



BIOEFFICACY OF CHLORPYRIFOS AND FIPRONIL INSECTICIDES AGAINST INSECT PESTS OF PADDY

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ABSTRACT

Present investigation was carried out at Bhankla, Saharanpur (U.P) situated on Saharanpur Delhi highway in Rampur Maniharan tehsil. The experiment was conducted in Randomized Block Design with seven treatments on rice variety Narendra 118. Chlorpyrifos and Fipronil insecticide alone and in combinations were used. The maximum plant height, number of tillers per hill root length and number of roots was observed in T₃ treatment comprising of Chlorpyrifos 50% EC + Fipronil 5% SC (Revised) @ 375+50 g a.i./ha at 25 DAT. It was also evident that per cent stem borer infestation was comparatively lesser in Fipronil treatments than Chlorpyrifos alone on 70 DAT. Similarly, the effect of treatments on leaf folder infestation also showed similar trend and fipronil (alone and in combination) treated plots had 0.2 to 0.4 percent infestation while untreated plots had 3.7 per cent infestation of leaf folders. The positive effect of Fipronil in increasing the rice grain yield was also evident. The maximum grain yield (2566.66 gm/4m²) was obtained from in T₁ and T₃ with 22.22 per cent increase over untreated plot. In the present investigation the positive effect of Fipronil on stem borer control and plant growth was observed. On the basis of results of present study, it is concluded that the treatment consisting of chlorpyrifos 50% EC + fipronil 5% SC (Revised) @ 375 + 50 g a.i./ha at 25 DAT was best for reducing the stem borer infestation and improving the plant growth and yield.

Keywords: Paddy, Insect Pests, Fipronil , infestation, Bioefficacy

1. INTRODUCTION

In India, rice is one of the most important grains and principal food crops. India is one of the leading producers of rice in the world and accounts for around 20 per cent of global production. Pest outbreaks can cause serious losses in rice production. Pest outbreaks occur for a number of reasons, but one of the most important ones is a breakdown in the natural ecological balance. Among the insect infesting paddy field stem borer is very important. There are six different species of this insect causes loss to paddy field. Stem borers can destroy rice at any stage of the plant from seedling to maturity. They feed upon tillers and cause dead hearts or drying of the central tiller, during vegetative stage; and causes whiteheads at reproductive stage. The stem borer larvae bore at the base of the plants during the vegetative stage. On older plants, they bore through the upper nodes and feed toward the base. High nitrogenous field favours population build-up of the stem borers. Fields planted later favours more damage by the insect pests that have built up in fields that have been planted earlier. Stubble that remains in the field can harbour stem borer larvae and or pupae. Numbers of insecticides are applied in rice field for control of insects like carbofuran, photae, monocrotophos, endosulfan etc. (Choi *et al.*, 1975; Estores *et al.*, 1980; Chiu, 1980, Stout *et al.*, 2000; Scott *et al.*, 2008). Information pertaining to insecticidal and phytotonic nature of these insecticides is of great importance. In this study the insecticidal and phytotonic nature of chlorpyrifos and Fipronil in different combinations was carried out.

2. MATERIALS AND METHODS

2.1. Experimental Location and Description

Present investigation was carried out at Bhankla, Saharanpur (U.P) situated on Saharanpur Delhi highway in Rampur Maniharan tehsil. It comes under tarai region. The experiment was conducted in Randomized Block Design with seven treatments on rice variety Narendra 118. The plot size was 5 x 10 m² and each treatment was replicated three times. The age of nursery was 27 days and crop duration was 148 days at Saharanpur. Chlorpyrifos and Fipronil insecticide alone and in combinations were used. The control consists of plots in which insecticides were not applied. The details of the treatments are as follows:

