International Journal of Agriculture Extension and Social Development

Production trend and export performance of apple from Afghanistan

[1]Fahimullah Wardak, [2]Dr. Lokesha H, [3]Dr. Mahin Sharif, [4]Dr. MN Venkataramana and [5]Khalandar S

[1]Ph.D. Scholar, Department of Agricultural Economics, University of Agricultural Sciences, GKVK, Bengaluru, Karnataka, India

[2]Professor and Head, Department of Agricultural Economics, University of Agricultural Sciences, GKVK, Bengaluru, Karnataka, India

[3]Assistant Professor, Department of Agricultural Economics, University of Agricultural Sciences, GKVK, Bengaluru, Karnataka, India

[4]Professor, Department of Agricultural Economics, University of Agricultural Sciences, GKVK, Bengaluru, Karnataka, India

[5]Consultant Agri Export Cell, KAPPEC, Karnataka, India

DOI: https://doi.org/10.33545/26180723.2024.v7.i3b.418

Corresponding Author: Fahimullah Wardak

Abstract

Afghanistan's horticultural sector has been growing steadily, and it play a significant role in the economy of the country. In 2019, fruit production in Afghanistan covered around 222 thousand hectares of arable land, representing almost (2.84%) of the total arable land area. Furthermore, the county presently produces approximately 1.5 million tonnes of fresh fruits annually. Wardak province was the highest apple producing province in Afghanistan as compared to another province. Wardak had the highest share in area under apple production with 29.05 percent while the production share was with 29.31 percent during 2007–2013; however, the share in area and production decreased from 2014–2019, which witnessed negative (-4.94%) and (-1.37%), respectively. However, the province observed a positive change in productivity (0.4%). The production of apple was 54,769 tonnes which accounted (9.71%) exported from Afghanistan during 2007, more ever in the year 2019 production increased to 2,50,324 tonnes, however percentage of export decreased to (9.33%). The percentage share of Afghanistan's apple exports to the world market ranges from almost negligible to (0.02%) between 2012 to 2020. The majority of Afghanistan's apples are exported to Pakistan and India. Exports of apples from Afghanistan to Pakistan in terms of value declined from (97.71%) in 2008 to (85.00%) in 2020. India shares import in term of quantity increased from 154.30 tonnes in 2008 to 1,379.79 tonnes in 2020, and in term of values increased from (2.00%) in 2008 to (9.00%) in 2020.

Keywords: Afghanistan, apple, production, export competitiveness

Introduction

Afghanistan's economic development is heavily dependent on agriculture. Nearly (75%) of rural households rely on agriculture as their main source of income. According to Anonymous (2020) [2], the combined contribution of agriculture and its allied industries to the GDP in 2020 was 27.01 percent. Apple holds a significant position in horticulture commodities traded in Afghanistan and its trade has expanded at a rate of 22 percent on average in the markets.

Apple is a temperate-climate fruit. It is native to many parts of temperate Europe and Asia. Its origin is in Central Asia. Apple is a highly popular fruit in Afghanistan and holds the second position in terms of production, right after grapes. The cultivation of apple is practiced in all the province of Afghanistan. Major contributors' provinces to the apple production are Wardak, Ghazni, Kabul, Uruzgan, Badakhshan, Takhar etc. As per the horticulture census in 2019, the total area occupied was 27,559 hectares, with a production of 2,503,242 tonnes. The average yield of apples in Afghanistan was 9.08 tonnes per hectare during 2019.

Almost all apples produced in Afghanistan are sold in Afghanistan, Pakistan and India and used for fresh consumption, with only small quantities used for processing into products such as apple juice, jelly, and jam. Afghan apples are in high demand around the world, with Pakistan and India being the main importers.

The overall performance of agriculture depends, not only on efficiency in marketing or supply, but also on production efficiency. Government intervention in the production system and export capabilities are imperative to ensure sustainability and improve rural life by reducing poverty among small and medium scale farmers. Export competitiveness studies are essentially empirical exercises that test economic theory predictions and provide insights into the transfer of production changes to other sectors, reflecting factory utilization levels and market efficiency.

The study focused on evaluating the production and export of Afghanistan's main commercial horticultural crops, which is (Apple). The study aimed to measure the extent of apple production and its significance in the country's agricultural sector, specific in term of export activities.

