Sindh Univ. Res. Jour. (Sci. Ser.) Vol. 45 (2) 247-252 (2013)

SINDH UNIVERSITY RESEARCH JOURNAL (SCIENCE SERIES)

Impact of Feretilizers Application on Insect Pests Populations in Okra, *Abelmoschus Esculentus* L. Crop

N. BALOCH[++], A. G. LANJAR*, M. A. SAMO*, A. W. SOLANGI*, S. A. KHUHRO*

Department of Zoology, University of Sindh, Jamshoro. Sindh, Pakistan

Received 07th February 2012 and Revised 12th July 2013

Abstract: The experiment on the impact of fertilizers application on insect pests' population in okra crop was conducted at the experimental fields of Faculty of Crop Protection, Sindh Agriculture University, Tando Jam during the Spring season 2006. Okra variety "Subzpari" was cultivated in a completely randomized block design with four treatments and three replicates. The treatments were: T1= urea, T2= DAP (Diamunium phosphate), T3= urea + DAP and T4= control. The population of jassid and whitefly was counted by examining thirty randomly selected leaves from each sub plots. The populations of *Helicoverpa armigera* Hb. and *Earias spp.* were recorded from 30 randomly selected plants from each sub plot. The results showed that sucking insect pests i.e. jassid and whitefly appeared on the crop just after transplanting until harvest. The populations of chewing insects i.e. *H. armigera* and *Earias spp.* were found very negligible. The amximum population of jassid (4.62 ± 0.52 per leaf) was recorded on the plants treated with DAP, followed by urea (4.20 ± 0.32), urea + DAP (3.99 ± 0.50) and control (0.11 ± 0.41). The overall results showed that the highest population of jassid (1.05 ± 0.66) was recorded on the plants treated with DAP, followed by urea + DAP (1.01±0.65), Control (0.83±0.52), and urea (0.78±0.47). The maximum population per leaf of whitefly (3.79 ± 0.24) was recorded on the plants treated with urea + DAP, followed by urea alone (2.00 ± 0.36), DAP (1.49 ± 0.18), and control (0.08 ± 0.06). The overall mean population of whitefly (0.60 ± 0.067) was recorded on plants treated with urea + DAP, followed by urea alone (0.40 ± 0.062), DAP (0.35 ± 0.064), and Control (0.05 ± 0.052). The yield of okra crop showed that plots treated with Urea+ DAP yielded 746 kg per acre, followed by urea (670), DAP (519), and control (354). Analysis of variance showed significant difference ($P < 0.05$) in population of whitefly, jassid and yield of okra between treatments plots.