2.2. Treatment details

T₁=Chlorpyrifos 50%EC+Fipronil 5% SC (Standard) @ 375+50 g a.i./ha at 25 DAT

T₂=Chlorpyrifos 50%EC+Fipronil 5%SC (New) @ 375+50 g a.i./ha at 25 DAT

T₃=Chlorpyrifos 50%EC+Fipronil 5%SC (Revised) @ 375+50 g a.i./ha at 25 DAT

T₄=Chlorpyrifos 50%EC @ 500 g a.i./ha at 25 DAT

T₅=Fipronil 5%SC (Standard) @75 g a.i./ha at 25 DAT

T₆=Fipronil 0.3%Gr @ 75 g a.i./ha at 15 DAT

T₇=Untreated control

Observations on phytotoxic and insecticidal properties of Fipronil and Chlorpyrifos in rice varieties were recorded at 15 days intervals. The plant height and root length was measured using meter scale. Numbers of tillers/hill, number of roots per plant were counted at 15 days intervals. The infestation of insects like stem borer was also observed at 15 days interval. In each treatment, five tagged plants from each plot were used for recording observations from 25 days after treatment (DAT) and continued up to maturity. Final yield was recorded in 4.0 m² per plot from middle of each plot. Data were subjected to analysis of variance (ANOVA) using SPSS software. Valid conclusions were drawn only on significant difference between the treatment means at 0.05 level of probability.

3. RESULTS AND DISCUSSION

The plant height recorded at 15 days interval clearly suggests significant increase in all the treatments. The maximum increase in plant height was noticed during 40 DAT and treatment (T₄) comprising of Chlorpyrifos 50% EC + Fipronil 5% SC (Revised) @ 375+50 g a.i. per ha registered maximum increase in plant height ((54%) followed by T₁ and T₂ treatments (Table 1). At 55 DAT combination of Chlorpyrifos and Fipronil had more height than the rest of all treatments. But among three treatment combinations, T₃ (Chlorpyrifos + Fipronil revised) treatment had maximum plant height on all other days of observations.

The initial number of tillers per hill before application of insecticides ranged from 6.13 to 6.26 per plants which was statistically non-significant (Table 2). At 40 DAT, the maximum number of tillers were recorded in T₃ (9.96) treatment which did not differ significantly with the T₁ (9.93 tiller per hill), T₂ (9.73 tillers per hill) and T₆ (9.73 tiller per hill) treatments. However, the minimum tillers per hill were observed in control (8.86 tillers per hill) which was *at par* with the T₄ treatment. At 85 DAT the number of tillers was slightly reduced due to drying up of ineffective tillers. However, at this point of time also the maximum number of tillers was observed in T₃ treatment. It was also evident that all treatments having Fipronil resulted in increased number of tillers compared to control and treatment having only Chlorpyrifos.

The effect of fipronil on root length of paddy was clearly visible at 40 DAT (Table 3). All fipronil treatments had significantly more root length than the chlorpyrifos alone (T₄) and untreated plots at 40, 55 and 70 DAT. On 40 DAT, the maximum root length was found in T₃ treatment (10.90 cm) which had non-significant differences with the treatment of Fipronil 0.3% Gr. @ 75 g *a.i.* per ha (T₆). Similarly, the root length was maximum in T₃ treatment (11.30 cm) on 55 DAT followed by T₆ (11.06 cm) and T₂ (10.66 cm) treatments.

The number of roots were significantly increased in all fipronil treatments at 40 DAT but the maximum number of roots were observed in T₃ (13.80 roots per plants) where chlorpyrifos + fipronil revised were applied. At 55 DAT the maximum number of roots was 17.73 per plant in T₆ followed by 17.60 in T₁ and T₃. Among combination treatments T₂ was given inferior performance than T₁ and T₃ while T₄ and T₇ had at per numbers of roots at all days of observations.

Stem borer attack was observed at 55 DAT only in untreated plot with 1.0 per cent infestation (Fig. 1). At 70 DAT, plots under T₃ and T₁ treatments were free from stem borer infestation. However, in other treated plots it ranged from 0.1 to 0.5 per cent while in untreated plots in reached up to 1.8 percent. It was also evident that per cent infestation was comparatively lesser in Fipronil treatments than Chlorpyrifos alone on 70 DAT. Infestation was further increased to 0.2 to 1.2 per cent in different treated plots and it reached to the maximum (3.9 per cent) in untreated control plots. The effect of Fipronil was clearly evident on all dates of observations and stem borer infestation was significantly less in the treatments comprising of Fipronil than Chlorpyrifos alone and un-treated control.

