

Compatibility of Insecticides and Fungicides against Major Insect Pests and Diseases of Rice

B. N. Chaudhari, P.S. Neharkar and G. R. Shamkuwar

ABSTRACT: Study was undertaken at AICRIP centre, Agriculture Research Station, Sakoli during Kharif 2012 to evaluate the compatibility of selected insecticides and fungicides as tank mix as reflected by their effectiveness against major insect pests and diseases of rice under field condition. (Buprofezin 20% + Acephate 50%WP) and (Buprofezin 20% + Acephate 50%WP)+ Hexaconazole 5% SC treatments were found effective against dead heart (stem borer) at 1st and 2nd spraying, respectively. Lowest white earhead (Stem borer) was observed in Sulfoxaflor 24% SC + Hexaconazole 5% SC treatment. In case of gall midge and leaf folder management (Buprofezin 20% + Acephate 50%WP)+ Tricyclazole 75% SP and Sulfoxaflor 24 % SC showed superior performance over other treatments at 1st and 2nd spraying, respectively. Buprofezin 20% + Acephate 50%WP treatment significantly reduced the population of brown plant hopper over other treatments. Sulfoxaflor 24% SC + Hexaconazole 5 % SC was found effective for management of white backed plant hopper. Meager incidence of blast was observed during the year. Tricyclazole 75 % SP treatment was found significantly superior over other treatments for management of blast at 1st spraying. (Buprofezin 20% + Acephate 50%WP) + Hexaconazole 5 % SC and (Buprofezin 20% + Acephate 50%WP)+ Tricyclazole 75 % SP treatments was found significantly superior over other treatments for management of blast at 2nd spraying. Minimum incidence of bacterial leaf blight was noticed in Tricyclazole 75% SP and (Buprofezin 20% + Acephate 50%WP)+ Tricyclazole 75% SP treatment after 1st and 2nd spraying, respectively. Phytotoxicity symptoms were not observed in any of the treatments.

Keywords: Insecticides, fungicides, compatibility, rice, stem borer, gall midge, leaf folder, brown plant hopper, white backed plant hopper, blast, bacterial leaf blight.

INTRODUCTION

Rice (*Oryza sativa* L.) is the staple food of more than three billion people in the world. Rice fulfills the nutritional requirement of half of the world population. Insect pests and diseases are the major evils responsible for lower yield of rice in India. Most of the times insect pests and diseases occurs together in rice. In such conditions use of combination of suitable insecticides and fungicides in the same tank is economical and practicable for their management. But at the same time, the effectiveness of the individual components in the mixture should not be reduced. Therefore, it is essential to evaluate compatibility of insecticides and fungicides against insect pests and diseases of rice. This practice reduces application cost in the event of simultaneous occurrence of both insect pests and diseases during crop growth period. The systematic efforts for

evaluation of compatibility of insecticides and fungicides were done at Directorate of Rice Research, Hyderabad, Bhaskaran *et. al.* (1976), Peter *et. al.* (1989), Krishnaiah and Reddy (1992), Reddy and Krishnaiah (1997), Bhuvaneshwari and Krishnam Raju (2013). Keeping this in view, the study was undertaken to evaluate the compatibility of selected insecticides and fungicides as tank mix as reflected by their effectiveness against major insect pests and diseases of rice under field condition.

MATERIALS AND METHOD

The experiment was conducted during Kharif 2012 in randomized block design. Two insecticides viz., (Buprofezin 20%+ Acephate 50%WP) and Sulfoxaflor 24% SC and two fungicides viz., Hexaconazole 5% SC and Tricyclazole 75% SP were evaluated singly as well as tank mix of insecticide and fungicide combination for their effectiveness against insect pests

* Agriculture Research Station, Sakoli 441802 Dist: Bhandara, (corresponding author E-mail:bncent@rediffmail.com)
(Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola) Maharashtra State, India.)

like stem borer, gall midge, leaf folder, brown plant hopper, white backed plant hopper diseases like blast and bacterial leaf blight of rice under field condition. Popular rice variety PKV HMT was transplanted in randomized block design with 9 treatments and 3 replications. A spacing of 20 X 15 cm was adopted in a gross plot size 20 m².

