



## Dynamics of Indian fresh mango export

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### ABSTRACT

Increasing integration of global markets after WTO has brought several changes in fresh mango export. The sustainability of exporters' income depends on acceptance of consignments by the importing countries who have established legally vetted system of safe import of food commodities. To adjust to these changes, the Indian system of export controls faltered to meet the standards of overseas markets. Adherence to safe export norms is *sine qua non* to have credible sustainable export. Visualizing the need to discern and quantify the direction of fresh mango export, time series data spanning from 1990-2012 was analysed. From the analysis, it can be concluded that domestic supply of mango is mainly driven by expansion of area rather than productivity. High standards of SPS measures of importing countries raised cost of compliance of safe export norms for which Indian exporters faced problems to adjust to these standards. These challenges need to overcome through generation of research based scientific knowledge for structuring food safety norms and policy alignment according to the changing global regulations. Policy options for streamlining diversified export are to encourage food testing laboratories to get accreditation from international agencies setting up world class food testing and inception infrastructure particularly in clusters with significant presence of exporters to encourage importing countries to set up office for certification of export consignments, and to strengthen prerequisite physical resources for safe export of fresh mango.

**Key words:** Export, Fresh mango

India is the largest producer and prominent exporter of mango with an annual production of about 18.68 million tonnes and a share of more than one-third of the world's mango production (FAOSTAT 2014). About 17 per cent is exported to countries to the European Union and 75 per cent in the Gulf. Review of literature highlighted the problems in mango production, marketing, post harvest handling etc. have been responsible for lower export and rejection of Indian consignments (Ayub and Siraj 2008). Over the years exports have been adversely affected due to unavailability of requisite infrastructural facilities in the production zones (Patil and Nirban 2013). At international level, the use of non-tariff barriers like sanitary and phytosanitary measures (SPS) and technical barrier to trade (TBT) by importing countries have affected the mango export from India. The US banned import of Indian mango in 1989 on account of excessive usage of pesticides and fear of invasion of fruit flies and stone weevil and India had to offer reduced pesticide levels and Hot Water Treatment (HWT) as a viable measure

of pest control (Rastogi 2011). In 2006, after prolonged negotiations, US permitted import of Indian mangoes with nuclear irradiation and strict inspection. The inspection norms were prohibitively strict as inspection in India by US inspectors increased the cost of mango manifold and rendered it uncompetitive (Sen 2007, Rabinowitz 2007). However, after further negotiations, US agreed for nuclear irradiation and routine inspection only. The EU also imposed ban on imports of Indian mangoes including the *Alphanso* along with four vegetables after observation of fruit flies in 207 consignments of produce. Indian system of exports controls failed to meet the international standard for years (Anonymous 2014) henceforth, Indian businesses and government need to address the concerns of EU by putting in place elaborate examination and certification procedure.

The implementation of provisions of World Trade Organization (WTO) among member countries has enabled integration of global agri-food markets. The increasing integration of global agri-food markets have been accompanied by stringent food safety measures viz. SPS and NTBs, especially in developed countries (OECD 2000). This has posed new challenges before the developing countries in modifying their food regulations and standards with the emerging global trends so as to sustain their share of global trade in food commodities and cash crops. The SPS requirements of importing countries (as per their Acts) are increasingly being applied to the production and trade

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of agricultural products. There are ample opportunities for developed countries to tweak the standards stronger than necessary to achieve the optimal level of social protection and to twist the related testing and certification procedures to make their imports more competitive (Aarthi *et al.* 2012). There are number of forces which directly and indirectly affect the compliance of SPS measures in fresh mango export. In this backdrop, it becomes essential to analyse the dynamics of Indian fresh mango exports since the inception of liberalization policy in the country. The knowledge emanating from the research would help policy makers to reorient and realign the mango production and trading system to meet the requirement of international markets.

