Asian Journal of Agricultural Extension, Economics & Sociology

39(10): 429-436, 2021; Article no.AJAEES.75417
ISSN: 2320-7027

A study on Economic Analysis of Organic Coconut Cultivation in Coimbatore District

J. J. Parthiban[1*] and M. Anjugam[1]

[1]Department of Agricultural Economics, AC & RI, Tamil Nadu Agricultural University, Coimbatore - 641003, India.

Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

Article Information

DOI: 10.9734/AJAEES/2021/v39i1030710
Editor(s):
(1) Dr. Roxana Plesa, University of Petrosani, Romania.
Reviewers:
(1) Tuhin Narayan Roy, Uttar Banga Krishi Viswavidyalaya,India.
(2) Filipe Altoé Temporim, University of São Paulo, Brazil.
(3) D. Bardhan, ICAR-Agricultural Technology Application Research Institute,India.
Complete Peer review History: https://www.sdiarticle4.com/review-history/75417

Original Research Article

Received 04 August 2021
Accepted 09 October 2021
Published 09 October 2021

ABSTRACT

The study analyses the economics of coconut production under organic farming in Coimbatore District of Tamil Nadu. Participatory Guarantee Scheme (PGS) was studied in accordance to how farmers get their organic farming certification under PKVY scheme in Tamil Nadu. The estimated variable cost was Rs. 43,025/ha. The total cost of cultivation was Rs.82,216/ha. The net income over operational cost was Rs.2,95,888/ha and net income over total cost was Rs.2,56,697/ha. Total yield was increasingly responsive with higher application of farm yard manure and bio- fertilizers. Results of scale efficiency shows majority of the farms were operating in optimum return to scale. Inadequate supply of labour and inadequate market for organic products poses as major constraints to organic coconut farming in the area of study.

Aim: The purpose of the study was to find out the profitability level and responsiveness of yield with input application of organic farming through Participatory Guarantee Scheme (PGS) and how farmers actively involved in organic farming to conserve natural resources.

Design of Study and Methodology: The study was conducted in Coimbatore district of Tamil Nadu (2020) with 60 sample respondents. Purposive sampling was adopted for the study and two blocks were selected based on the leading operator of PGS scheme. The data were collected through well-

**Corresponding author: E-mail: jjparthiban33@gmail.com;*

structured interview schedule which was prepared through pre-tested survey. The analytical methods followed in the study included cost and returns estimation, resource use efficiency and data envelopment analysis to reveal the exact scenario of organic farming practices.

Findings of the study:

The study showed about

- Organic coconut is found to be one of the most important and sustainable crop options.
- Estimates of Resource Use Efficiency show that coconut yield was relatively higher with use of farm yard manure and bio- fertilizers, compared to all other organic inputs
- Nearly, 32.5 per cent of the farms considered under study were found to be operating in constant returns to scale.
- The major marketing constraint faced by the sample farmers through organic farming was inadequate supply of labour and price fluctuations of coconut.

Keywords: Organic coconut; profitability; resource use efficiency; data envelopment analysis and constraints.

1. INTRODUCTION

Globally, 1.5 % of farmland is organic. The countries with the largest organic share of their total farmland are Liechtenstein (38.5%), Samoa (34.5%), and Austria (24.7%) (*Source- FiBL Survey, 2020*). The total organic agricultural area in Asia was 5.9 million hectares in 2018. This constitutes nine % of the world's organic agricultural land and 0.4 % of the total agricultural area. There are nearly 1.6 million producers. The leading countries by organic agricultural land are China (2.3 million hectares) followed by India (2.2 million hectares). The increasing demands for organic produce have created new export opportunities and many developing countries have started to tap lucrative export market for organic products [1].

India is home to 30% of the total organic producers in the world, but accounts for just 2.59% (1.5 million hectares) of the total organic cultivation area of 57.8 million hectares, according to the World of Organic Agriculture Report (2019). Cultivable land area under organic farming has more than doubled from 11.83 lakh ha in 2014 to 29.17 lakh ha in 2020. Over the years, the organic promotion activities led to development of state specific organic brands, increased domestic supply and exports of organic produce. India occupies a predominant position in the world in coconut production. India ranks third in the world map of coconuts and in due course became the largest producer of coconut with the production of 16.9 billion nuts from acreage under plantation of about 1.89 million hectares. Even though India is among the largest producer of coconut with a distinction of having the highest productivity of 7779 nuts per hectare as against 3630 nuts per hectare in Indonesia and 3859 nuts per hectare in Philippines, the per capita annual availability of coconut is estimated to have been 10 nuts only which is quite low, when compared to 222 of Philippines, 145 of Sri Lanka and 55 nuts of Indonesia [2-4].

