



## EFFICACY OF A NEW COMBINATION INSECTICIDE AGAINST RICE BROWN PLANTHOPPER *NILAPARVATA LUGENS* (STAL)

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### ABSTRACT

Efficacy of a new combination insecticide against rice brown plant hopper (BPH) *Nilaparvata lugens* Stal revealed that among all the treatments, significant reduction in the incidence (76.91% reduction over control) and higher grain yield (5.37 ton/ ha) was obtained with buprofezin 24%+ fipronil 40%SC (MAIRM-10) @ 875 ml/ ha. It was at par with buprofezin 24%+ fipronil 40%SC (MAIRM-10) @ 750 ml/ ha followed by buprofezin 25%SC @ 800 ml/ ha. Although maximum grain yield was obtained from buprofezin 24%+ fipronil 40%SC (MAIRM-10) @ 875 ml/ ha, maximum cost benefit in term of ICBR was observed with buprofezin 24%+ fipronil 40%SC (MAIRM-10) @ 750 ml/ ha (1:6.11) besides considering the environmental effect. Buprofezin 24%+ fipronil 40%SC (MAIRM-10) @ 750 ml/ ha was found to be most optimum one for BPH management.

**Key words:** *Nilaparvata lugens*, rice, combination insecticide, buprofezin+ fipronil, MAIRM-10, fipronil, imidacloprid, neem oil, incidence, grain yield

Rice (*Oryza sativa* L.) is the second largest cultivated crop worldwide while most important cereal crop of more than two third population of India and continues to play a vital role in food and livelihood security system in our country. Quite a good number of biotic and abiotic stresses adversely affect the crop yield, of which insect pest attack is responsible for 40% reduction (Pathak and Dhaliwal, 1981). The rice plant is attacked by more than hundred insect species throughout the world (Pasalu and Katti, 2006; Heinrichs, 1987). Among them Rice brown planthopper (BPH), *Nilaparvata lugens* (Stal) (Hemiptera: Delphacidae) is the most important sucking insect pest attacking rice crop throughout the rice growing countries including India. Extensive grain yield losses due to BPH have been reported from several parts of the country (Chandana et al., 2015). Use of insecticides is the most sought after strategy for BPH management by farmers despite several drawbacks such as development of insecticide resistance and resurgence (Baehaki et al., 2016) and widespread outbreaks of the BPH resulting substantial grain yield losses (Chander and Palta, 2010; Chander and Husain, 2018). BPH is causing severe yield losses due to monoculturing of rice in an extensive area, use of susceptible rice cultivars, availability of irrigation water in addition to indiscriminate use of insecticides. In recent days BPH has developed either resistance or found to be less effective against many insecticides

like organophosphates, neonicotinoids, insect growth regulator, feeding inhibitor and phenyl pyrazoles compounds. There is a need to assess the efficacy of new insecticidal compounds to monitor their efficacy. The present study evaluates the efficacy of a new combination insecticides against the BPH under field condition.

### MATERIALS AND METHODS

The field experiment was carried out at the Central Research Farm, Gayeshpur, Bidhan Chandra Krishi Viswavidyalaya, Nadia, West Bengal during kharif, 2019 and 2020, The moderately susceptible variety IET-4094 (Khitish) was raised as per the recommended package of practices, except for the plant protection measures. Experiment was laid on a Randomized Block design with eight treatments including untreated control and each treatment replicated thrice where 25 days old seedlings were transplanted (spacing of 15x 10 cm, plot size 20 m<sup>2</sup> each). The treatments include: T<sub>1</sub>- neem oil 3% @ 2500ml/ ha, T<sub>2</sub>- buprofezin 24%+ fipronil 40%SC (MAIRM-10) @ 625 ml/ ha, T<sub>3</sub>- buprofezin 24%+ fipronil 40%SC (MAIRM-10) @ 750 ml/ ha, T<sub>4</sub>- buprofezin 24%+ fipronil 40%SC (MAIRM-10) @ 875 ml/ ha, T<sub>5</sub>- buprofezin 25%SC @ 800 ml/ ha, T<sub>6</sub>- fipronil 5%SC @ 1500 ml/ ha, T<sub>7</sub>-imidacloprid 17.8%SL @ 125 ml/ ha, and T<sub>8</sub>- untreated control. Three sprays were given at fortnightly intervals starting at 45

