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Araku Valley Coffee Production study in Visakhapatnam district of Andhra Pradesh, India

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Aims: This study mainly intends to analyze the production side of coffee that would throw light on the scenario of coffee growers to understand the cost structure and returns from coffee cultivation in the study area.

Study Design: Purposive sampling technique was adopted for the current study on Araku valley coffee, where the primary data has been collected from 120 coffee growers.

Place and Duration of Study: The research was carried out in the Visakhapatnam district of Andhra Pradesh and the primary data was collected from April to July 2022.

Methodology: Costs and returns of coffee cultivation were estimated for Araku Valley Coffee in the study area.

Results: The establishment cost of Araku Valley coffee in the Visakhapatnam district was Rs. 144039.06/ha, which encompassed both the initial investment costs and maintenance costs during the coffee gestation period. The cost of cultivation during the coffee fruit-bearing period was Rs. 611353.67/ha. With this total cost per hectare, the cost per Kg of coffee produced turns out to be Rs

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9.83/kg. Fresh fruit berries were sold on the market for an average price of Rs. 40/kg. Net profits were Rs. 2317053.55/ha while gross returns were Rs. 3072446.28/ha. The BCR, NPV@12% discount rate, and IRR recorded were 1.68, Rs.144581, and 28.7% respectively. It was an undeniable fact that raising coffee plantations in Andhra Pradesh was lucrative and could be operated on a commercial scale for fostering profits over a generation.

Conclusion: The pace of tribal development in the Visakhapatnam district was sustained in large part by coffee production. From a long-term viewpoint, this study signifies and validates the real economics of coffee production for sustainable resource management, profitable revenue generation, and expanded employment opportunities.

Keywords: BCR; coffee production; establishment cost; IRR; net returns.

1. INTRODUCTION

Coffee is the world's second most traded commodity, behind petroleum and petroleum products. Coffee is an important plantation crop in India, which is cultivated mainly in the southern states of Karnataka (52.8%), Kerala (18.5%) and Tamil Nadu (7.7%), and non-traditional areas (Andhra Pradesh and Odisha). India cultivates both the commercially important species of coffee, viz., Arabica, and Robusta varieties in an area of 4,65,365 hectares in 2020-21, producing nearly 3,48,500 MT. Andhra Pradesh is a non-traditional coffee-growing region where coffee is planted in the regions of Paderu, Chintapalli, and Maredumilli in the Visakhapatnam and East Godavari districts. There are approximately 3,92,398 coffee holdings of which, nearly 98% of the holdings are small with less than 10 hectares per farm hold. These smallholdings occupy 71% of the total area under coffee and contribute about 60% of the country's total coffee production [1-3]. The remaining 2% of the holdings, which are large, occupy 29% of the area and contribute 40% of the total production. Coffee cultivation is a source of pride in the Araku valley hills of the Visakhapatnam district with ideal climatic conditions where 91 per cent of the population are from tribal communities [4]. The araku valley region has a distinctive production system where pepper, jackfruits, mangos, and vegetables are intercropped with wholly shade-grown coffee [5].

Tribal farmers in Visakhapatnam hilly tracts used to follow Jhum cultivation, which resulted in deforestation and ecological imbalance. Thus coffee plantations were introduced to restrict podu cultivation [6,7]. As a result of this living conditions of the tribal farmers were improved. Despite the expanding importance of coffee farming in these paderu agency regions, an attempt has been made to bring the coffee cultivation issues to light [9-11]. This makes

budding coffee producers and policymakers in comprehending the economic elements of the coffee plantation [12,13]. As a result, the research aids in higher returns by eliminating barriers to coffee growing.

2. MATERIALS AND METHODS

In the Visakhapatnam district, the Paderu division ranks top in the coffee-growing area with 88955.95 hectares and a yield of 10,729.58 Mt. Paderu division is purposefully chosen from the Visakhapatnam district since Araku Valley coffee is widely cultivated there. From the Paderu division, four Mandals namely, Paderu, G.Madugala, Chintapalli, and Arakuvalley were chosen randomly. From each Mandal, 2 villages are selected and from each village 15 farmers are selected randomly. Thus 120 Coffee farmers were selected from 8 villages for this study. This study findings were discussed and interpreted to arrive at meaningful conclusions.

