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Evaluating the Impact of Frontline Demonstrations on Rice Crops in Ramgarh District, Jharkhand

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ABSTRACT

Rice (Oryza sativa L.) is a key cereal crop in the Uttari Chhota Nagpur region of Ramgarh district, Jharkhand, where productivity is hindered by the non-adoption of drought-tolerant varieties and improved cultivation practices. To address this, Krishi Vigyan Kendra, Ramgarh, initiated a study to assess the impact of frontline demonstrations (FLDs) on the adoption of the high-yielding paddy variety Swarna Samridhi Dhan. Conducted over four years (2022-23 to 2024-25) in multiple villages, the study demonstrated significant yield improvements. The demonstrated variety achieved an average yield of 52.49q/ha under rainfed conditions, compared to just 45.59q/ha with farmers' traditional practices, showing a 15.21% increase in productivity. The study also highlighted technology gaps, extension gaps, and a technology index of 12.50%, pointing to the need for further dissemination of improved practices. The results show that the adoption of Swarna Samridhi Dhan Dhan significantly boosted productivity and economic returns, with average net returns of 64,774.30 per hectare for the demonstrated variety, compared to 50300.08 per hectare for local practices. It is also suitable for cultivation in water limiting irrigated and drought-prone areas. Beside drought (reproductive stage) tolerant, it can also tolerate10-12 days subemergence (vegetative stage).The findings underline the potential for scaling up these practices to enhance paddy production in the region.

Keywords: Adoption gap, Technological gap, Extension gap, Submergence, Multiple stress Rice variety, Swarna Samridhi Dhan

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INTRODUCTION

Rice (Oryza sativa L.) is a cornerstone of India's agricultural landscape and food security, contributing significantly to the nation's economy. It is the most important cereal crop in the country, occupying about 24% of the total cropped area, with its production accounting for 42% of the total food grain output. Over the past six decades, rice production in India has experienced remarkable growth, increasing nearly 3.5 times, from 250.3 lakh tons in the first Five-Year Plan to 857.3 lakh tons by the tenth plan period. Despite this impressive rise in production, India's average rice productivity of 2.722 tonnes per hectare lags behind top rice-producing nations like China, Vietnam, and Indonesia, reflecting untapped potential for further improvement (Suthar et al., 2016).

In the state of Jharkhand, and specifically in districts like Ramgarh, rice is a major staple crop grown primarily during the Kharif season in rainfed conditions. Traditional methods of cultivation dominate, but these techniques often result in sub-optimal yields. While, India has made significant strides in rice production, the challenge of achieving higher productivity persists, particularly in rainfed regions where unpredictable rainfall patterns and poor soil fertility hamper yields. To address these challenges, front-line demonstrations (FLDs) have emerged as an innovative approach to promote sustainable agricultural practices and enhance productivity in farmer's fields (Sharma et al., 2011; Chaudhary et al., 2018). FLDs showcase newly developed rice varieties and advanced farming techniques, including improved irrigation methods, seed treatments, and pest management practices (Singh et al., 2018). These demonstrations are designed to educate farmers about the potential benefits of modern agricultural technologies and encourage them to adopt new practices that can improve both the quantity and quality of rice produced (Singh, 2002). In Ramgarh District, where rainfed rice cultivation is widespread, such demonstrations hold the promise of transforming local farming practices and significantly boosting crop yields. This case study investigates the impact of field demonstrations on rice crops in Ramgarh,

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Jharkhand, focusing on the effectiveness of these new varieties and practices in improving productivity. By exploring the experiences of local farmers with these interventions, the study aims to assess how front-line demonstrations can contribute to more sustainable and productive rice farming in the region, thereby supporting food security and enhancing the livelihoods of rural communities.

MATERIALS AND METHODS

Frontline demonstrations (FLDs) on the paddy variety Swarna Shakti Dhan were conducted by Krishi Vigyan Kendra (KVK), Ramgarh, from 2021-22 to 2024-25 in different villages, including Jobla, Barka Chumba, and Tilliya, Gargali, Indrabad, Hesagarha under the Mandu block, and labga and Gegda under the Patratu block, in Ramgarh district. A total of 125 demonstrations were carried out across four villages. The soil in the study area was predominantly red and yellow soil, with some sandy components. The fertility status was low to medium, and the soil was acidic, with a pH range of 5.5 to 6.5.The paddy variety Swarna Samridhi Dhan is known for its disease tolerance, particularly to rice blast, and grows to a height of 105–110 cm. The crop has maturity duration of 115-120 days, with a potential yield of 45–55 quintals per hectare. The components of the frontline technology demonstrated included the improved variety, proper tillage, appropriate seed rate, sowing methods, balanced fertilizer application (120:60:40 NPK kg/ha), weed management, and protection measures (Table 1). A total area of 50 hectares was covered across the three consecutive years.

