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# Field Efficacy of Newer Insecticide against Yellow Stem Borer (*Scirpophaga incertulus* Walker) on Rice

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**A B S T R A C T**

Field efficacy of newer insecticides viz., Fipronil 0.3%GR, Chlorantraniliprole 0.4%GR, Cartap hydrochloride 50% SC, Cartap hydrochloride + Fipronil 4% + 0.5% CG, Fipronil 5% SC, Chlorantraniliprole 18.5% SC and Flubendiamite 9.35% SC, and untreated control were evaluated against yellow stem borer (*Scripophaga insertulas*) in rice during *kharif* 2020-21. The result showed that the Cartap hydrochloride + Fipronil 4% + 0.5%CG was proved to be best and recorded minimum infestation of 3.36% DH and 2.68% WE, followed by Fipronil 0.3%GR with 3.93% DH and 3.21% WE. Rests of the treatments were next level best over control. Whereas, the maximum infestation of 11.61% DH and 10.45% WE was recorded in control plot. The highest yield of 50.70 q/ha and net return of Rs. 61120.00/ha was obtained from Cartap hydrochloride + Fipronil 4% + 0.5%CG treated crop followed by Fipronil 0.3%GR with 45.75 q/ha and Rs.41863.76/ha, respectively. Whereas, due to cost of treatment, Fipronil 0.3%GR was recorded highest Benefit Cost Ratio (1:9.30) followed by Fipronil 5% SC (1:8.24) and remaining treatments. Minimum yield (38.40 q/ha), net return (Rs. 6402.12/ha) along with BC ratio (1:1.58) was found in Cartap hydrochloride 50%SP.

## Introduction

Rice (*Oryza sativa* L.) is the most important staple food crop in the world, with more than 50% of the world's population (FAO, 2004) dependent on rice as the primary dietary source of calories and protein. Asia accounts for around 90% of the world's rice and processing area (Khanjani 2006). In India, it constitutes about 52% and 55% of the total food grain and cereal production, respectively. It is grown under diverse ecosystems such as flooded, irrigated, rainfed lowland and upland conditions (Bhumireddy *et al.*, 2018; Dinesh *et al.*, 2018). In Chhattisgarh, rice is cultivated with different practices in five agroecosystems. These ecosystems are upland ecosystems, midland ecosystems, lowland

ecosystems, submergence-prone and irrigated ecosystems. The state of Chhattisgarh is known as the rice bowl of India. In Chhattisgarh, rice is mainly grown under rainfed ecosystem during *Kharif* season and is completely dependent on monsoon. It occupies an area of 3.68 million ha of total 5.9 million ha cultivated area with productivity of 2.02 tones. Chhattisgarh state contributes 5.26 per cent of the total rice production of the country.

Worldwide, around 52 per cent of the rice production is lost yearly due to biotic agents, of which insect-pests attribute 21 per cent (Yarasi *et al.,* 2008). Worldwide, around 52 per cent of the rice production is lost yearly due to biotic agents, of which insect-pests attribute 21 per cent (Yarasi *et al.,* 2008). The yellow stem borer (*Scripophaga insertulas*) is one of the major pests of rice. Its freshly developed larva, penetrate the stem for feeds into the inner tissues and cut the food supply to the upper part of the affected stem. Dead hearts are formed when the insect attacks the vegetative stage (Chatterjee and Mondal, 2014). Result in destruction of growing point and white ears head (WE) bearing panicles at the panicle bearing stage in older plant at reproductive stage. Yield decline is observed to be strongly associated with dead-heart and white ear-hair infestations of the crop (Dhaliwal *et al.,* 2010). The average loss of yield in rice accounted for 30 per cent due to stem borers, (Rahman *et al.,* 2004; Parwez *et al.,* 2005; Krishnaiah and Varma, 2015).

Chemical insecticides are still front-line weapons for pest control. However, the indiscriminate use of insecticides has resulted in a loss of protection leading to the growth of resistance to insecticides. In the circumstances of the use of novel insecticides, the requirement for justification of chemical protection as the first line of protection is unique to target species.

