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Performance of BPH tolerance rice variety Hasanta under rain fed condition in South Eastern Ghat Zone 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. The district, Malkaangiri comes under South Eastern Ghat zone of Odisha and rice productivity in this district is low (31.2q per ha) as compared to state average . It .has been identified that climatic and biotic factors like Brown plant Hopper (BPH) pest incidence sometimes resulted to severe yield loss . Farmers' participatory field trials were carried out in two blocks like Malkangiri and Korkunda of Malkangiri district to study the performance of BPH tolerant rice variety Hasanta and farmers ruling variety Pratikshya was taken as check. The field experiment was conducted during Kharif -2019 and 2020, in farmers' field in three adopted villages comprising 30 no of farmers, 10 from each village. The BPH incidence was significantly less in rice variety Hasanta. The result revealed that maximum number of tillers/ m2, panicle length, plant height and no of grains per panicle were rerecorded higher in Hasanta as compared to farmer's variety. It was observed that the average grain yield of rice variety Hasanta was 43.8 q ha^{-1} as compared to farmer's variety Pratikshya 39.3 q ha^{-1} and yield was 12 % higher over farmer's variety So, it was revealed that, performance of BPH tolerance rice variety Hasanta under rain fed condition was consistent and exhibited tolerance to BPH incidence . It was concluded that Hasanta can substitute farmer's variety

Pratikshya under rain fed semi-low land rice ecosystem with substantial higher yield and tolerance to BPH incidence , with higher net return .

Key words: Biotic Stresses, Demonstration, BPH Tolerance rice, Yield attributing Parameters, Semi-low land rice eco system**.**

INTRODUCTION

Rice (*Oryza sativa L*) is one of the important food production in India in terms of area, production and consumer preference. Rice covers about 65 per cent of cultivated area and is the major crop covering about 61 per cent of total area under food grains. It is the staple food of almost entire population of Odisha, therefore, the state economy is directly linked with the improvement in production and productivity of rice in the state. In the State Odisha, rice occupies about 91 % of total cereal production and it is grown an average about 4.4 million hectares of land comprising nearly 29.14 lakh ha is high land, 17.55 lakh ha medium land and 15.11 lakh ha low land. The coverage under paddy during kharif is about 41.24 lakh ha &during rabi 3.31 lakh . The total rice production in the state is 2.68 million tones with productivity of 1577 kg/ha. The technological breakthrough has no doubt recorded greater strides in augmenting rice production and productivity. Despite its economic, strategic, and cultural importance, rice productivity in Odisha is considerably low in the country . Insufficient and improper extension activities are the major factors resulting in non adoption of improved package of practices developed at university research institutes. Presently rice in Odisha is grown over an area of 4.4 million hectares, which accounts for 89 per cent of the area under cereals and contributes about 92 per cent of total cereal production in the state (Das,2012).Further, the replacement of traditional varieties with improved varieties and non- availability of sufficient quantity and quality seeds of improved variety in time, is considered as a major factor for low adoption of Improved High yielding and disease pest resistance rice cultivars by the rice growers . 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). With this view, the present investigation was undertaken to evaluate the performance of BPH and WBPH tolerance rice variety Hasanta (145 days duration) with farmer's variety Pratikshya (140 days) through front line demonstration. Hasanta variety released by OUAT in the year 2014 is moderately resistance to leaf folder, leaf blast, sheath blight & bacterial leaf blast with Small bold grains,white kernel,straw colour hull .

Malkangiri district comes under South Eastern Ghat Zone of Odisha and paddy is the major crop in kharif , the total paddy area is 73,121 ha out of which high land paddy 18816 ha , medium land

paddy area is 30282 ha and low land paddy area is 24025 ha . The productivity of kharif rice in the district is Low (3120 kg /ha) and it is due to incidence of BPH (Brown plant hopper) in semi-low land situation . BPH **(** *Nilaparvata lugens*) infest the rice crop at all stages of plant growth. Due to feeding by both the nymphs and adults at the base of the tillers, plants turn yellow and dry up rapidly. During the early infestation stage, round yellow patches appear which soon become brownish due to the drying up of the plants. Farmers in Malkangiri district suffered a huge loss as, it appears, Brown Plant Hopper (BPH) developed resistance against most of the insecticides like Imidacloprid, which is a systemic insecticide that acts as an insect neurotoxin. Farmers generally apply Imidacloprid, with a higher dose which did not work effectively due to resurgence. It was suspected resurgence of BPH due to regular use of one pesticide though it was always advised to the farmers to use alternate pesticides. Detailed investigations have been made in the past few years on the insecticide induced BPH resurgence in rice. (Rahaman 1981 and Reising et al 1982) . The continuous use of insecticides has destroyed the natural equilibrium between *N. lugens* and its natural enemies in India .

