Efficacy of some insecticides and biopesticides for the management of white stem borer, *Scirpophaga fusciflua* Hampson in paddy

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ABSTRACT

The field experiment was conducted on paddy at farmer’s field in the Kangra district, to find out the effectiveness and economically viable control measures for the management of white stem borer. Application of various insecticides viz. flubendiamide 48% SC @ 50 ml ha⁻¹, rynaxypyr 20 SC @ 150 ml ha⁻¹, dinotefuran 20 SG @ 200 g ha⁻¹, monocrotophos 36 SL @ 850 ml ha⁻¹ and two biopesticides viz. melia 5% @ 2.5 L ha⁻¹ and eupatorium 5% @ 2.5 L ha⁻¹, were tested along with untreated control. All the insecticidal treatments were found significantly superior to untreated control. Flubendiamide 48% SC @ 50 ml ha⁻¹ and rynaxypyr 20 SC @ 150 ml ha⁻¹ were found most promising with minimum dead heart and white ears. The data on dead heart, white ear incidence and grain yield showed that all the insecticides were found to have effective control against stem borer on paddy. Considering the efficacy data with very low dose of flubendiamide 48% SC proved to be better and economically viable option for management of stem borer.

Key words: Dead hearts, Kharif, Paddy, White ears, White stem borer.

INTRODUCTION

Rice (*Oryza sativa* L.), is the most important cereal crop of the world. More than 90 per cent of the world’s rice is grown and consumed in Asia, where 60 per cent of the earth’s people live. India is the largest rice growing country of the world.

Insect-pests are the major constraints in enhancing the rice productivity, besides diseases and weeds (Behura et al., 2011). More than 100 species of insects are known as pests of this crop out of which 20 are of major economic significance. Stem borers are key group of insect pests of rice. This insect attacks the crop from the seedling stage to the harvesting stage and thus causes complete loss of affected tillers. The yield losses caused by insect pests in rice have been reported to the tune of 25 per cent (Dhaliwal et al., 2010). The larvae of rice stem borers, after hatching, bore into the stem of rice plant and cut out the food supply to the upper part of the affected stem. Dead hearts are found when the insect attacks at vegetative stage while white ears occur when the stem borer attack at reproductive stage (Chatterjee and Mondal, 2014).

The indiscriminate use of chemical insecticides can be environmentally disruptive and can result in the accumulation of residues in the harvested produce (Rath, 2001). The use of conventional insecticides causes sudden decrease in the number of natural enemies also. This study was conducted to evaluate the effect of insecticides and biopesticides on the dead hearts and white ears by rice stem borer.

MATERIALS AND METHODS

Field experiment was conducted in randomized block design with three replications and seven treatments (6+1 untreated check) on paddy at farmer’s field in the Kangra district, during kharif 2015 and 2016. Plot size was of 9.6 m² with row to row and plant to plant spacing of 20cm and 15cm, respectively.

The treatments were applied at 30 days after transplanting and were repeated at 15 days interval. Two consecutive applications were made. For recording the data with regard to the incidence, ten hills were marked in each plot and observation on white stem borer incidence was recorded one day before and thereafter seven and fifteen days after spray. The per cent plant damage was calculated by counting number of dead hearts or white ears on 10 randomly selected hills/plot by using formula.

At vegetative stage:

\[ \text{Infestation(\%) = \frac{\text{Total number of dead hearts}}{\text{Total number of tillers}} \times 100} \]

At booting stage

\[ \text{Infestation(\%) = \frac{\text{Total number of white ears}}{\text{Total panicle bearing tillers}} \times 100} \]

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The grain yield per plot was recorded. The economics of different insecticidal treatments was worked out on the basis of prevailing market price of insecticides and application cost and finally the benefit-cost-ratio was also worked out. The data was analyzed statistically in RBD (Singh et al., 1991).

RESULTS AND DISCUSSION

A perusal of data on per cent dead hearts infestation due to white stem borer revealed that there were no significant differences in different treatments and infestation varied from 7.92 to 9.04 per cent (Table 2).

First spray: In all the treatments, there was a significant reduction in plant infestation as compared to the untreated control at seven days after first spray (DAFS) schedule. The treatment dinotefuran at 7 DAFS was found to be the most effective for the control of white stem borer with 8.54 per cent infestation as compared to untreated control with 12.05 per cent infestation. The next best treatments in descending order were flubendiamide > monocrotophos > rynaxypyr > melia > eupatorium, being at par with each other and also with dinotefuran. Fifteen days after first spray, rynaxypyr treated plots recorded 10.00 per cent infestation as compared to 16.42 per cent in untreated control plots and was significantly superior to other tested insecticides and biopesticides. This was followed by dinotefuran, flubendiamide and monocrotophos with respective dead hearts infestation of 10.27, 10.47 and 11.33 per cent being at par with each other as well as with dinotefuran. Among biopesticides, eupatorium treated plots showed minimum infestation (12.78%) and was at par with insecticide treatment monocrotophos. It was further at par with melia.

