Performance evaluation of Stress Tolerant Rice Variety Swarna Shreya under Front Line Demonstration in Bolangir District, Odisha

Abstract

Rice is the major crop of Odisha with a total coverage of 41 lakh ha which is about 65% of the total cultivable area of the state. Area under rice crop in Bolangir district is 218.97 thousand ha. Bolangir District is located under Western Central Table Land Agro climatic Zone characterized by hot and sub humid climate. About 168.91 thousand ha rice is under rainfed condition. Drought is a major abiotic stress that adversely affects the rice growth, mostly in the rainfed ecosystem that ultimately affects the biomass production and yield. Front line demonstrations have been conducted in NICRA adopted village- Odiapali, Block- Bolangir in the Kharif season of the year 2022 and 2023. The percentage increase in yield is 13.63 and 14.61 and net return is Rs 42,200/- and Rs 43,444/- per ha as compared to farmer's practice variety Swarna' performance respectively for the year 2022 and 2023.

Keywords*: Drought, Swarna Shreya, net profit, yield, Stress tolerant*

Introduction

Rice is the major crop of Odisha with a total coverage of 41 lakh ha which is about 65 % of the total cultivable area of the state (Mangaraj et al. 2021). The area under rice crop in Bolangir district of the state is 218.97 thousand ha. Bolangir District is located under Western Central Table Land Agro climatic Zone characterized by hot and sub humid climate. According to Agriculture Contingency Plan District: Bolangir, about 168.91 thousand ha rice is under rainfed condition. (https://www.icar-crida.res.in/CP/Orissa/OUAT,%20Bhubaneswar/Orissa%2012-%20Bolangir%2031.05.2011.pdf assessed on 27/08/2024). "The average annual rainfall of Bolangir district is 1190 mm. Owing to climate variation and climate extremes, rice yield fluctuates by up to 32%, which is about 3 million tons of annual yield loss. Decrease in productivity of rice is mainly related to extreme environmental conditions such as water deficit, high temperature, submergence, salinity, cold, and accumulation of heavy metals apart from higher incidence of pathogens and pests" (Nachimuthu et al., 2017). "This yield vulnerability in rice production stems from irregular rainfall pattern during growing season resulting to drought. Additionally, climate change has been predicted to increase the frequency and intensity of extreme weather conditions such as severe drought and heat stress. Drought has been recognized as the primary constraint to rainfed rice production. Drought is a major abiotic stress that adversely affects the rice growth, mostly in the rainfed ecosystem that ultimately affects the yield" [16]. Mangaraj et al. (2021) suggested that "rice needs to adapt a series of physiological mechanisms with complicated regulatory network to fight and cope up with the unfavourable conditions due to drought stress". Rumanti et al. (2018) reported that "Rice areas were damaged by drought sharply increase during El Niño years, while flood damage increased during La Niña years" (Boer, 2011). "The El Niño in 2015 caused serious drought for 815,132 ha of total rice fields in the country, mainly in

rainfed and coastal lowlands in Java, Sulawesi and Sumatra. Because of the absence of high yielding, good-quality drought-tolerant varieties, farmers in the rainfed ecosystem continue to grow Swarna Variety". Hence, there is a scope to introduce a short duration high yielding and stress tolerant rice variety in existing rice-based cropping system in West central table land zone of Odisha.

Materials and methods:

This study was conducted in National Innovations in Climate Resilient Agriculture (NICRA) adopted Village- Odiapali, Block: Bolangir of Bolangir district with an objective to evaluate the performance of short duration drought tolerant rice variety Swarna Shreya. Climate of Bolangir district is fairly hot and humid. Water scarcity is the major challenge to sustain the rice production in these areas.

Front line demonstration has been conducted in village Odiapali, Block- Bolangir in the Kharif season of the year 2022 and 2023. Foundation seeds of Swarna Shreya have been distributed to the farmers. This variety is a good stress tolerant variety.

The aerobic rice variety 'Swarna Shreya' (RCPR-8-IR84899-B-179-16-1-1-1) released and notified by the Central Sub-committee on Crop Standards Notification and Release Varieties for Agricultural Crops, Government of India. "The newly released promising high yielding variety Swarna Shreya is medium duration, high yielding, resistant to major insect and pest and suitable for both irrigated and rainfed condition. The soil of the area under study was mixed red and black. The components in FLDs comprised of improved variety Swarna Shreya, proper tillage practices, adequate seed rate, seed treatment, Soil test based fertilizer application and plant protection measures. The various training programmes and field day was organized prior and during the conduction of Front line demonstration. Total 20 ha area covered in two consecutive years. The crop was transplanted during the fourth week of July and harvested in first week of December. The yield data was collected from both demonstration and farmer practices by random crop cutting methods. Data on crop yield were recorded per twenty five square meter observation method and collected randomly from 3 to 4 places both for demonstrations and farmer's fields as described" by Phonglosa et al. (2022). The average data were collected from both the demonstrations and farmers' fields.

