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**RESEARCH PAPER**

# Efficacy of newer molecules of insecticides against white grub in sugarcane

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A field experiment comprised of seven insecticides was conducted at farmers field in endemic area of pest in Kolhapur district particularly area nearby riverbank during 2009-2010. The application of newer insecticides was done by drenching and the granules were applied along with dry soil. Soil drenching of imidacloprid 40 per cent + fipronil 40 per cent - 80 WG @ 300 g $ha^{-1}$ was found to be most effective treatment for control of white grub followed by clothianidin 50 WDG @ 250 g $ha^{-1}$, flubendiamide 480 SC @ 400 ml $ha^{-1}$ and rynaxypyr 0.4 per cent G @ 125 g $ha^{-1}$.

**Key words :** Imidacloprid, Clothianidin, Flubendiamide, Rynaxypyr, Sugarcane

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## INTRODUCTION

White grubs are immature stages of scarabid beetles. Different species of white grubs in recent years destroy the crop seriously in different sugarcane tracts in the country. They are highly polyphagus pest. The detailed gave the detailed biology, description and management of twelve most economically important species *viz.*, *Holotrichia consanguinea* Blanch, *H. serrata* (F.), *H. reynaudi* Blanch, *H. longipennis* Blanch, *H. seticollis* Mose, *H. nilgirla* Arrow, *Brahmina* (*Holotrichia*) *coriacea* Hope, *Leucopholis lepidophora* Blanch, *L. burmeistri* Blanch, *L. coneophora* Burm., *Anomala dimidiate* Hope, *Maladera insanabilis,* which appeared in severe form in different parts of the country reported by Yadava and Sharma (1995). *Leucopholis lepidophora* Blanchard reported as a serious pest of arecanut in Malnad district of Karnataka by Veeresh *et al.* (1982). *Leucopholis* sp (F.), *Phyllophaga helleri* (Brsk) and *Schizonycha* sp. have been reported to assume pest status in sugarcane-growing regions (Yubak, 2006). Besides sugarcane other cultivated crops such as groundnut, cereals, millets, pluses, vegetables and plantation crops were also attacked by white grub (David *et al.,* 1986). The yield loss due to white grubs was reported to be as high as 100 per cent in Tamil Nadu (Thamarai Selvi *et al.,* 2010). This pests considered threat to sugarcane cultivation in parts of Kolhapur and Sangli districts (Adsule and Patil, 1990). The incidence of *Leucopholis* reduces 40 per cent germination of the cane and causes 40 to 60 per cent reduction in cane yield and 78 units reduction in sugar recovery in heavily infested sugarcane fields. The losses to the extent of 100 per cent were also reported by Patil and Hapse (1981). Several tactics have been adopted for the management of white grubs including cultural, mechanical, biological, chemical and integrated methods suggested by various workers (Sahayaraj and Borgio, 2009; Srikanth and Singaravelu, 2011).

The grubs are subterranean having complex life cycle and actively feed on living roots, therefore, the control of this pest becomes difficult. Adult collection and insecticidal applications are the major tactics of management followed against all the white grub species (Veeresh, 1974 and Raodeo *et al*., 1976). Development of high level of resistance to the white grub there is necessity of implementation of alternative options, such as the performance of new group of insecticides which change insect plant environment interaction with specific and novel mode of action, less hazardous eco-friendly and compatible with eco-friendly pest management programmes.Now-a-days large number of newer insecticidal formulation in form of ready mixture individual are also available in market. Attempt was, therefore, made to test the efficacy against white grub in sugarcane crop.

## RESEARCH METHODOLOGY

Field trial was conducted at farmers field in endemic area of pest in Kolhapur Maharashtra. region during 2009-10 to study the efficacy of newer molecules of insecticides against white grub in sugarcane crop.