Second spray: The observations at 7 DASS (Table 2) revealed almost a similar trend as obtained after first spray. Flubendiamide recorded 10.56 per cent infestation which was significantly more effective as compared to untreated control (18.68 per cent) and over other biopesticides treatments. This was followed by rynaxypyr (11.33 per cent), dinotefuran (11.99 per cent) and monocrotophos (13.61 per cent). Eupatorium (14.99 per cent) was least effective followed by melia 15.49 per cent infestation, being statistically at par. After fifteen days of second spray, all the treatments gave significant reduction in white ears infestation as compared to untreated control that recorded 14.95 per cent infestation. Flubendiamide treated plots with 2.74 per cent infestation continued to be the most superior and was significantly superior to the biopesticides. Among biopesticides, eupatorium recorded minimum of 9.56 per cent and melia recorded 10.85 per cent of white ears infestation were least effective among all the treatments and more effective compare to the control.

Benefit-cost-analysis: Data obtained on the benefit-cost analysis of various treatments (pooled data) revealed that Monocrotophos (10.32: 1) and flubendiamide (10.31: 1) were the most economically viable treatments on the basis of benefit-cost-ratio (Table 3). This was followed by dinotefuran (6.69:1) and rynaxypyr (6.03:1). Among the biopesticides, eupatorium (4.19:1) was showed comparatively higher Benefit-cost ratio as compared to melia (3.69:1).

The present findings are supported by the result of Sekh et al., (2007) who reported that Flubendiamide 480 SC @ 24 and 30 g a.i ha⁻¹ effectively control the yellow stem borer.

Anonymous, (2006) has reported the damage suppression efficacy of rynaxypyr 0.4G @ 40 and 50 g a.i./ ha could effectively control stem borer complex and increasing grain yield. Gowda, (2005) reported that flubendiamide 20 WDG at 25 and 50 g a.i ha⁻¹ recorded low incidence of dead hearts (0.81 and 0.53 %) and white ears (1.26 and 1.20%) compared to other treatments. Thilagam, (2006) reported

Table 1: List of the insecticides and biopesticides.

| Treatments          | Dosage (per ha) |
|---------------------|-----------------|
| T₁                   | Flubendiamide 48 % SC | 50 ml |
| T₂                   | Rynaxypyr 20 SC   | 150 ml |
| T₃                   | Dinotefuran 20 % SG | 200 g |
| T₄                   | Monocrotophos 36 % SL (standard check) | 850 ml |
| T₅                   | Melia 5 %         | 1.5-2.5 L |
| T₆                   | Eupatorium 5 %    | 1.5-2.5 L |
| T₇                   | Untreated check   | -     |

Note: Figures in the parentheses are the arc sin transformed values.

Table 2: Efficacy of insecticides and biopesticides against white stem borer during kharif 2015 and 2016 at farmer’s field (Kohala).

| Treatments | Prior to spray | First spray | Second spray |
|------------|----------------|-------------|--------------|
|            | DH%            | 7 DAFS      | 15 DAFS      | 7 DASS       | 15 DASS      |
| T₁         | 8.98 (17.38)   | 9.19 (17.56)| 10.47 (18.75)| 10.56 (18.84)| 2.74 (9.52) |
| T₂         | 9.04 (17.40)   | 9.32 (17.67)| 10.00 (18.31)| 11.33 (19.52)| 3.58 (10.90)|
| T₃         | 8.23 (16.60)   | 8.54 (16.90)| 10.27 (18.53)| 11.99 (20.19)| 5.52 (13.57)|
| T₄         | 8.74 (17.15)   | 9.21 (17.63)| 11.33 (19.62)| 13.61 (21.62)| 6.73 (15.03)|
| T₅         | 7.92 (16.29)   | 9.67 (18.07)| 13.58 (21.55)| 15.49 (23.11)| 10.85 (19.22)|
| T₆         | 8.13 (16.42)   | 9.80 (18.14)| 12.78 (20.83)| 14.99 (22.68)| 9.56 (17.99)|
| T₇         | 8.75 (17.16)   | 12.05 (20.28)| 16.42 (23.84)| 18.68 (25.54)| 14.95 (22.74)|

