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ACTION OF GA_3 (PLANT GROWTH REGULATOR) AND K_2SO_4 (FOLIAR FERTILIZER) ON SQUASH IN RELATION WITH RESISTANCE TO INSECT PESTS

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ABSTRACT

Summer squash (Cucurbita pepo L.), plants growing in different soils; at Abiss and New Burg El-Arab, were provided with three foliar materials: gibberellic acid (GA_3), potassium sulphate (K_2SO_4) and their combination. Trials were conducted on the cultivar (Eskandrani) over two growing seasons.

Treatments influnced both yield and plant vitality as well as insect pest infestation. The control of these insects used to be affected by spraying K_2SO_4 into leaves and it is possible to combine both K_2SO_4 and GA_3 to apply them together.

Significant increments in early, and total yield as well as in average fruit number were detected when the plants recived K_2SO_4 alone or in a mixture with GA_3.

The foliar fertilizer K_2SO_4 significantly decreased the number of insects as compared with the control or GA_3 treatments.

INTRODUCTION

There is a general belief that potassium fetilizer reduces the intensity of several infection with several diseases and pests

(Chaboussou, 1976) The action of potassium on plant metabolism is manifold There is a large group of enzymes (Mulder, 1949) that is activated by K^+. Protein synthesis and many syntheses of many other compounds including; sugar, cellulose, cell wall, vitamins, etc. are promoted by the availability of potassium (Hewitt, 1963 and Kiraly, 1976). Still there are serveral investigations reported on the effects of K-fertilizers on insects or mites control.

Fritzsche (1961) was able to show with beans, that K- deficiency caused an increase of soulible carbohydrates in the leaves and in the multiplication consequence of Tetranychus urticae. Chaboussou (1976) reported that an important correct K- fertilizers use is for improving pest resistance. Moreover, potassium has a greater influence on fruit quality than that of any other element (Asif et al., 1972 and Michael etal., 1974).

The use of gibberellin on vegetable crops has received a considerable amount of attetion in recent years, because of its stimulatin effects. Sawhney and Greyson (1972) showed that the application of GA_3 to non-flowering plants significantly increased yield. GA_3, also, caused a marked increase on the number and area of leaves (Foda etal., 1972).

This report provides some information on the general effects of potassium foliar fertilizer and gibberellic acid on early and total yield and quality of squash fruits as well as on insect pests control

MATERIALS AND METHODS

Seeds of cv. Eskandrani squash were obtained from Noba-seed, (Nubaria seed production company) Alexandria, Egypt The present investigation included two experiments, that were conducted at the Experimental Farm,

Faculty of Agriculture, Alexandria Univ , and a third experiment at the new land of Burg El-Arab

The 1st experiment, of fall season 1987, was carried out to conduct a preliminary investigation on the tested chemicals, appling different GA_3, and K_2SO_4 concentrations. The experiments of 1988 and 1989- consisted of three spray treatments and the control. The treatments were K_2SO_4 (400 mg/L), GA_3 (150 ppm) and their combination (GA_3+ K_2SO_4) at the same doses in the mixture. The foliar treatments were applied (Foliar) towic, at 25 and 35 days old. A randomized complete blocks design, with 3 replicates, was used Seeds were sown in hills, 40 cm apart, on one side of the ridges (100 cm width and 5 m length). Plot area was 25 m^2. Sowing dates were the 15th of Agust 1988, and 19 th and 20 th of Agust 1989; in the two locations Abiss and New-Burg El Arab, respectively.

Leaves for chemical analysis were obtained, from the plants about 7 days prior to harvest. The 4th leaf from the growing terminal was obtained (25 leaves/plot) for analyses. The leaves were dry ashed as outlined by Chapman and Pratt, (1961). Total nitrogen was analyzed by the micro-kjeldahl method (AOAC, 1980). Phosphorus was determined by molybdate-blue method. Potassium was measured flame-photometrically against a standard. Calcium and magnesium were determined using a Perkin-Elmer Atomic Absorption Spectrophotometer Model 305 B.

Chlorophyll content was measured according to Osborn and Mc-Calla, (1961). The method used in this test were already detailed out in an earlier paper of Doss and Moussa, (1985).

Fruits harvested during the first 12 days in the harvesting period were considered as the early yield. Total yield and its components (fruit number and fruit weight) were

determined.

Numbers of individual insect pests: (Bemisia tabaci Gannandius, Thrips tabaci Lind. and Aphis gossypii Glover) on the leaves under various treatments were counted 7 days after the 2nd spraying Insecticides were never used insect pests.

All obtained data were statistically analysed and then multiple comparisons were carried out, according to Duncan's multiple range test (AL-Rawi and Khalf-Allah 1980).

