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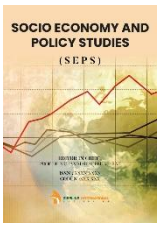

RESEARCH ARTICLE

ECONOMICS OF EARLY-SEASON CAULIFLOWER PRODUCTION AND MARKETING IN DHADING DISTRICT OF NEPAL

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ABSTRACT

The study was conducted during September-November 2020 to assess the economics of early-season cauliflower production and marketing in Dhading district of Nepal. Dhading district was purposely selected as it is one of the pocket area for cauliflower production. The study collected primary information from 60 farmers and 15 traders by using a semi-structured pre-tested questionnaire. The simple descriptive and statistical tools such as Cobb-Douglas production function and benefit-cost ratio were used to analyze the result. The total cost of production of early-season cauliflower was NRs 13588.81 per ropani while the average yield was 727.94 kg per ropani. Further, the gross margin, and net profit per ropani were calculated NRs 25194.54, and NRs 22855.51 respectively. Likewise, the benefit-cost ratio was estimated to be 2.60 that revealed the early season cauliflower production is highly attractive and profitable. The Cobb-Douglas production function showed that cost on manure had a significant contribution in total gross return. The return to scale value was computed to be 0.59 indicating decreasing return to scale in early-season cauliflower. The major marketing channel was found to be Producer-Collector-Wholesaler-Retailer-Consumer with highest price spread of NRs 35/kg. Major problem in the production and marketing of cauliflower was diseases and pests and inappropriate marketing channels. Therefore the finding suggests, productivity and profitability can be maximized if the existing problems of diseases and pests, and quality of seeds are solved and appropriate marketing prices and channel are ensured.

KEYWORDS

Cauliflower, gross margin, profitability, Cobb-Douglas, marketing channel.

1. INTRODUCTION

Agriculture remains the pillar of the economy in any part of the world, particularly in developing countries like Nepal. It solely contributes 26.98% to the national GDP (MoF, 2019).In Nepal, total agriculture cultivated land is 3,091,000 ha, out of which vegetable is cultivated in 297,195 ha with 4,271,270 metric tons production per year (AITC, 2077). Vegetable in Nepal is one of the most important farming practices. This sector has been growing rapidly in recent years due to its high demand. Many farmers are diversifying away from cereal crops in search of a better return. The growing interest of farmers in vegetables indicates that they have seen a better opportunity to raise their income. The vegetable itself has a significant role in food security and well- having a balanced vegetable is one of the easiest ways for people to improve their health and well-being.

Cauliflower (Brassica oleracea var. botrytis) is the major vegetable crop in the world. Global production of cauliflower (including broccoli) is 25.97 million tons led by China producing 10,263,746 tons which account for 39.9% of the total global production (FAO, 2019). In Nepal as per MOALD, (2019), the total area coverage of cauliflower is 35,764 ha producing 5, 74,795 mt in 2076/77 with average productivity of 16.07 metric tons per hectare. Cauliflower has the highest shares followed by tomato and cabbage in Dhading district (AITC, 2077). The production of cauliflower in the Dhading district is found to be 8035 metric tons with average productivity of 15.98 mt/ha which seems rising from the previous years (MOALD, 2019).

Cauliflower is grown both as a seasonal and off-seasonal vegetable. Cauliflower varieties are grouped in three different categories: early season varieties, main season varieties, and late-season varieties. Early season varieties are grown from May-August and harvested in September-November targeting the major festival of Nepal. The market price of cauliflower is highest in month of August-November (Timilsina & Bhandari, 2020). Therefore, growers have move toward early-season cauliflower production because of its high demand and market price.

2. STATEMENT OF PROBLEM

Although the production and productivity have risen, problems like inefficient marketing, price fluctuation and lack of market intelligence were seen. Because of this, the cost of production is increasing while the realization of benefits is decreasing. Despite the fact that the government has developed numerous programs and policies for the commercialization of agriculture, they have not been effectively implemented. Hence, most of the farmers have been following less profitable, traditional production practices which are characterized by the high cost of production, low productivity, and low profitability. It is not just enough to produce vegetables; they must be produced efficiently and marketed successfully (Singh, 2005). So, the major constraint associated with production and

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marketing in this area is still lacking. Hence, this research aims to address these research gaps.