## Materials and Methods

The present research work was conducted at the area of Research-cum-Instructional Farm of R.M.D College of Agriculture and Research Station, Ambikapur (C.G.) during *kharif* season 2020-21. The trials were laid in Randomized Block Design (RBD) with the three replications. The crop variety MTU-1010 was transplanted in the main field having 5 x 4 $m^2$, plot size with 30 cm x 15 cm (R x P). The data was recorded from randomly selected 10 hills per plot at 7 and 14 days after each application of insecticide. The effectiveness of treatments against yellow stem borer of rice was assessed on the basis of total number of dead hearts and white ears. The required quantity of insecticide was calibrated and applied in the field. The first application of insecticides were applied at 40 DAT by standard method and second application was done at15 days after first application

**Percent damage was subsequently worked out.**

Dead heart (%)

$$= \frac{\text{Number of Dead heart(DH)}}{\text{Total number of tillers}} \times 100$$

White ear head (%)

$$= \frac{\text{Number of White ear head(WEH)}}{\text{Total number of tillersl}} \times 100$$

The grain yield was recorded in plot basis and expressed in tones/ha. The data obtained from the individual plant observations from RBD experiment was analyzed statistically as per the standard procedure.

## Results and Discussion

The efficacy of seven newer insecticides viz., Fipronil 0.3%GR, Chlorantraniliprole 0.4%GR, Cartap hydrochloride 50%SC,

Cartap hydrochloride + Fipronil 4% + 0.5% CG, Fipronil 5%SC, Chlorantraniliprole 18.5% SC and Flubendiamite 9.35%SC along with untreated control were evaluated against the rice yellow stem borer (YSB) during *Kharif* 2020-21, which are presented in Table.2.

**Efficacy of newer insecticides against the infestation (dead heart) of YSB on rice after first and second spray**

**Pre treatment observation**

Pre-treatment observation was recorded for assessing whether the damage by the pest was uniformly distributed over all the treatments. The dead heart infestation percentage ranged from 7.62 to 10.35.

**15$^{th}$ day after first spray**

The result revealed on the pest infestation of 15th days after first spray, all the treatments had registered significantly low infestation as compared to untreated control. The Cartap hydrochloride + Fipronil 4% + 0.5% CG proved to be the best treatment with lowest infestation (4.86% DH). The next effective treatment was Fipronil 0.3% GR recorded 5.29% DH infestation followed by Chlorantraniliprole 0.4% GR, Chlorantraniliprole 18.5% SC, Fipronil 5% SC, Flubendiamite 9.35% SC and Cartap hydrochloride 50% SC, with 5.71, 6.34, 6.58, 7.24 and 7.85 per cent DH infestation respectively. However, the highest infestation per cent (10.63) was recorded in the untreated control plot.

**15$^{th}$ day after second spray**

On 15th day after second spray, the DH infestation per cent reached to minimum as compared with the first spray. All the treatments proved their superiority over untreated control in recording low infestation level. Cartap hydrochloride + Fipronil 4% + 0.5% CG was found most effective treatment in recording the least infestation of (1.86 per cent) dead heart. The next effective treatment was Fipronil 0.3% GR with 2.56 per cent dead heart infestation followed by Chlorantraniliprole 0.4%GR (3.01 per cent), Chlorantraniliprole 18.5%SC (3.41 per cent), Fipronil 5%SC (3.97 per cent), Flubendiamite 9.35%SC (4.08 per cent) and Cartap hydrochloride 50%SC (4.12 per cent) infestation which were at par with each other. The highest infestation (12.59 per cent) was recorded in untreated control plot.

**Overall efficacy after first and second spray**

The overall mean infestation percentage after 1st and 2nd sprays revealed that all the treatments had significantly superior to the untreated control. The infestation level ranged from 3.36 to 11.61per cent. The minimum infestation (3.36 per cent) was recorded in Cartap hydrochloride + Fipronil 4% + 0.5%CG and was superior over rest of the treatments which are as follows Fipronil 0.3%GR (3.93 per cent) followed by Chlorantraniliprole 0.4%GR (4.36 per cent), Chlorantraniliprole 18.5%SC (4.87 per cent), Fipronil 5%SC (5.28 per cent), Flubendiamite 9.35%SC (5.66 per cent) and Cartap hydrochloride 50%SC (5.98 per cent). The maximum infestation (11.61 per cent) was recorded in untreated control plot. 4.3.2

