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Structural changes in export of non-basmati rice from India

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Abstract

This study examined the structural changes in the export performance of Non-Basmati Rice from India over the period 1994-95 to 2023-24 using secondary data collected from APEDA, DGCIS, WITS, UN Comtrade and FAOSTAT. The study analyzed growth trends, instability and direction of trade by employing Compound Annual Growth Rate (CAGR), Cuddy Della Valle Instability Index (CDVI), Mann-Kendall trend test, Sen's Slope estimator and Markov Chain Analysis. The overall results revealed significant growth in both export quantity and value of Non-Basmati Rice, particularly during Period II (2009-10 to 2023-24) following the removal of export restrictions under the Foreign Trade Policy 2009-14. Trend analysis confirmed a significant increasing trend in exports, indicating India's emergence as a major global exporter of Non-Basmati Rice. Instability analysis showed moderate fluctuations in export quantity and value, especially during the post-liberalization period. The Markov Chain analysis indicated that most importing countries exhibited low retention probabilities, reflecting a highly dynamic and shifting export structure. The study concluded that India's Non-Basmati Rice export sector has undergone substantial structural transformation due to trade liberalization and increasing global demand, but long-term sustainability would require stable export policies, diversification of markets and improved production efficiency.

Keywords: Export, Basmati Rice, Compound annual growth rate, revealed comparative advantage, Trend

Introduction

Agriculture, the cornerstone of India's economy, continues to be the vital and significant sector that sustains livelihoods for a majority of the population, especially in rural areas. The sector serves as the backbone of economies worldwide, providing sustenance, income and employment opportunities to millions. Its significance transcends mere sustenance, driving economic growth and fostering socio-economic development. India is one of the world's leading exporters of agricultural commodities. In 2023-24, India's agricultural exports were valued at USD 48.8 Billion. This represented a decline from USD 53.2 Billion in 2022-23, mainly because of export restrictions on Wheat, Rice, Sugar and lower global commodity prices. India's share in global agricultural exports was 2.20 per cent during 2023-24, placing India among the top ten agricultural exporters globally (Farmer Connect Portal, APEDA, 2023-24). During 2024-25, India's total merchandise exports stood at USD 437.70 Billion out of which Agricultural products contributed USD 51.91 Billion which was 11.86 per cent of total export. Export of products monitored by APEDA was at USD 27.90 Billion (TRADESTAT, Ministry of Commerce and Industry, GOI, 2024-25). In 2022-23, Rice exports (Basmati and Non-Basmati) from India were valued at USD 20.36 Billion, as against USD 9.67 Billion in 2021-22, registering a growth of 15.22 per cent and holding a first rank at global level. The exports of Non-Basmati Rice in 2023-24 declined by 37.50 per cent in quantity due to a ban imposed in mid-2023 which remained partially through 2024, reducing its share from 1.41 per cent to 1.05 per cent in total exports. The major export destination for Rice includes Iran, Iraq, Saudi Arabia, UAE as well as African countries (DGCIS, 2023-24).

Research methodology**Description of data sources**

The current study primarily used secondary data to examine the structural changes in agricultural exports, growth rates, trends, instability and direction of trade of Non-Basmati Rice. The required data for the present study had been systematically retrieved from genuine and credible sources such as Agricultural and Processed Food Products Export Development Authority (APEDA), Directorate General of Commercial Intelligence and Statistics (DGCIS), World Integrated Trade Solution (WITS), UN Comtrade and Food and Agriculture Organization Statistical Database (FAOSTAT). The study examined a thirty-year period from 1994-1995 to 2023-2024 in order to analyse the stated objectives. This period coincided with significant periods of economic and trade liberalization in India as well as the development of global trade dynamics under the WTO regime (post-1995). In order to capture structural decadal trends that coincided with the Foreign Trade Policy 2009-14, the study period was further divided into Period I (1994-95 to 2008-09) and Period II (2009-10 to 2023-24).

Analytical Framework**Growth Performance:**

The growth in the export of Basmati Rice was analyzed by using compound annual growth rate (CAGR). The compound annual growth rate was calculated by fitting an exponential function to the data on export (quantity and value) and the ordinary least square method was used to fit the exponential function of the following form $Y = ab^t$. It was then converted into log linear function with the help of logarithmic transformation as under:

$$y = \log a + t \log b$$

Where,

Y = Export quantity and value of selected agricultural commodities

t = time variable

a = intercept

b = regression coefficient

The compound growth rate was then computed as:

$$\text{CGR (r)} = [\text{Antilog } b - 1] \times 100$$

Where,

r = Compound growth rate.