Observations on different growth and yield parameters were taken and economic analysis was done by calculating the cost of cultivation, gross return, and net return. Final crop yield was recorded, and the gross return was calculated based on prevailing minimum standard price fixed by Government. The field photographs of demonstration on Stress tolerant rice variety Swarna Shreya at different stages are given in Figure 1.

		
Transplanting of Swarna Shreya seedlings	Weed management in rice	Field day on Swarna Shreya

Figure 1. Field photographs of the demonstration

Results and discussion

Yield

"The yield economics of farmer practices and recommended technology of rice in Bolangir district is presented in Table 1. Rice yield ranged from 40.8 q/ha to 42.5 q/ha in demonstration plots and from 35.6 q/ha to 37.40 q/ha in farmers practice plot in two years demonstrations during Kharif 2022 and 2023. The average yield of rice through FLDs during two years was 41.7 q/ha under demonstration plots as compared to 36.5 q/ha in farmers practice plots. This result indicated that the average yield in demonstration plots was higher compared to farmers practice. The yield enhancement due to the improved practices ranged between 13.64 to 14.61 percent over farmers' practice. The percent increase in yield over farmers' practice was highest during Kharif-2022. Similar findings in rice and others crops have been reported" by Phonglosa et al. (2022), Mishra et al. (2019), Pandey et al. (2018) and Goswami et al. (2020).

"The yield gap was observed in case of high yielding variety, seed rate, seed treatment, fertilizer dose and plant protection measures, while, partial gap was observed in weed management practice. These are the reason for not achieving the potential yield. Farmers were generally not adopting the seed treatment which leads to make the crop more susceptible to disease and applied the higher dose of seed and fertilizer than the recommended leading to higher cost of cultivation with low yield" [15].

Table 1: Comparison of Yield economics of Swarna Shreya

Year	Area	No. of farmers	Average yield (q/ha)		% increase in yield
			Demo	Farmer's Practice	
2022-23	20 ha	30	42.5	37.4	13.64
2023-24	20 ha	30	40.8	35.6	14.61

The observation parameters of stress tolerant rice variety Swarna Shreya like hill length, no. of tillers per hill, no. of panicle per tiller etc. is given below in Table 2.

Table 2: Growth attributes of stress tolerant rice variety Swarna Shreya

Year	Av. Hill length (cm)	Av. No. of tillers per hill	Av. No. of panicle per tiller	Av. Panicle length (cm)	Av. No. of grains per panicle	Av. Biomass (Kg/m^2)	Av. Grain weight (Kg/m^2)	Av. Straw weight (Kg/m^2)
2022	108.4±1.6	12.3±3.1	9.6±2.4	23.4±2.3	105.3±3.8	1.01±0.25	0.37±0.14	0.64±0.2
2023	112.6±3.2	14.7±3.7	10.2±3.1	26.3±2.8	112.5±3.9	1.05±0.35	0.38±0.16	0.67±0.2

Economic Return:

The average net return of demonstrated variety Swarna Shreya was higher in demonstrated improved variety over the farmer's practice (Table 3). The benefit cost ratio under improved cultivation practices were 1.95 and 1.95 as compared to 1.69 and 1.66 under farmer practices for the year 2022 and 2023 respectively. This finding was collaborated with Samant (2015) and Girish et al. (2020). Mangaraj et. al. (2021) reported that Swarna Shreya recorded higher gross return (Rs. 67037±2980.2 ha-1), net return (Rs. 37037±2980.0 ha-1) and B: C ratio (2.23±0.20) as compared to farmers practice of growing MTU-1010. The higher yield may be due to higher yield obtained under improved technology compared to farmer's practice. The similar findings were also reported by the Singh and Sharma (2004), Singh et al. (2007), Beigh et al. (2015) and Shrivastava et al. (2021).

Table 3: Comparison of economics under FLD on Improved variety Swarna Shreya.

Year	Cost of cultivation (Rs/ha)		Gross return (Rs/ha)		Net return (Rs/ha)		B:C	
	FP	Demo	FP	Demo	FP	Demo	FP	Demo
2022-23	45,000	44,500	76,296	86,700	31,296	42,200	1.69	1.95
2023-24	46,000	45,500	76,184	88,944	30,184	43,444	1.66	1.95

Conclusion

Swarna Shreya is a very good stress tolerant variety suitable for Bolangir District. The percentage increase in yield was 13.64% and 14.61% respectively than farmers practice for the year 2022 and 2023. The net return from the demo is Rs 42,200/- and Rs 43,444/- per ha for the year 2022 and 2023 respectively. The benefit cost ratio under improved cultivation practices were 1.95 and 1.95 as compared to 1.69 and 1.66 under farmer practices for the year 2022 and 2023 respectively. The technology had a greater impact with farming community for horizontal spread.

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Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

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Details of the AI usage are given below:

1.

2.

3.

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