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Economics of production and marketing of apple (*Malus domestica)* in Mustang, Nepal

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Abstract

A study was carried out to assess the production and marketing status of apple in the Mustang district of Nepal in 2019. A total of 100 households were sampled by using simple random sampling technique and interviewed with a pre-tested semi-structured questionnaire. Descriptive statistics and independent-sample t-test was used for data analysis using SPSS and MS-Excel. Farmers were categorized into small farmers (n=68) and large farmers (n=32) based on the number of apple trees grown by farmers. The average area under apple cultivation was 6.64 ropani (0.3378 hactares). The overall average apple production was 2848 kg (2.84 Mt) and the large farmers had more apple production (7035 kg) as compared to small farmers (877 kg). The average annual household income from apple was NRs. 29,868 (248.90 USD). Apple farming was found to be a profitable farm enterprise with a benefit-cost ratio of 1.84. Two marketing channel was identified in the study area and Channel II was found more profitable. Education status of household head, ethnicity, number of economically active family members, experience on apple farming and visit of extension worker to apple farms were the significant factors that positively affected the production and marketing of apple. The satisfaction level of farmers from production and marketing of apple was found very poor (79%). Unavailability of inputs, lack of storage facilities, insect pest damage, poor technical knowledge and infrastructure were major production problems. Similarly, price variation, poor marketing infrastructure and linkage, high postharvest loss, poor bargaining power and low volume of production were the major marketing problems.

Keywords: BC ratio, Livestock standard unit, Marketing channel, Scaling technique

Introduction

Nepalese economy is predominantly an agricultural-based economy. Agriculture sector contributes 27% of GDP in the fiscal year 2018/19 (MoF, 2019) and employs 65.6% of the total Nepalese population (MoALD, 2017). The total area under fruit cultivation in Nepal was 150,387 ha while the productive area was 110,802 ha. The total fruit production within the country was 991,978 Mt with the productivity of 8.95 Mt/ha. Apple is a major temperate fruit of the country. The total area under apple production was 12,015 ha with the productive area of 3,707 ha (MoALD, 2017). Likewise, the global area under production was 4904305 ha with the production of 86142197 tonnes. Thus the productivity was 17.56 Mt/ha in the year 2018 (FAOSTAT, 2020). The area under apple production in Mustang was 1,115 ha but the productive area was only 360 ha. The production is about 4.500 Mt with the productivity of the 12.50 Mt/ha

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(MoALD, 2017). Globally, Apple accounts for about 50% of world's deciduous fruit tree production. China was the leading country in apple production accounting for about 41% of the total global production followed by the USA, India and Turkey (USDA, 2013).

Apple (*Malus domestica)*, belongs to the family Rosaceae and is perishable in nature. It is believed that the edible apple originated in Central Asia. It is small to medium tree with dark green serrated leaves and fleshy edible fruits (Collett, 2011).

Mustang district lies in the Gandaki Province of northern Nepal. The district headquarter located at Jomsom and covers an area of 3,573 km^2 and has a population (2011) of 13,452. The district straddles the Himalayas and extends northward onto the Tibetan plateau. Mustang is one of the remote areas in Nepal and is sparsely populated.

Mustang is a high hilly region located at an altitude of 2550 masl with an annual temperature of 12°C. 50% of the production form this region goes in the market and for processing.

Most of the farmers in the study area are poor and uneducated. According to the current census, the literacy rate of the district is only 66.2% (CBS, 2011). The marketing channels are not efficient in boosting the marketing of apple. In the year 2015/16, out of total 490 tons apples produced within the district, only 100 tons were marketed and remaining 390 tons of harvested apples were being used for domestic consumption (DADO, 2016). Intervention in the marketing of apple is required to increase the profitability of farmers and the promotion of agribusiness.

Apple production in mustang district is mostly subsistent in nature with low productivity. This may lead to the high inefficiencies in production and marketing of apple thereby hindering the commercialization of apple farming. To increase production, the smallholder farmers should efficiently utilize the limited resources for improving food security and generating farm income (Amos, 2007).

