RESEARCH ARTICLE

Export performance and direction of major agricultural commodities from Tamil Nadu

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Abstract

Tamil Nadu is India's second-largest economy and its agricultural performance is also significant. The state has been involved in trading of agricultural commodities for many years. In recent years, due to change in export policy of major commodities, it is necessary to measure the performance and direction at state level. Hence, the present study aims to analyze the trends and direction of the trade for selected agricultural commodities from Tamil Nadu. Port-wise export data of the major agricultural commodities from Tamil Nadu were used to assess the export dynamics during 2007-2022. Non-basmati rice, pulses and groundnut were selected for the study based on their significance in the state agriculture as well as in the export trade. The results of the study revealed that the export growth of pulses was the highest among the selected commodities with 21.8% and 28.1% in terms of quantity and value respectively followed by non-basmati with 16.27% and 20.1% in quantity and value terms respectively. However, the growth rate of export quantity of groundnut was negative with -0.1% whereas export value growth was positive with 5.9%. This revealed that export performance of pulses and non-basmati rice was better than groundnut. The Direction of export analysis revealed that Bangladesh and Benin for non-basmati rice, Sri Lanka, China and Singapore for pulses and Sri Lanka and Singapore for Groundnut would be the stable market for export from Tamil Nadu.

Keywords

agricultural exports; direction of trade; export performance; growth rate

Introduction

Tamil Nadu is the second largest economy in India, with a Gross State Domestic Product (GSDP) of Rs.3.15 million crores, of which the agricultural sector contributed 11.6% in 2022-23. Agriculture remains a primary occupation in the state, providing employment to 56% of the population. Employment in agricultural sector grew from 6.5 million in 2022 to 7.7 million in 2023, due to the reverse migration of workers from urban to rural areas after COVID-19 pandemic to secure livelihood in agriculture (1). Additionally, the export of agricultural and allied products has been significant, amounting to Rs. 0.73 lakh crores (USD 10 billion), with a positive net export balance in recent years (2). Over the decades, the state has experienced changes in crop production patterns due to climate and market factors. There has been positive growth in the production of rice, maize, banana, pulses, vegetables and fruits, whereas crops such as cotton, groundnut and sorghum have showed negative trends (3). Simultaneously, there has been a shift in the domestic demand

for agricultural commodities (4). However, the agricultural sector faces challenges due to environmental, economic and technological factors, which make farm incomes and livelihoods more vulnerable. Ensuring the sustainable development of the agriculture is essential for addressing the social and economic challenges in Tamil Nadu.

The implementation of schemes like the National Horticultural Mission (NHM) and Tamil Nadu Micro Irrigation Projects has significantly promoted the cultivation of fruits and vegetables in Tamil Nadu. Additionally, initiatives like the National Food Security Mission (NFSM) and National Mission on Edible Oils- Oil Palm (NIMEO-OP) have assisted to promote the production of cereals and oilseeds in the state. Infrastructure development for international trade like the development of processing facilities, improved road and rail networks and enhanced ports infrastructure, has provided opportunities to export agricultural commodities from the state. Among the commodities exported from the state, non-basmati rice, pulses and groundnut had a significant place due to the large area under these crops. The export of these commodities could help the state to diversify its market and reduce the dependency on a single commodity or market. Furthermore, this helps to stabilize the state's economy against global market fluctuations and trade imbalances. Hence, the paper focuses on export performance and trade direction of selected commodities from Tamil Nadu.

Materials and Methods

Among the various field crops cultivated in Tamil Nadu, rice was the major crop cultivated under 34.48% of the gross cropped area followed by pulses and groundnut with 12.64% and 5.61% respectively. These crops accounted for nearly 53% of the gross cropped area in the state. Hence, these crops were selected for this study to measure export performance and direction of trade. In this study, the port-wise data were collected from the Agricultural and Processed Food Products Export Development Authority (APEDA) Agri Exchange portal from 2007-2022 based on the availability of data to account for the export of selected crops from Tamil Nadu. Compound growth rate analysis and transition probability estimates were used to measure the export performance in this study. The study was performed during the year 2024.

