Research Article

Journal of Plantation Crops, 2015, 43(2):131-138

Analysis of organic farming practices in cocoa in India

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(Manuscript Received:01-07-14, Revised:29-04-15, Accepted:10-06-15)

Abstract

The study was conducted among 120 cocoa growers drawn randomly from one district each from Tamil Nadu, Kerala, Andhra Pradesh and Karnataka states. Profile characteristics of farmers were quantified based on socio-personal, psychological and economic variables. Majority of farmers were middle aged (64.2%), literate (96%), with less than 2 ha area under cocoa (64%) and farmers having livestock (77%). Most of the farmers had medium level of social participation, extension orientation and mass media exposure. One fifth of farmers had undergone training on organic farming, soil testing was done by nearly 31 per cent farmers and very few farmers (5%) had done organic certification. Mulching and use of green leaf manure were the main agronomic practices. Main organic inputs which were produced or prepared at the farm were, farm yard manure, crop residues, cow dung slurry, ash and vermicompost. Farm yard manure, neem cake, biofertilizers, goat manure *etc*. were the major inputs which were purchased from the market. Majority of cocoa growers (68.3%) had medium level of knowledge about organic farming practices. Knowledge of farmers on biocontrol agents (35%), botanical pesticides (33.3%) and biofertilizers (31.7%) was recorded. Variables like, education, social participation, extension orientation, mass media exposure and training attended were found to have positive and significant relationship with knowledge on organic farming practices. The mean yield and productivity of cocoa was found to be 1.2 kg dry beans tree^{-1}year^{-1} and 608 kg dry beans ha^{-1} respectively. Gross income from cocoa was calculated as ₹170 tree^{-1}year^{-1} and ₹ 83377 ha^{-1}. Non-availability of labour, non-availability of quality organic inputs, difficulty in controlling pests and diseases by organic methods and lack of knowledge about organic farming practices were the major constraints.

Keywords: Cocoa, constraint analysis, knowledge test, organic farming

Introduction

Commercial cultivation of cocoa, the native to Amazon region of South America, is being done in African, Latin American and Asian countries under palms and partially cleared forests for its dry bean which is the primary ingredient of chocolates. Introduction of cocoa in India was in early 20th century and large scale cultivation started in 1970s. At present, it is cultivated in 65500 hectares in India as component crop in arecanut, coconut and oil palm plantations with a production of 13400 tonnes (DCCD, 2013). It is mainly cultivated in four southern states *viz.,* Karnataka, Kerala, Tamil Nadu and Andhra Pradesh. Andhra Pradesh accounted for maximum area, while Karnataka registered maximum production. The production, productivity and quality of cocoa in India are less and not comparable with other major cocoa producing countries because of prevailing agro-climatic and socio-economic factors. There is a tremendous scope for area expansion of cocoa because of heavy demand in Indian chocolate industry and confectionaries which is portrayed as 60,000 MT for the year 2025.

Organic farming is a unique production management system which promotes and enhances agro eco-system health, including bio-diversity, biological cycles and soil biological activity and this is accomplished by using on-farm agronomic, biological and mechanical methods in exclusion of all synthetic off-farm inputs (FAO, 1993). Organic farming practices are gaining importance among

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farmers, trainers, entrepreneurs, policy makers, agricultural scientists, processors and extension personnel for varied reasons such as it minimizes the dependence of external inputs thus not only reduces the cost of cultivation but also safeguard and preserves quality of resources and environment. ICAR Institutes, KVKs, NGOs, State Department of Agriculture and other government and private agencies have started advocating organic farming practices in cocoa. If organic farming practices are to be advocated it requires the support of research findings for its propagation and implementation. With this background, a study was conducted to investigate the profile characteristics of cocoa growers, to document organic farming practices, to assess the knowledge of farmers on organic farming practices, to record the yield and returns from cocoa and to analyze the constraints in adoption of organic farming practices.

