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Economic Evaluation of Large Cardamom Cultivation in Sikkim

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ABSTRACT

The present study was conducted at North Sikkim and West Sikkim of Sikkim state using primary data collected from 90 growers. It was revealed that cultivation of large cardamom was found profitable. The establishment cost and per hectare annual total cost found to be higher with the larger farm size. Per hectare net return was found to be highest in small farm size. For overall farm size, the Net Present Worth, Internal Rate of Return (IRR), B:C ratio and payback period has been found to be Rs. 903246, 50.72, 2.54 and 2.27 respectively indicating economic viability and certainty of investment in large cardamom cultivation. The estimated Cobb-Douglas production function revealed that the sum of regression co-efficient for marginal, small and overall category was found to be greater than one except for medium farm. The ratio of MVP to MFC showed less than unity for human labour (X_4) in marginal farm, irrigation (X_3) in small farm and for human labour (X_4) was found negative in medium farm category. Provision should be made for availability of good quality disease free planting materials with exclusive research to enhance the production and yield of large cardamom in the study area.

Key words: large cardamom, cost, return, benefit cost ratio, efficiency, constraints.

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INTRODUCTION

Large cardamom (Amomum subulatum) is one of the important and economically valuable cash crops which is grown extensively in the sub-Himalayan state of Sikkim and Darjeeling district of West Bengal. Large cardamom was believed to have been first domesticated by the indigenous Lepcha tribe and then by other communities such as Bhutias and Nepalese of Sikkim (Sharma, 2015).

India is the largest producer of large cardamom with 54% share in world production and Sikkim contributes about 89 percent of the total area and production of 86 percent in the country (Shohe and Roy, 2018). The annual production varies from 5,000 to 5,500 MT in the country with an average productivity of 175 kg/ha. Sikkim is the largest producer of large cardamom and contributes a lion's share to the Indian and world market. It is also grown in Arunachal Pradesh, Nagaland and small pockets in Manipur and Mizoram. During 2019, Sikkim recorded a total area of 23 thousand ha with a production of 5 thousand tons contributing about 73.23 and 63.77 percent of the total area and production in the North Eastern Region (NER) (Anonymous, 2019). The total area under large cardamom in Sikkim, Darjeeling and Kalimpong districts of West Bengal during 2019 was 26,617 ha with an estimated production of 6,100 tons. During the same year the total area under the crop in Nagaland and Arunachal Pradesh was 16,209 ha with a production of 2,569 tonnes as per the estimates received from the respective state government. Under Horticulture Technology Mission, an additional area of 3775 ha has been reported under large cardamom in North East Region. Therefore, cardamom Board should focus more attention in promoting large cardamom in the hilly areas.

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Large cardamom is raised on commercial basis and is exported both within and outside the country. Stability of the system in the hill slopes under large cardamom is considered as a high value cash crop in Sikkim and generated employment for 80-100 days per ha. It is also one of the major sources of income for the farmer's as compared to other crops such pulses, oilseeds, fruits, vegetables and tuber crops (Sharma *et al*, 2014). With its production confined to majority of the district particularly in North and West Sikkim, the state has become as one of the large cardamom production hub of the country. However, no specific study has been made in terms of economics aspects for its production and efficiencies in its input used that would significantly help the policy makers to set up strategies for its production. Hence, there was a need to study the economics and efficiency of the resource used in the production of large cardamom.

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MATERIALS AND METHODS

Primary data were collected from 90 large cardamom growers from six villages viz, Kabi, Lingthem and Lingdem from Dzongu block of North Sikkim and Hee, Sapong and Sangkhu from Dentam Block of West Sikkim district using well structured pre-tested schedule through personal interview method during 2020. For analysis, budgeting technique was used and for estimation of total cost, annual fixed cost and annual variable cost was taken into account. To access the economic viability of large cardamom orchard, various economic feasibility measures viz, Net Present Value (NPV), Internal Rate of Return (IRR), Benefit Cost Ratio (BCR) and Payback Period (PBP) were used.

Annual cost and returns analysis

The establishment cost per hectare of large cardamom orchard was grouped as fixed and variable cost incurred in the first year. Fixed cost included cost on land preparation, investment on digging and pit filling, irrigation set up, construction of rest hut and drying house etc. On the other hand, variable cost included planting material, FYM, Planting material for gap feeling, labour cost for FYM application, gap filling, weeding, irrigation and other operational expenses etc.