Trend analysis

Growth rates of export quantity and value were calculated by fitting exponential growth function. Compound growth rate analysis was estimated using the formula $Y_{it} = A_i(l+r_i)^t$

$$Y_{it} = A_i(l + r_i)^t$$
(Eqn.1)

Where,

Y_{it} – Export quantity/value of ith crop at time t

r - Compound growth rate of Y_i

A_i - Initial year export quantity/value of ith crop

t - time in years

By taking natural logarithm of (Eqn.1) and adding disturbance term, equation can be written as $\ln Y_{it} = a_i + \beta_i t + U_i$

$$\ln Y_{it} = a_i + \beta_i t + U_i \qquad \text{(Eqn.2)}$$

Y_{it} = Export quantity/value of ith crop at time t

t = time in years

α. = constant term

β = regression co-efficient

This log linear function was fitted by using ordinary least square (OLS) method. The compound growth rate (r) was obtained using the formula $r_i = (\text{Antilog } \beta_i - 1) \times 100$. (5)

$$r_i = (\text{Antilog } \beta_i - 1) \times 100 \qquad \text{(Eqn.3)}$$

Direction of trade

The direction of trade is estimated using Markov chain analysis. The foundation of Markov chain analysis is the estimation of the transitional probability matrix P. In this matrix, the average exports to a given country were regarded as a random variable that depended only on its past exports to that country. The diagonal element P_{ij} measures the probability that a country's export share will be retained. Therefore, examination of this element indicates the loyalty of an importing country to a particular country's exports.

This was algebraically expressed as:

$$E_{jt} = \sum [E_{it} - 1] P_{ij} + e_{jt} \qquad \text{(Eqn.4)}$$

Where,

E_{jt} = Exports from India to the jth country in the year t

E_{it} = Export of ith country during the year t-1

P_{ij} = Probability that exports will shift from i^{th} country to j^{th} country

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

n=the number of importing countries

By analyzing the transition probabilities and initial state distribution, Markov chain analysis can provide insights into the long-term behaviour and trends of agricultural commodity exports, including patterns of growth, market dynamics and the impact of external factors on export patterns. This analysis can be valuable for forecasting future export trends, identifying potential risks and opportunities and informing strategic decision-making in the agricultural export sector(6).

Results and Discussion

Trends in export of major Agricultural commodities

Non-basmati Rice

Non-basmati rice is the major food crop cultivated in Tamil Nadu with an area of 21.58 lakh hectares. The state ranks seventh in the area and sixth in the production of rice in the country. It is also the major agricultural commodity exported from Tamil Nadu. The varieties like Matta, Sonamasuri and Ponni are predominantly exported non-basmati rice varieties from the state (7). However, the export ban of rice from India in 2007 and 2023 affected the export prospects of non-basmati rice which led to lower price realization in the absence of export opportunities and a shift toward alternative crops by the farmers. Hence, it is necessary to study the growth of non-basmati rice exports in quantity and value terms from 2007 to 2022. The results of variance and growth analysis of the export of non-basmati rice from Tamil Nadu are presented in Table 1 and Fig 1.

Table 1. Coefficient of variation and growth analysis for the export of selected commodities

