Indian Journal of Extension Education
Vol. 54, No. 2, 2018 (100-107)

Impact of Production Technologies on Area and Productivity of Cashew in North Kerala

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ABSTRACT

The study analyses the impact of production technologies on area, production and productivity of cashew in the Kannur and Kasaragod districts of Kerala state, as a prerequisite for developing and initiating innovative technology interventions for combating low productivity and profitability from cashew cultivation. Results revealed that highest area under cashew in farmer fields is occupied by the variety Priyanka followed by Madakkathara-2 with similar trend in adoption levels. The 'Priyanka + Madakkathara - 2' combination emerged to be the most popular one among farmers in the study area. Farmers realized highest production and productivity from variety Sulabha, followed by Madakkathara-2 and Priyanka. Correlation analysis showed that four technologies; recommended varieties, planting and initial care, pruning and training and plant protection as having highly significant relationship with the cashew productivity achieved by farmers. The regression analysis identified that increasing adoption of planting and initial care techniques, manures and fertilizers and development and popularization of user friendly plant protection measures can significantly increase the per unit productivity of cashew orchards in north Kerala. The study concludes that socio-economic and bio-physical factors along with policy environment have a larger contribution in explaining cashew productivity and technology component alone cannot be expected to bring a positive impact. Understanding the above dynamics in technology impact can help researchers and extension agencies working in cashew sector to design better innovations and effective outreach strategies.

Keywords: Cashew, impact, productivity, technology

INTRODUCTION

Fruit and nut tree crop systems and cashew nut in particular, offer significant opportunities to generate income for farmers in India. The cashew cultivation in India mainly confines to the states of Kerala, Karnataka, Maharashtra and Goa along the West Coast and Tamil Nadu, Andhra Pradesh, Orissa and West Bengal along the East Coast region. It is also grown in plains like Chhattisgarh, 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 (DCCD, 2012-13). India has the maximum area (21.6%) under cashew nut 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 percent 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

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only 38 percent. India earned Rs. 4450 crores through export of processed cashew kernels and cashew nut shell liquid during 2011-12 (CEPCI, 2013).

Cashew is one among the important commercial crops of Kerala and contributes significantly to national area and production (Sebastian *et al.* 2004). The tree can grow in fairly poor soils with relatively little rainfall, as long as there is a clear dry season of two-four months. These attributes, plus the facts that little capital is required for cashew establishment and that low nut perishability minimises the coordination requirements for post-harvest activities, have given cashew the reputation of being a poor man's crop (Jaffee, 1995). Cashew industry provides source of livelihood for the growers, empowers rural women in the processing sector, creates employment opportunities and generates foreign exchange through exports (Shalini, 2010). Cashew gained status of a commercial crop through technological advancements with respect to propagation, production and management (Sajeev *et al.* 2014). This change was fuelled as a result of increasing demand for raw cashew nuts and enhanced interest for its commercialization (Venkattakumar, 2009).

Presently, cashew cultivation receives dwindling importance in response to the price fluctuations in other plantation crops like areca nut, 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 percent in the last decade. Presently Kerala has only 43,848 ha of cashew down from 89718 ha in 2001-02 with Kannur district having major area of 17295 ha (Anon, 2011). To improve the cashew 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.

Impact assessments of agricultural technologies in the past primarily focused on release of modern varieties and their associated economic returns from increased production (Pingali, 2001; CGIAR, 2004). Accountability is the predominant aim of these impact assessments and their focus is primarily on the technology interventions, rather than the farmer communities subjected to the interventions (Friis-Hansen, 2011). Most empirical studies show that gains from new agricultural technology influenced the farmers directly, by raising incomes of farm households, and indirectly, by raising employment and wage rates of functionally landless labourers, and by lowering the price of food staples. (Bellon and Reeves, 2002; Evenson and Gollin, 2003). Most studies on impact of agricultural technologies appear to document overall positive impacts, with far less evidence at the individual household level that specifically shows the technology impact.

To improve the cashew cultivation scenario of major cashew-growing regions, assessment of the impact of recommended cashew production technologies are very important. Hence, to explore the applicability of technology impact premise in the context of Cashew cultivation in Kerala, the present study was undertaken with the objective to measure the impact of different varieties on area and productivity of cashew and to measure the impact of recommended production technologies on cashew productivity in North Kerala.

