

## **ANALYZING THE GROWTH TREND OF MAJOR FRUIT CROPS PRODUCED IN BANGLADESH FROM (1995-2014)**

<sup>1</sup>Mita Bagchi, \*<sup>1</sup>Lijuan Zhuang

<sup>1</sup>College of Economics and Management, South China Agricultural University  
483 Wushan Road, Guangzhou 510642 PR China.

\*Corresponding author

### **ABSTRACT**

The present study aimed to estimate the growth trend and the extent of instability for area, yield and production of five major fruits such as mango, banana, pineapple, jackfruit and litchi in Bangladesh covering a 20 years of study periods from 1995-96 to 2014-15 using secondary data. The result from Compound Growth Rate revealed that banana has recorded the positive and highest area growth rate of 16.6 % per annum, which was evidently contributed by the high profitability from banana in Bangladesh. Yield growth rate of all selected fruits recorded the significantly positive. Mango and litchi has been recorded the highest yield growth rate. On the other hand, largest production increase was achieved by jackfruit of 21.5% per year. The highest instability of area, yield and production was noticed in pineapple 57.3%, litchi 38.5% and litchi 83.8% respectively. The study also examine that Lithuania, Poland and Germany are the main importer of Bangladeshi fruits in the world and annual export value of fruits from Bangladesh is also increasing. On the other hand China is the main exporter of fruits to Bangladesh. The findings suggest that policy should be taken to provide training on scientific production harvesting technology by the different government organization to the farmer and public-private partnership can facilitates research which focuses on resolving the problems with yields and adaptability, post harvest losses and reduce the quality.

**Keywords:** Major fruit crops, compound growth rate, export and import trend, Bangladesh.

### **1. INTRODUCTION**

Bangladesh is predominantly an agricultural country. Agriculture plays an important role in its economy in terms of sustainable land management, food security, value addition, employment and export earnings. In recent years, there has been a significant increase in food grain production. Agricultural holding in Bangladesh is generally small but use of modern technology,

machinery and equipment is gradually increasing. Despite the significant increase in rice production, Bangladesh is still a leading food grain importer of palm oil, wheat, sugar, fruit and vegetables are also imported in South Asia. Bangladesh enjoys sub-tropical monsoon climate with temperature ranging from 20<sup>0</sup>C in winter to 42<sup>0</sup> C in summer with an average temperature of 27<sup>0</sup>C. Bangladesh climate (both tropical and sub-tropical) and soils are favorable for wide range of tropical fruits production.

Fruit is a structure formed from a mature or ripe ovary of any plant species after fertilization has occurred. More conveniently, fruit refer to the part of the seed suitable for human consumption. Bangladesh is plentiful with a large variety of tropical and subtropical fruits. About 30 species of fruits are common in Bangladesh. Among them mangoes, bananas, jack fruits, pine apple, litchi, Indian jujube, guava etc, are the most common. Some other common fruits are Black pulm, Sapodilla, Tamarind, palmyra palm, Indian olive, Star fruit, Hog pulm, Star Apple , Burmese Crape, Wood Apple, Indian Apple, melon, water melon, litchi, etc.

Bangladesh has suffering deteriorating land quality due to degradation, soil fertility problems, soil erosion and soil salinity which resulting the declining good quality agricultural land by 80,000 hectare which is accounted for 1% per year. In this situation, in order to meet the demand of increasing population, it is urgent to increase in agricultural growth (World Bank, 2005). Yield and area are the major factors affect the agricultural output growth (Singh, 1981; Cauvey, 1991). These sources of output growth have importance in determining the programme of agricultural development and priorities of investment in it (Rande, 1980; Deosthali and Chandrahekhar, 2004). Thus, it become important to find out why this growth rate differ from one another, so that the drawback could be removed to achieve the rapid development of agricultural sector (shikka and Vaidha, 1985). A breakdown of growth in various component area, yield and cropping pattern etc, facilities output forecast with alternative target and policy (Jamal and Zaman, 1992). Fruits play an important role in our life and economy. They are a great source of nutrition. Besides, thousands of people are engaged in fruit production and fruit selling. Govt and different NGO's have extended their helping hands to promote fruit production. Fruit-culture and fruit-eating can effectively lead to promote the national health as well as national economy (Fruits of Bangladesh, 2011). Keeping in view the importance of agriculture, the quantitative assessment of the contribution of these factors and past behaviors and the estimation of its growth rates is important for future predictions of agricultural output useful in rearranging the programs and priorities of agricultural development (Lakshmi and Pal, 1988). In this context, present study attempt to analyze the growth rate of major fruits produced in Bangladesh.

