# Export performance and competitiveness of fresh mangoes and mango pulp in India

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## ABSTRACT

Mango is one of the popular Asian fruits. The export performance and competitiveness of fresh mango and mango pulp in India have been examined using secondary data from 1987-88 to 1999-00 as period I and 2000-01 to 2011-12 as period II. The growth in export of fresh mango for period II was lower than period I which implies that there was no standard in quality. For mango pulp growth in export remained no change in two periods but export value and unit price was lowered during period II which implies demand was low in international market. Instability was worked for the export for periods I and II. The instability was observed high for export for fresh mango, but there were less fluctuations in export of mango pulp. For the assessment of direction of trade, the Markov chain model was used. The data regarding country-wise export of fresh mango for two periods indicated export retention share. UAE (72.73%) in period I and UK (48%), minor importing countries pooled under others category (59.62%) in period II. In case of mango pulp: Yemen Republic (86.06%) and others category (64.43%) in period I and Netherlands (58.02%), US (44.52%) in period II. For fresh mangoes; UK, Nepal in period I and Saudi Arabia, Bahrain in period II were not a stable importers. Netherlands in period I and Yemen Republic, UK in period II were not the stable importers. The study advocates that strategies for export may be oriented towards these countries for stabilizing the export of fresh mango as well as mango pulp.

**KEY WORDS :** Mango, Mango pulp, Instability, Markov chain model, Export competitiveness

**How to cite this paper :** Kumaresh, K. and Sekar, C. (2013). Export performance and competitiveness of fresh mangoes and mango pulp in India. *Internat. J. Com. & Bus. Manage*, **6**(2) : 154-159.

Mango is one of the popular Asian fruits. It is well known for its excellent exotic flavour and known as the "King of fruits". India is one of the major producers of mango in the world, growing more than half of the world's supply. It is a popular and economically important fruit, widely cultivated in the tropics and subtropics. Major mango growing states in India are Uttar Pradesh, Bihar, Andhra Pradesh, Orissa, West Bengal, Maharashtra, Gujarat, Karnataka, Kerala and Tamil Nadu. The major mango varieties grown in the country are Alphonso, Dashehari, Langra, Fajli, Chausa, Totapuri, Neelum etc. India is a rich source of mango varietal wealth and over 1300 varieties are grown in different parts of the country. However, only about 30 varieties are grown on a commercial scale in different states.

Mango is consumed as fresh as well as in processed forms. In India, less than five per cent of the produced mangoes are processed and mango pulp is the main export product both in terms of volume and value. Processed products that are made from mango are pickles, green mango powder, chutney, jam, jelly, juice, squash, syrups, etc. Because of its perishable nature, mango ripens fast during summer and becomes unfit in course of time. The demand for mango in the world market is increasing day by day. It is reported

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that the markets for mangoes have increased in temperate countries because of social change and promotion of fruit trade in developing countries.

India, China, Bangladesh, Thailand and Mexico are the leading mango producing countries, accounting more than 70 per cent of world production. India's share in world mango market is less than 20 per cent, but mangoes account for about 40 per cent of the total fruit exports from India. Nearly 200 million dollar had earned through export of mango and mango based products. Alphonso, Dashehari, Kesar, Banganapalli are the main varieties that are currently demanded in the international markets. Due to lack of knowledge and technology among farmers regarding production of good quality mango, lack of awareness and knowledge among consumers in importing countries about different varieties, lack of infrastructure facilities and poor coordination in marketing lead to changes in growth and direction of export of fresh mango and mango pulp. Thus, study focuses to estimate the trend and instability of mango export, export competitiveness and direction of trade for fresh mango and mango pulp.

**Objective :**

The specific objectives of the study were
– to analyze the trend in export of fresh mango and mango pulp.
– to estimate instability, if any in fresh mango and mango pulp.
– to study export competitiveness of fresh mango.
– to analyze the direction of trade for fresh mango and pulp.

