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Evaluation of different insecticides against major insect pests of rice in Punjab

■ GURMAIL SINGH SANDHU* AND N.S. DHALIWAL

Krishi Vigyan Kendra, SRI MUKTSAR SAHIB (PUNJAB) INDIA

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ABSTRACT

Field experiments were conducted at Krishi Vigyan Kendra, Sri Muktsar Sahib, Punjab, to find effectiveness of different insecticides against stem borer and leaf folder in rice and basmati rice. During *Kharif* 2014, Fame 480 SC (flubendiamide 39.35 %) @ 50 ml/ha, Dursban (chlorpyriphos 20% EC) @ 2500 ml/ha, Marktriazo (triazophos 40% EC) @ 875 ml/ha and Sutathion (triazophos 40 % EC) @ 875 ml/ha were tested along with untreated control in rice. All the insecticidal treatments were significantly superior to untreated control. Fame 480 SC @ 50 ml/ha was found most promising with minimum dead heart, white ear and leaf folder incidence. During, *Kharif* 2015, three different brands of fipronil 0.3 G (Mifpro-G, Mahveer GR, Regent) @ 15kg/ha, two brands of cartap hydrochloride 4 per cent G (Miftap, Nidan) @ 25 kg/ha were tested along with flubendiamide (Fame 480 SC) @ 50 ml/ha in basmati rice. The data on dead heart, white ear, leaf folder incidence, grain yield showed that all the insecticides effectively control the stem borer on basmati rice, but Fame 480 SC, Nidan and Miftap were comparatively more effective against leaf folder. Considering the efficacy data and very low dose (ha^{-1}), Fame 480 SC proved to be better option for management of two major pests of rice.

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***Corresponding author:**
Email: gurmailent@pau.edu

INTRODUCTION

Rice (*Oryza sativa* L.), is the most important cereal crop of the world, which occupies fore most status in human food requirements. 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 having 41.85 m ha area under this crop with 102 m tones production. In Punjab, rice is main crop, cultivated over 28.51 lakh ha area with annual grain production of 169.1 lakh tonnes, whereas basmati rice is cultivated in 20 per cent area under rice (Anonymous, 2015). The productivity of rice in India is quite low (3.01 tonnes ha^{-1}) as compared to world average of 4.02 tonnes ha^{-1} (Anonymous, 2012). Among the various factors, insect pests are the main causes of low yields of rice in India (Matteson, 2000 and Behura *et al.*, 2011). Rice crop is attacked by more than 100 species of insects, but 20 species are of

economic importance (Kalode, 2005). The yield losses caused by insect pests in rice have been reported to the tune of 25 per cent (Dhaliwal *et al*., 2010). Among the insect pests, yellow stem borer (YSB), *Scirpophaga incertulas* (Walker) is the most destructive pest of rice, causing yield losses to the tune of 10-60 per cent every year (Panda *et al.,* 1976; Mahar *et al.*,1985; Pasalu *et al.*, 2005 and Anonymous, 2006). Globally, yellow rice stem borer alone causes yield losses of 10 million tones and accounts for 50 per cent of all insecticides used in the rice field (Huesing and English, 2004). This insect attacks the crop from the seedling stage to the harvesting stage and thus causes complete loss of affected tillers. 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 produced when the insect attacks at vegetative stage while white ears occur when the stem borer attack at reproductive stage (Mahmood-ur-Rehman, *et al.*, 2007; Chatterjee and Mondal, 2014). Low percentage of dead hearts at early crop stage are compensated by rice plant, but 1-4 per cent loss of yield is expected for every per cent of white ear (Muralidharan and Pasalu, 2006). The rice leaf folder, *Cnaphalocrocis medinalis* (Guenee) is another important pest of rice in Punjab, which gained the status of economic pest during last few years. The larvae of this pest fastens the edges of leaves together, fold them longitudinally and feed on green matter from inside the folded leaves which results in reduced photosynthetic activity. Depending upon stage of the crop at the time of infestation, 18 to 60 per cent yield losses by leaf folder has been reported (Ramasamy and Jaliecksono, 1996 and Alvi *et al.*, 2003).