3. OBJECTIVES

The general objectives was to assess the economics of early-season cauliflower production and marketing of Dhading district as a broad objective.

Specific objectives

1. To identify the major actors involved in the marketing channel of cauliflower in Dhading district
2. To analyze the constraint regarding the production and marketing of cauliflower

4. METHODOLOGY

4.1 Description of study area

The research survey was carried out in Dhading, Nepal. This study area was purposely selected based on the high production potential of cauliflower. It lies in the central hilly region of Nepal with the coordinates 27.9711° N, 84.8985° E. The elevation ranges from 488 meter to 7409 meter above sea level. The study was carried out in command area of Prime Minister Agriculture Modernization Project (PMAMP), Project Implementation Unit (PIU), Vegetable Zone Dhading i.e. Benighat Rorang rural municipality, Siddhalekh rural municipality and Gajuri rural municipality.

4.2 Sample and data collection

Altogether 60 farmers were selected by using simple random sampling without replacement whereas 15 traders including 5 were collectors, 5 were wholesalers. 5 were retailers were selected based on referral information from focus group discussion and Key Informant Interview. Pre-tested semi-structured questionnaire was used to obtained data adopting face to face interview technique from September 20 to November 5, 2020. The secondary data were collected from different secondary sources, MOALD, CBS, journal articles, websites, reports of different NGOs and INGOs etc.

4.3 Method and Technique of data analysis

The information collected from the field was entered into the computer. Data entry and analysis were done by using computer software packages like the Statistical Package for Social Science (SPSS) and Microsoft excel. Simple descriptive statistics such as average, standard deviation, and percentage are used for the analysis of socio-characteristics of farmers. Also, the following analysis were performed;

4.3.1 Cost of Production

The total cost of production of cauliflower was calculated by using the following formula:

TC = TVC + TFC

where,

TC = Total cost of production

TVC= Total variable cost which included cost of production inputs namely- Human labor cost , Bullocks and machinery, seeds/seedling, fertilizers, manures, pesticides, irrigation, transportation and interest on operational expenses

TFC= Total fixed Cost which included water Tax, land Tax, land rent, and depreciation of farms machinery and equipment.

4.3.2 Profitability analysis

The study uses gross margin and net profit to determine profitability. The following formula was adopted from (Poudel, et al., 2019; Khadka & Adhikari, 2021).

Gross Margin = Gross Revenue – Total Variable Cost
Net Profit =Gross Revenue – Total Cost

Where,
Gross Revenue = Selling Price * Quantity produced

4.3.3 Benefit-Cost ratio

The benefit-cost ratio was carried out after calculating gross revue and total cost. A similar formula was also used by (Sapkota, Rokaya, Acharya, & Uprety, 2019).

It is the ratio of total revenue and total cost.

$$\textbf{BC Ratio} = \frac{Gross\ Revenue}{Total\ Cost}$$

4.3.4 Market Margin

The difference between the farm-gate price and the retailer's price is the marketing margin. It is calculated as follows:

Market margin= Retailer's Price – Farm gate price

4.3.5 Price Spread and Producer's share

Price spread = Price paid by the consumer – price received by the producer (farmers)

Producer's share in consumer's price = (price received by farmers/price paid by consumers) * 100

A similar formula was used by Patel & Pundir (2016) for assessing the price spread and producer's share.

4.3.6 Problem Ranking

The scaling technique was used for the production problem ranking. The index of the problem was calculated by using the formula:

$$I_{prob} = \sum \frac{SiFi}{N}$$

where,

I= index value for intensity of problem (0 to 1,)

S_i= scale value at i^{th} severity,

F_i= frequency of the i^{th} severity

N= total number of respondents

$\sum$ = Summation

Similar technique for problem ranking was used by Shrestha, et al., 2021 for ranking of problem in mango (Shrestha, et al., 2021).