In the demonstrations, a control plot was also maintained where the farmers' traditional practices were followed. The FLDs were carried out to examine the technology gap (the disparity between potential yield and actual yield), the extension gap (the difference between demonstrated yield and yield under farmer practices), and the technology index. Yield data from both demonstration and farmer practice plots were gathered using the random crop cutting method and analyzed with basic statistical techniques. The formulas suggested by Samui et al. (2000) were utilized to calculate the technology gap, extension gap, and technology index."

$$\text{Present increase yield} = \frac{\text{Demonstration yield- Farmers yield}}{\text{Farmers yield}} \times 100$$

Technology gap = Potential yield - Demonstrated yield

Extension gap = Demonstrated yield - Yield under existing practices

$$\text{Technology index} = \frac{\text{Potential Yield-Demonstration Yield}}{\text{Potential yield}} \times 100$$

At the time of seed distribution, the scientists gave the growers all kinds of information related to crop civilization. The issues concerning growers' crops were addressed, and implicit results were meditated upon. Throughout the crop season, the platoon visited the fields of named growers to assess their crops. In addition, they maintained regular communication with the growers via phone calls to gather updates on crop conditions. Data on crop yield and profitable performance from frontline demonstrations were collected, alongside information from a original variety of the same crops. Laterly, computations were made for grain yield, civilization costs, net returns, and the benefit-cost rate. A comprehensive interview schedule was used to gather data from direct relations. Following the study's pretensions, the data collected were reused, organized, and anatomized using mean percent scores and rankings. A notable difference of over 10 percent was observed between the heir's and non-beneficiaries. The extension gap, technology gap, and technology indicator were reckoned using the formula proposed by Samui et al. (2000).

Extension gap (qha-1) = Demonstration yield- Farmer's yield

Technology gap (qha-1) = Potential - Demonstration yield

Technology index (qha-1) = (Potential yield- Demonstration yield)/(Potential yield) X100

RESULTS AND DISCUSSION

The study was conducted as part of a front- line demonstration of the rice variety Swarna Shakti Dhan among growers in different townlets, including Jobla, Barka Chumba, Tilliya, Gargali, Indrabad, and Hesagarha under the Mandu block, as well as Labga and Gegda under the Patratu block in Ramgarh quarter. An aggregate of 115 demonstrations were conducted across four townlets, comparing the results to original or traditional husbandry practices. Table 1 illustrates the difference between the husbandry practices and the recommended technologies for paddy civilization in Ramgarh quarter. A full gap was observed in the areas of variety selection, summer ploughing, seed rate, weed operation, seed treatment, planting of seedlings, and factory protection. Partial gaps were noted in land medication, age of seedlings, and toxin boluses. These gaps were probably the reasons for not achieving the implicit yield. Growers were generally not apprehensive of the recommended technologies. In utmost cases, they used original or low-yielding kinds rather of the recommended high- yielding and complaint- resistant kinds. Attainability of seeds on time and a lack of mindfulness were the primary reasons for this.

Growers followed homemade planting or broadcast styles of sowing, rather than the recommended line sowing. As a result, they applied an advanced seed rate than recommended, which increased the cost of civilization and led to lower yields.

The yield of the demonstrated Swarna Samridhi Dhan variety was advanced compared to the yield attained from growers' practices, which included the use of non-descript original kinds, no balanced fertilization, early sowing broadcasting, and no pest operation measures. These findings are harmonious with the findings of Singh (2018) and are corroborated by the exploration of Girish et al. (2020).

Table 1: Technological intervention and farmers practices under Front Line Demonstration on paddy variety Swarna Shakti Dhan

Sl.No.	Particulars	Existing practices	Technological intervention	Gap
1.	Selection of variety	Local or low yielding	Swarna Samridhi Dhan	Full gap
2.	Summer ploughing	-	Ploughing	Full gap
3.	Land Preparation	Two ploughing and pudling	Three ploughing and pudling	Partial gap
4.	Seed rate	10 kg per hactare	30 Kg per Hactare	Full gap
5.	Seed Treatment	-	Babistin @ 2 gram per hactare	Full gap
6.	Age of seedling	30-35 Days	21-25days	Partial gap
7.	Transplanting	Manual	Manual	Nil
8.	Fertilizer Dose	50 kg Urea	NPK-120:60:40	Imbalance
9.	Weed management	Manual	Butachlor @2.0 Kg /ha	Full gap
10.	Plant protection	No	Need based	Full gap

Table 2: Gap in grain yield production and economic impact of paddy variety under FLDs

Year	Variety	No. of FLDs	Area (ha)	Avg. Yield (q/ha)		% increase over	Technological gap (q/ha)	Extension gap (q/ha)	Technology Index (%)	Net return (Rs/ha)		B C ratio	
				Demo.	FP					Demo.	FP	Demo	FP
2022-23	Swarna Samridhi Dhan	15	06	51.24	45.25	13.23	8.76	5.99	14.58	104529.60	92310.00	2.01	1.751
2023-24	Swarna Samridhi Dhan	50	20	53.10	44.22	20.08	6.90	8.88	11.50	121227.30	100954.26	2.28	1.90
2024-25	Swarna Samridhi Dhan	50	20	53.14	47.31	12.32	6.86	5.83	11.43	127536.00	113544.00	2.36	2.10
Average	-	-	52.49	45.59	15.21	7.50	6.9	12.50	-	-	-	-	

