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A combination fungicide for the management of sheath blight and stem rot diseases of paddy

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Abstract
A new combination fungicide TAQAT 75% WP(Captan70%+Hexaconazole5%) was tested in different doses against rice sheath blight (ShB)and stem rot (StR) diseases under field conditions during Kharif 2013-14. The combination fungicide TAQAT 75% WP (Captan70%+Hexaconazole5%)@750g/ha was found effective against ShB and StR diseases recording minimum percent disease index (PDI)of 28.15 and 41.26 respectively during Rabi 2013-14.Similartrend was observed during the Kharif 2014 where test fungicide TAQAT 75% WP were recorded least PDI of 21.48 and 45.45 against ShB and StR respectively. Compared to TAQAT 75% WP, other test fungicides such as Hexaconazole 5%SC and Captan 50%WP recorded highest PDI against Sh Band StR diseases in both Rabi 2013and Kharif 2014 respectively. Significant increase in grain yield (45.85Q/ha) was observed in the plot treated with the chemical TAQAT 75% WP@750g/ha in Rabi2013-14 and 47.72 Q/ha in Kharif 2014, whereas other fungicidal treatments recorded the yield in the range of 34.28 to 45.35q/ hain Rabi2013-14 and 35.31 to 40.92Q/ ha in Kharif 2014.

Keywords: Sheath blight, Stem rot, TAQAT 75 WP, PDI

Introduction
Rice (*Oryza sativa L.*) is one of the major cereal crop in the world and the ninety percent of world's rice is grown and consumed in Asia. It is constituting the dietary staple food for more than half of the planet's human population and also consider as most important stable food crop in India. Ever growing population in India is further demanding more rice production and productivity. Under field condition, the productivity of rice is affected by many biotic and abiotic factors. Among the different biotic constrains, disease caused by fungal pathogens such as sheath blight, sheath rot and stem rot cause significant damage in irrigated rice (Jackson *et al*., 1977; Bonman *et al.*,1991; Kindo and Tiwari, 2015).
Rice sheath blight caused by *Rhzoctonia Solani* Kuhn (Telemorph: Thanatephorus cucumis (Frank) Donk), is a destructive disease worldwide that causes significant yield losses and quality degradation (Teng *et al*.; 1990; Salvary *et al.* 2006). InIndia, a modest estimation of losses due to the sheath blight disease alone has been up to 54. 3% (Rajan 1987 and Roy, 1993). The disease is particularly important in intensive rice production systems (Salvary and Mew, 1996). Yield losses of 5-10% have been estimated for tropical lowland rice in Asia (Salvary *et al.*; 2000).
Stem rot of rice caused by *Sclerotium oryzae* is becoming a serious problem of rice cultivation in Indian subcontinent (Singh *et al*., 2002). The causal agent was first described from Italy in a sclerotial form and was named as *S. Oryzae* Catt. (Cattaneo, 1876). Singh and Devi (1999) reported the occurrence of rice stem rot in Manipur in almost the all varieties cultivated. In Karnataka, this disease occurred in epidemic form during 2012-13 and yield losses up to 30% was reported on paddy cultivar BPT5204 in North eastern part of Karnataka (Pramesh andguru Prasad; 2014). This disease was also reported to be a constraint in paddy cultivation in Chhattisgarh in recent years (Vandana Sahu, 2014).
Fungicide based management of sheath blight disease is successful at field level in majority of the cases (Kandhari Gupta; 2003; Grothj and Bond 2006; Bhubneswari and Raju, 2012, Kumar *et al.* 2013). Several fungicides such as Benomyl, Edifenphos, Thiophanate Methyl and Propiconazole have been found to be effective in reducing stem rot disease severity under field condition (Singh *et al*. 2002; Kumar *et al*., 2003; Gopika *et al.*; 2016). Present study was under taken to assess the field efficacy of TAQAT 75% WP (Captan70%+Hexaconazole5%), a combination fungicide against rice sheath blight (ShB) and stem rot (StR) diseases under field conditions.

