Research Article

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Adoption of recommended technologies by rubber growers in Kanyakumari district of Tamil Nadu

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Abstract

Rubber being an important plantation crop in our country, an attempt was made to analyse the adoption behaviour of rubber growers and the associated factors. The study was carried out in Thiruvattar block, Kanyakumari district of Tamil Nadu. Around 150 rubber growers were interviewed personally through a well structured and pre-tested interview schedule. Percentage analysis, cumulative frequency, simple correlation coefficient and multiple regressions were used for data analysis. Fourteen independent variables and one dependent variable were studied. Out of fourteen independent variables farming experience and scientific orientation had shown positive and significant association with adoption and mass media exposure had shown negative and significant relationship with the adoption. The results showed that 53.7 per cent of variation in the adoption and the results fit in the regression equation. Twenty five practices were identified to assess the adoption behaviour of rubber growers on rubber cultivation practices. Majority of the rubber growers had medium level of adoption on rubber cultivation practices. Regarding practice wise adoption, majority of the respondents adopted recommended spacing, weeding, first tapping during seventh year, tapping at the appropriate time, using tapping implements, yield stimulant and application of anti-coagulant in latex.

Keywords: Adoption, correlation coefficient, regression, rubber growers, technology

Introduction

Para rubber or *Hevea brasilensis* is the most commercially exploited species for natural rubber in the world. Rubber trees are now widely cultivated in 20 countries all over the world for the purpose of production of latex (Teoh and Ujang, 2011). Natural rubber, an industrial raw material of strategic importance, is among the most versatile agricultural products. It finds use in about 50,000 products across the world. In India, around 35,000 products are made out of natural rubber. Various products like auto tyre, auto tubes, automobile parts, wires, belts, cables, battery boxes, footwear *etc.* are produced by the rubber industry.

India's natural rubber production is increasing steadily over the past decade with the developments taking place in industrial, agricultural and transportation sectors and as a result of increasing efforts to find new uses of rubber. Improving the quality of sheet rubber is essential for healthy growth and sustainability of the Indian rubber plantation industry. The continuous growth of natural rubber production and rubber manufacturing sectors in the country had always been made possible by protection from external struggle through tariff and non-tariffs barriers during the period 1947 to 1991 (Mohanakumar and George, 2001; George *et al.*, 2002). It has been traditionally restricted to hinterlands of southwest coast, mainly in Kerala and Kanyakumari district of Tamil Nadu. Kerala and Tamil Nadu together comprise the traditional rubber growing regions in the country. Kerala alone contributes 89 per cent of the total rubber production

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in India and an area of 8,10,800 ha is under rubber plantation. Tamil Nadu contributes an added three per cent of the total natural rubber production. Kanyakumari is the only district under rubber plantation in Tamil Nadu with an area of 24,324 ha. Hence, an analytical study has been taken up with the objectives of assessing the adoption level among the rubber growers on the recommended rubber cultivation practices and to find out the association and contribution of characteristics of rubber growers with adoption.

Material and methods

The southern district of Tamil Nadu *viz*, Kanyakumari was purposively selected for the reason that this was the only district in Tamil Nadu where rubber was cultivated in more area. A total sample size of 150 rubber growers was selected for the study. Kanyakumari district has four taluks. The multi stage random sampling done purposively selecting district, taluk and block with the highest area under rubber cultivation in Tamil Nadu. Thiruvattar block comprises of nine revenue villages. The nine revenue villages were arranged in descending order based on the area under rubber. Then the first six villages which had the maximum area under rubber were selected for the study. The villages thus selected were Shurlacode, Thirparappu, Thumbacode, Ponmanai, Thiruvattar and Macode. For data collection, a well structured and pre-tested interview schedule was used.

The important cultivation practices of rubber were listed and finalized in consultation with the scientists and extension staff ahead for the interview schedule. The respondents were narrated about these practices one by one, each time enquiring whether they had adopted in the previous year. If the answer was 'yes' a score of one and if the answer was 'no' a score of zero was assigned. The scores of all these items were added up for each respondent to calculate the adoption score.

The cumulative frequency method suggested by Rao and Ragava (1987) was used to categorize the respondents into low, medium and high groups. Based on the score values, the number of respondents belonging to each class was determined. The square root of frequency was calculated. The cumulative frequency was multiplied by 1/3 and 2/3 to find out the two boundaries namely L_1 and L_2 respectively. The exact values of these boundaries were calculated by using the formula.

$$L = K + \left[\frac{L_i - C}{f}\right] \times n$$

where, K is the median between lower limit of the class in which L_i occurs and the upper limit of the previous class; L_i represents boundary values namely L_1 and L_2; C is cumulative square root of frequency upto the classes proceeding the class in which L_i lies; n is Interval of the class and f square root of frequency in the class in which the median lies

Then the three categories were arrived as detailed below

Below L_1 value	-	Low
Between L_1 and L_2 values	-	Medium
Above L_2 values	-	High

Percentage analysis was used to get the meaningful interpretation about their pattern of adoption of different practices.