The climatic condition of high hills of mustang district is best suitable for apple cultivation. The sloppy hills of this region have huge potential for apple production and apple-based agribusiness enterprises. However, the comparative advantage of apple for this region is not yet seriously explored and exploited. No any study about the problems and prospects of apple sub-sector in mustang district are carried out yet. A coordinated study is required for suggesting measures to be taken for expansion of area under apple cultivation and maximizing apple production and profitability of farmers. PMAMP has prioritized apple in mustang district and established apple zone in Jomsom (PMAMP, 2017). However, researches on apple are primarily focused in Jumla district and its periphery. The efforts for commercialization of apple in mustang are still lacking and researches are very limited.

About 40% of people of Mustang are under the poverty line which is very high in comparison to the other parts of the country, the national average being 25.16% (UNDP, 2014). National Planning Commission aims to narrow down population under poverty line from 25.16% as of now to 17% by the end of 14th National Plan. It aims to achieve 4.7% annual growth in the agriculture sector. It expects to increase fruit production from 1,200,000 Mt in 2015/16 to 1,230,000 Mt by 2017/18. It also expects increased farm mechanization, technology development and adoption, increased raw material production for agro-based industries, improved marketing infrastructures and storage facilities (NPC, 2016). According to CBS (2011), the export of fruits was worth NRs. 486 million in 2010 while total imports of the same year were worth NRs. 4,715 million. Thus, Nepal suffered a trade deficit of NRs. 4,228 million in the year 2010.

The productivity is lower than that global average but higher than of national average. So, the research on production and marketing help to identify the pros and cones associated with it. Therefore the research on production and marketing of the apple in the Mustang was carried out.

Materials and Methods

Selection of the study area

This study was conducted in the Mustang district of Nepal. Gharapjhong Rural Municipality was purposively selected because it was the major area of apple production. Similarly, it was also the command area of Prime Minister Agriculture Modernization Project (PMAMP), Project Implementation Unit, Apple Zone, Mustang.

Sample size and sampling procedure

The list of small farmers, large farmers and traders of from PMAMP were used as a sampling frame which consists of 1000 households in the study area. From the sampling frame, 10% of households (100 households) were selected for the study. Simple random sampling technique was used for the selection of samples.

Data collection methods

Both primary and secondary data were collected for the study. The primary data was collected by conducting field survey using pre-tested household interview schedule, focus group discussions, key informant interview, rapid market appraisal and the case study of apple producers and traders.

Secondary data were collected from documents and publications of MOAD, FDD, AICC, NPC, NARC, PMAMP, AKC, Mustang and other government agencies. Similarly, reports and publications of various concerned NGO's and INGO's like FAO, UNDP along with journal articles were the sources of secondary data for this study.

Data collection procedure

Reconnaissance survey

Several preliminary field visits were carried out to be familiar with notable features of the study area like topography, land use, agricultural infrastructures, government/non-government service providers and community-based organizations. The information obtained from these observations acted as a vantage point for the preparation of the interview schedule and checklists for systematic data collection.

Interview schedule design

A semi-structured interview schedule was prepared to collect information from apple farmers. The questionnaire was designed to meet the objectives of the study. Similarly, checklists were prepared for focus group discussion and key informant interview.

Pre-testing of the interview schedule

The interview schedule was pre-tested with 10 households (10% of total sample size) for its validity and efficacy. The final interview schedule, after necessary modifications, was used to interview the sampled households.

Field Survey

The field survey was carried out in April 2019 to May 2019. Farmers were personally visited and interviewed by face-to-face interview technique. The objective behind the survey was clearly stated and their permission was sought. A good rapport was built before starting the interview to ensure that the information given by them is reliable and unbiased.

Data collection techniques

Household Interview

All randomly selected households were visited and interviewed with the help of the interview schedule. All the necessary data was collected on socio-economic and demographic characteristics, cost and return from the cultivation, major production and marketing problems associated with the apple.

Focus group discussion

A total of five focus group discussions were conducted using FGD checklists with the progressive farmer, ward representatives, presidents of farmer groups and members of the zone management committee. The information from these discussions was used to verify the responses from the household interview.