3. RESULTS AND DISCUSSION

3.1 Production of Araku Valley Coffee

Coffee is a perennial crop that can grow for up to 30 years, but after 25 years, the yield starts to drastically decline. As a result, farmers incur maintenance costs for up to 25 years and after that, they would go for coffee replantation. Coffee plantations require continual labor-intensive maintenance. As a result, data on the costs and returns of Araku Valley coffee were gathered over 25 years. Various costs related to the production of Araku Valley Coffee had been collected on a per hectare basis.

3.2 Cost of Cultivation of Araku Valley Coffee

Coffee has a four-year gestation period and a 21-year economic maintenance period.

3.2.1 Establishment cost of araku valley coffee

The establishment cost incorporated all expenses incurred during the first four years of the coffee plantation, which is also known as the gestation phase, till it reaches the stage of economic yielding. (Imsuakum Pongener and Sanjoy Das, 2021). Initial Investment cost and maintenance cost involved in setting up a coffee plantation are involved in the coffee establishment cost.

3.2.2 Initial investment cost of araku valley coffee (1st year)

Initial Investment expenses are part of the establishment costs and function as fixed costs [14]. Land preparation, line marking, opening and closing of pits, raising and staking of shade plants, planting material costs, fencing costs, etc. are all included as Initial investment costs for Araku Valley Coffee and presented in the following Table1.

It could be seen that the total initial investment cost in the Visakhapatnam district was found to be Rs. 51663.24 (35.87 percent of the total establishment cost). The cost of land preparation was found to be Rs. 17300.34, the cost of line marking to be Rs. 1335.33, the cost of digging pits to be Rs. 24081.25, the cost of raising shade plants to be Rs. 842.33, the cost for staking to be Rs. 448.33, the cost of planting materials to be Rs. 6463.99, and the cost of fencing to be Rs. 1191.67, respectively. The majority of the costs were incurred for the opening and closing of pits as it requires 46.61 % of the initial investment cost.

3.2.3 Maintenance cost of araku valley coffee during gestation period/ non-bearing period (from second year to fourth year)

The maintenance cost incurred by the Araku valley coffee growers during the gestation phase is presented in Table 2.

Table 1. Investment cost of coffee plantation

S.No	Particulars	Value (Rs/ha)	%
1	Jungle clearance	5392	10.44
2	Bench terracing	11908.34	23.05
3	Line marking	1335.33	2.58
4	Opening and closing of pits	24081.25	46.61
5	Shade plants raising	842.33	1.63
6	Staking	448.33	0.87
7	Coffee seedling cost	2207.08	4.27
8	Seedling transport cost	1048.33	2.03
9	Planting cost	3208.58	6.21
10	Fencing	1191.67	2.31
	Total	51663.24	100

Table 2. Maintenance cost during gestation/non-bearing period

S.No	Particulars	I Year	II Year	III Year	IV Year	Total	%
1	Pit digging cost	0.00	1996.83	1811.08	1517.83	5325.74	5.77
2	Planting material cost	0.00	826.16	763.08	809.92	2399.16	2.60
3	Transport cost	0.00	870.42	891.25	852.17	2613.84	2.83
4	planting cost	0.00	327.75	326.33	329.17	983.25	1.06
5	FYM	10000.00	6127.92	5996.33	5217.00	27341.25	29.60
6	Neem Cake	2500.00	1261.08	1227.50	1306.92	6295.50	6.82
7	Vermicompost	2976.67	0.00	0.00	0.00	2976.67	3.22
8	Irrigation	6441.67	0.00	0.00	0.00	6441.67	6.97
9	Weeding	8175.00	5790.16	10098.75	11946.08	36009.99	38.98
10	Gap Filling	0.00	922.00	245.58	72.75	1240.33	1.34
11	Handling, desuckering and Pruning	0.00	0.00	303.42	445.00	748.42	0.81
	Total	30093.34	18122.32	21663.32	22496.84	92375.82	100.00

