



Research Article

Estimation of Growth Rate, Decomposition Analysis and Export Instability of Fruits in Afghanistan

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Abstract. The horticulture sector has important contribution in agricultural GDP and Afghanistan's economic growth. In 2024 total area under horticultural crops was 4.28 lakh hectares. Area under fruits was 3.38 lakh hectares which was accounted for 78.97 per cent of total horticultural area. This study aims to quantify the growth, decomposition and instability in area, production, yield and export of fruits in Afghanistan. Secondary data was collected from FAO statistics and ITC for a period of 24 years from 2001 to 2024. Compound Annual Growth Rate was computed for studying the trend in area, production, yield, export quantity and export value for fruits. Decomposition analysis is used to examine the effect of area and yield on production. The results of CAGR showed positive, high and significant growth in area, production, yield and export of fruits from Afghanistan. Effect of area during sub-period 1, was 55.74 per cent for the production variability, and in the second period, it gets reduced to 46.30 per cent of production. In case of productivity sub-period 1, was most responsible also, i.e., 14.54 per cent variability in production of fruits. The interaction effect of both area and productivity

on production was 8.07 per cent during sub-period 1, and 5.78 per cent during sub-period 2. The effect of area and productivity as well as interaction of both was positive and it was high in sub-period 1 than sub-period 2. Export of fruits to India and Russia were most stable as co-efficient of variation of 46.06 and 45.15 per cent and instability index of 30.23 and 32.11 per cent respectively. Pakistan was medium stable with co-efficient of variation of 62.23 per cent and instability index of 48.48 per cent.

Keywords: Fruits, Compound annual growth rate, Decomposition analysis, Instability Index, Export stability

INTRODUCTION

Horticulture is a key contributor to jobs and economic growth in Afghanistan. Farmers are the poorest people along with lowest literacy rate in the country. The security problems in the country are because of their unemployment, low income and illiteracy. Thus, there is higher need to increase the employment opportunities and income level of the farmers in rural areas and boost their literacy rate. The only best possible alternative is attention to horticulture and enhancement of horticulture which can be a higher income source for the Afghan farmers.

The horticulture sector generates 34 percent of Afghanistan's agricultural gross domestic product (GDP), 7 percent of national GDP and 50 percent of Afghanistan's export earnings (Akbari *et al.*, 2017). In 2024 total area under horticultural crops was 4.28 lakh hectares. Area under fruits was 3.05 lakh hectares which was accounted for 71.34 per cent of total horticultural area. The area under nuts and vegetables were 0.32 and 0.9 lakh hectares which contains 7.61 and 21.01 per cent to total horticultural crops area respectively.

Table 1. Area under Horticulture crops in Afghanistan in 2024

Sectors	Area (1000Ha)	Percentage to Total
Fruits	305.42	71.34
Nuts	32.57	7.61
Vegetables	90.00	21.01
Total	427.99	100

(Source: FAOSTAT, 2024)

