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BGREI Impact on Productivity & Income from Rice: Western Vs. Northern Odisha

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Abstract

The article provides a comparison of the impact of the BGREI on rice productivity and income in the western and northern portions of Odisha in 2016–17. After consulting with scientists of ICAR-NRRI, Cuttack, 2 districts Mayurbhanj and Bargarh were selected as the research location. Two blocks from each district, 4 villages from each block were taken into consideration purposively and 10 farmers were selected randomly. Two pre-tested questionnaires were administered separately to the randomly selected beneficiaries and non-beneficiaries to collect the required data. After analysis of the data, it was observed that there is an increase of 8.83 quintals/acre (61.92%) in the productivity of Kharif rice in western Odisha, whereas in northern Odisha it is 6.1 quintals/acre (60.10%). Likewise, in case of Income from Kharif rice, there is an increment of Rs.12980/acre in western Odisha, whereas in northern Odisha it is Rs.8967/acre. After a critical statistical study, it was also clarified that there is no such major difference in the impact of BGREI on the income of rice farmers and productivity of rice, based on the location (i.e. between western Odisha and northern Odisha). It can be said that there is no such biasness in the BGREI scheme implemented areas of Odisha.

Keywords

BGREI, Mean, Rice Productivity, Income from Rice, Rice Farmers

Introduction

In India, 59% of the labour force is employed in the agricultural sector, which greatly supports livelihood. Most BPL (Below Poverty Line) Indians live in rural regions and make up about 35% of the population. Their primary occupation is farming and they are heavily dependent on it, either directly or indirectly (1). Since the beginning of time, humans have relied on agriculture for their survival and nourishment. Several causes, including disasters (both man-made and natural), industrialization, deforestation and worldwide warming are currently having a significant negative impact on agricultural productivity and its quality. Consistent food output is crucial for maintaining human well-being and feeding the world's growing population (2). Increased soil fertility management, intense biotechnology use, extensive land consolidation and external inputs can all boost the production capacity of crops and land resources (3).

The Green Revolution was launched in India in the mid-1960s with the aim of increasing agricultural productivity through the introduction of high-yielding varieties of crops, the use of fertilizers and pesticides and the expansion of irrigation facilities. While the Green Revolution was successful in many parts of India, its impact on eastern India was limited due to a lack of irrigation facilities, poor soil quality and a fragmented landholding system. Rice is the most important crop in eastern India and while the Green Revolution brought some positive changes to rice production, its impact on the income of rice growers in the region has been mixed. While the increase in productivity led to higher yields and incomes for some rice growers, small and marginal farmers were unable to adopt the new technologies due to the high cost of inputs and lack of access to credit.

Estimating the yield gap and sustainable intensification of agricultural systems are essential if India wants to become self-sufficient in food and meet demand. Although rice is grown on 40% of the land in the states of eastern India, its production is not on par with that of other parts of the nation. A second green revolution should be implemented in this region of India as a result of the necessity to concentrate on these areas. For paddy and wheat, the anticipated yield gaps were 20 to 40% and 20 to 21% respectively. Several factors, including suboptimal and supra-optimal resource utilization, floods, droughts, state specificity etc., had an impact on the yield. Despite the challenges, the Green Revolution has helped to improve the livelihoods of rice growers in eastern India through the introduction of new varieties of rice and the use of fertilizers and pesticides, as well as the development of markets for agricultural inputs and outputs (4).

