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EFFECT OF POTASSIUM FERTILIZER ON THE POPULATION OF CERTAIN SUCKING INSECTS AND THEIR ASSOCIATED PREDATORS IN COTTON FIELDS

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ABSTRACT

Cotton plant is liable to be attacked all over its growing season by certain sucking insects, such as cotton aphids (*Aphis gossypii* Colov.), cotton jassid (*Empoasca lypica* de Berg), cotton whitefly (*Bemisia tabaci* Genn.) and cotton thrips (*Thrips tabaci* L.). The effect of soil and foliar applications with different rates of potassium sulfate fertilizer (48 % K_2O) was studied on the infestation of the previous insects and their associated predators, Lady-bird beetles (*Coccinella* spp. And *Scymnus* spp.), Aphid lion (*Chrysoperla carnea*), Anthocoride bua (*Orius* spp.) Rove beetles (*Paederus alfierii*) and true spiders which attacked Giza 89 cotton variety cultivated during 2002 and 2003 seasons at Sakha Agricultural Research Station, Kafr El-Sheikh, Governorate Egypt.

The results showed that insignificant differences were observed between treated and untreated plants, by potassium fertilizer in case of soil application with 50 and 25 kg/fed. of fertilizer, and slight effect was observed in reducing the population of sucking insects. On the other hand, significant differences were observed between two foliar applications with 8.165 kg/fed. and 16.33 kg/fed. of potassium fertilizer and untreated plants. Generally, potassium fertilizer reduced the population of *B. tabaci* than other insects. The effect of potassium fertilizer on the population of studied predators in the two seasons, showed that the three soil treatments had a slight effect on these predators, while the two foliar treatments affected the abundant of predators significantly than the untreated one where they reduced the mean numbers of predators than untrerated.

INTRODUCTION

Potassium is one of the most important elements in plant nutration, which affects on enzyme activation, water relation, energy relations, translocation of assimilates nitrogen-uptake, protein and starch synthesis. Many authors studied the effect of potassium application in cotton fields (Darwish 1991, Abou-zeid *et al*, 1997 and Hegazy and Genaidy, 1998). They observed positive response of cotton plants to potassium application. The effect of fertilizers on the population trend of the main insect pests on different crops has been undertaken (Farrag *et al.*, 1980, Hoda *et al.*, 1986, Sharaf and Nazer, 1983 and El-Hawary *et al.*, 1995). Insects particularly aphids are very sensitive to nutritional changes in the host plant (Kogan, 1975). Several authors studied the effect of different fertilizers on the population density of some pests, Cannon and Connel (1965), Nasretdinov (1984), Purohit and Deshpande (1991), and Wahba (1996). The predatory insect species found in cotton fields play an important role in regulating the populations of injurious insects. It was reported that insect predators were extensively occurring in cotton fields in July (Habib *et al.*, 1976), or throughout June – July (El-Mezayyen, 1993). The present work aimed to

study the effect of potassium fertilizer on some sucking insects attacking cotton plants and their associated predators.

MATERIALS AND METHODS

An experiment was conducted on the farm of Sakha Agricultural Research Station during 2002 and 2003 cotton seasons to study the effect of potassium sulfate fertilizer (48 % K_2O) on the population density of some sucking insects and their associated predators on cotton plants. In both two seasons, Giza 89 cotton variety was cultivated on the first week of April. Cottor plants were subjected to normal agricultural processes and were maintained far from any insecticidal treatments.

The experimental area was divided into plots of 1/24 feddan each. Six treatments were arranged in randomized complete blocks with 4 replicates each.

I- Treatments:

a. Soil application:

Potassium sulfate as (48 % K_2O) was added after thinning in one dose as soil application and the treatments were: t_1 (100 kg/fed.), t_2 (50 kg/fed.) and t_3 (25 kg/fed.)

b. Foliar application:

To prepare the solution of potassium sulfate (48 % K_2O), weighed the quantity of fertilizer for every treatment and soaked in 20 liters of water for 24 hours.

The solution was filtered and increased to 200 liters/fed. were: t_4 (8.165 kg/fed.) and t_5 (16.33 kg/fed.)

All tested foliar applications were sprayed using knapsack sprayer Model CP3 (200 l/fed.) and the cotton plants received three sprays of these solutions started at the beginning of flowering and setting (early bud formation) stages and the other sprays conducted at 15th day intervals while T_6 control without treatments.

II- Sampling procedures:

1. Sucking insects:

The cotton insects studied were *Thrips tabaci*, *Aphis gossypii*, *Empoasca lybica* and *Bemisia tabaci*. Examination of weekly samples (25 seedlings each/replicate) were initiated 20 days after sowing and continued till mid. June in 2002 and 2003 seasons. After thinning of cotton hills, sample size was changed to be 25 cotton leaves/replicate weekly beginning from half June till the late of the season. Leaves were randomly selected from lower, middle and upper portions of the plant. Seedling and leaf samples were examined in the field to record the number of nymphs and adults for aphids, jassids and thrips to express the population size of these insects at the respective dates.

