



AN OVERVIEW OF RICE PRODUCTION IN NORTHERN STATES OF INDIA SINCE 1991: ISSUES AND CHALLENGES

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ABSTRACT

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India is an agrarian economy in which more than 70% of its population is directly or indirectly depends upon agriculture (Economic survey 2011). Agricultural sector is the important and dominant sector among other sectors on economy both in term of providing employment opportunities as it provides employment to nearly 50% of its population as well as in term of providing food-grains to the growing population. The present study highlights trends in area, production and productivity of one of the major food crops i.e., rice in India and its Northern States. The data from the years 1991-92 to 2024-25 were collected from the different sources such as Directorate of Rice Development Patna, 2015, official website indiastat.com and Reserve Bank of India's website. The study revealed that production and yield of rice in India and its northern parts is increasing at a decreasing rate and has a fluctuating trend over the period of time due the shift of area under food crops to other commercial cash crop and many other factors like, due to building and other construction works, highways, shifting of land to other profitable horticulture fruits, non-availability of high yielding varieties of seeds, lack of efficient machinery, infestation of weeds, lack of technical knowledge, unfavourable climatic conditions and lack of credit facilities all these factors are playing a vital role in lowering the production and productivity of major food crops particularly rice in India as a whole as well as Northern region.

KEYWORDS: Agricultural crop, Land productivity, Trends, Challenges, Northern States.

INTRODUCTION

India is an agrarian economy. A vast majority of land is being used for farming and cultivation of crops and wide varieties of crops are being cultivated in its different agro-ecological climatic zones. Agriculture is the back bone of Indian economy which feeds a large chunk of population, the population of country is increasing day-by-day and agriculture is the major sector which provide employment and livelihood to its population. Agriculture is being considered as the major source of income and livelihood to its Poor people and provide raw material to its industrial sector at a large. The agricultural sector in the recent years has registered a rapid progress in the production and productivity of cereals, horticulture, apiculture, animal husbandry and its allied sector. In terms of Country's GDP agriculture sector was considered the main source in the past before independence but, has shown a declining trend over the past 50-60 years due to shifting of population from agricultural to industrial and service sector in order to gain profitable employment opportunities. The population of the country is increasing at an alarming speed which becomes difficult for survival of people if no much focus and attention paid towards this sector. As it is seen that India is both larger producer and consumer major food crops i.e., rice which is being cultivated in all the States and Union Territories of Country but, the biggest challenges to agriculture is that the land is rapidly shifting from agriculture towards other sectors

and for different constructions like, houses for growing population, construction of roads and buildings and other construction as well.

On the other hand, the problems of infrastructure and irrigation facilities also hamper the production as well as the productivity of crops. The problems of institutional and easy credit facilities is also a big problem which effects the agriculture which in turn also influence the livelihood and income of farmers which decline the income because the price of agricultural products is less rememorate and cost of production is high and there remains a wide gap between income and expenditure of farmers.

LITERATURE REVIEW

Longkumer, B. I., & Giribabu, M. (2019). Emphasis that fluctuating trends in production and productivity of rice in north eastern region is caused by geographical, topographical, and infrastructural factors. Promoting the accessibility to farm and crop insurance and expanding infrastructure and institutional credit facilities and agricultural development initiatives will enhance the farmers productivity level.

Ahmed, A. U., & Sampath, R. K. (1992). The main consideration in the creation and efficiency of rice in Bangladesh is the water system. The creation of rice is to a great extent relies on water system framework, as there exists under

25% inundated zone under rice development with the extending of flooded region under rice efficiency the hole between rice creation and prerequisite could be augmented up.

Fatima, Kaneez & Hassan, Anwar, (2014). Significant highlights in J&K state like geography, phonographic highlights assorted variety of natural surroundings and heights are the key component which makes the contrast between the slope and plain regions. Sloping regions are by and large contribution a tremendous extension for the producers and cultivators of differing crops like heartbeats, oilseeds, foods grown from the ground, the most significant highlights of slope cultivating is the little holding and minimal holding which relies on precipitation.