Keywords: Fertilizers, okra, jassid, whitefly, *H. armigera*, *Earias spp.*

1. INTRODUCTION

Okra, *Abelmoschus esculentus* L. (Moench) is one of the most widely known and utilized species of the family Malvaceae (Naveed *et al.,* 2009). It is a hot summer and annual vegetable (Pandita *et al*., 2010), commonly known as "lady's finger". It is primarily grown for its immature pods that can be consumed as a fried or boiled vegetable or may be added to salads, soups and stews (Kashif *et al.,* 2008). The pod of okra contains water, calcium, iron, protein, and starch. It is a rich source of vitamin, A and B, and also contains minerals, phosphorus, iodine, and salts which play a significant role in human diet (Khushk, *et al*. 2003). Total area under okra cultivation in Pakistan is estimated to be 2.21×10^5 hectares, yielding about 2.86×10^6 tons of green pods (Anwar *et al.,* 2011). The okra plant is attacked by a large number of insect pests i.e. Whitefly, aphid, jassid, thrip, and fruit borers (spotted bollworm, American bollworm etc.), which are the major pests of okra (Lanjar and Sahito, 2007). The most destructive insect pests are whitefly, *Bemisia tabaci* (Genn.) (Sahito *et al.,* 2012), thrip *Thrips tabaci* (Lind.) and jassid, *Amrasca devastans* (Dist.) (Atwal, 1994), aphid, *Aphis gossypii* (Glover) and American bollworm, *Helicoverpa armigera* (Hb.) (Shabozoi *et al*. 2011), spotted bollworm, *Earias spp.* (Aziz *et al*., 2011 and Aziz, 2012), etc. Among these insects, the whitefly is an injurious pest, which destroys the okra plant by sucking the sap from the leaves and transmitting certain viral diseases (Basu, 1995). Cultural methods such as application of fertilizers can affect susceptibility of plants to insect pests by altering plant tissue nutrient levels. Research shows that the ability of a crop plant to resist or tolerate insect pests and diseases is tied to optimal physical, chemical and mainly biological properties of soils. Soils with high organic matter and active soil biology generally exhibit good soil fertility. Crops grown in such soils generally exhibit lower abundance of several insect and herbivores reductions that may be attributed to a lower nitrogen content in organically farmed crops (Miguel *et al.,* 2003). Many studies suggest that the physiological susceptibility of crops may be affected by the form of fertilizer used (organic versus chemical fertilizers). High nitrogen fertilizers can stimulate outbreaks of Homopteran insects such as leafhoppers and aphids (Leal *et al.,* 1997; Morales *et al.,* 1997; Myers and Stolon, 1999). Many evidences have been highlighted where comparison between conventional versus organic fertilizers have shown high number of herbivores insects on conventionally managed plots than organically farmed crops (Magdoff, 1992; Altieri, 1994). There is possibility of changing the preference of insects by optimal plant nutritional requirement via

[++]Corresponding author: N. BALOCH e-mail: nbbaloch12@yahoo.com+92-336632208

* Sindh Agriculture University Tando Jam, Sindh, Pakistan

altering the fertilizer level of a soil (Phelan *et al.,* 1996). Seasonal mean aphid population was non-significantly different among plants receiving different levels of Nitrogen (Aslam *et al.,* 2004). Khattak *et al.*, (1996) reported that high level of Nitrogen favours the attack of aphid. They concluded that application of Nitrogen alone increased the aphid infestation, whereas nitrogen and phosphorous in combination suppressed the aphid attack. Wheeler and Ordung (2005) determined that the variation in plant quality frequently impacts the biology of herbivorous insects. Looking at the problem of insect pests on okra and information regarding the stimulation of fertilizers application towards insects attack, the experiment was conducted on impact of fertilizer applications on insect pests' activities in okra crop. The results of the experiment will be utilized for crop management stretigies.

2. MATERIALS AND METHODS

The experiment was conducted at experimental fields of the Faculty of Crop Protection, Sindh Agriculture University, Tando Jam in Spring season 2006. Okra variety Subzpari was cultivated in a completely randomized block design. Four treatments (applications of fertilizers) were used T1= urea, T2= D.A.P, T3= urea + DAP and T4= control (No fertilizer was added). Each treatment was replicated four times. These fertilizers were applied at the interval of 25 days. The 1st application was made at the time of cultivation and subsequent application was made after 25 days. All other cultivation operations such as sowing on ridges, weeding, irrigations, etc were carried out equally the same for all treatments.

Observations on Insect Pest

Population of jassid and whitefly was counted by examining thirty randomly selected leaves from each sub plots. The selection of the leaves was done by making a zigzag movement in each sub plot. To count population of *H. armigera* and *Earias spp.* 30 plants were examined at random from each sub plot. The plant parts such as leaves, squares, buds, flowers and fruits were examined to count the population of *H. armigera*, and *Earias spp.* The data thus collected were statistically analyzed using ANOVA (Statistix 0.8).

Yield

After fruits setting, picking of edible sized fruits was started at three days interval till the crop was completely harvested. The data was pooled and the yield was calculated as kgs per acre.

