Factors Influencing Adoption of Sericultural Technologies

S. Lakshmanan[1]

Abstract

This study examines factors influencing adoption of sericultural technologies by farmer households in Malavalli taluk of Mandya district in Karnataka. The results reveal that adoption of HYV of mulberry and rearing of CSR hybrids were significantly influenced by cocoon price, extension support and family labour. To increase adoption level in the study villages in particular and in general in Karnataka, the Department of Sericulture (DOS) has to encourage new farmers through free supply of HYV mulberry cuttings and arrange credit to construct rearing house and organize training for the farmers to rear CSR silkworm races. In addition, DOS has to maintain stable cocoon price to assure that sericulture is more profitable and sustainable.

Introduction

Adoption of technological innovation in backward agriculture and its allied sectors has been receiving considerable attention in recent years. However, the introduction of many new technologies has met with only partial success, as measured by the observed rate of adoption (Feder et al., 1985). It is understood that there are constraints such as credit, irrigation and price, which are not optimizing the productivity and quality of output of agricultural crops. Therefore, the major task of extension personnel is to identify the constraints with the farmers for not adopting the recommended technologies in the field, find out the reasons and work towards removing such constraints to increase yield and income from agriculture and allied crops.

Mulberry sericulture has become an alternative source of income for marginal and small landholders in India. Studies show (Lakshmanan et al, 1996, 1998, 2000, 2005, 2007 and 2008) that sericulture offers higher income opportunities and generates adequate family labour employment throughout the year. After 1990s, sericulture has been considered as an important competitive commercial enterprise in the rural segments; this has become possible due to introduction of high yielding technologies and improved cultivation and rearing methods in the field. The project on Promotion of Popularizing the Practical Bivoltine Sericulture Technology (PPPBST) by Japan International Co-operation Agency (JICA)

[1] Scientist-C, Central Sericultural Research and Training Institute, Sriramapura, Mysore

implemented in Southern India during 1997-2002 has made sericulture more sustainable and profitable.

Karnataka is the largest silk producing state in the country. Although in terms of mulberry acreage and silk output the state of Karnataka occupies the first position among silk producing states, silk productivity is below the national level. One of the reasons may be due to low level of adoption of recommended technologies by the farmers. Although an extensive body of literature exists for technology adoption in the agriculture sector, relatively few empirical studies have examined the adoption of sericulture technologies after implementation of JICA project in the field. In this context, a study has been conducted to examine factors, which influence the adoption of new sericulture technologies by the farmers in Karnataka.

Methodology

An empirical study was undertaken in Mandya district of Karnataka during 2001-02. Malavalli taluk of Mandya district was purposely selected based on potential of mulberry cultivation in the region. Three villages, viz., Halugur, DC pura and Megalapura, were selected considering mulberry acreage and number of bivoltine silkworm rearers. From each village, 30 farmers were selected randomly to conduct the study. Thus, the study constituted a total of 90 sample farmers. To analyze factors influencing adoption of new sericulture technologies, two technologies, viz., one each from mulberry (HYV) and silkworm race (CSR races), were considered for the study. The relevant socio-economic and extension support details were collected from the sample respondents by direct interview method using a pre-tested schedule. To find out factors influencing adoption of the two technologies by the sample farmers, probit and logit models were tried and finally the logit model was chosen for this study. When using logit model, the maximum likelihood estimation technique is preferred for the estimation of the parameters. Added to that, the inference is based on interpretation of probability rather than conventional regression interpretation.

Adoption model

The objective of this study was to develop a model of adoption behaviour for sericulture practices. The dependent variable in the model was discrete indicating whether sericultural technologies such as HYV (V_1 mulberry variety) and CSR races (bivoltine silkworm races), were adopted or not. Binary models are

appropriate when the choice between two alternatives depends on the characteristics of the problem. Generally, information on socio-economic, communication and psychological factors is used to ascertain if these factors affect the adoption of sericultural practices. Whether to adopt a new technology or not is essentially a whole-farm decision. The factors such as education of the family, credit support, extension contact, price of the produce, and availability of irrigation sources etc., which are included in the model are expected to have their influence on adoption of new technologies. Conceptually, the following is the technology adoption model used to examine the factors influencing adoption decision in sericulture.