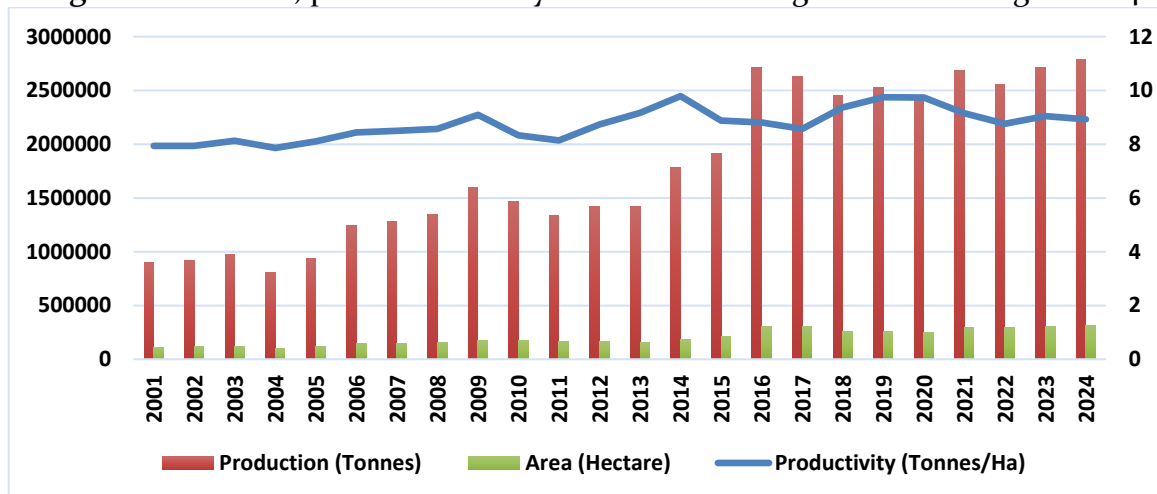
Afghanistan currently produces roughly 2.4 million tonnes of fresh fruits annually, which could be increased significantly. It is known for producing some of the finest fruits, especially grapes, apples, apricots, cherries, figs, melons, sweet mulberries, peaches and pomegranates. Fruits are produced for consumption and export. Dried fruits and nuts especially raisin, apricot and almond are important for export. Grapes, apple, pomegranates, apricots, mulberries and almonds are the major fruits cultivated in Afghanistan.

The area under fruits contributes to 11.39 per cent of area under crops in Afghanistan in 2024. From the figure 1 it could be inferred that area and production of fruits in Afghanistan is increasing over years. The area under fruits in 2001 was 1,12,787 hectares and it reached to the higher level of 305.42 hectares in 2024. Production of fruits also has shown an increasing trend. In 2001 it was 0.89 million

tonnes, which increased to 2.45 million tonnes in 2024. Productivity were consistent with 8 tonnes per hectare over the years from 2001-2024.

The details on area, production and productivity of fruits in Afghanistan for a period of 24 years from 2001-2024 is presented in figure 1.

Figure 1. The area, production and yield of fruits in Afghanistan during 2001-24



The specific objectives of the study are:

- to examine the trend in area, production, yield and export of fruits in Afghanistan
- to examine the effect of area and yield of fruits on the production of fruits
- to analyze the stability in export of total fruits from Afghanistan

REVIEW

Hashime et al., (2025) he examined the performance of Afghanistan's external trade in agricultural products over the period 2000 to 2019. Export and import data were obtained from FAOSTAT. The Compound Annual Growth Rate (CAGR) was used to measure growth, while the Cuddy-Della Valle Instability Index (CDVI) was employed to assess the degree of instability. The products examined included cereals, fruits, vegetables, pulses, and total agricultural products. The findings revealed that external trade, particularly the export of agricultural products, experienced considerable growth during the study period. However, both exports and imports were subject to varying degrees of instability. The authors emphasized that insecurity, damage to infrastructure and irrigation systems, and economic and political challenges were among the major factors affecting Afghanistan's external agricultural trade.

Ahmad et al., (2015) conducted a study to examine trends in area, production and yield of cereals in India as well Nigeria from period 1982-2012. The computed annual growth rate for cereals was negative (-0.0750) and significant ($P < 0.01$) for area, production computed growth trend was positive (0.84) and significant ($P < 0.01$) and growth for productivity was positive (0.94) and significant ($P < 0.01$). However, from Nigeria the computed growth was positive (1.056), (1.247) and (0.189) and significant

at degree of probabilities 1%, 1% and 5% for area, production and productivity respectively.

Zainullah and Radhika (2016) studied the trend in production and export of raisin from Afghanistan during 2000 to 2014. Raisins are the important high value crop and ranks number one in the export earnings of the country. The results of the analysis showed a significant growth in area, production and yield of raisin which were 1.73, 3 and 4.7 per cent respectively. Poor harvesting methods, lack of knowledge about export procedures and quality standards, poor packaging, limited government support in marketing and export and unscientific drying process are the major problem in export and marketing of raisins in Afghanistan.

