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RESPONSE OF GIZA 88 COTTON CULTIVAR TO FOLIAR SPRAYING WITH BORON, POTASSIUM OR A BIOREGULATOR SGA-1

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ABSTRACT

Two field experiments were carried out at Bassyoun centre , Gharbia Governorate during the two successive seasons 2003 and 2004. These experiments were conducted to evaluate the effect of two foliar sprays of boric acid at two levels i.e. 0.15 and 0.3% at each spray , K_2SO_4 at two levels i.e. 1 and 2% K_2O at each spray and a bioregulator SGA-1 at two levels i.e. 0.2 and 0.4% at each spray in comparison with spraying water as a control. The leaf nutrients content, growth traits, boll set attributes, earliness, seed cotton yield and its components of the Egyptian extra long staple (*Gossypium barbadense L.*)Giza 88 cotton cultivar were measured.

The leaf N and P contents were significantly increased due to the different spraying treatments where these contents reached their highest averages due to the foliar application of SGA-1 followed by the high level of boron. The same treatments recorded a high K and Ca contents and the highest Fe, Mn and Zn contents.

Foliar application of SGA-1 was effective to enhance cotton plant growth as expressed in taller plants and larger number of sympodia and hence larger number of bolls/plant than the control ones. These improvements were reflected in seed cotton yield/fed.

Foliar application of boric acid at a level of 0.3% or potassium sulphate at a level of 2% K_2O was also effective in these respects but with lower averages than those obtained due to the SGA-1 treatment.

The results concluded that two foliar sprays with a bioregulator SGA-1 at a level of 0.4% at the beginning of flowering and 15 days later is the best treatment for good growth and high productivity of the extra long staple , Giza 88 cotton cultivar. Also, two foliar feedings with boron as boric acid at a level of 0.3% or potassium as potassium sulphate at a level of 2% K_2O could be used for high productivity

INTRODUCTION

Cotton is grown in Egypt on flood – irrigated loamy or clayey soil with high pH (around 8). The crop is commonly rotated after a legume crop (*Trifolium alexandrinum L*) which was reported to add to the soil 30 – 50 kg available N/ha (Fawzi and El-Fouly, 1993). Meanwhile , having two cuts from this crop removes from the soil an average of 190 kg K_2O/ ha (El-Fouly *et al.*, 1987). In spite of this high K depletion from soil before cotton planting, farmers are not used to apply K. So, applying potassium fertilizers became very important in the recent years (Eid *et al.*, 1997).

Potassium is an essential macro element for all living organisms and is required in large amounts for normal plant growth and development. It is absorbed by roots from soil as the monovalent cation K^+ usually by active uptake. This element is very mobile in the plant and can be translocated against strong electrical and chemical gradients (Hoagland, 1944).However, Oosterhuis (1997) reported that modern K – deficiency syndrome appears to be a complex anomaly related to (1) the greater demand for K by modern cultivars, (2) the inability of the root system to supply these demands , due to a decrease in root activity late in the season and low or poor restricted root growth, (3) soil K fixation and (4) possibly low storage of K by modern cultivars prior to boll development.

Eid *et al* (1997)found that spraying cotton plants with potassium sulphate (48% K_2O) at the rate of 9 kg/ fed. increased plant height, earliness percentage and seed cotton yield due to an increase in number of open bolls / plant and average boll weight. The treatment had no significant effect on seed index and lint percentage . El- Shazly *et al* (2003) found that two foliar feedings with K at two levels (1% or 2% K_2O) gave insignificant increase in number of total bolls/plant, seed index, lint percentage, boll weight and seed cotton yield/plant as well as /fed. in two seasons and number of open bolls/plant in one season only, as compared with the control.

Boron (B) is involved in the uptake and metabolism of Ca by the plant and is essential for fruiting (Hearn, 1981). A deficiency in B may cause shedding of young bolls and deforming of flowers. In extreme cases the plant is stunted, the main stem splits and leaves are deformed (Hearn, 1981). B deficiency decreased leaf size and length of sympodial branches and hence increased shedding of ovaries and buds of cotton (Pak, 1976). Boron (B) shortages are usually found in alkaline soils with a pH of about 8 to 8.5 (Cardozier, 1957). El-Shazly *et al* (2003)found that two foliar feedings of boron as boric acid (17% boron) at two levels i. e 0.15 and 0.3 % at each spray gave the highest values of leaf N, P, K, Mg, B, Fe, Mn, and Zn contents as compared with the control treatment. Also, these treatments significantly increased plant height in two seasons and number of fruiting branches / plant in one season as compared with the control treatment. Moreover, these treatments significantly increased earliness and lint percentages, seed index and seed cotton yield/ plant especially when the high level was used as compared with the control treatment. In addition the high level of boron significantly increased number of total set bolls /plant, boll setting percentage, boll weight and seed cotton yield /fed. in two seasons and number of open bolls/plant in one season as compared with the control.

Recently, using bioregulators i. e. cytokinin and PGR- IV is carefully studied as they are more effective on growth and development which increase bolls set and productivity (Abdel- Al *et al.,* 1989 and El- Shazly *et al.,* 1998). A bioregulator, Snow Grow Ace (SGA-1)was prepared from *Basidiomycetes mycelium* (Ishii and Yoshida, 1991). SGA – 1 is composed of cytockinin (Zeatin riboside and free zeatin), amino acids, sugars and other organic substances (Yoshida, 1989). Ziadah et al (2000) found that SGA-1 application gave a significant effect on plant height at harvest in two seasons and on number of fruiting branches/plant in one season in favour of two foliar sprays by SGA – 1 at the rate of 2g/l as compared with untreated plants. Also, they found that boll weight, number of open bolls/plant, seed cotton yield /plant and/ fed. were significantly increased by foliar application of SGA – 1 in two seasons than untreated one, while the lint percentage was not significantly affected . Also, El-Shazly *et al.,* (2003) found that the two levels of SGA-1 (0.2% or 0.4%) significantly increased number of open bolls/plant, lint percentage, seed index and seed cotton yield/fed. as compared with the control treatment.