The experiment was laid out in Randomized Block Design with eight treatments and three replications, the plot size was 5×5m$^2$ and plant spacing was 90×90cm. The crop was raised following the recommended agronomic practices except plant protection measures. The application of newer insecticides was done by drenching and the granules were applied along with dry soil or sand in equal proportions at the time of planting. Second drenching was carried out at the time of earthing up *i.e.* 75 days after planting. The observations of field experiment was recorded at 5 spots with 1 m$^2$ area per plot which was selected randomly and number of damaged clumps was counted at 30, 45, 60 and 75 days after planting. The number of white grubs m$^{-2}$ after the harvesting of sugarcane was also recorded. The clump mortality data and number of grubs present per m$^2$ area in soil at harvesting were angularly transformed and subjected to analysis of varience.

## RESEARCH FINDINGS AND ANALYSIS

Looking to the demand of extension workers, State Department of Agriculture and quarries from the farmers for the new insecticides, the experiment described here in was undertaken.

**Efficacy of newer molecules of insecticides against white grub under field condition after first drenching :**

In a field experiment during 2010-2011 cropping season the efficacy of newer insecticides against white grub were evaluated. The results of the experiments are presented in Table 1.Treatments were given during first week of February. The population of white grub in experimental plots did not differ significantly indicating the uniformity in the distribution of pest in the field and number of grub population m$^{-2}$ area ranged from 8 to 10.66.

**Table 1 : Efficacy of newer molecules of insecticides against white grub as soil drenching in sugarcane after 1st drenching**

| Treatments | Name of insecticide | Dose a.i. ha$^{-1}$ | Per cent plant mortality days after 1$^{st}$ drenching | | |
|---|---|---|---|---|---|
| | | | 45DAT | 60DAT | 75DAT |
| $T_1$ | Rynaxypyr (E 2Y45) 0.4 (%)G | 125 g | 5.56 (13.49) | 6.67 (15.00) | 7.78 (16.15) |
| $T_2$ | Clothianidin 50 WDG | 250 g | 3.33 (10.47) | 4.44 (11.98) | 5.56 (13.49) |
| $T_3$ | Imidacloprid + Fipronil 40 (%) + 40 (%)-80WG | 300 g | 2.22 6.98) | 3.33 (10.47) | 4.44 (11.98) |
| $T_4$ | Flubendiamide (Fame) 480 SC | 400 ml | 4.44 (11.94) | 5.56 (13.49) | 6.67 (14.64) |
| $T_5$ | Imidacloprid 200 SL | 175 ml | 6.67 (14.67) | 7.78 (16.15) | 8.89 (17.29) |
| $T_6$ | Fipronil 5 (%) SC | 175 ml | 7.78 (15.00) | 8.89 (17.29) | 10.00 (18.44) |
| $T_7$ | Chlorpyriphos 20 EC | 1000ml | 8.89 (17.29) | 11.11 (20.40) | 13.33 (21.32) |
| $T_8$ | Untreated control | - | 14.44 (22.30) | 16.67 (24.12) | 18.89 (25.75) |
| | S.E. ± | - | 1.76 | 1.43 | 1.68 |
| | C.D. (P=0.05) | - | 3.78 | 3.06 | 3.60 |

(Figures in parentheses are arcs in transformation)

**Table 2 : Efficacy of newer molecules of insecticides against white grub as soil drenching in sugarcane after 2nd drenching**

| Treatments | Name of insecticide | Dose a.i.ha$^{-1}$ | Per cent plant mortality days after 2nd drenching | | |
|---|---|---|---|---|---|
| | | | 30DAT | 45DAT | 60DAT |
| $T_1$ | Rynaxypyr (E 2Y45) 0.4 (%)G | 125 g | 8.89 (17.29) | 11.11 (19.42) | 12.22 (20.41) |
| $T_2$ | Clothianidin 50 WDG | 250 g | 6.67 (15.00) | 8.89 (17.29) | 10.00 (18.28) |
| $T_3$ | Imidacloprid+Fipronil40 (%) + 40 (%) -80WG | 300 g | 5.56 (13.49) | 7.78 (16.15) | 8.89 (17.29) |
| $T_4$ | Flubendiamide (Fame)480 SC | 400 ml | 7.78 (16.15) | 10.00 (18.27) | 11.11 (19.42) |
| $T_5$ | Imidacloprid 200 SL | 175 ml | 10.00 (18.44) | 12.22 (20.41) | 15.56 (23.21) |
| $T_6$ | Fipronil 5 (%) SC | 175 ml | 13.33 (19.26) | 16.67 (24.02) | 18.89 (25.75) |
| $T_7$ | Chlorpyriphos 20 EC | 1000ml | 15.56 (23.21) | 18.89 (25.75) | 20.00 (26.51) |
| $T_8$ | Untreated control | - | 21.11 (27.33) | 25.56 (30.36) | 28.89 (32.51) |
| | S.E.± | - | 1.45 | 1.48 | 1.50 |
| | C.D. (P=0.05) | - | 3.12 | 3.19 | 3.21 |

