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ORIGINAL RESEARCH ARTICLE

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Production and marketing of turmeric (*Curcuma longa*) in Sunsari District, Nepal

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ABSTRACT

Turmeric is a popular spice in Nepalese households and a potential cash crop in the country's tropical areas; yet, due to limited study on production technologies and marketing channels, Nepalese farmers have struggled to earn a reasonable return from its production. For this study, 100 turmeric producers were selected by using simple random sampling technique from total turmeric growing population registered in PMAMP at Barahakshetra Municipality of the district. The research was carried out during January to May. Primary data were collected through field, survey, FGD, and KII while a literature review was carried out as the source of secondary data. Information collected from the field survey were coded, tabulated, and analyzed by using the statistical software of MS Excel 2010 and SPSS V26.0. It was found that majority of the respondent farmers had agriculture as their primary occupation. The average household turmeric area was 0.43 ha. The labor cost contributed 45.46% for the of cultivation with an average cost of cultivation pf NRs.110.63 per kg for dried turmeric. Moreover, the gross return of Rs.270057 per hectare and the BCR 1.35, indicate that turmeric farming is profitable. The average productivity of dry turmeric in the study area was 1800 kg per hectare. Insufficient technical services and low market price of the turmeric were main production and marketing problem faced by turmeric producing community This study suggests the adoption of innovative technology for farming, government intervention in price fixing and replacement of local seed by improved seed.

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INTRODUCTION

Agriculture is the backbone of the Nepalese economy and in terms of income, employment, and food security, the agriculture industry has been a substantial contributor to the economy. In the current fiscal year 2019/20, the agricultural sector (farm, forest, and fisheries) is expected to contribute 27.7% of total GDP, down from 37.1 percent in the fiscal year 2010/11 (MOF, 2019; 2020). Moreover, cereals account for 49.9%, livestock 25.68%, vegetables 9.71%, forestry 8.41%, fruits, and spices 7.04% of the total agricultural GDP (MoALD, 2017; 2018). Turmeric (*Curcuma longa*) is a species that belongs to class of Liliopsida, the subclass of Commelinids, order of Zingiberales,

family of Zingiberaceae and genus of Curcuma (Bagchi, 2012). It aids in the treatment of oxidative and inflammatory illnesses, metabolic syndrome, arthritis, anxiety, and hyperlipidemia, among other things. Also, it aids in the treatment of exercise-induced inflammation and muscle discomfort, promoting athlete recovery and performance. These benefits stem from its antioxidant and anti-inflammatory qualities (Hewlings and Kalman, 2017). Curcumin, a yellow pigment derived from the *C. longa* plant, is a key component of turmeric and is widely used as a spice and food coloring (Sarkar, 2016). In a world production scenario, India is dominated by contributing 80% followed by China (8%), Myanmar (4%), and Nigeria and Bangladesh together contributing to 6% of the global production of turmeric which

is about 11 lakhs tones per annum. India consumes over 80% of its total turmeric production, with the remainder going to export (TNAU, 2017). As turmeric is originated from South or South East-Asia, India is the largest producer and exporter in the world and it is also a major user of its production (Plotto, 2004). The high-value spice crops with the greatest export potential are ginger, turmeric and cardamom. When compared to 2005, the area and production of turmeric have increased by approximately 126.2 percent and 180 percent, respectively (NAGRC, 2018). In Nepal, among the spice crops turmeric occupies 9795 ha area with production of 99907 tons in 2021 (MoALD, 2021). After five years of implementation, the One Village, One Product program, which is built on the Public-Private Partnership strategy, has achieved outstanding results. Turmeric farming has recently been carried out in Sunsari under this initiative (Deshar, 2013). Sunsari district is one of the 14 districts in Province No.1, located in Eastern Terai covering an area of 1257sq.km. with the longitude of 86°55' to 87°21' East and latitude of 26°25' to 26°55' North. The total area under turmeric production in Sunsari district in 2019/2020 was 415 ha with a total production of 4314 Mton (MoALD, 2021).There is a high demand of value-added products turmeric in the international market and Nepal has high export potential because turmeric produced in Nepal is of high quality compared to other countries (White and Raizada, 2014).