Paramparagat Krishi Vikas Yojana (PKVY) is a Central-State shared scheme being implemented as a three-year continuous scheme under National Mission for Sustainable Agriculture (NMSA) to promote organic farming. The scheme aims at promotion of organic farming through cluster approach under Participatory Guarantee System (PGS) of certification. In the first phase implemented from 2015-16, 50 clusters were formed in 11 districts - Rs.6.81 crore benefiting 2,272 farmers covering 2,496 acres. In second phase during 2018 -19, new 150 clusters in 8 districts were formed and first year activities were implemented at an expenditure of Rs.4.91 crore covering 7,500 acres under Organic farming. The second-year activities in 150 clusters are being implemented in 2019-20 at a cost of Rs.5.1 crore for which an amount of Rs.3.89 crore has been spent so far and 4,943 farmers have been benefitted. Hence, the study was taken to find out the benefits obtained by farmers operating under Participatory Guarantee Scheme (PGS). Coconut is one of the important major crops in Coimbatore and hence organic farming helps the farmers use fewer pesticides, **reduces soil erosion, decreases nitrate leaching into groundwater and surface water**, and recycles animal wastes back into the farm. These benefits are counterbalanced by higher food costs for consumers and generally lower yields.

2. REVIEW OF LITERATURE

Shyamal Roy [5] in his study states that, in a study conducted in India, the yield performance

varied from about 3,000 to 10,000 nuts per hectare, giving an all-India average of 5,400 nuts hectare. In Tamil Nadu yield per hectare was over 9,000 nuts whereas in Kerala, the major coconut producing state, it was about 6,000 nuts. In the other coconut growing states, the yield ranges between 4,000 and 5,000 nut per hectare.

Das [6] in his report states that the cost of production of coconuts in Kerala had been estimated at Rs. 1.10 per nut in 1982-83 factor costs, without taking the value of land into consideration. In view of the fact that the rate of appreciation of land was significantly higher than that of bank interest rates and the land market was out of normal economic ambit, there was no justification to include land value in the investment in the present situation of Kerala When a moderate price of Rs.50.000 per hectare of land was added to the investment on coconuts, the production cost came about Rs.1.94 per nut. Considering the average production cost and farm gate price of coconut as Rs. 1.10 and Rs. 1.50 per nut respectively, the net returns worked out to be Rs. 4,200 per hectare. The cost of bringing one hectare of coconut garden to bearing or the total establishment cost per hectare came about Rs. 35,000. The annual maintenance cost came about Rs. 5,500. Since coconut was a small holder plantation crop, at least 75 per cent of labour required for various operations, excluding harvesting could be expected from the farmer's family itself. Therefore, the returns to family labour and investment per hectare of coconut garden worked out to be Rs. 5,760 per annum. The study thus reveals that coconut cultivation under good management was a profitable proposition in Kerala.

2.1 Objectives of the Study

1. To find out profitability of the coconut farming in the study area.
2. To estimate the resource use efficiency of coconut farms in the study area.
3. To identify the constraints in adoption of organic farming under Participatory Guarantee Scheme (PGS) at farm level.

3. METHODOLOGY

3.1 Sampling Plan and Data Collection

Purposive sampling technique was employed to select the respondents from the study area. Coimbatore district was purposively selected since Participatory Guarantee Scheme (PGS) is operating throughout the district and is observed to be a leading operator in this scheme. The selection was done based on the data collected from Assistant Director of Horticulture, Department of Agriculture, Coimbatore, Tamil Nadu. The selected blocks from the study area were (i) Thondamuthur (ii) Pollachi North are the best performer in Coimbatore district. The number of farmers interrogated from each block was 20 sample respondents.

The returns include income earned by selling main and by products. The products are coconut oil, coconut butter, coconut cream, etc., and they are sold through retail outlets in Coimbatore district.