The hot and humid environment during rice growing season is very conductive for proliferation of insect pests. Pesticides are commonly used by the farmers to manage stem borer and leaf folder in rice. Use of insecticides has shown a positive impact on rice production (Misra and Parida, 2004), though they have some environmental impact also (Khan *et al*., 2010). Keeping in view the importance of rice and basmati rice, studies were conducted to evaluate efficacy of different insecticides against rice stem borer and leaf folder. The objective of the study was to find effective insecticide and provide option to the farmers for choice of insecticides for efficient control of important pest of rice in Punjab.

MATERIAL AND METHODS

The adaptive research trials were conducted during *kharif* 2014 and 2015 at Krishi Vigyan Kendra, Sri Muktsar Sahib, Punjab, to find effectiveness of some new insecticides as well new brand of already recommended insecticides at field level. During *Kharif* 2014, four insecticides *viz.,* Fame 480 SC (flubendiamide 39.35 %) @ 50 ml/ha, Dursban (chlorpyriphos 20% EC) @ 2500 ml/ha and two different brands of triazohos 40 per cent EC *i.e*. Marktriazo and Sutathion were tested @ 875 ml/ha along with untreated control. Thirty five days old seedlings of rice variety PR 111 was transplanted in the field on 1-07-14. Seedlings were transplanted in lines at 20 x 15 cm (33 hills/sq m). The agronomic practices were carried as per recommended package of practices (Anonymous, 2015). In *Kharif* 2015, five granular insecticides *viz.*, Mifpro-G (fipronil 0.3 % G), Miftap (cartap hydrochloride 4 % G), Mahveer GR (fipronil 0.3 G), Regent (fipronil 0.3 % G), Nidan (cartap hydrochloride 4 % G) of different companies along with one liquid insecticide, Fame 480 SC (flubendiamide 39.35 %) and untreated control were tested for their efficacy against stem borers and leaf folder in basmati rice. Thirty days old nursery of basmati rice variety Pusa Basmati 1121 was transplanted on 10-07-15 as per recommended package of practice. The crop was observed regularly for pest attack and insecticides were applied when stem borers incidence reached above Economic Threshold Level (ETL) of 5 per cent in paddy and 2 per cent in basmati rice. Pre-treatment observation was taken 24 hours before the application of insecticides which was about 50 days after transplantation of crop. Fifteen hills were observed per treatment, selected at random and dead hearts were counted at vegetative stage. Post treatments data were recorded at ten days after the application of insecticides. White ear were also counted in the same manner, before crop harvest. The leaf folder damage was also recorded and per cent incidence was worked out. Ten hills per plot were selected randomly and leaf showing damage symptom in at least one-third its area, was considered. Total numbers of leaves per hill were counted and per cent leaf folder damage was worked out. The yield data were recorded on whole plot basis. All the data recorded were subjected to analysis of variance (ANOVA) and means were compared by least significant difference (LSD) test at 5 per cent level of significance.

RESULTS AND DISCUSSION

The results of the experiment conducted during 2014 are summarized in Table 1. Pre treatment stem borer incidence in term of dead heart varied from 5.0-5.74 per cent in different plots. The data recorded at 10 days after treatment (DAT) revealed that all the insecticides were significantly better than untreated control in reducing the dead heart incidence by stem borer. Fame 480 SC @ 50ml/ha was most promising with 4.44 per cent dead heart incidence, significantly lower than remaining treatments. Dursban @ 2500 ml/ha was next best treatment followed by Marktraizo @ 875 ml/ha and Sutathion @ 875ml/ha. Similarly, white ear incidence at harvest was significantly lower in insecticidal treated plots as compared to untreated control (3.75 %). The white ear incidence being minimum in Fame 480 SC (0.90%), was on par with all the other test insecticides. Leaf folder incidence during study period was low and it varied from 1.47-4.11 per cent in different treatments. All the insecticides significantly reduced the leaf folder damage than untreated control. Leaf folder incidence was significantly lower in Fame 480 SC, followed by Marktraizo and Sutathion. The incidence in Dursban was higher than other insecticidal treatments but significantly lower than untreated control. The grain yield data also showed that all the insecticidal treatments were significantly superior to untreated control. Grain yield in the insecticidal treated plot being on par with each other varied from 65.50-66.75 q/ha as compared to 62.50 q/ha in untreated control. The B:C ratio was highest in case of Sutathion 40 (1.95:1 each) and lowest in untreated control (1.81:1). The B:C ratio of other insecticides were comparable. The results of this study were in agreement to the findings of Sontakke and Dash (2000), who reported that application of chlorpyriphos, triazophos, ethoprophos, carbofuran and fipronil at 50 DAT effectively controlled stem borer. Prasad *et al*., 2010 reported that flubendiamide 480 SC@ 24 g.a.i. ha^{-1} and the combination of acetamiprid 0.4 per cent and chlorpyriphos 20 per cent @ 510 g.a.i. ha^{-1} were effective