Key informant interview

A total of 10 interviews were conducted with key informants from Gharapjhong rural municipality, other non-government organizations, members of the zone management committee, progressive and lead farmers.

Data analysis technique

Data coding, entry and cleaning

The collected data were coded and entered in Statistical Package for Social Sciences (SPSS). The data was further cleaned by removing errors, inconsistencies and overlapped responses. The data was further analyzed using SPSS, Microsoft Excel and STATA.

Qualitative data analysis

The qualitative data were either analyzed qualitatively or further quantified to carry out the quantitative analysis.

Quantitative data analysis

The collected quantitative data were analyzed using both descriptive and analytical statistics.

Descriptive analysis

The average number of apple tree was found to be 126. Based on average apple trees, the farmers were categorized into small farmers (<126 trees) and large farmers (>126 trees). The further analysis was done by comparing between these two categories of farmers. The socio-demographic and economic characteristics were described using descriptive statistics.

Cost of production

The total cost of production per ropani was calculated by summation of variable and fixed cost. Variable cost includes input cost like fertilizer, irrigation, pesticide, planting, labour cost etc. Fixed cost includes the rental value of land and depreciation cost. The variable costs were separately calculated for the first and second year. From 3 to 15 years, the variable cost was increased each year by 10 percent. From 16 to 25 years, the cost was considered the same as that of 15 years but the production was assumed to be decreased by 20 percent than that of 15th year.

The variable cost was estimated by using the following formula:

$$\text{Variable cost} = C_{planting} + C_{labour} + C_{fym} + C_{irrigation} + C_{pesticide} + C_{management} + C_{other}$$

Where,

$C_{planting}$: Cost of planting (NRs.)

C_{labour}: Cost of human and animal labour used (NRs.)

C_{fym}: Cost of farmyard manure (NRs.)

$C_{irrigation}$: Cost of water/snow pond establishment (NRs.)
$C_{management}$: Cost of orchard management (NRs.)
C_{other}: Other miscellaneous costs (NRs.)

Similarly, the fixed cost was estimated by using the following formula:

Fixed cost = $C_{land\ tax} + C_{depreciation}$

Where,

$C_{land\ tax}$ = Cost of land tax (NRs.)

$C_{depreciation}$ = Depreciation cost of farm equipment (NRs.)

Gross return

The total gross return was calculated by multiplying the quantity of apple produced (kg) with the average price of apple (NRs.).

Profit/loss analysis

Profit or loss is the difference between gross return and total cost of production. If the difference is positive, it indicates that apple production is profitable while a negative value represents the loss in apple production in the study area.

Benefit-cost analysis

Benefit-cost ratio (BCR) is a quick and easy measure of the economic performance of any firm. BCR was calculated by using the following formula:

$$\text{Benefit-cost ratio (BCR)} = \frac{\text{Gross return (NRs.)}}{\text{Total cost of production (NRs.)}}$$

Scaling technique

Five-point scaling technique was used to measure the relative severity of production and marketing problems. The most severe, highly severe, moderately severe, less severe and least severe were given the scale values 1, 0.8, 0.6, 0.4 and 0.2 respectively. The index was calculated using the following formula:

I =

Where,

I: Index ($0 < I < 1$)

S_i: Scale value at i^{th} severity

f_i: Frequency of the i^{th} severity

n: Total number of respondents

Results

Socio-economic and demographic characteristics of the respondents

Population distribution of age group

The population below 15 years in the study area was found to be less than a fifth (15.87 %), between 15 to 59 years (economically active group) was about seven in ten (71.64%) and above 60 years was a minority (12.47%)(Table 1).

Table 1. Population distribution by age group in the study area (2019).

Age group	Frequency
<15	84 (15.87%)
15-59	379 (71.64%)
>60	66 (12.47%)
Total	529

Ethnicity of apple farmers

It was found that the majority of the apple farmers in the study area were Janajati (88%), one in ten (10%) of farmers were Dalit and a very small farmers (2%) were Chettri. Among Janjati, small farmers hold 56 households and the large farmers hold 32 households (Table 2).

Table 2. Ethnicity of apple farmers in the study area (2019).