3.2 Analytical Framework

A. Cost and Returns Estimation

Costs and returns were worked out from the data collected from the sample respondents in the study area. The cost includes both establishment and maintenance costs. The establishment cost shows the cost incurred in coconut garden at pre-bearing stage. The maintenance cost indicates the cost incurred by the farmers since the bearing stage. Establishment cost for a coconut plantation includes all those costs incurred during the first six years of a plantation. Cost per hectare of these six years of grower's was taken as the estimated cost per hectare in the first six years of planting form these establishment cost of one acre coconut holding. Fixed cost includes the items such as rent paid for leased in land or rental value of land, depreciation farm assets and interest on fixed investment. Rental value of own land was work out based on the rates paid for leased in lands of similar type in the same localities. Variable costs include the ploughing, harrowing, FYM cost, fertilizer cost, manual weeding and irrigation, harvesting etc.

B. Resource Use Efficiency

Production function analysis was carried out to assess the resource use efficiency in coconut production. After examining the association between the dependent and independent variables with a scatter diagram, Cobb-Douglas production function was selected for the study.

The form of regression model used was

$$Y = a\, X_1^{b1}\ X_2^{b2}\ X_3^{b3}\ X_4^{b4}\ X_5^{b5}\ X_6^{b6}\ X_7^{b7}$$

Where,

Y = Yield of Coconut (Nuts)
X_1 = Quantity of Farm Yard Manure (FYM) (kgs)
X_2 = Quantity of Bio – Fertilizer Manure (kgs)
X_3 = Quantity of Neem- Cake Manure (kgs)
X_4 = Quantity of Coconut Cake Manure (kgs/)
X_5 = Quantity of Organic Inputs (Jeevamirtham) (Rs.)
X_6 = Total Cost of Labour used (Rs.)
X_7 = Total Cost of Machine used (Rs.)
μ_t = Error term
a, = Parameters to be estimated
$b_{1,}\ldots b_{10}$

3.3 Allocative Efficiency Analysis

Estimate of the parameters $b_{1\ldots}b_n$ were elasticities of Y with respect to j^{th} input. The marginal products of the resources were derived from these elasticity coefficients. The marginal value productivities of significant inputs were worked out at its geometric mean level by using the formula.

$$MVP_j = b_j \frac{\overline{Y}}{\overline{X}_j} . P_Y$$

Where,
MVP_j -Marginal value product of j^{th} input
Y - Geometric mean level of output
X_j - Geometric mean of input 'j'
β_j - Estimated co-efficient of elasticities
P_y - Price per unit output

Marginal Value Product (MVP) of each input was compared with Marginal Input Cost (MFC) in order to estimate the allocative efficiency. Marginal factor costs are the additional costs created by adding a single unit of input. The marginal factor cost is the change in the total factor cost divided by the change in the factor of quantity.

The efficiency of resources was judged by computing the ratio of MVP of resource to its factor cost, and drawing necessary inferences as given below:

$MVP/Px_i = 1$------ optimum utilization of resources
$MVP/Px_i < 1$ ---------- over utilization of resources
$MVP/Px_i > 1$ ---------- underutilization of resources

3.4 Technical Efficiency Analysis (Data Envelopment Analysis)

DEA is a frontier method that does not necessitate a specific condition of a functional or distributional form, and can accommodate scale issues. This approach was first used by "Farrell (1957)" as a part in linear convex hull approach for demonstration of frontier estimation. The DEA was applied by using only VRS (variable returns to scale) with input orientation, in which one seeks input minimization to obtain a particular product level.

C. Identify the constraints in adoption of organic farming

- **Application of Garrett's Ranking Technique**

  The respondents were asked to rank their constraints in organic farming. The value of R ij is then multiplied by the Garrett Value to determine the Total Garrett Score. The average Garrett Score is then calculated by **dividing the Total Garrett Score by the number of alternatives**. The alternative ranking is done based on the highest average value. In Garrett's ranking technique, these ranks were converted into per cent position by using the formula

$$\textbf{Percent position} = \frac{\textbf{100 X } (R_{ij} - 0.5)}{N_j}$$

  Where,
  R_{ij} = Ranking given to the i^{th} attribute by the j^{th} individual
  N_j = Number of attributes ranked by the j^{th} individual.

