Gujarat Journal of Extension Education Vol. 34 : Issue 1 : December 22 *https://doi.org/10.56572/gjoee.2022.34.1.0014*

EXPORT PERFORMANCE OF INDIAN CHILLI

Rachna Bansal[1], Mohit Kumar[2] and A. S. Shaikh[3]

1 & 3 Assistant Professor, Dept. of Agril. Economics, BACA, AAU, Anand - 388110
2 PhD Scholar, Dept. of Agricultural Economics, BACA, AAU, Anand - 388110
Email: rkbansal@aau.in

ABSTRACT

India is called as spice wealthy nation as its total production of spices is around 101.25 lakh tonnes from an area of about 43 lakh hectares. This study was entirely based on secondary data. During the year 2020-21, India exported 15.65 lakh tonnes of spices worth of Rs 27143.2 crores. Chilli alone accounts for 38.43 per cent in volume and 31 per cent in value to total export of spices. Exports of chilli grew from 37191 tonnes worth Rs 12246 lakh in the year 2000-01 to 601500 tonnes worth Rs 842975 lakh in the year 2020-21 with an increasing growth rate of 14.47% and 24.48 per cent respectively. China, Thailand, Sri Lanka, UAE and Bangladesh are the major buyers for Indian chillies. Destination wise export of chilli showed that China was the most loyal importer of Indian chilli with retention of 95.09 per cent while Sri Lanka showed zero retention in importing Indian chillies. India had enjoyed a comparative advantage in chilli and NPC for chilli are less than one which clearly indicated that Indian chillies are competitive in the international market. The rigorous quality measures implemented by the Spices Board and the lower output by other competing countries like China and Pakistan had also helped India to achieve record performance.

Keywords: *competitive, comparative advantage, direction of trade, output, quality, retention*

INTRODUCTION

India has wide diversity of climate and soils on which large number of horticultural crops such as fruits, vegetables, ornamentals, medicinal and aromatic crops, plantation crops, spices *etc.* are grown. India is called as spice wealthy nation as its total production of spices is around 101.25 lakh tonnes from an area of about 43 lakh hectares. It had been the major supplier of spices and its value-added products to the world market (Bansal *et al.*, 2022). Out of the total spices production, Indian households consume about 70-75 per cent either in whole form or in value added form (powder or masalas), 5-10 per cent is utilized by oleoresins, pharmaceuticals and cosmetics companies, 15-20 per cent is exported and the remaining 5 per cent goes for seed purposes (www.commodityindia.com). Cumin, chilli and coriander are first, second and third most grown spices in the country with 29.56, 14.44 and 12.25 per cent area and 9.01, 18.19 and 6.92 per cent production share to total spices in the year 2019-20 respectively (www.indiastats.com).

Chilli (*Capsicum annum L.*) is a tropical and sub-tropical spice crop. Chilli is one of the most important spice crops due to its colour and pungency in India. India is the world's largest producer, consumer and exporter of chilli in the world. Dry chilli is extensively used as spice in curried dishes. Dry chilli ranks first among the spices eaten per capita in India. Besides these properties, chilli is a rich source of vitamin A, C, E and P and has certain medicinal properties. And it is widely used in homeopathy.

Indian chilli has been dominating international chilli market due to its pungency, high quality and price competitiveness. In USA, chilli is used in self-defence sprays consists of capsicum oleoresin at ultra-high emission rate which temporarily immobilizes the attacker. The export potential of chilli has enormously increased with the liberalization of trade. Therefore, it is very much vital to study the trade pattern and performance of export in respective importing countries as India is the largest global exporter.

OBJECTIVES

(1) To study the growth and instability in area, production and export of chillies from India

(2) To assess the export competitiveness and export performance of chillies from India

METHODOLOGY

The study focuses on an analysis of dry chillies export from India for a period of 20 years due to its highest percentage share in value of overall spices exports from India. The yearly time series data of export quantity, export value, export destinations and data of area and production was collected from various websites. Data on transportation

cost as well as the other costs involved between the domestic market and port was taken from the telephonic contact with exporters.

