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Comparative Efficacy of Some Insecticides Against Rice Stem Borers (*Tryporyza incertulus* wik. and *T. innotata* wik.) and Leaf Folder (*Cnaphalocrocis medinalis* gn.) in D.I.Khan, Pakistan

[1]Jamshed Iqbal, [1]Liaqatullah Khan, [1]Masood Khan Khattak, [1]Agha Shah Hussain and [2]Khalid Abduilah

[1]Faculty of Agriculture, Gomel University, D.I.Khan, Pahistan

[2]Agriculture Research Institute, Ratta Kulachi, D.I.Khan, Pakistan

Abstract: All the insecticides except Padan 3G, when applied 25 and 55 days after the transplanting of rice, significantly reduced the damage by rice stem borer as compared to the control. The insecticides also significantly reduced the mean percent folding of leaves by rice leaf folder, however, Fastac 5EC had no significant difference with that of the control.

Key words: Efficacy of some insecticides against rice stem borers

Introduction

Rice (*Oryza sativa* L.) belongs to family Graminae and is grown in tropical and subtropical regions of the world. In Pakistan, it is a major source of foreign exchange in agricultural commodities next to Cotton. Rice germ is rich in protein, oil, sugar and vitamins. Rice bran contains 15-20 percent oil. Pakistan has developed the capabitlity to extract edible oil from rice bran and has estimated that about 34000 tones of edible oil, worth of 340 million rupees can be extracted every year (Ahmed, 1989).

Realizing the importance of rice as export commodity, food and value of its by-products, public as well as private sectors are putting efforts to increase its yield by putting more area under cultivation. Out of 2112.7 thousand hactares with the production 3260.8 thousand tones and 1543 kilograms in Pakistan, 7760 hactares with the production of 21754 tones is grown in D.I.Khan district (Anonymous, 1996).

Many insects species have been reported to attack rice crop, among these, rice stem borer and rice leaf folder are dominant and have attained the status of key pests in rice growing area of Pakistan (Panda and Shi, 1989). Rice stem borer attack the crop right from seedling stage till the harvest. In the infested plants, panicals may not emerge at all and may remain folded while those emerge do not produce grain and become conspicous (Atwal, 1976). Rice leaf folder is destructive in its larval stage only. The leaves are folded and inside the chlorophyl portion is eaten which ultimately restrict the photosynthesis and expose the plant to bacterial and fungal infection (Atwal, 1976). A single larva may damage a number of leaves as it migrates from one leaf to another (Cheng, 1987).

Cultural and mechanical control measures, pheromones and light traps, resistant varieties against these insect pests are being in practice since long. For quick knock down effect, the application of judicious dose of insecticides is desired to save the crop from toll of insects. By the change in the resistance level of the pest and discovery of new chemicals with insecticidal activities always provide room to conduct field trails to evaluate their efficacy.

This study was conducted to evaluate the effect of insecticides on the white heads and dead hearts of rice by rice stem borer and to find out the the insecticides effect on leaf infestation and rating value of rice by rice leaf folder.

Materials and Methods

Chemical Control of Rice Stem Borer and Rice Leaf Folder: An experiment to evaluate the efficacy of four granular (Furadan 3G, Padan 4G, Rotap 4G and Thimet 3G) and two emulsifiable concentrates (Fastac SEC and Regent 300EC) against rice stem borer and rice leaf folder was conducted in D.I.Khan. All the insecticides used in this study were obtained from the local market in the sealed containers. The experiment was laid out in Randomized Complete Block Design with 7 treatments and three replications.

Fifty days old rice nursery of variety KS-282 was planted in 5×3m plots maintaining 20 cm inter plants and inter rows distance in the 3rd week of June. All the plots were separated by raised mud structure to avoid any mixing of field water after the insecticides application. Uniform agronomic practices were applied each treatment. The recommended doses of granular insecticides (Furadan 3G---8 Kg A^{-1}, Padan Rotap 4G---9 Kg A^{-1} and Thimet 3G---10 Kg A^{-1}) were weighed on electronic balance and broadcasted to the assigned plots uniformly. The recommended doses of the sprayable insecticides (Regent 300EC---80 ml A^{-1} and Fastac 5EC---250 ml A^{-1}) were measured with auto-filter pipet and mixed with the predetermined amount of water. The insecticides were sprayed with spray machine observing all protective measures of insecticides handling.

The 1st application of all the insecticides was made 25 days after transplanting. Ten days after the 1st application rice stem borer infestation data in terms of Dead Hearts and leaf folder in terms of total and infested leaves were recorded. Second application of the insecticides was made

55 days after transplanting. Ten days after the 2nd application, rice stem borer data in terms of Dead Hearts and White Heads while that of leaf folder in term of infested leaves were recorded. In each treatment 5 randomly selected plants per replication were counted for their total tillers and dead tillers because of stem borer. The results thus obtained were converted into percent dead hearts with the following formulae.

$$\%DHS = \frac{\text{Damaged tillers} \times 100}{\text{Total tillers}}$$

While Heads data in 5 randomly selected plants per treatment were recorded by counting total number of spikes and number of white spikes. The data obtained were converted into percent while heads by the following formulae.

$$\%WHS = \frac{\text{No. of white spikes} \times 100}{\text{Total number of spikes}}$$

The leaf folder damage was converted into damage rating value (R-value). The damage leaves by leaf folder were grouped into three categories on the basis of the damage surface area of each leaf (Heinrichs *et al.*, 1985).