Therefore, the objective of this study was to test the effect of two foliar feedings with potassium, boron and a bioregulator SGA – 1 at two levels with regard to leaf nutrients content, growth traits , boll set attributes, earliness, yield and its components. Certainly the question of a possible complementary effect between K soil addition and foliar feeding with K needs an answer in this respect

MATERIALS AND METHODS

Two field experiments were carried out at Bassyoun district, Gharbia Governorate, in the middle of Delta of Egypt, during the two successive seasons 2003 and 2004 to study the effect of two foliar sprays of a bioregulator (Snow Grow Ace, SGA-1), boron and potassium at two levels in comparison with a control (spraying with tap water) on leaf nutrients content, growth traits, boll set attributes, earliness, seed cotton yield and its components of the Egyptian extra long staple *(Gossypium barbadense L),* Giza 88 cotton cultivar.

The experimental design was a randomized complete blocks with four replicates.

Seven treatments were applied as follows:

T_1 Untreated (sprayed with tap water) as a control .

T_2 Foliar spray of a bioregulator Snow Grow Ace (SGA-1) twice at the rate of 0.2 % SGA -1 at each spray.

T_3 Folair spray of a bioregulator Snow Grow Ace (SGA-1) twice at the rate of 0.4 % SGA -1 at each spray.

T_4 Folair spray with boric acid (17% boron) twice at the level of 0.15% boric acid at each spray.

T_5 Folair spray with boric acid (17% boron) twice at the level of 0.3% boric acid at each spray.

T_6 Folair spray with potassium sulphate (48% K_2O) twice at the level of 1% K_2O at each spray.

T_7 Folair spray with potassium sulphate (48% K_2O) twice at the level of 2% K_2O at each spray.

The treatments were applied as foliar sprays on cotton plants at the commence of flowering stage followed by another spray , 15 days later using hand operated sprayer compressed at a low volume of 200 liter / fed.

In both seasons, the plot size was 41.6 m^2 with 8 rows of 65 cm wide and 8 m long with hills 25cm apart. The two outer rows were left as borders.

Planting date was on 1st April in both seasons.

The preceding crop was Egyptian clover (*Trifolium alexandrinum L*) "berseem", from which two cuts were taken in both seasons .

Phosphorus fertilizer was added at the level of 22.5 kg P_2O_5/fed. as calcium superphosphate (15.5% P_2O_5)during land preparation. Nitrogen fertilizer was applied at the level of 60 kg N/fed. as ammonium nitrate (33.5%

N) in two equal splits after thinning (36 days after planting, two plants/hill) and the following irrigation.

Potassium fertilizer was soil added at the level of 24 kg K_2O/fed. as potassium sulphate (48 % K_2O)in one dose with 1st dose of nitrogen fertilizer. All other cultural practices were followed as recommended in cotton fields.

Soil analysis :

Representative soil samples were taken from one layer 0 – 40 cm before planting. The soil analysis for the two sites is shown in Table (1)

Table (1): Analysis of the experimental soil in 2003 and 2004 seasons.

Properties		Methods (References)	2003	2004
Texture		Hydrometer (Bauyoucos, 1951)	Clay	Clay loam
pH		1 soil : 2.5 water (Jackson, 1973	7.9	8.0
EC mmhos/cm.			0.95	1.5
$CaCO_3$%		Calcimeter	1.2	1.6
O.M. %		(Walkley and Black, 1934)	1.6	2.0
Total N	Mg/ 100 g soil	Semi-micro Kjeldahl (Piper, 1950)	56	70
Available N			2.98	3.1
Available P		Vanadate- molybdate spectroph-otometer (Olsen *et al.*, 1954)	1.9	1.54
Available K		Flame photometer and Atomic absorption (Chapman and Pratt, 1978)	23.8	24.8
Available Ca			16.8	24.6
Available Mg			165.4	109.8
Available Na			34.4	34.0
Available Fe	ppm	Atomic absorption spectro- photometer (Lindsay and Norvell, 1978)	11.4	14.6
Available Mn			3.8	6.4
Available Zn			1.4	1.1
Available Cu			3.8	4.6
Available B		Azomethin – H (Wolf, 1971)	0.5	0.42

The data in Table (1) indicate that the two experimental soil sites had high pH and medium salinity. $CaCO_3$ and organic matter contents were low. Soil texture was clay and clay loam in the first and second seasons , respectively. Concerning soil macronutrients content, the soils of the two sites were low in available and total N, medium in available P, K and Na and high in available Ca and Mg. Regarding soil micronutrients content, the soil of the two sites were medium in their available content of Fe , low in their available contents of B, Mn and Zn and high in their available content of Cu measured by the critical levels according to Ankerman and Large (1974).

Studied parameters :-

A- Leaf nutrients content :-

115- days after planting a representative leaf sample (20 leaves) was taken from the upper 4th leaf on the main stem from each plot. After sample preparation for analysis, concentrations of Fe, Mn, Zn and Cu were determined with an atomic absorption spectrophotometer and contents of total P, K, Mg and Ca were determined according to Chapman and Pratt (1978). Also, the total N content was determined using Micro – Kjeldahl method as described by Allen (1953) . B was detrmined with Azomethin – H according to Wolf(1971).

B- Growth traits:

At harvest, plants of five guarded hills were taken at random from the second row of each plot to determine plant height (cm) and number of fruiting branches/plant.

