Performance and prospects of spice trade in India: An economic analysis

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ABSTRACT

This paper is an attempt to analyse the international trade potential of Indian spices along with its constraints in the global markets. Spice exports from India experience high growth rate along with significant instability. The results of the revealed symmetric comparative advantage indicate that India is having unique comparative advantage in exports of turmeric, cardamom and seed spices. Decomposition analysis of the value of Indian spice exports suggested the contribution of change in mean export quantity to be highest for pepper (1152%), chilli (231%), ginger (95%) and cardamom (63%); however for crops like turmeric, nutmeg and seed spices, it was contributed by the change in mean export unit value. SPS measures were also studied by finding import detentions from USFDA. During 2017, out of 448 import detentions, a lion share of 232 was found to be in spice lots. The major cause for these detentions are adulteration, misbranding, filthy and presence of unsafe additives and colours. Indian spice exports face significant challenges including poor post-harvest handling, inadequate legal provisions, insufficient quantity of legal spices and loss of indigenous products.

***Keywords*:** Growth, Hazell's decomposition, instability, revealed symmetric comparative advantage and SPS measures

Rapid urbanization and changing dietary patterns are triggering the growth of horticulture sector in our country. The sector has enhanced the growth of agricultural development along with wide choices to farmers for enhancing and sustaining farm production and profitability (Idris *et al*., 2015).The production of total horticulture products surpassed the food grain production in 2012-13 and now the production estimates reached a figure of 295.15 million tons from an area of 24.92 million ha. Among various horticultural products, spices deserve a special mention since these are high valued commodities and contribute considerable income to the total exports of Indian agricultural products.

During 2012-13 out of total agricultural exports from India, spices accounted a share of 3.3 per cent, however, it underwent significant compositional changes over the years (Suresh and Mathur, 2016).India is now the spice bowl of the world with a lion share of 73 per cent in total spice exports (FAO Stat, 2016). The diverse climatic and geographic features of the country makes is apt for growing several spices, and these also bestow geographic indicator tag on spice products. Currently, Rajasthan tops the list of states in both area and production of spice crops (28% of total area and 15% of total production of spices) due to its immense potential in producing seed spices. Seed spices like cumin, celery, poppy and coriander accounts for maximum area of spice production in the state. In terms of production, celery, dill, and poppy seeds along with ginger and vanilla captures the major chunk (NHB data base 2016).This paper looks into the compositional changes in the spice exports of India, and attempts to bring out the trade competitiveness for the Indian spice exports in international markets. Spices trade decomposition along with the sanitary and phytosanitary measures relevant for trade are also dealt.

MATERIALS AND METHODS

The study analyses the scenario of spice trade by using data sets from UNCOM Trade, Spice Board data base, Ministry of Commerce and Industry data base and Hand Book of Horticulture. The growth rate of export value uses compound annual growth rate (CAGR). Mathematically,

$$Y_t = Ab^t \qquad \dots (1)$$
$$\log Y_t = \log A + t * \log b \qquad \dots (2)$$
$$CAGR (\%) = \{Antilog (\log b) - 1\} * 100 \qquad \dots (3)$$

Where,
Y_t = Output at time 't'
$b = (1+r)$,
r = Compound growth rate of Y,
A = Intercept, and
t = Time in years

Instability index is calculated for crop wise value of exports by using the cuddy-Della Valle index formula:

$$CDVI = C.V. * (1 - R^2)^{0.5}$$

Where C.V. = Coefficient of Variation

R^2 = ESS/TSS *i.e.* ratio of explained variation to total variation.

ESS = Variation explained by explanatory variable.
TSS = Total Variation.

CDVI is used instead of C.V. due to the possibility of trends in production with time. Here C.V. adjusts with R^2 to de-trend the production series, because it is statistically sound.

