Efficacy of Different Organophosphate Pesticides against Jassid Feeding on Okra *(Abelmoschus esculentus)*

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Abstract Field studies were conducted for the determination of efficacy of different organophosphate pesticides viz Profenofos, Dimethoate , Acephate and Malathion against jassid (*Amrasca devastans*) feeding on okra crop. Seeds of okra crop were planted in randomized block design with 3 replicates. The pretreatment observations were recorded at 24 hour before spray, while, the post-treatment observations were taken after 1, 2, 3,4,5,6 and 7 days of treatment. The crop was sprayed four times repeatedly with 7 day interval during the experimental period. The results revealed that all of the tested pesticides reduced the population of *Amrasca devastans* except Profenofos. Though the Profenofos was unable to reduce the pest population but it was able to somewhat control the further proliferation of pest. In contrary Dimethoate was found as the most effective against the jassid with significant reduction in pest population against the control and other treatments.The results obtained from the research concluded that the organophosphate pesticides including Dimethoate, Acephate, and Malathion were found effective for controlling the jassid population feeding on okra but the low dose of pesticides including Profenfos were found ineffective.

Keywords: Organophosphate, Pesticides, Bioefficacy, Pests, Okra.

1. INTRODUCTION

Okra *Abelmoschus esculentus* belonge to the family *malvacea* and grown throughout the Sindh during the summer season. The okra plants normally grow up to the height of 5 feet. It bears yellow fascinating flowers and produces fruits 60 days after plantation. Because of its fast growth, picking is done on daily or alternate days basis. Okra provides vitamin A, B, C, protein, amino acids, minerals and iodine [1]. Because of the heavy pest infestations, we are getting very low per acre green pod production of okra. Biswas *et al.* stated that the best quality of marketable okra fruits is related with the efficacy of synthetic chemical pesticides used for managing the infesting insect pests [2]. Jassids (*Amrasca devestant)* is one of the major insect pest feeding on okra crop [3]. Jassids remains active all over the year excluding two months of winter season. High humidity favors the jassids population growth and maximum population is observed during the month of July and August [4].

Usage of chemical insecticides is a cheap and quick result giving method for controlling the okra insect pests. There is a vast range of chemical insecticides belonging to organophosphate, Organochlorine, Carbamates and Pyrethroid groups used for controlling the insect pests of okra. Bio efficacy of different insecticides of organophosphate group against jassid infesting the okra crop has been evaluated in our present studies. The tested pesticides were Profenofos, Dimethoate, Acephate and Malathion. Profenofos is cholinesterase inhibitor which possesses ability to inhibit acetylcholinesterase [5], and effective for controlling the okra pests including jassids, white fly and spotted boll worm [6, 7]. Dimethoate is an anticholinesterase which disables cholinesterase enzyme and damages the central nervous system of insects [8, 9]. Acephate is effective against a vast range of biting and sucking insects including aphids, Heliothis spp, leaf miners, lepidopterous larvae, sawflies and thrips. It interferes the acetylcholinesterase enzymes and damages the activity of central nervous system of insects. It is used against the pest of fruits, vegetables, horticulture, turf, mint and forestry [10, 11]. Malathion is effective against a vast range of insects including mosquitoes, lice, sucking and chewing insect pests of crops, fruits and vegetables. Malathion 50 EC @ 0.05% is effective against alfalfa weevil larvae for approximately 25DAT [12].

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Table 1: Pesticides used During Experiments

Pesticides	A.I./LIT,KG	DOSE/ACRE	DOSE/PLOT
Profenofos	44%	400-800ml/acre	5ml/lit
Dimethoate	35%(400gm/lit)	300-400ml/acre	5ml/lit
Acephate	75%	750-800/acre	5gm/lit
Malathion	57%	750-800ml/acre	5ml/lit