3. RESULTS

Chewing insect pests

The populations of chewing insects i.e. *Helicoverpa armigera* and *Earias spp.* were very negligible. Both the borers showed discrete population pattern. *H. armigera* appeared only in 4th week of May with a population 0.01 (± 0.01) per plant on the plants fertilized by urea + DAP. *Earias spp.* was also negligible. However, its population was a bit higher than the population of *H. armigera*. Its maximum population 0.043 (±0.02) per plant was recorded in 4th week of June **(Figs. 1 and 2).**

Sucking pests

Sucking pests jassid and whitefly showed their appearance throughout the cropping season. However, their population trend was different from each other. The abundance and population trend of both the insects are given below:

Jassid, *Amrasca devastans*

The data **(Fig. 3)** showed significant difference ($P < 0.05$) in population of jassid appearance on okra crop treated with different fertilizers. The maximum population of jassid recorded at the initial stage of the crop. At the initial stage, the population (4.62 ± 0.52) per leaf was recorded on the plants treated with DAP, followed by urea (4.20 ± 0.32), urea + DAP (3.99 ± 0.50), and Control (0.11 ± 0.41). After that, the population started declining for next five weeks. Then a bit rise in population was recorded in 6th week. It was the time when second dose of the fertilizer was applied. Jassid showed significant response to the application of the fertilizer with regards to time period. The over all mean showed that the highest population was recorded on the plants treated with DAP (1.05 ± 0.66), followed by urea + DAP (1.01 ± 0.65), Control (0.83 ± 0.52), and urea (0.78 ± 0.47). This further indicated that the jassid preferred okra plants fertilized with DAP alone or in combination with urea.

Whitefly, *Bemisia tabaci*

The data **(Fig. 4)** showed that significant difference ($P < 0.05$) in population of white fly appeared on the plants treated with different fertilizers. The whitefly appeared in all treatments from second week of crop's transplanting till the harvest of the crop. In response to fertilizer applications, the maximum population of whitefly was recorded in third week of the crop. The highest population (3.79 ± 0.24 per leaf) was recorded on the plants treated with urea + DAP, followed by urea alone (2.00 ± 0.36), DAP (1.49 ± 0.18) and control (0.08 ± 0.06), respectively.

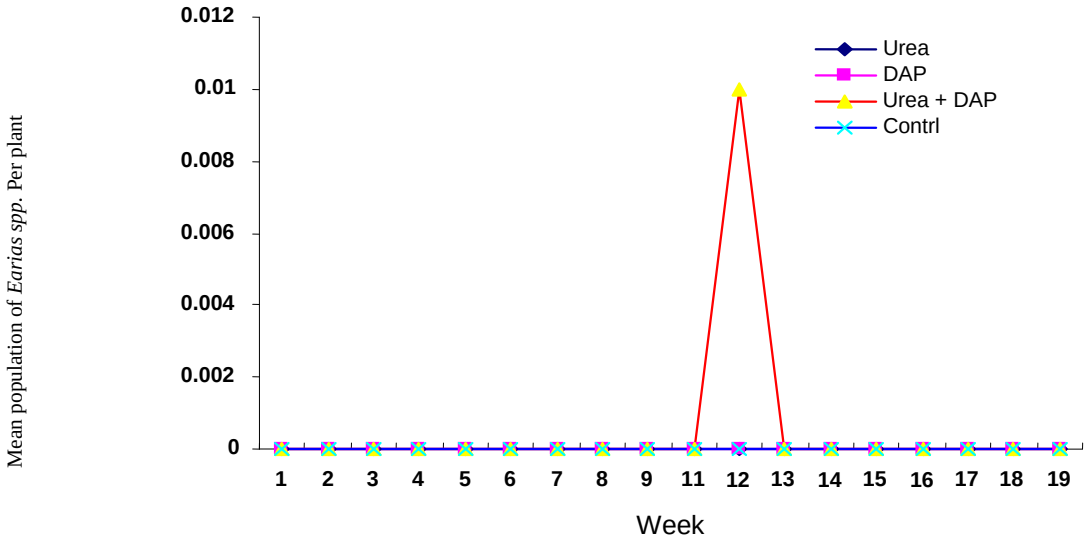


Fig. 1. Mean population of *E. vittella* per plant on okra after application of different fertilizers in Spring 2006.

