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RESEARCH ARTICLE

ECONOMICS OF PRODUCTION OF TURMERIC IN SURKHET DISTRICT OF NEPAL

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ABSTRACT

Turmeric (Curcuma longa) is a high value spice crop of high medicinal and economic concern in Nepal. The most important component found in turmeric which makes it valuable in the market is curcumin which is very helpful in the treatment of many diseases. For this study, proportionate sampling technique was taken to select a total of 120 sample farmers from the five study areas of surkhet district viz. Panchapuri municipality, Lekbesi municipality, Bheriganga municipality, Chaukune rural municipality and Barahataal rural municipality. The study showed that the BC ratio of turmeric production was 1.32 with the total production cost of NRs. 13083.18 and gross revenue of NRs. 17225.91. The low BC ratio was due to the high seed rhizome price which shares about 34.07% of total cost of production and low mechanization. The regression analysis of the obtained data showed that the input resources like human labor, bullock labor, FYM cost and miscellaneous costs are underutilized whereas the seed cost is over utilized. The coefficient of return to scale is 0.317709 which indicates the diminishing rate of return in turmeric production meaning if 10% of the input resource is increased, only 3.2% of production will be increased. Price of turmeric seed rhizomes have been increased by 62.07% in recent 5 years showing the high price variation in seed rhizomes in study area. Thus, to fight with various problems associated with turmeric production, government intervention, extensive trainings, and mechanization are strongly recommended.

KEYWORDS

Curcumin, BC ratio, Resource Productivity, Return to Scale

1. INTRODUCTION

Turmeric is a perennial herbaceous tuberous plant of the family Zingiberaceae. It is native to India and China, is also known as "golden spice of life," and is the most commonly used spice in the culinary arts all over the world. The word "turmeric" is derived from the French word "terre-mérite," meaning "merit of the earth" (Kadte et al., 2018). The most important component found in ginger, which makes it valuable in the market, is curcumin, which is very helpful in the treatment of many diseases. It is a well-known treatment in Ayurveda for a number of different respiratory conditions such as asthma, bronchial hyperactivity, and allergy, as well as liver disorders, anorexia, rheumatism, diabetic wounds, runny noses, coughs, and sinusitis (Araújo and Leon, 2001).

It contributes about 11% area and 15.07% production among these five highly valued spice crops, viz. Ginger, turmeric, chilli, garlic, and cardamom, in Nepal (MOALD, 2019). If we talk about the production of turmeric all around the globe, India ranks first, followed by China and Myanmar (Bishnoi et al., 2020). The global turmeric production is about 1.1 million metric tons per year, where India alone contributes to about 80% of total turmeric production and also 60% of total turmeric exports (TPCI, 2019). Other major producers and exporters are Myanmar, Indonesia, the Netherlands, the United Kingdom, Peru, Germany, China, France, and the United States (Chhetri, 2019). Fresh turmeric (Kapurkot haledo 1) has a 13.8% powder forming ability, and 92.8% of dry turmeric is converted into powder (Chhetri et al., 2020). It contains 4.89% curcumin and 6.65% aromatic oils (PMAMP, 2017).

Agriculture contributes to about 27.10% of total GDP and provides livelihood and employment to 65.6% of the total labor force in Nepal (AITC, 2019). Nepal is federally divided into seven provinces, and among them is the Karnali province, where our study area, Surkhet district, is situated. Birendranagar is the headquarter of surkhet district and the capital of Karnali Province. It is further divided into nine local level units: five municipalities and four village municipalities. The districts surrounding Surkhet are Salyan in the east, Doti and Achham in the west, Achham, Dailekh, and Jajarkot in the north, and Kailali and Bardiya in the south (PMAMP, 2017). The major agricultural crops of this district are ginger, turmeric, vegetables, mandarin, citrus, mango, litchi, banana, and cereals like rice, maize, wheat, millet, and barley, legumes like lentil, chickpea, gram, soyabean, etc., and mustard (PMAMP, 2017). The area occupied by turmeric in Nepal is 9795 ha, resulting in an annual production of 99907 metric tons with a productivity of 10.2 Mt/ ha (AITC, 2021) whereas in Surkhet, it is 331 ha and the production is 3499 MT with a productivity of 10.57 Mt/ ha (MOAD, 2020). It is one of the top turmeric producing districts in Nepal and also supplies turmeric to various parts of the country.