METHODOLOGY

The study was conducted by Directorate of Cashew Research, Puttur along with AICRP Cashew Centre, RARS, Pilicode as part of the project 'Impact of Cashew Production Technologies on Area, Production and Productivity of Cashew'. Purposive sampling technique was used to select Kannur and Kasaragod districts of north Kerala since they are the major cashew producing districts of 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 were found contributing largely for the Kerala state's figures (Salam, 1998; Anon, 2011). Farmers from Taliparamba and Kannur taluks of Kannur district and Hosdurg and Kasaragod taluks of Kasaragod district represented the sample.

Detailed pre-tested questionnaire was administered to 68 respondents. In the present study,

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. Since cashew is a perennial crop with multiple phases of growth, only those orchards and trees which are in economic yielding period of above 6th year of growth were considered for the study of their productivity.

An interview schedule measuring the adoption status of the farmers, along with their profiles, was developed. The questionnaire contained 123 questions and took about 45 minutes to elicit information from one household. The instrument was pre-tested on a group equivalent in size to 10% of the sample used in the subsequent research. 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 at various institutes under the Indian Council of Agricultural Research. The data were collected during the 2012-13 through questionnaire and personal interviews. Appropriate statistical measures such as Phi, Spearman's rank correlation and regression analysis were employed to arrive at conclusions. Data were analyzed using Microsoft Excel 2007 and IBM SPSS Statistics Ver. 20.

RESULTS AND DISCUSSION

Adoption and Impact of different varieties on cashew area

Study on impact of recommended varieties on total cashew area (Table 1) showed that highest area under farmers field in north Kerala is covered by the variety Priyanka (41%) followed by variety Madakkathara - 2 (18%). It may also be noted that adoption pattern also shows similar trend with variety Priyanka adopted by 44 per cent of farmers followed by variety Madakkathara - 2 (18%). Most farmers have adopted a mix of seedling origin trees and modern variety in their field and 'Priyanka + Seedling Origin' combination emerges to be the most popular one in the study area followed by the varietal combination of 'Priyanka + Madakkathara - 2'. Seedling origin trees still cover 29 percent of area under cashew in farmer fields of North Kerala. The coverage of other recommended varieties like Sulabha (3.3%), Kanaka (3.01%), Raghav (2.05%) and Dhana (1.24%) were found to be negligible along with similar levels of adoption. The coverage and adoption of varieties Bhaskara, Ullal-3, Amrutha and Vengurla-4 (V-4) were also found to be extremely less. Varieties Bhaskara and Ullal-3 which are having highest popularity in adjoining Dakshina Kannada district of Karnataka (Sajeev *et al.* 2014) were found less favoured in this region.

Table 1: Varietal adoption and impact on cashew area

(n=68)

Variety	Adopted by (% farmers)*	Area covered (%)
Priyanka	44	40.72
Kanaka	7	3.01
Dhana	3	1.24
Bhaskara	4	0.83
Raghav	4	2.05
Madakkathara-2	18	17.76
Sulabha	6	3.32
Amrutha	1	0.64
V-4	3	0.64
Ullal-3	3	0.71
Total (under recommended varieties)	68**	70.94
Seedling origin	43	29.06

**the percentages won't add up to 100 due to adoption of multiple varieties by single farmer **represents total percentage of farmers who have adopted released varieties*

Even though nearly ten cashew varieties were released and recommended for this region, the planting material for these new varieties are not available in sufficient quantities for farmers. This reasons the coverage of large areas under seedling origin senile plantations even now. The same also explains high demand for cashew grafts of latest varieties reported from government run as well as private nurseries in the nearby Dakshina Kannada district of Karnataka (Venkattakumar *et al.* 2004). Variety wise adoption and impact on area is given in table 1. In total, improved varieties were found to be adopted by 68 percent of the farmers while 43 percent were still

having seedling origin plantations. Farmers were largely found to have a mix of seedling origin trees with that of modern varieties. Seedling origin plantations have considerable coverage in farmer fields (29.06%).

Impact of cashew varieties on production and productivity

Analysis of variety wise impact on cashew production showed that farmers realized highest yield from variety Sulabha (13.0 kg/tree) followed by Madakkathara-2 (8.0 kg/tree) and Priyanka (7.6 kg/tree) (Table 2). This was followed by Ullal-3 (6.75 kg/tree) and Vengurla-4 (6.35 kg/tree). Dhana, another recommended variety was at sixth position with a yield of 5.00 kg/tree while Kanaka fared low at seventh place with 4.80 kg/tree. Productivity under normal density (8x8m) as was highest for Sulabha (2096 kg/ha) and Madakkathara-2 (1402 kg/ha). This was followed by Priyanka (1215 kg/ha), Ullal-3 (1080 kg/ha) and Vengurla-4 (1016 kg/ha). Plantations under seedling origin trees reported an average yield of 5.2 kg/tree with productivity of 518 kg/ha.

