EFFECT OF INTERCROPPING OKRA AND MAIZE ON THE INFESTATION RATE WITH SOME PESTS AND THEIR ASSOCIATED PREDATORS AND ON THE RESULTANT YIELD

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Abstract

Field trials were conducted in two different Governorates, Qualyoubeya (Quaha) and Sharqueya (Majazer) to study the effectiveness of different types of cropping system of okra (*Hibiscus esculentus* L.) against the major insect pests in order to provide comparative measures of these pests and their associated predators.The study consisted of three cropping system and control replicated each three times.Data obtained recorded that the piercing sucking pests, *Tetranych usurticae* Koch*, Aphis gossypii Glover, Bemisia tabaci* (Gennadius) were found. In addition, the bollworms, *Heliothis armigera* (Hübner) and *Earias insulana* Boisduval and their associated predators, *Chrysoperla carnea* (Stephens) and *Coccinella undecimpunctata* Linnaeus were present on okra plants. The results revealed that okra, *Hibiscus esculentus* L. intercropped with maize, *Zea mays*L. in alternating rows (1:1), treatment A,proved to be the most efficient cropping system,wherethe lowest infestation of different pestscompared to the control (the monoculture system) and the other cropping systemin the two governorates. Moreover, treatment (A)recorded the best pod yield of 78.9 & 75.9 kg / karat in Majazer and Quaha, respectively

Key words: Aphid, bollworms, cropping system, *Earias insulana, Heliothis armigera,* intercropping, okra, monoculture, piercing sucking insect, spider mites, whitefly.

INTRODUCTION

Okra, *Abelmoschus* (*Hibiscus*) *esculentus*, family Malvaceae (mallows), is mainly grown for its young immature pods, known as "lady's finger", or "bamia" which are consumed as a vegetable and can be conserved by drying. It is one of the popular nutritious vegetables of North-East African origin, contains many important minerals such as iron, calcium, manganese, potassium, vitamin B & C and folic acid. The bamia pods are among the very low calorie vegetables, besides containing no saturated fats or cholesterol. Nonetheless, they are rich sources of dietary fiber;it is one of the vegetables with highest levels of anti-oxidants; often recommended by nutritionists in

cholesterol controlling and weight reduction programs (Okra nutrition facts), also, best fibers from the stem of okra plants has industrial uses (Igor et al. 2010).

Okra plant is attacked by several pests causing economic losses in the crop yield. Theyare infested by spider mite, *T.urticae* whitefly, *B. tabaci* (Gennadius), jassid, *E. lubica* and aphid, *A. gossypii*. These pests infest leaves, stems, branches and pods during the winter.The sucking insect pests transmit viral diseases of okra such as leaf curl and stunting virus. In addition they secrete honeydew

which falls on the upper surface of the leaves resulted in growinga black sooty mould develops fungus. Also, okra plants attacked by the bollworms of *H. armigera*, which take it up as food.Pods and flowers are primary targets of spiny bollworm, *E. insulana*, while the American bollworm caterpillar, *H. armigera* prefers the reproductive parts of the plant, including buds, flowers and fruits (Mudathir, 2000).There is always a pressing need for surveying, identifying and studying the activity of important pests infesting this crop in the field.

In Egypt,many authors studied the effect of intercropping system throughout certain crops combinations such as Metwally (1978) and Shafshak *et al.* (1984) and Ghallab *et al*. (2005), it is a popular system of cultivation for maximizing yields of cropsEl-Khouly *et al*.(1994). Several authors have reported that infestation rates and pest populations are reduced in poly- culture system than in monoculture of different field crops Altieri *et al*. (1978); Sharaf-El-Din *et al*. (1993); Rizk et al. (2002), Abro *et al*. (2004).

The objective of this work was planned to clarify the effect of okra grown in monoculture and in mix cropping systemsokra and maizeon theinfestation rate of pests' and their associatedpredatorsand theyield crop.

MATERIALS AND METHODS

The field experimentwere conducted at different sites, atthe Agricultural Research station "Quaha"in Qualyoubeya Governorate and at "Majazer" in Sharqueya Governorate, in order to provide comparative measures of different pests and their associated natural enemies.