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Trade competitiveness was analysed by using the Revealed Comparative Advantage Indices (RCA). The original index of RCA was first formulated by Balassa (1965) and can be written as per Equation (4):

$$B = (X_{ij}/X_{ik})"(X_{nj}/X_{nk}) \qquad \ldots (4)$$

X_{ij} = Exports of country 'i' of commodity 'j'

X_{ik} = Exports of country 'i' of a set of commodities 'k'

X_{nj} = Exports of a set of countries 'n' of commodity 'j', and

X_{nk} = Exports of a set of countries 'n' of a set of commodities 'k'

RCA is a measure of international trade specialisation. It identifies the comparative advantage or disadvantage a country has for a commodity with respect to another country or group of countries. It considers the intrinsic advantage of a particular export commodity and is consistent with the changes in an economy's relative factor endowment and productivity. But, the disadvantage is that it cannot distinguish improvements in factor endowments and pursuit of appropriate trade policies by a country (Batra and Khan, 2005). Also it suffers from the problem of asymmetry. A symmetric index was formulated by Dalum *et al.* (1998) is known as Revealed Symmetric Comparative Advantage (RSCA) can be expressed mathematically as :

$$RSCA = (RCA-1) / (RCA+1) \qquad \ldots (5)$$

Its value ranges from 1 to +1, and a positive value indicates a comparative advantage in its exports and vice versa. In this study, crop wise comparative advantage in exports was assessed by using RSCA among major Asian competitors, since Asian countries are major players in the global spice trade scenario. To identify the drivers in export of various spices, decomposition analysis was employed. Decomposition analysis of the components of change in average export value of Indian spices was done by using Hazell's decomposition method by using 2005-2010 as base year and 2011-16 as terminal year. The method involves, de-trending the variables followed by decomposition analysis. Mathematically,

De-trending

$$Z_t = a + bt + e_t \qquad \ldots (6)$$

Z_t- Export quantity and export unit value, t - Time variable, and e_t- Random variable residual

$$Z^*_t = e_t + \overline{Z} \ldots (7)$$ $\overline{Z}$ - Mean of export quantity/unit value, Z^*_t - Detrended export quantity or unit value

The de-trended values were subjected to the following analysis

$$EV = EQ. EUV. \qquad \ldots (8)$$

EV -The export value of marine products

EQ - The export quantity of marine products

EUV - The export unit value of marine products

The variance of the 'Export Value'(V (EV)) will be expressed as :

$$V (EV) = \overline{EQ}^2 \, V (EUV) + \overline{EUV}^2 + \overline{EUV}^2 \, V (EQ) + 2$$

$$\overline{EQEUV} \, Cov (EQ \, EUV) \, Cov(EQ.EUV)^2 + R \qquad \ldots (9)$$

Where, $\overline{EQ}$ and $\overline{EUV}$ are the mean export quantity and mean export unit value, respectively.

Components of change in average export value

Sl. No.	Source of change	Symbol	Components of change
1.	Change in mean export value	$\Delta \overline{EUV}$	$2\Delta \overline{EQ} \, 1\Delta \, \overline{EUV} \, Cov (EQ_1 EUV_1)+$ $[2 \overline{EUV} \, EUV+(\Delta \overline{EUV})^2] \, V (EQ_1)$
2.	Change in mean export quantity	$\Delta \, \overline{EQ}$	$2\Delta \overline{EUV} \, \Delta \overline{EQ} \, Cov (EQ_1 EUV_1)+$ $[2 \overline{EQ} \, EQ+(\Delta \overline{EQ})^2] \, V(EUV_1)$
3.	Interaction between changes in (1) and (2)	$\Delta \overline{EUV} \, \Delta \overline{EQ}$	$2\Delta \overline{EUV} \, \Delta \overline{EQ} \, Cov (EQ_1 EUV_1)$
4.	Change in EQ-EUV covariance	$\Delta \, Cov$ (EQ,EUV)	$[2 \overline{EUV} \, 1 \overline{EQ} \, 1-2 \, Cov (EQ_1 EUV_1)]$ $\Delta Cov(EQ,EUV)-[Cov(EQ,EUV)]^2$

RESULTS AND DISCUSSION

Scenario of Indian spice trade

In the year 2016, India stands first in the world, for export of spice and spice products, with a value of 1766.2 million US$. This accounts for about 17.2% of the total world exports. Vietnam, China, Indonesia, Netherlands and Madagascar are the main competitors in the field for spice export in global market. In general, Asian countries possess a distinct advantage in the production and export of spices due the geographic and climatic factors. Table 1 shows the world trade of spices in last three consecutive years in comparison with its competing countries. The share figures are almost similar for 2014 to 2016.