**Data :**

In order to study export performance and competitiveness of fresh mango and mango pulp from India, time series data were used for the period 1987-88 to 2011-12. Secondary data on exports in quantity and value terms, unit value of exports, country-wise exports, world exports and imports, country-wise imports, monthly and annual data on domestic and international prices were collected from various magazines and government publications.

The secondary data covering a period of 25 years from 1987-88 to 2011-12 were categorized into two sub-periods to know dynamic changes *viz.,* Period I (1987-88 to 1999-00) and Period II (2000-01 to 2011-12). The trend, instability, dynamics in the direction of exports, export competitiveness were studied using the secondary data.

## METHODOLOGY

**Export performance and competitiveness :**

Export performance and export competitiveness of mango in India were calculated by using the given formula:

*Compound growth rate :*

The annual compound growth rates for export quantity and value, domestic and international prices for mango were computed by using the following procedure :

$$Y_t = Y_o (1+r)^T e^u$$

where,
$Y_t$ = Value at time 't',
$Y_o$ = Initial value,
$r$ = Growth rate,
$T$ = Time in years; 0, 1, 2 …... n, and
$u$ = Random error-term.

*Coppock's instability index :*

Instability in export is expected to hamper the process of economic development. To study the export instability of mango, Coppock's instability index was used to estimate the variation and stability in Indian mango exports which is algebraically expressed as below :

$$V N \frac{1}{N-1} \left[ \log \frac{X_{t<1}}{X_t} - m \right]^2$$

The instability is = $(\text{anti} \log \sqrt{V-1}) \tilde{I} 100$

where,
$X_t$ = Value or volume of exports in year 't'
$n$ = Number of years
$N = n - 1$

$$m N \frac{1}{N} \sum_{t N1}^{n-1} (\log X_{t-1} - \log X_t)$$

Coppock's instability index was estimated for mango export (quantity and value and unit value realized for the periods I and II, respectively.

*Markov chain analysis :*

The structural change in mango exports was examined using Markov chain model. Central to the Markov model is the transitional probability matrix 'P'. The elements $P_{ij}$ of this matrix indicate the probability that exports of mango will switch from country 'i' to country 'j' over time. The diagonal element $P_{ij}$ where i=j, measures the probability of a country retaining its market share. In other words, as examination of the diagonal elements of the transitional probability matrix indicates the loyalty of an importing country to a particular country's exports. In the context of current application, structural change was treated as a random process in which six importing countries like UAE, Bangladesh, UK, Saudi Arab, Nepal and Bahrain for fresh mango and mango pulp were considered. The average exports of the Indian mango for six importing countries from the period I and II were taken. This is algebraically expressed as :

$$E_{jt} = E_{it-1} P_{ij} + e_{jt}$$
where,

$E_{jt}$ = Exports of mango from India during the year 't' to $j^{th}$ country,

$E_{it-1}$ = Exports to $i^{th}$ country during the year' t-1',

$P_{ij}$ = The probability that exports will shift from $i^{th}$ country to $j^{th}$ country,

$e_{jt}$ = The error-term which is statistically independent of $E_{it-1}$

r = The number of importing countries.

*Nominal protection co-efficient (NPC)* **:**

Nominal protection coefficient (NPC) is defined as the ratio of the domestic price to the world reference price of the commodity under consideration. In the study, NPC was worked out to measure the competitive advantage enjoyed by mangoes in the context of free trade. The ratio shows the competitive advantage of mango export,

$$NPC \mathbb{N} \frac{p_d}{P_b}$$

NPC = Nominal Protection Co-efficient

$P_d$ = Domestic wholesale price of the mango

$P_b$ = World reference price of the mango

If NPC is greater than one, then the commodity is protected. NPC is less than unity, the commodity is treated as globally more competitive.