Although the turmeric subsector has a huge potentiality of development in the eastern region of Nepal due to the suitability of the topography and climate, it has not been able to flourish due to the lack of proper market channels, proper training on the right cultivation practices, and nonetheless a commercialized approach of farming. Moreover, complementation of solution on determinants on production is felt necessary to flourish the turmeric subsector. Study allows documentation of benefit cost analysis that play vital role in making policy for economic upliftment of farmers. In order to analyze the economics and marketing of turmeric production in Nepal's Sunsari district, this research was carried out.

MATERIALS AND METHODS

Selection of the site
Barahakshetra municipality within the Sunsari district was selected purposively for the study as it is one of the most important turmeric growing areas. It is also selected as zones of the turmeric program by the PMAMP project

Selection of turmeric farmers
A list of turmeric growers of the command area of the turmeric zone was obtained from the zone profile. Out of the 500 growers residing in the command area of the turmeric zone, a total of 100 turmeric growers were selected by Simple Random Sampling technique to draw a representative sample. The respondents were deliberately chosen to be above 18 years age since the data and information provided would be more reliable and valuable to address and solve the problem.

Sources of data
Primary data was collected through face-to-face interviews with the targeted farmers using open and close-ended questionnaires who had been cultivating turmeric. FGD, a key informant's survey was used for this purpose. Similarly, Agriculture Knowledge Centre (AKC) officers and agro vet's owner were also interviewed for further reliable information. A detailed review of available literature on the subject matter was done, which included the study of the such materials as journals, articles, magazines, newspapers, related websites, different institution and organization like MoALD, NARC, FAO, Zone Profile etc. to obtain the necessary secondary data.

Data analysis
Information collected was coded, tabulated, and analyzed using Statistical Packages for Social Science (SPSS V26.0) and MS-Excel 2010. The result was presented in descriptive, graphical, and tabular form.

Cost of production
Cost of production of fresh turmeric includes land rent cost, cost of inputs (like FYM, seed), cost for labor used in land preparation, planting, weeding, manuring, harvesting and other activities in production process of fresh turmeric. Average cost of each component was calculated from field survey data then cost of production of fresh turmeric was calculated by summation of all cost occurring in production process. Cost of production of dried turmeric was calculated by summation of cost of production of fresh turmeric and cost for processing(boiling), drying, firewood, other equipment's used during production of dried turmeric.

Benefit cost analysis
For benefit-cost analysis, total costs of production of turmeric and total gross return from produce were used. For calculating gross return, income from produce sale was accounted. So, the B/C ratio was calculated using the following formula:
B/C ratio= Gross return/Total cost

Market margin and producers share
Market margin: The difference between the price paid by the customer and the price paid by the producer is known as the market margin.
Market margin = price of commodity – price received by the farmer
Producer's share: The producer's share is the amount received by the producer to the amount purchased by the consumer. Producer's share is the price received by the farmer i.e., farm gate price expressed as a percentage of the retailer's price i.e., the price paid by the Consumers
It is expressed in percentage.
Ps = Pp/Pc* 100
Where,
Ps = producer's share
Pp = Producer's price

Pc = Price paid by consumer/retailer's price

Scaling technique/indexing

The reason for turmeric cultivation and problems related to production and marketing was ranked by using scaling technique/ indexing. The indexing was done by using the Likert's scale. The index was prepared mainly taking into account the qualitative data. Scaling techniques provides the direction and extremity attitude of the respondent towards any position. Each respondent was asked to rank various problems based upon their perception. Also, problems of input and production were ranked with the use of index. The categories were scored and the total score measures the respondent's attitude, which was the sum of the score of categories. As a result, each response was assigned a numerical score, and the overall score was calculated by adding his scores for each response. The total score indicates position in continuum. The indexing of importance was calculated by using following formula: The index was calculated by using the following formula;

$I = \sum S_i f_i / N$

Where,

$\sum$ = Summation

I = Index (0<I<1)

S_i = Scale value at i^{th} intensity

f_i = Frequency of ith response

N = Total no of respondents $\sum$

RESULTS AND DISCUSSION

Production status

Among 100 households interviewed, the total turmeric cultivated land was found to be 986 kattha (32.87Ha). The details of the production status of turmeric in the study site are presented in Table 1. The average land holding size of people in this area was 0.96 ha. Among that average land, area under turmeric cultivation was 0.43 ha. According to (Shrestha *et al.*, 2021) area of turmeric production is positively correlated with the level of production in same area of Sunsari.

