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RESEARCH ARTICLE

A RESOURCE USE EFFICIENCY OF ORTHODOX TEA IN ILLAM DISTRICT OF NEPAL

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ABSTRACT

Despite of the high rate of the orthodox tea, the net margin is still below the satisfactory level. Thus, the present research was conducted to estimate the cost and production efficiency of orthodox tea in Ilam district of Nepal. A total of 160 samples were collected, 80 each from organic and conventional tea growing area of Deumai rural municipality, Ilam municipality and two wards of Suryodaya municipality. Similarly, 4 tea processing factories and 5 local traders were selected purposely. The B:C ratio of conventional orthodox tea farming (2.76) was significantly higher organic orthodox tea production (2.07). With 1 percent increase in fertilizer and manure cost would significantly decrease ($p<0.05$) the revenue from orthodox tea by 0.07 percent keeping another factor constant. Similarly, organic orthodox tea over conventional orthodox tea farming, the revenue will significantly decrease ($p<0.01$) by 47 percent other factors remaining constant the result indicate that with respect to fertilizer and labor it was found that increase in fertilizer and manure cost would decrease the revenue from orthodox tea.

KEYWORDS

Economic analysis, Production efficiency, B: C Ratio, Nepalese tea.

1. INTRODUCTION

Tea (*Camellia sinensis*) is the manufactured drink which most consumed in the world. China is the largest tea producing country with an output of 2.4 million tons, accounting for more than 35 percent of the world total, while production in India, the second largest producer, is 1.3 million tons in 2018. Output in the two largest exporting countries is 330000 tons in Kenya and 309174 tons in Sri Lanka.

Production in India is 260000 tons, production in other major producing countries like Kenya is 245300tons; Indonesia is 182700 tons; Bangladesh is 76500 tons; Uganda is 58300 tons; Malawi is 46500 tons; Tanzania is 32400 tons; and Rwanda is 25200 tons. Other production in African countries like Burundi is 8800 tons; Zimbabwe is 8500 tons; and South Africa is 2500 tons (NTCDB, 2017).

The production of orthodox tea in Ilam, Panchthar, Dhankuta and Terathum districts accounted for 96.38 percent of total production of Orthodox tea in the country in 2017/18. By type of farming, small farmers accounted for 59.52 percent of total area under cultivation and 54.37 percent of total tea production of these districts. The rest is accounted for by the gardens or estates. There is a wide variation in the number of farmers involved and the area of tea production, across these four districts. Ilam is the leading district with 6,995 small farmers, 7965 ha of land under tea, and 4884.8 thousand kg of production.

Next to Ilam is Panchthar which has 1140 farmers, 1339 ha of land under tea and 503033 kg of production. Dhankuta is in the third position and Terhathum grows the least (NTCDB, 2015). Similarly, Nepal's yield is only 71 percent of the other global tea industry leader-Kenya (Subedi, 2000).

Currently Nepal's tea yield per ha is 800 -1500 kg/ha made tea. Production potentiality of tea is 5000kg/ha made tea. Thus, there is still a lot of room for the improvement of productivity in yield as well as in quality.

1.1 Objectives

a) To assess the cost, return and profitability of orthodox tea production,
b) To gauge the productivity and efficiency of resource use in the production of orthodox tea,

2. MATERIALS AND METHODS

This chapter includes different methodological framework used in the research conducted in Ilam district of central Nepal during January and February, 2018.

2.1 Selection of the study area

Ilam district of eastern Nepal was purposively selected as a research site which ranks first position in terms of tea production in Nepal (NTCDB, 2017). Figure 2 illustrates the study area of map of Nepal.

Four Palikas of eastern part of Ilam district i.e. Ilam Municipality, Deumai Rural Municipality, Suryadaya-8 and Suryadaya-11 were purposively selected for the study due to (i) potentiality of producing orthodox tea and (ii) easily accessible. The site for the Ilam district was in the range of 26º 54” North and 87º56” East.