OBJECTIVE

The field experiment was undertaken by Krishi Vigyan Kendra , Malkangiri in the year 2019 and 2020 in kharif season to study the performance of Rice var Hasanta in semi-low land rain fed situation. The present investigation was undertaken to evaluate the field performance of newly released rice variety Hasanta against BPH incidence under rain fed condition. The demonstrations were carried out in Malkangiri district covering three villages like Pedawada, MV-3 and MPV-6 to evaluate BPH resistance and yield performance and its performance in different micro farming situations and assess the technological gap with an objective to popularize the Hasanta variety in the district.

MATERIALS AND METHODS

The study was carried out in adopted villages of Krishi Vigyan Kendra (KVK), Malkangiri during Kharif season in the year 2019 and 2020. The study was under taken in Malkangiri and Korkunda blocks of Malkangiri district of Odisha and the blocks were selected purposefully as rice is the major cereals crop grown in large area in kharif season and BPH incidence were recorded in last two years . The demonstrations were conducted in three different adopted villages Pedawada, MV-3, MPV-6 comprising total thirty numbers of farmers, ten farmers from each village. The Front Line Demonstration (FLD) is an applied approach to accelerate the dissemination of proven technologies at farmer's fields in a participatory mode with an objective to explore the maximum available resources of crop production and also to bridge the productivity gaps by enhancing the production in national basket. The necessary steps for selection of site and farmers and layout of demonstrations etc were followed as suggested by Choudhary (1999). Thirty numbers front line demonstrations on HYV

Hasanta were conducted in three clusters. All the participating farmers were trained on various aspects of rice production technologies and recommended agronomic practices and certified seeds of Rice variety Hasanta were used for demonstration. The soil of demonstration site was slightly acidic in reaction (pH-5.4 to 6.5) with sandy loam in texture and EC was 0.178 (dS m −1). The available nitrogen, phosphorus and potassium was between 221 .00, 24 .00, 184 .00 (Kg ha−1) respectively. The crop was sown in under rain fed condition in the first to second week of July and 21 days of seedling were transplanted Proper nutrient management and soil test based fertilizer application was done . The crop was raised with recommended agronomic practices and harvested within 4th week of November up to 2nd week of December.

The technologies demonstrated were as follows: Popularization of high yielding BPH resistance rice variety Hasanta, Seed treatment with *Vitavax power* @ 2g kg^{-1} seed , Line sowing with soil test based fertilizer application along with need based plant protection measures. Need based plant protection measures were taken along with soil test based fertilizer application was done with fertilizer dose 80: 40:40 kg. N: P_2O_5: K_2O kg ha^{-1}. In case of local checks existing practices being used by farmers were followed. The observations were recorded for various parameters of the crop. The farmers' variety Pratikshya was maintained as local checks. The field observations were taken from demonstration plot and farmer's plot as well. Parameters like Plant height, number of tillers per plant, BPH incidence (no of hoppers per hill) , no of EBT per hill and grain yield were recorded at maturity stage and the gross returns (Rs ha -1) were calculated on the basis of prevailing market price of the produce. The gross cost of cultivation and net return along with B: C ratio was calculated and the data were statistically analyzed applying the statistical techniques. Statistical tools such as percentage, mean score, Standard deviation, co-efficient of variation, Paired 't' test , were employed for analysis of data (Cochran and Cox,1977). The farmer's practices (FP) plots were maintained as local check for comparison study.

Table 1. Comparison between farmer's practices and Technology demonstrated

Sl no	Particulars	Farmer's practice	Demonstrated Technology
1	Variety	Pratikshya	Hasanta
1	Seed rate	60 kg ha^{-1}	50 kg ha^{-1}
2	Seed treatment	No seed treatment	*Vitavax power* @ 2g kg^{-1} seed
3	Method of sowing	No line sowing	Line sowing with spacing 30 x 20 cm
4	Fertilizer application	Imbalanced dose and more use of nitrogenous fertilizer	Fertilizer dose NPK - 80:40:40 N: P_2O_5: K_2O Kg. ha^{-1}. (N in Three splits)
5	Plant population	More plant population	Optimum plant population ,
6	Weed management	Late weeding after 40-50 DAT and	Manual weeding at 25-30 DAT with post emergence spray of @ Bispyrabac sodium

		Manual weeding	10% SC @ 25 g/ha
7	Plant protection measure s	Injudicious use of pesticides and fungicides/	Approaches of Integrated pest and disease management and Need based PP measure,