Analytical Tools and Techniques

1. Exponential growth model

2. Instability Index

3. Revealed Comparative Advantage

4. Nominal Protection Coefficient

5. Markov Chain Analysis

(1) Exponential growth model

Growth rate of exports of dry chillies for the study period was computed using the exponential growth model. The model is specified as follows:

$$Y = ab^t e \text{ ---------- (1)}$$

Where,

- Y= Export (quantity and value) of dry chillies for the year t
- a = Intercept
- b = Regression coefficient
- t = Time variable
- e = Residual term

By converting the equation (1) into its natural logarithmic form in order to obtain the compound growth rate is given below.

$$\ln Y = \ln a + t \ln b + \ln e$$

The percentage of compound annual growth rate was derived by using the following formula.

$$CAGR = [(\text{anti } \ln b) - 1]*100$$

(2) Study of instability

Cuddy-Della instability index was calculated as follows.

$$II = CV\sqrt{(1 - \bar{R}^2)}$$

Where, II = Instability Index

CV = Coefficient of variation

Adjusted Coefficient of Determination of time trend regression of the original data of exports quantity or value of dry chillies

Similar type of methods is also used by Parmar and Devi (2021) for growth performance in area, production, productivity of Soyabean.

(3) Revealed Comparative Advantage (RCA)

The comparative advantage of India's export of dry chillies was measured on the basis of the observed pattern of trade termed as the Revealed Comparative Advantage (RCA) or the Export Performance Ratio (EPR), one of the most widely used methods (Balassa, 1965) was applied to measure the comparative advantage.

$$RCA = (Xij/Xwj)/(Xi/Xw)$$

Where, Xij = ith country's export of commodity j

Xwj = world exports of commodity j

Xi = total agricultural exports of country i

Xw = world's agricultural exports

If the RCA takes the value greater than unity *i.e.,* RCA> 1, then India has a revealed comparative advantage in exports of dry chillies. If the value is less than one *i.e.*, RCA<1 then exports of dry chillies do not have revealed comparative advantage for India.

However, the RCA can take any value and hence it cannot be used to compare the RCA of two or more commodities. Therefore, in order to make it comparable, the Revealed Symmetric Comparative Advantage (Laursen, 1998) worked out as follows:

$$RSCA = (RCA-1)/(RCA+1)$$

RSCA ranges from -1 to +1. The positive value of RSCA indicated the comparative advantage in exporting the dry chillies whereas its negative value indicated that India has no comparative advantage in exporting the chillies.

(4) Nominal Protection Coefficient (NPC)

Nominal Protection Coefficient is a straight forward measure of the export competitiveness. It is calculated as a ratio between domestic prices to the international price of the comparable grades of the commodity. The nominal protection coefficient was calculated by using the formula:

$$NPC = Pd/Pb$$

Where, NPC = Nominal Protection Coefficient

Pd = Domestic price of the commodity

Pb = International reference price of the commodity adjusted

for the transportation cost and any other costs involved between the domestic market and the port.

If the NPC is less than 1 indicated that the commodity is competitive and the NPC value more than 1 indicated that the export of the commodity is non-competitive. The NPC was calculated for minimum of latest 3 years based on the availability of data on transportation cost with the exporters.

(5) Study of Direction of trade

Annual trade data of the study period was used to analyse the direction of trade and changing pattern of exports of chillies. Markov chain analysis was employed to analyse the structural change in any system whose progress through time can be measured in terms of single outcome variable (Dent, 1967). Markov chain model involves developing a transitional probability matrix 'p', whose elements, P_{ij} indicated the probability of exports switching from country 'i' to country 'j' over time. The diagonal element Pij where i=j, measures the probability of a country retaining its market share or in other words, the loyalty of an importing country to a particular country's exports.

In this context the structural changes were treated as a random process and the assumption that the exports of chillies from India amongst the importing countries in any period depends only on the export in the previous period and this dependence was same among all the periods. This can be algebraically expressed as:

$$\mathbf{Ejt} = \sum_{i=1}^{n}[\boldsymbol{Eit} - \mathbf{1}]\boldsymbol{Pij} + \boldsymbol{eij}$$

Where, Ejt = exports from India to the j^{th} country in the year t

Ejt-1 = exports from India to the j^{th} country in the year t-1

Pij = the probability that exports will shift from i^{th} country to j^{th} country

e_{jt} = the error term which is statistically independent

n = the number of importing countries

The transitional probabilities Pij, which can be arranged in a (c*n) matrix, have the following properties:

$$\sum_{i=1}^{n} \mathbf{Pij} = \mathbf{1 Where,\ 0 \leq Pij \leq 1}$$

Thus, the expected export share of each country during period 't' is obtained by multiplying the exports to these countries in the previous period (t-1) with the transitional probability matrix.