Cost of production

Turmeric was grown in the study region using traditional farming methods. It was discovered that all turmeric growers cultivated a native type of turmeric with a strong application of FYM during field preparation. No pesticides or chemical fertilizers were utilized on the turmeric field, and no irrigation was performed. A similar result was reported in the (Acharya *et al.*,

2021); the purpose of this study was to determine the productivity of organic turmeric. Mulching was accomplished utilizing natural litter such as dried leaves, green leaves, tiny branches, straw, and so on. The cost of production was determined for this study using data from a field survey and focus group discussion with farmers. The fresh-to-dry conversion ratio was determined to be 1:5, i.e., from 500 kg fresh turmeric, 100 kg dried turmeric is produced so the total production of fresh turmeric was 9001.9kg for per hectare from the conversion ratio total 1800.38kg of dry turmeric was produced. Farmers were reported to be storing seeds from past harvests. Farmers separated 25% of their yield as seed, and approximately 8 kg dried turmeric was separated to produce powder for home use, with the remainder sold to collectors. Similarly, farmyard manure was primarily made in the field. Farmers generally rely on the adjacent forest for mulching. Family members were involved in cultivation, processing, and marketing. Women were largely responsible for production and post-harvest/processing operations (cleaning, packaging drying etc.,), while men were mostly responsible for land preparation and marketing. At the farm gate, the cost of producing fresh turmeric is around NPR 20.77/Kg. Similarly, the cost of production for dried turmeric (after extra processing and drying costs) is about NPR 110.63/Kg at the farm gate. As shown in Table 2, the overall cost of production for fresh turmeric production per hectare is Rs. 187041.24, while the total cost of production for dry turmeric production per Ha is Rs. 199177.68. Farmers of the respondent area only sell the dry turmeric(sutho) at the average of Rs150 for per kg.

Benefit cost ratio

The benefit-cost ratio of dry turmeric was calculated by dividing the Total Gross Return by the Total costs of productions. The benefit-cost ratio was calculated at 1.35 as presented in Table 3. The study showed 46.45%of the total costs go to the labor for land preparation, FYM application, plantation, mulch application, weeding, harvesting, cleaning and boiling, and drying. Similarly, 34.10% goes to seeds, 13.11% goes to FYM cost, 3.10% goes to packaging cost,2.71% transportation cost and 0.53% goes to other costs (firewood and equipment's for boiling). It was found that the highest cost was incurred for labor cost (45.46%) However, from the previous study of (Chhetri et al., 2020; HVAP, 2011; Timsina *et al.*, 2011), the percentage contribution in labor was 39.39%,33%,38.29%, respectively. The highest contribution of labor cost is due to all the operation were labor intensive.

Table 1. Production status compared to land area of turmeric.

Description	Minimum	Maximum	Mean
Total Owned land in Ha	0.20	2.33	0.96
Area of turmeric cultivation in Ha	0.07	1.50	0.43
Total production of fresh turmeric in kg	600	17100	3944.8

Table 2. Description of cost production cost and return of dried turmeric (sutho) per hectare.

S.N	Description	Quantity	Unit	Rate	Total (NRs.)
1	Seed	2122.90	kg	32	67932.80
2	FYM	475	Doko	55	26125
3	Labor cost				
3.1	Land preparation	29.94	Man-days	500	14970
3.2	Ploughing	30.27	Bullocks	800	24216
3.2	FYM application and planting	20.27	Man-days	250	5067.50
3.3	Mulch collection	212.44	Doko/sack	25	5311
3.4	Weeding	35.99	Man-days	250	8997.50
3.5	Harvesting (kg)	45.99	Man-days	500	22995
3.6	Cleaning	20.94	Man-days	250	5235
4	Packaging Cost	162.93	Bora	38	6191.34
	Total cost for fresh turmeric production per hectare (9001.9 kg)				187041.14
	Total cost for fresh turmeric production per kg				20.77
5	Additional cost for sutho production				
5.1	Labor cost for boiling and drying	22.94	Man-days	250	5735
5.2	Transportation Cost (1800.38kg)		kg	3	5401.44
5.3	Firewood and other equipment's for boiling		Lump-sum		1000
	Grand Total Cost (1800.38kg)		199177.58		
	Total cost of dry turmeric production per kg		110.63		
	Gross Return (1800.38*NRs150)		270057		

Table 3. Description of cost production cost and return of dried turmeric (sutho) per hectare (Source: Field Survey, 2021).

