

Original Research Article

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Efficacy of Different Insecticides against Green Semilooper *Chrysodeixis acuta* on Soybean

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ABSTRACT

The present study entitled, efficacy of Different Insecticides against Green Semilooper *Chrysodeixis acuta* on Soybean was undertaken incorporating nine treatments were evaluated for their efficacy against Green Semilooper on soybean. The experiment was laid out in RBD and was conducted during *khari* season of 2013-14. The results were found to be statistically significant. However, numerically minimum cumulative average numbers of larvae of Green Semilooper were recorded treatment (T4) Profenophos 50EC @ 0.185% followed by the Treatment (T3) Profenophos 50EC @ 0.125%, (T6) Quinalphos 25EC @ 0.075%, (T5) Quinalphos 25 EC @ 0.05%, (T2) Chlorpyrifos 20EC @ 0.06%, (T1) Chlorpyrifos 20 EC @ 0.04%, (T8) Triazophos 40 EC @ 0.06% and (T7) Triazophos 40 EC @ 0.04%. The treatment (T4) Profenophos 50EC @ 0.185% ranked first in recording maximum yield but, in treatment (T3) Profenophos 50EC @ 0.125% highest ICBR was recorded. The other treatments in descending order in respect of yield were of T3 > T6 > T5 > T2 > T1 > T8 > T7 and regarding ICBR T4 > T5 > T6 > T1 > T2 > T7 > T8. The overall picture on the basis of ICBR and yield of treatment, the treatment (T3) profenophos 50 EC @ 0.125 % and (T4) profenophos 50 EC @ 0.185 % shown promise in recording lower infestation of soybean semilooper.

Keywords

Chemical insecticide, Green semilooper *Chrysodeixis acuta* and soybean

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Introduction

Soybean (*Glycine max* L.) is one of the miracles 'Golden bean' of the 20th century. In India, soybean was first time introduced as food in 1935 (Sharma, 2004). Soybean possess a very high nutritional value, on an average it contains 20 per cent oil, 40 per cent protein, Vit A, B, C, D, E and K along with 0.69 per cent phosphorus, 0.112 per cent iron and 0.024 per cent calcium. Edible soya

proteins are one of the worlds least expensive and high quality protein source (Bishnoi, 2005). This crop is attacked by 88 insect pest species belonging to six different orders of insects and some mites. Most economic injury caused by 25 insects belongs to order Lepidoptera and Hemiptera. Insect pests associated with crop are (Aphid *Aphis gossypii*, *Aphis craccivora*), Whitefly (*Bemisia tabaci*), Green semilooper (*Chrysodeixis acuta*), Bihar Hairy caterpillar

(*Spilosoma oblique*), Girdle beetle (*Obereopsis brevis*), Stem fly (*Melanagromyza sojae*), Tobacco leaf eating caterpillar (*Spodoptera litura*), Leaf miner (*Aproaerema modicella*), Grasshopper (*Atractomorpha crenulata*) and Grey weevil (*Mylocerus undecimpustulatus*), (Singh and Singh, 1990). Among them, the leaf defoliator's viz., green semilooper (*Chrysodeixis acuta*) are the noxious pests that damage the soybean crop extensively by skeletonizing the leaves and thus reducing the photosynthetic capacity of the plant. Many insecticides have been involved for the control of these notorious pests (Purwar and Yadav, 2003, Harish, 2008). At present, synthetic insecticides have been used extensively to overcome the pest problem but indiscriminate use, resulted in number of problems viz., the development of insect resistance to insecticides and induced resurgence of secondary pests (Dodia *et al*, 2008). The Present study entitles efficacy different insecticides against green semilooper on soybean were help in selection of most effective chemical insecticide against green semilooper (*Chrysodeixis acuta*) of soybean.

Materials and Methods

The experiment was conducted at Agricultural Entomology Section, College of Agriculture Nagpur during kharif season 2013-2014. Details of materials used for conducting these studies land, soybean seed (JS-335), insecticides, agricultural implements, manures and fertilizers, knapsack sprayer, measuring tape, rope, pegs, tags, bullock pair, labours, polythene bags, weighing balance etc were utilized and the methods followed during the course of studies are described herewith. The trail was laid out in Randomized block design with nine treatments and three replication. The soybean variety JS- 335 was sown on dated 18 June 2013 at 45 X 0.5 cm spacing.