Several studies have been conducted on fruit production and marketing system of Bangladesh. Matin et al., (2008) studied mango marketing system in selected areas of Bangladesh by

estimating the marketing margin and marketing efficiency and marketing channel. Bisakha et al., (2015) conducted the research to determine growth rates of production of major fruits, identifying marketing channel and problems of fruits marketing of Chittagong Hill Tracts. To the best of our knowledge there is no research has been conducted on the growth rate of major fruits in Bangladesh. To address this research gap present study attempt to analyze the growth rate and the extent of instability of major fruits produced such as mango, banana, pineapple, jackfruit in Bangladesh covering a 20 years of study periods from 1995-96 to 2014-15. Along with growth rate the study also examine the export and import trend of Bangladeshi fruit.

The structure of the paper is organized as follows. Methodology is discussed in section 2. Section 3 represents and interprets the estimated results. Section 4 recommends some policy guideline for the improvement of fruit industry in Bangladesh .Finally, the conclusion is in section 5.

## **2. METHODOLOGY**

In this study, Compound Growth Rate (CGR) of production, area, yield of major fruits produced in Bangladesh were estimated for each period to show the growth in production, area, yield of these fruits. The study is based on secondary data for the 20 years of study period from 1995-96 to 2014-15. The necessary data were collected from Bangladesh Bureau of Statistics (BBS) and Food and Agricultural Organization (FAO). Microsoft Excel and SPSS program was applied for analyzing data in a meaningful way.

### **2.1 Growth rate analysis:**

Growth rate can be estimated by employing two common methods of growth rate including Linear Growth Rate and Compound Growth Rate (CGR). Linear growth rate has inherent limitations to perform the comparison of growth rates between periods and crops. Thus, it seems more appropriate to use the compound growth rate rather than linear growth rate (Adi Shadmehri, 2008; Dandekar, 1980) for any comparison of growth between two period and two crops. However in our present study we used Compound Growth Rate (CGR) that usually estimated by following a semi-log trend equation of the form:

$$\log Y_t = \alpha + t\beta + \varepsilon_t \quad (1)$$

Where,

$Y_t$  = Production, area and yield of fruits in  $t^{\text{th}}$  year respectively.

$t$  =Year (1, 2...n)

$\alpha$  = constant coefficient to be calculated

$\beta$  = slope coefficient to be calculated, and

$\varepsilon$  = random error term.

The slope coefficient  $\beta$  measured the relative change in Y for a given absolute change of the independent variable t. If we multiply the relative change in Y by 100, we get the percentage change or growth rate in Y for an absolute change in variable t.

The above equation (1) has been calculated by employing Ordinary Least Squares (OLS) technique. The significance of  $\beta$  is tested by using t-test. This equation is generally based on the consideration that the agricultural output change in a given year would depend on the output in the preceding year (Adi Shadmehri 2008; Dandekar 1980; Deosthali and Nikam 2004; Minhas 1996; Singh et al., 1997).

We can estimate the Compound Growth Rate (CGR) by the following equation:

$$CGR = [(Antilog\ of\ \beta - 1) * 100] \quad (2)$$

The extent of instability for each fruit area, production and productivity/yield was calculated through the coefficient of variation (CV). The following equation is applied to estimate the coefficient of variation (CV):

$$CV = \text{Standard deviation} / \text{Mean value} \times 100 \quad (3)$$

### **3. RESULT AND DISCUSSION**

#### **3.1 Major fruit production volume, area and yield of Bangladesh:**

Fruit production and consumption have been growing rapidly in recent years in Bangladesh, as the economy grows and consumers diversify their diets. This trend is likely to continue in the future. Furthermore, domestic agricultural markets have undergone modernization. Increased production of all varieties of fruits could bring self-reliance to the rural people contributing to the national economy after meeting their nutrition demand. Currently, fruits are being cultivated approximately on 0.141 million hectares of land with producing about 4.39 million tones annually (BBS, 2013). Table 1 represents the area under fruit cultivation in Bangladesh during the study periods 1995/96 -2014/15. It revealed that 50.2 thousand hectares of land was under mango cultivation in 195/96, followed by banana, jackfruit and litchi. The trend of fruit cultivated area is not stable over the study period. During 1995-96 to 2003-04 the area cultivated for mango, jackfruit and litchi shows the considerable positive trend among other fruits. In case

of pineapple, this positive trend of area cultivated continued up to the period 2004-05 and after that it started declined and this declined trend continued during the year 2014-15. Among the all selected fruits, banana shows the considerable positive trend over the study period. Still, banana is found to acquire maximum area of cultivation among the other fruits crops over the period 2004-05 to 2014-15