4.3.7 Analysis of factor affecting gross return

To determine the contribution of different inputs as well as for the estimation of the efficiency of variable production input in two different production systems, the Cobb-Douglas production function was used as described by (Khadka & Adhikari, 2021; Adhikari, 2012). The general form of Cobb-Douglas production function was used to determine resource productivity, and efficiency is as follow:

$$Y=X_1^{b1}X_2^{b2}X_3^{b3}X_4^{b4}X_5^{b5}X_6^{b6}$$

Where,

Y= Gross return (NRs. /ropani), X_1=Cost on seed (NRs. /ropani), X2=Cost on Fertilizer (NRs. /ropani), X_3= Cost on manure (NRs. /ropani), X_4= Cost on Plant protection (NRs. /ropani), X_5=cost on labor (NRs. /ropani), X_6=cost on transportation, (NRs. /ropani), and b1, b2...b7 are coefficient of respective variable.

5. RESULTS AND DISCUSSIONS

5.1 Socio-characteristics of selected respondents

The important socio-demographic characteristics of respondents is mentioned in Table 1. The total respondents of farmers were 60 out of which 47(78.3) were male and the remaining 13(21.7) were female. This shows that males were more involved in cauliflower farming in this area. Age group 15-35 belongs to the economically active age group. The study showed that 20% of respondents of cauliflower were from age group 15-35, 35 (58.3%) were from age group 36-50 and 13(21.7%) were from age group above 50. Brahmin was the dominating caste in the study area. In the total sample, 57% were Brahmin followed by 28% Janajati, 10% Chettri, and 5% Dalit. Out of total respondents, 40% of the respondents in

the study area had secondary level of education followed by a primary level of 35%. Similarly, 15% of respondents had a higher secondary level of education, and 10% were simply illiterate. Among the total respondents, agriculture (53%) is the major occupation whereas 47% of the respondents has other occupation along with agriculture.

Table 1: Socio-demographic characteristics of selected farmers

Particulars		Percentage
Average sex distribution	Male	78.3
	Female	21.7
Average family size		5.27
Ethnicity	Brahmins Janajati Dalit Chhetri	57 28 5 10
Educational status of respondents	Illiterate	10
	Primary	35
	Secondary	40
	Higher secondary	15
Occupational Status	Agriculture only	53
	Agriculture and others	47
Average Cultivated Land(Ropani)		13.05
Cauliflower cultivated land (Ropani)	Below 5	51.3
	Above 5	48.7

5.2 Cost of production of early-season cauliflower

For calculating total production cost, fixed cost, and variable cost were taken into consideration. In this study, the fixed cost included land tax, water tax, depreciation of farm machinery and equipment and land rent and variable cost included all the labor and inputs cost that were directly related to cauliflower production like seed, seedlings, fertilizers, plant protectants, micro-nutrients, seed treatment, irrigation, transportation, and interest on total variable cost.

From the study, it was evident that the total cost (TC) of the seed of early-season cauliflower per ropani was NRs 783.48 which covers 5.6 percent of the total cost of early-season cauliflower. TC of human labor was found to be 4689 per ropani which was 33.5 percent of the total cost. Similarly the total cost of machinery and bullocks was found to be 850 which covers 6.07 percent of total cost. The farmers used different kinds of fertilizers for a higher yield of cauliflower. Commonly used fertilizers were Urea, DAP, and MOP. Costs of fertilizers were estimated according to the cash price paid. The cost of chemical fertilizer was found to be 1225.08 per ropani of land. It accounts for 9.08 percent of the total cost. Farmers spent NRs 391.05, NRs 655.7, and NRs 178.34 per ropani for Urea, DAP, and MOP respectively. Most of the farmers used cow dung as Farmyard Manure (FYM) and it was found that the cost of FYM was NRs 1468.65 per ropani. The cost of FYM accounts for 10.4 percent of the total cost. Micronutrients like Boron, Calcium, and Vitamins were used by farmers for better growth and it was found that the cost of micronutrients was found to be NRs494.15 per ropani. It accounts for 3.53 percent of the total cost. Among the micronutrient farmer spent NRs200.61 for Boron. The cost of plant protection for early season cauliflower in the study area amounted to NRs887.20. It accounts for 6.3 percent of the total cost. The cost of transportation was found to be NRs855.2 per ropani which accounts for 6.3 percent of the total cost. Farmers from the study area usually hand over their produced cauliflower to nearby cooperatives rather than directly supplying it to distant markets which reduces the transport cost.