MATERIALS AND METHODS

The experimental field was selected in Department of Agriculture & Agribusiness Management, University of Karachi for conducting the research trials. Approximately 4 meters long and 3 meters wide plots with three replicates were managed for the research purposes. For observing the differences between treated and untreated plots, an untreated controlled plot was kept there. Plant to plant distance was managed by 9 inches. While, a distance of 24 inches between row to row and 3 meters distance between plot to plot was managed. For managing the difference in between each plot, the Pigeon pea (Cajanus *cajan* L. family *fabaceae*) was sown in between the experimental plots. The tested chemicals were procured from the authorized dealers of the manufacturing companies. Approximately 5ml of the tested chemical was diluted in one litre of water for spraying the okra plants based on the randomized complete block design. The Pest population data was taken in early morning every day from 10 randomly selected plants from each experimental plot up to the period of seven days. The nature of damage caused to the stems, leaves, flowers and fruit was assessed by visual observation. The data was analyzed by using the Handerson-Tilton formula for measuring the efficacy of tested insecticides against jassids.

RESULTS

The results showed that Dimethoate was the most effective for controlling the pest with maximum reduction. Significant difference $P<0.05$ in day one was observed in Dimethoate with Profenofos, Malathion and control plots while non significant difference with Acephate was observed on day one which remain continue till the third day of treatment (Figure **1**). After fourth day a significant difference of ($P<0.05$) was observed in. A 57.78% reduction in jassid population was observed on first day of treatment which increased with the time period and goes upto 84.66% on sixth day of treatment but it decreased to 78% on seventh day of application. Acephate effects were followed by the Dimethoate with a significant difference of ($P<0.05$) with the Profenofos, Malathion and control plots during the seven days of observation and non significant to the Dimethoate for three days which changed into significant difference ($P<0.05$) after fourth day of treatment. Acephate provided 54.25% reduction in pest population on first day and increased to 83.90% on third day which started losing the effectiveness after fourth day and reached to 53.10% on seventh day of treatment. Malathion reduced 43.61% jassid infestation on first day with a significant difference ($P<0.05$) to the Profenofos, Dimethoate and Acephate and control plots during the seven days of observations, but it was

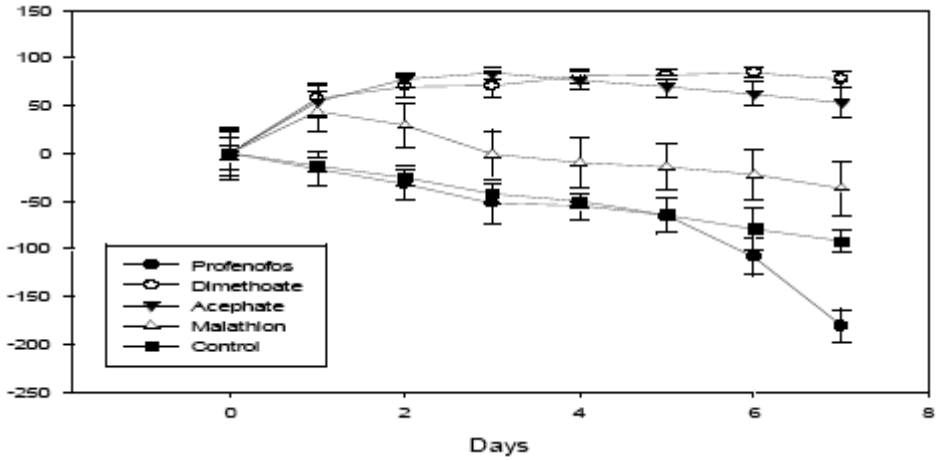

Figure 1: Graph showing % reduction in Jassid population after treatment and interval after 1st spray.

unable to check the pest population two days after treatment, while an increase of 36.78% in jassid population was observed on seventh day of treatment. Though the Profenofos was unable to reduce the pest population but it was found better than control plot. Significant differences (P<0.05) were observed in between Profenfos and Dimetoate, Acephate and Malathion treated plots. The overall results revealed that the Dimethoate was found as the most effective pesticide for controlling the jassid infestation on okra crop followed by Acephate and Malathion.