Ethnicity	Small farmers (n=68)	Large farmers (n=32)	Overall (N=100)
Chettri	2 (2.9%)	0	2 (2%)
Janajati	56 (82.4%)	32 (17.6%)	88 (88%)
Dalit	10 (14.7%)	0	10 (10%)

Education status of the household head

In total, more than two fifths (44%) of studied household head was found to be illiterate. The population of illiterate farmers was higher in small farmers (45.6) than that of large farmers (40.6) and rest 56% of farmers were literate. Among the literate household head, 17.64%, 33.82%, and 2.94% of the small farmers had received a primary, secondary and higher level of education respectively. Similarly, In the case of large farmers, 12.5%, 43.75% and 3.12% had received a primary, secondary and higher level of education respectively (Table 3).

Table 3. Education status of household head of apple farmers in the study area (2019).

Education	Small farmers (n=68)	Large farmers (n=32)	Overall (N=100)
Illiterate	31 (45.6%)	13 (40.6%)	44 (44%)
Primary	12 (17.64%)	4 (12.5%)	16 (16%)
Secondary	23 (33.82%)	14 (43.75%)	37 (37%)
Higher Level	2 (2.94%)	1 (3.12%)	3 (3%)

Religion followed of households

Majority of the households in the studied area follow Buddhism. On average, a very large majority (86%) of the household follow Buddhism while only minorities (14%) of the households follow Hinduism (Table 4).

Table 4. Religion followed by apple farmers in the study area (2019).

Religion followed	Small farmers (n=68)	Large farmers (n=32)	Overall (N=100)
Hinduism	14 (20.6%)	0	14 (14%)
Buddhism	54 (78.40%)	32 (100%)	86 (86%)

Landholding of households

The average landholding in the studied area was estimated to be 8.18 ropani (0.416 ha). The average landholding of the large farmers (14.37 ropani = 0.731 ha) was found significantly higher than that of small farmers (5.27 ropani = 0.268 ha) at 1% level of significance. The average khet land owned by farmers of the study area was found to be 6.54 ropani (0.3327 ha) of which 6.13 ropani (0.3119 ha) was irrigated land. The average cultivated land owned by farmers of the study area was found 7.02 ropani (0.357 ha). Large farmers (13.28 ropani = 0.675 ha) were found significantly higher than that of small farmers (4.07 ropani = 0.207 ha) at 1 % level of significance (Table 5).

Table 5. Distribution of landholding of respondents by apple farm size category in the study area (2019).

Type of land	[1]Small farmers (n=68)	[2]Large farmers (n=32)	Overall (N=100)	[1-2]Mean Difference	t value
Total owned land (ropani)	5.27 (0.268)	14.37 (0.731)	8.18 (0.416)	-9.1***	-4.56
Bari (ropani)	0.09 (0.00457)	0.69 (0.035)	0.28 (0.014)	-0.599*	-2.07
Khet (ropani)	4.07 (0.207)	11.78 (0.599)	6.54 (0.332)	-7.7***	-5.02
Kharbari (ropani)	0.53 (0.02696)	0.41 (0.02)	0.49 (0.024)	-0.12	0.35
Irrigated land (ropani)	3.56 (0.1811)	11.59 (0.589)	6.13 (0.311)	-8.03***	-4.82
Cultivated land (ropani)	4.07 (0.207)	13.28 (0.6756)	7.02 (0.357)	-9.2***	-5.6
Leased in (ropani)	0.32 (0.0162)	1.22 (0.062)	0.61 (0.031)	-0.89	-1.7

Notes: *, *** indicates the level of significance at 10% and 1% respectively, 1 hectare = 19.65 ropani, figures in parenthesis represents land units in hectares

Livestock standard unit of the household

Livestock rearing is an integral component of Nepalese agriculture. Livestock holding of each household was studied by calculating the Livestock Standard Unit (LSU). All the livestock species were converted into livestock standard unit by using the formula,

LSU = 1 cow + 1.5 buffalo + 0.6 pig + 0.4 goat/sheep + 0.02 poultry

The livestock holding unit was calculated to be 8.36 for small farmers whereas 32.36 for large farmers (Table 6).