Thus, transitional probability matrix (T) was estimated using linear programming (LP) framework by a method referred as minimization of Mean Absolute Deviation (MAD). The LP framework was constructed as given below:

$$\mathbf{Min,\ OP^* + I\ e}$$

Subject to,

$$\mathbf{XP^* + V = Y}$$
$$\mathbf{GP^* = 1}$$
$$\mathbf{P^* \geq 0}$$

Where, P* is a vector of the probabilities Pij

O is the vector of zeros

I is an appropriately dimensional vectors of areas

e is the vector of absolute errors

Y is the proportion of exports to each country

X is a block diagonal matrix of lagged values of Y

V is the vector of errors

G is a grouping matrix to add the row elements of P arranging in P* to unity

RESULTS AND DISCUSSION

India is dominating in producing spices due to the environmental condition. India is the world's largest producer in terms of spices; the country produces about 75 varieties of spices and exporting a huge amount.

Domestic Scenario: Chilli is being cultivated in almost all the states of India. It was observed from the table 1 that Indian states *viz.*, Andhra Pradesh, Telangana, Madhya Pradesh, Karnataka and Orissa were the leading chilli producing states with 90% share to the total production of chilli in the country in the year 2019-20. The contribution of rest of the states towards chilli production of the country was only about 10 per cent. Among the five major chilli producing Indian states, Andhra Pradesh is the leading state in the country contributing 43.71 per cent of the nation's chilli production.

Table 1: Top five producing states of Chilli (2019-20)

Major Producing States	Production ('000 tonnes)
Andhra Pradesh	805.03 (43.71)
Telangana	436.38 (23.69)
Madhya Pradesh	208.63 (11.33)
Karnataka	129.24 (7.02)
Odisha	69.28 (3.76)
India	1841.80 (100.00)

Note: Data in parentheses denotes percentage to the India's production of chilli

Source: www.indiastats.com

Over the period of 20 years, the area under chilli has declined continuously from 884 thousand ha in the year 2000-01 to 780 thousand ha in the year 2019-20 with a negative growth rate of 0.513%. But the production has increased from 1046 thousand tonnes in the year 2000-01 to 1841.80 thousand tonnes in the year 2019-20 with a significant positive growth rate of 3.52%. During the year 2020-21, the area and production under chilli was 623.45 '000 ha and 2092 '000 tonnes. Looking to the data it is apparent that the increase in chilli production is due to increase in the productivity. The increased productivity may be attributed to advent of high yielding varieties, favourable weather conditions and improved crop management practices.

Export

The quantum of exports and export value has increased over the period of 20 years. It could be observed from the table that the quantity of chillies exported over the years rose from 37191.25 tonnes in 2000-01 to 496000 tonnes in 2019-20 with a significant growth rate of 14.47%. The export of chillies in proportion to production was just 3.56 per cent in the year 2000-01 rose to26.93 per cent in the year 2019-20, still there is a potential to increase its export. The value of chilli exports grew from Rs 12246 lakh in the year 2000-01 to Rs 671039.53 lakh in the year 2019-20 with an increasing growth rate of 24.48 per cent. The quantity and value of chilli export during the year 2020-21 was 601500 tonnes and Rs 842975 lakh respectively. The remarkable growth in both quantity and value of chilli export recognized was mainly due to increased demand in the world market. The rigorous quality measures implemented by the Spices Board, viz. mandatory sampling and analysis for the presence of aflatoxin in export consignment of chilli had made Indian chilli more acceptable in the international markets. The lower output by other competing countries like China and Pakistan had also helped India to achieve record performance. Joshi and Singh (2015) also found similar results in case of Indian spices.

