Journal of Natural Sciences Research www.iiste.org
ISSN 2224-3186 (Paper) ISSN 2225-0921 (Online)
Vol.4, No.23, 2014

Effect of Number of Sprays, Time of Application on Natural Enemies and Okra Crop Duration

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Abstract
The present study on irrational use of pesticides in okra crop was carried at Tando Jam, District Hyderabad during spring season, 2009. The four different farms v/z Muhammad Ismail Sehto, Noor Muhammad Sehto (Village Hakim Ali Khatian), Abdul Karim Khaskheli (Village Moosa Khatian) and Ghulam Serwar Sheikh (Village Shaman Ali Sheikh) were surveyed. The okra crop was sown on ridge and drill method under natural conditions. All the practices were followed by the farmers, from sowing to harvesting. The farmers were interviewed and data was collected on pesticides application, dose and time of usage by farmer. The insect pests' infestation, occurrence of natural enemies, production and crop life duration were studied. The results regarding irrational use of pesticides in okra crop reveals that the farmers are applying pesticide on their own, without consulting/suggestions of Agriculture Experts. The farmers applied pesticide in single and in mixture with micronutrients and repeat on weakly basis, but no pest populations observed under control while the populations of natural enemies were found decreased. The yield of okra crop was also not improved due to huge application of pesticides. The crop comes in stress, pollination of flower affected and crop life reduced. The farmers are advised for proper pest scouting before any pesticide spray. If pests found at ETL then selected pesticide may be applies to control the target pests. The rational use of pesticide reduces cost-benefit ratio, increase activities of natural enemies, yield and crop life duration under natural condition (Agro-ecosystem).
Keywords: Spray Number, Application Time, Natural Enemies and Okra.

1. Introduction1

Okra (Abemoschus esculentus L.) is one of the most important and delicious vegetable crop belonging to family Malavaceae and is thought to be native to Africa, South East Asia and North Australia in the Pacific. It is herbaceous annual plant and widely cultivated in the tropical and sub-tropical regions of the world in home gardening and commercial market purpose (Khoso, 1994).

Okra is locally called as "Bhindi" and considered as a main kharif vegetable crop of Pakistan grown in all parts of the country. The climatic condition of Sindh province is highly suitable for the cultivation of okra crop; therefore, it is grown twice a year; in spring and summer seasons (Mangrio, 2004). It is good source of vitamins A, B and D, protein, starch, salts and also rich in minerals like Ca, Mg and Fe and iodine which play a significant role in human diet. Its fruits can be cooked in a variety of ways; fried in butter or oil and cooked with other ingredients. The stem of this plant provides fiber which is used in the paper industry (Yadav and Dhankhar, 2001 and Baloch, 1996).

Most of the okra cultivars are adapted to high temperatures and a wide range of soil types. The average temperature of 68-80 oF is considered as best for growth, flowering and pod development. It is also tolerant to wide variation in rainfall (Paul et al. 2000).

The total cultivated area under okra crop in Pakistan is 14,780 hectares, with annual production of 111,565 tons. The cultivated area in Sindh is 4910 hectares with annual production of 22,112 tons (GOP, 2006-07). Inspite of all efforts, the average yield is very low as compared to other countries of the world due to various biotic and abiotic factors including insect pest and diseases.

To minimize these injurious pests and crop losses, chemical control measures have been used since long time and were given emphasis. Due to indiscriminate use of pesticides, the pest has developed resistance. Besides, that pesticides are hazardous to human health also reduces density of eco-friendly insects and soil microorganisms. According to the WTO, more than 3 million people are severely sickened and 220,000 die from pesticides each year worldwide. Moreover, 60 to 70 million birds are killed each year from Pesticide poisonings. Fish and other wildlife are also at risk from pesticide misuse and accidents. Activities of wild bees and honey bees, which are essential for pollination of many crops, are being suffered due to pesticide exposure that showed the irrational use of pesticides to manage pests (Parveen and Dhandapani, 2001). Inspite of the hazardous effects of pesticides on human and animal health, eco-friendly organism and agro-ecosystem, their use for the control of pests is still prevailing.