The land rent cost was NRs 2142.25 per ropani. There was a difference in the land cost majorly due to different on type of land and topography, access to road and irrigation facilities. The land cost accounts for 15.03 percent of the total cost. From the study, it was found that the cost of land and water tax in the study area was NRs 61.6 and NRs 46.1 per ropani respectively. It accounts for 0.44 percent and 0.32 percent respectively. Farm equipment and machinery were fixed inputs used in cauliflower cultivation. Analyzing the study it was found that the depreciation charge per ropani was NRs 89.04 which accounts for 0.63 percent of the total cost.

Table 2: Cost of cultivation of early season cauliflower

SN	Cost	Values (NRs per ropani)	Percentage of TC
	Variable Cost (A)		
	Human Labor	4689	33.5
	Machinery and Bullocks	850	6.07
	Seed/Seedling	783.48	5.6
	FYM	1468.65	10.4
	Chemical Fertilizer	1225.08	8.7
	Micronutrients	494.15	3.53
	Plant Protection	887.20	6.3
	Irrigation	46.86	0.33
	Transportation	885.2	6.3
	Interest on operational expenses	325.76	2.3
	Total Variable Cost	11655.39	116.69
	Fixed Cost (B)		
	Land Tax	61.6	0.44
	Water Tax	46.13	0.32
	Depreciation	89.04	0.63
	Land Rent	2142.26	15.30
	Total Fixed Cost	2339.03	16.69
	Total Cost (A+B)	13994.43	100

5.3 Profitability analysis of early-season cauliflower

From Table 3, the total cost of production of early-season cauliflower was NRs 13994.43 per ropani. The average cost of production per unit of early-season cauliflower was found to be Rs 18.66. The average price received by farmers for early season cauliflower was NRs 50.065 and is supported by the study conducted by Timsina, et al., (2011). It is higher than the price of Tanahu district, this may be due to higher demand of cauliflower in the study area (Poudel, Pokharel, KC, & Adhikari, 2019).

The gross return was found to be NRs 36440.67 per ropani. Similarly, gross margin and net profit per ropani were NRs 24785.29 and NRs 22446.24 respectively. The Benefit-Cost ratio was found to be 2.60. The calculated benefit-cost ratio is found to be higher than the benefit-cost ratio calculated in the study area of Tanahu (1.84) (Poudel, Pokharel, KC, & Adhikari, 2019).

Table 3: Profitability analysis of early-season cauliflower

Particulars	Amount
Total cost (NRs)	13994.43
Average price of cauliflower (NRs/kg)	50.06
Production of cauliflower (Kg/ropani)	727.94
Cost of unit production(NRs/kg)	18.66
Gross return (NRs/ropani)	36440.67
Gross margin (NRs/ropani)	24785.29
Net profit (NRs/ropani)	22446.24
Benefit cost ratio	2.60

5.4 Analysis of coefficient of multiple determination

Table 3 presents the result of Cobb-Douglas Production Function analysis of cauliflower production in the study area. The result showed that the F value (10.978) was statistically significant at 5% level of significance and has good explanatory power for the model function applied as in Islam, (2020). The regression analysis revealed that the coefficient of multiple determination (R2) was found to be 0.513 which implies that the estimated variables explained 51% of the variation in gross return of cauliflower. It was found that only manure have a significant contribution to output. The detail of contribution of different factors of production to the total revenue is presented in Table 3.

The magnitude of regression coefficient of manure was 0.001 with a positive sign. This coefficient was statistically significant at 5% level and implies that 1% increase in manure cost keeping other factors constant, would lead to an increase in gross return by 0.446%. Similarly the estimated coefficient of seed and transportation were found to be negative and insignificant to gross return which implies 1% increase in cost of seed and transportation keeping other factors constant, would lead to decrease in gross return by 0.23% and 0.045% respectively.

Return to scale analysis

From the regression analysis of Cobb Douglas Production Function, the sum of coefficient was computed to be 0.59 which signifies decreasing return to scale in the production of early-season cauliflower in the study

area. 100% increase in all the variable factors included in the model would result in 59% increase in gross return.