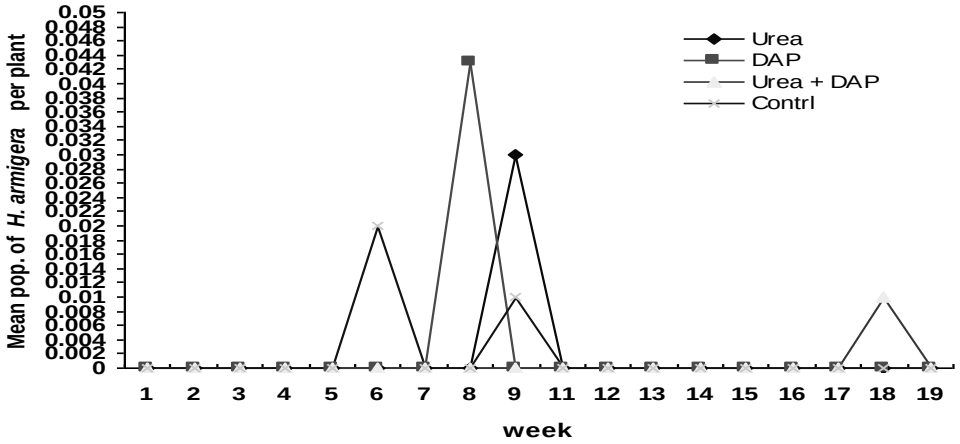


Fig. 2. Mean population of *H. armigera* per plant on okra after application of different fertilizers in Spring 2006.

The white fly population in response to second application of fertilizer showed almost the same response as it was observed after the 1st application. After 2nd application of the fertilizers, the maximum population of whitefly was again recorded on the plants treated with urea + DAP (2.27 ± 0.05), followed by urea alone (1.91 ± 0.16), DAP alone (1.63 ± 0.14) and Control (0.10 ± 0.05).

The overall mean population showed that the highest mean population (0.60 ± 0.067) per leaf was recorded on plants treated with urea + DAP, followed by urea alone (0.40 ± 0.062), DAP alone (0.35 ± 0.064), and Control (0.05 ± 0.052), respectively. The data clearly revealed that maximum activities of whitefly were recorded in plots treated with urea + DAP and minimum population on plants, which were kept untreated. This clearly showed the response of whitefly to different fertilizers applications.

Yield of okra crop

The data **(Fig. 5)** showed significant difference ($P < 0.05$) in yield of the plots treated with different fertilizers. It showed that plots treated with Urea+ DAP yielded 746 kgs okra fruit per acre, followed by Urea (670), DAP (519) and Control (354), respectively.

