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A Study on Economics of Coffee (*Coffea arabica*) Plantation in Nagaland, India

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Authors' contributions

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

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ABSTRACT

The present study was conducted for estimating the economics of coffee plantation in Nagaland. Three districts were selected, and 60 respondents were interviewed from the selected districts. Selection of respondents was carried out with the help of snowball sampling method. Snowball sampling method was used due to limitation of secondary data on coffee farmers and the uneven distribution of coffee farmers. The cost of coffee cultivation was estimated by using different cost concepts used in farm management studies. This study revealed that total establishment cost of coffee was Rs. 22,271/- per acre. The gestation period of arabica coffee found as 4 years for the present study, thereafter the maintenance stage begins with an annual maintenance cost of Rs. 17,762/- per acre. Average yield reported in the study area was 229 kg/acre and making a gross income of Rs. 45,868 /- per acre. The net return worked out as Rs 28,106/- per acre / annum. The productivity of coffee was found as lower than the national average, which maybe as a result of poor availability of labour, the plantations are rainfed and organic by default, therefore absence of fertilizer input may attribute to low productivity. The cost as well as the yield was found lower in the marginal category and increased as the plantation size increases, this may be due to the absence of competitiveness and poor technical knowledge on the management of the plantation among the marginal growers. However having a return to scale value of 1.03 and benefit cost ratio of 1.6, it was cleared that the coffee plantation in Nagaland is profitable and can be undertaken in a commercial scale.

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1. INTRODUCTION

Coffee is one of the leading commodities in the international trade and it is considered as world's most important agricultural export product. Coffee is known for being the second largest traded commodity next to crude oil. The stimulating beverage crop is currently grown in over 80 countries across the globe, which is considered to be its major producers. Annual global production of coffee is over nine million metric tonnes. Brazil tops the list of the world producers followed by Vietnam and Colombia. The growth and cultivation of coffee in the world is mostly found at the tropical and subtropical regions of Africa, Asia and Central Latin America. India stands at 6th position in terms of production in the world and 3rd position in Asia after Vietnam and Indonesia [1].

In India, coffee is mainly cultivated in the hilly tracts of Karnataka, Kerala and Tamil Nadu and Southern states forming the traditional areas and to a small extent in non- traditional areas such as Andhra Pradesh, Orissa, West Bengal, Maharashtra and North Eastern states. Being an agricultural commodity it is exposed to the vagaries of weather, which affect its prices. Coffee industry contributes significantly to the Indian economy by earning foreign exchange of about 3500 crore annually, besides in the area of rural development, employment generation and environment presentation [2]. Some study shows that coffee had a stable and positive fluctuation trend in the export performance ratio. India is the growing exporter of coffee among world competitors. (Kumareswaran *et al.* 2019).

Coffee cultivation in Nagaland started in the early 1980s, but poor marketing channel left farmers disillusioned. Reviving of coffee cultivation started with the success story of rubber cultivation undertaken by the department of Land Resources. Initially coffee cultivation in Nagaland was spread over in five districts Mon, Wokha, Mokokchung, Zunheboto and Kohima, which offer specialty high-altitude coffee grown in the natural shade of the forest, these coffee estates established during the 80's have been revived by the department and it is currently in production .The government has extended coffee cultivation to every district of Nagaland later on. The programme commenced during 2015-16, wherein 6 lakh coffee saplings were raised and planted in 230 hectares by 450 households in

seven districts of the state. The state cultivates both of the higher altitude arabica coffee and the lower altitude robusta coffee, however more focus has been given to the arabica because of its distinctive superior quality. With this trend it is expected that coffee development in Nagaland will have a total of about 1.1 crore standing coffee trees by 2020 and a total production of about 12500 Metric ton generating an income of worth 200 crore rupees [3].

Keeping in view the extension of coffee cultivation in Nagaland in recent years, present study on "A study on economics of Coffee (*Coffea arabica*) plantation in Nagaland" has a great importance specially for coffee growers. Major objective of this study was to estimate the economics of coffee cultivation in Nagaland considering all the concepts used in farm management studies.