Table 2: Growth and instability in area, production and export of dry chillies from India

Sr. No.	Year	Area ('000 ha)	Production ('000 tonnes)	Export Quantity (tonnes)	Export Value (₹ lakhs)
1	**2000-01**	884	1046	37191.25	12246
2	**2001-02**	881	1113	39973.27	12512
3	**2002-03**	832	907	54024.48	17613
4	**2003-04**	774	1236	56093.1	21220
5	**2004-05**	738	1186	101191.05	31233
6	**2005-06**	654	1015	113174	40300.51
7	**2006-07**	763	1242	148500	80775
8	**2007-08**	806	1298	209000	109750
9	**2008-09**	803	1382	188000	108095
10	**2009-10**	810	1470	204000	129172.8
11	**2010-11**	716	1299	240000	153554
12	**2011-12**	805	1276	241000	214408
13	**2012-13**	794	1304	301000	238060.9
14	**2013-14**	775	1492	312500	272227.2
15	**2014-15**	761	1605	347000	351710
16	**2015-16**	811	1520	347500	399743.97
17	**2016-17**	840	2096	400250	507075.63
18	**2017-18**	752	2149	443900	425632.74
19	**2018-19**	780	1743	468500	541117.5
20	**2019-20**	623.45	1841.80	496000 (26.93)	671039.53
21	**2020-21**	729	2092	601500 (28.75)	842975.00
CAGR (%)		-0.513	3.52**	14.47**	24.48**
II		7.94	11.30	17.82	19.11

Note: Data in parentheses denotes percentage to the total production of chilli

Export Destinations

Chilli alone accounts for a major chunk *i.e.* 31 per cent (about Rs 8429.75 crore) of total export of spices in the country during the year 2020-21. Chillies exports from India are mostly to China, Thailand, Sri Lanka, USA, Indonesia, Bangladesh, Malaysia, UAE, Vietnam and UK. Among these countries, China, Thailand, Sri Lanka, UAE and Bangladesh are the major buyers for Indian chillies. It exports in different forms like chilli powder, dried chilli, pickled chillies and chilli oleoresins. India's chilli exports to major destinations during the year 2019-20 and their share to the total exports is presented in the given table. It can be seen that China was the largest importer of Indian chilli in terms of both quantity and value, which imported 139.97 thousand tonnes of chilli worth Rs 2178.27 crore during the year 2019-20. It contributed a share of 28.22% and 32.46% to the total quantity and value of chilli exports respectively. In terms of quantity and value of exports, Thailand and Sri Lanka was the second and third largest importer by importing 59.36 & 50.84 thousand metric tons worth Rs 903.02 & 623.02 crore of chilli. USA showed the highest unit value of 16694.82 Rs/q, followed by China with unit value of 15562.82 Rs/q. Lowest unit value was shown by UAE, which was 7062.17 Rs/q.

Table 3: Top 10 Export destinations for indian chilli (2019-20)

Rank	Country	Quantity (tonnes)	Value (₹ Lakhs)	Unit Value (₹/q)
1	**China**	139966.1 (28.22)	217826.76 (32.46)	15562.82
2	**Thailand**	59363.72 (11.97)	90302.24 (13.46)	15211.69
3	**Sri Lanka**	50835.35 (10.25)	62302.03 (9.28)	12255.65
4	**USA**	30688.19 (6.19)	52154.04 (7.77)	16994.82
5	**Indonesia**	36601.82 (7.38)	46411.2 (6.92)	12680.03
6	**Bangladesh**	39551.2 (7.97)	43359.44 (6.46)	10962.86
7	**Malaysia**	26083.47 (5.26)	40198.63 (5.99)	15411.53
8	**UAE**	40779.24 (8.22)	28798.99 (4.29)	7062.169
9	**Vietnam**	9435.24 (1.90)	13598.18 (2.03)	14412.12
10	**UK**	8334.88 (1.68)	11287.78 (1.68)	13542.82
11	**Others**	54360.75 (10.96)	64800.24 (9.66)	11920.41
Total (Incl. others)		496000 (100.00)	671039.53 (100.00)	13529.02

Export Competitiveness

Competitiveness is the ability of a nation to grow successfully and to maintain its share in world trade.