## ANALYSIS AND DISCUSSION

The findings of the present study as well as relevant discussion have been presented under following sub heads :

### Trend analysis of mango export from India :

The trend in fresh mango export in quantity was found to be lower in the period II than in period I and overall period (Table 1). It implies that a lower quantity of fresh mango is being exported during period II, which increased the unit price of fresh mangoes with marginal decrease in export value. The main hurdle to fresh mango export was the quality, had the quality been maintained, the growth in export quantity would have been increased by many fold.

In case of mango pulp, trend in export quantity did not show any change in both periods I and II, but there was a decrease in unit price and export value in period II. This shows that there had been less demand for mango pulp from India. The overall export quantity, export value and unit value of fresh mango and mango pulp exported were significant at one per cent level over the study period (Table 1).

### Coppock's instability analysis of fresh mango and mango pulp trade :

The Coppock's instability index was worked out for fresh mango and mango pulp trade in India for the two periods to analyze the extent of instability. It was observed from Table 2. that the fluctuations in the export quantity of fresh mango were marginally high (24.8) during period II (2000-12), whereas during period I (1987-00) there was less instability (22.3). This indicates that export growth during period II fluctuated marginally due to more restriction and decrease in demand of

| Table 1 : Trend in export quantity, total value and unit value of fresh mango and mango pulp | | | | | | |
|---|---|---|---|---|---|---|
| Year | Export quantity | | Export value | | Unit value | |
| | Fresh mango | Mango pulp | Fresh mango | Mango pulp | Fresh mango | Mango pulp |
| 1987-88 to 1999-00 | 7.0* | 10.1* | 10.6* | 19.8* | 3.3* | 8.7* |
| 2000-01 to 2011-12 | 5.2* | 10.1* | 10.2* | 12.7* | 4.7* | 2.3* |
| Over all | 6.8* | 11.3* | 9.5* | 16.6* | 2.5* | 4.7* |

*One per cent significant level

| Table 2 : Coppock's instability in fresh mango and mango pulp trade | | | | | | |
|---|---|---|---|---|---|---|
| Particulars | 1987-88 to 1999-00 | | 2000-01 to 2011-12 | | Over all | |
| | Fresh mango | Mango pulp | Fresh mango | Mango pulp | Fresh mango | Mango pulp |
| Quantity | 22.3 | 24.8 | 24.8 | 15.7 | 24.7 | 21.93 |
| Value | 19.0 | 19.7 | 21.0 | 22.7 | 19.8 | 22.13 |
| Unit value | 8.31 | 15.2 | 18.6 | 22.5 | 14..09 | 22.29 |

| Table 3 : Direction of trade of fresh mango from India (1987-00) – markov chain approach | | | | | | |
|---|---|---|---|---|---|---|
| Countries | UAE | Saudi Arabia | Others | Bangladesh | UK | Bahrain | Nepal |
| UAE | 0.7273 | 0.0992 | 0.1059 | 0.0000 | 0.0467 | 0.0210 | 0.0000 |
| Saudi Arabia | 0.5433 | 0.3619 | 0.0000 | 0.0000 | 0.0000 | 0.0948 | 0.0000 |
| Others | 0.0000 | 0.2393 | 0.2083 | 0.4458 | 0.0714 | 0.0326 | 0.0027 |
| Bangladesh | 0.0000 | 0.0000 | 0.2966 | 0.6182 | 0.0847 | 0.0000 | 0.0005 |
| UK | 0.0000 | 1.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Bahrain | 0.0000 | 0.0000 | 0.6555 | 0.0000 | 0.1212 | 0.2234 | 0.0000 |
| Nepal | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 | 0.0000 | 0.0000 |

Indian fresh mango. The instability in the total value of fresh mango export was marginally high during period II (21), compared to period I (19). Compared to the quantity and value, the unit value showed a lower instability during the period I, but the unit value became highly instable during the period II. Moreover, there were stiff competitors in the international markets which led to decrease in the demand for fresh mango.

