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Field Evaluation of Compatibility of Pesticides against Major Pests of Paddy

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ABSTRACT: *Two insecticides and two fungicides were evaluated as tank mix for their compatibility and effectiveness against major pests of paddy under field condition at Agriculture Research Station, Sakoli, Dist: Bhandara during* Kharif *– 2013. The results indicated that Triazophos 40 % EC and Triazophos 40 % EC + Hexaconazole 5% SC was recorded minimum damage of stem borer (deadheart) after 1st spraying. Triazophos 40% EC + Tricyclazole 75% WP was found effective against gall midge at 1st spraying. Triazophos 40% EC and Triazophos 40% EC + Hexaconazole 5% SC treatments were found effective for leaf folder management at 1st and 2nd spraying, respectively. Triazophos 40 % EC + Hexaconazole 5% SC and (Flubendiamide 4% + Buprofezin 20% SC) + Tricyclazole 75 % WP treatments were exhibited significantly superior for management of brown plant hoppers at 1st and 2nd spraying, respectively. (Flubendiamide 4% + Buprofezin 20% SC) + Hexaconazole 5% SC and Triazophos 40% EC + Tricyclazole 75% WP were found significantly superior over other treatments for management of white backed plant hoppers at 1st and 2nd spraying, respectively. Triazophos 40% EC + Hexaconazole 5% SC and Hexaconazole 5% SC treatments were exhibited effectiveness against blast. Phytotoxicity symptoms were not observed in any of the treatments. Treatment with Triazophos 40% EC has recorded highest yield. There were no significant differences in the performance of the insecticide formulations in their efficacy when applied alone or in combination with fungicides. Hence, there was no adverse impact on the efficacy of either the combination product of Flubendiamide 4% plus Buprofezin 20% SC or Triazophos 40% EC due to their combination with either Hexaconazole 5% SC or Tricyclazole 75% WP or vice versa confirming the compatibility of the chemicals when used as tank mix in the field.*

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

INTRODUCTION

Rice (*Oryza sativa* L.) is grown mainly in Asian countries like China, India, Japan, Korea Republic, Srilanka, Pakistan, Bangladesh, etc. More than 90 % of rice is produced and consumed in these Asian countries. India ranks first in the world in rice area with 44.3 million hectares followed by China (29.3 million ha). However, with respect of productivity, India occupies 15th or still lower position with 3.01 t/ ha of rough rice. The major reason for low productivity in India is the losses due to insect pests and diseases. 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), Song *et. al*. (1987), Bhatnagar (2004), Bhuvaneshwari and Krishnam Raju (2013). Keeping this in view, the study was undertaken to evaluate the compatibility of two new and different groups of insecticides and fungicides based on their efficacy against major insect pests and diseases of rice when applied as tank mix in the field.

MATERIALS AND METHOD

The experiment was conducted during *Kharif* 2013 in randomized block design. Two insecticides viz.,

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Flubendiamide 4% + Buprofezin 20% SC and Triazophos 40% EC and two fungicides viz., Hexaconazole 5% SC and Tricyclazole 75% WP were evaluated singly as well as tank mix of insecticide and fungicide combination for their effectiveness against insect pests viz., stem borer, gall midge, leaf folder, brown plant hopper, white backed plant hopper and diseases viz., 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 m^2.

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. Recorded populations 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. A grain yield was recorded from each plot by excluding 2 border rows on all sides. Data was analyzed statistically.

RESULTS AND DISCUSSION

Minimum damage of stem borer i.e. 0.00% deadheart was recorded in treatment with Triazophos 40% EC and Triazophos 40% EC + Hexaconazole 5% SC, whereas the maximum damage 4.64% deadheart in untreated control after 1st spraying. Minimum damage 0.58% deadheart was recorded in treatment with Triazophos 40% EC + Tricyclazole 75% WP treatment, whereas the maximum damage 2.81% deadheart in untreated control after 2nd spraying. At heading stage, lowest incidence of stem borer i.e. 6.20% white earhead was recorded in treatment with Triazophos 40 % EC + Hexaconazole 5% SC while the highest incidence i.e. 13.02% white earhead was recorded in untreated control.

Gall midge infestation was ranging from 3.37 to 53.21% silver shoot across treatments including control, after 1st and 2nd Spraying. Triazophos 40 % EC + Tricyclazole 75% WP showed significantly superior performance over other treatments including untreated control in after 1st spraying.

For leaf folder management Triazophos 40% EC and Triazophos 40% EC + Hexaconazole 5% SC were the better treatments showing the least damage i.e. 0.20 and 2.63% damaged leaves at 1st and 2nd spraying, respectively.

