Research Article

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Technology adoption and socio-economic determinants of cashew farming in North Kerala

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Abstract

The present investigation analyses the existing technology utilization status in the Kannur and Kasaragod districts of Kerala state, as a prerequisite for developing and initiating innovative cashew production technology interventions for combating low productivity and profitability from cashew cultivation. An 'ex-post-facto cause to effect' design was used, and a rural appraisal ascertained that the levels of technology utilization were significantly low among cashew farmers in this region. The majority of farmers surveyed exhibited a low level of technology utilization status in cashew farming. Four socio-personal variables *viz.,* extension contact, extension participation of cashew farmers, information and communication technologies (ICT) usage and cosmopoliteness and seven economic variables *viz.*, farm size, area under cashew, number of yielding cashew trees, expenditure in agriculture, net income from agriculture, expenditure in cashew farming and net income from cashew farming were found to have a significant positive contribution towards adoption of cashew production technologies. Stepwise regression yielded a model with four predictors *viz*., number of yielding cashew trees, extension participation, net income from agriculture and farm size (negative effect) explaining up to 47.5 per cent of the variation in technology utilization among cashew farmers.

Keywords: Cashew farmers, determinants, production technologies, technology adoption

Introduction

Cashew (*Anacardium occidentale* L.) is one among the important commercial crops of Kerala and contributes significantly to national area and production (Sebastian *et al*., 2004). Often referred to as 'wonder nut', cashew is one of the most valuable processed nuts traded on the global commodity markets. As an important cash crop, it provides livelihood to the cashew growers, empowers rural women in the processing sector, creates employment opportunities and generates foreign exchange through exports. Presently, cashew has gained status of a commercial crop through technological advancements with respect to propagation, production, management and mechanized processing. This change was fuelled as a result of increasing demand for raw cashew nuts and enhanced interest for its commercialization (Venkattakumar, 2009). Cashew can grow in fairly poor soils with relatively low rainfall, as long as there is a clear dry season of two-four months. These attributes, coupled with low capital requirement for orchard establishment and low nut perishability which minimises post-harvest activities, have given cashew the reputation of being a poor man's crop (Jaffee, 1995).

The cashew cultivation in India mainly confines to peninsular region covering the states of Kerala, Karnataka, Maharashtra and Goa along the west coast, whereas in Tamil Nadu, Andhra Pradesh, Orissa, West Bengal along the east coast region. It is also grown in plains like Chhattisgarh, Jharkhand, Gujarat, Bihar and Northeast hill regions like Meghalaya, Manipur and Tripura and also in Andaman and Nicobar Islands (DCR, 2011). In India, it is cultivated in an area of 9.82 lakh ha with a production of 7.28 lakh tonnes and productivity of 772 kg ha^{-1} (DCCD, 2013). India has the

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maximum area (21.6%) under cashew and is the third largest producer (17.3%) of raw nuts in the world. After Vietnam, the country is the second largest exporter, accounting for 34 per cent of the world's export of cashew kernels. India has a comparative advantage in the production and processing of cashew nuts on account of its cheap and skilled labour force. There are 3650 cashew processing industries in the country (both organized and unorganized sector together), with an installed capacity for processing of 15 lakh tonnes, for which the contribution from the indigenous production is only 38 per cent (Yadav, 2010). India earned ₹ 4450 crores through export of processed cashew kernels and cashew nut shell liquid during 2011-12 (CEPCI, 2013).

Presently, cashew cultivation receives dwindling importance in response to the price fluctuations in other plantation crops like arecanut, cocoa, rubber and coconut (Venkattakumar and Bhat, 2003). The cashew farmers are shifting to rubber plantation and other more remunerative cash crops (Ganapathi and Akash, 2013). In Kerala, area under cashew has drastically decreased by 51 per cent in the last decade. Presently, Kerala has only 43,848 ha of cashew down from 89,718 ha in 2001-02 with Kannur district having major area of 17295 ha (Anon, 2011). To improve the cultivation scenario of major cashew-growing regions, assessment of the technology adoption status and factors that contribute to adoption of recommended cashew production technologies are very important. To explore the applicability of technology adoption premise in the context of cashew cultivation in India, this study was undertaken to measure the technology utilization status in terms of adoption levels of recommended technologies, identify the socio-economic determinants of farm level adoption and provide a model for predicting adoption of cashew production technologies.