Kesh, H., Ram, K., (2017). The process of rice cultivation requires a large amount of water, before sowing the rice seeds in puddled soil which cause great wastage of water and further all the process of rice cultivation requires water due to which the water table loss to a great extent

Kannan, E., & Sundaram, S, (2011). Cropping pattern in India has undergone a significant change as there is a continues shifts from food grains / cereals crops to commercial crop the output and yield under the cereal's crops decline during the reference period. Modern most techniques like, irrigation and fertilizers have increased the productivity of food grains at a considerable level.

Mazumdar, L. (2012). Certain conventional and non-conventional factors of production tend to increase the productivity of food grains and this increase in productivity in linked with reducing the rural food security and poverty, the increasing of productivity in necessary for developing nations.

OBJECTIVES

1. To analyse the Compound Annual Growth Rate (CAGR) in area, production and productivity of rice among northern states of India.
2. To forecast the future trends of rice production in India and northern states.
3. To find out the problems and prospects in rice production and suggest some policy implications in order to overcome those problems.

METHODOLOGY

The present study is based on secondary data, which is collected from the different sources such as Directorate of Rice Development Patna, 2015, official website of indiastat.com, Reserve Bank of India's website and Statistical digest of J&K 2024-25. For the purpose of analysis panel data on area, production and productivity of rice among the eight northern states and all India as a whole is taken in order to calculate the compounded growth rate over the period of time since economic reforms i.e., 1991-92 to 2024-25 to forecast the future production and growth of rice in India and north region. In order to analyse the data various tables and graph are used besides

this, descriptive statistic like percentage, average and Compound Annual Growth Rate are also applied. The data from 1991-92 to 2024-25 has been divided in different decades/phases in order to analyse the CAGR in area, production and yield over the different period of time.

DISCUSSION AND RESULTS

As shown in the below table No.1, area under rice crop in Northern States of India and India as whole since economic reforms i.e., 1991-92 to 2024-25 is discussed/analysed. For the purpose of analysis, the data has been divided into five different time period in order to analyse the variation in growth rate of area over the period of time. The data shows considerable long-term variation in area under rice crop in the northern states and Union Territories over the period of time from 1991-92 to 2024-25. Among all the northern states, 03 states/Ut's i.e., National Capital Territory (NCT) of Delhi, Haryana and Rajasthan have recorded relatively high growth in area under rice crop from 02 to 5.4 in Delhi, from 640 to 1609.2 in Haryana and from 140.9 to 353.4 (000) ha in Rajasthan with a Compound Annual Growth Rate (CAGR) of 3.1% in Delhi and 2.8% each in Haryana and Rajasthan. Punjab State also showed sustained growth in area under rice increasing from 2,074 to 3,243.3, with a CAGR of 1.4% while Uttar Pradesh State has recorded an increase in area from 5,413.1 to 7,350 from 1991-92 to 2024-25 with a CAGR of 0.9%, which is almost equal to the all-India growth rate. Uttarakhand State has recorded a relatively low but positive CAGR of 0.5% over the period of time despite an initial increase its value which significantly declined from 289.5 in 2010-11 to 216.1 in 2024-25. Whereas, at the all-India level, the CAGR value increased from 38,133.05 in 1991-92 to 51,266.6 in 2024-25, corresponding to a CAGR of 0.9% among the states.

In contrast, Jammu & Kashmir and Himachal Pradesh states have recorded negative CAGRs of 0.3% and 0.6%, respectively, indicating a marginal long-term decline in area under rice cultivation this is due to hilly terrain and shifting of agriculture land to other horticulture crops. Jammu & Kashmir state has showed considerable fluctuations, while Himachal Pradesh showed a relatively persistent decline in area from 83.3 (000) ha in 1991-92 to 68.3 (000) ha in 2024-25.

The overall, results/finding reveal that there is long-term variation in growth pattern of area under rice cultivation. Haryana and Rajasthan states have recorded relatively higher growth in area, followed by Punjab, NCT of Delhi also shows relatively positive growth rate in area but, the number is negligible small from 2 in 1991-92 to 5.4 in 2024-25, whereas Jammu & Kashmir and Himachal Pradesh states have experienced negative growth in area. Whereas, Uttar Pradesh state has recorded moderate growth rate which is almost near to the national average, while Uttarakhand state has showed only marginal long-term growth despite substantial fluctuations during the period of time.