The significance of estimated coefficients was tested by using 't' test.

$$\text{Calculated 't'} = b/\text{Se (b)}$$

Where,

b = Estimated coefficient of the model

Se(b) = Standard error of the estimated coefficient

The present study applied the Cuddy Della Valle Index (CDVI) to measure the instability in export quantity and value of selected agricultural commodities.

The estimable form of the equation was computed as follows:

$$\text{CDVI} = \text{CV} \sqrt{1 - R^2}$$

$$\text{CV (\%)} = \text{Standard Deviation}/\text{Mean} \times 100$$

Where,

CV = Co-efficient of variation

R^2 = Co-efficient of determination

Mann-Kendall Test:

This approach looked for trends in time series without distinguishing between linear and non-linear trends. It was computed as follows:

For the time series $x_1, \dots, x_n$, the Mann-Kendall statistic S was given as:

$$S = \sum_{i=1}^{n-1} \sum_{j=i+1}^n \text{sgn}(x_j - x_i)$$

Where, n = number of data points

x_j and x_i = data values in time series i and j ($j > i$), respectively

The application of trend test was done to a time series x_i that was ranked from $i = 1, 2, \dots, n-1$ and x_j , which was again ranked from $j = i+1, i+2, \dots, n$. Each of the data point x_i , was taken as a reference point which was further compared with the rest of the data point's x_j .

$\text{sgn}(x_j - x_i)$ was the sign function which was given as:

$$\text{sgn}(x_j - x_i) = \begin{cases} +1, & (x_j - x_i) > 0 \\ 0, & (x_j - x_i) = 0 \\ -1, & (x_j - x_i) < 0 \end{cases}$$

It had been documented that when $n \geq 8$, the statistic S was supposed to be normally distributed with the mean:

$$E(S) = 0$$

The variance statistic was given as:

$$\text{VAR}(S) = \frac{1}{18} \{n(n-1)(2n+5)\} - \sum_{i=1}^m t_i(t_i-1)(2t_i+5)$$

Where,

n = total number of data points in time-series dataset

m = cluster of data points having same data value

t_i = total equal observation of extent i at a particular timestamp

Further, Kendall's tau (τ) was calculated as its value was highly imperative to understand the presence and direction of trend in the data set. Positive values of Kendall's tau showed an increasing trend while negative values showed the presence of decreasing trend. Its formula is given below:

$$\text{Kendall's tau } (\tau) = \frac{2S}{n(n-2)}$$

Sen's Slope Estimator:

The Sen's Slope equation for a number of N data sample pairs was written as follows:

$$Q_i = \frac{X_j - X_i}{j - i}, \quad i = 1, 2, 3, \dots, N$$

X_j and X_i were data values at time j and i ($j > i$), respectively. If there were n values from X_j in the time series, there would be $N = n(n-1)/2$ slope estimates. The value of Q_i was sorted from smallest to largest, then Sen's Slope used median Q_i (Q_{med}). A two-tailed test estimated the value of Q_{med} at a confidence interval of 90 per cent and 95 per cent, which was calculated as:

$$Q_{\text{med}} = \begin{cases} Q_{[\frac{N+1}{2}]} & \text{if } N = \text{odd} \\ \frac{Q_{[\frac{N}{2}]} + Q_{[\frac{N+1}{2}]}}{2} & \text{if } N = \text{even} \end{cases}$$

Markov Chain Analysis

The direction of trade was analyzed by the use of Markov chain analysis of the first order. The estimation of Transitional Probability Matrix (TPM) was central to this analysis. This was algebraically indicated as:

$$E_{lt} = \sum_{k=1}^q E_{kt-1} \times P_{kl} + e_{lt}$$

Where,

E_{lt} = India's export to the l^{th} country in the year t

E_{kt-1} = Exports of k^{th} country during the year $t-1$

P_{kl} = the probability that exports will switch from k^{th} country to l^{th} country

e_{lt} = The error term which is statistically independent of E_{kt-1}

q = The number of importing countries

Results and discussion

Growth performance of non-basmati rice exports from India for the period under study

Table 1 indicates the Compound Annual Growth Rate (CAGR), Coefficient of Variation (CV) and Cuddy Della Valle Instability Index (CDVI) for the export quantity and value of Non-Basmati Rice from India, respectively.