Materials and methods

The study was conducted by Directorate of Cashew Research, Puttur along with AICRP Cashew Centre, RARS, Pilicode. Kannur and Kasaragod districts of north Kerala were purposively selected as they are the major cashew producing districts in Kerala with presence of three cashew research stations nearby, besides other development departments working on cashew and hence having better probability of technology utilization at farm level. Cashew area and production in this region was found contributing largely for the Kerala state's figures (Salam, 1998; Anonymous, 2011). Farmers from Taliparamba and Kannur taluks of Kannur distirct and Hosdurg and Kasaragod taluks of Kasaragod district represented the sample.

Detailed pre-tested schedule were administered to 68 respondents spread among four taluks of Kannur and Kasaragod districts. In the present study, the researchers had no option to manipulate the independent variables, as these had already occurred. Inferences on the relationships between independent and dependent variables had to be drawn on the basis of effects already manifested. Hence, an 'ex-post-facto cause to effect' design was applied. The non-manipulative variables that were already evident formed the presumed cause (independent variables).

An interview schedule containing 123 questions measuring the adoption status of the farmers, along with their profiles, was developed. The questions were divided into five sections *viz*., (a) personal and economic characteristics of the cashew farmers, (b) adoption level of cashew production technologies at farm level (c) status of technology discontinuance, (d) socio-economic impact on cashew growers in the study area and (e) constraints faced by farmers in cashew cultivation. The instrument was pre-tested on a group equivalent in size to 10 per cent of the sample. Based on the results, the schedule was structured, sharpened and standardized. The content validity was ensured by examining the responses for appropriateness and through subsequent discussion with the researchers working on impact analysis. The data were collected during the 2013-14 through personal interviews.

Data analysis

The overall adoption score for a particular farmer was the sum of his scores obtained for adoption of 49 recommended practices under seven technology components namely, planting and initial care, soil and water conservation, manures and fertilizers application, pruning and training, plant protection technologies, intercropping and harvesting and post-harvest techniques. Proper adoption, symbolic adoption (including

re-invention) and non-adoption received scores of 2, 1 and 0 respectively, for each practice. For each technology component, the adoption index was calculated using the formula: AI = (Score obtained by the farmer ÷ Maximum score obtainable on full adoption of all practices) x 100. Overall adoption index for the farmer was calculated as mean of sum of adoption scores obtained for all seven technology components measured. Appropriate statistical measures such as Phi, Spearman's rank correlation and linear regression and stepwise regression analysis were employed to arrive at conclusions. Data was analyzed using Microsoft Excel 2007 and IBM SPSS statistics Ver. 20.

Results and discussion

Socio-personal profile of cashew farmers

The twelve socio-personal variables studied are furnished in Table 1. It can be noted that cashew farmers were equally distributed as far as their age was concerned with mean age of 59 years. Majority had low level of education (7th standard pass) (53%) and 90 per cent had agriculture as their primary occupation. Most farmers (40%) had high level of experience in farming with an average experience of 32.4 years. Similar findings were made by Lakshmisha (2000), Shivaramu *et al.* (2004), Veerkar *et al.* (2006) and Venkattakumar (2006; 2008; 2009). Cashew farmers were equally distributed with respect to their experience in cashew farming with an average experience of information and communication technologies 27.7 years. These findings are in line with that of Veerkar *et al.* (2006) but in contrast with studies conducted by Venkattakumar (2006). Contact with extension agencies was found to be medium among majority of cashew farmers (60%) while participation in extension programmes was found to be low for almost half of the farmers (50%). These findings are in line with that of Lakshmisha (2000) and Shivaramu *et al.* (2004). Almost half of the cashew farmers (46%) exhibited medium levels of ICT usage while majority had low level of cosmopoliteness (50%). These findings are in line with earlier findings by Lakshmisha (2000), Shivaramu *et al.* (2004) and Venkattakumar (2006). Three-fourth of cashew farmers were giving irrigation for other crops grown by them while 69 per cent of them cultivated cashew under rainfed system only. For majority (59%) of farmers, the cashew plots were far from their homes, having an average distance of 1350 m.