To estimate the numbers of the whitefly, the leaf samples were transferred to the laboratory on the same day and the total number of immature stage on both surfaces of each leaf was counted using a suitable hand lens.

2. Associated predators:

The associated predators on the selected cotton samples were counted in the field, where the sample contained of ten plants of every replicate of the experiment.

The considered predators were *Coccinella undecimpunctata, Scymnus spp., Chrysoperla carnea, Orius* spp., *Paederus alfenii* and true spiders.

Data were subjected to the analysis by Duncan's multiple range test (DMRT) at 5 % level.

RESULTS AND DISCUSSION

Data obtained in table (1) and (2) represented the effect of potassium sulphate fertilizer on the population of certain sucking insects attacking cotton plants during 2002 and 2003 seasons namely; *Thrips tabaci L., Aphis gossypii Colov, Empoasca lybica de Berg* and *Bemisia tabaci Genn.*

Effect on *T. tabaci*

Data in table (1) showed insignificant differences in *T. tabaci* population between treated plants with potassium sulphate fertilizer as soil application at 50 and 25 kg/fed and untreated plants during 2002 season, where the mean numbers of *T. tabaci* were 208, 210.4 and 210.9 individuals/25 leaves respectively. The decrease percentage than control were 1.37 and 0.2. While there was significant difference between treatment 100 kg/fed. (206) and the untreated plants (210.9) individuals/25 leaves and the reduction was 3.4.

Table (1): Mean numbers of sucking insects as affected by potassium (as K_2o) fertilization during 2002 cotton growing season.

Treatments			Mean numbers of sucking insects				% different than control			
			T. tabaci	*A. gossypii*	*E. lybica*	*B. tabaci*	*T. tabaci*	*A. gossypii*	*E. lybica*	*B. tabaci*
Soil Application	t_1	100 kg/fed.	206.0 a	391.08 b	82.41 a	798.1 a	- 3.4	- 5.15	- 8.9	- 13.62
	t_2	50 kg/fed.	208.0 ab	397.58 bc	85.29 a	827.5 b	- 1.37	- 3.58	- 5.7	- 10.44
	t_3	25 kg/fed	210.4 b	410.75 c	90.41 b	882.75 d	- 0.2	- 0.003	- 0.03	- 4.46
Foliar application	t_4	8.165 kg/fed	220.4 c	372.9 a	98.87 c	939.08 f	+ 4.5	- 9.55	+ 9.3	+ 1.63
	t_5	16.33 kg/fed.	206.1 a	359.9 a	90.41 b	871.08 c	- 2.77	- 12.71	- 0.005	- 5.73
Control	t_6	--	210.9 b	412.0 c	90.44 b	924.0 e	-	-	-	-

For the foliar application, data showed significant difference between treatment 16.33 kg/fed. (206.1), 8.165 kg/fed. (220.4) and untreated plants (210.9 individuals/25 leaves).

In table (2) the same trend of the population density of *T. tabaci* was appeared in 2003 season where there was insignificant difference between all the treatments by soil applications and the untreated plants, except the treatment with 100 kg/fed., where the percent reductions were 3.40, 0.08 and 0.007 for treatments No. 1, 2, and 3. On the other hand, significant differences were observed between two foliar applications with 8.165 kg/fed. and 16.33 kg/fed of potassium fertilizer and untreated plants, where the mean populations were 245.5, 226.1 individuals/25 leaves respectively and 238.75 with untreated plant.

These results are in agreement with those of Khamraev *et al* (1985), Rosseto *et al* (1997), and Balasubramanian and Muralibaskaran (2001).

Table (2): Mean numbers of sucking insects as affected by potassium (as K_2O) fertilization during 2003 cotton growing season.

Treatments			Mean No. of sucking insects				% different than control			
			T. tabaci	*A. gossypii*	*E. lybica*	*B. tabaci*	*T. tabaci*	*A. gossypii*	*E. lybica*	*B. tabaci*
Soil application	t_1	100 kg/fed.	230.75 a	519.25 b	73.25 a	909.27 a	- 3.40	- 4.66	- 5.56	- 22.48
	t_2	50 kg/fed.	236.75 b	533.17 c	77.19 ab	997.91 b	- 0.08	- 2.11	- 0.41	- 14.93
	t_3	25 kg/fed	237.0 b	541.42 d	77.19 ab	1037.73 c	- 0.007	- 0.005	- 0 40	- 11.53
Foliar application	t_4	8.165 kg/fed	245.5 c	531.42 c	82.19 c	1175.22 e	+ 2.82	- 2.40	+ 5.97	0.00
	t_5	16.33 kg/fed.	226.1 a	484.83 a	77.42 b	1054.0 d	- 5.29	- 10.98	- 0.002	- 10.14
Control	t_6	--	238.75 b	544.66 d	77.56 b	1173.0 e	-	-	-	-

Effect on *A. gossypii*

Data presented in table (1), showed that the total mean numbers of *A. gossypii* were 391.08, 397.58 and 410.75 with the ratio 100, 50, 25 kg/fed. of potassium fertilizer by soil application comparing with untreated one (412).

