

Performance of Stress Tolerant Rice Variety Swarna Shreya under Rainfed Drought-Prone Areas of South Eastern Ghat Zone of Odisha

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ABSTRACT

Stress like drought is an important production constraint that drastically reduces rice yield. The present study was conducted during *kharif* season of 2019 through the front line demonstrations in Malkangiri district of South Eastern Ghat Zone of Odisha to evaluate the performance of drought tolerant rice variety Swarna Shreya with recommended package (demonstrated technology) of practices. Rice variety Sahabhazi dhan was considered as local check (farmers practice). Performance of Swarna Shreya was better in terms of plant height (110.4 cm), number of tillers hill⁻¹ (17.8), panicle length (23.5 cm), number of grains panicle⁻¹ (162), test weight (23.4 g) with yield of 42.4 q ha⁻¹. In terms of yield, it was 15.2% more with Swarna Shreya as compared to local check Sahabhazi dhan. Highest economic return with more B:C ratio (1.8) was also recorded with Swarna shreya. So, drought tolerant rice variety Sahabhazi dhan can be replaced with Swarna Shreya for more yield and higher economic return in rainfed upland ecosystem of South Eastern Ghat Zone of Odisha.

KEYWORDS

Drought, economics, rice, swarna shreya, yield

ARTICLE INFO

Received on	:	30/09/2021
Accepted on	:	25/11/2021
Published online	:	31/12/2021



INTRODUCTION

Rice (*Oryza sativa* L.) is one of the most important crop and staple food for about half of the humankind on the planet (Pathak *et al*, 2020). The country's total rice cultivated area is 43.79 million ha with production of 116.42 million tonnes and productivity of 2659 kg ha⁻¹ (Anonymous, 2019). In Odisha, rice is cultivated in about 41 lakh ha area and it is about 65% of total cultivated area (Mangaraj *et al*, 2021). Average rice productivity in Odisha (1972 kg ha⁻¹) is quite low as compared to national average (Anonymous, 2019). Economy related to agricultural sector in Odisha mainly depends on rice production as it is the main food in this state. Farmer faces serious challenges of low income due to different reasons associated with rice production system. Among them, drought is a major abiotic stress that adversely affects the rice growth and production mainly in the rainfed ecosystem (Emam *et al*, 2014). The challenges facing rice production in drought-prone areas are becoming even more complex with the long-term adverse effects of climate change. Malkangiri district comes under South Eastern Ghat Zone of Odisha and paddy is the major crop grown in rainfed ecosystem in kharif season. The major constraints for higher productivity are water stress condition at critical stages of rice growth and which is badly affected majority of the farmers in this region. In drought years, value of rice production lost in eastern India has been estimated and it was 36% of the total value of rice production (Arora *et al*, 2019). So, cultivation of stress like drought tolerant rice varieties is considered as one

of the most efficient and cheapest techniques for food safety and improves farmer's income. Rice variety Swarna Shreya has been developed by the ICAR Research Complex for Eastern Region with maturity period of 120-125 days. It has capacity to withstand drought and also tolerant to many diseases and insect pests. Average productivity of this variety is 4.5 to 5.0 t ha⁻¹. Under severe drought, it can produce 2.0 to 2.5 t ha⁻¹ (Anonymous, 2015; Malik *et al*, 2020). Keeping the above points in view, the front line demonstrations were conducted to evaluate the field performance of drought tolerant rice variety Swarna Shreya with recommended package of practices in Malkangiri district of South Eastern Ghat Zone of Odisha.