Production and productivity profile of cashew farmers

The production and productivity profile of cashew farmers showed that farmers achieved a mean production of 1298 kg/household and productivity of 6.91 kg/tree (Table 3). In case of production, majority fell into medium (49%) and low (34%) producer categories while they were almost equally divided into high (26%), medium (40%) and low (34%) categories with respect to productivity achieved. As far as their operational holdings are concerned, majority (52%) belonged to medium holding group while the rest were almost equally divided between small (26%) and large holder (22%) groups with an average holding size of 4.37 ha.

Table 2: Varietal impact on production and productivity of cashew

(n=68)

Variety	Production (kg/tree)*	Productivity (kg/ha)	Rank
Priyanka	7.6	1215	III
Kanaka	4.8	730	VII
Dhana	5	750	VI
Bhaskara	3.8**	575	-
Raghav	2.5**	370	-
Madakkathara-2	8	1402	II
Sulabha	13	2096	I
Amrutha	0.4**	64	-
V-4	6.35	1016	V
Ullal-3	6.75	1080	IV
Seedling origin	5.2	518	-

** In trees above 5 years of age, ** in trees below 5 years of age*

Table 3: Classification of farmers based on production and productivity of cashew

(n=68)

Categories	Production			Productivity		
	f	%	Range	f	%	Range
Low	23	34	<250	23	34	<4.4
Medium	33	49	250-2389	27	40	4.4-9.4
High	12	18	>2389	18	26	>9.4
Mean		1297.45			6.91	

Technology impact on production and productivity of cashew

The recommended cashew production technologies starting with recommended varieties were categorized to eight groups such as Varieties, Planting and initial care, Soil and water conservation, Manures and fertilizers, Pruning and training, Plant protection, Intercropping and Harvesting and post-harvest technologies. Their impact on productivity was studied and is presented here.

Adoption and relationship of cashew production technologies towards cashew productivity

The overall adoption of cashew production technologies had received an index score of 34. (51%) of the farmers were equally distributed to high (34.8%), medium (33.8%) and low (31.4%) adopter categories (Table 4).

Most cashew production technologies scored moderate to poor adoption index with exception of recommended varieties (62) and planting and initial

Table 4: Adoption index of farmers for cashew production technologies

(n=68)

Category	Range	Respondents	
		f	%
High (>Mean+ 0.5 S.D)	>42.3	24.00	34.78
Medium (Mean(+/-) 0.5 S.D)	24.9-42.3	23.00	33.82
Low (<Mean- 0.5 S.D)	<24.9	21.00	31.40
Mean= 33.58, S.D=17.39			

care technology (58). Manures and fertilizers (35) and plant protection (31) showed medium adoption index while harvesting and post-harvest technologies (26), soil and water conservation technology (22), intercropping (21) and pruning and training (13) scored low adoption index. Similar findings were made by Zagade *et al.* (2000, 2003), Lakshmisha (2000), Bhairamkar *et al.* (2004), Shivaramu *et al.* (2004), Venkattakumar (2005, 2006, 2008, 2009) and Sajeev *et al.* (2014). 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). Correlation analysis showed that four technologies; recommended varieties, planting and initial care, pruning and training and plant protection had highly significant relation with the cashew productivity achieved by farmers (table 5).

Table 5: Relationship of cashew production technologies towards cashew productivity

Technology	Adoption Index	Productivity 'r' value
Recommended Varieties	62	0.386**
Planting and Initial Care	58	0.308*
Soil and Water Conservation	22	0.086NS
Manures and Fertilizers	35	0.051NS
Pruning and Training	13	0.291*
Plant Protection	31	0.362**
Intercropping	21	-0.059NS
Harvesting and Post Harvest	26	-0.074NS
Overall adoption	34	-

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

Cashew farmers were found to adopt recommended varieties along with maximum practices under planting and initial care. Recommended varieties (0.386**) along with planting and initial care technologies (0.308*) were found to have significant relation with the productivity achieved by farmers. The findings can be read along with that of Sajeev *et al.* (2014), Lakshmisha (2000), Venkattakumar *et al.* (2004) and Shalini (2010). Also, these practices were easy to adopt and initial interest plays a major role in the high adoption rate of this technology.

Soil and water conservation techniques were poorly followed by most of the farmers. 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 *et al.* 2005). Also, the practices under this technology are mostly adopted along with or in continuance with planting and aftercare thereby increasing its chance of adoption due to initial interest.