Natural enemies; parasitoids and predators are the main sources of reductions in the populations of noxious insect pests. In natural agro-ecosystem they suppress the population of pests and regulate the natural

balance of ecosystem. These biological agents reduce the pest population below the level that causes economic damage (Pfadt, 1980). The grubs of lady bird beetle feed on eggs, nymphs and adults of the prey. The beetles have high feeding rate and consume nearly 500 aphids before reaching its adult stage. Their adult feed on aphid at the rate of 30-40 per day (Lohar, 2001).

1.1 Materials and Methods 2

The present study regarding irrational use of pesticides in okra crop was carried at Tando Jam, District Hyderabad during spring season, 2009. The four different farms v/z Muhammad Ismail Sehto and Noor Muhammad Sehto (Village Hakim Ali Khatian), Abdul Karim Khaskheli (Village Moosa Khatian) and Ghulam Sarwar Sheikh (Village Shaman Ali Sheikh) were surveyed for examining irrational use of pesticides. The okra crop was sown on ridge and furrow method at all farms, under natural conditions. All the practices were followed by the farmers, from sowing to harvesting. The farmers were interviewed and crop was observed from sowing to the final picking/harvesting. The data was recorded on weekly basis.

Pesticide, Dose and time of application.

The spray application was recorded to estimate irrational use of pesticide in okra crop cultivated by Muhammad Ismail Sehto, Noor Muhammad Sehto, Abdul Karim Khaskheli and Ghulam Serwar Sheikh at Tando jam

Insect Pests Infestation and Occurrence of Natural Enemies in Okra Sprayed Fields

The insect pests infestation and occurrence of natural enemies was calculated on different okra fields v/z Muhammad Ismail Sehto, Noor Muhammad Sehto, Abdul Karim Khaskheli and Ghulam Serwar Sheikh. The nine okra plants randomly were selected from each farmer's field. From each plant two top, two middle and two bottom portion of the leaves were observed to record the insect pest and natural enemies' population.

Yield

The yield productions were also recorded from first to the final picking to asses the total yield/hector.

Okra crop life duration of pesticide sprayed areas

The crop duration from sowing to final picking was recorded to analysis the adverse effect of pesticide from the okra field of Muhammad Ismail Sehto, Noor Muhammad Sehto, Abdul Karim Khaskheli and Ghulam Sarwar Sheikh at Tando Jam.

Analysis of data

Data thus obtained were subjected to statistical analysis using statistical computer software package, Statistix 8.0.

1.1.1 Results

The result so for achieved during studies on irrational use of pesticides in okra crop were carried out near Tando Jam, District Hyderabad, during spring season, 2009 are as:

Number and time of Sprays/ applications.

The results regarding number of sprays and time of application of pesticides at different farms shows highly significant difference at $P < 0.05$, i.e. 0.0061 for morning, 0.1328 for evening and 0.0031 (Table 1) The maximum number (27) of sprays were recorded at the farm of Ghulam Sarwar (26 morning and 1 evening), followed by Abdul Karim khashkeli (20), Muhammad Ismail (19) (17 in morning and 2 in the evening) and Noor Muhammad farm 17 sprays, (13 in morning and 4 in the evening) (Table 1).

Table 1. Number of Sprays, Time of application on okra crop at different farms in the near Tando jam.

