



## Analysis on Apple Production and Trade of Nepal

Sanjay Subedi<sup>a</sup>, Wang Jian<sup>b\*</sup>, Gao Zhuo<sup>c</sup>

<sup>a,b\*,c</sup> College of Economics and Trade, Agricultural University of Hebei, Baoding China

**Abstract:** The study was to analyze the fresh apple production and its trade status of Nepal. The fiscal year 2015/16 apple was cultivated in 5,625 hectares with production of 41,011 metric tons. Nepal import 2.8 million metric ton of apples while export was 477 metric tons on average over the 6 fiscal years. The country has great scope in producing apple but these have not been properly explored. This study attempted to analyze the production, trade and consumption and its correlation coefficients. The export and consumption correlation revealed that there was significant negative correlation. Similarly there was a negative correlation between production and import. The consumption trend of apple shows increasing and was consumed fresh and processed product. The results found in this study are an indicative for taking appropriate measures to improve the domestic production and trade status. Hence it was suggested to produce more apples by adopting systematic production and utilizing available resources to become self-sufficient in the apple production.

**Keywords:** Apple Production, Consumption, Trade, Correlation.

### 1. Introduction

Fruits are consumed for rituals and cultural purposes since ancient time (Karki, 2017). They are very essential part of the agriculture sector contributing 14% of the total GDP in Nepal. The total fruits including summer fruits, winter fruits and citrus fruits produce in Nepal were 976,461 metric ton and yield 8.83 mt/ha in the year 2015/16 while in the year 2009/10 was 706,972 metric ton and the yield 10 mt/ha (ABPSD, 2017). There is need to explore the potentiality of fruit cultivation in Nepal for export promotion as well as import substitution (MRSMP, 2016). Presently the major fruit crops in Nepal are Mango (*Mangifera indica*), Banana (*Musa acuminata*), Mandarin orange, Apple (*Malus pumila* Mill), Litchi (*Litchi chinensis* Sonn.), Pear, Sweet orange (*Citrus sinensis*), Guava (*Psidium guajava* L.), Jackfruit (*Artocarpus heterophyllus*) and Papaya (*Carica papaya*). These crops comprised 88% of the total fruit production in 2015/16 (ABPSD, 2017). However, among this fruits apple is the first most produced fruit in the mountainous region. This fruit contributes about 4.2 percent of the total fruit production and occupies 5.08 percent of the total fruit area in Nepal (ABPSD, 2017).

Apples are consumed worldwide and are commercially cultivated and processed for improving the living standard of farmers. It is also the most significant fruit in terms of production in the high mountain districts of western Nepal (Amgai *et al.*, 2015). The apple plays major role in human nutrition and to generate income and employment opportunities. Despite of that, the trend of apple production has not been increased in Nepal. In addition with increasing demand of it the country has to depend on foreign production (FDD, 2016). The low yield and production could be caused by several reasons: It could be inadequate fertilization or lack of modern cultivation practices resulting poor production (MRSMP, 2016). The country's annual imports of apples were 66,007 tones, valued at USD 34.8 million in fiscal year 2015/16 (TEPC, 2017). It was recognized that nearly 30% of the fruits were lost due to spoilage, due to poor handling, weak transportation and lack of cold storage and processing techniques therefore, the demands remain largely unfulfilled from the domestic production. It should be noted that apples were one of the most produced and consumed fruits in the world which can be grown in temperate areas and has a great importance for world agriculture (Ucar *et al.*, 2016). So undoubtedly, it is commercially the most important temperate fruit and the widely produced fruits in the world after banana, orange and grape and the most traded fruit in the world (FAO, 2016); (Wang *et al.*, 2016).

Apples are consumed worldwide in greater quantities than any other temperate region tree fruit such as peaches and pears (Lynch, 2010) and more than 7500 varieties of apples were grown globally and are mostly consumed fresh. Mainly Red delicious, Royal delicious and Golden delicious are the leading commercial cultivars grown by the farmers of Nepal (Subedi et al., 2016). Nepal has a relatively short history in horticulture development when government of Nepal and India signed an agreement and many horticulture experts were in Nepal for technical cooperation and at the time various fruits and varieties were also imported from India including the apple cultivars in the decade of 1960s (R.D., 2005). Presently, the government has started the agricultural development strategy, 2015-35 focusing the horticultural sector to substitute the import of fruits and foreign earning from export within 20 years period (MRSMP, 2016); (FDD, 2016). However there is a gap of information about the apple production and consumption. The present study for the annual data covers the period 2010/11 to 2015/16. The data on fresh fruit refers to apple (product code 08081000). This study was carried out with statistical analysis and its current development status of apple fruit in Nepal.