An area of about 700 m^2 (4 Karats) in both sites (Quahaand Majazer) was divided into four equal plots comprised four different types of cultivations as follows: Treatment A,(plot I) intercropped okra with maize in alternating rows at ratio (1:1); Treatment B, (plot II) intercropped okra with maize in alternating rows at ratio (2:1); Treatment C, (plot III)cultivated okra surrounded by two rows of maize; Treatment D (plot VI), cultivated okra as monoculture (Check control).

Each plot with 9 ridges (3 replicates) of 5 meters length and 60 cm apart; all normal cultural practices of land preparation, thinning, irrigation, mechanical weed control were followed out and kept free from any insecticidal application.

Okra seeds were planted about 2-3 cm deep in a single row on top of the ridgeson 10 April 2014 while those of maize were sown one month later.

A - Counting of the piercing sucking pests and the abundance of the associated predators

Sampling started on May 16th and continued weekly until the 18th of July. Samples of 10 leaves of okra plants from each replicatemaking a sum of 30 leaves for each treatment were picked randomly from three levels of the plant. Each sample were kept in tight close paper bag and transferred to the laboratory to estimate the different piercing sucking pests attacked the leaf surface and their associated predators by the aid of the Sterio-binocular microscope.

B - Estimating the rate of damage caused by bollworms:

The infestation of *E. insulana* and *H. armigera* in monoculture and mix crops okra and maize was assessed by estimating the damage caused by borers. The percentage fruit damage by larvae was evaluated by counting the total and attacked number of fruits in a sample of 10 pods of okra selected at random per treatment.The observations were taken at weekly intervals. The data were recordedfrom a monthafter sowing of seeds in the fieldtill harvest of the crop.

C - Estimating the crop yield of different treatments

Themean okra yield (in Kg) were estimated for each treatment per Karat or feddan; fruits of 10 plants / treatment were picked and weighed.

Statistical Analysis

Data subjected to Portable statistical analysis SAS 9.3.1. to determine the significance between means of the tested intercropping systems at the two governorates.

RESULTS AND DISCUSSION

Populationof different pests in relation to cultivation system

Three piercing sucking pests, *T.urticae, A.gossypii* and *B. tabaci*; two bollworms, *H. armigera* and *E. insulana* Boisduval and two predators, *C. undecimpunctata* and *C. carnea* were concerned in this study.

Data in Tables (1&2) show weekly counts of mean numbers of the motile stages&eggs of spider mites, adult & nymphs of aphidand nymphs&eggs of whitefly

on ten okra leaves in each treatment in both sites of the study area (Quaha), Qualyoubeya and (Majazer) Sharqueya Governorates).

1- Spider mite, *T.urticae*

Among the different treatments in the two sites, all cropping systems registered low infestation by spider mites. There are high significant differences between the mean numbers in Treatment (A) and (B)and those in the control plot. Treatment (A) recordedthe lowest infestation of means 4 & 3.6 individuals in Quaha and Majazer, respectively, while were lower than those of the check plot 17.3 & 9.1 individuals, respectivelywith high significant differences.No significant differences between the mean numbers in treatment (C) of 11.6 & 6.9 individualscompared to control17.3 & 9.1 individuals in Quaha and Majazer, respectively.

The total numbers of eggs deposited by *T.urticae* on leaves of okra plants in the two sites were showed in Tables (1& 2) . The highest mean number of eggs recorded in treatment (C) in the two sites, followed by treatment (B) recorded 5.5 & 5.3 eggs,and 6.9 & 4.4 eggs, in Quaha and Majazer, respectively; while the lowest mean numbers of eggs was recorded in treatment (A) 4.4 & 3.9 eggs in Quaha and Majazer, respectively, compared to those of control 11.1& 16.3 eggs . The statistical analysis proved the significant differences between mean numbers of eggs in the check plot and alltreatments except the treatment (C) in Majazer.

The present results go in line with the finding of Mohanasundaram *et al*. (2012), they indicated thatall the intercropping treatments significantly reduced the leafhopper, whitefly, red spider mite and fruit damage.

2 -Whitefly, *B. tabaci*

According to the different cultivation systems, the treatment (A) showed the lowest attraction of whitefly, *B .tabaci* population amounted 5.1individuals followed by treatments (B) then (C) with average 6.6&6.8 individuals, respectively in Qualyoubeya Governorate, while the control showed the mean number 7.7 individuals withno significant differences between meanswere observed; the same trend was observed in Sharqueya Governorate.

