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## Growth and instability analysis of area, production, productivity and export performance of almond in Afghanistan

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### Abstract

Almonds have been valued throughout the world for their delicious taste, and increasingly, for their nutritional value. The present study evaluates the growth in area, production, productivity and export performance of almonds in Afghanistan. The analysis was made using compound annual growth rate analysis (CAGR), instability index and tabular analysis. The area, production and productivity of almonds in world grew at the CAGR of 0.98, 1.70 & 0.71% with instability of 3.44, 7.48 and 7.42% respectively. Similarly in Afghanistan area, production and productivity of almonds in world grew at the CAGR of 6.33, 8.08 & 1.65% with instability of 19.56, 41.66 and 55.47% respectively. The share of area and production of almonds in Afghanistan as compared to total area of almonds cultivation in world grew from 0.42% to 1.52% and 0.42% to 1.31% respectively. The majority of dried fruits export of Afghanistan during 2020 registered a negative% change when compared to 2018 except for almonds without shell whereas its value decreased by 3.77%. Among dry fruits export the share of value of almonds export stood at third position with a share of 6.95% (for almonds without shell) and 2.06% (for almonds with shell) with first two places being occupied by dried fig (30.49%) and raisins (25.66%).

**Keywords:** Compound annual growth rate, India, Afghanistan, almonds, nutritional value

### Introduction

Almond is frequently known as the top nut among the dry fruits. Since ancient times, almonds have been prized throughout the world for their delicious taste, crunchy texture, and increasingly, for their nutritional value and worth in other industries, like cosmetics. Like nectarines, peaches, and plums, the almond is categorized botanically as a fruit. Almonds are classified as either sweet (*Amygdalus communis* L. var. *dulcis*) or bitter (*Amygdalus communis* L. Var. *amara*) Almonds are mentioned as far back in history as the Bible. They were a prized ingredient in breads served to Egypt's pharaohs. Their exact ancestry is unknown, but almonds are thought to have originated in China and Central Asia. Explorers ate almonds while traveling the "Silk Road" between Asia and the Mediterranean. Before long, almond trees flourished in the Mediterranean -- especially in Spain and Italy. 2 Spanish explorers brought then almonds to the Americas. Types of Product Almonds may be processed and presented in different way, the most common ones are: Natural, Cut, Sliced, Slivered, Diced, Roasted, In-shell Almonds [In-shell Almonds come in two types: Hard shell (completely closed shell, tools needed to open, Paper shell (easily opened by hand)]. Flour (natural or blanched), Butter or Paste and Oil. Almonds have natural antioxidants that promote a long shelf life when properly handled.

### Afghanistan scenario

The Almond production in Afghanistan was ranked ninth in the FAO list of almond-producing countries of the world in 2009, though its domestic production is limited to 2% of the world production. Its production has shown a rising trend in the recent years. Within the country, the southwestern and northern regions have the maximum area under cultivation with Kandahar and Samangan provinces, accounting for much of its production, followed by the provinces of Uruzgan, Kunduz, Balkh, and Saripul.

As of 2019, the cultivated area of almonds was 29,203.00 ha with a yield rate of 1.31 tonnesha<sup>-1</sup> per ha, recording a total yield of 3,82,05,000 tonnes, with conducive climatic conditions for growing variety of almond landraces of hard shell and soft-shell varieties. The preferred markets for the export of Afghan almonds are India and Pakistan, with the former preferred because of better profitability. The quality and taste of Afghan almonds attract a premium price on the world market, especially in India and Pakistan. Expanding the high-value crop's production offers an important niche market entry for rural Afghan farmers to increase their incomes in an economically sustainable way.

Afghan almonds belong to two core classes: soft-shell almonds (badam-e kaghaz, lit paper almond) and hard/medium-shell almonds (badam-e-sangi, lit. stone almond). Both classes are subdivided in several types, and then multiple varieties. For instance, the popular type called Sattarbai belongs to the soft-shell class. There are also numerous varieties of Sattarbai, such as Sattarbai Sufi, Sattarbai Guldar and Sattarbai Mamakhail.