## 2. Materials Obtained and Variables Definition

### 2.1 The Case of Apple Production in Nepal

To achieve the objectives of study estimation of annual data relating to production, exports, imports and consumption were collected from secondary sources. The statistical data for 2010/11 to 2015/16 used in this study have been obtained from Ministry of Agriculture Development, Ministry of Commerce and Supplies, Fruit Development Directorate (FDD), Market Development Directorate (MDD), Agro-Enterprise Center (AEC), Central Bureau of Statistics (CBS) and District Agriculture Development Office (DADO). Based on the table 1 show the status of apple production, area and yield during years 2010/11 to 2015/16 in Nepal.

**Table 1.** Status of apple production during 2010/11 to 2015/16 in Nepal

Fiscal Year	Cultivated Area (Ha)	Production (MT)	Yield (MT/Ha)
2010-11	5,048	42,704	8.45
2011-12	5,674	48,946	8.6
2012-13	5,063	42,813	8.45
2013-14	5,140	35,920	7
2014-15	5,599	43,502	8.1
2015-16	5,625	41,012	7.3

**Source:** Ministry of Agriculture Development Annual Report, 2017

While the table 2 shows the status of trade, production and consumption in quantity (MT), supposing let  $Q_P$  to denote native apple production, then  $Q_X$  for apple export and  $Q_M$  for apple import were recorded by CBS. Thus, we can calculate the related annual consumption of apple in Nepal by equation  $Q_C = Q_P + Q_M - Q_X$ .

**Table 2.** Status of apple exports, imports, production and consumption in metric ton (MT) during 2010/11 to 2015/16

Fiscal Year	Production (MT)	Imports (MT)	Exports (MT)	Consumption (MT)
2010/11	42,704	45,294.83	326.69	87,672.14
2011/12	48,946	47,021.38	583.31	95,384.07
2012/13	42,813	56,307.09	264.11	98,856.79
2013/14	35,920	58,089.27	23.99	93,985.28
2014/15	43,502	48,647.81	32.81	92,117
2015/16	41,012	66,007.15	13.02	107,006.13

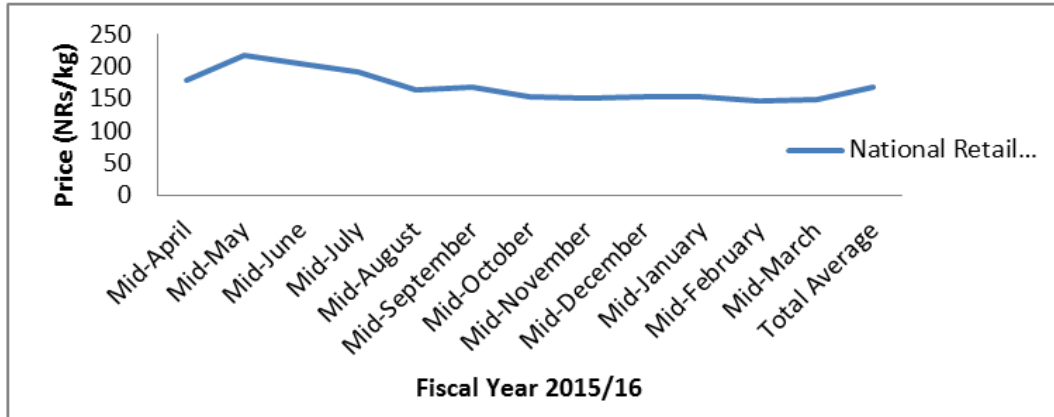
**Source:** Ministry of Agriculture Development Annual Report and TEPC, 2017

### 2.2. Market Price and Production Cost of Nepal Apple

The study was the average mean national retail price of fresh apple in Nepal in one year period. There was a varied price in 12 months. The apple was mainly the most consumed fruits and is available throughout the year. The Figure 1 shows the trend of monthly retail price in rupees (Rs.) in the year 2016 which was obtained from fruits and vegetable market development board and statistical analysis report of Nepal 2015/16. From the analysis of monthly price we can see that prices are changing due to seasonal

factors which affect the price of apples. The harvesting of apple was done in August- November and the fresh apple price gets lower in this month because of surplus amount. Therefore higher harvest or higher quantities of apple import mean even lower price. However the problem for the apple price is due to storage and transportation because in off season there should be a good storage system for apple to have a better price. Usually harvested apple or import apple keep in store until put them to the market. Thus for this enough storage capacity should be required in Nepal.