Table 6. Livestock standard unit of the respondent by apple farm size in the study area (2019).

Livestock	Small farmers (n=68)	Large farmers (n=32)	Mean difference	t value
LSU	8.36	32.36	-24	2.93

Area, production, productivity and experience of apple farming

The average area of apple farm was estimated to be 6.64 ropani (0.337 ha). The average area under apple cultivation of large farmers (13.18 ropani = 0.670 ha) was found significantly higher than that of small farmers (3.35 ropani = 0.180 ha) at 1% level of significance.

The overall average productivity of apple in the study area was calculated as 8.57 Mt/ha. The average productivity of apple in the studied area was found significantly higher for large farmers (10.62 Mt/ha) than that of small farmers (4.94 Mt/ha).

The overall average production of apple among the studied area was found to be 2848 kg (2.84 Mt). The quantity of apple produce by large farmers (7035 kg) was found significantly higher than that of small farmers (877 kg) at 1 % level of significance.

Apple farmers in the studied area were found to have 15 years of experience in apple cultivation. Farmers having larger apple farms were found to have more experience (20 years) than that of small farmers (13 years) which was found statistically significant at 1% (Table 7).

Table 7. Area, production, productivity and apple cultivation experience by farmers category in the study area (2019).

Variables	[1]Small farmers (n=68)	[2]Large farmers (n=32)	[1-2]Overall (N=100)	Mean difference	t- value
Total area under apple cultivation (ropani)	3.55 (0.180)	13.18 (0.670)	6.64 (0.337)	-9.62***	-5.96
Total production (kg)	877	7035	2848	-6157***	-4.00
Productivity (Mt/ha)	4.94	10.62	8.57	-240	-2.78
Years of experience	13	20	15	-7.66***	-4.63

Notes: *** indicates the level of significance at 1%, 1 hectare = 19.65 ropani, kg = kilogram, Mt/ha = Metric tons/hectare, figures in parenthesis represents land units in hectares

Cost and return analysis

The total cost of apple production in one ropani on a year considering farmer's practices was estimated as NRs. 1,628,385 (13569.875 USD). The variable cost and fixed cost was accounted for to be NRs. 999,261 (8367.175 USD) and NRs. 629,124 (5242.7 USD) per ropani respectively. The total gross return from apples was estimated to be NRs. 3,001,568. The benefit-cost ratio was calculated as 1.84 representing profitable farm enterprise (Table 8).

Table 8. Cost and return estimation of apple production in a ropani of land in the study area (2019).

Particulars	Value
Variable cost (NRs./Ropani)	9,99,261 (8367.175)
Fixed cost (NRs./Ropani)	6,29,124 (5242.7)
Total Cost (NRs./Ropani)	16,28,385 (13569.875)
Gross return (NRs./Ropani)	30,01,568 (25013.06)
Profit	13,73,183 (11443.191)
BC ratio	1.84

NRs. = Nepalese Rupees, BC = Benefit cost,
1 United States Dollar = approx 120 NRs.,
figures in parenthesis represents currency in USD

Benefit-cost ratio

The benefit-cost ratio gives an idea about the recovery of expenditure incurred during the production by the return from the product. BC ratio in the studied area indicates that the large farmer (2.18) was profitable than that of small farmers (1.64) (Table 9).

Table 9. Benefit-cost ratio of the apple farmers in the study area (2019).

Variables	Small farmers (n=68)	Large farmers (n=32)	Mean difference	t value
BC ratio	1.64	2.18	-0.54	-1.76

Note: BC = Benefit cost

Marketing channel

Channel 1: Producer-Consumer

Channel 2: Producer – Trader – Consumer

Two marketing channels were found in the study area in which channel I was found more profitable than channel II. Considering Channel I, the marketing margin and producer's shares are 0 and 100 percent respectively. Similarly for the channel II (producer – traders – consumer) the marketing margin and producer's share was found 114.95 and 42.10 percent respectively (Table 10).

Table 10. Market channel, market margin and producer's share of apple farmers in the study area (2019).

