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PERFORMANCE OF CLIMATE-SMART RICE VARIETY 'BINADHAN-11' IN EAST AND SOUTH EAST COASTAL PLAIN ZONES OF ODISHA

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ABSTRACT

In Odisha, about 40 lakh ha area covered under rice crop, which occupies about 24 percent of gross cropped area of the country, and basically the coastal plains are major dominant in rice production of the state but this coastal regions are more prone to flash and heavy flood. The district, Jagasinghpur comes under East and South East coastal plain zone of Odisha and this district is vulnerable to flood, flashflood, cyclone and water stagnation for longer period in crop fields. Submergence has been identified as the third most important constraint for higher productivity, because it sometimes resulted in total yield loss. Farmers' participatory field trials were carried out in two blocks like Tirtol, Jagatsinghpur of Jagatsinghpurdistrict to study the performance of submergence tolerant rice variety Binadhan- 11 and farmers ruling variety Lalat was taken as check. The field experiment was conducted during Kharif -2017, in farmers' field in two flood prone villages i.e. Nagapura of Tirtol block and Gobindapokhari of Jagatsinghpur block, comprising 30 no of farmers, 15from each village. The result revealed that maximum number of tillers/ m2, panicle length, plant height and no of grains per panicle, we rerecorded higher in Binadhan -11 as compared to farmer's variety, Lalat. It was observed that the average grain yield of Binadhan-11 was 47.62 q ha-1 as compared to farmer's variety Lalat 45.23 q ha-1and yield was 6 % higher over farmer's variety Lalat. The farmer's feedback showed that the rice variety Binadhan-11 can tolerate water lodging condition and can successfully overcome water submergence for 4-8 days during tillering to stem elongation stage. So, it was revealed that, performance of Binadhan-11 under submergence condition was consistent and exhibited tolerance towards submergence with higher grain yield as compared to Lalat. It was concluded that Binadhan -11, the "climate change-ready rice"can substitute farmer's variety Lalat in Medium land situation with substantial higher yield and tolerant to submergence condition, with positive impacts in the lives of poor marginal farmers of coastal districts of Odisha. From this experiment, it was concluded that Binadhan -11 exhibited highest survivable percentage under sub mergence condition and was the highest performing medium duration rice variety as compared to Lalat in East and South East coastal plain zone of Odisha.

KEYWORDS: *Coastal Region, Climate Smart, Environmental Stresses, Submergence Tolerance*

INTRODUCTION

The rate of world population growth has exceeded the rate of growth in food-grain production. It is predicted that the world population will exceed 8 billion people by 2025, and to meet these global food demands, the production of grain needs to increase up to 50% more by the year 2025 (Khush, 1999). The emergence of new diseases and pests and the changing climate are the major issues that address the requirement for sustainable crop development and resistance to biotic and abiotic stresses (Hasan et al., 2015). Environmental stresses constrain rice production, affecting about 30% of the 700 million poor in Asia alone, who live in rainfed rice-growing areas. These stresses can be caused by extreme climatic changes like drought, flooding, or rising sea levels. In Odisha, about 40 lakh ha area covered under rice crop which occupies about 24 percent of gross cropped area of the country, and basically the coastal plains are major dominant in rice production of the state, but are more prone to flash and heavy flood. The district Jagasinghpur comes under East and South East coastal plain zone of Odishaand climate of this district is hot and humid, the average rainfall is 1370 mm. About 80% of rainfall occurs during month of June to September. This district is vulnerable to flood, flashflood, cyclone and water stagnation for longer period in crop fields. Submergence has been identified as the third most important constraint for higher productivity, because it sometimes resulted in total yield loss. Development of submergence tolerant high yielding rice varieties for optimum productivity is essential to cope up with this problem.

Paddy is a major crop in the district and is cultivated in 91,000 ha, the main cropping system of the district was Paddy followed by Green gram/Black Gram and Paddy, followed Vegetables.
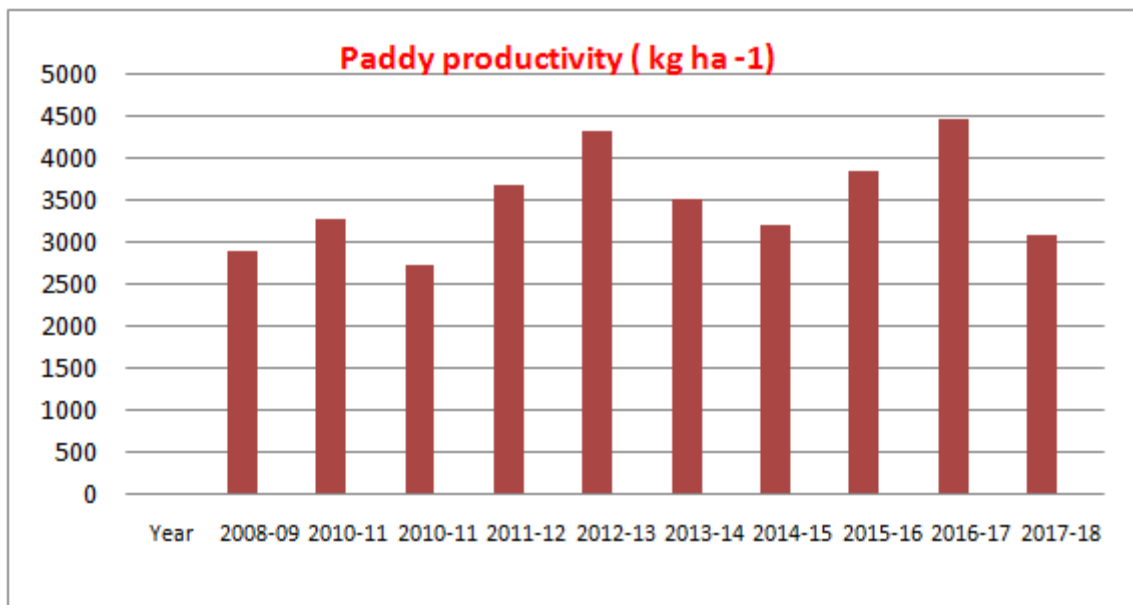