Table 1. Area under Rice crop among the Northern States of India

S. No	States/UTs	Area (000) ha.					CAGR (1991-92 to 2024-25) %
		1991-92	2000-01	2010-11	2015-16	2024-25	
1	Jammu & Kashmir	282.2	244.1	261.3	304.5	258.2	-0.3
2	Himachal Pradesh	83.3	81.5	77.1	73.7	68.3	-0.6
3	Punjab	2074	2611	2831	2975	3243.3	1.4
4	Uttarakhand	185.5	280.2	289.5	264.1	216.1	0.5
5	Haryana	640	1054	1245	1354	1609.2	2.8
6	NCT of Delhi	2	6.1	7	6	5.4	3.1
7	Rajasthan	140.2	166.3	131.1	182.9	353.9	2.8
8	Uttar Pradesh	5413.1	5907.1	5657	5862	7350	0.9
9	All India	38133.05	41727	42,862.4	43,499.2	51,266.6	0.9

Source: - Directorate of Rice Development Patna, 2015 and website of <https://www.indiastat.com>.

As shown in table No. 2, trends of rice production in northern states of India from 1991-92 to 2024-25 have been analysed. The table shows the trends in rice production (000 tonnes) across the northern states of India since economic reforms 1991-92 to 2024-25. The results depict significant variation in the rice production and annual growth rate among the northern states. At all-India level, rice production has increased from 68,641.1 thousand tonnes in 1991-92 to 135,542 thousand tonnes in 2024-25, recording a CAGR of 2.1%. As among the northern states, Punjab, Haryana and Uttar Pradesh have remained the major contributors in terms of absolute production of rice over the period of time. Punjab has increased rice production from 6755 thousand tonnes in 1991-92 to 13146.7 thousand tonnes in 2024-25 and has recorded CAGR of 2% over the period of time. Rice production in Haryana has increased from 1812 (000) tonnes in 1991-92 to 5406.9 (000) tonnes in 2024-25 and has achieved a CAGR of 3.4% over the period. While Uttar Pradesh state has increased from 9,411.4 to 15,173.3 thousand tonnes from 1991-92 to 2024-25 and has recorded CAGR of 1.5% but absolute production in terms of rice has considerably increased. Meanwhile, Rajasthan has also recorded the highest CAGR of 4.9%, increasing substantially from 119.5 to 577.4 thousand tonnes over the period of time but contribution in total production is low. Although NCT

of Delhi has recorded a CAGR of 4.0%, over the study period but its contribution to total production at National level remained negligible because of its low absolute production level.

Whereas, rice production in Jammu & Kashmir has increased from 550.1 (000) tonnes in 1991-92 to 640.2 (000) tonnes in 2024-25 and its CAGR percentage remained 0.5%, Himachal Pradesh has slightly increased from 103 to 119.2 and has recorded growth rate 0.4% only while Uttarakhand has also slightly increased from 520.1 to 641.7 over the study period and has recorded 0.6% of growth rate which is relatively a slow growth.

The overall, results reveal that there are substantial disparities among the states in rice production and its growth rate across the north region. Uttar Pradesh and Punjab states have attained the highest rice production levels whereas Rajasthan and Haryana have experienced comparatively faster growth during the period of time. The overall growth of rice production in the northern region shows an expanding production level, although the pace of growth varied considerably among states.

