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# Dynamics of Area, Production, Productivity and Export of Rice in India

**Shreeshail Rudrapur[1*] and Deepa Hiremath[2]**

[1]Dept. of Agricultural Economics, COA, Navsari Agricultural University, Waghai (394 730), India
[2]Dept. of Agricultural Economics, COA, Navsari Agricultural University, Bharuch (392 012), India

**Corresponding Author**

Shreeshail Rudrapur
*e-mail*: shree4476@gmail.com

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**Abstract**

The study was conducted for the period of 20 years (2004–05 to 2023–24) and over 15 years (2008–09 to 2022–23) for its exportto know the growth rate and instability in area, production and productivity of rice.The study was based on secondary data. The data was collected from different e-resources. Compound annual growth rate and instability index analysis were used for the analysis and interpretation of the results.The major findings of the study showed that the growth rate in productivity was higher than the growth rate in area under rice cultivation. A low instability index indicated that the area, production and productivity of rice were relatively stable with minimal fluctuations. The study also revealed that the export of both basmati and non-basmati rice showed significant positive growth rate. The growth rate and instability in export of non-basmati rice were found to be more than the growth rate in basmati rice. India is the major producer of basmati rice, Indian farmers and traders need to make use of this opportunity to earn more profit through the production of quality product, its standardisation and market diversification. Export earnings of rice is the major source of foreign exchange as far as agriculture commodities are concerned that stabilises the balance of payment of the country and hence Indian export policies need to encourage the farmers in producing and supplying export quality basmati and non basmati rice by reducing export restriction, streamlining export procedures and addressing quality concerns.

***Keywords:*** Area, export, growth, instability, production, productivity, rice

## 1. Introduction

Rice (*Oryza sativa*) is the most widely consumed staple food of more than half of the world's population especially in Asia,Sub-Saharan Africa and South America (Anonymous, 2025b). Rice was the world's third most produced agricultural commodity with 756 mt in 2019 behind sugarcane and maize (Anonymous, 2022). Around 90% of world's total rice production has been recorded from Asian countries (Ashkra et al., 2023). Production of rice has huge impact on food and nutrition security in India and World (Tiwari et al., 2023). Rice serves as source of income for worldwide population (Norhashila, et al., 2024). Most countries were unprepared for the significant increase in food prices when the food crisis of 2007 to 2008 hit, particularly the price of rice (Nodin et al., 2022). Asia dominates in the world's rice area as well in production with 90% and 92%, respectively and hence Asian countries take immense pride in vibrant rice farming system in the world. China and India dominate the world's rice production, both accounting for over half of the global output followed by Bangladesh, Indonesia, Vietnam, Thailand, and the Philippines (Anonymous, 2025a). Rice constitutes around 44% of total food grain consumption in the country and occupies 23% of gross sown area of India (Satishkumar et al., 2016). In India, the area under rice crop has been increased from 30.81 mha in 1950–51 to 46.28 mha in 2021–22. The rice production also registered a substantial increase from 20.58 mt during 1950–51 to 129.47 mt in 2021–22. India is the second largest producer of rice in the world after china and ranks first in its export and is projected to reach around 40% of total rice exports during 2022–23. Since 2010, India's rice production has increased by 40% by over 40 mt, to a grand total of 136 mt, making it the second largest producer in the world after China's 146 mt. Rice export from India rose by 20 mt during the same period (Anonymous, 2023). There are around 40000 varieties of rice worldwide and out of which India produces around 6000 varieties and these varieties broadly categorized into Basmati and Non-Basmati rice. The Basmati rice known as queen of scents is grown in the fields of Himalayan foothills. All rice other than Basmati rice is called non-basmati rice and is grown in the southern regions of the

Indian sub-continent. The major Basmati rice producing states within the country are Punjab, Haryana, Uttar Pradesh, Jammu and Kashmir and Uttarakhand. In the international market the rice is being traded under two main categories like basmati known for its aroma, fragrance and taste and non-basmati. Basmati rice exports are in three categories like white, brown and parboiled. Basmati rice constitutes foremost share of total exports from India.It is crucial for understanding the vital role in domestic food security, supporting millions of livelihood, driving economic growth, and maintaining its position as major global rice producer. Since India is the world's leading exporter and significantly influencing global food security and national economy, the study on export trends of rice from India and its stability analysis is also crucial. Thus, with this backdrop, the present study was undertaken to study the growth as well as stability in area, production, productivity and export of rice from India.