Figure 1: Trend Analysis of Paddy Productivity in Jagatsinghpur District.

Quick regeneration, following submergence is a desirable trait under frequent or prolonged flooding, asit can ensure early recovery and production of sufficient biomass. Current threat due to climate variability will only exacerbate this vulnerability, particularly for small and marginal farmer

OBJECTIVE

Hence, this study was undertaken to study the performance of stress tolerant rice variety Binadhan-11 in medium land situation. The on-farm trials were carried out during Kharif -2017, under the Head to Head trials, in collaboration with

International Rice Research Institute (IRRI), Philippines in Jagatsinghpur district covering two villages like Gobindapokhari of Jagatsonghpur block and Nagapura village of Tirtolblock.

MATERIALS AND METHODS

The study was under taken in two adopted villages under Tirtoland Jagatsinghpur block, and the villages were selected from each block purposefully, as most of the areas are prone to submergence in Kharif. Total 30 no of on -farm trials were conducted in farmers field situation, taking a high yielding stress tolerant rice variety Oryza sativa L. cv. "Binadhan-11"and farmers ruling variety Lalat as local check. Submergence tolerance rice variety Binadhan-11was tested against farmer's conventional variety "Lalat" and all the agronomical recommended package of practices and need based plant protection measures were followed. The field was submerged due to heavy rainfall and the water level was 15-20 cm during last week of July 2017, and the water level varied from 40-50 cm during last week of August 2017.

RESULTS AND DISCUSSIONS

Under submergence condition, Binadhan-11exhibited more than 90% survival and average plant height was 110 cm, the no of tillers m-2 was recorded389 and no lodging was there in Binadhan -11. In spite of frequent storms and rainfall, Binadhan- 11 did not lodge while Lalat exhibited 70-90 % lodging in farmer'sfield.

Table 1: Observed Agronomical Parameters, Yield Attributes and Yields of Ricevariety Binadhan -11 Under Experimental Plots

SI No.	Observation of Parameters	Farmer's Variety / Local Check	Trialed Variety
	Variety	**Lalat**	*Oryza sativa* **L. cv. Binadhan -11**
1	No of tillers per meter square	339	389
2	Plant height(cm)	103-108	100-109
3	Incidence of pest and disease		
	i)Nursery stage	NO	NO
	ii)Active tillering stage	Leaf folder, Stem borer	Leaf folder, Stem borer
	iii)Panicle initiation stage	Leaf folder, Stem borer	Leaf folder, Stem borer
4	Days to maturity(days)	135	125-130
5	Number of panicles at harvest (no m^{-2})	335	387
6	Grains per panicle	103	110
7	1000 grain wt (gm)	23.4	28.1
8	Fertility %age		
	I)No of filled grains	91.2	90.9
	Ii)No of unfilled grains	8.8	9.1
9	Crop Cutting results (5m x5m) in kg	11.3	11.9
10	Grain Yield (q ha^{-1})	45.23	47.62
11	Condition of crops under stress	70-90 % lodging during submergence.	Non lodging

Results from the above table revealed that maximum number of tillers/m2, panicle length and no of grains per panicle wererecorded higher in Binadhan -11 as compared to Lalat i.e. local check. It was revealed from the above table that the average grain yield of Binadhan-11, (Medium long grain)was 47.62 q ha-1 as compared to 45.23 q ha-1in farmer's variety Lalat (long

slender grain), and the yield was 6% higher over farmer's variety Lalat.The varieties which produced higher number of effective tillers hill–1 and higher number of filled grains panicle–1, gave higher grain yield ha–1and the findings were in agreement with the findings reportedby Pruneddu and Spanu (2001)and Mondal et al. (2005).The panicle length significantly varied due to varieties. (Bakul et al. 2009) also reported that higher yield in rice can be achieved from longer panicle length. (Jeng et al. 2009), and many other scientists reported the similar results in their studies. The genotypes, which produced higher number of effective tillers per hill and higher number of grains per panicle also showed higher grain yield in rice (Dutta et al. 2002).