The results showed that the Dimethoate was the most effective for controlling the pest with maximum reduction. Significant difference (P<0.05) in day one was observed in Dimethoate with Profenofos, Malathion and control plots while non significant difference with Acephate was observed on day one which remain continue till the third day of treatment (Figure **2**). After fourth day a significant difference was observed (P<0.05). A 12.57% reduction in jassid population was observed on first day of treatment which increased with the time period and goes upto 67.92% on sixth day of treatment but it decreased to 49.62% on seventh day of application. Acephate effects were followed by the Dimethoate with a significant difference of (P<0.05) with the Profenofos and control plots during the seven days of observation and non significant to the Dimethoate and Malathion on first day of treatment. A significant difference of Acephate with Profenofos , Malathion and control plots was observed on second and third day of treatment and again a significant difference with Dimethoate was observed on 4-7 days of treatment. on the first day of treatment. Acephate provided 11.58 % reduction in pest population on first day and increased to 29.87% on third day which started losing the effectiveness after fourth day and reached to 100.6% on seventh day of treatment. Malathion reduced 14.65% jassid infestation on first day with a significant difference (P<0.05). to the Profenofos and control plots which changed into non significant after second and remain continue till the seventh day of observation, while a significant difference in between Malathion and Acephate was observed in second and third day of treatment, Malathion showed significant difference with Dimethoate from 2-7 day of treatment, It was unable to reduce the jassid population two days after treatment, while an increase of 90.17% in jassid population was observed on seventh day of treatment. Though the Profenofos was unable to reduce the pest population but it was able to reduce the further proliferation of pest population. Significant differences were observed (P<0.05) in between Profenfos and Dimetoate during the seven days of observations, significant difference with Acephate for initial three days of treatment and significant difference with Malathion on first day of treatment while a non significant difference with untreated control was observed during all the seven days. Overall, Dimethoate provided the best results for reducing the jassid population infesting okra crop, followed by Acephate and Malathion. The effectiveness of all the tested pesticides was observed comparatively low than the first spray.

During the third spray, the Acephate provided the best results 60.69% reduction in pest population on first day of treatment which remains continue for three days with 69.60% reduction but after fourth day, the pesticide started losing the effectiveness against the pest. A significant difference (P<0.05) in between Acephate and Profenofos, Dimethoate, Malathion and

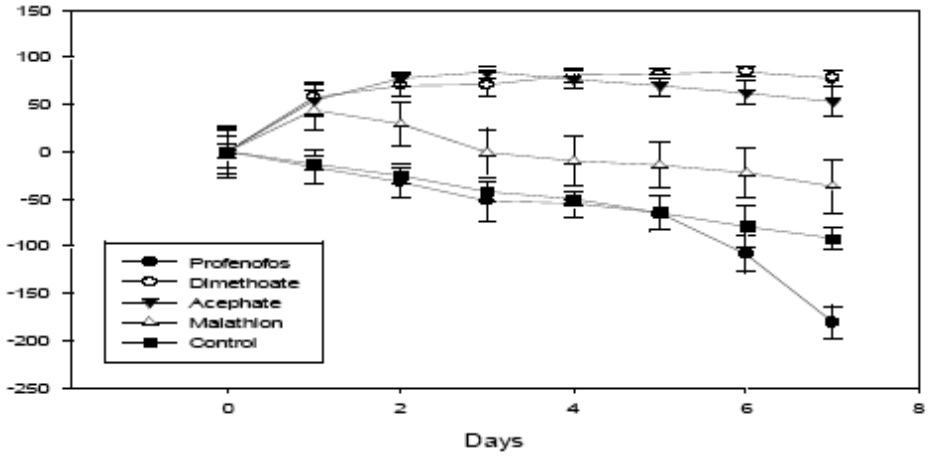

Figure 2: Graph showing % reduction in Jassid population after different treatment time interval after 2nd spray.