Damage grade Leaf surface area damaged
1/3 of the total area.
More than 1/3 but less than 1/2 of the total area.
More than 1/2 of the total area.

R-Value

$$\frac{(\text{No. of leaves with damage grade of } 1 \times 100)1}{\text{Total number of leaves observed}} +$$
$$\frac{(\text{No. of leaves with damage grade of } 2 \times 100)\,2}{\text{Total number of leaves observed}} +$$
$$\frac{(\text{No. of leaves with damage grade of } 3 \times 100)\,3}{\text{Total number of leaves observed}} +$$

All the data collected and converted into percentage or R-value were subjected to the statistical analysis using Linear Model for RCBD.

$Y = u + ai + Bj + eij$ i = 1,-----a j = 1,-----b

All the statistical analysis were performed using MSTAT-C and the means were separated by Least Significant Difference Test.

Results and Discussion

Chemical control of rice stem borer

In all the treatments including control, no dead hearts were recorded when checked 10 days after the first application.

Plots after 2nd application treated with Fastac 5EC and Furadan 3G showed identical efficacy to each other and statistically lowest percentage of dead hearts compared to other treatments, as 6.94 percent and 7.24 percent dead hearts were significantly different from that of 18.00 percent in control plot and 14.40 percent and 16.30 percent in the plots treated with Rotap 4G and Padan 4G, respectively (Table 1). Thimet 3G and Regent 300EC also reduced dead hearts percentage but were not statistically different to that of the control plots.

All the treated plots showed significantly lower percentage of white heads as compared to the untreated plots (Table 1). Rotap 4G and Regent 300EC with 2.41 percent white heads each ranked first in their efficacy followed by Thimet 3G, Furadan 3G, Fastac 5EC and Padan 4G with 7.21, 7.42, 7.69 and 10.03 percent, respectively.

Table 1: Mean Percent Infestation (Dead Hearts + White Heads) By Rice Stem Borer 10 Days After 2nd Application

Treatments	Mean Dead Hearts (%)	Percent White Heads (%)	Infetation Total Infestation (%)
Control	18.01 A	17.93 A	35.94 A
Thimet 39	13.02 AB	17.21 B	20.23 B
Regent 300EC	12.93 AB	02.41 B	15.34 B
Rotap 49	14.40 A	02.41 B	16.81 B
Fastac 5EC	06.94 B	07.89 B	14.83 B
Furadan 3g	07.24 B	07.42 B	14.66 B
Paden 4g	16.30 A	10.03 B	26.33 AB
LSD Values	06.897	07.873	13.28
S.E.	02.238	02.555	04.31

Means with similar letters are statistically non-significant at 5 percent level of probability

Total Percent Infestation (DHS + WHS) by Rice stem borer: When percent means of all the treatments in terms of dead hearts and white heads were combined and statistically analyzed, the results obtained showed that all the insecticides except Padan 4G gave significantly better results than the control. Plot treated with Padan 4G showed 26.40 percent infestation which was statistically similar to the 35.95 percent infestation in the untreated plot (Table 1).

The results in this studies by Fastac 5EC (a pyrethroid insecticide) are identical to that of Gupta *et al*. (1990) and Babu and Rajasekaran (1984) who used different pyrethroid insecticides at different concentrations against *Helicoverpa armigera* on gram. Similar results have also been found by Purohit *et al*. (1987) after using Cypermethrin at the rate of 0.15 percent a.i. ha^{-1} against *Scirpophaga incertulus.* Kumar *et al*. (1988) significantly controlled the rice stem borer when used the same chemicals at the rate of 1.25 percent.

The small variation in the results of the present study with that of the other research workers could be becuase of the

different ecosystem and agro-ecological conditions of the experiment.

Chemical control of rice leaf folder

Percent Leaf Infestation after 1st Application: All the treated plots showed significantly low percentage of folded leaves compared to the untreated plot (Table 2). Rotap 4g with 0.15 percent folded leaves ranked 1st. while Regent 300EC with 1.093 got second position among the tested insecticides. Thimet 3g, Fastac 5EC, Furadan 3g and Padan 4g with 2.56, 2.82, 2.597 and 2.607 percent, respectively, were statistically similar to each other but significantly different from 4.737 percent in the control.

Rating Value after 1st Application: Although, all the insecticidal treatments had low R-value than the untreated check, Furadan 3g with 1.70 and Thimet 3g with 1.94 R-value were non significantly different from 2.83 R-value in the control (Table 2). Rotap 4G showed the lowest R-value (0.012) followed by 0.483, 0.515 and 1.213 R-values by Regent 300EC, Fastac 5E and Padan 4g, respectively. These R-value were significantly different from 2.83 R-value of the control treatment.