In Majazer region, an obvious increase in population of whitefly in control plot of mean reaching 17.2 individuals which is more than twice the individuals collected from Quaha region which was 7.7 individualsbut in both regions, there were no significant differences between mean numbers in all intercropping systems and their corresponding control.

Table 1. The mean numbers of piercing sucking pests on okra leaves in Quaha

Date	*Tetranychusurticae*				**Total**	Eggs of *Tetranychusurticae*				Total
	Cont.	A	B	C		Cont.	A	B	C	
16-May	5	4	4	32	45	27	13	4	5	**49**
23-May	4	5	4	11	24	17	11	4	5	**37**
30-May	26	4	9	10	49	15	7	7	7	**36**
6-Jun.	28	1	15	9	**53**	6	4	4	8	**22**
13-Jun.	29	3	16	11	**59**	8	7	2	7	**24**
20-Jun	28	2	21	12	**63**	9	1	27	7	**44**
27-Jun	18	2	8	3	**31**	7	1	0	4	**12**
4-Jul.	23	5	11	6	**45**	1	0	5	3	**9**
11- Jul.	6	12	0	19	**37**	21	0	0	9	**30**
18- Jul.	6	2	3	3	**14**	0	0	0	0	**0**
Total	173	40	91	116	**420**	111	44	53	55	**263**
Mean	17.3	4	9.1	11.6		11.1	4.4	5.3	5.5	
LSD at 5 %	7.2					5.5				

Date	*Whiteflies*				**Total**	Eggs of *Whiteflies*				Total
	Cont.	A	B	C		Cont.	A	B	C	
16-May	4	1	7	5	**17**	12	7	3	8	**30**
23-May	4	3	7	5	**19**	11	6	2	8	**27**
30-May	8	6	6	8	**28**	5	3	5	5	**18**
6-Jun.	24	8	4	0	**36**	0	1	0	0	**1**
13-Jun.	15	7	7	12	**41**	1	3	5	5	**14**
20-Jun	5	5	7	6	**23**	1	2	1	0	**4**
27-Jun	8	4	14	21	**47**	5	0	0	3	**8**
4-Jul.	4	2	3	2	**11**	17	2	5	7	**31**
11- Jul.	2	5	1	4	**12**	12	0	3	1	**16**
18- Jul.	3	10	10	5	**28**	1	0	0	1	**2**
Total	77	51	66	68	**262**	65	24	24	38	**151**
Mean	7.7	5.1	6.6	6.8		6.5	2.4	2.4	3.8	
LSD at 5 %	4.2					2.6				

Date	*aphid*				**Total**
	Cont.	A	B	C	
16-May	0	0	4	6	**10**
23-May	0	4	5	5	**14**
30-May	20	4	6	21	**51**
6-Jun.	41	0	0	38	**79**
13-Jun.	55	6	25	20	**106**
20-Jun	98	6	13	9	**126**
27-Jun	89	3	5	33	**130**
4-Jul.	80	7	12	46	**145**
11- Jul.	5	2	3	10	**20**
18- Jul.	15	3	13	12	**43**
Total	403	35	86	200	**724**
Mean	40.3	3.5	8.6	20	
LSD at 5 %	17.2				

Cont. = Okra in monoculture ; A = 1:1(okra : maize) ; B = 2 :1 (okra: maize) ; C= Okra surrounded by maize

Table 2. The mean numbers of piercing suking pests on okra leaves in Majazer

Date	*Tetranychusurticae*				**Total**	Eggs of *Tetranychusurticae*				Total
	Cont.	A	B	C		Cont.	A	B	C	
16-May	8	3	2	5	**18**	4	3	2	0	**9**
23-May	6	4	5	4	**19**	6	5	4	6	**21**
30-May	0	0	0	3	**3**	0	0	6	0	**6**
6-Jun.	15	5	8	8	**36**	57	6	6	25	**94**
13-Jun.	18	11	10	8	**47**	76	10	4	25	**115**
20-Jun	14	4	8	2	**28**	10	0	0	8	**18**
27-Jun	5	0	2	9	**16**	0	0	4	0	**4**
4-Jul.	9	5	7	10	**31**	8	7	6	5	**26**
11- Jul.	11	4	11	20	**46**	2	8	12	0	**22**
18- Jul.	5	0	0	0	**5**	0	0	0	0	**0**
Total	91	36	53	69	**249**	163	39	44	69	**315**
Mean	9.1	3.6	5.3	6.9		16.3	3.9	4.4	6.9	
LSD at 5 %	2.9					10.57				

