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Effect of newer chemicals on planthoppers and their mirid predator in rice

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Abstract : A field trial was conducted at the Agricultural Research Station, Siruguppa for two consecutive kharif seasons of 2004 and 2005 to study the effect of buprofezin 25 SC at different concentrations against planthoppers (Brown planthopper and white backed planthopper) and their mirid predator, *Cyrtorhinus lividipennis* Reuter. The results clearly indicated that buprofezin 25 SC @ 1 ml/l recorded the lowest plant hopper population at 10 days after spray. The next best treatment was buprofezin 25 SC @ 0.75 ml/l which recorded lower planthopper population and was at par with standard check thiamethoxam 25 WG @ 0.2 g/l, while imidacloprid 17.8 SL @ 0.3 ml/l was on par with buprofezin 25 SC @ 0.75 ml/l and significantly superior to all the remaining treatments. Buprofezin at all dosages tested recorded significantly higher predatory mirid bug population over other treatments. Buprofezin 25 SC @ 1 ml /l recorded highest yield and was on par with Buprofezin 25 SC @ 0.75 ml/l.

Key words: Buprofezin, brown planthopper, white backed planthopper, mirid bug

Introduction

Resurgence of brown planthopper (BPH), *Nilaparvata lugens* (Stal.) and white backed planthopper (WBPH), *Sogatella furcifera* (Horv.) after insecticide application is a common phenomenon in rice in south east Asia including south India. Spraying of isoprocarb, carbofuran and fenobucarb resulted in significant reduction in the nymphal populations (Mishra and Sontakke, 1986). The pest was most susceptible to the pyrethroids at lower temperatures and to other insecticides at higher temperatures (Fabellar and Mochida, 1988). Zang and Zang (1996) stated that imidacloprid was very effective against BPH on rice. In Andhra Pradesh the synthetic pyrethroids, cypermethrin (0.005%) and deltamethrin (0.0025%) showed moderate toxicity to BPH and WBPH, but were highly toxic to GLH under green house conditions (Krishnaiah *et al*., 1996). Thiamethoxam 25 WG @ 25 g a.i./ha and imidacloprid 17.8 SL @ 50 g a.i./ha were equally effective against brown planthopper on rice (Hegde, 2005). Heinrichs (1984) observed the resurgence of *N. lugens* after the application of methyl parathion and decamethrin at 55 and 65 days after planting. Wang *et al.* (2008) found that buprofezin is especially effective against homopteran pests, such as planthopper, with very low risks to environment including human beings. Koichi *et al.,*(2000) reported the toxicity of nine insecticides to predators of rice planthoppers *i.e.,* first instars of four spider species where in deltamethrin was most toxic to the spiders followed by ethofenprox. The mired bug, *Cyrtorhinus lividipennis* Reuter abundance declined to a low level in all the insecticide treated plots except those treated with buprofezin. Though several studies have been conducted on the management of planthopper in irrigated rice ecosystem, the planthopper resurgence and consequent reduced yield are the major production constraints in irrigated rice in Tungabhadra project area. With this back ground, a field trial was undertaken to assess the effect of buprofezin against planthoppers and their predatory mirid bug in irrigated rice.

Material and methods

Field trials were conducted for two consecutive seasons of kharif 2004 and 2005 at the Agricultural Research Station, Siruguppa in a randomized block design with seven treatments (Table 1) replicated thrice. The treatments were imposed twice, at 60 and 85 days after transplanting which coincided with the reproductive phase of the crop when maximum BPH and WBPH population was observed. The planthoppers (*N. lugens* and *S. furcifera*) population was recorded one day before and three and ten days after the spray. The predatory mirid bug (*C. lividipennis*) population was recorded at ten days after the spray. The planthopper population was recorded on randomly selected ten hills in each treatment and expressed per hill basis. Similarly, the mirid population was recorded at ten days after spray from the same randomly selected hills. The yield per plot was recorded and computed on hectare basis.

