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Integrated approach for the Management of Blast Disease of Paddy in Hill Zone of Karnataka, India

G. N. Hosagoudar[1], Sheshaiah[2] and M. Shivaprasad[3]

[1]*Rice Pathologist and Head, AICRIP on Rice, AHRS, Ponnampet, Karanataka, India-571 216*
[2]*Rice Breeders on contract basis, AHRS, Ponnampet, Karanataka, India-571 216*
[3]*Agronomist and Associate Director of Research, ZAHRS, Mudigere, Karanataka, India-577 132*
Keladi Shivappa Nayaka University of Agricultural and Horticultural Sciences, Shivamogga, Karanataka, India-577 204
Corresponding Author:gnhosagoudar@rediffmail.com

Abstract: Rice (*Oryza sativa* L.) is an important cereal crop belonging to the grass family Poaceae. Experiments were conducted during *Kharif* 2019 and 2020 to know the impact of six integrated disease management treatments. Among six treatments, T_5: Seed treatment with carbendazim (2 g/kg) + one blanket application of combination fungicide (trifloxystrobin 25% + tebuconazole 50%) @ 0.4 g/l at booting stage and T_2: Seed treatment with bio-control agent + one application of bio-control agent at 15-20 DAT (10 g/l) with least pooled leaf blast disease index of 19.28% and 21.40% respectively and neck blast disease incidence of 19.28% and 21.40% respectively. Further, the highest pooled yield was recorded in T_5 (3901.85 kg/ha) and T_2 (3502.78 kg/ha) followed by T_4 (3416.67 kg/ha) when compared to control (2483.33 kg/ha). The least pooled grain yield were observed in T_1 (3367.59 kg/ ha) when compared to other treatments.

Keywords: Blast, Disease, Integrated, Management and Paddy

INTRODUCTION

Rice (*Oryza sativa* L.) is the principal staple food for more than two billion people; most of them live in rural and urban areas of tropical and subtropical Asia. Rice is grown on millions of small farms with an average size ranging from 0.4- 3.5 ha, primarily to meet family needs. Rice is the important cereal crop grown throughout the world and is the second most staple food crop of the world next to wheat and staple food for two third of world's population (Abodolereza and racionzer, 2009).

Starting in 2500 B.C. rice has been a source of food for people. Rice production originated in China, and was spread to countries such as Sri Lanka and India. It is believed that rice was brought to West Asia and Greece in 300 B.C. by Alexander the Great's armies.

China and India account for roughly 50 per cent of the world's total rice area and jointly produce 55 per cent of world's rice. Other major rice-growing countries are Indonesia, Bangladesh, Vietnam, and Thailand, which produce respectively nine, six, five, and four percent of world's rice.

Projection of India rice production target for 2025 AD is 140 million tons, which can be achieved only by increasing the rice production by over 2 million tons per year in the coming decade and this has to be achieved against back drop of diminishing natural resource such as land and water.

Globally, rice is cultivated with an area about 161.4 million hectare, production of about 633.3 million tonnes with a productivity of 3.14 tonnes per hectare (Anon, 2017). In India area under rice cultivation is 44 million hectare and production of about 104 million tonnes with productivity of about 2.4 tonnes per hectare (Anon, 2017). In Karnataka, rice is cultivated with an area of 13.43 lakh ha, production of 39.53 lakh tonnes and productivity of 3.09 tonnes per hectare (Anon, 2017).

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The productivity of rice is highly affected by several biotic and abiotic factors. Rice crop is susceptible to many fungal, bacterial, viral and nematode diseases (Hollier, et al., 1984). The most significant disease in rice is blast disease incited by *Pyricularia oryzae* as it is reported in more than 85 countries wherever rice is grown (Gilbert, et al., 2004). Heavy yield losses have been reported in many rice growing countries *viz*., 75, 50 and 40 percent grain loss was occur in India (Padmanabhan, 1965), Philippines (Ou, 1985) and Nigeria (Awodera and Esuruoso, 1975). The pathogen can cause damage up to 90% and sometime total crop loss under favourable conditions (Samira, et al., 2002). The rice blast fungus can causes symptoms like leaf blast, nodal blast and neck or panicle blast. The most severe stage is neck blast (Bonman, et al., 1989). The usual practices followed for management of blast disease of rice includes use of resistant varieties, use of fungicides, application of fertilizers and irrigations (Georgopoulos and Ziogas, 1992, Naidu and Reddy, 1989). Thus, the study was conducted for the Integrated Blast Disease Management of Paddy under field condition by using different management approaches.