Marketing Channels	Farm-gate price (NRs.)	Retail price (NRs.)	Market margin	Producer share
Channel I	117.5 (0.979)	117.5 (0.976)	0	100%
Channel II	83.55 (0.69625)	198.5 (1.65)	114.95	42.10%

NRs.: Nepalese Rupees, figures in parenthesis represents currency in USD, USD: United States Dollar

Production problems

Unavailability of inputs was identified to be the major problem in apple production with an index value of 0.81. It was due to the lack of market facilities in the study area for agriculture inputs like fertilizer, pesticide, phytohormones, lime etc.

Lack of storage facilities was ranked to be the second most serious problem for apple production with an index value of 0.74. It is due to the lack of storage facilities restricting to produce few products. Large quantities of apple were also damaged and farmers were unable to get good price due to lack of storage facilities.

Insect pests possess a severe threat to apple production. Damage by insect pests was ranked third serious problem in apple production with an index value of 0.73. The serious menacing insects were tent caterpillar, sanjose scale, apple woolly aphid and shoot borer while major diseases were powdery mildew, papery bark and foot and root rot disease.

The fourth major problem in apple production was identified to be poor technical knowledge about apple farming (0.406). Apple farming was an entirely different enterprise as compared to subsistence farming of food crops, farmers lacked information and skills about apple cultivation and improved orchard management practices. Farmers were found to be adopting faulty farming practices due to their ignorance.

The fifth major problem in apple production was identified to be lack of infrastructure with an index value of 0.312. Infrastructure includes irrigation, pruning and harvesting equipment which was essential for apple production (Table 11).

Table 11. Ranking of problems associated with apple production in the study area (2019)

Production problem	Index value	Rank (1= severe)
Unavailability of inputs	0.81	1
Insect pest damage	0.73	3
Poor technical knowledge	0.406	4
Infrastructure	0.312	5
Lack of storage	0.744	2

Marketing problems

The data revealed that the price variation (0.86) was the most serious marketing problem followed by poor marketing infrastructure (0.656), technical knowledge about the minimization of postharvest loss (0.546), poor bargaining power (0.496) and low volume of production (0.442).

There were no proper marketing infrastructures for the marketing of apple in the study area. There was difficult in the transportation to produce apple with very few processing industries of apple. The postharvest loss was also found to be very high. Poor storage facilities and poor handling of apple fruits during harvesting, distant market and poor transportation facilities were found to be the major cause of high postharvest loss. The bargaining power of farmers was also found to be low as there were very few options available to farmers for marketing (Table 12).

Table 12. Ranking of problems associated with apple marketing in the study area (2019).

Marketing problem	Index	Rank (1= severe)
Low volume of production	0.442	5
Price variation	0.86	1
Poor marketing infrastructure	0.656	2
Technical knowledge	0.546	3
Poor bargaining power	0.496	4

Discussions

The primary centre of origin of apple is the region of Asia Minor, the Caucasus, Central Asia, Himalayan India, Pakistan and western China where at least 25 native species of *Malus* are found (Juniper et. al., 1998).

The relationship between farm size and productivity of the farm has been heavily debated. Farm size and yield can have a different type of relationships. There exists an inverse relationship in farm size and yield which means small farms are more productive than large farms. This is because small farms utilize family labour while large farms have to spend more on hired labour (Jha, 2000; Mazumdar, 1965; Dyer, 1997). Pender et al. (2004) found that age of household head, the main source of income, livestock holding, agro-climatic zones, landholding and participation in extension activities positively affected yield. These results are in line with our result as our findings demonstrated the education status, landholdings and livestock holdings were found higher in the large farmers than small farmers.

A positive relationship between farm size and its productivity was reported by Rao and Chotigeat (1981) which was due to the intensive application of nutrients by large farms than that of small ones. A thorough and careful review of the relationship suggested that the positive relation between these two widely debated variables can exist due to managerial factors which may be more efficient in large farms **(**Rao and Chotigeat, 1981)**.** This results supports the findings of this study as higher productivity was demonstrated in larger farms than that of small farms.