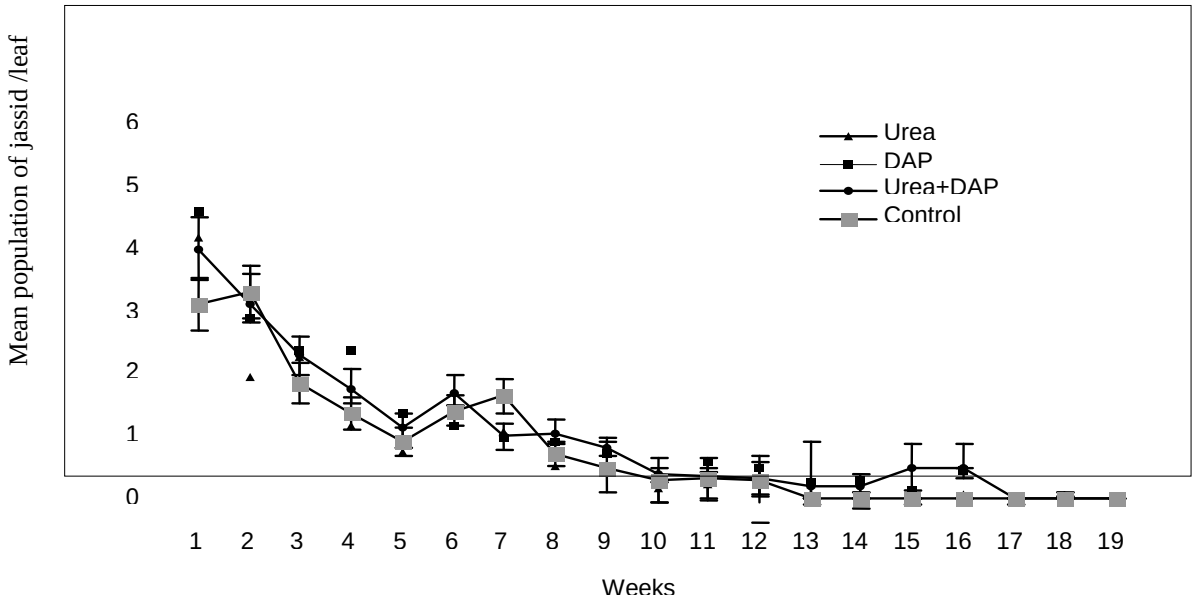


Fig. 3. Mean population of *Amrasca devastans* per leaf on okra after application of different fertilizers in Spring 2006.