Table 1: Compound Annual Growth Rate (CAGR) and Instability Matrix of Non-Basmati Rice Exports from India

Period	Quantity CAGR (%)	Value CAGR (%)
Overall (1994-95 to 2023-24)	8.54*	10.74*
Period I (1994-95 to 2008-09)	5.51 ^{NS}	6.65 ^{NS}
Period II (2009-10 to 2023-24)	21.50**	19.73**
Period	Quantity CV	Value CV
Overall (1994-95 to 2023-24)	0.87	0.96
Period I (1994-95 to 2008-09)	0.42	0.37
Period II (2009-10 to 2023-24)	0.64	0.60
Period	Quantity CDVI	Value CDVI
Overall (1994-95 to 2023-24)	0.75	0.71
Period I (1994-95 to 2008-09)	0.42	0.35
Period II (2009-10 to 2023-24)	0.51	0.48

*Significant at 1 per cent; **Significant at 5 per cent; ^{NS} Non-Significant

CDVI <0.5: Low Instability; 0.5-1.0: Moderate Instability; >1.0: High Instability

Non-Basmati Rice recorded overall significant CAGR of 8.54 per cent in export quantity and 10.74 per cent in export value, respectively with significance level of 1 per cent, reflecting India's structural transformation into the world's largest Rice exporter. Period I performance showed modest and statistically insignificant growth in both quantity and value indicating constraints under export bans. Further, Period II breakthrough achieved a significant growth of 21.50 per cent in quantity and 19.73 per cent in value, respectively, with significance level of 5 per cent, coinciding with the export ban removal in 2011 under Foreign Trade Policy 2009-14. This structural shift validated with the findings of Satishkumar *et al.* (2023) ^[6]. Further, the narrowing value-quantity differential in Period II suggested price competition in bulk markets, warning against over expansion that could trigger "immiserizing growth" through terms of trade deterioration. This implied that the growth of Non-Basmati rice in Period II represented the most dramatic structural break in Indian agricultural trade history, transforming India from a marginal exporter to the world's largest exporter (21% global share by 2021). The Minimum Support Price (MSP) system, coupled with subsidized electricity for groundwater pumping, created a comparative advantage where Punjab and Haryana farmers received 40-50 per cent above international prices, enabling export competitiveness through volume rather than efficiency which clearly threatened the sustainability (Singh, 2023) ^[5].

Across the overall Period (1994-95 to 2023-24), Non-Basmati Rice showed high coefficient of variation of 0.87 for quantity and 0.96 for value reflecting substantial fluctuations around rapidly growing mean levels. In addition, the CDVI of 0.75 for quantity and 0.71 for value indicated a moderate to high instability. Period I (1994-95 to 2008-09) exhibited a lower volatility with CV of 0.42 for quantity and 0.37 for value. Further, a lower CDVI was also found with value of 0.42 for quantity and 0.35 for value, indicating less instability in both quantity and value. However, Period II (2009-10 to 2023-24) demonstrated a different scenario with CV of 0.64 for quantity and 0.60 for value and CDVI was 0.51 for quantity and 0.48 for value, suggesting a moderate instability. These findings aligned with Prahadeeswaran *et al.* (2022) ^[7].

Table 2: Trend Analysis for Export Quantity (MT) and Value (USD Million) of Non-Basmati Rice from India

Crop	Kendall's Tau (τ)	Mann-Kendall S Statistic	p-value	Sen's Slope (MT/year)	Trend
Basmati Rice					
Quantity (MT)	0.5494	239	<0.0001	349,164.33	Significant Increase
Value (USD Million)	0.5770	251	<0.0001	153.94	Significant Increase

Table 2 represents the trend analysis results for export quantity and value of Non-Basmati Rice from India, respectively. It was observed in the analysis that Non-Basmati Rice exhibited a significant increasing trend with τ of 0.5494, S statistic of 239 and Sen's slope 349,164.33 MT/year. This suggested a volume-driven growth pattern, where exports were expanding aggressively due to price competitiveness and global supply gaps. This result additionally validated the structural shift after the export ban removal with India in 2011, capturing major global market share. Prahadeeswaran *et al.* (2022) ^[7] also reported the similar export pattern for Non-Basmati Rice.

