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Econometric Analysis of Organic Large Cardamom Production in Yongam Village, Longleng District of Nagaland

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Abstract

Yongam is the thirteen largest village of Longleng in terms of demographic determinant. It is located in the Far East region of East Asia towards Myanmar and is gradually becoming the hub of organic large cardamom *(Amomumsubulatum Roxb)* production in Longleng district, Nagaland. Agriculture is the backbone of Yongam and supports more than 71.08% of the total population. In recent time, organic large cardamom cultivation has become one of the foundation economies and farmers were motivated for cultivation of organic large cardamom by various governmental agencies like Agriculture Technology Management Agency, Horticulture Department, Agriculture Department and Krishi Vigyan Kendra. They are shifting their choice from growing food crops to commercial crops i.e., organic large cardamom as the aforesaid agencies provide proper training and ad rem suggestions to the farmers. Total of 40 respondents i.e., organic large cardamom growers were selected using simple random sampling technique. The paper investigates the size of area, production, productivity, cost and net return. The result shows higher Benefit Cost Ratio for large acres of areas as 1.23, 1.94, 3.10 and 3.31. This paper examines the Cobb-Douglas production function on the organic large cardamom production in various spaces and dimensions. The objective of this study is to investigate the logical relationship between production and capital invested on labour and inputs. The finding shows Cobb-Douglas production function exhibits diminishing return to scale. Presently, organic large cardamom cultivation in Yongam suffers from various challenges like marketing, credit, maintaining the quality of the product and lack of scientific technique to tackle the situation. Monitoring and analysis of these data over time are important for continued situational awareness on production and productivity of large cardamom with ensuring stable economies and livelihood.

Keywords: Organic large cardamom, Production, Productivity, Benefit-Cost Ratio Cobb-Douglas production function

JEL Classification: *Q1, Q11, Q12, Q13, Q15*

1. Background

Agriculture is an integral part of the Nagaland economy (Rongsen 2003, 47; Mandal et al. 2006, 360; Krishan 1992, 29; Kalamkar 2006, 351; Alam 1993, 3). Agriculture and allied sector plays noteworthy role in the socio-economic development of Nagaland (Dhakre & Sharma 2009, 71; Laxminarayan 1970, 1971; Kuba & Jha 2008, 113; Bhatt 2006, 55). This sector is the second largest contributor to the Nagaland economy as well as providing livelihood to more than 70% of the working

population (Rongsenchiba et al. 2017, 22; Saikia, 2006 340; Borah & Chakraborty 2006, 342). However, the mountainous topography, uneven terrain, low level of investment, lack of irrigation facilities, credit, and lack of modern technology is a hindrance to a large scale production of agriculture crops for commercial purpose (Bagchi 2006, 347; Misra & Mishra 2006, 345; Nair 2006, 352, Das et al. 2018, 250). Despite of all these obstacles, the farmers have significantly moved on to adopt system such as integrated approaches, organic, dry land farming and double cropping system (Nakro 2009, 10; Murry 2019, 311). Some farmers have gone forward to grow commercial crops such as tea, rubber, kholar, ginger, large cardamom, oilseeds, black pepper, pluses and tuber crops (Economic survey of Nagaland 2017-18, 8; Barah & Birthal 2006, 18 ; Singh et al. 1997, 147).

In the course of time the predominance of chemical intensive farming has resulted in a near stagnant of production and productivity of many of the economically crops and the indiscriminate use of chemical fertilizers and pesticides has eventually emerged as a potential source of danger not only to the sustainability of the environment (Ghosh 2009, 372; Laxminarayana et al. 2005, 495; Saha et. al. 2012, 1; Saha et al. 2007, 112; Borthakur 1992, 31). As a result of loss of agro-ecosystem vitality and productivity, the cost of cultivation has escalated and this led most of the small and marginal farmers to shift away from raising food crops to cash crops in order to sustain their economic viability of agriculture. This scenario can be predominantly observed in states like Nagaland (Yano & Lanusosang 2013, 651; Rawat, 2014, 1; Yano et al. 2012; Devi 2010, 199). This situation made it inevitable to think beyond the unsustainable agricultural practices of state (Singh 1992, 219) and slowly, a number of alternative eco-friendly farming practices have evolved from different parts of Nagaland (Wangshimenla & Renthungo 2012, 78; Singh, et al. 1996, 18). While analyzing all the developments from different parts of the world *Organic Agriculture* seems to have an edge in the adoption process among the farming community of Nagaland and the success of organic farming is predicted by the availability of eco-friendly method capable to sustain agricultural productivity, increase market potential and maintain economic viability (Kuotsuo et al. 2014, 23; Das et al. 2018, 301; Bujarbaruah 2004, 4; Avasthe 2006, 585).