Brown plant hopper incidence was very severe up to 12.30 hoppers/hills. Triazophos 40 % EC + Hexaconazole 5% SC and (Flubendiamide 4% + Buprofezin 20% SC) + Tricyclazole 75% WP were found superior over other treatments for management of brown plant hopper at 1st and 2nd spraying, respectively.

White backed plant hopper infestation was ranging from 2.73 to 12.27 hoppers/hills. (Flubendiamide 4% + Buprofezin 20% SC) + Hexaconazole 5% SC and Triazophos 40% EC + Tricyclazole 75% WP were found significantly superior over other treatments for management of White backed plant hopper at 1st and 2nd spraying, respectively.

Meager incidence of blast (ranging from 0.02 to 0.13%) was observed during the year. Triazophos 40% EC + Hexaconazole 5% SC and Hexaconazole 5% SC were found superior treatment for management of blast.

Bacterial leaf blight incidence was ranging from 1.63 to 4.60%. No treatment was found significantly effective for management of bacterial leaf blight.

Phytotoxicity symptoms were not observed in any of the treatments which indicated the positive compatibility of the evaluated pesticides.

Treatment with Triazophos 40% EC recorded highest yield of 14.63 q/ha was followed by Triazophos 40% EC + Tricyclazole 75% WP. These treatments were significantly superior to that of other treatments including control (7.26 q/ha). The highest incidence of gall midge may be the reason of lower yield.

Based on the performance of the treatments when applied alone vis a vis their respective combinations in reducing pest infestation, it was evident that there were no significant differences in the performance of the insecticide formulations in their efficacy when applied alone or in combination with fungicides.

Hence, the results revealed that there was no adverse impact on the efficacy of either the combination product of Flubendiamide 4% plus Buprofezin 20% SC or Triazophos 40% EC due to their combination with either Hexaconazole 5% SC or Tricyclazole 75% WP or vice versa confirming the compatibility of the chemicals when used as tank mix in the field.

These findings are in agreements 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 pests viz., sheath blight, brown plant hopper, leaf folder and stem borer.

Similarly, Prajapati *et. al.* (2005) reported that insecticide Triazophos 20% EC alone or tank mixed with fungicides Carbendazim 50% WP and Tricyclazole 75% WP was found effective in controlling leaf folder damage as well as white backed plant hopper as compare to untreated control.

Similar findings were reported by Reddy and Krishnaiah (1997) who found that the insect growth regulator buprofezin (0.02%) was compatible with the three fungicides *viz.*, captafol (0.16%), IBP (Iprobenphos) (0.048%) and edifenphos (0.05%) in all insecticide fungicide combinations against brown plant hopper and sheath blight under glass house.

Krishnaiah and Reddy (1992) observed that the combinations of insecticides carbaryl and ethofenprox (at recommended doses against brown plant hopper) and fungicides carbendazim and thiophanate methyl (at recommended doses against sheath blight) were compatible in all insecticides – fungicide combinations both physically as well as biologically.

Peter *et. al.* (1989) from Tamil Nadu also observed that ethofenprox was compatible with fungicides *viz.*, edifenphos and mancozeb.

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.