## 2. Materials and Methods

The study was based on secondary data on area, production, productivity of rice over a period of 20 years (2004–05 to 2023–24) and export of Indian Basmati and non-basmati rice over the period of 15 years (2008–09 to 2022–23) based on the availability of data on different e-resources.According to the availability of data, area, production and productivity of total rice was considered for the study and for export, it was categorised into basmati and non basmati since Indian rice was being exported in these two main categories. The data was collected from different e-resources like Agricultural Processed Products Export Development Authority (APEDA), World Integrated Trade Solution (WITS), and Indiastat.

### *2.1. Growth rate analysis*

For computing compound annual growth rate of area, production, productivity and export of Indian rice, the exponential function of the following form was used.

$$Y=a\ b^{t}e^{Ut} \quad \text{.....(1)}$$

Where,

Y=Area/production /productivity/export

a=Intercept

b=Regression coefficient

'a' and 'b' are the parameters to be estimated

t=time period

$U_t$=Disturbance term in year 't'

The equation (1) was transformed into log linear form and written as;

$$\log Y=\log a+t \log b+U_t \quad \text{.....(2)}$$

Equation (2) was estimated by using Ordinary Least Squares (OLS) technique.

Compound annual growth rate (g) was then computed by using the formula;

$$g=(b-1)\times 100 \quad \text{.....(3)}$$

Where,

g: Compound growth rate in per cent per annum

b: Antilog of log b

The standard error of the growth rate was estimated and tested for its significance with student's t test.

### *2.2. Instability*

*Analysis*The coefficient of variation was used as measure of the variability in area under cultivation, production, productivity and export of rice. The coefficient of variation or index of instability was computed by using the following formula;

$$CV=(\text{Standard deviation }(\sigma)/\text{Mean }(\bar{X}))\times 100 \quad \text{.....(4)}$$

Linear trend was fitted to the original data of area, production, productivity and export of rice from the country. The trend coefficients were tested for their significance. Whenever the trend of series found to be significant; the variation around the trend rather than the variation around mean was used as an index of instability. The formula suggested by Cuddy and Della was used to compute the degree of variation around the trend. The Coefficient of variation was multiplied by the square root of the difference between the unity and coefficient of multiple determinations ($R^2$) to obtain the Instability Index.

$$\text{Instability index } (I_x)=CV\times\sqrt{(1-R^2)} \quad \text{.....(5)}$$

## 3. Results and Discussion

### *3.1. Growth and stability in area, production and productivity of rice in India*

Growth rates and instability index of area, production and productivity of rice in India for the period of 20 years (2004–05 to 2023–24) were worked out and were represented in Table 1. It was evident from the table that the area under rice was 41907 t ha during 2004–05 and has been increased to 47828 t ha during 2023–24 with the growth rate of 0.42% per annum. The table also indicated that the production of rice in India was also increased from 83131 to 137824 thousand tonnes during 2023–24 with the annual growth rate of 2.29%. The productivity of rice in India was increased from 1.98 t $ha^{-1}$ to 2.88 t $ha^{-1}$ during the study period with the annual growth rate of 1.86%.

In order to analyse the stability in growth performance of these variables, an instability index for each variable was worked out and depicted in the Table 1. The instability indices for area, production and productivity of rice in India were found to be 2.68%, 3.92% and 2.24%, respectively and these low instability indices indicate that the variables like area, production and productivity of rice in India were relatively stable.