The turmeric cultivation over the past eight years in surkhet district with its area, production, and productivity is shown in the table below:

Table 1: Turmeric Cultivation Over the Past 8 Years

Year	Area	Production	Productivity	Source
2013/14	12	54	4.5	(MOAD, 2014)
2014/15	121	975	8.06	(MOAD, 2015)
2015/16	115	1035	9	(MOAD, 2016)
2016/17	120	1080	9	(MOAD, 2017)
2017/18	226	2047	9.06	(MOAD, 2018)
2018/19	241	2424	10.05	(MOALD, 2019)
2019/20	331	3499	10.57	(MOALD, 2020)
2020/21	230	2432	10.57	(MOALD, 2021)

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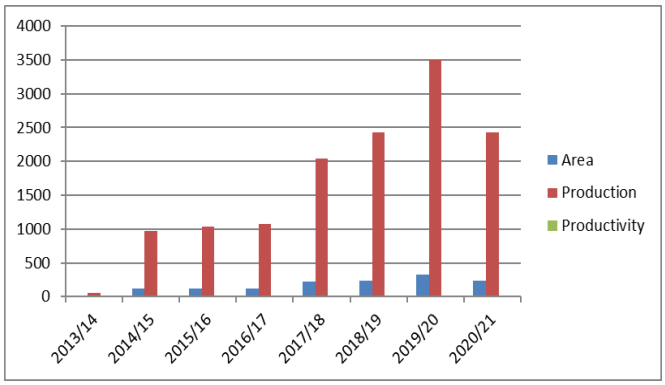

Figure 1: Trend analysis of turmeric production in Surkhet over a period of last 8 years

Surkhet is a district with high potential for turmeric production. However, due to the improper technical knowledge and insufficient supply of inputs during sowing as well as poor handling after the harvest, there is the lower yield of quality turmeric (Acharya et al., 2021). The overall scenario of production and consumption of turmeric is not in balanced condition. In fiscal year 2019, Nepal imported turmeric worth Rs. 225,393,948 and exported turmeric worth only Rs. 121,650 (MOAD, 2019). Moreover, the high price of seed rhizomes, lower and unstable market price of turmeric and turmeric products, high price fluctuation has caused the low benefit cost ratio of the turmeric producers in surkhet as well as in whole country.

So, the overall production processes are to be understood and the actions are to be taken to minimize the existing problems. The production of turmeric can be enhanced by optimum utilization of the available resources. Some of the input resources in the turmeric production are over utilized whereas some are underutilized. The income of the turmeric farmers and their living standard is low due to the low productivity of turmeric which is due to the insufficient amount of inputs like labor, low mechanization, lack of transportation and storage facility, lack of quality seed rhizomes. The migration of people for the foreign employment has also hindered the increment of turmeric production, area, and productivity.

The PMAMP zone office was established for the purpose of increasing turmeric cultivation area, and its productivity, but it has not been successful yet in its commanding areas of Surkhet due to above mentioned potential reasons. The main aim of this research is to find out the overall scenario of turmeric production, level of the exploitation of the inputs done in turmeric production and to identify the major problems associated with the production of this commodity in Surkhet. Therefore, this research will help the concerned authority deal with the existing problems and develop effective solutions to mitigate these constraints, thereby promoting turmeric production and commercialization.

2. METHODOLOGY

2.1 Site Selection

Surkhet district was selected for this study because it has a high potential of turmeric production due to presence of high productive land. Moreover, the climate here also favors turmeric cultivation. The total area under cultivation of turmeric in this district is 325 ha producing about 4897Mt of turmeric according to the recent data of 2017/18(MOALD, 2019). Within this district, five study areas were chosen among which 3 are municipalities viz. Panchapuri municipality, Lekbesi municipality and Bheriganga municipality and two were rural municipalities, viz. Chaukune and Barahataal.

