

Original Research Article

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Effectiveness of Agrochemicals on Development of Diseases during Reproductive Phase in Paddy

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ABSTRACT

Keywords

Rice, Sheath rot, Brown spot, Grain discoloration, Benefit cost ratio, Reproductive stage, Fungicides

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A two year field study was conducted at Agricultural Research station, Ragolu to study the efficacy of selected agrochemicals on the development of diseases (sheath rot, brown spot and grain discoloration) during reproductive phase in paddy. Treatments were imposed for two times, once at 50% panicle emergence and 15 days subsequently. Among the fungicides, foliar application of *propiconazole* @ 1 ml/L was found most effective in minimizing the development of sheath rot (5.9%), brown spot (8.8%) and grain discoloration (7.4%) in comparison to 27.0, 25.8 and 10.9 percent disease incidence respectively recorded in untreated control. The treatment was found to be statistically at par with *trifloxystrobin + tebuconazole* @ 0.4 g/L and carbendazim (1 g/L). Benefit cost ratio of 1.5:1 was realized in *propiconazole* and *trifloxystrobin + tebuconazole* treatments. The ineffectiveness of antibiotic treatment (streptomycin sulphate + tetracycline) suggests the predominant role of fungal pathogens in the development of sheath rot symptoms. The study emphasizes the importance of timely chemical interventions in minimizing disease load and maximizing returns in paddy.

Introduction

Rice (*Oryza sativa* L.) is the major crop under rainfed conditions of the north coastal zone of Andhra Pradesh. Paddy yields in this part of India are governed by the rainfall distribution and successful management of biotic constraints during the crop season. During reproductive phase in paddy, a number of diseases *viz.*, sheath rot, neck blast, leaf spots etc. are responsible for causing significant damage to the crop *viz.*, partial emergence of panicle, partial or total chaffiness of grains,

grain discoloration, and in some instances loss of seed viability (Sumangala *et al.*, 2011; Gopalakrishnan *et al.*, 2010). Under ideal climatic conditions, disease problems during reproductive phase could cause significant damage to the crop (Sakthivel, 2001). Timely management of diseases during reproductive phase is of paramount importance in realising quality harvest. Literature suggests the use of fungicides, botanicals and bioagents for the management of individual diseases during reproductive phase *viz.*, sheath rot, leaf spots, neck blast etc., (Kumar and Kumar 2012;

Meera and Balabaskar, 2012; Sharma *et al.*, 2013; Sarkar *et al.*, 2014). However, information on comprehensive management of possible pathogens responsible for loss in grain yield and quality is lacking. Keeping in view, the potential losses caused by pathogens infecting paddy at panicle emergence to harvesting stage, present study was undertaken to evaluate agrochemicals against pathogens influencing seed health and yields in paddy.

Materials and Methods

A two year field trial was conducted at Agricultural Research Station, Ragolu (Acharya N G Ranga Agricultural University) during kharif 2011-13 in F. No. 13-IIB to evaluate the efficacy of nine selected agrochemicals (carbendazim, mancozeb, trifloxystrobin + tebuconazole, propiconazole, metiram, tebuconazole, metiram and streptomycin sulphate + tetracycline) against development of diseases during reproductive phase.

The experiment was laid out in Randomized block design with a plot size of 12.54 m² and spacing of 20x 15 cm, each treatment was replicated thrice. Standard package of practices (120-60-40 kg/ha NPK) were adopted during the trial. Locally popular, high yielding and neck blast resistant variety, RGL 2537 (Srikakulam Sannalu) was used as test variety. Treatment imposition (foliar spray) of individual agrochemicals at their recommended dosage was carried out for two times, first at 50% panicle emergence and second spray 15 days later. Foliar spray of water constituted untreated control.

Observations on the development of sheath rot, brown spot and grain discoloration were recorded periodically and expressed as percent disease incidence (Standard Evaluation System for Rice, IRRI 1996).

Arc sine transformation of data was done for statistical analysis. Pooled mean of data for two years was done and presented. Yield was expressed as Kg/ha. Total cost of cultivation, total returns and benefit cost ratio was calculated and presented.

Results and Discussion

In the field trial conducted for two years i.e., kharif 2011-12 and 2012-13 to study the efficacy of nine agrochemicals on the management of diseases during reproductive phase in paddy, foliar spray with the selected agrochemical at the recommended dosage was done at 50% panicle emergence and at 15 days after the first spray.