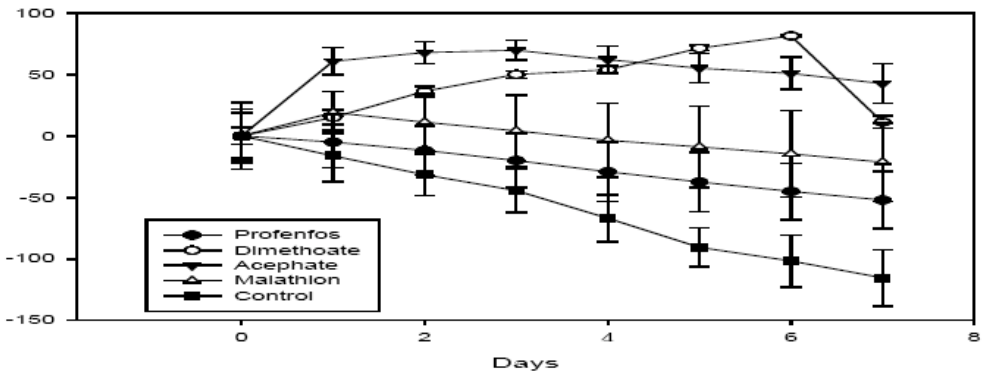

Figure 3: Graph showing % reduction in Jassid population after different treatment time interval after 3rd spray.

control plots was observed during the entire period of observations (Figure **3**). Dimethoate provided 15% control against the jassid on first day, showing an increasing trend with the time period up to the maximum reduction of 81.25% on sixth day and started reducing with 11.25% on seventh day of treatment. Significant difference (P<0.05) in day one was observed in Dimethoate with Profenofos , Malathion and control plots while non significant difference with Acephate was observed on day one which remain continue till the third day of treatment, after fourth day a significant difference of P<0.05was observed. Malathion reduced 19.07% jassid population on first day with a significant difference of P<0.05 (Figure **3**) to the Profenofos and control plots which was observed till third day of treatment. Malathion started losing its effectiveness on second day and was unable to reduce the pest population after three days of treatment, while an increase of 21.38% in jassid population was observed on seventh day of treatment. Significant difference was observed in between Malathion with Acephate during the all seven days of observation and from day 2-7 with Dimethoate. It provided better results as compared to the second spray. Profenofos could not reduce the pest population but it was found better than control plot. Profenfos provided significant differences (P<0.05) with Dimetoate and Acephate during the entire period of seven days, from day 1-3 with Malathion and non significant with untreated plot during all the seven days. The overall results revealed that the Dimethoate provided longer control against the jassid feeding on okra crop, Acephate provided higher results but only for three days and it was followed by Malathion.

The results showed that the Dimethoate reduced 12.67% jassid population on first day, which increased every day up to 70.42% on sixth day and decreased to 14.78% on seventh day. Dimethoate showed significant difference (P<0.05) with Profenofos and control plots during the seven days and from day 2-7 with Malathion while with Acephate it was significant on day one but non significant on day 2-3 and again significant on day 4-7 (Figure **4**). Acephate provided maximum reductions of 25.31% and 56.8% on first two days but it started losing the effects after that and could not reuce the pest population after fourth day of treatment. An increased jassid population 18.67% was observed on seventh day of treatment. Acephate showed significant difference (P<0.05) with Profenofos and control plots during the seven days of observation and on day 2-3 with Malathion, while with the Dimethoate , it showed significant diference on day-1, non significant on day 2-3 and again significant on day4-7. Malathion reduced 17.15% jassid population on first day and could not reduce it two days after treatment and an increase of 38. 83% in jassid population was observed on seventh day of treatment. Malathion showed significant difference of (P<0.05) with Profenofos and control plots on day-1 and non significant during rest of the six days of observations,; non significant on day one and significant on day2-7 with Dimethoate and significant on day1-3 and non significant on day4-7 with Acephate. Though the Profenofos was unable to reduce the pest population but it was found better than control plot. Significant differences (P<0.05) were observed in between Profenfos and Dimetoate during the seven days of observation. Profenofos showed significant difference on day1-3 and non significant on day 4-7 with Acephate, while it was significant on day-1 and non significant on rest of six days for Malathion. Profenofos showed non significant difference with untreated plots during the entire period of observations.. The overall results revealed that the Dimethoate initially provided low results as compared to the Acephate but it provided longer time control against the targeted pest. Acephate provided higher results for initial two days but it lost its effectiveness