Table 2. Trends in Rice production among the Northern States of India

S. No	States/UTs	Production (000) tons					CAGR (1991-92 to 2024-25) %
		1991-92	2000-01	2010-11	2015-16	2024-25	
1	Jammu & Kashmir	550.1	414.9	507.7	646.4	640.2	0.5
2	Himachal Pradesh	103	137.4	128.9	129.9	119.2	0.4
3	Punjab	6755	9154	10837	11823	13146.7	2.0
4	Uttarakhand	520.1	621.5	550.4	639.1	641.7	0.6
5	Haryana	1812	2695	3472	4145	5406.9	3.4
6	NCT of Delhi	4.4	5	19.6	17.3	16.1	4.0
7	Rajasthan	119.5	155.7	262.5	369.8	577.4	4.9
8	Uttar Pradesh	9411.4	11679.2	11992	12501	15173.3	1.5
9	All India	68641.1	44561.5	95979.8	104408	135542	2.1

Source: - Directorate of Rice Development Patna, 2015 and website of <https://www.indiastat.com>.

Table No. 3, depict the trends in rice productivity (yield) among the Northern States of India after economic reforms i.e., 1991-92 to 2024-25. The overall productivity of rice shows an increasing trend during the study period although there remains a considerable inter-state variation. At the all-India level, average yield of rice has increased from 1,570 kg/ha in

1991-92 to 2,929 kg/ha in 2024-25, recording a CAGR of 1.9 %. Among the northern states, Punjab has attained the highest yield level in 2024-25 (4,428 kg/ha), followed by Haryana state (3,766 kg/ha), Uttar Pradesh (2,824 kg/ha), Delhi (2,800 kg/ha), Rajasthan (2,593 kg/ha), Jammu & Kashmir (2,482 kg/ha), Uttarakhand (2,710 kg/ha), and Himachal Pradesh (2,080

kg/ha). In terms of growth of rice Uttarakhand state has recorded the highest CAGR of 5.1 %, followed by Rajasthan 3.4 %, while Himachal Pradesh and Uttar Pradesh have registered growth rates of 1.6 and 1.5 % respectively. Punjab and Haryana states have recorded lower CAGRs of 0.9 per cent each, despite having relatively high productivity levels. NCT of Delhi and Jammu & Kashmir have recorded a CAGR of 0.7 % each. Specifically, Uttarakhand and Rajasthan states have experienced substantial improvements in productivity over the study period, whereas Punjab and Haryana have maintained higher productivity levels with slower growth rate.

The overall, results signify that rice productivity in the Northern States of India has improved over the study period, but the pace of improvement has varied among the states. The states with relatively low initial productivity, particularly Uttarakhand and Rajasthan, have experienced faster growth, while states like Punjab and Haryana have already comparatively high productivity levels attained a slower growth. The observed variations signify the differences in technological adoption, irrigation facilities, input use, agro-climatic conditions and improvements in production practices, institutional credit facilities among the farmers across the states are varying which shows significant variation in production as well as productivity level.