S.No	Commodities	Mean		Standard deviation		Coefficient of variation		Compound Annual Growth Rate	
		Export Quantity	Export Value	Export Quantity	Export Value	Export Quantity	Export Value	Export Quantity	Export Value
1.	Non Basmati Rice	3.30 Lakh tonnes	1219.4 crores	3.0006	1383.55	90.8%	113.4%	16.27%	20.10%
2.	Pulses	0.09 Lakh tonnes	55.44 Crores	0.1154	68.10	161.1%	122.8%	21.68%	28.11%
3.	Groundnut	2.1 Lakh tonnes	1340.1Crores	0.64	520.42	30.5%	3.8%	-0.11 %	5.99%
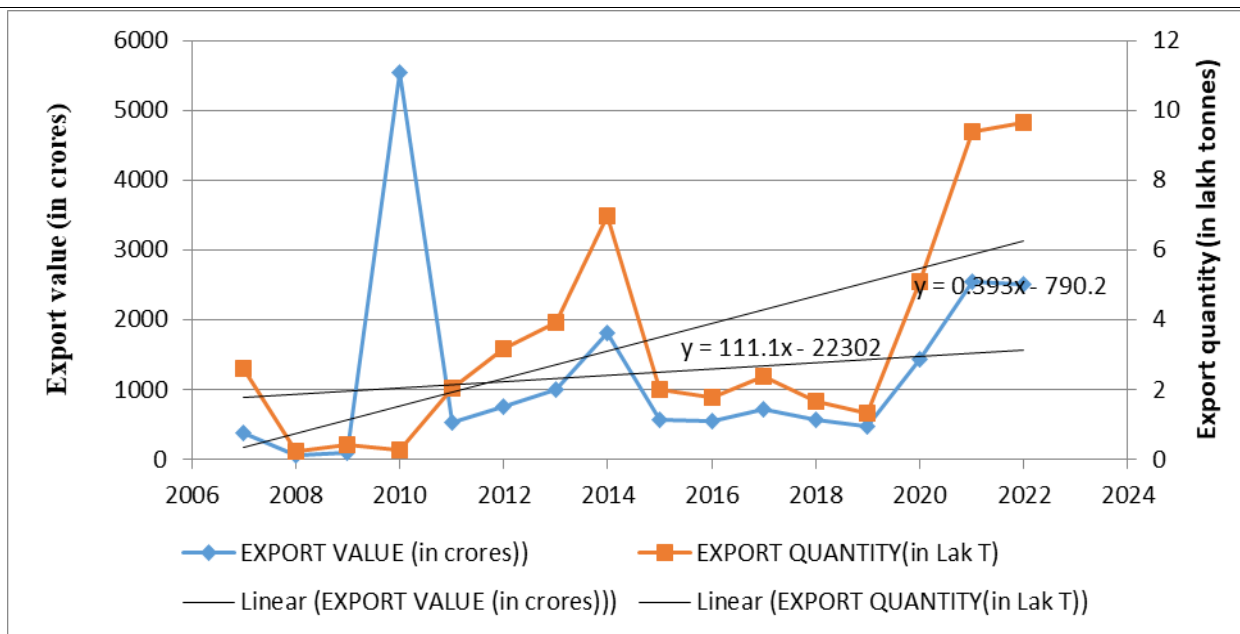
Fig. 1. Trends in export quantity and value of non-basmati rice from Tamil Nadu during 2007-2022.

The export quantity of non-basmati rice from Tamil Nadu increased drastically from 2.5 lakh tonnes in 2007 to 9.8 lakh tonnes in 2022. In consequence, the export value had also shown a positive growth trend during this period. It is evident from the results that exports reached a peak during 2014 and 2021. The increase in rice exports from Tamil Nadu during 2014 was attributed mainly due to higher yields and water availability, resulting in increased production. The growth rate of the export of rice was positive and significant with 16.27% and 20.10% per annum in terms of quantity and value respectively during 2007-2022. However, higher variation was found in terms of export quantity and value during the same period which was also aligned with the national trend (8).

Pulses

Global pulse production grew at 1.3% annually and per capita availability remained stagnant at around 6.5 kg/year (9). However, India experienced declining trends in exports during the recent decades (10). In Tamil Nadu state, pulses are the second most important field crop cultivated in 7.91 lakh hectares and major pulses are toor dal (pigeon peas), moong dal (green gram), urad dal (black gram) and chana dal (gram). Tamil Nadu's diverse agro-climatic zones provide the ideal conditions for pulse cultivation. The state has moderate to high rainfall zones supported by soil fertility and cropping patterns like rice fallow pulse and mixed cropping which are highly suitable for pulses production. This diversity ensures robust and competitive pulse production across the state. However, the value of exports from the states took around Rs.236 Crores which accounted for 4.1 per cent of the value of agricultural exports from India. Further, year-on-year variation was also found in export quantity and value

terms of state. Hence, variance and growth analysis for the export of pulses were carried out and results are presented in Table 1 and Fig. 2.