#### MATERIALS AND METHODS

To present the trend of world mango trade, the data were collected from National Horticultural Board publications and FAO Trade Year Book for a time series spanning from 1990 to 2012 on area, production, productivity and export of mango. To discern the export performance of Indian mango, the total period was divided into three regimes, viz. pre-WTO period (1990-1995), early post WTO period (1995 to 2005) and recent period (2006-2012). The extent of instability in mango production and export was estimated using Cuddy Della Valle Index (Cuddy and Della Valle, 1978). The instability measure in relative terms by this index corrects the overestimation of the level of instability in time series data characterized by the long term trends. The Cuddy Della Valle Index (I) is expressed as:

$$I = CV (1-R^2)^{0.5}$$

where,  $CV = (\text{Standard deviation/mean}) * 100$ , and  $R^2 = \text{Coefficient of multiple determination from time trend regression adjusted by number of degrees of freedom}$ .

The growth in the export over the years was computed using compound annual growth rate. The growth rate of value was calculated after converting the nominal prices into real prices by using wholesale price index of all commodities at 2004-05 prices in order to adjust for inflation.

Diversification in export was calculated using Simpson Index of Diversification (SID) expressed as:

$$SID = 1 - \sum W_i^2$$

$$\text{And, } W_i = \frac{X_i}{\sum_{i=1}^n X_i}$$

where,  $X_i$  is the value of export of  $i^{\text{th}}$  mango products; and  $W_i$  is proportionate value of export of  $i^{\text{th}}$  mango in total horticultural export. The value of the index ranges between 0 and 1. Value of one indicates total diversification, and zero indicates perfect concentration of trade towards a particular product. Both commodity diversification and geographical diversification are worked out.

#### RESULTS AND DISCUSSION

##### *World-wide mango production*

Mango is commercially grown in more than 80 countries in the world. Major producers are India, China, Mexico, Pakistan, Indonesia, Thailand, Nigeria, Brazil, Philippines and Haiti.

World mango production increased from 17.2 MT in 1990-91 to 42 MT in 2012-13, registering an increase of nearly two and half times (Table 1). India enjoys the top slot (15.3 MT) followed by China (4.67 MT), Kenya (2.8 MT), Thailand (2.7 MT) and Indonesia (2.4 MT). However, the share of Indian mango production in total world production has been consistently falling from 50% in 1990-91 to 36% in 2012-13. Contrary to it, the share of China, Kenya, Thailand, Indonesia and Bangladesh in total world mango production has been consistently surging up. Notable increase in mango production in China is about 3.34 MT in a span of just over a quarter century, thereby contributing to the extent of 11% of global production followed by Kenya. The results infer that mango production globally is diversifying over the years. To sustain in overseas mango trade, India needs to develop a strategy to enhance yield as well as quality of fresh mango.

Table 1 Major mango producing countries

Country	Production (Million tonnes)						% share in total world production					
	1990	1995	2000	2005	2010	2012	1990	1995	2000	2005	2010	2012
India	8.6	11.0	10.5	11.8	15.0	15.3	50.4	48.8	42.5	37.4	40.4	36.2
China	0.9	2.0	3.2	4.2	4.1	4.6	5.3	8.9	13.0	13.4	11.1	10.8
Kenya	0.1	0.1	0.1	0.3	0.6	2.8	0.4	0.4	0.5	0.8	1.6	6.6
Thailand	0.9	1.1	1.6	1.8	2.6	2.7	5.2	4.7	6.6	5.7	6.9	6.3
Indonesia	0.5	0.9	0.9	1.4	1.3	2.4	3.0	3.9	3.5	4.5	3.5	5.6
Pakistan	0.8	0.9	0.9	1.7	1.8	2.0	4.5	3.9	3.8	5.3	5.0	4.6
Mexico	1.1	1.3	1.6	1.7	1.6	1.8	6.3	6.0	6.3	5.3	4.4	4.2
Brazil	0.5	0.6	0.5	1.0	1.2	1.2	3.2	2.8	2.2	3.2	3.2	2.8
Bangladesh	0.2	0.2	0.2	0.6	1.0	0.9	1.0	0.8	0.8	2.0	2.8	2.2
Total World	17.2	22.6	24.7	31.6	37.2	42.1	100	100	100	100	100	100

Source: FAOSTAT (1991-2014).

### Major mango exporting countries of the world

Mango in general and *Alphonso* in particular is a premium commodity and is high in demand in the overseas markets. The trend in area, production and productivity of mango in India is presented in Table 2.