MATERIAL AND METHODS

An experiment was conducted during *Kharif* 2019 and 2020 at Agricultural and Horticultural Research Station, Ponnampet. The susceptible variety Intan were sown on 17/07/2019 & 29/07/2020 and transplanted on 20/08/2019 & 31/08/2020 respectively in RCBD with 4 replications and 7 treatments. The spacing followed was 15 X 15 cm and total plot size were 6.75 m^2 (Table 1 and Plate 1). The treatments were imposed in nursery and Main field as mentioned below.

Treatment Details of Integrated approach for the Management of Blast Disease of Paddy.

Sl. No.	*Treatments Details*
T_1	Seed treatment with bio-control agent (10 g/kg seeds) (Bio-control agent formulation will be supplied by ICAR-NRRI.
T_2	Seed treatment with bio-control agent + one application of bio-control agent at 15-20 DAT (10 g/l)
T_3	Seed treatment with bio-control agent + one application of propiconazole (1 g/l) at booting stage
T_4	Seed treatment with bio-control agent + one application of bio-control agent at 15-20 DAT (10 g/l) + One blanket application of propiconazole (1 g/l) at booting stage
T_5	Seed treatment with carbendazim (2 g/kg) + one blanket application of combination fungicide (trifloxystrobin 25% + tebuconazole 50%) @ 0.4 g/l at booting stage
T_6	Control (No seed treatment, No spraying of bio-control agent or any fungicide)
T_7	Control

Five hills were randomly selected from each plot and were tagged. The observations for leaf blast was recorded as PDI after first spray by using 0-9 scale given by IRRI (1996) and for the neck blast as percent neck blast incidence at second spray and at harvest, The leaf blast incidence was calculated by using formula given by Wheeler, 1969.

$$PDI = \frac{Sum\,of\,individual\,rating}{Number\,of\,leaves\,assessed \times Maximum\,disease\,grade\,value} \times 100$$

From the selected five hills randomly from each plot, the neck blast incident was calculated by using the formula given below.

$$Per\,cent\,neck\,blast\,incidence = \frac{Infected\,panicles}{Total\,number\,of\,panicles} \times 100$$

Statistical analysis was carried out as per the procedure given by Panse and Sukathme. The original means were converted into arc sine transformed values. The yield was recorded at harvest in all the treatments.

RESULTS AND DISCUSSIONS

The pooled data results obtained indicates that, all the treatments recorded significantly reduced the pooled per cent leaf blast disease index and per cent neck blast disease incidence compared to untreated control. T_5: Seed treatment with carbendazim (2 g/kg) + one blanket application of combination fungicide (trifloxystrobin 25% + tebuconazole 50%) @ 0.4 g/l at booting stage and T_2: Seed treatment with bio-control agent + one application of bio-control agent at 15-20 DAT (10 g/l). Both the treatments (T_5 & T_2) were on par with each other with least pooled leaf blast disease index of 19.28% and 21.40% and neck blast disease incidence of 14.23% and 16.43% respectively, when compared to control (59.44% and 53.20%).

The maximum leaf blast per cent disease reduction over control (PDC) were observed in T_5 (67.56 PDC) and T_2 (64.00 PDC) followed by T_4 (60.72 PDC). Similarly, the maximum neck blast per cent disease reduction over control (PDC) was observed in T_5 (73.25 PDC) and T_2 (69.12 PDC) followed by T_4 (66.35 PDC).