Grower name	Morning	Evening	Total Number of Spray
Ghulam Sarwar Sheikh	26	1	27
Abdul Karim Khaskheli	20	0	20
M.Ismail Sehto	17	2	19
Noor M.Sehto	13	4	17
Mean	19.000	1.7500	20.500
SE	2.7386	0.8539	2.3274
P value	0.0061	0.1328	0.0031

Natural enemies population on okra crop

The result regarding natural enemies recorded on okra crop, under irrational use of pesticide at Muhammad Ismail Sehto, Noor Muhammad Sehto, Abdul Karim Khaskheli and Ghulam Sarwar Sheikh Farms, near Tandojam, are given in Table 2 The natural enemies were observed with highly significant difference due to irrational use of pesticides application. Averagely population of ants, Orius sp., spiders and lady bird beetles varied with one another and fluctuated differently, through out the cropping season, at all four farms.

The presence of ant was recorded occasionally, during 1st week of March with population of (1.52) 4th week of March with 0.25 and in 2nd week of April with a mean population of 0.24 per plant (Table 2). Average

mean population was recorded at the farm of Muhammad Ismail and Noor Muhammad (0.23), followed by Abdul Karim Khaskheli and Ghulam Sarwar farm (0.07) per plant (Table 2).

Orious sp. found present only in two weeks (4th and 5th week of Mar.) with a mean population of 0.25 and 0.22 per plant, respectively (Table 2), only at the farm of Ghulam Sarwar with an over all mean population of 0.14 per plant (Table 2).

The spider was appeared during last week of February population of 0.69, but its maximum population (1.52 and 1.08 per plant was recorded during 2nd and 1st week of March (Table 2). It was 0.25, 0.45, 0.05, 0.51, 0.25, 0.50, 0.36 and 0.41 during 4th and 4th week of March, 1st to 4th week of April and 2nd and 3rd week of May, respectively (Table 2). However, spider was present at all farms, with a mean population of 0.59, 0.58, 0.38 and 0.31 per plant at Noor Muhammad Sehto, Muhammad Ismail, Ghulam Sarwar and Abdul Karim Khaskheli farm, respectively (Table 2).

Seven spotted beetle was present 0.44 during 1st week of April followed by 0.25 during 3rd and 4th week of March and 0.11 per plant during 5th (last) week of March (Table 2). However, maximum mean population of seven spotted beetle was recorded at the farm of Ghulam Sarwar (0.15 per plant), followed by M. Ismail farm (0.09) and Noor Muhammad farm (0.07 per plant); whereas it was not observed at Abdul Karim Khaskheli farm (Table 2).

Zigzag beetle activities were recorded during March and population was (0.79) 3rd and 4th week followed by 0.25 during 1st, 0.22 during 2nd per plant during 3rd and 4th week of March (Table 2). However, it was recorded at the entire farms with a maximum mean population of 0.22 per plant at Ghulam Sarwar farm, followed by 0.17 at Muhammad Ismail farm, 0.15 at Noor Muhammad farm and 0.07 per plant at Abdul Karim Khaskheli farm (Table 2).

Table 2. Mean population of natural enemies in okra crop under irrational use of pesticides, at different target farms in the surroundings of Tando jam.

Grower	Population of Predators per plant				
	Ant	Seven spotted	Zigzag	Spider	Orious
M.Ismail Sehto	0.2392 a	0.0938 a	0.1795 a	0.5813 a	0.0000 b
Noor M. Sehto	0.2308 a	0.0769 a	0.1541 a	0.5982 a	0.0000 b
Ghulam Sarwar Sheikh	0.0769 a	0.1538 a	0.2223 a	0.3846 a	0.1454 a
Abdul Karim Khaskheli	0.0767 a	0.0000 a	0.0772 a	0.3164 a	0.0000 b
SE	0.1487	0.0791	0.1012	0.1677	0.0599
CV= 0.05	0.2938	0.1564	0.1999	0.3313	0.1184

Crop Life duration from irrational use of pesticides

Table 3 represents that the earlier okra crop was sown (08th Feb., 2009) at M. Ismail farm, who continued picking up to 16th May, 2009 and maximum crop duration are 98 days and 23 picking at Ghulam Sarwar farm, followed by 94 days duration with 25 pickings at Noor Mohammad farm, crop duration 91 days at Muhammad Ismail farm and 79 days at Abdul Karim farm respectively shown in Table-3.