An increase in the area under rice cultivation in India was found to be 0.42% $annum^{-1}$ during the period of 20 years under consideration**.** There might not be significant change

Table 1: Area, production and productivity of rice in India

| Year | Area (000' ha) | Production (000' t) | Productivity (t $ha^{-1}$) |
|---|---|---|---|
| 2004–05 | 41907.00 | 83131.00 | 1.98 |
| 2005–06 | 43656.80 | 91794.00 | 2.10 |
| 2006–07 | 43813.60 | 93355.10 | 2.13 |
| 2007–08 | 43914.40 | 96692.90 | 2.20 |
| 2008–09 | 45536.70 | 99182.50 | 2.18 |
| 2009–10 | 41918.40 | 89093.00 | 2.13 |
| 2010–11 | 42862.40 | 95970.00 | 2.24 |
| 2011–12 | 44006.00 | 105301.00 | 2.39 |
| 2012–13 | 42753.90 | 105241.40 | 2.46 |
| 2013–14 | 44135.90 | 106645.50 | 2.42 |
| 2014–15 | 44110.10 | 105481.90 | 2.39 |
| 2015–16 | 43499.20 | 104408.20 | 2.40 |
| 2016–17 | 43993.40 | 109698.40 | 2.49 |
| 2017–18 | 43774.07 | 112757.61 | 2.58 |
| 2018–19 | 44156.44 | 116477.82 | 2.64 |
| 2019–20 | 43662.30 | 118870.32 | 2.72 |
| 2020–21 | 45768.69 | 124368.32 | 2.72 |
| 2021–22 | 46278.68 | 129471.42 | 2.80 |
| 2022–23 | 47832.00 | 135755.00 | 2.84 |
| 2023–24 | 47828.29 | 137824.58 | 2.88 |
| CAGR | 0.42*** | 2.29*** | 1.86*** |
| Instability index | 2.68 | 3.92 | 2.24 |

***: Indicates significance at $p$=0.01 level

in the overall context of rice area over 20 years but the area under rice in India was already substantial as mentioned by National Food Security Mission (NFSM). The increase in area under rice was positive but minute and this might be due to the fact that the 85% of rice in India was cultivated under rainfed conditions and due to erratic behaviour of monsoon over the last two decades. The other reasons for small growth rate in rice cultivation in India might be due to shifting of farmers to other cash crops where they were expecting export opportunities and fetching higher returns due to high international prices. Growth rates of production and productivity of rice in India were found to be positive, comparatively high and significant. The reasons for increased growth in production and productivity of rice might be due to the factors like use of improved agronomic practices, high yielding varieties and improved infrastructural facilities for farming. The results were in line with the findings of Singh et al. (2021).

The instability indices for area, production and productivity of rice in India were found to be less, indicating that these variables were more or less stagnant and relatively consistent with no much fluctuation during the period under investigation. This might be due to the technological advancements, shifting cropping patterns, government support and efficient supply chain. These results were found to be with mixed findings of Singh et al. (2021) where the instability index of area under rice was less and it was more in case of production and productivity.

### *3.2. Growth and stability in export of rice from India*

Apart from the area, production and productivity, the growth and stability in export of rice was also estimated and the results were represented in Table 2. As far as export of rice was concerned, the rice was being traded as basmati and non basmati in the international market and hence an attempt was made to study the export of rice under two sub-categories like Basmati and Non-Basmati Rice. It was evident from the table that the growth in export quantity as well as export value of non-basmati rice was more (30.90% and33.79%, respectively) compared to that of basmati rice (6.34% 8.91%, respectively). The annual growth rates of export quantity and export value to total rice were found to be 15.67% and 14.61%, respectively. The results were in line with the findings of Tiwari et al. (2023) where the growth rate in export quantity and export value of basmati rice were also found positive.