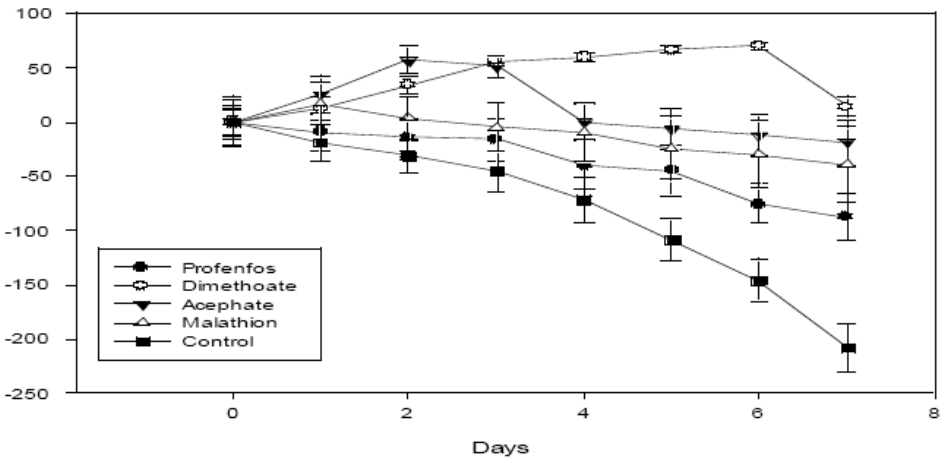

Figure 4: Graph showing % reduction in Jassid population after different treatment time interval after 4th spray.

after that, Malathion provided results only for two day after treatment and the Profenofos was unable to reduce the pest population.

DISCUSSION

The results of the conducted experiments revealed that the Dimethoate was found as the best for controlling the jassids infestations on okra crop. Dimethoate provided maximum results and controlled jassid population for a longer period as compared to the other tested pesticides. Acephate reduced the jassid populations but it lost its effectiveness after 3-4 days of treatment.Malathion reduced the jassid population but after 2-3 days of treatment it lost its effectiveness against the jassids. Though the Profenofos could not reduce the jassid population on okra but it was observed better than the untreated plot. The failure of Profenofos for controlling jassids may be either because of the application doses of Profenofos or application of Profenofos without mixing it with any other pesticides, inspite of this reason, change in the pest species may be a reason for Profenofos failure. Similar results were defined by Biswas *et al*. [2], that the Dimethoate is effective for controlling the insect pests of okra but the highest marketable fruits yields were obtained through the combination formulation of Cypermethrin and Profenphos. Das *et al*. stated that the Acephate was found effective for controlling the fruit borer infesting okra fruits with highest yield and best cost benefit ratios of (1:5.58) [13]. Mahmoud Shalby reported that Malathion was the second most effective after the diazinon for controlling the *Helicoverpa armigera* feeding on okra [14]. Misra *et al*. reported that Profenofos was found effective in combination with Cypermethrin for controlling the leafroller, *Sylepta derogata* and fruit borer, *Earias* spp infesting the okra crop [15]. In present studies results are in contrast with Misra *et al*. that may be either because of change of pest or change of application doses of pesticides [15], moreover usage of Profenofos singly instead of in combination with Cypermethrin may be a reason for change in results. Pareek *et al*. reported that the Dimethoate was found effective for managing okra pests including jassids, apids and fruit borer, these results were in resemblance with the present studies [16]. Soliman and Shalby reported the Malathion effective against *Helicoverpa armigera* feeding okra crop [17]. Sharma and Shukla reported that the Malathion was found effective against jassid infesting the okra crop [18]. Moreover he described that the lower doses were found ineffective for controlling the pest problem. Similar results were observed in the present studies. Comparatively low effectiveness of the tested pesticides was observed which may be because of change of doses of pesticides applied. Sinha and Chaudhary also found the Malathion effective for controlling the jassid feeding on okra [19]. These are similar to the present studies. Sivakumar *et al.* found Profenofos effective against okra pest including jassid, aphid and red spider mites in combination of Cypermethrin [20]. In the present studies Profenofos did not provided similar results that may be either because of change in Profenofos quantity or application of Profenofos without any combinations.

CONCLUSION

Present studies concluded that though most of the organophosphate pesticides were found effective against jassid feeding on okra but the best results were obtained by the Dimethoate and Acephate followed by the Malathion. Moreover the present studies showed that the Profenofos applied singly without combining it

with any other pesticides, could not reduce the jassid population, but it was able to somewhat control the further proliferation of pest.

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