



Economic analysis of Farmers' club programme and its adoption behaviour for smallholder rice cultivators: An empirical study in Manipur

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ABSTRACT

The present study was undertaken in Manipur state among members and non-members of farmer's club to study cost and return of rice cultivation, examine resource use efficiency, factors affecting participation and constraints in farming. The study revealed that per hectare cost of rice cultivation were Rs. 50386 and Rs.52293 respectively for member and non-member group. Net return and benefit cost ratio were higher for members group. The use of fertilizer and labour had significant positive effect on the return from rice cultivation for members while seed and fertilizer had significant positive effect for non-member group. Age had significant negative effect on participation in farmers' club while family size and rice variety had positive significant effect. High cost of fertilizer was the major constraint faced by farmers. In a nutshell, farmers' club had become an effective approach for transfer of technology and bringing changes at grassroots level.

Keywords: Constraints, cost and return, Farmers' club, Logit model, rice cultivation

Rice is a staple food for more than half of the world's population. More than 3.5 billion inhabitants depend on rice for obtaining 20 per cent of their daily calorie intake (IRRI, Africa Rice and CIAT, 2010). As the world population is increasing so the supply of rice must be doubled to fulfil the demand for food by 2050 (FAO, 2009). India is the second largest rice producing country in the world next to China with a production of 116.42 million metric tonnes during the year 2018-19 (Statista 2021). India is also the second largest rice consuming country of the world and it plays an important role in the national food security. Rice occupies 35 % of the total area under food grains and contributes about 41 % to the total food grain production in the country (Statistical Year Book India, 2018).

Rice is the major crop of Manipur state which is located in the Eastern Himalayan Region of North East India. Rice accounted for 98 % of the total food grain production of Manipur state. During the year 2017-18, the total rice cultivated area in the state was 179.10 thousand hectares with a production of 508.10 thousand tonnes. The average yield of rice in the state was 2837.01 kg per hectare (2017-18) which is higher than the national average ie.2578 kg per hectare (Economic Survey 2018-19).

Of the total 16 districts in the state, Imphal West has the largest area (24.28 thousand ha) and largest production (86.96 thousand tonnes) and productivity ie. 3581.99 kg/ha of rice in the state. Being located in a hilly and challenging region, the farmers in the state are affected by a number of problems and challenges in rice cultivation like flood, drought, pest and disease infestation, etc. A study by Gupta *et al.* (2014) reported

that cost of paddy cultivation has increased at a rate higher than the increase in the value of the produce. In order to sustain and increase the rice production, adoption of high yielding variety seed, new farming techniques, modern farm inputs, effective plant protection measures and effective extension contacts are very essential. Farmers' club programme was one of the interventions taken up to support and uplift the farmers in the state. The programme was implemented by NABARD with the support of agricultural institutions like ICAR, SAUs, KVKs and line departments for capacity building, technology transfer, extension contacts and linkages with banks for farm credit. Rao (2018) reported that there was significant difference in adoption of improved technology by member and non-member. Farmers were benefited in both social and economic aspects. Darsana and Chandra Kumar (2017) reported that members consider the club as a credible source of information. Along with technology adoption, the programme has enabled farmers to improve their production, productivity and income (Khanduri *et al.* 2015)

In the last five years, farmers' club has come up in a big way for transformation of rural areas and farmers in Manipur state. A number of farmers' training programme, expert's interaction, technology demonstration, field visit, extension contact etc. have been conducted as part of the programme with active involvement of KVKs and other related departments. The present study is an attempt to examine the socio economic status, cost and return, resource use efficiency, factors affecting participation of farmer's club and analysis of constraints faced by the farmers in the state.