The plot size was kept 4.5 x 3.0m. The chemical treatments(T1) Chlorpyrifos 20 EC @ 0.04%, (T2) Chloropyrifos 20EC @ 0.06%, (T3) Profenophos 50 EC @ 0.125%, (T4) Profenophos 50 EC @0.185%, (T5) Quinalphos 25 EC 0.05%, (T6) Quinalphos 25 EC @ 0.075%, (T7) Triazophos 40EC @ 0.04%, (T8) Triazophos 40 EC @ 0.06% and (T9) control (water spray) were evaluated.

Methods of recording observation

The observations on green semilooper was recorded on randomly selected one meter row length at five places from each plot, 24 hours before the application of treatments and the post treatment observations were recorded at 7 and 14 days after application of treatment. The yield of soybean from each net plot was recorded to know the influence of the different treatments. The yield data from each treated plot were used to calculate economics of spraying. The cost of insecticide cost of spray applications i.e. labour charges prevailing during the course of investigations were taken into consideration to work out the cost of each treatment per hectare. Similarly, income obtained from the sale of soybean as per the prevailing market rates was also calculated for each treatment to work out the cost benefit ratio. The field data collected during the course of experimentation was subjected to statistical analysis after appropriate transformation for interpretation of results. Randomized block design used in order to test level of significance among the various treatments as per Gomez and Gomez (1984).

Results and Discussion

The present study was evaluated for their efficacy against Green semilooper on soybean. The average population of major pests on soybean was observed at 7 and 14 days after each spray application. The average

population in each treatment was worked out. Then data was transformed into corresponding square root values and was subjected to statistical analysis.

Effect of different treatments on average population of green semilooper larvae 7 and 14 days after first spray

AT 7DAS

The data on average number of larvae of Semilooper/mrl was recorded at 7 DAS after 1st spray is presented in Table 1. The treatments (T4) Profenophos 50 EC @ 0.185% (0.53/mrl) was found to be most effective treatment but was at par with the treatments of (T3) Profenophos 50 EC @ 0.125% (0.83/mrl), (T6) Quinalphos 25EC @ 0.075% (1.13/mrl), (T5) Quinalphos 25 EC @ 0.05% (1.03/mrl) and (T2) Chlorpyriphos 20 EC @ 0.06% (1.07/mrl). The next superior treatments were of (T1) Chlorpyriphos 20 EC @ 0.04% (1.33/mrl) which observed to be equally effective with (T8) Triazophos 40 EC @ 0.06% (1.63/mrl) followed by the treatment of (T7) Triazophos 40 EC @ 0.04% (1.77/mrl).

The maximum average number of larvae of semilooper (3.10/mrl) was recorded in treatment (T9) control. The above results are on parallel line with the findings of Raju *et al.*, (2013), who reported Profenophos 50 EC @ 1250 ml/ha and Quinalphos 25 EC @ 1500ml/ha to offer maximum protection against green semilooper upto 35 DAG after application of first spray and reported 0.00 larvae/mrl and 0.11 larvae/mrl, respectively. Khandwe and Waghmare (2003) studied the efficacy of chlorpyriphos 20 EC against green semilooper, *C. acuta* on soybean. A single spray of chlorpyriphos (0.1%) at 30 days after sowing (DAS) was highly effective in reducing the larval population to 0.33 larvae per 10 plant as compared with 8 larvae per plant in the untreated control.