In the case of mango pulp, the fluctuations in the export quantity were high (24.8) during period I (1987-00), whereas during period II (2000-12) there was less instability (15.7). This indicates that export growth during period II did not fluctuate much due to less restriction and growing demand for Indian mango pulp. The instability in the total value of mango pulp export was high during period II (22.7), compared to period I (19.7). The unit value showed a lower instability during the period I, it showed high instability during the period II. There were stiff competitors in the international market for mango pulp also during the said period.

## Direction of trade of fresh mango export from India (1987-00) :

The transitional probability presented in Table 3, depicts a broad idea of change in the direction of trade of Indian fresh mango in period I (1987-00). The six major countries which imported Indian fresh mango were UAE, Saudi Arabia, Bangladesh, UK, Bahrain and Nepal. The export to remaining countries was pooled under the category of other countries. It can be seen from Table 3 that UAE was found to be one of the stable importers of Indian fresh mango because it retained its original share of around 72.73 per cent over the period. It gained a major share from the Saudi Arabia to an extent of

54.33 per cent.

The Saudi Arabia retained 36.19 per cent of its original share and gained major share from UK and hence in future Saudi Arabia will be one of the most stable importers and its growth may be higher for fresh mango import from India. Bangladesh was also found to be a stable importer as it retained its share of 61.82 per cent and it did not gain or lost any share from/to the others. UK and Nepal were not a stable importers of fresh mango because it did not retain its shares even though the quantity imported by UK and Nepal was higher. Bahrain retained its original share of 22.34 per cent without gaining or losing its share.

## Direction of trade of fresh mango export from India (2000-12) :

The transitional probability presented in Table 4, depicts a broad idea of change in the direction of trade of Indian fresh mango from the Period II (2000-12). The six major countries which imported Indian fresh mango were UAE, Saudi Arabia, Bangladesh, UK, Bahrain and Nepal. The export to remaining countries was pooled under the category of other countries. It can be seen from Table 4 that Bangladesh was found to be one of the stable importer of Indian fresh mango because it retained its original share of around 39 per cent over the period. It gained major share from the Nepal and UAE of 99.54 and 61.07 per cent, respectively and it lost major share to UAE to an extent of 44.22 per cent.

The UAE retained 27.02 per cent of its original share and gained major share from UK and Saudi Arabia of 40.42 and 80.06 per cent, respectively. Hence, in future UAE will be one of the most stable importers and its growth may be higher in

| Table 4 : Direction of trade for fresh mango (2000-12) – Markov chain approach | | | | | | |
|---|---|---|---|---|---|---|
| Countries | Bangladesh | UAE | Others | Nepal | Saudi Arabia | UK | Bahrain |
| Bangladesh | 0.3939 | 0.4422 | 0.0518 | 0.0452 | 0.0332 | 0.0321 | 0.0017 |
| UAE | 0.6107 | 0.2702 | 0.0000 | 0.1018 | 0.0000 | 0.0074 | 0.0099 |
| Others | 0.0913 | 0.0000 | 0.5962 | 0.0000 | 0.3126 | 0.0000 | 0.0000 |
| Nepal | 0.9954 | 0.0000 | 0.0000 | 0.0046 | 0.0000 | 0.0000 | 0.0000 |
| Saudi Arabia | 0.0577 | 0.8006 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.1417 |
| UK | 0.0000 | 0.4042 | 0.0000 | 0.0000 | 0.0000 | 0.4843 | 0.1115 |
| Bahrain | 0.0000 | 1.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