Mango accounted for more than one third (36%) of total area under fruit crops and about 22 per cent of total fruit production in the country in 2013-14 (Table 2). The mango production increased from 8.7 MT in 1991-92 to 18.7 MT in 2013-14, registering an annual compound growth rate of around 3 percent. The area under mango crop has also been shown an increase in absolute term, i.e from 1.1 M ha in 1991-92 to 2.6 M ha in 2013-14. The growth in area under mango was 4.19 percent per annum which was higher to growth in mango production. The area increase is more than a proportionate increase in production. This is also evident from a continuous fall in mango productivity from 8.10 t/ha in 1991-92 to around 7 t/ha in 2013-14. This infers that mango production in the country is driven by expansion of area only. Therefore, to sustain the production to meet growing domestic and overseas demand, appropriate technology, policy and institutions are needed to arrest the productivity fall. The lucrative markets of developed countries have legally vetted system of Codex compliance (standards) with advancement of science for production of safe mango would facilitate for granting, maintaining and moving forward with Good Agricultural Practices (GAPs). This necessitates research on product and process standardization and alignment of the local standards with the international standards.

### Major mango exporting countries of the world

Indian fresh mango is the most sought fresh agricultural commodity in overseas markets. From 1991, mango export volumes of total world increased from 0.22 MT to 1.43 MT (Table 3). Major exporting countries, viz. India, Thailand, Brazil, Peru, Netherland and Pakistan have consistently enhanced their production and correspondingly increased their shares of export in world mango market. Mexico is the leading global exporter with 0.29 MT, whereas it ranks 8<sup>th</sup> in mango production in the world with a production between

1.1 MT and 1.8 MT. Almost 20 percent of Mexico mango production is exported with the fact is that it has lost almost half of its share in world export mango market since 1991. It can be inferred that global trade in fresh mango is diversifying over the years. Several most sought varieties like *Alphonso* in overseas market have well entrenched in production niches in diverse Indian agro-climatic conditions revealing good potential of increasing its fresh mango export. To capture new markets and to sustain the traditional lucrative markets of developed countries, the available systematic and scientific approach to risk assessment and management in fresh mango supply chain need to put in practice for identification of hazards validated control measures operated at Critical Control Points.

### Market composition of Indian fresh mango export

Premium mango markets of the EU and other developed countries have enacted and enforced plant health controls and certification system. Mango export to premium markets of the world by India is subjected to several measures to guarantee safe exports. Consumer preferences, protection of brand image, strict food regulations in the EU during 1990s have forced many countries to raise their food safety standards (Aarthi *et al.* 2012). Super markets in the developed countries have responded to the changing regulatory and demand conditions by seeking to meet consumer demand for all the products (Dolan and Humfrey, 2002). Major importing countries of Indian mango are Gulf countries like Bahrain, Qatar, UAE, Saudi Arabia, Kuwait; EU countries like United Kingdom, Netherland; USA, Singapore and Bangladesh. In 1990-91, total export of fresh mango on constant price of 2004-05 was ₹ 1 050 million, which increased to ₹ 1 490 million in 2013-14 (Table 4). Temporal and geographical dynamics of Indian mango trade hovers around forces like emergence of competitors, revision and enforcement of Codex of safe trade in developed countries, besides prevailing mango production environment based on resource endowment. The Gulf countries accounted for

Table 2 Area, production and productivity of mango in India

Year	Area (M ha)	% of total fruit area	Production (MT)	% of total fruit production	Productivity (t/ha)
1991-92	1.08	37.5	8.72	30.4	8.1
1994-95	1.23	28.5	10.99	28.5	9.0
1999-00	1.49	37.3	10.50	23.0	7.1
2004-05	1.97	39.7	11.83	24.0	6.0
2009-10	2.31	36.5	15.03	21.0	6.5
2013-14	2.55	35.7	18.68	22.1	7.3
CAGR	4.19		2.97		-1.17

Source: Indian Horticulture Database, various years.