The analysis of spice export destinations in value terms shows US, China, UAE and Indonesia are the major countries where the Indian spice demand lies. Figure 1 depicts the value of Indian Spice exports during TE 2015-16. Spice export as a percentage of total agricultural export shows that during 2015-16 India reached a percentage share of 7.7% and in general there existing an increasing trend. Fig. 2 portraits the total agricultural exports along with total spice export from the country.

Table 1: World trade in spices

Country	2014		2015		2016	
	Value (million US$)	World share (%)	Value (million US$)	World share (%)	Value (million US$)	World share (%)
India	1574.6	16.3	1701.0	17.3	1766.2	17.2
Vietnam	1330.7	13.8	1435.6	14.6	1499.7	14.6
China	957.5	9.9	926.7	9.4	967.5	9.4
Indonesia	660.9	6.8	564.5	5.7	774.8	7.6
Madagascar	248.6	2.6	388	3.9	574.9	5.6
Netherlands	446.1	4.6	365.4	3.7	385.3	3.8
World	9665.5	100.0	9838.5	100.0	10255.6	100.0

Note: Calculated from UN COM TRADE data base

Table 2: Compositional changes in India's spice exports, 2005-06 to 2016-17 (TE average)

Commodities	Value (US $ million)		Share (%)		Growth (%)	Instability (%)
	2005-06	2016-17	2005-06	2016-17		
Pepper	29.71	224.42	11.91	13.35	18.35	11.48
Chilli	83.35	594.54	33.41	35.38	17.79	14.79
Nutmeg	5.07	33.99	2.03	2.02	17.18	9.12
Cardamom	26.06	233.09	10.45	13.87	20.03	8.10
Coriander	14.98	59.49	6.01	3.54	12.18	39.34
Cumin	43.32	274.35	17.36	16.32	27.81	15.89
Ginger	8.47	45.82	3.39	2.73	15.11	21.90
Turmeric	31.53	142.29	12.64	8.47	13.38	19.64
Vanilla	3.64	6.58	1.46	0.39	5.07	27.54
Total spices	**249.47**	**1680.60**	**100**	**100**	**17.23**	**12.52**

Source: Calculated from Ministry of Commerce and Industry data base

Table 3: Decomposition analysis of the components of change in average export value of Indian spices (2005-2010 to 2011-2016)

Sl. No.	Source of change	Pepper	Chilli	Turmeric	Ginger	Cardamom	Nut meg	Seed spices
1.	Change in export value	0.36%	5.47%	10.95%	33.40%	18.63%	21.59%	8.12%
2.	Change in mean export quantity	1152.21	231.29	5.60	95.60	63.57	15.76	18.45
3.	Change in mean export unit value	-1205.64	-228.40	47.49	6.89	31.42	84.76	88.15
4.	Interaction between 1 and 2	-48.58	-26.98	0.28	2.14	3.71	2.88	1.33
5.	Change in EQ- EUV Covariance	202.01	124.09	46.64	-4.63	1.30	-3.41	-7.94

Table 4: Number of US FDA import detentions of Indian spice and spice products exports, Jan 2017 to Dec 2017