AT 14 DAS

The data on average number of larvae of *semilooper*/mrl recorded at 14 DAS after 1st spray are presented in Table 1. The result was found significant. The treatment (T4) Profenophos 50 EC @ 0.185% (0.97/mrl) was observed significantly superior treatment and was at par with (T3) Profenophos 50 EC @ 0.125% (1.13/mrl), (T6) Quinalphos 25 EC @ 0.075% (1.27/mrl), (T5) Quinalphos 25 EC @ 0.05% (1.43/mrl), (T2) Chlorpyriphos 20 EC @ 0.06% (1.53/mrl) and (T1) Chlorpyriphos 20 EC @ 0.04% (1.70/mrl) followed by treatments of (T8) Triazophos 40 EC @ 0.06% (1.83/mrl) and (T7) Triazophos 40 EC @ 0.04% (2.03/mrl) which proved equally effective amongst each other. Maximum average number of larvae of semilooper (4.17/mrl) was recorded in (T9) control (water spray). Balaji *et al.*, (2012) reported diafenthiuron 50 WP, profenofos 50 EC, triazophos 40 EC and emamectin benzoate 5 SG to be highly effective against green semilooper and remained effective upto 5 days after treatment. Singh and Singh (1987) studied the incidence and damage caused by the noctuid *Chrysodeixis acuta* to soyabean pods and flowers and reported effective control by the treatment with quinalphos 25 EC at 0.05% upto 42 days after spraying.

Effect of different treatments on average population of green semilooper larvae 7 and 14 days after second spray

AT 7 DAS

The data on average number of larvae of *semilooper*/mrl were recorded at 7 DAS after 2nd spray are presented in Table 1. The treatment (T4) Profenophos 50 EC @ 0.185% found(0.70/mrl)significantly superior all over other treatments but was at par with the treatments of (T3) Profenophos 50 EC @ 0.125% (0.87/mrl), (T6) Quinalphos 25 EC@

0.075% (0.93/ml) followed by treatments (T5) Quinalphos 25 EC @ 0.05% (1.07/ml), (T2) Chlorpyrifos 20 EC @ 0.06% (1.20/ml) and (T1) Chlorpyrifos 20 EC @ 0.04% (1.27/ml). The next superior treatments were of (T8) Triazophos 40 EC @ 0.06% (1.77/ml) and (T7) Triazophos 40 EC @ 0.04% (1.90/ml). Maximum average number of larvae of *Spodoptera* (4.73 /ml) was recorded in (T9) control (water spray).

The above results are in confirmation with the findings of Raju *et al.*, (2013) who reported Pofenophos 50 EC @ 1250 ml/ha and Quinalphos 25 EC @ 1500ml/ha to be effective against green semilooper upto 55 DAG after application of first spray and reported 0.77 larvae/ml and 0.61 larvae/ml, respectively. Balaji *et al.*, (2012) reported diafenthiuron 50 WP, profenophos 50 EC, triazophos 40 EC and emamectin benzoate 5 SG to be highly effective against green semilooper and remained effective upto 5 days after treatment. Dubey *et al.*, (1998) reported triazophos 40 EC as highly and significantly more toxic against Green semilooper (*Chrysodeixes accuta*).

AT 14 DAS

The data on average number of larvae of *semilooper*/ml were recorded after 2nd spray at 14 DAS is presented in Table 1. The treatment (T4) Profenophos 50 EC @ 0.185% (0.80/ml) was found significantly superior over all other treatments but was also found at par with the treatments of (T3) Profenophos 50EC @ 0.125% (1.00/ml), (T6) Quinalphos 25 EC @ 0.075% (1.40/ml) and (T5) Quinalphos 25 EC @ 0.05% (1.60/ml). The next effective treatments were of (T2) Chlorpyrifos 20 EC @ 0.06% (1.80/ml) which was at par with the treatments of (T1) Chlorpyrifos 20 EC @ 0.04% (1.93/ml), (T8) Triazophos 40 EC @ 0.06% (1.97/ml) and (T7) Triazophos 40 EC @ 0.04% (2.20/ml). Maximum average larval

population (5.03/ml) was recorded in (T9) control plots. Similar results were reported by Singh and Singh (1987) who studied the incidence and damage caused by the noctuid *Chrysodeixis acuta* to soyabean pods and flowers and reported effective control by the treatment with quinalphos at 0.05%, 42 days after spraying. Nagrale *et al.*, (2009) reported treatment of Quinalphos 25 EC 0.05% as most significantly superior over all the other treatments and recorded maximum green semilooper (83.80, 66.64, 72.26, 63.93, 97.42, 97.00) per cent larval reduction and was at par with Neem seed extract 5% to some extent in which 60.90 per cent larval reduction was observed after three spraying.