**Efficacy of newer insecticides against infestation (white ear head) of YSB on rice after first and second spray**

The overall mean infestation percentage after first and second sprays showed that all the treatments were significantly superior to the untreated control. The infestation level ranged from 2.68 to 10.45 per cent. The minimum infestation 2.68% was recorded in Cartap

hydrochloride + Fipronil 4% + 0.5% CG and was superior over rest of the treatments which were as follows Fipronil 0.3%GR (3.21%) followed by Chlorantraniliprole 0.4%GR (3.48 %), Fipronil 5%SC (3.66%), Chlorantraniliprole 18.5%SC (4.21%), Flubendiamite 9.35%SC (4.57%) and Cartap hydrochloride 50%SC (4.88%). However, the maximum (10.45%) infestation was recorded in untreated plot.

**Cost assessment of different treatments against Yellow stem borer on rice during *Kharif* 2020-21.**

A perusal of results represented in Table 4.7 revealed that all the treatments recorded higher grain yield of rice over untreated control. Cartap hydrochloride + Fipronil 4% + 0.5%CG proved to be the best and obtained highest yield (50.70 q/ha) followed by Fipronil 0.3%GR (45.75 q/ha). Fipronil 5%SC (42.45 q/ha) was the next level best treatment followed by Chlorantraniliprole 18.5%SC (41.85), Flubendiamite 39.35%SC (40.95 q/ha), Chlorantraniliprole 0.4%GR (40.80 q/ha) and Cartap hydrochloride 50%SP (38.40 q/ha). Whereas, the lower yield (36.65 q/ha) gained from control plot

The net return amount of different insecticidal treatments applied for the management of YSB also showed that the highest was obtained in Cartap hydrochloride + Fipronil 4% + 0.5%CG (Rs. 61120.44/ha) followed by Fipronil 0.3%GR (Rs. 41863.76/ha), Fipronil 5% SC (Rs. 26370.44/ha), Chlorantraniliprole 18.5% SC (Rs. 19868.24/ha), Flubendiamite 39.35%SC (Rs. 18367.68/ha), Chlorantraniliprole 0.4%GR (Rs. 14245.76/ha), whereas the minimum net profit (Rs. 6402.12/ha) was recorded in Cartap hydrochloride 50%SP.

**Table.1** Details of the insecticides used for the experiment

| S. No. | Treatments | Trade Name & Formulations | Dose ha$^{-1}$ | Chemical Groups |
|---|---|---|---|---|
| **T1** | Fipronil | Fiproper 0.3%GR | 15kg | Phenyl pyrazoles |
| **T2** | Chlorantraniliprole | Ferterra 0.4%GR | 12Kg ha$^{-1}$ | Anthralinic Diamides |
| **T3** | Cartap hydrochloride | Carrox-50 50%SP | 1Kg ha$^{-1}$ | Nereistoxin analoques |
| **T4** | Cartap hydrochloride+ Fipronil | Exotica 4% + 0.5%CG | 20 Kg ha$^{-1}$ | Nereistoxin analoques + Phenyl pyrazoles |
| **T5** | Fipronil | Fiproper 5%SC | 1000ml ha$^{-1}$ | Phenyl pyrazoles |
| **T6** | Chlorantraniliprole | Cosko 18.5%SC | 150ml ha$^{-1}$ | Anthralinic Diamides |
| **T7** | Flubendiamite | Fame 39.35%SC | 150ml ha$^{-1}$ | Phthalic acid diamide |
| **T8** | Control | - | - | |