Materials and methods

The study was undertaken in four districts *viz.,* Coimbatore in Tamil Nadu, Kozhikode in Kerala, West Godavari in Andhra Pradesh and Dakshina Kannada in Karnataka primarily on the ground of its advantage in having maximum area under cocoa cultivation. A list of farmers was prepared based on information from farmers' organizations, State Department of Horticulture and agencies involved in cocoa cultivation in the district. Two taluks were identified in each district and from each taluk three villages were selected. Simple random sampling procedure was used for selecting the sample. Five farmers from each village were selected thus the sample was 30 per district constituting a total sample size of 120 farmers. The data collection was done during August 2011 to August 2012 through personal interview, non-participant observation technique and focus group discussions.

Based on the review of literature, discussion with experts and observation made by the researchers, a list of profile characteristics were identified along with their operational definitions. The profile characteristics of farmers were analyzed by gathering data related to socio-personal, psychological and economic variables. Documentation of organic farming practices envisaging agronomic management, pests and diseases management *etc*., was made through observation, interview schedule based interactions and in-depth discussions with farmers.

A standard teacher made knowledge test was developed for measuring the knowledge of the farmers about organic farming practices by following the procedures adopted by Bonny (1991) and Jaganathan (2009). Ten knowledge items were administered to the respondents. A score of 'one' was assigned to the correct answer and 'zero' to wrong answer. The sum of scores obtained for all items indicated the knowledge score of a respondent. Thus the maximum knowledge score that could be obtained by a respondent was 10 and the minimum was zero. Based on the knowledge score, knowledge index was calculated using the following formula.

$$\text{Knowledge Index} = \frac{\text{Respondent's total score}}{\text{Maximum possible score}} \times 100$$

The constraints in adoption of organic farming practices were collected through open ended schedule. Responses were obtained and the constraints were ranked based on the number of farmers' responses to each constraint. Statistical analysis was done using SAS and the tools employed were mean, standard deviation, percentage analysis and correlation.

Results and discussion

Profile characteristics of cocoa growers

Thirteen socio-personal and economic characteristics of farmers were analyzed and are furnished in Table 1. Majority of farmers (64.2%) belonged to middle age category and young farmers were only 8.3 per cent. Farming was considered to be a non-profitable business, therefore, most of the youngsters were not willing to take up cocoa cultivation as their occupation. Ninety six per cent of farmers were literates. Majority (78.3%) of farmers were having rich experience (>16 years) in farming. More than 60 per cent of farmers had less than 2 ha area under cocoa, which typically represents the small and marginal category of holdings. Fifty seven per cent of farmers had less than 4 ha area under cultivation. More than three fourth of farmers had livestock component in

Table 1. Profile characteristics of cocoa growers (n=120)

Sl. No.	Profile characters	Classification		Respondents %
1	Age (years)	Young (< 35)		8.3
		Middle (35 -60)		64.2
		Old (>60)		27.5
		Mean: 53.3	**SD: 13.1**	
2	Educational status	Illiterate		4.2
		Primary		10.0
		Secondary		34.2
		Higher secondary		19.2
		Graduate		23.2
		Post-graduate		9.2
		Mean: 2.8	**SD: 1.3**	
3	Farming experience (years)	Low (< 16)		21.7
		Medium (16- 42)		65.0
		High (> 42)		13.3
		Mean: 29.3	**SD: 13.3**	
4	Area under cocoa (Ha)	Marginal (< 1)		40.0
		Small (1- 2)		24.2
		Medium (2.1- 4)		20.8
		Big (4.1-10)		12.5
		Very big (> 10)		2.5
		Mean: 2.8	**SD: 5.3**	
5	Total area under cultivation (Ha)	Marginal (< 1)		10.8
		Small (1- 2)		17.5
		Medium (2.1- 4)		29.2
		Big (4.1-10)		27.5
		Very big (> 10)		15.0
		Mean: 6.27	**SD: 8.5**	
6	Livestock possession (₹)	Very low (0)		22.5
		Low (< 10,000)		1.7
		Medium (10,001-30,000)		14.2
		High (30,001- 50,000)		20.0
		Very High (>50,000)		41.6
		Mean: 101173.3	**SD: 190921.7**	
7	Social participation	Low (< 3)		5.0
		Medium (3- 6)		78.3
		High (> 6)		16.7
		Mean: 5.0	**SD:1.9**	
8	Extension orientation	Low (< 4)		5.0
		Medium (4 - 9)		81.7
		High (> 9)		13.3
		Mean: 6.9	**SD: 2.6**	
9	Mass media exposure	Low (< 4.2)		19.2
		Medium (4.2 - 8)		70.8
		High (> 8)		10.0
		Mean: 6.1	**SD: 1.9**	
10	Training attended on organic farming	Yes		20.0
		No		80.0
11	Maintenance of farm records	Yes		30.0
		No		70.0
12	Soil testing	Yes		30.9
		No		69.1
13	Organic certification	Yes		5.0
		No		95.0