Table 3. Yield of rice among the Northern States of India

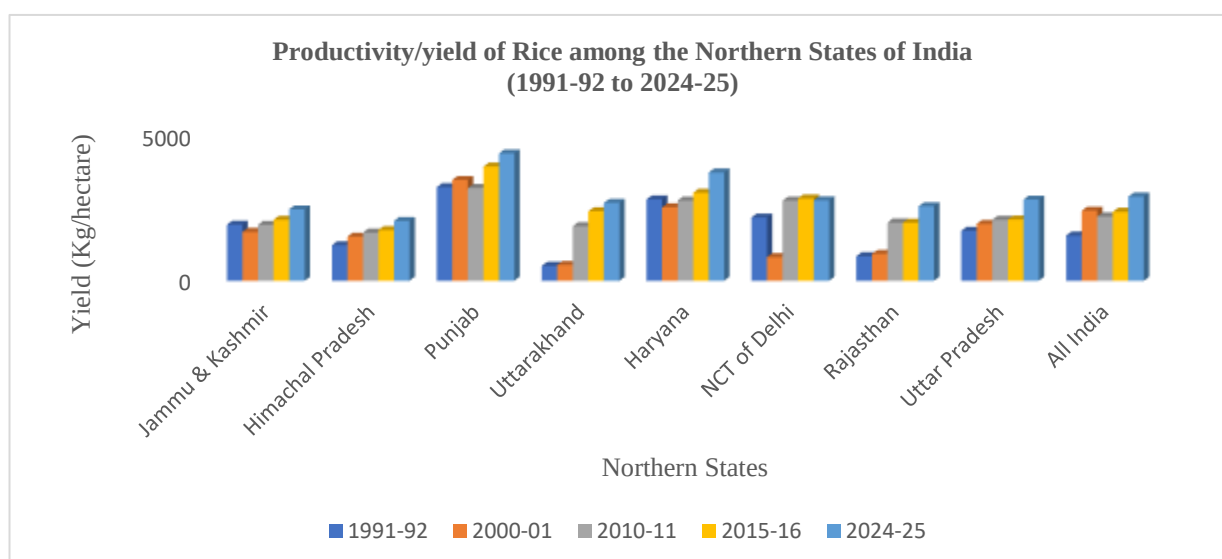
S. No	States/UTs	Yield (Kg/hectare)					CAGR (1991-92 to 2024-25) %
		1991-92	2000-01	2010-11	2015-16	2024-25	
1	Jammu & Kashmir	1949	1700	1942	2123	2482	0.7
2	Himachal Pradesh	1236	1533	1673	1763	2080	1.6
3	Punjab	3257	3506	3228	3974	4428	0.9
4	Uttarakhand	520.1	550.3	1901	2420	2710	5.1
5	Haryana	2831	2557	2789	3061	3766	0.9
6	NCT of Delhi	2200	820	2787	2862	2800	0.7
7	Rajasthan	852	936	2025	2022	2593	3.4
8	Uttar Pradesh	1739	1977	2120	2133	2824	1.5
9	All India	1570	2438	2,239	2,400	2,929	1.9

Source: - Directorate of Rice Development Patna, 2015 and website of <https://www.indiastat.com>.

As shown in the below figure, productivity/yield of rice in eight northern states and India as a whole is shown from 1991-92 to 2024-25. For better analysis of result the data has been divided into five different time period in order to show variation in the yield of rice across states. As it depicts that productivity of rice in Punjab and Haryana states across all the time period remain favourable and satisfactory which almost cross the national average productivity level as the data shows. Uttar Pradesh state average yield level remains almost same the nation's average across all the time which is favourable. Jammu & Kashmir,

Himachal Pradesh, Rajasthan and NCT of Delhi shows moderate productivity of rice across the different time period. Whereas, Uttarakhand state yield remain considerably insignificant in 1991-92 and 2000-01 thereafter starts rising and in the year 2024-25 it almost crosses 2000 kg/per hectare which seems to be a significant improvement over the period of time. In general yield of rice across northern states and India as a whole show's significant improvement in the year 2024-25 over the previous years.

Figure 1. Yield of rice among the Northern States of India



Source: - Estimated from data source.

Issues and Challenges to rice production

Following are some major issues and challenges to rice production in northern region and in India as whole;

1. **Climatic Variability.** Climate remain the major issue which effects the production as well as productivity of rice in all the regions of India at a large. The persistent rainy season, waterfall and draught like conditions significantly effects the production as well as productivity of all crops particularly rice in India. The temperature is an important determinant for rice production which is highly depends upon climatic condition. The favourable temperature for rice production in India is 20-35 degree Celsius, if it goes up and down from this range it significantly affects the rice production.
2. **Availability of Water.** Water level plays a major role in the production and productivity of rice generally 2-5 cm of water is required and considered favourable for rice production. If the water level raise much beyond the favourable then it becomes harmful for its production. In the north region particularly in hilly region like Himachal Pradesh, Uttarakhand and Jammu & Kashmir the water level plays significant role in the production of rice which is largely depends on monsoon.
3. **Economic, and Institutional challenges.** It also plays a vital role in the production of rice. In India generally there seems lack of economic and institutional facilities i.e., institutional credit to farmers, Kissan credit scheme, loan at affordable rate of interest. If these facilities are enlarged to the farmers the problem of economic and institutional credit would be overcome.
4. **Groundwater depletion.** The problem of ground water is also a major issue in the way of rice production. In north India particularly in some parts of Haryana and Uttar Pradesh, the level of ground water is declining due to over extraction of water as there is problem of running water like, rivers and streams and due to this production of rice effects a large.
5. **Flooding and Waterlogging.** Also, this problem effects the rice production in larger way. When there is flood like situation or the water table raise above its normal average level then its hampers the production and productivity of rice to the great extent.
6. **Small and fragmented landholdings.** In India, particularly in the northern region maximum land holding size is marginal and small which is not able to produce the crops like rice in large amount. If the size of holding will be medium and large there becomes significant increase of rice production and productivity.
7. **Labour constraints.** There is also labour constraints in India particularly in northern region there is shortage of labour force and the available labour is not technically efficient which tends to produce the rice production and productivity in a better and more favourable way.
8. **Declining soil health.** Due to the regular and continuous use of different quality of fertilizer, pesticides and insecticides the quality of soil is degrading day by day to its original level which in turns tends to reduce the production and productivity of rice.
9. **Regional differences in productivity.** Also, there is regional difference across inter-states, some regions are hilly some are moderate hilly and some plain in which

