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RESOURCE USE EFFICIENCY OF COFFEE PRODUCTION IN PALPA DISTRICT, NEPAL

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Abstract: **This survey was conducted to assess the profitability and resource use efficiency of coffee production in Palpa district in 2013. The survey was conducted in Barangdi, Boughapokharathok, Madanpokhara and Khaseauli. A house holds survey of 110 coffee growers which includes 30 households each from first three VDCs and 20 from Khaseauli. Face to face interview, direct observation, FGD was conducted to collect primary data and other sources for secondary data collection and was analyzed by using SPSS and Microsoft Excel. Cobb-Douglas production function analysis was done and return to scale and resource use efficiency was estimated. Cobb-Douglas production function analysis showed that labour cost, expenses on organic manures and fertilizers and other associate costs contributed significantly to gross income of coffee at 1 % level of significance. The return to scale was found 1.09 and the resources used in the coffee production were all underutilized and should adjust the labour by 42.51% , manure and fertilizers by 66.15% and other costs by 71.39%. It shows that the resources used in coffee production were underutilized.**

Keywords: **Coffee, Cobb-Douglas Production function, Resource use efficiency.**

I. INTRODUCTION

Coffee is a high value low volume cash crop. This crop is economically more (nearly three times) profitable in the present context as compared to cash crops and 5 times than other cereal crops (Bajracharya, 2003; Dhakal, 2004 and Banjara, 2014). Some Districts like Gulmi, Palpa, Argakhanchi, Lalitpur, Tanahu, Kavre, Sindhupalchowk, Lamjung, Kaski, Gorkha, Syangja, Parbat, Baglung are successfully growing and producing Coffee beans and is increasing gradually (NTCDB, 2014). Among the various cash crops for commercialization, coffee is emerging as a likely agro-enterprise with great potential to provide farm employment and income generation opportunities in the mid hills of Nepal (CoPP, 2007).

Coffee is one of the important beverages in the world. Coffee which falls under Rubiaceae family and genus *Coffea*, has two major species *C. arabica* and *C. robusta* and one minor species *C. liberica*. As the climate and soil in the mid and high hills of Nepal are found to be very suitable for Arabica coffee, the coffee planted in Nepal is all *Arabica* (Giri, 2006). Coffee is high value cash generating crop for hill farmers of Nepal (Khanal, 2003).

Coffee being a new crop in Nepal, coffee production and the technologies are still in a rudimentary stage. Coffee farming has been started since five decades but it has not been able to contribute in the economy of the farmers' as expected. Considering its potential for poverty reduction of rural hill people, both government and non-government organizations have initiated research and development works on coffee (Shrestha et al., 2008).

This research survey was conducted to assess the production function and resource use efficiency of coffee production in Palpa district.

II. MATERIALS AND METHODS

A. Study area and sample size

Barangdi, Boughapokharathok, Madanpokhara and Khaseauli VDCs of Palpa were purposively selected as the study site. 30 from each first three VDCs and 20 from Khaseauli, altogether 110 coffee growers were selected. The field survey was conducted in September 2013. Face to face interview was conducted to fill up the semi structured interview schedule. Focus group discussions were conducted and key informant survey was carried out and secondary data were collected from different sources. The final analysis was done with the help of computer software Statistical Package for Social Science (SPSS), Microsoft Excel and STATA V.12.

B. Analysis of contribution of different factors to gross income of coffee

The following form of Cobb- Douglas production function was used to determine the contribution of different factors on production and to estimate the efficiency of the variable factors of production of coffee.

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

Where,

Y= Gross Income (Rs./Ropani)

X_1= Labor cost (Rs./Ropani)

X_2= Expenditure on nutrients (Rs./Ropani)

X_3= other expenses (Rs./Ropani)

u = Random disturbance term

$b_1 \ldots b_4$ are the coefficient to be estimated.

