



Performance of Drought Tolerant Rice Varieties in Malkangiri District of South Eastern Ghat Zone of Odisha

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Abstract

Drought is the major problem in India and occurrence at the time of critical growth stages, reduce crop yield significantly. The National Rice Research Institute, Cuttak, Odisha has developed so many drought tolerance rice varieties to reduce the economic loss due to drought. Krishi Vigyan Kendra, Malkangiri introduced NRRI released two rice varieties i.e. Sahbhagi Dhan and Satyabhama at framers' field to evaluate the performance of these drought tolerant varieties in South Eastern Ghat Zone of Odisha. The highest plant height was observed with the rice variety Satyabhama (104.1 cm). But, overall performance of Sahbhagi Dhan was better as compare to Satyabhama and local check verity (Khandagiri). Sahbhagi Dhan gave highest yield of 36.5 q/ha, which was statistically differed from others. Correlations study for Sahbhagi Dhan was assessed and observed the positive correlation for grain yield with all studied characters except plant height. For economic point of view, Sahbhagi Dhan recorded highest net return of Rs.19, 925/- per ha along with B:C ratio of 1.6 as compared to the rest two varieties.



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Introduction

India produces a variety of large crops, within that rice is most important that's feed more than 60% of the population. The country's total rice cultivated area is 43.86 million ha with production of 104.80 million tonnes and productivity of 3.77 t/ha¹. In Odisha, 69% cultivated area is under rice and occupied 63% of total area under food grains production.² Economy of Odisha mainly depends on rice production as it is

the main food in this state. The total rice cultivated area of Malkangiri district of Odisha is 142740 ha and it was occupied more than 50% cultivated area and within that upland area is 29%, medium land 40% and low land is 31%.³

Droughts and submergence are the most important phenomenon for rice production. About 40% of total rice cultivated area in India is rainfed⁴; hence crop

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suffered a lot for occurrence of drought. Droughts and floods are the common incident in Odisha. During 2011, it was estimated that about 0.8–0.10 million hectares area of cultivated rice in rainfed condition was experienced drought stress in Odisha.⁵

Drought during critical stages in the rice growth cycle reduces available moisture for crop growth and ultimately there is a drastic reduction in yield. Rainfall in Malkangiri district is sufficient (Average-1668 mm) but dry spell during critical crop growth stages drastically reduces productivity of rice.

The lost of rice production during drought years in eastern India is estimated to be 36% of the total rice production⁶. For that reason, development of drought tolerant or less water requirement rice varieties is measured one of the most efficient and cheapest techniques for food safety.

To evaluate performance of drought tolerant rice varieties in South Eastern Ghat Zone of Odisha, Krishi Vigyan Kendra, Malkangiri carry out an on-farm trial (OFT) with improved rice varieties viz., Sahbhagi Dhan and Satyabhama against locally cultivated short duration variety Khandagiri.

Materials and Methods

The Malkangiri district comprises of seven community blocks i.e. Malkangiri, Korkunda, Mathili, Kalimela, Khairput, K. Guma and Podia and among that,

Malkangiri block was chosen for conducting On-Farm Trial (OFT). Three villages were selected based on first round study where farmers were cultivating old variety (Khandagiri) in their rice based cropping system in Malkangiri block. Total seven growers were selected in three villages. Kharif 2015, on farm testing conducted in different location (three) of Malkangiri block. For this, three technical options were presented on the way to the field trial and important inputs, such as seeds of rice varieties viz., Sahbhagi Dhan and Satyabhama were given to the chosen growers. On Farm Trials conducted in 2.0 ha area. The initial soil properties in three different locations ranged between 0.45-0.55% organic C, 190-220kg/ha available N, 38-60 kg/ha available P₂O₅, 95-105 kg/ha available K₂O and soil pH 5.5-6.0. In all places, rice was sown in nursery on 3rd week of July, 2015 @ 60kg /ha and 20 days old seedlings were transplanted with spacing of 15 cm between rows and 10 cm between plants. The recommended fertilizer dose was 40:20:20 kg/ha N, P₂O₅ and K₂O, respectively. Full dose of P₂O₅ and K₂O along with 25% N were applied as basal. Remaining 50% N top dressed at three weeks after transplanting and 25% at panicle initiation stage. Top dressing was done after 1st and 2nd hand weeding. Blast and leaf folder infestation observed for rice variety Khandagiri and to control these recommended plant protection measures were followed. Rainfall during crop growing period presented in Fig-1.