RCA (Revealed Comparative Advantage) and RSCA (Revealed Symmetric Comparative Advantage)

Though India is the leader, competition from other major producing countries can't be ruled out. Trade competitiveness of export of dry chillies from India was analysed using various indices like RCA, RSCA and NPC. From the results, it can be seen that throughout the years spices remained as an efficient export commodity with better competitiveness as RCA values were found to be more than one.

Chilli

The RSCA values were also found to be in increasing trend from 0.85 during 2013 to 0.91 during 2020 indicating that, over the years India is having less and less comparative disadvantage. India had enjoyed a comparative advantage in chilli exports. A gradual increase in India's comparative advantage had been depicted for exports of chilli. India had strengthened its position in the global markets in exports of chilli. India's status in exports of chilli been very comfortable and it is assumed to be more due to a growing demand among the international consumers.

Table 4: RCA & RSCA of india's spices and chilli export

Year	Chilli		Spices	
	RCA	RSCA	RCA	RSCA
2011	16.46	0.89	10.86	0.83
2012	14.14	0.87	6.54	0.73
2013	12.07	0.85	5.21	0.68
2014	15.76	0.88	7.08	0.75
2015	17.90	0.89	8.85	0.80
2016	19.12	0.90	10.28	0.82
2017	19.42	0.90	8.85	0.80
2018	17.03	0.89	11.52	0.84
2019	19.55	0.90	10.10	0.82
2020	20.87	0.91	9.95	0.82

Nominal protection coefficient (NPC)

Nominal protection coefficient is found to be the best measure to assess the price competitiveness of commodity exported. The nominal protection coefficient was calculated for the period of three years from 2017-18 to 2019-20. The results of the nominal protection coefficient are presented in the table. During 2017-18, 2018-19 and 2019-20 the NPC of chilli was equal to 0.92, 0.87 and 0.99. NPC less than unity was observed due to less domestic price compared to the international reference price. This shows that Indian chilli was competitive at international market during all the three periods of study. But, the export of chilli is facing a steep competition from China. The factors like domestic price, exchange rate and world export price along with lagged domestic production significantly influence export preference of Indian chilli.

Table 5: Nominal protection coefficient of chilli export from India (Three years)

Year	Domestic Price	FOB Price (₹/q)	Average Marketing Expenses (₹/q)	Border Price (₹/q)	NPC
2017-18	10626.72	14136.82	2625	11511.82	**0.92**
2018-19	11776.50	16383.45	2857.71	13525.74	**0.87**
2019-20	13704.17	16994.82	3091.08	13903.74	**0.99**

Direction of trade of chilli exports from india

Structural changes in the exports of chilli from India was analysed by using the Markov chain analysis by choosing seven major importing countries *viz.* China, Thailand, Sri Lanka, USA, Indonesia, Bangladesh, Malaysia and remaining countries grouped under 'Others' category. The period of study was from 2010-11 to 2019-20. Transitional probability matrix of chilli exports from India to different destinations are presented in the Table. The results showed that, China was the most loyal importer of Indian chilli with retention of 95.09%. It lost its 4.91% of the share to Bangladesh. On the other hand, it also gained 1.89% share of 'Others'. Malaysia was found to be loyal with its retention of 66.07%. It gained 20.29% share of USA and 2.96% share of Bangladesh. On the other hand, it lost its 27.55% share to 'Sri Lanka, 4.63% share to 'others' and 1.75% share to USA during the study period.

Thailand was found to be the loyal importer with its retention of 56.73%. It lost its share of 13.06% to Indonesia and remaining 30.21% share to others. It also gained 39.49% share of Sri Lanka and 6.61% share of others. USA and Bangladesh were also found to be the loyal importer of Indian chilli with retention of 19.85% and 9.09%. Sri Lanka showed zero retention in importing Indian chilli and their major share 60.51% lost to other countries. 'Other' remaining countries together showed retention of 51.70%. Ashoka *et al.,* (2013) and Mendhe& Degaonkar (2010) also studied the direction of trade in chilli export to other countries.

