Research Article,

# Resource use efficiency in large cardamom production of Bhojpur District, Nepal.

Kedar Sapkota[a], Kapil Khanal[b](advisor)

**Department of Horticulture, Institute of Agriculture and Animal science (*IAAS*)**

**Mahendra Ratna Multiple Campus, Ilam**

**Corresponding author e-mail address:-** kedarsapkota34@gmail.com

**Abstract**

The study was conducted to determine the resource use efficiency in large cardamom production of Bhojpur district. This study was conducted among 60 large cardamom produces, 30 Farmers from agricultural group and 30 farmers from Agricultural cooperatives. Pretested semi-structured questionnaire was administrated to randomly selected farmers. Cardamom producers were interviewed using face to face interview method in March 2020. All the data were entered into SPSS and Microsoft Excel and analysis was done by using Microsoft Excel and SPSS. Cobb-Douglas production function was used to determine the resource used efficiency of cardamom production. For optimum allocation of resource expenditure on samplings, labour, fertilizer, and capital need to be increased by 23.83%, 45.46%, 56.39%, and 91.06% respectively.

Keywords; Cardamom, Cobb-Douglas Production function, Resource use efficiency

## 1. Introduction

The large cardamom grown in Nepal, known as *Alaichi*, is one of Nepal's largest export crops. It is one of the highest commercial product among all Nepal's export products. The Government have selected cardamom as priority sector part of the Nepal Trade Integration Strategy (NTIS 2016). It was first introduced in the Ilam district in 1865, but commercial cultivation began in the late1950. Currently, it is grown in 51 (Figure 1) districts, mainly in the eastern hill and mountain areas and gradually expanding to the western parts (Shrestha, 2018).

Large cardamom is one of the popular spices found in the Zingiberaceae family. It is a tall, perennial, evergreen, herbaceous monocot plant (Kumar et al., 2012). The height of this plant is 1.5 to 3.0 m (Bisht et al., 2011) and on the upper part of the stem there are leaves. The rhizomes are off dull red color and the flower buds protrude from the base of the rhizome. Spring is the flowering period of large cardamom flowers. Short peduncle and buds covered with tight red bracts. The individual flowers

remain open for three days or more. At the same time, new ones are opened. Flowering remains intact with the flowers for one month (Sharma et al., 2000).

This research survey was conducted to assess the production function and resource use efficiency of large cardamom production in Bhojpur District.

## 2. MATERIALS AND METHODS

The study was conducted in Bhojpur district. Bhojpur Municipality and Arun Rural municipality were purposively chosen as the study area. 60 respondents were selected using simple random sampling method of commercial large cardamom growing farmers. And those 60 respondents were divided into 2 equal parts i.e. 30 respondents were member of an agricultural group and 30 members were of cooperative. Face to face interview method was used to collect primary data using pretested semi-structured questionnaire in the month of March 2020. Data about socio-economic and demographic information, variable cost incurred for large cardamom production and income were collected during survey. Focus group discussion (FGD) and key informant interview (KII) were conducted to validate information obtained from respondents. Data analysis and comparisons were made to obtain results. The data were entered in Microsoft excel and SPSS. Analysis was done by using SPSS and Microsoft excel.

### A. Econometric Models

Cobb-Douglas production function was accessed to calculate economics of maize production. This model is widely used to represent the relationship of an output to inputs and it gives good approximation to actual production (Yuan, 2011). It is use to determine the resource use efficiency of production of agricultural commodity (Dahal and Rijal, 2019).

$$Y=aX_1^{b1}X_2^{b2}X_3^{b3}X_4^{b4}e^u$$

Y is income of cardamom production in ropani (Nrs), $X_1$ is cost of cardamom sampling per ropani, $X_2$ is cost of labor per ropani, $X_3$ fertilizer cost (Farm Yard Manure) per ropani, $X_4$ capital investment i.e. firewood cost + transport cost per ropani e is error term and b1 to b4 is coefficient to be estimated.

The above mentioned equation is linearized in logarithmic function.