2. METHODOLOGY

Designing an effective methodology and proper selection of analytical tools are significant for a meaningful analysis of any research problem. In the study, extensive uses of both primary and secondary data were made. This study was a descriptive research [4] based on the survey method. Primary data were collected through face-to-face interview using well-structured interview schedule. In Nagaland, Mokokchung, Wokha and Zunheboto districts are known for its significant contribution in coffee arabica production. Therefore these three districts were selected because of the availability of coffee plantation in large number. Selection of respondents was carried out with the help of snowball sampling method. A total of 60 respondents were interviewed from 3 different villages from 3 different RD Blocks. Snowball sampling method was used due to limitation of secondary data on coffee farmers and the uneven distribution of coffee farmers. Avinash Kumar [5] in his study on coffee in Chikmagalur district of Karnataka used multistage random sampling procedure for selection of coffee farmers. Thanuja and Singh [6] also used similar type of procedure for selection of Taluk and villages and after that a total of 60 farmers were selected based on probability proportion to total numbers. The cost of coffee cultivation was estimated by using different cost concepts used in farm management studies.

3. RESULTS AND DISCUSSION

3.1 Economics of *coffea arabica* Plantation

The cost of cultivation includes mainly viz. variable cost and fixed cost incurred on sapling cost, labour cost, transportation cost, cost of farm implements, rental value of owned land, depreciation value on fixed assets etc. For better understanding of the economics involved in the cultivation of coffee the cost has been studied under different sub category.

3.2 Cost of Establishment

Establishment cost included all the expenses incurred during the first 4 years of plantation till the plantation arrives to commercial yielding stage. These four years of establishment is also known as the gestation period. The total establishment cost comprises of preparatory operations, cultural operations, cost of planting materials, rental value of land, cost of implements and other miscellaneous work. The estimates of establishment cost computed from the data presented in Table 1.

It shows that the cost of establishment (overall) in general per acre of coffee plantation up to commercial yielding i.e. up to 4th year amounted to Rs. 22,271.4/-. More than 50 per cent of the

total cost was spent during the first year itself. There is a massive labour and capital input of most of which is labour input during the gestation period of year one to year four. The establishment cost was maximum in the first year due to high labour intensive operations such as clearing of the land, pitting and refilling, planting and cost of planting material, Table 1 also reveals that the cost of planting material took the highest share (38 % per cent) of the total, preparatory operations took the second place (32 per cent) of the total establishment cost, followed by cultural operation (26 per cent), cost of land (0.45 percent) and cost of implements (3.55 percent).

3.3 Cost of Maintenance

Coffee plantation enters the maintenance stage when it reaches the 5th year and the plants attain the bearing period. The cost of maintenance in general of coffee plantation was computed and is presented in Table 2. The maintenance cost included depreciation, rental value of land and expenditure on operations like weeding, pruning, shade regulation, harvesting and processing. Also, it included the expenses on input materials and transportation. However, none of the farmers apply manure, fertilizers and land treatment techniques. The transportation cost was zero in all cases because of the availability of agency to purchase the bean direct from the producer.

Table 1. Establishment cost of coffee by category of coffee growers (in Rs per acre)

Particulars	Marginl	Small	S. medium	Overall
Preparatory	5851.28 (30%)	8000 (33%)	8596.15 (36%)	7,482.5 (32%)
Cultural operation	4643.53 (23%)	7166.66 (29%)	6346.15 (27%)	6,052.11 (26 %)
Cost of sapling	8328.20 (42%)	8666.65 (35%)	8076.92 (34%)	8,357.24 (38%)
Rental value of land	100.00 (0.5%)	100.00 (0.41%)	100.00 (0.43%)	100.00(0.45%)
Cost of implemens	444.40 (4.5%)	222.20 (2.59%)	173.07 (0.77%)	279.89 (3.55%)
Total (rupees)	19,407.01/-	24,155.51/-	23,292.29/-	22,271.4 /-