**Figure 1.** Monthly retail price (Rs/kg) of fresh apple in Nepal, 2016

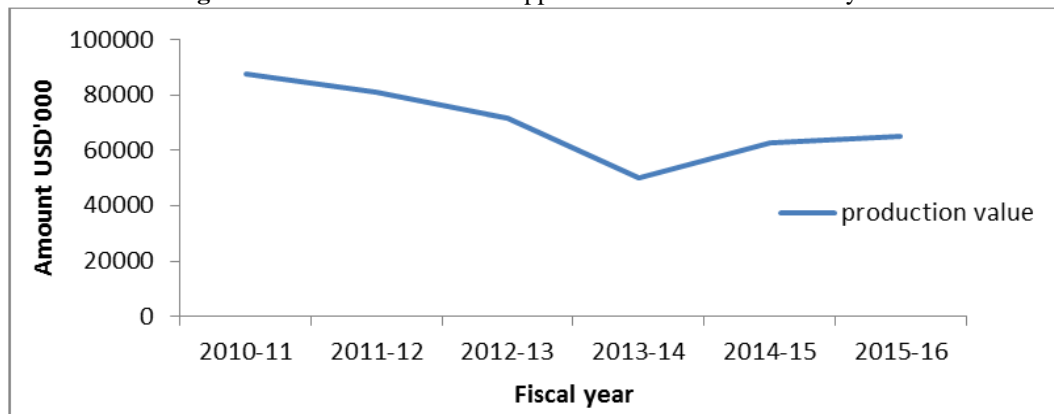


Source: Ministry of Agriculture Development Annual Report, 2017

The Figure 1 describes the monthly retail price in Nepal revealing the average retail price is Rs 169 per kg (\$ 1.59). Retail sellers include push carts, street vendors, shops, supermarket and weekly market in Nepal. It is reckoned that apple production income depends if farmers or stakeholders receive the reasonable profit from the apple production and for this price is an important factor in order to take advantage from the competition in the markets.

Accordingly, the production value was calculated based on retail price from several years. Figure 2 shows the production value of apple in 2010/11 to 2015/16. During these years the average value was 69,805.40167 in thousand US Dollar and the standard deviation was 13,500.25251.

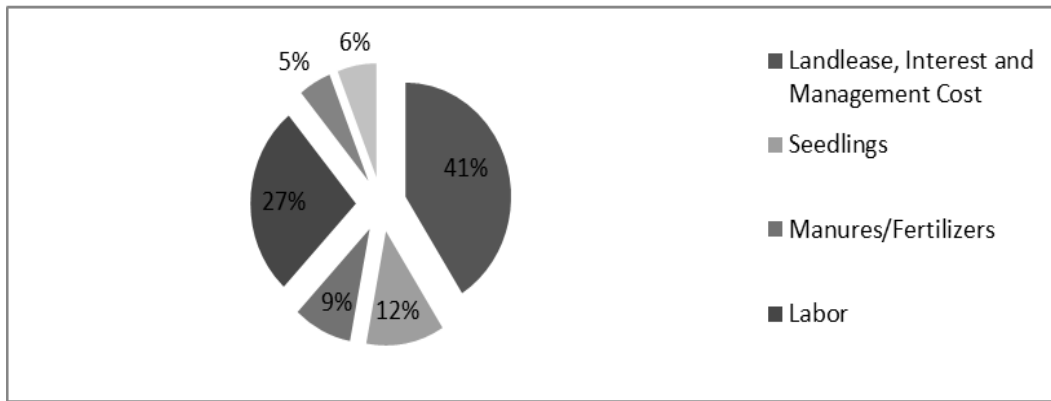
**Figure 2.** Production Value of Apple in US Dollar in different years



Source: Ministry of Agriculture Development Annual Report, 2017

The below Figure 3 was the expenditure percentage on different items for production of fruit crops which shows that land lease, interest on variable cost and management cost has higher cost percentage (41%) compared to others followed by labor (27%), seedling cost (12%), manures or fertilizers (9%), plant protection (5%) and miscellaneous (6%). Moreover according to review paper fruit trees are perennial in nature so the gross income will be positive only when it begins to produce fruit and during that period the farming has negative gross income. However from the study of production cost and gross profit from fruit farming in Nepal (MRSMP, 2016) it was suggested that profit gained from fruit business was higher than from cereals and vegetables.