Several programmes were introduced in India to increase productivity of crops and income of farmers. With the introduction of HYVP (High Yielding Variety Programme) in 1966, a new approach to agricultural development was witnessed. The introduction of crop varieties with high yields was not the only area of technological improvement. A "Green Revolution" in the nation was made possible by the application of high analysis and balanced fertilizer, irrigation, plant protection, improved equipment etc. Punjab, Haryana and the western sections of Uttar Pradesh were first chosen for this programme because agricultural scientists there have been effective in developing new high-yielding varieties of several crops, particularly in wheat, rice and maize. High-yielding technology has a pervasive impact on various aspects of agricultural production, including animal husbandry, fisheries, sericulture, social forestry etc. The high-yielding technologies used in these production enterprises share several other traits with conventional technologies, including a shorter gestation period, good responsiveness with better management, higher return in terms of yield and revenue and a larger investment. Several agriculture-related programmes were also launched, including IADP (Intensive Agricultural District Programme). IADP known as "Package Program," was introduced in the nation in Kharif 1960. The IADP's main tenet was that higher agricultural productivity would result in economic growth, which would improve society. The approach used in the IADP was to show that it was feasible to enhance agricultural productivity quickly by focusing on all production elements at once in an integrated action programme in chosen areas with ideal conditions. Because all enhanced methods were applied simultaneously and collectively, including better seeds, irrigation, fertilizer, plant protection, equipment, storage facilities, marketing facilities and credit, the initiative became known as the "Package Programme". These programmes were started to increase the intention of increasing crop productivity (5). Adopting new or cutting-edge technologies will boost the yield of agricultural produce. The Indian government placed a greater emphasis on rural and agricultural development in its first five-year plan (1951–1956) by spending funds on the construction of dams, irrigation channels, an agricultural research system and the modernization of the British-era agriculture bureaucracy. India concentrated on industrial development throughout the second and third FYPs (Five-Year Plans), but after a series of droughts in the middle of the 1960s, the government of India turned its attention to food self-sufficiency (6). To end poverty and hunger in the nation and increase food security, India started the Green Revolution in agriculture in the 1960s. HYVs (High-Yielding Varieties) of the two crops rice and wheat were introduced. In India, the output of rice and wheat crops underwent a notable change as a result of the execution of numerous initiatives and programmes (7).

Increasing production all around the nation was the green revolution's primary goal. Food grains are farmed in all the states of India, but they are mostly grown in the deltas, river valleys and low-lying coastal regions in the southern and north-eastern halves of the country. The principal states that grow paddy include West Bengal, Uttar Pradesh, Andhra Pradesh, Odisha, Tamil Nadu, Bihar, Assam, Madhya Pradesh, Karnataka, Maharashtra, Gujarat, Kerala and Jammu and Kashmir (Highest-West Bengal and Lowest-Jammu and Kashmir). About 95 percent of the total of India's total rice production is contributed by these states (5).

The average production of cotton, chilli and sugarcane improved dramatically by 36.26%, 26.08% and 17.8% correspondingly after the implementation of precision farming under the RKVY (Rashtriya Krishi Vikas Yojana) project in the districts of Dharwad, Belgaum Bagalkot and Haveri in the state of Karnataka. The income of those crop growers improved significantly in all three of the following categories: cotton (75.63%), sugarcane (24.5%) and chilli (29.53%) (8).

BGREI (Bringing Green Revolution to Eastern India) was one of the programmes of RKVY (Rashtriya Krishi Vikas Yojana) was the programme. To boost production through an enhanced set of procedures, it was introduced in 2010-2011. It was put into place in the eastern region of the nation, which includes the states of Odisha, Bihar, Assam, Jharkhand, Chhattisgarh, eastern Uttar Pradesh and West Bengal. Crop production, asset development, water

collection, recycling and site-specific activities were the main areas of attention (9). According to Socio-economy at Glance, 2012, rice output increased in certain areas between 2011 and 2012 by 19.8% compared to the prior 2 years. In rainfed zones in southern and coastal areas of Odisha, where the BGREI programme was implemented, productivity improved in comparison to the northern plateau. In Odisha's BGREI-implemented plots, improvements were observed in the transplantation time, length and growth rate (10). It is imperative to ascertain the impact of the BGREI programme in the various states where it has been implemented after many years of deployment. The BGREI had a favourable effect on farmers' adoption of contemporary farming techniques, cropping intensity and the narrowing of yield gaps in the state of Chhattisgarh rice harvests. The region under HYVs and hybrid paddy have indeed been enlarged up to 156.13 and 14.25 percent among the beneficiaries and non-beneficiaries respectively, after the state's BGREI programme was put into action. The Beneficiaries mistreated the system more than the non-beneficiaries. In Chhattisgarh, the amount of paddy yield gap was estimated to be roughly equal (697 Kg/ha) for beneficiaries and non-beneficiaries (2281 Kg/ha) (11).