The effect of treatments on leaf folder infestation also showed similar trend. Leaf folder infestation was also started at 55 DAT in control plots with 0.9 per cent infestation (Fig. 2). At 70 DAT, the treatments having combination of Fipronil and Chlorpyrifos (T₁, T₂ & T₃) had no infestation. However, chlorpyrifos 50 EC alone treated plots had 0.6 per cent and untreated plots had 2.4 percent infection at 85 DAT. Fipronil (alone and in combination) treated plots had 0.2 to 0.4 percent infestation while untreated plots had 3.7 per cent infestation of leaf folders.

The positive effect of Fipronil in increasing the rice grain yield was also evident (Fig. 3). The maximum grain yield (2566.66 gm/4m²) was obtained from in T₁ and T₃ with 22.22 per cent increase over untreated plot. While T₂, T₅ and T₆ treatments resulted in 15.87 per cent increment (2433.33 gm/4m²) over control. While in the treatment having chlorpyrifos 50 EC alone applied plots only 1.59 percent increase in yield was recorded.

In the present investigation the positive effect of Fipronil on stem borer control and plant growth was observed. All the treatments having Fipronil resulted in better number of tillers, root length and plant height. In contrast the effect of Chlorpyrifos alone was not significant in improving plant growth parameters. The higher yield obtained from the plots where Fipronil was applied showed better grain yield. This might be due to the fact that paddy plants in Fipronil treated plots had less insect infestation as well as better growth of plants. The results of the present investigation are in conformity with the findings of Adiroubane *et al.* (1993) and Dabhi, *et al.* (2012).

On the basis of results of present study, it is concluded that treatment consisting of Chlorpyrifos 50% EC + Fipronil 5% SC (Revised) @ 375 + 50 g *a.i./ha* at 25 DAT was best for reducing the stem borer infestation and improving the plant growth and yield.

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(Tables & Figures)

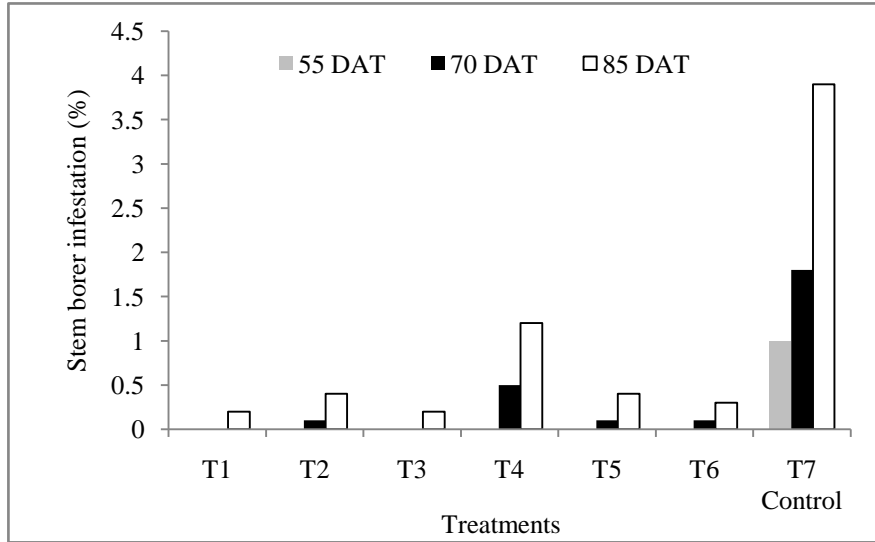


Fig. 1. Per cent infestation by borer insects.