Table 4: Factor share to total output in cauliflower

Variables	Estimated coefficient	Standard error	T value	p-value
Constant	7.550	2.309	3.270	0.002
Seed	-0.233	0.233	-0.998	0.323
Human Labor	0.064	0.167	0.658	0.514
Plant protection	0.012	0.109	0.106	0.916
Transportation	-0.045	0.105	-0.425	0.673
Chemical fertilizer	0.117	0.086	1.353	0.182
Manure	0.446*	0.109	4.085	0.001
Bullock and machinery	0.006	0.208	0.030	0.976
R= 0.769, R2 = 0.592, adjusted R = 0.532, F ratio=10.978				

*significant at 5% level of significance ($p<0.05$) and 1% level of significance ($p<0.01$)

5.5 Marketing

5.5.1 Marketing Channel

Four marketing channels were found in the study area. Producer-Collector-Wholesaler-Retailer-Consumer (Channel I) was identified as a major marketing channel from where 68% of total production reaches consumers. While 11.6%, 12%, and 8.4% of the total produce reach the consumer through marketing channel Producer-Wholesaler-Retailer-Consumer (Channel II), Producer-Retailer-Consumer (Channel III), and Producer-Consumer (channel IV) respectively. The marketing channel identified in the study area is better illustrated in a flow diagram.

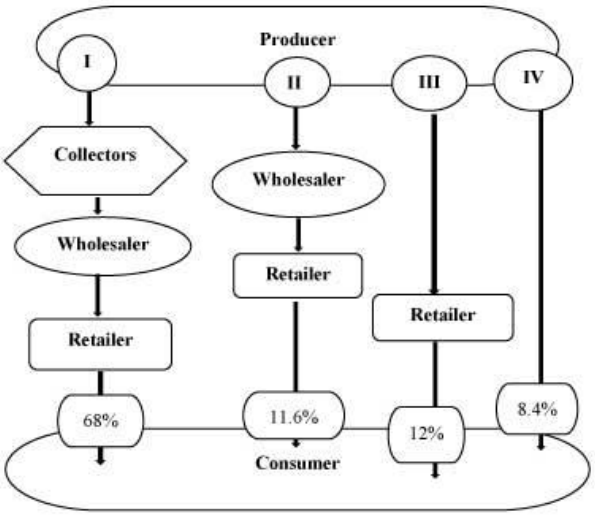

Figure 1: Flow diagram of marketing channel distribution

Note: Percentage in the box describes the amount of cauliflower marketed through respective channels.

5.5.2 Price Spread and Producer's share

Table 5 shows the price spread was highest in channel I followed by channel II, channel III and channel IV. The price spread is higher when there is a large number of intermediaries involved.

Producer's share in consumer's price was observed as 57.14%, 68%, 67.3%, and 100% in channel 1st, 2nd, 3rd, and 4th respectively. Study shows that producer's share is inversely proportional to the length of the marketing channel. The low producer's share in the study area is attributed to fact that major marketing of cauliflower is done through marketing channel I. Timilsina and Bhandari supports the low producer's share of cauliflower in Pokhara because farmers pays high marketing cost to various market functionaries as their marketing cost (Timilsina & Bhandari, 2020). Producer's share was maximum (100%) in channel 4 where no marketing intermediaries were involved. This result is supported by the result of Tanahu district (Poudel, Pokharel, KC, & Adhikari, 2019).

Table 5: Price spread and producer's share in consumer's price

Particulars	Channel I	Channel II	Channel III	Channel IV
Price Spread (Rs)	35	32	25	0
Producer's Share (%)	57.14	68	67.3	100

5.5.3 Market Margin

Study showed market margin was highest in channel-I as compared to other channels. Channel-IV had least consumer's price, which indicates that there was least price spread in channel-IV. It indicates that market margin is high when there are more intermediaries in the marketing channel. The market margin of different intermediaries is presented in Table 6:

Table 6: Marketing margins of different marketing intermediaries

Channel	Collector's		Wholesaler's		Retailer's		Consumer's Price	Total Market Margin
	Price	Margin	Price	Margin	Price	Margin		
I	60	+18	78	+12	90	+15	105	45
II			68	+18	88	+17	100	32
III					64	+31	95	31
IV							90	0