MATERIALS AND METHODS

The paper is based on primary data collected from Imphal West district of Manipur. Imphal West district was purposively selected as it has the largest number of farmers' club and highest rice production in the state. The detail village wise list of farmers' club in the district were taken from Krishi Vigyan Kendra, Imphal West. For the purpose of the study, four villages were randomly selected which were Sangaitel, Khumbong, Heikrujam and Bamdiar village respectively. From each village, 25 farmers who were members of farmers' club were randomly selected with a total of 100 members' respondent. In order to compare the result, a matching sample comprising of 100 farmers, 25 from each village who were not members of farmer's club were selected randomly for the study. Primary data were collected from the respondent during the year 2016-17 through personnel interview using well-structured interview schedule. Primary data collected from respondent

$$\text{Ln}Y = \beta_0 + \beta_1\text{Ln}X_1 + \beta_2\text{Ln}X_2 + \beta_3\text{Ln}X_3 + \beta_4\text{Ln}X_4 + \beta_5\text{Ln}X_5 + \beta_6\text{Ln}X_6 + \varepsilon \quad \dots\dots\dots (1)$$

where, Y = value of rice yield per household per hectare (Rs.), X_1 = expenditure on seed per household per hectare (Rs.), X_2 = expenditure on fertilizer per household per hectare (Rs.), X_3 = expenditure on plant protection chemicals per household per hectare (Rs.), X_4 = expenditure on machine labour per household per hectare (Rs.), X_5 = expenditure on human labour per household per hectare (Rs.), X_6 = miscellaneous expenses (transport, loading and unloading, etc) per household per hectare (Rs.).

Logistic regression model

A logistic regression model is used to empirically quantify the relative influence of various factors in the

$$\text{Ln} \left(\frac{P_i}{1-P_i} \right) = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6 + \varepsilon \quad \dots\dots\dots (2)$$

where,

P_i takes the value 1 if i th household is a member of farmers' club

P_i takes the value 0 if i th household is not a member of farmers' club

Ln is the natural log

β_0 = intercept

X_1 = age of head of households (years)

X_2 = family size

X_3 = education level of head of household

X_4 = size of landholding in hectare

X_5 = rice variety (improved = 1, otherwise = 0)

X_6 = occupation of head of household

β_s = parameters to be estimated and

include age, educational level, landholding, occupation, rice variety grown, yield, farm resources, etc. Details of various inputs used in rice cultivation, including material inputs, labour, their quantities and prices were collected.

Analytical framework

Descriptive statistical analysis was carried out for making comparison of socio economic characteristics of sample household and in other analysis wherever necessary. Gross returns were obtained by multiplying yield with the prevailing prices of rice in the study area. Net returns were calculated by subtracting total cost from gross returns. The ratio of gross value of output to total cost is calculated to see the benefit cost ratio and to identify whether rice cultivation is viable or not.

In order to examine the input output relationship in rice cultivation, Cobb Douglas production function has been fitted which has been specified in equation 1.

decision to participate in farmers' club. The study postulated that the probability of a farmer to participate in farmers' club depends on the attributes like age, family size, education, main occupation, land holding and rice variety grown. Several researchers have used logistic regression model with similar factors to study farmer's participation and adoption (Brithal *et al.*, 2005; Noorhosseini and Allahyari, 2012; Kariyasa and Dewi, 2013; Singh *et al.*, 2018; Kumar *et al.*, 2019). The expression of the model is given in equation 2.

ε = random error term

Garrett ranking technique

The Garrett ranking technique was used to study the problems and constraints faced by the farmers in crop cultivation. The percent position of each rank was found out by using the equation

$$\text{Percent Position} = 100 \left(\frac{R_{ij} - 0.50}{N_j} \right)$$

where,

R_{ij} = Rank given for the i th items by the j th individual and

N_j = Number of items ranked by the j th individual

RESULTS AND DISCUSSION

Socio economic characteristics of farmers

The summary of socio-economic profile of the respondent households is given in Table 1. The study reveals that significant differences existed in socio-economic characteristics among farmers' club member and non-member group. The average age of the member and non-member group were 44.55 and 47.78 years respectively. Literacy rate was more among the members with only 1 per cent illiteracy and 17 per cent graduate and above compared to 4 per cent and 10 per cent in case of non-members group. Pearson's Chi-square test shows that there is no significant difference in the educational level of the two group. The average

household size was higher in member group i.e. 5.11 persons compared to 4.71 persons for non-members and the difference is statistically significant. Similarly, the average size of land holding was higher in member group i.e. 0.645 ha compared to 0.537 ha for non-members and is statistically significant at 1 per cent level of significance. Member group had a higher percentage of household having farming as primary occupation compared to non-members. With rice as the major crop grown by farmers in the state, the adoption of improved rice variety by replacing the traditional cultivar was higher among members group. Also, cropping intensity among members was higher with more farmers adopting crop cultivation in winter and summer season which otherwise remained fallow.