$\ln Y = \ln a + b1\ln X1 + b2\ln X2 + b3\ln X3 + b4\ln X4 + u$

Where, ln= natural logarithm, a= constant and u is random disturbance

The efficiency ratio (r) was computed using the formula

$$r = \frac{MVP}{MFC}$$

where,
MFC= Marginal factor cost
MVP= Marginal value product,

the marginal value product was computed by using formula:

$$MVP_i = bi \times \frac{Y}{X1}$$

Where, bi = Estimated regression coefficients

Y and Xi are the values from geometric mean.

**B. Efficiency estimation**

r = 1 indicate the efficient use of resource

r < 1 indicate overused of resource

r > 1 indicate underuse of resource

The relative percentage change in MVP of each resource was estimated by using following formula

D= (1- MFC/MVP) ×100

Or, D= (1-1/r) ×100

Where, D= Absolute value of percentage change in MVP of each resource

## 3. Result and Discussion

### Demographic and socioeconomic study

Majority of household head in the research area was male. 46.67% of the household head was male in the families in group and 76.67% of the household were male-headed in a family belonging to cooperatives. The group household was dominated by Janajatis i.e. 73.33% and in case of cooperative the it was dominated by Brahmin/chhetri i.e 53.33% over Janajatis i.e 46.67%.

**Table 1**: Demographic and socioeconomic study of Bhojpur

| Variables | Total (n=60) | Group (n=30) | Cooperatives (n=30) | Chi-square value |
|---|---|---|---|---|
| **Gender** | 60(100) | 30(100) | 30(100) | |
| **Male** | 37(62) | 14(46.67) | 23(76.66) | 5.711** |
| **Female** | 23(38) | 16(53.33) | 7(23.33) | |
| **Ethnicity** | 60(100) | 30(100) | 30(100) | |
| **Brahmin/Chhetri** | 24(40) | 8(26.66) | 16(53.33) | 4.444** |
| Janajatis | 36(60) | 22(73.33) | 14(46.67) | |

Figures in parenthesis indicate percent. *, ** and *** indicate 10%, 5% and 1% level of significance

Farmers who were members of cooperative had grater land holding than farmers of group

**Table 2:** land holding and Irrigation situation between the group and cooperative farmers

| Variable | Total (n=60) | Group (n=30) | Cooperative (n=30) | Mean difference | Standard error | T- value |
|---|---|---|---|---|---|---|
| **Total Land** | 6.03 | 4.37 | 7.70 | -3.33 | 1.26 | -2.64*** |
| **Irrigated** | 3.97 | 2.85 | 5.10 | -2.25 | .95 | -2.37** |
| **Non-irrigated** | 2.05 | 1.48 | 2.63 | -1.15 | .55 | -1.67 |

** And *** indicate 5% and 1% level of significance.

Average land holding of cooperative farmers was 7.70 ropani and that of group farmer was 5.30 ropani. The difference was statistically highly significant at 1% level of significance.

The irrigation facility on the cardamom cultivated area was statistically significant at 5% level in between group and cooperative farmers.

**Table 31**: Classification and comparison of labour numbers per ropani between the groups and cooperative in the study area.

| Variable | Total (n=60) | Group (n=30) | Cooperatives (n=30) | Mean difference | Standard error | T-value |
|---|---|---|---|---|---|---|
| **land Preparation** | 2.90 | 2.16 | 3.65 | -1.49 | 6.24 | -2.39** |
| **Irrigation** | 1.93 | 1.44 | 2.42 | -.98 | .36 | -2.68*** |
| **Weeding** | 14.36 | 11.00 | 17.73 | -6.73 | 2.10 | -3.20*** |
| **Harvesting** | 8.94 | 6.38 | 11.50 | -5.11 | 1.64 | -3.10*** |
| **Processing** | 3.58 | 2.10 | 5.06 | -2.96 | .75 | -3.91*** |
| **Clearing** | 4.65 | 3.20 | 6.10 | -2.90 | .99 | -2.90*** |
| **Total labour** | 40.68 | 29.70 | 51.67 | -21.97 | 6.55 | -3.35*** |

** And *** indicate 5% and 1% level of significance.

The variable like labor for irrigation, weeding, harvesting, processing, clearing, and total labor were significantly different at a 1% level of significance whereas labor for land preparation pit construction, and transplanting was significance at 5% level of significance between group and cooperative.