Technology gap

The "technology gap" refers to the difference in crop production methods between existing practices and technological intervention. This disparity reflects farmers' lack of knowledge, application of scientific methods. When a conscientious farmer employs the aforementioned scientific techniques, he realizes their significance, and other farmers are impressed and try to emulate him. The crop data in Table 2 clearly show this technological gap. The differences between farmers practices plot yield and yield of demonstration plots were 8.76, 6.90and 6.86 q/ha during 2022-23, 2023-24 and 2024-25 respectively on an average technology gap under three year FLD programme was 7.50q/ha. The technology gap observed may be ascribe to dissimilarity in the soil agricultural practices and local climatic situation.

Extension gap

Extension gap of 5.99, 8.88 and 5.83 q/ha was observed during 2022-23, 2023-24 and 2024-25 respectively. On an average extension gap was observed 6.90q/ha which emphasized the need to educate the farmers through various extension means i.e. front line demonstration for adoption of improved rice variety and protection technologies to revert the trend of wide.

Technology index

The technology index shows the feasibility of the demonstrated technology at farmer's field. The technology index varied from 11.00 to 14.58 percent (Table 2). On an average technology index was observed 12.50 percent during the three years of FLD programme, shows the efficacy of good performance of technical interventions. This will accelerate the adoption of demonstrated technical intervention to increase the yield performance of rice.

Economic return

The cultivation of rice under adopting high yielding Swarna Samridhi Dhan variety gave higher net return of Rs. 52529.60, 68227.30 and Rs. 73536.00 per ha respectively as compared to farmers practices with Rs. 40310.00, 51046.00 and Rs.59544.00 respectively during 2022-23, 2023-24 and 2024-25. Similar findings were observed by Kiran et al. (2016). The benefit cost ratio of paddy cultivation under improved cultivation practices were 2.01, 2.28 and 2.36 as compared to 1.75, 1.90 and 2.10 under farmer's practices. The higher yield achieved with advanced technology, as opposed to traditional farming practices, could explain this result. This finding aligns with the conclusions of Mokidue et al. (2011), and Girish et al. (2020), he improved technology gave higher gross and net returns with a higher benefit-cost ratio than farmers' practices when studying FLD's impact on pulse yields. In their study, Raj et al. (2013) and Singh et al. (2017) reported similar findings.

The producers involved in the Front-Line Demonstrations (FLD) showed significant positive results, providing the researchers with an opportunity to demonstrate the productivity potential and profitability of the latest technologies (interventions) under real farming conditions. These demonstrations have also played a key role in the transfer of technology over time.

Impact of technology (Horizontal Spread)

The technology has had a significant impact on the adoption of the drought-tolerant rice variety, covering an area of 125 hectares over the past three years. This variety has key quality traits such as drought tolerance and is well-suited for cultivation in water-limited, irrigated, and drought-prone areas. In addition to being tolerant to drought during the reproductive stage, it can also withstand 10-12 days of submergence during the vegetative stage. With a higher yield potential of up to 60 quintals per hectare, it offers substantial benefits.

The demonstration also promoted the use of mechanization across various stages of rice cultivation, including land preparation, transplanting, weed management, plant protection, and fertilizer application. The improved technology and the Swarna Samridhi Dhan variety have been integrated into the seed chain with the relevant line departments, enabling farmers to access subsidies for both rice seeds and mechanization.

CONCLUSION

The study on frontline demonstrations (FLDs) of the Swarna Samridhi Dhan variety in Ramgarh district, Jharkhand, demonstrated significant improvements in rice productivity and farmer profitability. The adoption of this high-yielding, drought-tolerant variety resulted in an average increase in yield of 15.21%, compared to traditional farming practices. The study revealed substantial technological gaps, especially in areas like variety selection, seed treatment, fertilizer use, and pest management, which contributed to lower yields under farmers' conventional practices. The demonstrated variety also yielded higher net returns and improved the benefit-cost ratio, indicating the economic viability of adopting modern agricultural practices. The technology index, which measures the feasibility of adopting these innovations, was found to be 12.5%, signaling that the demonstrated technologies have great potential for wider adoption. The success of these demonstrations has not only enhanced the income of the farmers involved but also set the stage for scaling up the adoption of these practices across the region. Overall, the study emphasizes the need for continued efforts in extending these technologies, bridging the gaps in knowledge and application, and promoting practices that can help increase productivity and economic returns in rice farming. The positive outcomes from the FLDs point toward a promising future for rice farming in the region, contributing to enhanced food security and rural economic development.

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