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# Evaluation of effectiveness of newer insecticidal formulations against rice brown plant hopper *Nilaparvata lugens* Stal (Delphacidae: Hemiptera)

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**Abstract**
Brown plant hopper is one of the major pests of rice which is presently controlled by various insecticides. The present investigation was aimed to study the effectiveness of newer insecticidal formulations against rice brown plant hopper. After 1st insecticidal spray Acephate + Imidacloprid 50% +1.8% SP shows superior over the other treatments with lowest number of pests (7.12), followed by Flubendiamide 480 SC (7.85), Chlorfenapyr 2 SC (8.88), Thiacloprid 240 SC (9.25), Spinosad 45 SC (9.44), Fipronil 5 SC (9.51), Emamectin benzoate 5 SG (9.91%), Chlorpyriphos + Cypermethrin 50%+ 5% EC (10.19), which is least effective against the rice brown plant hopper when compared to the other treatments, untreated check (14.99). After 2nd insecticidal spray Acephate + Imidacloprid 50% +1.8% SP shows superior over the other treatments with lowest number of pests (6.08) followed by Acephate 75 SP (6.46), Flubendiamide 480 SC (6.63), Chlorfenapyr 2 SC (7.07), Thiacloprid 240 SC (7.17), Fipronil 5 SC (7.44), Spinosad 45 SC (7.54), Emamectin benzoate 5 SG (7.70) Chlorpyriphos + Cypermethrin 50% + 5% EC (8.2), which is least effective against the rice BPH when compared to the other treatments. While untreated check recorded highest incidence as there was no intervention with the insecticide spray.

**Keywords:** Newer insecticidal formulations, rice brown plant hopper, *Nilaparvata lugens*

## Introduction
Rice (*Oryza sativa* L.) is one of the major cereal crops in the world and it forms the daily food for more than 65% of the total population in India. The crop plays a crucial role in ensuring food security, sustaining rural livelihoods, and contributing to the country's economy. Rice cultivation in India is primarily done during the kharif season, which starts with the onset of the monsoon in June and continues until September. One of the significant challenges in rice farming in India is the invasion of insect pests during various stages of the crop's growth. In India, there are approximately 220 species of insect pests that feed on rice crops (Arora and Dhaliwal, 1996) [1]. The prominent pests that cause damage to rice crops include the rice yellow stem borer, leaf folder and brown plant hopper (BPH).

Among all *Nilaparvata lugens*, is the most destructive sucking pest of rice and causes significant yield losses in paddy-growing regions throughout Asia (Surekha *et al.*, 2018) [2]. BPH feeds on the phloem tissues of rice plants, extracting essential nutrients. When the population of BPH is high, it can cause the affected plants to turn dry and brown, a condition known as "hopper burn symptom." Although BPH alone may not directly kill rice plants, its feeding can lead to substantial yield These diseases further reduction (Norton *et al.*, 2010) [3]. The brown plant hopper also acts as a vector for transmitting viral diseases like rice grassy stunt (Rivera *et al.*, 1996) [4] and rice ragged stunt virus (Ling *et al.*, 1978) [5] contribute to crop damage and yield loss. In India, approximately 50% of paddy-growing farmers use insecticides, applying them one to six times per crop season, to control pests such as yellow stem borers, brown plant hoppers, white-backed plant hoppers, and leaf folders (Shepard 1995) [6].

Newer insecticidal formulations play a key role in dipping the pest population level very promptly as compared to other insecticides. The present investigation was aimed to evaluate the effectiveness of newer insecticidal formulations against rice brown plant hopper.

## Material and Methods
The purpose of this study was to assess the effectiveness of newer insecticidal formulations against the rice brown plant hopper. The data collected for analysis included pre-treatment data

recorded one day before spraying, as well as post-treatment data recorded on the 1st, 3rd, 7th, and 10th day after spraying. The experiment was conducted on the HUR105 variety of rice at the Agricultural Research Farm, Institute of Agricultural Sciences, BHU, Varanasi. The experimental plot size was 3m×3m, and a randomized block design (RBD) was employed with three replications and ten treatments, including an untreated control. The study was conducted during the kharif season of 2018, and all necessary agronomic practices were followed throughout the crop growth period.