Further, in the pooled data of yield observations, the highest pooled yield was recorded in T_5 (3901.85 kg/ha) and T_2 (3502.78 kg/ha) followed by T_4 (3416.67 kg/ha) when compared to control (2483.33 kg/ha). The least pooled grain yield was observed in T_1 (3367.59 kg/ ha) when compared to other treatments (Table 1 and Plate 1).

All the treatments investigated under field condition showed significant differences in blast disease reduction and grain yield. The results obtained are also in agreement with the work of Neelakanth, *et. al.,* 2017, Wasimfiroz, *et. al.,* 2018 and Hosagoudar GN, 2019a, who also reported the complete inhibition of growth of *Pyricularia oryzae* in Trifloxystrobin 25% + Tebuconazole 50% WG and Tricyclazole 75% WP as effective fungicides against *Pyricularia oryzae*. who Singh and Singh (1988) reported weed hosts of *P. oryzae* Cav. were *Leersia hexandra* and *Cyperus rotundus*, while *Brachiaria mutica*, *Digitaria* sp., *Echinichloa* sp. and *Leersia hexandra* reported by Kim *et. al.,* 1981. Prasad *et. al.,* 1998, who reported *Digitaria ciliaris* and *D. marginata* act as collateral hosts for the blast fungus. Six bio-control agents' *viz*., *Trichoderma harzianum, Trichoderma polysporum, Trichoderma pseudokoningii, Gliocladium virens*, *Paecilomyces variotii* and *Paecilomyces lilacinus* were used. Maximum mycelial inhibition of *M. oryzae* was provided by *P. lilacinus* followed by *Trichoderma* spp. (Hajano, *et. al.,* 2012 and Hosagoudar, 2019b).

Figure 1: Field view of integrated approach for the Management of Blast Disease of Paddy in Hill Zone of Karnataka

Table 1: Integrated approach for the Management of Blast Disease of Paddy in Hill Zone of Karnataka, during 2019 and 2020

Tr. No.	*Treatments Details*	*Leaf blast PDI*			*PDC*	*Neck blast PDI*			*PDC*	*Grain yield Kg/ha*		
		2019	*2020*	*Pooled*		*2019*	*2020*	*Pooled*		*2019*	*2020*	*Pooled*
T_1	Seed treatment with bio-control agent (10 g/kg seeds) (Bio-control agent formulation will be supplied by ICAR-NRRI.	30.32 (33.36)	29.33 (32.75)	**29.83 (33.06)**	49.81	22.88 (28.54)	21.88 (27.84)	**22.38 (28.19)**	57.93	3372.22	3362.96	**3367.59**
$\mathbf{T_2}$	Seed treatment with bio-control agent + one application of bio-control agent at 15-20 DAT (10 g/l)	21.91 (27.83)	20.90 (27.16)	21.40 (27.50)	64.00	16.93 (24.11)	15.93 (23.38)	**16.43 (23.75)**	69.12	3509.26	3496.30	**3502.78**
$\mathbf{T_3}$	Seed treatment with bio-control agent + one application of propiconazole (1 g/l) at booting stage	33.49 (35.33)	32.50 (34.73)	**33.00 (35.03)**	44.48	24.35 (29.58)	23.35 (28.90)	**23.85 (29.25)**	55.17	3368.52	3355.56	**3362.04**
$\mathbf{T_4}$	Seed treatment with bio-control agent + one application of bio-control agent at 15-20 DAT (10 g/l) + One blanket application of propiconazole (1 g/l) at booting stage	23.86 (29.24)	22.85 (28.56)	**23.35 (28.90)**	60.72	18.40 (25.41)	17.40 (24.66)	**17.90 (25.04)**	66.35	3422.22	3411.11	**3416.67**
$\mathbf{T_5}$	Seed treatment with carbendazim (2 g/kg) + one blanket application of combination fungicide (trifloxystrobin 25% + tebuconazole 50%) @ 0.4 g/l at booting stage	19.77 (26.33)	18.78 (25.63)	**19.28 (25.99)**	67.56	14.73 (22.35)	13.73 (21.58)	**14.23 (21.97)**	73.25	3907.41	3896.30	**3901.85**
$\mathbf{T_6}$	Control (No seed treatment, No spraying of bio-control agent or any fungicide)	59.95 (50.48)	58.94 (50.18)	**59.44 (50.48)**	-	53.70 (46.86)	52.70 (46.57)	**53.20 (46.86)**	-	2488.89	2477.78	**2483.33**
	Mean	**31.55 (33.76)**	30.55 (33.17)	**31.05 (33.49)**		**25.16 (29.47)**	24.16 (28.82)	**24.66 (29.18)**		**3344.75**	3333.33	**3339.04**
	CV (%)	6.73	6.15	6.37		9.92	8.65	9.21		8.69	8.74	8.72
	CD (0.05)	3.66	3.24	3.41		4.45	3.81	4.10		443.69	444.83	444.25