Chowti *et al.*, (2018) made to identify the trend in area and production of medicinal and aromatic crops in India. The result of analysis showed increasing trends. Domestic herbal industry's demand of medicinal plants is 195,000 MT and in export of herbal raw drugs, and it extracts estimated as 1,345,000 MT (2015-16).

Shaheen and Shiyani (2004) viewed the period wise level of instability in area, production and yield of major fruit crops in the state using data from 1974 to 2002. Since simple coefficient of variation often contains the trend component and thus over estimates the level of instability in time series data. Value of index greater than 40 indicates high stability for area and production and greater than 20 for high instability for yield and lower than the respective said values indicate low instability. The study found low instability in area, production and yield of apple crop in all the periods. High instability in production and yield during the first and second periods was noticed in case of pear and cherry. For whole period, all the fruit crops showed high instability in production and yield except apple.

Sharma and Kalita (2008) studied the variation and instability in area, production and productivity of major fruit crops in Jammu and Kashmir for the period from 1974-75 to 1999-2000. It revealed that growing of pear, cherry and almond were riskier compared to other fruit crops in the state as revealed by higher coefficient of variation. The coefficient of area, production and productivity of these were more than 78%. The raising of apple in the state was less risky, which had a coefficient of variation of less than 35%.

Chaudhari and Singh (2017) studied the Growth and decomposition analysis of mango and sapota in South Gujarat. To know the performance of these crops the present investigation undertaken study the growth and instability in area, production and productivity. The results of investigation showed that area and production of mango and sapota significantly raised during study period in majority of districts of South Gujarat. The yield of mango significantly increased in Dang district while yield of sapota increased in all the districts except Tapi and Valsad district. The variability was observed in South Gujarat in respect of area, production and yield of mango and sapota. Yield was the major factor responsible for production of mango while area was dominant factor for production of sapota in most of districts of South Gujarat.

Rahimi and Artukoğlu (2019) studied the Foreign Trade Structure of Afghanistan Agricultural Products. This study aims at assessing the role of agriculture in Afghanistan's economy and recent agriculture development after Taliban Government. According to the finding, the agricultural products contributed about

73.3% to the total export in Afghanistan as of 2016 with 61.6% labor force engaged in this sector. It is one of the major contributors to the country's gross domestic product (GDP) after service which was 19.88% in 2018. Simulations with an economy wide model showed that by raising productivity in agriculture, Afghanistan could raise its GDP growth rate to 5.8 percent annually, on average, over the next ten years. Therefore, it is essential for Afghanistan to make better use of its geographical location opportunities in the region to realize its potential for regional and international trade.

Nazir *et al.*, (2016) made to study the Growth Variability and Decomposition Analysis of Fruit Crops In Punjab, Pakistan. The study examines the trends and variation of area, production and yield of fruit in Punjab province from 1971 to 2014. The growth trend of fruits production showed positive behavior for major fruits (citrus, mango and guava) in almost all the decades, except for mango in 1970s and guava in 2000s. The decline in production of mango in 1970s was due to negative growth in both area and yield. While, a slowdown growth in the area and decrease in yield were reasons of decline in production of guava in 2000s. During the study period, fruit production varied due to area, though productivity altered considerably. The results of decomposition analysis indicated a relatively stronger stimulus of area expansion in production of citrus. While yield affect remained dominant in production of mango, guava and minor fruits across decades as well as during the study period.

Hikmat *et al.*, (2019) Studied the Problems of Production and Marketing of Saffron, And SWOT Analysis Of Export Potentials In Ghoryan District, Herat Province of Afghanistan. The study was conducted with the objectives to identify the problems of saffron production and marketing in Afghanistan and suggested for suitable mandatory for policy implication. The result showed that Iranian traders purchase most of the saffron produced in Afghanistan. The saffron is then integrated into the larger saffron market in Iran and exported as Iranian saffron. Afghan farmers sell the bulk of their saffron to Iranian merchants for the simple reason that Iran is tied to the global saffron market, and Afghanistan is not, which puts farmers in a poor negotiating position. The largest global producer and exporter of saffron right next door, Iran can easily absorb the miniscule amount of saffron that Afghan farmers currently produce.