**Table.2** Efficacy of newer insecticides against yellow stem borer on rice during *Kharif* 2020-21

| S. No | Treatments | Trade Name | Dose/ha | Mean infestation (%) | | | Overall mean infestation (DH) | DH (%) reduction over control | Overall mean infection (WE) | WE (%) reduction over control |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Pre treatment | 15th day after 1st spray | 15th day after 2nd spray | | | | |
| $T_1$ | Fipronil 0.3% GR | Fiproper | 15 kg | 7.62 (15.95)* | 5.29 (13.27) | 2.56 (9.18) | 3.93 | 66.19 | 3.21 | 69.33 |
| $T_2$ | Chlorantraniliprole 0.4% GR | Ferterra | 12 kg | 8.65 (17.05) | 5.71 (13.78) | 3.01 (9.92) | 4.36 | 62.47 | 3.48 | 66.73 |
| $T_3$ | Cartap hydrochloride 50% SC | Carrox-50 | 1 kg | 9.79 (18.19) | 7.85 (16.22) | 4.12 (11.59) | 5.98 | 48.46 | 4.88 | 53.31 |
| $T_4$ | Cartap hydrochloride + Fipronil 4% + 0.5% CG | Exotica | 20 kg | 8.05 (16.42) | 4.86 (12.65) | 1.86 (7.64) | 3.36 | 71.07 | 2.68 | 74.38 |
| $T_5$ | Fipronil 5% SC | Fiproper | 1000ml | 9.52 (17.96) | 6.58 (14.54) | 3.97 (11.36) | 5.28 | 58.01 | 3.66 | 64.94 |
| $T_6$ | Chlorantraniliprole 18.5% SC | Cosko | 150ml | 10.35 (18.74) | 6.34 (14.83) | 3.41 (10.61) | 4.87 | 54.91 | 4.21 | 59.74 |
| $T_7$ | Flubendiamite 9.35% SC | Fame | 150ml | 9.75 (18.19) | 7.24 (15.54) | 4.08 (11.49) | 5.66 | 51.22 | 4.57 | 56.31 |
| $T_8$ | Control | - | - | 8.90 (17.33) | 10.63 (19.01) | 12.59 (20.76) | 11.61 | 0.00 | 10.45 | 0.00 |
| | SEm (±) | | | - | 0.57 | 0.72 | | | | |
| | CD (P=0.05) | | | NS | 1.73 | 2.29 | | | | |
| | CV (%) | | | - | 6.54 | 10.71 | | | | |

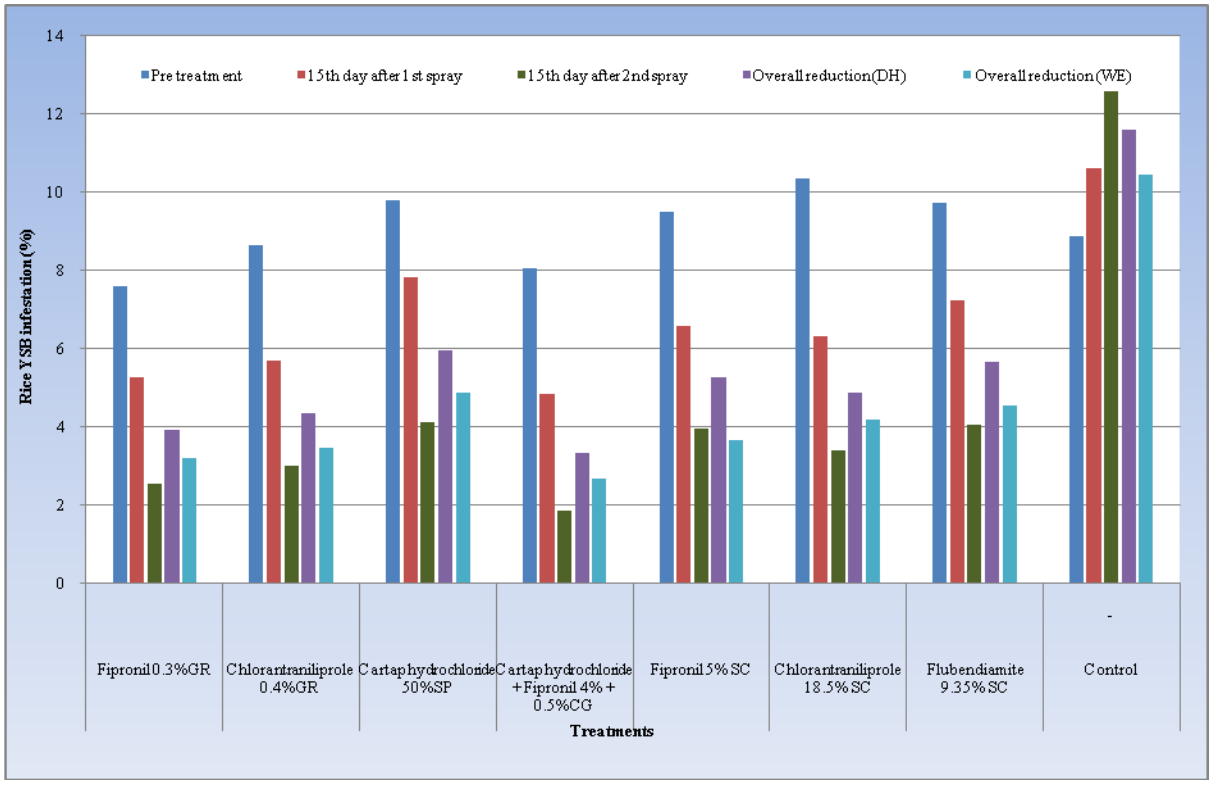
*The data are parenthesis in angular transformed value, (DH) Head heart, (WE) White ear