Table 1. the purpose for the selection of Coimbatore district for the past three years the number of farmers under PGS is found to be increasing and hence the study reveals the importance of this scheme and organic farming demand in the study area

District	2015	2016	2017	2018	2019	2020
Coimbatore (No. of farmers)	0	0	100	451	902	626
Percentage	0%	0%	16%	13%	20%	12%
Total PGS in TN	0	151	602	3544	4531	5242

(Source – Compiled from PGS website)

4. RESULTS

To estimate the establishment cost the last year's cost under different heads of sample growers in 2nd, 3rd, 4th, 5th, 6th and 7th years of starting the plantation have been estimated. For instance, if a grower has two holdings two and four year's old then the grower's current year's expenditure under different heads in the two holding were collected separately. Cost per hectare of these six years of grower's was taken as the estimated cost per hectare in the first six years of planting form these establishment cost of one acre coconut holding was calculated

Table 2 shows the operation wise and year wise establishment cost of one acre coconut plantation by an individual grower operation wise, there are 7 functions have been carried out in the establishment of coconut plantation. They are land preparation, cost of seedling, cost of manure and application, pit formation and planting, irrigation charges, intercultural plough and maintenance, weeding cost. It is seen that the total establishment cost of one acre coconut plantation was worked out for Rs. 1,61, 995. The total establishment cost between the growers did not suffer much there are variations year wise and operation wise.

4.1 Operational Cost

Operational cost includes the items such as organic manures and inputs, application charges, irrigation charges, weeding cost, harvesting charges and interest on working capital is Rs. 43,025.

Table 2. Year wise Establishment Costs of Coconut (Per acre)

Sl.No.	Particulars	I - Year	II - Year	III – Year	IV - Year	V – Year	VI – Year	Total
1.	Land Preparation	9,580	0	0	0	0	0	9,580
2.	Cost of Seedling	10,500	0	0	0	0	0	10,500
3.	Cost of Manure and Application	12,000	7,155	6,410	4,737	5,850	6,625	42,777
4.	Pit Formation and Planting	18,195	0	0	0	0	0	18,195
5.	Irrigation	6000	6000	6000	6000	6000	6000	36,000
6.	Intercultural Plough and Maintenance	6,092	2,812	3,655	3,580	4,330	4,525	24,994
7.	Weeding Cost	2,425	2,962	3,085	3,275	3,857	4,345	19,949
8.	**Total Establishment Cost**							**1,61,995**

(Figures in parentheses indicate percentages to total)

Table 3. Cost and Returns of Coconut Cultivation (Per acre)

Particulars		**Amount (Rs.)/ha.**	
Total Establishment Cost		**1,61,995**	
Sl.No.	**Particulars**	**Amount (Rs.)**	**Per cent to total cost**
A.	**Operational cost**		
1.	Organic Manures and Inputs	9,832	11.95
2.	Application Charges	5,000	6.08
3.	Irrigation Charges	5,000	6.08
4.	Weeding Cost	2,578	3.13
5.	Harvesting	17,800	21.65
6.	Interest on working capital @ 7 per cent	2,815	3.42
	Total Operational Cost	**43,025**	**52.33**
B.	**Fixed cost**		
1.	Interest on Fixed Capital/Investment	2,960	3.60
2.	Depreciation on Fixed Assets	15,000	18.24
3.	Rental Value of Land	18,000	21.89
	Total Fixed Cost	**35,960**	**43.73**
C.	**Annual establishment cost**	**3,231**	**3.92**
Total Cost of Cultivation (A+B+C)		**82,216**	**100.00**

4.2 Fixed Cost

Fixed cost includes interest on fixed capital, depreciation on fixed assets and rental value of land is Rs. 35,960. Rental value of own land was work out based on the rates paid for leased in lands of similar type in the same localities which was estimated as Rs.18000 per annum.

The findings from the study indicated that on an average the yield from coconut farm under organic cultivation practises gives around 25,292 nuts per acre. The gross income from one acre coconut farm is Rs.3.4 lakhs. The total operational cost was estimated to be Rs. 43,025 per acre and the total fixed cost was found to be Rs. 35,960 per acre. The net income over operational cost was found to be Rs. 2.96 lakhs and net income over total cost was found to be Rs. 2.56 lakhs.