METHODOLOGY

Secondary data on area, production and productivity were collected from FAOSTAT for a period of 24 years from 2001-2024. Export data was collected from ITC (International Trade Center) for 24 years from 2001-24.

The collected data was analyzed with reference to the objectives of the study. The analytical techniques employed in this study are explained in this section.

Compound annual growth rate analysis

Compound growth rate of total fruits will be worked out to examine the tendency of variable to increase, decrease or stagnant over a period of time.

Compound annual growth rates of exports of fruits from the country are estimated by using the exponential growth function of the form:

$$Y_t = a b^t U^t \dots\dots\dots (1)$$

Where,

Y_t = Dependent variable for which growth rate of fruits was estimated

a = Intercept

b = Regression coefficient

t = Year which takes values of (1, 2, 3, ... n)

U_t = Disturbance term in year 't'.

The equation (1) will be transformed in to log-linear and written as:

$$\log Y_t = \log a + t \log b + \log U_t \dots\dots\dots (2)$$

Equation (2) will be estimated by using Ordinary Least Square (OLS) technique.

The compound growth rate (g) will be then estimated by the identity given in equation(3)

$$g = (b-1) \times 100 \dots\dots\dots (3)$$

Where,

g = Estimated compound growth rate per annum in percentage.

b = Antilog of $\log b$

Decomposition Analysis

To estimate the contribution of area, productivity and interaction of the two in total production, decomposition analysis has been done as given below:

$$P = A_0(Y_n - Y_0) + Y_0(A_n - A_0) + \Delta A \Delta Y$$

$$I = \left[\frac{Y \Delta A}{P} \right] \left[\frac{A \Delta Y}{P} \right] \left[\frac{\Delta A \Delta Y}{P} \right]$$

Where,

P = Change in Production

A_0 = Area in the base year

A_n = Area in the current year

Y_0 = Yield in the base year

Y_n = Yield in the current year

ΔA = Change in area ($A_n - A_0$)

ΔY = Change in Yield ($Y_n - Y_0$)

Instability Analysis

The coefficient of variation was used as a measure to study the variability in export of total fruits. The coefficient of variation or index of instability was computed for instability export of fruits using the following formula:

$$CV = \frac{\text{Standard Deviation } (\sigma)}{\text{Mean } (X)} \times 100$$

The trend coefficients were tested for their significance. Whenever the trend of export data found significant; the variation around the trend rather than the variation around mean was used as an index of instability. The formula suggested by Cuddy and Della (1978) was used to compute the degree of variation around the trend. That is coefficient of variation was multiplied by the square root of the difference

between the unity and coefficient of multiple determination (r^2) was significant to obtain the instability Index.

$$\text{Instability Index} = \frac{\text{Standard Deviation } (\sigma)}{\text{Mean } (X)} \times 100 \times \sqrt{(1 - r^2)}$$

$r^2 = \text{RSS/TSS} = \text{Goodness of fit}$

RSS = Regression Sum of Square

TSS= Total Sum of square

Instability index analysis is used to find the stability in export of total fruits for a period of 22 years from 2003 to 2024 in Afghanistan. To know the stability in export of fruits, co-efficient of variation and instability index are used. In co-efficient of variation, the value of more than 60 per cent indicate unstable market and less than 60 per cent indicate stable market. For instability index the value of more than 50 per cent indicate unstable and less than 50 per cent indicate stable market.

RESULTS AND DISCUSSION

Results of Trend Analysis

Trend analysis is used for analyzing data and to find a pattern in the data. Here, it is used for knowing the trend in five parameters: area, production, productivity, export quantity and export value of fruits in Afghanistan. The trends of fruits for above parameters were computed for 24 years, from 2001 to 2024. The compound growth rates and their significance were estimated for area, production, yield, export quantity, and export value of annual fruits by employing the exponential growth functions for the given period (2001-24). The results of estimated growth rates are presented in Table2.