Product	No. of refusals	Reason
Turmeric	15	Adultaration, *Salmonella*
Capsicum	14	Adulteration, Aflatoxin, Misbranding (List of ingradients)
Pepper	51	Filthy, Adulteration, Foreign objects
Fennel	16	Misbranding (List of ingradients)
Mace and Nutmeg	4	Filthy, Adulteration, *Salmonella*
Cumin	3	*Salmonella*, Adulteration
Fenugreek	6	*Salmonella*
Mixed spice and seasonings	66	Unsafe colour, *Salmonella*, filthy, List of ingradients, Adulteration, Nutrient labelling(MIS Branding)
Asafoetida	8	*Salmonella*, Adulteration
Spices and seasoning, ground, cracked, with salt, N.E.C.	26	Filthy, Adulteration, *Salmonella*, Misbranding, Lacks numerical count, Nutrient labelling, Unsafe additive
Curry powder	7	*Salmonella*, Adulteration
Whole spice, N.E.C.	5	Unsafe colour, *Salmonella*, Misbranding
Coriander	1	*Salmonella*
Paprika	1	*Salmonella*
Cardamom	2	Unsafe colour, *Salmonella*
Oils	5	*Salmonella*, Filthy, Misbranding
Total	**232**	

Commodity wise compositional changes was analysed by using growth and instability index during the period of 2005-06 to 2016-17. Chilli, cardamom, cumin and pepper are the four major spice commodities which account maximum shares in the total value of spice exports from India. There is an increment in the shares of Pepper, Chilli and Cardamom in between these two periods, but crops like coriander and turmeric experienced a significant decline in the export value. Growth figures indicated that cumin accounts for the maximum growth rate (27.81%) followed by cardamom (20.03%), pepper (18.35%), and chilli (17.79%). There was a considerable decrease in the growth in case of vanilla after boom, and the instability wasalso the highest for coriander (39.34%) and vanilla (27.54%) (Table 2). International price fall and varying EXIM policies are making the export of these crops highly volatile. But traditional crops like chilli, cardamom and pepper fall in the medium to low instability categories. Trade balance in case of spices show an increasing trend in general and during the 2010-13 period it showed an exceptionally high balance of trade (Fig. 3). During 2011 it touched the maximum figure of 1142.9.

Trade competitiveness

Trade competitiveness analysis (2003-2013) show that in case of Pepper, India doesn't possess a distinct advantage among Asian countries. Vietnam and Indonesia hold a relative advantage in comparison with China and India. They are consistent players in pepper trade but Indian performance is below the line and there are good signs for improvement in recent time. In case of chilli RSCA figures are indicating a positive value and it clearly shows the relative advantage position of Indian chilli export. At the same time china is emerging as one of the major competitor as compared to other Asian countries. Chinese dominance in the study period is clearly depicted in the fig. 5 where it crosses the India multiple times. RSCA values for ginger shows a pessimistic picture for Indian ginger exporters. Thailand and China are the two Asian countries which clearly shows the upper hand in case of ginger export and they consistently showed values higher than 0.5 during the ten years' time period. But after 2010, Indian exports are also picking upto high levels in comparison with other nations. Cardamom is another high value crop that fetches maximum foreign earnings in the market. In cardamom India improved its relative position after 2010. Saudi Arabia (re-export) and Singapore are the two main competitors. RSCA figures for seed spices points that India holds relative advantage as compared to other Asian countries. During 2013 it touched a value of 0.34 and after 2007 it improved the relative position. Syria is a country that is emerging as major seed spice exporting hub and it shows a positive value above 0.5 during the whole study period.
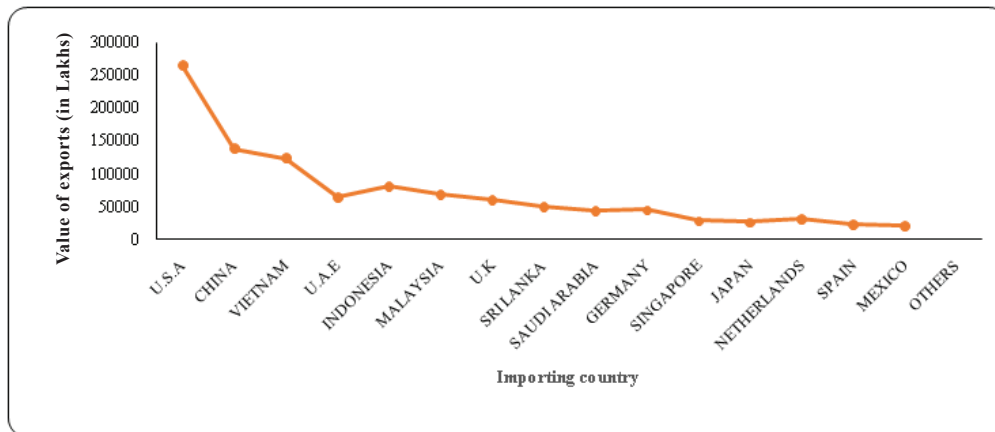
Fig. 1: Value and quantity of spice export (TE average 2015-16) [Source: Spice board]
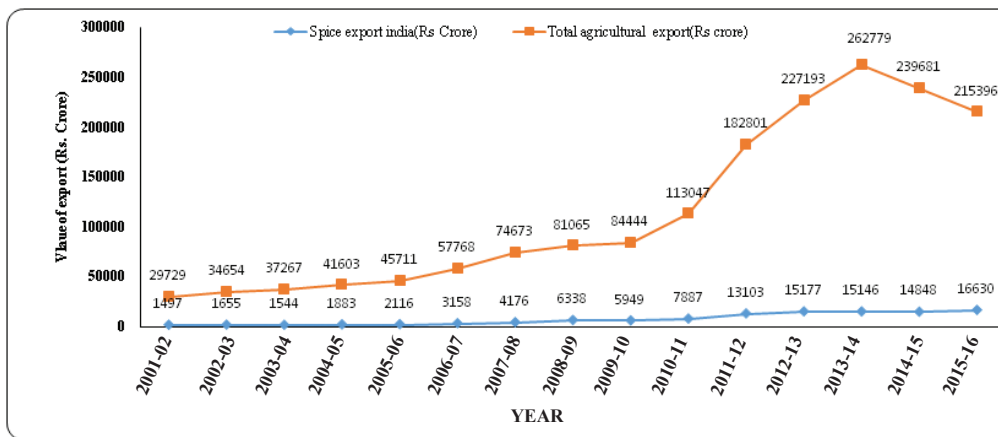