**Table 4:** 2Cost comparison of labour per ropani between the group and cooperative in the study area.

| Variables | Total (n=60) | Group (n=30) | Cooperative (n=30) | Mean difference | Standard error | T- value |
|---|---|---|---|---|---|---|
| **Land preparation** | 1455.00 | 1082.50 | 1827.50 | -745.00 | 311.97 | -2.38** |
| **Fertilizer Application** | 2425.00 | 1816.66 | 3033.33 | -1216.66 | 520.50 | -2.33** |
| **Irrigation** | 990.41 | 720.00 | 1260.83 | -540.833 | 191.94 | -2.81*** |
| **Weeding** | 7183.33 | 5500.00 | 8866.66 | -3366.66 | 1051.52 | -3.20*** |
| **Harvest** | 4470.83 | 3191.66 | 5750.00 | -2558.33 | 822.86 | -3.10*** |
| **Processing** | 2475.00 | 1050.00 | 3900.00 | -2850.00 | 1031.79 | -2.76*** |
| **Clearing** | 2408.33 | 1600.00 | 3216.66 | -1616.66 | 547.63 | -2.95*** |
| **Total Cost** | 20322.91 | 14975.00 | 25660.83 | -10695.83 | 3265.57 | -3.27*** |

** And *** indicate 5% and 1% level of significance.

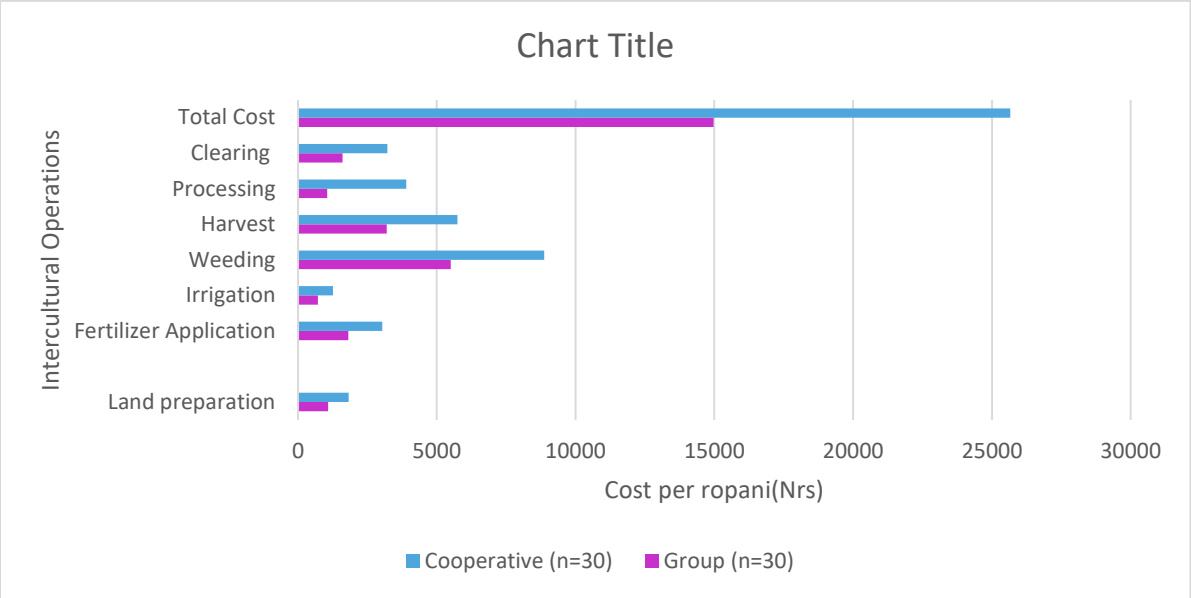


**Figure 1:** Showing the line diagram of different intercultural operations with their average cost per ropani between group and cooperatives

The cooperative farmers were investing more amount than group farmers for the samplings, labors, fertilizer and material cost but which were statistically non-significant between group farmers. They were investing because the farmers of cooperative were receiving higher return than farmers of groups per ropani.