First application of insecticides and fungicides was made at 15 days after transplanting (DAT). Subsequent second application of insecticides and fungicides was made when the insect population/damage reaches economic threshold level. Surveyed insect populations in experimental plots as well as at light trap at 10 days intervals to judge the time of insecticide application. Silver shoot/dead heart counts on 10 plants based on stratified random sampling was recorded at 15 days after each application along with total tillers. The same method was followed for white ears at the time of harvest along with total productive tillers. Populations were recorded one day before and 5 days after each application in case of external feeders like leaf hoppers and plant hoppers on ten random plants. In each plot 10 random plants were selected and recorded damaged leaves by leaf folder and total leaves one day before and 10 days after each application. Percentage disease severity of blast and bacterial leaf blight was recorded 1 day before and 10 days after each application of treatments. Symptoms of phytotoxicity were also recorded at 5 and 10 days after application of treatments. Grain yields were recorded from each plot by excluding two border rows on all sides. Data was analyzed statistically.

RESULTS AND DISCUSSION

Minimum damage of Stem borer i.e. 4.09% dead heart was recorded in treatment with Buprofezin 20% + Acephate 50% WP whereas the maximum damage 24.69% dead heart in untreated control, after 1st spraying. Minimum damage 0.83% dead heart was recorded in treatment with (Buprofezin 20% + Acephate 50% WP)+ Hexaconazole 5% SC whereas the maximum damage 12.03% dead heart in untreated control, after 2nd spraying. At heading stage, lowest incidence of stem borer i.e.14.72 % white earhead was recorded in treatment with Sulfoxaflor 24% SC + Hexaconazole 5% SC while the highest incidence i.e. 32.86% white earhead was recorded in untreated control. Gall midge infestation was ranging from 9.29 to 39.85% silver shoot across treatments including control, after 1st and 2nd spraying. Overall, (Buprofezin 20%+ Acephate 50%WP)+ Tricyclazole 75% SP and

Sulfoxaflor 24% SC treatments showed significantly superior performance for gall midge management over other treatments including untreated control after 1st and 2nd spraying, respectively. For leaf folder management (Buprofezin 20%+ Acephate 50%WP)+ Tricyclazole 75% SP and Sulfoxaflor 24% SC treatments were the best treatment showing the least damage i.e. 4.74 and 0.25% damage leaves after 1st and 2nd spraying, respectively. Brown plant hopper incidence was very severe up to 12.17 hoppers/hill. Buprofezin 20%+Acephate 50% WP was found significantly superior over other treatments for management of brown plant hopper. White backed plant hopper infestation was ranging from 1.10 to 14.57 hoppers/hill. Sulfoxaflor 24% SC + Hexaconazole 5% SC was found significantly superior over other treatments for management of white backed plant hopper.

Meager incidence of blast (ranging from 0.02 to 0.58%) was observed during this year. Tricyclazole 75% SP treatment was found significantly superior over other treatments for management of blast at 1st spraying. (Buprofezin 20%+ Acephate 50%WP) + Hexaconazole 5% SC and (Buprofezin 20%+ Acephate 50%WP)+ Tricyclazole 75% SP treatments was found significantly superior over other treatments for management of blast at 2nd spraying. Bacterial leaf blight incidence was ranging from 0.91 to 5.50%. Tricyclazole 75% SP and (Buprofezin 20%+ Acephate 50%WP)+ Tricyclazole 75% SP treatments were found significantly superior over other treatments for management of bacterial leaf blight at 1st and 2nd spraying, respectively. Phytotoxicity symptoms were not noticed in any of the treatments which indicated the positive compatibility of the evaluated chemicals. Treatment with Sulfoxaflor 24% SC + Hexaconazole 5% SC recorded highest yield of 28.05 q/ha than other treatments. Lowest yield was recorded in control (19.11 q/ha).

Based on the performance of the treatments when applied alone vis a vis their respective combinations in reducing pest infestation, it is evident that there was no significant difference in the performance of insecticides formulations in their efficacy when applied alone or in combination with fungicides. Hence, they are compatible with each other for spray application to manage the rice pest.