Date	*Whiteflies*				**Total**	Eggs of *Whiteflies*				Total
	Cont.	A	B	C		Cont.	A	B	C	
16-May	105	6	14	10	**135**	79	4	4	4	**91**
23-May	2	7	14	10	**33**	22	2	5	4	**33**
30-May	7	8	12	32	**59**	29	4	6	5	**44**
6-Jun.	7	8	14	20	**49**	8	2	2	4	**16**
13-Jun.	9	7	16	19	**51**	2	3	1	2	**8**
20-Jun	39	6	18	13	**76**	0	1	1	3	**5**
27-Jun	0	3	4	5	**12**	3	0	2	2	**7**
4-Jul.	0	1	0	0	**1**	0	0	1	0	**1**
11- Jul.	0	5	2	1	**8**	0	0	0	0	**0**
18- Jul.	3	4	1	2	**10**	0	0	0	0	**0**
Total	172	55	95	112	**434**	143	16	22	24	**205**
Mean	17.2	5.5	9.5	11.2		14.3	1.6	2.2	2.4	
LSD at 5 %	15.2					13.11				

Date	*aphid*				**Total**
	Cont.	A	B	C	
16-May	1	11	0	1	**13**
23-May	4	0	4	4	**12**
30-May	77	1	50	36	**164**
6-Jun.	4	7	4	4	**19**
13-Jun.	3	0	4	1	**8**
20-Jun	4	1	8	2	**15**
27-Jun	16	3	2	32	**53**
4-Jul.	0	15	13	5	**33**
11- Jul.	5	42	3	4	**54**
18- Jul.	2	3	0	0	**5**
Total	116	83	88	89	**376**
Mean	11.6	8.3	8.8	8.9	
LSD at 5 %	12.4				

Cont. = Okra in monoculture ; A = 1:1(okra : maize) ; B = 2 :1 (okra: maize) ; C= Okra surrounded by maize

Tantawy *et al*. (1989) attributed lower populations of whitefly and thrips in cowpea intercropped with maize was due to the greater height of maize plants which may shelter the crop from pest infestation.

In case of *B. tabaci* eggs, the three cultivation systems recorded lower numbers of eggsby the mean numbers2.4, 2.4, 3.8 eggs, for treatments (A), (B)and (C), respectively, with a significant difference comparing to the control 6.5 eggs. Moreover, the number of the whitefly eggs in Majazer region in the control plot was appeared in high numbers (twice) more than Quaha region. In both locations, there were insignificant differences between all treatments.

3- Aphid, *A. gossypii*

Among the different cultivation systems, treatment (A) recorded the lowest attraction of aphids with mean numbers3.5 individualsfollowed by (B),then (C) of mean numbers 8.6 and 20individuals, respectively, but, with no significant differences between means and highly significant difference comparing to the control which counted 40.3 individuals in Quaha, Qualyoubeya Governorate. In Majazer, Sharqueya Governorate, the population of aphiddecreased obviouslyin control plot of mean reaching 11.6 individuals which is very few than those individuals collected from Quaha region which was 40.3 individuals and withno significant differences between means of other cropping systems.

Previous results are in agreement with the finding of El-khouly *et al*. (1994) who reported that intercropping of maize with cowpea in different patterns is suitable for decreasing the infestation rare of both crops with the cowpea aphid and the corn leaf aphid**.** Moreover, Ghallab *et al*. (2005) proved that intercropping tomato with pumpkin caused relatively high reduction in numbers of Collembola, aphids, leaf-hoppers and *Thrips* sp. This reduction of pests could be explained according to Parfait & Jerry (1987) , who stated that intercropping may reduce pest dispersion , due to the change of microclimate caused by the presence of the second crop thus affecting the biology of the pest at different stages of its development . Subsequently the density of insect population and its infestation degree evidently decrease.

Population of bollworms in relation to cultivation systems

Data in Tables 3 (a & b) show weekly counts of mean numbers of two bollworms, *H. armigera* and *E. insulana* of ten okra pods in each cultivation systems in both sites of the study, (Quaha and Majazer). The infested fruit with borer were recorded at each picking and their weight was noted. The fruits were weighed separately and their infestation due to fruit borer was recorded for each treatment.