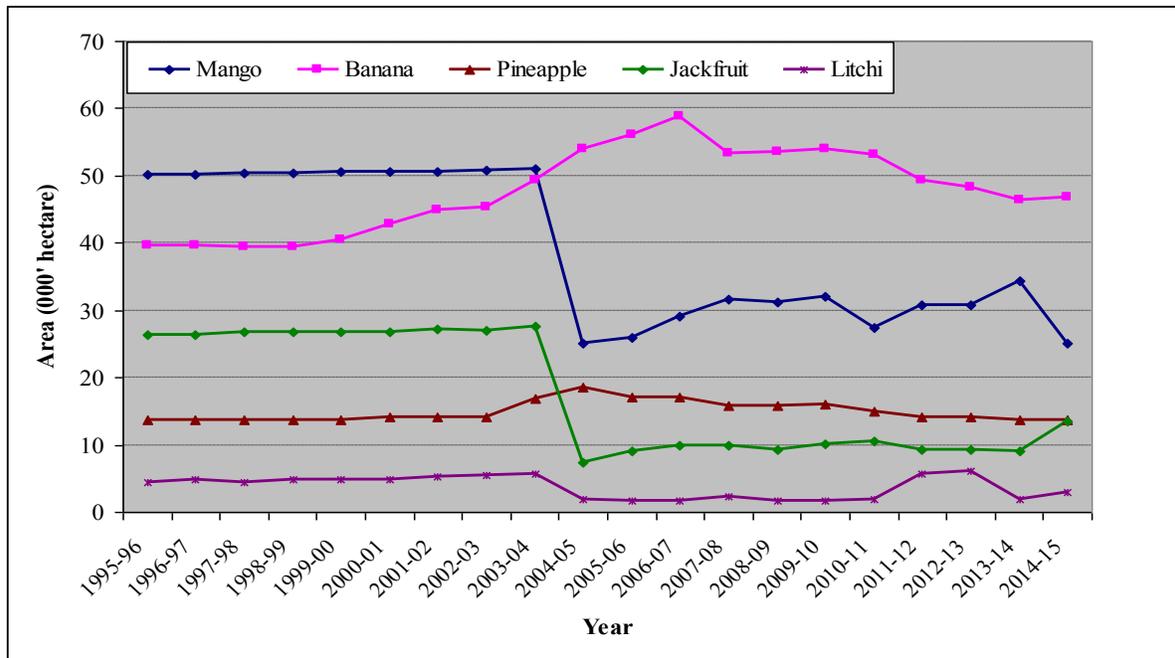
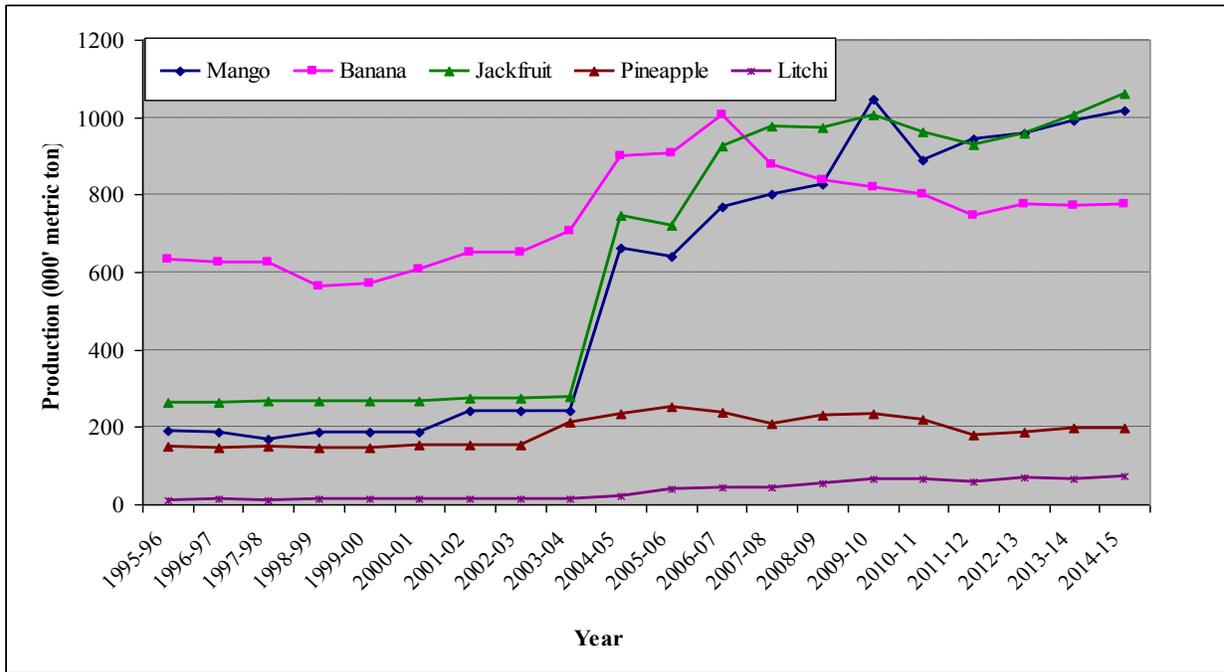


