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BIO EFFICACY OF NOVEL INSECTICIDES AGAINST PLANTHOPPERS IN DIRECT SEEDED RICE

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Abstract

A field experiment was carried out at Agriculture Research Station, Gangavathi, Koppal district, Karnataka, during *Kharif* 2015 to evaluate the bio efficacy of novel insecticides against Brown planthopper, *Nilaparvatha lugens* (Stal) (BPH) and White backed planthopper, *Sogatella furcifera* (Hoverth) (WBPH) on direct seeded rice. The results revealed that application of Triflumezopyrim 10.6 SC @ 237 ml ha^{-1} was found to be superior insecticide by registering 1.83 and 2.03 hoppers of BPH and WBPH per hill, respectively. The next best treatment was Dinotefuran 20SG @ 200g ha^{-1} with 3.58 and 4.02 hoppers of BPH and WBPH per hill, respectively. The effect of these applications was also resulted on the yield attributes, with highest grain yield of 62.64 q/ha was observed in Triflumezopyrim 10.6SC @ 237 ml /ha^{-1} treated plot followed by Dinotefuran 20 SG @ 200 g ha^{-1} (56.26 q ha^{-1}).

Key words : Triflumezopyrim, Dinotefuran, BPH, WBPH.

Introduction

Rice (*Oryza sativa* L.) is an important staple food crop for more than two third of the population of India and the total area under rice in Karnataka is 1.42 m ha with an annual production of 3.5 million tonnes and the productivity is about 2.63 tons per ha (Anon., 2015). Dry direct seeded rice (DDSR), probably the oldest method of crop establishment, is gaining popularity because of its low-input demand. It offers certain advantages *viz.,* it saves labour, requires less water, less drudgery, early crop maturity, low production cost, better soil physical conditions for following crops and less methane emission, provides better option to be the best fit in different cropping systems. It has been recognized as the principal method of rice establishment since 1950's in developing countries. Comparative yields in DDSR can be obtained by adopting various cultural practices *viz.*, selection of suitable cultivars, proper sowing time, optimum seed rate, proper weed and water management (Pandey and Velasco, 2005). Low productivity in DDSR is attributed by many factors. Among so many biotic and abiotic constraints of rice production insect, mite and nematode pests are the key biotic stresses limiting rice production in India, while Kalode and Pasalu (1986) reported that over 100 species of insect pests attack the rice crop at various stages of its growth, of which 20 are economically important. Among the major insect pests brown planthopper *Nilaparvatha lugens* (Stal) (BPH) and white backed planthopper *Sogatella furcifera* (Hoverth) (WBPH) are predominant in Tungabhadra project area of North Karnataka. However, BPH and WBPH cause huge crop loss of 10-70 per cent (Kulshreshtha, 1974) and 35-95 per cent (Sindhu, 1979), respectively by both pests. Presently, chemical control is the only practical method for a farmer to respond to an increasing planhoppers infestation. Keeping these in view the present study was undertaken to test the relative efficacy of some novel insecticides with conventional insecticides in DDSR system.

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Materials and Method

The experiment was conducted at Agriculture Research Station, Gangavathi, University of Agricultural Sciences, Raichur, Karnataka during *kharif* 2015. The experiment was laid in randomized block design (RBD), having twelve treatments and were replicated thrice. The plot size was 5 × 5 m with spacing of 22.5 × 10 cm. Crop was raised with recommended package of practice of UAS, Raichur (Anon. 2013) except plant protection measures. All these insecticides were applied with knapsack sprayer and sprayed twice during cropping period. First spray was done at 50 days after sowing (based on ETL) and second sprays at 25 days after first spray.

Observations on numbers of BPH and WBPH were recorded on 10 randomly selected hills per plot one day before spray (DBS), 5, 10, and 15 days after each spray and further these data were presented as average number of insects per hill. The details of treatments for management of insect pests under DDSR system are mentioned in table 1. The data on number of hoppers per hill was subjected to the square root transformation (v× + 1) and grain yield recorded at harvest was converted to quintal per ha prior to statistical analysis. The data was analysed by the following the statistical procedure given by Panse and Sukhatme (1985).

