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EFFECTS OF CERTAIN AGRICULTURAL PRACTICES ON THE INFESTATION OF SOYBEAN PLANTS BY SOME HOMOPTEROUS INSECT PESTS AT DIARB – NIGM DISTRICT SHARKIA GOVERNORATE

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ABSTRACT

The present investigation aimed to study the influance of some soybean varieties (Karfordid, Giza 22 and Giza 21) under the effect of different potassium fertilization levels (zero, 25, 50 and 75) kg potassium sulphate /feddan). Effects of some chemical contents (protein, carbohydrate and pH values) on the infestation of aphids, leafhoppers, trips and whitefly insects were also investigated. The obtained results showed pronounced differences in the population density of these insects under test as influenced by the aforementioned agricultural practices. The tested soybean varieties can be arranged descending according to the degree of infestation with insects as following Giza 21, Giza 22 and Karfordid. Chemical analysis results showed a positive relationship between protein and carbohydrate contents and aphids, leafhoppers, whitefly and thrips infestation in soybean varieties, while reverse relationship between pH values and insect infestation. Negative relationship between insect infestation and quantity of yield was also recorded. Therefore, it could be recommended that potassium fertilization 75 kg potassium sulphate /feddan along with the most suitable plant variety must be included in the integrated pest management programs of soybean plants.

Keywords: soybean plants, varieties, fertilization, chemical analysis, leafhopper, aphid, thrips and whitefly.

INTRODUCTION

The homopterous insects (aphids, leafhoppers, thrips and whitefly) are economic pests of many agricultural crops in Egypt. Soybean plants are infested by these insect pests which affect the quantity of yield as results of their direct feeding on plant, in addition, these insects are responsible for natural spread of several virus diseases to soybean plants (Nielson, 1968 and Hegab,Ola 2001). The fauna of these insects on most maize fields has been studied in Egypt (Herakly, 1970 ; El Nahal *et.al*, 1977 and Hegab *et al* 1987). Further studies are needed to assess the relation between plant varieties, potassium fertilization rates and chemical constituent of plant and the level of population density of aphids, leafhoppers, whitefly and trips. Therefore, it was necessary to perform the present work for studying the effects of soybean varieties, along with certain chemical constituents of soybean plants on the population density of aphids and leafhoppers. The effects of tested agricultural practices were all taken in consideration collectively and quantity of the resulted yield was recorded.

MATERIALS AND METHODS

An area about 2100 m^2 was chosen to carry out this investigation in Diarb-Nigm district, Sharkia Governorate, the experimental design was a split plot with three replications. Treatments were distributed as split plot within

replication each sub plot consisted four ridges (4 meters long and 14 meters wide). Each replication was divided into 18 lines, the space between holes was 25-30 cm. The sowing date of soybean plants was during the last week of May, in 2009 and 2010 seasons. The normal agricultural practices were followed in due time and all plots were kept free of any insecticide treatments. In such experiments, the following three soybean varieties were used (Karfodid, Giza 22 and Giza 21).

Four potassium fertilization rates of 75, 50, 25 and zero kg/feddan. were applied in these experiments in the form of potassium sulphate 48% K_2O when plants become 20 days old . Sampling started when the age of soybean plants reached about 21-28 days after sowing and continued at weekly intervals throughout the growing seasons in 2009 and 2010 season. The following procedures of sampling were adopted:

1) Direct counting 25 leaves representing different strata, viz. terminal, middle and bottom parts and tassel were taken from randomly chosen of each variety. These leaves and tassels were examined in the laboratory using a binocular microscope and the total number of existing of aphids, thrips and whitefly on both surfaces of the leaves and tassels were recorded.
2) Sweep net, 30 cm diameter and 60 cm deep. Each sample consisted of 100 double strokes were taken from both diagonal directions of the experimental area. Each sample was kept in a tight closed paper bag and transferred to the laboratory for inspection by binocular microscope and the collected leafhoppers and whitefly were killed by cyanide, sorted into species and identified according to the work of Ribaut (1952), Nielson (1968) and Hegab *et .al*. (1989). Counts of captured leafhoppers were recorded for each sample.