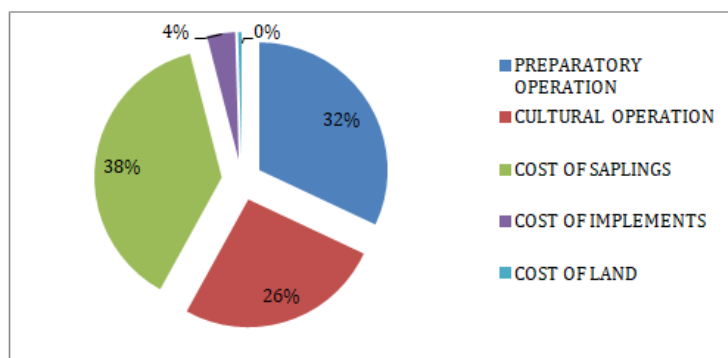


Fig. 1. Establishment cost of coffee (Overall)

Table 2. Maintenance cost of coffee in Rs per acre

Particular	Marginal	Small	S. medium	Overall
Cultural Operation	2410.25 (40.3%)	2750.00 (31.7%)	3346.15 (27.6%)	2,835.5 (31.8%)
Havesting& Processing	3420.60 (57.3%)	5791.66 (66.8%)	8654.84 (71.4%)	5,955.7 (66.7%)
Transporta-Tion	0.0 (0%)	0.0 (0%)	0.0 (0%)	0.0 (0%)
Depreciation on Implments	44 (0.7%)	22 (0.25%)	17 (0.2%)	27.6 (0.003%)
Rental Value of Land	100.00 (1.7 %)	100.00 (1.2%)	100.00 (0.8%)	100.00 (1.12%)
Total (Rupees)	5,974.06	8,663.12	12,117.07	8,918.5

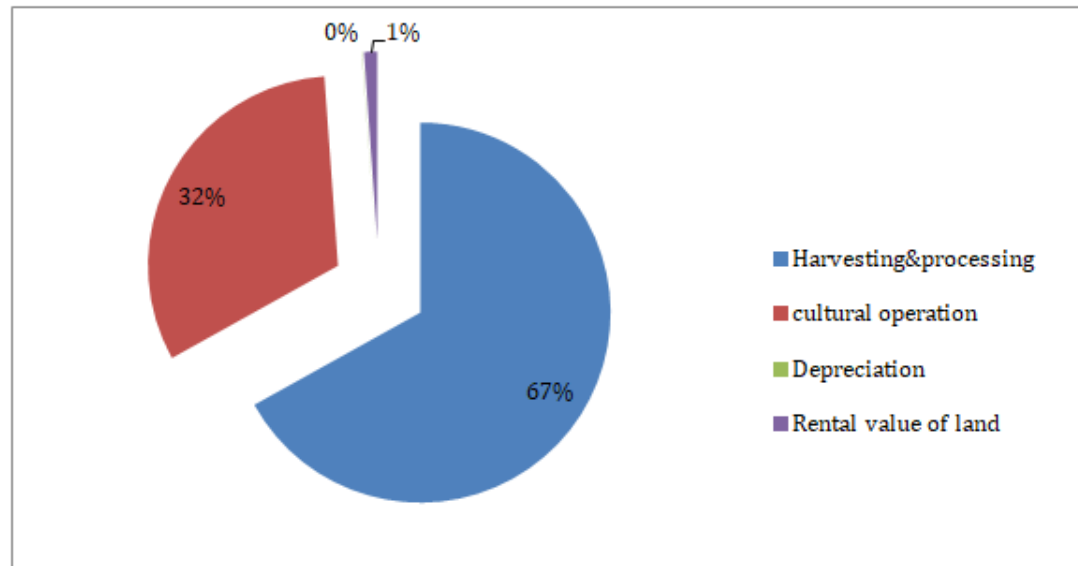


Fig. 2. Maintenance cost of coffee

The total maintenance cost of coffee in general amounted to Rs. 8918.5 per acre. Harvesting and processing constituted 66.7 per cent of the total maintenance cost in general. This is accounted by the intensive labour requirement for harvesting. The remaining 31.8 percent was spent on cultural operations, 1.12 percent on rental value of land and 0.003% on depreciation value. Control of competing weed is an important part of coffee plantation maintenance. Weeding also includes cleaning and release operations which is concerned with removal or killing of perennial plants, unwanted trees, vines and creepers likely to smother trees in young plantations. Since the imputed value of family labour is also included in the calculation, the cost of harvesting and processing assume the highest proportion.