**Figure 3:** Expenditure Percentage on different items for production cost of fruit crops



Source: MRSMP (2016)

### 3. Statistics Analysis

Statistical analysis was done by finding correlation coefficient, using Microsoft Excel. The estimation was performed on the relationship between production, trade and consumption. The correlation coefficient, average mean and standard deviation were estimated and discussed in the results. The detailed analysis was based on the [table 1](#) and [2](#).

According to the [Table 3](#) shows the detailed statistical analysis for the different variables and its correlation coefficient. During the analysis the average value was 42,482.83333 in metric tons and the standard deviation was 4,200.078114. The minimum value for production was 35,920 ton in the year 2013/14 while the maximum value was 48,946 ton in the year 2011/12. The critical value for a 95% confidence degree in production was 4407.711664.

Similarly during the past 6 years the average value for export was 207.3245 tons and import was 53,561.256 tons respectively. The standard deviation for the export shows 228.324715 and import 7,977.326513. The critical value for a 95% confidence degree in export shows 239.6120938 while for import was 8,371.690751. The maximum value for export was 583.314 tons in the year 2011/12 while for import the maximum value was 66007.15 tons in 2015/16.

The estimation was also done for consumption in which the average value was 95,836.68333 tons. In the year 2015/16 there was a maximum value of 107,006.1 tons while minimum value was 87,672 tons in the year 2010/11. The standard deviation for the consumption shows 6,603.088568 and the critical value for a 95% confidence degree in total consumption showed 6,929.51647.

**Table 3.** Statistical analysis for the production, export, import and consumption (2010/11-2015/16)

Variables	Production (Q <sub>p</sub> )	Export (Q <sub>x</sub> )	Import (Q <sub>m</sub> )	Consumption (Q <sub>c</sub> )
Average mean(MT)	42482.83333	207.3245	53561.256	95836.68333
Standard error	1714.67471	93.21317478	3256.729911	2695.69962
Median	42758.5	148.462	52477.449	94684.5
Standard deviation	4200.078114	228.3247155	7977.326513	6603.088568
Variance	17640656.17	52132.17571	63637738.3	43600778.64
Kurtosis	1.860942249	-0.150644535	-0.796086432	1.222766642
Skewness	-0.059763787	0.91299195	0.63716331	0.853206463
Region	13026	570.294	20712.32	19334.1
Minimum value(MT)	35920	13.02	45294.83	87672
Maximum value(MT)	48946	583.314	66007.15	107006.1
Sum	254897	1243.947	321367.536	575020.1
Observation Number	6	6	6	6
Confidence degree (95.0%)	4407.711662	239.6120938	8371.690751	6929.516475

Source: Authors elaboration

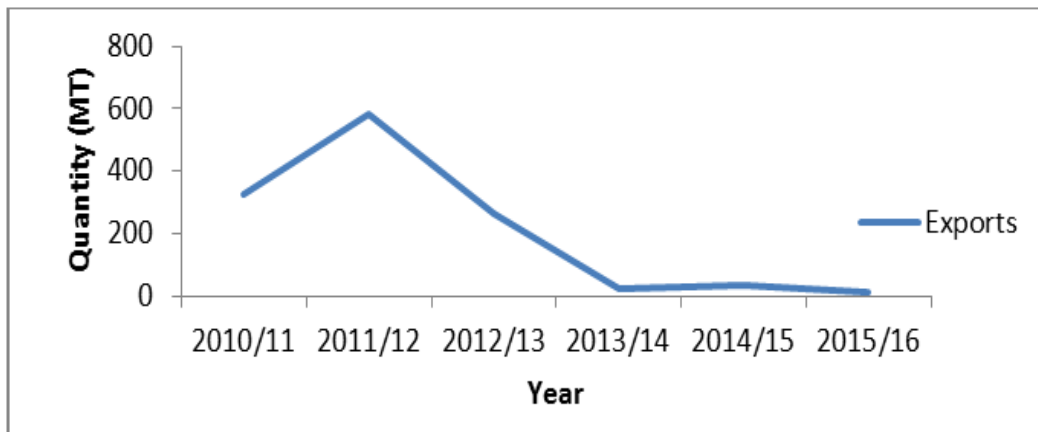
**Table 4. The correlation coefficient**

	Q <sub>P</sub>	Q <sub>X</sub>	Q <sub>M</sub>	Q <sub>C</sub>
Production	1			
Export	0.789653846	1		
Import	-0.57435572	-0.623763473	1	
Consumption	-0.085107827	-0.285876698	0.864354074	1