Economic profile of cashew farmers

The economic profile of cashew farmers is presented in Table 2. While half of them (50%) gave highest priority to cashew farming, rest was equally divided into low and medium categories. These findings are in contrary with that of Venkattakumar (2008). The average farm size was found to be 4.37 acres while average area of un-used land available for cultivation was found to be 3.19 cents. Majority (82%) had nil or negligible amount of unused land available for cultivation. The study showed that on an average, households had 117 numbers of cashew trees under mean area of 1.71 acres with a mean yield of 6.9 kg tree^{-1}. Majority of the farmers (40%) realized only moderate yields from cashew with an average net income of ₹ 32,000 per year against an average expenditure of ₹ 15,800 per year and the levels of yearly investment in agriculture by majority of them (41%) was of ₹ 62,200 with a net income to the tune of ₹ 1,18,800 per year.

Technology utilization status of recommended cashew production technologies

The adoption of specific recommended practices under each production technology was studied and the results are presented in Table 3. The overall adoption of cashew production technologies was found to be very poor with an index score of 29.5 with majority farmers (43%) showing low level of adoption. Similar findings were made by Zagade *et al.* (2000, 2003), Lakshmisha (2000), Bhairamkar *et al.* (2004), Shivaramu *et al.* (2004) and Venkattakumar (2005, 2006, 2009). The low to medium perception level of cashew farmers in Kerala was reported earlier by Kannan (1983), Aravindhakshan and Beevi (1992), Salam (1999) and Balasubramanian (1999). Cashew farmers were found to adopt maximum practices under planting and initial care (Rank 1) including recommended varieties and planting material (grafts). This reasons the high demand for cashew grafts in government and private nurseries in the locality. The findings can be read along with that of Lakshmisha (2000) and Venkattakumar *et al.* (2004). Also, these practices were easy to adopt and initial interest plays a major role in the higher adoption of this

Table 1. Socio-personal profile of cashew farmers (n=68)

Independent variables	Mean	SD	Category		Respondents	
					f	%
Age (Years)	59.0	12.16	Young	<53	22	31
			Middle age	53-65	25	37
			Old	>65	21	32
Level of education	3.0	1.07	Low	<2.82	36	53
			Medium	2.82-3.89	15	22
			High	>3.89	17	25
Primary occupation			Agriculture		61	90
			Others		7	10
Experience in farming (Years)	32.4	14.4	Low	<25.2	23	34
			Medium	25.2-39.6	18	26
			High	>39.6	27	40
Experience in cashew farming (Years)	27.7	13.4	Low	<21.0	23	34
			Medium	21.0-34.4	21	31
			High	>34.4	24	35
Extension contact	1.74	3.37	Low	<0.05	23	34
			Medium	0.05-3.42	41	60
			High	>3.42	4	6
Extension participation	3.62	6.24	Low	<0.50	34	50
			Medium	0.50-6.74	22	32
			High	>6.74	12	18
ICT usage	4.26	1.22	Low	<3.65	12	18
			Medium	3.65-4.87	31	46
			High	>4.87	25	37
Cosmopoliteness	18.8	14.9	Low	<11.32	34	50
			Medium	11.32-26.29	13	19
			High	>26.29	21	31
Type of land used for cashew			Fully irrigated		9	13
			Partially irrigated		12	18
			Rain-fed		47	69
Type of land used for other crops			Fully irrigated		51	75
			Partially irrigated		13	19
			Rain-fed		4	6
Distance of cashew plot from home (meters)	1350	2872	Less/Nil		28	41
			Moderate		26	38
			Large		14	21

technology. More than half of the farmers exhibited high (43%) and medium (28%) levels of adoption for this technology. This finding is in line with earlier reports of Bhairamkar *et al.* (2004) and Shivaramu *et al.* (2004). Adoption of manures and fertilizers was found to be low among farmers with adoption index of 35 while half (50%) of the farmers apply little or no manures or fertilizers to their cashew crop (Rank 2). Similar observations were made by Nirban and Sawant (2000) with respect to adoption of manures and fertilizers in cashew plantations.