Effect of different treatments on average population of green semilooper larvae 7 and 14 days after third spray

AT 7DAS

The data on average number of larvae of semilooper /ml were recorded at 7 DAS after 3rd spray are presented in Table 1. All the treatments were found significantly superior over the control. The treatment (T4) Profenophos 50 EC @ 0.185% (0.00/ml) was the most superior treatment which was at par with (T3) Profenophos 50 EC @ 0.125% (0.00/ml), (T6) Quinalphos 25 EC @ 0.075% (0.07/ml), (T5) Quinalphos 25 EC @ 0.05% (0.17/ml), (T2) Chlorpyrifos 20 EC @ 0.06% (0.23/ml) and (T1) Chlorpyrifos 20 EC @ 0.04% (0.37/ml).

The next superior treatment recorded (T8) Triazophos 40 EC @ 0.06% (0.53/ml) followed by treatment (T7) Triazophos 40 EC @ 0.04% (0.83/ml). The maximum average number of larvae of *semilooper* (4.50/ml) was recorded in (T9) control (water spray). Balaji *et al.* (2012) reported diafenthiuron 50 WP, profenophos 50 EC, triazophos 40 EC and emamectin benzoate 5 SG to be highly effective against

green semilooper and remained effective upto 5 days after treatment. Khandwe and Waghmare (2003) studied the efficacy of chlorpyrifos 20 EC sprays against green semiloopers, *C. acuta* on soyabean. A single spray of chlorpyrifos (0.1%) at 30 days after sowing (DAS) was highly effective in reducing the larval population to 0.33 larvae per 10 plants as compared with 8 larvae per plant in the untreated control. So, the present results could be compared with the findings of those workers.

AT 14 DAS

The data on average number of larvae of semilooper/mrl recorded at 14 DAS after 3rd spray are presented in Table 1. The result was found most significant in treatment (T4) Profenophos 50 EC @ 0.185% (0.00/mrl). But this treatment was found at par with treatments (T3) Profenophos 50 EC @ 0.125% (0.17/mrl), (T6) Quinalphos 25 EC @ 0.075% (0.27/mrl). The next superior treatments recorded were of (T5) Quinalphos 25 EC @ 0.05% (0.50/mrl) which was at par with treatments (T2) Chlorpyrifos 20 EC @ 0.06% (0.73/mrl), (T1) Chlorpyrifos 20 EC @ 0.04% (0.97/mrl) followed by (T8) Triazophos 40 EC @ 0.06% (1.10/mrl) and (T7) Triazophos 40 EC @ 0.04% (1.23/mrl). Maximum average number of larvae of semilooper (4.13/mrl) was recorded in treatment (T9), control plots.

Dubey *et al.*, (1998) reported Triazophos 40 EC as highly and significantly more toxic against green semilooper (*Chrysodeixes accuta*). Nagrale *et al.*(2009) reported Quinalphos 25 EC 0.05% as significantly superior over all the other treatments and recorded maximum green semilooper (83.80, 66.64, 72.26, 63.93, 97.42, 97.00) per cent larval reduction and was at par with Neem seed extract 5% to some extent in which 60.90 per cent larval reduction was observed after three spraying.

Cumulative mean population of Green semilooper larvae in different treatments at 7 DAS and 14 DAS after three spraying AT 7 DAS

The data on cumulative mean number of larvae of semilooper/mrl recorded at 7 DAS and presented in Table 1. The result was found to be statistically significant. However, numerically minimum number of larvae of semilooper (0.41/mrl) was recorded in treatment (T4) Profenophos 50 EC @ 0.185% which was at par with treatments (T3) Profenophos 50 EC @ 0.125% (0.57/mrl), (T6) Quinalphos 25 EC @ 0.075% (0.71/mrl), (T5) Quinalphos 25 EC @ 0.05% (0.76/mrl) and (T2) Chlorpyrifos 20 EC @ 0.06%(0.83/mrl). The next effective treatments were of (T1) Chlorpyrifos 20 EC @ 0.04% (0.99/mrl), (T8) Triazophos 40 EC @ 0.06%(1.31/mrl) and (T7) Triazophos 40 EC @ 0.04% (1.50/mrl). While, maximum cumulative average number of semilooper larvae (4.11/mrl) was recorded in (T9) control (water spray). The above results are in confirmation with Balaji *et al.*, (2012) who reported diafenthiuron 50 WP, profenophos 50 EC, triazophos 40 EC and Emamectin benzoate 5 SG to be highly effective against green semilooper and remained effective upto 5 days after treatment. Khandwe and Waghmare (2003) studied the efficacy of chlorpyrifos 20 EC sprays against green semiloopers, *C. acuta* on soybean. A single spray of chlorpyrifos (0.1%) at 30 days after sowing (DAS) was highly effective in reducing the larval population to 0.33 larvae per 10 plants as compared with 8 larvae per plant in the untreated control.

