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Appraise a seed Treatment of Carbendazim 50% WP against Sheath Blight Disease of Rice (*Oryza sativa* L.)

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ABSTRACT

An investigation was carried out to evaluate the efficacy of different dose of Carbendazim 50 % WP as seed treatment on the severity of sheath blight disease and yield contributing characters of rice in the Department of Plant Pathology and the field of University of Agricultural and Horticultural Sciences farm, Shivamogga, Karnataka during the period of 2017 to 2018. Four doses of Carbendazim 50 % WP were evaluated against sheath blight disease at three growth stages (flowering, milking and maturity) and yield attributing features. It was observed that disease severity was gradually increased from flowering stage to maturity stage with the age of the plant and minimum severity gave the maximum yield. seed treatment of Carbendazim 50% WP @ 4g / kg of seeds or Carbendazim 50% WP @ 3g / kg of seeds was found to be highly effective in managing sheath blight disease at early stage of crop growth and significantly reduces further spread under field condition by mitigating inoculum at seedling stage which in turn provided higher grain yield and other yield attributing characters. Present study clearly indicated that, Carbendazim 50 % WP was best chemical to control sheath blight disease as seed treatment.

Key words: *Seed treatment, Rice, Sheath Blight disease, Carbendazim 50 % WP and Seed Borne diseases*

Introduction

Rice (*Oryza sativa* L.) is a major target to supply stable food and nutritional security to millions population of the world and is one of the major foodstuffs in Asia. The population stress in rice consuming countries hassle to sustainable rice production in Asia. Rice affected by quite a lot of diseases among them sheath blight is the most frequent and ferocious disease in irrigated rice of both temperate and subtropical areas of East Asia and which appeared at all stages of vegetative growth. Sheath blight, caused by *Rhizoctonia solani* Kuhn is a soil and seed borne disease of rice occurs in all rice production regions of the world (Ou, 1985; Teng *et al.,* 1990; Savary *et al.,* 2000; Savary *et al.,* 2006).

Out of 43 diseases known to occur on the rice, 27 are seed-borne of which 14 are of major importance, the most destructive ones are fungal such as Brown spot (*Bipolaris oryzae*), Blast (*Pyricularia oryzae*), Sheath rot (*Sarocladium oryzae*), Sheath blight (*Rhizoctonia solani*), Leaf scald (*Michrodochium oryzae*), Seed rot and Seedling blight (*Bipolaris oryzae, Sclerotium rolfsii and Fusarium* spp.), Grain spot (*Curvularia lunata, Nigrospora oryzae, Phoma glumarum, Cladosporium* spp.) (Fakir, 2000). In India a modest estimation of losses due to the sheath blight disease alone has been up to 54.3% was re-

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ported (Rajan, 1987; Roy, 1993) and yield losses of 5-10% in susceptible variety have been estimated in Asia (Savary *et al.*, 2000).

The pathogen is known to cause the damage at different stages *viz.*, seed germination, seedling establishment and vegetative growth phase. As a result, productivity and quality of grains and seeds are reduced considerably. Besides the disease management, practice through cultural methods, chemical control, is the net promising method. Hence, in the present study Carbendazim 50 % WP was used for seed treatment to evaluate efficacy in controlling sheath blight. Of late, diverse group of fungicides with varied mode of action are being used for management of sheath blight disease under field condition. These recommended fungicides are not suitable due to phytotoxicity and mammalian toxicity; however, currently many products are available in the markets which are mainly systemic with residual action of some days. Hence, present situation envisaged the scope of seed treatment in management of sheath blight disease. Since, pathogen causes disease is seed borne in nature usage of seed protectants is the best way to mitigate the disease at vegetative and maturity stages. Therefore, information about efficient fungicide with different modes of action should be offered to farmers. In this context, the present exploration was undertaken to appraise the efficacy of commercially available Carbendazim 50 % WP as a seed treatment at different doses against sheath blight disease under field conditions.

Materials and Methods

Seed material, Fungicide and field preparation for planting

The experiment was conducted in red sandy loam soils with unique soil properties consist of pH 5.9 to 6.2, adequate organic matter with available NPK contents. The experimental plots were swamped with water and ploughed until any soil aggregates were wrecked up. Excess water was drained out, and the field was partitioned into several blocks based upon the prerequisite for the experiment. In the present investigation, Carbendazim 50 % WP fungicide as a seed treatment against sheath blight of rice was screened and susceptible Jyothi variety was used for the study.

