

International Journal of Agriculture Extension and Social Development

Volume 7; Issue 12; December 2024; Page No. 542-546

Received: 16-10-2024
Accepted: 20-11-2024

Indexed Journal
Peer Reviewed Journal

International trade potential of Indian mango: An analysis of export competitiveness

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DOI: <https://doi.org/10.33545/26180723.2024.v7.i12h.1470>

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Abstract

The competitiveness of a country's agricultural produce is not only related to its capacity to export but also to the sustainability of its agricultural sector. How to improve the competitiveness of a country's agricultural produce while maintaining sustainability is a practical problem for a country like India. The export of mangoes from India generates significant revenue for the country and also promotes India's unique fruit and agricultural heritage in the global market. The purpose of this study is to check the competitive landscape and variables influencing the growth of mango exports in international trade. The results revealed that the trend in export quantity declined significantly but export value and unit value increased which showed that there is good demand for Indian mango internationally. Instability was found low to medium in all periods except export quantity and export value in period III. In export competitiveness, NPC data showed that Indian mango export was not price competitive but RCA analysis showed that Indian mango export has a comparative advantage over other commodities.

Keywords: International trade, mango, comparative advantage, export competitiveness, etc.

Introduction

Highlights

- Export competitiveness is an indicator that demonstrates a nation's advantage or disadvantage in selling products in foreign markets.
- NPC data showed that Indian mango export was not price competitive but RCA analysis showed that Indian mango export has a comparative advantage over other commodities.

Mango (*Mangifera indica*) is the most popular Asian fruit, known as the 'king of fruits' because of its delicious quality of fruit and rich in vitamins and minerals. The mango being one of the most ancient Indian fruit originated 4,000 years ago in India and are considered a sacred fruit (UNCTAD, 2016) ^[19]. There are currently more than a hundred mango-producing nations with thousands of varieties grown in different countries. Mangoes were not widely recognized by consumers outside of the tropic region before the 1960s, and there was hardly any fresh fruit trade. Produce was primarily bound for internal consumption in the producing countries. Over the last 20 years, the global economy has experienced a boom, with global production nearly doubled. Demand for mango is rising in the world, particularly in temperate countries where mangoes are gaining popularity. Mango exports were only 68 crores in 2000-01, which increased to 400.21 crores (5.88 times) in 2019-20. (APEDA, 2022) ^[1]. Thailand, Mexico, Brazil, Peru, Spain and the Netherlands are some of the leading countries in the

world mango trade. Thailand exported 20.25 percent of global mangos in 2020, making it the world's largest mango exporter with 433.32 thousand tonnes. Brazil and Thailand are the countries that export the majority of the mangoes produced (FAO, 2022) ^[10]. India, the world's largest mango grower with 20.32 million tonnes produced, only 0.049 million tonnes (less than 1%) of mangoes were exported in 2019-20.

India, the world's largest mango producer, accounts for more than 45 percent of the world's mango production, followed by Indonesia (7%), Mexico (4%), and China (4%). The mango yield in India is 9.6 MT/ha, which is similar to the global average (TE 2020). Conversely, India's mango productivity is 1.5-2 times lower than that of other countries like Mexico (11.11 MT/ha), Brazil (22.79 MT/ha), and Israel (17.61 MT/ha) (FAO, 2022) ^[10]. The major mango importing countries are the United States, European Union, and United Arab Emirates. Tommy Atkins, Keitt, Palmer, Kent, Maya/Aya, Irwin, and Indian varieties Alphonso, Kesar, Totapuri, and Chausa are among the most widely traded mango varieties in the world. Mangoes are exported from India in a variety of forms and types, including ripe, pulp, puree, dice, slices, concentrate, chunks, and so on.

The cultivation and production of mango have been almost steadily increasing over the years. Mango cultivation grew from 1.08 million hectares in 1991-92 to 2.29 million hectares in 2019-20. Andhra Pradesh, Uttar Pradesh, Karnataka, Bihar, Telangana, Maharashtra, Gujarat, West Bengal, Tamil Nadu, Madhya Pradesh, and Odisha are states

that produce a significant amount of mangoes. Maharashtra is the state that contributes the most to the country's mango exports. Approximately 60 percent of India's mango exports are minimally processed mango (pulp, puree, dried, extracts). Secondary processed exports (juices, jams, etc.) account for only 5-10 percent of total exports. Alphonso, Dasheri, Kesar, and Banganapalli are the major varieties that have good demand in the international markets (Financial Commission, 2020).