The Cobb- Douglas production function in the form expressed above was linearised in to a logarithmic function with a view to getting a form amenable to practical purposes as expresses below.

$$\ln Y = \ln a + b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + u$$

Where,

ln= Natural logarithm

a= constant

u= Error term

For the calculation of return to scale from coffee, Cobb-Douglas production function was used and calculated using formula;

$$RTS = \sum b_i$$

Where, $b_{i\,=}$ regression coefficient of i^{th} variables.

The sum of b_i from the Cobb-Douglas production function indicates the nature of return to scale.

Return to Scale decision rule:

RTS<1: Decreasing return to scale,

RTS=1: Constant return to scale,

RTS>1: Increasing return to scale.

TABLE.1. DESCRIPTIONS OF THE VARIABLES USED IN THE COBB-DOUGLAS PRODUCTION FUNCTION ANALYSIS

Variables	Unit	Description
Gross income from coffee(Y)	Rs./Ropani	It indicates the total income from fresh cherry of coffee in Rs.
Cost on labour (X_1)	Rs./Ropani	This includes the total cost on labour used in the coffee production process in Rs.
Expenditure on nutrients (X_2)	Rs./Ropani	It indicates the expenditure on nutrients including FYM, organic manure and other fertilizers.
Other expenses(X_3)	Rs./Ropani	It includes the expenses on plant protection chemicals, post-harvest chemicals, processing in early stage, irrigation cost and other cost.

C. Resource use efficiency

The efficiency of resource use in production of coffees was determined by the ratio of Marginal Value Product (MVP) to Marginal Factor Cost (MFC) of variable inputs based on the estimated regression coefficients. The coefficients from Cobb-Douglas production are used in the resource use efficiency measurement (Manjunath et.al, 2013). Following Rahman and Lawal (2003) and Manjunath et.al (2013) efficiency of resource use was calculated using formula;

$$r = \mathrm{MVP}/\mathrm{MFC}$$

Where,

r= Efficiency ratio

MVP= Marginal value product of a variable input,

MFC= Marginal factor cost (Price per unit input).

The value of MVP was estimated using the regression coefficient of each input and the price of the output.

MVP= MPP $x_i \times$ Py (Unit price of output)

But,

$$\mathrm{MPPx_i} = \frac{d\overline{y}}{d\overline{x_i}}$$

$$b_i = \left(Y/\overline{x}_i\right)$$

Where; b_i= Estimated regression coefficient of input X_i

$\bar{y}$= Geometric mean value of output

$\overline{x}_i$= Geometric mean value of input being considered

The prevailing market price of input was used as the Marginal Factor Cost (MFC).

MFC= Px_i Where, Px_i= Unit price of input x_i.

The decision rule for the efficiency analysis was as;

r=1; Efficient use of a resource

r>1; Underutilization of a resource

r<1; Overutilization of a resource

Again the relative percentage change in MVP of each resource required so as to obtain optimal resource allocation i.e r=1 or MVP= MFC was estimated using the equation below;

$$D = \left(\frac{MFC}{MVP}\right) * 100$$

$$\text{or}, D = (1 - r^{-1}) * 100$$

Where, D = absolute value of percentage change in MVP of each resource (Mijindadi, 1980; Manjunath *et al*, 2013) and r= efficiency ratio

III. RESULTS AND DISCUSSION

A. Socio-demographic characteristics

TABLE 2 revealed that the male population were higher in the sampled household, male headed household were in majority(77.33 percent) with nuclear family of about 56 percent and the economically active family population was higher(60.37 percent) and the major occupation of the economically active population was agriculture (41.54 percent) in the sampled households. About 73 percent respondents were involved in group and majority of the growers have received training on coffee production.