(Figures in parentheses are arcs in transformation)

**30 days after treatment :**

First application of newer insecticides was carried out at the time of sugarcane planting. The mortality of sugarcane clump was not observed within 30 days after treatment.

**45 days after treatment :**

Observations recorded 45 days after treatment indicated that all the treatments were found significantly superior over untreated control. The treatment imidacloprid 40 per cent + fipronil 40 per cent - 80 WG @ 300 g $ha^{-1}$ was significantly superior over all other treatments. The mortality of the plants varies from 2.22 to 8.89 per cent as compared to 14.44 per cent in untreated control.

**60 days after treatment :**

In treatment imidacloprid 40 per cent + fipronil 40 per cent - 80 WG @ 300 g $ha^{-1}$ was found significantly superior over all other treatments and recorded 3.33 per cent plant mortality however, it was at par with treatment clothianidin 50 WDG @ 250 g $ha^{-1}$, flubendiamide 480 SC @ 400 ml $ha^{-1}$ which recorded 4.44 an 5.56 per cent plant mortality, respectively. In untreated control 16.67 per cent plant mortality was observed. The mortality of plants varied from 3.33 to 11.11 per cent in rest of treatments.

**75 days after treatment :**

All the treatments proved significantly superior to untreated check. The treatment imidacloprid 40 per cent+ fipronil 40 per cent 80 WG @ 300 g $ha^{-1}$ recorded 4.44 per cent plant mortality which followed same trend as that of earlier observation interval and noticed significantly superior over all other treatments.

**Efficacy of newer molecules of insecticides against white grub under field condition after second drenching :**

Treatment were imposed after first earthing up in sugarcane plot which was carried out 75 days after planting. Thus, second drenching was carried out 75 days after planting and the observations were recorded 30, 45, 60, 75 days of treatments and presented in Table 2.

**30 days after treatment :**

Observations recorded 30 days after second application of insecticides indicated that all the treatments were significantly superior over untreated control. The treatment imidacloprid 40 per cent + fipronil 40 per cent–80 WG @ 300 g $ha^{-1}$ was significantly superior over all other treatments (5.56%) in reducing mortality of plants and was at par with treatment clothianidin 50 WDG @ 250 g $ha^{-1}$ (6.67%) and flubendiamide 480 SC @ 400 ml $ha^{-1}$ (7.78%). The mortality of the plants varied from 5.56 to 15.56 per cent as compared to 21.11 per cent in untreated control.

**45 days after treatment :**

Significant reduction in plant mortality was registered in the treatment imidacloprid 40 per cent + fipronil 40 per cent - 80 WG @ 300 g $ha^{-1}$ (7.78%) and found superior over untreated control in reducing plant mortality and was at par with treatments clothianidin 50 WDG @ 250 g $ha^{-1}$ and flubendiamide 480 SC @ 400 ml $ha^{-1}$ where 8.89 and 10.00 per cent plant mortality was recorded, respectively. The mortality of plants varied from 7.78 to 18.89 per cent as compared with 25.56 per cent plant mortality in untreated control.