2. Materials and Methods

2.1 Source of data

The research was conducted in Afghanistan for the agricultural year 2020-21, utilizing time series data on apple cultivation. The study focused on variables such as area, production, productivity, and apple exports from Afghanistan.

2.2 Compound Annual Growth Rate (CAGR)

The compound annual growth rate (CAGR) analysis was carried out to ascertain the growth in area, production and productivity of apple in Afghanistan. The mean annual growth rate of a parameter over a defined period of time. Compound fit is given by the equation.

$$Y = ab^t e^{Ut} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (1)$$

Where,

Y = Dependent variable (Area / Production / Productivity)
a = Intercept (constant)
b = Regression coefficient
'a' and 'b' are the parameters to be estimated
t = time period
Ut= Disturbance term for the year 't'
Ordinary Least Squares (OLS) approach was used to estimate the equation (1) after it was translated into log linear form as shown below.

$$InY = In\,a + t\,In\,b + Ut \dots\dots\dots\dots\dots\dots\dots (2)$$

The given relationship was used to calculate the compound growth rate (g) as a percentage.

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

Where,

g = Compound growth rate in percent per annum
b = Antilog of b
The significance of regression co-efficient was tested using, 't' test as defined below

$$T = \frac{b_i}{SE(b_i)} \dots\dots\dots\dots\dots\dots\dots\dots\dots (4)$$

Where,

b_i = Regression co-efficient
$SE(b_i)$ = Standard error of the regression co-efficient
The standard error of the regression co-efficient was used to test its significance with 't' statistic.

2.2. Markov Chain Analysis

The Markov chain analysis was utilized to determine the competitiveness of the export of apple composition from Afghanistan. Annual export data from 2008 to 2020 in quantities as well as value terms realized were used for the analysis. The trade direction of Afghanistan's apple exports was analyzed using the first order Markov chain approach. Central to Markov chain analysis is the estimation of the transitional probability matrix "P" whose elements indicate the probability of export switching from country "i" to country 'j' over time. The diagonal element where i=j,

measures the probability of a country retaining its market share, or, in other words, the loyalty of an importing country to a particular country's exports.

$$E_{jt} = \sum_{i=1}^{r} E_{it-1} * P_{ij} + e_{jt}$$

$$\tag{5}$$

Where,

Ejt = Exports from Afghanistan to j^{th} country during the year 't'.
E_{it-1} = Exports to ith country during the period t-1.
P_{ij} = Probability that the exports will shift from i^{th} country to j^{th} country.
e_{jt} = The error term which is statistically independent of E_{it-1}.
t = Number of years considered for the analysis.
r = Number of importing countries.

2.3 Revealed Comparative Advantage Index (RCA)

The RCA index is calculated as the ratio between two shares. The numerator represents the proportion of a country's total exports of a specific commodity to its overall exports, while the denominator represents the proportion of global exports of the same commodity to total global exports. The concept of RCA, introduced by Balassa in 1965, 1977, 1986, and 1989, pertains to the comparative trading patterns of countries concerning specific goods.
The Balassa's index is calculated as,

$$RCA_{IA} = \frac{(X_{IA}/X_{IT})}{(X_{WA}/X_{WT})} \dots\dots\dots\dots\dots\dots\dots\dots\dots (6)$$

Where:

RCA_{IA} = Revealed comparative advantage ratio for Afghanistan apple
X_{IA} = Afghanistan's exports of apple
X_{IT} = Total exports of Afghanistan
X_{WA} = World export of apple
X_{WT} = World total exports
RCA value lies between 0 and ∞. A country is said to have a comparative advantage if the value exceeds 1.

2.4 Revealed Symmetric Comparative Advantage (RSCA)

The RCA index has a wide range from one to infinity when a country has a comparative disadvantage, making it difficult to compare. On the other hand, the RSCA index is more concise, ranging from -1 to +1, and avoids the issue of zero values. Positive RSCA values indicate a comparative advantage, while negative values indicate a comparative disadvantage.

$$RSCA = \frac{RCA - 1}{RCA + 1} \dots\dots\dots\dots\dots\dots\dots\dots (7)$$

RSCA avoids the troublesome 0 values and has a range of -1 to +1 (-1RSCA1). Positive indices demonstrate a competitive advantage, whilst negative indices demonstrate a comparative disadvantage.