MATERIALS AND METHODS

The study was carried out in adopted villages of Krishi Vigyan Kendra (KVK), Malkangiri during kharif season of 2019. The demonstrations were conducted in two different adopted villages i.e. Boilapari and Tandapali of Malkangiri district in Odisha comprising total twenty numbers of farmers, ten farmers from each village. Twenty numbers front line demonstrations on stress tolerant rice variety Swarna shreya (demonstrated technology) were conducted in two clusters taking farmers variety Sahabhazi dhan as local check (farmers practice). All the participating farmers were trained on various aspects of rice production technologies and recommended agronomic practices. The soil of demonstration site was slightly acidic in reaction (pH-5.4 to 6.5) with sandy loam in texture. The available nitrogen, phosphorus and potassium

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were 185.05, 23.10 and 184.41 kg ha⁻¹, respectively. Average annual rainfall of the experimental region was 1667.60 mm and 86% of it was received during rainy season. The crop was grown in rainfed upland condition in the first to second week of July and 21 days old seedling were transplanted in main filed in case of demonstrated field. The crop was raised with

recommended agronomic practices (Table 1) and harvested within the last week of October to first week of November. The field observations were taken from demonstration plot and farmer's plot as well. Parameters like plant height, number of tillers per hill, panicle length,

Table 1: Comparison between farmer's practices and demonstrated technology

Sl. No.	Particulars	Farmer's practice	Demonstrated Technology
1	Variety	Sahabhazi dhan	Swarna shreya
1	Seed rate	60 kg ha ⁻¹	50 kg ha ⁻¹
2	Seed treatment	No seed treatment	With Carbendazim 50% WP @ 2 g kg ¹ seed.
3	Method of sowing	Broadcasting	Line sowing with spacing of 15 cm x 10 cm
4	Fertilizer application	Imbalanced dose and more use of nitrogenous fertilizer.	Fertilizer dose of 60, 30 and 30 kg ha ⁻¹ N, P ₂ O ₅ and K ₂ O, respectively. Full dose of P ₂ O ₅ and K ₂ O along with 25% N were applied as basal. Remaining 50% N top dressed at three weeks after transplanting and 25% at panicle initiation stage.
5	Plant population	More plant population	Optimum plant population.
6	Weed management	Late hand weeding at 40-50 days after sowing.	Application of Bispyrabac sodium 10% SC @ 300 ml/ha at 8-10 days after transplanting followed by hand weeding at 40-45 days after transplanting.
7	Plant protection measures	Spraying of Carbendazim 50% WP for fungal diseases and Chlorpyrifos for different insect pests.	Need based plant protection measures.

number of grains per panicle, test weight and yield were recorded at maturity stage. Gross returns (Rs. ha⁻¹) were calculated on the basis of the prevailing market price of the paddy and net return (Rs. ha⁻¹) was calculated by deducting the cost of cultivation from gross return. B: C ratio was calculated by dividing the total cost of cultivation by gross return. Data were tabulated and analyzed by using mean, standard deviation, Pearson's product-moment correlation, paired 't' test to draw the inferences.

RESULTS AND DISCUSSION

The variety Swarna shreya (Demonstrated technology) exhibited superior performances in terms of all parameters (Table 2) and recorded plant height of 110.4 cm with average number of tillers per hill (17.8), panicle length (23.5 cm), number of grains per panicle (162), test weight (23.4 g) and yield (42.4 q ha⁻¹). On other hand, Sahabhazi dhan (Farmer's practice) gave a yield of 36.8 q ha⁻¹ with plant height of 95.6 cm, 15.5 numbers of tillers hill⁻¹, panicle length of 22.4 cm, 11 numbers of grains panicle⁻¹ and test weight of 22.9 g.

Table 2: Growth and yield parameters of rice varieties

Varieties	Plant height (cm)	No. of tillers hill ⁻¹	Panicle length (cm)	No. of grains panicle ⁻¹	Test weight (g)	Yield(q ha ⁻¹)
Swarna shreya	110.4	17.8	23.5	162	23.4	42.4
Sahabhazi dhan	95.6	15.5	22.4	112	22.9	36.8

Swarna shreya with recommended package of practices (Demonstrated technology) has showed excellent performance at farmers' fields under upland rainfed situation with 15.2% higher yield over Sahabhazi dhan (Farmers practices). Mean differences of two varieties were significant at 5% level of significance (Table 3). More numbers of tillers per hill, panicle length, number of grains per panicle and test weight were responsible for maximum yield with Swarna shreya. The major differences were observed between demonstrated tech-

nology and farmer's practices were optimum seed rate and plant population, seed treatment, sowing method, balance dose of fertilizer application and plant protection measure (Table 1). These differences with more stress tolerant capacity of Swarna shreya (Malik *et al*, 2020) could exhibit superior performance. The genotypes, which produced higher number of effective tillers per hill, longer panicle length and higher number of grains per panicle also showed higher grain yield in rice (Malik *et al*, 2020; Mangaraj *et al*, 2021).

