RESEARCH ARTICLE

PRODUCTION AND MARKETING OF APPLE IN APPLE SUB-SECTOR DOLPA, NEPAL

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ABSTRACT

Dolpa is the largest district and one of the major apple-producing districts of Nepal. It had seemingly an increasing trend of production and productivity of apple despite having low productivity than the national average. A study was carried out to study the production and marketing status of the district. Preliminary studies were done and a household survey was carried out among 125 apple-growing farmers from different wards of Tripurasundari and Thulibheri Municipality. 10 commercial farmers in Juphal along with five wholesalers and retailers each based in Nepalgunj were also interviewed to observe the marketing status of apple. 16.59 % of the income was generated through apple production behind government jobs and other agricultural activities. Apple farming was found profitable with BC ratio of 1.39. Training, technical assistance, experience, and landholding were found to have a positive influence on the apple-growing farmers. The overall productivity of apple in the area was 7.55 MT per ha, which was lower than the national average. Improper Post-harvest handling and storage facility had created a post-harvest loss of 14.33 %. Most of the produce was marketed within the district only due to lack of good roads. Lack of irrigation and insect pest attack were the major production problems whereas lack of storage and poor transportation as the major marketing problems. Increasing the frequency of extension works, technical assistance and good transport of the produce were needed to be focused.

KEYWORDS

Fruits, Apple, Production, Production, Marketing

1. INTRODUCTION

Apple is also a major temperate fruit of Nepal. Apple is grown in a total of 10,886 ha, of which 4133 ha is the productive area and the average productivity of apple in the country is 7 Mt per ha (MoALD, Statistical Information on Nepalese Agriculture, 2017). Apple is the most important winter deciduous fruit of Nepal in terms of area, production and household economy for rural mountainous districts of Nepal (Atreya and Kafle, 2016). The Government of Nepal has also envisaged apple as one of the most important high-value cash crops. The fruit production in Nepal is increasing but at a slow rate (Thapa et al., 2004). Dolpa district is one of

the major apple-producing districts of the country. The largest productive area under apple in Nepal is in Jumla (850 ha) followed by Mustang (360 ha) and Dolpa (315 ha) (MoALD, Statistical Information on Nepalese Agriculture, 2017). Of the total cultivated area under apple in Dolpa, the percentage productive area is only 33.15%. It is the largest district of Nepal which is located at 28°43'N to 29°43'N latitude and 82°23'E to 83°41'E longitude. The district spreads over an altitudinal range of 1,525 to 7,625 meters above mean sea level. The major part of the district (70.2%) lies in the Trans Himalayan climatic zone while only 5.2 % of the area lies in the temperate zone (Wikipedia, 2020).

Table 1: Production and productivity status of Dolpa District

Years	Area apple (ha)	Productive area (ha)	Production (MT)	Productivity Dolpa (MT/ha)	Productivity Nepal (MT/ha)
2015/16	850	355	568	1.6	7.3
2016/17	950	315	1150	3.65	5.36
2017/18	955	331	1654	5	7
2018/19	967	338	1696	5	7.22

Statistical Information on Nepalese Agriculture 2015/16, 2017/18, 2018/19

As per the above-mentioned data, Dolpa has seemingly an increasing trend of production and productivity of apple despite having low productivity than the national average. The study of the production and marketing status and related problems was very important to enlighten the capacity of the district in apple production. The households of the district have been cultivating apple trees for a long and the commercialization of apple

farming was recently been increasing which suggests the study of all the aspects related.

The apples of Dolpa, because no chemicals are used in their production, are, by default, organic which can open possibilities of earning higher remunerations by marketing them under the label 'Organic'. Since the

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district offers great potential in apple farming, a scientific study aimed at the aspects of production and marketing is imperative. Agricultural marketing services play an important role in the rural agricultural development of the country. However, farmers in the mountainous regions of Nepal are being harassed and exploited by intermediaries because of their weak bargaining power and poor economic condition (Pokhrel and Thapa, 2007).

The major constraints to apple farming in Solukhumbu district (which has a similar climatic scenario as of Dolpa) were found to be a predominance of smallholder farming, a longer gestation period of apple fruit trees, lack of technical know-how, unfavorable climatic conditions such as hailstones and high rainfall during fruit set, the incidence of disease and insect pests, lack of quality saplings and fruit damage by wild animals and birds (Shahi, 2005). These type of the status and problems which creates obstacles in proper production and marketing of produce in the area were needed to be addressed.