The costs in establishment and maintenance of coffee plantation in general is discussed in detail according to the various operations involved in the process and its share in percentage. However, there is variation in the cost within the different category of farms. Therefore the total cost of establishment and maintenance in different farm category is given in the Table 3.

Table 3 reveals that there is a slight difference in the cost of establishment and cost of maintenance among the category of farmers or

farm size. This slight difference among the farm size is more visible to a greater extent in the maintenance cost. The cost incurred for establishment among the marginal farmers was Rs.19407/-; among the small farmers it was Rs. 24155/- and Rs 23292/- among the semi medium farmers. The cost incurred for maintenance among the marginal category was Rs 5974/-; among the small category was Rs 8663/- and among the semi medium category was 12117/-. Avinash and Kumar [4] in Chikmagalur district of Karnataka found per hectare establishment cost of coffee as Rs 393371.00 and Rs 361860.00 in small and large plantations respectively. Per hectare maintenance cost during bearing period worked out as Rs 110761.90 and Rs 102968.20 in small and large plantations respectively.

3.4 Cost of Production

The cost of coffee production is the cost incurred for all the operations in maintaining the plantation in a year and the cost of sapling. Fixed cost includes the imputed rental value of owned land, depreciation on fixed assets, and interest on fixed capital, which is absent among the sample farmers. Variable costs included cost of labour for weeding, pruning, harvesting, processing, marketing cost and cost of sapling. The total cost of production is given in Table 4.

Table 3. Establishment & maintenance cost of coffee in Rs per acre

Particulars	Marginal	Small	S.medium	Overall
Establishment cost	19,407/-	24,155	23,292	22,271
Maintenance cost	5,974	8,663	12,117	8,918

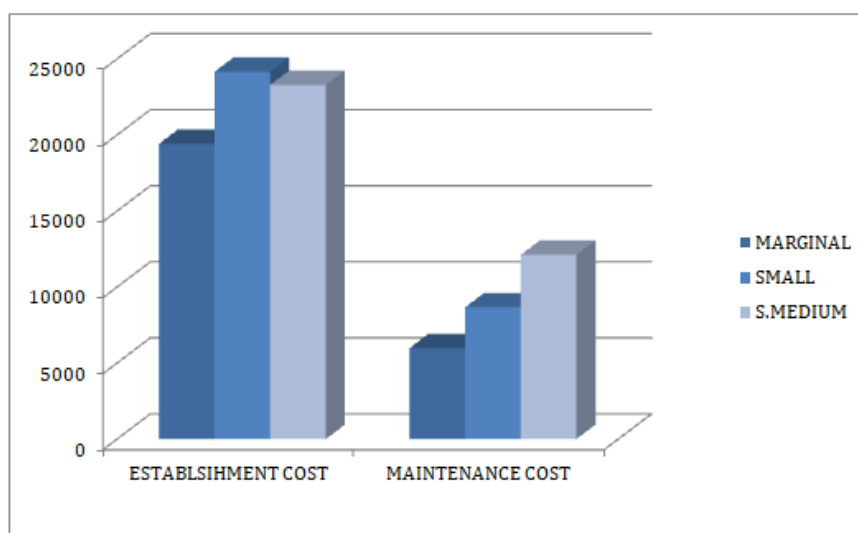


Fig. 3. Establishment cost & maintenance cost

Table 4. Cost involved in coffee production in Rs per acre

A	Variable cost	Marginal	Small	S.medium	Overall
1	Cost of sapling	8328.20	8666.65	8076.92	8,356.10
2	Cost of labour				
	Hired	1520	5289	10383	5730
	Imputed Family Labour	5778	3252	1617	3549
3	Transportation Cost	0	0	0	0
	Total Variable Cost	15626	17,207	20,076.92	17635
B	Fixed cost				
1	Imputed Rental Value of Land	100.00	100.00	100.00	100.00
2	Depreciation on Implements	44.40	22.20	17.07	27.66
	Total fixed cost	144.40	122.20	117.07	127.66
	Total cost	15770	17329	20193	17762

A trial had been made here to highlight the cost of cultivation of coffee plantation by category of cost concepts used in farm management studies. Table 5 indicates the different category of costs involved in coffee plantation by category of farmer groups.