Experimental design and treatments in the field

The experiment was set out in a randomized complete block design (RCBD) each with six treatments replicated four times during two consecutive years *Kharif* 2017 and 2018. The uniform plant population was sustained throughout the plot, with the spacing of 20 x 20 cm between rows and plants. Treatments consisted of a rice plant seed treated with different dosages of Carbendazim 50 % WP against sheath blight disease were tested. Seeds were treated with different disease of Carbendazim 50 % WP of seed weight and seeds were allowed for air drying before sowing. The seeds were then taken kept in gunny bags at room temperature for 72 hours for sprouting before sowing in seedbed. Seed bed preparation, seed sowing, fertilization, land preparation, transplanting and intercultural operations were done following standard procedure and recommendation. Treatment details of the experiment was furnished hereunder,

Sl. No	Treatments	Dosage /kg seed
T1	Carbendazim 50% WP	1 g
T2	Carbendazim 50% WP	2 g
T3	Carbendazim 50% WP	3 g
T4	Carbendazim 50% WP (Market sample)	2 g
T5	Untreated Check	-
T6	Carbendazim 50% WP (only for phytotoxicity)	4 g

Method of seed treatment

Before sowing, the seeds were dressed with either a dry formulation or wet treated with a slurry or liquid formulation. Earthen pots can be used for mixing fungicides with seed or seed can be spread on a polythene pane and required quantity of fungicides can be strewn on seed lot and mixed thoroughly. In the present investigation, a different dose of Carbendazim 50 % WP was used for seed treatment.

Seed germination assay

Seed germination assay was carried out to test viability and purity of the treated seeds. Blotter test was used to test the seed health, in this process; treated seeds are placed on moistened layer of blotter paper and incubated under a condition that promotes fungal growth. Further, seeds allowed to germinate and recorded the sign or symptom of fungal growth and germination percentage to envisage effect of different doses of Carbendazim 50 % WP.

Disease assessment

Disease assessment was carried out and in each trial, three observations were registered. Disease severity was recorded at three growth stages such as flowering, milking and maturity stage. For disease scoring, the disease severities were subjected in 0-9 scale using a typical assessment system for rice developed by the International Rice Research Institute (SES, 2002). Further, the disease severity was calculated using the following recipe. Subsequently, the data on disease severity and yield parameters were collected and subjected to appropriate statistical analysis.

Disease Scale and scoring: The following disease scales were utilized for assessment of diseases variables under field condition and disease scale used in during investigation was referred below given by IRRI (2002),

0 - No infection 1 - Vertical spread of the lesions up to 20% of plant height
3 - Vertical spread of the lesions 21 - 30% of plant height
5 - Vertical spread of the lesions 31 - 45% of plant height
7 - Vertical spread of the lesions 46 - 65% of plant height
9 - Vertical spread of the lesions > 65% of plant height

$$\text{Disease severity (\%)} = \frac{\text{Sum of individual grading X No. of infected tillers/hill}}{\text{Total no. of tillers assessed X Maximum disease grade}} \times 100$$

Result

Effect of Carbendazim 50%WP as seed treatment against sheath blight of rice during *Kharif* 2017

Effect of Carbendazim 50% WP on Seed germination

Data from the seed germination assay (Table 1) found that, the maximum seed germination was observed in seeds treated with Carbendazim 50% WP @ 4g/kg seed (86.25%) followed by Carbendazim 50% WP @ 3g/kg seed (82.75%) treated seeds. However, Carbendazim 50% WP @ 1g/kg treated seeds recorded the seed germination of 65.50 per cent whereas; the minimum seed germination was documented in untreated check (51.00 %). The higher concentration of Carbendazim 50 % WP was found to be effective in germination percentage of the treated seeds.

Effect of seed treatment on per cent disease severity

Bioefficacy of Carbendazim 50 % WP at four doses was screened against sheath blight disease at flowering, milking and maturity stage and results indicate that, all the treatments checked the further spread of disease and low level of disease index was observed after each dose of treatment (Table 1). Among the them, seeds treated with Carbendazim 50% WP @ 4g/kg seed found to be highly effective in reducing the sheath blight severity (30.00 %) at flowering stage, followed by Carbendazim 50% WP @ 3g/kg seed treated plots (33.50%). Both test sample and market sample of Carbendazim 50% WP @ 2g/kg seed found to be statistically on par and recorded the per cent disease severity of 35.25 and 35.00 respectively. However, Carbendazim 50% WP @ 1g/kg seed treated plots noticed the disease severity of (41.50%) whereas; the maximum disease severity was observed in untreated check (48.50%).