The purpose of the study is to determine the export performance and export competitiveness of Indian mango in the international market. To achieve this goal, the following objectives were stipulated for the study.

- To study the growth and instability in export of Indian mango;
- To study the export competitiveness of Indian mango in international markets.

Literature review

Many Researchers had carried out studies to check export performance and export competitiveness of different Indian commodities over the years. In the late nineties, Tamanna *et al.* (1999) ^[17] calculated the nominal protection coefficient to analyze the export potential of Indian fruits. Nominal Protection Coefficient values were found below one in the case of Mango (0.87), grape (0.59), and banana (0.49), which are indications of products that are competitive on the global market. Ayyaz *et al.* (2019) ^[12] studied on competitiveness of Pakistan's mango trade using trade data from 2010-2016. the study assessed multiple revealed comparative advantage (RCA) indices, including InRCA, RSCA, and competitive export performance (CEP). The results showed that Pakistan's mango export competitiveness was consistent over the course of the study, except in 2014–2015 when it decreased. The prospects for Pakistan's mango exports were significantly threatened at the same time by increases in the comparative advantages of Mexico, Thailand, and the Philippines in the export of mangoes. An index of comparative export performance (CEP) reveals that Pakistan has a competitive advantage over the majority of the top mango-producing and exporting countries, except Thailand and the Philippines. Patil *et al.* (2018) ^[14] examined mango export performance and growth in India. The study's findings showed that the area, mango output, and productivity all saw favorable and considerable development. The production category had the most fluctuation or 15.88%. The state of Odisha had the highest rates of area and output growth, whereas Maharashtra had the greatest variations in these two metrics. Sujatha *et al.* (2003) ^[16] researched the performance of Indian mango exports. The study concluded that the post-WTO period (1995-1996 to 2001-2002) had greater price and quantity instability for fresh mangoes and mango pulp than the pre-WTO period. Export profits were generally quite constant when compared to the pre-WTO and post-WTO years. Mango pulp's nature became more unstable after the WTO.

Methodology

The study was based on secondary data gathered from different sources *i.e.*, Agricultural Processed Foods and Export Development Authority (APEDA), Food and Agriculture Organization (FAO), and Directorate General

for Commerce Intelligence and Statistics (DGCIS) related to the export quantity and value data. The periods of 20 years were separated into three periods: period I (2000-01 to 2009-10), period II (2010-11 to 2019-20), and overall period (2000-01 to 2019-20).

Growth rate analysis

Trends in export quantity, export value and export unit price were estimated by compound annual growth rate (CAGR). The periods were classified as low growth rate (0-5%), medium growth rate (5-10%), and high growth rate (>10%) based on CAGR values (Das *et al.*, 2016) ^[7]. The percent compound annual growth rate (g) was computed using the following relationship

$$g = \text{antilog of } \log(b-1) * 100$$

Instability analysis

The coefficient of variation (C.V) and the Cuddy Della-Vella Index (CDVI) were employed to study the level of export instability in export quantity, value, and unit price.

$$\text{Coefficient of variation} = \frac{\sigma}{X} * 100$$

Where, σ = Standard deviation and X = Mean Cuddy Della — Vella Index:

Cuddy Della proposed a modification of the coefficient of variation to have a meaningful indicator of instability. The calculation of the amount of variation around the trend was done using the formula proposed by Cuddy Della (1978) ^[5]. The instability was classified as low (<15), medium (15-30), and high instability (>30) (Sihmar, 2014) ^[15].

$$\text{Cuddy Della-Vella Index (CDVI)} = \text{Coefficient of variation} * \sqrt{1 - R^2}$$

Where, R^2 = the coefficient of determination of the trend equation.