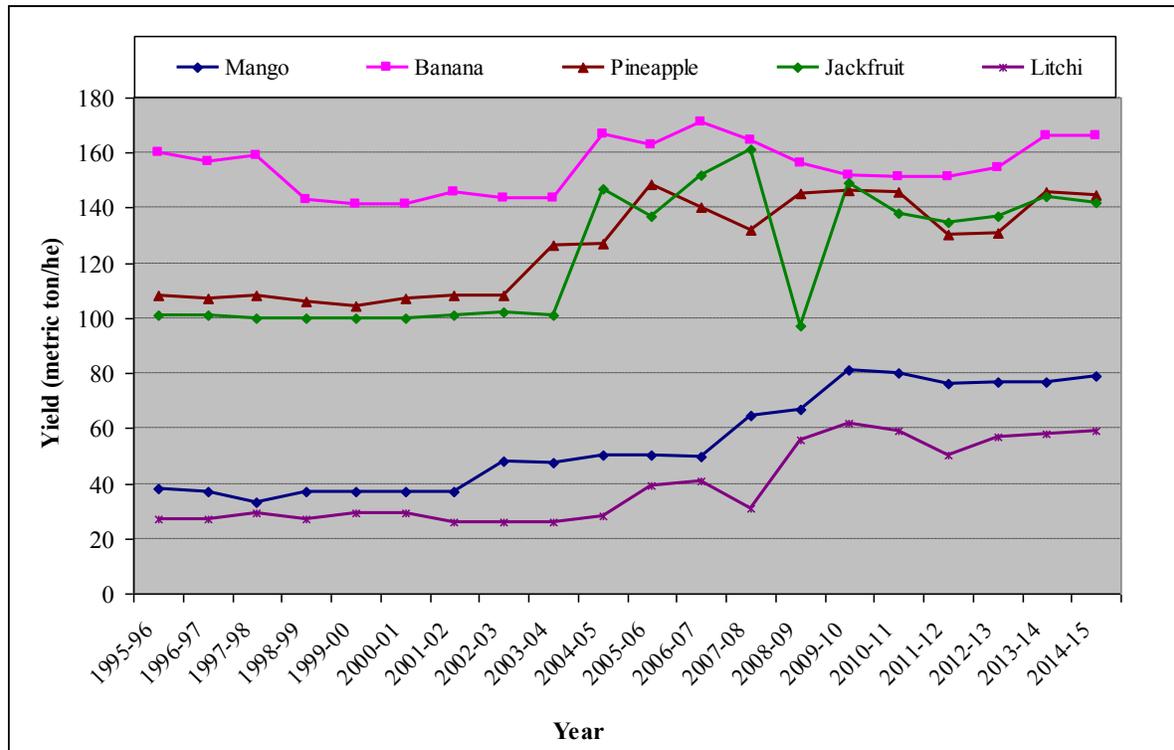
Figure 1. Acreage of fruits production in Bangladesh during 1995/96–2009/2010.