Organic large Cardamom may offer sustainable economic guarantees for the farmers, with a stable demand, and hence a lucrative price level for the farm works, despite the high transportation cost to a market centre. It is generally assumed that the option of organic farming is a practice leading to agricultural development (Sharma et al. 2001, 261: Gupta 1983, 3; Rao et al. 1993, 77; Sharma et al. 2000, 108; Gupta et al. 2012, 7). It is one of the highly priced and expensive spices and rightly called as the *"green gold"*. Till early 1970s, India was the main producer and exporter of this commodity. Now Guatemala has emerged as world's largest producer, offering stiff competition to Indian cardamom in the international market. Since the ancient time India is an organic produce exporting country. So, export of organic agricultural produce, especially which of low volume high price commodities like spices have an impact on India's economic future (Gills 2012, 2).

As per the statistics available with Agricultural and Processed Food Products Export Development Authority, currently, India

ranks 33rd in terms of total land under organic cultivation and 88th in terms of the ratio of agricultural land under organic crops to total farming area. The cultivated land under certification is around 2.8 million hectare (2007-08). This includes 1 million hectare under cultivation and the rest is under forest area (APEDA 2011, 2). Sikkim, which has been declared India's first organic farming state, grown large cardamom over 17,000 hectare and produces 4000 tonnes annually, Sikkim share 90% of the country's organic production. Exports of large cardamom in 2015-16 (April-March) were at 600 tonnes, decline 10% from 665 tonnes a year ago. However, large cardamom exports are higher than India's export target of 500 tonnes for 2015-16. (Indian Agriculture Report 2015-16, 3).

In Nagaland during 2015-16, 5667 hectare was cultivated under these crops as against 5508 hectare during 2014-15 registering a percentage increase of 2.89%. The production too has increased from 17759 MT in 2014-15 to 18179 MT in 2015-16 showing an increase of 2.36%. In terms of productivity, almost all organic spices improved except large cardamom. During 2014-15 the total area cultivated under large cardamom was 3153 hectare and production was 1378 MT having a productivity of 437 Kilogram/Hectare. Again during 2015-16 the total area increases 3231 hectare and production was 1408 (MT) having a productivity of 436 (Kilogram/Hectare) (Economic Survey of Nagaland 2015-16). In Longleng district as per the VISION 2025, Government of Nagaland, prosperity through Agriculture Food for All, the Phonli Self Help Groups (SHGs) of the village solely works for Large Cardamom. The area covered by the cardamom in Longleng district is 75 hectare. Its productivity per hectare (in MT/Hectare) is 0.3 and production (in MT) is 22.5 (KVK 2017, 2).

2. Materials and Methods

1.2.1. Study area and period of research survey

Longleng, smallest district of Nagaland, situated in the Eastern region bordering towards Myanmar, lies between 94°E-95°E longitude and 26°N27°N latitude of the equator, the district is mountainous with an area of 562 Sq.km. The home of the Phom Nagas is the tenth district of Nagaland. As per census 2011, Longleng had a population of 50,484 of which males and females were 26,502 and 23,982 respectively. The district has an average literacy rate of 72.17% lower than national average of 79.55% (Census of Longleng 2011, 6). The proposed study has planned to cover the Yongam village of Longleng district which is the largest producer of organic large cardamom for many years. The data collected relate to the agricultural year 2017.