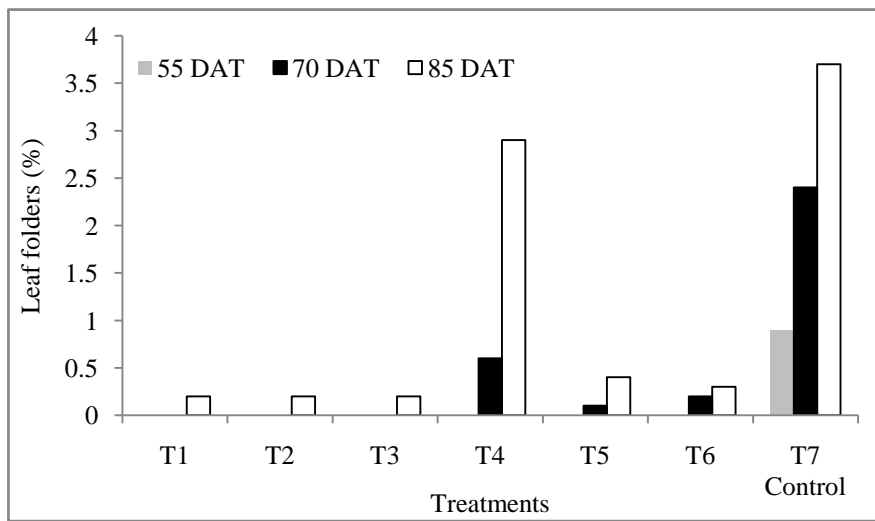


Fig. 2. Per cent infestation by borer insects.

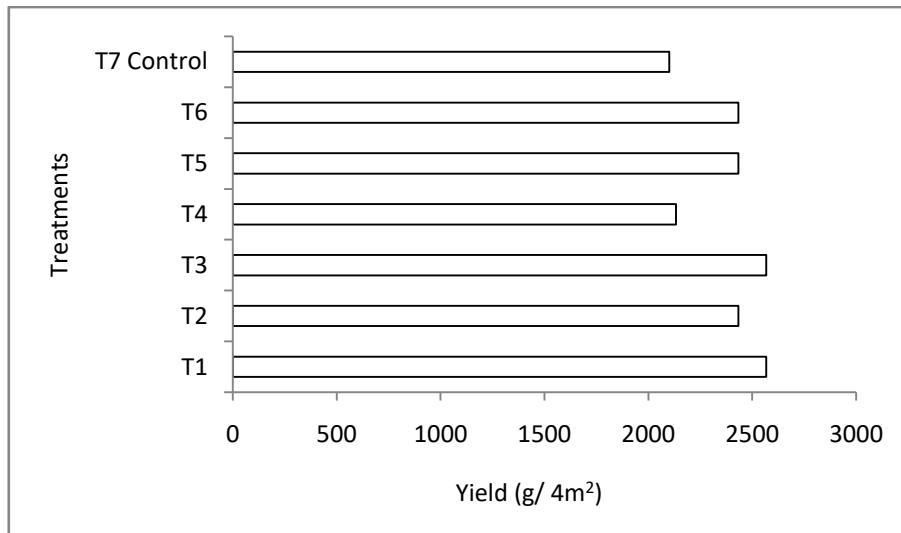


Fig. 3. Paddy yield ((gm/4 m²) under different treatments.

Table 1. Plant height of paddy in different treatments of Chlorpyrifos 50%EC + Fipronil 5% SC (tank mix) formulations.

Treatment	Plant height (cm)				
	25 DAT	40 DAT	55 DAT	70 DAT	85 DAT
T ₁ =Chlorpyrifos 50%EC+Fipronil 5% SC (Standard) @ 375+50 g a.i./ha at 25 DAT	67.8	103.0	106.8	135.9	137.4
T ₂ =Chlorpyrifos 50%EC+Fipronil 5%SC (New) @ 375+50 g a.i./ha at 25 DAT	68.1	101.7	104.3	133.2	137.0
T ₃ =Chlorpyrifos 50%EC+Fipronil 5%SC (Revised) @ 375+50 g a.i./ha at 25 DAT	67.9	104.6	105.0	137.7	139.2
T ₄ =Chlorpyrifos 50%EC @ 500 g a.i./ha at 25 DAT	68.0	95.6	101.4	125.3	129.2
T ₅ =Fipronil 5%SC (Standard) @75 g a.i./ha at 25 DAT	67.9	98.6	104.8	129.1	135.0
T ₆ =Fipronil 0.3%Gr @ 75 g a.i./ha at 15 DAT	68.0	100.0	104.0	134.3	136.0
T ₇ =Untreated control	67.8	94.6	100.4	120.9	129.8
C.D. at 5%	NS	3.34	3.00	3.90	3.39

NS, Non-significant; DAT, days after transplanting

Table 2. Number of tillers/hill of paddy in different treatments of Chlorpyrifos 50%EC + Fipronil 5% SC (tank mix) formulations.