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

S.N.	Insecticide / Fungicide	Dose g/ml per litre of spray fluid	Stem Borer infestation (% Dead Heart)		% WE	Gall Midge infestation (% Silver Shoot)		% LF Damaged Leaves			
								1st Spraying		2nd Spraying	
			1st Spraying	2nd Spraying		1st Spraying	2nd Spraying	1 DBT	8 DAT	1 DBT	8 DAT
1	(Flubendiamide 4% + Buprofezin 20% SC)	1.75	0.34 (0.88)	0.65 (1.07)	8.55 (2.98)	7.08 (2.75)	49.40 (44.46)	3.10 (1.72)	0.58 (0.76)	6.05 (2.46)	4.13 (2.01)
2	Triazophos 40% EC	1.5	0.00 (0.71)	1.13 (1.13)	10.84 (3.25)	9.51 (3.16)	40.87 (39.70)	2.75 (1.64)	0.20 (0.26)	6.13 (2.47)	3.31 (1.81)
3	Hexaconazole 5% SC	2.0	0.36 (0.89)	1.46 (1.32)	12.04 (3.51)	7.48 (2.80)	41.24 (39.94)	2.42 (1.55)	2.56 (1.56)	5.46 (2.33)	6.32 (2.51)
4	Tricyclazole 75% WP	0.6	0.96 (1.16)	1.11 (1.22)	7.93 (2.90)	7.05 (2.74)	45.12 (42.20)	2.68 (1.63)	2.45 (1.55)	3.94 (1.96)	5.95 (2.43)
5	(Flubendiamide 4% + Buprofezin 20% SC) + Hexaconazole 5% SC	1.75+2.0	0.29 (0.86)	1.26 (1.26)	8.44 (2.99)	7.05 (2.73)	41.93 (40.35)	2.34 (1.50)	0.33 (0.45)	6.91 (2.63)	2.80 (1.61)
6	(Flubendiamide 4% + Buprofezin 20% SC) + Tricyclazole 75% WP	1.75+0.6	0.36 (0.89)	1.24 (1.29)	8.04 (2.90)	5.74 (2.50)	43.60 (41.30)	2.50 (1.58)	0.31 (0.44)	6.35 (2.51)	3.16 (1.73)
7	Triazophos 40% EC + Hexaconazole 5% SC	1.5+2.0	0.00 (0.71)	0.83 (1.15)	6.20 (2.28)	4.86 (2.31)	39.53 (38.95)	3.13 (1.76)	0.45 (0.55)	6.75 (2.58)	2.63 (1.59)
8	Triazophos 40% EC + Tricyclazole 75% WP	1.5+0.6	0.34 (0.88)	0.58 (1.02)	6.75 (2.66)	3.37 (1.80)	44.31 (41.70)	3.24 (1.80)	1.50 (1.20)	5.94 (2.42)	2.77 (1.66)
9	Untreated control	Water spray	4.64 (2.27)	2.81 (1.78)	13.02 (3.68)	12.45 (3.60)	53.21 (46.85)	2.51 (1.57)	3.10 (1.75)	6.37 (2.52)	6.49 (2.54)
	'f' test	**–**	**Sig.**	**NS**	**NS**	**Sig.**	**NS**	**NS**	**Sig.**	**NS**	**Sig**
	SE (±M)	**–**	0.14			0.24			0.19		0.20
	CD at 5%	**–**	0.42			0.71			0.56		0.59
	CV (%)	**–**	23.87			15.18			34.20		17.22

DBT-Days before treatment, DAT-Days after treatment

*Figures in parentheses are corresponding values of square root (n+0.5) (% Dead Heart, % WE and % SS at 1st Spraying), square root (n) (% LF Damaged Leaves) and Arc sine (% SS at 2nd spraying) transformation.

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

S.N.	Insecticide/Fungicide	Dose g/ml per litre of spray fluid	Brown Plant Hopper/hill				White Backed Plant Hopper/hills			
			1st Spraying		2nd Spraying		1st Spraying		2nd Spraying	
			1DBT	5DAT	1DBT	5DAT	1DBT	5DAT	1DBT	5DAT
1	(Flubendiamide 4% + Buprofezin 20% SC)	1.75	12.30 (3.50)	3.10 (1.76)	7.47 (2.73)	3.93 (1.97)	10.60 (3.26)	3.67 (1.91)	10.30 (3.21)	7.07 (2.65)
2	Triazophos 40% EC	1.5	10.87 (3.29)	3.00 (1.72)	7.43 (2.73)	3.63 (1.90)	10.00 (3.16)	3.20 (1.79)	10.90 (3.30)	5.73 (2.39)
3	Hexaconazole 5% SC	2.0	10.47 (3.23)	7.63 (2.75)	6.50 (2.55)	4.73 (2.18)	9.97 (3.16)	10.07 (3.17)	11.90 (3.45)	8.20 (2.86)
4	Tricyclazole 75% WP	0.6	10.87 (3.29)	3.00 (1.73)	6.50 (2.54)	4.90 (2.21)	12.27 (3.50)	8.83 (2.97)	10.77 (3.27)	9.20 (3.03)
5	(Flubendiamide 4% + Buprofezin 20% SC) +Hexaconazole 5% SC	1.75+2.0	11.40 (3.38)	2.63 (1.62)	6.33 (2.51)	2.87 (1.69)	10.50 (3.24)	2.73 (1.65)	10.57 (3.25)	6.30 (2.51)
6	(Flubendiamide 4% + Buprofezin 20% SC) + Tricyclazole 75 % WP	1.75+0.6	11.60 (3.40)	2.77 (1.64)	5.30 (2.30)	2.83 (1.68)	10.87 (3.30)	3.00 (1.73)	11.33 (3.36)	5.90 (2.42)
7	Triazophos 40% EC + Hexaconazole 5% SC	1.5+2.0	10.67 (3.26)	2.33 (1.53)	6.27 (2.50)	3.63 (1.90)	9.13 (3.02)	3.20 (1.79)	10.17 (3.18)	5.77 (2.40)
8	Triazophos 40% EC + Tricyclazole 75% WP	1.5+0.6	10.33 (3.21)	3.10 (1.75)	5.87 (2.42)	3.53 (1.87)	10.17 (3.19)	2.87 (1.69)	8.27 (2.87)	5.40 (2.30)
9	Untreated control	Water spray	10.03 (3.17)	8.03 (2.83)	6.57 (2.55)	5.53 (2.35)	9.93 (3.15)	10.80 (3.29)	10.87 (3.29)	9.73 (3.15)
	'f' test	—	**NS**	**Sig**	**NS**	**Sig.**	**Sig.**	**Sig.**	**NS**	**Sig.**
	SE (±M)	—		0.09		0.10	0.06	0.06		0.11
	CD at 5%	—		0.28		0.29	0.19	0.17		0.33
	CV (%)	—		8.44		8.48	3.34	4.46		7.31