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2.2 Conceptual framework

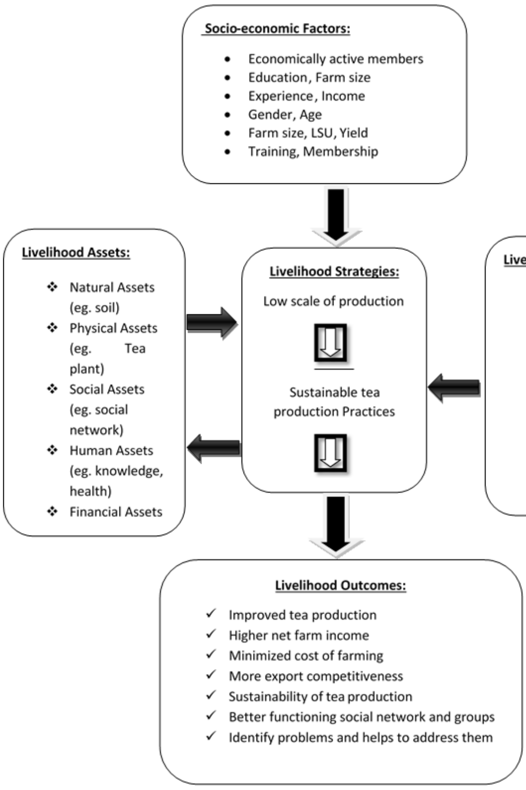

Figure 1: The conceptual framework of the study

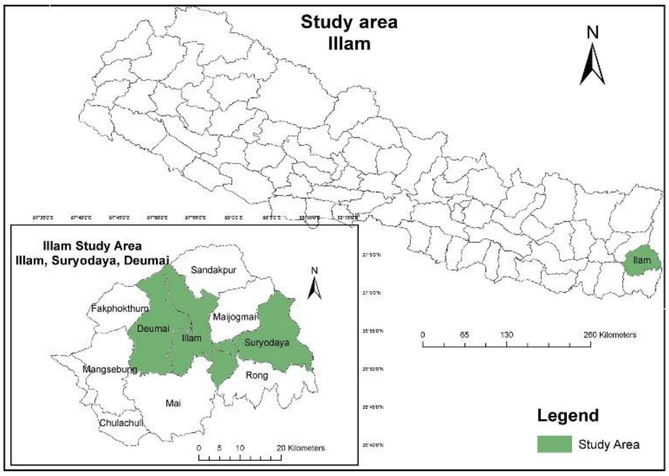

Figure 2: Map of Nepal showing study area (Source: https://www.google.com/url)

2.3 Designing questionnaire and checklist

A semi-structure questionnaire was developed using KOBO Toolbox and used that deals with issues specific to the resource use efficiency. An effort was incorporated into the questionnaires questions pertaining to key issues identified during the interaction with the project officials. In addition, checklists was developed and used for producers, traders, and other stakeholders. In most cases though, interviewees were conducted to rate the perceived quality in a particular relationship by providing a verbal assessment.

2.4 Sampling method, sampling frame and sample size

Respondents were selected by using multi-stage sampling procedure based on purposive random sampling. As mentioned earlier, Ilam was purposively selected as it is the major orthodox tea producing district of Nepal. And then 4 Palikas of Ilam were also purposively selected as presented in **Error! Reference source not found.** based on area coverage, production, number of farmers and access to road facilities. Sampling frame was prepared in district after discussion with key informants from the district.