Figure 1: Map of surkhet district (Source: Google chrome)

2.2 Sample Size, Sampling Technique and Sampling Procedures

The turmeric growing population was not distributed uniformly in all of the municipalities of surkhet district. Moreover, some municipalities had more number of turmeric farmers whereas some had lesser number of turmeric farmers. So depending on the number of farmers in respective municipality and rural municipality, the number of sample farmers was taken by proportionate sampling technique i.e. 10% of the total turmeric farmers registered in the zone office for the study. So a total of 120 farmers are selected as a sample and the farmers for the household survey were selected by simple random sampling technique.

2.3 Methods and Techniques for Data Collection

The primary data were collected through household surveys, Key Informant Interviews, and Focus Group Discussions, with the sample farmers through the questionnaire developed for the primary data purpose. Secondary data were gathered from journals, relevant articles, newspapers, zone office, MOAD, Krishi Diary (AITC), HVAP, Ministry of Agriculture, internet, etc. Production area, productivity, yield of different districts and trend analysis were carried out. Entering, coding, and analyzing of the gathered data from various primary and secondary sources were done by using SPSS and MS-Excel. For the analysis, both descriptive and analytical methods were used.

2.4 Cost of Production

The cost of production is the total amount of money spent on the various production processes by the farmers. It was calculated by adding total fixed cost and total variable cost i.e.

Total cost = Total fixed cost + Total variable cost

The total fixed cost and total variable cost were calculated by using the following formulae i.e.

Total fixed cost = $C_{land} + C_{depreciation} + C_{repair\ and\ maintenance}$

Where,

C_{land} = Land cost

$C_{depreciation}$ = Depreciation cost

$C_{repair\ and\ maintenance}$ = Repair and maintenance cost

And,

Total variable cost = Total cost of inputs + Total cost of labour

Where,

Input costs include the cost of seed, manure, packaging materials, transportation and communication and miscellaneous costs (NRs.).

Labour costs include costs of bullocks, field preparation, FYM placement and planting, mulch collection, weeding, spraying, irrigation, harvesting, cleaning, grading, sorting, packaging, marketing and transportation (NRs.).

2.5 Gross Return

It is the total amount of the revenue after the total quantity of the turmeric produce is sold. It was calculated by using the following formula

Gross return = Quantity (Kg) * Price per unit (NRs.)

2.6 Benefit Cost Ratio Analysis

Gross return of production of turmeric and total cost for production were used to analyze the B/C ratio. The formula used for calculating the B/C ratio is:

$$\text{B/C ratio} = \frac{\text{Discounted benefit}}{\text{Discounted cost}}$$

$$= \frac{\frac{\text{Total gross return}}{(1+r)^t}}{\frac{\text{Total cost}}{(1+r)^t}}$$

$$= \frac{\text{Total gross return}}{\text{Total cost}}$$

Where,

r = discounting rate

t = time period

Total gross return was calculated from the income of sold product (NRs.)

The total cost of production was calculated by summation of variable cost and fixed cost incurred in the production process (NRs.)

If B/C ratio>1, project is feasible

If B/C ratio<1, project is infeasible

If B/C ratio=1, neutral

2.7 Cobb Douglas Production Function

To estimate the contribution of different variable inputs on turmeric production, the general form of Cobb-Douglas production function was used which has the following formula.

$$Y = AX_1^{\alpha_1} X_2^{\alpha_2} X_3^{\alpha_3} X_4^{\alpha_4} X_5^{\alpha_5}$$

Where,

Y_t = Total Production of turmeric (quintal)

X_1 = Human labor in man days

X_2 = Bullock labor

X_3 = Cost of seed rhizome in rupees

X_4 = Cost of manures in rupees

X_5 = Miscellaneous cost

α_1 = Coefficient of regression for human labor

α_2 = Coefficient of regression bullock labor

α_3 = Coefficient of regression for cost seed rhizomes

α_4 = Coefficient of regression for cost of manures

α_5 = Coefficient of regression for miscellaneous costs

Above model can be expressed in log linear form as follows:

$$\ln Y_t = \ln A + \alpha_1 \ln X_1 + \alpha_2 \ln X_2 + \alpha_3 \ln X_3 + \alpha_4 \ln X_4 + \alpha_5 \ln X5 + u$$

Where,

ln = natural logarithm

A = constant

u = random disturbance.