Nominal Protection Coefficient (NPC)

The nominal Protection Coefficient was calculated to check the extent of a competitive advantage enjoyed by India in terms of fresh mango free trade. Mango's NPC was determined by dividing the domestic price of mangoes by the international reference price, with transit, packing, port clearing, insurance, and other costs considered. NPC helps in determining the degree of the commodity's export competitiveness by measuring the difference between domestic and international prices.

$$\text{NPC} = P_d / P_b$$

P_b = World reference price of the mango

P_d = Domestic wholesale price of the mango

If $\text{NPC} > 1$, the commodity is protected and not price competitive and if $\text{NPC} < 1$, the commodity is not protected and price competitive.

Revealed Comparative Advantage (RCA)

The RCA index, also known as the Revealed Comparative

Advantage index, was created by Balassa in 1965. The numerator shows the proportion of a given commodity's exports to the country's overall exports at a particular point in time. The denominator shows the proportion of that commodity's exports to all exports in the world. The value of the RCA index ranges from 0 to infinity. When the RCA (for a commodity) is more significant than unity, it indicates that a country has a revealed comparative advantage in the commodity's exports because its exports of that commodity account for a larger portion of global exports than the country's overall export share.

$$RCA_{ij} = (X_{ij} / X_{wj}) / (X_i / X_w)$$

Results and Discussion

Trend analysis in the export of fresh mango from India

The growth rate in export quantity, export value, and export price are presented in Table 1. Growth in export quantity (8.56%) and export value (11.56%) was highest in period I (2000-01 to 2009-10) whereas growth in export unit value was highest in period II (2010-11 to 2019-20) which shows good demand of Indian mango. The trend in export quantity declined significantly but export value and unit value increased which means there was good demand for Indian mango in the international market. In the overall period, negative and non-significant growth rates were found in export quantity of fresh mango while there was significant and good growth in export value and unit value. This shows overall good demand for mango for a long period.

(Table 1. Growth rate analysis in the export of fresh mango from India)

Instability analysis of fresh mango exports from India

The Cuddy Della Valle Index and coefficient of variation are used in this study to assess instability. Instability in mango export is attributed to changes in technology, institutions, and trade policies. Mango exports have been hampered by causes such as lack of grading, quality control, excessive use of pesticides and insecticides, transportation, storage issues, marketing issues, productivity decline, and fluctuations in output due to weather conditions (Kumaresh and Sekar, 2013)^[12]. In the period I, medium instability was found in export quantity whereas low instability was found in export value and export unit value. In period II, low instability was found in export quantity and export value whereas medium instability was found in export unit value. In period III (overall period), medium instability was observed in export value and unit value and high instability in terms of export quantity. If the time series data show any trend, the variance evaluated by CV may be overestimated. It can be seen in the export value and export unit value in period III. Cuddy-Della Valle index, on the other hand, uses the coefficient of determination (R^2) to detrend the CV. As a result, it is a better indicator of agricultural export instability.

Exporting countries must manage and stabilize export instability to maximize earnings. When compared to other periods, Period I had a low level of instability. This is because, post-globalization, developed countries rejected Indian exports due to the presence of banned and excessive pesticides in horticultural items. In 2014, the Standing Committee on Plant Health of the European Union placed a

ban on Indian mango and some vegetables (*Colocasia* sp., *Momordia* sp., etc.). This situation was addressed by a significant improvement in its quality standard; however, exporting nations must maintain these standards for trade to continue and for European agriculture to remain healthy. To continue exporting to these nations, India has created phytosanitary certification measures under the legislative requirements of mango-importing countries as laid down by the International Codex.