Results and Discussion

The results of the investigation on the bio-efficacy of novel insecticide molecules against planthopper conducted during *kharif* 2015-16 are presented here under.

Bioefficacy against Brown planthopper *Nilaparvatha lugens* (Stal):

Prior to imposition of treatments population of BPH was uniform throughout the experiment and varied between 9.57 to 12.33 hoppers per hill. Hence it showed non-significant among the treatments (table 1). However, variation among the population was noticed at five day after treatment imposition. Treatment triflumezopyrim 10.6 SC @ 237 ml/ ha recorded significantly lower number of BPH population (2.23 hoppers/hill) which was followed by dinotefuran 20% SG @ 200 g/ ha, pymetrozine 50 WG @ 400 g/ ha and ethiprole + imidacloprid 80 WG @ 150 g/ ha, buprofezin 15 + acephate 35 WP @ 500 g/ ha, acephate 50 + imidacloprid 1.8 WG @ 500 g/ ha, buprofezin 25 SC @ 500 g/ ha (4.53, 4.63, 5.07, 9.57, 10.07 and 10.50 hoppers/hill, respectively) but these treatments were at par with each other. However, the highest population of BPH was noticed in untreated control (11.50 hoppers/hill) (table 1). Same trend was followed at 10 and 15 days after first spray. Similarly, the same trend was observed at 5, 10 and 15 days after second spray.

The present findings of superior performance of the Triflumezopyrim 10.6 SC @ 237 ml/ ha against brown planthopper was in accordance with reports of Anon., (2015) who opined that Triflumezopyrim 10.6 SC was found to be best treatment and was followed by dinotefuran @ 25 g a.i. /ha at in Warangal and Marutheru and Gangavathi. Similarly, Cardova *et al.* (2016) who also summerized that triflumezopyrim is novel insecticides belongs to mesoionic group of insecticides and provides good control against brown planthopper. Similarly, previous report of BPH control with a novel chemical *viz,*suloxaflor, which at 100-75 g. a.i./ha was found to be effective for management of BPH under field condition (Ghosh *et al.,* 2013). Guruprasad *et al.* 2016, who also noticed effective control of brown planthopper with Triflumezopyrim 10.6 SC under field condition

Bioefficacy against white backed planthopper *Sogatella furcifera* (Hoverth):

Population of WBPH was found uniform throughout experiment and did not varied significantly among the treatments. However, significantly variation was noticed at five days after spray. Significantly lowest number (2.33 hoppers/hill) of hoppers was observed in the treatment triflumezopyrim 10.6 SC @ 237 ml/ha but it was on par with dinotefuran 20 SG @ 200 g/ha, pymetrozine 50 WG @ 400 g/ha, ethiprole + imidacloprid 80 WG @ 150 g/ ha which recorded 4.50, 7.00 and 7.33 WBPH per hill. However, the highest WBPH population was noticed in untreated control (7.03 hoppers/hill) and it was on par with imidacloprid 17.8 SL @ 200 ml/ ha, acephate 75 SP @ 500 g/ ha, flonicamid 50 EC @ 200 ml/ ha , flubendiamide + buprofezin 24 SC @ 100 ml/ ha (8.07, 8.05, 8.00 and 7.90 hoppers /hill). Simillar trend was observed at 10 and 15 days after firest spray. Same trend was noticed at 5, 10 and 15 days after second spray also (table 2).

The present findings are in line with Muralibhaskaran *et al.* (2009) who also recorded 89.4 and 87.56 per cent reduction in population of WBPH after application of pymetrozine 50 WG (Chess 50 WG) @ 400 and 350 g/a, respectively. Similarly, Anon. (2015) was also registered significantly less number of WBPH in Triflumezopyrim 10.6 SC treatment and Dinotefuran 20 SG was next best treatment. The results are also in close association with Guruprasad *et al.* (2016) who obtained the similar trend under transplanted field condition.

Yield:

All the treatments resulted in higher grain yield and proved significantly superior over untreated control (table 3). The highest seed yield of 62.64 q/ha was harvested

Table 1 : Management of brown planthopper *Nilaparvatha lugens* (Stal) in DDSR through novel insecticides during *kharif* 2015.