AT 14 DAS

The data on cumulative mean number of larvae of *semilooper*/mrl recorded at 14 DAS and presented in Table 1. The result was found to be statistically significant. However, minimum cumulative average number of

semilooper larvae (0.59/mrl) was recorded in treatment (T4) Profenophos 50EC @ 0.185% which was also found at par with the treatments (T3) Profenophos 50 EC @ 0.125% (0.77/mrl), (T6) Quinalphos 25 EC @ 0.075% (0.98/mrl), (T5) Quinalphos 25 EC @ 0.05% (1.18/mrl) and (T2) Chlorpyriphos 20 EC @ 0.06% (1.35/mrl). The next effective treatments were of (T1) Chlorpyriphos 20 EC @ 0.04% (1.53/mrl), (T8) Triazophos 40EC @ 0.06% (1.63/mrl) and (T7) Triazophos 40EC @ 0.04% (1.82/mrl). While, maximum cumulative average number of larvae of semilooper (4.44/mrl) was recorded in (T9) control (water spray). The above results are in confirmation with the findings of Raju *et al.*, (2013) who reported Profenophos 50 EC @ 1250 ml/ha and Quinalphos 25 EC @ 1500ml/ha to offer maximum protection against green semilooper which was recorded upto 35 DAG after application of first spray and reported 0.00 larvae/mrl and 0.11 larvae/mrl, respectively. Dubey *et al.*, (1998) reported that Triazophos 40 EC was highly and significantly more toxic against green semilooper (*Chrysodeixes accuta*).

Effect of different treatments on Average yield of Soybean crop

The plots treated with Profenophos 50 EC @ 0.185% recorded maximum yield of soybean i.e. 22.75 q/ha followed by (T3) Profenophos 50 EC @ 0.125% and (T6) Quinalphos25 EC @ 0.075% recording 20.29 q/ha and 19.23 q/ha yield and were found to be statistically at par with each other and significantly superior over rest of the treatments. However, the yield recorded in the treatments of (T3) Profenophos 50 EC @ 0.125% (20.29 q/ha) followed by, (T6) Quinalphos25 EC @ 0.075 % (19.23q/ha), (T5) Quinalphos 25 EC @ 0.05% (18.48q/ha), (T2) Chlorpyriphos20 EC @ 0.06% (16.34q/ha), (T1) Chlorpyriphos 20 EC @ 0.04% (15.70q/ha), (T8) Triazophos 40 EC @ 0.06% (15.06q/ha) and (T7)

Triazophos 40 EC @ 0.04(14.63q/ha) and were found statistically at par with each other but found significantly superior over control (T9; water spray) in which 9.40 q/ha yield was recorded. The above results are in confirmation with Keshbhat *et al.*, (2002) who recorded the efficacy of Quinalphos 0.05%, Decamethrin 0.0025% and Profenophos 0.15% in reducing larval population. It was also reported that, maximum grain yield was recorded in Profenophos (31.24 q/ha) followed by Quinalphos (29.62 q/ha) and Decamethrin (29.39 q/ha) and were at par with each other. These observations are comparable with the yield observation reported by Sinha *et al.*, (2013) who reported Profenophos 50 EC @ 0.1% as most effective against lepedepterian pests with 19.40q/ha yield with the increase in the yield up to 8.15 q/ha over control.