Results and discussion

There was no significant difference in planthopper population among the treatments before the application of treatments during both the seasons. Thiamethoxam 25 WG @ 0.20 g/l recorded the lowest population (7.43 and 5.10/hill during 2005 and 2006, respectively) and was on par with imidacloprid (11.20 and 8.30/hill) and superior to rest of the treatments at three days after spray. Buprofezin 25 SC @ 1 and 0.75 ml/l recorded low BPH population of 28.53, 9.53 and 39.30, 18.63 BPH per hill and statistically differed from each other and also differed significantly from remaining treatments during both the seasons. Buprofezin 25 SC @ 0.50 ml/l and indoxacarb recorded high BPH populations during both the years and were not superior to monocrotophos 36 SL @ 1.50 ml/l. After 10 days, the efficacy varied and BPH population in various treatments differed. The lowest population was recorded in buprofezin 25 SC @ 1.00 ml/l (7.60 and 7.50/hill) and it was on par with buprofezin 25 SC @ 0.75 ml/l, thiamethoxam 25 WG @ 0.20 g/l and imidacloprid 17.8 SL @ 0.30 ml/l and significantly different

from all the remaining treatments. All other treatments recorded higher planthopper population (Table 1). WBPH population varied among the treatments at 3 and 10 days after spray. Lowest WBPH population was recorded in thiamethoxam 25 WG @ 0.20 g/l which was on par with imidacloprid 17.8 SL @ 0.30 ml/l, buprofezin 25 SC @ 1.00 and 0.75 ml/l and monocrotophos 36 SL @ 1.50 ml/l at 3 days after spray. However, after 10 days, buprofezin 25 SC @ 1.00 ml/l recorded the lowest WBPH population which was on par with thiamethoxam 25 WG @ 0.20 g/l, imidacloprid 17.8 SL @ 0.30 ml/l, buprofezin 25 SC @ 0.75 ml/l, monocrotophos 36 SL @ 1.5 ml/l and superior to remaining treatments (Table 2). The present study is in line with the findings of Heinrichs (1984) who reported that buprofezin (Applaud) was highly selective and effective at low rates against nymphs of *N. lugens, S. furcifera* and *Nephotettix virescens* (Distant). Wang *et al.*(2008) reported that buprofezin was effective against homopteran insect pests, such as planthopper with very low risks to environment and human beings. He further, stated that buprofezin was recently recommended as one of the alternatives for highly toxic organophosphorous insecticides for controlling important insects on rice and also cautioned that over use of buprofezin might induce resistance. To avoid development of resistance to buprofezin, the chemicals may be alternated with other effective molecules.

The predatory mirid bug population recorded at 10 days after spray indicated significant variation among the treatments. Significantly higher mirid bug population was recorded in buprofezin treatments and untreated check (Table 1). Heinrichs (1984) reported that buprofezin safe to predators of plant hoppers including *C. lividipennis.* Koichi *et al.,* (2000) observed that *C. lividipennis* decreased to low level in many insecticide treated plots except those treated with buprofezin. He further stated that phenthoate, imidacloprid and deltamethrin were found toxic to *C. lividipennis.* Significantly higher yield was recorded in buprofezin 25 SC @ 1.00 ml/l and it was on par with buprofezin 25 SC @ 0.75 ml/l and different significantly from remaining treatments. The yield in buprofezin @ 0.75 ml/l was on par with thiamethoxam and imidacloprid and was significantly superior to rest of the treatments (Table 2). The

Table 1. Effect of newer insecticides on brown planthopper, *Nilaparvata lugens* and mirid bug, *Cyrtorhinus lividipennis*