Pearson's product moment correlation co-efficient was calculated to find out the degree of relationship between two variables, by using the following formula.

$$r = \frac{\Sigma xy - \frac{(\Sigma x)(\Sigma y)}{n}}{\sqrt{\left(\Sigma x^2 - \frac{(\Sigma x)^2}{n}\right) \times \left(\Sigma y^2 - \frac{(\Sigma y)^2}{n}\right)}}$$

where,

N	=	Sample size
xy-(x) (y)/n	=	Sum of product of x and y
x^2-$(x)^2$/n	=	Sum of square of x
y^2-$(y)^2$ / n	=	Sum of square of y

The 't' test of significance was used to test the significance of the 'r' value, using the formula.

$$\text{Stn-2df} = \frac{r \times \sqrt{n-2}}{\sqrt{1-r^2}}$$

Where, n = Sample size; r = Correlation co-efficient value;

The significant of calculated 'r' values was tested for 5 per cent and 1 per cent levels of significance.

Multiple regression analysis was used to find out the functional relationship between dependent and the independent variables. The following is the general formula of multiple regression equation

$$Y = a + b_1X_1 + b_2X_2 + \ldots.+b_nX_{n+e}$$

where, Y is dependent variable; a is intercept, X_1 to X_n are independent variables; b_1 to b_n = partial regression co-efficient and e = error term.

Results and discussion

Adoption level of rubber growers on rubber cultivation practices

According to Rogers (1983) adoption is referred to the decision of an individual or farmer to make full use of an innovation as the best course of action available. Hence, an attempt was made to assess the adoption level of the rubber growers on rubber cultivation practices. The findings on the adoption of rubber cultivation practices by the respondents are presented as follows:

Overall adoption level

The distribution of respondents according to their overall adoption of rubber cultivation practices is presented in Table 1.

Table 1. Overall adoption level on rubber cultivation practices (n=150)

Category	No. of respondents	Per cent adoption
Low	24	16.0
Medium	100	66.7
High	26	17.3
Total	150	100.0

It is revealed from Table 1 that 67.7 per cent of the respondents had medium level of adoption followed by 17.3 per cent of respondents had high level of adoption on recommended rubber cultivation practices. Only 16.0 per cent of the respondents had low level of adoption. The finding draws support from the findings of Chaudhary and Punjabi (2005) and Lanjewar (2009) who also had reported that majority of the respondents had medium level of adoption.

Practice-wise adoption level

Twenty five rubber cultivation practices have been identified and included for this purpose (Table 2).

Crop production Technologies

Table 2 shows that 53.3 per cent of the respondents adopted recommended spacing. The reason might be that the rubber growers felt that the recommended spacing would increase the latex flow in later years which would fetch remunerative price and more over the rubber plantations with recommended spacing alone were eligible for subsidy by Rubber Board. This result was in line with Mohammad (2000) who also reported that more than half of the guava growers adopted the recommended spacing in guava cultivation.

About 52.7 per cent of the respondents adopted weeding and the reason might be its traditional nature. Fifty per cent of the respondents followed apiculture in rubber plantation and the reason might be the additional income from apiculture.

Two-fifth of the growers adopted the recommended rubber varieties and 30.0 per cent of the growers adopted the recommended size of pits for rubber plantation. Since these are one time practices, lack of awareness during the time of establishment might be the reason for low level of adoption. Cultivating cover crop in rubber plantation was adopted by only 26.7 per cent of the respondents. Pine apple was normally used as cover crop in this region. Since it was not suitable for slopy region as well as it involved additional expenditure, labour, time and inputs, majority of growers were not cultivating cover crops.

Only 25.3 per cent of the respondents adopted basal fertilizer application. The reason might be the lack of awareness and the cost at the time of establishment. This result was in accordance with Agarwal (2000) who revealed that low level adoption of fertilizer application in improved cultivation of pea by the farmers. Less than one-fourth of the respondents adopted the soil testing and application of top dressing of fertilizers. Lack of awareness, complexity of technologies and less visibility of the impact of the adoption of the technologies might be the reasons for less adoption measures, high yielding varieties, soil treatment, seed treatment and harvesting and drying practices.