Adoption of manures and fertilizers was found to be poor among farmers with adoption index of 35. Similar observations were made by Nirban and Sawant (2000) with respect to adoption of manures and fertilizers in cashew plantations. Intercropping was another technology which was poorly adopted. Similar observation was made by Shivaramu *et al.* (2004). Adoption of pruning and training along with harvesting and post-harvest technologies also had poor adoption status. This finding is in line with earlier reports of Shivaramu *et al.* (2004). Pruning and training was also found to have significant relationship productivity (r=0.291*) of cashew. Low to medium adoption with respect to most cashew production technologies could be attributed to the fact that farmers are yet to realize the importance of recommended technologies on the yield and potential economic benefits that accrue from their adoption.

Plant protection, which is one of the most important components affecting production, also scored low adoption index (31) 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 by Venkattakumar (2009) who reported fairly good adoption of plant protection measures in cashew. However, 90 percent 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 *et al.* (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. The technology showed highly significant positive relation with cashew productivity (0.362**). It is obvious from these findings that there is tremendous scope in the region for increasing adoption of recommended cashew production technologies.

Table 6: Contribution of cashew production technologies towards variability in cashew productivity

Technology	Productivity 'b' value
Varieties	0.274 NS
Planting and Initial Care	0.385*
Soil and Water Conservation	-0.038 NS
Manures and Fertilizers	0.286*
Pruning and Training	-0.196 NS
Plant Protection	0.331*
Intercropping	-0.287 NS
Harvesting and Post Harvest	0.271 NS

R^2 =0.346

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

Contribution of cashew production technologies towards variability in cashew productivity

Regression analysis revealed the extent of contribution of each production technology towards variability found in levels of cashew productivity in the region (Table 6). Plant protection component which scored low adoption index and also showed highly significant relation with cashew productivity achieved by farmers emerged as the most significant contributor towards cashew productivity (b=0.331*) in the district. This clearly indicates that adoption of plant protection techniques cannot be ignored at any cost if cashew production in the district has to be improved. Although farmers in Kannur district were found to adopt plant protection measures against TMB; due to declaration of Kasaragod as an organic farming district, the adoption of chemical methods of plant protection in cashew is very meager in the district. However, research shows that TMB, the serious pest of cashew cannot be effectively controlled by any organic methods and the yield loss due to TMB attack is to the tune of 40 per cent (DCR, 2011). This aspect will certainly pull down cashew productivity in the district unless TMB escaping variety like Bhaskara is given wide popularity among farmers and adopted. The findings also call for development of plant protection measures against CSRB which are user-friendly (less complex), having relative advantage over existing technology and also compatible with farmer situations. Planting and initial care technology which showed a significant relationship with cashew productivity, is also found to have a significant contribution towards explaining the variability in cashew productivity (b=0.385*). Manures and fertilizers were found to have a significant contribution towards cashew productivity (0.286*). This is explained by the fact adoption of manures and fertilizers were found to be very poor among farmers of the region thus making it clear that by increasing the adoption of above technologies showing significant contribution we can bring a quantum increase in cashew productivity in the district. The contribution of production technologies towards productivity in North Kerala shows a different trend with that of in nearby Dakshina Kannada district of Karnataka where overall adoption levels of cashew production technologies where found to be higher (Sajeev *et al.* 2014).

Farmers in the study area were found to have poor adoption in case of harvesting and post-harvest practices. The study also found that harvesting cashew from the trees itself is a common practice to avoid theft and this coupled with improper drying practices including less number of drying days has contributed more volume to the cashew production. If proper harvesting and drying practices are followed it will decrease the total volume of cashew thus explaining the negative relation. All the recommended production technologies together could explain only up to 34.6 percent of variability in cashew productivity (R^2 = 0.346).

The present study analyses the technology impact on area, production and productivity of cashew as a pre-requisite for developing and initiating innovative technology interventions for combating low productivity and profitability from cashew cultivation. Even though highest production was recorded by Sulabha, Madakkathara – 2 and Priyanka varieties, these varieties except Priyanka covered only minimal share of total area under cashew cultivation. By increasing the adoption and area coverage of above varieties we can bring a quantum increase in cashew production in the district. Increasing adoption of planting and initial care techniques, manures and fertilizers and development and popularization of user friendly plant protection measures can contribute largely to increased cashew productivity of cashew orchards. The results clearly indicate that socio-economic and bio-physical factors along with policy environment have a larger contribution in explaining cashew production and productivity and technology component alone cannot be expected to bring a positive impact. Understanding the above dynamics in technology impact can help researchers and extension agencies working in cashew sector to design better innovations and effective outreach strategies.

Paper received on : December 17, 2017
Accepted on : January 03, 2018

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