level production and productivity varies to a considerable level. Different regions have different agro climatic condition which raises the regional difference in productivity of rice.

10. **Pest and disease pressure.** There is also pressure of pests and disease which effects the production and productivity level at large. Instead of many insecticides and pesticides the crop is largely affected by different disease which in turn reduce both the level of production and productivity in a great extent.

SUGGESTION AND POLICY IMPLICATIONS

The following are some policy implications which can strengthen the production and productivity of rice in India:

1. **Introduction of high-yielding and climate-resilient varieties of seeds.** With the introduction of HYVs and climatic resilient varieties of seed the rice production as well as productivity can be increased and enhanced. As there are different agro climatic zones of different regions if, the selection of seeds will be according to the climatic condition of the particular region then production as well as productivity of rice will improve to the larger extent.
2. **Improve irrigation and water-use efficiency.** By improving the irrigation and water use efficiency and timely availability of water in balanced amount will full-fill the nutritional requirement of crop which in turn will strengthen production and productivity of rice.
3. **Adoption of Direct Seeded Rice (DSR).** Generally, the rice plant is seedlings/growing in the nurseries and manually transplanting them into the main filed which loss the nutritional values if, instead of it rice seeds are directly planted into the main filed will enhance the level of production and productivity by improve the plant health.
4. **Address climate-related risks.** It will be done by adopting the plan for changing the weather conditions, by reducing the green house gas emissions, preparing for storms and draughts by taking the necessary steps for reducing climatic risks.
5. **Strengthen agricultural extension services.** By strengthening the agriculture extension service like providing timely training to farmers, adoption of modern tool and technology, providing information about pest and disease management, marketing and other government schemes will help a lot in increasing the production and productivity of rice.
6. **Increase investment in agricultural research.** By a huge investment in agriculture research and development i.e., improving technology from primitive to latest modern technology, improve farming structure, improving farming sustainability, by adoption of crop friendly pests control techniques and developing of high yielding resilient crops etc. will increase the production and productivity of rice in India.

CONCLUSION & FINDING

The agriculture sector in northern region of India is better performing in some states while in other states the agriculture production as well as productivity in increasing at a decreasing rate due to its agro climatic conditions, irrigation

facilities, infrastructure, holding size is mostly marginal and small size and agricultural practices are used in such a way which is not very much productive and effective, we can easily say that agricultural sector in northern states mainly in Himachal Pradesh, Jammu and Kashmir, Uttarakhand and Delhi are slightly improving from the previous some years while in case of Uttar Pradesh, Haryana, Punjab and Rajasthan which is significantly better. As compared to other states of the country the agricultural production and yield rate in some states are approximately more or less same. Jammu and Kashmir and Himachal Pradesh and Uttarakhand states are hilly and mountainous states in which the agriculture production is low, but the productivity kg/ha is nearly around the national average. The lack of marketing facilities, transport, communication, and infrastructure all these acts as hindrance in the way to progress and prosperity of agriculture sector. Investment in agriculture sector and introduction of modern tools and techniques will boost the agricultural sector.

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