Source: Authors elaboration

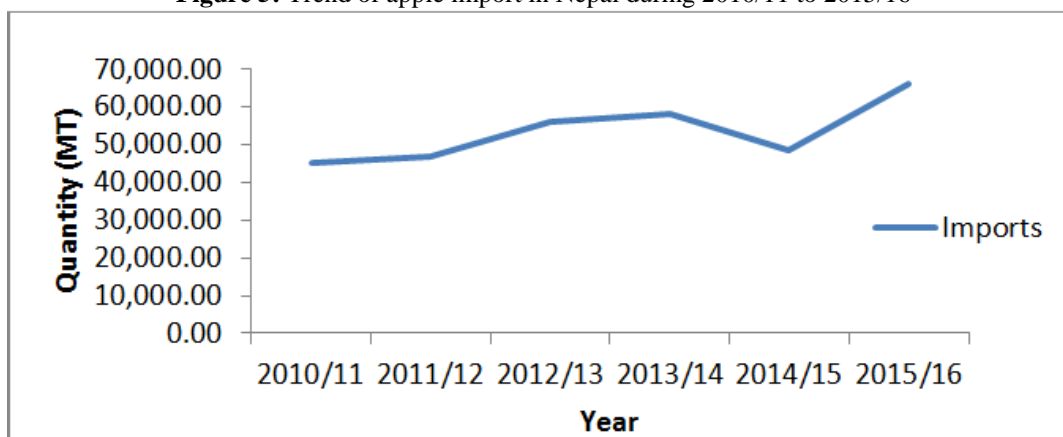
Further from the table 4, the study reveals that there was a positive correlation 0.789653845 between production and export which signifies that if the production is high than exports will also increase and vice-versa. Similarly there was a negative correlation -0.085107827 between production and consumption because domestic production could not meet the demand of consumers resulting higher import. Therefore there was a negative correlation value -0.57435572 between production and import. Besides that there was a negative correlation between export and import which shows that the balance of trade is negative resulting higher trade deficit. It can also be seen that there was a negative correlation between export and consumption because the results signifies that the domestic production was fully utilized and the export quantity was lower. Moreover the study shows that there was a positive correlation between import and consumption which reckoned that the trend of import meets the demand of consumer and the low price plays an important factor for higher consumption than domestic production. By the year 2010/11 to 2015/16 the consumption average value was 95,836.68 tons and standard deviation was 6,603.088. Similarly the critical value for consumption at 95% confidence degree is 6,929.516477. The maximum value for the consumption shows 107,006.1 tons in the year 2015/16 and the minimum value 87,672 tons in year 2010/11. The following figure 4 and 5 shows the trends of apple export and import during the past 6 years.

**Figure 4.** Trend of apple export in Nepal during 2010/11 to 2015/16



Source: TEPC, 2017

**Figure 5:** Trend of apple import in Nepal during 2010/11 to 2015/16



Source: TEPC, 2017



## 4. Discussion

In Nepal, Mountainous region has great scope for apple production due to relatively temperate areas and favorable temperature which is suitable for apple cultivation. In producing apples soil, climate, terrain position and agro techniques are the most important (Pokos, 2012). However the study for low production shows farmers are less aware about scientific agro commercial practices, horticulture schemes and agri inputs due to lack of communication facilities at high hills. According to the (Subedi *et al.*, 2016), the farmers do not have adequate knowledge on when or how to efficiently irrigate, fertilized and prune their apple trees. Also states that reduction of post-harvest losses is a complementary means for increasing production. Therefore this effect has caused the unsatisfactory production and needs to be solved by making policy and bringing effective technology for better production in the future. It is important to raise the living standard of farmers who do farming and increase the employment for the people in remote areas. It is also necessary to understand that the domestic production of apple has to compete with import and the price becomes important factor for consumers to buy fresh apples. We can see that trade deficit is higher and the demand for apple fruit is increasing which signifies the need of domestic production to be raised. Hence from the correlation analysis it can be suggested that there was the strong positive linear association between variables such as production and export. Similarly, it was found that negative correlation between export and import respectively as shown in the [table 4](#).

## 5. Conclusion

Nepal has great scope in producing apple because this was the mostly consumed fruits but these have not been properly explored. At the current situation, it has not been able to fully utilize the opportunities associated with production and export of fruits and vegetables including apple. In the near future if it is improved than the trade deficit can be minimize. The export and consumption correlation revealed that the production influenced consumption and export with significant negative correlation and also there shows a negative correlation between production and import. Therefore, it necessitates to produce more apples by adopting systematic production and utilizing available resources so that, it in near future it will help reduce the trade deficit and become self-sufficient in the apple production.

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