Total production of major fruit crops cultivated in Bangladesh for the study periods 1995-96 to 2014-15 represent in Figure 2. It is evident from the table that all of selected fruits are found have consistent positive trend over the study periods. Banana is found to hold its first place in production during the period 1995-96 to 2008-09 as compare with other fruit crops. Considering the year round availability, popularity and production, banana is considered to be the number one fruit in Bangladesh. This crop accounts for more than 40% of the total fruit production in the country with 25% share in area during last decade. The total production of banana is recorded to be 818000 metric tones from an area of 54000 hectares of land in 2009/10. It was followed by jackfruit 21% and mango 14% during the same time period.



**Figure 2. Production volume of major fruit produced in Bangladesh during 1995/96–2009/2010.**

Yield of major fruit crops in Bangladesh for the periods 1995-96 to 2014-15 reveals in Figure 3. According to the data reflecting in figure the yield of mango, banana, pineapple, jackfruit and litchi increased from 3.8, 16, 10.8, 10.1 and 2.7 metric ton per hectare in 1995-96 to 7.8, 16.6, 14.5, 14.2 and 5.2 metric ton per hectare in 2014-15. Among all the fruits, the yield of mango and litchi seems to be double during the study periods.



**Figure 3. Average yield of major fruit crops produced in Bangladesh during 1995/95-2005/06**

All the selected fruits excluding litchi are found unstable trend of yield over the study periods. Figure 3 reveals that mango is found have consistent positive trend over the period from 1995-96 to 2009-10 but seem to have downtrend in the following years. The pineapple is found to have consistent positive trend in its yield up to the year 2005-06, but seem to have uneven in the following years. In case of litchi, the yield trend seems to be positive. While in case of banana, the yield seems to be highly volatile. Still, it found to hold its first place in term of yield as compare with other fruit crops. But still the average yield of banana is lower compared to other banana-producing countries in the world. But in commercial orchard, yield is not less than 30 t/ha. The average yield of mango, pineapple and jackfruit is increasing day by day. Like banana the average yield of litchi is also lower compared to other litchi-producing countries in the world.

**Table 1. Compound Growth Rate (CGR) of area, yield, and production of major fruits in Bangladesh during the study periods 1995-96 - 2014-15.**

Fruits	Area	Yield	production
Mango	-3.8***	5.3***	12.6***
Banana	16.6***	0.4**	1.9***
Jackfruit	0.3***	2.0***	21.5***
Pineapples	-6.9***	2.4***	2.2***
Litchi	-3.9***	5.3***	12.5***

Source: Based on authors own estimation. \*\*\*= significant at 1 % level ( $p < 0.01$ ). \*\*= significant at 5 % level ( $p < 0.05$ ).

Most importantly, the Compound Growth Rate (CGR) of area of cultivation, yield and production of major fruit crops in Bangladesh over the study period 1995-96 to 2014-15 are estimated and depicted Table 1. The result revealed that, among all fruits, banana have recorded the positive and highest area growth rate of 16.6 % per annum, which was evidently contributed by the high profitability from banana in Bangladesh. It was found to be statistically significant at one per cent level. Jackfruit is also recorded the positive yield growth rate of 0.3%. Mango, pineapple and litchi recorded the declining growth rate in area as evident from negative rate of growth per annum. The largest decline in area has been reported by pineapple at the rate of -6.9% per annum followed by litchi at the rate of -3.9% and mango at the rate of -3.8%. The improvement of yield per hectare is an important factor in order to increase the production of agricultural crops. According to the table, it is clear that the Compound Growth Rate (CGR) of yield of all selected fruits recorded the significantly positive. Mango and litchi has been recorded the highest yield growth rate of 5.3% followed by pineapple (2.4%) and jackfruit (2%). The lowest yield growth rate was recorded by banana (0.4%).

Among the major fruit crops produced in Bangladesh, the largest production increase was achieved by jackfruit at the annual growth rate of 21.5% per year. Production of mango and litchi were recorded to the tune of 12.6% and 12.5% per year, respectively during this period. Pineapple has been increased at the annual growth rate of 2.2%. The production growth rate for banana was found 1.9% per annum, which was relatively low as compared to other fruit crops. Lowest production growth rate of banana can be explained due to lowest growth rate of yield per year.