| Table 5 : Direction of trade for mango pulp (1987-00) – Markov chain approach | | | | | | |
|---|---|---|---|---|---|---|
| Countries | Others | Saudi Arabia | UAE | Yemen Republic | Netherlands | U K | U S |
| Others | 0.6453 | 0.0000 | 0.2383 | 0.0000 | 0.0400 | 0.0228 | 0.0536 |
| Saudi Arabia | 0.2456 | 0.4886 | 0.0000 | 0.0221 | 0.1851 | 0.0586 | 0.0000 |
| UAE | 0.0000 | 0.5095 | 0.2665 | 0.0000 | 0.0827 | 0.0000 | 0.1412 |
| Yemen Republic | 0.0937 | 0.0000 | 0.0000 | 0.8606 | 0.0260 | 0.0197 | 0.0000 |
| Netherlands | 0.1152 | 0.0000 | 0.3390 | 0.1402 | 0.0000 | 0.4057 | 0.0000 |
| UK | 0.6424 | 0.2925 | 0.0000 | 0.0000 | 0.0000 | 0.0570 | 0.0082 |
| US | 0.0000 | 0.8616 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.1384 |

fresh mango import from India. UK was also found as stable importer as it retained its share of 48.43 per cent and it lost only about 11 per cent of its share to Bahrain. Bahrain, Saudi Arabia and Nepal were not stable importers of fresh mango because they did not retain its shares even though the quantity imported by Bahrain, Saudi Arabia and Nepal was higher. The countries pooled under other category retained 59.62 per cent of its original share which implied that even though they imported in lower quantities, there was high stability, which shared that they retained most of their original share.

**Direction of trade of mango pulp from India (1987-00):**

The transitional probability presented in Table 5, depicts a broad idea of change in the direction of trade of Indian mango pulp for the period (1987-00). The six major countries which imported Indian mango pulp were UAE, Saudi Arabia, Yemen Republic, UK, Netherlands and US. The export to remaining countries was pooled under the category of other countries. It can be seen from Table 5 that Yemen Republic was found as one of the stable importers of Indian mango pulp because it retained its original share of around 86 per cent over the period of 1987-00. It also gained share from

| Table 6 : Direction of trade for mango pulp (2000-12) – Markov chain approach | | | | | | | |
|---|---|---|---|---|---|---|---|
| Countries | Others | Saudi Arabia | Yemen Republic | Netherlands | UAE | U K | U S |
| Others | 0.2089 | 0.4723 | 0.2971 | 0.0000 | 0.0000 | 0.0000 | 0.0218 |
| Saudi Arabia | 0.4885 | 0.2821 | 0.0758 | 0.0000 | 0.1536 | 0.0000 | 0.0000 |
| UAE | 0.0696 | 0.5172 | 0.0000 | 0.2040 | 0.1771 | 0.0278 | 0.0044 |
| Yemen Republic | 0.0000 | 0.0000 | 0.0000 | 0.5802 | 0.1906 | 0.2212 | 0.0080 |
| Netherlands | 0.6618 | 0.0000 | 0.0000 | 0.0924 | 0.0442 | 0.1459 | 0.0557 |
| UK | 0.7615 | 0.0000 | 0.0000 | 0.2385 | 0.0000 | 0.0000 | 0.0000 |
| US | 0.0000 | 0.5548 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.4452 |

| Table 7 : Nominal protection coefficient for mangoes from 1987-2012 | |
|---|---|
| Year | NPC |
| 1987-88 | 0.46 |
| 1988-89 | 0.51 |
| 1989-90 | 0.50 |
| 1990-91 | 0.44 |
| 1991-92 | 0.68 |
| 1992-93 | 0.50 |
| 1993-94 | 0.42 |
| 1994-95 | 0.44 |
| 1995-96 | 0.42 |
| 1996-97 | 0.46 |
| 1997-98 | 0.52 |
| 1998-99 | 0.50 |
| 1999-00 | 0.50 |
| 2000-01 | 0.54 |
| 2001-02 | 0.51 |
| 2002-03 | 0.58 |
| YEAR | NPC |
| 2003-04 | 0.42 |
| 2004-05 | 0.40 |
| 2005-06 | 0.38 |
| 2006-07 | 0.42 |
| 2007-08 | 0.52 |
| 2008-09 | 0.47 |
| 2009-10 | 0.42 |
| 2010-11 | 0.41 |
| 2011-12 | 0.42 |

the Netherlands (14.02 %).