TABLE.2. SOCIO-DEMOGRAPHIC CHARACTERISTICS OF THE SAMPLED HOUSEHOLD

Characteristics	Frequency
Population distribution of sampled household	
Male	416(51.61)
Female	390(48.39)
Sex of household head	
Male	85(77.3)
Female	25(22.7)
Family Type	
Nuclear	62(56.40)
Joint	48(43.60)
Age distribution of sampled population	
≤15 years	211(26.05)
16-59 years	489(60.37)
≥60 years	110(13.58)
Major occupation of economically active members	
Agriculture	204(41.54)
Daily wage	3(0.61)
Domestic service	79(16.08)
Service abroad	69(14.05)
Student	105(21.38)
Business	31(6.31)
Member in group	
Involvement in Group	80(72.73)
No involvement in group	30(27.27)
Training on coffee	
Received training related to coffee	93(84.55)
Training not received	17(15.45)

Figures in parenthesis indicate percentage. *Source:* Field survey, 2013

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B .Factors contributing to total revenue from coffee

The coefficient of multiple determinations (R^2) of the model was 0.727. R^2 value indicates that 73 percent of the variation in gross income from coffee was explained by the independent variables which were included in the model.

The F value of the equation was 94.24 which is highly significant at 1percent level of significance indicating that the variation of gross income mainly depends on the explanatory variable included in the model. The estimated coefficient and related statistics of Cobb-Douglas production function were presented in the TABLE 3.

TABLE.3. ESTIMATED VALUES OF COEFFICIENTS AND THEIR RELATED STATISTICS OF COBB-DOUGLAS PRODUCTION FUNCTION OF COFFEE PRODUCTION IN THE STUDY AREA (2013)

Explanatory variables	Coefficient	Standard error	t-value	Sig.level
Constant	1.09	0.508	2.00	0.048
Labour cost (X_1)	0.635***	0.072	8.76	0.001
Expense on fertilizers and manure (X_2)	0.281***	0.045	6.16	0.001
Other expenses (X_3)	0.167***	0.036	4.63	0.001

*** significant at 1 percent level

Dependent Variable: log value of gross income from coffee

R^2 = 0.727, Adjusted R^2 = 0.719, F-value=94.24, return to scale=1.09

It was clear from the table that the coefficient of labour cost, expenses on fertilizers and manure and other associated costs were positive and significant also. The value indicates that keeping all factors constant 1 percentage increase in the labour cost will increase the gross income by 0.63 percent, which is significant at 1 percent level. The value indicates that the one percent extra expense on the manures and fertilizers, other things remaining constant increase the gross income by 0.28 percent. The coefficient indicates that the one percent more expense on these items will add positively 0.17 percent to the gross income which is also significant at the 1 percent level of confidence.

Similar case was found by Pandit (2008), that factor affecting the coffee production in Palpa was significant for labour at 1 percent level. Return to scale was found 1.09 from the analysis, which shows the coffee production was profitable in the area, similar case was found by Pandit (2008), as the return to scale in coffee production was 1.05 in Palpa district.

C. Resource use efficiency

Resource use efficiency was calculated from the elasticities of Cobb-Douglas production function analysis. TABLE 4 estimates the resource use level and utilization of the inputs used in the coffee production in Palpa district.

TABLE.4. ESTIMATED RESOURCE USE EFFICIENCY AND REQUIRED ADJUSTMENT IN MARGINAL VALUE PRODUCT (MVP), 2013

Expenditure (Rs/Ropani)	GM	Coefficient	MVP	MFC	r	Efficiency	D
Labour	3140.22	0.66	1.74	1.00	1.74	Under utilized	42.51
Organic manure	644.35	0.23	2.95	1.00	2.95	Under utilized	66.15
Others	426.20	0.18	3.50	1.00	3.50	Under utilized	71.39

TABLE 4, revealed that, in coffee production for optimum allocation of human labor, expenditure on FYM and organic manures and other inputs such as irrigation, plant protection materials are required to increase by 42.51 per cent, 66.15 per cent, 71.39 per cent as all the resources were underutilized in the coffee production.

IV. CONCLUSION

Coffee is the newer crop and there was less management of coffee plants and productivity per plant was found also low. Labour cost, expenses on FYM and organic manure and other expenses contribute significantly on the gross income of coffee. The coffee business was profitable as shown by the return to scale analysis. The resources used in the coffee production were found underutilised and proper utilisation of resources is necessary. It is necessary to promote the resources used in the coffee production for the better production and better revenue.

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