CD (0.05) (NS) (1.61) (1.58) (1.48) (0.66)

Note: Figures in the parentheses are the arc sin transformed values.
DAFS: Days after first spray and DASS: Days after second spray.
DH= dead hearts, WE = white ears.
Table 3: Benefit-cost-analysis for the management of rice white stem borer

| Treatments         | Dose (ha) | Cost of spray (Rs) | Yield (q/ha) | Value of additional grain yield (Rs) | BCR |
|--------------------|-----------|--------------------|--------------|-------------------------------------|-----|
| Flubendiamide 48% SC | 50 ml     | 950                | 41.83        | 20924                               | 10.31: 1 |
| Rynaxypyr 20 SC      | 150 ml    | 2100               | 40.62        | 19169                               | 6.03: 1 |
| Dinofeturan 20%G     | 200 g     | 1300               | 38.38        | 15921                               | 6.69: 1 |
| Monocrotophos 36% SL | 850 ml    | 364                | 37.68        | 14906                               | 10.32: 1 |
| Melia 5%             | 2.5 L     | 1500               | 33.96        | 9512                                | 3.69: 1 |
| Eupatorium 5%        | 2.5 L     | 1500               | 34.86        | 10817                               | 4.19: 1 |
| Control              | -         | -                  | 27.4         |                                     |     |

that flubendiamide 480 SC at 30 g a.i ha⁻¹ was effective against stem borer in rice and also found to be safe to the spiders and coccinellids in the rice ecosystem. Dinofeturon 20% @ 200 ml/ha and Monocrotophos (Monocrown) 36% @ 1390ml/ha were effective against rice stem borer Rath, (2012). Sandhu and Dhaliwal (2016) found Fame 480 SC @ 50 ml/ha was most promising with minimum dead heart and white ears. Rana and Singh (2017) found chlorantraniliprole 18.5 SC was most effective and minimum infestation of *S. incertulas* with 2.73 per cent (DH) and 2.06 per cent (WE) after first and second spray, respectively. Considering the efficacy of low doses Fame 480 SC proved to be better and economically viable option for the management of rice white stem borer.

REFERENCES

Anonymous, (2006). Handbook of Agriculture, Indian Agril. Res. Inst., New Delhi, PP. 817-844.
Behura, N., Sen, P. and Kar, M.K. (2011). Introgression of yellow stem borer (*Scirpophaga incertulas*) resistance gene into cultivated rice (*Oryza* sp.) from wild spp. *Indian Journal of Agricultural Sciences.* 81: 359-362
Chatterjee, S. and Mondal, P. (2014). Management of rice yellow stem borer, *Scirpophaga incertulas* (Walker) using some biorational insecticides. *Journal of Biopesticides.* 7: 143-147.
Dhaliwal, G.S., Jindal, V. and Dhawan, A.K. (2010). Insect pest problems and yield losses: Changing trends. *Indian Journal of Ecology,* 37: 1-7.
Gowda, J. (2005). Bio efficacy of flubendiamide 20 WDG (RIL- 038) against rice stemborer, *Scirpophaga incertulas* (Wlk). *Pestology.* 29: 19-20.
Rath, P.C. (2001). Efficacy of insecticides, neem and Bt formulation against stem borer on rice yield in West Bengal. *Journal of Applied Zoology Research.* 12: 191-93.
Rath, P.C. (2012). Field evaluation of newer insecticides against insect pest of rice. *Indian Journal of Plant Protection.* 40: 148-149.
Rana, R. and Singh, G. (2017). Efficacy and economics of newer insecticides against yellow stem borer, *Scirpophaga incertulas* walker in basmati rice. *Journal of Plant Development Sciences* 9 (1): 35-39.
Sandhu, G.S. and Dhaliwal, N.S. (2016). Evaluation of different insecticides against major insect pests of rice in Punjab. *International Journal of Plant Protection* 9: 187-192.
Sekh, K., Nair, N., Gosh, S.K. and Somachoudhury, A.K. (2007). Evaluation of flubendiamide 480 SC against stem borer and leaf folder of rice and effect on their natural enemies. *Pestology.* 31: 32-34.
Singh, S., Singh, T., Bansal, M.L. and Kumar, R. (1991). Statistical Methods for Research Workers. Kalyani Publishers, New Delhi.
Thilagam, P. (2006). Evaluation of flubendiamide 480 SC against bollworm complex in cotton and leaf folder and stem borer in rice.
Un published. PhD thesis. Tamil Nada Agricultural University, Coimbatore, India. PP 232.