We consider, in this study, a multivariate technique for estimating the probability that an event occurs, the binary logistic regression model (Lakshmanan, 1998). Conceptually, the following is the adoption behavioral model used to examine the factors influencing adoption of new sericulture technologies:

$$Y_i = g(I_i) \qquad \ldots(1)$$

$$I_i = b_0 + \Sigma b_j X_{ji} \qquad \ldots(2)$$

Where Yi is the observed response for i-th observation (i.e., binary variable, Yi = 1 for an adopter and Yi = 0 for a non-adopter). The description of explanatory and the corresponding binary variables are given in Table 1.

It is an underlying and unobserved stimulus index for the i-th observation (conceptually there is a critical threshold (I^*_i) for each farmer; if Ii $< I_i^*$, the farmer is observed to be a non-adopter, if $I_i > I_i^*$, the farmer is observed to be adopter). g is the functional relationship between the field observation (Y_i) and the stimulus index (I_i), which determines the probability of adoption of sericultural practices.

Ii = 1,2,...,k, are the observations on variables for adoption model, k being the sample size; j = 0,1,2,...,n is the total number of independent variables. Xji is the j-th explanatory variable for the i-th observation; b_0 is the intercept and bj are the coefficients of explanatory variables. The final form of the logit model used in this study for the adoption behaviour of the farmers is :

I_i (adoption of V1 mulberry) = $b_0 + b_1$ farm size + b_2 irrigation + b_3 education b_4 credit + b_5 Extension contact + b_6 price of cocoon ..... (3)

I_i (adoption of CSR silkworm race) = $b_0 + b_1$ farm size + + b_2 extension contact + b_3 credit + b_4 family size + b_5 cocoon price + b_6 rearing house ...(4)

Table 1: Description of Variables used by Logit Model

Sl. No	Variable		Unit of variable	Description of Variable
1	Irrigation	X_1	Binary	0 Inadequate irrigation 1 Adequate irrigation
2	Farm size	X_2	Numerical	Acre
3	Education	X_3	Binary	0 Illiterate farmer 1 Literate farmer
4	Price	X_4	Binary	0 Unfavorable cocoon price 1 Favorable cocoon price
5	Credit	X_5	Binary	0 Credit not availed 1 Credit availed
6	Extension contact	X_6	Binary	0 No extension advice received 1 Extension advice received
7	Rearing house	X_7	Binary	0 No separate rearing house 1 Separate rearing house
8	Family size	X_8	Numerical	Number
9	Adoption of V1 mulberry	Y_i	Binary	0 Non adoption of HYV (V_1 Mulberry) 1 Adoption of HYV (V1Mulberry)
10	Adoption of bivoltine races	Y_i	Binary	0 Non adoption of CSR races 1 Adoption of CSR races

Results and Discussion

Socio-economic Profile of the Sample Farmers

Socio-economic profile of sample farmers was collected during the field study and the details are given in Table 2.

Age of the Sample Respondents

The age of the farmers village wise reveals that the average age of respondents was observed to be 34.4 for Halugur, while it was 38.6 and 33.6 for DC Pura and

Megalapur villages respectively. A majority of the respondents were middle aged. Farmers of middle age are usually enthusiastic, matured in taking decisions on adoption of technologies.

Table 2: Socio-economic profile of sample farmers

Sl.No	Particulars	Unit	Halugur (n= 30)	DC Pura (n= 30)	Megalapura (n= 30)	Pooled sample (n= 90)
1	Age	Year	34.4	38.6	33.6	35.53
2	Education (schooling)	Year	7.3	6.3	8.9	7.5
3	Family size	No	5.2	4.7	7.5	5.8
4	Area under mulberry	Acre	1.15	1.05	0.92	1.042
5	Separate rearing house	No	12	15	8	11.67
6	Irrigation (per year)	No	28	25	26	26.33

Education

The findings revealed that the average years of schooling of the pooled sample were 7.5. The years of schooling for Halugur, DC Pura and Megalapura were 7.3, 6.3 and 8.9 respectively. It was reported by the respondents during the field study that majority of the faming households had school education, as there are a few primary and high schools located in and around the villages. Further, those villages are located near Malavalli town that helped many farmers to acquire higher education.

Family size

The information about family size showed that sample farmers from Megalapura had an average family size of 7.5 members, whereas it was 5.2 for Halugur and 4.7 for DC Pura. The reason for higher number of family members in Megalapura was due to the fact that most of the sample farmers had joint family and were working together on the same land.