**Profitability of cardamom farming in Bhojpur**

The benefit-cost ratio (B/C) per ropani of cardamom production in cooperative farmers was 2.54 and that of group farmers was 1.85. This value was statistical significance at a 1% level of significance. By investing in one rupee in large cardamom production farmers who were engaged in cooperative gets a profit of 1 rupee 54 Paisa (1.54 Rs) and 85 Paisa (0.85 Rs) only in groups.

**Table 5**: Profitability of cardamom farming in the study area

| Variables | Overall | Group | Cooperative | T value |
|---|---|---|---|---|
| **B/C Ratio per ropani** | 2.19 | 1.85 | 2.54 | -3.88*** |
| **Average income per ropani** | 11043.20 | 9451.551 | 12634.86 | -3.01*** |
| **Average (cost/ropani )** | 5031.49 | 5102.34 | 4960.65 | -2.85*** |
| **Productivity (ton/ha)** | 0.33 | 0.31 | 0.36 | -1.45 |
| **Net profit/ropani** | 6011.00 | 4349.20 | 7674.20 | -2.91*** |

** And *** indicate 5% and 1% level of significance.

Average cost incurred in production of cardamom in one ropani for group and cooperative farmers was Rs 5102.34 and Rs 4960.65 respectively The Average cost per ropani and average income per ropani of members of group and cooperatives were significantly different at a 1% level of significance. The average cost for the cooperative farmers was higher than the group farmers because they were cultivating the cardamom with better management practices. The farmers belonging to the cooperative has a high level of income and profit than the farmers belonging to a group because of better management practices and use of improved driers. The average income and cost per ropani were significant at a 1% level so the Net profit/ropani was also significant at a 1% level farmers of the group were getting about 4500 Rs Net profit/ropani while the farmers who were engaged in cooperative were getting about 7500 Rs Net profit/ropani.

**Production function**

The R square value 94.5% for the group, 88% for cooperative member farmer indicates that 94.5% of the variation in income of large cardamom was explained by the independent variable like sampling cost, labor cost, fertilizer cost, and capital investment included in the model for the farmer who was a member of the group whereas it was 88% for the cooperative farmers.

**Table 6**: Production function comparison between the group and cooperative of cardamom in Bhojpur

| **Category** | **Group** | | | **Cooperative** | | |
|---|---|---|---|---|---|---|
| **Variables/ Ropani** | **Coefficient** | **Standard error** | **T value** | **Coefficient** | **Standard error** | **T value** |
| **Ln(Sampling cost)** | 0.07 | 0.24 | 0.24 | 0.12 | 0.09 | 1.14 |
| **Ln(Labor cost)** | 0.76*** | 0.25 | 0.25 | 0.51*** | 0.21 | 3.03 |
| **Ln (Fertilizer)** | 0.03 | 0.15 | 0.15 | 0.12 | 0.19 | .80 |
| **Ln(Capital)** | 0.13 | 0.11 | 0.11 | 0.28*** | 0.09 | 2.83 |
| **Constant** | | 0.11 | 0.11 | | 0.12 | 0.80 |
| **R square** | 0.945 | | | 0.880 | | |
| **Adjusted R** | 0.937 | | | 0.861 | | |
| **F value** | 107.92 | | | 45.73 | | |

*** indicates a 1% level of significance

labour and capital investment were statically significant at a 1% level of significance whereas the other two inputs samplings and fertilizer seemed to be non-significant for cooperative farmer.

Whereas for group farmers only the labour cost was highly significant at 1% level of significance and others factors remained non-significant.

**Allocative efficiency**

Resource use efficiency was calculated from the elasticities of Cobb-Douglas production function analysis. The adjustment in the MVPs for optimal resource use is shown in Table no. which indicated that for optimal allocation of resource expenditure on samplings, labor, fertilizer and capital investment were need to increase by 50.06%, 42.39%, 85.89% and 95.20% respectively for cooperative farmers.

