RESEARCH ARTICLE :

Economic nuances in Indian mango exports: the way forward for economic growth

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SUMMARY : Mango is one of the important fruit crops in India contributing 20.71 per cent of the total fruit production. The export of fresh mango from India during 2015-16 was 41280 tonnes with 0.22 per cent share to total production. In this paper an attempt was made to quantify the growth, instability, structural changes and quality attributes of Indian mango exports. Data for a period of 20 years from 1996-97 to 2015-16 was collected to estimate Compound Growth Rate and Coppock's Instability Index. The growth rate of export quantity, export value and unit value of mango was positively significant and the export value and unit value were more stable than the export quantity of mango. The growth of exports to Bangladesh was high. The instability index of mango exports from India to both U.A.E and Bangladesh was found low. The Markov chain analysis was attempted through linear programming method to assess the loyal markets for Indian mango. The major Indian mango export markets were categorized as stable market (Bangladesh and U.A.E.) and unstable markets (Saudi Arabia and U.K) based on the magnitude of transition probabilities. The conjoint analysis was used to determine the relative importance of each quality attributes and revealed that the variety is the most important attribute for mango export. Despite of a huge production base, the Indian mango markets are confined to neighbouring countries. Hence efforts are needed to improve the efficiency of production and quality in order to make the product acceptable and price competitive in European countries.

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BACKGROUND AND OBJECTIVES

India is the home of wide variety of fruits and vegetables and holds a unique position in production. The country is the second largest producer of fruits in the world after China (137.07 million tonnes) with production of 88.98 million tonnes from an area of 7.22 million hectares and contributes 13.59 per cent to the world fruit production during 2015-16. India is the home of 1000 mango varieties comes in various shapes, sizes and colours with a wide variety of flavor, aroma and taste. During 2015-16, the production mango in India was 18.43 million tonnes contributing a share of 20.71 per cent of the total fruit production. It is a special product that substantiates the high quality standards and bountiful nutrients

packed in it. The major mango growing states in India are Andhra Pradesh, Uttar Pradesh, Karnataka, Bihar, Gujarat and Tamil Nadu. Andhra Pradesh ranks first in mango production with a share of 24.48 per cent.

Mexico is the major exporter of mango with a share of 23.18 per cent to the total world export quantity. India has vast potential in exporting fresh mangoes to different countries. It has exported 41280 tonnes of fresh mangoes to the world worth of Rs. 285.43 crores during 2015-16. India ranks ninth among the mango exporting countries with a share of 1.96 per cent to the total world exports. While the import share of fresh mango is only 0.04 per cent.

United Arab Emirates, Kuwait, United Kingdom, Bangladesh, Saudi Arabia and Nepal are the major export destinations for Indian mangoes. Among which, United Arab Emirates alone constitutes 55.83 per cent of the Indian mango exports. The share of export to total mango production in India was only 0.22 per cent. The production is likely to increase further due to technological improvements. Hence it is important to identify potential export markets and make necessary arrangements to export mango which is a perishable commodity. Therefore, an attempt was made to quantify the growth and changing structure of Indian mango exports. The main objective of the paper was to study the growth, instability, structural changes and quality.

RESOURCES AND METHODS

The study is based on the time series data on total (1996-97 to 2013-14) and country wise exports (2006-07 to 2015-16) of mango from India obtained from Agricultural Produce Export Development Authority. The compound growth rate analysis was carried out to ascertain the growth in exports of mango from India for 20 years period. The instability in exports was estimated using Coppock's instability index. The structural and direction of change in the export of mango was analysed using Markov chain analysis. The factors influencing mango exports from India was estimated using multivariable double log linear regression model.