RESULTS AND DISCUSSION

Mineral content: The data of the present study show that, in both experimental locations, the leaves treated with GA_2 had a higher concentrations of nitrogen and calcium. However, in new Burg-Arab, Calcium level in leaves was not affected by GA_3 application or other treatments (Table 1). Concentrations of other elements ;phosphours, potassium and calcium in leaves were significantly affected by K_2SO_4 treatment. It was, also, noticed that magnesium level did not significantly differ with respect to second seasons. Similar results were obtained by Midan et al., (1981).

Chrophyll content: GA_3, alone or in a combination with K_2SO_4, significantly increased the total chlorophyll as well as chlorophyll a and b, in both experiments than the control. This result suggested that either chlorophyll was synthesized at a higher rate in the leaves which were externally treated with GA_3 and K_2SO_4 and/or that some chlorophyll was degraded as a result of increased rate of insect pests multiplication on control leaves (Fig 1 and Table 3). These results are in general agreement with those of Fritzsche (1961).

Leaf area: Leaf area estimates are listed in Table (2). The foliar application with GA_3

Table 1: Effect of gibberellic acid, potassium sulphate and their combination of both on mineral contents of squash leaves, fall seasons 1988 and 1989.

	% Abiss					% New-Burg El-Arab									
	1988					1989					1989				
Treatments	N	P	K	Ca	Mg	N	P	K	Ca	Mg	N	P	K	Ca	Mg
1. Control	1.82b	0.20c	1.51c	0.96b	0.30b	1.52c	0.20b	1.64c	0.92b	0.38	1.80b	0.15c	0.68d	1.07	0.33
2. GA_3	2.36a	0.27b	1.89b	1.19a	0.37ab	2.19a	0.20b	2.03b	1.08a	0.40	1.96a	0.22b	1.02c	1.10	0.35
3. K_2SO_4	1.61c	0.34a	2.12a	1.22a	0.45a	1.70b	0.29a	2.31a	1.13a	0.38	1.82b	0.35a	2.05a	0.99	0.34
4. $GA_3+K_2SO_4$	1.90b	0.30a	2.20a	1.30a	0.39a	1.81b	0.26ab	2.27a	0.99ab	0.43	2.00a	0.24b	1.78b	1.01	0.39

Table 2: Effect of gibberellic acid, potassium suplhate and their combination on leaf area (Cm^2/plant) 45-growth days of squash, fall seasons 1988 and 1989.

Treatments	Season location character	1988 Abiss Leaf area	1989 Abiss Leaf area	1989 New Burg El-Arab Leaf area
1. Control		3110.12c	4580.20d	2910.20c
2. GA_3		5260.18a	6088.25a	3564.13a
3. K_2SO_4		4985.92b	5051.64c	3617.40a
4. $GA_2+K_2SO_4$		5189.73a	5735.63b	3444.64b

- Means in each table in a columns, within each location not having the same letter did not differ significantly at the 0.05 level. Columns without indicate no differences.

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or K_2SO_4 promoted the leaf area, relative to the control. GA_3 commonly resulted in increased leaf area in several crops (Foda et al, 1972). Calwert and Smith (1972) found that K_2SO_4, as a foliar, may be used to increase leaf area.

Pest control: From Table (3), the results showed that B. tabaci congregated on the plants having different treatments with different rates. GA_3 treatment showed a very large population of B. tabaci that differed significantly from that of the control and reached many times those of other treatments. The treatment with K_2SO_4 reduced the popukation of this insect to a great extent and its population gave the ratios 1:9 and 1:4, relative to that of the control, in the experiments of the two locations. The populations of A. gossypii and T. tabaci reflected similar trends to that just mentioned for of B. tabaci. Similar significant reductions, compared with control, was also detected as a result of the combined treatments. On the contrary, the treatment with GA_3 increased significantly the populations of the studied insect pests. The population counted on the leaves of treated plants with GA_3 appeared significantly higher even than those of the control. These results seem to agree with those reported by Tsngawa et al., (1964) and Chaboussou, (1976) who stated that potassium - fertilizer - sprays generally reduced the numbers of insect pests.

Yield and its components: Early and total yield, and its components of squash in both experiments are listed in table (4). The comparisons among the different means showed that K_2SO_4 treatments gave significantly higher values for early and total yield than those of the control. The results reported for average fruit weight reflected some significant differences, as shown in Abiss in 1988 and in new Burg El-Arab in 1989. However, in Abiss, the different treatments did not have any significant differences in 1989. The average

Table 3: Effect of gibberellic acid, potassium sulphate and their combination of both on No. of individuals insect pests of squash leaves, fall seasons 1989.