1.2.2. Demographic and socio-economic information of the study area

Yongam village is situated in Yongnyah, Teshil, Longleng district. The village has total population of 1304 as per 2011 census. The census data of 2011, shows the male and female population comprises of 51.45% and 48.54%. Literacy rate of Yongam is 64.87%, for male and female literacy rate is 55.18% and 44.81%. The entire working population is 927 which are either main or marginal workers. Total main workers are 668 out of which 51.49% and 48.51% were male and female.

Table 1: Demographic and socio-economic indicators of Yongam village

Indicators	Total Number	%	Indicators	Total Number	%
Household	358	---	Main workers	668	100
Total population	1304	100	Male	344	51.49
Male	671	51.45	Female	324	48.51
Female	633	48.54	Total workers	927	100
Age group 0-6 years	248	100	Male	473	51.02
Male	129	52	Female	454	48.97
Female	119	48	Cultivators	570	100
Literates	685	100	Male	271	47.54
Male	378	55.18	Female	299	52.45
Female	307	44.81	Agriculture	10	100
Illiterates	619	100	Male	8	80
Male	293	47.33	Female	2	20
Female	326	52.66	---	---	---

Source: Census of 2011

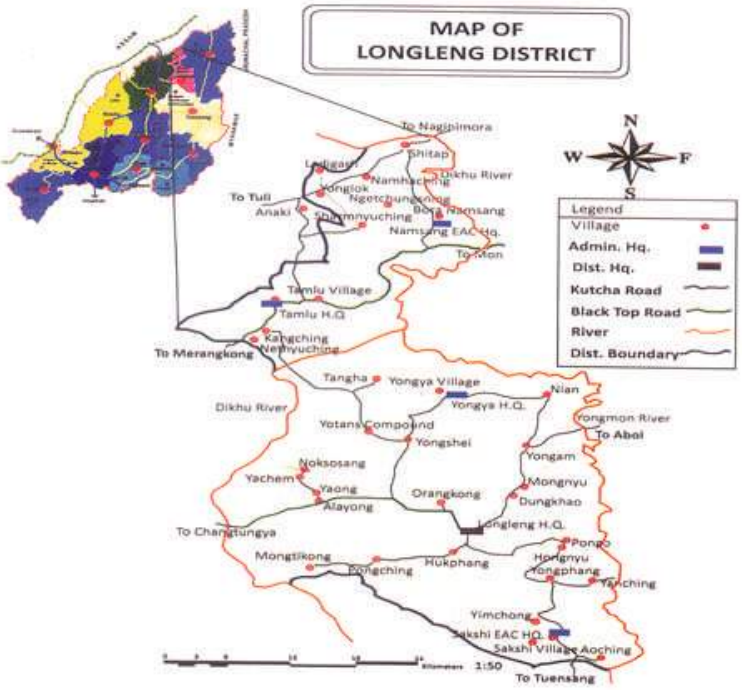

Fig. 1: Map of Longleng district
Source: National informatics Centre, Longleng: Nagaland

1.2.3. Sample size and sampling method

Total of forty (40) respondents i.e., organic large cardamom growers were selected using simple random sampling technique to study production and productivity of organic large cardamom (Cochran 1963, 3; Deming 1960, 3).

1.2.4. Research instrument and study design

The data were collected from four size classes, viz., below 1 acre, 1-2 acres, 2-4 and 4 and above. The maximum yielding life of organic large cardamom, according to cultivators is approx 3-5 years depending on soil fertility. Data collection was done through personal interviews. Primary methods were used to collect data, shared experiences, observation and find out the real problems mostly faced by the larger cardamom grower which were collected through questionnaire, key informant interview and focus group discussion (Ackoff 1961, 45; Bailey 1978, 3; Bowley 1937, 1). The target groups were asked a series of open and close-ended questions. All three such as structured, semi structured and unstructured questions were included in the interview schedule.

1.2.5. Statistical analysis

Information collected from the field survey was coded and tabulated on Statistical Package for Social Science version (SPSS) 20 and Microsoft Excel. The data were collected from four size classes, viz., below 1 acre, 1-2 acres, 2-4 and 4 and above. Benefit cost analysis was estimated using the total cost of production of large cardamom and gross return from large cardamom production. The total cost of production was calculated by summing the variable cost and fixed cost items incurred in the production process. The collected data were analyze using Benefit-Cost Ratio (BCR) and Cobb Douglas production function model.