Cost A_1 includes all the variable expenses incurred in cultivation of coffee including costs such as interest on working capital and depreciation of farm implements owned by the growers. On an average, the cost A_1 calculated at Rs 14,113/-. The Cost A_1 found as Rs 9892/-, Rs 13,974/- and Rs 18,476/- for the three different categories of growers marginal, small and semi medium farmers respectively. Cost A_2 includes Cost A_1 and the rent paid for leased in land. Thus Cost A_2 remained equivalent to Cost A_1 as there was no leased in or leased out of land involved among the respondents. Cost B_1 is calculated by summing up the interest on the capital assets (excluding land) with the amount of Cost A_1 . However no such provisions for interest were found among the farmers, therefore the Cost B_1 for the three different categories was found as same as like of Cost A_1 and Cost A_2 .

Cost B_2 is calculated from Cost B_1 with the inclusion of rental value of owned land. Hence

Cost B_2 was found as Rs 9992/-, Rs 14,074/- and Rs 18,596/- for the three different categories of growers marginal, small and semi medium category of farmers respectively and as a whole on an average Cost B_2 calculated as Rs 14,213/- per acre.

Cost C_1 is calculated when Cost B_1 is added with imputed value of family labour. The per acre Cost C_1 for the three different category of farmers were found as Rs 15,670/-, Rs 17,226/- and Rs 20,113/- respectively. As a whole Cost C_1 for all the categories of growers together was found as Rs 17,662/-. Similarly Cost C_2 is calculated when Cost B_2 is added with imputed value of family labour. The per acre Cost C_2 for the three different category of farmers were Rs 15,770/-, Rs 17,326/- and Rs 20,213/- respectively and as a whole Cost C_2 for all the categories of growers was found as Rs 17,762/-.

Cost C_3 is the total cost or the comprehensive cost of cultivation and is calculated by adding 10% of Cost C_2 as managerial cost with total Cost C_2 . The average Cost C_3 for all the categories of growers was found as Rs 19,538/-. The cost C_3 for the three different categories of growers worked out as Rs 17,347/-, Rs 19,058/- and Rs 22,234/- respectively.

Table 5. Categories of Cost involved in coffee production in Rs per acre

Sl. No	Particulars	Marginal	Small	S Medium	Overall
1	Cost A1	9892	13974	18476	14113
2	Cost A2	9892	13974	18476	14113
3	Cost B1	9892	13974	18476	14113
4	Cost B2	9992	14074	18596	14213
5	Cost C1	15670	17226	20113	17762
6	Cost C2	15770	17329	20193	17762
7	Cost C3	17347	19062	22212	19538

3.5 Cost and Return

The average yield obtained per acre of coffee (parchment coffee) was 188.35 kg among marginal farmers, 240.19 kg in case of small farmers and 259.62 kg among the semi medium farmers. However, on an average the yield or productivity of sample farmers of the study area was 229 kg/acre and the price per kilogram of parchment coffee is Rs 200. Reddy *et al.* [6] also found the production cost of Arabica coffee in Chikmagalur area of Karnataka, India as Rs. 52 955/ha, which translated into a cost of production of Rs. 51/kg with an average yield of 1040 kg/ha. Similarly, Avinash Kumar [4] made a study on the economics of coffee and found that the average per ha yield from small plantation was 3143.80 kg and from large plantation it was 3125.96 Kg. Net returns were Rs 201634.40 from small plantation and Rs 215664.67 from large plantation. Thanuja and Singh [5] made a similar study on the economics of coffee and found that the total establishment cost of coffee plantation was Rs. 464947.47 on small farmers, Rs. 442513.24 on large farmers. Average yield reported in the study area was 1619.8kg/ha, which was sold at an average price of 191.25 Rs./kg.