The Saudi Arabia retained 48.86 per cent of its original share and gained major share from US and UAE (86.16 and 50.95 %) and lost to Netherlands (18.51 %). Hence, in future Saudi Arabia would be one of the most stable importers and its growth would be higher for mango pulp import from India. UAE retained its share of 26.65 per cent and gained about 34 per cent from Netherlands and lost 14.12 per cent to US. UK and Netherlands were not stable importers of mango pulp because they did not retain their shares even though the quantity imported by UK and Netherland was higher. US retained its original share of 13.84 per cent without gaining or losing the share. The countries pooled under other category retained 64.53 per cent of its original share which implied that even though they imported lower quantities, there was high stability, and they retained most of their original share. It gained 64.24 per cent of UK share, 24.56 per cent of Saudi Arabia share and 11.52 per cent of Netherlands share. Hence, compared to major importing countries at present, the countries pooled under 'others category' would import more mango pulp from India in near future.

**Direction of trade of mango pulp from India (2000-12) :**

The transitional probability reported in Table 6, depicts a broad idea of change in the direction of trade of Indian mango pulp from the period 2000-12. The six major countries which imported Indian mango pulp were UAE, Saudi Arabia, Yemen Republic, UK, Netherlands and US. The export to the remaining countries was pooled under the category of other countries. It could be seen from Table 6 that Netherlands was found to be one of the stable importers of Indian mango pulp because it retained its original share of around 58 per cent over the period. It gained share from the UK (23.85 %) and lost to UAE and UK (19.06 and 22.12 %, respectively).

The US retained 44.52 per cent of its original share and lost major share to Saudi Arabia (55.48 %). Hence, in future US will be one of the most stable importers and its growth may be higher in mango pulp import from India. Saudi Arabia retained its share of 28.21 per cent and gained 15.36 per cent from Netherlands and it lost 55.48 and 51.72 per cent, respectively to US and UAE. UK and Yemen Republic were not stable importers of mango pulp because they did not retain their shares even though the quantity imported by UK and Yemen Republic was high.

**Nominal protection coefficient for fresh mangoes from 1987-2012 :**

The nominal protection co-efficients of export of fresh mangoes were found to be lower than unity as shown in Table 7.

This implies that fresh mangoes were a good exportable product.

The foregoing results revealed that fresh mangoes were price competitive in the international market and have vast potential for expansion of the domestic industry in the years to come. Srinivasamurthy and Subramanyam (1999), Velvavan (2004) and Guledagudda (2005) have made some investigations related to be present study.

**Conclusion :**

The analysis of the rate of growth in export of fresh mango and pulp revealed that there was no standard in quality as well as demand was low in international market. The instability was observed high for export for fresh mango, but there were less fluctuation in export of mango pulp.

In assessment of direction of trade, UK, Nepal in period I and Saudi Arabia, Bahrain in period II were not stable importers of fresh mango. In case of Netherlands in period I and Yemen Republic, UK in period II were not stable importers. The plans for export may be oriented towards these countries and also plans should be formulated for stabilizing the export of fresh mango and mango pulp to other countries.

The policy implications emerging out of the study are outlined below :

To maintain quality of mango, trainings should be organized for the farmers on the way to produce good quality mango. The facilities such as cold storage and infrastructure facilities need to be provided by the government and mango industries to marginal and small farmers.

The results of Markov chain analysis had indicated that India is likely to lose its export markets in some of the countries like UK, Saudi Abrbia, Netherlands and Bahrain. Bangladesh, US, Yemen Republic are the countries where our export will be concentrated in future. Hence, appropriate promotion strategies and policy should be evolved to maintain the export share.

There is a need to disseminate information on international markets, price behaviour and other trade matters to Indian farmers and institutions to reap the benefits.

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