In terms of productivity, the majority of members (80.00%) and non-members (63.33%) had medium productivity in the cultivation of paddy and low productivity (53.33% members and 56.67% non-members) in the cultivation of toria, according to the study "Assessing Effect of Technologies Showcasing Programme on Adoption of the Demonstrated Technologies - A Case of Assam" (12). Beneficiaries of the test had greater Kharif paddy grain yields and net returns per acre of land harvested than non-beneficiaries by 7% and 47% respectively. Contrary to expectations, the cost per acre of land for beneficiaries was 18% lower than for non-beneficiaries. In Karnataka, the region, production and productivity of rice increased by 1.51%, 14.77% and 13.08% respectively, at the end of the eleventh FYP (2011-12) compared to the base year (2006-07), while the production and productivity of pulses increased by –2.79%, 26.99% and 30.50% respectively as compared to the arrangement starting period and plan concluding period (13).

To solve the problems of productivity and income from rice crop, "Bringing Green Revolution to Eastern India (BGREI)" programme was launched. The BGREI was made up of several broad categories of interventions, such as: 1. Block Demonstrations; 2. Asset Building; 3. Site Specific Activities; 4. Marketing Support and Post-Harvest Management; 5. Seed Production and Distribution; 6. Subsidy on Need-Based Inputs; 7. Training Program on Cropping System Based Demonstrations etc. (14).

As this programme was implemented in 2010-2011, it was planned to evaluate how it performed in terms of how it affected changes in rice productivity and beneficiary farmers' earnings. Due to regional variations in rice output, the current study, BGREI Impact on Productivity and Income from Rice: Western Vs. Northern Odisha was done.

Materials and Methods

The study conducted in the years 2016-17 focused on evaluating the impact of the BGREI program in the Northern and Western regions of the state of Odisha. Two districts, namely Mayurbhanj and Bargarh were purposively chosen due to the implementation of the BGREI scheme since its inception in these regions. These districts were selected because of their distinct agro-ecological settings and geographical distance from one another, with Mayurbhanj situated in the North and Bargarh located in the West. The research design involved selecting two blocks from each district, with one block having a greater number of BGREI-implemented villages and the other with fewer BGREI-implemented villages. From each block, two BGREI-implemented and 2 non-BGREI-implemented villages were selected, resulting in a total of 16 villages for the study. The sample size consisted of 10 farmers selected randomly from each village, with a total of 160 respondents, including 80 beneficiaries and 80 non-beneficiaries (Table 1). To obtain relevant information from the respondents, a study-specific interview schedule was created, which was tailored to the study's objectives. Two different schedules were prepared, one for beneficiaries and another for non-beneficiaries which were written in English but delivered in the local language, Odia. These schedules were pretested on 10% of the sample size and questions were appropriately reworded and revised to ensure clarity and relevance before finalizing the interview schedules. The interview schedules covered a range of topics, including the respondents' socio-economic backgrounds, such as family size, age, occupation, education, knowledge level, land ownership and income. Additionally, the schedules explored the challenges faced by farmers and potential solutions. The questions also addressed dependent factors such as rice productivity and farmer income. Data collection involved personal interviews with the respondents at their workplaces and homes, with the help of local leaders, Sarpanch, Gram Panchayat members, Kissan Sathi and Assistant Agriculture Officers. Although the respondents initially felt hesitant, rapport-building efforts facilitated the data collection process, which was completed within 2 months (January-February, 2017).