The expected lifespan of large cardamom orchard is 15 yr. The variable cost incurred from 1st yr to 7th yr was taken as the maintenance cost for the same period. However, average variable cost for 1 to 7 yr was taken as maintenance cost for the period from 8 to 15 yr, In addition, repairing cost of irrigation materials, rest hut, store house, modified bhatti after every five year was considered as maintenance cost.

Total cost= Annual fixed cost + Annual variable cost

Gross return = Average yield X Price

Net return = Gross return – total cost

Net present value (NPV)

Net present value of an investment is the discounted rate of all cash flow and cash inflow of the orchard during its life time. An investment in large cardamom cultivation is considered as economically feasible if the NPV is positive. The net present value was worked out at saving deposit interest rate of 5 % discounted rate per annum. It was computed as

$$NPV=\sum_{t=0}^{n}\left\{\frac{(B_t-C_t)}{(1+r)^t}\right\}$$

Where,

B_t = Gross return in time t

C_t = Variable cost in time t

r = Rate of interest

t = Time period (t = 0, 1, 2……..)

Internal Rate of Return (IRR)

Internal rate of return is the rate of return at which the net present value of a stream of payments/ income is equal to zero or near to zero. An investment is considered as economically feasible

if the Internal Rate of Return is greater than the required rate of return. It was calculated at different rate of discounted rate as

$$IRR = \left[\begin{matrix}\text{lower}\\ \text{discount rate}\end{matrix}\right] + \left[\begin{matrix}\text{difference}\\ \text{between the}\\ \text{two discount rate}\end{matrix}\right] \times \left[\frac{\begin{matrix}\text{present worth of the}\\ \text{cash flow at the}\\ \text{lower discounte rate}\end{matrix}}{\begin{matrix}\text{absolute difference between}\\ \text{the present worth of the}\\ \text{cash flow at the two discounte rate}\end{matrix}}\right]$$

Benefit Cost Ratio (BCR)

The benefit cost ratio (BCR) of an investment is the ratio of the discounted value of all cash inflow to the discounted value of all cash outflow during the life of the project. If the ratio is positive and greater than 1.00 then the investment on large cardamom orchard is considered to be economically viable. It is estimated as

$$BCR = \sum_{ü}^{n} \left\{ \frac{\left(ü_t \left(\quad + r \right)^t \right)}{\sum \left[\left(C_t \right) / \left(1 + r \right)^t \right]} \right\}$$

Where,

B_t = Gross return in time t

C_t = Variable cost in time t

r = Rate of interest

t = Time period (t = 0, 1, 2, ……..)

of this ratio is greater than 1.00 then the investment on large cardamom orchard is considered to be economically viable.

Pay-back period

The pay-back period is defined as the length of time required to recover an initial investment through cash flow generated by the investment. An investment in large cardamom cultivation is worthy if the initial investment is recovered within a short period of time. It is estimated as

$$\text{Pay back period} = \frac{\text{Cost of investment}}{\text{Annual net cash flow}}$$

RESULTS AND DISCUSSION

Cost and return of large cardamom cultivation

It can be revealed from (Table 1) that per hectare total establishment costs of large cardamom orchard was found to be higher with the larger farm size i.e. Rs. 96864 for marginal, Rs. 99755 for small and Rs.103077 for medium farm. In fixed cost, construction of drying house was the major cost items for all the different farm categories. Among the variable costs incurred in first year, the cost of planting materials was the major cost item for all the categories of large cardamom orchard and it was accounted to be 31.07, 30.25, 29.25 and 30.57 percent of the total establishment cost for marginal, small, medium and overall farm size. The second major cost item in all the farm sizes was cost of drying house followed by plantation labour cost, irrigation set up, weeding, FYM application, FYM, irrigation and other operational expenses respectively.

(Table 2) revealed that the annual fixed cost per hectare for cultivation of large cardamom was found to be highest in medium farm (Rs. 18900) followed by small (Rs. 18777) and marginal farm (Rs. 18679) and for overall farm it was accounted to be Rs. 18738.83. Among the different cost items, rental value of owned land accounted for larger share in annual fixed cost with 80.30, 79.88 and 79.36 percent for marginal, small and medium farm sizes followed by depreciation, land revenue an interest on saving deposit.