Compound growth rate :

$Y = a \, b^t \, e_t$

where,

Y = mango export quantity, value and unit value

t = time variable

e_t = Error term

'a' and 'b' are unknown constants to be estimated. Logarithmic transformation of provided the estimating equation was :

$\ln Y_t = \ln a + t \ln b + \ln u_t$

The equation was estimated by ordinary least square technique (OLS). Compound growth rate (g) was then estimated by the identity given in equation g = (anti log of b)-1) *100

where, g = estimated compound growth rate in per cent per year and

b = anti log of b

Export Instability for top five countries :

Export Instability was estimated for 10 years data (2006-07 to 2015-16) using Coppock's instability index (Coppock, 1962). The estimable form is given below :

$$V = \frac{1}{N}[\log \frac{X_{t+1}}{X_t} - m]^2$$

The instability index is $= (\text{Antilog of } (\sqrt{V-1}) - 100)$

where,

X_t = Value or volume of exports in year t

n = Number of years

N = n – 1

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

Direction of trade - Markov chain model :

Markov chain analysis was employed to analyze the structural change in any system whose progress through time can be measured in terms of single outcome variable (Dent, 1967). In this study the structural change in export of fresh mango from India were examined by estimating the transition probability using first order Markov-chain approach (Laxminarayana, 2012). The matrix gives a broad indication of direction of trade of Indian fresh mango export. The row elements in the transitional probability matrix provide the information of the extent of loss in trade, on account of competing countries. The column element indicates the probability of gains in volume of trade from other competing countries and the diagonal element indicates probability of retention of the previous year's trade volume by the respective country. To get the transition probability matrix, LP was solved

using LINGO (version 10) software Package. Diagonal elements of transition probability matrix indicate the loyalty of the importing country to exporting country (Atkin and Blandford, 1982). To know the direction of trade of fresh mango from India, quantity exported to top five importing countries for ten years period (2006-07 to 2015-16) were taken. The annual export quantity of top five countries and pooling all other countries export as 'other countries' were formulated into a Linear Proogramming (LP) problem under the method of Minimization of Mean Abolute Deviations. This data was converted into a Liner Programming (LP) problem by a method referred to as Minimisation of Mean Absolute Deviation (MAD), and then solving the LP problem and arrived the transition probability matrix elements.

Conjoint analysis :

Conjoint Analysis is a technique used for measuring preferences about the attributes of a product or service. Conjoint analysis determines both the relative importance of each attribute and the levels of each attribute, which are most preferred. The potential of conjoint measurement is illustrated by applying it to the quality evaluation. The analysis was developed primarily by mathematical psychologists Luce and Turkey (1964), Krantz and Tversky (1971) and introduced into the marketing research by Green and Srinivasan in 1978. In this study, Conjoint Analysis was used to find the relative importance of the quality attributes of mango preferred by the traders. The plancards used for the purpose included important attributes of the fruit essential for export of mangoes. These attributes are: Variety (Alphanso, Kesar, Banganapalli), Size (200-250 g, 250-300 g, 225-250 g), Colour (yellow to red, brown to red, green to yellow), Shape (oval oblong, ovate oblique, elongated), Flavour (high, medium, low)

OBSERVATIONS AND ANALYSIS

The results obtained from the present study as well as discussions have been summarized under following heads :

Export performance of mango in India :

The export performance was assessed based on compound growth rates for quantity exported, value of exports and unit price. The growth rates of export quantity, export value and unit value of mango for three periods were estimated and are presented in Table 1.

It could be seen from the table 1 that the compound growth rate of export quantity of fresh mango from India was positive and significant during the overall period and non-significant during Period I. Both the export value and unit value of mango export was positive and highly significant at one per cent level. The unit value realized for mango export had a positive growth during Period II. During the overall period from 1996-97 to 2015-16, the growth rate of export quantity, export value and unit value of mango was 4.82, 10.12 and 5.05, respectively.

Export instability of Mango in India :

India is a major producer and exporter of fruits and vegetables and earned more foreign exchange through export. There was a fluctuation in quantity and value of these commodities exported, and unit value realized throughout the study period. The export performance of a country for any commodity during any given period is measured not only from the point of view of increase in quantity exported, value and unit value but also on the extent of fluctuations taking place in the above aspects.