2.8 Return to Scale Analysis

The term Return to scale refers to the change in output as input change by the same proportions. It was determined by summing up the regression coefficients of respective inputs from the Cobb Douglas Production Function (CDPF) regression analysis.

2.9 Problem Ranking

Production problems were ranked by five point scaling technique by using following formula:

$$= \Sigma S_i F_i / N \quad I_{imp}$$

Where,

I_{imp} = Index of importance

$\sum$ = Summation

S_i = Scale value

F_i = Frequency of importance

N = Total number of respondents

2.10 Price Stability and Price Variation

The difference in the price of same commodity in different time duration, different location and due to various factors is price variation. A very low rate of inflation or deflation of the price of a commodity or sustainability of price of a commodity over a period of time is called price stability. The price of turmeric per kg for recent 5 years were calculated and the price variation was observed from it.

3. Results and Discussion

3.1 Socio-Demographic Analysis

The participants in the household survey were aged between 21 and 75. Their average age was 45.56, and among them, 57.5% were male and 42.5% were female. Ethnicity patterns were categorized as Brahmin, Chhetri, Janajati, and Dalit. The analysis showed that 32.5% were Brahmin, 29.2% were Chhetri, 21.7% were Janajati, and 16.6% were Dalits. Similarly, the education level of the respondents was categorized into 7 categories, where results showed that 9.2% were illiterate, 38.3% could read and write only, 12.5% were at the primary level, 16.7% were at the lower secondary level, 12.5% were at the secondary level, 5.8% were at the intermediate level, and 5.0% were at the graduate level.

3.2 Family Member Migration

According to the data obtained in the survey study, 63.3% of the respondents had at least one of their members migrate to other countries for employment purposes, whereas 36.3% did not have any members migrate to other countries. This shows that the majority of the households have had family members migrate for foreign employment purposes, which has directly affected the production of turmeric in this district due to the labor unavailability in the production process.

3.3 Decision Making and Involvement in Trainings

Males dominate the decision making in the turmeric production process in 76.7% of the households, whereas females dominate the decision making in about 23.3% of the households. The data shows that only 35.8% of the turmeric growers have actually received the trainings related to the turmeric farming whereas majority i.e. 64.2% of the turmeric growers perform turmeric cultivation without the formal training related to the turmeric cultivation.

3.4 Livestock Category

Livestock are the major source of manure, FYM and compost which are the foundation for organic farming. Out of 120 respondents, each household has at least one livestock. The average population of the cattle, buffalo, goat, poultry and pig was 1.94, 1.99, 5.51, 9.03 and 1.23 respectively.

3.5 Area Under the Turmeric Cultivation

The mean and standard deviation of the area under the turmeric cultivation of sample respondents in surkhet were 3.17 ropani and 6.428. The maximum and minimum area under ta cultivation of turmeric by the farmers are 50 and 1 ropani respectively.

3.6 Cost of Production

The cost of production in turmeric cultivation includes both fixed and variable costs. Fixed costs include land rent, machinery depreciation, and repair and maintenance costs, whereas variable costs include input costs, labor costs, and other miscellaneous costs. The turmeric growers in the study area are mechanized in a negligible amount, and hence the cost of machinery is not included in the fixed cost. The input cost includes the cost of seeds and compost/FYM, whereas the labor cost includes the cost of land preparation, FYM placement and planting, mulch collection, intercultural operations, harvesting, postharvest activities and marketing, transportation, and miscellaneous. The turmeric growers in the study perform organic farming practices, and hence the cost of the chemical fertilizers, insecticides, and pesticides is neglected and not included in the input cost.