	Average No. of individuals on 10 leaves					
	Location					
	Abiss			New Burg-Arab		
Treatments	B. tabaci	T. tabaci	A. gossypii	B. tabaci	T. tabaci	A. gossypii
1. Control	2030b	98b	400b	4325b	102a	217a
2. KA_3	2441a	218a	618a	5119a	110a	230a
3. K_2SO_4	343d	24d	198c	1290d	32c	156b
4. $6A_3+K_2SO_4$	598c	53c	180c	1370c	58b	149b

Table 4: Effect of gibberellic acid, potassium sulphate and their combination of both on early, total yield, and its components of squash, fall seasons 1988 and 1989.

	Abiss								New Burg El-Arab							
	1988				1989				1989							
Treatments	Early yield g/plant	Total yield g/plant	Fruit size "g"	No. of fruit/ plant	Early yield g/plant	Total yield g/plant	Fruit size "g"	No. of fruit/ plant	Early yield g/plant	Total yield g/plant	Fruit size "g"	No. of fruit/ plant				
1. Control	209.00 c	585.56 d	94 b	6.24 c	216.24 d	727.26 d	102	7.13 d	131.32 d	580.00 d	100 b	5.80 c				
2. $6A_3$	455.88 b	1346.22 c	106 a	12.70 b	430.52 c	1470.01 c	100	14.70 c	315.18 c	926.17 c	101 b	9.17 b				
3. K_2SO_4	478.40 b	2007.78 a	104 a	18.42 a	596.20 a	2201.10 a	104	20.01 a	494.40 a	1656.00 a	120 a	13.80 a				
4. $6A_3$ + K_2SO_4	545.18 a	1799.20 b	109 a	17.30 a	504.12 b	1684.80 b	110	16.90 b	380.70 b	1257.42 b	114 a	11.03 b				

- Means in each Table and in a colum, in each location, not having the same letter did not significantly differ at the 0.05 level. Columns without letters indicate no significants differences.

effects of K_2SO_4 and GA_3 treatments on the average number of fruits per plant appeared to reflect some significant differences. The general trend, noticed from these comparisons, showed that fruit number was increased to agreat a extent with K_2SO_4 treatment. Furthermore, GA_3 alone or with K_2SO_4 produced significantly higher values of fruit no. than that of the control. These results generally agreed with numerous reports such as that of Michael et al., 1974 and Gezerel and Donmez., (1986).

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الملخص العربى

تاثير حمض الجبريلك وسماد سلفات البوتاسيوم الورقى على القدرة الانتاجيه لمحصول الكوسة وعلاقته بمقاومة الحشرات الضارة

اجريت تجربتان حقليتان بمزرعة بحوث الكلية وشالشة فى برج العرب الجديدة فى الموسم الخريفى (النيلى) لعامى ١٩٨٨، ١٩٨٩ على محصول الكوسة الاسكندرانى بغرض دراسة تاثير استخدام الرش الورقى لسماد سلفات البوتاسيوم (٤٠٠ ملليجرام/لتر) وحمض الجبريلك (١٥٠ جزء فى المليون) وخليطهما على بعض الصفات الخضرية والثمرية بالاضافة الى دراسة أثر هذه المعاملات على اعداد الحشرات من حيث تواجدها على الاوراق والتى نلخص نتائجها فيما يلى :-

أولا :- أدى استخدام حمض الجبريلك منفردا أو مخلوطا مع سماد سلفات البوتاسيوم رشا على الاوراق الى زيادة مؤكدة احصائيا للمساحة الورقية عن الكنترول.

ثانيا :- أظهرت النتائج ايضا زيادة محتوى الاوراق من عنصرى البوتاسيوم والفوسفور فى معاملات الرش سماد سلفات البوتاسيوم، فيما أظهرت الأوراق المعاملة بحمض الجبريلك زيادة مؤكدة لعنصر النيتروجين.

ثالثا :- قيم الكلورفيللات المستخرجة من الاوراق أوضحت زيادة مؤكدة لمعاملات التجربة من حمض الجبريلك والبوتاسيوم ومخلوطهما عن الكنترول.

رابعا :- أدى استخدام سماد البوتاسيوم رشا الى زيادة مؤكدة للمحصول المبكر والكلى عن معاملة حمض الجبريلك والكنترول، فى حين لم يكن هناك تاثير معنوى على حجم الثمار.

خامسا :- أوضحت النتائج ايضا أن ميكانيكية التاثير الخاص لكل من سلفات البوتاسيوم وحمض الجبريلك مختلفة على احداث ظاهرة المقاومة السلبية (تنفير أو ترغيب) ضد متوسط اعداد الحشرات النامية على أوراق معاملاتها بالمقارنه بالكنترول.