It could be observed from the results that export quantity and value were 0.17 lakh tonnes and 87.24 crores respectively in 2016 which was increased to 0.47 lakh tonnes with a value of 274.4 crores in 2021. Despite being the largest producer and consumer of pulses, India still imports 3-4 million tonnes annually to meet domestic demand (11). Due to favourable weather conditions and good agricultural practices, the pulse production in Tamil Nadu reached to new level in 2020-2021. This surplus production could have naturally led to an increase in exports. The compound growth rate of the value of export was 28.11% which was higher than the growth rate of quantity of export with 21.68 %. The change in the exchange rate of the importing countries could be the major reason for higher export growth in value terms. The coefficient of variation of the export quantity was the highest at 161.1% which was higher than the variation of export value (122.8%). It is inferred that despite the high growth rate, there was a high variation in export quantity as well as value.

Groundnut

India is the largest cultivator and second largest producer of groundnut and a major exporter, but quality issues like the presence of aflatoxin led to a decline in export in recent years (12). In Tamil Nadu, groundnut is an important oilseeds crop cultivated around 3.5 lakh hectares accounting for about one million tonnes of groundnut annually, contributing a significant portion of national production. India's overall groundnut
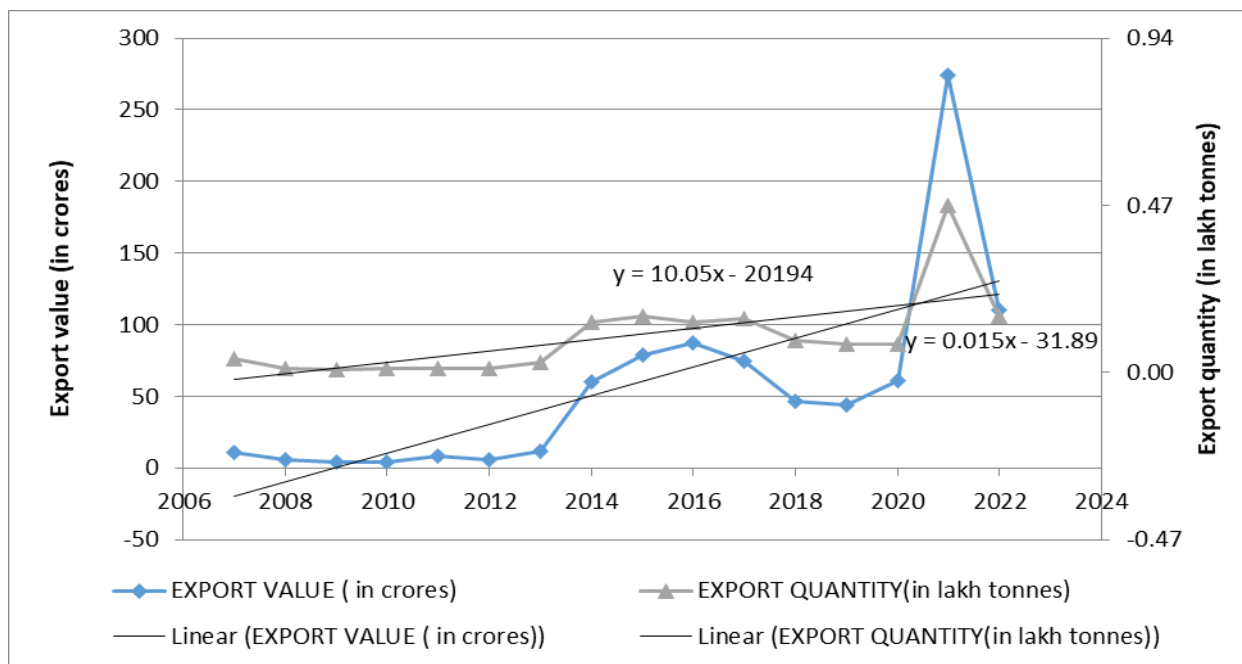
Fig. 2. Trends in export quantity and value of pulses from Tamil Nadu during 2007-2022.