(Table 2. Instability analysis of fresh mango exports from India)

Export competitiveness of Indian mango

Nominal Protection Coefficient (NPC) of fresh mango

(Table 3. Nominal Protection Coefficient (NPC) of fresh mango)

The export competitiveness of fresh mango from India has been analyzed by calculating the nominal protection coefficient (NPC). According to the NPC data, India's mango exports were only competitive for five years between 2010–11 and 2019–20. The average NPC was 1.21 which means mango exports from India were not price competitive during 2010-11 to 2019-20. Major destination for mango export was the Asia Pacific and MENA countries which offered less price compared to the US and European countries. Europe has been a challenging market to enter, due to its stringent sanitary and phytosanitary standards, lack of agreements, and non-tariff barriers. Indian mango exports to the US come at a very high cost because of irradiation and costly logistics. (Indian Alphonso costs \$4.1/kg versus \$0.9/kg for Kent from Brazil and Mexico) (XV Finance Commission, 2020). Indian mangoes are significantly more expensive for US consumers than mangoes from Mexico or Brazil, primarily because of transportation costs, which could be reduced by rising trade quantities. Indian mangoes must be exported via air freight due to their shorter shelf life than Thai and Brazilian varieties, which results in a significant increase in logistics costs. In 2014, the EU prohibited the imports of Alphonso mangoes, brinjal, taro, bitter gourd, and snake gourd from India due to the presence of pests such as fruit flies in some of the consignments. The restriction was in place from May 2014 to December 2015. On the other hand, the EU revoked the ban on mango exports earlier than anticipated. Mangoes imported from India cost more than those from Mexico, Ecuador, and the Philippines since they had to travel farther by air to reach the US, the EU, Japan, and other nations. Frequently, the price of air freight is more expensive than the price of mangoes at the farm gate. India is unable to compete in the US and EU markets due to the high cost of air freight. (Baliyan, 2017; Devi, 2019; Thulasiram, 2020; Baliyan *et al.* 2022)^[3, 8, 18, 4]. As a consequence, India can market mangoes in markets like the United States, the European Union, Japan, and Korea, where consumers have more purchasing power than in the Middle East, and advertise the distinct flavor, appearance, and flavor of Indian mangoes abroad.

Revealed Comparative Advantage (RCA) of Indian fresh mango

The results of the RCA for Indian mangoes are presented in Table 4. The results are presented for the years 2005, 2010,

2015 and 2020. The RCA is calculated based on the HS classification of the products. Among all the periods, the RCA was found above one for fresh mango. The RCA for fresh mango has been decreasing since 2005. This implies that the comparative advantage of the Indian mango has decreased over time. This suggests that India's competitive advantage in mango is eroding. If a commodity has a comparative advantage, it suggests that this country's exports are becoming a larger portion of global exports, yet the commodity may not be price competitive for export.

This implies that the competitiveness of Indian fresh mango is impacted by both the high delivery cost and competition from other Asian nations. The cost of domestic and international transportation accounts for between 25 and 40 percent of the retail price, making it the single highest cost factor. This outcome matched Mittal's (2007) ^[13] findings. India's competitive advantage in mango exports may be due to the rising demand for Indian mangoes in the US and European markets. (Table 4 Revealed Comparative Advantage (RCA) of fresh mango).

Table 1: Growth rate analysis in export of fresh mango from India

Sr. No.	Year	Export quantity (Percent)	Export value (Percent)	Export Unit value (Percent)
1.	Period I (2000-01 to 2009-10)	8.56**	11.56**	2.76
2.	Period II (2010-11 to 2019-20)	-1.95**	10.08**	12.27**
3.	Period III (2000-01 to 2019-20)	-0.44	10.47**	10.96**

Note: ** indicates the level of significance at 1 percent. Export Data of the year 2020-21 was not considered because the export of mango was banned in other countries due to COVID-19.

Source: Author's computation based on data of mango export from APEDA (2000-01 to 2019-20)

Table 2: Instability analysis of fresh mango exports from India

Sr. No.	Year	Export quantity		Export value		Export unit value	
		CV (%)	CDVI (%)	CV (%)	CDVI (%)	CV (%)	CDVI (%)
1.	Period I (2000-01 to 2009-10)	28.29	16.58	35.19	12.89	15.76	13.74
2.	Period II (2010-11 to 2019-20)	17.67	10.00	28.50	11.31	33.32	18.85
3.	Period III (2000-01 to 2019-20)	25.76	26.23	55.96	15.66	65.76	28.91

CV: Coefficient of Variation and CDVI: Cuddy Della Valle Index

Source: Author's computation based on data of mango export from APEDA (2000-01 to 2019-20)