The percent reductions of insect were 5.15, 3.58 and 0.003 for the same previous ratios.

Significant differences were observed between treated and untreated plants in case of foliar applications at the rates of 8.165 and 16.33 kg/fed., where the decrease percentages were 9.55 and 12.71 individuals/25 leaves respectively. In table (2) data revealed significant differences between treated and untreated plants except the treated soil application with 25 kg/fed. The percent reductions were 4.66, 2.11, and 0.005 with 1, 2, and 3 treatments respectively. On the other hand significant differences were observed

between the two foliar applications and untreated plants, where the decrease of percentages were 2.4 and 10.98 individuals/25 leaves respectively.

These results are in agreement with those of YuzBash and Khamraev (1989), Klingaut (1987), and El-Basouni (2003).

Effect on *E. lybica*

Data in tables (1) and (2) showed that potassium fertilizer decreased the population density of *E. lybica* on cotton in case of the treated soil applications than untreated one where the percent reduction were, 8.9, 5.7 and 0.03 in 2002 season and were 5.56, 0.41 and 0.4 in 2003 season. It was observed that the decreasing of insect population were recorded with the high ratios of fertilizer in the two growing seasons. No significant difference was observed between treated foliar application with 16.33 kg/fed. of fertilizer and untreated plants in the two cotton growing seasons where the mean numbers were 90.41 and 77.42 for treatment No. 5 in both two seasons comparing with the mean numbers of untreated plants where they were 90.44 and 77.56 respectively.

An increasing numbers were appeared in treatment No. 4 than untreated one in the two seasons where the means were 98.87 and 82.19 and these numbers revealed significant differences than control.

Sehail *et al* (2003) found that the effect of fertilizers N at 69 kg/acre, P at 34 kg/acre and K at 25 kg/acre at sowing on white flies, Jassids and Thrips were non significant.

Effect on *B. tabaci*

Data presented in tables (1) and (2) revealed that potassium fertilizer reduced the population of *B. tabaci* in the two cotton growing seasons, where the decrease percentages in treated soil application were 13.62, 10.44 and 4.46 in (2002) and were 22.48, 14.93 and 11.53 in 2003 season. Significant differences were observed between treatments of foliar applications with 8.165 and 16.33 kg/fed. of potassium fertilizer and untreated plants in the two growing seasons and the treatment with 8.165 kg/fed. of potassium fertilizer may be increase the population density by little rate in the two cotton growing seasons, where the increase percentages were 1.63 and zero in 2002 and 2003 respectively.

Sharaf (2003) found that $N_1P_1K_1$ [90 (N) + 30 (P_2O_5) + 48 (K_2O)] and $N_2P_2K_2$ [60 (N) + 15 (P_2O_5) + 24 (K_2O)] fertilizer increased the population of *B. tabaci* in two cotton growing seasons (1996 and 1997). Also, Purohit and Deshpande (1991) mentioned that normal and double rates of NPK fertilizer increased the *B. tabaci* infestation of cotton plants compared with untreated plants.

Effect of potassium fertilizer on associated predators:

Data in tables (3) and (4) showed that there were no significant differences among untreated plants and the three soil fertilizer treatments in the two growing seasons in the case of the *Coccinella* spp., where the mean population ranged between 12.9 to 14.15. There were significant differences

among the two foliar applications and the untreated one in the two seasons, where the mean numbers in the treatments were less than untreated.

In case of *Scymnus* spp. the mean populations were more in the soil treatments than the untreated, while they were less in the foliar treatments than the untreated in the two growing seasons. For the *Chrysopa* spp. the mean numbers in all the treatments were less than the untreated one in the two seasons, although the analysis of these means showed no significant differences between the control and some treatments. The mean population of *Orius* spp. showed no significant differences between control and all soil treatments in the two seasons, except the treatment with 25 kg/fed. in 2002 season. There were significant differences between control and the two foliar treatments in the two seasons, where the mean numbers were more in the soil treatments and less in the foliar treatments than the untreated one. The population trend of *Peadrus alfenii* in all treatments decreased than the untreated plants in the two seasons and the decreasing showed significant differences. The same previous trend appeared in case of true spiders where there were significant differences between control and all treatments. For all the studied predators the two foliar treatments affected the abundant, where they reduced the mean numbers of predators than untreated one in the two seasons, while the soil treatments showed slight effect on the studied predators.