production is around 10 million metric tonnes per year out of which Tamil Nadu contributed 10% of the country's output. The state's ability to meet international quality standards and its efficient export logistics played a crucial role in maintaining and expanding its international market presence. However, there is a variation in the export of groundnut from the state due to the change in domestic demand and production. Hence, variance and growth analysis of groundnut export from the state were performed and the results are presented in Table 1 and Fig. 3.

It is observed from the results that the export quantity and value of groundnut had gradually increased in Tamil Nadu during the study period. The export had reached a peak with 3.57 lakh tonnes accounting for 2094.23 crores during 2011. Though the export reached a peak in 2011, it declined during subsequent years due to quality issues, particularly aflatoxin content. The results of the study revealed that the compound growth rate of the export of groundnut was -0.11% and 5.99% per annum in quantity and value terms during 2007-2022. The results inferred that the groundnut export was stagnant in terms of quantity and positive and significant in terms of value. The coefficient of

variation was also higher (30.5%) in terms of export quantity than export value (3.8%). Hence, it is concluded that the groundnut export quantity was stagnant with moderate variation than the value of export.

Direction of trade in export of major agricultural commodities

Non-basmati Rice

India is a leading exporter of both basmati and non-basmati rice, with significant export volumes and values. Major destinations for non-basmati rice from India include Benin, Bangladesh and Senegal, while unstable markets are South Africa and Liberia (13). However, the non-basmati rice export was influenced by frequent changes in trade policies to meet the domestic demand. Hence, India is considered an unreliable import partner for many developing countries which need of food grains to feed its population. The export of non-basmati rice from Tamil Nadu contributes 10% of total rice export from India. The major rice importing countries from Tamil Nadu are Sri Lanka, Bangladesh, UAE, Benin and South Africa. Non-basmati rice from Tamil Nadu is highly competitive in terms of price which makes it attractive
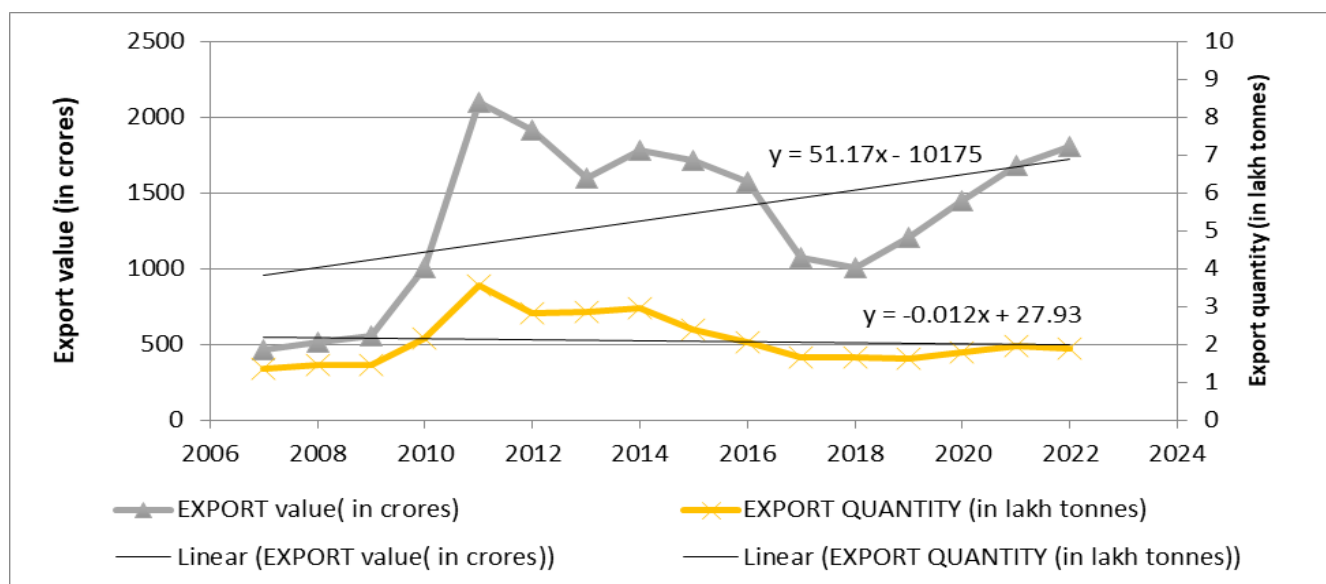