In case of export value, Non-Basmati Rice revealed a consistent but somewhat variable growth with a moderate τ of 0.5770 and S statistic of 251, while the high slope (153.94 USD Million/year) indicated towards large annual gains in export earnings. This growth might be driven mainly by volume expansion rather than price improvements, reflecting India's role as a bulk commodity supplier in global rice markets. The similar results were recorded by Prahadeeswaran *et al.* (2022) ^[7].

Direction of export of non-basmati rice from India for the period under study

Table 3, Table 4 and Table 5 presents the Transition Probability Matrices of export of Non-Basmati Rice from India to the major international markets for overall period (1994-95 to 2023-24), Period I (1994-95 to 2008-09) and Period II (2009-10 to 2023-24), respectively.

Table 3: Transition Probability Matrices for Non-Basmati Rice Exports from India for overall period (1994-95 to 2023-24)

Countries	Bangladesh	Benin	Senegal	Nepal	Cote D'Ivoire	South Africa	Guinea	Others
Bangladesh	0.3118	0.0000	0.0000	0.0000	0.0000	0.0689	0.0000	0.6193
Benin	0.0000	0.1698	0.0821	0.0065	0.0000	0.0000	0.0000	0.7416
Senegal	0.0000	0.4256	0.4669	0.0000	0.0000	0.0000	0.1075	0.0000
Nepal	0.0000	0.0000	0.0023	0.2112	0.0000	0.0000	0.0000	0.7865
Cote D'Ivoire	0.5437	0.0898	0.0000	0.0593	0.3072	0.0000	0.0000	0.0000
South Africa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0812	0.0000	0.9188
Guinea	0.0000	0.2861	0.0000	0.2558	0.0000	0.0000	0.4582	0.0000
Others	0.0659	0.0187	0.0424	0.0685	0.0542	0.1088	0.0193	0.6221

The results of the Transitional Probability Matrix in Table 3 revealed that no single major market exhibited very high stability, reflecting a relatively dynamic and shifting export structure for Non-Basmati Rice exports from India during the overall period. Among the principal importers, Senegal emerged as the most stable market, with a retention probability of 0.4669 (46.69%). However, a considerable share of its exports was redirected towards Benin (42.56%) and Guinea (10.75%), suggesting moderate rather than strong stability. Similar observations were recorded by Satishkumar *et al.* (2016)^[6].

Guinea also demonstrated moderate consistency, retaining 45.82 per cent of its import share. At the same time, it experienced notable shifts towards Benin (28.61%) and Nepal (25.58%), indicating a balanced mix of stability and redistribution.

Bangladesh showed relatively low stability, with a retention probability of 0.3118 (31.18%), while a dominant portion of its exports shifted to the 'Others' category (61.93%) and to a lesser extent towards South Africa (6.89%). This reflected a high degree of diversification away from Bangladesh over the long period.

Cote D'Ivoire displayed moderate retention at 0.3072 (30.72%), but a substantial share of its exports was redirected to Bangladesh (54.37%), followed by smaller shifts to Benin (8.98%) and Nepal (5.93%). This pattern indicated strong trade inter-linkages with Bangladesh.

Nepal exhibited low stability, retaining only 21.12 per cent of its share, while a very large proportion (78.65%) was diverted to the 'Others' category. This suggested that Nepal's role as a stable importer weakened considerably over time.

Benin recorded relatively low retention (16.98%), with a major portion of its exports shifting to the 'Others' category (74.16%) and smaller shares to Senegal (8.21%) and Nepal (0.65%). This indicated a highly volatile trade pattern.

South Africa emerged as one of the least stable markets, with a very low retention probability of 0.0812 (8.12%), while the majority of its exports (91.88%) were redirected to the 'Others' category. This reflected a significant decline in its role as a consistent importer. Similar findings were reported by Satishkumar *et al.* (2016)^[6].

The 'Others' category demonstrated comparatively higher stability, with a retention probability of 0.6221 (62.21%). It also contributed to multiple markets, particularly south Africa (10.88%), Nepal (6.85%) and Bangladesh (6.59%), underscoring the importance of diversified smaller markets in sustaining export continuity.