C- Boll set attributes and earliness :

The forementioned five guarded hills were also used to estimate the following attributes : number of total flowers/ plant,

$$\textbf{boll setting \%} = \left(\frac{\textbf{Number of total set bolls/plant}}{\textbf{Number of total flowers/plant}} \times 100 \right)$$

and

$$\textbf{earliness \%} = \left(\frac{\textbf{Seed cotton yield of the first pick}}{\textbf{Total seed cotton yield}} \times 100 \right)$$

according to Richmond and Radwan (1962)

D- Seed cotton yield and its components :

The same five guarded hills were also used to determine the following yield components : numbers of total and open bolls/plant, boll weight (g), seed cotton yield/plant (g), lint % and seed index "100 seed weight".

Seed cotton yield/feddan* in kentars** was calculated from the yield of the six inner rows of each plot.

The obtained data were subjected to statistical analysis as outlined by Snedecor and Cochran (1981). The treatments means were compared using LSD at 0.05 level of probability.

RESULTS

A-1- Leaf macronutrients content:-

Data in Table (2) show that the tested treatments gave a significant effect on leaf N, P, K and Ca contents but gave insignificant effect on leaf Mg content in both seasons. The highest values of leaf N and P contents were obtained from foliar application of SGA-1 followed by the high level of boron and potassium while the lowest values were obtained from the low level of boron or potassium and from the control. With regard to leaf K content, the highest values were obtained from foliar feeding with K treatments followed by foliar spraying of SGA-1 treatments and the high level of boron while the lowest values were obtained from the low level of B and from the control treatment.

* One feddan = 4200.83 m^2

** One kentar = 157.5 kg

The highest values of leaf Ca content were obtained from 0.3% boric acid, 0.15% boric acid, 0.4% SGA-1 and 0.2% SGA-1, respectively while the lowest values were obtained from 2% K_2O, 1% K_2O and from the control, respectively .

Table (2): Effect of the tested treatments on leaf macronutrients content at 115 days after sowing in 2003 and 2004 seasons.

Treatments	%									
	N		P		K		Ca		Mg	
	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004
T_1 Control	3.6	3.4	0.11	0.14	1.61	1.91	1.07	1.04	0.25	0.42
T_2 SGA-1 (0.2 %)	5.2	4.8	0.24	0.21	2.04	2.46	1.36	1.33	0.30	0.44
T_3 SGA-1 (0.4 %)	5.4	4.9	0.26	0.23	2.40	2.50	1.39	1.62	0.31	0.46
T_4 Boric acid(0.15%)	4.1	3.4	0.15	0.16	1.73	1.92	1.95	1.66	0.27	0.45
T_5 Boric acid (0.30 %)	5.1	4.2	0.21	0.17	2.07	2.48	2.09	1.99	0.29	0.45
T_6 K_2O (1 %)	3.9	3.4	0.14	0.15	2.66	2.53	1.08	1.10	0.28	0.42
T_7 K_2O (2 %)	4.9	3.9	0.18	0.16	3.15	2.62	1.13	1.14	0.27	0.45
F- test	**	**	**	**	**	**	**	**	NS	NS
L . S. D 0.05	0.5	0.2	0.05	0.03	0.22	0.20	0.50	0.48	-	-

** and NS indicate P < 0.01 and not significant, respectively.

A-2- Leaf micronutrients content :-

Leaf B, Fe, Mn and Zn contents were significantly affected by the tested treatments. While leaf Cu content was insignificantly affected by the tested treatments in both seasons (Table 3). The highest values of leaf boron content were obtained from foliar feeding with boron treatments followed by K treatments and the highest level of SGA-1 foliar application, while the lowest values were obtained from the low level of SGA-1 foliar application and from the control. With regard to leaf Fe, Mn and Zn contents the highest values were obtained from SGA-1 treatments followed by the high level of B or K while the lowest values were obtained from the low level of B or K and from the control.

Table (3) : Effect of the tested treatments on leaf micronutrients content at 115 days after sowing in 2003 and 2004 seasons.

Treatments	Ppm									
	B		Fe		Mn		Zn		Cu	
	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004
T_1 Control	30.8	25.6	113.7	100.3	36	36.3	35.7	27.8	9.8	9.8
T_2 SGA-1 (0.2 %)	32.7	25.6	152.8	153.4	46.7	47.3	42.3	42.7	9	8.9
T_3 SGA-1 (0.4 %)	35	30	159.9	158	47.7	48.1	42.5	46.2	9.3	8.5
T_4 Boric acid (0.15 %)	37.4	40.5	146.3	129	40	40.3	39.9	28.3	8.6	8.9
T_5 Boric acid (0.30 %)	37.6	44	156	134	41.3	42.4	42.1	32.9	9	8.2
T_6 K_2O (1 %)	35.2	26.1	141.1	104.1	39.2	41.3	37.6	27.8	8.7	8.1
T_7 K_2O (2 %)	37.2	30.7	148.9	132.6	40.1	43.5	40.1	32.1	9.4	8.0
F- test	**	**	*	*	*	*	*	**	NS	NS
L . S. D 0.05	4.1	5.7	24.8	35.2	5.4	6.3	4.2	6.8	-	-

*, ** and NS indicate P< 0.05, P < 0.01 and not significant, respectively.

B- Growth traits :

Data in Table (4)show that the tested treatments exhibited significant differences in plant height at harvest and number of fruiting branches/plant in both seasons. The highest values of these traits were obtained from SGA-1 treatments followed by foliar feeding with boron treatments and K treatments, respectively, while the lowest values were obtained from the control.

Table (4): Effect of the tested treatments on some growth traits and numbers of total flowers and total set bolls / plant in 2003 and 2004 seasons.