5.6 Production and Marketing Problems

Cauliflower grower in the study area have faced several constraints related to production and marketing. Production constraints faced by farmers are mentioned in Table 7.From the study, it was clearly depicted that farmers were constrained by disease and pest problems followed by availability of fertilizer and manure, irrigation water and facility, quality of seed material, and problem-related to soil fertility. On the other hand, inappropriate marketing channel is the important problem faced by farmers followed by price fluctuation, access to market, problem in the transportation of produces and lack of proper storage facilities. The detailed marketing problem faced by the sampled farmers is presented in Table 8. Moreover, lack of policy implication in time due to the instability of government could be the reason behind this problem.

Table 7: Problem in production of cauliflower

Production Problems	Index value	Rank
Diseases and pests	0.76	I
Unavailability of fertilizer and manure	0.63	II
Irrigation water and facility	0.60	III
Quality of seed material	0.51	IV
Mechanization	0.48	V

Table 8: Problem of cauliflower farming

Marketing Problems	Index value	Rank
Inappropriate marketing channel	0.76	I
Price fluctuation	0.68	II
Distant market (No nearby access to market)	0.62	III
Transportation	0.54	IV
Storage facilities	0.38	V

5.7 Government policy to increase production

Among the many sectors in the country, Nepal has placed a greater emphasis on agricultural development and mechanization in order to reduce poverty levels in rural areas. The improvement of Nepal's agriculture sector has been prioritized in many plans and initiatives. Various programs and initiatives have been introduced in recent years. Agriculture Development Strategy (ADS) was designed as 20 years project (2015-2035) with the vision to accelerate the agricultural sector's growth through four components i.e. good governance, productivity, competitiveness, and profitable commercialization (MOAD, 2015).Likewise, the Government of Nepal launched the Prime Minister Agriculture Modernization Project (2016-2025) with the goal of increasing agricultural production and productivity through mechanization, and to make famers self-sustained through commercialization.

For agriculture production, PMAMP has established the notion of pockets, blocks, zones, and super zones (PMAMP, 2016). Vegetable zones, for example, have been established in many locations to boost productivity including Dhading where cauliflower is the major vegetable. Land pooling

has been established along with some subsidies for the development of a specific crop in one area. Farmers have received essential farm equipment's, seeds and other important materials from involved authorities, from production to commercialization, as a part of subsidy strategy.

6. Conclusion and Suggestions

The early season cauliflower bears a huge potential of production in Dhading district. Based on the results of benefit-cost ratio and net profit, it signifies that there is ample scope to get high return from early-season cauliflower in Dhading district of Nepal. The study reveals that cost on manures has a significant impact on gross return. The sum of coefficients was 0.59 which implies decreasing return to scale, 100% increasing in the variable factor included in the model would result in 59% increase in gross return. To maximize the gross return from early-season cauliflower, it would be better to increase the amount of manure while lowering seed and transportation costs. The flow of cauliflower from producers to collectors – wholesalers, retailers, and consumers – was the most often used marketing channel in the research area. Marketing margins were found to be higher on longer channels than on shorter channels which also implies longer the channel greater the margin.

Suggestion

Based on the study's finding, some recommendation have been made that may be valuable to the relevant government authorities and other interested parties that are working to increase cauliflower production.

- Farmer's awareness and training (production, management, and marketing) should be arranged.
- Farmers should be educated on cauliflower variety selection during early, main and late season.
- There is a need for more study into disease and pest status, as well as management approaches.
- As much as possible shortest marketing channel should be chosen.
- Creating a digital profile in preparation for the launch of new agricultural plans.

Acronyms

% : Percentage
BCR : Benefit-Cost Ratio
CBS : Central Bureau of Statistics
DAP : Diammonium Phosphate
FYM : Farmyard Manure
GDP : Gross domestic Products
mt : Metric ton
mt/ha : Metric ton per Hectare
MS : Microsoft
MOALD : Ministry of agriculture and Livestock Development
MOP : Muriate of potash
NRs : Nepalese Rupee

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