Table 1. Efficacy of insecticides against *N. lugens* in rice

Treatments	Dose (g or ml)/ha	PTC	Mean BPH incidence/ plant after first spray			Mean BPH incidence/ plant after second spray			Mean BPH incidence/ plant after third spray			Overall mean	Reduction over control (%)	Yield (ton/ha)	Yield increase over control (%)
			10 DAS	3 DAS	7 DAS	10 DAS	7 DAS	3 DAS	10 DAS	7 DAS	3 DAS				
T <sub>1</sub>	Neem oil 3%	2500	36.33	30.46 (5.56) <sup>bc</sup>	33.59 (5.83) <sup>c</sup>	34.81 (5.94) <sup>cd</sup>	27.66 (5.30) <sup>d</sup>	27.07 (5.25) <sup>c</sup>	28.55 (5.39) <sup>d</sup>	19.23 (4.44) <sup>c</sup>	17.96 (4.29) <sup>c</sup>	26.98 (5.24) <sup>c</sup>	46.52	3.58	13.58
T <sub>2</sub>	Buprofezin 24% + Fipronil 40% SC (MAIRM-10)	625	35.17	27.67 (5.31) <sup>ab</sup>	30.79 (5.59) <sup>bc</sup>	32.01 (5.70) <sup>b</sup>	24.87 (5.04) <sup>cd</sup>	24.28 (4.98) <sup>c</sup>	25.76 (5.12) <sup>c</sup>	20.67 (4.60) <sup>c</sup>	15.17 (3.96) <sup>c</sup>	24.18 (4.97) <sup>c</sup>	52.07	4.02	27.62
T <sub>3</sub>	Buprofezin 24% + Fipronil 40% SC (MAIRM-10)	750	36.34	22.65 (4.81) <sup>ab</sup>	22.00 (4.74) <sup>ab</sup>	23.22 (4.87) <sup>a</sup>	11.89 (3.52) <sup>a</sup>	11.64 (3.48) <sup>a</sup>	12.58 (3.62) <sup>a</sup>	6.60 (2.07) <sup>a</sup>	2.41 (1.71) <sup>a</sup>	12.97 (3.67) <sup>a</sup>	74.28	5.29	67.94
T <sub>4</sub>	Buprofezin 24% + Fipronil 40% SC (MAIRM-10)	875	32.30	20.99 (4.64) <sup>a</sup>	21.28 (4.67) <sup>a</sup>	22.06 (4.75) <sup>a</sup>	10.11 (3.26) <sup>b</sup>	9.59 (3.18) <sup>a</sup>	10.57 (3.33) <sup>a</sup>	5.44 (2.44) <sup>a</sup>	2.83 (1.82) <sup>a</sup>	11.64 (3.49) <sup>a</sup>	76.91	5.37	70.48
T <sub>5</sub>	Buprofezin 25% SC	800	35.37	26.40 (5.19) <sup>ab</sup>	26.66 (5.21) <sup>bc</sup>	28.32 (5.37) <sup>b</sup>	18.66 (4.38) <sup>b</sup>	18.90 (4.40) <sup>b</sup>	20.43 (4.58) <sup>b</sup>	15.40 (3.99) <sup>b</sup>	12.87 (3.66) <sup>b</sup>	19.86 (4.51) <sup>b</sup>	60.62	4.37	38.73
T <sub>6</sub>	Fipronil 5% SC	1500	36.28	27.91 (5.33) <sup>abc</sup>	27.05 (5.25) <sup>bc</sup>	28.69 (5.40) <sup>b</sup>	18.82 (4.40) <sup>c</sup>	18.90 (4.40) <sup>b</sup>	20.30 (4.56) <sup>b</sup>	15.03 (3.94) <sup>b</sup>	12.17 (3.27) <sup>b</sup>	19.89 (4.52) <sup>b</sup>	60.57	4.17	32.38
T <sub>7</sub>	Imidacloprid 17.8% SL	125	35.18	29.34 (5.46) <sup>bc</sup>	29.18 (5.45) <sup>cd</sup>	30.73 (5.59) <sup>bc</sup>	24.39 (4.98) <sup>c</sup>	25.45 (5.09) <sup>c</sup>	26.43 (5.19) <sup>c</sup>	21.09 (4.65) <sup>c</sup>	18.25 (4.33) <sup>c</sup>	24.64 (5.01) <sup>c</sup>	51.16	3.99	26.67
T <sub>8</sub>	Untreated Control		33.89	37.13 (6.13) <sup>c</sup>	37.92 (6.96) <sup>c</sup>	42.48 (6.56) <sup>d</sup>	47.66 (6.94) <sup>d</sup>	52.06 (7.25) <sup>d</sup>	54.32 (7.40) <sup>d</sup>	58.20 (7.66) <sup>d</sup>	61.64 (7.88) <sup>d</sup>	50.45 (7.14) <sup>d</sup>	-	3.15	-
S. Em. (±)			NS	0.14	0.11	0.09	0.05	0.09	0.06	0.06	0.07	0.06			
CD (p=0.05)			-	0.44	0.34	0.29	0.15	0.27	0.18	0.18	0.21	0.18			

Mean values of three replications represented as mean; Figures in parentheses  $\sqrt{(x+0.5)}$  transformed values; Values followed by same letter not significantly different from each other, Tukey HSD ( $p \leq 0.05$ ); S.Em.: Standard Error of mean; CD: Critical Difference.