Table 1: Socio-economic profile of member and non-member

Characteristics	Member	Non-member	Difference	t-statistics (p-value)
Age of respondent (years)	44.55 (1.278)	47.78 (1.270)	-3.23	-1.792 (0.037)
Level of education				20.059# (0.218)
Illiterate	1	4	-3	
Primary Std (5 th Std)	9	6	3	
Middle Std (8 th Std)	26	28	-2	
High School and Intermediate	47	52	-5	
Graduation and Above	17	10	7	
Household size (nos)	5.11 (0.137)	4.72 (0.134)	0.39	2.028** (0.022)
Size of operational land holding (Ha)	0.645 (0.036)	0.537 (0.026)	0.1077	2.384*** (0.009)
Household having farming as primary occupation (%)	73	66	7	
Farmers adopting improved rice varieties (%)	30	8	22	
Household growing winter and summer crops (%)	27	16	11	

Source: Author calculation based on field data.

Figure in parentheses is indicate standard error.

Note: *** and ** denote significance at 1 per cent and 5 per cent levels respectively.

denote Pearson's Chi-square

Cost and return of rice cultivation

The various expenses incurred and return obtained from rice cultivation are presented in Table 2. The cost of rice cultivation was Rs. 52293/ha for non-member group which was higher compared to member i.e. Rs.50386/ha. Among the various expenses incurred in rice cultivation, human labour and machine labour accounted the highest comprising 81.41 per cent and 78.55 per cent of the total cost of rice cultivation for member and non-member group. This is followed by the expenses on fertilizer which accounted for 5.85 per cent and 7.86 per cent of the total cost for member and

non-member group respectively. It has been found that expenditure on seeds, plant protection chemicals and fertilizers were less in case of members compared to non-member group. Fixed cost comprising of expenses on depreciation on implements and farm building and land revenue constituted less than 1 per cent of the total cost of rice cultivation.

Expenses on labour constituted a major share in both the group as rice cultivation is a labour intensive activity and mechanisation is still lacking in the state. Other researchers viz. Devi and Ponnarasi (2009), Singh *et al.* (2016), Agarwal *et al.* (2018) and Kumar *et al.* (2018)

Table 2: Cost and return of rice cultivation (Rs. ha⁻¹)

Particulars	Member	Non Member
Value of seed	1705 (3.38)	1787 (3.42)
Value of human labour	20805 (41.29)	20181 (38.59)
Value of bullock and machinery	20213 (40.12)	20895 (39.96)
Value of insecticide and pesticide	1618 (3.21)	2644 (5.06)
Value of fertilizer	2945 (5.85)	4109 (7.86)
Interest on working capital	1587 (3.15)	946 (1.81)
Miscellaneous expenses	1281 (2.54)	1542 (2.95)
Depreciation on implements and farm building	121 (0.24)	103(0.19)
Land revenue, cesses and other taxes	111 (0.22)	86 (0.16)
Total cost of cultivation	50386 (100)	52293 (100)
Productivity (Kg ha ⁻¹)	4820.56	4105.24
Gross Return (Rs ha ⁻¹)	101231.76	83952.15
Cost of production (Rs tons ⁻¹)	10452.31	12738.11
Net Return	50845.76	31659.16
B :C Ratio	2.01	1.61

Table 3: Estimates of parameters of Cobb-Douglas production function for rice cultivation

Variables	No. of household	Seed	Fertilizer	Plant protection chemical	Machine labour	Human labour	Misc	R ²
Members	100	0.251 (0.168)	0.224** (0.076)	-0.018 (0.015)	0.338** (0.111)	0.434*** (0.081)	0.181 (0.100)	73
Non-Members	100	0.377*** (0.058)	0.329*** (0.095)	0.039 (0.022)	-0.065 (0.087)	0.021 (0.086)	0.155 (0.143)	61

Figure in parentheses indicate standard error of estimates.