Treatment	No. of tillers/hill				
	25 DAT	40 DAT	55 DAT	70 DAT	85 DAT
T ₁ =Chlorpyrifos 50% EC + Fipronil 5% SC (Standard) @ 375+50 g a.i./ha at 25 DAT	6.16	9.93	9.93	9.93	9.76
T ₂ =Chlorpyrifos 50% EC + Fipronil 5% SC (New) @ 375+50 g a.i./ha at 25 DAT	6.23	9.73	9.73	9.73	9.83
T ₃ =Chlorpyrifos 50% EC + Fipronil 5% SC (Revised) @ 375+50 g a.i./ha at 25 DAT	6.23	9.96	9.96	9.96	9.86
T ₄ =Chlorpyrifos 50% EC @ 500 g a.i./ha at 25 DAT	6.20	8.96	8.96	8.96	8.90
T ₅ =Fipronil 5%SC (Standard) @75 g a.i./ha at 25 DAT	6.16	9.40	9.40	9.40	9.26
T ₆ =Fipronil 0.3%Gr @ 75 g a.i./ha at 15 DAT	6.26	9.73	9.73	9.73	9.63

T ₇ =Untreated control	6.13	8.86	8.86	8.86	8.80
CD at 5%	NS	0.52	0.51	0.51	0.50

NS, Non-significant; DAT, days after transplanting

Table 3. Root length of paddy in different treatments of Chlorpyrifos 50% EC + Fipronil 5% SC (tank mix) formulations.

Treatment	Root length (cm)			
	25 DAT	40 DAT	55 DAT	70 DAT
T ₁ =Chlorpyrifos 50% EC + Fipronil 5% SC (Standard) @ 375+50 g a.i./ha at 25 DAT	7.63	10.50	10.80	10.40
T ₂ =Chlorpyrifos 50% EC + Fipronil 5% SC (New) @ 375+50 g a.i./ha at 25 DAT	7.66	10.26	10.66	10.16
T ₃ =Chlorpyrifos 50% EC + Fipronil 5%SC (Revised) @ 375+50 g a.i./ha at 25 DAT	7.63	10.90	11.30	10.73
T ₄ =Chlorpyrifos 50% EC @ 500 g a.i./ha at 25 DAT	7.60	9.50	9.70	9.33
T ₅ =Fipronil 5%SC (Standard) @75 g a.i./ha at 25 DAT	7.70	10.33	10.60	10.20
T ₆ =Fipronil 0.3%Gr @ 75 g a.i./ha at 15 DAT	8.03	10.80	11.06	10.90
T ₇ =Untreated control	7.63	9.56	9.66	9.30
CD at 5%	NS	0.23	0.22	0.22

NS, Non-significant; DAT, days after transplanting

Table 4. Number of roots/plant of paddy in different treatments of Chlorpyrifos 50% EC + Fipronil 5% SC (tank mix) formulations.

Treatment	No. of roots/plant			
	25 DAT	40 DAT	55 DAT	70 DAT
T ₁ =Chlorpyrifos 50%EC+Fipronil 5% SC (Standard) @ 375+50 g a.i./ha at 25 DAT	6.86	13.60	17.60	17.10
T ₂ =Chlorpyrifos 50%EC+Fipronil 5%SC (New) @ 375+50 g a.i./ha at 25 DAT	6.66	13.16	17.06	16.63
T ₃ =Chlorpyrifos 50%EC+Fipronil 5%SC (Revised) @ 375+50 g a.i./ha at 25 DAT	6.83	13.80	17.60	16.93
T ₄ =Chlorpyrifos 50%EC @ 500 g a.i./ha at 25 DAT	6.80	12.36	16.20	16.13
T ₅ =Fipronil 5%SC (Standard) @75 g a.i./ha at 25 DAT	6.80	13.40	17.33	17.06
T ₆ =Fipronil 0.3%Gr @ 75 g a.i./ha at 15 DAT	6.83	13.73	17.73	17.20
T ₇ =Untreated control	6.83	12.20	16.36	16.00
CD at 5%	0.249	0.236	0.307	0.303