days after transplantation (DAT) when the incidence was noticed above economic threshold level. The BPH counts were recorded one day before and three, seven and ten DAT, on randomly selected five hills/ treatment. The yield/ plot was recorded and computed on ha basis. Efficacy of insecticides was calculated on basis of surviving insect population (nymph and adult)/ plant after treatment. Data on BPH counts were subjected to square root transformation, and along with yield were subjected to ANOVA and Tukey HSD; besides the yield increase in treated plots/ avoidable loss was worked out. Paddy from net plot area were harvested and recorded in kg/ plot were converted to ton/ ha. In order to assess the economics, Incremental Cost Benefit-Ratio (ICBR) was worked out. For these, net realization was worked out for all insecticidal treatments by deducting the cost of protection from the gross realization of produce. Net gain over control was calculated by deducting the realization of control from realization of each treatment. ICBR from each treatment was calculated by dividing net gain over control by total cost of plant protection measures.

### RESULTS AND DISCUSSION

Non-significant difference in BPH counts was observed before spraying, and all the treatments were found significantly superior over control after first spray of insecticides, and insecticidal formulation buprofezin 24%+ fipronil 40%SC (MAIRM-10) @ 875 ml/ ha (74.28% reduction was proved to be superior which is at par with its lower dose i.e. 750ml/ ha (42.20% reduction). This was followed by buprofezin 25%SC @800 ml/ ha and fipronil 5%SC @1500 ml/ ha while neem oil 3% was found to be the least effective, and

at par with imidacloprid 17.8%SL @ 125ml/ ha. After second spray too buprofezin 24%+ fipronil 40%SC @ 875 ml/ ha was found to be the best ( 80.30% reduction) which is at par with its dose of 750 ml/ ha (76.60% reduction). More or less similar trend was observed after third spray. The pooled data of three sprays revealed that all the insecticidal treatments were significantly superior. Among all the treatments, maximum reduction in incidence over control was observed in buprofezin 24%+ fipronil 40%SC @ 875 ml/ ha (76.91%); and it was at par with its dose of 750 ml/ha (Table 1).

These results are in conformity with those of Shashank et al. (2012) and Ghosh and Chattarjee (2012); that buprofezin is the most effective. Buprofezin 24%+ fipronil 40%SC @ 875 ml/ ha gave significantly maximum grain yield (5.37 t/ ha), at par with its dose of 750 ml/ ha (5.29 t/ ha; 70.48% yield increase); this is followed by buprofezin 25%SC (4.37 t/ ha; 67.94% increase). The grain yield was the least with neem oil @ 3% (3.58 t/ ha) along with that of imidacloprid 17.8%SL @ 125 ml/ ha (3.99 t/ ha). Economics of insecticide revealed that maximum net realization (94,242.41 Rs/ ha) was found with buprofezin 24%+ fipronil 40%SC @ 875 ml/ha followed by its dose of 750 ml/ha (93193.33 Rs/ ha), while incremental cost benefit was found to be 1:5.83 and 1:6.11, respectively. (Table 2). Thus, buprofezin 24%+ fipronil 40%SC (MAIRM-10) @ 875 ml/ha was found to be the most effective in BPH management.

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Table 2. Economics of insecticides

Treatments	Cost of insecticides Rs/ha (3 spray)	Total cost (Rs/ ha)	Paddy yield (t/ ha)	Gross realization (Rs/ ha)	Net realization (Rs/ ha)	Net gain (Rs/ ha)	ICBR
T <sub>1</sub> Neem oil 3%	975.00	3927.00	3.58	66874.40	62947.40	4105.40	1:1.04
T <sub>2</sub> Buprofezin 24% + Fipronil 40% SC (MAIRM 10)	2226.56	5178.56	4.02	75093.60	69915.04	11073.04	1:2.14
T <sub>3</sub> Buprofezin 24% + Fipronil 40% SC (MAIRM-10)	2671.87	5623.87	5.29	98817.20	93193.33	34351.33	1:6.11
T <sub>4</sub> Buprofezin 24% + Fipronil 40% SC (MAIRM-10)	3117.18	6069.18	5.37	100311.6	94242.41	35400.41	1:5.83
T <sub>5</sub> Buprofezin 25% SC	3750.00	6702.00	4.37	81631.60	74929.60	16087.60	1:2.40
T <sub>6</sub> Fipronil 5% SC	6581.25	9533.25	4.17	77895.60	68362.35	9520.35	1:0.99
T <sub>7</sub> Imidacloprid 17.8% SL	731.25	3683.25	3.99	74533.20	70849.95	12007.95	1:3.26
T <sub>8</sub> Untreated Control	-	-	3.15	58842.00	58842.00	11073.04	-

Labour cost Rs/ha (3spray) Rs 2952 and chemical cost and price of paddy as per market

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