* figures in parenthesis are arc sine transformed values. PDI- Per cent Disease Index. PDC – Per cent Disease reduction over Control.

References

Abodolereza A and Racionzer P (2009), Food outlook: Global market analysis. pp. 23-27.

Anonymous (2017), Statistical database. http://www.fao.org.

Awodera VA and Esuruoso OF (1975), Reduction in grain yield of two rice varieties infected by rice blast disease in Nigeria. Nigerian Agric J.; 11:170-173.

Bonman JM, Estrada BA and Banding JM (1989), Leaf and neck blast resistance in tropical lowland rice cultivars. Plant Dis.; 73:388-390.

Georgopoulos SG and Ziogas BN. (1992) Principles and methods for control of plant diseases, Athens., 236.

Gilbert MJ, Soanes DM and Talbot NJ (2004), Functional Genomic Analysis of the Rice Blast Fungus *Magnaporthe grisea*. Appl. Mycol. and Biotechnol.; 4:331-352.

Hollier CA, Groth DE, Rush MC and Webster AK (1984), Common Names of Plant Diseases. The American Phytopathological Society, St. Paul, MN,.

Hosagoudar GN (2018), Evaluation of fungicides for the management of blast diseases of rice under field condition. *J. of Pharmacognosy and Phytochem.*; 7(5): 1948-1951.

Hosagoudar GN (2019a), Investigation of Combi Product Fungicides for the Management of Blast Diseases of Paddy. *Int. J. Curr. Microbiol. App. Sci.*, *8*(7): 2128-2134.

Hosagoudar GN (2019b), Integrated Blast Disease Management of Paddy in Hill Zone of Karnataka, India. *Int. J. Curr. Microbiol. App. Sci.*, 8(10): 1766-1772.

Naidu VD and Reddy GV (1989), Control of blast (BI) in main field and nursery with some new fungicides. R.P.P.; 69:209.

Neelakanth, SiddeGowda DK, Chethana BS, Parasappa HH (2017), *In vitro* and *In vivo* Evaluation of Fungicides Against *Pyriculariaoryzae* Causing Blast of Rice. Int. J. Pure App. Biosci.; 5(3):259-263.

Ou SH (1985), Rice Diseases, CAB International Mycological, Institute Kew, Survey, UK. Johan Hopkins Press, Baltinoie, Maryland. : 203-221.

Padmanabhan SY (1965), Estimating losses from rice blast in India. Proceeding of symposium at IRRI Pages 203-221 in the rice blast disease.

Panse VG, Sukathme PV (1967), Statistical methods for agricultural workers. ICAR, New Delhi., 145-155.

Samira S, Afifa M, Amina D and Allal D (2002), *In vivo* effect of fungicides on the development of *Pyricularia grisea* and *Heliminthosporium oryzae*. Phytopathol. Mediterranian.; 41:235-246.

Wasimfiroz RM, Hosagoudar GN, Narayanaswamy H and Balanagouda Patil (2018), Evaluation of fungicides, bio-agents and plant extracts against *Pyricularia oryzae.* International Journal of Chemical Studies; 6(2): 1875-1879.

Wheeler BEJ (1969), An Introduction to Plant Diseases. John Wiley and Sons, Ltd. London., 301.