**Table 7**: Estimation of allocative efficiency of large cardamom in Bhojpur district

| **Category** | | **Group** | | | | **Cooperative** | | |
|---|---|---|---|---|---|---|---|---|
| **Variables** | **Coefficient** | **MVP** | **R** | **D** | **Coefficient** | **MVP** | **R** | **D** |
| Sampling (RS/rop) | 0.07 | 0.81 | 0.81 | 22.08% | 0.13 | 2.00 | 2.00 | 50.06% |
| Labour (Rs/rop) | 0.76 | 1.75 | 1.75 | 43.02% | 0.51 | 1.73 | 1.73 | 42.39% |
| Fertilizer (Rs/rop) | 0.03 | 1.16 | 1.16 | 14.39% | 0.12 | 7.08 | 7.08 | 85.89% |
| Capital (Rs/rop) | 0.13 | 5.25 | 5.25 | 80.96% | 0.28 | 20.83 | 20.83 | 95.20% |

Whereas for the group farmers all of the resources were underused except sampling which was overused. The regression coefficient value 0.76 for group farmers indicates that a 100% increase in the cost of labour would lead to an increase in Gross return by 76%.

## 5.2 CONCLUSION

The study revealed that the majority of people were Janajati i.e. Rai/Limbu and the majority of respondents were literate. In the study area, most of the farmers were cultivating varieties like Ramsai, Golsai, and Dambarsai. In conclusion, the cardamom production in Bhojpur district can be more commercialize and production also increases by investing more capital on samplings, fertilizer, and labour. The farmer who was a member of the group overusing one resource i.e. sampling others were underused and underfunded. For the efficient use of the money on sampling farmers should maintain the scientific spacing and should install their own Nursery of cardamom. While comparing

group and cooperatives farmers' cooperative farmers were getting more profit from cardamom farming than group farmers. This was because the cooperative farmers were doing cardamom farming with better management practices and selling their product at a relatively high price than group farmers because of large scale production and availability of the market.

## References


(2019). *A review on status and profitability of large cardamom production in Nepal.* Agriculture and Forestry University, Chitwan. Nepal 1. International Journal of Financial, Accounting, and Management (IJFAM).

Agriculture knowledge center(AKC) Bhojpur . (2020).

Bhishma Raj Dahal, S. R. (2019). Production economics and determints of potato production of Nuwakot district of Nepal. *International Journal of Applied Science and Biotechnology.7(1)*, 62-68.

Bhishma Raj Dahal, S. R. (2019). *Resource Use Efficiency and Profitability of Maize Farming in Sindhuli, Nepal:.* International Journal of Applied Sciences and Biotechnology.

Bibek Acharya, S. C. (2014). *RESOURCE USE EFFICIENCY OF COFFEE PRODUCTION IN PALPA DISTRICT, NEPAL.* chitwan Nepal: International Journal of Social Science and Humanities Research.

GoN. (2076). *Krishi Dairy*. Lalitpur, Nepal: Government of Nepal, Ministry of Agriculture, Land Management and Co-operatives, Agriculture Information and Communication Center (AICC).

International Trade Centre. (2017). *NEPAL NATIONAL SECTOR EXPORT STRATEGY LARGE CARDAMOM 2017-2022.* Geneva, Switzerland: The International Trade Centre ( ITC ).

MoALD. (2076). *Cardamom production.* Kathmandu.

(2017- 2021). *National sector export strategy Large Cardamom.* Government of nepal.

sharma, N. B. (2018). *Marketing and Socioeconomics Aspects of Large Cardamom Production in Tehrathum, Nepal.* Institute of Agriculture and Animal Science (IAAS),. Journal of Nepal Agricultural Research Council.

Shrestha et al. (2018). Large Cardamom In Nepal: Production practice and economics, Processing and Marketing. *Nepal Agricultural Research Council, National Commercial Agriculture Research Program,*.

Shrestha, K. P. (2018). *Profitability of large cardamom enterprise in Nepal?: Evidence from financial analysis.* Nepal Agricultural Research Council (NARC),. Journal of Agriculture and Natural Resources.

T, B. H. ((2008, November 20).). *Cobb-Douglas Production function.*

Z, Y. (2011). *Analysis of agricultural input-output based on Cobb-Douglas production function in Hebei Province, .* North china.: African Journal of Agricultural Research.