2.5 Cost of production

2.5.1 Cost of organic orthodox tea production

From the empirical study in Ilam, depreciation cost of tea bush and other farm equipment used in production was also beyond the scope of this study and hence not included in cost calculation of orthodox tea production. The irrigation cost is also not included because whole of the district depends upon natural rainfall for irrigation. Therefore, for analysing the cost of orthodox tea production, the study considered only variable costs. The variable cost included were cost of labour (for harvesting and intercultural operation), cost of manure, cost of plant protection, operation cost of irrigation and other costs, if included. Total variable cost was calculated by summing all the variable cost items as in the

$Cland$ = Opportunity cost of land (Rs)
$C_{harvesting}$ = Cost of labour used in harvesting (Rs).

$$Cost\ of\ orthodox\ tea\ production(Rs) = C_{land} + C_{harvesting} + C_{plucking} + C_{fertilizer} + C_{protection} + C_{weeding} + C_{other}$$

C_{land} = Opportunity cost of land (Rs)
$C_{harvesting}$ = Cost of labour used in harvesting (Rs)
$C_{plucking}$ = Cost of labour used in plucking (Rs)
$C_{fertilizer}$ = Cost of FYM/organic and inorganic fertilizer used (Rs)
$C_{protection}$ = Expenditure on plant protection materials (Rs)
$C_{weeding}$ = Cost of labour and chemicals used in weeding (Rs)
C_{other} = Other cost of cultivation (Rs)

2.6 Gross margin analysis

A gross margin is a simple and quick method to analyse the performance of a farm business. It is calculated by deducting the total variable cost gross return as shown in equation.

$$Gross\ margin\ (GM) = Gross\ return\ (GR) - Total\ variable\ cost\ (TVC)$$

Where,
$Gross\ return\ (GR)$
$= Sales\ quantity\ of\ tea\ product\ X\ Price\ of\ tea\ product$

2.7 Profit/loss analysis

Profit/loss is the difference between the gross return and total variable cost from the orthodox tea production.

Profit/loss was calculated as:
Profit/loss= Gross return- total variable cost
Where, gross return was calculated as,
Gross return= Price of orthodox tea leaves * Total amount of orthodox tea leaves produced
Total variable cost= Summation of cost incurred for all variable inputs
Profit/loss=+ve indicates profit
=-ve indicates loss

2.8 Benefit cost analysis

The purpose to do benefit cost analysis is to find the investment made on the resources will yield a reasonable return to the resources engaged. Benefit Cost Ratio (BCR) is assumed as a quick and one of the easiest method for evaluating the economic performance of any farm (Dhakal, et al., 2015). BCR compares the benefit per unit of cost. Thus, BCR was calculated by using the following formula:

$B/C\ ratio = Gross\ return(NRs.)/\ Total\ Cost\ (NRs.)$
If B/C ratio is greater than 1, the farm business is considered to be profitable.
If B/C ratio is less than 1, the farm business is considered to be in loss.
If B/C ratio is equal to 1, the farm business is recovering cost of production.

2.9 Estimation of efficiency ratios using Cobb-Douglas production function

The efficiency of resources use in orthodox tea production was estimated using Cobb-Douglas production function. The ratio of Marginal Value Product (MVP) to Marginal Factor Cost (MFC) was computed based on the regression coefficients of each input. The method to estimate overused to underused resources were based on MVP value.

Cobb-Douglas production function was;
$Y= aX_1^{b1}X_2^{b2}X_3^{b3}$
The dependent and explanatory variables were transformed to natural logarithm

$lnY= lna+b_1lnX^1+b_2lnX_2+b_3lnX_3$
Where,
Y= Total income from orthodox tea production per ropani
X_1= Total fertilizer and manure cost
X_2= Total labour cost
X_3= Total pesticide cost
A=Intercept
Ln=Natural logarithm
The efficiency ratio was computed using the formula
r=MVP/MFC
Where,
r= Efficiency ratio
MVP= Marginal Value Product
MFC= Marginal Factor Cost
The MVP was estimated using the formula:

$$MVP_i = b_i \times \frac{y}{X_i}$$

Where,
b_i=Estimated regression coefficients
Y= Geometric mean of total income from orthodox tea production
X_i=Geometric mean of i^{th} inputs
Decision criteria:
r =1 indicate the efficient use of the resource
r > 1 indicate underused of resource
r < 1 indicate overused of the resource
The relative percentage change in MVP of each resource was estimated as follow:

D = (1-MFC/MVP)*100
Or, D = (1-1/r)*100

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

3. RESULTS AND DISCUSSION

3.1 Socio- economic and demographic information of household

Table 1: Socio- economic and demographic information of household

Variables	Overall	Organic	Conventional	t-value
Age	41.8	41.18	42.43	0.97
Years of education	7.69	7.6	7.79	-0.35
Gender				
Male	2.53	2.8	2.3	3.14***
Female	2.59	2.9	2.3	3.96***
Economically active population	3.22	3.6	2.9	4.23***
Economically dependent population	1.9	2	1.8	2.77
Area of own land (ropani/HH)	27.11	30.8	23.5	1.14
Area of rented land (ropani/HH)	0.59	0	1.19	-2.007
Area of tea land (ropani/HH)	13.78	12.8	14.8	-0.44
Years of experience	15.86	14.34	17.39	-2.36 **

The overall area of own land in ropani per household was 27.11 and of rented land ropani and area of rented land was 0.59 ropani and area under tea land was 13.78 ropani. The overall average years of experience was 15.86 and 17.39 and 14.34 years for the conventional and organic orthodox tea areas respectively. The overall mean age of the study area was 41.8 with the mean age of 42.43 for conventional and 41.18 for organic orthodox tea farming. The overall years of education was 7.69 years of schooling. The male and female overall per household average was 2.53 and 2.59 and same average for both male and female i.e. 2.3 in conventional orthodox tea area and 2.8 and 2.9 male and female respectively in organic orthodox tea growing area. Both of the gender were highly significant in the study.

3.2 Cost of cultivation

The overall plucking, weeding and pruning and training cost was NRs. 40514, NRs. 8001 and NRs. 11226 respectively whereas NRs. 42379, NRs. 8527.5 and NRs. 11003 for organic orthodox tea and NRs. 38650, NRs. 7475 and NRs. 11450 for conventional orthodox tea farming respectively. The mean difference between organic and conventional orthodox tea cost of cultivation was NRs. 3729, NRs. 1052.5, and NRs. 447 for plucking, weeding and training and pruning. There was no significant difference between these three costs.

Table 2: Cost of orthodox tea production by type of farming

Variables	Overall	Organic	Conventional	Mean difference	t-value
FYM labor cost	2317	2786.5	1847.5	939	1.77
FYM other expenditure and	9308	11226	7390	3836	1.81
Urea labor cost	1026	0	19776.9	-19776.9	-9.65***
Urea other expenditure	9233	0	17791.9	-17791.9	-9.65***
Potash labor cost	66	0	132.5	-132.5	-2.98***
Potash other expenditure	596	0	1192.5	-1192.5	-2.98***
Inorganic pesticide labor cost	483	0	966.3	-966.3	-6.74***
Inorganic pesticide other expenditure	3860	0	7720	-7720	-9.72***
Plucking cost	40514	42379	38650	3729	0.16
Weeding cost	8001	8527.5	7475	1052.5	0.32
Pruning and training cost	11226	11003	11450	447	-0.11
Micronutrients labor cost	178	0	342.5	-342.5	-7.62***
Micronutrients other expenditure	1598	0	3082.5	-3082.5	-7.62***

The result revealed that the average total cost of orthodox tea production of organic tea was 5967.769 NRs. per ropani and average total cost of orthodox tea production of conventional tea was 7138.776 NRs. per ropani. The result is quite lower to the similar study conducted in Ilam Nepal which found the average cost of orthodox tea cultivation per ropani was NRs. 8236.315 (Tiwari, 2015).

3.3 Benefit cost ratio analysis

Table 3: Gross margin and benefit cost analysis by type of farming (2018)

Type of farming	Total cost per ropani (NRs.)	Total revenue per ropani (NRs.)	Gross margin (NRs./ropani)	B:C Ratio
Organic	5967.76	9716.59	3748.82	2.07
Conventional	7138.77	14023.06	6884.28	2.76

The return of orthodox tea was calculated and total return form orthodox tea was obtained from the orthodox tea cultivation from two clusters i.e. organic (Deumai rural municipality and Ilam municipality) and conventional (Suryodaya municipality 8 and 11). The profitability from orthodox tea production was calculated by deducting the grand total cost from return. The return and cost from orthodox tea production was NRs. 9716.595 and NRs.5967.769 and NRs. 14023.06 and NRs. 7138.776 for organic and conventional orthodox tea per ropani in the study area. Average total cost and average total revenue per household was calculated for profitability analysis of different farm categories. The benefit cost ratio of the study area was 2.072 and 2.760 for organic and conventional orthodox tea respectively.