Table (3): Mean numbers of natural enemies as affected by potassium fertilization during cotton growing seasons 2002.

Treatments			Mean No. of predators					
			Coccinella spp.	*Scymnus* spp.	*Chrysopa* spp.	*Orius* spp.	*Paederus alferii*	True spiders
Soil application	t_1	100 kg/fed.	13.6 b	41.45 cd	9.75 b	9.45 d	66.55 d	42.55 c
	t_2	50 kg/fed.	13.7 b	42.05 d	10.60 c	9.15 c	67.30 c	43.85 d
	t_3	25 kg/fed	14.0 b	42.9 e	10.85 c	9 75 e	68.80 d	42.15 c
Foliar application	t_4	8.165 kg/fed.	12.05 a	31.55 b	9.20 b	8.10 b	63.90 b	28.65 b
	t_5	16.330 kg/fed.	11.20 a	25.3 a	7.20 a	6.60 a	52.00 a	25.90 e
Control			14.15 b	40.80 c	11.20 c	9.25 cd	82.35 e	45.50 e

El-Basyouni (2003) reported that Nitrogen appeared to be the most effective fertilizer with true spiders and all treatments increased significantly the population density.

YuzBash *et al* (1989) reported that the number of natural enemies (among which *Orius predominated*) remained unaffected with fertilization of

irrigated cotton in the form of an application of 1.5 % potassium chloride or 2.5 % super phosphate solution in 400 – 500 liters water/ha.

Sharaf (2003) found that *Paederus alferii* was the most abundant species, followed by true spiders, *Scymnus* spp. and *Coccinella undecimpunctata* respectively with [N (90) + P (30) + K (60)] combination.

Table (4): Mean numbers of natural enemies as affected by potassium fertilization during cotton growing seasons 2003.

Treatments			Mean No. of predators					
			Coccinella spp.	*Scymnus* spp.	*Chrysopa* spp.	*Orius* spp.	*Paederus alferrii*	True spiders
Soil application	t_1	100 kg/fed.	13.0 b	39.05 c	8.65 c	8.00 c	65.50 d	40.25 c
	t_2	50 kg/fed.	12.15 b	40.30 c	9.30 d	7.85 c	64.30 c	41.75 d
	t_3	25 kg/fed	12.9 b	40.05 c	9.55 d	8.15 c	65.85 d	39.70 c
Foliar application	t_4	8 165 kg/fed.	11.0 a	33.15 b	8.05 b	6.55 b	60.55 b	26.35 b
	t_5	16.330 kg/fed.	10.6 a	24.00 a	6.00 a	5.55 a	48.90 a	23.70 a
Control			13.2 b	39.05 c	10.22 e	7.95 c	79.1 e	42.15 d

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تأثير التسميد البوتاسى على تعداد بعض الحشرات الثاقبة الماصة وعلى الأعداء الحيوية المصاحبة لها على نباتات القطن

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أجريت هذه الدراسة بمزرعة محطة البحوث الزراعية بسخا خلال موسمى ٢٠٠٢ و ٢٠٠٣ على صنف جيزة ٨٩. والغرض من البحث هو تأثير التسميد البوتاسى على إصابة القطن ببعض الأفات الثاقبة الماصة مثل التربس ومن القطن والجاسيد والذبابة البيضاء وكذلك دراسة للتأثير البوتاسى على بعض الأعداء الطبيعية المصاحبة.

أوضحت النتائج ما يلى:-

- وجود اختلافات غير معنوية بين النباتات المعاملة والغير معاملة بالسماد البوتاسى وبخاصة عند إضافته للتربة بمعدلات ٥٠ و ٢٥ كجم/فدان.
- انخفاض تعداد الحشرات الثاقبة الماصة (التربس – الجاسيد – الذبابة البيضاء) بصورة طفيفة عن المقارنة.
- أثر التسميد البوتاسى بصورة معنوية على تعداد الحشرات عند استخدامه رشا على الأوراق بمعدلات ٨,١٦٥ ، ١٦,٣٣ كجم/فدان.
- بصفة عامة، كان للتسميد البوتاسى تأثيرا معنويا واضحا على حشرة الذبابة البيضاء مقارنة بالحشرات الأخرى.
- بالنسبة للتأثير على الأعداء الحيوية (المفترسات) كان هناك تأثير واضح ومعنوى فى انخفاض تعدادها فى حالة الرش الورقى فقط فى كلا الموسمين.