Results and Discussion

The information provided indicates that the implementation of BGREI (Bringing Green Revolution to Eastern India) has had a favorable effect on rice productivity and income in both the Western and Northern parts of Odisha. According to the study, the increase in productivity was 8.83 Quintal/acre (61.92%) in Western Odisha and 6.1 Quintal/acre (60.10%) in Northern Odisha. Likewise, the increase in income was Rs. 12980/acre in Western Odisha and Rs. 8967/acre in Northern Odisha (Table 2).

Table 1. Selection of respondents and study area

Selected districts	Selected blocks	Type of Respondents	Selected villages	No. of selected respondents
Bargarh	Paikmal	Beneficiary	Mandosil	10
			Bhutmunda	10
		Non-beneficiary	Salepali	10
			Baidpali	10
	Barpali	Beneficiary	Remta	10
			Dhirpur	10
		Non-beneficiary	Badgan	10
			Gadgaddala	10
Mayurbhanj	Baripada	Beneficiary	Badjor	10
			Gualdihi	10
		Non-beneficiary	Langal Kanta	10
			Keshipur	10
	Udala	Beneficiary	Balabhadrapur	10
			Sunapal	10
		Non-beneficiary	Khaladi	10
			Rangamatia	10
Total 2	4	8	16	160

Table 2. Impact on Productivity and Income from Kharif Rice after implementation of the BGREI programme

	Western Odisha				**Northern Odisha**			
	Non-beneficiaries	**Beneficiaries**	**Increase in Quantity or Price**	**% increase**	**Non-beneficiaries**	**Beneficiaries**	**Increase in Quantity**	**% increase**
Productivity	14.26	23.09	8.83	61.92	10.15	16.25	6.1	60.10
Gross Income	20962.2	33942.3	12980	61.92	14921	23888	8967	60.10

*To minimize the effect of MSP and other factors on income, all produce are calculated based on same selling price (MSP) i.e. Rs.1470/

It is noteworthy that the statistical difference in productivity of Kharif rice between BGREI Beneficiaries and Non-Beneficiaries of Western Odisha was found at the 0.01 level of probability, indicating a high degree of confidence in the findings (Table 3). Likewise, difference in productivity of Kharif Rice between BGREI Beneficiaries and Non-Beneficiaries of Northern Odisha was also found statistically significant indicating a high degree of confidence in the findings (Table 4). Additional information provided compares the impact of BGREI on productivity and income from Kharif rice in Western and Northern parts of Odisha. The study found that there is a difference in the impact on the productivity of Kharif rice between Western and Northern parts of Odisha, with a difference of 2.73 Quintal/acre. Similarly, there is a difference in impact on income from Kharif rice between Western and Northern parts of Odisha, with a difference of Rs. 4013/acre (Table 5).

However, it is essential to note that the difference in the impact of the BGREI scheme on productivity from

Table 3. Statistical comparison of Productivity of Kharif Rice between BGREI Beneficiaries and Non-Beneficiaries of Western Odisha

z-Test: Two Sample for Means		
	BGREI Beneficiaries	*BGREI Non-Beneficiaries*
Mean	23.0875	14.25875
Known Variance	29.9633013	26.6156266
Observations	40	40
Hypothesized Mean Difference	0	
z	7.423382829**	
P(Z<=z) two-tail	1.14131E-13	
z Critical two-tail	1.959963985	

**Significant at 0.01 level of probability

Table 4. Statistical comparison of Productivity of Kharif Rice between BGREI Beneficiaries and Non-Beneficiaries of Northern Odisha

z-Test: Two Sample for Means		
	BGREI Beneficiaries	*BGREI Non-Beneficiaries*
Mean	16.25	10.15
Known Variance	31.47435897	25.47692308
Observations	40	40
Hypothesized Mean Difference	0	
z	5.11220285**	
P(Z<=z) two-tail	3.18424E-07	
z Critical two-tail	1.959963985	