The return from orthodox tea production was NRs. 9716.595.13 and NRs. 14023 and profitability was NRs. 3748.826 and NRs. 6884.284 from organic and conventional respectively in the study area. In case of Orthodox tea cultivation of 12 years age, annual average gross return from one ropani area was NRs. 9465 (DAARD, 2001). The results was lower than our study result. A benefit-cost ratio (BCR) is an indicator, used in the find the investment made on the resources will yield a reasonable return to the resources engaged (Sapkota et al., 2018).

3.4 Estimation of efficiency ratios using Cobb-Douglas production function

In order to determine the effect of various inputs (in NRs.) on the total gross income (NRs.) from orthodox tea production, the Cobb-Douglas production function was estimated. The cobb-Douglas production function was transformed into linear form by using the natural logarithm of both dependent and independent variables. After transformation, the Cobb-Douglas production function was estimated using Ordinary Least Square (OLS) method. The obtained coefficients represent the elasticity of individual inputs. The elasticities associated with all inputs were less than one. So, for inputs less than one, a unit increase in the respective input would result in less than a unit increase in orthodox tea income. The overall F value was 27.77 and it was statistically highly significant at 1 percent level of significance. This indicates that the explanatory variable included in the model were important for the explanation of variation in formal discipline of cost-benefit analysis that attempts to summarize the overall value of money of a project or proposal. The major purpose is to the orthodox tea income. The R^2 value was 0.36 which implies that about 36 percent of variation on orthodox tea income was explained by the explanatory variable. So, the model was more or less satisfactory.

The multi-collinearity was checked by using VIF and there was no problem. There were 3 variables significant whether at 1 percent or 10 percent level. With respect to fertilizer and manure, it was found that 1 percent increase in fertilizer and manure cost would decrease the income from orthodox tea by 0.048 percent keeping other factor constant and it was found highly significant at 10 percent level of significance. Similarly, 1 percent increase in cost of labor would increase the return form orthodox tea by 0.145 percent other factors remaining constant and is statistically highly significant at 1 percent level of significance. Also, the 1 percent increase in the cost of pesticide would increases the return form orthodox tea by 0.032 percent and also significant at 1 percent level of significance. The return to scale was calculated by summing up the elasticity of respective individual inputs which was estimated using Cobb-Douglas production function and found 0.13 which implies that there was decreasing return to scale from orthodox tea production.

Table 4: Estimates of measures of allocative efficiency of inputs used in orthodox tea production

Variable	Coefficient	Standard error	t-value	P>|t|	MVP	MFC	r	D
Log fertilizer and manure cost	-0.048*	0.027	-1.79	0.076	-0.523	1	-0.523	291.11
Log labor cost	0.145***	0.032	4.50	0.000	0.379	1	0.379	146.30
Log pesticide cost	0.0.032***	0.004	7.85	0.000	585.38	1	585.38	99.83
Constant	8.501***	0.4621	27.40	0.000				
Number of observation = 152								
F(3, 156) = 27.77***								
Prob > F = 0.000								
R-squared = 0.36								
adjusted R squared = 0.34								
Root MSE = 0.27189								
Return to scale = 0.11								

Notes: ***, * indicate significant at 1% and 10% levels, respectively.