Table 3 Major mango exporting countries in the world

Country	Quantity (Million tonnes)			% share		
	1991	2001	2011	1991	2001	2011
Mexico	0.10	0.19	0.29	44.5	29.8	20.1
India	0.02	0.05	0.23	10.3	7.1	16.0
Thailand	0.00	0.01	0.15	1.4	1.7	10.7
Brazil	0.01	0.09	0.13	3.4	14.4	8.9
Peru	0.00	0.03	0.12	0.8	4.1	8.7
Netherlands	0.00	0.04	0.11	2.2	6.5	7.7
Pakistan	0.01	0.05	0.11	4.7	8.0	7.4
Ecuador	0.00	0.03	0.05	0.1	5.2	3.4
Yemen	0.00	0.01	0.04	0.0	1.0	2.5
EU (12) ex.int	0.00	0.01	0.03	0.3	1.2	2.3
Other Countries	0.07	0.14	0.18	32.2	21.1	12.3
World + (Total)	0.22	0.65	1.43	100.0	100.0	100.0

Source: FAOSTAT (1991-2014).

Table 4 Market structure of fresh mango export from India (2004-05=100)

Country	Value (Million ₹)				% share			
	1990-91	1999-00	2009-10	2013-14	1990-91	1999-00	2009-10	2013-14
UAE	454.2	361.4	731.3	899.9	43.2	35.7	51.8	60.4
Saudi Arab	265.2	125.0	94.8	63.7	25.2	12.3	6.7	4.3
Kuwait	95.6	53.2	36.6	43.0	9.1	5.3	2.6	2.9
UK	89.4	106.8	123.0	237.4	8.5	10.5	8.7	15.9
Bahrain	68.3	32.3	28.3	21.1	6.5	3.2	2.0	1.4
Bangladesh	1.2	134.9	232.1	21.5	0.1	13.3	16.4	1.4
Qatar	42.7	22.0	36.1	34.2	4.1	2.2	0.26	2.3
Singapore	3.3	23.0	13.4	26.3	0.3	2.3	0.9	1.8
Netherland	4.7	49.4	4.2	7.8	0.4	4.9	0.3	0.5
USA	2.8	20.8	18.1	29.3	0.3	2.1	1.3	2.0
Other Countries	23.3	83.9	94.4	106.5	2.2	8.3	6.7	7.1
Total world	1050.7	1012.7	1412.5	14907	100.0	100.0	100.0	100.0

Source: Monthly Statistics of Foreign Trade, Ministry of Commerce, Government of India.

around 87 per cent of the total mango export in value terms in 1990-91, whereas other major country was United Kingdom. On the other hand, during 2013-14 per cent share of Gulf countries has reduced to almost 71 per cent due to consistent fall in shares of Saudi Arabia, Kuwait, Bahrain and Qatar over the periods. Indian mango export was impressive in case of UK, USA, Singapore and other countries.

This discerns the structural change of world mango export from standpoint of geographical compositions over years.

The picture during 2009-10 (post WTO) was dramatically different and export was more evenly distributed. Though UAE continued to be the single largest market, its share further increased to 52 percent in 2009-10 and 60 percent in 2013-14. By 2009-10, significance of Saudi Arabia shifted towards UAE and Bangladesh. In 2013-14, share of Bangladesh has decreased but share of UK has increased sharply (15%). The shares of USA and Netherland had increased in Pre WTO but quite contrary happened in post WTO. USA and Japan had slapped ban on mango import from India due to significant shortcomings in SPS measures. A little increment in export to USA was discerned when the ban on imports of mango from India was lifted by USA and Japan in 2006. The countries classified as 'others' accounted for 6-7 per cent. Most of these countries were of East Asian, viz the Philippines and Vietnam. The decline of export in percentage terms towards the traditional markets of India is a matter of serious concern. Indian mango production and trading system needs to be steered to meet the requirement of emergent market standards especially post WTO not only to arrest the falling share in these markets but also to capture more share by smart ways of doing business.

Diversification in export is a long term strategy that has power to absorb the shock in international economic scenario. But after 2002-03, Simpson Index value of geographical diversity of Indian mango started decreasing, means that

India has concentrated more in one or two markets. During the period, India was losing its stronghold in new markets for mango export which was a bad sign for mango export in international market. The index value of geographical diversity of Indian mango export was 0.73 in 1991-92 which increased to 0.83 in 1998-99. It means Indian mango reached more in quantities in new markets of world after WTO agreement. Simply increasing geographical diversification index value indicates that Indian exports were more diversified (Fig 1).

In recent period, the value of Geographical diversification index has slightly decreased up to 0.60 in 2012-13. It can be inferred that India has consolidated its position of mango export to its already existing markets.