3. Results and Discussion
The results in Table 1 depicts that the area under apple cultivation in the year 2007 was 7.00 thousand hectares which had been increased significantly to 27.56 thousand hectares in the year 2019 with cumulative compound annual growth rate (CAGR) of 13.68. Similarly, the production has increased from 54.77 thousand tonnes to 250.32 thousand tonnes from 2007 to 2019 with a significant positive change in (CAGR) 12.38 percent. Whereas the productivity of apple has increased from 6.80 to 9.10 tonnes per hectare from 2007 to 2019 with a non-significance CAGR -0.68 percent. As a studied of (Mohammad, S. *et al* 2020) [9] which was conducted on Economic analysis of apple production in Kabul province, Afghanistan, the production of was 1,70,443 metric tons in 2017 to 2018.

Table 1: Trends in area, production and productivity of apple in Afghanistan (2007- 2019)

Sl. No.	Year	Area ('000 ha)	Production ('000 t)	Productivity (t/ha)	Percentage change area	Percentage change production	Percentage change productivity
1	2007	7.00	54.77	6.80	-	-	-
2	2008	7.00	77.00	11.00	0.00	40.60	61.60
3	2009	8.55	72.68	8.50	22.10	-5.60	-22.70
4	2010	8.55	59.85	7.00	0.00	-17.60	-17.60
5	2011	8.86	62.04	7.00	3.70	3.70	0.00
6	2012	9.5	69.99	7.70	3.20	12.80	9.30
7	2013	10.34	78.59	7.60	13.00	12.30	-0.70
8	2014	12.53	95.43	7.60	21.10	21.40	0.20
9	2015	13.04	89.73	6.90	4.10	-6.00	-9.70
10	2016	19.37	140.9	7.30	48.50	57.00	5.70
11	2017	26.85	170.44	6.30	38.60	21.00	-12.70
12	2018	28.38	213.59	7.50	5.70	25.30	18.50
13	2019	27.56	250.32	9.10	-2.90	17.20	20.70
CAGR		13.68***	12.38***	-0.68[NS]	-	-	-

Note: 1. *** indicates significance at one percent level.
'NS' indicates non-significant values
Source Anonymous, 2020 [2]. and own competition

Province wise share in the area, production and productivity of apple in Afghanistan
The province wise analysis reveals in Table 2 that the area and production are highest in Wardak Province in Afghanistan compared to another province. Wardak had the highest share in area under apple production with (29.05%) while the production share was (29.31%) in period I (2007–13). The share in area and production decreased in Period II (2014–2019), which witnessed a negative (-5.94%) and (-1.37%) share in area and production, respectively. However, the province observed a positive change in productivity (0.4 %) despite the significant negative change in area. Other provinces in Afghanistan, such as Ghazni, Kabul, and Uruzgan, are also higher apple producer provinces in Afghanistan. As reported by (Matiullah, A. *et al.,* 2015) [7] The major area of apple production, that is, producing more than 1,000 metric tons per year, are Ghazni, Kabul, Paktika, Wardak. Wardak is the first province by cultivation and producing of apple in Afghanistan.

Table 2: Province wise share in the area, production and productivity of apple in Afghanistan

Sl. No.	Province	Area (ha) %		% Change	Production (t) %		% Change	Productivity (t / ha) %		% Change
		2007- 2013	2014- 2019		2007- 2013	2014- 2019		2007- 2013	2014- 2019	
1	Wardak	29.05	23.11	-5.94	29.31	27.94	-1.37	8.20	8.60	0.40
2	Ghazni	8.51	9.57	1.05	8.87	12.53	3.66	8.10	10.40	2.30
3	Kabul	17.49	8.96	-8.53	16.39	7.41	-8.99	8.00	6.20	-1.08
4	Uruzgan	1.83	4.81	2.97	1.72	3.34	1.62	7.80	5.20	-2.60
5	Badakhshan	0.96	4.78	3.82	1.29	4.92	3.63	7.90	7.60	-0.30
6	Takhar	0.93	4.17	3.23	0.90	3.45	2.56	7.80	7.30	-0.50
7	Balkh	4.00	3.84	-0.16	3.75	3.52	-0.23	7.80	6.50	-1.30
8	Parwan	3.29	3.47	0.18	3.26	3.24	-0.02	8.10	6.50	-1.60
9	Logar	5.52	3.20	-2.32	5.43	3.07	-2.36	8.00	6.70	-1.30
10	Baghlan	1.54	3.01	1.47	1.48	2.67	1.18	7.80	6.40	1.40
11	Paktia	2.35	2.68	0.33	2.33	4.02	1.69	8.00	10.70	2.70
12	Kandahar	9.40	2.59	-6.81	9.43	2.05	-7.38	8.10	5.30	-2.80
13	Zabul	0.98	2.58	1.60	1.01	2.08	1.07	8.10	7.70	-0.40
14	Herat	1.63	2.51	0.88	1.58	2.50	0.92	8.00	7.30	-0.70
15	Bamyan	0.82	2.44	1.61	0.78	2.28	1.50	7.80	6.80	-1.00
16	Samangan	0.80	2.00	1.21	0.78	0.97	0.19	7.90	4.10	-3.80
17	Panjshir	1.01	1.98	0.97	0.97	2.79	1.82	8.00	8.50	0.50
18	Paktika	2.17	1.87	-0.29	2.14	1.96	-0.18	8.00	8.00	0.00