Treatments	Plant height at harvest (cm)		No.of fruiting branches/plant		No. of total flowers/plant		No. of total set bolls /plant	
	2003	2004	2003	2004	2003	2004	2003	2004
T_1 Control	124	130.2	14.9	15.2	21.7	23.1	14.7	16.0
T_2 SGA-1 (0.2 %)	131.4	135.4	16.4	16.9	24.6	25.8	18.6	19.4
T_3 SGA-1 (0.4 %)	133.4	136.3	16.6	17.7	24.8	25.9	19.3	20.1
T_4 Boric acid (0.15 %)	129.6	134.3	16.2	16.1	23.9	25	16.6	17.7
T_5 Boric acid (0.30 %)	130.5	134.9	16.3	16.6	24.3	25.5	17.4	18.4
T_6 K_2O (1 %)	128.1	133.1	15.3	15.6	23.8	24.7	14.8	17.5
T_7 K_2O (2 %)	128.5	133.9	16.1	15.8	24.0	24.8	15.8	17.7
F- test	**	**	**	**	**	**	**	**
L . S. D 0.05	2.6	1.5	0.9	0.8	2.0	1.8	1.5	1.3

** indicates $P < 0.01$.

C-Boll set attributes and earliness :-

The tested treatments significantly affected numbers of total flowers and bolls set/plant, boll setting and earliness percentages in both seasons(Tables 4 and 5), in favour of foliar application with 0.4% SGA-1, 0.2% SGA-1and 0.3% boric acid, respectively. However, the lowest values of these traits were obtained from the control treatment.

Table (5): Effect of the tested treatments on boll setting, and earliness percentages, lint % and seed index in 2003 and 2004 seasons.

Treatments	Boll setting %		Earliness %		Lint%		Seed index (gm)	
	2003	2004	2003	2003	2003	2004	2003	2004
T_1 Control	67.7	69.3	44.8	46.7	36.7	37.0	9.60	9.55
T_2 SGA-1 (0.2 %)	75.6	75.2	58.9	61.3	37	37.7	10.08	10.58
T_3 SGA-1 (0.4 %)	77.8	77.6	61.1	62.4	37.1	38.0	10.33	10.63
T_4 Boric acid (0.15 %)	69.5	70.8	52.0	52.3	36.8	37.1	10.02	10.50
T_5 Boric acid (0.30 %)	71.6	72.2	53.3	58.9	36.9	37.5	10.05	10.58
T_6 K_2O (1 %)	62.2	70.9	49.6	51.5	36.6	36.9	9.88	9.90
T_7 K_2O (2 %)	65.8	71.4	50.9	56.2	37.1	37.6	9.93	10.48
F- test	**	**	**	**	NS	NS	*	*
L . S. D 0.05	2.6	5.9	4.8	3.9	–	–	0.37	0.63

*,** and NS indicate $P < 0.05$, $P < 0.01$ and not significant, respectively

D- Seed cotton yield and its components:

The tested treatments had a significant effect on number of open bolls/plant, boll weight, seed cotton yield/plant and seed index in both seasons (Tables 5 and 6), in favour of 0.4% SGA-1, 0.2% SGA-1, 0.3% boric acid , 0.15% boric acid, 2% K_2O and 1% K_2O, respectively. However, the tested treatments gave insignificant effect on lint% in both seasons (Table 5). Also, the tested treatments gave a significant effect on seed cotton yield/ feddan in both seasons (Table 6). The highest seed cotton yield/ feddan was obtained from foliar application with 0.4% SGA-1, 0.2% SGA-1, 0.3% boric acid , 0.15% boric acid, 2% K_2O and 1% K_2O, respectively, but the lowest yield was obtained from foliar application with 0.15%boric acid, 1% K_2O and tap water (control), respectively. The yield increase percentages over the control amounted to 28.15, 22.89, 21.69 , 18.73 , 15.66 and 5.81 % in the first season and 23.66, 15.93, 13.00, 10.95 , 7.72 and 5.67 % in the second season, in respective order.

Table (6) : Effect of the tested treatments on seed cotton yield/feddan and its components in 2003 and 2004 seasons.

Treatments	Calculated boll weight (g)		No. of open bolls/plant		Seed cotton yield / plant(g)		Seed cotton yield / feddan(kentar)	
	2003	2004	2003	2004	2003	2004	2003	2004
T_1 Control	2.59	2.66	10.9	13.2	28.23	35.11	9.13	10.23
T_2 SGA-1 (0.2 %)	2.77	2.88	13.7	14.9	37.95	42.91	11.22	11.86
T_3 SGA-1 (0.4 %)	2.83	2.96	14.4	15.7	40.75	46.47	11.7	12.65
T_4 Boric acid (0.15 %)	2.72	2.81	12.6	14.1	34.27	39.62	10.84	11.35
T_5 Boric acid (0.30 %)	2.77	2.84	13.6	14.6	37.67	41.46	11.11	11.56
T_6 K_2O (1 %)	2.64	2.81	11.1	13.6	29.3	38.22	9.66	10.81
T_7 K_2O (2 %)	2.69	2.81	12.3	13.8	33.09	38.78	10.56	11.02
F- test	**	**	**	**	**	**	**	**
L . S. D 0.05	0.08	0.13	1.1	0.8	3.5	2.4	0.53	0.42

** indicates $P < 0.01$.

DISCUSSION

Effect of SGA-1:-

The positive effect of SGA-1 on leaf nutrients content as compared with the other treatments is mainly due to cytokinins the main component of SGA-1 which favoures nitrogen–absorption and enhance leaf nutrient contents.