#### *Growth and instability of mango export*

During pre WTO period, the total mango export registered a negative growth rate of 6.7 per cent which increased to 2.4 per cent during early post WTO (Table 5). But during 2005 to 2013 (recent period), the growth rate slumped nearly -1.4 per cent per annum. Interestingly, during post WTO period, most of the countries registered negative/insignificant growth rate but exemplary growth rate for Bangladesh. In addition, the instability index also increased for eight out of ten countries under consideration by exemplary higher overall instability (20.8%) observed in case of Bangladesh and Bahrain compared to pre WTO period (20.8%). In recent period, Bangladesh slumped in growth rate but Qatar, USA and Kuwait surged up in growth rate. This is because in 2006, USA lifted ban on mango export from India. Moreover, UK and Singapore had discerned positive growth rates. UAE registered modest growth rate of 3.1 per cent during the overall period. Higher growth rates were posted by relatively smaller importers. During the overall period, the export of total mango from India registered a growth rate of 1.9 per cent per annum. It can be inferred from the results that there is gradual diversification base of fresh mango export market in general

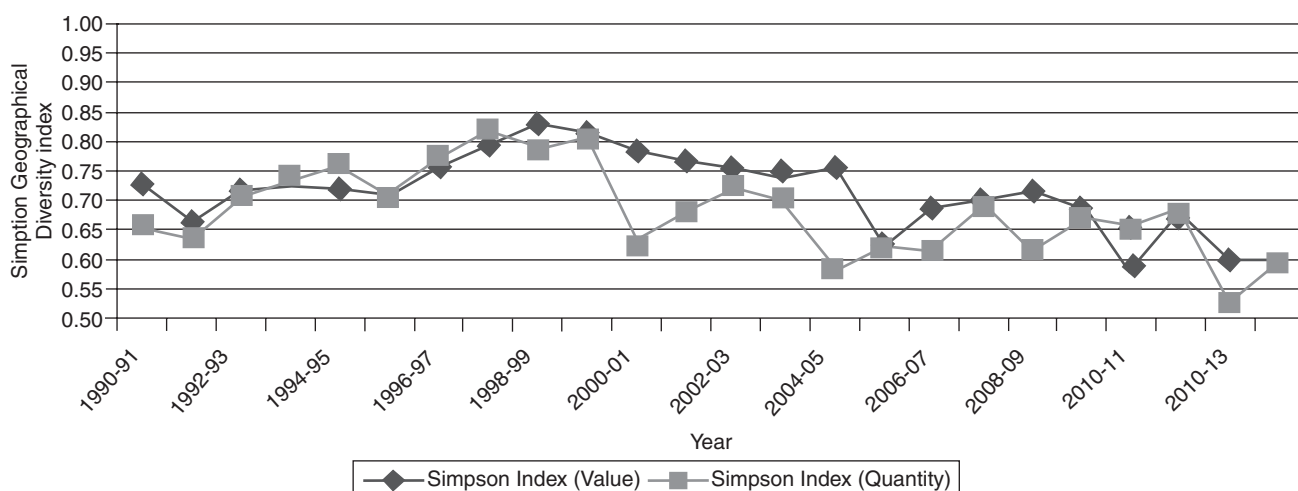


Fig 1 Trend in geographical diversification of export of mango from India, 1990-91 to 2012-13

Table 5 Growth and instability of export of fresh mango from India [At constant price (2004-05 base year)]

Country	Growth rate (%)			Instability index				
	1990/91 to 1995/96	1996/97 to 2004/05	2005/06 to 2013/14	1990/91 to 2013/14	1990/91 to 1995/96	1996/97 to 2004/05	2005/06 to 2013/14	1990/91 to 2013/14
UAE	-5.8	3.0	1.0	3.1***	12.7	32.7	23.3	29.7
Saudi Arab	-12.4*	-8.0*	3.2	-6.7***	18.5	35.3	35.1	33.5
Kuwait	-5.7	-15.3***	10.7**	-4.2***	55.4	30.5	27.0	47.7
UK	-9.7	1.8	7.7	4.7***	33.2	33.9	45.6	45.6
Bahrain	-24.7***	-0.4	-4.1	-4.6***	14.5	30.6	29.4	37.4
Bangladesh	61.4	22.6***	-26.3***	9.9**	86.9	32.8	39.3	74.0
Qatar	-25.9***	-16.0*	41.3**	-2.4	22.1	55.9	62.7	74.6
Singapore	50.3***	-5.1	9.0**	3.6**	24.6	28.1	25.3	38.6
Netherland	54.4**	8.1	-9.6	-3.5	39.6	56.6	57.8	86.1
USA	20.4	-13.1	76.1***	2.9**	55.8	57.2	51.1	69.7
Other Countries	11.7**	2.2	-6.4*	5.2**	32.7	36.0	26.0	43.7
Total	-6.7	2.8	-1.4	1.9***	16.3	20.8	19.8	20.3