Table 1 : Efficacy of different insecticides against stem borer and leaf folder on rice during *Kharif* 2014

Treatments	Dose (ml/ha)	Dead heart (%)		White ear (%)	Leaf folder incidence (%)	Yield (q/ha)	Gross Return (Rs./ha)	Net return (Rs./ha)	B:C Ratio
		Pre treatment	10 DAT						
Fame 480SC (flubendiamide 39.35 %)	50	5.00	4.44	0.90	1.47	66.25	92750	60950	1.92:1
Dursban (chlorpyriphis 20% EC)	2500	5.39	4.89	1.36	2.85	65.75	92050	60325	1.90:1
Marktriazo (triazophos 40 % EC)	875	5.05	5.15	1.25	2.00	65.50	91700	60200	1.91:1
Sutathion (triazophos 40 % EC)	875	5.74	5.30	0.94	2.14	66.75	93450	61805	1.95:1
Untreated control	-	5.30	5.77	3.75	4.11	62.50	87500	56400	1.81:1
C.D. (P=0.05)		NS	0.36	0.52	0.91	1.32	-	-	-

DAT= days after treatment NS=Non-significant

Table 2 : Efficacy of different insecticides against stem borer and leaf folder on basmati rice during *Kharif* 2015

Treatments	Dose/ha	Dead heart (%)		White ear (%)	Leaf folder incidence (%)	Yield (q/ha)	Gross return (Rs./ha)	Net return (Rs./ha)	B:C ratio
		Pre treatment	10 DAT						
Mifpro-G (fipronil 0.3 % G)	15 kg	3.12	1.35	1.27	4.50	28.50	71250	43010	1.52:1
Miftap (cartap hydrochloride 4 % G)	25 kg	3.07	1.16	1.11	1.50	29.00	72500	43210	1.48:1
Mahveer GR (fipronil 0.3 % G)	15 kg	2.80	1.27	1.19	4.75	28.13	70333	42083	1.49:1
Regent (fipronil 0.3 % G)	15 kg	2.96	1.02	1.22	4.00	28.25	70625	42085	1.47:1
Nidan (cartap hydrochloride 4 % G)	25 kg	2.84	0.83	0.95	1.00	29.37	73417	44002	1.50:1
Fame 480 SC(flubendiamide 39.35 %)	50 ml	3.00	1.17	0.90	2.00	28.75	71875	43760	1.56:1
Control	-	2.74	3.86	3.47	6.00	27.00	67500	40085	1.46:1
C.D. (P=0.05)		NS	0.37	0.27	1.21	1.32	-	-	-

DAT= days after treatment NS=Non-significant

against yellow stem borer. Prasad *et al.*, 2014, also who reported that flubendiamide 20 WDG @ 175 g $ha^{-1}$was effective against yellow stem borer in semi deep water rice.