Hence the Coppock's instability index was constructed to understand the behaviour of mango export during periods 1996-97 to 2005-06, 2006-07 to 2015-16

Table 1 : Compound growth rate of export of fresh mango from India				
Sr. No.	Category	Period I (1994-95 to 2003-04)	Period II (2004-05 to 2013-14)	Overall Period (1994-95 to 2013-4)
1	Quantity	8.77[NS]	2.92**	4.82*
2	Value	10.27**	11.79*	10.12*
3	Unit value	1.38***	15.15**	5.05*
*, ** and *** indicate significance of values at P=0.01, 0.05 and 0.1, respectively			NS=Non-significant	

Table 2 : Coppock's instability index for fresh mango export from India (%)				
Sr. No.	Category	Period I (1994-95 to 2003-04)	Period II (2004-05 to 2013-14)	Overall Period (1994-95 to 2013-14)
1.	Quantity	28.11	29.06	29.00
2.	Value	21.34	18.85	21.30
3.	Unit Value	9.38	18.35	17.09

and overall period. The instability indices were constructed for export quantity, value of export and unit value mango and the results are presented in Table 2.

It is evident from table 2 that for mango, the instability index for export quantity has no major change between Period II when compared to Period I. The instability index of export quantity during Period I was 28.11 per cent and Period I was 29.06 per cent; whereas the same for export value has slightly decreased from Period I (21.34 %) to Period II (18.85 %). The instability in unit value of export has increased from 9.38 per cent to 18.35 per cent. For the overall period of twenty years from 1996-97 to 2005-06, the instability index for export quantity, value and unit value of mango was 29 per cent, 21.30 per cent and 17.09 per cent. This clearly shows that the export value and unit value were more stable than the export quantity of mango.

Country-wise growth and instability of fresh mango export from India :

The major importing countries of Indian fresh mango were taken and the compound growth rate and instability index were worked out for the period from 2006-07 to 2015-16 and are presented in Table 3.

It is revealed that the growth was more for Bangladesh. It was 12.84 per cent for quantity, 14.81 per cent for export value and 1.74 per cent for unit value. This is followed by U.A.E. with 6.31 per cent and 7.19 per cent of growth rate, respectively for quantity and value. During 2004-05 to 2013-14, the growth of mango

exports to UK and Nepal was negative. The table also showed that the instability index of mango export was more for UK. The instability index of mango exports from India to both U.A.E and Bangladesh is found to be low. These results are in line with findings of Prakash Mokashi (2012).

Direction of trade – markov chain analysis :

The major importing countries of Indian mangoes are UAE, Bangladesh, Nepal, Saudi Arabia and UK and all other importing countries were grouped under category of "others". The transition probability matrix was formed and the results are presented in Table 4. It is evident from the table that Bangladesh was the most stable market among the major importers of Indian mango as reflected by the retention of 66.10 per cent. It has gained 81 per cent of the export quantity from Nepal. Though the export quantity to Bangladesh was less during 2013-14, it was high during the overall period of ten years

U.A.E was another stable market with retention of 50.30 per cent and gained 21.97 per cent of the exports from Bangladesh i.e. U.A.E retained 50.30 per cent of the total export from India. This result is in line with the findings of Pramod Kumar et al., (2007) and Yeledhalli et al., (2012). The most unstable markets among the importing countries were Saudi Arabia and U.K with zero per cent retention. Nepal retained only 19.12 per cent of the mango exports from India. Though India is the largest producer of mango in the world, it exports less than one per cent of its total production. India has a good potential

Table 3 : Growth and instability of mango export to top five countries from India

Sr. No.	Country	C.G.R			Coppock's instability index (%)		
		Quantity	Value	Unit value	Quantity	Value	Unit value
1.	U.A.E	6.31**	7.19**	0.83[*]	48.59	22.18	31.94
2.	Bangladesh	12.84*	14.81*	1.74**	38.50	38.72	21.40
3.	Nepal	-12.55**	1.52[NS]	1.09*	67.03	66.27	42.07
4.	Saudi Arabia	13.15**	12.21**	0.83[NS]	44.54	48.71	19.93
5.	U.K	-20.10**	-20.22**	0.16*	107.72	138.85	155.41

* and ** indicate significance of values at P=0.01 and 0.05, respectively   NS=Non-significant

Table 4 : Transition probability matrix of fresh mango exports from India

Sr. No.	Countries	UAE	Bangladesh	Nepal	Saudi Arabia	UK	Others
1.	UAE	0.5030	0.1445	0.0194	0.0594	0.1211	0.1526
2.	Bangladesh	0.2197	0.6610	0.0710	0.0181	0.0000	0.0301
3.	Nepal	0.0000	0.8088	0.1912	0.0000	0.0000	0.0000
4.	Saudi Arabia	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000
5.	UK	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	Others	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000

for export of mango and it needs to strive hard to improve its export by improving upon the quality of mango exports and also by the yield levels.