The coefficients of cost of fertilizer and manure, labor and pesticide were found less than one. This indicated that increase in 1% of each input would increase the returns of orthodox tea production by less than 1% except fertilizer and manure, increase in 1% of fertilizer and manure cost would decrease the return from orthodox tea production. It was found that 1 percent increase in fertilizer and manure cost would decrease the income from orthodox tea by 0.048 percent keeping another factor constant. The result was quite different to the study conducted by who found that1 percent increase in fertilizer and manure cost would increase the income from orthodox tea by 0.045 percent keeping another factor constant (Hong and Yabe, 2015). Similarly, 1 percent increase in cost of labor would increase the return form orthodox tea by 0.145 percent other factors remaining constant and is statistically highly significant at 1 percent level of significance. This result was greater than the results which was 0.068 other factors remaining constant (Hong and Yabe, 2015). Also, the 1 percent increase in the cost of pesticide would increases the return form orthodox tea by 0.032 percent and also significant at 1 percent level of significance which was quite lower to the result which revealed 0.123 percent (Hong and Yabe, 2015).

3.5 Resource Productivity

In order to determine the productivity of various inputs (in NRs.) on the total revenue (NRs.) from orthodox tea production, the Cobb-Douglas production function was estimated. The Cobb-Douglas production function was transformed into linear form by using the natural logarithm of both dependent and independent variables. After transformation, the cobb-Douglas production function was estimated using Ordinary Least Square (OLS) method. The obtained coefficients represent the elasticity of individual inputs. The elasticities associated with all inputs were less than one. So, for inputs less than one, a unit increase in the respective input would result in less than a unit increase in orthodox tea income. The overall F value was 31.32 and it was statistically highly significant at 1 percent level of significance. This indicates that the explanatory variable included in the model were important for the explanation of variation in the orthodox tea income. The R^2 value was 0.38 which implies that about 38 percent of variation on orthodox tea income was explained by the explanatory variable. So, the model was more or less satisfactory. The multi-collinearity was checked by using VIF and there was no problem.

With respect to fertilizer and manure, it was found that 1 percent increase in fertilizer and manure cost would decrease the revenue from orthodox tea by 0.07 percent keeping other factor constant and it was found significant at 5 percent level of significance. Similarly, 1 percent increase in cost of labor would increase the revenue form orthodox tea by 0.14 percent other factors remaining constant and is statistically highly significant at 1 percent level of significance. Similarly, if the farmer chooses organic orthodox tea farming over conventional orthodox tea farming, the revenue will decrease by 47 percent other factors remaining constant and it is highly significant at 1 percent level of significance.

Table 5: Resource productivity of inputs used in orthodox tea production (Revenue per ropani from tea in NRs. natural log)

Variables	Coefficient	Standard Error	t	P > |t|
Log LABOUR_COST	0.14***	0.31	4.63	0.000
Log FERTILIZER_COST	-0.07**	0.02	-2.52	0.013
FARMING#	-0.47***	0.05	-8.44	0.000
Constant	8.85***	0.31	28.26	0.000
Number of observations	=152			
F (3, 148)	=31.32***			
Prob > F	=0.000			
R-squared	=0.38			
Adj R-squared	=0.37			
Root MSE	=0.26			

Notes: ***, ** indicate significant at 1% and 5% levels, respectively.
#resembles dummy variable (1 if farmer grows organic orthodox tea; 0 for conventional farmer

4. Conclusion

This study concluded that the role of the tea cultivation in Nepal is growing steadily despite various problems they encounter. All most all the villagers of eastern part of Nepal and other region have tea plantation in this own land. With respect to fertilizer and labor it was found that increase in fertilizer and manure cost would decrease the revenue from orthodox tea. Similarly, increase in cost of labor would increase the revenue form orthodox tea and if the farmer chooses organic orthodox tea farming over conventional orthodox tea farming, the revenue will decrease. Further research assessing the efficiency on other areas of Ilam as well as other districts can be conducted to find the difference in efficiency level. This study encourages further to have study on the technical efficiency and certification side of orthodox tea production. Farmers are supposed to be economically efficient when they are technically and allocatively efficient. So, further research should consider measuring of all these three efficiencies (TE, AE and EE) which could help in accurate policy recommendation.

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