### Methodology

The secondary data like area, production, productivity, quantity and value of export of almonds from Afghanistan required for the study was collected from various published authentic sources. The analysis was made for the period of 2019-20. Province wise area, production and productivity data of almonds within Afghanistan was collected to ascertain the major province contributing to country's production.

### Analytical Tools

#### Tabular analysis

The data collected was presented in tabular form to facilitate easy comparisons. The tabular presentation technique was followed to study the economic characteristics in relation to area, production and productivity of almond and for analysing the data elicited through secondary data from various authentic public sources.

The data were summarized with the aid of descriptive statistical tools like averages, percentages to obtain the meaningful interpretations.

### Compound Growth Rate Analysis (CAGR)

In order to analyse the growth in area, production and productivity of Almond, compound growth rates were computed using the following model.

$$Y_t = ab^te^u$$

Where,

$Y_t$  = dependent variable (area / yield / production of Almond)

$a$  = intercept

$b = (1+r)$

$r = (b - 1)$

' $r$ ' is the compound annual growth rate% per annum,

$t$  = time period

$u$  = error term

The above model in the Logarithmic form is expressed as,  $\log Y = \log a + t \log b + \log u$

We can, thus, calculate the compound growth rates ( $r$ ) as under:

$$\text{CAGR in\% (r)} = (\text{Antilog of } \log b - 1) \times 100$$

The coefficient of variation (CV) was calculated by using the equation given below:

$$CV(\%) = \frac{\text{Standard deviation (sd)}}{\text{Mean}} \times 100$$

The coefficient of variation (CV) was modified as Cuddy-Della Valle index (CDVI).

In this study we have used Cuddy-Della Valle index to measure instability of soyabean crop. The instability index is given by the expression:

$$\text{Instability index} = CV \times \sqrt{1 - R^{*2}}$$

Where,

$R^{*2}$  = Adjusted Coefficient of Determination

### Results and Discussion

Table 1 indicates that area, production and productivity of almonds in world grew at the CAGR of 0.98, 1.70 & 0.71% with instability of 3.44, 7.48 and 7.42% respectively as measured by cuddy-Della valle index. Thus, there was a positive and significant growth rate. Thus there is a scope to increase productivity by adoption of improved varieties and follow recommended package of practices to meet increasing demand owing to health benefits of almonds.

Table 2 specifies that area under almonds in Afghanistan grew at the CAGR of 6.33% with instability of 19.56% as measured by cuddy-Della valle index whereas production registered a growth rate of 8.08% with instability of 41.66% and productivity had a meagre growth of 1.65% with instability of 55.47% when compared to growth in area and production. Thus, there was a positive and significant growth rate. This was mainly due to the fact that almonds grown in Afghanistan are preferred for import by many countries especially India and Pakistan. These findings were in line with research carried out by Faridullah *et al.* (2016) [8].

The % share of area under almonds cultivation in Afghanistan as compared to total area of almonds cultivation in world grew from 0.42% to 1.52%. Similarly, the production share of Afghanistan almonds increased from 0.42% to 1.31% indicating accelerating importance of Afghanistan in world production of almonds. The difference in % share of area and production was mainly due to lower productivity which could not keep in pace with growth in area as indicated by Table 3. This predictions were in accordance with observations made by Sayed (2021) [21].

As observed in table 4 the majority of dried fruits export of Afghanistan during 2020 registered a negative% change when compared to 2018 except for almonds without shell which retained its export share probably due to trade restrictions imposed owing to widespread corona pandemic disease. But almonds share remained unaffected because of the health consciousness created among people due to the same pandemic whereas the value of almond exports decreased by 3.77% in 2020 as compared to 2018 (Table 5). The composition of value of dry fruits export as portrayed in Table 6 indicates that share of value of almonds export stood at third position with a share of 6.95% (for almonds without shell) and 2.06% (for almonds with shell) with first two places being occupied by dried fig (30.49%) and raisins

(25.66%).

