



# Estimating cost of production of coconut in a region

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## Abstract

A methodology for estimating cost of production of coconut in a region is proposed by taking into account the establishment cost of the garden as well as the annual maintenance cost. Stratified multistage sampling design was adopted for collecting data from different growth stages of the crop. District level estimates of cost of production of coconut have been worked out on the basis of a survey carried out in three districts of Kerala state namely Kozhikode, Ernakulam and Thiruvannanthpuram. The cost of production of coconut (i.e., all paid out cost (Cost A) + imputed family labour) per 100 nuts, in Kozhikode, Ernakulam and Thiruvannanthpuram districts as estimated from the survey data is Rs. 198, 374 and 293, respectively for the year 2001. The per cent standard error obtained was 11.18, 15.4 and 15.45 in that order. The methodology evolved in this study can be used for arriving cost of production in all the major coconut growing districts/states in India.

**Keywords:** Coconut, cost of production, data collection, sample survey

## Introduction

In general, cost of production studies are undertaken in the context of country's planned economy, development and for formulating a proper price policy keeping in view of the interests of both consumers and producers. The cost concepts developed for field crops are not fully relevant to perennial crops as they are limited to estimating the annual maintenance cost. As perennial crops have long gestation period, any cost calculation in respect of such crops should include: (i) estimating the cost of raising a garden to the bearing stage, i.e. establishment cost and (ii) estimating the annual cost for maintaining a garden including the harvest charges. While annual maintenance cost can be obtained by the usual cost accounting method, estimating the establishment cost of a garden is a problem as farmers seldom maintain any input records. A number of operations are involved while establishing a garden as well as its maintenance in the bearing stage. Some of these operations have fixed cost while others have variable cost. While computing the cost of production, the entire cost of raising a garden to the bearing stage is considered as an investment which should be realized during the economic life span of the

crop. The cost to be realized per year, which is the annuity value of the establishment cost of a garden, should be added to the annual maintenance cost to obtain the cost of production. To work out the establishment cost, it becomes necessary to select gardens containing palms of different age groups including the young ones at the sample selection stage. Due to these technical reasons, most of the earlier field level estimates of cost of production were limited to the annual maintenance cost of a bearing garden. However, realistic estimates of production cost can only be obtained by taking into account the establishment cost of a garden to bearing stage along with the annual maintenance cost. Accordingly, there is a need to develop an appropriate methodology for obtaining reliable estimates of cost of production for coconut crop. Therefore, IASRI, New Delhi in collaboration with CPCRI, Kasaragod took up a study entitled "A pilot study on cost of production of coconut in Kerala" in three districts of Kerala. The primary objective of the study was to develop a suitable methodology for obtaining reliable, district level estimates of cost of production of coconut.

## Materials and Methods

Sample survey approach was adopted for the study. A representative sample of coconut cultivating farmers was selected to collect required information on various inputs as well as output using three stage simple random sampling design, community development blocks (hereafter referred as block), gram panchayat (henceforth called as panchayat) and coconut cultivators. As a first step, four blocks from Kozhikode district and five blocks each from Ernakulam and Thiruvananthapuram districts were randomly selected. Two or three panchayats were next selected from each of the blocks in the three districts. The selected panchayats were surveyed by field investigators for listing coconut growing households (limited to nearly half of their total number). The listed households were stratified into four categories according to the area under coconut as marginal, small, medium and Large having area under coconut (in ha)  $\leq 0.05$ ,  $>0.05$  to  $0.20$ ,  $>0.20$  to  $\leq 0.80$  and  $>0.80$ , respectively. Twenty households were selected from each sampled panchayat with proportional allocation from the three categories of small, medium and large holdings. Holdings in the first category were excluded as no commercial production is possible from such holdings. It was further ensured that a selected holding would have at least 10 coconut palms. The sampling units at each stage were selected by simple random sampling without replacement.

The palms in the selected holdings were post-stratified, on the basis of their age, into four groups: (i) up to 1 year, (ii) 1-3 years, (iii) more than 3 years but not yet started bearing and (iv) bearing or adult palms. During data collection, farmers were requested to recollect the average age at first bearing and number of years taken for yield stabilization. Data were collected twice in this regard and inconsistent responses were rejected. Average age at first bearing was obtained as eight years. Hence, while deriving cost components, the third growth stage was considered as having duration of five years (i.e. 4 to 8 years after planting). Average number of years taken for yield stabilization since bearing was four.

The survey was spread over a period of 15 months including an initial period (October to December, 2000) for preparation of sampling frame and for selection of third stage units. Detailed data on input and output were collected in four quarterly rounds during January to December, 2001.