Table 6 also shows the per acre gross return of coffee production on marginal plantation was

Rs.37, 644/-, small plantation was Rs. 48,038/- and semi medium plantation was relatively higher with Rs 51,924/-. The overall figure was Rs 45,868/- per acre. However, net return was worked out as Rs. 21,874/- on marginal plantation, Rs 30,709/- on small plantation and Rs.31,734/- on semi medium plantation. The overall net return from the parchment coffee obtained was Rs. 28,106/- per acre. Net return recorded highest of Rs. 31,731/- among the semi medium farmers. In contrary to this result Swamy *et al.* [7] in Kodagu district of Karnataka found that net return per acre annually was highest in the case of medium planters (Rs. 26109.3) as against Rs. 20566.7 and Rs. 18572.7 in the case of small and large planters.

3.6 Benefit Cost Ratio

The benefit cost ratio worked out as 1.6 for overall coffee growers, which was positive and more than one. Not only that BCR recorded above 1 for all the category of farmers. This indicated the economics of coffee cultivation in Nagaland. Overall economics of coffee plantation per acre gives a generation of Rs. 45,868/- as total return, having a total cost of Rs. 17,762/- and realizing a net return of Rs.28106/- per annum. Mamata and Reddy [8] in their research on Kodagu organic coffee plantation also concluded with similar economics.

Table 6. Cost and returns of coffee plantation in Rs per acre

Particulars	Marginal	Small	S.medium	Overall
Yield in kg	188.35	240.19	259.62	229
Total return	37,644	48,038	51,924	45,868
Total cost	15,770	17,329	20,193	17,762
Net return	21,874	30,709	31,731	28,106
Bcr	1.4	1.7	1.5	1.6

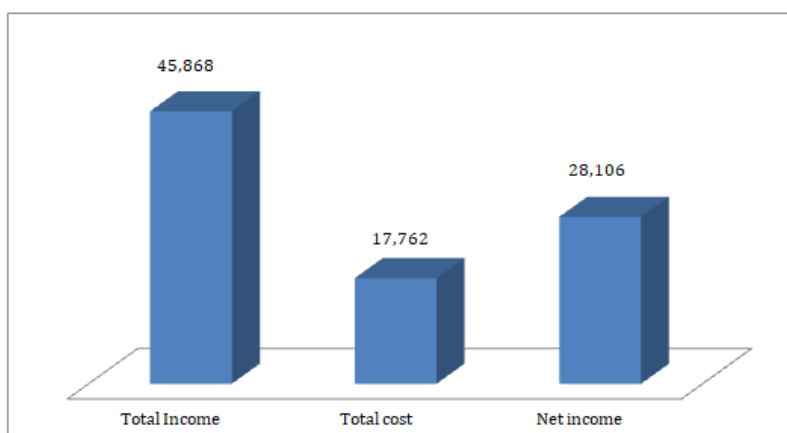


Fig. 4. Cost and return of coffee

4. CONCLUSIONS

Coffee cultivation is economically profitable as the state falls under the coffee cultivation zone in India and categorized under the non-traditional region. The cultivation is undertaken as shade grown coffee and therefore the product is distinct in quality and superior. The income is steady and attractive, however challenges and obstacles are part of the practice and therefore there is room for improvement in the cultivation of coffee in the state. Coffee being a perennial plantation crop requires heavy investment and cost for maintaining the plantation. Productivity of coffee in the study area was found to be lower than the national average, which maybe as a result of poor availability of labour and aged coffee plantations that has exceeded the most productive stage. The plantations are rainfed and organic by default, therefore absence of fertilizer input may attribute to low productivity. Also, there has been a slight variation among the category of growers in terms of cost and yield. The cost as well as the yield was lower in the marginal category and increases as the plantation size increases, this may be due to the absence of competitiveness and poor technical knowledge on the management of the plantation among the marginal growers.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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