Table 2. Economic profile of cashew farmers **(n=68)**

Independent variables	Mean	SD	Category		Respondents	
					f	%
Importance given to cashew	3.35	1.28	Low	<2.71	17	25
			Medium	2.71-3.99	17	25
			High	>3.99	34	50
Farm size (acres)	4.37	3.00	Low	<2.87	18	26
			Medium	2.87-5.87	35	52
			High	>5.87	15	22
Cultivable land available (cents)	3.19	2.80	Available		12	18
			Not available		56	82
Area under cashew (acres)	1.71	1.40	Low	<1.00	22	32
			Medium	1.00-2.40	34	50
			High	>2.40	12	18
Yielding cashew trees (Nos.)	117	98	Low	<68	26	38
			Medium	68-166	24	35
			High	>166	18	26
Yield of cashew per tree (kg)	6.9	5.0	Low	<4.4	23	34
			Moderate	4.4-9.4	27	40
			High	>9.4	18	26
Expenditure in agriculture (₹)	62200	63000	Low	<31000	26	38
			Medium	31000-94000	28	41
			High	>94000	14	21
Net income from agriculture (₹)	118800	111000	Low	<63000	26	38
			Medium	63000-175000	26	38
			High	>175000	16	24
Expenditure in cashew farming (₹)	15800	19000	Low	<6000	27	40
			Medium	6000-25000	25	37
			High	>25000	16	23
Net income from cashew farming (₹)	32000	46000	Low	<9000	14	20
			Medium	9000-55000	44	65
			High	>55000	10	15

Plant protection, which is one of the most important components, also scored low adoption index (30.7) among cashew farmers in the present study. This finding is in line with earlier reports of Nirban and Sawant (2000) and Zagade *et al.* (2000; 2003) but in contrast with findings of Venkattakumar (2009). However, 90 per cent of demonstration farmers who availed subsidies were found to have adopted plant protection measures (Venkattakumar *et al*., 2005). Non-adoption was particularly high for plant protection technologies against cashew stem and root borer (CSRB) due to the complexity of the technology while majority had adopted measures against tea mosquito bug (TMB) due to less complexity, higher trialability and observability of results in comparison to measures recommended against CSRB. Dixit and Bhaskara Rao (1999) and Venkattakumar (2005) also reported farmer responses indicating that recommended control measures could not check attack of CSRB explaining poor adoption rates of plant protection technology as a whole.

Majority of the farmers were not following proper harvesting and drying practices. Also

Table 3. Adoption levels of recommended cashew production technologies (CPTs) (n=68)

Cashew production technologies	Index Adoption	Rank	S.D.	% farmers under various levels of adoption		
				Low	Medium	High
Planting and initial care	57.8	1	22.95	29	28	43
Soil and water conservation	22.0	5	24.60	28	51	21
Manures and fertilizers	35.0	2	38.28	51	6	43
Pruning and training	12.3	7	17.76	51	32	16
Plant protection	30.7	3	16.21	32	40	28
Intercropping	20.8	6	40.25	78	1	21
Harvesting and post harvest	27.6	4	12.60	34	44	22
Overall adoption of CPTs	29.5	-	15.27	43	29	28

post-harvest processing of produce was not being adopted by majority (Rank 4). Soil and water conservation techniques were also found to have low adoption (Rank 5). This is in line with findings by Shivaramu *et al.* (2004) and Venkattakumar (2009). Earlier studies had shown a positive perception of cashew demonstration farmers towards soil and water conservation techniques (Venkattakumar, 2005). Almost half of the farmers (50%) exhibited medium level of adoption for soil and water conservation technology. Intercropping was another method which was poorly adopted (Rank 6) with highest rate of low adopters (78%). Similar observation was made by Shivaramu *et al.* (2004).

Table 4. Relationship between adoption and socio-personal variables and their contribution in explaining the variability in adoption (n=68)

Sl. No.	Socio-personal variables	'r' value
1.	Age	-0.073 NS
2.	Level of education	0.113 NS
3.	Primary occupation	0.039 NS
4.	Experience in farming	0.073 NS
5.	Experience in cashew farming	0.003 NS
6.	Extension contact	0.298 *
7.	Extension participation	0.449 **
8.	ICT usage	0.301 *
9.	Cosmopoliteness	0.461 **
10.	Land used for cashew	0.167 NS
11.	Land used for other crops	0.037 NS
12.	Distance of cashew plot from home	0.169 NS

NS – Non-significant, ** - Significant at 1% level,
* - Significant at 5% level

Adoption of pruning and training had the lowest rank with adoption index of 12.3 while majority farmers (51%) belonged to low level adopter category for this technology. This finding is in line with earlier reports of Shivaramu *et al.* (2004). Low to medium adoption with respect to most cashew production technologies shows that farmers are yet to realize the importance of these technologies on the yield level and potential economic benefits that accrues from it. It is obvious from these findings that there is tremendous scope in the region for increasing adoption of recommended cashew production technologies.