Table 2. Adoption of recommended technologies by rubber growers (n=150)

Technologies	No. of respondents	Per cent adoption
Crop production Technologies		
Size of pit for rubber plantation	45	30.0
Rubber varieties	60	40.0
Spacing	80	53.3
Basal fertilizer application	38	25.3
Application of top dressing of fertilizers	20	13.3
Weeding	79	52.7
Cover crop	40	26.7
Soil testing	31	20.7
Apiculture in rubber plantations	75	50.0
Crop protection technologies		
Protection of young plants against sun burn	18	12.0
Control measure for mealy bug	40	26.7
Control measure for termite infestation	29	19.3
Control measure for powdery mildew	42	28.0
Control measure for abnormal leaf fall	62	41.3
Control measure for tapping panel dryness	45	30.0
Technologies pertaining to harvest		
First tapping during seventh year	126	84.0
Recommended methods of tapping	25	16.7
Implements used for tapping	150	100.0
Optimum time for tapping	150	100.0
Standard girth for tapping	20	13.3
Depth of cut for tapping	23	15.3
Tapping intervals	67	44.7
Rain guarding of trees	56	37.3
Application of anticoagulant	90	60.0
Yield stimulant	120	80.0

Crop protection technologies

Table 2 shows that 41.3 per cent of the respondentsadopted the control measure for abnormal leaf fall followed by 30.0 per cent for tapping panel dryness, 28.0 per cent for powdery mildew and 26.7 per cent against mealy bug. Nearly one fifth of the respondents adopted the control measure for termite infestation. The low level of adoption might be due to less infestation of pest, disease and physiological disorders. The other reason might be that the growers might have perceived that these infestations would not affect the yield of the tree. Only 12.0 per cent of the respondents adopted the protection of young plants against sun burn. The reason for less adoption might be the non-occurrence of the symptoms. This result was in line with the study of Jaitawat (2008) who also reported that the less adoption was observed in plant protection in fennel cultivation.

Technologies pertaining to harvest

All the respondents had done tapping at the appropriate time. This might be due to the fact that all the respondents were aware of that timely tapping would yield more and higher income. Similarly all the respondents used tapping implements like knives, spouts, collection cups, cup hangers, collection buckets and scrap baskets for tapping. Without these implements tapping could not be done might be the reason for cent per cent adoption.

It could be seen from the table that 84.0 per cent of the respondents adopted the first tapping during seventh year and four fifths of the respondents used yield stimulant. Sixty per cent of the respondents adopted the practice of applying anti-coagulant. Since these technologies had direct impact on yield and income, the adoption rate was high. About 44.7 per cent of the respondents adopted the tapping intervals and 37.3 per cent of the respondents adopted rain guarding of rubber trees during rainy

season. Lack of awareness might be the reason for low adoption.

Only less than one fifth of the respondents adopted the recommended methods for tapping (16.7 per cent), depth of cut for tapping (15.3 per cent) and standard girth for tapping (13.3 per cent). Lack of awareness and skill on the part of labourers, might be the reason for low adoption.

Association and contribution of characteristics with adoption

The contribution of independent variables namely age (X_1), farming experience (X_2), educational status (X_3), occupational status (X_4), family type (X_5), farm size (X_6), social participation (X_7), extension agency contact (X_8), mass media exposure (X_9), innovativeness (X_{10}), scientific orientation (X_{11}), risk orientation (X_{12}), credit orientation (X_{13}) and annual income (X_{14}) were studied with the dependent variable adoption and the results are presented.

Analyzing the association and contribution of characteristics of rubber growers with their adoption on rubber cultivation practice is one of the objectives of the present study. Hence, simple correlation and multiple regression coefficients were analysed and the results are presented in Table 3.

It could be foundfrom the Table 3 that out of fourteen independent variables studied, two variables namely, farming experience (X_2) and scientific orientation (X_{11}) had shown positive and significant association with adoption at one per cent level of significance. The variable mass media exposure (X_9) had shown negative and significant relationship with the adoptionat five per cent level of significance. The other variables did not show any relationship with adoption.

In general the more the farming experience and scientific orientation, the more will be chances for accepting, understanding and adopting the technologies and that might be the reason for positive and significant association of farming experience and scientific orientation with adoption level of respondents . This result was in line with Christian *et al.* (2005) who stated that scientific orientation had positive significant relationship with their extent of adoption. In this study more than four fifth of the respondents had low to medium level of mass media exposure. Most of the mass media in Tamil Nadu which were having audience throughout Tamil Nadu would not cover rubber regularly. This might be the reason for significant negative association of mass media with adoption.