**Table 1:** Growth in area, production and productivity of almonds in world

No.	Year	Area (ha)	Production (000, tons)	Productivity (tons/ha)
1	2000	16,49,709.00	22,04,781.00	1,336.47
2	2001	16,64,635.00	22,24,729.00	1,336.47
3	2002	16,74,891.00	22,38,436.00	1,336.47
4	2003	15,95,788.00	21,32,718.00	1,336.47
5	2004	16,22,280.00	21,68,123.00	1,336.47
6	2005	16,98,514.00	22,70,007.00	1,336.47
7	2006	16,59,640.00	22,18,054.00	1,336.47
8	2007	16,83,208.00	22,49,552.00	1,336.47
9	2008	16,73,922.00	24,82,861.00	1,483.26
10	2009	17,57,154.00	23,45,221.00	1,334.67
11	2010	17,17,328.00	25,69,793.00	1,496.39
12	2011	17,27,686.00	30,20,210.00	1,748.12
13	2012	17,67,444.00	28,24,871.00	1,598.28
14	2013	18,22,879.00	28,38,962.00	1,557.41
15	2014	17,35,516.00	26,37,275.00	1,519.59
16	2015	17,73,788.00	24,47,193.00	1,379.64
17	2016	18,91,156.00	24,93,303.00	1,318.40
18	2017	19,19,853.00	26,87,810.00	1,400.01
19	2018	20,71,884.00	31,82,902.00	1,536.24
20	2019	19,16,919.53	29,11,567.33	1,518.88
CAGR (%)		0.98	1.70	0.71
CDVI (%)		3.44	7.48	7.42

**Source:** FAOSTAT | Food and Agriculture Organization**Source:** Ministry of Agriculture, Irrigation and Livestock, Afghanistan**Table 2:** Growth in area, production and productivity of almonds in Afghanistan

No.	Year	Area (ha)	Production (000, tons)	Productivity (tons/ha)
1	2000	7,000.00	9,297.25	1.33
2	2001	9,000.00	11,953.60	1.33
3	2002	5,500.00	7,304.98	1.33
4	2003	5,700.00	7,570.61	1.33
5	2004	12,000.00	15,938.14	1.33
6	2005	11,768.00	15,630.00	1.33
7	2006	12,000.00	20,000.00	1.67
8	2007	12,000.00	31,481.00	2.62
9	2008	12,000.00	42,000.00	3.50
10	2009	11,029.00	43,183.00	3.92
11	2010	11,210.00	56,000.00	5.00
12	2011	13,469.00	60,611.00	4.50
13	2012	13,490.00	62,000.00	4.60
14	2013	14,114.00	42,215.00	2.99
15	2014	13,703.00	27,400.00	2.00
16	2015	14,676.00	24,246.00	1.65
17	2016	19,481.00	32,843.00	1.69
18	2017	19,793.00	27,291.00	1.38
19	2018	20,053.00	34,413.00	1.72
20	2019	29,203.00	38,205.00	1.31
CAGR (%)		6.33	8.08	1.65
CDVI (%)		19.56	41.66	55.47

**Source:** FAOSTAT | Food and Agriculture Organization**Table 3:** Comparison of area and production of Afghanistan and world

Years	Area (ha)			Production (000, tons)		
	Afghanistan	World	% Share of Afghanistan	Afghanistan	World	% Share of Afghanistan
2000	7,000.00	16,49,709.00	0.42	9,297.25	22,04,781.00	0.42
2001	9,000.00	16,64,635.00	0.54	11,953.60	22,24,729.00	0.54
2002	5,500.00	16,74,891.00	0.33	7,304.98	22,38,436.00	0.33
2003	5,700.00	15,95,788.00	0.36	7,570.61	21,32,718.00	0.35
2004	12,000.00	16,22,280.00	0.74	15,938.14	21,68,123.00	0.74
2005	11,768.00	16,98,514.00	0.69	15,630.00	22,70,007.00	0.69
2006	12,000.00	16,59,640.00	0.72	20,000.00	22,18,054.00	0.90