Properly structured and pre-tested schedules were used by the field investigators for collection of requisite data. The interview schedules used are: schedule-I for

enumeration of coconut growing farmers; schedule-II for general information regarding selected farmers; schedule III for assessment of fixed assets of the selected farmers and schedules IV to VII for quantification of input/output in the selected holdings at quarterly intervals. Data collection was carried out by field investigators identified locally. During each round of the survey, training was imparted to these investigators so as to obtain quality data free from reporting errors. Further periodic cross checking was carried out for assuring correctness of the data collected.

Cost-accounting method was used in estimating the cost of production of coconut and the data obtained through the survey were analyzed using different concepts of cost and also taking care of the sampling design. In this study, the following parameters of cost: (i) Cost per unit area (ha); (ii) Cost per 175 palms and (iii) Cost per 100 nuts have been estimated using Cost A and Cost A+ Imputed value of family labour cost concept, where Cost A comprises of all paid out costs.

The major components of cost of cultivation of coconut are the cost of input materials and cost of hired human labour. The type of input materials and items of cultivation practices depend on the growth stages of the crop. Item wise cost components for the four growth stages were calculated on the basis of data obtained. As majority of the holdings were having palms of different growth stages, respective cost components were derived by apportioning the total cost of an item for the whole holding into corresponding growth stages. Cost of input material generated at holding level and cost of family labour were imputed.

As for the labour cost, majority of the holdings reported only the total number of man-days utilized for various agronomic operations such as basin opening, fertilizer application and mulching put together instead of man-days spent on individual operations. Therefore, these operations were combined together and reported under the head 'basin management'. Experimental data from CPCRI on proportion of labour utilization for various agronomic practices in different growth stages of coconut palm (Sairam *et al.*, 1997) and proportion of palms under different growth stages in the holding were utilized for apportioning the labour-days.

## Results and Discussion

### *Cost components according to growth stages*

Usually coconut seedlings are planted before the onset of South-West monsoon or immediately after the monsoon. Planting was reported only in limited number

of holdings. Data from holdings, with at least five seedlings planted only were considered for deriving costs. Cost of seedlings was the major input in the year of planting. Costs incurred for materials used to provide shade, fencing, manures, transportation of seedlings etc. were recorded in a few holdings only.

Annual cost of material inputs during the first three years of planting was reported only in a few holdings and that too mainly for gap filling. Though application of chemical fertilizers was reported from a few holdings only, its usage was observed to be relatively more in Ernakulam district. The material cost with regard to irrigation was arrived primarily as apportioned value.

The most important input component in the case of juvenile palms of four to eight years of age was organic manures. However, adequate quantities of organics were not applied in any of the three districts. Extent of adoption of inorganic fertilizers was also very low. No plant protection cost was reported from this growth stage.

The major input component during the bearing stage was organics in all the three districts: Farmyard manure was the most commonly applied organic manure (64.8 %). Green leaves and ash were applied in 50 % of the holdings. Application of neem cake was found in 14.1 % holdings. Compost and marketed organic fertilizers were applied in 3.1 and 3.8 per cent holdings, respectively.

Application of organic manures and chemical fertilizers was low in Kozhikode district as compared to the other two districts. Plant protection operations were reported only from 6 % holdings selected from the three districts. Phytosanitary measures such as crown cleaning were practiced only in very few holdings. Crown cleaning was often clubbed with harvesting operations.

Though damage of nuts due to eriophyid mite incidence was reported in all the districts, remedial measures were taken only in a few holdings (0.5 % and 1.0 % holdings in Ernakulam and Thiruvananthapuram districts, respectively). Plant protection measures against leaf rot and bud rot diseases were reported from 7 % holdings in Ernakulam district. In the case of Thiruvananthapuram district it was respectively 3 and 1 %. In Kozhikode district, control measure against stem bleeding was reported in 1 % of the selected holdings.

In all the districts, the maximum expenditure on input material in the bearing stage was for organic manures followed by chemical fertilizers. The material cost related to irrigation was less than 5 % of the total input cost in all the districts. Utilization of machine

and animal labour was not reported in the sample. Use of weedicide was also not reported from any of the holdings.

Cost of hired labour as well as imputed family labour cost was worked out for various operations performed during the year of planting. It was observed that planting and shading operations were carried out exclusively through hired labour. The family labour was mainly utilized for irrigation and weed control by way of intercultural operations.

Apart from gap filling and shading, the labour requirements during the first to three years after planting were reported from basin management, irrigation and intercultural operations. As in the case of input use, labour utilization was also low for this growth stage. For the juvenile palms, hired labourers were chiefly employed for basin management and intercultural operations. Cost of irrigation was mainly incurred through family labour.