farming. Majority of farmers belonged to medium category with respect to social participation (78.3%) as farmers were members in social organizations like cooperative societies, farmers club, SHGs, *etc.* wherein they had discussion related to farming. Farmers had contact with extension agencies, they accessed information from different extension sources *viz.,* seminars, meetings, study tours *etc*. which resulted in having medium level of extension orientation (81.7%).

Majority of farmers (70.8%) were having medium level of mass media exposure as they could access information through news papers, farm magazines, TV, CDs, internet *etc*. Only one fifth of farmers (20%) had undergone training on organic farming which reveals a lack of opportunity to attend the training on organic farming practices in cocoa. Thirty per cent of farmers were maintaining farm records to know the expenditure and returns from cocoa farming. Soil testing was done by less than one third (30.9%) of farmers which demands the need for strengthening the soil testing facilities in order to follow soil test based manuring schedule. Very few farmers (5%) had done organic certification as farmers felt certification as a cumbersome and costly affair. Moreover, certification was mainly done by foreign agencies.

Adoption of organic farming practices by cocoa growers

a. Adoption of agronomic/cultural practices

The practices *viz.,* mulching (70.8%) and use of green leaf manure (36.7%) were adopted by cocoa growers and are furnished in Table 2. Cocoa is an intercrop in coconut gardens in all the districts except Dakshina Kannada district of Karnataka where, it is planted in arecanut gardens. Mulching was practiced using crop residues of coconut, arecanut, banana, cocoa *etc*. to conserve the soil and water. Green manure crops like *Glyricidia*, neem, *Calotropis, etc.* were used by farmers for enhancing soil properties.

b. Use of organic inputs produced/prepared at farm by cocoa growers

Farm yard manure (78.3%), crop residues (72.5%), cow dung slurry (26.7%), ash (20%), vermicompost (17.5%), goat manure (6.7%) and poultry manure (2.5%) were found to be the major organic inputs available at farm which are given in Table 3.

Majority (77.5%) of farmers had livestock component which resulted in application of FYM for cocoa. Crop residues of coconut, banana, cocoa and other weeds were used as organic matter for

Table 2. Agronomic/cultural practices by cocoa growers (n=120)

Sl. No.	Practices	Respondents (%)				
		Coimbatore (n=30)	Kozhikode (n=30)	West Godavari (n=30)	Dakshina Kannada (n=30)	Total (n=120)
1	Mulching	73.3	63.4	86.7	60.0	70.8
2	Use of green leaf manure	26.7	23.3	70.0	26.7	36.7

Table 3. Use of organic inputs produced/ prepared at farm by cocoa growers (n=120)