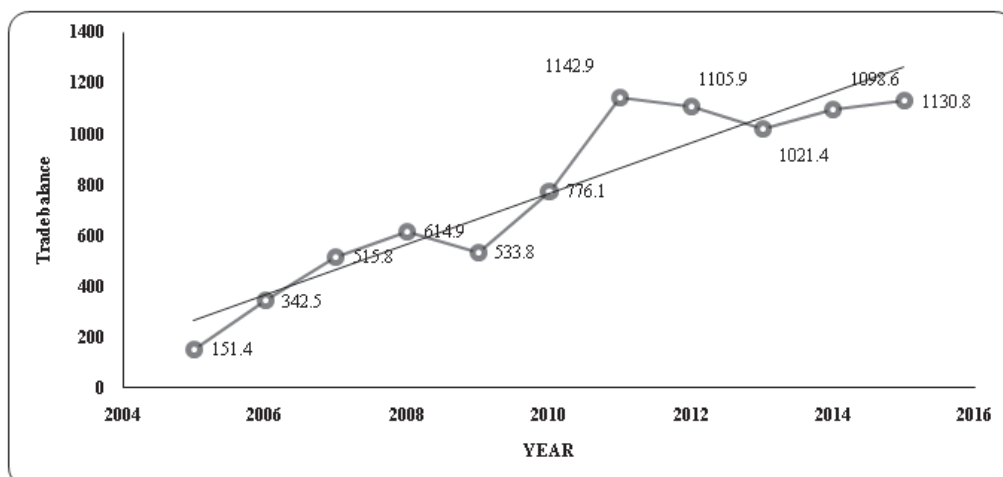**Fig. 2: Spice export vs. agricultural export (value in Rs. Crore)**