The cost of production of fresh turmeric was found to be Rs. 13083.18 per ropani. Among all costs, land rent accounts for 6.11%, input costs for 58.55%, and labor costs for 35.34%. Seed rhizome costs account for 34.07 percent of total costs, while manure and FYM costs account for 18.06 percent. However, the seed rhizome costs, according to a study are 50%, 31%, and 11.7%, respectively (Acharya et al., 2021; Chhetri, 2019; HVAP, 2011). Land preparation, FYM placement and planting, mulch collection, intercultural operations, harvesting, postharvest activities, marketing, transportation, and miscellaneous costs contribute 5.49%, 10.07%, 3.29%, 1.95%, 6.17%, 3.72%, 4.63%, and 5.87%, respectively, of the total cost of production. Fresh turmeric production was found to be 622.1 kg, with an average loss of 17.47 kg, accounting for 2.81% of total fresh turmeric production in one ropani of land. 1 kg of fresh turmeric costs Rs. 28,49 to produce.

Table 2: Calculation of Cost of Production of Fresh Turmeric

S.N.	Description	Quantity	Unit	Rate	Total
A.	Land rent	1	Ropani	800	800
B. **1.** **2.** **3.**	Cost of input Seed Compost/FYM Miscellaneous	 121.27 56.63 1	 Kg Doko Lump sum	 36.76 42.98	 4457.88 2433.96 768.56
C. **1.** **2.** **3.** **4.** **5.** **6.** **7.**	Cost of labor Land preparation FYM placement and planting Mulch collection Intercultural operations Harvesting Post-harvest activities Marketing and transportation	 0.719 2.20 0.719 0.427 1.350 0.813	 Bullock day Man days Man days Man days Man days Man days Lump sum	 999.83 598.75 598.75 598.75 598.75 598.75	 718.88 1317.25 430.50 255.56 808.31 486.78 605.5
D.	Grand total cost of production				13083.18
E.	Total turmeric production	622.1	Kg		
F.	Loss in Kg	17.47(2.81%)	Kg		
G.	Production after loss	604.63	Kg		
H.	Cost per Kg of fresh turmeric		Rupees		28.49

Source: Field survey, 2021

3.7 Benefit Cost Ratio Analysis

The benefit cost ratio is calculated by dividing the gross returns by the total cost of production. The gross return of the fresh turmeric was found to be Rs. 17225.91 and the total cost of production was Rs. 13083.18. The BC ratio of the fresh turmeric was found to be 1.32. It signifies that a total of 32% profit is obtained by the turmeric growers after the production of fresh turmeric.

3.8 Resource Productivity Analysis

For resource productivity analysis, Cobb-Douglas production function was used whose estimated value of the coefficients and related statistics are shown in the given table. The coefficient of intercept, multiple R, R square, adjusted R square, standard error and F value are 7.074271, 0.751082, 0.571203, 0.530886, 0.0281509 and 12.670831 respectively. Out of five independent variables included in the regression analysis viz. human labor, bullock labor, seed rhizome cost, compost/FYM cost and miscellaneous cost, the human labor and bullock labor were found significant at 5% level of significance, seed cost was found highly significant at 1% level of significance and FYM cost and miscellaneous cost were found non-significant in the study area. These data show that when 10% of human labor is increased, the total production is increased by 2.3%, 10% increase in bullock labor increases the production by 1%, 10% increase in the cost of seed rhizome decreases the production by 4%, 10% increase in the cost of manures and FYM increases the production by 3.6%, and 10% increase in the miscellaneous cost increases the production by 0.3%.