Table 3: Variation in average yield of rice variety Swarnashreya and Sahabhazi dhan

Particulars	Sahabhazi dhan	Swarna shreya	% increase	't' cal	't' tab
Mean Yield	36.8	42.4	15.2	5.48	2.09
Variance	3.24	2.85	The means of two varieties are significantly different at		
Standard deviation	1.58	1.14	p<0.05		

In case of rice variety Swarna Shreya, significant positive correlation between panicle length and number of grains per panicle indicated that greater number of grains could be accommodated in longer panicles (Table 4). Parameters like number of tillers per hill, panicle length and number of grains

per panicle were significantly correlated with the grain yield. It was specified that more yield could be obtained with a greater number of tillers per hill, panicle length and number of grains per panicle (Malik *et al*, 2020; Mangaraj *et al*, 2021).

Table 4: Correlation for rice grain yield with other agronomic characters of Swarna shreya

Variables	Plant height	No. of tillers hill ⁻¹	Panicle length	No of grains panicle ⁻¹	Test weight	Yield
Plant height	1					
No. of tillers hill ⁻¹	-0.326	1				
Panicle length	-0.232	0.293	1			
No of grains panicle ⁻¹	0.441	0.215	0.640*	1		
Test weight	0.211	-0.024	-0.028	0.283	1	
Yield	-0.007	0.841*	0.674*	0.676*	0.014	1

*Correlation is significant at the 0.05 level

Table 5: Economic comparison between farmers practice and demonstrated practice

Varieties	Cost of cultivation (Rs. ha ⁻¹)	Gross return(Rs. ha ⁻¹)	Net return(Rs. ha ⁻¹)	B:C ratio
Swarna shreya	36800	65700	28900	1.8
Sahabhazi dhan	35600	57040	21800	1.6

The results on economic analysis of rice production under demonstration i.e. Swarna shreya revealed that the gross expenditure was higher than farmers practice. The rice vari-

ety Swarna shreya recorded higher gross return (Rs. 65700 ha⁻¹), net return (Rs 28900 ha⁻¹) with more B: C ratio (1.8) as compared to Sahabhazi dhan. Though the cost cultivation

was higher with demonstration but higher economic return was also obtained with this practice because of increase yield by 16.0%, whereas increase in cost of cultivation was less i.e. 3.4% as compared to Sahabhagi dhan. Malik *et al* (2020) was also reported higher economic return with Swarna shreya as compared to Sahabhagi dhan.

CONCLUSION

On the basis of assessment, result revealed that drought tolerant rice variety Swarna Shreya was superior over the Sahabhagi dhan in terms of production with more numbers of tillers

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per hill, panicle length, number of grains per panicle and test weight. Rice variety Swarna shreya was also gave more economic return to the farmers. So, rice variety Sahabhagi dhan may be replaced with Swarna Shreya for more production and higher economic return for farmers of South Eastern Ghat Zone of Odisha in upland rainfed ecosystem.

ACKNOWLEDGEMENT

The authors are thankful to Odisha University of Agriculture and Technology, Bhubaneswar and ICAR-Agriculture Technology Application Research Institute, Kolkata.

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Citation:

Dash SR, Routray BK, Das H and Behera N. 2021. Performance of Stress Tolerant Rice Variety Swarna Shreya under Rainfed Drought-Prone Areas of South Eastern Ghat Zone of Odisha. *Journal of AgriSearch* **8**(4): 360-363