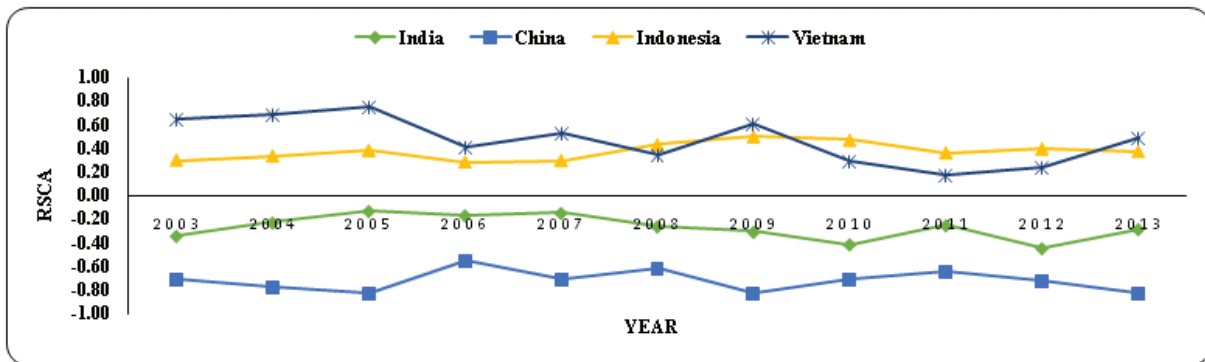**Fig. 3: Spice trade balance (2004-2015)**

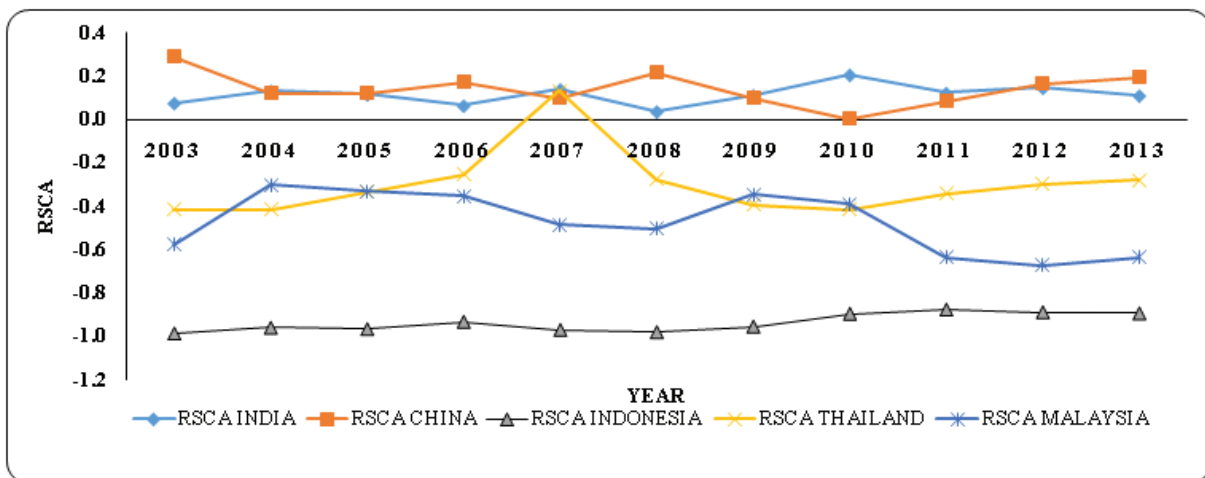**Fig. 4: Trends in RSCA estimates of pepper exports from India and other Asian countries**