**60 days after treatment :**

The observations recorded 60 days after second application regarding plant mortality varied from 8.89 to 20.00 per cent as compared to 28.89 per cent in untreated control. All the treatments were found significantly superior over untreated control. Again the treatment imidacloprid 40per cent + fipronil 40 per cent - 80 WG @ 300 g $ha^{-1}$ was found consistently superior (8.89%) in reducing mortality of plants which was at par with treatment clothianidin 50 WDG @ 250 g $ha^{-1}$ (10.00%) and flubendiamide 480 SC @ 400 ml $ha^{-1}$ (11.11%). The treatment rynaxypyr 0.4 G @ 125 g $ha^{-1}$

**Table3 : Efficacy of newer molecules of insecticides as soil drenching in sugarcane and number of white grubs $m^{-2}$ at the time of harvesting**

| Treatments | Name of Insecticide | Dose a.i. $ha^{-1}$ | Average number of grubs $m^{-2}$ at time of harvest |
|---|---|---|---|
| $T_1$ | Rynaxypyr 0.4G (E 2Y45) | 125 g | 3.67 (2.04) |
| $T_2$ | Clothianidin 50WDG | 250 g | 3.00 (1.87) |
| $T_3$ | Imdacloprid + Fipronil 40( (%)) + 40( (%)) - 80WG | 300 g | 2.67 (1.77) |
| $T_4$ | Flubendiamide (Fame) 480 SC | 400 ml | 3.33 (1.95) |
| $T_5$ | Imidacloprid 200SL | 175 ml | 4.00 (2.12) |
| $T_6$ | Fipronil 5 (%) SC | 175 ml | 4.33 (2.19) |
| $T_7$ | Chlorpyriphos 20EC | 1000 ml | 4.67 (2.27) |
| $T_8$ | Untreated Control | - | 9.33 (3.13) |
| | S.E. ± | - | 0.089 |
| | C.D. (P = 0.05) | - | 0.191 |

Figures in parenthesis are $\sqrt{x}+0.5$ arcs in transformation.

(12.22%), imidacloprid 200 SL @ 175 ml $ha^{-1}$ (15.56%), fipronil 50 per cent SC @ 175 ml $ha^{-1}$ (18.89%), chlorpyriphos 20 EC @ 1000 ml $ha^{-1}$ (20.00%) were next in order of efficacy.

**75 days after treatment :**

The grub undergo pupal stage in month of July. Therefore, no any damage of plant was observed at 75 days after drenching.

**Efficacy of newer molecules of insecticides against number of white grubs $m^{-2}$ at the time of harvesting :**

The number of white grubs $m^{-2}$ were found after sugarcane harvesting are presented in Table 3.

The observations recorded at the time of sugarcane harvesting indicated that the grub population in all the treated plot was significantly lower than untreated control (9.33 grub $m^{-2}$). It observed lowest in imidacloprid 40per cent + fipronil 40per cent - 80 WG @ 300 g $ha^{-1}$ (2.67 grub $m^{-2}$) found significantly superior to untreated control and was at par with clothianidin 50 WDG @ 250 g $ha^{-1}$ and flubendiamide 480 SC @ 400 ml $ha^{-1}$ where 3.00 and 3.33 grubs $m^{-2}$ were observed, respectively.

Outcome of the present investigation under field condition indicated that among these newer molecules of insecticides, imidacloprid 40 per cent + fipronil 40 per cent- 80 WG @ 300 g $ha^{-1}$ emerged as the most effective treatment on the basis of per cent plant mortality and number of white grubs $m^{-2}$ area at the time of sugarcane harvesting, it was followed by clothianidin 50 WDG @ 250 g $ha^{-1}$, flubendiamide 480 SC @ 400 ml $ha^{-1}$ and rynaxypyr 0.4% G @ 125 g $ha^{-1}$. The per cent plant mortality in the different treatments at 75 days after first drenching ranged from 4.44 to 13.33 per cent and 18.89 per cent in untreated control. During 60 days after second drenching 8.89 to 20.00 per cent plant mortality was recorded in the different treatments and 28.89 per cent in untreated control.

Present findings are in conformity with that of Patel *et al*. (2010), they reported that soil drenching of imidacloprid 40 per cent + fipronil 40 per cent-80 WG @ 187 g $ha^{-1}$ was most effective in groundnut crop for control of white grub. Similar findings were also reported by Suthar (1994), Patel *et al.* (1985) and Patel and Patel (2000). However, not much work has been reported on E2Y45 and clothianidin being a new insecticide from the literature reviewed.

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