In this concern, Ziadah *et al*(2000) found that spraying cotton plants with SGA-1 (two times at squaring stage and beginning of flowering stage at the rate of 2 g/l in each spray) significantly increased K and Cu leaf contents in two seasons and Mg and Zn leaf contents in one season, while it significantly decreased leaf Fe content in one season. Also, El- Shazly *et al* (2003) found that foliar spray of SGA-1 at two levels (0.2% or 0.4%) significantly increased leaf N, B, Fe, Mn and Zn contents in two seasons and leaf Mg content in one season only as compared with the control. Also, the high level significantly increased leaf P content in two seasons and leaf K content in one season as compared with the control.

SGA-1 significantly increased plant height at harvest as compared with the other treatments and number of fruiting branches/plant as compared with the low level of K and the control in both seasons and this may be due to that cytokinin and amino acids in SGA-1 can promote growth .

In this concern, Ziadah *et al* (2000) found that SGA-1 foliar application gave a significant effect on plant height at harvest in both seasons and on number of fruiting branches/plant in the second season only in favour of two foliar sprayings by SGA-1 at a rate of 2g/l as compared with untreated plants and El-Shazly *et al* (2003) found that foliar spray of SGA-1 at two levels (0.2% or 0.4%) significantly increased final plant height and number of fruiting branches/ plant as compared with the control treatment.

The positive effect of SGA-1 on boll set attributes and earliness percentage may be due to that sprayed cotton plants with SGA-1 produced the greatest number of flowers/plant due to amino acids, sugars and cytokinin which lead to higher boll setting percentage and consequently higher number of total set bolls/plant.

In this regard El-Shazly *et al* (2003) found that spraying SGA-1 at two levels (0.2% or 0.4%) significantly increased boll setting percentage and earliness percentage as compared with the control in two seasons.

It was quite evident that the foliar application of SGA-1 reflected significant increases over the control in almost all leaf nutrients content under study. Foliar application of SGA-1 was effective to increase the leaf N, P and K contents.These increases might have had enhanced photosynthesis.Hearn(1981) reported that N rich cotton leaves were more active regarding their photosynthesis rates than poor ones. This was attributed to a noticeable decrease in mesophyl resistance to Co_2 conductance to the carboxylation sites in the chloroplast (Milthrope and Moorby, 1979).The increase of leaf P content also enhances photosynthesis (Hearn 1981). The role of K in this respect can not be denied or neglected (Hearn 1981).

A reference to Table (3) indicates that leaf B, Fe , Mn and Zn contents were significantly increased due to SGA-1 foliar application as compared with the control and thus improved flow of assimilates and accumulate more dry weight in fruiting oranges.

According to these results , it could be concluded that the role of SGA-1 was to enhance photosynthesis and hence more photosynthates seemed to be more available for cotton plant growth and development. Results in Table (4) indicated that SGA-1 sprayed plants had taller plants than the control ones. They had, also, larger number of fruiting branches with larger number of flowers and bolls/plant. All these improvements were reflected in seed cotton yield/fed. (Table 6) . It seems evident that the SGA-1 content from cytokinin played a great role in prolonging leaf area duration and hence delayed cotton leaf scenscence which in turn improved cotton plant growth and yield .

In this concern, Ishii and Yoshida (1988) found that foliar application of SGA-1 at 0.1% concentration, markedly increased the yield of wheat ,potato. suger beet and garlic. Ziadah *et al* (2000) found that boll weight, number of open bolls/ plant , seed cotton yield/plant and /fed. were significantly increased by two foliar applications of SGA-1 at a rate of 2g/l as compared with the control in two seasons. Also, El-Shazly *et al* (2003) found that foliar application of SGA-1 at two levels (0.2% or 0.4%) significantly increased number of open bolls/ plant, boll weight , seed cotton yield/plant, lint percentage and seed index in two seasons. Seed cotton yield /fed was significantly increased by foliar application with SGA-1 as compared with the control where, the increase percentages amounted to 23.14 and 30.69% in the first season and 27.53 and 37.64 % in the second one due to the low level (0.2%) and the high level (0.4%), respectively

Effect of boron :-

The positive effect of foliar feeding with B on leaf nutrients content as compared with the control is mainly due to (1) its role in regulating K and Ca absorption, (2) B related with Ca function where it makes Ca in a solving form and thus Ca deficiency did not appear, (3)B regulates water rate in the plant by controling the speed of water absorption by the plant and its different parts , (4) when B absence from the nitrogen and sugar compounds transport are stoped. (El-Fouly and Abd El-Hamid , 1992),(5) Tang and Fuente (1986)reported that boron is important for K transport into guard cells and thus for stomatal opening, the solute leakage across the plasma membrane is increased with B deficiency and, (6)Boron is involved in the uptake and metabolism of Ca by the plant (Hearn 1981).

The increase of leaf N content was reported by Hearn (1981) to enhance photosynthesis due to activate CO_2 fixation in the chloroplast (Milthrope and Moorby , 1979). Also, the increase of leaf P content was reported by Hearn (1981) to increase photosynthesis due to its role in energy transfer processes in both photosynthesis and respiration.

In this concern, Ahmed *et al.,* (1992) found that the leaf N, P and K contents were increased by boron spraying. Saeed (2000) found that all used boron concentrations significantly increased N, P and K percentages in cotton leaves and El-Shazly *et al* (2003) found that foliar feeding with B treatments gave the highest values of leaf N, P, K, Mg , B, Fe, Mn, and Zn contents as compared with the control.

The positive effect of foliar feeding with B on plant height and number of fruiting branches/plant as compared with the control may be due to that B is involved in a number of metabolic pathways sugar transport , respiration, carbohydrate, RNA, IAA and phenol metabolism (Parr and Loughman (1983).