Materials and methods

Layout, fungicides and crop establishment

A field experiment was conducted to evaluate the bio-efficacy of new fungicide combination against sheath blight and stem rot disease at the experimental fields of Directorate of Research Services, IGKV, Raipur Chhattisgarh during Rabi 2013 and Kharif 2014. A popular variety Swarna which is susceptible to sheath blight and stem rot diseases was used for the study.ForRabi2013 experiment, seeds were sown in the month of November and planted in the month of December. For Kharif 2014 experiment, seeds were sown in the month of June and planted in the month of July. The land was prepared by puddling method by applying one ploughing followed by two ploughing after one week. The experiment was laid out by randomized block design (RBD) with a plot size of 5x2 meter for all treatments. Seedlings of 30 days old were planted in trial plots at 20x10 cm spacing. All standard agronomic practices were followed except using higher nitrogenous (200kg/ha) and lower Potassic dose than the normal dose (N_2:P_2O_5:K_2O, 150:75:75).

The RBD experiment comprises eight with three replications each. A new combination formulation *viz;* TAQAT 75% WP (Captan70%+Hexaconazole5%) was tested in two doses (500g/ha and 750g/ha) along with Captan 50% WP @700g/ha& 1050g/ha and Hexaconazole 5% SC@500, 750 and 1000ml/ha. Bio-efficacy was evaluated after spraying all the test chemicals twice at 10 days interval starting from initiation of the disease.

Artificial inoculation

The crop was inoculated with *R. solani* sclerotia infected rice plant sheath bits by placing them in between tillers/sheath at maximum tillering stage. Inoculations with the *Sclerotium oryzae/* sclerotial bodies were done on plants on crop plants, one sclerotia was gently placed on pseudo stem /stem portion (whichever applicable) and gently supported for the adherence with transplant cello tap.

Disease assessment and statistical analysis

Ten days after the fungicide application, disease assessment was carried out for measuring Sheath blight disease, 0-9 disease rating scale developed by International Rice Research Institute (IRRI.1996) was used. For stem rot disease, disease was measured based on 0-9 scale (SES IRRI, 1980). Further, the score data was converted into percent disease index (PDI) using formula given below. The data on the yield were recorded. The data on disease severity and yield parameters were subjected to appropriate statistical analysis.

PDI = [(Sum of scores)/(Number of observation x highest number in Rating Scale)]x100

Result and Discussion

Sheath blight

In recent time, combination fungicides are widely used in disease management under field condition because of their curative action, broad rage and lower dose compare to their solo formulations. In rice, efficacy of such combi products in managing many fungal diseases have been reported (Bag and Saha, 2009; Bhubneswari and Raju, 2012, Kumar and Verabhadraswamy, 2014; Pramesh *et al*., 2016b). In the present study, field experiment revealed that the treatment TAQAT 75% WP (Captan70%+Hexaconazole5%) @ of 750g/ha recorded lowest PDI of sheath blight in Rabi 2013 (28.15) and Kharif 2014 (21.48) compared to other treatment (Table 1). This finding is of agreement with the previous reports where combination fungicides Trifloxystrobin 25%+Tebuconazole 50% (Nativo 75 WG) @ 0.4g/l performed better in reducing the sheath blight severity (Bag and Saha, 2009, Pramesh *et al*. 2016a). Similarly, Bhubneswari and Raju (2012) reported the batter efficacy of a combination fungicide Azoxystrobin18.2% +Difenoconazole 11.4% SC against sheath blight disease.

Table 1: Effect of Taqat 75%WP (Capton70%+Hexaconazole 5%) on Sheath blight disease of rice

Treatment	Dose/ha (formulation)	Sheath blight Disease Severity(PDI)	
		Rabi2013-14	Kharif-2014
Taqat 75% WP	500g	37.78 (37.93)	22.96 (28.63)
Taqat 75% WP	750g	28.15 (32.04)	21.48 (27.61)
Captan 50% WP	700g	53.62 (47.08)	56.44 (48.70)
Captan 50% WP	1050g	51.11 (45.64)	55.56 (48.19)
Hexaconazole 5% SC	500ml	45.93 (42.66)	40.10 (39.29)
Hexaconazole 5% SC	750ml	44.00 (41.55)	34.44 (35.88)
Hexaconazole 5% SC	1000ml	38.52 (38.36)	28.57 (32.31)
Control	-	72.06 (58.09)	74.73 (59.85)
SEm+		1.00	0.76
CD at P=0.05		2.75	2.11