**Table.3** Cost assessment ratios among different insecticidal treatments against YSB on rice during *Kharif* 2020-21.

| S. No | Name of treatment | Dose/ha | Yield (q/ha) | (%) Yield over control | Additional yield (Rs/ha) | Cost of treatment including labour charge (Rs/ha) | Net return (Rs/ha) | Benefit Cost Ratio |
|---|---|---|---|---|---|---|---|---|
| $T_1$ | Fipronil 0.3% GR | 15 kg | 45.75 | 24.82 | 46363.76 | 4500 | 41863.76 | 1:9.30 |
| $T_2$ | Chlorantraniliprole 0.4% GR | 12 kg | 40.80 | 11.32 | 21145.76 | 6900 | 14245.76 | 1:2.06 |
| $T_3$ | Cartap hydrochloride 50% SP | 1 kg | 38.40 | 5.59 | 10442.12 | 4040 | 6402.12 | 1:1.58 |
| $T_4$ | Cartap hydrochloride + Fipronil 4% + 0.5% CG | 20 kg | 50.70 | 38.33 | 71600.44 | 10480 | 61120.44 | 1:5.83 |
| $T_5$ | Fipronil 5% SC | 1000ml | 42.45 | 15.83 | 34651.4 | 3200 | 26370.44 | 1:8.24 |
| $T_6$ | Chlorantraniliprole 18.5% SC | 150ml | 41.85 | 14.18 | 26488.24 | 6620 | 19868.24 | 1:3.00 |
| $T_7$ | Flubendiamite 9.35% SC | 150ml | 40.95 | 11.76 | 42310.2 | 3600 | 18367.68 | 1:5.10 |
| $T_8$ | Control | - | 36.65 | | | | | |

Labour rate per day = Rs. 300/ labour (2 labour required for spraying in $ha^{-1}$/day), Price of paddy Rs. 1868/q

**Fig.1** Efficacy of newer insecticides against infestation of yellow stem borer on rice during *Kharif* 2020-21



Likewise Fipronil 0.3%GR was high with Benefit Cost Ratio of (1:9.30) followed by Fipronil 5%SC (1:8.24), Cartap hydrochloride + Fipronil 4% + 0.5%CG (1:5.83), Flubendiamite 39.35%SC (1:5.10), Chlorantraniliprole 18.5%SC (1:3.00) and Chlorantraniliprole 0.4%GR (1:2.06), while Cartap hydrochloride 50%SP was recorded with least Benefit Cost Ratio (1:1.58).

The current findings are supported by Yadav and Gupta (2020) who reported that the Fipronil 5%SC was reduced the dead heart of rice after first dose of insecticide application and it also reduced the white ear heads of rice after second dose of insecticide application at 3, 10 and 15 days, respectively.

Similarly, supported by the work of Mondal and Chakraborty (2016), they found that the new molecule of Fipronil showed the maximum reduction of 56.28% DH and 65.27% WH over control after 35 days of spraying, while, Dursban had reduced 30.01% DH and 40.27% WH. Chormule *et al.*, (2014) also reported that the infestation of rice stem borer was effectively checked due to spray of Fipronil 5 SC @ 30 g a.i./ha and proved to be most effective treatment (4.08 per cent). The next best treatment was Flubendiamide 480 SC @ 30 g a.i./ha, Indoxacarb 14.5 SC @ 30 g a.i./ha, Cartap hydrochloride 50 SP @ 375 g a.i./ha, Lambda cyhalothrin 5 EC @ 25 g a.i./ha and Imidacloprid 17.8 SL @ 25 g a.i./ha. Biopesticides viz. *M. Anisopliae,* Bt. It has been shown to be comparatively least successful.