It could be inferred that total Maintenance costs during the non-bearing / gestation period were found to be Rs. 92,375.82 (64.13 percent of the total establishment cost) of which cost of Rs. 30093.34, Rs. 18122.32, Rs. 21663.32 and Rs.22496.84 occurred during first, second, third and fourth years respectively. Hence the total establishment cost was summed to Rs. 144039.06. The cost of digging pits was found to be Rs. 5325.74, the cost of overall planting (seedlings cost, transport cost and planting cost) to be Rs. 5996.25, the cost for manures and fertilizers (FYM, Neem cake and Vermicompost) was found to be Rs. 36,613.42, the cost of Irrigation to be Rs. 6441.67, the cost of weeding to be Rs. 36009.99, the cost for gap filling was Rs. 1240.33 and the cost for handling, desuckering and pruning was Rs. 748.42. Majority of the costs were incurred for weeding operation in between the coffee plantations (38.98%).

3.2.4 Maintenance cost of araku valley coffee during bearing period (from fifth year to twenty fifth year)

The maintenance cost incurred by the Coffee growers in during the bearing period is presented in the Table 3.

The results revealed that in the Visakhapatnam district, total maintenance cost during the bearing period (fifth year to the twenty-fifth year) accounted for Rs. 611353.67. The cost of digging pits was found to be Rs. 16553.66, the cost of overall planting (seedlings cost, transport cost and planting cost) to be Rs. 23123.9, the cost for manures and fertilizers (FYM, Neem cake and Vermicompost) was found to be Rs. 130651.6, the cost of weeding to be Rs. 167280.11, the cost for gap filling was Rs. 1156.41 and the cost for handling, desuckering and pruning was Rs. 89374.49, the cost of harvesting was Rs.

183213.50 Majority of the costs were incurred to coffee harvesting.

3.3 Average Annual Cost of Araku Valley Coffee

The total average annual cost was depicted in the following Table 4.

From the above table, it is inferred that the total cost of cultivation of coffee for 25 years was Rs. 755392.73 and thus the average annual cost was Rs. 30215.71.

3.4 Costs and Returns of Araku Valley Coffee

The Coffee growers harvested fresh fruit berries for three months (November, December, and January) in a year. The costs incurred and returns realized from the sale of Araku Valley Coffee were presented in Table 5. In accordance with the research by C.H. Satish Kumar et al. [15], the costs and returns of Araku valley coffee in the study region were computed using the spreadsheet model over 25 years and presented in Table 5.

From the above Table 5, it is inferred that the initial investment cost is high for the Araku valley coffee plantation establishment. Returns are generated from the fifth year onward and rise annually until the nineteenth year, at which point they start to drop as the plantation becomes older. The total returns generated from the Araku valley coffee plantations are Rs. 3072446.28 and net returns observed for 25 years plantations were Rs. 2317053.55

From the above-annualized production cost, net returns and BCR (Benefit to cost ratio) are presented in the following Table 6

Table 3. Maintenance cost during bearing period

S.No	Particulars	(5- 25) Years	%
1	Pit digging cost	16553.66	2.71
2	Planting material cost	9833.24	1.61
3	Transport cost	10347.17	1.69
4	planting cost	2943.49	0.48
5	FYM	103156.10	16.87
6	Neem Cake	27495.50	4.50
9	Weeding	167280.11	27.36
10	Gap Filling	1156.41	0.19
11	Handling, desuckering and Pruning	89374.49	14.62
12	Harvesting	183213.50	29.97
	Total	611353.67	100.00

Table 4. Average annual cost of coffee plantations (ha)

S.No	Particulars	Value (Rs)	%
1	Investment Cost	51663.24	6.839255654
2	Maintainance cost during gestation period	92375.82	12.22884684
3	Maintainance cost during bearing period	611353.67	80.9318975
4	Total cost	755392.73	100
5	Average annual cost	30215.71	