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

S.N.	Insecticide / Fungicide	Dose g/ml per litre of spray fluid	% incidence of Blast				% incidence of Bacterial leaf blight				Yield (q/ha)
			1st Spraying		2nd Spraying		1st Spraying		2nd Spraying		
			1DBT	10DAT	1DBT	10DAT	1DBT	10DAT	1DBT	10DAT	
1	(Flubendiamide 4% + Buprofezin 20% SC)	1.75	0.02 (0.72)	0.11 (0.78)	0.08 (0.76)	0.10 (0.77)	1.63 (1.28)	2.73 (1.64)	4.37 (2.09)	4.43 (2.09)	10.00
2	Triazophos 40% EC	1.5	0.07 (0.76)	0.10 (0.77)	0.10 (0.77)	0.08 (0.76)	2.67 (1.63)	2.93 (1.70)	3.33 (1.82)	3.80 (1.95)	14.63
3	Hexaconazole 5% SC	2.0	0.10 (0.77)	0.04 (0.73)	0.11 (0.78)	0.03 (0.73)	2.40 (1.54)	2.50 (1.56)	3.67 (1.91)	4.17 (2.04)	7.37
4	Tricyclazole 75% WP	0.6	0.07 (0.75)	0.04 (0.73)	0.09 (0.77)	0.05 (0.74)	4.07 (2.01)	3.03 (1.74)	3.33 (1.82)	4.50 (2.11)	8.10
5	(Flubendiamide 4% + Buprofezin 20% SC) + Hexaconazole 5% SC	1.75+2.0	0.07 (0.76)	0.04 (0.73)	0.09 (0.77)	0.04 (0.73)	3.13 (1.77)	2.67 (1.63)	3.60 (1.89)	4.20 (2.05)	8.84
6	(Flubendiamide 4% + Buprofezin 20% SC) + Tricyclazole 75% WP	1.75+0.6	0.11 (0.78)	0.09 (0.77)	0.10 (0.78)	0.05 (0.74)	2.27 (1.49)	2.80 (1.67)	4.57 (2.14)	4.27 (2.06)	9.89
7	Triazophos 40% EC + Hexaconazole 5% SC	1.5+2.0	0.09 (0.77)	0.04 (0.73)	0.07 (0.76)	0.02 (0.72)	2.43 (1.56)	3.03 (1.74)	4.43 (2.10)	4.23 (2.05)	10.21
8	Triazophos 40% EC + Tricyclazole 75 % WP	1.5+0.6	0.12 (0.81)	0.05 (0.74)	0.08 (0.76)	0.04 (0.73)	2.17 (1.47)	2.67 (1.63)	4.60 (2.13)	4.50 (2.11)	12.63
9	Untreated control	Water spray	0.12 (0.79)	0.13 (0.79)	0.08 (0.76)	0.08 (0.76)	2.23 (1.49)	4.27 (2.04)	4.47 (2.11)	4.33 (2.08)	7.26
	'f' test	—	**Sig.**	**Sig.**	**NS**	**Sig.**	**Sig.**	**NS**	**NS**	**NS**	**Sig**
	SE (±M)	—	0.01	0.01		0.01	0.08				0.82
	CD at 5%	—	0.03	0.02		0.02	0.25				2.46
	CV (%)	—	2.20	1.58		1.69	9.22				14.38

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.

Thus, the results reveal that there was no adverse impact on the efficacy of either the combination product of (Flubendiamide 4% + Buprofezin 20% SC) or Triazophos 40% EC due to their combination with Hexaconazole 5% SC or Tricyclazole 75% WP or vice versa confirming the compatibility of chemicals when used as a tank mix in the field.

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