19	Sar -e pol	0.13	1.86	1.74	0.16	0.90	0.73	7.50	3.60	-3.90
20	Ghor	0.75	1.76	1.01	0.73	0.71	-0.01	7.90	4.00	-3.90
21	Daykundi	1.06	1.45	0.39	1.04	1.16	0.13	7.90	6.50	-1.40
22	Helmand	0.59	1.42	0.84	0.55	1.19	0.64	7.60	5.80	-1.80
23	Kapisa	1.36	1.40	0.04	1.32	1.61	0.29	8.00	7.80	-0.20
24	Faryab	0.55	1.40	0.85	0.52	1.17	0.65	7.80	6.90	-0.90
25	Kunduz	0.95	0.82	-0.14	0.93	0.67	-0.26	7.90	5.20	-2.70
26	Badghis	0.81	0.64	-0.17	0.77	0.56	-0.20	7.80	6.20	-1.60
27	Farah	0.61	0.40	-0.21	0.58	0.39	-0.19	7.80	6.10	-1.70
28	Jowzjan	0.23	0.35	0.12	0.30	0.13	-0.17	7.60	3.30	-4.30
29	Kunar	0.02	0.34	0.32	0.17	0.28	0.12	7.60	6.10	-1.50
30	Nangahar	0.02	0.24	0.22	0.13	0.09	-0.04	7.60	5.20	-2.40
31	Nuristan	0.18	0.14	-0.03	0.38	0.22	-0.16	7.40	11.00	3.60
32	Khost	0.07	0.11	0.04	0.47	0.12	-0.35	7.60	9.20	1.60
33	Laghman	0.07	0.06	-0.01	0.22	0.04	-0.18	7.60	4.50	-3.10
34	Nimroz	0.32	0.03	-0.29	0.30	0.02	-0.29	7.80	3.60	-4.2
	Total	100	100	0.00	100	100	0.00	7.8	6.6	-1.2

Source: Anonymous, 2020 [2].

Apple production to export share in Afghanistan

Afghanistan's share of apple production in export quantity, Table 3 presents the obtained results of the study. That the production of apples in Afghanistan during 2007 was 54,769 tonnes and the quantity exported was about 5,320 tonnes which accounted for 9.71 percent of production exported from Afghanistan. Between 2017 and 2019, production increased from 1,70,442 tonnes up to 2,50,324 tonnes, but the percentage of exports decreased from 9.34 to 9.33 percent.

Table 3: Afghanistan shares in apple production to exports from 2007 to 2019

Year	Production (t)	Export (t)	Export share in production of apple (%)
2007	54,769	5,320	9.71
2008	77,000	7,715	10.01
2009	72,676	9,366	12.88
2010	59,850	6,125	10.23
2011	62,041	5,635	9.08
2012	69,994	3,509	5.01
2013	78,593	8,169	10.30
2014	95,427	3,569	3.74
2015	89,733	5,234	5.83
2016	1,40,903	22,923	16.2
2017	1,70,442	15,920	9.34
2018	2,13,592	19,317	9.04
2019	2,50,324	23,475	9.33

Source: Anonymous, Custom & Revenue Department (CRD) in Afghanistan, and (MAIL) 2020

Apple production to export share in Afghanistan

Table 4. It was discovered that global apple exports increased in quantity from 55.85 million tonnes in 2012 to 63.88 million tonnes in 2020. Similarly, in Afghanistan, the export of apples increased from 3,509 tonnes in 2012 to 15,331 tonnes in 2020. Apple exports have decreased in value from US$ 1.18 million in 2012 to US$ 0.83 million in 2020. The CAGR of Afghanistan apples revealed a growth of 25.34 and 12.89 percent respectively, in quantity as well as in value terms for the period from 2012 to 2020. Between 2012 and 2020, the percentage share of Afghan apple exports to global markets ranges from almost non-existent to 0.02 percent.