Multiple regression analysis was applied to find out the extent of contribution of each variable towards the adoption level of rubber growers on rubber cultivation practices. The R^2 value 0.537 revealed that 53.7 per cent of variation in the adoption level was explained by the fourteen independent variables selected for the study. The 'F' value was

Table 3. Correlation and multiple regression coefficients of characteristics of respondents with their adoption (n=150)

S. No.	Variables	'r' value	Regression co-efficient	Standard error	't' value
X_1	Age	-0.015 ^{NS}	-0.03037	0.025457	-1.19293 ^{NS}
X_2	Farming experience	0.634**	0.434867	0.044341	9.807313**
X_3	Educational status	0.053 ^{NS}	0.173348	0.167468	1.035112 ^{NS}
X_4	Occupation	0.016 ^{NS}	-0.17438	0.287404	-0.60676
X_5	Family type	0.033 ^{NS}	0.813961	0.411989	1.975687*
X_6	Farm size	-0.084 ^{NS}	-0.82932	0.405947	-2.04292*
X_7	Social participation	0.025 ^{NS}	0.077998	0.116763	0.668002 ^{NS}
X_8	Extension agency contact	-0.055 ^{NS}	-0.04106	0.024711	-1.66173 ^{NS}
X_9	Mass media exposure	-0.145*	-0.14324	0.097843	-1.464 ^{NS}
X_{10}	Innovativeness	-0.031 ^{NS}	-0.16682	0.376304	-0.44332 ^{NS}
X_{11}	Scientific orientation	0.358**	0.266368	0.065329	4.077361**
X_{12}	Risk orientation	0.033^{NS}	-0.04228	0.052673	-0.80262 ^{NS}
X_{13}	Credit orientation	-0.039^{NS}	0.185722	0.156371	1.187701^{NS}
X_{14}	Annual income	0.047 ^{NS}	0.466585	0.323313	1.443138 ^{NS}
		$R^2 = 0.537$		F = 11.19574	

*Significant at 5 per cent level; **Significant at 1 per cent level; NS - Non Significant

also significant at one per cent level of significance. Hence, the results fit in the regression equation.

The prediction equation was fitted for adoption level of the respondents and is given below:

$$Y2 = 22.25 - 0.030X_{1+} \; 0.434X_{2}** + 0.173X_{3} - 0.174X_{4} + 0.813X_{5}* - 0.829X_{6}* + 0.077X_{7} - 0.041X_{8} - 0.143X_{9} - 0.166X_{10} + 0.266X_{11}** - 0.042X_{12} + 0.185X_{13} + 0.466X_{14}.$$

It could be seen from the above equation that the regression co-efficient of variables namely farming experience (X_2) and scientific orientation (X_{11}) were positively related to adoption at one per cent level of significance. The variable family type (X_5) was positively related to adoption at five per cent level of significance. But the variable farm size (X_6) was negatively related to adoptionat five per cent level of significance.

Therefore, it could be inferred from the above equation that one unit increase in the variables namely farming experience (X_2), family type (X_5) and scientific orientation (X_{11}) would result in consequent increase of 0.434, 0.813 and 0.266 units respectively in adoption level of the respondents on rubber cultivation. But a unit increase in farm size (X_6) of rubber growers would decrease their adoption level by 2.042 units.

Farming experience showed positive contribution with the adoption level due to the reason that the farmers with more experience would adopt technologies easily than other farmers. In general, the farmers with more scientific inclination would adopt technologies easily than other farmers and hence that might be the reason for positive significant association of scientific orientation with adoption. Farm size showed negative association with adoption. The reason might be, many of the rubber cultivation practices were labour intensive and the farmers with large size of holdings would not adopt the technologies due to non-availability of skilled labour.

Conclusion

From the present investigation the variables, farming experience, scientific orientation and family type showed positive contribution with the adoption and the variable mass media exposure showed negative association with adoption. Trainings may be conducted to improve the farmer's capacity in rubber cultivation. The study also exhibited that majority of the rubber growers possessed medium level of adoption on rubber cultivation practices. Since knowledge is the pre-requisite for adoption, it is essential to enhance the knowledge level of farmers on rubber cultivation technologies through proper trainings and demonstrations. The practice like protection of young rubber plants from sun burn and the method of tapping in rubber tree were adopted by less number of rubber growers. Hence,the extension personnel should make the respondents to understand the complex practices and convince them by conducting demonstrations, exhibitions, group meetings *etc.*

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