Measurement of Cost-Benefit using Benefit-Cost Ratio method

Mathematical expression for BCR

1. $BCR = \frac{DiscountBenefit}{DiscountedCost}$

   Discount Benefit = (Quantity of mean product Price of main product) + (Quality of by product price of by product)

   Cost = Expenses incurred for agronomic operation in terms of labour, farm machinery and inputs costs such as seed etc., (Gitting 1984, 5).

2. The production function named after two economists C.W. Cobb and P.H. Douglas is known as Cobb-Douglas production function. This production is widely used in economic analysis. A production function in which two inputs K and L are expressed in multiplicative form is known as Cobb-Douglas production function. It can be expressed as

$$Q = AK\alpha\ L\beta$$

Where, $A > 0$: Technical / efficiency parameter

$\alpha, \beta > 0$: Share of capital and labour / Substitution parameter Homogeneity

Multiplying k and L by λ times

$$Q = AK\alpha\ L\beta \qquad (\therefore \alpha+\beta) = 1,\ \beta = 1-\alpha)$$

$$=A\ (\lambda k)^{\alpha}\ (\lambda\ L)^{\beta}$$

$$= A\lambda^{\alpha+\beta}\ \ K^{\alpha}K^{\beta}$$

$$=\lambda\ \alpha+\beta\ .Q$$

Thus, Cobb-Douglas production function is homogeneous of degree $(\alpha+\beta)$.

If $\alpha+\beta>1$ is increasing returns to scale (IRS).
If $\alpha+\beta<1$ is increasing return to scale (DRS).
If $\alpha+\beta=1$ constant returns to scale (CRS).

Cobb-Douglas production function is linear homogeneous

When,

$$(\alpha+\beta) = 1$$

$$\text{or, } \beta = 1-\alpha$$

Thus the linear homogeneous Cobb-Douglas production function is

$$Q = AK^{\alpha} L^{1-\alpha}$$

Model specification is a mathematical expression showing the inter-relationship between the economic relationship existing between economic variables (dependent and independent). The model is a two-variable model and stated covers the production of organic large cardamom as the dependent variable; while agricultural sector output and labour, capital expenditure on inputs as the independent variables (Cobb & Douglas 1928, 18).

1.3. Objectives of the Research Work

Study the size of land holding, production and productivity.

To examine cost components of the organic large cardamom growers.

1.4. Hypothesis

Null Hypothesis $\mathbf{H_o}$

There is no relationship between organic large cardamom production per acre and the labour as well as capital expenditure on inputs.

Alternative Hypothesis $\mathbf{H_1}$

There is statistical significance between organic large cardamom production per acre and the labour as well as capital expenditure on inputs.

1.5. Results and Discussions

Table 2 indicates that in the sample of 40 organic large cardamom growers out of which 10.8 acres of land is covered by farm size below 1 acre which comprises of 30% of the total share, 35 acres of land is covered by farm size 1-2 acres which comprises of 57.5%, 11.4 acres of land is covered by farm size 2-4 acres which comprises of 10% and 4.5 acres of land is covered by farm size 4 and above acres which comprise of 2.5%. The result showed that the average land under organic large cardamom cultivation was 1.54 acre ranging from 0.84 to 4.5 acre.

Table 2: Size of land of the sample households

Size	No. of Sample	Own land	Total	Percentage
Below 1 Acre	12	10.80	10.80	30.00
1-2 Acres	23	35.00	35.00	57.50
2-4 Acres	4	11.40	11.40	10.00
4 and above	1	4.50	4.50	2.50
Total	40	61.7	61.7	100

Source: Author computed from the field survey report, 2017

Table 3: Area production and productivity

Size	Area	Production (Kg)	Productivity (Yield)
Below 1 acre	10.80	380	35.18
1-2 acres	35.00	2700	77.14
2-4 acres	11.40	950	83.33
4 and above	4.50	300	75.00
Total	61.70	4330	70.17

Source: Author computed from the field survey report, 2017

The total area under large cardamom in Nagaland during 2010-11 was 3180 hectare but further increased to 4208 hectare in 2016-17. Production area is the actual area that provides an agronomic yield on a yearly basis. Total production of large cardamom in Nagaland during 2010-11 was 15 metric ton and increased to 74 metric ton in 2016-17. During the same year the areas under organic large cardamom cultivation in Longleng was 50 hectare and increase to 234 hectare (Statistical Handbook, 2011, 36 2018, 19).