Table 4: Afghanistan shares of apples in the world total apple exports

Year	World export		Afghanistan's export		Afghanistan shares in the world apple export	
	Quantity (mt)	Value (million US$)	Quantity (t)	Value (million US$)	% Quantity	% Value
2012	55.85	7,232.79	3,509	1.18	0.0063	0.0164
2013	60.36	8,212.44	8,169	3.00	0.0146	0.0366
2014	61.07	7,770.542	3,569	1.53	0.0064	0.0197
2015	60.34	7,458.60	5,234	2.54	0.0094	0.0341
2016	63.91	7,356.56	22,923	15.66	0.0410	0.2129
2017	65.50	7,745.75	15,920	9.74	0.0285	0.1258
2018	57.49	7,761.55	19,317	9.73	0.0346	0.1254
2019	67.71	7,154.68	23,475	10.14	0.0420	0.1418
2020	63.88	6,750.06	15,331	0.83	0.0274	0.0123
CAGR	1.41	-1.08	25.34	12.89	-	-

Source: Anonymous, Custom Revenue Department (CRD), Tridge, 2012-20

Afghanistan apple export to Pakistan and India (2008 to 2020)

Afghanistan exports the majority of its apple quantity to Pakistan, India, and other countries (Table 5). The export of Afghan apples to Pakistan has increased from 7,538.33 tonnes in 2008 to 13,031.35 tonnes in 2020. Similarly, the export share of apple exports to Pakistan in value terms declined from (97.71%) in 2008 to (85.00%) percent in 2020. In terms of volume, India's share of Afghan apple imports increased from 154.30 metric tonnes in 2008 to 1,379.79 metric tonnes in 2020. The percentage share of apple exports from Afghanistan to India increased from (2.00%) in 2008 to (9.00%) in 2020.

Table 5: Afghanistan apple export to Pakistan and India during 2008 – 2020

Year	Pakistan		India		Others	
	Quantity (t)	Value (Million US$)	Quantity (t)	Value (US$)	Quantity (t)	Value (US$)
2008	7,538.33	2.80 (97.71)	154.30	57,322.67 (2.00)	22.37	8,311.79 (0.29)
2009	8,991.36	3.17 (96.00)	280.98	99,068.53 (3.00)	93.66	33,022.84 (1.00)
2010	5,818.75	0.81 (95.00)	214.38	30,094.40 (3.50)	91.88	12,897.60 (1.50)
2011	5,465.95	1.29 (97.00)	112.70	26,667.50 (2.00)	56.35	13,333.75 (1.00)
2012	3,308.99	1.11 (94.30)	122.82	41,434.32 (3.50)	77.20	26,044.43 (2.20)
2013	7,678.86	2.82 (94.00)	375.77	1,38,147.63 (4.60)	114.37	42,044.93 (1.40)
2014	3,401.26	1.46 (95.30)	107.07	45,982.75 (3.00)	60.67	26,056.89 (1.70)
2015	4,888.56	2.37 (93.40)	209.36	1,01,685.43 (4.00)	136.08	66,095.53 (2.60)
2016	21,570.54	14.74 (94.1)	916.92	6,26,561.71 (4.00)	435.54	2,97,616.81 (1.90)
2017	14,328.00	8.77 (90.00)	811.92	4,96,987.55 (5.10)	780.08	4,77,497.84 (4.90)
2018	17,655.74	8.89 (91.40)	1,197.65	6,03,408.33 (6.20)	463.61	2,33,577.42 (2.40)
2019	20,258.93	8.75 (86.30)	1,643.25	7,10,053.42 (7.00)	1,572.83	6,79,622.56 (6.70)
2020	13,031.35	0.70 (85.00)	1,379.79	74,806.03 (9.00)	919.86	49,870.69 (6.00)

Note: Figures in parenthesis indicates percentages
Source: Custom & Revenue Department (CRD) in Afghanistan

Revealed Comparative Advantage (RCA) and Revealed Symmetric Comparative Advantage Index (RSCA)

The result in Table 6 of the RCA and RSCA reveals that Afghanistan is competitive in the world market in terms of apple exports. Since the calculated values of RCA and RSCA for the year under study were greater than one and greater than zero, respectively.