4.3 Estimation of Resource use Efficiency

4.3.1 Allocative efficiency

It could be determined from the Table 4 that the coefficients of multiple determinations (R^2) were 0.71 and Adjusted (R^2) was 0.65. It indicated that 71 per cent of the systematic variation in coconut yield can be attributed to the independent variables included in the model. In Cobb-Douglas production function, the coefficients characterize the production elasticity of the resources used. The yield responded significantly to the inputs such as farmyard manure, bio – fertilizer and coconut cake. The coefficient of farmyard manure, bio - fertilizers were positive and significant at one per cent level with the coefficient values of 1.12 and 0.93 correspondingly, which means coconut cake manure was also observed to be positive and significant with coefficient values 3.93 indicating that an increase in the usage of farmyard manure and bio- fertilizers by one per cent, *ceteris paribus* would increase the yield of coconut by 1.12 and 0.93 per cent respectively at the existing geometric mean level. Therefore, from these results we can conclude that the response was relatively high to the farm yard manure and bio- fertilizers.

The findings of the study for estimating economic efficiency of resource use indicates that the input farm yard manure and bio-fertilizer is found to be more than one and it is under- utilised. Hence, the selected respondents should increase the usage of these two input factors.

Table 4. Annual Gross and Net Returns from Coconut Cultivation (Per hectare)

Sl. No.	Particulars	Value
1.	Average Yield (Nuts)	25,292
2.	Average Price (Price in Rs. / Nut)	13.4
3.	Gross Income (Rs.)	3,38,913
4.	Total Operational Cost (Rs.)	43,025
5.	Total Cost of Cultivation (Rs.)	82,216
6.	Total Fixed Cost (Rs.)	35,960
7.	Net Income over Operational Cost (Rs.)	2,95,888
8.	Net Income over total cost (Rs.)	2,56,697

Table 5. Factors affecting organic coconut yield in the farms under study

Sl. No.	Variables	Regression coefficient	Standard error	p-value
1.	Intercept	10.27773	5.61	0.07459
2.	FYM	1.127475	0.3672	0.00388 **
3.	Neem Cake	3.162768	1.758	0.07975 ^{NS}
4.	Bio – Fertilizer	0.93926	0.3267	0.00651**
5.	Coconut cake	3.939156	2.424096	0.02008*
6.	Organic Input – Jeevamirtham	6.56215	4.153	0.122164 ^{NS}
7.	Human Labour	0.065212	0.02134	0.07476 ^{NS}
8.	Machine Hours	0.0273	0.0156	0.0878 ^{NS}

R^2 = 0.71; Adjusted R^2 = 0.65; N = 40

Note: ***Significant at 1 percent level *Significant at 5 percent level*

^{NS} *Non-significant*

Table 6. Economic Efficiency of Resource use

Sl. No.	Variables	Regression coefficient	MVP	MIC	RUE
1.	FYM	1.127475	5732.95	3200	1.791
2.	Neem Cake	3.162768	537.97	1600	0.336
3.	Bio – Fertilizer	0.93926	4295.11	2800	1.533
4.	Coconut cake	3.939156	462.09	1400	0.330
5.	Organic Input – Jeevamirtham	6.56215	546.69	3600	0.151
6.	Human Labour	0.065212	61.60	400	0.154
7.	Machine Hours	0.0273	41.17	850	0.048

Table 7. Descriptive Statistics of Coconut Farms based on Scale of Operations in the Study Area

Scale of operation	Efficient firms		Efficiency measures			
	No.	%	Mean	Standard deviation	Maximum	Minimum
Technical efficiency (constant returns)	21	52.5	0.92	0.07	1	0.77
Technical efficiency (variable returns)	14	35.0	0.95	0.06	1	0.80
Scale efficiency	27	67.5	0.97	0.04	1	0.78

On the other hand, the resources like neem cake, coconut cake, organic input, labor and machine were found to be less than one and it is over-utilised. Hence, proper measures must be suggested to the interrogated sample farmers to optimally use the resources.

From the analysis, it is revealed that about 52.5 per cent of the farms are under the constant returns to scale condition operated with the efficiency level equal to 0.90 or higher. The average efficiency score was 0.92 indicating that 19 farms were inefficient.

