)	5 (11.11)	40 (88.89)	13 (28.89)	23 (51.11)	9 (20.00)	36 (80.00)	16 (35.56)	21 (46.66)	8 (17.78)	37 (82.22)
8.	Plant protection measures	2 (4.44)	21 (46.67)	22 (48.89)	23 (51.11)	3 (6.67)	19 (42.22)	23 (51.11)	22 (48.89)	3 (6.67)	18 (40.00)	24 (53.33)	21 (46.66)

Figures in parentheses indicate percentage
FA =Full Adoption, PA=Partial Adoption, NA= No Adoption, TA= Total Adoption

46.67% were found to adopt recommendations in partial.

The results indicate that farmers were in poor adoption of the recommendations of those relatively complex practices in nature such as seed treatment, application of manure and fertilizers and plant protection measures. This was more pronounced among those old farmers compared to young farmers.

Relationship of Independent Variables with Extent of Adoption of Rice Technology

In order to study the relationship between independent variables and dependent variables, the data were subjected to simple correlation analysis under the selected three farming systems. To identify the significant cause and effect relationship, that is, to ascertain the role of independent variables on the dependent variable, "t" test was applied to respective co-efficients of correlation (Table 3). It is seen from the table that independent variables namely, education, extension contact, annual income, operational land holding, economic motivation, innovation proneness and attitude towards farm diversification of respondents were found significantly correlated with their extent of adoption of selected rice cultivation practices in FS_1. Positive and significant relationship were also reported in case of education, extension contact and size of land holdings in adoption of rearing practice of CSR hybrids (Rajeev et al. 2006) and cut flower production technologies (Singh et al. 2010). In case of FS_2, except operational land holding, all significant variables in FS_1 were also found having significant association with the extent of adoption of paddy cultivation practices. Decision making ability of the respondents was additional variable which had significant "t" value (t=2.264*). While the characteristics such as extension contact, annual income, operational land holding, innovation proneness, decision making ability and attitude towards farm diversification were significantly related with the extent of adoption of rice cultivation practices in case of FS_3. In this farming system (FS_3), age of the respondents was exceptionally found negatively significant with extent of adoption of improved rice cultivation practices, as shown by significant "t" value (t=-2.355*).

It can be interfered from the table that the characteristics such as: extension contact, annual income, innovation proneness and attitude to-

Table 3: Simple correlation analysis of socio-economic and psychological characteristics of the respondents with their extent of adoption of rice cultivation practices under different farming systems

S. No.	Independent variables	FS_1		FS_2		FS_3	
		'r' value	't' value	'r' value	't' value	'r' value	't' value
1.	Age	0.117	0.763	0.237	1.510	-0.390	-2.355*
2.	Education	0.601	3.150**	0.528	2.940**	0.279	1.760
3.	Extension contact	0.342	2.107	0.393	2.370*	0.454	2.653*
4.	Annual income	0.44.	2.591*	0.398	2.394*	0.428	2.537*
5.	Operational land holding	0.345	2.123*	0.143	0.925	0.379	2.300*
6.	Economic motivation	0.54.	2.98**	0.340	2.097*	0.011	0.075
7.	Innovation proneness	0.376	2.285**	0.374	2.275*	0.392	2.365*
8.	Risk orientation	-0.123	-0.801	0.051	0.333	0.358	2.192*
9.	Decision making ability	0.150	0.974	0.372	2.264*	0.335	2.070*
10.	Attitude towards farm diversification	0.376	2.285*	0.383	2.320*	0.437	2.577*

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

wards farm diversification had significant impacts on farmers' extent of adoption of rice cultivation practices under all farming systems. It implies that those respondents who had higher level of these characteristics would make more level of adoption of rice cultivation practices under the selected diversified farming systems. However, some of those significant variables identified separately for the three farming systems should get more emphasis while considering specified farming system.

Multiple Regression Analysis of Independent Variables with Extent of Adoption of Rice Technology

In order to study contributory effects of independent variables on dependent variables, multiple regression analysis was employed.

The data in Table 4 reveals that five out of ten variables viz., education, extension contact, annual income innovation proneness and attitude towards farm diversification of farmers had significant contributions to their extent of adoption of paddy cultivation practices under all farming systems. Significantly, two variables- operational land holding and economic motivation in case of FS_1, economic motivation and decision making ability in FS_2 and three variables namely; operational land holding, risk orientation and decision making ability in case of FS_3 were found to influence in the variation of the extent of adoption of rice cultivation practices by the farmers. This means that positively significant variables under different farming systems had significant contribution to the level of adoption of improved rice cultivation practices under different farming systems. The negatively significant "t" value of age (t=-2.568*) in case of FS_3 indicates that age of the respondents had negative role in their contribution towards extent of adoption of rice cultivation practices was concerned. This might

Table 4: Multiple regression analysis of selected independent variables of the respondents with their extent of adoption of rice cultivation practices under different farming systems