\*\*\*, \*\* and \* indicate level of statistical significance at 1%, 5% and 10%, respectively.

and European countries in particular.

Instability of mango export is attributed by change in technology, institution and policy. At the domestic level, factors viz. lack of gradation and quality control, excessive use of pesticides and insecticides, transport, storage problem, marketing problems, decline in productivity and fluctuations in output due to weather conditions, have affected mango exports (Sekhar *et al.* 2013).

The stakeholders in mango trade have to work according to evolving business formats emanating from new global regime after adjustments and restructuring the global supply chains. Mitchell (2003) has advocated that a well functioning market provides incentives for firms to supply products that embody the characteristics of safety and quality that consumers demand. Compliance with a safety standard is a must to maintain the market. Fluctuation in instability values for markets (Table 5) highlight fragility of exports to these markets to various economic and product safety/quality factors. Consistency in instability values for markets indicates

sustenance of market shares in global mango trade. UAE and Saudi Arabia depicted lower instability, means more reliable destined markets for Indian mango. Negative growth along with higher instability values draw a picture of sudden fall of exports to these markets but insignificant growth along with lower instability values draw a picture of secular decline of exports to these markets. Indian exports were rejected by developed countries because of presence of banned and excessive pesticides in horticultural products, now on the basis of pests. The European Union's Standing Committee on plant health has imposed a ban on Indian mango and some vegetables (*Colocasia sp*, *Momordia sp* etc.) in 2014 justify the fact that the potential introduction of new pests and carriers of various viruses could threaten the European agriculture marked improvement to its safe export system is important because these standards are maintained so that trade can continue and European agriculture remains healthy. Indian phyto-sanitary certification measures have to be developed in consonance

with the legal requirement of mango importing countries according to international Codex.

India is the largest producer of mango in the world, although it exports less than one percent of its total production. In recent period, per cent share of Gulf countries has reduced mainly due to consistent fall in share of Saudi Arabia and the space created herein has been occupied by Asian countries but India has trailed far behind in sustaining its pie in the whole cake. The high standards of phytosanitary certification system (like presence of pesticides, pests, aflatoxin etc. fixed by developed countries) and inability of Indian exporters to meet the standards of developed countries have resulted losing these premium markets by India. The exporters bear huge amount of risk and harvest big profits on success to comply with the phytosanitary certification system. Adherence to safe export norms is very important to have credible sustainable export. SPS Codex brings nations together to evaluate agricultural, processing and handling methods and bring out commonly accepted guidelines for the international food safety. It becomes essential to generate knowledge by scientific research for structuring food safety norms and policy alignment according to the changing global regulations. Availability of physical infrastructure (certified export plant with the required equipment and other paraphernalia) is a *sine qua non* of a successful exporter to comply SPS issues to earn profit from the lucrative markets. The major areas of attention would be establishment of diseases free zones, strict compliance regarding the use of banned and excessive chemicals and pesticides against diseases. Other measures may include establishment of food testing laboratories to get accreditation from international agencies and set up world class food testing and inception infrastructure particularly in clusters with significant presence of exporters. Government should also promote export of mango through appropriate policies like subsidies on use of organic manures and fertilizers, technologies for insect trap and financial support to stakeholders and establish agro export zones in addition to facilitation of importing countries to set up office for certification of export consignments. In order to avoid dependency on a single market, there is a need to identify the consumer preferences of new markets. In short-run, policies should aim to broaden present markets and capture markets where India's export shares are likely to increase, whereas, in long-run, quality mango production needs to be aimed so as to meet the requirement of international markets.

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