The following newer insecticidal formulations used in the experiment Thiacloprid 240 SC, Fipronil 5 SC, Chlorfenapyr 2 SC, Flubendiamide 480 SC, Spinosad 45 SC, Emamectin benzoate 5 SG, Chlorpyriphos 50% + cypermethrin 5% EC, Acephate 50% + imidacloprid 1.8% SP and Acephate 75% SP. The population of nymphs and adults of paddy hoppers was observed on five hills in each plot at random on the first day before spraying (1 DBS). Subsequently, the number of nymphs and adults of paddy hoppers per five hills was recorded on the 1st, 3rd, 7th, and 10th day after the spraying occurred.

**Statistical Analysis**

The mean values obtained from the field experiments were subjected to statistical analysis using the ANOVA method with the SPSS package after converting it to Square root transformed values.

**Results and Discussion**

To evaluate the effectiveness of newer insecticidal formulations against rice brown plant hopper, the level of infestation caused by rice brown plant hopper was recorded at two different time points: first spray at 40 days after transplanting (DAT) and second spray at 55 days after transplanting (DAT), the observations were taken at 1 day before spraying (DBS) and 1, 3, 7 and 10 days after spraying (DAS).

Results show that after the first insecticidal spray, among these treatments, Acephate 50% + Imidacloprid 1.8% SP demonstrated superior effectiveness with an average of 7.12 insects per 5 hills. Following this, the Flubendiamide 480 SC treatment had an average of 7.85 insects per 5 hills. The Chlorpyriphos 50% + Cypermethrin 5% EC treatment had an average of 10.19 insects per 5 hills, making it the least effective among the evaluated treatments. In comparison, the untreated check exhibited the highest infestation rate with an average of 14.99 insects per 5 hills (Table 1) (Figure 1).

Second insecticidal spray was administered 15 days after the first spray; The Acephate 50% + Imidacloprid 1.8% SP treatment exhibited superior effectiveness once again, with an average of 6.08 insects per 5 hills. Following this, the Acephate 75 SP treatment recorded an average of 6.46 insects per 5 hills. The Chlorpyriphos 50% + Cypermethrin 5% EC treatment had an average of 8.2 insects per 5 hills, making it the least effective among the evaluated treatments. Untreated check had the highest infestation rate, with an average of 10.31 insects per 5 hills (Table 2) (Figure 1).

The results were closer to Bhavani and Rao (2005) [7] revealed that imidacloprid 200 SL reported a higher degree of efficacy against rice plant hoppers than other treatments, its followed by acephate 75 SP whereas Chlorpyriphos 10 G was least effective against plant hoppers recording higher population as compared to untreated control. Dinotefuran demonstrated excellent effectiveness throughout different seasons against the population of BPH, surpassing the performance of conventional acephate and commonly employed neonicotinoids. Its broad spectrum of action ensures efficient control of BPH, irrespective of the time of year Ghosh *et al*., (2014) [8]. Chander *et al*., (2012) [9] reported that acephate was effective against rice brown plant hoppers. Ghosh *et al*., (2010) [10] observed that imidacloprid 17.8 SL show the better in control of the rice brown plant hopper as compared to acephate 50% + imidacloprid 1.8% SP. Hegde and Nidagundi (2010) [11] reported that Imidacloprid @ 17.8 SL and @ 200 SL proved to be effective against the rice brown plant hoppers. Application of sulfoxaflor at rates of 100 and 75 grams of active ingredient per hectare proved to be effective in controlling brown plant hopper in field conditions Ghosh *et al.* (2013) [12].

Triflumezopyrim (30 g a.i. ha−1), pymetrozine (175 g a.i. ha−1), and sulfoxaflor (30 g a.i. ha−1), along with a rotational application of aqueous extract from *Jatropha gossypiifolia* mixed with cow urine at a 1:1 ratio (3.5%) and aqueous extract of *Argemone maxicana* blended with 'toddy' at a 1:2 ratio (3.0%), exhibited significant efficacy in reducing the populations of nymphs and adults of the brown plant hopper, Royand and Chakraborty (2021) [13].