Table 2: Growth and Yield Attributes of Binadhan -11 in Medium Land Condition

Variety Bina dhan -11	Tillers (No m^{-2})	Plant ht (cm)	Panicle (No m^{-2})	No of Grains /Panicle (No)	Test wt, 1000 Grain wt(gm)	Yield (q ha^{-1})
Mean	389.77	110.87	386.48	110.82	28.17	47.6
Standard Deviation	9.876	3.695	9.500	4.529	0.691	1.151
CV%	2.53	3.33	2.46	4.09	2.45	2.42
SE m (±)	*1.803*	*0.66355*	*1.70633*	*0.81338*	*0.12419*	*0.20672*
CD at 5%	5.03	1.89	4.92	2.28	0.35	0.57

It was concluded that Binadhan-11 was recorded the tallest plant, production of more effective and total number of tillers, filled and total grains panicle–1 and highest weight of 1000 grains as well as larger sizes of grains. Tiller(s) number hill–1 is an important yield contributing character in rice (Uddin et al. 2010). The variety Binaidhan-11, which produced higher number of effective tillers hill–1 and higher number of filled grains panicle–1also gave average grain yield of 47.55 q ha-1.

Table 3: Correlation Matrix of Parameters of Yield of Binadhan-11

Variables	No of Tillers m-^{2} (X$_1$)	Plant ht in Cm (X$_2$)	No Panicle / m2 (X$_3$)	No of Grains /Panicle (X4)	Test wt (X$_5$)	Yield q ha-1 (X$_6$)
No of tillers,(X$_1$)	1					
Plant ht in cm , (X$_2$)	-0.228	1				
No Panicle / m2,(X$_3$)	**.984**[**]	-0.232	1			
No of grains /panicle (X4)	0.121	0.090	0.074	1		
Test wt,(X$_5$)	-0.004	0.209	-0.025	0.267	1	
Yield q ha-1,(X$_6$)	0.293	-.007	0.320	.076	-.014	1

** Correlation is significant at the 0.01 level (2-tailed)

Pearson's product-moment correlation co-efficient was calculated to find out the relationship between independent variables and dependent variable like yield. It was revealed from the above table that parameters like, no of tillers per m2 and plant height were significantly correlated with the yield of Binadhan -11.

It was further observed that Binadahn-11 had remarkable superiority to growth, yield attributes and grain yield over variety Lalat due to their genetic differences among the varieties. Sohel et al. (2009) reported that these variations in yield might be due to genetic makeup of the varieties.

Table 4: Difference in Average Yield between Rice Variety, Lalat and Binadhan -11

Yield	Lalat	Binadahn-11	% Increase	't' cal	't' tab
Mean Yield	45.23	47.6	5.2	**6.0732**	**2.011**
Variance	3.162	3.162	*Significance at 95% probability*		
Stand. Dev.	1.77	1.13	**The means of two varieties are significantly**		
CD at 5%	0.906	0.57	**different at p < 0.05**		

Paired 't' test was conducted for testing the significance of mean difference between average yield of the two varieties and the result was depicted in table -3. As calculated 't' vale was 6.0732 being greater than 't' table value 2.011, the value of 't' at 5% level of significance, it was concluded that the yield difference between Lalat (check/ farmer's variety) and Bina dhan-11 was significant .

Table 5: Regression Analysis of Yield Parameters on Yield of Binadhan-1

Coefficients						
Variables	**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**	**95.0% Confidence Interval for B**	
	B	**Std. Error**	**Beta**			**Lower Bound**	**Upper Bound**
No of tillers m-2,(X_1)	-.091	.126	-.789	**-.719**	.479	-.351	.170
Plant ht in cm , (X_2)	.020	.061	.066	.329	.745	-.106	.147
No Panicle / m2,(X_3)	.130	.128	1.104	**1.012**	.322	-.135	.394
No of grains/panicle,(X4)	.023	.052	.091	.443	.662	-.084	.131
Test wt,(X_5)	-.044	.332	-.027	-.132	.896	-.730	.642

R Square=0.429, Adj R2=-.052, Std Error=1.165

Further attempt was made to assess the influence of the parameter variables accelerating the yield of Bina dhan-1 in the submergence situation and the result was recorded in Table5. As observed from the Table no.:5, the best fitted regression equation could explain 42.9% of the total variance in increasing the yield and among the five variables no of tillers/ m2 and no Panicle /m2, exhibited significant influence on enhancing the yield in Binadhan -11.

CONCLUSIONS

The farmers 'feedback showed that the Paddy var Binadhan-11 can tolerate water lodging condition and can successfully overcome water submergence for 4-8 days during tillering to stem elongation stage. And, the yield was significantly higher than Lalat under submergence condition. So, taking into account the results of all the trials in two blocks, it was revealed that the performance of Binadhan-11 under submergence condition was consistent and exhibited tolerance towards submergence with higher yield as compared to Lalat. It was concluded that Binadhan -11, the "climate change-ready rice "can substitute farmer's variety Lalat in Medium land situation with substantial higher yield and tolerant to submergence condition, with positive impacts on the livelihoods of resource poor and marginal farmers of coastal districts of Odisha.

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