Treatments were imposed during afternoon hours for preventing disruption in fertilization. During the study, it was observed that mean sheath rot incidence in untreated control was comparatively higher (35.5%) in 2012-13 compared to 18.8% incidence recorded during 2011-12 (Table 1). It is evident from Table 3 that higher rainfall recorded during November 2012 coincided with flowering in paddy, which could have resulted in comparatively more sheath rot incidence. Similarly, mean grain discoloration was higher in 2012-13 (17.6%) compared to 2011-12 (4.2%).

Among the individual treatments against sheath rot, trifloxystrobin + tebuconazole was the most effective treatment recording pooled mean sheath rot incidence of 7.7%, statistically at par with propiconazole and carbendazim. Antibiotic (streptomycin sulphate + tetracycline) treatment recorded a pooled mean sheath incidence of 19.2% in comparison to 24.2% recorded in untreated control. The ineffectiveness of antibiotic treatment suggests the predominant role of fungal pathogens in the development of sheath rot symptoms.

Table.1 Effect of selected fungicides on the development of diseases during reproductive phase in paddy (two year study - 2011-13)

S. No.	Treatment	Dose (g/l)	Per cent Incidence								
			Sheath rot			Brown spot			Grain Discoloration		
			2011-12	2012-13	Pooled Mean ⁺	2011-12	2012-13	Pooled Mean	2011-12	2012-13	Pooled Mean
1	Carbendazim 50% WP	1	5.0 (12.9)*	10.0 (18.4)	7.5 (15.7)	9.5 (17.9)	14.6 (22.4)	12.1 (20.2)	3.4 (10.6)	9.6 (18.1)	6.5 (14.3)
2	Mancozeb 75% WP	2.5	10.2 (18.5)	25.1 (30.0)	17.7 (24.2)	9.7 (18.1)	12.2 (20.4)	11.0 (19.2)	2.8 (9.5)	12.5 (20.5)	7.7 (15.0)
3	Trifloxystrobin + tebuconazole 75 WG	0.4	3.2 (10.2)	7.7 (15.6)	5.5 (12.9)	7.7 (15.8)	9.9 (18.4)	8.8 (17.1)	3.4 (10.4)	9.8 (18.2)	6.6 (14.3)
4	Propiconazole 25% EC	1	4.3 (11.8)	7.4 (15.8)	5.9 (13.8)	7.9 (16.2)	9.6 (17.8)	8.8 (17.0)	3.4 (10.7)	9.4 (17.8)	6.4 (14.2)
5	Metiram 80% WG	2	10.2 (18.6)	22.9 (28.3)	16.6 (23.5)	14.5 (22.3)	18.1 (25.1)	16.3 (23.7)	4.4 (11.3)	14.1 (21.9)	9.3 (16.6)
6	Tebuconazole 29.5EC	2	12.7 (20.9)	22.0 (27.7)	17.4 (24.3)	12.6 (20.8)	18.4 (25.1)	15.5 (22.9)	3.0 (9.8)	12.2 (20.4)	7.6 (15.1)
7	Propineb 70% WP	1	9.6 (18.0)	18.8 (25.7)	14.2 (21.8)	16.7 (24.0)	16.5 (23.9)	16.6 (23.9)	3.2 (10.2)	12.8 (21.0)	8.0 (15.6)
8	Streptomycin Sulphate + Tetracycline Hydrochloride (9:1)	0.1	13.0 (21.1)	24.6 (29.7)	18.8 (25.4)	19.2 (25.9)	22.8 (28.5)	21.0 (27.2)	3.6 (10.4)	12.9 (21.0)	8.3 (15.7)
9	Control	-	18.8 (25.6)	35.1 (36.3)	27.0 (31.0)	24.2 (29.4)	27.5 (31.6)	25.8 (29.4)	4.2 (11.7)	17.6 (24.8)	10.9 (18.3)
	CV (%)		10.5	8.9	6.3	11.3	11.3	6.8	26.1	8.9	9.4
	CD (0.05)		3.5	3.9	2.3	4.1	4.6	2.6	NS	3.1	2.5

* Figures in parenthesis are arc sine transformed values

+ Pooled mean for two years (2011-13)

Table.2 Influence of selected fungicides on yields in paddy over two years (2011-13)