The data of Table 1 revealed that under the demonstrated plot only recommended high yielding variety, proper weeding and optimum plant population maintaining and the farmers used herbicides and the farmers timely performed all the other package and practices. It was also observed that farmers were unaware about balanced fertilizer application, seed treatment, and use of fertilizers application and maintenance of plant population for enhancing the yield. Majority of the farmers in the study area were unaware about use of pest and weed management practices. The findings are in corroborated with the findings of (*Katar et al. ,2011*)

Table 2. Yield attributes and BPH incidence of rice varieties under rain fed condition

Variety	No of Tillers/Hill	Plant Height (cm)	No. of Hoppers / hill	Yield (q/ha)
Pratikshya(local check)	11	94.10	25.2	39.3
Hasanta	13	115.0	11.5	43.8

It was revealed from the above table that plant height and no of tillers per hill in rice variety Hasanta was comparatively more than Pratikshya. The BPH incidence (No. of Hoppers / hill) was 11.5 in case of Hasanta. This indicated that Hasanta has exhibited more degree of tolerance to BPH as compared to farmer's variety Pratikshya.

Performance of rice variety Hasanta under demonstration

Phenological observations like plant height, no. of tillers/hill, No. of Panicles/sq.m , dry matter, grain yield and yield attributes like panicles/hill, and test weight were recorded and Harvest index was calculated .

Table 3. Yield attributing Parameters of rice variety Hasanta

Yield attributing Parameters	Plant height at maturity (cm)	No. of Panicles/sq.m (No)	No of grains /panicle (No)	Grain Yield (q ha-1)	Straw Yield (q ha-1)	Harvest Index (%)	TEST Weight (g)
Mean	115.06	281.79	124.2	43.8	49.67	49.67	21.13
Standard Error *(SE±)*	1.19	2.04	0.85	0.810	0.296	0.29	0.10
Standard Deviation (SD)	6.441	11.004	4.5	4.364	1.599	2.505	0.539

Phonological observations like plant height, no. of tillers/hill, dry matter, yield and yield attributes like panicles/hill, and test weight were recorded and Harvest index, and economics of cultivation were computed as per the farmers selling price.

The Hasanta variety recorded highest plant height 115.06 cm with average No. of Panicles/sq.m was 281.79, average no of grains /panicle was (124 . 2) under demonstration. The average grain yield was 43.8 (q ha-1) with Harvest index at maturity stage was found (HI) as 49.6 percent. The grains were bold with test weight 21.13 gm. It was concluded that Rice Variety Hasanta gave 12 percent more yield , due to production of more number of effective of tillers (13 no of Tillers/Hill) and more No. of Panicles/sq.m The attributes like , Tiller(s) number $hill^{-1}$ and No. of Panicles/sq.m are important yield contributing character in rice (Uddin et al. 2010). The variety Hasanta which produced higher number of effective tillers $hill^{-1}$ and higher number of No. of Panicles/sq.m also gave average grain yield of 43.8 q $ha^{-1.}$ under rain fed situation . The varieties which produced higher number of effective tillers $hill^{-1}$ and higher number of panicles per sq m, No of grains /panicle (No) , gave higher grain yield ha^{-1} and the findings of the study was in consonance with the results reported by *Pruneddu and Spanu (2001)* and Mondal et al. (2005).

Table 4. Comparison of Yield performance of Rice variety Hasanta and Pratikshya under rain fed situation

Variety	Average yield (q ha^{-1})	Variance in yield	't ' stat value	't ' two tail table value	P Value (T<=t) two-tail
Pratikshya	39.3	2.748	10.622	2.003	*0.000*
Hasanta	43.8	2.531			

(Significance at 95% probability)

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 10.62 being greater than 't' table value 2.003 , the value of 't' at 5% level of significance , it was concluded that the yield difference between rice Variety Pratikshya and Hasanta was significant. The rice variety Hasanta recorded 12 per cent higher yield under demonstration plots over farmers' practices .The results are similar with the findings of Tomer et al. (2003) and Tiwari et al. (2003).