These findings are in agreement with the findings of Bhuvaneshwari and Krishnam Raju (2013) who reported that the effectiveness of six insecticides viz., buprofezin, pymeterozine, acephate, chlorantraniliprole, dinotefuron, and imidacloprid +

ethiprole did not in any way hinder by mixing with different fungicides and they are compatible with each other for spray application to control the insect pests viz., sheath blight, brown plant hopper, leaf folder and stem borer. Similarly, Singh *et. al.* (2010) who found combination treatments of fungicides (tricyclazole and iprobenphos) and insecticides (indoxacarb and cartap hydrochloride) were biologically as effective as their individual treatments against neck blast, leaf folder and stem borer of rice respectively during Kharif 2006 and 2007 along with corresponding grain yield in Taraory Basmati. Similar finding was reported by Bhatnagar (2004) that the combination of cartap (Padan 50% WP) and tricyclazole (Bean 75% WP) was effective in reducing the damage of rice leaf folder and blast, and found to be compatible. Dodan *et. al.* (1997) from Kaul, Hariyana, studied the compatibility of carbendazim and edifenphos (fungicides) and monocrotophos and phosphomidan (insecticides) at

different doses and observed their compatibility as reflected by their effectiveness against stem borer and neck blast under field conditions. They realized higher grain yields in combination treatments compared to either insecticide or fungicide treatments alone. Song *et. al.* (1987) reported that the combination of pencycuron and isoprocarb exhibited very high synergism against sheath blight and brown plant hopper. Bhaskaran *et.al.*(1976) observed that combination of phasalone (Insecticide) and edifenphos (Fungicide) gave the best control of leaf folder, green leaf hopper and *Helminthosporium* leaf spot disease.

Thus, the results reveal that there was no adverse impact on the efficacy of either the combination product of Buprofezin 20%+ Acephate 50%WP or Sulfoxaflor 24%SC due to their combination with Hexaconazole 5%SC or Tricyclazole 75% SP or vice versa confirming the compatibility of chemicals when used as a tank mix in the field.

Table 1
Effect of Pesticides on Incidence of Stem Borer, Gall Midge and Leaf Folder of Paddy in Kharif 2012.

S.N.	Insecticide / Fungicide	Dose g/ml per litre of spray fluid	Stem Borer infestation (% Dead Heart)		Gall Midge infestation (% Silver Shoot)			% LF Damaged Leaves			
			1 st Spraying	2 nd Spraying	% WE	1 st Spraying	2 nd Spraying	1 st Spraying		2 nd Spraying	
								1 DBT	8 DAT	1 DBT	8 DAT
1	(Buprofezin 20%+ Acephate 50%WP)	2.00	4.09 (2.00)	1.66 (1.27)	17.73 (24.83)	11.18 (19.34)	17.72 (24.88)	7.27 (2.66)	6.97 (2.57)	2.53 (1.57)	0.99 (0.77)
2	Sulfoxaflor 24% SC	0.60	5.66 (2.38)	1.68 (1.29)	19.23 (25.93)	11.17 (19.48)	15.06 (22.75)	8.69 (2.93)	6.24 (2.49)	2.09 (1.44)	0.25 (0.41)
3	Hexaconazole 5% SC	2.00	11.26 (3.35)	5.89 (2.42)	18.10 (25.14)	28.07 (31.91)	36.35 (37.07)	10.59 (3.24)	13.67 (3.68)	6.01 (2.45)	7.57 (2.75)
4	Tricyclazole 75% SP	0.60	13.89 (3.72)	5.77 (2.40)	16.28 (23.67)	22.50 (28.31)	30.18 (33.32)	6.41 (2.52)	5.58 (2.36)	6.49 (2.53)	7.90 (2.79)
5	(Buprofezin 20%+ Acephate 50%WP)+ Hexaconazole 5% SC	2.00+2.00	7.33 (2.67)	0.83 (0.75)	17.27 (24.51)	11.82 (20.02)	19.20 (25.85)	6.24 (2.47)	5.54 (2.34)	2.45 (1.56)	1.01 (0.82)
6	(Buprofezin 20%+ Acephate 50%WP)+ Tricyclazole 75% SP	2.00+0.60	5.55 (2.33)	1.65 (1.24)	16.32 (23.76)	9.29 (17.65)	20.27 (26.75)	6.74 (2.59)	4.74 (2.17)	2.90 (1.70)	0.45 (0.66)
7	Sulfoxaflor 24% SC + Hexaconazole 5% SC	0.60+2.00	5.68 (2.36)	2.54 (1.55)	14.72 (22.46)	11.99 (20.25)	21.14 (27.36)	7.19 (2.49)	7.15 (2.65)	2.63 (1.62)	1.07 (0.95)
8	Sulfoxaflor 24% SC + Tricyclazole 75% SP	0.60+0.60	6.72 (2.55)	1.41 (0.94)	19.74 (26.25)	17.97 (24.87)	18.48 (25.43)	8.81 (2.96)	6.74 (2.59)	1.60 (1.26)	0.26 (0.30)
9	Untreated control		24.69 (4.97)	12.03 (3.40)	32.86 (34.95)	25.31 (30.14)	39.85 (39.14)	13.47 (3.66)	14.29 (3.78)	8.20 (2.86)	6.29 (2.51)
	f' test	—	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.
	SE (±M)	—	0.23	0.31	0.70	1.54	0.99	0.19	0.21	0.09	0.24
	CD at 5%	—	0.69	0.92	2.07	4.62	2.98	0.57	0.63	0.28	0.71
	CV (%)	—	13.69	31.23	4.71	11.33	5.90	11.54	13.22	8.69	30.82

