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- Short communication

MANAGEMENT OF RICE BLAST (*MAGNAPORTHE ORYZAE* B. COUCH) USING BIOAGENTS AND FUNGICIDES UNDER HILL RICE ECOSYSTEM OF UTTARAKHAND STATE IN INDIA

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Abstract

A field study was conducted during Kharif-2015 and 2016 on management of leaf and neck blast disease of rice caused by *Magnaporthe oryzae* under hill rice ecosystem. Different treatments including biological control agents like *Trichoderma* sp. and *Pseudomonas* sp. and chemical fungicides like tricyclozole, azoxystrobin and carbendazim were used at different growth stages of rice. Among the treatments, tricyclozole @ 0.06% was highly effective followed by azoxystrobin @ 0.1% with application immediately after appearance of disease. *Trichoderma* and *Pseudomonas* were not effective in reducing the disease pressure.

Rice is a major cereal crop of himalayan ecosystem in India. Among the diseases, rice blast is one of the most destructive diseases under hill conditions owing to its severity and yield loss (Rajashekara *et al.* 2019). In Hill rice growing system, it is observed in moderate to severe forms in blast endemic locations. The stages of blast occur at leaf blast, node blast and neck blast but neck blast is the most damaging phase in major rice growing area and is more detrimental to rice yield (Laha *et al.* 2016).

Management of blast disease involves the selection of suitable variety possessing field resistance to the disease through host plant resistance, use of chemical fungicides and bioagents for suppressing disease pressure (Rajashekara *et al.* 2014, Gopi *et al.* 2016). Use of integrated approach in managing the disease is suitable option available like selection of suitable resistant genotype, use of bioagents and chemical fungicides.

Keeping this in view the present field experiment was conducted to evaluate the bioagents (*Trichoderma* spp. and *Pseudomonas fluorescens*) and chemical fungicides like tricyclozole, azoxystrobin and bavistin for management of leaf and neck blast disease of rice.

Field experiments were conducted during *Kharif* 2015 and 2016 at the experimental farm of Indian Council of Agricultural Research-Vivekananda Parvatiya Krishi Anusandhan Sansthan (ICAR-VPKAS) located in the Indian Himalayan region at Hawalbagh of Uttarakhand state, India. The experiment was conducted in a randomized block design (RBD) with different treatments and was replicated three times. Uniform plant population was maintained throughout the plot (5 m^2) with the spacing of 20 × 10 cm between rows and plants. Treatments consisted of biocontrol agents and fungicides sprayed with different doses. The biocontrol agents *Trichoderma harzianum* Tr-133 and Tr-202 were maintained at Plant Pathology Laboratory, ICAR-VPKAS and *Pseudomonas* sp. PB1RP3 and PCRP7(2) were maintained at Microbiology Laboratory, ICAR-VPKAS, Almora, Uttarakhand, India. The treatments were applied at different stages, biocontrol agents were used as seed treatment and seedling dip at the time of transplanting and fungicides

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sprayed at the time of initial disease appearance and sprayed at three intervals. Highly susceptible genotype, VLK-39 was used for sowing on third week of June in both the years and proper agronomic practices were followed to maintain good crop stand and treatments were set up for management of rice blast disease and the data were analyzed using OPSTAT software (Table 1).

Table 1. Details of chemical treatments, bio-control and time of treatments used in the field experiment.

Treat-ments	Chemical treatment	Biological	Time of treatment (dose)
T1	Azoxystrobin 23SC	-	At the time of first disease appearances (0.1%)
T2	Bavistin 75WP	-	At the time of first disease appearances (1.0 %)
T3	-	*Trichodema*-133	Seed treatment (10 g/kg) and seedling dip (4 g/l)
T4	-	*Trichodema*-202	Seed treatment (10 g/kg) and seedling dip (4 g/l)
T5	-	*Pseudomonas* sp. PB1RP3	Seed treatment (10 g/kg) and seedling dip (4 g/l)
T6	-	*Pseudomonas* sp. PCRP7(2)	Seed treatment (10 g/kg) and seedling dip (4 g/l)
T7	-	*Trichodema*-202 and *Pseudomonas* sp. PCRP7(2)	Seed treatment (10 g/kg) and seedling dip (4 g/l)
T8	Tricyclozole 75WP	-	At the time of first disease appearances (0.06%)
T9	Control	-	-

- means not applied.

The actively growing mycelial disc (0.5 cm) of *T. harzianum* (Tr-133 and Tr-202) were transferred to potato broth medium in 250 ml conical flasks and incubated at 27^0 C for 8-10 days. The sterilized wheat grains were also used for mass multiplication of *T. harzianum* (Tr-133 and Tr-202), 5g of Carboxy Methyl Cellulose (CMC) was added to 1 kg of talc and mixed thoroughly. The mycelial mat was homogenized and blended with talc powder in 1 : 2 ratio. The materials were shade dried and packed in polypropylene bags, heat sealed and kept at 27°C and used as seed treatment agent or foliar spray at recommended doses.