Fig. 3. Trends in export quantity and export value of groundnut in Tamil Nadu during 2007-2022.

for low-and middle-income countries like Bangladesh and Benin. The efficient production rice production system of the state gave an edge over international trade competitors like Thailand and Vietnam. In this condition, it is necessary to identify reliable import partners to meet the quality and quantity requirements and results are presented in Table 2.

It is inferred from the results that the high probability of retention of export share of other countries was 0.7663. However, the probability of retention share of the export was 0.2895 for Bangladesh and 0.2354 for Benin. The retention in exports could be attributed to high international prices due to the geo-political scenario, El Nino sentiments and extreme climatic conditions in other rice-producing countries (14). Bangladesh retains 28.9% of its import share and gains 49.7% from Sri Lanka and 39.7% from Benin however, it loses 44% of its import share to other countries and 14.2% share to Sri Lanka.

It is evident from the results that Benin retained 23.5% of the import share and it lost 39.7% and 29.4% to Bangladesh and other countries respectively. Likewise, other countries have a retention share of 76.6% and it gained 44.1% share from Bangladesh and 29% share from Benin. Therefore, it is concluded from the results that other countries, Bangladesh and Benin had a higher probability of retention. To sustain its position in the international market, Tamil Nadu needs to focus on these markets with competitive pricing, quality improvement and adherence to sanitary and phytosanitary standards.

Pulses

Despite stable domestic production, India faces a pulse shortage, necessitating imports to meet demand. However, the country's pulse exports have also shown growth in quantity and value, with key destinations including Pakistan, Bangladesh and the UAE (15). Pulse production of Tamil Nadu is about 5 lakh metric tonnes and export is 23.38 thousand tonnes annually. The state contributes two per cent of 28 million metric tonnes of the national production. The state exports pulses to many international markets, including the Middle East, Southeast Asia and parts of Africa and Europe. These regions are major consumers of pulses due to their dietary preferences and demand for protein-rich foods. Sri Lanka, UAE, China, Bangladesh and Singapore are the major international markets for pulses from the state. Hence, these countries were selected for the estimation of transition probabilities and the results are presented in Table 3.

The results of the transition probability matrix indicated that the probability of retention of import share of Sri Lanka was 85.9% followed by China with 60.4%. Sri Lanka gains 48.3% of its import share and would not lose its share to other countries. UAE retains 20.5% import share and gains 33.3% share from China and losses 57.2% to other countries and 11.8% to Bangladesh. China would also retain a major share of 60.4% and gain 58.5% from Singapore and lose 33.3% to UAE. Bangladesh would not retain any import share. Singapore retains 41.4% of its import share and eventually gains a negligible amount of share from other countries. It is concluded from the results that the probability of retention of import share was high among Sri Lanka, China and Singapore.

Groundnut

Groundnut exports from India have grown significantly growth to the Association of Southeast Asian Nations (ASEAN) region in recent years with Indonesia being the largest importer (16). The export from India is influenced by export price, exchange rate, domestic price and population. Tamil Nadu exports around 1.8 lakh tonnes of groundnut with a value of 1,964 crores per year which accounts for 27% of India's export. Groundnut is predominantly cultivated as a rainfed crop in the state and variation in rainfall affects the productivity frequently. The production surplus available for exports varies from year to year which makes the state unreliable among the importers. Groundnut from Tamil Nadu was exported to Malaysia, the Philippines, Vietnam, Singapore and Sri Lanka. The transition probability matrix was estimated for these countries to identify the reliable importers of groundnut and results are presented in Table 4.