S. No.	Independent variables	FS_1		FS_2		FS_3	
		'b' Value	't' value	'b' Value	't' value	'b' Value	't' value
1	Age	1.644	1.430	2.934	1.732	-3.426	-2.568*
2	Education	1.637	3.85*	1.903	2.656*	2.894	2.398*
3	Extension contact	1.978	2.353*	2.207	2.039	3.309	2.062*
4	Annual income	4.421	2.784**	3.237	2.472*	2.961	2.340*
5	Operational and holding	2.676	2.105*	2.654	1.490	3.593	2.724*
6	Economic Motivation	2.451	2.220*	4.423	2.264*	0.145	0.480
7	Innovation proneness	2.267	2.062*	3.577	2.537*	2.529	2.558*
8	Risk orientation	-0.139	-0.524	0.329	0.738	3.090	2.575*
9	Decision making ability	0.551	1.923	2.931	5.702**	3.517	9.210**
10	Attitude towards farm diversification	2.101	3.532**	3.080	2.391*	2.674	2.722*
R^2 (with 10 independent variables)		0.394		0.551		0.594	
'F' value		2.212		2.489*		2.855*	

* Significant at 0.05 level of probability ** Significant at o.o1 level of probability

be attributed to the fact that due to conservativeness and more security consciousness, older farmers hesitate to take the risk of adoption of recommended agricultural technology. The old aged respondents might not have enthused them to venture for new practices or information. The R^2 values of 0.394, 0.551 and 0.594 in FS_1, FS_2 and FS_3 clearly signify that ten independent variables taken together helped in explaining about 39.40%, 55.105% and59.40% of the total variation in respondents` extent of adoption of improved paddy cultivation practices in FS_1, FS_2 and FS_3 respectively. The computed "F" ratio values of 2.212, 2.489 and 2.855 were found significant at 0.01 level of probability, indicating that all the 10 independent variables contributed significantly in the variation of respondents in their extent of adoption in case of FS_1, FS_2 and FS_3 respectively.

IV. CONCLUSION

The present investigation revealed that farmers, by and large, had low and medium level of adoption of improved rice cultivation practices under the selected farming systems. Therefore, extension agencies should be geared up and continue their efforts including organizing different farmers' level training programmes so that they can develop confidence in them to take up rice technology in combination with other non-crop enterprises, not only for improving their farm production and income but also inspiring others to do so. The findings also disclosed that except age, other variables such as education, extension contact, annual income, innovation proneness, and attitude towards farm diversification had significant impacts on extent of adoption of improved rice cultivation practices under selected three farming systems. Hence, there is a call for the extension agencies and other concerned department to manipulate these crucial factors in order to bring about desirable practices under selected farming systems. It can also be suggested that those significant variables under different farming systems should get more emphasis and care through concerted efforts while formulating different development strategies and programmes for different categories of farmers.

V. RECOMMENDATIONS

Based on the results of the study, the following recommendations are suggested to improve farmers' socio-economic profile in study area-

1. Both public and private extension agencies should be geared up in their efforts to organize different farmers' level and location specific training programmes.
2. Both extension and intensive hands on-training programmes should be emphasized through proper assessment of training needs for different target groups.
3. The extension agencies should mount education and enlightenment programme on the significance and impact of different farming systems on socio-economic condi-tions of the farmers.
4. The concerned stakeholders should pay relatively higher emphasis and care on those crucial factors, thus identified by this study through concerted efforts while formulating different development strategies and programmes for farmers.

REFERENCES

Anand Kumar, Chandrakandan K, Kangagasbai N, Nandani N 1997. A scale to measure the attitude of farmers towards farm diversification. *Journal of Extension Education*, 8(4): 1847-1849.

Anonymous 2000. *Agriculture in Assam*. Assam Agricultural University Publication, Jorhat.

Anonymous 1995. *Statistical Hand Book of Assam*. Directorate of Economics and Statistics, Govt. of Assam, Guwahati.

Das Gupta S 1989. *Diffusion of Agricultural Innovation in Village India.* New Delhi: Wiley Eastern Ltd.

Moulick TK, Rao CSS 1965. *Measurement in Extension Research.* Instrument Developed at I.A.R.I., New Delhi.

Rajeev BN, Venkatappa R, Gokulraj MP 2006. Adoption level of CSR hybrids by the sericulturists of Kolar District of Karnataka. *Journal of Extension Education*, 18(3 and 4):3857-3861.

Singh BK, Rajesh ES, Yadav VPS, Singh DK 2010. Adoption of commercial cut flower production technology in Meerut. *Indian Journal of Extension Education*, 10(1):50-53.

Singha AK 1991. *A Study on Determinants of Entrepreneurial Behaviour of the Adoption of Selected Farm Practices by the Farmers of Cachar district of Assam.* M.Sc (Agri) Thesis, Unpublished. Assam Agricultural University, Jorhat.

Sivanaryana G, Reddy SJ 1993. Adoption of diversified farming system technologies. *Indian Journal of Extension Education*, 24 (3 and 4): 69-75.

Thyagarajan S, Vasanthakumar J 2000.Characteristics of rice farmers and adoption pattern of recommended rice technologies. *Indian Journal of Extension Education*, 36(1 and 2): 48-52.

Trivedi G, Pareek U 1964. *Socio-economic Status Scale (Rural).* New Delhi: Manasyan.