From table 3 reveals that the farm size between 1-2 acres shows the highest production with 2700 Kg and the lowest was found in the farm size 4 and above with 300 Kg. The farm size 2-3 acres shows the highest productivity with 83.33 Kg. The lowest was found in the farm size 0-1 acre with 35.18 Kg. The total area as a whole is 61.70 acres and total production is 4330 Kg and productivity is 70.17 Kg. The average production and productivity of cardamom were 0.27 MT/acre and 0.02 MT/acre respectively in the study area which was lower than the national productivity of cardamom (1.67 MT/acre) and productivity of large cardamom (0.07 MT/acre).

The study found that the productivity of organic large cardamom started to decline in recent times, because the large cardamom farmers did not apply recommended amount of manure and fertilizer to the cardamom orchard which degrade fertile soil (Gudade et al. 2013, 4). In addition, the incidence of large cardamom stem borer, rhizome rot, viral diseases such as *Chirkey* (Mosaic streak) and *Foorkey* (Bushy dwarf) also seems to have effect on yielding. Besides this, climate change, poor management of cultivation area, unavailability of suitable variety according to the altitude etc. are other reasons behind the decline of large cardamom production (Annamalai et al. 1988, 5). Due to all above discuss reasons of lower production and efficiency, organic large cardamom growers are destroying the cardamom orchard and reestablishing the orchard of cardamom.

As a consequence of long dry spells and disease infestations during 2018-2019, the production area and yield decreased each year (Chattopadhyay & Bhowmick 1965, 272; Biswas et al. 1986, 105; Sharma et al. 2001, 261). Revitalization strategies were then initiated by improving the management of the

farms such as use of manures before flowering and after harvesting, uprooting infected plants, and manual management of pests and diseases followed by application of bio-pesticides (Karibasappa 1987b, 2: Karibasappa 1987a, 1; John 1984, 3; Biswas et al. 1986, 105). Farmers planted cardamom in new fields, leaving the old plantations fallow, while the Horticulture Department Longleng, Government of Nagaland provided them with incentives for reviving organic large cardamom.

Table 4: Cost components organic large cardamom growers (Cost in ₹)

Cost components	Below 1 Acre	1-2 Acres	2-4 Acres	4 and above
Hired labour	65,000	414,000	128,000	32,000
Imputed value of family labour	30,600	36,800	6,400	2600
Seedling	35,500	2,76,000	37,000	17,000
Drying of cardamom using firewood	4,000	9,000	2000	1400
Total	131,100	722,800	173,400	53,000

Source: Author computed from the field survey report, 2017

** Interest on working capital,
** Rental value of land,
** Repair and maintenance deprecation,
** Manure and fertilizers,
** Plant protection and
** Mulching, shading and drying (Nil).

From the above table 4 it is evident from the analysis that cardamom cultivation requires three major costs such as labour, seedling and drying cost, farm size below one labour cost is Rs. 65000, imputed value of labour is Rs. 30600, seedling cost Rs. 35,500 and drying cost is Rs. 4000. For farm size 1-2 acres labour cost is Rs. 414000 imputed value of labour is Rs.36800, seedling cost Rs. 276000 and drying cost is Rs. 9000. For farm size 2-4 acres labour cost is Rs. 128000, imputed value of labour is Rs. 6400, seedling cost Rs. 37000 and drying cost is Rs. 2000. Size 4 and above labour cost is Rs 32000, imputed value of labour is Rs. 2600, seedling cost Rs. 17000 and drying cost is Rs 1400. It has been found that in all the farm size labour cost is highest. Till now cost in other components is negative.