Table 3. Okra crop duration under irrational use of pesticides at different farms near Tando jam.

GROWER	DATE OF SOWING	DATE OF LAST PICKING/ HARVESTING	CROP DURATION IN DAYS
Muhammad Ismail	08 Feb., 2009	16-May-2009	98
Noor Muhammad	11 Feb., 2009	15-May-2009	94
Ghulam Sarwar	15 Feb., 2009	16-May-2009	91
Abdul Karim	20 Feb., 2009	09-May-2009	79
Mean			90.500
SE			4.0927
CV = 0.05/P value			0.0002

1.1.2 Discussion

The result achieved during studies on irrational use of pesticides in okra crop were carried out in Tando Jam, District Hyderabad, during spring season, 2009 to observed irrational application of pesticide.

The results showed that the irrational use of pesticides on okra crop showing the names of pesticides, dose per hector number of applications at different farms in accordance with Lohar et al. 1996; Gul, 1998; Suryawanshi et al. 2000; Mohamed, 2002; Kumar et al. 2002; Arora and Singh, 2004; Sunitha et al. 2005; Al-Haj et al., (2005) and Khan et al. (2006).

The results regarding number of sprays/ applications and time of application of pesticides at different

farms shows highly significant difference at $P < 0.05$, i.e. 0.0061 for morning, 0.1328 for evening and 0.0031 for total number of sprays. The maximum number (27) of sprays were recorded at the farm of Ghulam Sarwar (one in evening and remaining (26) in the morning), followed by Abdul Karim khashkeli (20 sprays, in the morning only), Muhammad Ismail (19 spray, 17 in morning and 2 in the evening) and at the farm of Noor Muhammad (17 sprays, 13 in morning and 4 in the evening). The maximum (46) applications of six different pesticide products were done on okra crop, at the farm of Ghulam Sarwar, followed by 39 applications of three different pesticide products on okra crop at the farm of Abdul Karim khashkeli, 38 applications of five different pesticide products on okra crop at the farm of Muhammad Ismail and 31 applications of five different pesticide products on okra crop at the farm of Noor Muhammad. The results are in accordance with Al-Haj et al., (2005) who conducted interviews with farmers applied different kinds of pesticides. Khan et al. (2006) studied the frequency and time of pesticide application applied by local farmers through conducting a field survey.

The result regarding predators recorded in okra crop, sprayed with different pesticides at Muhammad Ismail Sehto, Noor Muhammad Sehto, Abdul Karim Khaskheli and Ghulam Sarwar Sheikh Farms, in the surroundings of Tandojam, are also in accordance with world scientists. The presence and population of beneficial insects was observed with highly significant difference due to many seen and un-seen reasons. On an overall, the population of ants, Orius sp., spiders and lady bird beetles varied with one another and fluctuated differently, no one recorded through out the cropping season, at all four target farms.