Table 6: RCA and RSCA of export of apple from Afghanistan to world

Year	RCA of Apple	RSCA of Apple
2012	7.44	0.76
2013	14.73	0.87
2014	6.47	0.73
2015	9.70	0.81
2016	56.39	0.97
2017	26.35	0.93
2018	27.46	0.93
2019	30.51	0.94

Source: Tridge, Trade Map, and Custom & Revenue Department (CRD) in Afghanistan

Direction of exports of apple from Afghanistan

Table 7 presents the transition probability matrix used to analyze changes in apple exports from Afghanistan. Pakistan retained 98.65% of its import share from Afghanistan while gaining export competitiveness from India and other countries. India retained 87.99% of its share, with gains primarily from Pakistan and other nations. Other countries experienced losses to India but retained the majority.

Table 7: Transition probability matrix showing shifts in export of apple from Afghanistan (2008 to 2020)

Countries	Pakistan	India	Others
Pakistan	0.98658	0.00871	0.0047
India	0	0.87992	0.12008
Others	0	0.31174	0.68826

4. Conclusion

The study has clearly revealed the scenario of apple production and export performance in Afghanistan. The apple cultivation in Afghanistan has expanded from 7,000 hectares to 27,559 hectares between 2007 and 2019, while apple production has increased from 54,769 metric tonnes to 250,324 metric tonnes. Productivity has also improved from 6.8 metric tonnes to 9.1 metric tonnes per hectare. The major apple-producing provinces in Afghanistan, namely Wardak, Ghazni, Kabul, Badakhshan, and Paktia, have contributed significantly role in the horticulture of Afghanistan. The export share of Afghan apples to Pakistan has grown, from 7,538.33 metric tonnes in 2008 to 13,031.35 metric tonnes in 2020. However, the export share of Afghan apples to Pakistan, in terms of value, has declined from 97.71% to 85.00% during the same period. India has shown an increased import share of Afghan apples, with quantities rising from 154.30 metric tonnes in 2008 to 1,379.79 metric tonnes in 2020. The percentage share of apple exports from Afghanistan to India, in terms of value, has increased from 2.00% to 9.00%. Despite being ranked 46th globally in apple production, Afghanistan has demonstrated competitiveness in the global market according to the (RCA) and (RSCA) analysis. The transitional probability matrix highlights the retention of import shares, with Pakistan retaining 98.65% of the previous year's share from Afghanistan, and India retaining 87.99% while gaining shares from Pakistan and other countries.

5. References

1. Abdullah Y. Horticulture in Afghanistan: Challenges and opportunities. J Dev Sustainable Agric. 2016;11:36-42.
2. Anonymous. Afghanistan Statistical Yearbook, National Statistics and Information Authority, Afghanistan; c2020. p. 8-167.
3. Anonymous. Customs & Revenue Department (CRD), Ministry of Finance, and Central Statistics, Afghanistan Statistical yearbook; c2012-20.
4. Anonymous. Islamic Republic of Afghanistan, Ministry of Agriculture, Irrigation & Livestock; c2020.
5. Bhat MS, Lone FA, Shafiq M, Rather, Javaid A. Evaluation of long-term trends in apple cultivation and its productivity in Jammu and Kashmir from 1975 to 2015. Gio J. 2021;86:1193-1202.
6. Kusuma DK, Basavaraja H. Stability analysis of mango export markets of India: Markov Chain approach. Karnataka J Agric Sci. 2014;1:36-39.
7. Matiullah A, MAOY, Tsutomu M, Shungo O, Katsuhiro S, Shogo M. Apple cultivation and breeding in Afghanistan: S-RNase genotypes and search system for suitable cultivar combination. Int J Agron; c2015. p. 1-7.
8. Mustafa N. Consumers apple consumption preferences in Afghanistan. 2017;3:299-304.
9. Mohammad S, Padma R, Anjugam M. Economic analysis of apple production in Kabul province, Afghanistan. Int J Agric Sci Res. 2020;10(4):47-54.