**Table 1:** Effect of newer insecticidal formulations against rice brown plant hopper after 1st insecticidal spray

| Sl. No. | Treatments | Dosage a.i/l | Avg. no. of nymphs and adults per 5 hills at different days after 1st insecticidal spray | | | | | Post treatment mean |
|---|---|---|---|---|---|---|---|---|
| | | | 1 DBS | 1 DAS | 3 DAS | 7 DAS | 10 DAS | |
| 1. | Thiacloprid 240 SC | 0.25 g/l | 11.04* (3.46)** | 9.76 (3.28) | 8.66 (3.10) | 8.73 (3.12) | 9.84 (3.29) | 9.25 |
| 2. | Fipronil 5 SC | 2 g/l | 11.33 (3.51) | 9.77 (3.283) | 8.93 (3.152) | 8.55 (3.09) | 10.78 (3.43) | 9.51 |
| 3. | Chlorfenapyr 2 SC | 2 g/l | 10.43 (3.38) | 8.96 (3.15) | 8.3 (3.0) | 8.31 (3.05) | 9.79 (3.28) | 8.84 |
| 4. | Flubendiamide 480 SC | 0.1 g/l | 11.38 (3.51) | 7.83 (2.97) | 6.9 (2.811) | 7.03 (2.83) | 9.66 (3.26) | 7.85 |
| 5. | Spinosad 45 SC | 0.2 g/l | 10.34 (3.36) | 8.29 (3.04) | 9.42 (3.229) | 9.16 (3.18) | 10.88 (3.44) | 9.44 |
| 6. | Emamectin benzoate 5 SG | 0.25 g/l | 11.46 (3.53) | 9.99 (3.31) | 9.53 (3.24) | 9.19 (3.19) | 10.94 (3.45) | 9.91 |
| 7. | Chlorpyriphos 50% + cypermethrin 5% EC | 0.1 g/l | 11.60 (3.54) | 10.03 (3.32) | 9.82 (3.28) | 9.39 (3.22) | 11.51 (3.53) | 10.19 |
| 8. | Acephate 50% + | 0.2 g/l | 8.82 | 6.44 | 6.32 | 6.9 | 8.84 | 7.12 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | imidacloprid 1.8% SP | | (3.13) | (2.72) | (2.70) | (2.81) | (3.13) | |
| 9. | Acephate 75% SP | 1 g/l | 7.87 (2.97) | 7.33 (2.88) | 6.7 (2.77) | 6.33 (2.70) | 9.9 (3.30) | 7.56 |
| 10. | Control | | 11.42 (3.52) | 14.59 (3.94) | 15.83 (4.10) | 15.26 (4.03) | 14.3 (3.91) | 14.99 |
| C.D. at 5% | | | 0.16 | 0.06 | 0.06 | 0.08 | 0.14 | |
| S.Em. ± | | | 0.05 | 0.02 | 0.02 | 0.02 | 0.04 | |

*Mean of 3 replications, ** Figures in parenthesis are Square root transformed values, DAS-Days after spraying