In bearing palms, harvesting charge was the major component of hired labour cost, followed by basin management. Large variation was observed for harvesting charges, the range being Rs.1.5 to 25.0 per palm per harvest. In some holdings, permanent labourers engaged on daily wages were attending to the harvesting also which reduced the per palm cost. Similarly the charges for climbing young palms were comparatively low which also resulted in reduced harvesting charge. But in certain holdings, harvesting operations were combined with crown cleaning for which the wage rate was high. The average harvesting charge per palm in Kozhikode, Ernakulam and Thiruvananthapuram districts were Rs.3.44, 5.30 and 5.85, respectively.

#### *Cost of cultivation in different growth stages*

District level estimates of cost of cultivation of coconut in different growth stages are shown in Table 1. To work out Cost A, land tax @ Rs.25 per hectare was added to the total cost of hired labour and material input. The cost of cultivation on adding imputed value of family labour is also furnished in Table 1.

District level cost of cultivation (i.e. cost A) during the year of planting at varied from Rs.6,803 (medium holdings in Thiruvananthapuram district) to Rs.11,189 (large holdings in Ernakulam district). The higher values for Cost A in Ernakulam district were mainly attributed to costs related to fencing and intercultural operations including soil and water conservation measures. Further, the district had relatively large area under irrigation, which has reflected in the higher cost A and also on adding imputed cost of family labour.

Average cost of cultivation per 175 palms during the initial years of planting (1 to 3 years) at district level varied between Rs.7,065 (small holdings in Thiruvananthapuram district) and 13,674 (medium holdings in Ernakulam district). When imputed cost of family labour was added, the cost varied between Rs.8,416 (small holdings in Kozhikode district) and 22,672 (small holdings in Ernakulam district). Cost of cultivation of juvenile palms was in between Rs.20,440 (small holdings in Kozhikode district) and 47,845 (large holdings in Ernakulam district). On adding the cost of imputed value of family labour, the annual cost of cultivation varied between Rs.23,052 (small holdings in Kozhikode district) to Rs.70,921 (small holdings in Ernakulam district). The family labour is chiefly used for irrigation and the cost of cultivation is obviously more in such gardens.

Based on the aforesaid cost components, the total establishment cost was worked out at district level and is furnished in Table 1. The paid out cost (Cost A) of establishing coconut garden was comparatively high in Ernakulam district.

The per cent contribution of the important cost components in the pre-bearing stage viz., labour, manures, fertilizers and seedlings remained the same in the three districts. The labour cost accounted for maximum share of the total cost (69-79%) followed by cost incurred on manures and fertilizers (13-20%) and seedlings (4-9%).

The annual cost of cultivation in the bearing stage (Table 1) varied between holding categories as well as among the districts. It varied between Rs.10,513 per 175

palms (small holdings in Kozhikode district) to Rs.18,479 (medium holdings in Ernakulam district).

#### *Estimated cost of production*

The items required for working out the cost of production are the annual cost of cultivation of bearing palms, annuity value of the total establishment cost based on the economic life span of the crop and annual yield. The first two components have been discussed in the earlier sections. Data on total number of bearing palms in the holding, number of harvests, number of palms and number of nuts harvested were compiled for working out the average yield per palm in a holding for the year 2001. Based on the estimates of per palm yield, the productivity of coconut gardens in the district was worked out by taking the palm density as well as per cent bearing palms. It was 6,787 nuts/ha in Kozhikode district; 6,104 nuts/ha in Ernakulam district and 7,708 nuts/ha in Thiruvananthapuram district. The higher productivity in Thiruvananthapuram was due to high palm density in that district.

The cost of cultivation per 175 palms and per 100 nuts at district level along with % SE is shown in Table 2. The cost of maintenance per nut (on adding imputed cost of family labour) varied between Rs.1.65 (Kozhikode) to Rs.2.92 (Ernakulam). The % SE is below 12.5 for cost A (per 100 nuts), while it was 15-21 on per hectare basis and is discussed in the project report (Sud *et al.*, 2004).