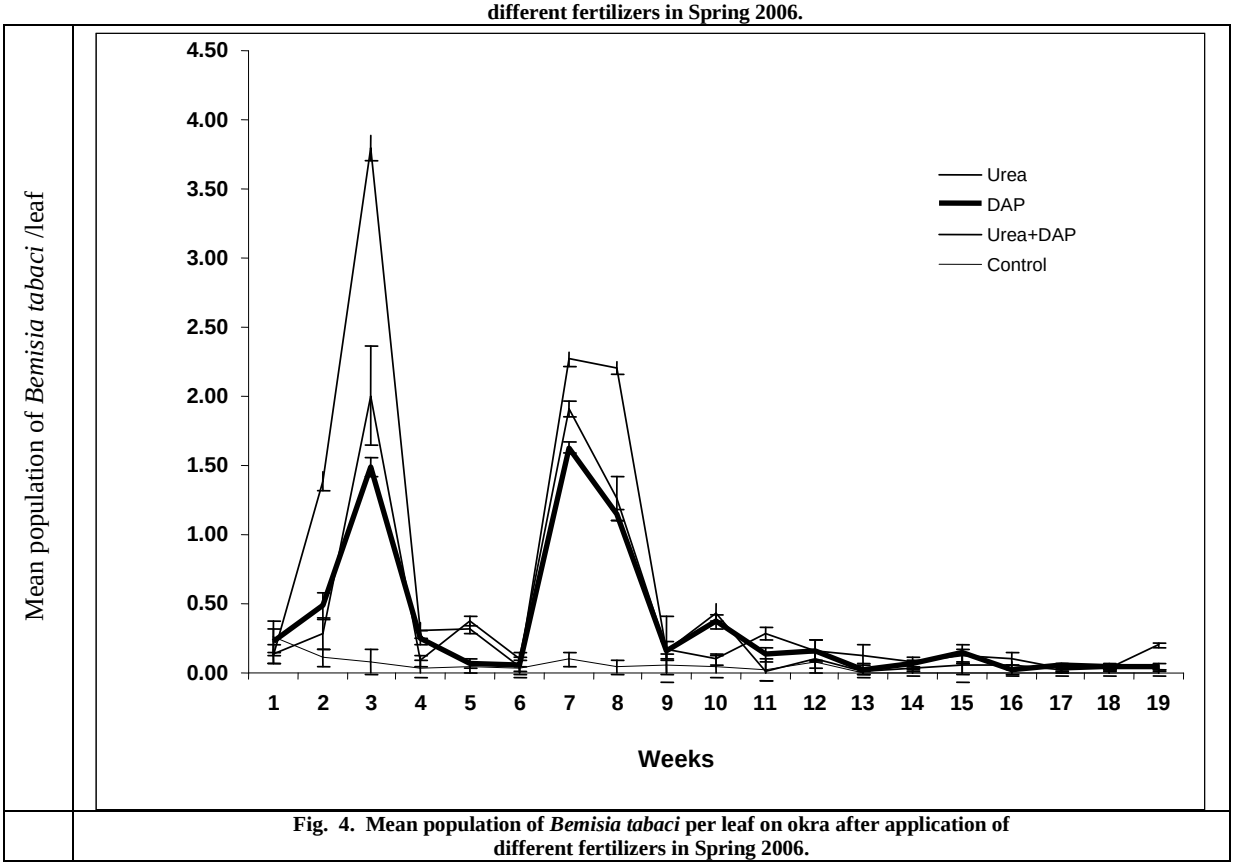


Fig. 4. Mean population of *Bemisia tabaci* per leaf on okra after application of different fertilizers in Spring 2006.

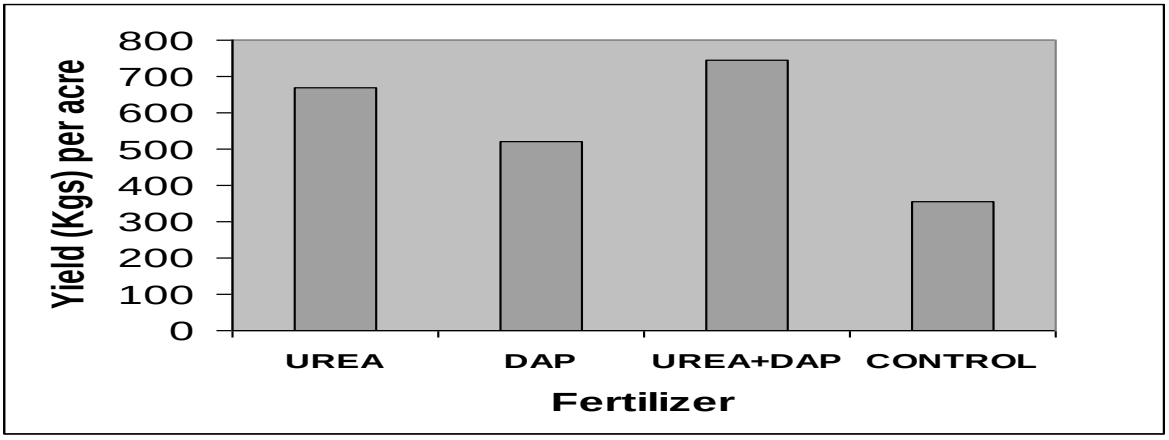


Fig. 5. Yield of okra crop after application of different fertilizers.