Sl. No.	Inputs	Respondents %				
		Coimbatore (n=30)	Kozhikode (n=30)	West Godavari (n=30)	Dakshina Kannada (n=30)	Total (n=120)
1	FYM	93.3	56.7	86.7	73.3	77.5
2	Crop residues	73.3	63.3	93.3	60.0	72.5
3	Cow dung slurry	26.7	23.3	40.0	16.7	26.7
4	Ash	16.7	20.0	23.3	20.0	20.0
5	Vermicompost	13.3	10.0	36.7	10.0	17.5
6	Goat manure	13.3	0	13.3	0	6.7
7	Poultry manure	3.3	0	3.3	3.3	2.5

enriching the soil. Thomas (2010) reported that residues from coconut garden would be 14 t ha^{-1} $year^{-1}$ in the form of leaves, spathe, bunch waste and husk. Since crop residues were locally available farmers could recycle it as organic manure. A few farmers made cow dung slurry/*Jeevamrutham* to increase the microbial activity in soil. One fifth of farmers used ash as a source of potash in the soil. Vermicompost was also prepared and applied by a few farmers as they had undergone training on vermicompost preparation and its application. Goat manure and poultry manure were used as organic manures by very few farmers.

c. Use of organic inputs purchased from outside by cocoa growers

Table 4 describes that organic inputs *viz.,* farm yard manure (49.2%), neem cake (45%), biofertilizers (29.2%), goat manure (24.2%), poultry manure (19.2%), vermicompost (18.3%) neem based insecticides (17.5%), *etc.* were the major inputs which were purchased from outside. As the farmers strongly believed that farm yard manure would increase the soil fertility, nearly fifty per cent of them purchased it and applied. Neem cake was purchased for increasing the soil fertility and controlling insects. Biofertilizers like Phosphobacteria, *Azospirillum etc.* were used for improving the nutrient use efficiency. Goat manure and poultry manure were the inputs which were purchased from outside since farmers believed that it would supply essential micro nutrients. Other inputs *viz.,* vermicompost, neem based insecticides, ash, biocontrol agents, bone meal *etc*. were used by few farmers as they could not afford to procure with reasonable price and quality in time.

Knowledge of cocoa growers on organic farming practices

Majority of cocoa growers (68.3%) had medium level of knowledge about organic farming practices followed by low (20%) and high (11.7%) levels of knowledge based on the knowledge index classification using mean and SD (Table 5). Cocoa growers had better education, social participation, extension orientation and mass media exposure which might have influenced knowledge of farmers on organic farming practices. Knowledge of farmers on green manures (73.3%), oil cakes (85%), intercropping (87.5%), mulching (75%), earthworm as farmers' friend (95.8%), compost using earth worms (78.3%) and importance of pruning (79.2%) were fairly high when compared to the knowledge of farmers on biocontrol agents (35%), botanical pesticides (33.3%) and biofertilizers (31.2%) (Table 6). This conveys strong message to the scientists, extension workers, input dealers and change agents

Table 5. Knowledge index of cocoa growers on organic farming practices (n=120)

Sl. No.	Category	Score range	Respondents (%)
1	Low (< Mean – SD)	< 52.39	20.0
2	Medium (Mean±SD)	52.39 – 82.45	68.3
3	High (> Mean + SD)	>82.45	11.7
	Mean	67.42	SD: 15.03

Table 4. Use of organic inputs purchased from outside by cocoa growers (n=120)

Sl. No.	Inputs	Respondents (%)				
		Coimbatore (n=30)	Kozhikode (n=30)	West Godavari (n=30)	Dakshina Kannada (n=30)	Total (n=120)
1	FYM	63.3	56.7	66.7	10.0	49.2
2	Neem cake	50.0	23.3	86.7	20.0	45.0
3	Bio-fertilizers	33.3	13.3	43.3	26.7	29.2
4	Goat manure	10.0	20.0	36.7	30.0	24.2
5	Poultry manure	26.7	3.3	20.0	26.7	19.2
6	Vermicompost	13.3	10.0	23.3	26.7	18.3
7	Neem pesticides	16.7	16.7	23.3	13.3	17.5
8	Ash	0	10.0	20.0	36.7	16.7
9	Bio-control agents	13.3	13.3	16.7	10.0	13.3
10	Bone meal	0	26.7	0	0	6.7

Table 6. Knowledge of cocoa growers on organic farming practices (n=120)