Similarly, per hectare annual variable cost which is taken as an average of 1 to 7 yr showed that among the different farm sizes, the annual variable cost was found to be highest in medium farmers followed by small and marginal. Among the various variable cost items, weeding constitute the highest share in all the farm sizes with 40.80, 37.98 and 35.27 percent for marginal, small and medium farm sizes followed by harvesting and curing as shown in table 3.

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Table 1. Establishment cost of large cardamom cultivation in 1st year

	Amount (Rs./ha)			
Particulars	**Marginal**	**Small**	**Medium**	**Overall**
Fixed cost				
1. Construction of rest house	6138 (6.33)	6275 (6.29)	6915 (6.70)	6288 (6.38)
2. Construction of drying house	12633 (13.04)	13080 (13.11)	13073 (12.68)	12821 (13.00)
3. Irrigation setup	8731 (9.01)	8877 (8.89)	9115 (8.84)	8827 (8.95)
4. Jungle cutting	3332 (3.44)	3415 (3.42)	4447 (4.31)	3516 (3.56)
5. Digging & pit filling	3373 (3.48)	3840 (3.84)	3864 (3.74)	3574 (3.62)
Sub-total (A)	34209 (35.31)	35488 (35.57)	37415 (36.29)	35027 (35.53)
Variable/ operational cost				
1. Planting material	30104 (31.07)	30178 (30.25)	30157 (29.25)	30132 (30.57)
2. FYM	4660 (4.81)	4604 (4.61)	4441 (4.30)	4613 (4.68)
3. Plantation labour cost	10129 (10.45)	10380 (10.40)	10445 (10.13)	10244 (10.39)
4. FYM application	6390 (6.59)	6385 (6.40)	6944.21 (6.73)	6469 (6.56)
5. Weeding	7899 (8.15)	7821 (7.84)	7898 (7.66)	7877 (7.99)
6. Irrigation	2317 (2.39)	2395 (2.40)	2974 (2.88)	2434 (2.46)
7. Any other operational expenses	1152 (1.18)	2500 (2.50)	2800 (2.71)	1764 (1.79)
Sub-total (B)	62654 (64.68)	64266 (64.42)	65661 (63.70)	63536 (64.46)
Grand total (A+B)	96864 (100)	99755 (100)	103077 (100)	98564 (100)

Note: Figure in parentheses are percentage of the total

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Table 2. Per hectare annual fixed cost of large cardamom cultivation

	Amount (Rs/ha)			
Particulars	**Marginal**	**Small**	**Medium**	**Overall**
1. Land revenue	40 (0.21)	60.00 (0.31)	90.00 (0.47)	52.78 (0.28)
2. Rental value of owned land	15000 (80.30)	15000 (79.88)	15000 (79.36)	15000 (80.04)
3. Depreciation on fixed assets @10%	2750 (14.72)	2823 (15.03)	2910 (15.39)	2793 (14.90)
4. Interest @ 5 % per annum	889 (4.76)	894 (4.76)	900 (4.76)	892 (4.76)
Total	18679 (100)	18777 (100)	18900 (100)	18738 (100)

Note: Figure in parentheses are percentage of the total

Table 3. Per hectare annual variable cost (average of 1 to 7 years) of L. Cardamom cultivation. (Rs/Ha)

Particular	**Amount (Rs./ha)**			
	Marginal	**Small**	**Medium**	**Overall**
1. Planting material (Gap filling)	4582 (8.52)	4609 (8.56)	4771 (8.69)	4617 (8.55)
2. FYM	731 (1.36)	725 (1.34)	693 (1.26)	724 (1.34)
3. Plantation labour cost	1699 (3.15)	1734 (3.22)	1951 (3.55)	1745 (3.23)
4. FYM application	1129 (2.10)	1130 (2.09)	1329 (2.42)	1158 (2.14)
5. Weeding	21942 (40.80)	20446 (37.98)	19351 (35.27)	21152 (39.21)
6. Irrigation	2314 (4.30)	2129 (3.95)	2585 (4.71)	2302 (4.26)
7. Harvesting	12500 (23.24)	12787 (23.75)	13269 (24.19)	12691 (23.52)
8. Curing	5027 (9.34)	4798 (8.91)	4857 (8.85)	4939 (9.15)
9. Any other operational expenses	1285 (2.38)	2903 (5.39)	3428 (6.25)	2044 (3.78)
Sub-total	51212 (95.23)	51264 (95.23)	52239 (95.23)	51375 (95.23)
10. Interest on variable expenses @ 5 % per annum	2560 (4.76)	2563 (4.76)	2611 (4.76)	2568 (4.76)
Total variable cost per hectare	53773 (100)	53828 (100)	54851 (100)	53944 (100)