Effects of different potassium fertilization rates, and the chemical constituents of different soybean plant varieties on the population density of the aforementioned homopterous insects were statistically analyzed according to split analysis (Little and Hills 1975)

Chemical analysis of the used soybean plant varieties were carried out in central laboratory, Faculty of Agriculture, Moshtohour, Banha University to determine the total protein, carbohydrate contents, pH value, Phosphorous, calcium and potassium contents, according to Dubois *et.al*. (1956); Barrowes and Simpson(1962); Bremmer and Mulvaney 1982.

RESULTS AND DISCUSSIONS

Effect of some agricultural practices on the population density of certain homopterous insects infesting soybean plants

Plant varieties

Effect of plant varieties on the population density of aphids, leafhoppers, thrips and whitefly insects infesting soybean plants was investigated and the results are shown in Table (1)

Aphid insects:

Statistical analysis of the obtained date revealed that the differences between mean numbers of aphids on the three tested soybean varieties showed highly significant during 2009 and 2010 seasons. The most

susceptible varieties were Giza 21 (40.77 and 26.27) insects/sample in both seasons, respectively, while the least susceptible variety was Karfordid 30.72 and 20.90 insects/sample for *Aphis gossypii* (Glov.) in both seasons, respectively.

Leafhopper insects:,.

As shown in Table (1) the differences between the mean numbers of leafhoppers infested the three soybean plant varieties. It can be noted that, their were highly significant during 2009 and 2010 seasons. The most susceptible variety was Giza 21 followed by Giza 22, whereas Karfordid varieties were the least susceptible one recording the respective values 13.65, 12.15 and 10.98 insects/sample in 2004 season and 20.55, 17.06 and 16.34 insects/sample in 2005 season for *Empoasca decipiens* (Paoli) or the three varieties, respectively. While the most susceptible variety was Giza 21 followed by Giza 22, whereas Karfordid varieties were the least susceptible one recording the respective values14.99, 13.44 and 12.23 insects/sample in 2009 season and 13.1,12.21and 12.47 insects/sample in 2010 season for *Empoasca decedens* (Paoli) for the three varieties, respectively

Thrips insects

The date presented in Table (1) showed the differences between the mean numbers of *Thrips tabaci* (Lind.) infested the three soybean plant varieties. The statistical analysis of the obtained results showed that, there were highly significant during 2009 and 2010 seasons. The most susceptible variety was Giza 21 followed by Giza 22, whereas Karfordid varieties were the least susceptible one recording the respective values 13.96, 12.21 and 10.89 insects/sample in 2009 season and 13.24, 12.48 and 10.33 insects/sample in 2010 season for *Thrpis tabaci* (Lind.) for the three varieties, respectively.

Whitefly insects *Bemisia tabaci* (Genn.) :-

Data given in Table (1) indicated that the differences between mean numbers of whitefly *Bemisia tabaci* (Genn.)on the three tested soybean varieties were highly significant for the two seasons of study. Cultivar Karfordid was the least susceptible host plant for adult stage infestation, 53.08 and 69.61 insects /sample, while the variety Giza 21 appeared to be the most susceptible soybean variety 66.15 and 78.85 insects/sample during 2009 and 2010 seasons respectively. While Cultivar Karfordid was the least susceptible host plant for immature stage infestation 65.33 and 89.04 insects /sample, while the variety Giza 21 appeared to be the most susceptible soybean variety 72.5 and 97.04 insects/sample during 2009 and 2010 seasons respectively.

Mean of yield quantity (kg/plot)

With regard to the influence of soybean plants cultivars on soybean yield , data presented in Table (1) show that Karfordid variety yielded the highest mean of 18 and 20.73 kg / plot in 2009 and 2010 seasons , respectively. Followed by Giza 22 cultivars yielded a mean of 17.62 and 19.6 kg /plot in two seasons, respectively. While Giza 21 yielded the lowest mean of 12.31 and 14.35 kg /plot in 2009 and 2010 seasons, respectively.

Generally, from the obtained results, it could be concluded that Giza 21 variety was more susceptible to aphids, leafhoppers, thrips and whitefly insects' infestation, whereas Karfordid variety was the least susceptible cultivars. The results agreed with the findings of Akbar *et al* . (2000), Hegab, Ola (2001) , Youssef (2006) and Pherson *et al.* (2009) who mentioned that varieties of maize plants had a great effect on the incidence of some homopterous insects.

Effect of potassium fertilization.