**Significant at 0.01 level of probability

Table 5. Difference in impact of BGREI on Productivity and Income from Kharif Rice between Western and Northern Odisha

	Difference in impact between Western and Northern part of Odisha	Difference in impact between Western and Northern part of Odisha
Productivity	2.73	1.82
Gross Income (Rs./	4013	1.82

Kharif rice between Western and Northern Odisha was found to be statistically non-significant after the z-test (Table 6).

The implementation of BGREI has been shown to have a positive effect on rice productivity and income in both Western and Northern parts of Odisha. The study found a significant increase in productivity and income among beneficiaries of the programme compared to non-beneficiaries in both regions. These findings suggest that the programme has been successful in improving rice productivity and income in Odisha, which is a major agricultural state in India. While there is a difference in the impact of the programme on productivity and income between Western and Northern parts of Odisha, the study found that this difference is not statistically significant. This suggests that the impact of the programme is similar across both regions, which is important information for policymakers and programme implementers looking to replicate the programme in other regions of India facing similar agricultural challenges.

Overall, the study provides valuable scientific evidence supporting the implementation of the BGREI programme in other regions facing similar challenges. The results of the study suggest that the programme can lead to significant improvements in rice productivity and income for farmers, which can have a positive impact on the overall economic development of the region. However, further research is needed to determine the long-term impact of the programme and to identify potential challenges to its implementation in other regions.

Conclusion

The study on the impact of BGREI on rice productivity and income in Western and Northern Odisha suggests that the implementation of the programme had a positive effect on both productivity and income. The increase in productivity and income was observed in both regions, indicating that the programme was successful in improving rice productivity and income. The statistical analysis showed that the difference in productivity between BGREI Beneficiaries and Non-Beneficiaries of both regions was significant, indicating a high degree of confidence in the findings. However, the study found that there was no significant difference in the impact of the programme on productivity and income based on the area where it was implemented. Overall, the study provides scientific evidence supporting the implementation of the BGREI

Table 6. Statistical difference in impact of BGREI on Productivity from Kharif Rice between Western and Northern Odisha

z-Test: Two Sample for Means		
	Impact on Western Odisha	*Impact on Northern Odisha*
Mean	8.82875	6.1
Known Variance	57.57409	71.00256
Observations	40	40
Hypothesized Mean Difference	0	
z	1.521993127*	
P(Z<=z) two-tail	0.128010803	
z Critical two-tail	1.959963985	

*Not significant

programme in other regions facing similar agricultural challenges. The findings of this study have important implications for agricultural policies and practices in regions facing similar agricultural challenges. The successful implementation of the BGREI programme in Odisha can serve as a model for other regions to improve rice productivity and income. The study's results also suggest that the programme's impact on productivity and income is similar across different regions, which highlights the potential for widespread adoption of the programme.

Moreover, the study's finding that there is no significant difference in the impact of the BGREI programme on productivity and income based on the area where the programme has been implemented in Odisha implies that the programme can be implemented in various regions with similar agricultural challenges. This implies that policymakers and practitioners can apply the programme's approach to other regions to achieve similar results in enhancing agricultural productivity and increasing farmers' income. The future use of this study lies in informing policy decisions aimed at improving agricultural productivity and income in Odisha and other regions facing similar agricultural challenges. Policymakers and practitioners can use the findings to design more effective and efficient agricultural policies and programmes that address the specific needs of farmers in different regions. Further research could also be conducted to assess the long-term impact of the BGREI programme and to identify other factors that may influence its effectiveness.

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Authors contributions

RK is the main author who has done the research work with the help and guidance of SKM, LD and RKR. SM, SSD and SS helped in writing. All authors read and approved the final manuscript.

Compliance with ethical standards

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