Table 2. Compound Annual Growth Rate in area, production, yield, export quantity, export value and share of export to production of fruits in Afghanistan (2001 to 2024)

S. No.	Variables	Growth rate (Percentage)
1	Area	5.77***
2	Production	6.70***
3	Productivity	0.88***
4	Export quantity	12.48***
5	Export value	18.38***

(*** 1% level of significance)

It could be inferred from the table 2. that trend in area, production and yield of fruits were 5.77, 6.70 and 0.88 per cent per annum respectively. The area, production and yield of fruits showed positive and significant growth rates. The trend in export quantity and export value showed positive and high growth rates of 12.48 and 18.38 per cent per annum respectively. Growth in export quantity and export value of fruits were statistically significant.

Results of Decomposition analysis

Decomposition analysis was used to study the contribution of area, yield and their interaction effects on the variability of production. The decomposition of production variability in to its different components was done for the two sub-periods for total fruits production, and the results are presented in Table 3.

During sub-period 1, the area effect of Afghanistan's total fruits was mostly 55.74 per cent for the production variability, and in the second period, it gets reduced to 46.30 per cent of production. In case of productivity sub-period 1, was most responsible also, i.e., 14.54 per cent variability in production of fruits. The interaction effect of both area and productivity on production was 8.07 per cent during sub-period₁, and 5.78 per cent during sub-period 2. Overall area effect was 24.53 per cent and productivity effect was 3.34 per cent and interaction effect on production was 4.42 per cent. However, both area and productivity recorded positive effect and influence the production of fruits in the country. The effect of area and productivity as well as interaction of both, in sub-period 1 were high than sub-period 2.

Table 3. Decomposition of production variability in fruits

Period	Area effect (%)	Yield effect (%)	Interaction effect (%)
Sub - period-I	55.74	14.54	8.07
Sub - period-II	46.30	11.89	5.78
Overall period	24.53	3.34	4.42

Results of Instability in Export of fruits

The instability in export of fruits from Afghanistan to different countries was analyzed by calculating the co-efficient of variation and Instability index, the results are presented in Table 4.

Table 4. Instability in export of fruits from Afghanistan (2003 to 2024)

S. No.	Country	Average Export (Tonnes)	Coefficient of Variation (Percentage)	Instability Index (Percentage)
1	India	25580	46.08	30.23
2	Russia	10120	45.15	32.11
3	Pakistan	115135	62.23	48.48
4	Germany	631	92.93	90.67
5	UK	391	96.89	91.26
6	Belarus	1255	129.86	129.81
7	Turkey	406	133.56	130.36
8	Others	7460	101.72	68.03
9	Total	160979	50.77	33.37

It is observed from the table that, the export of fruits in terms of quantity to UK, Germany and Others was relatively unstable compared to other countries as indicated by their co-efficient variation (more than 60%) and instability index (more

than 50%). While export of fruits to India and Russia were most stable as co-efficient of variation of 46.06 and 45.15 per cent and instability index of 30.23 and 32.11 per cent respectively. Pakistan is medium stable with co-efficient of variation of 62.23 per cent and instability index of 48.48 per cent. The average export quantity for India, Russia and Pakistan were 25580, 10120 and 115135 tonnes per annum respectively.

CONCLUSION

Afghanistan currently produces 2.4 million tonnes of fresh fruits annually, which has a good contribution in agricultural GDP. Fruits are produced mostly for consumption as well as for export. Grapes, apple, pomegranates, apricots, mulberries, pear and peach are the major fruits of Afghanistan. The growth of the area, production, yield, export quantity and export value were in a positive trend. There are a high variability in the area and production of fruits in the country over the years. The area and yield effect on fruits production was positive and more responsible in the country. India and Russia were most stable to export fruits as co-efficient of variation of 46.06 and 45.15 per cent and instability index of 30.23 and 32.11 per cent respectively. Pakistan is medium stable with co-efficient of variation of 62.23 per cent and instability index of 48.48 per cent.

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