The coefficient of variation (CV) is used as the measure of instability in the cultivated area, yield and production of major fruit crops produced in Bangladesh which is represented in Table 2. The result from the table shows that the production instability is of a higher order for fruits like litchi mango and jackfruit (the value of CV larger than 20%) and of a lower order in other remaining fruit crop (the value of CV ranging from 20.2% to 17.1%). The highest CV of production was noticed in litchi with the value of 83.8% followed by mango, jackfruit, pineapple and banana. Thus the highest CV of production increased with rapid growth of production. In other words, high growth in production obtained by increase the variation in production, thus increasing variability in production, thus increasing the risks related with the production of these fruits. The highest instability of area was noticed in pineapple with the value of CV is 57.3% followed by litchi (51.5%), mango (29.4%), banana (13.1%) and jackfruit (9.8%). It is also revealed from the table that the yield instability or productivity coefficient of variation was high in case of litchi (38.5%) followed by mango (34.1%), pineapple (19.3%), jackfruit (13.7%) and banana (6.2%).

**Table 2: Coefficient of Variations for area, yield and production of major fruit crops in Bangladesh (1995/96-2014/15).**

<b>Fruit</b>	<b>Area</b>	<b>Yield</b>	<b>production</b>
Mango	29.4	34.1	79.3
Banana	13.1	6.2	17.1
Jackfruit	9.8	13.7	76.9
Pineapple	57.3	19.3	20.2
Litchi	51.5	38.5	83.8

Source: Author's own calculation based on BBS data

### **3.2 Current Import and export trade performance of fruits in Bangladesh:**

Export of fruits from Bangladesh has grown steady, but the total export value remains small. Table 3 present the Bangladeshi fruits export and import value and quantity from 2000 to 2007. It is clear from the data that export value shows an upward trend since 2006 with a dip in 2007. On import side, the total value of importing fruit to Bangladesh has an overall wavy upward trend. Data shows that import value was sharply dip in 2002 and after that it again increased.

**Table 3. Export and import trade of fruits in value and quantity in Bangladesh**

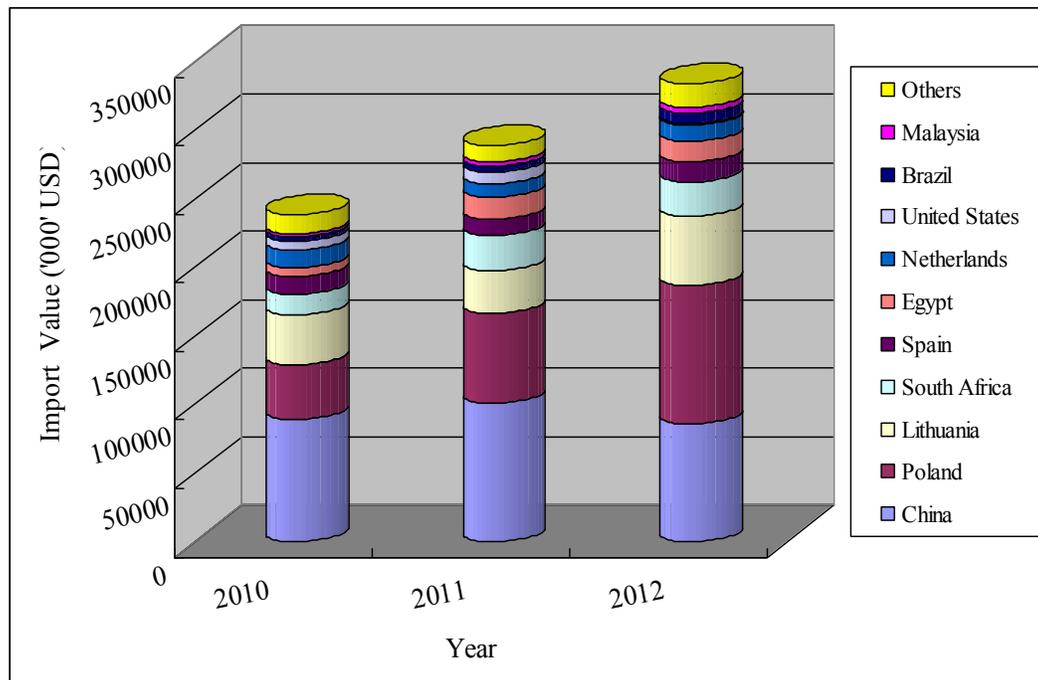
Year	Export		Import	
	Trade (000'USD)	Weight (000'kg)	Trade (000'USD)	Weight (000'kg)
2000	10	35	23567	48533
2001	16	16	28814	59260
2002	–	–	19230	46260
2003	497	1105	36435	75729
2004	4390	10386	27725	76326
2005	36943	42026	30418	88420
2006	44195	45116	30081	81072
2007	21670	17310	70295	141906

Source: Authors calculation based on UN Comtrade Database.