Note: *** and ** denote significance at 1 per cent and 5 per cent levels respectively.

also reported that expenditure on labour account for the highest share in paddy cultivation. Overall, it was found that members were more efficient in the rice cultivation as they had a lesser cost of production. Farmers' club members were trained on use of quality seeds, timely sowing, judicious use of fertilizer and plant protection chemicals. Members had a better extension contact which helped in taking better decision for profitable farming.

The productivity of rice was higher among members with an average production of 4820.56 kg ha⁻¹ compared to 4105.24 kg ha⁻¹ for non-member group. The gross return for member was found to be Rs 101231.76 ha⁻¹ compared to Rs. 83952.15 ha⁻¹ for non-member group. Net return was higher for members ie. Rs 50845.76 ha⁻¹ compared to non-members group which was only Rs. 31659.16 ha⁻¹. It was observed that member group had a higher benefit cost ratio i.e. 2.01 as against 1.61 for non-member group. Various demonstration, awareness and training programme and agro advisories by experts through Farmers' club programme had helped to reduce the cost thereby increasing the net return.

Input output relationship in rice production

The result of input output relationship of rice production using Cobb-Douglas production function is given in Table 3. The coefficient of multiple determination or R square for member group was 73 per cent revealing that 73 per cent of the total variation in return from rice cultivation was explained by the variables taken in the model. The sign and significance of the estimated coefficients of the production function indicate that for member group fertilizer, machine labour and human labour were statistically significant at 5 per cent and 1 per cent level of significance. Fertilizer used in rice cultivation had an elasticity of 0.22, indicating that 1per cent increase in fertilizer use would increase return from rice cultivation by 0.22 per cent. Similarly, 1per cent increase in the use of machine and human labour use would increase the return from rice cultivation by 0.33 and 0.43 per cent respectively.

In case of non-member group, the R square value was 61 per cent revealing that 61 per cent of the variation in return from rice cultivation was explained by the variables taken in the model. Among the various explanatory variables, seed and fertilizers were

Table 4: Determinants for farmer participation in farmers' club programme

Variables	Co-efficient	SE	Odd ratio
Age	-0.033 **	0.013	0.968
Family size	0.229 **	0.112	1.258
Education	0.112	0.117	1.119
Land holding	-0.237	0.440	0.789
Rice variety	1.701 ***	0.437	5.481
Main occupation	0.561	0.345	1.753
Constant	-0.609	0.856	0.544
No. of observation	200		
Prob>Chi ²	0.000		
-2 Log likelihood	246.612		
Cox & Snell R Square	0.142		
Nagelkerke R Square	0.189		

Note: SE denote Standard Error

*** and ** denote significance at 1 per cent and 5 per cent respectively.

statistically significant at 1 per cent level of significance. Seed and fertilizer used in rice cultivation had an elasticity of 0.37 and 0.32, indicating that 1 per cent increase in expenditure in seed and fertilizer would bring 0.37 per cent and 0.32 per cent increase in return from rice cultivation. In fact, in rainfed areas, improved seed and fertilizer are very crucial inputs in increasing agricultural productivity. Similar findings were also reported by other studies conducted by Srinivasan (2012), Alarima *et al.* (2013) and Devi and Singh (2015).