Table 5. Yields and returns of coffee plantations

Age of garden (Years)	Total variable Cost (Rs)	Total Fixed Cost (Rs)	Total Cost (Rs)	Coffee Yield (kg)	Total Returns (Rs)	Net Returns (Rs)
1	30093.34	51663.24	81756.58	0.00	0.00	-81756.58
2	18122.32	0	18122.32	0.00	0.00	-18122.32
3	21663.32	0	21663.32	0.00	0.00	-21663.32
4	22496.84	0	22496.84	0.00	0.00	-22496.84
5	22804.66	0	22804.66	1326.75	53070.00	30265.34
6	24574.58	0	24574.58	1864.08	74563.20	49988.62
7	25459.75	0	25459.75	2341.67	93666.80	68207.05
8	25794.33	0	25794.33	2431.50	97260.00	71465.67
9	26721.66	0	26721.66	2607.00	104280.00	77558.34
10	26873.75	0	26873.75	2726.50	109060.00	82186.25
11	26474.91	0	26474.91	3058.58	122343.20	95868.29
12	27781.33	0	27781.33	3367.83	134713.20	106931.87
13	28989.33	0	28989.33	3772.25	150890.00	121900.67
14	28869.16	0	28869.16	4145.08	165803.20	136934.04
15	29689.08	0	29689.08	4758.33	190333.20	160644.12
16	31700.41	0	31700.41	4956.67	198266.80	166566.39
17	34950.25	0	34950.25	5112.50	204500.00	169549.75
18	34291.41	0	34291.41	5577.42	223096.68	188805.27
19	33804.66	0	33804.66	5215.25	208610.00	174805.34
20	30707.75	0	30707.75	4881.83	195273.20	164565.45
21	29433.83	0	29433.83	4041.50	161660.00	132226.17
22	29808.33	0	29808.33	3980.17	159206.80	129398.47
23	31269.91	0	31269.91	3859.75	154390.00	123120.09
24	31951.41	0	31951.41	3623.83	144953.20	113001.79
25	29403.16	0	29403.16	3162.67	126506.80	97103.64
Total	703729.49	51663.24	755392.73	76811.16	3072446.28	2317053.55

Table 6. Net returns, bcr, npv, irr of coffee plantations (ha)

S.No	Particulars	Units	Overall average Value
1	Total annual cost	Rs/haYr	30215.71
2	Fruit Yield obtained	Kg/ha Yr	3072.45
3	sale price	Rs/kg Yr	40
4	Total returns realized	Rs/ha Yr	3072446.28
5	Production cost	Rs/Kg Yr	9.83
6	Net Returns	Rs/ha Yr	92682.14
7	Benefit Cost Ratio		1.68
8	Net Present Value	Rs/ha Yr	144581
9	Internal Rate of Returns	%	28.7

From above Table 6, it is inferred that the total annualized production cost of Araku Valley coffee is found to be Rs. 9.38/kg, and annualized net returns observed are Rs. 92,682.14/ha. For coffee growers, the benefit-cost ratio worked out to be 1.68, which was favorable and more than one indicating remunerative returns per rupee of investment on coffee plantations.

The cost details of Araku Valley Coffee are presented in Table 7 which showed that the Net Present Values at a 12% discount rate for the whole life of the coffee (25 years) were favorable

for the Visakhapatnam district and that the NPV was determined to be Rs. 144581. The benefit-cost ratio for Araku Valley Coffee was 1.68, showing profitable returns on every rupee invested. 28.7% was found to be the internal rate of returns. The study's findings proved that farmers' investments in the cultivation of Araku Valley coffee were profitable.

The total variable cost details of Araku Valley Coffee are presented in Table 8 for all the 25 years of the coffee plantation collected through a primary survey that revealed that variable costs