Sl. No	Treatment details	Dose ml or gha^{-1}	BPH / hill at 1st spray				BPH / hill at 2nd spray				Mean Before spray	Mean After spray
			1 DBS	5 DAS	10 DAS	15DAS	1 DBS	5 DAS	10 DAS	15DAS		
1	Pymetrazin 50 WG	400	11.97 (3.57)^{a}	5.67 (2.57)^{bc}	2.63 (1.90)^{bc}	2.80 (1.94)^{bc}	10.97 (3.42)^{a}	8.63 (3.09)^{abc}	3.63 (2.15)^{bc}	4.00 (2.23)^{bc}	11.47	4.56
2	Ethriprole + Imidacloprid 80 WG	150	9.73 (3.27)^{a}	5.83 (2.59)^{bc}	3.07 (2.01)^{bcd}	3.23 (2.04)^{c}	13.20 (3.66)^{a}	9.40 (3.22)^{bcd}	4.03 (2.24)^{bcd}	4.33 (2.30)^{bcd}	11.46	4.98
3	Dinotefuron 20 SG	200	11.97 (3.59)^{a}	4.53 (2.30)^{b}	2.03 (1.73)^{b}	1.63 (1.62)^{ab}	10.77 (3.41)^{a}	7.70 (2.90)^{ab}	3.30 (2.07)^{b}	2.33 (1.81)^{b}	11.37	3.58
4	Buprofezin 25SC	500	10.50 (3.38)^{a}	6.23 (2.69)^{bc}	5.60 (2.56)^{egf}	3.60 (2.14)^{cd}	15.37 (4.04)^{a}	11.60 (3.53)^{cd}	5.87 (2.61)^{cde}	4.73 (2.39)^{de}	12.93	6.27
5	Buprofezin 15% + Acephate 35% WP	500	9.57 (3.25)^{a}	5.87 (2.61)^{bc}	4.23 (2.28)^{cde}	3.37 (2.09)^{cd}	14.83 (3.97)^{a}	10.23 (3.32)^{bcd}	5.30 (2.51)^{cd}	4.43 (2.32)^{bcde}	12.2	5.57
6	Acephate 50% + Imidachloprid 1.8% WG	500	10.07 (3.32)^{a}	6.13 (2.67)^{bc}	4.50 (2.34)^{def}	3.40 (2.08)^{cd}	15.83 (4.09)^{a}	10.50 (3.39)^{bcd}	10.50 (2.56)^{cde}	4.50 (2.33)^{cde}	12.95	5.76
7	Triflumezopyrim 106 SC	237	9.93 (3.31)^{a}	2.23 (1.80)^{a}	0.20 (1.09)^{a}	0.93 (1.39)^{a}	11.30 (3.49)^{a}	5.47 (2.49)^{a}	1.27 (1.50)^{a}	0.90 (1.38)^{a}	10.61	1.83
8	Flubendiamide + Buprofezin 24% SC	1000	12.33 (3.65)^{a}	7.07 (2.81)^{c}	5.30 (2.50)^{egf}	3.67 (2.15)^{cd}	12.80 (3.71)^{a}	11.30 (3.50)^{cd}	6.30 (2.69)^{cde}	5.03 (2.43)^{ef}	12.56	6.44
9	Flonic amide 50% EC	200	10.13 (3.33)^{a}	7.60 (2.93)^{c}	6.60 (2.74)^{gf}	4.10 (2.24)^{cd}	12.83 (3.69)^{a}	12.23 (3.63)^{cd}	7.60 (2.93)^{de}	5.13 (2.44)^{ef}	11.48	7.21
10	Acephate 75 SP	500	10.00 (3.31)^{a}	7.87 (2.96)^{c}	6.53 (2.73)^{gf}	5.20 (2.46)^{ed}	12.03 (3.61)^{a}	12.53 (3.68)^{cde}	7.57 (2.92)^{e}	5.97 (2.63)^{ef}	11.01	7.61
11	Imidachloprid 17.8 SL	200	9.73 (3.25)^{a}	7.37 (2.86)^{c}	7.43 (2.88)^{g}	6.20 (2.67)^{e}	15.47 (4.04)^{a}	13.43 (3.77)^{de}	8.40 (3.05)^{e}	6.20 (2.68)^{f}	12.60	8.17
12	Untreated control	-	10.57 (3.36^{a}	11.50 (3.52)^{d}	13.63 (3.82)^{h}	14.00 (3.87)^{f}	16.50 (4.16)^{a}	17.00 (4.24)e	14.90 (3.96)^{f}	13.67 (3.83)^{g}	13.53	14.11
	Sem ±		0.2	0.2	0.1	0.1	0.3	0.2	0.2	0.1		
	CD		0.6	0.5	0.3	0.4	0.8	0.6	0.5	0.4	-	-
	CV		10.2	10.6	10.5	10.4	12.6	10.6	10.3	10.7	-	-