The cost of production was worked out by adding the annual maintenance cost in the bearing stage and annuity value of the total establishment cost. The cost of

**Table 1. Average cost of cultivation in different growth stages (Rs. per 175 palms)**

Growth stage/Farm size	District	Cost A			Cost A+ Imputed family labour cost		
		Small	Medium	Large	Small	Medium	Large
At the time of planting	Kozhikode	7,319	7,862	8,504	7,781	8,267	8,630
	Ernakulam	11,022	11,094	11,189	16,844	14,302	12,309
	Thiru'puram	6,937	6,803	8,569	10,370	8,612	9,809
1 to 3 years after planting	Kozhikode	7,426	8,492	9,433	8,416	9,482	9,816
	Ernakulam	12,245	13,674	13,411	22,672	20,634	15,969
	Thiru'puram	7,065	9,100	9,574	14,070	12,811	12,271
4 to 8 years after planting	Kozhikode	20,440	23,592	34,059	23,052	25,883	35,477
	Ernakulam	42,352	42,758	47,845	70,921	61,052	53,443
	Thiru'puram	21,932	29,540	30,513	39,886	39,380	38,704
Total establishment cost	Kozhikode	35,185	39,945	51,995	39,249	43,633	53,923
	Ernakulam	65,619	67,526	72,445	110,436	96,077	81,720
	Thiru'puram	35,934	45,443	48,656	64,325	60,803	60,784
Annual cost during bearing phase	Kozhikode	10,513	12,417	14,102	11,600	13,495	14,560
	Ernakulam	17,307	18,479	17,179	23,123	22,903	18,302
	Thiru'puram	13,864	15,360	17,119	18,574	17,817	18,967

Table 2. Estimated annual cost of maintaining bearing coconut palms with per cent Standard Error

District	Cost A				Cost A + Imputed Family labour cost			
	Rs./175 trees		Rs./100 nuts		Rs./175 trees		Rs./100 nuts	
	Estimate	% SE	Estimate	% SE	Estimate	% SE	Estimate	% SE
Kozhikode	12424	15.20	152	11.26	13508	15.50	165	10.38
Ernakulam	18809	18.02	241	12.46	23127	15.49	292	15.09
Thiru'puram	14303	17.26	191	8.82	18401	21.07	241	13.77

production of coconut per 175 palms and per 100 nuts was worked out and is given in Table 3. The per cent standard errors of estimates of Cost A at district level varied between 9.15(Thiruvananthapuram) and 12.83 (Ernakulam). Though it is ideal to have % SE within 5 %, the relatively higher standard errors obtained in the present study (which is less than 15 %), were due to large variation in yield and also for the cost of inputs. Higher cost of cultivation and low productivity in Ernakulam district resulted in higher cost of production in all the holding categories in that district. The low cost of production in Kozhikode district was mainly due to low input use and fairly better yield.

Table 3. Estimates of cost of production of coconut (Rs./100 nuts) with per cent SE (shown in parenthesis)

District	Cost A		Cost A + Imputed Family labour cost	
	Rs./175 trees	Rs./100 nuts	Rs./175 trees	Rs./100 nuts
	Kozhikode	14933 (14.54)	183 (12.22)	16273 (14.76)
Ernakulam	23196 (17.90)	296 (12.83)	19529 (15.21)	374 (15.40)
Thiruvananthapuram	16688 (16.99)	223 (9.15)	22352 (22.25)	293 (15.46)

### Returns from coconut

The average farm gate price during the study period (2001) was Rs.2.57, Rs.2.84 and Rs.2.65 per nut in Kozhikode, Ernakulam and Thiruvananthapuram districts, respectively. Income from byproducts was not considered for computing the gross returns, as only a negligible quantity was sold by the farmers. The net returns were positive across holding categories in Kozhikode district irrespective of the cost concepts employed. The net return per 175 trees was worked out to be Rupees 5818, 7059 and 9671 respectively for small, medium and large holdings in Kozhikode district. In Ernakulam and Thiruvananthapuram districts, the net returns were by and large positive only when it was calculated based on annual maintenance cost. When other

cost concepts were applied, the net returns were generally found negative: Overall net return based on the holdings included in the study was only Rs.735/- per 175 trees in Thiruvananthapuram district and it was -1398 rupees in Ernakulam district. It may be noted that the price of coconut was comparatively low during the period of the study. Farmers also suffered loss due to the eriophyid mite infestation in terms of production as well as price. The low farm gate price realized also indicated that the intervention by the Government through the policy on minimum support price for copra did not ensure a fair price for coconut.

### Conclusion

Following the cost accounting method and data collected from different growth stages for 2001, cost of production of coconut in three districts of Kerala (i.e., Kozhikode, Ernakulam and Thiruvananthapuram) was estimated. The per cent standard errors of the estimates were below 15 in most of the cases. Although the methodology was developed by conducting a sample survey in the state of Kerala, it can be used for developing estimates for any other area. The proposed methodology, with minor changes, can also be used for estimating cost of production of perennial crops in general.

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