Effect of different potassium fertilization levels on the population density of aphid, leafhopper, whitefly and thrips insects infesting soybean plants was studied and the results are shown in Table (2)

Aphid insects:

The obtained results in Table (2) showed that the effect of different potassium fertilization rates on the mean number of aphid insects infesting soybean was highly significant during the two seasons of study 2009 and 2010. According to Table (2), the highest mean number of 49.13 and 26.52 insects/sample for *A. gossypii* was recorded with F4 treatment (zero potassium fertilization/feddan) during 2009 and 2010 seasons, respectively, while the lowest mean number of (26.97 and 19.45 insects/sample for *A. gossypii*) occurred with F1 treatment (75 kg potassium sulphate /feddan) during two seasons, respectively.

Leafhopper insects:

The date presented results in Table (2) showed that the effect of different potassium fertilization rates on the population density of leafhopper insects infesting soybean plant was highly significant during the two seasons of 2009 and 2010. According to Table (2) the highest mean number of 15.61 and 20.53 insects/sample for *E. decipiens* was occurred with F4 treatment (zero potassium fertilization /feddan) during 2009 and 2010 seasons, respectively, while the lowest mean number of 8.89 and 15.06 insects/sample for *E. decipiens* was recorded with F1 treatment (75 kg potassium sulphate /feddan) during two the seasons, respectively. While the highest mean number of 16.55 and 16.41 insects/sample for *E. decedens* was occurred with F4 treatment (zero potassium fertilization /feddan) during 2009 and 2010 seasons, respectively, while the lowest mean number of was 9.49 and 10.44 insects/sample for *E. decedens* was recorded with F1 treatment (75 kg potassium sulphate /feddan) during two the seasons, respectively.

Thrips insects

The obtained results in Table (2) showed that the effect of different potassium fertilization rates on the population density of leafhopper insects infesting soybean plant was highly significant during the two seasons of 2009 and 2010. According to Table (2) the highest mean number of 13.64 and 13.3 insects/sample for *T.tabaci* (Lind.) was occurred with F4 treatment (zero potassium fertilization /feddan) during 2009 and 2010 seasons, respectively, while the lowest mean number of 10.37 and 10.86 insects/sample for *T.tabaci* was recorded with F1treatment (75 kg potassium sulphate /feddan) during two the seasons, respectively.

Whitefly insects:

The date presented in Table (2) showed that the effect of different potassium fertilization rates on the mean number of whitefly insects infesting soybean was highly significant during 2009 and 2010 seasons. According to Table (2) the highest mean number of 71.57 and 84.14 insects/sample for adult stage was recorded with F4 treatment (zero potassium fertilization /feddan) during 2009 and 2010 seasons, respectively, while the lowest mean number of 48.79 and 61.66 insects/sample for adult stage occurred with F1 treatment (75 kg potassium sulphate /feddan) during two seasons, respectively. While the highest mean number of 83.67 and 105.33 insects/sample for immature stage) was recorded with F4 treatment (zero potassium fertilization /feddan) during 2009 and 2010 seasons, respectively, while the lowest mean number of 53.42 and 79.84 insects/sample for immature stage) occurred with F1 treatment (75 kg potassium sulphate /feddan) during two seasons, respectively.

In general, it could be concluded that the potassium fertilization levels influenced pronouncedly on the insects infestation and yield quantity. As the results show the highest number of insects recorded with the least level of potassium fertilization treatment (zero kg potassium sulphate/feddan) and lowest quantity of yield, while increasing this level to 75 kg potassium fertilization/feddan reduced the insect infestation and markedly increased the yield quantity. Therefore it could be recommended that fertilization with 75 kg potassium fertilization/feddan is very suitable to decrease insect infestation and increasing the resulted yield. These results are in agreement with finding of Baghour *et. al.* (2001) , Hegab, Ola (2001), Hashem (2005) , Youssef (2006) and Gulluoglu Leyla *et al.* (2010) who mentioned that the occurrence of aforementioned homopterous insects on wheat, maize and leguminous plants varied greatly according to applied fertilizers.

Relationship between certain chemical contents of soybean plant varieties and aphids, leafhoppers and whitefly insects infestation

Samples (3 leaves) of different soybean plant varieties were chemically analyzed and the obtained results are recorded in Tables (3). Data given in Table (3) showed significant effects of different chemical constituents of the three tested soybean varieties on the aphids, leafhoppers, thirps and whitefly insects during 2010 season.