Table 3: Nominal Protection Coefficient (NPC) of fresh mango

Years	FOB price in (Rs. /kg) [1]	Total marketing expenses in (Rs. /kg) [2]	Reference price (Pb) in Rs. /kg [3] = [1] – [2]	Wholesale Price (Pd) in Rs. /kg [4]	NPC = (Pd/Pb) [4] / [3]
2010-11	28.00	12.00	16.00	43.25	2.70
2011-12	33.06	12.10	20.96	48.00	2.29
2012-13	47.62	13.25	34.37	39.58	1.15
2013-14	76.53	13.65	62.88	46.09	0.73
2014-15	70.36	13.90	56.46	58.13	1.03
2015-16	87.18	14.20	72.98	45.63	0.63
2016-17	84.09	15.40	68.69	58.56	0.85
2017-18	77.19	16.45	60.74	45.00	0.74
2018-19	85.83	16.95	68.88	63.78	0.93
2019-20	80.59	18.00	62.59	63.65	1.02
Average					1.21

Source: The author's computation is based on data on mango export from ITC Trademap and the wholesale price of mango was taken from Navsari APMC (Gujarat) as a base (201011 to 2019-20)

Table 4: Revealed Comparative Advantage (RCA) of Indian fresh mango

Sr. No.	Particulars	2005	2010	2015	2020
1.	India's export of Mango (USD billion)	0.03	0.04	0.05	0.06
2.	World's total export of Mango (USD billion)	0.71	1.27	2.15	3.62
3.	India's export of edible fruits & nuts to the world (USD billion)	0.87	1.09	1.48	1.31
4.	World's total export of edible fruits & nuts (USD billion)	49.15	75.89	103.65	133.92
	RCA	2.25	1.95	1.53	1.55
	RSCA	0.39	0.32	0.21	0.22

Source: Author's computation based on data of mango export from ITC Trademap (2005 to 2020)

Conclusion

India is the largest mango-producing country by a wider margin in the world. Despite being the world's largest mango producer, India only exports less than 1 percent of total production. So, there is a need to study export performance and competitiveness in the international market. Fresh mango export depicted very good and significant growth in terms of export quantity, export value,

and export unit value in the period of 2001-02 to 2009-10 compared to 2010-11 to 2019-20. Cuddy Della-Vella Index showed that low to medium instability was found in terms of export quantity, export value, and export unit value in both periods individually. The overall period (2001-02 to 2019-20) showed medium to high instability in export quantity, value, and unit value. Hazell's Decomposition Analysis exhibited that change in mean export price was the

primary driver to change in average export value. India should focus on high-income countries where consumer's purchasing capacity is which will lead to an increase in export earnings from exporting mangoes. According to the NPC analysis, India's mango exports were only competitive for five years between 2010–11 and 2019–20. The average NPC was 1.21 which means mango exports from India were not price competitive during 2010-11 to 2019-20, but RCA analysis showed that Indian fresh mango exports have a comparative advantage over other countries or commodities which is decreasing over time. Domestic and international transportation costs and competition from other Asian countries impact the competitiveness of Indian fresh mango.

Policy implication

- There is plenty of opportunity for expansion in the profitable mango export sector. To boost the export of mangos, basic infrastructure facilities such as pre-cooling, cold storage, grading and handling systems, laboratories, reefer vans, vapor heat treatment facilities, and irradiation facilities must be created.
- The export of fresh mangoes and mango pulp had a reasonably high level of instability for the majority of the countries, which raises market risk for exporters. It is crucial to pay special attention to the quality criteria of the importing countries in order to reduce instability.
- To understand more about consumers' preferences for quality, there may be hosted international trade fairs, exhibits, etc. The Indian embassy might then launch well-thought-out planned initiatives to encourage the required quality of mango and mango pulp in underdeveloped nations.

Acknowledgments

This study was part of original doctoral research of the author. This study was technically supported by the NAHEP-CAAST project at Anand Agricultural University, Anand-388110 and financially supported by the SHODH (Scheme of Developing High-quality Research) fellowship program of Gujarat state.

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