DBT-Days before treatment, DAT-Days after treatment

*Figures in parentheses are corresponding values of Arc sine (% WE & % SS) and square root (% Dead Heart & % LF Damaged Leaves) transformation.

Table 2
Effect of Pesticides on Incidence of Brown Plant Hopper, White Backed Plant Hopper of Paddy in Kharif 2012

S.N. Insecticide/Fungicide	Dose g/ml per litre of spray fluid	Brown Plant Hopper/hill				White Backed Plant Hopper/hills			
		1 st		2 nd		1 st		2 nd	
		Spraying		Spraying		Spraying		Spraying	
		1DBT	5DAT	1DBT	5DAT	1DBT	5DAT	1DBT	5DAT
1 (Buprofenzin 20%+ Acephate 50%WP)	2.00	10.90 (3.30)	2.43 (1.56)	5.77 (2.40)	1.70 (1.28)	11.40 (3.38)	6.13 (2.48)	4.27 (2.07)	1.37 (1.12)
2 Sulfoxaflor 24% SC	0.60	10.57 (3.25)	2.50 (1.58)	5.33 (2.31)	1.80 (1.34)	12.90 (3.59)	6.50 (2.55)	4.03 (2.01)	1.43 (1.20)
3 Hexaconazole 5% SC	2.00	11.00 (3.31)	8.37 (2.89)	6.00 (2.45)	3.80 (1.95)	12.23 (3.49)	13.67 (3.70)	5.33 (2.31)	3.00 (1.72)
4 Tricyclazole 75% SP	0.60	11.10 (3.33)	10.13 (3.18)	5.57 (2.35)	3.83 (1.96)	11.87 (3.44)	12.83 (3.58)	4.77 (2.18)	3.00 (1.73)
5 (Buprofenzin 20%+ Acephate 50%WP)+Hexaconazole 5% SC	2.00+2.00	11.50 (3.39)	4.37 (2.09)	5.57 (2.35)	2.23 (1.49)	10.70 (3.27)	6.40 (2.53)	4.97 (2.23)	1.47 (1.20)
6 (Buprofenzin 20%+ Acephate 50%WP)+Tricyclazole 75% SP	2.00+0.60	10.77 (3.28)	4.53 (2.13)	4.83 (2.20)	2.03 (1.43)	10.97 (3.31)	7.07 (2.66)	4.37 (2.09)	1.30 (1.14)
7 Sulfoxaflor 24% SC + Hexaconazole 5% SC	0.60+2.00	10.17 (3.19)	5.63 (2.37)	5.57 (2.36)	1.77 (1.33)	10.47 (3.23)	6.00 (2.44)	5.20 (2.28)	1.10 (1.04)
8 Sulfoxaflor 24% SC + Tricyclazole 75% SP	0.60+0.60	10.70 (3.27)	5.07 (2.25)	5.90 (2.43)	1.90 (1.38)	11.43 (3.38)	6.73 (2.59)	5.23 (2.29)	1.50 (1.22)
9 Untreated control	Waterspray	10.67 (3.26)	12.17 (3.48)	4.87 (2.21)	4.93 (2.22)	12.20 (3.49)	14.57 (3.82)	4.17 (2.04)	3.73 (1.93)
'f' test	—	NS	Sig	NS	Sig.	Sig.	Sig.	Sig	Sig.
SE (+M)	—		0.07		0.08	0.07	0.08	0.06	0.12
CD at 5%	—		0.20		0.24	0.21	0.24	0.18	0.35
CV (%)	—		4.82		8.75	3.60	4.65	4.75	15.01

DBT-Days before treatment, DAT-Days after treatment

*Figures in parentheses are corresponding values of square root transformation.