The transition probability matrix indicates that Sri Lanka retains the maximum share of 61.2% and Vietnam retains 15.6% of the import share from Tamil Nadu. Malaysia would not retain any share and lose 99.8% share to other countries. Similarly, the Philippines would not retain any share of imports. Vietnam retains 15.6% of its import share and loses 78.2% share to other countries and 6% share to Singapore. Singapore would not retain any share but gain 38.7% from Sri Lanka and 6% from Vietnam. Sri Lanka retains a maximum share of 61.2% but loses 38.7% share to Singapore. Other countries gain 99.8% and 78.2% from Malaysia and Vietnam respectively. Hence, it could be concluded that Sri Lanka and Singapore would be the stable market for the export of groundnut from Tamil Nadu.

Table 2. Transition probability matrix for the export of non-basmati rice from Tamil Nadu (2007-2022)

Country	Sri Lanka	Bangladesh	UAE	Benin	South Africa	Others
Sri Lanka	**0**	0.49787	0.34485	0.00616	0	0.15164
Bangladesh	0.14236	**0.28954**	0.12597	0	0.00050	0.44192
UAE	1	0	**0**	0	0	0
Benin	0.07331	0.39729	0	**0.23567**	0	0.29087
South Africa	0	0	0	0	**0**	1
Others	0.23368	0	0	0	0	**0.76362**

Table 3. Transition probability matrix for the export of pulses from Tamil Nadu (2007-2022)

Country	Sri Lanka	UAE	China	Bangladesh	Singapore	Others
Sri Lanka	**0.85903**	0	0	0.07536	0.00342	0.06218
UAE	0.00087	**0.20587**	0.07987	0.11837	0.02203	0.57296
China	0	0.33354	**0.60405**	0.06240	0	0
Bangladesh	1	0	0	**0**	0	0
Singapore	0	0	0.58509	0	**0.41490**	0
Others	0.48337	0.00882	0	0	0.03022	**0.47757**

Table 4. Transition probability matrix for the export of groundnut from Tamil Nadu (2007-2022)

Country	Malaysia	Philippines	Vietnam	Singapore	Sri Lanka	Others
Malaysia	**0**	0	0	0	0.00128	0.99871
Philippines	1	**0**	0	0	0	0
Vietnam	0	0	**0.15689**	0.06012	0	0.78298
Singapore	0	0	0	**0**	0	1
Sri Lanka	0	0	0	0.38744	**0.61255**	0
Others	1	0	0	0	0	**0**

Conclusion

The results revealed that exports of non-basmati rice and pulses had grown 16.7% and 21.68% in quantity terms and 20.1% and 28.11% in value terms, respectively in Tamil Nadu. However, groundnut exports exhibited a marginal decline in quantity (-0.11%) but moderate growth in value (5.99%) in the study period. Furthermore, the high coefficients of variation in export quantity and value with 161.1% for pulses and 90.8% for non-basmati rice indicated substantial volatility in export performance of these commodities. Hence, efforts need to be taken to ensure adequate domestic surplus for export and development of stable export policy for sustained growth of these commodities. Additionally, the cost of production of commodities needs to be stabilized to be competitive in the international market. The trade analysis revealed that there were stable importers for the selected commodities. Hence, policymakers and stakeholders should focus on enhancing trade relationships with these countries to capitalize on their consistent demand.

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Authors' contributions

Conceptualization was done by GR, CV Methodology finalized by CV, MP Validation done by CM. Formal analysis was made by CV; Investigation was done by GR. Resources made available by RP. Data curation was done by CV. Writing-original draft was done by GR review & editing was done by CV. Visualization made by GR. Supervision and project administration were done by CV. All authors reviewed the final version and approved the manuscript before submission.