Determinants for farmer participation in Farmers' club programme

The results of the binary logistic regression model for examining factors affecting farmers' participation in farmers' club programme are presented in Table 4. The explanatory variables included in the model were age, family size, education, land holding, rice variety and main occupation. Farmers participating in farmers' club were given value P = 1 while for others the value of P was assigned as zero. The P-value for the model fit statistic was less than 0.05 and highly significant at $p < 0.001$ with six degree of freedom, indicating that at least one of the parameter in the model is non-zero. The Cox and Snell R-square was 0.14, indicating that 14 percent of the variations in probabilities of farmers participating in farmers' club programme was explained by the covariates defined in the logistic model. Regression result revealed that age, family size and rice variety were the significant determinants of farmers' participation in farmers' club programme. The coefficient of the estimated parameter revealed that age had a negative effect on participation in farmers' club whereas family size and rice variety had a positive effect. It also reflects that young people were more

willing to learn new technology and try new techniques in farming. Also, higher family size helped in conducting various farm operation as they have the manpower.

The odd ratio of age indicates that one unit increases in age decreases the odd of participating the farmers' club programme by 3.2 per cent. Odd ratio of family size indicates that for one-unit increase in family size, the odd of participating in farmers' club programme increase by 25.8 per cent. The rice variety had the highest odd ratio indicating that for one-unit increase in adoption of improved rice variety the odd of participating in farmers' club programme increase by 448 per cent. The result is in conformity with that reported in Devi and Ponnarasi (2009) and Singh *et al.* (2018).

Constraints faced by the farmers in rice cultivation

Problems faced by the farmers both member and non-member in rice cultivation were ranked by the respondents' based on their priority and the ranks assigned by them are converted into mean scores using Garrett's Ranking Technique and the result is presented in Table 5. Altogether, five main constraints faced by the farmers based on ranks were listed for both the groups. It has been found that high cost of fertilizer was the most important constraint for both the group. Basyal *et al.* (2019) and Acharya (2019) also reported high cost of chemical fertilizer as the major economic constraints in paddy cultivation. One reason is that there is no chemical fertilizer manufacturing plant in the state and it has to be imported from other states like Assam West Bengal etc. to meet the state requirement. Above this, being located in hilly and challenging region, logistic and transportation is a problem which needs to be addressed as top priority for the benefit of the farmers.

Table 5: Constraints faced by the farmers in rice cultivation

Particulars (Member)	Mean score	Rank
High cost of fertilizer	42.3	1
Fertilizer not available as and when required	42.05	2
Pest and disease	37.5	3
Lack of finance and credit	25.25	4
High cost of hired labour	16.05	5
Particulars (Non- Member)		
High cost of fertilizer	36.9	1
Pest and disease	35.25	2
Poor extension contact	25.95	3
Lack of finance and credit	25.1	4
Fertilizer not available as and when required	22.25	5

The other constraints faced by the member group are fertilizer not available as and when required (2nd rank), pest and disease problem (3rd rank), lack of finance and credit (4th rank) and high cost of hired labour (5th rank). Rice crop is susceptible to a number of pest and diseases. Pathak and Khan (1994) reported that rice crop has almost 20 insect-pests, including stem borers, gall midge, defoliators, and vectors (leaf hoppers and plant hoppers) which cause economic damage to the crop directly or act as vector in disease transfer. Climate change also influences the occurrence of pest and diseases. With respect to the non-member group, the other constraints in order of importance are pest and disease problem (2nd rank), poor extension contact (3rd rank), lack of finance and credit (4th rank) and fertilizer not available as and when required (5th rank) respectively. Similar findings were also reported by other researchers like Phenica and Singh (2018) and Thanh and Singh (2006).

It is observed from the study that farmers' club members have higher adoption of improve rice varieties and also undertake crop cultivation in *rabi* and winter season which otherwise remain fallow in the state. It reflects the positive outcome of expert's interaction and extension contact which is a part of the farmers' club programme. To reduce the expenses on labour in rice cultivation, farmers' club are trying to popularise labour saving equipment's and small machinery by setting up of village tool banks. The yield of rice for both the groups can be increased through better utilization of the underutilized farm inputs. In order to solve the rice farming related problems and shortage of production in the state on a long term basis, formulation of a state rice policy by consolidation of various departments, organization and stakeholders including banks is very much required. The study concluded that farmers' club will act as a good model for implementation of farmer development programmes for achieving higher yield and doubling farmer's income especially in hilly and

challenging regions of Manipur and other North Eastern States.

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