DBS- Day before spraying; DAS- Days after spraying; figures in the parenthesis arevx+1 transformed value. Per hectare 500 litre of spray solution is required, transformed values with letter are DMRT values. Transformed values with letter (s) in common are not significant.

Table 2 : Management of white backed planthopper *Sogatella furcifera* (Hoverth) in DDSR through novel insecticides during *kharif* 2015.

Sl. No	Treatment details	Dose ml or gha^{-1}	WBPH / hill at 1st spray				WBPH / hill at 2nd spray				Mean Before spray	Mean After spray
			1 DBS	5 DAS	10 DAS	15DAS	1 DBS	5 DAS	10 DAS	15DAS		
1	Pymetrazin 50 WG	400	8.53 (3.08)^{a}	7.00 (2.82)^{abc}	1.90 (1.70)^{bc}	2.00 (1.73)^{bc}	15.23 (4.03)^{a}	14.17 (3.89)^{b}	6.00 (2.62)^{bc}	1.63 (1.62)^{b}	11.88	5.45
2	Ethriprole + Imidacloprid 80 WG	150	7.77 (2.94)^{a}	7.33 (2.85)^{abc}	2.00 (1.72)^{bc}	2.13 (1.76)^{bc}	17.93 (4.33)^{a}	14.20 (3.88)^{b}	6.33 (2.64)^{c}	1.60 (1.60)^{b}	12.85	5.59
3	Dinotefuron 20 SG	200	8.03 (2.95)^{a}	4.50 (2.34)^{ab}	0.97 (1.39)^{ab}	1.47 (1.56)^{b}	16.37 (4.17)^{a}	12.50 (3.66)^{b}	3.40 (2.09)^{ab}	1.33 (1.53)^{ab}	12.20	4.02
4	Buprofezin 25 SC	500	7.97 (2.98)^{a}	7.43 (2.89)^{bcde}	2.13 (1.77)^{c}	2.60 (1.89)^{bcd}	16.67 (4.20)^{a}	14.70 (3.94)^{b}	7.27 (2.82)^{cde}	2.37 (1.83)^{bc}	12.32	6.08
5	Buprofezin15% + Acephate 35% WP	500	9.03 (3.15)^{a}	7.40 (2.88)^{bcde}	2.03 (1.74)^{c}	2.30 (1.81)^{bc}	16.60 (4.19)^{a}	14.27 (3.89)^{b}	6.80 (2.75)^{cd}	2.43 (1.85)^{bcd}	12.81	4.75
6	Acephate 50% + Imidachloprid 1.8% WG	500	7.97 (2.99)^{a}	7.43 (2.87)^{abcd}	2.07 (1.74)^{c}	2.40 (1.84)^{bcd}	16.83 (4.22)^{a}	14.47 (3.91)^{b}	7.00 (2.78)^{cd}	2.47 (1.86)^{bcd}	12.40	5.97
7	Triflumezopyrim 106 SC	237	8.70 (3.11)^{a}	2.33 (1.83)^{a}	0.13 (1.06)^{a}	0.23 (1.11)^{a}	16.00 (4.05)^{a}	7.03 (2.77)^{a}	1.93 (1.71)^{a}	0.53 (1.24)^{a}	12.35	2.03
8	Flubendiamide + Buprofezin 24% SC	1000	8.03 (3.00)^{a}	7.90 (2.97)^{bcdef}	4.17 (2.27)^{d}	3.03 (2.00)^{cde}	18.53 (4.41)^{a}	15.97 (4.12)^{b}	9.70 (3.17)^{de}	3.10 (2.02)^{cde}	13.28	7.31
9	Flonic amide 50% EC	200	9.07 (3.14)^{a}	8.00 (3.00)^{cdef}	4.33 (2.29)^{d}	3.30 (2.07)^{cde}	17.97 (4.33)^{a}	16.20 (4.15)^{b}	10.00 (3.24)^{de}	3.60 (2.14)^{cde}	13.52	7.57
10	Acephate 75 SP	500	8.73 (3.12)^{a}	8.05 (3.00)^{def}	4.67 (2.37)^{d}	3.80 (2.19)^{de}	19.50 (4.52)^{a}	18.00 (4.33)^{b}	10.53 (3.31)^{e}	3.80 (2.19)^{de}	14.11	8.14
11	Imidachloprid 17.8 SL	200	8.33 (3.05)^{a}	8.07 (3.00)^{ef}	4.93 (2.42)^{d}	4.23 (2.29)^{e}	18.13 (4.36)^{a}	18.14 (4.37)^{bc}	10.67 (3.31)^{e}	4.50 (2.34)^{e}	13.23	8.42
12	Untreated control	—	9.90 (3.29)^{a}	10.70 (3.40)^{f}	11.50 (3.54)^{e}	13.17 (3.74)^{f}	22.00 (4.76)^{a}	25.07 (5.10)^{c}	20.67 (4.64)^{f}	16.67 (4.18)^{f}	15.95	13.30
	Sem ±		0.20	0.20	0.10	0.10	0.30	0.30	0.20	0.10		
	CD		0.70	0.50	0.30	0.4	0.8	0.7	0.5	0.3	-	-
	CV		12.70	10.90	10.10	10.5	10.6	10.8	10.9	10.1		