Table 3: Resource Productivity Analysis

Factors	Coefficients	Standard error	T-stat	P-value
Intercept	7.074271	2.763929	2.559498	0.011791**
Human labor	0.22795	0.115059	1.98115	0.049982**
Bullock labor	0.10438	0.049881	2.09249	0.038614**
Seed rhizome cost	-0.40189	0.125048	-3.21385	0.0001703***
FYM cost	0.359347	0.279516	1.285603	0.201187^{NS}
Miscellaneous costs	0.027922	0.168138	0.16605	0.8684^{NS}
Multiple R	0.751082			
R square	0.571203			
Adjusted R square	0.530886			
Standard error	0.0281509			
F value	12.670831			
Return to scale	0.317709			

Note: *** significant at 1% , ** significant at 5%, NS non-significant

Source: Field survey, 2021

3.9 Return to Scale Analysis

The sum of coefficients of all the factors, according to the above calculation using Cobb-Douglas production function is 0.317709. This represents the fact that the production of turmeric will decrease by 3.2% if the cost of production is increased by 10%. Thus, the above findings represent the diminishing return to scale in the production of turmeric in the study area.

3.10 Problem Ranking of the Production Problems

Major problems during the production process were prioritized according to the farmers point of view and perception during the survey which were ranked and presented in the table. Farmers explained that major problem in their locality was high price of seed rhizomes followed by lack of labor availability, incidence of disease/ pest, lack of quality seed rhizome, lack of transportation and storage facility, lack of financial support, and a lack of appropriate training.

Table 4: Scaling of Production Problem

S.N.	Problems	Frequency	Rank
1	High price of seed rhizomes	103	I
2	Lack of labor availability	92	II
3	Incidence of disease/pest	83	III
4	Lack of quality seed rhizome	66	IV
5	Lack of transportation and storage facility	54	V
6	Lack of financial support	49	VI
7	Lack of appropriate training	38	VII

Source: Field survey 2021

3.11 Price Variation

The average price of seed rhizome over a period of five years viz. 2078, 2077, 2076, 2075 and 2074 are Rs. 43.45, Rs. 36.76, Rs. 31.91, Rs. 29.82 and Rs. 26.81. The average price of seed rhizome in five years is Rs. 33.75 with a standard deviation of 6.52. It shows that every year the price of seed rhizome is increasing. Price of turmeric seed rhizomes have been increased by 62.07% in recent 5 years showing the high price variation in seed rhizomes in study area.

4. Conclusion

The average age of the respondents was 45.56 and lions' share (38.3%) of the turmeric farmers could only read and write. This is because the majority of the youths had migrated to other areas for various purposes. The youth's share of migration for foreign employment alone was 63.3% which is the major reason for the labor availability issues. The trend for the turmeric cultivation, according to the Key Informant Interview and Focus Group Discussion, was that the youths, first go for foreign employment, earn some money, and with that money, they do turmeric farming in their area after their return. The result also showed that the majority of population involved in farming and decision making were males.

Almost every household had livestock holdings due to which the organic fertilizers needed in the field were easily available. Thus, the turmeric producers in the study area use organic farming method for turmeric production. Since farmers normally do not use chemical fertilizers, irrigation, and pesticides in turmeric, the seed cost was found the highest contributor (34.07%) to the total production cost of turmeric followed by human labor cost (25.21% %), organic manure cost (18.06 %), other costs (5.87%), land preparation cost (5.49%) and marketing and transportation cost (4.6%). The total production and productivity of the study area were found to be 604.63 kg and 11.89 Mt/ha which is above the national average 10.98 Mt/ha. The loss after production accounts for 17.47 Kg (2.81%) which can be minimized by safe handling of the turmeric after production.

The average gross margin for turmeric production in 1 ropani of land area was about NRs. 4142. The output-input ratio (without land rent) of fresh turmeric was 1.40 which indicates that a return of Rs. 1.4 can be led by an investment of one rupee on turmeric production. The BC ratio was 1.32 which was quite low due to the high cost of the purchased seed. Thus, turmeric production does not yield a significant amount of profit in the study area due to problems like the high cost of seed, the unavailability of labor, and low market price. To solve these problems, government intervention is strongly recommended so that the seed price would be maintained, the selling price of turmeric in the market would be reasonable, farmers would get subsidiary and new and modern technology would be adopted by the farmers. The lack of labor availability can only be solved by modern technologies and machinery. The extension programs for transfer of technology by the government should be promoted and more and more training services to the farmers in the study area could result in the increment in BC ratio.

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