During, *Kharif* 2015, three different brands of fipronil 0.3 G (Mifpro-G, Mahveer GR, Regent), two brands of cartap hydrochloride 4 G (Miftap, Nidan) were tested along with flubendiamide (Fame 480 SC) for their efficacy against stem borer and leaf folder in basmati rice (Table 2). Pre treatment observations showed that stem borer incidence varied from 2.74-3.12 per cent in different treatments and differences among the treatments were non significant. At 10 DAT, all the insecticides were significantly superior over untreated control to reduce stem borer infestation. Nidan @ 25 kg/ha was found most promising insecticide with 0.83 per cent dead heart incidence, which was at par with Regent @ 15kg/ha (1.02 %), Miftap @ 25 kg/ha (1.16 %) and Fame 480 SC @ 50 ml/ha (1.17 %). Mifpro-G @15 kg/ha and Mahveer GR @15kg/ha were also effective with dead heart incidence lower than ETL (2.0 %) as compared to 3.86 per cent in untreated control. The data on white ear incidence also showed that all the insecticides effectively control the stem borer. All the insecticides were on par with each other for white ear incidence (0.90-1.27 %) but significantly better than untreated control (3.47%). The leaf folder incidence was low during the study period which ranged from 1.0-6.0 per cent in different treatments at 21 DAT. The leaf folder incidence being minimum in Nidan @ 25 kg/ha was on par with Miftap @ 25 kg/ha, and Fame 480 SC @ 50 ml/ha, but significantly lower than other treatments. Moderate level of efficacy was recorded with Regent @ 15kg/ha, Mifpro-G @15 kg/ha and Mahveer GR @15kg/ha against leaf folder. As we consider grain yield, it ranged from 28.13-29.37 q/ha in insecticidal treated plot, which were on par with each other, but significantly better than untreated control, where 27.0 q/ha grain yield was recorded. Benefit cost ratio (B:C) was calculated and it was highest with Fame 480 SC @ 50 ml/ha (1.56:1) and lowest in untreated control (1.46:1). The B:C ratio for other insecticides was intermediate (1.47:1 to 1.52 :1).Thus, all the insecticides were effective against stem borers in basmati rice, but Fame 480 SC (flubendiamide 39.35 %), Nidan and Miftap (cartap hydrochloride 4% GR) were comparatively more effective against leaf folder.

There are many studies reported in literature on the effect of insecticides in reducing infestation of rice stem borer. Salijoqi *et al*. (2002) determined efficacy of fipronil and other insecticides against rice stem borer and found that cartap hydrochloride was most effective in reducing rice stem borer infestation followed by fipronil and carbofuran. Panda *et al.* (2004) evaluated fipronil at various dose levels against rice stem borer and observed that its application significantly reduced dead hearts and produced more tillers and higher grain yields. Singh *et al*. (2005) reported the effectiveness of fipronil, chlorpyriphos and cartap hydrochloride granules against stem borer. Sachan *et al*.(2006) reported cartap hydrochloride 50 SP as the second best treatment in managing the stem borer in rice. Prasad *et al.* (2005 and 2007) determined efficacy of insecticides in controlling rice stem borer and found that cartap hydrochloride followed by fipronil and carbofuran were most effective in controlling stem borer infestation and increasing crop yield. Dhaka *et al*. (2011) and Singh *et al*. (2015) reported fipronil 5 SC as the best treatment in reducing the infestation of insect pests in rice. Some other workers also tested the efficacy of different insecticides against rice leaf folder and reported that this pest can be effectively controlled by application of insecticides (Saroja and Raju, 1982; Wakil *et al*., 2001; Zhu *et al*., 2002; Panda *et al*., 2004; Dash, 2007; Bhanu and Reddy, 2008; Firake *et al.*, 2010; Chander and Palta, 2008; Kathikeyan *et al*., 2008; Mahal *et al.*, 2008; Sarao and Mahal, 2008; Bhutto and Soomro, 2009; Dhawan *et al.*, 2010; Chakraborty and Deb, 2011 and Sarao and Kaur, 2014).

Overall, the study revealed that fame 480 @ 50 ml/ha was effective against stem borer and leaf folder in rice as well as in basmati rice. Dursban @ 2500 ml/ha, Marktriazo @ 875 ml/ha and Sutathion @ 875 ml/ha were equally effective to decrease dead heart as well as leaf folder incidence in rice. Different brands of fipronil 0.3 per cent GR (Regent, Mahveer and Mifpro-G) @ 15kg/ha and cartap hydrochloride 4 per cent (Nidan, Miftap) @ 25kg/ha were found equally effective against stem borer and leaf folder in basmati rice. This will increase the choice of farmers in selecting insecticides from different group. But, as we consider per hectare dose, it was very low in case of Fame 480 SC as compare to other insecticides. So, application of fame will result in less pesticide load per unit area, which should be

preferred for control of important pest of rice. However, different insecticides should be used alternatively to avoid risk of development of resistance in insect pests.

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