**Table 2:** Effect of newer insecticidal formulations against rice brown plant hopper after 2nd insecticidal spray

| Sl. No | Treatments | Dosage a.i/l | Avg. no. of nymphs and adults per 5 hills at different days after 2nd insecticidal spray | | | | | Post treatment mean |
|---|---|---|---|---|---|---|---|---|
| | | | 1 DBS | 1 AS | 3 DAS | 7 DAS | 10 DAS | |
| 1. | Thiacloprid 240 SC | 0.25 g/l | 10.23* (3.35)** | 8.57 (3.09) | 7.98 (2.99) | 7.23 (2.86) | 7.11 (2.84) | 7.17 |
| 2. | Fipronil 5 SC | 2 g/l | 10.95 (3.45) | 8.95 (3.15) | 8.45 (3.07) | 7.55 (2.92) | 7.25 (2.87) | 7.40 |
| 3. | Chlorfenapyr 2 SC | 2 g/l | 11.19 (3.49) | 8.392 (3.065) | 7.49 (2.91) | 7.19 (2.86) | 6.94 (2.82) | 7.07 |
| 4. | Flubendiamide 480 SC | 0.1 g/l | 12.43 (3.66) | 8.20 (3.03) | 7.20 (2.692) | 6.71 (2.77) | 6.56 (2.75) | 6.63 |
| 5. | Spinosad 45 SC | 0.2 g/l | 11.30 (3.50) | 9.19 (3.19) | 8.61 (3.10) | 7.82 (2.97) | 7.27 (2.87) | 7.54 |
| 6. | Emamectin benzoate 5 SG | 0.25 g/l | 11.25 (3.5) | 9.42 (3.22) | 8.63 (3.1) | 8.14 (3.02) | 7.26 (2.87) | 7.70 |
| 7. | Chlorpyriphos 50% + cypermethrin 5% EC | 0.1 g/l | 12.11 (3.62) | 10.57 (3.32) | 8.77 (3.12) | 8.36 (3.06) | 8.15 (3.02) | 8.26 |
| 8. | Acephate 50% + imidacloprid 1.8% SP | 0.2 g/l | 10.57 (3.40) | 6.29 (2.81) | 6.24 (2.69) | 6.11 (2.66) | 6.04 (2.65) | 6.08 |
| 9. | Acephate 75% SP | 1 g/l | 11.51 (3.53) | 7.28 (2.87) | 6.34 (2.79) | 6.46 (2.73) | 6.45 (2.73) | 6.46 |
| 10. | Control | | 15.72 (4.08) | 12.79 (3.71) | 11.45 (3.52) | 11.03 (3.46) | 9.58 (3.25) | 10.31 |
| C.D. at 5% | | | 0.06 | 0.15 | 0.08 | 0.09 | 0.05 | |
| S.Em. ± | | | 0.02 | 0.05 | 0.027 | 0.03 | 0.01 | |

*Mean of 3 replications, ** Figures in parenthesis are Square root transformed values, DAS-Days after spraying