The similar trends of results were observed at milking stage, where the lowest disease severity was recorded in the treatment of Carbendazim 50% WP @4g/kg seed (24.50%), followed by Carbendazim 50% WP @ 3g/kg seed (28.75%) treated plots. Both test sample and market sample of Carbendazim 50% WP @ 2g/kg seed found to be statistically on par and recorded the per cent disease severity of 32.00 and 31.75 respectively. Whereas, the maximum disease severity was observed in untreated check (56.25%). Similarly at maturity stage, the lowest disease severity was recorded in the treatment Carbendazim 50 % WP @ 4g/kg seed (25.50 %), followed by Carbendazim 50 % WP @ 3g/kg seed (20.50 %). Both test sample and market sample of Carbendazim 50 % WP @ 2g/kg seed found to be statistically on par and recorded the per cent disease severity of 25.50 and 25.00 respectively. However, the Carbendazim 50 % WP @ 1g/kg seed treated plots showed the disease severity of (33.25 %) whereas; the maximum disease severity was noticed in untreated check (63.00 %) (Table 1).

Effect of seed treatment on grain yield

Data pertaining to grain yield gathered in different treatments furnished in Table1. From the table it was noticed that, maximum yield of rice was observed in Carbendazim 50% WP @4g/kg seed (4.90 t/ha) followed by Carbendazim 50% WP @ 3g/kg seed treated plots (4.5 t/ha) whereas; least yield was observed in untreated check (2.8 t/ha).

Effect of Carbendazim 50%WP as seed treatment against sheath blight of rice during *Kharif* 2018

Effect of seed treatment on seed germination

Similar trend was observed during second year trial (Table 2) and it was indicated that, the maximum seed germination was documented in 50 % WP @ 4g/kg seed treated plots (87.5%) followed by Carbendazim 50 % WP @ 3g/kg seed (83.75 %) treated plot. However, the seeds treated with Carbendazim 50 % WP @ 1g/kg seed noticed the seed germination of 63.30 % whereas; the minimum seed germination was recorded in untreated check (51.50 %).

Effect of seed treatment on per cent disease severity

The seed treatment of Carbendazim 50% WP @ 4g/kg seed found to be highly effective in reducing the sheath blight severity with disease severity of 30.25 % at flowering stage, which was followed by Carbendazim 50% WP @ 3g/kg seed treated plots (35.00%) (Table 2). However, both test sample and market sample of Carbendazim 50% WP @ 2g/kg seed recorded the per cent disease severity of 37.25 and 35.25 respectively. Whereas, the maximum disease severity was noticed in untreated check with disease severity of 49.50 %.

Data gathered at milking stage indicated the similar trend of efficacy and the lowest disease severity was observed in the seed treated with Carbendazim 50% WP @4g/kg seed (22.50 %) which was followed by Carbendazim 50% WP @ 3g/kg seed (27.75 %). However, both test sample and market sample of Carbendazim 50% WP @ 2g/kg seed found to be statistically on par and documented the per cent disease severity of 31.25 and 30.75 respectively. Whereas, maximum disease severity was noticed in untreated check (57.5%). Similarly, at maturity stage, the lowest disease severity was recorded in the treatment Carbendazim 50% WP @ 4g/kg seed (18.00 %) followed by Carbendazim 50% WP @ 3g/kg seed (20.20%). Similar results were documented in seed treatments of test sample and market sample of Carbendazim 50% WP @ 2g/kg seed, however, the Carbendazim 50% WP @ 1g/kg seed treated plots showed the disease severity of (32.50 %) whereas, the maximum disease severity was observed in untreated check (66.25 %).

Effect of seed treatment on grain yield

Results from Table 2 with regard to data on grain yield showed that, the maximum yield of rice was collected in Carbendazim 50% WP @4g/kg seed (4.4 t/ha) followed by Carbendazim 50% WP @ 3g/kg seed (4 t/ha) whereas; least yield was recorded in untreated check (2t/ha).