Table 4: Transition Probability Matrices for Non-Basmati Rice Exports from India for Period I (1994-95 to 2008-09)

Countries	Bangladesh	South Africa	Nigeria	Saudi Arabia	Cote D'Ivoire	UAE	Somalia	Others
Bangladesh	0.2996	0.0000	0.0000	0.0000	0.0029	0.1190	0.0126	0.1517
South Africa	0.0000	0.0000	0.0000	0.0000	0.0000	0.4786	0.0603	0.3902
Nigeria	0.0000	0.0000	0.0000	0.0000	0.1974	0.0000	0.0000	0.6492
Saudi Arabia	0.0000	0.0000	0.0000	0.0000	0.0000	0.1354	0.0000	0.8646
Cote D'Ivoire	0.9167	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0833
UAE	0.0000	0.0000	0.0000	0.0000	0.3752	0.0000	0.1123	0.5125
Somalia	0.5869	0.0000	0.0821	0.0000	0.2315	0.0000	0.0996	0.0000
Others	0.3748	0.0000	0.0000	0.0000	0.0000	0.0260	0.0149	0.5109

The analysis indicated in Table 4 revealed that none of the major markets exhibited high retention, pointing towards a highly dynamic and fluctuating export structure during the Period I also. Among the importing countries, Bangladesh showed relatively low stability, with a retention probability of 0.2996 (29.96%). A significant portion of its exports was diverted to the UAE (11.90%), Somalia (1.26%) and the 'Others' category (15.17%), reflecting a pattern of redistribution rather than consistency.

In contrast, Cote D'Ivoire stood out as a highly unstable market, with zero retention probability. A dominant share of its exports (91.67%) shifted towards Bangladesh, indicating a strong reorientation of trade flows. Similarly, South Africa, Nigeria and Saudi Arabia also recorded zero retention, highlighting complete instability in these markets. South Africa redirected a large share of its exports to the UAE (47.86%) and the 'Others' category (39.02%), while Nigeria diverted a substantial portion towards Cote D'Ivoire (19.74%) and 'Others' (64.92%). Saudi Arabia, on the other hand, shifted the majority of its exports to the 'Others' category (86.46%) and to the UAE (13.54%).

Further, the UAE emerged as a completely unstable market as well, with no retention of its previous share. Its exports were redistributed mainly to the 'Others' category (51.25%), Cote D'Ivoire (37.52%) and Somalia (11.23%), indicating its role as a transitional and re-export-oriented destination.

Somalia displayed low stability, retaining only 9.96 per cent of its export share. A considerable portion of its exports shifted to Bangladesh (58.69%) and Cote D'Ivoire (23.15%), suggesting strong inter-linkages among these markets.

The 'Others' category demonstrated moderate stability, with a retention probability of 0.5109 (51.09%). It also contributed significantly to Bangladesh (37.48%), along with smaller shares to the UAE (2.60%) and Somalia (1.49%), highlighting the importance of diversified markets in maintaining export continuity.

Table 5: Transition Probability Matrices for Non-Basmati Rice Exports from India for Period II (2009-10 to 2023-24)

Countries	Benin	Senegal	Nepal	Cote D'Ivoire	Guinea	Somalia	UAE	Others
Benin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000
Senegal	0.0000	0.3608	0.3845	0.0000	0.0000	0.2014	0.0532	0.0000
Nepal	0.0000	0.0000	0.0000	0.1260	0.0000	0.0000	0.0000	0.8254
Cote D'Ivoire	0.0000	0.3863	0.0000	0.0000	0.0000	0.0000	0.0000	0.6137
Guinea	0.0000	0.3000	0.0000	0.0214	0.0000	0.1947	0.4839	0.0000
Somalia	0.0000	0.0000	0.1935	0.0000	0.3371	0.3944	0.0290	0.0460
UAE	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000
Others	0.0498	0.0799	0.0669	0.0773	0.0217	0.0176	0.0353	0.6514

The results of the Markov Chain Analysis presented in Table 5 revealed that most major markets exhibited low or zero retention, suggesting that export flows during Period II were highly dynamic and frequently reallocated. Notably, Benin emerged as a completely unstable market, with zero retention probability, as its entire export share (100%) shifted to the 'Others' category. This reflected a complete loss of continuity in trade with this destination.