Incremental cost benefit ratio (ICBR) for different treatments

The data presented in Table 2 with parameters increased yield over control (q/ha) revealed that, the treatment with three spraying of profenophos 50 EC @ 0.125 % (T3) had offered the maximum ICBR to the extent of 6.43 followed by (T4) profenophos 50 EC @ 0.185 % (6.41); (T5) Quinalphos 25 EC @ 0.05 % (6.24); (T6) Quinalphos 25 EC @ 0.075 % (5.55); (T1) Chlorpyriphos 20 EC @ 0.04% (5.25); (T2) Chlorpyriphos 20 EC @ 0.06% (5.14); (T7) Triazophos 40 EC @ 0.04% (3.90); (T8) Triazophos 40 EC @ 0.06% (3.64).

The above results are in confirmation with Raju *et al.*, (2013) who reported that, spraying of triazophos was economical and most remunerative and recorded 1: 7.32 ICBR, followed by profenophos 50 EC @ 1250 ml/ha (1:5.36) and quinalphos 25 EC @ 1500 ml /ha (1:5.09).

From the findings of the present investigations, it could be concluded that, minimum average population of Green semilooper was observed in the treatments of (T4) Profenophos50 EC @ 0.185% followed by treatment (T3) Profenophos50EC @ 0.125%, (T6) Quinalphos 25 EC @ 0.075%, (T5) Quinalphos 25 EC @ 0.05%, (T2) Chlorpyriphos 20 EC @ 0.06%, (T1) Chlorpyriphos 20 EC @ 0.04%, (T8) Triazophos 40 EC @ 0.06% and (T7) Triazophos 40 EC @ 0.04% 7 and 14 days after three sprayings and were proved to be effective in controlling the semilooper. The treatment (T4) Profenophos 50EC @ 0.185%

ranked first in recording maximum yield but in treatment (T3) Profenophos50EC @ 0.125% highest ICBR was recorded. The other treatments in descending order in respect of yield were of T3 > T6 > T5 > T2 > T1 > T8 > T7 and regarding ICBR T4 > T5 > T6 > T1 > T2 > T7 > T8. The overall picture on the basis of ICBR and yield of treatment, the treatment (T3) profenophos 50 EC @ 0.125 % and (T4) profenophos 50 EC @ 0.185 % shown promise in recording lower infestation of soyabean defoliators and comparative higher yield but further needs to be tested.

Table.1 Cumulative mean population of green semilooper larvae in different treatments at 7 and 14 days after three spraying

| Tr. No. | Treatments | 7 DAS | | | | 14 DAS | | | |
|---------|----------------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| | | 1 st spray | 2 nd spray | 3 rd spray | Mean | 1 st spray | 2 nd Spray | 3 rd spray | Mean |
| T1 | Chlorpyriphos 20 EC @0.04% | 1.33 (1.35) | 1.27 (1.32) | 0.37 (0.93) | 0.99 (1.21) | 1.70 (1.47) | 1.93 (1.55) | 0.97 (1.20) | 1.53 (1.42) |
| T2 | Chlorpyriphos 20 EC @0.06% | 1.07 (1.25) | 1.20 (1.30) | 0.23 (0.86) | 0.83 (1.14) | 1.53 (1.42) | 1.80 (1.51) | 0.73 (1.08) | 1.35 (1.35) |
| T3 | Profenophos 50 EC @0.125% | 0.83 (1.15) | 0.87 (1.16) | 0.00 (0.71) | 0.57 (1.01) | 1.13 (1.27) | 1.00 (1.22) | 0.17 (0.82) | 0.77 (1.11) |
| T4 | Profenophos 50 EC @0.185% | 0.53 (1.01) | 0.70 (1.09) | 0.00 (0.71) | 0.41 (0.94) | 0.97 (1.20) | 0.80 (1.14) | 0.00 (0.71) | 0.59 (1.02) |
| T5 | Quinalphos 25 EC @0.05% | 1.03 (1.23) | 1.07 (1.25) | 0.17 (0.82) | 0.76 (1.10) | 1.43 (1.39) | 1.60 (1.44) | 0.50 (1.00) | 1.18 (1.28) |
| T6 | Quinalphos 25 EC@ 0.075% | 1.13 (1.27) | 0.93 (1.19) | 0.07 (0.75) | 0.71 (1.08) | 1.27 (1.32) | 1.40 (1.37) | 0.27 (0.87) | 0.98 (1.20) |
| T7 | Triazophos 40 EC @0.04% | 1.77 (1.51) | 1.90 (1.55) | 0.83 (1.14) | 1.50 (1.40) | 2.03 (1.57) | 2.20 (1.64) | 1.23 (1.31) | 1.82 (1.52) |
| T8 | Triazophos 40EC @ 0.06% | 1.63 (1.46) | 1.77 (1.50) | 0.53 (1.01) | 1.31 (1.33) | 1.83 (1.52) | 1.97 (1.57) | 1.10 (1.26) | 1.63 (1.45) |
| T9 | Control (waterspray). | 3.10 (1.88) | 4.73 (2.28) | 4.50 (2.22) | 4.11 (2.14) | 4.17 (2.12) | 5.03 (2.33) | 4.13 (2.14) | 4.44 (2.20) |
| | F TEST | Sig. | Sig. | Sig. | Sig | Sig. | Sig. | Sig. | Sig |
| | SE (m) | 0.09 | 0.09 | 0.07 | 0.07 | 0.09 | 0.11 | 0.08 | 0.11 |
| | CD @ 5% | 0.28 | 0.28 | 0.21 | 0.22 | 0.29 | 0.33 | 0.24 | 0.33 |
| | C.V. | 12.29 | 11.80 | 12.93 | 10.32 | 11.35 | 12.47 | 12.24 | 13.94 |