Preferred quality attributes for mango export :

Conjoint analysis was done on the preferences of mango traders. The important quality attributes considered by the traders were variety, size, colour, shape and flavor hence these attributes were selected for the analysis. For each trader the part-worths (co-efficients) were estimated using OLS regression analysis. The fit of the additive model was good. The relative importance of the part–worth functions were compared across different attributes within segments in order to arrive at the relative importance of each attribute (Moore, 1980). A high positive or lower negative part worth denotes, *Cetaris paribus*, a higher perceived quality.The results of conjoint analysis on the average part-worths and the relative importance of each attribute of mango are presented in Table 5.

It is very clear that quality has a strong influence on exports. Among all attributes studied variety was found to have the greatest influence on the trade of mango as it accounted for 38.86 per cent of relative importance and the individual utility for each variety namely Alphonsa, Kesar and Banganapalli were 2.6543, 1.1235 and -3.7778, respectively. The most preferred by the traders was Alphonsa variety. The size of mango was yet another important factor influencing the traders with a relative importance of 22.78 per cent. The range of 200-250g had the highest utility value of 5.9815 while 225-250g had less utility value of 1.9938.

The colour of mango influenced the traders with a relative importance of 18.62 per cent. Among the levels of colour attribute, colour between green to yellow had a high utility of 4.8889 followed by brown to red (utility 3.2593) and yellow to red (1.6296). Shape of mango was one of the attributes influencing the export traders with a relative importance of 14.53 per cent. Ovate oblique had a utility value of 3.8148 while Oval oblong had a utility value of 2.5432. The least important attribute was the flavor which had a relative importance of 5.21 per cent.

Among which, high and medium flavored mango received high utility with values of 0.4444 and 0.3951, respectively. The results of the present study also corroborate the findings of Reddy *et al.*(1997) on mango quality attributes where the variety was found to have greater influence on the mango export accounting for 36.74 per cent of relative importance. Brosen (1984) on quality attributes of rice by hedonic scale measurement and Steenkemp and Benedict (1990) on ham quality evaluation are also in conformity with the results. They had selected four important quality attributes of ham, *viz.,* brand name, packing, selling store and price whose relative importance were 41.0, 40.5, 6.2 and 12.3 percent, respectively.

Table 5 : Group results from conjoint analysis for mango				
S. No.	Characteristic	Level	Utility	Relative importance (%)
1.	Variety	Alphonsa	2.6543	38.86
		Kesar	1.1235	
		Banganapalli	-3.7778	
2.	Size	200-250g	5.9815	22.78
		250-300g	3.9877	
		225-250g	1.9938	
3.	Colour	Yellow to red	1.6296	18.62
		Brown to red	3.2593	
		Green to yellow	4.8889	
4.	Shape	Ovate oblique	3.8148	14.53
		Oval oblong	2.5432	
		Elongated	1.2716	
5.	Flavour	High	0.4444	5.21
		Medium	0.3951	
		Low	-0.8395	
Pearson's R = 0.583 (p <= 0.01)		Kendall's Tau = 0.533 (p <= 0.01)		

Conclusion :

The results of the study revealed that fresh mango export from India registered significant growth. The variation in quantity, value and unit value of fresh mango export was low which indicates the stability. Among the countries, growth of Indian fresh mango export to Bangladesh and Saudi Arabia is high. The quality attribute of variety was found to have the greatest influence on the trade of mango. In view to export maximum quantity of mango from India, priority may be given to increase the production of good quality mangoes in order to meet out the quality standard requirements of importing countries. s, hence efforts are needed to improve the efficiency of production and quality in order to make the product acceptable and price competitive in European countries.

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