Note: Figure in parentheses are percentage of the total

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Table 4. Per hectare annual total cost of large cardamom cultivation (Rs/Ha)

Particulars	Marginal	Small	Medium	Overall
Annual fixed cost	18679 (25.78)	18777 (25.86)	18900 (25.62)	18738 (25.78)
Annual variable cost	53773 (74.21)	53828 (74.13)	54851 (74.37)	53944 (74.21)
Total cost	72453 (100)	72605 (100)	73751 (100)	72683 (100)

Note: Figure in parentheses are percentage of the total

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The annual total cost per hectare for large cardamom cultivation are presented in table 4 and it was found to be highest in medium farm size followed by small and medium. The annual variable cost contributes the major share to the annual total cost accounting to 74.21, 74.13 and 74.37 percent for marginal, small and medium farm sizes. For overall farm category the annual fixed cost was estimated at 25.78 percent while 74.21 percent was contributed from annual variable cost.

Generally, large cardamom plants starts fruiting from second year onwards depending upon the varieties but the productivity is minimal as compared to third year. From third year, the return per hectare increased as the age of the plant increased. The average yield of large cardamom varies from 230 to 240 kg/ha as per location and varies from variety to variety.

Among the different farm sizes, the net return per hectare was found to be highest in small farm accounting to Rs. 59183.87 and least in medium farm with Rs. 56723.48. Also the benefit cost ratio was found to be highest in small farm size followed by marginal and medium farm with 1.81, 1.79 and 1.81. For overall farm size, the net return was estimated at Rs. 57892.62 with benefit cost ratio of 1.79.

The economic feasibility indicators of investment on large cardamom plantation for different farm size are presented in table 6. The Net Present Value for marginal, small and medium was Rs. 878413.75, Rs. 922000.94, Rs. 966512.57 and overall it was estimated at Rs. 903246.69 for at 5% discount rate indicating financially soundness of investment on large cardamom cultivation.

The Internal Rate of Return ranges from 44.92 percent in marginal farm to 59.37 percent in small farm indicates that cultivation of large cardamom was a profitable enterprises and the average rate of return for minimum of 15 years period of large cardamom plantation would be 50.72. For marginal farm, the benefit cost ratio was estimated at 2.50, for

Table 5. Per hectare returns and economic feasibility of large cardamom cultivation (Rs/Ha)

Particulars	Marginal	Small	Medium	Overall
Annual gross return per hectare	130017	131789	130475	130575
Net return per hectare	57564	59183	56723	57892
B:C ratio	1.79	1.81	1.76	1.79
NPW	878413.75	922000.94	966512.57	903246.69
IRR (%)	44.92	59.37	57.26	50.72
B:C ratio	2.50	2.57	2.61	2.54
Payback period (Year)	2.22	2.34	2.36	2.27

Table 7. Estimated Cobb-Douglas production function for large cardamom among different size group.

Particulars	Marginal	Small	Medium	Overall
Constant	2.14 * (1.87)	5.57 *** (1.33)	6.905 * (2.98)	3.78 (1.88)
Planting materials (X_1)	0.43^{NS} (0.54)	0.36 *** (0.28)	0.64 *** (0.58)	0.44* (0.47)
FYM (X_2)	0.54^{NS} (0.10)	0.22 ** (0.34)	0.17^{NS} (0.40)	0.39 ** (0.21)
Irrigation (X_3)	0.50^{NS} (0.22)	0.24^{NS} (0.48)	0.22 * (0.23)	0.38^{NS} (0.29)
Human Labour (X_4)	0.20 ** (0.27)	0.70^{NS} (0.22)	-0.053 * (0.22)	0.30 ** (0.25)
Σ bi	1.67	1.52	0.97	1.51
Coefficient of determination (R^2)	0.82	0.84	0.86	0.83
No. of observation	52	25	13	90

Note: Figure in parentheses are standard errors of regression coefficients

*** Significant at 1% level of significance

** Significant at 5% level of significance

* Significant at 10% level of significance

NS –Non Significant

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small and medium it was 2.57 and 2.61. The benefit cost ratio was found to be more in the medium category because of the increase in productivity of medium farms. Analysis of B: C ratio indicates that the investment in large cardamom cultivation is economically viable and on overall 1 investment brings 2.54 returns from 15 years lifespan. Further, the payback period was estimated at 2.22 years for marginal farm, 2.34 years for small farm and 2.36 for medium farm from the bearing year. For overall, it was found to 2.27 years after fruiting to repay back the investment incurred in the large cardamom orchard during 15 years lifespan.