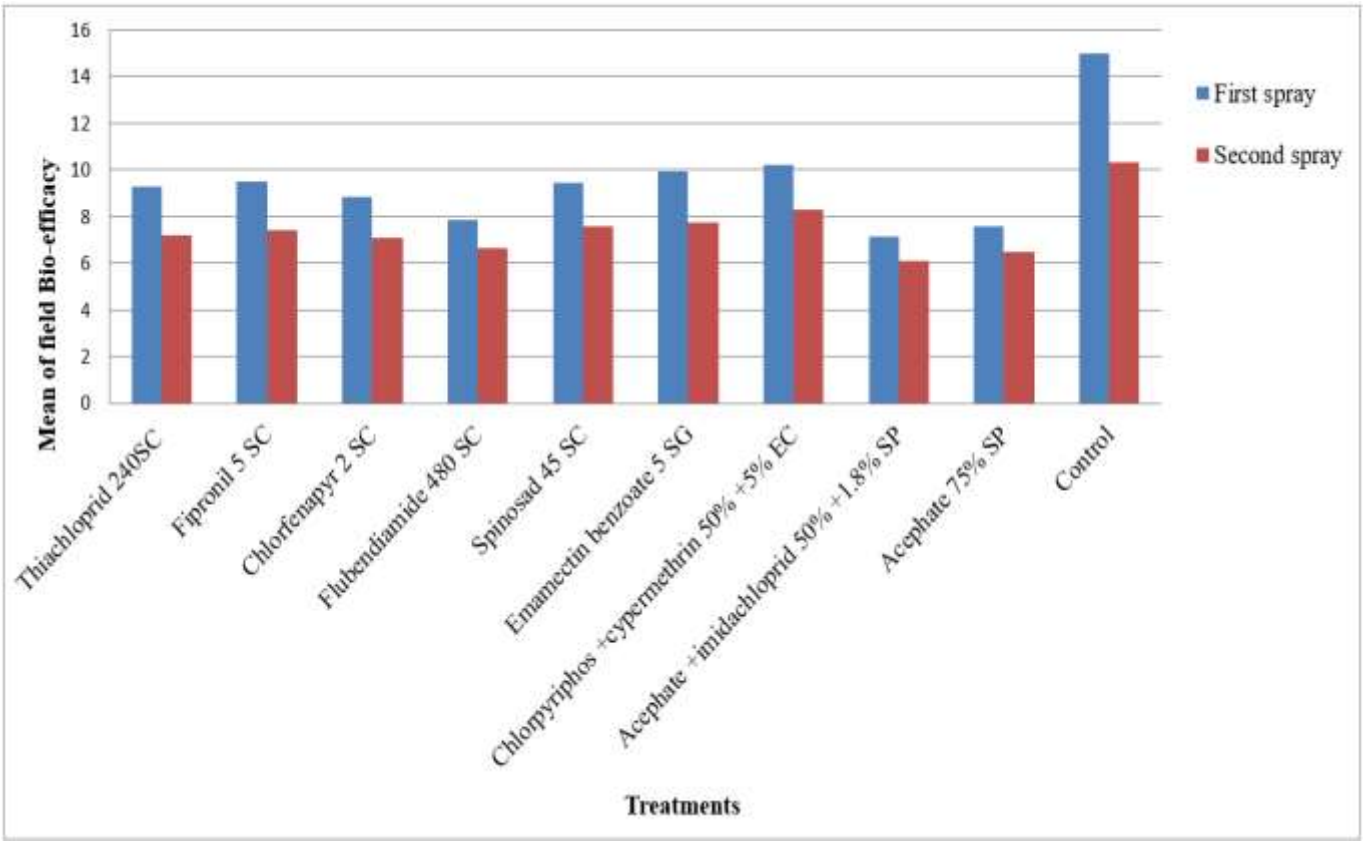


**Fig 1:** Overall mean field effectiveness of newer insecticidal formulations against rice brown plant hopper

## Conclusion

Among all tested insecticidal formulations**,** Acephate 50% + Imidacloprid 1.8% SP a combination product shows higher effective on nymph and adults of brown plant hopper with lowest incidence in the treated plots in both the first and second spray. Whereas, Chlorpyriphos 50% + Cypermethrin 5% EC another combination product shows least effective even after both first and second spray. Since imidacloprid is a novel insecticide used against sucking pests and effectively manages sucking pests along with combination product.

## Reference


1. Arora R, Dhaliwal GS. Agroecological changes and insect pest problems in Indian agriculture. Indian J Ecol. 1996;23(2):109-122.
2. Surekha M, Kiran S, Reddy SR, Reddy SM. Moulds and Mycotoxins of Paddy: Incidence, Impact and Management. Scientific Publishers; c2016.
3. Norton GW, Heong KL, Johnson D, Savary S. Rice pest management: issues and opportunities. Rice in the global economy: strategic research and policy issues for food security. IRRI, Los Banos; c2010.
4. Rivera CT, Ou SH, Iida TT. Grassy stunt disease of Rice and its transmission by the planthopper *Nilaparvata lugens* Stal. Plant Disease Reporter. 1996;50(7):453-456.
5. Ling KC, Tiongco ER, Aguiero VM. Rice ragged stunt, a new virus disease. Plant disease reporter. 1978;62(8):701-705.
6. Shepard BM. Rice-feeding insects of tropical Asia. Int. Rice Res. Inst; c1995.
7. Bhavani B, Rao PRM. Bioefficacy of certain insecticides against rice plant hoppers vis-a.-vis natural enemies under irrigated field conditions, Indian Journal of Plant Protection. 2005;33(1):64-67.
8. Ghosh A, Samanta A, Chatterjee ML. Dinotefuran: A third generation neonicotinoid insecticide for management of rice brown planthopper. African journal of Agricultural research. 2014;9(8):750-754.
9. Chander S, Sujithra M, Palta RK. Efficacy of a novel insecticide and combination product against rice insect pests. Pesticide Research Journal. 2012;24(2):235-237.
10. Ghosh A, Chatterjee ML, Samanta A. Field evaluation of some new insecticides against brown planthopper *Nilaparvata lugens* (stål) in rice. Journal of Entomological Research. 2010;34(1):35-37.
11. Hegde M, Nidagundi J. Effect of newer chemicals on planthoppers and their mirid predator in rice. Karnataka Journal of Agricultural Sciences. 2010;22(3).
12. Ghosh A, Das A, Samanta A, Chatterjee ML, Roy A. Sulfoximine: A novel insecticide for management of rice brown planthopper in India. African Journal of Agricultural Research. 2013;8(38):4798-4803.
13. Roy D, Chakraborty G. Bio-efficacy of novel chemicals and tribal pesticide-based integrated modules against brown planthopper in rice. International Journal of Tropical Insect Science. 2021;1-1.