Treatments	Dosage	Number of BPH per hill						Number of Mirids per hill			
		1 DBS		3 DAS		10 DAS		1 DBS		10 DAS	
		2005	2006	2005	2006	2005	2006	2005	2006	2005	2006
Buprofezin 25 SC	0.50 ml/l	73.20	60.10	50.17	30.17	42.13	25.47	41.53	20.13	55.45	23.65
Buprofezin 25 SC	0.75 ml/l	71.57	54.57	39.30	18.63	9.57	9.50	44.52	17.60	52.62	14.69
Buprofezin 25 SC	1.00 ml/l	66.87	51.13	28.53	9.53	7.60	7.50	39.81	19.03	51.74	9.81
Thiamethoxam 25 WG	0.20 g/l	73.13	56.97	7.43	5.10	12.13	10.77	30.27	23.63	34.20	10.36
Imidacloprid 17.8 SL	0.30 ml/l	76.83	60.00	11.20	8.20	16.73	11.53	35.29	23.40	35.83	11.22
Indoxacarb 15 EC	0.30 ml/l	70.30	53.33	59.70	39.70	78.70	33.70	33.17	23.13	30.80	25.92
Monocrotophos 36 SL	1.50 ml/l	74.80	58.27	32.83	13.83	36.83	23.50	38.45	22.30	34.97	17.26
Untreated control	-	70.83	54.23	110.53	52.60	134.10	40.33	42.56	23.80	60.10	38.56
S. Em.±	-	4.30	4.01	3.78	2.64	3.52	1.74	3.52	2.07	3.75	1.84
C.D. (0.05)	-	NS	NS	11.47	8.00	10.68	5.28	NS	NS	11.38	5.57
C.V. (%)	-	17.09	12.50	15.43	20.57	14.44	14.67	17.45	19.47	14.61	20.92

DBS- Day before spray, DAS- Days after spray

Table 2. Effect of newer chemicals on white backed planthopper, *Sogatella furcifera*

Treatments	Dosage	Number of WBPH per hill						Yield (kg/ha)	
		ADBS		3DAS		10 DAS			
		2005	2006	2005	2006	2005	2006	2005	2006
Buprofezin 25 SC	0.50 ml/l	32.57	22.57	23.03	19.70	22.17	24.48	4380	4613
Buprofezin 25 SC	0.75 ml/l	35.00	25.00	15.07	16.40	16.87	17.38	5528	5715
Buprofezin 25 SC	1.00 ml/l	31.63	21.63	10.87	9.87	11.83	10.13	5907	6107
Thiamethoxam 25 WG	0.20 g/l	33.70	23.70	9.50	9.17	12.30	12.18	5413	5647
Imidacloprid 17.8 SL	0.30 ml/l	29.00	19.00	11.77	10.43	13.07	15.29	5257	5457
Indoxacarb 15 EC	0.30 ml/l	25.80	15.80	18.53	15.20	32.97	26.10	4233	4400
Monocrotophos 36 SL	1.50 ml/l	28.83	18.83	13.60	11.93	14.90	17.03	4527	4627
Untreated control	-	30.57	20.57	45.33	35.33	37.03	37.21	4132	4398
S. Em.±	-	2.31	2.32	1.87	1.39	1.91	1.64	124	153
C.D. (0.05)	-	NS	NS	5.70	4.22	5.82	4.97	377	465
C.V. (%)	-	13.03	19.27	17.63	15.07	16.61	15.42	4.48	5.30

DBS- Day before spray, DAS- Days after spray

Table 3. Effect of newer insecticides on cost economics

Treatments	Mean yield (kg/ha)	Gross returns(Rs)	Gross cost (Rs)	Net Returns (Rs)	Incremental Returns (Rs)	B: C Ratio
Buprofezin 25 SC	4497	40470	15500	24970	1720	2.61
Buprofezin 25 SC	5621	50589	15750	34839	11454	3.21
Buprofezin 25 SC	6007	54060	16000	38060	14810	3.38
Thiamethoxam 25 WG	5530	49770	15900	33870	10620	3.13
Imidacloprid 17.8 SL	5357	48210	15630	32580	9330	3.08
Indoxacarb 15 EC	4317	38850	15600	23250	-125	2.49
Monocrotophos 36 SL	4577	41190	15540	25650	240	2.65
Untreated control	4265	38385	15000	23385	135	2.56

reduction in planthopper population has led to reduced damage to crop and hence higher yields were recorded. The cost effectiveness was worked out based on the average yield of two seasons. The highest gross returns, net profit, incremental returns and benefit cost ratio was obtained with buprofezin 25 SC @ 1.00 ml/l followed by buprofezin 25 SC @ 0.75 ml/l, thiamethoxam 25 WG @ 0.20 g/l and imidacloprid 17.8 SL @ 0.30 ml/l (Table.3).

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