Total protein, Carbohydrate contents "C.C." and PH value:

In case of Karfordid variety the mean numbers of aphids, leafhoppers, thirps and whitefly insects was 24.11, 33.99, 11.3 and 184.47 insects/sample, respectively, with 20% total protein, 30.18% C.C. and 5.51pH. In case of Giza 22 variety the mean number of aphids, leafhoppers, thirps and whitefly insects was 26.56, 35.25, 13.86 and 182.48 insects/sample, respectively with 20.5% total protein, 23.48% C.C. and 5.32 pH, while Giza 21 variety infested with the mean number of aphids, leafhoppers, thrips and whitefly insects was 28.87, 39.56, 14.66 and 201.37 insects/sample, respectively with 22.75% total protein, 40.25%C.C. and 4.27 pH during 2010 season.

Potassium (K) and Phosphorous (P)

As clear in Table (3) the effects of Potassium and Phosphorous percentages in the test soybean plant varieties and aphids, leafhoppers, thrips and whitefly insects infestation were statistically not significant.

From the obtained results Krafordid variety, proved to be the least total protein and carbohydrate contents and the highest pH value, the least susceptible to insect infestation and the highest yield.

Generally it is worth to notice that the aphids, leafhoppers, thrips and whitefly insects infestation was correlated with the chemical constituents of the used soybean varieties and also with quantity of yield.

Hegab, Ola (2001), El.Gindy (2002), Hashem (2005), Myers *et al* . (2005) and Youseef (2006) pointed out that the chemical constituents of some graminaceous and leguminous plant varieties effected on the population density of the aphids, leafhoppers and planthopper insects .

Table (3): Effect of different levels of potassium fertilization on protein %, carbohydrate %, PH, K%, Ca% ,and P % of three soybean varieties and its relation with certain homopterous insect infesting during 2010 season.

Variety	Total Protein %	Carbohy-drate % CC	PH	K	Ca	P	Aphid/ sample	Leaf-hoppers/ sample	Thrips/ sample	Whitefly /sample	Yield/ sub-sub plot (kg.)
Krafordid	20	30.18	5.51	2.64	2.3	0.64	24.11	33.99	11.3	184.47	14.5
Giza 22	20.5	23.48	5.32	3.61	2.2	0.11	26.56	35.25	13.86	182.48	15
Giza 21	22.75	40.25	4.27	2.9	2.2	0.69	28.87	39.56	14.66	201.37	10.2

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تأثير بعض العمليات الزراعية على إصابة نباتات الفول الصويا ببعض حشرات المتشابهة الاجنحة فى ديرب نجم محافظة الشرقية

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أجريت هذه الدراسة في منطقة ديرب نجم بمحافظة الشرقية وذلك خلال موسمى 2009و 2010 وذلك لتقييم حساسية ثلاثة أصناف من فول الصويا وهى جيزة 21 , جيزة 22 , Karfodid للإصابة بحشرات المن ونطاطات الأوراق والتربس والذبابة البيضاء.

ولقد أوضحت النتائج أن جيزة 21 هو أكثر أصناف الفول الصويا حساسية واقلهم محصولا وأن Karfordid هو أقل ألاصناف إصابة وأكثرهم محصولا.

وقد وجد أن التسميد البوتاسى يلعب دورا هاما فى التأثير على الكثافة العددية للحشرات الثاقبة الماصة (المن ,نطاطات الأوراق والتربس والذبابة البيضاء)حيث أنه ثبت من التجربة أن إضافة التسميد البوتاسى بمعدلات 75,50,25كجم سلفات بوتاسيوم/فدان إلى النباتات تحت الدراسة كان له تأثير كبير على تعداد تلك الحشرات وان اقل تعداد وجد عند مستوى تسميد 75كجم سلفات بوتاسيوم /فدان. لذلك يوصى بالاهتمام بالتسميد البوتاسى مع اختيار الأصناف المناسبة ووضعها ضمن برنامج المكافحة المتكاملة للآفات.