Area under Mulberry

It is clear from Table 2 that the mulberry holding size was less than one acre in Megalapura (0.92 acre) than other two villages viz., DC pura (1.05 acre) and Halugur (1.15 acre), indicating that all the farmers were marginal. The possible

reason could be that bivoltine sericulture was not only new to them but also more risky. Further, they did not have sufficient infrastructure to expand mulberry acreage beyond one acre or more.

Irrigation

An important resource to cultivate high yielding mulberry variety is irrigation. The HYV requires adequate irrigation to produce quality and quantity of mulberry shoots to feed silkworms. It is recommended to irrigate the mulberry garden at least once every 10 days. The study villages had sufficient irrigation sources to supply water throughout the year. On an average, irrigation was given 26 times by pooled farmers to cultivate mulberry. The study reports that all the sample farmers of the three villages have given irrigation more or less equal number of times.

Separate Rearing House

For rearing silkworms, independent rearing house with required appliances are advocated. Due to inadequate investment in the rearing house, most of the sample farmers reared silkworms within the domestic house itself. Table 2 reveals that only about 12 farmers had separate rearing house with adequate rearing equipments for pooled samples. The least was in Megalapura (8 farmers) and the highest was in DC Pura (15 farmers).

Factors influencing Adoption of HYV (V_1 Mulberry)

The influence of explanatory variables on the probability of adoption of high yielding mulberry variety (V_1) is given in Table 3. The findings reveal the results of logit model estimation of adoption influencing factors of mulberry variety in the three study villages. The results indicate that among the six variables used, the probability of adoption of V_1 variety by the sample farmers in Halugur and DC Pura village was significantly associated with credit, extension support and cocoon price. In the case of Megalapura, cocoon price was the prime factor to adopt HYV in mulberry. However, considering all the three villages together, except farm size, all other variables had a positive influence.

Table 3. Non-linear parameter estimates of Logit model for HYV (V1 mulberry)

Name of Variable	Halugur (n = 30)		DC Pura (n = 30)		Megalapura N = 30)		Pooled sample (n = 90)	
	Wald statistic	Standard error	Wald statistic	Standard error	Wald statistic	Standard error	Wald statistic	Standard error
Constant	0.345	2.456	0.227	2.894	0.678	2.601	0.554	2.561
Irrigation	0.234	1.340	0.896	1.984	0.567	1.987	0.399	1.483
Farm size	-0.567	0.367	-0.784	1.678	-0.875	0.939	-0.906	0.384
Credit	2.358*	0.874	2.898*	0.498	0.568	1.520	0.111	1.641
Extension contact	3.289**	0.459	2.897*	0.523	3.984	0.290	0.024	1.960
Cocoon price	2.674*	0.980	2.987*	0.874	3.115**	0.764	3.213**	2.411
Education	0.568	0.8456	0.823	0.498	0.896	1.783	0.471	2.232
- 2 Log likelihood	13.498	-	16.895	-	15.784	-	14.610	-
Cox & Snell R^2	0.48	-	0.67	-	0.63	-	0.40	-
Nagelkerke R^2	0.66	-	0.79	-	0.72	-	0.64	-

* Significant at 5 per cent level

** Significant at 1 per cent level

Mulberry sericulture has become a commercial crop and the decision to expand or discontinue in sericulture is significantly influenced by the market price of cocoons. During the study, the interaction with the sample farmers revealed that sericulture offers them higher income than other agricultural crops due to the prevailing good price for cocoon in the market. Apart from the cocoon price, the new farmers were given subsidy and credit support by Department of Sericulture (DOS) to plant V_1 variety in the study villages. These factors motivated the farmers to plant HYV variety and replace low yielding varieties. It was observed that farm size had not influenced the probability of adoption of HYV and in turn it showed a negative sign. This implies that most of the farmers were marginal whose investment capacity was limited to increase mulberry farm size in the study villages.

Factors influencing Adoption of CSR Races

With regard to probability of adoption of CSR hybrid races by the sample farmers, it could be seen from Table 4 that cocoon price, family size and extension contact were the important variables which influenced significantly to rear CSR hybrid races. The farm size, which showed negative sign, was found to be disassociated with adoption of CSR hybrid races.

The other variables such as credit and rearing house were also positively influenced to rear CSR races. It was reported by the DOS officials that farmers were encouraged to rear CSR races like providing free supply of disinfectants and regular supervision to assist the farmers during the rearing period. Another important factor is that availability of surplus own family labour, helped the farmers to rear CSR silkworm rearing in the study villages.