2. MATERIAL AND METHODS

2.1 Study Area

Two wards (3 and 4) from Tripurasundari Municipality and four wards (4,7,8,9) from Thulibheri Municipality were purposively selected for the study because most of the apple production is concentrated around the only airport of the district – Juphal airport, because airways are the only means of transporting apples to Nepalgunj and other cities.

Figure 1: Map of Nepal showing Dolpa district with study site

2.2 Research Instruments

Preliminary information about the field conditions, socio-cultural settings, demographic and topographic features of the study area was collected through field visit, key informant interview and Focus Group Discussion (FGD). A semi-structured questionnaire was developed and a sampling frame was prepared on the basis of information collected through the tools mentioned and the profile of apple growing farmers made by respective wards. A total of 20 households were selected from each ward, except ward no 8, from where 25 households were sampled using simple random techniques. 10 commercial farmers in Juphal along with five wholesalers and retailers each based in Nepalgunj were selected for the interview. A total of about 10 Rapid Market Appraisals (RMA) were conducted among apple collectors, wholesalers and retailers using a semi-structured interview schedule to obtain information on marketing channels, the volume of trade flow, market price, marketing margin, and demand and supply.

2.3 Data Analysis

Socio-demographic and farm characteristics were analyzed using descriptive statistical tools such as frequencies, means, percentages and standard errors.

2.3.1 Benefit cost analysis

The benefit cost analysis was carried out using the formula:
Benefit cost ratio = Gross returns/Total Variable Cost

2.3.2 Margin and Producer's Share

The marketing margin and producer's share were calculated using following formulas:

Marketing margin = Retailer price – Farm gate price

Producer's share = Farm gate price/Price paid by the consumers × 100

2.3.3 Socio-economic factors affecting production of apple

Ordinary Least Square (OLS) regression model as given was used to analyze the socio-economic factors affecting production of apple in Dolpa district, expressed as (Hayes and Matthes, 2009):

$$Y = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7 + b_8X_8 + b_9X_9 + U$$

Where, Y= Production of apple (quintals); b_0 = Regression coefficient; $b_1, b_2, \dots, b_9$ = regression coefficients; X_1 = Gender of household head; X_2 = Age of the household head; X_3 = Annual household income; X_4 = Family size; X_5 = Training Received; X_6 = Constant technical assistance received; X_7 = Experience of the farmers (years); X_8 = Institutional involvement; X_9 = Land holding of the farmers(ha) and U = Error term

Variables X_2, X_3, X_4, X_7 and X_9 are continuous variables (scale) and the rest were created as dummy variables.

2.3.4 Regression diagnostics

The response variable 'Production' was tested for normality using the Shapiro-Wilk test and the statistic obtained was found to be non-significant. The explanatory variables used in models were tested for multicollinearity through the estimation of the Variance Inflation Factor (VIF). The VIF value of 10 is recommended as the maximum level.

2.3.5 Farmers' perception on production and marketing related problems

The index was prepared mainly taking into account the qualitative data. On the basis of responded frequencies, weighted indexes were calculated for the analysis of farmers' perception on the extent of production and marketing problems of apple growers in the region. The farmers' perception was ranked by using five-point scale of problems: 5 for the first priority, 4 for second, 3 for third, 2 for fourth and 1 for fifth priority. Then the priority index for each variable was calculated by weightage mean in order to draw valid conclusion and making a reasonable decision. The index of importance was then computed with the help of the formula:

$$I_{imp} = \frac{\sum S_i \times F_i}{N}$$

where, I_{imp} = index of importance; $\sum$ = summation; S_i = i^{th} scale value; F_i = frequency of i^{th} importance given by the respondents; N = total number of respondents

3. RESULT AND DISCUSSION

The sex ratio of the respondent households was found to be 0.93. The dependency ratio was found to be 0.65, which is less than the national mean (0.85). The percentage economically active population was 60.73, which was slightly lower than the national mean (64%). The average family size in the study area was 5.93, which is higher than the national average of household size (4.9) in 2011 (CBS, 2011). Only 14.44 percent of the respondent population were illiterate. The ethnicity of the population was dominated by Chhetri (89.6%) followed by Dalits, Brahmin and Janajati. Livestock rearing was also a major agricultural activity with the average Standard Livestock Unit (LSU) of 7.11 with a minimum of 1 and a maximum of 26 (1 LSU= 1000 pounds).