Sl. No.	Knowledge items	Respondents with correct answer (%)
1	Name one green manure crop which is used for increasing the soil fertility	73.3
2	Name two oil cakes used for pest and disease control	85.0
3	Advantages of Intercropping are	87.5
4	Mulching is done for	75.0
5	Which one is called as farmers' friend?	95.8
6	Mention one bio-control agent which is used for disease management	35.0
7	Name one botanical pesticide which is used for pest management	33.3
8	The method of producing compost using earthworms is	78.3
9	Importance of pruning in cocoa	79.2
10	Name one bio-fertilizer	31.7

that farmers knowledge were high on practices which they have been doing traditionally. So intervention programmes *viz.,* training programmes, exposure visits, method demonstration *etc*. are needed with respect to botanical pesticides, biofertilizers and bio- control agents in order to improve the know-how of farmers which will result in better adoption.

Profile characteristics and knowledge of cocoa growers on organic farming practices

Profile characteristics like education, social participation, extension orientation, mass media exposure and training attended were found to have positive and significant relationship with knowledge on organic farming practices (Table 7). Farmers with more education, social participation, extension orientation, mass media exposure and training attended had more knowledge on organic farming practices compared to other farmers. Educated farmers had an opportunity to know the benefits of organic farming practices. Farmers acquired information on organic farming through exposure and interaction within and outside the social system which might have influenced their knowledge. Active participation of farmers in training programmes on sustainable agriculture, interaction with scientists, extension personnel *etc*. might have paved way for increasing their knowledge. Farmers were attracted to organic farming practices since information was disseminated through mass media like TV, radio, printed materials *etc.* Authentic information from reliable sources might have facilitated in increasing knowledge.

Table 7. Correlation between profile characteristics and knowledge on organic farming practices

Sl. No.	Profile characteristics	r value
1	Age	0.072
2	Educational status	0.356 **
3	Farming experience	0.070
4	Area under cocoa	-0.009
5	Livestock possession	0.056
6	Social participation	0.221 *
7	Extension orientation	0.344 **
8	Mass media exposure	0.321 **
9	Training attended	0.267 **

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

Yield and returns from cocoa

The mean yield and productivity of cocoa was found to be 1.2 kg dry beans tree^{-1} year^{-1} and 608 kg dry beans ha^{-1} respectively. Gross income from cocoa was calculated as ₹170 tree^{-1} year^{-1} and ₹ 83377 ha^{-1}. The productivity of cocoa (dry beans) from the study area *i.e.,* 608 kg ha^{-1} is more than the all India productivity of 380 kg ha^{-1} (DCCD, 2012). The highest yield and returns were observed in West Godavari district and the least in Dakshina Kannada district. This difference might have been due to agro climatic and socio economic factors. Still, the productivity can be improved by adopting various scientific practices coupled with organic farming practices.

Table 8. Yield and returns from cocoa

Sl. No.	Particulars	Mean values				
		Coimbatore	Kozhikode	West Godavari	Dakshina Kannada	Overall Mean
1	Age of the tree	7.0	8.5	7.1	8.0	7.7
2	Number of cocoa trees	2562	331	1618	1055	1392
3	Dry beans yield tree^{-1}(kg)	0.9	1.3	1.9	0.8	1.2
4	Dry beans yield ha^{-1} (kg.)	440	640	960	395	608.8
5	Gross returns tree^{-1} (₹)	123.2	179.2	268.8	110.6	170.5
6	Gross returns ha^{-1} (₹)	54208	89600	134400	55300	83377

Constraints in adoption of organic farming practices

The constraints in adoption of organic farming practices were categorized into input, technical/ extension, economic and institutional constraints (Table 9). The constraints under each category were ranked based on the number of farmers' responses. Among the input constraints, non availability of labour was expressed by nearly eighty seven per cent of the farmers as they faced great difficulty in getting labour for their field works. Similar result was reported by Anithakumari *et al*. (2012) and Jaganathan *et al.* (2013). Labourers had other opportunities like National Rural Employment Guarantee Act (NREGA) programme. As per farmers' opinion, labourers had permanent source of employment with nominal wages under NREGA. Majority of the farmers (75%) expressed non availability of quality organic inputs as another constraint. Inputs like bio-fertilizer, oil cakes, vermicompost, bio-control agents *etc*. were not available in time. Thamban *et al.* (2006), Mathew (2010) and Jaganathan *et al.* (2013) reported that lack of availability of organic inputs and their poor quality was a major constraint faced by farmers. Farmers mostly used locally available inputs like green manure, green leaf manure, FYM *etc*. for meeting the nutrient and improving soil properties. For increasing the yield, they were dependent on external organic inputs. Poor electricity supply was