Estimated Cobb-Douglas production function

It was evident from the table 7 that the inputs included in the model explained 82, 84 and 86 percent variation for marginal, small and medium farmers in the production of large cardamom as revealed by co-efficient of determination (R^2). The outline of regression co-efficient indicated increasing return to scale for marginal and small farmers as it is greater than unity indicating one percent increase in all the inputs used would enhance the output by 1.67 and 1.52 percent. However, in medium farm category, it was found to be less than unity. This indicates decreasing return to scale which implies that a one percent increase in all the inputs used in the production of large cardamom would decrease the output by 0.97 percent.

For overall farm category, the sum of regression co-efficient was found to be greater than one indicating the efficiency in the use of those inputs in large cardamom production. Also, the co-efficient of determination R^2 was high indicating that 83 percent variation is explained by the inputs used in the production of large cardamom.

Table 8. Resource use efficiency of large cardamom among different size group.

Marginal				
Particulars	**Prodn elasticities**	**MVP**	**MFC (Rs)**	**MVP/MFC (r)**
Planting materials (X_1)	0.43	2.39	1	2.39
FYM (X_2)	0.54	12.89	1	12.89
Irrigation (X_3)	0.50	5.88	1	5.88
Human labour (X_4)	0.20	0.69	1	0.69
Small				
Planting materials (X_1)	0.36	1.33	1	1.33
FYM (X_2)	0.22	3.37	1	3.37
Irrigation (X_3)	0.24	0.91	1	0.91
Human labour (X_4)	0.70	2.27	1	2.27
Medium				
Planting materials (X_1)	0.64	3.22	1	3.22
FYM (X_2)	0.17	5.813	1	5.81
Irrigation (X_3)	0.22	3.39	1	3.39
Human labour (X_4)	-0.05	-0.16	1	-0.16
Overall				
Planting materials (X_1)	0.44	2.22	1	2.22
FYM (X_2)	0.39	9.22	1	9.22
Irrigation (X_3)	0.38	4.14	1	4.14
Human labour (X_4)	0.30	1.01	1	1.01

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Estimated resource use efficiency

The data showed that the ratio of MVP to MFC was found to be greater than one for planting materials (X_1), FYM (X_2) and irrigation (X_3) indicating under utilization of these resources. However, for human labour (X_4) the ratio was found to be less than one which implies over utilization the resource. Also, the MVPs of all the inputs were non-negative indicating that large cardamom farmers still use these resources within the economically rational range despite they were not optimally used. For small farm category, planting material (X_1), FYM (X_2) and human labour (X_4) were found to be greater than one but irrigation was found less than unity. For medium farm size, all the inputs used were found to be greater than one except for human labour (X_4) which was found to be negative. This implies the under-utilization of human labours in large cardamom cultivation. For overall farm, utilization of all the inputs were efficient as indicated by the positive and greater than one and hence indicates that there is more space for pushing up the production in large cardamom production in the study area.

CONCLUSION

Study revealed that the establishment cost and the annual total cost incurred in large cardamom cultivation in terms of capital and labour was found to be high. But the net return per hectare for marginal (Rs. 57564), small (Rs. 59183) and medium (Rs. 56723) as well as for overall farm (Rs.57892) realized that it was a profitable spice crop. Also, the estimated feasible parameters showed that investment in large cardamom orchard in the study area indicated economically profitable, financially feasible. The result of the Cobb-Douglas production function analysis indicated that except

for medium farm category the sum of regression co-efficient was found to be greater than one. The ratio of MVP to MFC showed less than unity for human labour (X4) in marginal farm, irrigation (X3) in small farm and for human labour (X4) it was found negative in medium farm category. For overall farm the values of all the inputs were greater than one indicating efficient utilization of resources. To enhance the production and yield of large cardamom in the study area, provision should be made for availability of good quality disease free planting materials, development of infrastructure and adoption of proper package of practice with exclusive research through collaboration of research institution and other related organization should be done.

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