Table 7. Discounted costs and returns

Age of garden (Years)	Total Cost (Rs)	Coffee Yield (kg)	Total Returns (Rs)	Net Returns (Rs)	Discount factor at 12%	Total Cost discounted at 12%	Total Returns discounted at 12%	Discount factor at 40%	Total cost discounted at 40%	Total Returns discounted at 40%
1	81756.58	0.00	0.00	-81756.58	1	81757	0	1	81756.58	0.00
2	18122.32	0.00	0.00	-18122.32	0.893	16181	0	0.714286	12944.51	0.00
3	21663.32	0.00	0.00	-21663.32	0.712	15420	0	0.364431	7894.80	0.00
4	22496.84	0.00	0.00	-22496.84	0.636	14297	0	0.185934	4182.94	0.00
5	22804.66	1326.75	53070.00	30265.34	0.507	11554	26887	0.094865	2163.35	5034.46
6	24574.58	1864.08	74563.20	49988.62	0.452	11116	33729	0.048400	1189.42	3608.88
7	25459.75	2341.67	93666.80	68207.05	0.361	9181	33777	0.024694	628.70	2313.01
8	25794.33	2431.50	97260.00	71465.67	0.322	8305	31315	0.012599	324.98	1225.38
9	26721.66	2607.00	104280.00	77558.34	0.257	6859	26766	0.006428	171.77	670.32
10	26873.75	2726.50	109060.00	82186.25	0.229	6159	24994	0.003280	88.14	357.68
11	26474.91	3058.58	122343.20	95868.29	0.183	4837	22352	0.001673	44.30	204.71
12	27781.33	3367.83	134713.20	106931.87	0.163	4532	21975	0.000854	23.72	115.01
13	28989.33	3772.25	150890.00	121900.67	0.130	3770	19622	0.000436	12.63	65.72
14	28869.16	4145.08	165803.20	136934.04	0.116	3352	19251	0.000222	6.42	36.85
15	29689.08	4758.33	190333.20	160644.12	0.093	2748	17617	0.000113	3.37	21.58
16	31700.41	4956.67	198266.80	166566.39	0.083	2620	16385	0.000058	1.83	11.47
17	34950.25	5112.50	204500.00	169549.75	0.066	2303	13473	0.000030	1.03	6.04
18	34291.41	5577.42	223096.68	188805.27	0.059	2017	13123	0.000015	0.52	3.36
19	33804.66	5215.25	208610.00	174805.34	0.047	1585	9782	0.000008	0.26	1.60
20	30707.75	4881.83	195273.20	164565.45	0.042	1286	8176	0.000004	0.12	0.77
21	29433.83	4041.50	161660.00	132226.17	0.033	982	5396	0.000002	0.06	0.32
22	29808.33	3980.17	159206.80	129398.47	0.030	888	4745	0.000001	0.03	0.16
23	31269.91	3859.75	154390.00	123120.09	0.024	743	3668	0.000001	0.02	0.08
24	31951.41	3623.83	144953.20	113001.79	0.021	678	3075	0.000000	0.01	0.04
25	29403.16	3162.67	126506.80	97103.64	0.017	497	2139	0.000000	0.00	0.02
Total	755392.73	76811.16	3072446.28	2317053.55		213665	358246		111439.49	13677.44