ولقد أكدت نتائج التحليل الكيماوي لأوراق أصناف الفول الصويا الثلاثة أن هناك علاقة موجبة بين محتوى النبات من البروتين و الكربوهيدرات ومستوى الإصابة بالحشرات على حين أنة توجد علاقة سالبة بين قيمة PH وتعداد الحشرات على نباتات الفول الصويا.

قام بتحكيم البحث

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Table (1): Effect of different varieties on the infestation of soybean plants by aphid, leafhoppers, thrips and whitefly insects during 2009 and 2010 seasons at Diarb- Nigm district in Sharkia Governorate.

Varieties	Mean of insect number/ sample												Mean yield kg/plot	
	aphid		leafhoppers						Whitefly					
	A. gossypii		*E. decipiens*		*E. decedens*		*T. tabaci*		B. tabaci					
									Adult stage		Immature stage			
	2009	2010	2009	2010	2009	2010	2009	2010	2009	2010	2009	2010	2009	2010
V1	30.72^{b}	20.90^{b}	10.975^{a}	16.34^{b}	12.23^{a}	12.47^{a}	10.89^{a}	10.33^{b}	53.08^{c}	69.61^{b}	65.33^{b}	89.04^{b}	18.0^{a}	20.73^{a}
V2	39.08^{a}	22.78^{b}	12.15^{a}	17.06^{b}	13.44^{a}	12.21^{a}	12.21^{a}	12.48^{a}	61.66^{b}	71.34^{b}	67.9^{b}	91.68^{b}	17.62^{a}	19.6^{a}
V3	40.77^{a}	26.275^{a}	13.65^{a}	20.55^{a}	14.99^{a}	13.1^{a}	13.96^{a}	13.24^{a}	66.15^{a}	78.85^{a}	72.5^{a}	97.04^{a}	12.31^{b}	14.35^{b}
F.	**	*	ns.	*	n.s.	n.s.	n.s.	*	**	**	**	**	**	**
L.S.D.	3.83	3.461	2.825	2.58	2.83	4.32	1.95	2.02	4.32	3.83	2.58	3.83	1.24	1.38

V1 = Karfordid V2= Giza 22 V3 = Giza 21

Table (2): Effect of different levels of potassium fertilization on the infestation soybean plants by aphid, leafhoppers, thrips and whitefly insects infestation during 2009 and 2010 seasons at Diarb- Nigm district in Sharkia Governorate .

Fertili-zation rats	Mean of insect number/ sample												Mean yield kg/plot	
	aphid		leafhoppers				Thrips		Whitefly					
	A. gossypii		*E. decipiens*		*E. decedens*		*Thrips tabaci*		B. tabaci					
									Adult stage		Immature stage			
	2009	2010	2009	2010	2009	2010	2009	2010	2009	2010	2009	2010	2009	2010
F1	26.97^{d}	19.45^{b}	8.89^{c}	15.06^{a}	9.49^{a}	10.44^{b}	10.37^{b}	10.86^{a}	48.79^{d}	61.66^{d}	53.42^{d}	79.84^{d}	20.4^{a}	22.58^{a}
F2	31.02^{c}	22.48^{ab}	11.05^{bc}	17.30^{a}	13.44^{ab}	12.44^{ab}	11.54^{ab}	11.43^{a}	55.86^{c}	69.19^{c}	63.8^{c}	88.60^{c}	18.33^{b}	20.9^{b}
F3	40.31^{b}	24.83^{a}	13.47^{ab}	19.04^{a}	14.72^{ab}	13.83^{ab}	12.66^{ab}	12.51^{a}	64.95^{b}	78.05^{b}	73.42^{b}	97.74^{b}	13.84^{c}	16.17^{c}
F4	49.13^{a}	26.52^{a}	15.61^{a}	20.53^{a}	16.55^{a}	16.41^{a}	13.64^{a}	13.3^{a}	71.57^{a}	84.14^{a}	83.67^{a}	105.33^{a}	11.31^{d}	13.23^{d}
F	***	*	**	n.s.	*	*	*	n.s.	***	***	***	***	* **	**
LSD	3.65	3.65	2.98	4.1	4.25	3.99	2.25	2.33	3.99	3.65	3.65	2.98	1.43	1.59

F1=36 unit of potassium fertilization / fed. F2=24 unit of potassium fertilization / fed.
F3=12 unit of potassium fertilization / fed. F4= control (without potassium fertilization)