Pallavi *et al.*, (2018) recorded the new molecules of Chlorantraniliprole 0.4 GR and Flubendiamide 480 SC was proved very effective in recording lowest per cent infestation on rice against yellow stem borer, whereas Acephate 95 SG, Lambda-cyhalothrin 4.9 CS and Fipronil 0.3 GR were recorded lowest damage compared to standard check chlorpyriphos 20 EC.

However, the current finding showed that the Fipronil 0.3%GR had best reduction of YSB infestation after Cartap hydrochloride + Fipronil 4% + 0.5%CG, and Chlorantraniliprole 0.4%GR was found second level best treatment

## References

Khanjani, M. 2006. Crop pests of Iran. Buali Sina University Press. Pp. 717

Dinesh, G. K., Ramesh, P. T., Chitra, N. and Sugumaran, M. P. 2018. Ecology of birds and insects in organic and conventional (In-organic) rice ecosystem. International Journal of Current Microbiology and Applied Sciences, **7**(4): 1769-1779.

Food and Agriculture Organization (FAO), FAOSTAT, 2004, (Fide: http: //www. faostat.fao.org/site/339/default.aspx.).

Bhumireddy, S., Simon, S. and Nagar, S. 2018. Seasonal incidence of rice leaf folder, *Cnaphalocrocis medinlis* (Guen) in Allahabad region. Journal of Pharmacognosy and phytochemistry, 7(4); 2528-2530.

Yarasi, B, Sadumpati, V., Immanni, C. P., Vudem, D. R. and Khareedu, V. R. 2008. Transgenic rice expressing *Allium sativum* leaf agglutinin (ASAL) exhibits high-level resistance against major sap sucking pests. BMC Plant Biology 8(1): 102-115.

Mondal, I. H. and Chakraborty, K. 2016. Relative efficiency of some selected insecticide formulations on yellow stem borer, *Scirpophaga incertulas* (walk.) In rice field at Murshidabad, West Bengal, India. Journal of Entomology and Zoology Studies 2016; 4(6): 471-477.

Dhaliwal, G. S., Jindal, V. and Dhawan, A. K. 2010. Insect pest problems and crop losses: changing trends. Indian Journal of Ecology, 37(1): 1-7.

Krishnaiah, and Varma, N. R. G. 2015. Changing Insect Pest Scenario in the Rice Ecosystem – A National Perspective. IRRRI Book, 31-42.

Parwez, A., Misra, A. K., Mandal, S. K. and Sattar, A. (2005). Activity of *Scirpophaga incertulas* and *Lycosa pseudoannulata* in boro rice as influenced by meteorological parameters. J. Appl. Biol., 15(2): 55-59.

Rehman, A., Ehsan-ul-Haq and Inayatullah, C. 2002. Impact of tillage Prac. And cropping patterns on the survival of yellow rice stem borer, *Scirpophaga incertulas*. Pak. J. Agri. Res., 17 (2): 163-169.

Yadav, A. and Gupta, P. K. 2020. Evaluation of New Insecticide Molecules against Rice Yellow Stem Borer *Scirpophaga incertulas* Walker (Pyralidae: Lepidoptera) under Faizabad Condition. Int. J. Curr. Microbiol. App. Sci., 9(04): 2772-2777.

Chormule, A. J. Kharbade, S. B., Patil, S. C. and Tamboli, N. D. 2014. Bioefficacy of new insecticide molecules against rice Yellow stem borer, *Scirpophaga incertulas* (walker). An International Quarterly Journal of Environmental Sciences. Vol., 6: 63-67.

Pallavi, D, Sharanabasappa and Girijesh G K. 2018. Evaluation of newer insecticide molecules against rice stem borer *Scirpophaga incertulas* on paddy. International Journal of Chemical Study, 6(2): 2551-2554.

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