In this concern , Saeed (2000) found that plant height and number of fruiting branches/plant were insignificantly affected with B spraying and El-Shazly *et al* (2003) found that foliar feeding of B treatments significantly increased plant height at harvest in two seasons and number of fruiting branches/plant in one season as compared with the control.

The positive effect of foliar feeding with B on boll setting percentage is mainly attributed to the following : (1) B enhances carbohydrate transport through cells wall and consequently maximum production of starch and sugar (2) in B absence the transport of nitrogeneous and sugar compounds are stoped. (3) B is important in pollen germination and pollen tube growth which is necessary for successful fruit setting (Oosterhuis and Zhao,2001), (4) B acts as activator of many enzymes which stimulates plant growth and flowers formation and (5) Shedding of young bolls occurs in case of B deficiency .

In this regard, El-Shazly *et al* (2003) found that the high level of B significantly increased number of total bolls set/plant, bolls setting % and earliness % as compared with the control.

The positive effect of foliar feeding with B on seed cotton yield and its components is mainly attributed to that (1) The available B in the experimental soil sites is low as shown in Table 1, (2) B significantly increased leaf N, P, K, Fe, B, Mn and Zn contents as compared with the control (Tables 2 and 3) and consequently producing more number of fruiting branches and taller plants (Table 3). (3) B significantly increased number of flowers/plant, number of bolls set/ plant, boll setting % and earliness % (Tables 4 and 5) and (4) The higher number of open bolls/plant, heavier bolls and higher seed cotton yield/plant (Table 6)

In this concern, Ahmed *et al* (1992) found that spraying cotton with boron increased boll weight, number of open bolls /plant, seed cotton yield, seed index and lint % . Jiang *et al* (1986) spraying cotton with 0.2% B as borax or boric acid and they found that in one season 3 spray applications increased yield by 15.1% ,2 applications by 13.1% and 1 application by 8.6 %. In the other season the average yield increase was 16.1% . Sabino *et al* (1996)found that application of boron increased boll weight and seed index. Badr *et al* (1998) found that the highest yield of cotton was obtained by spraying the plant with B where the increase over control reached 56%, Saeed (2000) found that the increases in seed cotton yield/fed. were 8.01% in 1998 season and 8.77% in 1999 season for 5 ppm of boron. and El-Shazly *et al* (2003) found that the high level of boron significantly increased boll weight, lint%, seed index and seed cotton yield/ plant as well as/fed. in two seasons and number of open bolls/plant in one season only as compared with the control.

Effect of K :

The positive effect of foliar feeding with K on leaf macronutrients (N, P and K) contents and on leaf micronutrients (B, Fe, Mn and Zn) contents may be due to that (1) K- application may enhance many nutrients uptake (Mengel and Kirkby, 1987) and(2) K balanced charges of anions and influences their uptake and transport.

On the other hand, the negative effect of K on leaf Mg content may be due to that K antogenises the absorption of this element (El-Fouly and Abd El-Hamid, 1992).

In this concern, El-Shazly and El-Masri (2003) found that foliar application of 2% potassium sulphate significantly increased leaf N, K, Fe and Mn contents and decreased leaf Mg content as compared with the control in two seasons. Also, El-Shazly *et al* (2003) found that two foliar feedings with K at two levels (1% or 2% K_2O) significantly increased leaf N, P, B, Fe and Zn contents in two seasons and leaf K and Mn contents in one season as compared with the control.

The positive effect of foliar feeding with K on growth traits i. e. plant height at harvest and number of fruiting branches/plant may be due to that K is involved in many processes in the plant such as photosynthesis, respiration, carbohydrate metabolism, translocation and protein synthesis (Hearn , 1981).

In this concern, Eid *et al* (1997) found that spraying cotton plants with potassium sulphate (48% K_2O) at the rate of 9 kg/fed. increased plant height. El-Shazly and El-Masri (2003) found that foliar application of 2% potassium sulphate produced plants with the same height of the control ones, but significantly increased number of fruiting branches/plant as compared with the control in one season.Also, El- Shazly *et al* (2003) found that two foliar feedings with K at two levels (1% or 2% K_2O) significantly increased number of fruiting branches/plant in one season

The positive effect of foliar feeding with K on boll set may be due to its role in photosynthesis (Huber, 1985) where K increases both the quantity and the distance that photosynthate moved from the source leaves (Ashley and Goodson, 1972).

In this concern, Eid *et al* (1997) found that spraying cotton plants with potassium sulphate (48% K_2O) at the rate of 9 kg/fed. increased earliness percentage. El- Shazly *et al* (2003) found that two foliar feedings with K at two levels (1% or 2% K_2O) significantly increased earliness percentage in two seasons as compared with the control.

Although the level of available potassium in the experimental soil sites (Table1) seems to be with 24 kg K_2O/fed. soil application above the limit at which the response of cotton yield to foliar feeding with potassium may occur . Yet , there was a significant yield increase due to foliar feeding with 2% K_2O as compared with the control. This result could be explained in view of the following points.

(1) Foliar feeding with 2% K_2O to cotton plants on soils moderate in K (Table 1) significantly increased leaf K content as compared with the control (Table 2). The increase in leaf K content was reported by Hearn (1981) to increase N metabolism and protein synthesis. Bennett *et al* (1965) found that cotton plants continue to accumulate K at rates above that needed to produce maximum yields with the highest K content occurring in older leaves and petioles. Also, Melgar *et al* (1994) found that yield was correlated with petiole K content at floral initiation.

(2) Oosterhuis *et al* (1991) found that K deficiencies can develop even when soil K levels are more than adequate. This is due to the use of higher *yielding faster fruiting* varieties coupled with the decline in root growth *during boll filling.*

(3) Earlier – maturing higher *yielding, faster- fruiting cotton varieties creating* a greater demand than the plant root system is capable of supplying (Oosterhuis *et al* 1991).