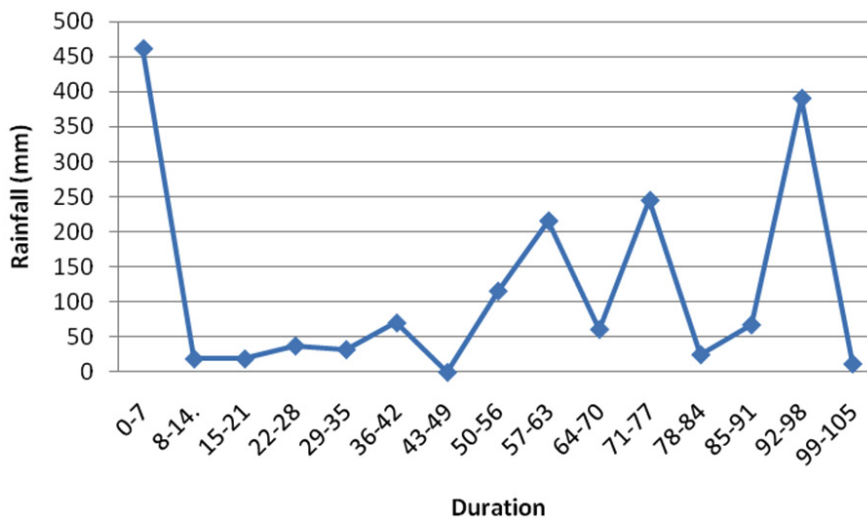


Fig. 1: Weekly rainfall during the cropping period

Table 1: Details of Technological Options

Technological Options	Variety	Year of release	Season	Varietal characters	Source of Technology
TO-1	Khandagiri	1994	Kharif	"It is an early duration (90-95 days), dwarf statured and drought tolerance variety. It produces white husked medium bold seeds and average productivity of 3.5 t/ha". (OUAT)	Farmers' practice
TO-2	Sahbhagi Dhan	2009	Kharif	"It is an early duration (105 days) dwarf statured (85-90 cm) extremely drought tolerance popular variety appropriate for upland, rainfed direct seeded as well as in transplanted situations. It produces yellow (golden) husked long bold seeds and average efficiency of 3.5-4.0 t/ha. It is resistant to leaf blast and moderate resistant to brown spot, sheath rot, stem borer, and leaf folder" (NRRRI, Odisha).	NRRRI, Cuttack, Odisha
TO-3	Satyabhama	2012	Kharif	"It is an early duration (110 days) variety. It has medium slender grains and tolerance to glume discoloration. It has an average productivity of 2.3-4.7 t/ha. It shows resistance to major pests viz., yellow stem borer, leaf folder, whorl maggot and moderate resistant to leaf blast, rice tungro virus, white backed plant hopper, brown plant hopper, gall midge, hispa and +thrips"(NRRRI, Odisha).	NRRRI, Cuttack, Odisha

Data of yield attributing characters were recorded from all seven farmers of three locations.

One farmer represented the one relocation and the total seven replication data collected. During the data collection, the characters of crop like plant height (cm), the number of tillers per hill, panicle length (cm), grains per panicle, test weight (g) and yield (q/ha). The economics of trials were calculated as follow:

Net Return (Rs/ha) = Gross Return – Cost of Cultivation

BC Ratio = $\frac{\text{Gross Return}}{\text{Cost of Cultivation}}$

All the collected information from seven replications were statistically analyzed by analysis of (ANOVA) as randomized block design to conclude the significant level within treatments⁸ whereas correlation analyze through SPSS statistics.²²