The presence of ant was recorded occasionally, during 1st week of Mar. with a mean population of 1.52, 4th week of March with 0.25 and in 2nd week of April with a mean population of 0.24 per plant. Its maximum population was recorded at the farm of Muhammad Ismail and Noor Muhammad (0.23), followed by Abdul Karim Khaskheli and Ghulam Sarwar farm (0.07) per plant. Orious sp. found present only in two weeks (4th and 5th week of Mar.) with a mean population of 0.25 and 0.22 per plant, respectively, only at the farm of Ghulam Sarwar with an over all mean population of 0.14 per plant. The spider was not found present during 3rd week of March and 1st week of May. It was found present first time during last week of February with a mean population of 0.69, but its maximum population (1.52 and 1.08 per plant was recorded during 2nd and 1st week of March (Table 2). It was 0.25, 0.45, 0.05, 0.51, 0.25, 0.50, 0.36 and 0.41 during 4th and 4th week of March, 1st to 4th week of April and 2nd and 3rd week of May, respectively. However, spider was present at all the four target farms, with a mean population of 0.59, 0.58, 0.38 and 0.31 per plant at Noor Muhammad Sehto, Muhammad Ismail, Ghulam Sarwar and Abdul Karim Khaskheli farm, respectively. Seven spotted beetle was not found during last week of Feb., 1st and 2nd week of March, and from 2nd week of April to 3rd week of May. It was found present with a maximum mean of 0.44 during 1st week of April followed by 0.25 per plant during 3rd and 4th week of March and 0.11 per plant during 5th (last) week of March. However, maximum mean population of seven spotted beetle was recorded at the farm of Ghulam Sarwar (0.15 per plant), followed by M. Ismail farm (0.09) and Noor Muhammad farm (0.07 per plant); whereas it was absent at the farm of Abdul Karim Khaskheli during course of study. Zigzag beetle activities were recorded during March only, with a mean population of 0.25 during 1st, 0.22 during 2nd and 0.79 per plant during 3rd and 4th week of March. However, it was recorded at the entire target farms with a maximum mean population of 0.22 per palnt at Ghulam Sarwar farm, followed by 0.17 at Muhammad Ismail farm, 0.15 at Noor Muhammad farm and 0.07 per plant at Abdul Karim Khaskheli farm. The results are in accordance with Arora et al. (1996) given an overview on various management practices including biological control (Spider, Ant, lady bird Beetle, Orius, Mirid bug, Mystery bug, Chrysopa, Tichogramma, Encarsia, Brumus, Big Eyed bug, assassian bug, damsel bug etc) of insect pests found on okra. Parveen and Dhandapani (2001) reported that chemical control measures have been used since long time to minimize the injurious pests but due to indiscriminate use of pesticides, the pest has developed resistance. Besides, that pesticides are hazardous to human health also reduces density of eco-friendly insects and soil microorganisms. Activities of wild bees and honey bees, which are essential for pollination of many crops, are being suffered due to pesticide exposure that showed the irrational use of pesticides to manage pests. Natural enemies; parasitoids and predators are the main sources of reductions in the populations of noxious insect pests. In natural agro-ecosystem they suppress the population of pests and regulate the natural balance of ecosystem. These biological agents reduce the pest population below the level that causes economic damage (Pfadt, 1980). But indiscriminate use of pesticides has destroyed the bio-control agents in the agro-ecosystems and the populations of natural enemies of the insects and pests have declined up to 90 percent during the last decade (of the past century) (Khan et al. 2002). Geoghegan (2000) reported that seven spot ladybirds (Coccinella septempunctata) is a potentially useful predator for biological study. Shimoyakawa (2002) examined the control of insect pests on okra using indigenous natural enemies including ladybird beetles, Orius spp. and spiders in an open field. Kumar et al. (2004) determined the predatory potential of spiders on insect pests of bhendi [okra]. Kubar et. al. (2006) also observed many spider species in okra crop feeding on phytophagous insects. Singh and Brar (2004) reported that coccinellids are the most important predators and prey upon large numbers of sucking pests like aphids, jassid, white flies and lepidopteran eggs and neonate larvae. Rao and Raguraman (2005) reported that predators re-colonization in the botanical-sprayed plots, while it was not so in the chemical

treatment. Sardana et al. (2005a) evaluated the impact of integrated pest management programmes to reduce pests infesting on okra. A large build-up of natural enemies such as spiders and coccinellids were observed in the plots where none of the pesticides were applied.

1.1.3 Conclusions

The result obtained from this Inspections shows that irrational use of pesticides destroy the natural ecosystem as well as harmful effects on natural enemies of insect pest, however the farmers applied pesticides on their own experience, have no any consulting/suggestion of agriculture experts, farmers were unaware about ETL of pest, pesticides dose, time of application and repetition. Due to irrational use of chemicals the crop comes under stress and life duration decreases.

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