The country's fresh fruit exports increased 12 times in the past five years, earning 59374 thousand USD in 2011-2012 fiscal year (BSS, 2013).

### **3.3 Country wise export and import trade of Bangladeshi fruits:**

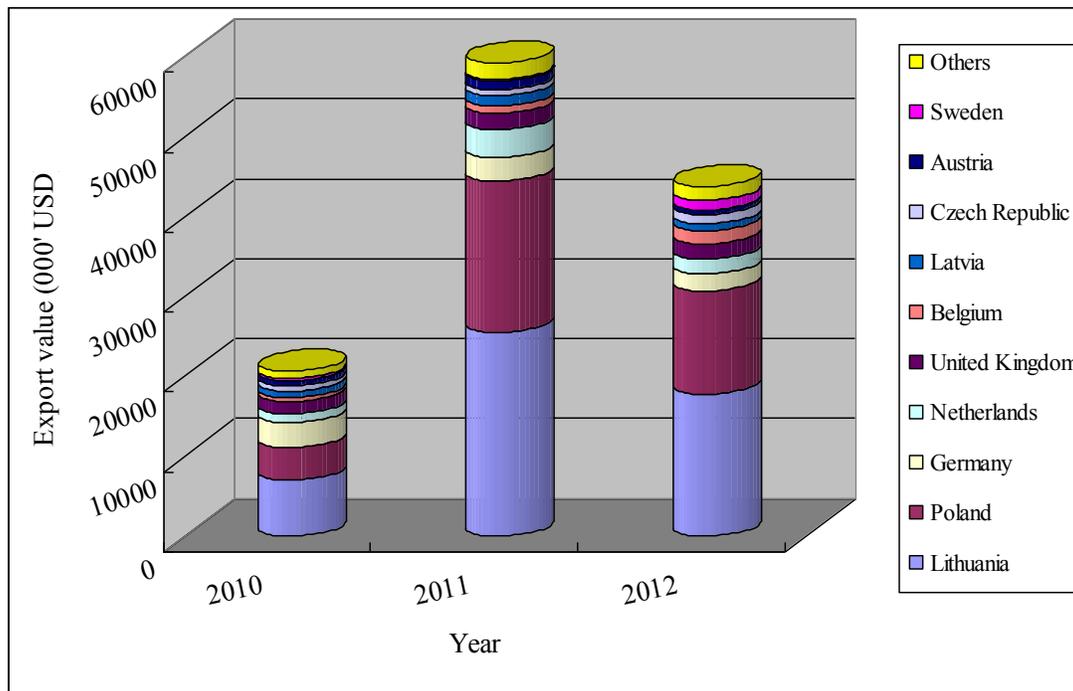
Figure 4 represents the import value of fruits to Bangladesh from different countries of the world. It is evident from the Figure 1 that the total value of imported fruits to Bangladesh has an overall straight upward trend, with markets mainly in the China, Poland and Lithuania. In 2012, the value of imported fruits from different to Bangladesh was 334008 USD, which was more than 13% comparing with that in the year of 2011. It is also revealed from the Figure 1 that the main importing country of fruits is China in each of the every year 2010, 2011 and 2012. China imported fruits of 89169 thousands USD, accounted for more than 37% of the total imported value to Bangladesh in 2011.



Source: Authors calculation based on Trade. Nosis.Com data

**Figure 4. Import Value of fruits to Bangladesh from the different countries of world**

On the other hand the annual export value of fruits is also increasing. Figure 5 represents the annual export value of fruits by Bangladesh to the different countries of the world. It is clear from the Figure that the major importers of Bangladeshi fruits in the world are the Lithuania, Poland and Germany. In 2010, the Lithuania accounted for 34% (6933 thousand USD) of total exports value of fruits by Bangladesh (20654 thousand USD). It was followed by Poland which was accounted for 20% (4073 thousand USD) and Germany 15% (3157 thousand USD) of total export value, respectively.



