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Research Paper

Food Grains: A case study of Rice in India

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Abstract
Food security has emerged as a priority across nations, prompting the implementation of various missions to enhance the yield and quality of food grains. Rice, a staple food for a large segment of India's population, has been selected for this study. The analysis focuses on the growth of production, area, and yield of rice in India using secondary data. Results indicate that production, area, and yield increased by 1.18, 1.04, and 1.14 times respectively, with low coefficients of variation (0.06, 0.02, and 0.05), suggesting very marginal fluctuations during the study period. Chi-square test results reveal that the calculated values for production and area are lower than the table values at both 1% and 5% significance levels, indicating insignificant growth. However, the chi-square value for yield (63) exceeds the table value, confirming significant growth in rice yield. The findings offer useful insights for policymakers aiming to stabilize and enhance India's food grain performance.

Key Words: ***Food grain; Rice, Yield.***

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I. Introduction

The agricultural sector plays a pivotal role in the economic development of nations, particularly developing economies like India. Among food grains, rice holds a unique position due to its dominance in the Indian diet and its contribution to the agricultural economy. Historically regarded as one of the earliest cultivated crops, rice remains central to India's food security framework. With a large vegetarian population depending on food grains as their primary source of nutrients, improving rice production is vital to ensuring adequate supply, enhanced income, and broader socio-economic development.

Government strategies have consistently emphasized increasing productivity, generating rural employment, and improving farmers' income. Against this backdrop, the present study examines in rice production, area under cultivation, and yield, thereby assessing whether growth has occurred over the past decade.

II. Review of Literature

Anjani Kumar, Rajini Jain (2013), in their study, 'Growth and Instability in Agricultural Productivity: A District Level Analysis' observed trends; growth and instability at the district level in Indian agriculture and identified drivers of productivity growth across districts.

NeerjaDhingra (2015), in research article on 'Yield of Principal Crops in India: Growth and Trends' examined in his study that there are serious yield gaps in India. As the yield rate increases, the cost of production would decline and the market prices would stabilize at a lower level. He observed that in cases of rice and wheat which are the major constituents of food grains CAGR is 1.97 and 1.35 respectively. In case of cereals and pulses it is 2.34 and 2.44 respectively.

Dr B.Bondyalu (2017), in his study on *'Food Grains Production Growth Rates and Availability of Per-capita Food Grains in India – A Macro Level Study'* resulted that the decade-wise food grains production in India not even, proportion of Rice, wheat and Cereals are the major food grins. He found that during the 70 years of Independent India food grains production raised by more than 5 times. Share of Rice & Wheat is significant whereas shares of Pulses is insignificant. Population is increased more than 104 cr as such the availability of per-capita food grains not much increased is only 2.0 of growth rates

NeelamKumari, V.P. Mehta and J.K. Bhatia (2020) in their study, 'Foodgrains Production in India: Trend and Decompositions Analysis' observed that there is positive and significant growth rates for production and productivity of all major food grains except jowar. It is found that area under wheat, maize and gram is increased however the area under jowar and bajra decreased. during the study period. They observed that positive growth rate of area of rice, wheat maize, jowar and gram is associated with positive growth rate of yield.

Sajeev U, Vidya T. (2020) concluded in their study on the topic *'Agricultural Production in India: An Anlysis of Food Grains and Non-Food Grains Production'* that there was a slow trend is increase in production, fall in area of land use under cultivation. Also observed a positive relationship between agriculture production of food grains and yields.

Mr.Venkataraju, S.N. and Prof. D.V.Gopalappa(2021), in their research paper on *'The Performance of Foodgrain Crops in India over a Period of Time'* that there is a positive and significant growth rates for production and productivity of all major food grain crops, but the production of jowar, barley and total small millets are negative. They also noticed that wheat and maize have shown the increase in area, yield and production it may be due to its increasing demand for industrial usage.

ChandralekhaGhosh andMazumder (2021-22), in their research paper on *'Profitability of Rice Production across Indian States'* concluded that the profits are having positive association with farm size while the irrigation cost has negative impact on profitability.

Objectives of the Study

1. To examine the growth in rice production, area, and yield in India.
2. To test whether the production, area, and yield of rice are increasing over the study period.

Hypotheses of the Study

- **H01**: The production of rice in India is not increasing over the study period.
- **H02**: The area under rice in India is not increasing over the study period.
- **H03**: The yield of rice in India is not increasing over the study period.

III. Methodology

The study is entirely based on secondary data related to rice production, area, and yield in India for the period **2011–12 to 2020–21**. The data were sourced from the Ministry of Agriculture, Government of India. Analytical tools such as mean, coefficient of variation (C.V.), index numbers, and chi-square tests were employed to evaluate the objectives.

IV. Analysis and Discussion

The data analysed have been presented in different tables reflecting upon the various objectives of the study.