Senegal displayed moderate stability, with a retention probability of 0.3608 (36.08%). However, a substantial proportion of its exports was redirected to Nepal (38.45%), followed by Somalia (20.14%) and the UAE (5.32%). This indicated that while Senegal retained some importance, its trade pattern remained fluid.

Nepal exhibited complete instability, with zero retention probability. A dominant share of its exports shifted to the 'Others' category (82.54%), along with a smaller portion to Cote D'Ivoire (12.60%), suggesting a significant decline in its role as a consistent importer. Similarly, Cote D'Ivoire recorded zero retention, with a major share of its exports redirected to the 'Others' category (61.37%) and Senegal (38.63%). This highlighted a strong redistribution of trade rather than sustained import dependence. Guinea also showed complete instability, with no retention of its previous share. Its exports were mainly diverted to the UAE (48.39%), Senegal (30.00%) and Somalia (19.47%), indicating active reallocation across multiple markets.

Somalia demonstrated moderate stability, retaining 39.44 per cent of its export share. It also redistributed a considerable portion to Guinea (33.71%) and Nepal (19.35%), suggesting partial consistency combined with dynamic trade shifts.

The UAE emerged as a completely unstable market, with zero retention probability, redirecting its entire export share to Cote D'Ivoire (100%). This pointed to its role as a transitional channel rather than a stable destination.

The 'Others' category showed relatively strong stability, with a retention probability of 0.6514 (65.14%). It also contributed to several markets, including Senegal (7.99%), Cote D'Ivoire (7.73%) and Nepal (6.69%), reinforcing the importance of diversified smaller destinations in maintaining overall export balance.

Conclusion

The study revealed that Non-Basmati Rice experienced significant growth in both export quantity and value during the overall period. The growth became particularly strong during Period II following the removal of export restrictions under the Foreign Trade Policy 2009-14, which transformed India into one of the world's leading exporters of Non-Basmati Rice. Trend analysis further confirmed a significant upward movement in export quantity and value over time. The instability analysis indicated moderate fluctuations in exports, especially during the post-liberalization period, suggesting that although exports expanded rapidly, they remained vulnerable to policy interventions, global price variations and market uncertainties. The Markov Chain analysis revealed that most importing countries exhibited low retention probabilities, reflecting a dynamic and shifting export structure. Markets such as Senegal and Somalia showed comparatively better stability, while several destinations demonstrated complete instability, indicating frequent reallocation of export shares among importing countries. Overall, the study concluded that India's Non-Basmati Rice export sector has undergone a major structural transformation driven by trade liberalization, rising global demand and competitive pricing. However, sustaining export growth would require stable trade policies, diversification of export destinations and improvement in production efficiency to enhance long-term competitiveness in the global market.

References

1. Agricultural and Processed Food Products Export Development Authority (APEDA). *APEDA annual report 2024*. New Delhi: APEDA; 2024.
2. Directorate General of Commercial Intelligence and Statistics (DGCI&S). *Export-import data 2023-24*. Kolkata: Ministry of Commerce and Industry, Government of India; 2024.
3. Agricultural and Processed Food Products Export Development Authority (APEDA). *Farmer Connect Portal*. New Delhi: APEDA; 2023-24. Available from: <https://farmerconnect.apeda.gov.in>
4. Ministry of Commerce and Industry. *TRADESTAT database*. New Delhi: Government of India; 2024-25. Available from: <https://tradedstat.commerce.gov.in>
5. Singh P. An analysis of trend and export competitiveness of APEDA products, tobacco, spices, tea and coffee in India. *SSRN*. 2023;1-45.
6. Satishkumar M, Harishkumar HV, Rangegowda R. Growth, export performance and competitiveness of basmati and non-basmati rice of India: a Markov chain approach. *Int J Agric Environ Biotechnol*. 2016;9(2):305-311.
7. Prahadeeswaran M, Balaji R, Senthilnathan S, Lavanya SM, Gurunathan S. Trends in export of major agricultural commodities and products from India. *Asian J Agric Ext Econ Soc*. 2022;40(9):367-373.
8. Adhikari A, Sekhon MK, Kaur M. Export of rice from India: performance and determinants. *Agric Econ Res Rev*. 2016;29(1):135-150.
9. Suresh A, Mathur VC. Export of agricultural commodities from India: performance and prospects. *Indian J Agric Sci*. 2016;86(7):876-883.