Particulars	Total
Gross Return	Rs.270057
Total Cost	199177.68
B/C ratio	1.35

Marketing system and channel

The marketing system involves individuals involved from production to consumption through various market channels. Agriculture Produce Market (APM) of Dharan, Bi-weekly Vegetable Market (Chatara), and Sabjimandi were major markets. Around 90% of sutho produced in Sunsari was sold to collectors in Bi-weekly Vegetable Market (Chatara) because Bi-weekly Vegetable Market (Monday and Thursday) was near to (around 6-8 km). Around 10% of sutho produced in Sunsari was sold to collectors in APM because APM was near low turmeric-producing areas (around 25 km). The major export of turmeric to India was found to occur from the APM. Different actors involved in this process are producers, wholesalers, retailers, local traders, commission agents, collectors, and consumers which are briefly described as follows

Input suppliers: Farmers are the main input suppliers since they use their own seeds, manure, and labor during turmeric production.

Producers: Two types of farmers are engaged in turmeric production: I) Small farmers with subsistence turmeric production II) Commercial farmers characterized by large production volume The produce from the first category of farmers generally does not enter the market or enters in a very limited quantity in the market. Commercial farmers sell most of their produce to collectors in market. The producers generally deal with collectors at Agriculture Produce Market (APM) of Dharan and Bi-weekly Vegetable Market (Chatara). In most cases, market information is not known to general farmers, and they have to depend on the information provided by collectors.

Collectors: Farmers in the area and collectors in the APM and Bi-weekly Vegetable Market are involved in marketing business directly. Farmers of Sunsari district carry the produce on their own and sell to collectors. The collectors fix the price by themselves, and this price has to be agreed upon by the farmers. Then keeping some profit margin on the produce, they sell it to processors and retailers in Dharan, Itahari, Kathmandu and terai districts like Biratnagar, Saptari, Siraha, Janakpur etc. Work of wholesalers and distributors is also done by collectors.

Processors: Mill operators are the Masala producers in the study area. They grind the dry turmeric (sutho) and sell loose powder form to the retailers after packaging. Masala Producers get dry turmeric pieces (sutho) from collectors.

Retailers: These actors are found very effective in turmeric marketing. There are two types of retailers. Retailers of local vegetable market get dried turmeric from collectors and sell dried turmeric (sutho) and/or turmeric powder (after processing) to consumers along with other vegetables. Other type of retailers is Kirana shoppers who buy turmeric powder from local processors or grinding miller and sell to consumers. Generally, they have permanent customers who usually purchase foodstuff and other requirements of daily need. The retailers do not have direct relation with farmers. The common marketing channel found in the flow of turmeric from producers of Sunsari is presented in the Figure 1.

Cleaning and turmeric sutho making were the primary value addition activities in the study region at the production level.
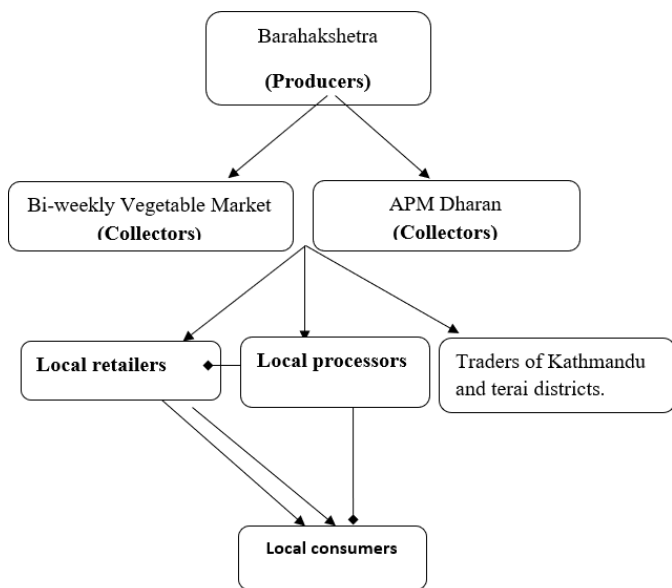
Figure 1. *Marketing channel of turmeric in Sunsari District.*