Cursory look at the table indicated that the significantly high instability was observed in case export quantity and export value of non-basmati rice (48.04% 48.19%, respectively) followed by low/medium instability in case of export quantity and export value of basmati rice (13.76% 18.04%, respectively). The instability indices of export quantity and export value of total rice were found to be 27.53% and 22.38%, respectively.

Export of basmati and non basmati rice in terms of both export quantity and export value had recorded a highly significant growth at 1% level of significance during the study period. The significant positive growth rate in export of basmati rice was due to the increased demand for basmati rice in the international market because of its superior taste and aroma. There was a continuous increased demand for Indian basmati rice and new international markets were emerged during the study period. In order to maintain the price position in the world Basmati trade, India would have to take effective steps to enhance the production of Basmati rice through expansion in area and improving productivity. This gave huge potential for India in exporting Basmati rice to the world. At the same time, export of basmati rice from India showed low to medium instability index indicating that the export quantity was relatively stable and moderate variability and fluctuations in the export value but these fluctuations were not excess. The results were found to be with mixed findings of Jeetendra et al. (2022) where the instability index was very high.

The significant positive growth rate in export of non-basmati

Table 2: Export of rice from India

| Year | Basmati rice | | Non-basmati rice | | Total rice | |
|---|---|---|---|---|---|---|
| | Export qty in 000' mt | Export value in Crore ₹ | Export qty in 000' mt | Export value in Crore ₹ | Export qty in 000' mt | Export value in Crore ₹ |
| 2008–09 | 1556.41 | 9477.03 | 931.88 | 1687.37 | 2488.29 | 11164.40 |
| 2009–10 | 2016.78 | 10889.13 | 139.54 | 365.30 | 2156.32 | 11254.43 |
| 2010–11 | 2370.66 | 11354.63 | 100.69 | 231.29 | 2471.34 | 11585.92 |
| 2011–12 | 3178.17 | 15449.60 | 3997.72 | 8659.13 | 7175.89 | 24108.72 |
| 2012–13 | 3459.90 | 19409.39 | 6687.99 | 14448.81 | 10147.89 | 33858.20 |
| 2013–14 | 3757.27 | 29299.96 | 7133.18 | 17749.96 | 10890.45 | 47049.92 |
| 2014–15 | 3702.26 | 27597.89 | 8274.05 | 20428.54 | 11976.31 | 48026.43 |
| 2015–16 | 4045.82 | 22718.60 | 6464.57 | 15483.39 | 10510.39 | 38201.99 |
| 2016–17 | 3985.20 | 21512.91 | 6770.80 | 16929.88 | 10756.00 | 38442.79 |
| 2017–18 | 4056.76 | 26870.17 | 8648.49 | 22967.82 | 12705.25 | 49837.99 |
| 2018–19 | 4414.58 | 32804.30 | 7599.67 | 21185.28 | 12014.26 | 53989.58 |
| 2019–20 | 4454.66 | 31025.88 | 5040.71 | 14364.66 | 9495.36 | 45390.54 |
| 2020–21 | 4630.46 | 29849.89 | 13095.13 | 35476.61 | 17725.59 | 65326.50 |
| 2021–22 | 3948.16 | 26416.54 | 17262.24 | 45652.35 | 21210.40 | 72068.89 |
| 2022–23 | 4558.97 | 38524.11 | 17786.09 | 51088.72 | 22345.06 | 89612.83 |
| CAGR | 6.34*** | 8.91*** | 30.90*** | 33.79*** | 15.67*** | 14.61*** |
| Instability Index | 13.76 | 18.04 | 48.04 | 48.19 | 27.53 | 22.38 |

***: Indicates significance at *p*=(0.01) level

rice from India might be due to the factors like competitive pricing, high quality production, growing global demand, favourable climatic conditions and increased production and diversification of export markets. At the same time the export of non-basmati rice from India was highly unstable during the study period. This might be as a result of higher inter-year fluctuations in demand, price competitiveness in international markets, whereas rice production and consumption remained more or less stable during the study period (Velmurugan, 2016). Non-basamti rice export from India also suffered much due to the competition from other countries like Thailand, Vietnam, China, Japan, and Pakistan because of their low cost of production (Udhayakumar and Karunakaran, 2020).