Results and Discussion

Varietal Performance

Significant response was noted for plant height between rice varieties (Table 2). The highest plant height was recorded with Satyabhama (104.1 cm) followed by Sahbhagi Dhan (97.6cm) and Khandagiri (89.9 cm). Similar findings were found in

short duration rice variety Satyabhama by Samant *et al.*,⁹. The number of tillers per hill was recorded significantly maximum with Sahbhagi Dhan (16.1) whereas Satyabhama and Khandagiri recorded 15.3 and 13.1, respectively. Variation in change in tillers per hill may be due to the unique genetic potential of the individual varieties. These results are in agreement with Sarker *et al.*,¹⁰ and Mondal *et al.*,¹¹. Both the improved varieties, Sahbhagi Dhan and Satyabhama recorded average panicle length of 22.3 cm and 21.9 cm, respectively, whereas low length was observed in Khandagiri (20.1 cm). The highest number of grains per panicle was significantly noticed in Sahbhagi Dhan (110.7) followed by Satyabhama (106.4), while lowest for Khandagiri (98.8). Significant variability in test weight (1000 grain weight) was recorded in rice varieties and found to

be the highest in (22.9 g) followed by Satyabhama (22.3 g) and Khandagiri (20.7 g). Significant variation among different rice varieties was observed (Table 2). Sahbhagi Dhan (36.5 q/ha) was recorded more yield followed by Satyabhama (34.3 q/ha). Rice variety Sahbhagi Dhan and Satyabhama recorded 22.5 and 17.4% higher yield over the local check Khandagiri. Sahbhagi Dhan performed better as compared to old variety Khandagiri in respect to the yield attributing characters. Variation in yield within different varieties might due to be differences in growth habit and their response to the climatic condition. This result was also supported by Samant *et al.*,¹². Among the three varieties Khandagiri matured early (97.1 days) followed by Sahbhagi Dhan (101.1) and Satyabhama (104.3).

Table 2: Growth and yield parameters of drought tolerant rice varieties

Variety	Plant height (cm)	No. of tillers/hill	Panicle length (cm)	No. of grains/panicle	Test weight (g)	Grain yield (q/ha)	Maturity duration (days)
Khandagiri	89.9	13.4	20.1	98.8	20.7	28.3	97.1
Sahbhagi Dhan	97.6	16.1	22.3	110.7	22.9	36.5	101.1
Satyabhama	104.1	15.3	21.9	106.4	22.3	34.3	104.3
S.Em±	2.57	0.29	0.22	0.72	0.15	0.82	0.68
CD at 5%	7.91	0.90	0.69	2.23	0.46	2.52	2.11

Table 3: Analysis of correlation for rice grain yield and other agronomic characters of Sahbhagi Dhan.

Characters	Tillers/ hill	Panicle	Grains / length	Test panicle	Yield weight
Plant height	-0.441	-0.481	-0.472	0.094	-0.595
Tillers/ hill		-0.009	0.214	0.144	0.008
Panicle length			0.957**	0.598	0.857*
Grains/ panicle				0.714	0.814*
Test weight					0.246

** Significant at the 0.01 level. * Significant at the 0.05 level.

Correlation Among Parameters

In case of rice variety Sahbhagi Dhan, plant height showed positive correlation with test weight whereas non-significantly negative correlation was observed

with other parameters like tillers/hill, panicle length, grains/panicle and yield.¹³ Tillers per hill were found to display positive correlation with test weight, grains per panicle, and grain yield but negative correlation

was found with panicle length.¹³ Highly positive significant association was obtained between panicle length and grains per panicle as well as grain yield (Table 3). The positive correlation was showed by test weight with all the parameters whereas significant positive correlation of grain yield was recorded with grains per panicle and panicle length. However, yield with plant height was negative correlated. The most important yield attributing traits in rice are number of tillers, panicle length and number of grains per panicle which are directly proportional to yield^{14, 15, 16}.

Improved rice varieties shown more net return than the local check variety (Table 4). Sahbhagi Dhan recorded more net return of Rs.19, 925/- per ha, whereas Rs. 16,735/- per ha by Satyabhama. The highest net return rates in the case of Sahbhagi Dhan are obtained by the highest gross return (Rs. 52,925/- per ha) followed by Satyabhama (Rs. 49,735/- per ha). Average highest B:C ratio of drought tolerant varieties was noted 1.6 for Sahbhagi Dhan and 1.5 for Satyabhama and were higher than the farmers' variety (1.4).¹⁷

Conclusion

On the basis of assessment, it may be concluded that the drought tolerant rice variety Sahbhagi Dhan was superior over the Satyabhama as well as old popular variety Khandagiri due to the highly drought tolerant capacity and short duration with more productivity. Therefore, Sahbhagi Dhan can replace the local check variety (Khandagiri) in experimental region.

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Conflict of Interest

There is no conflict of interest.

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