DBS- Day before spraying; DAS- Days after spraying; NS- Non significant; figures in the parenthesis arevx+1 transformed values per hectare 500 litre of spray solution is required, transformed values with letter are DMRT values. Transformed values with letter (s) in common are not significant.

Table 3: Effect of new insecticides against grain yield, *Kharif* 2015.

Sl. No	Treatment details	Dose ml or gha^{-1}	Grain yield (Kg/ plot)	Grain yield (q/ha)
1	Pymetrazin 50 WG	400	13.75	55.00^{abc}
2.	Ethriprole + Imidacloprid 80 WG	150	13.30	53.16^{abcd}
3	Dinotefuron 20 SG	200	14.07	56.26^{ab}
4	Buprofezin 25 SC	500	11.50	46.00^{cdefg}
5	Buprofezin15% + Acephate 35% WP	500	12.74	50.96^{bcde}
6	Acephate 50% + Imidachloprid 1.8% WG	500	12.17	48.66^{bcdef}
7	Triflumezopyrim 106 SC	237	15.66	62.64^{a}
8	Flubendiamide + Buprofezin 24% SC	1000	10.87	43.46^{defg}
9	Flonic amide 50% EC	200	10.27	41.06^{efg}
10	Acephate 75 SP	500	9.80	39.2^{fg}
11	Imidachloprid 17.8 SL	200	9.53	38.12^{g}
12	Untreated control	-	5.53	24.53^{h}
	SEm±	3.5		
	CD@0.05	10.2		
	CV	12.90		

Per hectare 500 litre of spray solution is required.

with Triflumezopyrim 10.6 SC @ 237 ml/ ha while, Dinotefuran 20SG @ 200 g/ ha, Pymetrozine 50 WG @ 400 g/ ha and Ethriprole + Imidacloprid 80 WG @ 150 g/ ha, Buprofezin 15 + Acephate 35 WP @ 500 g/ ha and Acephate 50 + Imidachloprid 1.8 WG @ 500 g/ ha were next best treatments.

Management of planthoppers under DDSR ecosystem through novel insecticides is practical and easily approachable to farming community. Among the various novel insecticides Triflumezopyrim 10.6 SC @ 237 ml/ ha followed by Dinotefuran 20 SG @ 200 g/ ha and Pymetrozine 50 WG @ 400 g/ ha were proved to be best insecticides and these could be included in IPM and/ or IRM strategies to cater the needs of farming community.

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