S. No.	Treatment	Dose (g or ml/L)	Yield (Kg/ha.)			Benefit: cost ratio
			2011-12	2012-13	Pooled Mean	
1	Carbendazim 50% WP	1	3926	4730	4328	1.45
2	Mancozeb 75% WP	2.5	3630	4677	4153	1.38
3	Trifloxystrobin + tebuconazole 75WG	0.4	4207	5082	4645	1.50
4	Propiconazole 25% EC	1	4119	4960	4539	1.50
5	Metiram 80% WG	2	3385	4229	3807	1.28
6	Tebuconazole 29.5EC	2	3974	4651	4312	1.44
7	Propineb 70% WP	1	3563	4671	4117	1.36
8	Streptomycin Sulphate + Tetracycline Hydrochloride (9:1)	0.06	3674	4578	4126	1.39
9	Control	-	3337	4361	3849	1.31
	CV (%)		8.1	4.3	4.8	
	CD (0.05)		521	341	348	

+ Pooled mean for two years (2011-13)

Table.3 Rainfall distribution at ARS, Ragolu during *kharif* 2011-12 and 2012-13

S. No.	Month	Rainfall distribution				
		Normal Rainfall (mm)	2011-12		2012-13	
			Actual (mm)	Deviation (%)	Actual (mm)	Deviation (%)
1	June	134.9	131.2	-2.6	55.1	-59.1
2	July	189.4	155.6	-17.8	190.5	+0.5
3	August	185.1	251.8	+36.0	113.0	-39.0
4	September	196.3	187.1	-4.7	163.2	-16.9
5	October	182.8	30	-83.6	78.0	-57.3
6	November	90.6	0	-100.0	266.0	+193.6
7	December	2.6	12.3	373.1	0.0	0.0
Total		981.7	755.7	-23.0	765.8	-22.0

Present findings are in agreement with the observations of Lore *et al.*, (2007) and Naik *et al.*, (2016) regarding use of fungicides for minimizing the growth of fungal pathogens of rice.

During the two year study (Table 1), it was observed that propiconazole @ 1 ml/L treatment recorded pooled mean brown spot incidence of 8.8% and mean grain discoloration of 6.4 % as against 25.8 and 10.9% respectively in untreated control. The treatment was found statistically at par with carbendazim and trifloxystrobin + tebuconazole treatment in terms of its efficacy against brown spot and grain discoloration. Metiram was found to be least effective in managing brown spot and grain discoloration. The findings of the present study were in agreement with Dinakaran *et al.*, (2012) regarding effectiveness of certain fungicides against grain discoloration in rice. Lower mean brown spot and grain discoloration incidence during 2011-12 can be attributed unfavourable weather conditions as evidenced by lack of rains (Table 3) during flowering and grain hardening stages of crop growth.

Comparatively higher yields realized during the second year of study i.e., 2012-13 (Table 2) in spite of higher mean disease incidence (sheath rot, grain discoloration) could be attributed to favourable weather conditions as evidenced by uniform distribution of rainfall during the crop growth period, which resulted in growth promotion and enhancement of yields.

In our two year study, higher pooled mean yield (4645 kg/ha) was realized in trifloxystrobin + tebuconazole treatment (Table 2) followed by propiconazole treatment (4539 kg/ha), although, yields obtained in propiconazole treated plots is marginally lower, the cost incurred on this chemical is comparatively lower in

comparison to trifloxystrobin + tebuconazole treatment (0.4g/L), both the treatments recorded benefit cost ratio of 1.5:1.0. Among other fungicides evaluated, tebuconazole treatment followed by carbendazim treatment resulted in benefit cost ratio of 1.44:1 and 1.45:1 respectively. The study emphasizes the importance of timely chemical interventions in minimizing disease load and maximizing returns in paddy.

From the field study conducted for two years to evaluate the efficacy of selected fungicides on the development of diseases during reproductive phase in paddy, It can be concluded that foliar application of propiconazole @ 1 ml/L was found most effective followed by trifloxystrobin + tebuconazole @ 0.4 g/L recording a benefit cost ration of 1.5:1.0 in comparison to 1.28:1.0 recorded in metiram treatment. It was observed that lack of rainfall during critical stages of crop growth and prolonged dry weather during 2011-12 resulted in lower mean disease incidence (Sheath rot, brown sport and grain discoloration) and lower mean yields. It is evident that Propiconazole or trifloxystrobin + tebuconazole treatments resulted in significant reduction of sheath rot, brown spot and grain discoloration in paddy in addition to enhancing yields.

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