Fig. 2: Organic large cardamom plantation under 50% shade in Yongam

Table 5: Cost and return of organic large cardamom growers (Cost and return in ₹)

Farm size	Cost	Return	Net Return	BCR
Below 1 Acre	135,100	304,000	168,900	1.23
1-2 Acres	735800	2170000	1447200	1.94
2-4 Acres	172400	760000	540600	3.10
4 and above	53,000	240000	177000	3.31
Total	1,096,300	3,474,000	2,333,700	2.12

Source: Author computed from the field survey report, 2017

Table 6: Generation of income of different farm sizes

Farm size	Total cost	Production (in Quintals)	Return from sale	Total income
Below 1 Acre	135,100	380	304,000	1,68,900
1-2 Acres	735,800	2700	2170000	14,47,200
2-4 Acres	173,400	950	760000	5,40,600
4and above Acres	53,000	300	240000	1,77,000
Total	1,097,300	4,330	3,474,000	2,333,700

Source: Author computed from the field survey report, 2017

Cultivation of large cardamom includes various types of cost, since it uses various kinds of inputs in terms of labour, seedling, cardamom plantings, equipment, firewood etc. It is evident from the analysis of Benefit Cost Ratio (BCR) that all categories of the farmers enjoyed some profit since BCR varied from 1.23 to 3.31. The farmers of large farm size enjoyed the highest profit as per acre, cost is comparatively low than the farmers of small farm size. Benefit and Cost Ratio (BCR) were used to analyse whether the large cardamom enterprise was profitable or not. Any producing unit with BCR ratio less than 1 are not feasible since they are not profit yielding. However, BCR ratio greater than 1 denotes feasible enterprise/producing unit that could be sustained or making profit. So, overall BCR was estimated in the study area, which was found greater than unity (BCR 2.12). This showed that the large cardamom enterprise is profitable in Yongam village. The details on benefit cost analysis of large cardamom in the study area presented (refer table 5 and fig. 3).

The estimated coefficients of Cobb-Douglas production function show that if labour increases by 10%, output increases by 7.30%, whereas if capital invested on raw material and transport cost (Seedling and firewood cost) increases by 10% output increases by 4.12% i.e., has a positive impact on production, even if at diminishing marginal returns. Since the coefficients value of labour and capital cost is less than 1 it exhibits diminishing return to scale and the Cobb-Douglas production function is not statistically significant. Thus, the null hypothesis which states that production per acre and the labour as well as capital expenditure on inputs is rejected.