3.1 Analysis of share of apple in household income

The study indicated that the contribution of apple farming in total annual household income was 16.59% only behind Government jobs (40.71%) and Agriculture other than apple production (23.79%) implying that apple production is one of the major contributors to total household income in Dolpa district. The mean income from the sales from apple and related products was found to be NRs.64,450. The average annual household income of the apple growers in the study site was found to be NRs.3,23,190.

Table 2: Contribution of different sectors in household income (NRs '000') of the study area, 2020

Source of income	Mean $\pm$ SE	Share %
Agriculture (other than apple production)	78.13 $\pm$ 4.34	23.79
Livestock	50.05 $\pm$ 3.57	12.64
Business	133.96 $\pm$ 16.40	7.96
National job	288.51 $\pm$ 16.08	40.71
Apple	64.45 $\pm$ 7.94	16.59
Total	323.19 $\pm$ 14.70	100

(Field Survey, 2020), SE: Standard error

3.2 Benefit Cost analysis

Growing apple and other temperate fruits than other crops would best utilize the marginal mountains of Western and far-western mountains. The inputs and outputs were valued at prevailing market prices. The

variable costs incurred during a production year were summed to get the total variable costs of a farm enterprise. The revenues obtained from the selling of apples at Rs 45 per kg were taken as gross returns. The Benefit-Cost ratio was found to be 1.39 which is greater than 1, thus apple farming was found to be profitable in the study region.

3.3 Factors affecting production of apple

The dependent variable production was expressed in quintals (100 kg). The coefficients of the regression were obtained as tabulated below:

Table 3: Parameter estimates of regression model for production of apple with different explanatory variables of the study area				
Production (in quintals)	Coefficients	Std. Error	t	p> t
Gender of the household head (X1)	-0.950	1.393	-0.68	0.497
Age (X2)	-0.009	0.078	-0.12	0.905
Household income (X3)	0.036	0.037	0.97	0.335
Family size (X4)	-0.106	0.329	-0.32	0.747
Training (X5)	3.445	1.730	1.99	0.049**
Technical assistance (X6)	4.169	1.240	3.36	0.001***
Experience (X7)	0.383	0.118	3.25	0.002***
Institutional involvement (X8)	-1.688	1.526	-1.11	0.271
Land holding (X9)	0.188	0.085	2.21	0.029**
Constant	5.498	3.762	1.46	0.147
Observations				
F (9,104)	6.45***			
R ²	0.3580			
Adjusted R ²	0.3025			

(Field Survey, 2020), Shapiro-Wilk test's significance for normality test of 'Production' = 0.078

Mean VIF = 1.15

Note: *** and ** refer to being significant at 0.01 and 0.05 level of significance, respectively.

The coefficients of variables X_6 and X_7 were found to be highly significant at 1 percent level of significance which implied that each year addition of experience and each unit addition of technical assistance would increase the production of apple by 0.383 and 4.169 units respectively, taking all other variables constant each time. Similarly, the coefficients of variables X_5 and X_9 (Training and landholding) were found to be significant at 5 percent level of significance indicating that landholding was related to increased production in the study site. Likewise, training farmers for entrepreneurial and technical skills were also related to increment in apple production. However, regression coefficients of other variables were found to be non-significant. The mean VIF for the independent variables was 1.15 and none of its value for independent variables crossed 1.25 indicating that there was significantly little multicollinearity among the variables.

3.4 Status of production, productive area and experience of the farmers in the study area

The area under apple cultivation per household in the study area was found to be 0.41 ha. However, the area under productive trees was, on average, 0.23 ha. The number of apple trees per household was 116, with an average of 65 productive trees and 55 unproductive trees. The average apple production was found to be 1,476 kg. The overall productivity of apple in the area was 7.55 MT per ha, which was lower than the national average.