Table 6: Transition Probability Matrix of Chilli Exports from India (2010-11 to 2019-20)

Countries	China	Thailand	Sri Lanka	USA	Indonesia	Bangladesh	Malaysia	Others
China	**0.9509**	0.0000	0.0000	0.0000	0.0000	0.0491	0.0000	0.0000
Thailand	0.0000	**0.5673**	0.0000	0.0000	0.1306	0.0000	0.0000	0.3021
Sri Lanka	0.0000	0.3949	**0.0000**	0.0000	0.0000	0.0000	0.0000	0.6051
USA	0.0000	0.0000	0.0000	**0.1985**	0.0000	0.5987	0.2029	0.0000
Indonesia	0.0000	0.0000	0.0000	0.0000	**0.0000**	0.0000	0.0000	1.0000
Bangladesh	0.0000	0.0025	0.3621	0.0000	0.0000	**0.0909**	0.0296	0.5149
Malaysia	0.0000	0.0000	0.2755	0.0175	0.0000	0.0000	**0.6607**	0.0463
Others	0.0189	0.0661	0.1143	0.1847	0.0990	0.0000	0.0000	**0.5170**

CONCLUSION

The quantity and value of chilli export during the year 2020-21 was 601500 tonnes and Rs 842975 lakh and has increased over the period of 20 years with a significant growth rate of 14.47 per cent and 24.48 per cent respectively. China, Thailand, Sri Lanka, UAE and Bangladesh are the major buyers for Indian chillies. China was the most loyal importer of Indian chilli with retention of 95.09%. India had enjoyed a comparative advantage in chilli and in spices exports as RCA values were found to be more than one throughout the years. NPC for chilli are less than one which clearly indicated that Indian chillies are competitive in the international market. The sustainability of Indian spices industry is mainly

depending on exports. Despite being largest producer, Indian chillies are facing stiff competition from countries including China, Turkey and Netherland. In China, the local production of Paprika's is reportedly down by 20 per cent and there is a huge difference in prices and growing seasons of Indian chilli and Chinese Paprika, makes China as large buyer.

POLICY IMPLICATION

International countries have taken a fancy to the Indian spice, which is much hotter than their locally grown Paprikas. As international countries are demanding more and more high heat Indian chillies, it is recommended for producers and traders to cultivate good quality products with utmost care, storage precautions and less contamination to reduce shipment rejections. Exporters should focus on the countries having high retention in the last 10 years like china and Thailand.

CONFLICT OF INTEREST

No conflict of interest among researchers.

REFERENCES

Ashoka, N., Kuldeep, C., Ramachandra, V. A. and Yeledhalli, R.A. (2013) A study on growth, instability and direction of chilli trade in India. *J. of Spices and Aromatic Crops*, *22*(1): 76-80.

Balassa, B. (1965) Trade liberalisation and "revealed" comparative advantage 1. *Themanchester school*, *33*(2): 99-123.

Bansal, R., Kumar, M. and Shaikh, A. S. (2022) Growth and export trends of major spices in India: An analytical study. *Guj. J. of Ext. Edu.,* 33(2):145-150.

Chaitra, G. B. and Sonnad, J. S. (2019) Export performance of chilli and cumin from India: An empirical analysis. *J. of Pharmacognosy and Photochemistry*, *8*(2): 2014–2020.

Cuddy, J. D. and Valle, P. D. (1978) Measuring the instability of time series data. *Oxford bulletin of econ. and stat.*, *40*(1): 79-85.

Dent, W. T. (1967) Application of Markov analysis to international wool flows. *The Review of Econ. and Stat.*, 613-616.

Joshi, D. and Singh, H. P. (2015) An empirical analysis of growth and instability in major spices in India. *Int. J. of Agri. Sci.*, *7*(2): 440–444.

Laursen, K. (1998) *Revealed Comparative Advantage and the Alternatives as Measures of International Specialisation* (No. 98–30). https://wp.druid.dk/wp/19980030.pdf

Mendhe, N. P. and Degaonkar, A. M. (2010) Export performance of chillies from India. *Int. J. of commerce and business mgt.,* 3(2): 252-257.

Parmar, P. and Devi, G. (2021). Growth and decomposition analysis of area, production and yield of soybean. *Guj. J. of Ext. Edu.,* 32(1):116-119.

www.fao.org/faostat/en/#data/TCL

www.apeda.gov.in

www.agmarknet.gov.in

www.commodityindia.com

Received : October 2022 : Accepted : December 2022