Table 5. Economics and benefit cost ratio comparison between Farmers practice and recommended practice

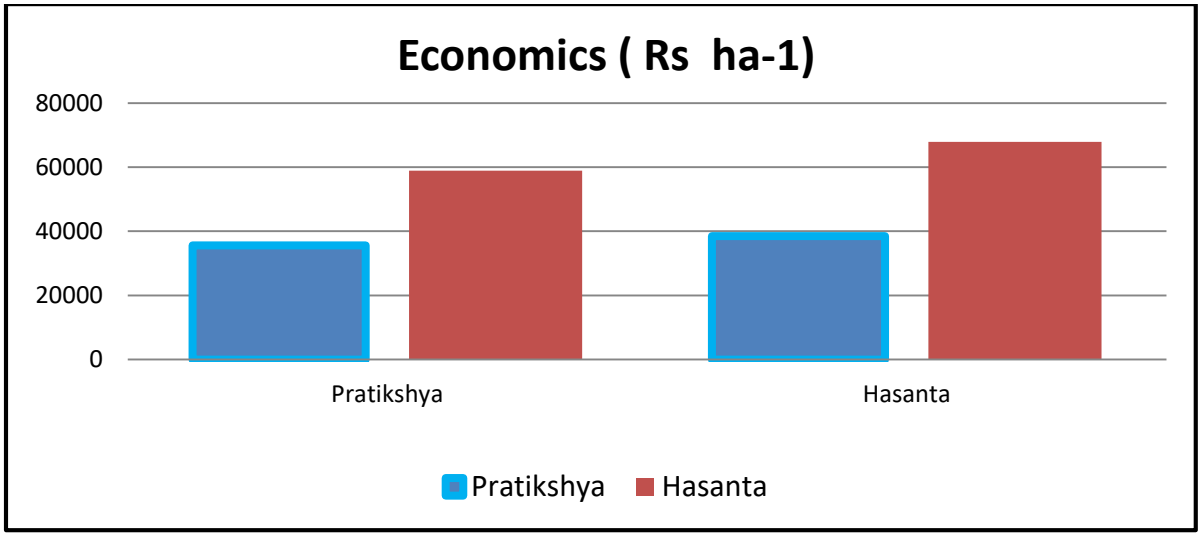
Economics of cultivation were computed as per the farmers selling price and cost of cultivation was calculated as per the local situations.

Treatment	Cost of cultivation (Rs ha^{-1})	Gross Return (Rs ha^{-1})	Net Return (Rs ha^{-1})	B:C ratio
Farmer's practice (FP) Pratikshya	35600	58950	23350	1.6
Recommended practice (RP)- Hasanta	38540	67900	29360	1.8

(Market price of Paddy was Rs 1500/ per q)

The economics and B: C ratio of farmers practice and Demonstration practice has been presented in Table 5. Keeping the prevailing local market price of Paddy as 1500.00 (Rs q^{-1}) in the particular year. The results on economic analysis of rice production under demonstration revealed that the gross expenditure in case of Recommended practice (RP) was higher than farmers practice. The Rice variety Hasanta recorded net return of Rs 29360 per ha, which was 25.7 percentage higher than farmers practice and it was due to higher productivity of variety Hasanta under demonstration. The benefit cost ratio (1.8) was higher in rice variety Hasanta under demonstration plot as compared to farmer's practices (1.6). The findings are in corroborated with the findings of Yadav et al. (2004) and Lathwal (2010).

Fig 1. Comparison between cost of cultivation with gross return (Rs ha^{-1})



The results on economic analysis indicated that Rice variety Hasanta performed better than farmer's variety Pratikshya. The HYV variety Hasanta recorded higher gross return of Rs 67900 per

ha which was which was 15 percent higher than Pratikshya and it was due to higher productivity of Hasanta variety under demonstration and less incidence of BPH .

CONCLUSION

The results revealed that in Malkangiri district rice variety Hasanta rerecorded 12 % more yield over Pratikshya with proper package and practices under rain fed condition. From the above study it was concluded that use BPH, tolerance rice variety Hasanta with scientific methods and technological practices can reduce the technological gap and enhance the productivity in the district. Yield improvement of Rice variety Hasanta under demonstration was due to less BPH incidence and recommended management practices adopted by the farmers. Yield of rice under rain fed condition in the district can be increased to a great extent by conducting effective front line demonstrations in larger area. On the basis of the result obtained in present study, it can be concluded that use of BPH, tolerance rice variety Hasanta can reduce the technology gap to a considerable extent thus leading to increased productivity of rice in rain fed situation in the district. The farmers' feedback showed that the Paddy variety Hasanta can tolerate BPH incidence and the yield was significantly higher than Pratikshya under rain fed rice eco system So, taking into accounts the results of all the trials in two blocks, it was concluded that the performance of Hasanta was consistent and exhibited tolerance towards BPH with 12% higher yield as compared to Pratikshya. It was concluded that Hasanta, the " BPH tolerant rice" can substitute farmer's variety in semi-low land rain fed situation with substantial higher yield with positive impacts on the livelihoods of resource poor and marginal farmers in South Eastern Ghat Zone of Odisha .

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This article does not contain any studies with human participants or animals performed by any of the authors.

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