Table 2: Percent Folded Leaves and R-value by Rice Leaf Folder 10 Days after 1st. Application

Treatments	Percent Folded Leaves	R-Value
Control	4.737 A	2.830 A
Thimet 3g	2.560 BC	1.940 AB
Regent 300EC	1.093 CD	0.483 CD
Rotap 4g	0.156 D	0.012 D
Fastac SEC	2.820 B	0.515 CD
Furadan 3g	2.597 B	1.703 AB
Padan 4g	2.607 B	1.213 BC
LSD values	1.491	1.129
SE	0.386	0.483

Means with similar letters are statistically non-significant at 5 percent level of probability

Percent Infested Leaves after 2nd Application: Results showed that maximum of 16.94 percent infested leaves were found in the untreated plot followed by 12.37 percent, 12.83 percent and 13.83 percent infested leaves in plots treated with Furadan 3g, respectively (Table 3). These observations were statistically non-significant to each other. Plot treated with Padan 4g showed 11.17 percent infested leaves which were significantly different from the untreated plot. The 1.487 and 1.973 percent infested leaves in plots treated with Rotap 4G and Regent 300EC, respectively, were although at par to each other, significantly different from that of control.

Rating Value after 2nd Application: Results indicated that R-value in plots treated with Rotap 4G and Regent 300EC were significantly from that of the untreated plots (Table 3). Except the plot treated Fastac 5EC, other plots treated with Furadan 3g, Thimet 3g and Padan 4g did not show any significant difference in their R-values to the R-value of the untreated plot. It means that among the tested insecticides, the emulsifiable concentrates and only Rotap 4G (a granular insecticide) were effective against the test insect in terms of R-values.

Table 3: Percent Folded Leaves and R-Values by Rice Leaf Folder 10 Days after 2nd Application

Treatments	Percent Folded Leaves	R-Value
Control	16.94A	8.577A
Thimet 3g	12.83AB	6.223AB
Regent 300EC	1.973C	0.588C
Rotap 4g	1.487C	0.297C
Fastac 5EC	13.38AB	4.800B
Furadan 3g	12.37AB	5.043AB
Padan 4g	11.17B	6.363AB
LSD values	5.316	3.736
SE	1.725	1.216

Means with similar letters are statistically non-significant at 5 percnet level of probability

Combined Percent Infestation by Rice Leaf Folder after 1st. and 2nd Application: Results showed that except Fastac 5E the combined percent infestation in plots treated with insecticides was significantly lower than in the untreated plot (Table 4). Rotap 4G ranked 1st followed by Regent 300EC in the reduction of combined percent infestation by rice leaf folder as 0.821 and 1.533 percent were even statistically significantly lower than the 6.888, 7.485 and 7.693 percent in the plots treated with Padan 4g, Furadan 3g and Thimet 3g, respectively. Padan 4g, Furadan 3g and Thimet 3g were statistically similar in reducing the combined percent infestation by rice leaf folder.

Table 4: The Combined Folded Leaves Percentage and Toatl R-Value (after 1st and 2nd Application) by Rice Leaf Folder

Treatments	Percent Folded Leaves	R-Value
Control	10.84 A	5.703 A
Thimet 3g	7.693 B	4.082 AB
Regent 300EC	1.533 C	0.535 CD
Rotap 4g	0.821 C	0.155D
fastac SEC	8.102 AB	2.658 BC
Furadan 3g	7.485 B	3.373 B
Padan 4g	6.888 B	3.774 AB
LSD values	2.829	2.149
SE	0.918	0.697

Means with similar letters are statistically non-significant at 5% level of probability

Combined Rating Value: It is clear from the figures in Table 4 that the R-values of the treatment 7 and treatment 2 were statistically similar to the R-value of the treatment 1. Rotap 4G once again with 0.155 low R-value maintained its 1st position followed by 0.535, 2.658 and 3.373 R-values

of the Regent 300EC, Fastac SEC and Furadan 3g, respectively. In short, among the tested insecticides, all the granular insecticides and Regent 300EC significantly reduced the percent infestation by rice leaf folder.

Although, Rotap 4g and Padan 4g have the same active ingredients, Rotap 4g proved to be effective than Padan 4g against rice stem borer and rice leaf folder. The difference in their effectivity could be due to different innert material used by the manufacturers, different recommended and or different marketing and storage conditions. Another reason could be that Padan 4g used in this study was close to its expiry date.

As it is hard to find references on the effect of Rotap 4g on the rice leaf folder, therefore, it can be compared with insecticidal management of other Lepidopterous pests. Ismail *et al*. (1991) found Cartap most effective for the control of rice stem borer. Thakur and Mishra (1989) investigated that Carbofuran and Phorate significantly reduced the incidence if rice stem borer. Murthy *et al*. (1990) found that Terbufas at 1.0 Kg a.i. ha^{-1} was effective against the insect pests of rice except *Cnaphalocrocis medinalis,* while Isoprocarb at 1.0 Kg a.i. ha^{-1} was effective against rice stem borer.

In general, the results of the present study are identical to the results of other research workers. The partial differences could be attributed to different sites of experimentation, different agro-climatic conditions, croping pattern, dose of chemical used, time of application and of course the resistant level of the insect strain tested could be different in the insects of two different locations.

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