Table 4: Productive and Unproductive area

Descriptions	Area under (in ropani) Apple	Area under (in hectare)	Types of trees
		Productive trees	Productive
Mean	0.41	0.23	65
Sum	51.1	27.21	7,588

(Field Survey, 2020)

Most of the growers were new farmers, taking apple production from few trees for home consumption to increasing the scale of production. The average number of years, the farmers had been growing apples were found to be 11.28 years, ranging from 2 years to 28 years.

3.5 Status of post-harvest handling and storage

Table 5: Farmers' perception on intensity of production problems in apple

Consumption headings	Percentage
Home consumption	21.10
Livestock feed	12.50
Post-harvest loss	14.33
Sold produce	52.07

(Field Survey, 2020)

Home consumption was in the form of fresh apples, or in dried forms, or in processed form as 'Marpha' – an indigenously prepared liquor.

Post-harvest handling of the fruits was found to be poor in the region. The farmers didn't have the fruit picking equipment as required. The existing storage facilities were indigenously built thatched houses using locally available resources alongside water sources (small rivulets) in the northern slopes. The commonly used storage facilities were cattle sheds or dark store rooms which were without proper ventilation and were not moisture-proof. The houses built for storage in the farms were prone to attack by wild animals too. This has led to 14.33 % of post-harvest loss.

3.6 Marketing channels in the study area

Compared to traders, producers were in a large number in the study area. Very less of the apple produced in Dolpa reaches the markets in Nepalgunj and other cities through contractors. The primary consumers of the produce were consumers in Dolpa, processing industries within the district and passengers traveling to Nepalgunj by airways. The apple produced by the farmers were also dispatched through chartered flights to Nepalgunj and to major markets of Nepalgunj. Thus, the major market of apple produced in Dolpa is Jupal airport – the only running airport of the district. Contractual system was rarely in the place.

Figure 1: A schematic diagram of the marketing channels existing in the transfer of Dolpa apples

Existing Marketing channels:

- Producer – Consumers in Dolpa
- Producers – Retailers – Consumers in Dolpa
- Producers – Processing industries in Dolpa (Distillery, Wine industry)
- Producers – Collector – Wholesaler in Nepalgunj – Retailer – Consumers

3.7 Marketing margin and Producers' share

The farm gate price differed for different places. The farm gate price of apple at Juphal was NRs. 50 per kg while the minimum farm gate price was NRs. 40 per kg. The average farm-gate price was NRs. 45 per kg. The wholesale price of apple in Nepalgunj was NRs. 105 per kg while the retail price was NRs. 140 per kg. The price spread on different channels ranged from NRs. 40 to NRs. 140 per kg. The marketing margin, in channel D, was therefore NRs. 95 and the producer's share in it was 32.14%. In channel B, the marketing margin differed from NRs. 5 to NRs. 10, therefore an average of NRs. 7.5 per kg. The producers' share in this marketing channel was 85.71%.

3.8 Problems faced by the farmers in apple production

Among the major five problems faced by the farmers; lack of irrigation was the most important one. From the information obtained from the respondents, the most important insect pests were wooly aphid. The important diseases prevalent in the area were papery bark, pink disease.

Table 6: Farmers' perception on intensity of production problems in apple

Problems	Index value	Rank
Lack of irrigation	0.85	I
Lack of technical knowledge	0.39	V
Disease and insect pests	0.72	II
Lack of adequate nutrients	0.59	III
Lack of quality planting materials	0.45	IV

(Source: Field Survey, 2020)

3.9 Marketing related problems of apple

The site was deprived of access by good roads, and transportation by airplanes was costly for the farmers and traders. Farmers also lack the availability of durable packaging materials, which is an important requisite for safe transport. Five major marketing problems were ranked as below.

Table 7: Farmers' perception on marketing related problems in apple

Problems	Index value	Rank
Poor transportation	0.90	I
Lack of storage	0.76	II
Lack of processing facility	0.38	IV
Poor market infrastructure	0.68	III
Lack of packaging materials	0.28	V

(Source: Field Survey, 2020)

4. CONCLUSION

Despite climatic potentiality, production problems like lack of irrigation, disease and pests, and lack of nutrients availability were prevalent. So, increasing the frequency of extension works and technical assistance may be beneficial to increase the production of apple in Dolpa district. The marketing system of apple in Dolpa was still in its infant stage. The portion of apple production marketed was only half of the total produce. Aid to the storage facility and a good road transportation could influence the market of the produce from the District.

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