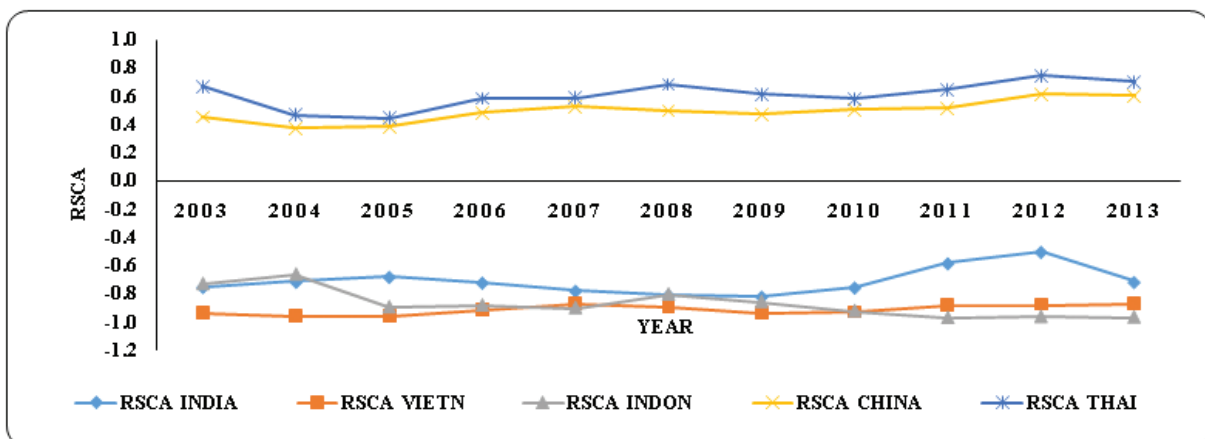**Fig. 5: Trends in RSCA estimates of chilli exports from India and other Asian countries**

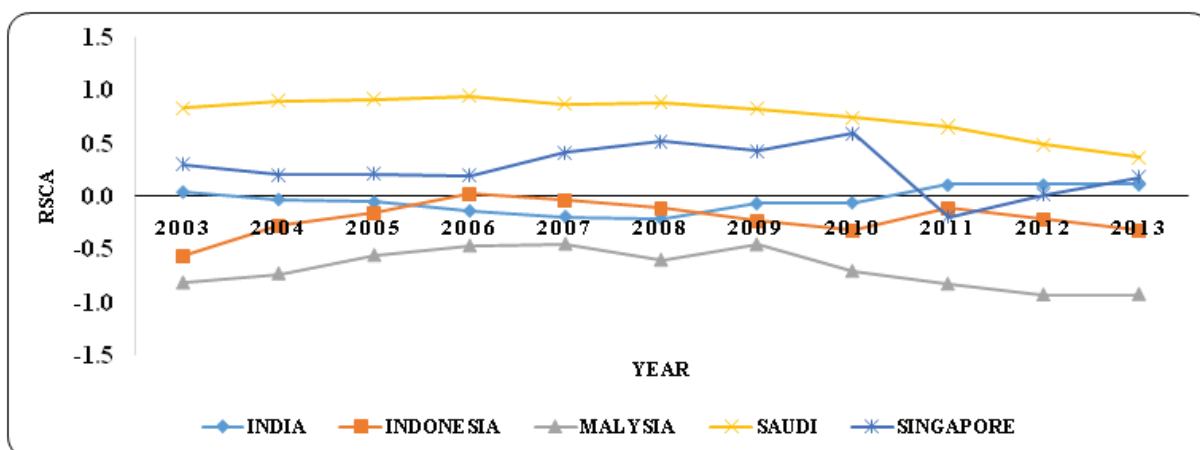**Fig. 6: Trends in RSCA estimates of ginger exports from India and other Asian countries**

Fig. 7: Trends in RSCA estimates of cardamom exports from India and other Asian countries
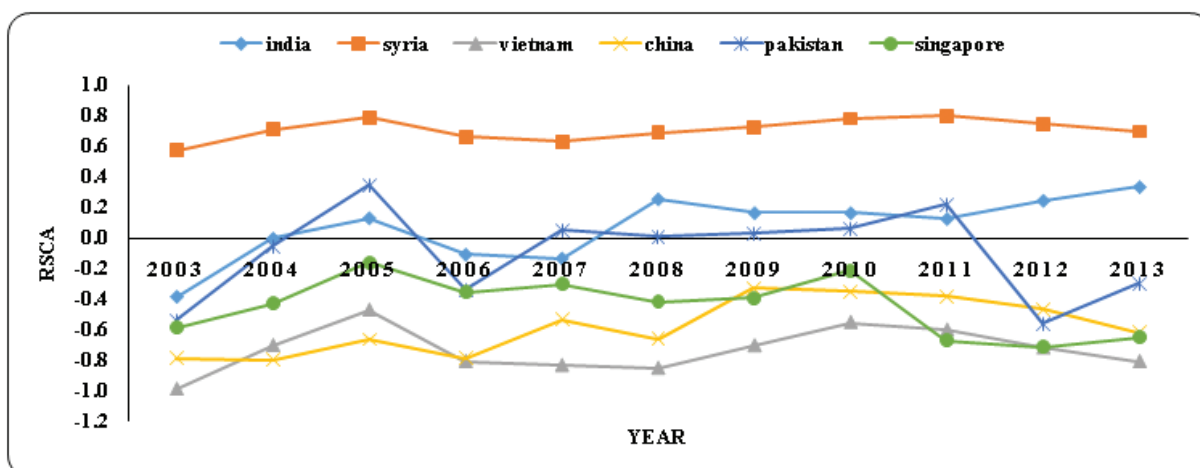