Table 3 a. The mean numbers of cotton bollworms in ten okra pods in Quaha

Date	*Eariasinsulana*				Total	*Heliothisarmigera*				Total
	Cont.	A	B	C		Cont.	A	B	C	
16-May										
23-May										
30-May										
6-Jun.	2	0	2	2	**6**	2	1	1	1	**5**
13-Jun.	5	1	4	4	**14**	3	1	2	1	**7**
20-Jun	9	5	4	5	**23**	6	3	3	4	**16**
27-Jun	12	5	4	7	**28**	12	5	8	7	**32**
4-Jul.	19	9	9	11	**48**	15	8	9	7	**39**
11- Jul.	23	11	12	15	**61**	21	9	11	11	**52**
18- Jul.	26	15	15	22	**78**	24	14	12	15	**65**
Total	96	46	50	66	**258**	83	41	46	46	**216**
Mean	9.6	4.6	5.0	6.6		8.3	4.1	4.6	4.6	
LSD at 5 %	2.5					2.4				

Table 3 b. The mean number of cotton bollworms in ten okra pods in Majazer

Date	*Eariasinsulana*				**Total**	Heliothis				Total
	Cont.	A	B	C		Cont.	A	B	C	
16-May										
23-May										
30-May										
6-Jun.										
13-Jun.	2	0	0	1	**3**	4	0	0	2	**6**
20-Jun	3	1	1	1	**6**	3	1	3	0	**7**
27-Jun	4	2	4	2	**12**	5	2	2	1	**10**
4-Jul.	6	3	6	7	**22**	9	3	4	3	**19**
11- Jul.	12	6	9	12	**39**	12	4	5	9	**30**
18- Jul.	23	10	15	20	**68**	25	10	8	12	**55**
Total	50	22	35	43	**150**	58	20	22	27	**127**
Mean	5.0	2.2	3.5	4.3		5.8	2.0	2.2	2.7	
LSD at 5 %	1.7					2.3				

1-Spotted bollworm, *E. insulana*

Tables 3 (a & b) show the effects of different cropping systems of okra on population of *E. insulana* indicated that the okra cropped with maize in alternating rows at ratio 1:1, treatments (A), was the best system, where a low infestation of

Earias sp. was observed amounted 4.6 & 2.2 individuals in the two regions, Quaha and Majazer, respectively, followed by treatments (B) then (C) The data revealed significant differences between treatments (all cropping systems) and control in Quaha, whereas in Majazer, the significant differences was only between treatment (A) and control. The results indicated that no significant differences between all treatments.

This result was coinciding with that of Abro *et al*. (2004) who indicated that pest infestation in mix crop was recorded two weeks later than monoculture**;** so, *Earias* sp. infestation in okra grown as mono crop remained higher than in okra grown as mix crop, recorded 24.9 & 12 %, respectively.

2-American bollworm, *H. armigera*

The results in Tables 3 (a & b) showed significant differences between different treatments and control in both regions, while no significant differences between all treatments.

Regarding the effect of treatments in the two sites, treatment (A) recorded the lowest infestation by *H. armigera* of means 4.1 & 2.0 individuals in Quaha and Majazer, respectively which, were lower than those of the check plot 8.3 & 5.8 individuals, respectively with high significant differences; while no significant differences compared to treatment (B) & (C).

This finding was coinciding with Ofuya (1991)who recorded that damage by *H. armigera* was significantly higher in sole cowpea than in cowpea intercropped with tomato. Also, Sundararajan and Chitra, (2012),registered the sucking pests' whitefly, *B. tabaci*, leaf hopper, *Empoasca* sp. and the pod borer, *Heliothis* sp. caused low damage in sorghum intercropped blackgram plants.

Population of predators in different cultivation systems

Data in tables 4 (a & b) show weekly counts of mean numbers of two predators*C. undecimpunctata* and *C.carnea*from different cultivation systems throughout the period from May16th until July18th onokra plants.