Socio-economic determinants of farm level adoption of cashew production technologies

Correlation analysis was employed to ascertain the relationship between adoption and socio-economic variables. The results are presented

Table 5. Relationship between adoption and economic variables (n=68)

Sl. No.	Economic variables	'r' value
1.	Importance given to cashew	0.032 NS
2.	Farm size	0.355 **
3.	Area under cashew	0.354 **
4.	Cultivable land available	-0.208 NS
5.	No: of yielding cashew trees	0.576 **
6.	Yield of cashew per tree	0.135 NS
7.	Expenditure in agriculture	0.439 **
8.	Net income from agriculture	0.443 **
9.	Expenditure in cashew farming	0.463 **
10.	Net income from cashew farming	0.277 **

NS – Non-significant, ** - Significant at 1% level

separately for socio-personal variables and economic variables in tables 4 and 5. The correlation analysis identified that four socio-personal variables *viz,* extension contact, extension participation of cashew farmers, ICT usage and cosmopoliteness had a significant relationship with farmers' adoption of cashew production technologies. It may be noted that majority of the farmers recorded low levels of extension participation and cosmopoliteness and medium levels of extension contact and ICT usage (Table 4).

The study identified seven economic variables *viz.,* farm size, area under cashew, number of yielding cashew trees, expenditure in agriculture, net income from agriculture, expenditure in cashew farming and net income from cashew farming which were having significant relationship with adoption of cashew production technologies (Table 5).

Identifying predictors of adoption of cashew production technologies

Stepwise regression was used to identify predictors and select models explained the variation in adoption of cashew production technologies. In this analysis, four models were tested to examine the variation in adoption among the respondents (Table 6). Model 4 was found explaining up to 47.5 per cent of the variation in adoption using the predictors; number of yielding cashew trees (X1), extension participation (X2), net income from agriculture (X3) and farm size (negative effect) (X4) (Table 6). The model 4 also had the lowest standard error of the estimate (11.4) thus making it the best model suited to predict adoption of cashew production technologies by farmers. The model is fitted as: *CPT AI = 18.948 + 0.493 X1 + 0.268 X2 + 1.882 X3 - 0.830 X4*. The model can be used to predict adoption of cashew production technologies by farmers under similar agro-ecological situations.

Conclusions

Cosmopoliteness makes the farmer more aware of information and its utilization and causes them to stay abreast of latest cashew production technologies. Consequently, information usage sets the stage for better technology realization in cashew fields. Long-term investments may cause cashew farmers to be more committed and enthusiastic in

Table 6. Identifying predictors for adoption of cashew production technologies

Model		Unstandardized coefficients		Standardized coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	19.199	2.367		8.111	0.000
	CSWTR	0.088	0.015	0.576	5.719	0.000
2	(Constant)	18.743	2.285		8.202	0.000
	CSWTR	0.072	0.016	0.472	4.482	0.000
	EXTNPTN	0.641	0.256	0.264	2.504	0.015
3	(Constant)	16.846	2.361		7.136	0.000
	CSWTR	0.052	0.018	0.341	2.922	0.005
	EXTNPTN	0.705	0.249	0.290	2.827	0.006
	AGRINC	3.385	1.467	0.249	2.307	0.024
4	(Constant)	18.948	2.498		7.586	0.000
	CSWTR	0.076	0.021	0.493	3.683	0.000
	EXTNPTN	0.651	0.244	0.268	2.670	0.010
	AGRINC	6.014	1.882	0.442	3.195	0.002
	FRMSZ	-1.779	0.830	-0.353	-2.143	0.036

a. Dependent Variable: AI

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
4	0.689[d]	0.475	0.442	11.4067307

d. Predictors: (Constant), CSWTR, EXTNPTN, AGRINC, FRMSZ

their undertakings. The farm size and the number of yielding cashew trees also showed significant relation with the adoption thus bringing focus on the large cashew plantations in the region with wide spacing and less number of yielding trees per unit space. The variable; number of cashew trees/unit which emerged as a predictor in the study calls for the popularization of high density orchards of cashew owing to better productivity and returns to farmers. Majority of the respondents were not sure about the benefits of extension contact and participation. The variables that were identified as key indicators towards explaining adoption of cashew production technologies can be utilized in this context.

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