Table -1 Growth analysis of production, area and yield of Rice in India

Year	Production (Million Tonnes)	Index	Area (Million Hectares)	Index	Yield (Kg/Hectares)	Index
2011-12	105.30	100	44.01	100	2393	100
2012-13	105.23	99.93	42.75	97.14	2461	102.84
2013-14	106.65	101.28	44.14	100.30	2416	100.96
2014-15	105.48	100.17	44.11	100.23	2391	99.92
2015-16	104.41	99.15	43.5	98.84	2400	100.29
2016-17	109.70	104.18	43.99	99.95	2494	104.22
2017-18	112.76	107.08	43.77	99.45	2576	107.65
2018-19	116.48	110.62	44.16	100.34	2638	110.24
2019-20	118.87	112.89	43.66	99.20	2722	113.75
2020-21	124.37	118.11	45.77	104.00	2717	113.54
Mean	110.925		43.986		2520.8	

C.V.	0.06		0.02		0.05	

Source: Ministry of Agriculture, GOI

Table No.1 shows growth analysis of production, area and yield of Rice in India over the reference period. Growth of production noticed to be 1.18 times with c.v. value 0.06. Area has grown to be 1.04 times with c.v. value 0.02. Yield of Rice has risen about 1.14 times with c.v. value 0.05. C.V. values proves that there is very slight variation in the growth of production ,area and yield during the study period.

Table -2 Analysis of production of Rice in India

Year	O	E	O-E	$O-E)^2$	$(O-E)^2$ /E
2011-12	105.3	110.925	-5.625	31.64	0.29
2012-13	105.23	110.925	-5.695	32.43	0.29
2013-14	106.65	110.925	-4.275	18.28	0.16
2014-15	105.48	110.925	-5.445	29.65	0.27
2015-16	104.41	110.925	-6.515	42.45	0.38
2016-17	109.7	110.925	-1.225	1.50	0.01
2017-18	112.76	110.925	1.835	3.37	0.03
2018-19	116.48	110.925	5.555	30.86	0.28
2019-20	118.87	110.925	7.945	63.12	0.57
2020-21	124.37	110.925	13.445	180.77	1.63
Chi-Square test					3.91

Source: Authors' calculation

Where, O = Observed Frequencies, E= Expected Frequencies
In table no. 2 observed that production of Rice in India from 2011-12 to 2020-21. Chi Square test value 3.91 is less than the table value at one t and five percent level of significance. It proves that hypotheses (H01) is accepted. It may be concluded that production of rice in India has not increasing during the study period.

Table 3 Analysis of Area of Rice in India

Year	O	E	O-E	$O-E)^2$	$(O-E)^2$ /E
2011-12	44.01	43.986	0.024	0.001	0.000
2012-13	42.75	43.986	-1.236	1.528	0.035
2013-14	44.14	43.986	0.154	0.024	0.001
2014-15	44.11	43.986	0.124	0.015	0.000
2015-16	43.50	43.986	-0.486	0.236	0.005
2016-17	43.99	43.986	0.004	0.000	0.000
2017-18	43.77	43.986	-0.216	0.047	0.001
2018-19	44.16	43.986	0.174	0.030	0.001
2019-20	43.66	43.986	-0.326	0.106	0.002
2020-21	45.77	43.986	1.784	3.183	0.072
Chi-Square test					0.12

Source: Authors' calculation

Table 3 reported the analysis of area of rice in India. The chi-square test value (0.12) is less than the table value at one and five per-cent level of significance. It proves that null-hypothesis (H02) is accepted. Hence, area of rice has not been increasing under the study period.

Table -4 Analysis of Yield of Rice in India

Year	O	E	O-E	$(O-E)^2$	$(O-E)^2/E$
2011-12	2393	2520.8	-127.8	16332.84	6.479
2012-13	2461	2520.8	-59.8	3576.04	1.419
2013-14	2416	2520.8	-104.8	10983.04	4.357
2014-15	2391	2520.8	-129.8	16848.04	6.684
2015-16	2400	2520.8	-120.8	14592.64	5.789
2016-17	2494	2520.8	-26.8	718.24	0.285
2017-18	2576	2520.8	55.2	3047.04	1.209
2018-19	2638	2520.8	117.2	13735.84	5.449
2019-20	2722	2520.8	201.2	40481.44	16.059
2020-21	2717	2520.8	196.2	38494.44	15.271
Chi-Square test					63.00

Source: Authors' calculation

Table 4 highlighted yield of rice in India less than ten years period of study. The chi-square test value at one and five per-cent level of significance is 21.67 and 16.92 respectively. The calculated value (63) is more than the table value. The null-hypotheses (H03) is rejected. It proves that yield of rice in India is increasing in the study period.

Table-5 Results Analysis

Hypothesis	Table Value		Degree of Freedom	Expected Value	Results
	0.01	0.05			
Ho1	21.67	16.92	9	3.91	Accepted
Ho2	21.67	16.92	9	0.12	Accepted
H03	21.67	16.92	9	63	Rejected

After applying the chi-square test, table 5 resulted that hypothesis (H01) and (H02) are accepted. It proves that production and area of rice have not been increasing over the study period. Hypothesis (H03) is rejected. It is evident that yield of rice has increasing during study period.

V. Findings

In India, majority of the population earns their livelihood from farming. Rice continues to play a central role in India's food system and livelihoods.Production, area, and yield increased by **1.18**, **1.04**, and **1.14 times**, respectively, with low C.V. values (0.06, 0.02, and 0.05), indicating stable growth patterns. Chi-square tests show: **No significant increase** in rice production and area (H01 and H02 accepted) and **Significant increase** in rice yield (H03 rejected). The results highlight that yield improvements, rather than expansion in area or production, contributed to better performance in rice cultivation. These insights are helpful for policymakers to design strategies aimed at sustaining and enhancing India's food grain stability.

Limitation of the study

The analysis is restricted to a ten-year period (2011–12 to 2020–21). A longer time series could provide deeper and more robust insights into the long-term trends in rice production, area, and yield.

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