According to LSD, the mean numbers of the predaceous insects, the ladybird and the green lacewing captured from okra contoured by maize (treatment C) were 1.0 & 1.3 individuals for *Coccinella* sp. and *Chrysoperlla* sp., respectively, represent the highest occurrence and exceeded those collected from (treatments A & B) recorded 0.69 & 0.79 individuals of *Coccinella* sp. and 1.04 & 1.26 individuals of *Chrysoperla* sp without significant differences. Moreover, Majazer region harbored higher mean numbers of these previous predators in Treatment C, 1.27 &1.38 individuals, respectively, more than the two other treatments A & B without significant differences.

Table 4 a. The average numbersof twopredatorson ten okra leaves in Quaha

Date	*Coccinellaundecimpunctata*				**Total**	*Chrysoperllacarnea*				**Total**
	Cont.	A	B	C		Cont.	A	B	C	
16-May	0.6	0.2	0.4	0.6	**1.8**	1.8	0.4	0.6	0.8	**3.6**
23-May	1.2	0.6	0.8	1.0	**3.6**	2.2	1	1.2	1.4	**5.8**
30-May	1.3	1.2	0.5	0.4	**3.4**	2.4	1.6	0.9	0.8	**5.7**
6-Jun.	2.0	0.3	0.7	1.2	**4.2**	2.1	0.6	0.9	1.2	**4.8**
13-Jun.	2.6	0.4	0.8	1.4	**5.2**	2.1	0.8	1.0	1.2	**5.1**
20-Jun	3.2	0.6	1.0	1.6	**6.4**	2.5	0.8	1.0	1.4	**5.7**
27-Jun	4.1	1.2	0.8	0.6	**6.7**	3.3	1.2	1.4	1.6	**7.5**
4-Jul.	4.6	0.4	0.9	1.2	**7.1**	3.5	1.4	1.8	1.6	**8.3**
11- Jul.	5.1	0.6	0.8	1.0	**7.5**	5.0	1.6	2.0	1.4	**10**
18- Jul.	5.3	1.4	1.2	1.0	**8.9**	4.4	1	1.8	1.6	**8.8**
Total	30.0	6.9	7.9	10.0	**54.8**	29.3	10.4	12.6	13	**65.3**
Mean	3.00	0.69	0.79	1.00		2.93	1.04	1.26	1.3	
LSD at 5 %	0.77					0.42				

Table 4 b. The average numbersof twopredatorson ten okra leaves in Majazer

Date	*Coccinellaundecimpunctata*				**Total**	*Chrysoperllacarnea*				**Total**
	Cont.	A	B	C		Cont.	A	B	C	
16-May	0.3	0.1	0.1	0.2	**0.7**	0.7	0.5	0.3	0.4	**1.9**
23-May	0.4	0.2	0.1	0.3	**1**	1.1	0.7	0.6	0.8	**3.2**
30-May	0.7	0.4	0.02	0.7	**1.82**	2.3	1.4	1.2	1	**5.9**
6-Jun.	1.4	0.7	0.8	1.2	**4.1**	1.8	0.8	1	0.7	**4.3**
13-Jun.	1.9	1	1.2	1.3	**5.4**	2.2	1	1.2	0.9	**5.3**
20-Jun	2.5	1.5	1	1	**6**	2.7	1.2	1.5	1	**6.4**
27-Jun	2.8	1.8	2	2.2	**8.8**	3.2	2	1.6	1.4	**8.2**
4-Jul.	3.6	2.2	2.6	2.2	**10.6**	3.7	1.7	1.9	1.8	**9.1**
11- Jul.	4	1.5	2.2	1.8	**9.5**	4.4	2.4	2.2	2.8	**11.8**
18- Jul.	5	1.2	1.6	1.8	**9.6**	4.6	2	1.8	3	**11.4**
Total	22.6	10.6	11.62	12.7	**57.52**	26.7	13.7	13.3	13.8	**67.5**
Mean	2.26	1.06	1.16	1.27		2.67	1.37	1.33	1.38	
LSD at 5 %	0.51					0.37				

Regarding the total number of predators, it appear that the region Majazer harbored the highest number of Chrysoperla and *Coccinella* (67.5 & 57.5 individuals), respectively, compared to those collected from Quaha region recorded 65.3 & 54.8 individuals, respectively.