4. DISCUSSION

The results of the present experiment showed that sucking insect pests i.e. jassid and whitefly appeared on the crop just after transplanting until harvest, whereas, *Helicoverpa armigera* and *Earias spp.* appeared with negligible populations on okra crop throughout the cropping season. Atwal (1994) reported that the most destructive insect pests are whitefly, thrip, jassid, aphid, spotted bollworm, American bollworm, etc. Among these insect pests, the whitefly is the injurious one. In present study the insect population with regards to fertilizer application showed that maximum population of jassid was recorded on the plants treated with DAP followed by urea, urea + DAP and Control. This further indicated that the only jassid responded more to okra plants treated with DAP than other fertilizer applications. The results are well supported by Letourneau *et al.* (1996). They mentioned that damage to tomato foliage by some insect pests did not increase with increased N content of the crop. Helda *et al.* (2001) reported that corn fields treated with synthetic fertilizer for at least 2 years hosted more aphids (*Rhopalosiphum maidis*) than corn treated with organic fertilizer. The present study also indicated the trend of whitefly population was different to jassid population. The highest population per leaf of whitefly was recorded on the plants treated with urea + DAP, followed by urea alone, DAP alone and control, respectively. Sanford and Pimentel (1988) advocated that chemical fertilizer enhance the attack of insect pests. Thomas and Pimentel (1986) reported the ecological effects of the different treatments on herbivore populations. They suggested that insect abundance was probably due to changes in the nutritional quality and chemistry of the plants raised in the various treatments. High nitrogen fertilizers can stimulate outbreaks of Homopteran insects such as leafhoppers and aphids (Leal *et al.*, 1997; Morales *et al.*, 1997; Myers and Stolon, 1999). Wheeler (2003) suggested that in mass rearing activities increased production of weevils will occur in high-fertilized (90 g/pot) treatments due to increased larval survival. However, Miguel and Nicholls (2003) disagreed with the results and mentioned that soils with high organic matter and active soil biology generally exhibit good soil fertility, which generally exhibit lower abundance of several insect pests species.

5. CONCLUSIONS

It is concluded that the attack of *H. amigera* and *Earias spp.* was very negligible. The application of synthetic fertilizers enhanced the attack of sucking insect pests. Whitefly was abundant in the plots treated with urea + DAP; while, Jassid was abundant in the plots treated with DAP alone.

REFERENCES:

Altieri, M.A., (1994) Biodiversity Pest Management. Agroecosystem, Howarth Press, NY. 185Pp.

Anwar, F., U. Z. Rashid, M. T. Iqbal and T. Sherazi. (2011) Inter-varietal variation in the composition of okra (Hibiscus esculentus l.) seed oil. Pak. J. Bot., 43 **(1):** 271-280.

Aslam, M., M. Razaq and A. Maalik. (2004) Effect of nitrogen fertilizer application on population of mustard aphid (Lipaphis erysimi kalt.) on different canola varieties. Pak. Entomol. Vol. 26 **(1):** 115-119.

Atwal, S. N. (1994) Agricultural Pests of India and South East Asia. Kalyani Publishers New Delhi, India. 529 Pp..

Aziz, M. A. (2012) Roll of different physio-chemical characters of okra as a host plant for preference of *Earias spp*. Pakistan J. of Zool. 44 **(2):** 361-369.

Aziz, M. A., M. Hassan, A. Ali, A. Sohail and S. T. Sahi. (2011) Impact of Abiotic Factors on Incidence of Fruit and Shoot Infestation of Spotted Bollworms

Earias spp. on Okra (Abelmoschus esculentus L.). Pakistan J. Zool., vol. 43 **(5):** 863-868.
Basu, A.N. (1995) *Bemisia tabaci* (Gennadius) Crop pest and principal whitefly vector of plant viruses. Westview Press, Boulder, 173 Pp.

Helda, M., I. Perfecto and B. Ferguson. (2002) Traditional fertilization and its effect on corn insect populations in the Guatemalan highlands. Agriculture, Ecosystems and Environment, 84 **(2):** 145-155.

Karungi, J., B. Ekbom and S. Kyamanywa. (2006) Effects of organic versus conventional fertilizers on insect pests, natural enemies and yield of *Phaseolus vulgaris*. Agriculture, ecosystems and Environment, 115 **(1-4):** 51-55.

Kashif, S.R., M. Yaseen, M. Arshad and M. Ayub. (2008) Response of okra (*Hibiscus esculentus* L.) to soil given encapsulated calcium carbide. Pak. J. Bot., **(40):** 175-181.