Conclusion

The empirical study clearly showed that adoption of HYV of mulberry (V_1) and rearing of CSR hybrids by the sample farmers in the three study villages were influenced mainly by cocoon price, extension support and family labour. Further, the findings support the prevailing field situation for adoption of new technologies. To increase adoption level in the study villages in particular and in general in Karnataka, DOS has to encourage new farmers through free supply of HYV mulberry cuttings and arrange credit to construct rearing house and organize training for the farmers to rear CSR silkworm races. In addition the DOS needs to maintain stable cocoon price to assure more profitable and sustainable sericulture.

Table 4. Non-linear parameter estimates of Logit model for CSR races

Name of Variable	Halugur (n= 30)		DC Pura (n= 30)		Megalapura N= 30)		Pooled sample (n= 90)	
	Wald statistic	Standard error	Wald statistic	Standard error	Wald statistic	Standard error	Wald statistic	Standard error
Constant	1.786	0.568	1.576	0.981	1.896	0.784	1.697	0.193
Rearing house	0.879	1.986	0.998	1.893	0.910	1.986	2.384	0.123
Farm size	-0.789	1.712	-0.165	1.984	-0.560	0.167	-1.817	0.178
Credit	1.845	0.872	0.985	1.867	0.984	1.890	0.117	0.732
Extension contact	3.756**	0.278	4.986**	1.789	3.913**	0.598	2.678*	0.102
Cocoon price	3.560**	0.654	3.091**	0.874	4.981**	0.189	5.120**	0.014
Family size	2.891*	0.886	3.893**	0.789	2.982*	0.674	3.133**	0.716
- 2 Log likelihood	18.781	-	17.893	-	16.984	-	19.572	-
Cox & Snell R2	0.69	-	0.65	-	0.69	-	0.52	-
Nagelkerke R2	0.71	-	0.69	-	0.73	-	0.69	-

* Significant at 5 per cent level
** Significant at 1 per cent level

References

Feder, G., R.E. Just and D. Zilberman (1985). Adoption of Agricultural Innovations in developing countries, Economic Development and Cultural Change, 33(2): 159-165.

Lakshmanan, S., B.Mallikarjuna., H.Jayaram., R.. Ganapathy Rao., M..R..Subbuswamy, R..G.Geetha Devi and R..K.Datta (1996). Economic Issues of Production of Mulberry Cocoon in Tamil Nadu; A Micro Economic Study, Indian Journal of Sericulture, 35(2):128-131.

Lakshmanan, S. (1998) Adoption of Technological Innovations and Productivity Behavior of Sericulture in Tamil Nadu: An Econometric Analysis. Unpublished Ph.D thesis, University of Mysore, Mysore

Lakshmanan, S., H. Jayaram, R.. Ganapathy Rao., B. Mallikarjuna, and R.G. Geetha Devi (1998). Manpower utilization in mulberry sericulture An empirical analysis, Manpower Journal, XXXIII (4): 50-63.

Lakshmanan, S., R..G.Geetha Devi, and N.Suma (2000) Studies on economics of bivoltine versus cross-bred cocoon production in K.R.Nagar taluk of Mysore district, Indian Journal of Sericulture, 39(2):149-151.

Lakshmanan, S. and R..G. Geetha Devi (2005). A comparative analysis of economics of bivoltine and cross-breed cocoon production in Mandya district of Karnataka, Indian Journal of Sericulture, 44 (2) :179-182.

Lakshmanan S. and R.G. Geetha Devi (2007a) Employment Generation in dry farming sericulture in Karnataka- An Empirical study, Manpower journal, XLII (1): 181-198.

Lakshmanan S. and R.G. Geetha Devi (2007b) Knowledge and adoption levels of farmers of CSR and cross-breed sericultural technologies, Indian Journal of Sericulture, 46(1):56-61.

Lakshmanan S. and R.G. Geetha Devi (2007c) Employment opportunities in mulberry sericulture versus agricultural crops- An empirical study, SBI Monthly Review, April, 16-19.

Lakshmanan. S. (2007d). Growth trends in mulberry silk production in India. An Economic analysis, Financing Agriculture, 39(4):28-30.

Lakshmanan. S. (2007e). Yield Gaps in Mulberry Sericulture in Karnataka: An Econometric Analysis, Indian Journal of Agricultural Economics, 62(4): 623-636

Lakshmanan, S, H.M. Munikrishnappa., B. Mallikarjuna and R.G. Geethadevi (2008). An Economic appraisal of silk cocoon production in Southern India, Indian Journal of Sericulture , 47(1) : 40-44.