(4) Cotton bolls are heavy consumers of K during the entire boll development stage. If the soil's ability to supply K is not sufficient, the boll will pull K from nearby leaves leading to their breakdown, if leaves drop below 2% K their ability to function declines. At 1% K they have essentially shut down. Leaves shed when the level drops to 0.2% K, (Oosterhuis *et al,* 1991)
(5) Foliar feeding with 2% K_2O significantly increased leaf N, P, K, Fe, B, Mn and Zn contents as compared with the control (Tables 2 and 3) and consequently producing more number of fruiting branches and taller plants (Table 3).
(6) Foliar feeding with 2% K_2O significantly increased number of flowers/plant, number of bolls set/ plant, boll setting % and earliness % (Tables 4 and 5)
(7) The higher number of open bolls/plant, heavier bolls and higher seed cotton yield/plant were produced from foliar feeding with 2% K_2O and this was reflected on producing higher yield/fed. (Table 6).

In this concern, Eid *et al* (1997) found that spraying cotton plants with potassium sulphate (48% K_2O) at the rate of 9 kg/fed. increased seed cotton yield/fed. El-Shazly and El-Masri (2003) found that foliar application of 2% potassium sulphate significantly increased numbers of total and open bolls/plant , seed cotton yield/plant as well as /fed. as compared with the control in two seasons. Also, El- Shazly *et al* (2003) found that two foliar feedings with K at two levels (1% or 2% K_2O) gave significant increase in number of total bolls/plant , seed index, lint percentage, boll weight and seed cotton yield/plant as well as /fed. as compared with the control in two seasons.

CONCLUSION

It could be concluded that seed cotton yield of the extra long staple , Giza 88 cotton cultivar grown in Bassyoun region could be increased by two foliar sprays with a bioregulator SGA-1 at the level of 0.4%, at the beginning of flowering and 15 days later where this treatment is the best treatment for good growth and high productivity. Also, two foliar feedings with boron as boric acid at a level of 0.3% or potassium as potassium sulphate at a level of 2% K_2O could be used for high productivity

REFERENCES

Abdel Al , M.H. ; F.M. Ahmed and S.H. El-Halawany (1989). Effect of cytokinin on growth, yield and some chemical constituents of Giza75 cotton cultivar. Agric, Res. Rev. 67: 785-797.

Ahmed, Fatma M. ; M.S. Ismail and A.S.M. Azab (1992). Physiological response of cotton to foliar application of urea,copper and boron. Zagazig J. Agric. Res. 19(4/A): 1683-1694.

Allen,O.N. (1953). Experiments in Soil Bacteriology.1st Ed .Burgess. Publ.Co., USA.

Ankerman, D. and L. Large (1974): Soil and plant analysis. A & L. Agriculture Laboratories. Inc . New York . USA.

Ashley, D. A. and R.D. Goodson (1972) . Effect of time and plant potassium status on C^{14} labeled photosynthate movement in cotton. Crop Sci., 12(5) : 686- 690.

Badr, M.M.A.; S.A. Abd El-Rahim ; T.H. Abou El-Defan and Nadia 0. Monged (1998). Effect of different methods of some micronutrients applications on yield, chemical content and some fiber properties of cotton Giza 77cv. Egypt, J. Appl. Sci.,13 (7): 365-373.

Bauyoucos, H.H. (1951). A recalibration of hydrometer method for making mechanical analysis of soils. Agron . J. 43 , 343 .

Bennett, O.L., R.D. Rouse, D.A. Ashley and B.D. Doss (1965), Yield, fiber quality and potassium content of irrigated cotton plants as affected by rates of potassium. Agron.J. 57 : 296 – 299.

Cardozier (1957). Growing cotton . Mc Grow Hill Book Library of Congress Catalog. Card. Number: 56 – 889, p. 115- 116.

Chapman, H.D. and P.P. Pratt (1978), Methods of Analysis for Soils , Plants and Water. Univ . of California , Div . of Agric. Sci . Priced Publ,4034.

Eid, Etidal T.; M.H. Abdel-Al ; M.S. Ismail and O.M.M. Wassel (1997). Response of Egyptian cotton to potassium and micronutrie application. Proc. FAO. IRCRNC. Joint Meeting of the Working Groups 4 & 3 (Cotton Nutrition & Growth Regulators), 20-23 March. 1995, Cairo, Egypt, pp 139-145.

El-Fouly, M.M., Fawzy, A.F.A. and Firgany ,A.H.(1987). Removal of nutrients by *Trifolium alexandrinum* and effect of NPK fertilization on yield. Medit. Potash News. 3,8 – 10

El-Fouly, M.M. and A.F. Abd El-Hamid (1992). Principles of plant nutrition, fertilization and problems of micronutrients in Egypt, National Research Center, El-Dokki, Cairo. Project of micronutrients and problems of plant nutrition in Egypt,3rd Ed. Pp;1-156 (In Arabic).

El- Shazly , W.M.O.; K.A. Ziadah and M.F. El-Masri (1998). Response of extra long staple cotton cultivar, Giza 70 to a bioregulator PGR-IV rate and time of its application under three planting dates. J. Agric. Sci.,. Mansoura Univ., 23:603 – 631.

El- Shazly , W.M.O. and M.F. El-Masri (2003). Response of Giza 89 cotton cultivar to foliar application of ascorbic acid, gibberellic acid, phosphorus and potassium. J. Agric. Sci. Mansoura Univ., 28 (3): 1579 – 1579

El- Shazly, W.M.O.; R.Kh. M. Khalifa and O.A. Nofal (2003). Response of cotton Giza 89 cultivar to foliar spray with boron, potassium or a bioregulator SGA-1. Egypt J. Appl. Sci., 18 (4B) : 676 – 699.