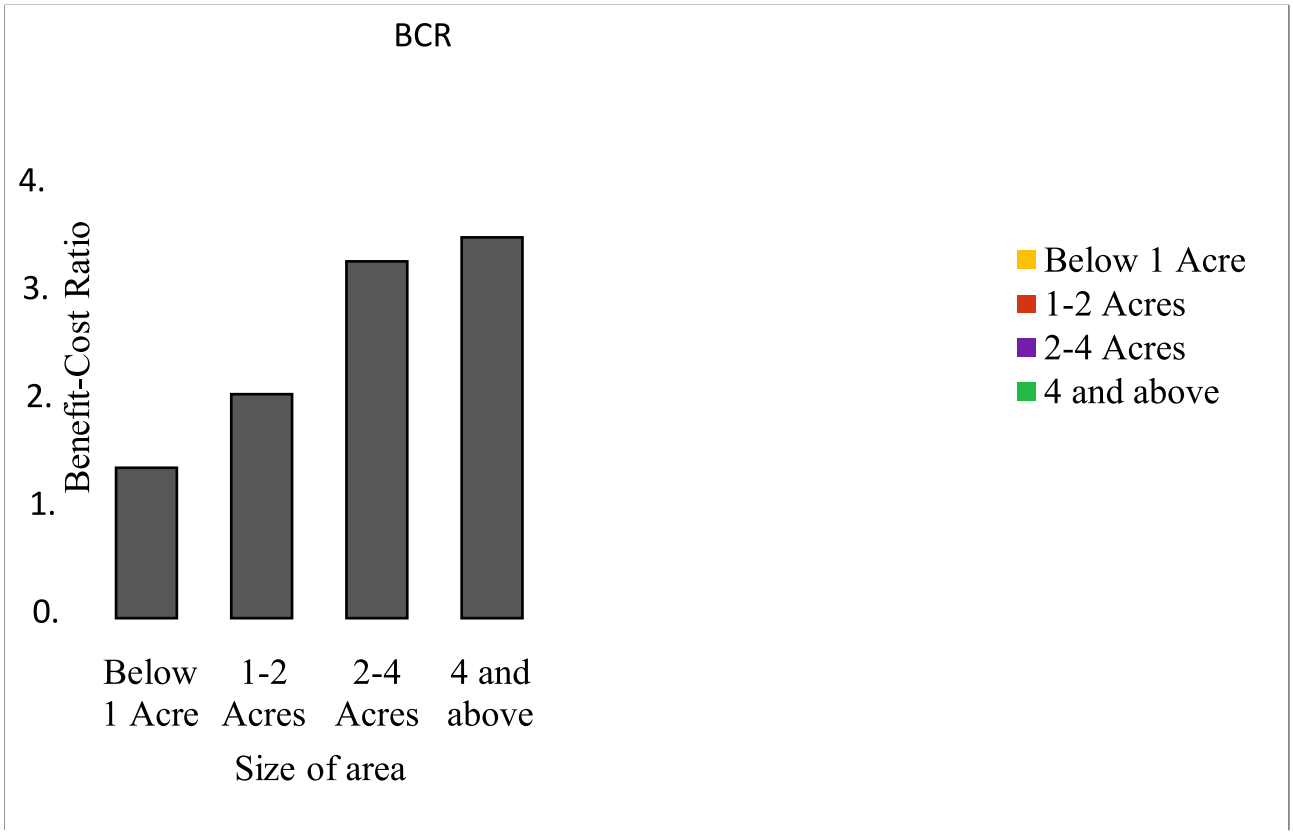

Fig. 3: Benefit-Cost Ratio (BCR) and size of area

1.6. Conclusion

The area under cultivation of organic large cardamom in Yongam village during 2017 is 61.7 acres and the total production was found to be 43.3 quintals/4330 kg and average yield per is 70.17 kg. The finding show the average cost per acre is Rs 1,096,300 and the return per acre is found Rs 3,474,000, net return in all farm size is found Rs 2,333,700. The Benefit-Cost Ratio (BCR) was found to be 2.12 and show higher BCR for large acres of area. It was also found that out of four major cost, the highest is the labor cost, followed by seedling cost, imputed value of family labor, it is also found that other cost such as manure, plant protection, mulching, shading, maintain and depreciation cost is negative. It is clear to see that fact finding of Cobb Douglas production function, where 10% change expenditure and labour and capital inputs leads to 7.30% and 4.12% change in production function. So system is less efficient or exhibits diminishing return to scale. As a result, large cardamom growers are not getting enough benefits despite change in agriculture policy issues. So, agriculture production policies should be interlinked with macroeconomic policies. The large cardamom growers in the district is facing several problems in its efforts for increasing production and the most important of which is the limited scope for extensive cultivation, prevalence of diseases *(Foorkey and Chirkey),* cultivation based on traditional methods, land put to other use, labor problem, improper management of plant,

absence of work force education, lack of processing facility, un remunerative prices, lack of credit, inadequate government investment, existence of middlemen, lack of market knowledge about price and finally the most important, is the increasing cost of production. There is a need to promote organic cultivation of large cardamom among farmers so as to enable them to enhance their earning in an ecologically sustainable manner. At the present time, organic large cardamom farming is gaining impetus for income and employment generation and improving the livelihood of the farming community (Jamir 2021, 8; Jamir 2020, 221; Jamir & Ezung 2017b, 50; Jamir 2019, 4-14). So, the government agencies should come forward and provide proper training and ad rem suggestions to the farmers so as to promote organic cultivation of large cardamom among farmers so as to enable them to enhance their earning capacity and boost livelihood among the farmers (Jamir & Ezung 2017a, 64).

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