Perusal of findings of the present investigation on efficacy of doses of Carbendazim 50 % WP on sheath blight disease of rice envisaged that, seed treatment of Carbendazim 50% WP @ 4g / kg of seeds or Carbendazim 50% WP @ 3g / kg of seeds was found to be highly effective in managing sheath blight disease at early stage of crop growth and significantly reduces further spread under field condition by mitigating inoculum at seedling stage which

Table 1. Bioefficacy evaluation of Carbendazim 50%WP as seed treatment against sheath blight of rice (*Kharif* 2017)

Sl. No	Treatments	Dosage/ kg seed	Seed germination (%)	Disease Severity (%)			Yield (t/ha)
				Flowering	Milking	Maturity	
T1	Carbendazim 50% WP	1 g	65.50(54.03)	41.50(40.10)*	38.75(38.50)	33.25(35.21)	3.26
T2	Carbendazim 50% WP	2 g	80.50(63.80)	35.25(36.42)	32.00(34.45)	25.50(30.33)	4.10
T3	Carbendazim 50% WP	3 g	82.75(65.47)	33.50(35.37)	28.75(32.42)	20.50(26.92)	4.50
T4	Carbendazim 50% WP (Market sample)	2 g	65.00(53.73)	35.00(36.27)	31.75(34.29)	25.00(30.00)	3.90
T5	Untreated Check	-	51.00(45.57)	48.50(44.14)	56.25(48.59)	63.00(52.54)	2.80
T6	Carbendazim 50% WP (only for phytotoxicity)	4 g	86.25(68.25)	30.00(33.21)	24.50(29.67)	25.50(23.18)	4.90
	SE.m±**		**0.88**	**0.48**	**0.62**	**0.37**	**0.15**
	CD@0.05***		**2.68**	**1.52**	**1.85**	**1.14**	**0.51**

* Values in the parenthesis are Arc sine transformed

**Mean of standard error

***Critical difference between treatments at 0.05 % level of confidence

Table 2. Bioefficacy evaluation of carbendazim 50%WP as seed treatment against sheath blight of rice (*Kharif* 2018)

Sl. No.	Treatments	Dosage /kg seed	Seed germination (%)	Disease Severity (PDI)			Yield (t/ha)
				Flowering	Milking	Maturity	
T1	Carbendazim 50% WP	1 g	63.32(52.77)	42.5(40.70)*	37.25(37.63)	32.5(34.77)	2.9
T2	Carbendazim 50% WP	2 g	82.5(65.36)	37.25(37.63)	31.25(34.00)	24.25(29.51)	3.9
T3	Carbendazim 50% WP	3 g	83.75(66.29)	35.25(36.44)	27.75(31.80)	20.20(26.72)	4.0
T4	Carbendazim 50% WP (Market sample)	2 g	67(54.98)	35(36.29)	30.75(33.69)	24.50(29.51)	3.5
T5	Untreated Check	-	51.5(45.88)	49.5(44.74)	57.5(49.34)	66.25(54.52)	2.0
T6	Carbendazim 50% WP (only for phytotoxicity)	4 g	87.5(69.49)	30.25(33.38)	22.5(28.33)	18(25.11)	4.4
	SE.m±**		1.11	0.44	0.47	0.41	0.07
	CD@0.05***		3.5	1.39	1.47	1.28	0.23

* Values in the parenthesis are Arc sine transformed
**Mean of standard error
***Critical difference between treatments at 0.05 % level of confidence

in turn provided higher grain yield and other yield attributing characters.

Discussion

These findings corroborate with Dharma *et al*. (1970) who reported the complete control of seed-borne *D. oryzae*, *D. sativa* and *D. avenae* on rice, barley and oats respectively through seed treatment with Carbendazim at 0.3g /kg seed and found to be increase in seed germination. Amin *et al.* (2014) observed that Dithane M 45, and Carbendazim 50 % WP showed the best result in reducing incidence and severity of sheath blight disease and increasing seed germination, yield and other growth and yield characters. Reported that seeds of BR10 and BR11 with natural infection of seed borne pathogens were treated with Bavistin, Benlet, Dithane M 45, Homai, Rovral-50, Tecto-60, Topsin-M and Vitavex-200 at the rate of 3g/kg and among the nine fungicides tested, Dithane M 45 gave a very good control of all the fungal pathogens associated with seeds of BR10 and BR11. The best control of *D. oryzae* was obtained with Rovral-50 WP and Dithane M 45, followed by Vitavax-200. Seed germination increased in all the cases over control (Anon, 1988).

Conclusion

Sheath blight disease of rice is devastating and seed borne nature, hence, its management under field condition paved challenge to farmers or stakeholders. Data gathered from the two season trial showed that minimum severity results maximum yield and also observed that disease severity was gradually increased from flowering stage to milking stage to maturity stage. Carbendazim 50 % WP as seed treatment at 4g or 3g was found highly effective against sheath blight disease of rice under field condition and reduced the extent of damage or loss caused by the disease. As a result, it may also increased grain yield and other yield attributing traits, net profit, economic return and lastly helps in realizing more income from the investigation. However, present investigation showed that seed treatment with fungicide is best method of application and reducing the disease spread and damage at early crop stages.

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