Table 9. Constraints in adoption of organic farming practices in cocoa (n=120)

Sl. No.	Constraints	Respondents (%)	Rank	Overall rank
	Input constraints			
1	Non availability of labour	86.7	I	I
2	Non availability of quality organic inputs	75.0	II	II
3	Poor electricity	31.7	III	XII
	Technical/Extension constraints			
1	Difficult to control pests and diseases by organic methods	72.5	I	III
2	Lack of knowledge about organic farming practices	63.3	II	IV
3	Lack of standard package of practices for organic farming	40.8	III	X
	Economic constraints			
1	High cost for transporting organic inputs	50.0	I	VII
2	High labour wages	43.3	II	IX
3	Price fluctuation	39.2	III	XI
4	Inadequate subsidies for adopting organic farming	30.0	IV	XIII
	Institutional constraints			
1	Lack of specialized markets for organic produce	61.7	I	V
2	Lack of indigenous certification agencies	50.8	II	VI
3	Lack of farmers cooperatives for marketing	45.8	III	VIII

expressed as constraint since farmers could not irrigate cocoa which in turn resulted in delayed intercultural operations.

Among the technical/extension constraints difficult to control pests and diseases by organic methods was expressed by 72.5 per cent of farmers. Organic farming demands high technical know-how especially for pests and diseases management. Pests and diseases were managed by prophylactic methods rather than curative methods. More than sixty per cent of farmers opined that lack of knowledge about organic farming practices as a constraint and majority required know-how on biofertilizers, bio control agents, bio pesticides, certification *etc*. Lack of standard package of practices for practicing organic farming was perceived as a constraint. Package of practices for organic farming have to be evolved to make the cocoa farming economically viable (Mathew, 2010).

High cost for transporting organic inputs was the first under economic constraints. For getting inputs like FYM, goat manure, poultry manure, neem cake *etc*. farmers had to hire vehicles for transporting them to the field of application and the cost incurred was high. Farmers (43.3%) felt that labour wages were high for weeding, organic manure application, irrigation *etc*. but their produce fetch same price every year. Price fluctuation was expressed by about forty per cent of farmers and they demand assured price for cocoa. Inadequate subsidy for adopting organic farming practices was expressed as a constraint. Farmers who wished to adopt organic farming practices did not receive any subsidy unlike inorganic farming which enjoyed subsidies for fertilizers and other chemicals.

More than sixty per cent of the farmers perceived lack of specialized markets for organic produce as a constraint. Farmers were ready to produce high quality and residue free produce provided there is market for organic produce with assured price. Lack of domestic certification agencies was expressed by 50.8 per cent of farmers. At present certification is done by foreign agencies. Farmers wanted to certify their farm products by national or local agencies with reasonable fee for certification. Lack of farmers' cooperatives for marketing was expressed by 45.8 per cent of farmers. Farmers felt that assured marketing would help them in doing profitable farming.

From the study, it is apparent that the cocoa growers who have implemented the organic farming practices do reflect the concern for sustainable agriculture. The study highlights the comparatively higher cocoa productivity as well as returns obtained from cocoa farming. On the other hand, it is noteworthy that most of the farmers do not have awareness and expertise on advanced organic farming practices such as, application of bio pesticides and bio fertilizers, which could be a point of intervention from the research front. Cocoa growers are more confronted with market-related difficulties such as low and highly fluctuating prices and it is a challenge to find favourable market outlets for the products. To realize the higher prices for organic cocoa it is imperative to obtain organic labeling for the product.

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