Total production cost of dried turmeric (sutho) was NRs. 110.63 per kg. Farmers sold dried turmeric after packing in sacks to collectors in market. Farmers were getting NRs. 150 per kg of turmeric sutho from collectors. Collectors used to sell dried turmeric from market to local retailers and processors of Sunsari and traders of other districts in NRs. 165. At the processor level, milling and packing were the most important value-added operations. It cost around NRs. 23 per kg turmeric. There was around 10% loss in weight while processing from dried turmeric to powder. Processors sold turmeric powder to retailers in price NRs. 350 to NRs. 380 and to consumers in price NRs. 380 to NRs. 400. It was found that local consumers were paying NRs. 175 for per kg of dried turmeric and NRs. 380 to NRs. 400 for per kg of turmeric powder in packaged form to retailers.

Market margin and producers share

Marketing margin is the difference between the price paid by the consumer and the price received by the farmers. Producer's share is the proportion of the consumer's payment received by the producers. Marketing margin and producer's share area are the indicators of the efficiency of the existing marketing system. Lower marketing margin and higher producer's share ensure the efficiency of the marketing system. The marketing margin of dry turmeric was Rs.25 per kg with 81.08 % producer's share.

MM = Retailer's price (Pr) – Farm gate price (Pf)

= Rs. (175 – 150)

= Rs. 25/kg

Producers' Share = (Pf/Pr) × 100%

= (150/175) ×100%

= 81.08%

Problems in turmeric production and marketing

Lack of practice in modern agriculture system, Nepalese agriculture is facing several problems in production and marketing

levels. From my study, I tried to find out the problems that arise during the production and marketing process of turmeric through questionnaires to turmeric growers and ask them to attend the question and rank all the problems as they receive from a long period. The severity of problems was identified by ranking with an appropriate score. The intensity of problems related to the production and marketing of turmeric with their ranks has been presented below.

Production problems of turmeric faced by a growers

Different problems are faced by turmeric growers while producing turmeric in the vicinity areas. I find out six major problems faced by the growers during the production process through interaction with farmers during field visits and Focus Group Discussion (FGD). Six points scaling techniques (1, 2, 3, 4, 5, and 6) were applied to find out the seriousness of the production problems. The value obtained from the rank scale showed that 'Lack of Technical Services' has an index value (0.94) and ranked as a first major problem whereas 'Insufficient seed rhizome' with index value (0.22) was ranked as the last problem which is presented in Table 4. Relative seriousness of the problems faces by the turmeric grower followed the sequence of Lack of Technical Services, Incidence of disease/pest, Poor quality seed, Lack of appropriate training, Scarcity of Irrigation water, and insufficient seed rhizome.

Marketing problems of turmeric faced by a growers

Marketing problems are a major concern to the turmeric growers. As market situation determines the economic status of growers. Different marketing problems faced by growers while marketing the turmeric are scaled in six points through scaling techniques (1, 2, 3, 4, 5, 6, 7, and 8) as per the seriousness of the marketing problems. The ranking is done based on index value where high value gets 1st rank and less index value gets 8th rank. The rank scale showed that 'Low market price of Turmeric' has the highest index value (0.94) and least was 'Quality issue' with index value (0.13) as presented in Table 5. Relative seriousness of the problems faces by growers followed the sequence of the low market price of turmeric, lack of processing facilities, unawareness of market price information, lack of proper transportation facilities, unorganized market, lack of storage facility, problem in selling, quality issues.