Figures in parenthesis are angular transformed

Stem rot

The fungicide TAQAT 75% WP (Captan70%+Hexaconazole 5%)@750g/ha was performed better than other chemicals in both of the seasons in reducing the stem rot PDI (Table 1). It recorded PDI of 41.26 and 45.45 in Rabi 2013 and Kharif 2014 respectively which is statistically significant over all other treatments. Several fungicides in solo formulation such as Benomyl, Edifenphos, Thiophanate Methyl, Propiconazole has been reported earlier as effective in reducing stem rot disease under field conditions (Singh *et al*., 2002; Kumar *et al*., 2003; Gopika *et al.*, 2016). In this experiment, we have reported the superiority of combination fungicide (Captan70%+Hexaconazole5%) over other solo fungicide in reducing the stem rot disease severity under field conditions.

Table 2: Effect of Taqat 75%WP (Captan 70%+Hexaconazole 5%) on Stem rot disease of rice

Treatment	Dose/ha (formulation)	Stem rot Disease Severity(PDI)	
		Rabi2013-14	Kharif-2014
Taqat 75% WP	500g	42.40 (40.61)	49.99 (44.98)
Taqat 75% WP	750g	41.26 (39.95)	45.45 (42.34)
Captan 50% WP	700g	60.31 (50.97)	59.08 (50.25)
Captan 50% WP	1050g	52.37 (46.36)	56.81 (48.89)
Hexaconazole 5% SC	500ml	56.34 (48.65)	57.57 (49.40)
Hexaconazole 5% SC	750ml	47.42 (43.48)	57.57 (49.40)
Hexaconazole 5% SC	1000ml	46.39 (42.91)	53.02 (46.72)
Control	-	66.66 (54.91)	67.42 (55.22)
SEm+		1.53	1.43
CD at P=0.05		4.69	4.34

Figures in parenthesis are angular transformed

Yield

Difference in the disease in the disease severity of sheath blight and stem rot in different treatment was finally reflected in the grain yield. Significant increase in the grain yield in Rabi 2013-14 i.e. 45.85q/ha and 47.72 Q/hain Kharif 2014 (Table 1), whereas other fungicide treatments recorded yield in the range of 35.31-40.92Q/hain Rabi 2013-14 and 34.28-45.36 in Kharif 2014 (table 1). Our results are in confirmatory with previous report (Soodand Kapoor, 1997; Tirmali *et al*., 2001; Prabhu *et al. 2003,* Usman *et al.* 2009 and Naik *et al. 2012)* reported that fungicides applications increase the yield of rice. The increased yield is mainly due to reduced disease severity of sheath blight and stem rot of rice.

Table 3: Effect of Taqat 75%WP (Capton70%+Hexaconazole5%) on grain yield

Treatment	Dose/ha (formulation)	Yield(q/ha)	
		Rabi 2013-14	Kharif-2014
Taqat 75% WP	500g	40.63	45.36
Taqat 75% WP	750g	45.85	47.72
Captan 50% WP	700g	35.31	34.28
Captan 50% WP	1050g	36.79	34.93
Hexaconazole 5% SC	500ml	37.42	37.46
Hexaconazole 5% SC	750ml	39.64	40.61
Hexaconazole 5% SC	1000ml	40.92	45.35
Control	-	32.24	33.82
SEm+		1.43	1.17
CD at P=0.05		4.18	3.56

Figures in parenthesis are angular transformed

Combination fungicides are better compare to other solo fungicides due to their broad range of action, lower dose and also possess lower risk of fungicide resistant development in target fungal population

In case of rice, resistance varieties for sheath blight and, stem rot are not developed / available /yet to the farmer. Moreover, poor bio-efficacy of the bio-control agents under the severe epidemic condition makes the chemical control is an inevitable and ultimate means for disease management for farmers. Thus, in present situation cultural practices combined with foliar spray of fungicide is the most common practice to manage the disease and even in integrated pest management system need based application of fungicide has been recommended (Bag *et al.*; 2016).

In conclusion, present investigation provides the field efficacy of a fungicide premixture TAQAT 75% WP (Captan70%+Hexaconazole5%) @750g/ha for management of sheath blight and stem rot disease of paddy.

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