A loop full of *Pseudomonas* sp. PB1RP3 and PCRP7(2) were transferred into King's B broth and incubated in a rotary shaker at 150 rpm for 48 hrs at room temperature. After 48 hrs of incubation the broth containing 9×10^8 cfu/ml was used for the preparation of talc based formulation. A total 400 ml of bacterial suspension, 1 kg of the talc powder, calcium carbonate 15 g and CMC 10 g were mixed under sterile condition. The materials were dried and packed in polypropylene bags, heat sealed and kept at 27°C. The disease data were recorded on visual basis on regular intervals till harvesting of crop by using the disease rating scale of (0-9) Standard Evaluation System (SES) developed by International Rice Research Institute (IRRI 1996).

The disease pressure in experimental plots was allowed to establish naturally under field conditions in both the seasons. Among the treatments, tricyclozole @ 0.06% gave best reduction in disease pressure with 2.6 and 3.0 for leaf and neck blast disease, respectively in disease rating scale of 0-9, followed by azoxystrobin @ 0.1% (Table 2). The control treatment had disease pressure of 4.6 for leaf blast and 8.3 for neck blast disease, while carbendazim @ 1% inhibited disease of 3.0 in leaf blast disease and 6.6 in neck blast disease. The use of alternative fungicide based on field studies like azoxystrobin instead of widely used and selective fungicide, tricyclozole will reduce the risk of resistance development by pathogen.

Results of grain yield showed that treatment with tricyclozole reported higher yield (20.58 q/ha) followed by azoxystrobin (16.14 q/ha) while untreated check gave yield of 2.59 q/ha and bavistin treated plot showed a yield of 9.4 q/ha (Fig. 1).

Table 2. Evaluation of biological agents and chemical fungicides against blast incidence during cropping season.

Treatment	First year (2015)		Second year (2016)		Mean	
	Leaf blast	Neck blast	Leaf blast	Neck blast	Leaf blast	Neck blast
T1	2.6	5.6	3.6	5.6	3.1	5.6
T2	3.0	6.6	4.3	6.3	3.65	6.45
T3	2.6	7.0	5.6	7.0	4.1	7.0
T4	4.3	7.3	5.6	7.0	4.95	7.15
T5	3.6	6.0	5.6	7.0	4.6	6.5
T6	3.0	7.0	5.6	6.3	4.3	6.65
T7	2.0	7.0	5.6	6.3	3.8	6.65
T8	2.6	3.0	3.0	3.0	2.8	3.0
T9	4.6	8.3	6.3	7.3	5.45	7.8
				CD at 5%	2.11	1.39
				CV	20.85	12.58

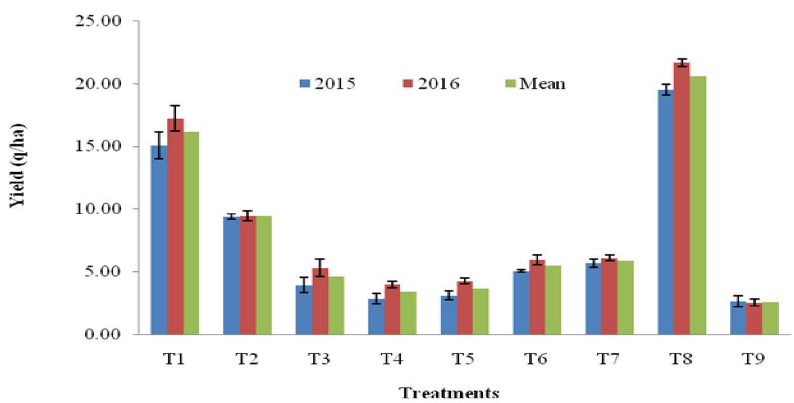

Fig. 1. Effect of different treatments on rice grain yield during cropping season of 2015 and 2016.

None of the biocontrol agents used was effective in managing both leaf and neck blast disease. Based on comparative basis a combination of Tr-202 and *Pseudomonas* sp. PCRP7 (2) treatment was found slightly better among the biological treatments and disease, reduction of 3.8 for leaf blast and 6.6 for neck blast and least effective treatment was Tr-202 strain with disease inhibition of 4.9 in leaf blast and 7.0 rating for neck blast (Table 2 and Fig. 1) with *Pseudomonas* sp. PCRP7(2) with reduction of 4.3 and 6.6 for leaf and neck blast disease respectively followed by *Pseudomonas* sp. PB1RP3 bioagent reduced disease incidence of 4.6 and 6.5 for leaf and neck blast disease while the control treatment had disease pressure of 4.6 for leaf blast and 8.3 for neck blast disease. It was confirmed from two-year field study that tricyclozole @ 0.06% was highly effective against leaf and neck blast disease followed by azoxystrobin @ 1.0%.

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