In the specification of variable returns to scale, the influence of production scale on technical efficiency (TE) was shown. The farms showed an increased efficiency by a higher mean technical efficiency score of 0.97. The improved outcome from variable returns can be attributed to inclusion of scale efficiency. In the aspect of scale, 27 farms were performing at their best level or were operating near to the best level of efficiency. On assessing the scale efficiency of small farms, 27 farms out of the 40 farms performed at the optimum scale or nearby the optimum scale (farms having scale efficiency values equal to or higher than 0.90).

It is necessary to identify number of efficient farms, degree of inefficiency and finest scale of operation and to know the distribution of farms in all three regions of production frontier, i.e., under increasing, decreasing or constant returns. Further, in the increasing returns to scale, 18 farms were operating at increasing return to scale. The production scale of these farms might be amplified by reducing the costs, because their performance is observed to be below the optimum production scale. In the region of decreasing returns to scale, 9 farms were holding their share of 22.5 per cent and can improve their TE by refining production levels. The remaining 32.5 per cent of the farms were classified under the category of constant returns to scale.

Table 8. Distribution of Coconut Farms in the study area based on types of returns among different scale of operations

Types of returns	Small farms	
	No	%
Increasing returns	18	45
Constant returns	13	32.5
Decreasing returns	9	22.5

Table 9. Constraints faced by Sample Farmers in Organic Farming

Sl. No.	Constraints	Mean Score	Rank
1.	Non- Availability of Labour	67.40	I
2.	Price Fluctuation	58.67	II
3.	No exclusive market for organic produce	42.33	III
4.	Incidence of Pest and Diseases	41.80	IV

The most important marketing constraint faced by the farmers under organic farming was Non – availability of labour (67.40) followed by Price fluctuations (58.67) in the study area. No exclusive market for organic produce (42.33) was the next important constraint encountered by the farmers and Incidence of Pest and Diseases (41.80) was found to be comparatively a least constraint.

5. CONCLUSION

The study shows that total cost of production of organic coconut farms was Rs.82,216/ha. The net income over operational cost was Rs.2,95,888/ha and net income over total cost was Rs.2,56,697/ha indicating highly prospective crop. The results of the linear regression indicate that the coconut yield responded significantly to inputs such as farmyard manure, bio–fertilizer and coconut cake. The results of farm efficiency analysis revealed that about 52.5 per cent of the farms are operating under the constant returns to scale (average efficiency level = 0,90). This results also remain in conformity with scale efficiency where majority of the farms have shown good economic performances. In case of low efficiency farms, the production scale might be amplified by reducing the costs. Nearly, 32.5 per cent of the farms were found to generate in constant returns to scale. The Garette ranking technique showed that inadequate supply of labour (67.40) and price fluctuations (58.67) were the two most important constraints. Thus, organic coconut is found to be one of the best and sustainable crop options that can be recommended to extend its cultivation. The organic coconut cultivation in the study area represents a group formation from the local area and farmers operate in a cumulative approach to obtain the benefits from government in terms of input subsidiaries and organic certification under PGS – Participatory Certification System. The products and by products like coconut oil, cream, butter etc. are sold only to the local retails' organic shops for sale to the consumers and the study is limited to this extent. NPOP ccertified products can be traded in export and in domestic market including imports, PGS-India certified products can be traded only in domestic market.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Deshmukh MS, Babar N. Present status and prospects of organic farming in India. European Academic Research. 2015;3(4): 4271-4287.
2. Govindaraju A. Development of Coir Industry in India. Southern Economist. 2010;49(10):17-19.
3. Kalathiya KV, Dave SK, Mehta DR. Cost and return in different sizes of coconut holding in Valsad district (South Gujarat). Indian Journal of Agricultural Research, 2007;41(3):13-18
4. Nagaraja G. Prospects and Problems of coir Industry in India. Southern Economist. 2011;49(9):40-44.
5. Shyamal Roy. Coconut Oil Situation in India – analysis of Trends and Prospects. Agricultural Situation in India. 1982;37(2): 85-90.
6. Das PK. Estimating Production costs and returns for Coconut in Kerala. Journal of Plantation Crops. 1984;12(2):152-159.

Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle4.com/review-history/75417