The average production cost of apple crop is found to decrease with an increase in the number of plants. A study revealed that farmers having more than 500 plants in their orchards had to bear significantly lower variable cost per plant (Mehta et al., 2013). The 126 apple trees were used to distinguish between large and small farmers so this result couldn't demonstrate such relationships.

The benefit-cost ratio of apple is found to be higher than the food crops due to its high value and higher production and productivity. A study in Iran estimated benefit-cost ratio to be 1.77 (Fadavi et. al., 2011)**.** The BC ratio for small famers was comparable to this result but there was higher BC ratio for the large holder farmers in the study area. This results slightly supports the findings of this study.

Large farms were found to have relatively higher economic productivity attributed due to relatively better management and financial ability and hence were relatively more successful as compared to small farms (Fadavi et al., 2011). Similar result was demonstrated in this study.

It was reported that the marketing channel that involved transaction of apples from producer to primary wholesaler, secondary wholesaler, retailer and consumer is most efficient (Chand et al., 2017). But, our studied identified only two marketing channels in the study area.

The major marketing problems were identified to be lack of transportation facility, lack of market information, perishability of product, lack of packaging materials, lack of processing facility, price instability and lack of storage facility (Amgai et al., 2015). The marketing system of apple crop is quite simple. Most of the farmers, considered in a study, are found to prefer commission agent for channelizing their products in the market. Problems related to lack of marketing intelligence information are the major problems in the marketing of apple fruits (Mehta et al., 2013).

Several constraints may hinder apple marketing. The major marketing problems of apple in Mustang district, Nepal were identified to be lack of transportation facility, lack of market information, perishability of product, lack of packaging materials, lack of processing facility, price instability and lack of storage facility (Amgai et al., 2015). Problems related to lack of marketing intelligence information are the major problems in the marketing of apple fruits in India (Mehta et al., 2013). A study from the Mustang district establishes a fact that apple farmers make a lucrative profit when the region is connected by road transportation (Sachs, 2017). This study identified price variation as the major marketing problem in the study area.

The average national retail price of apple in the fiscal year 2015/16 was NRs. 169 per kg. The seasonality of apple production results from a fluctuating price in different months: highest in summer and lowest during winter (MoALD, 2017).

Kashyap and Guleria (2015) found 4 marketing channels with 4 intermediaries which contradict with our result. Our study revealed 2 marketing channel with 1 intermediary.

There were several constraints to the promotion of apple farming in Nepal. The major farm-level problems prevailing in apple production in Nepal are small landholding and farmers' obligation to grow staple food crops, relatively longer gestation period of fruits, lack of technical know-how, unfavourable climatic conditions like hailstone and erratic rainfall, higher incidence of pests, lack of quality saplings and other inputs and damage by wild animals (Shahi, 2005). This study revealed the unavailability of the inputs as the major problem.

Conclusion

Apple farming in Mustang district is dominated by Janajati and the majority of the community followed Buddhism. Apple production in larger farms was found more profitable which was supported by higher BC ratio. Among the two marketing channel, Channel I was found to be more profitable. Unavailability of inputs was found as the major production problem whereas price variation was found as the major marketing problem.

Compliance with Ethical Standards

Conflict of interest

There is no conflict of interest associated to the research, authorship and publication of this article.

Ethical approval

Ethical approval for the study was obtained from Prime Minister Agriculture Modernization Project, Project Implementation Unit, Apple Zone, Mustang.

Consent to participate

Survey participants were not particularly vulnerable and data was processed in anonymized form. The survey participants had the possibility to escape the questions and terminate the enumeration process.

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Authors' contributions

Bikash Gayak: He was involved in the overall process of the research beginning from the preparation of the questionnaire, data collection, data analysis, data interpretation, preparation of manuscript, correction of the manuscript to final publication.

Subodh Raj Pandey: He was involved in the overall process of the research beginning from the preparation of questionnaire, data collection, data analysis, interpretation, preparation of manuscript, correction of the manuscript to final publication.

Sandesh Bhatta: Major supervisor, provided valuable feedback during the entire research period.

Data availability

The data generated and analyzed during the current research are available from the authors on reasonable request.

Consent for publication

The publisher had the author's permission to publish this contribution.

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