Figures in parentheses indicates square root transformation ($\sqrt{X + 0.5}$)

Table.2 Incremental cost benefit ratio (ICBR) for different treatment

| Treatments | Quantity of insecticides required per ha. (Lit) | Price of insecticides (RS)/L | Cost of treatment | | Total cost Rs/ha (A) | Yield of soybean (q/ha) | Increase d yield over control (q/ha) | Increas ed yield over control (Rs/ha) (B) | Net grain over control (C) (B-A) | ICBR (C/A) | Rank |
|---|---|------------------------------|-------------------------------------|--|----------------------|-------------------------|--------------------------------------|---|----------------------------------|------------|-------------|
| | | | Cost of insecticides 3sprays Rs./ha | Labour charges and rent of sprayer (3 spray) | | | | | | | |
| T1-Choloropyriphos 20 EC @ 0.04% | 1.00 | 210 | 630 | 1950 | 2580 | 15.70 | 6.30 | 16128 | 13548 | 5.25 | V |
| T T2-Choloropyriphos 20 EC @ 0.06% | 1.50 | 210 | 945 | 1950 | 2895 | 16.34 | 6.94 | 17766 | 14871 | 5.14 | VI |
| T3-Profenophos 50 EC @ 0.125 % | 1.25 | 480 | 1800 | 1950 | 3750 | 20.29 | 10.89 | 27878 | 24128 | 6.43 | I |
| T4 profenophos 50 EC @ 0.185 % | 1.85 | 480 | 2664 | 1950 | 4614 | 22.75 | 13.35 | 34176 | 29562 | 6.41 | II |
| T5 Quinalphos 25 EC @ 0.05 % | 1.00 | 420 | 1260 | 1950 | 3210 | 18.48 | 9.08 | 23245 | 20035 | 6.24 | III |
| T6 Quinalphos 25 EC @ 0.075 % | 1.25 | 420 | 1890 | 1950 | 3840 | 19.23 | 9.83 | 25165 | 21325 | 5.55 | IV |
| T7. Triazophos 40 EC @ .04% | 0.50 | 520 | 780 | 1950 | 2730 | 14.63 | 5.23 | 13389 | 10659 | 3.90 | VII |
| T8 Triazophos 40 EC @ 0.06% | 0.75 | 520 | 1170 | 1950 | 3120 | 15.06 | 5.66 | 14890 | 11370 | 3.64 | VIII |
| T9 Control | - | - | - | - | | 9.40 | - | - | - | - | IX |

- 1). 5 Labour charges for one spray/ha. @ Rs. 120 / labour / day,
- 3). Sale price of Soybean @ Rs. 2560/qtl.

- 2).charges for hiring 3 Spray pump/ha @Rs. 25/day/pump,
- 4) Considering 500 lit of water required for one application /ha area of the crop)

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