Table 3
Effect of Pesticides on Incidence of Major Diseases and Yield of Paddy in Kharif 2012

S.N. Insecticide / Fungicide	Dose g/ml per litre of spray fluid	% incidence of Blast				% incidence of Bacterial leaf blight				Yield(q/ha)
		1 st Spraying		2 nd Spraying		1 st Spraying		2 nd Spraying		
		1 DBT	10 DAT	1 DBT	10 DAT	1 DBT	10 DAT	1 DBT	10 DAT	
1 (Buprofenzin 20%+ Acephate 50%WP)	2.00	0.34 (0.92)	0.35 (0.92)	0.17 (0.82)	0.19 (0.83)	3.17 (1.77)	3.50 (1.87)	2.28 (1.50)	2.08 (1.42)	23.32
2 Sulfoxaflor 24% SC	0.60	0.30 (0.90)	0.37 (0.93)	0.21 (0.84)	0.17 (0.82)	2.67 (1.63)	3.90 (1.97)	1.65 (1.24)	1.46 (1.16)	23.82
3 Hexaconazole 5% SC	2.00	0.22 (0.85)	0.14 (0.80)	0.23 (0.85)	0.09 (0.77)	2.57 (1.60)	3.50 (1.87)	2.63 (1.57)	3.70 (1.89)	22.92
4 Tricyclazole 75% SP	0.60	0.16 (0.81)	0.09 (0.77)	0.23 (0.85)	0.11 (0.78)	2.40 (1.55)	3.03 (1.74)	1.27 (1.12)	1.20 (1.09)	21.00
5 (Buprofenzin 20%+ Acephate 50%WP)+ Hexaconazole 5% SC	2.00+2.00	0.19 (0.83)	0.11 (0.78)	0.14 (0.80)	0.02 (0.72)	2.47 (1.56)	3.43 (1.85)	1.90 (1.36)	1.46 (1.17)	23.34
6 (Buprofenzin 20%+ Acephate 50%WP)+ Tricyclazole 75% SP	2.00+0.60	0.16 (0.81)	0.12 (0.78)	0.12 (0.79)	0.02 (0.72)	2.87 (1.69)	3.63 (1.90)	1.23 (1.11)	0.91 (0.95)	23.23
7 Sulfoxaflor 24% SC + Hexaconazole 5% SC	0.60+2.00	0.19 (0.83)	0.10 (0.77)	0.12 (0.79)	0.03 (0.73)	2.70 (1.64)	3.40 (1.84)	2.60 (1.57)	2.00 (1.36)	28.05
8 Sulfoxaflor 24% SC + Tricyclazole 75% SP	0.60+0.60	0.23 (0.86)	0.15 (0.80)	0.14 (0.80)	0.06 (0.75)	2.63 (1.62)	3.50 (1.87)	1.60 (1.24)	1.12 (1.02)	23.63
9 Untreated control	Waterspray	0.19 (0.83)	0.58 (1.03)	0.33 (0.78)	0.26 (0.87)	3.60 (1.89)	5.50 (2.33)	3.60 (1.88)	3.42 (1.81)	19.11
'f' test	—	Sig.	Sig.	Sig.	Sig.	NS	Sig.	NS	Sig.	NS
SE (+M)	—	0.01	0.03	0.02	0.02		0.10		0.21	
CD at 5%	—	0.04	0.09	0.07	0.07		0.30		0.62	
CV (%)	—	3.01	6.42	4.93	5.24		9.02		27.30	

DBT-Days before treatment, DAT-Days after treatment

*Figures of Blast in parentheses are corresponding values of square root (n+0.5) transformation.

*Figures of Bacterial leaf blight in parentheses are corresponding values of square root (n) transformation.

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