Khattak, S. U., Khan, A. S. M. Shah, Z. Alam and M. Iqbal, (1996) Effect of nitrogen and phosphorus fertilization on aphid infestation and crop yield of three rapeseed cultivars. Pak. J. Zool., 28 **(4):** 335-338.

Khushk, A.M., M. Usman Shar and M.A. Memon. (2003) The cultivation of okra in Sindh and its economic view. PARC Technology Transfer Institute, Tandojam. 1-2.

Lanjar, A. G. and H. A. Sahito (2007) Impact of weeding on whitefly, *Bemisia tabaci* (genn.) population on okra crop. Pak. J. Weed Sci. Res. 13 **(3-4):** 209-217.

Leal, E. J., R. Chac and G. Sanchez, (1997) The effect of organic soil amendments on soil pests and crop nutrition of broccoli. IPM CRSP, 4th Ann. Rept., Office Intl. Res. Develop., Virginia Tech. Blacksburg, 24061-0334.

Letoureau, D. K., L. E. Drinkwater and C. Shennan. (1996) Effects of soil management on crop nitrogen and insect damage in organic vs. conventional tomato fields Agriculture, Ecosystem and Environment. 57 **(2-3):** 179-187.

Magdoff, F. (1992) Building Soils For Better Crops. University of Nebraska Press, Lincolnn and London. 90-102.

Miguel, A.A and C.I. Nicholls. (2003). Soil fertility management and insect pests: harmonizing soil and plant health in agro-ecosystems. Soil and Tillage Research, 72 **(2):** 203-211.

Morales, H., R. Williams, I. Perfecto and R. Perez, (1997) Pest control and soil management in the Guatemalan Highlands. CAR News, **(4):** 1–2.

Myers, D. and S. Stolton, (1999) Organic Cotton-From field to Final Production, 250Pp. Intermed. Technol. Publication, NY.

Naveed, A., A.A. Khan and I.A. Khan. (2009) Generation mean analysis of water stress tolerance in okra (*Abelmoschus esculentus* L.). Pak. J. Bot., **(41)**: 195-205.

Padita, V.K.., A. Anand, S. Nagarajan, R. Seth and S.N. Sinha (2010). Solid matrix priming improves seed emergence and crop performance in okra. .

Phelan, P. L., K. H. Norris and J. F. Mason, (1996) Soil management history and host preference by *Ostrinia nubilalis*: Evidence for plant mineral balance mediating insect-plant interaction. Environ. Entomol., **(25):** 1329–36.

Shabozoi, N. U. K., G. H. Abro, T. S. Syed and M. S. Awan (2011). Economic appraisal of pest management options in okra. *Pak. J. Zool.,* 43 **(5):** 869-878.

Sahito, H. A., G. H. Abro, S. A. Memon, B. Mal and R. Mahmood. (2012) Influence of abiotic factors on population development of *Bemisia tabaci* infesting *Abelmoschus esculentus*. International Res. J. Plant Sci. 3 **(2):** 012-018.

Sanford, D. E and D. Pimentel. (1988) Effects of manure and chemical fertilizers on insect pest populations on collards. Agriculture, Ecosystems and Environment. 20 **(2):** 109-125.

Thomas, W.C. and D. Pimentel. (1986) Ecological effects of organic agricultural practices on insect populations. Agriculture, Ecosystems and Environment. 15 **(4):** 253-266.

Wheeler, G. S. (2003) Minimal increase in larval and adult performance of the biological control agent *Oxyops vitiosa* when fed *Melaleuca quinquenervia* leaves of different nitrogen levels. Biological Control. 26 **(2):** 109-116.

Wheeler, G. S. and K. M. Ordung. (2005) Secondary metabolite variation affects the oviposition preference but has little effect on the performance of *Boreioglycaspis melaleucae*: A biological control agent of *Melaleuca quinquenervia*. Biological Control. 35 **(2):** 115-123.