Table 8. Total variable cost of coffee plantations

Age of garden (Years)	Jungle clearance	Bench terracing	Line marking	opening and closing of pits	Shade plants raising	staking	coffee seedling cost	Seedlings transport cost	planting cost	Manures and fertilizers	Gap filling	Fencing	Irrigation	Weeding	Pruning	Harvesting	Total variable cost
1	5392.00	11908.34	1335.33	24081.25	842.33	448.33	2207.08	1048.33	3208.58	15476.67	0.00	1191.67	6441.67	8175.00	0.00	0.00	81756.58
2	0.00	0.00	0.00	1996.83	0.00	0.00	826.16	870.42	327.75	7389.00	922.00	0.00	0.00	5790.16	0.00	0.00	18122.32
3	0.00	0.00	0.00	1811.08	0.00	0.00	763.08	891.25	326.33	7223.83	245.58	0.00	0.00	10098.75	303.42	0.00	21663.32
4	0.00	0.00	0.00	1517.83	0.00	0.00	809.92	852.17	329.17	6523.92	72.75	0.00	0.00	11946.08	445.00	0.00	22496.84
5	0.00	0.00	0.00	1370.42	0.00	0.00	772.92	741.25	370.58	6684.08	69.50	0.00	0.00	6377.83	3331.25	3086.83	22804.66
6	0.00	0.00	0.00	1367.00	0.00	0.00	819.83	725.25	349.58	6729.08	59.58	0.00	0.00	7104.00	3111.00	4309.25	24574.58
7	0.00	0.00	0.00	1315.75	0.00	0.00	725.92	422.33	301.50	6859.75	52.67	0.00	0.00	7740.17	3219.83	4821.83	25459.75
8	0.00	0.00	0.00	1110.33	0.00	0.00	521.17	386.50	279.58	6893.08	69.08	0.00	0.00	7932.17	3422.92	5179.50	25794.33
9	0.00	0.00	0.00	909.33	0.00	0.00	419.08	370.92	189.25	6919.75	72.25	0.00	0.00	7755.33	3656.25	6429.50	26721.66
10	0.00	0.00	0.00	823.33	0.00	0.00	391.25	343.92	110.50	6932.25	65.42	0.00	0.00	6544.50	3236.50	8426.08	26873.75
11	0.00	0.00	0.00	853.17	0.00	0.00	311.92	410.42	115.00	7035.75	25.58	0.00	0.00	7135.08	3440.58	7147.42	26474.91
12	0.00	0.00	0.00	819.83	0.00	0.00	296.25	440.42	88.50	6319.75	45.17	0.00	0.00	7336.08	3492.17	8943.17	27781.33
13	0.00	0.00	0.00	611.17	0.00	0.00	281.08	472.25	96.67	6159.75	36.92	0.00	0.00	7414.75	3517.50	10399.25	28989.33
14	0.00	0.00	0.00	607.83	0.00	0.00	250.25	511.75	114.17	5609.75	33.83	0.00	0.00	7636.25	3522.83	10582.50	28869.16
15	0.00	0.00	0.00	568.67	0.00	0.00	276.25	437.50	127.83	5251.42	25.83	0.00	0.00	7922.33	3541.67	11537.58	29689.08
16	0.00	0.00	0.00	543.67	0.00	0.00	323.75	528.33	103.08	5701.42	40.00	0.00	0.00	8226.33	4132.33	12101.50	31700.41
17	0.00	0.00	0.00	725.92	0.00	0.00	585.33	552.50	96.25	5750.58	44.17	0.00	0.00	8425.17	4356.17	14414.17	34950.25
18	0.00	0.00	0.00	869.67	0.00	0.00	619.50	578.67	88.25	6184.50	48.33	0.00	0.00	8934.42	4478.08	12490.00	34291.41
19	0.00	0.00	0.00	718.50	0.00	0.00	684.92	591.83	86.67	6383.00	51.50	0.00	0.00	9032.42	4674.33	11581.50	33804.66
20	0.00	0.00	0.00	643.50	0.00	0.00	642.83	580.92	89.83	7365.50	60.42	0.00	0.00	9169.17	5003.08	7152.50	30707.75
21	0.00	0.00	0.00	627.00	0.00	0.00	522.58	466.00	84.42	5109.75	52.92	0.00	0.00	9243.50	5124.25	8203.42	29433.83
22	0.00	0.00	0.00	518.58	0.00	0.00	414.17	451.17	70.67	5761.42	71.17	0.00	0.00	9374.00	5334.42	7812.75	29808.33
23	0.00	0.00	0.00	477.42	0.00	0.00	382.08	447.42	61.58	5660.33	75.33	0.00	0.00	8512.75	6126.33	9526.67	31269.91
24	0.00	0.00	0.00	563.67	0.00	0.00	318.42	427.08	64.25	5803.83	77.83	0.00	0.00	7860.50	6240.58	10595.25	31951.41
25	0.00	0.00	0.00	508.92	0.00	0.00	273.75	460.75	55.33	5536.83	78.92	0.00	0.00	7603.41	6412.42	8472.83	29403.16

continuously increase annually until the seventeenth year, at which point they start to drop as the plantation becomes older.

4. CONCLUSION

Due to the rainfed conditions and nearly absence of farming equipment usage in the study area, where coffee plantations are grown, the capital expenses have been reduced. Coffee farms are by default organic, and cultivation is done using shade-grown coffee, therefore the finished product is superior in quality. It is apparent fact that coffee cultivation has a higher potential for generating wealth and employment at the farm level due to its economic prominence. It is inferred that the total yearly cost of cultivation per hectare of the coffee plantations was worked out for Rs. 30215.71. The annual net returns generated by araku valley coffee growers after covering investment costs and maintenance costs were Rs. 92682.14. Returns are generated from the fifth year onward and rise annually until the nineteenth year, at which point they start to drop as the plantation becomes older. In conclusion, raising coffee offers excellent prospects for farmers to boost their revenue.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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