2007	12,000.00	16,83,208.00	0.71	31,481.00	22,49,552.00	1.40
2008	12,000.00	16,73,922.00	0.72	42,000.00	24,82,861.00	1.69
2009	11,029.00	17,57,154.00	0.63	43,183.00	23,45,221.00	1.84
2010	11,210.00	17,17,328.00	0.65	56,000.00	25,69,793.00	2.18
2011	13,469.00	17,27,686.00	0.78	60,611.00	30,20,210.00	2.01
2012	13,490.00	17,67,444.00	0.76	62,000.00	28,24,871.00	2.19
2013	14,114.00	18,22,879.00	0.77	42,215.00	28,38,962.00	1.49
2014	13,703.00	17,35,516.00	0.79	27,400.00	26,37,275.00	1.04
2015	14,676.00	17,73,788.00	0.83	24,246.00	24,47,193.00	0.99
2016	19,481.00	18,91,156.00	1.03	32,843.00	24,93,303.00	1.32
2017	19,793.00	19,19,853.00	1.03	27,291.00	26,87,810.00	1.02
2018	20,053.00	20,71,884.00	0.97	34,413.00	31,82,902.00	1.08
2019	29,203.00	19,16,919.53	1.52	38,205.00	29,11,567.33	1.31

Source: FAOSTAT, Food and Agriculture Organization

Source: Ministry of Agriculture, Irrigation and Livestock, Afghanistan

**Table 4:** Quantity wise export of Dry fruits from Afghanistan (tons)

Dried fruits	2018	2019	2020	% Change
Raisin	68,778	31,740	39,786	-73
Black raisin	7,533	7,641	2,500	-201
Oleaster	37	43	22	-68
Dried apricot	9,624	9,626	19,056	49
Dried cherry	18	24	15	-20
Dried fig	9,593	12,070	16,318	41
Almonds (without shell)	3,339	6,211	3,329	0
Almond (with shell)	9,532	6,026	3,895	-145
Others	1,08,454	73,381	84,921	-28
Total	1,23,090	85,563	1,01,591	-21

Source: Afghanistan statistical year book, 2020

**Table 5:** Value wise export of Dry fruits from Afghanistan (value in US\$ thousands)

Dried fruits	2018	2019	2020	% Change
Raisin	74,593	65,599	80,410	7.23
Black raisin	19,557	22,375	6,557	-198.26
Oleaster	28	145	26	-7.69
Dried apricot	22,904	15,465	15,702	-45.87
Dried cherry	88	50	7	-1,157.14
Dried fig	67,716	85,581	95,540	29.12
Almonds (without shell)	22,613	35,232	21,791	-3.77
Almond (with shell)	10,855	9,587	6,466	-67.88
Others	74,270	68,414	86,763	14.40
Total	2,92,624	3,02,448	3,13,262	6.59

Source: Afghanistan statistical year book, 2020

**Table 6:** Composition of value of export of Dried fruits in Afghanistan

Dried fruits	Value (US\$ thousands)	% Share
Raisin	80,410	25.66
Black raisin	6,557	2.09
Oleaster	26	0.008
Dried apricot	15,702	5.01
Dried cherry	7	0.002
Dried fig	95,540	30.49
Almonds (without shell)	21,791	6.95
Almond (with shell)	6,466	2.06
Others	86,763	27.69
Total	3,13,262	100

Source: Afghanistan statistical year book, 2020

## Conclusion

There is a increasing demand for almonds grown in Afghanistan in International market especially India and Pakistan. Though there has been a good growth in terms of area and production the productivity growth remained

meagre. Thus, almond and its by-products may be considered to be potential products for export. Afghanistan, having a favourable climatic condition may explore this opportunity by providing incentives and schemes to encourage farmers to increase production of almonds with higher productivity.

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