Source: Authors calculation based on Trade. Nosis.Com data

**Figure 5. Export Value of Bangladeshi fruits to the different countries of world.**

In 2011, the export value of fruits to Lithuania was increase by 9% than 2010, accounted for 43% (25532 thousand USD) of total exports value of fruits by Bangladesh (59238 thousand USD). It was followed by Poland which was accounted for 32% (18866 thousand USD) while Germany recorded decreased to 5% (2914 thousand USD) during the same period. The total Bangladeshi fruit export value is slight decline in every country in the year of 2012.

#### 4. RECOMMENDATION AND POLICY IMPLICATION FOR THE IMPROVEMENT OF FRUIT INDUSTRY IN BANGLADESH

Domestic consumption and production of fruits has grown rapidly. Fruit consumption has increasing from 10 to 13 Kg per capita per year, equivalent to a 25% increased. In real term, per capita expenditure on fruits increased 24% between 2000/01 to 2004/05 (World Bank, 2008). Despite increasing domestic consumption, production, processing and marketing of fruits have been suffered because the improvement productivity, post harvest technology and infrastructure are greatly neglected. In this circumstance, specific policy recommendations constitute important guidelines for the development of existing production and marketing system of Bangladesh fruit industry which are highlighted below:

#### **4.1 Post harvest technology:**

Post harvest loss is one of the main constrain to growth in supply of fruits due to inadequate packaging, transportation and storage facilities, lack of familiarity with good post harvest practice, under utilization of arable land for horticultural crops. Training on scientific harvesting technology along with other post harvest activities should be imparted to the farmers and the marketing intermediaries.

#### **4.2 Availability of reliable planting materials:**

Lack of availability and use of reliable planting materials and poor access of high-quality seed are important challenges for fruit production in Bangladesh. So reliable planting materials and high-quality seed should be provided not only for the increase the productivity but also for the increase the export of fruit from Bangladesh. Training on scientific production practices should be provided by the different government organization to the farmer.

#### **4.3 Market infrastructure:**

The market infrastructure of Bangladesh is yet congested which are old, dirty and lack of basic support such as godowns, cold storage, potable water, drainage and access for vehicles to load and unload produce. So the infrastructure facilities of the fruit market should be developed.

#### **4.4 Processing industry:**

The role of processing industry in domestic and export economy is quite small. For the development of processing industry and other facilities attempts should be undertaken through public, private and also public-private partnership basis. Public-private partnership can facilitates research on processing techniques, use and manufacture of equipments and develop new product.

#### **4.5 Promote innovative research:**

Bangladesh requires a research system that can address full ranges of constraints and opportunities of fruits in national agricultural economy. Research must focus on resolving the problems with yields and adaptability, post harvest losses and reduce the quality.

#### **4.6 Increase the cold storage facility:**

Sometimes huge amount of fruits are wastage due to the shortage of cold storage facilities. Increase and make better use of existing cold storage facilities for domestic distribution.

## **5. CONCLUSION**

This study employed a more appropriate approach to estimate the growth performance of area, yield and production of major fruit crops produced in Bangladesh. For this research we used secondary data during the periods from 195-96 to 2014-15 to estimate the growth rate per year of selected fruits by applying Compound Growth Rate (CGR) of area of cultivation, yield and production. In Bangladesh, banana holds good performance in absolute term among other fruit crops. But the result from compound growth rate reveals the different scenario. The result reveals that banana was found to be positive and records highest growth rate among other fruits in terms of cultivation area but its production growth rate was lowest due to its lowest yield growth rate. The present study also examines the export and import trend of Bangladeshi fruits. This result revealed that Lithuania, Poland and Germany are the main importer Bangladeshi fruits in the world and annual export value of fruits from Bangladesh is also increasing. On the other hand China is the main exporter of fruits to Bangladesh. The demand for food is shifted from traditional staples food to high-value food like fruits in Bangladesh due to economic growth, rising income and urbanization. The structural changes of domestic food demand are providing considerable opportunities for expanding the production to meet the increasing demand. Given the increased importance of fruits in nutritionally balanced diets, it will be important to have efficient marketing systems that reduce risk and allow higher prices for farmers and lower prices for consumers. There is an urgent need to increase fruit production, which will become inevitable in view of population growth. The government policy should be taken to increase the productivity of our major fruit crops of Bangladesh

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