## 4. Conclusion

The area, production, productivity and export of rice showed a positive growth rate and all these variables found to be significant at *p*=0.01 level. Area, production and productivity of rice were found to be stable with least fluctuations. On the other hand export of rice was found to be highly instable and showed more fluctuations due to changes in government export policies, global demand and price volatility in the international market.

## 5. References

Anonymous, 2022. World Economic Forum. Available from: http://www.weforum.org/stories/2022/03/visualising-the-world-s-biggest-rice-producers/. Assessed on: 9th March 2022.

Anonymous, 2023. India's new ban on rice exports: Potential threats to global supply, prices, and food security. Available from: https://www.ifpri.org/blog/indias-new-ban-rice-exports-potential-threats-global-supply-prices-and-food-security/. Assessed on: 25th July, 2023.

Anonymous, 2025a. Major rice producing countries. Available from: https://iref.net/major-rice-producing-countries/. Assessed on: 1st July 2025

Anonymous, 2025b. Rice-rice sector at a glance. Available from:https://www.ers.usda.gov/topics/crops/rice/rice-sector-at-a-glance. Assessed on: 1st July 2025.

Ashkra, Khan, A.A., Kumar, J.K.,2023. Estimating the potential effect of climate change on rice yield in India by considering the combined effects of temperature and rainfall. Bharatiya Krishi Anusandhan Patrika 38(3), 284–289. DOI: 10.18805/ BKAP649.

Jeetendra, S., Shekhawat, P.S., Kharkwal, S., Verma, D.K., 2022. Growth, instability and comparative advantage in export of Indian rice. International Journal of Social Sciences 11(4), 213–218. DOI: 10.46852/2249-6637.04.2022.3.

Nodin, M.N., Mustafa, Z., Hussain, S.I., 2022. Assessing rice production efficiency for food security policy planning in Malaysia: A non-parametric bootstrap

data envelopment analysis approach. Food Policy 107, 102208. DOI: 10.1016/j.foodpol.2021.102208.

Norhashila, H., Maimunah, M.A., Muhammad, R.M., Ahmad, F.A., Aimrun, W., Muhamad, S., Mohd, K., Askiah, J., 2024. Smart farming for sustainable rice production: An insight into application, challenge and future prospect. Rice Science 31(1), 47–61. DOI: 10.1016//j.rsci.2023.08.004.

Satishkumar, M., Harishkumar, H.V., Ramesh, Rangegowda, R., 2016. Growth, export performance and competitiveness of basmati and non-basmati rice of India-anmarkov chain approach. International Journal of Agriculture, Environment and Biotechnology 9(2), 305–311. DOI: 10.5958/2230-732X.2016.00040.1.

Singh, K.M., Ahmad, N., Pandey, V.V., Kumari, T., Singh, R., 2021. Growth performance and profitability of rice production in India: An assertive analysis. Economic Affairs 66(3), 481–486. DOI: 10.46852/0424-2513.3.2021.18.

Tiwari, A., Choudhary, V.K., Pandey, N., Suryakant, C., 2023. Analysis on area, production, productivity and export competitiveness of basmati rice in India. International Journal of Statistics and Applied Mathematics 8(6), 6–9. DOI: 10.22271/maths.2023.v8.i6Sa.1346.

Udhaykumar, M., Karunakaran, K.R., 2020. Growth and stability of basmati and non-basmati rice export in India. Current Journal of Applied Science and Technology 39(40), 9–18. DOI: 10.9734/cjast/2020/v39i4031107.

Velmurugan, M., Velavan, C., Sivakumar, S.D., 2016. Growth, instability and structural changes of non-basmati rice exports from Tamil Nadu Ports. Arthshatra Indian Journal Economics and Research 5(4), 11. DOI: 10.17010/aijer/2016/v5i4/100768.