Fig . 8: Trends in RSCA estimates of seed spice exports from India and other Asian countries

Decomposition analysis

Hazell's decomposition method was applied to find out the components of change in average export value of Indian spices in two time periods; base period 2005-2010 and terminal period 2011-2016.Seven crops were taken for analysis.The result indicated that in the crops like pepper (1152.21), chilli (231.29), ginger (95.60) and cardamom (63.57), the change in mean export quantity contributes higher to change in export value (Table 3). For turmeric (47.49), nutmeg (84.76) and seed spices (88.15) this was affected by change in mean export unit value. It simply describes differential policy needed for whether area expansion or price stability measures.In crops like pepper, chilli, ginger and cardamom, the change in the mean export quantity was highest as compared to other components of change. This is an expected result since the export quantity had recorded significant higher growth rates during both the periods whereas export unit value touched negative growth rates during terminal period. The changes in the covariance between mean export unit value and mean export quantity accounted for decrease in values of 4.63, 3.41 and 7.94 for ginger, nutmeg and seed spices respectively. The changes in the covariance could arise through the changes in the variance of export quantity and export unit value. When it comes to interaction effect the export value has benefitted less from both mean export quantity and mean export unit value in all those crops taken except pepper and chilly where the interaction effect is significantly higher and negative in figures (-48.58 and -26.98). Among the various components, the contribution of change in mean export quantity of Indian spices was the dominant source for the change in average export value followed by mean export unit value.

Sanitary and phyto-sanitary issues impacting spice exports

SPS measures are important in the global export market of all crops and products. During last three

consecutive years more than 2000 consignments were detented by USFDA. In 2017 out of 448 total spice import detentions from all over the world, 232 spice lots were from India,which is more than half. The major reasons behind detentions were identified by crop wise. The major problems are *Salmonella* infection, filthiness, adulteration and Misbranding. Mixed spices and seasonings counted the maximum number of detentions (66 nos) followed by pepper (51nos). The detailed information is cited in the table 4.

Indian challenges in the world spice trade domain are not even confined to the SPS measures. It starts from the field level difficulties including low productivity and traditional way of handling post-harvest operations. This points out the importance of post-harvest handling and need for adequate mechanisation in spice production and post-harvest operations. Loss of indigenous varieties from India is occurring due to the lack of proper conservation practices eg: Cochin ginger (*viz*., Kuruppampady, Ellackal), Alleppey finger turmeric (*viz*., Elanji), and Byadagi chilli, *etc*.Insufficiency in the legal provisions still existing in our country. India does not have a National Standard covering all the requirements of the agreement under SPS measures. Provisions existing under the Prevention of Food Adulteration Act are also not comprehensive and provide loopholes for import of cheap spices from other countries of origin. USFDA prescribes Maximum Residue Limits (MRLs) for all food crops and Indian farmers are not aware about the standards which will ultimately results in import detentions. When it comes to competition in world market, Most of the Asian countries have no domestic market for the spices they are producing so that they are forced to sell their produce even at cost price. To surpass these crisis Indian spice export need to concentrate on higher level of value addition through value chain improvements.

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