Compliance with ethical standards

Conflict of interest: Authors do not have any conflict of interests to declare.

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References

1. Delhi. Press Information Bureau. Government of India, Ministry of Finance;2024[cited 2024 Dec 2]. Available from: https://pib.gov.in/Pressreleaseshare.aspx?PRID=2034946

2. Chidambaranar Port VO. Thoothukudi. Tamil Nadu export promotion strategy. Government of Tamil Nadu; 2021 [Cited 2024 Dec 2].

3. Senthilnathan S, Elamathy S, Kiruthika N, Gurunathan S, Prahadeeswaran M, Rameshkumar D, Krishnakumare B. Economic analysis of agricultural growth and crop diversification in Tamil Nadu. International Journal of Plant & Soil Science. 2022;34(19):370-76. https://doi.org10.9734/ijpss/2022/v34i19312900

4. Suresh A, Mathur V.C. Export of agricultural commodities from India: Performance and prospects. The Indian Journal of Agricultural Sciences. 2016;86(7):876-83. https://doi.org/10.56093/ijas.v86i7.59741

5. Velavan C, Balaji P. Crop diversification in Tamil Nadu-a temporal analysis. Agricultural Situation in India. 2012;78(12):655-58.

6. Murthy DS, Subrahmanyam K. Onion exports markets and their stability for increasing India's exports Markov chain approach. Agricultural Economics Research Review. 1999;12(2):118-28.

7. Velmurugan M, Velavan C, Sivakumar S. Growth, Instability and structural changes of non-basmati rice exports from Tamil Nadu ports. *Arthshastra:* Indian Journal of Economics & Research.2016;5(4):11-19. https://doi.org/10.17010/aijer/2016/v5i4/100768

8. Suman J, Singh SP, Sheela K, Kumar VD. Growth instability and comparative advantage in export of Indian rice. International Journal of Social Sciences. 2022;11(04):213-18. https://doi.org/10.46852/2249-6637.04.2022.3

9. Joshi PK, Rao PP. Global and regional pulse economies: current trends and outlook. Washington D.C International Food Policy Research Institute. IFPRI Discussion Paper 01544; 2016.

10. Maharjan NK, Grover D. Growth trends and direction of international trade of pulses in India- a Markov chain approach. Indian Journal of Economics and Development. 2019;15(1):84-90. https://doi.org/10.5958/2322-0430.2019.00009

11. Barik AK. Pulse cultivation-A venture for food, nutrition and livelihood. International Journal of Bio-resource and Stress Management. 2021;12(2):1-2. https://doi.org/10.23910/1.2021.2192b

12. Bansal RK, Gondaliya VK, Shaikh AS. A review of the status of the groundnut production and export of India. Indian Journal of Economics and Development. 2017;13(2):369-74. https://doi.org/10.5958/2322-0430.2017.00190.1

13. Satishkumar M, Harishkumar HV, Rangegowda R. Growth, export performance and competitiveness of basmati and non-basmati rice of India-a Markov chain approach. International Journal of Agriculture, Environment and Biotechnology. 2016;9(2):305-11. https://doi.org/10.5958/2230-732x.2016.00040.1

14. Delhi. Press Information Bureau. Ministry of Consumer Affairs, Food and Public Distribution. Centre amends export policy of non-basmati white rice to ensure adequate domestic availability at reasonable prices. 2023; [cited 2024 Dec 2]. Available from: https://www.pib.gov.in/PressReleasePage.aspx?PRID=1941139

15. Divya K, Prahadeeswaran M, Malarkodi M, Uma K, Kavitha M, Vishwa KS. Comprehensive analysis of production and import dependency

of pulses in India. *Legume Research: An International Journal.* 2024; 47(6):996-01. https://doi.org/10.18805/lr-5294

16. Palanisingh V, Vijayalakshmi R, Sathishkumar R, Palanichamy V. Groundnut exports of India direction and trends. *International Journal of Scientific and Technology Research.* 2020;9(6):397-00.