Price trend analysis

The price of turmeric gets fluctuates according to the demand of the market, Season, and quantity of production. So, it is difficult to ensure the price of turmeric. The price of turmeric gets fluctuates every year in recent years; there is a heavy decrease in the price of turmeric as a result farmers are demoralizing cultivated turmeric is less area in their field. It was found that the average per kg received price of turmeric by growers was highest in 2073/74(2016/17) which was Rs.300 whereas the price of turmeric was Rs250 and Rs 180 in 2074/2075(2017/2018) and 2075/76(2018/19) respectively. Per kg selling price of turmeric by producers was found relatively decreasing in 2076/77

Table 4. Intensity of production problems faced by a turmeric grower in the study area, 2021 (Source: Field Survey, 2021).

Reasons for cultivating turmeric	Weight	Index	Rank
Lack of Technical Services	70.62	0.94	I
Incidence of disease/pest	63.87	0.86	II
Poor quality seed	49.95	0.67	III
Lack of appropriate training	37.71	0.50	IV
Scarcity of Irrigation water	23.4	0.33	V
Insufficient seed rhizome	16.95	0.22	VI

Table 5. Intensity of marketing problems faced by a turmeric grower in the study area, 2021 (Source: Field Survey, 2021).

Marketing Problems	Weight	Index	Rank
Low market price of Turmeric	70.76	0.94	I
Lack of Processing facility	66.33	0.88	II
Unawareness of market price information	51.4	0.68	III
Lack of transportation	45.87	0.61	IV
Unorganized market	43.4	0.57	V
Lack of storage facility	27.16	0.36	VI
Problem in selling	20.33	0.27	VII
Quality issue	10.11	0.13	VIII
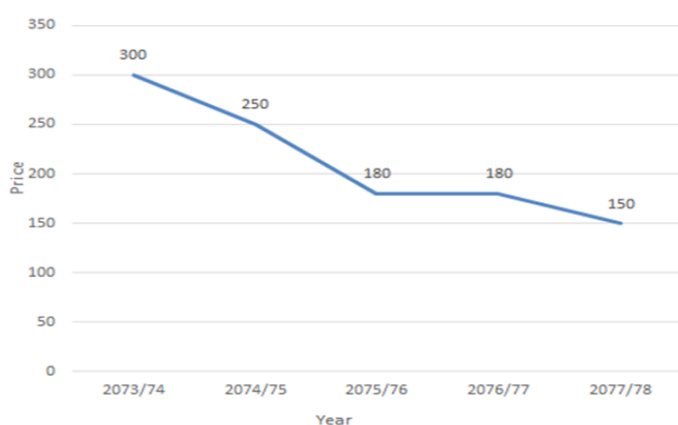
Figure 2. *Line graph showing the price of turmeric in recent years, 2021.*

(2019/20) as NRs.180 and the mean price of dried turmeric (sutho) in the year 2077/78(2020/21) was found to be NRs. 150 which is found to be consequently decreasing as presented in Figure 2. The mode of selling products was non-contract. Price fixing was done by limited collectors, so farmers were not getting a good price of dried turmeric (sutho). The turmeric-producing community faced serious issues as a lack of price to cover production costs which is due to the one of the major reasons as trader domination in pricing (Chhetri *et al.,* 2020).

Conclusion

The field survey to study the economics of production and marketing of turmeric was conducted in the PMAMP ginger/turmeric zone, Barahakshetra, Sunsari as this region represents a relatively large share in terms of area coverage and total turmeric production in the district, though they were found to be aware of its importance. Gross margin analysis, higher net profit, benefit-cost ratio showed that turmeric cultivation was a profitable and lucrative enterprise in Sunsari. Therefore, the investment in turmeric enterprise was found financially viable in the study area. The results of the study further revealed that farm-

ing was done traditionally, and the farmers were the main input suppliers themselves. The majority of the population surveyed, were illiterate, the level of awareness among them about the quality seed rhizomes and measures to control diseases was very low which showed that there was a weak linkage between researchers and turmeric growers, the price was fixed by limited collectors in the market and there was no coordination between different actors of the value chain. Hence the finding of this study suggests that there should be government intervention in market to make market organized and to reduce price gap between producer and consumer, strengthen training programs related to turmeric production and marketing, disease and insect management and replacement of old seed with the improved rhizome for increasing the production and productivity of turmeric in the Sunsari district of Nepal.

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Conflict of interest

The authors declare that there is no conflict of interests regarding the publication of this paper.

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