This finding in agree with Kares *et al.* (1993) and Shalaby *et al*. (1983), who proved that cotton surrounded by maize on the periphery of the plots refuge thehighest numbers of predators followed by cotton and maize in alternating rows at the ratio (2:1), then cotton and maize at the ratio (1:1). Also, these data in accordance with the concept of Agnew & Smith (1989) who determined the abundance of predators could be a result of high numbers of herbivores in dense foliage of maize which offer shade, protection and humidity and favorable to predators.

Total fruit yield

Results concerning total okra pods yield of the four mix crops, in the two governorates, are presented in (Table, 5). The highest total okra pods yield was obtained in treatments (A) amounted 75.9&78.9 Kg. / Karat, followed bytreatments (C) then (B) 70.6and69.6 Kg. / Karat in Quaha and Majazer, respectively.

Table 5. Yield of okra podsfrom each cultivation systemin kg. / Karatin Qualyoubeya and Sharqueya Governorates

System of cultivation	Total yield in k.g. / Karat	
	Quaha (Qualyoubeya)	Majazer (Sharqueya)
Rows of okra to maize, 1:1	**75.9**	**78.9**
Rows of okra to maize, 2 :1	**69.6**	**69.6**
Okra surrounded by maize	**70.6**	**70.6**
Okra in monoculture(Control)	**68.73**	**68.37**

Mean of harvested okra pods yield in the previous cropping systems exceeded that of the control (untreated) which recorded the lowest total okra pods yield of 68.73 & 68.37 Kg. / Karat in the two regions.

CONCLUSION

From the results obtained, it can be concluded that it is more advantageous to intercrop okra and maize. Intercropping generally, not only minimizes risks of pest infestations but also,it is associated with a higher predaceous insects and a greater total intercrop yield.

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تأثير تحميل البامية بالذرة على معدل الإصابة ببعض الآفات والمفترسات المصاحبة وعلى المحصول الناتج

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تصاب البامية بالعديد من الآفات مثل العنكبوت الأحمر، والذبابة البيضاء، والتربس، والمن، وديدان اللوز وتسبب هذه الآفات خسائر تؤثر على جودة المحصول. ونظراً للضررالذي تسببه هذه الآفات على محصول البامية تم دراسة تأثير نظم مختلفة من الغطاء النباتي والزراعي (التحميل، والزراعة المنفردة) في منطقتين، قها والمجازر بمحافظتي القليوبية والشرقية على التوالي لمعرفة مدى قابلية هذه النظم للإصابة بالآفات وأطوارها المختلفة وعلى الأعداء الحيوية المصاحبة لهم والمحصول الناتج.

في كل محافظة من المحافظتين تم تخصيص مساحة ٧٠٠ م٢ وقد قسمت هذه المساحة إلى أربعة قطع تجريبية متساوية تم زراعتها بنظم زراعة مختلفة ولكل منها ثلاثة مكررات. خصص الحوض الأول لزراعة البامية محملة بالذرة في صفوف متبادلة بنسبة ١:١، والثاني في صفوف متبادلة بنسبة ٢: ١، والثالث البامية محاطة بخطين من الذرة، والرابع زراعة البامية منفردة (المقارنة).

أسفرت النتائج المتحصل عليها أن أنظمة التحميل المختبرة أعطت إختلافاً معنوياً في معدلات الإصابة بالآفات المختلفة مقارنة بالزراعة المنفردة (المقارنة) في كلا المنطقتين، فقد أصيبت نباتات البامية المنزرعة بدون تحميل بأعلى تعداد من الآفات المختلفة بينما أعطى تحميل البامية بالذرة بنسبة ١:١ أقل تعداد للآفات المختلفة، تلاه التحميل بنسبة ١:٢ ثم البامية المحاطة بالذرة، ويعكس هذا التأثير الغير مباشر لهذا النظام الزراعي فيما يخص المكافحة الحيوية.

المحصول : أعطى تحميل البامية بالذرة بنسبة ١:١ أعلى انتاج من قرون البامية الخضراء بمتوسط ٧٥,٩ ، و٧٨,٩ كجم / قيراط بقها والمجازرعلى التوالي تلاه تنازلياً المحصول الناتج في حالة التحميل ٢: ١ ثم البامية المحاطة بالذرة. أما الزراعة المنفردة فقد أنتجت أقل محصول بالمقارنة بالنظم الأخرى ٦٨,٧٣ ، و٦٨,٣٧ كجم / قيراط بقها والمجازرعلى التوالي.