Fawzi, A.F.A. and El-Fouly, M.M.(1993). Inputs for computerized expert system for fertilizer recommendations in Fayoum Governorate, NRC-GTZ Report (Unpublished)pp. 94.

Hearn, A,B. (1981). Cotton nutrition .Field Crop Abst., 34 (1) 11-34.

Hoagland, D.R. (1944). Lectures on the inorganic nutrition of plants. Chronica Botanica . pp. 48-71. Walthan, Massachusefts.

Huber, S.C.(1985). Role of potassium in photosynthesis and respiration. Pp 369-396 In potassium in Agriculture Am. Soc.Agron. Madison, WI.

Ishii, K. and R. Yoshida (1988). Effects of new bioregulator SGA-1 on Growth and yield of several crops. 13th International Conference on Plant Growth Substances. Calgary Canada, July 17-22.

Ishii, K. and R. Yoshida (1991). Effect of new bioregulator SGA-1 on the coloration of grape berries. 14th International Conference on Plant Growth Substances. Amsterdam, July 21-26.

Jackson, M.L. (1973). Soil Chemical Analysis. Prentice Hall of Indian Private Limited, New Delhi. Jiang, S.H. ; M. Lin and O.Z. Liang (1986). The available soil boron in cotton growing areas in the Jiang and effect of B fertilizers. Zhejaing Agric., Sci., 1: 25-30. (C.F. Field Crop Abst. 41: 668,1988).

Lindsay, W.L. and W.A. Norvell (1978). Development of a DTPA micronutrients soil tests for zinc , iron , manganese and copper . Soil Sci, Am .J.42,421

Melgar R; M. Mendez; C. Sanabria and L. Gimenez (1994). Effect of nitrogen and potassium on the yield of fibre, seed and total biomass of cotton in corrientes Argentina. Argentina Ciencia del suelo 12(2): 68-74(C.F.Field Crop Abst. 48(8): 6161,1995).

Mengel, K. and E.Kirkby(1987).Principals of Plant Nutrition.International Potash Institute. P.O. Box. CH.3048 Vorblan Fen-Bern,Switzerland

Milthrope , E.L. and J. Moorby (1979). An introduction to crop physiology. 2nd Ed. Cambridge Univ. Press

Olsen , S.R.; C.V. Cole; F.S. Watanabe and L.A, Dean (1954) . Estimation of available phosphorus in soil by extraction with sodium bicarbonate USDA - Cricular,939: 1 .

Oosterhuis, D.M. (1997) . Potassium nutrition of cotton in the USA with particular reference to foliar fertilization. Proc. FAO-IRCRNC; Joint Meeting of the Working Groups 4 & 3 (Cotton Nutrition & Growth Regulators); 20-23 March, 1995, Cairo- Egypt, PP. 101 – 124.

Oosterhuis, D; K . Hake and C. burmester (1991). Foliar feeding cotton. Cotton physiology Today . News letter of the cotton physiology Education Program National Cotton Council . July 1991, 2(8): 1-8.

Oosterhuis, D.M. and D. Zhao (2001). Effect of boron deficiency on the growth and carbohydrate metabolism of cotton "Plant nutrition-Food security and sustainability of Agro- ecosystems. WJ. Horst *et al.,* (Eds). Pp. 166-167.

Pak ; S.N.(1976).physiological role of boron in cotton nutrition (C.F.Field Crop Abst. Vol: 29 N0.6, 5035, 1976)

Parr, A.J, and B.C. Loughman (1983). Boron and Membrane Functions in Plants. In Metals and Micronutrients: Uptake and Utilization by plants. (Annu. Proc. Plytochem. Soc. Eur, No 21, D.A. Robb andW.S. Pisrpoint. Eds.), pp. 87-107. Academic Press. London.

Piper , C.S. (1950) .Soils and Plant Analysis .Inter. Sci Publ. Inc . New York

Richmond, T.R. and S.R.H. Radwan (1962). Comparative study of seven methods of measuring earliness of crop maturity in cotton. Crop Sci.2: 397-400.

Sabino , N.P. ; N.M. Silva ; J.I. Kondo and R.M.A. Gondim Tomaz (1996). Effect of boron application and its cumulative effect on agronomic characteristics of cotton and technological properties of cotton fiber. Boron in Agriculture. 1998; 18 (I): 0006.

Saeed, M.A. (2000). Physiological response of cotton cultivar Giza 80 to foliar spray of boron. Minufiya J. Agric. Res. 5: 1185-1 197,

Snedecor, G.W. and W.G. Cochran (1981). Statistical Methods. Iowa State Univ, Press 7th ed. Iowa, USA.

Tang, M.P. and D. Fuente (1986). The transport of indole - 3 - acetic acid in boron and calcium - deficient sunflower hypocotyls segments. Plant Physiol- 81: 616-650,

Walkley , A. and I.A. Black (1934) . An examination of the Degtjureff method for determining organic matter and a proposed modification of the chromic acid titration method . Soil Sci ; 37 , 29 .

Wolf, B. (1971). The determination of boron in soil extracts, plant Materials, composts, manures, water and nutrient solutions. Soil Sci. and Pl Anal., 2: 363.

Yoshida, R. (1989).Report on Cytokinin Analysis in SGA. Toyama College of Technology. Kosugi- machi, Toyama, Japan.

Ziadah, K.A. ; O.A. Nofal , A.M. Hamissa and E.I. El-Maddah (2000). Effect of irrigation intervals, potassium levels and bioregulator SGA-1 application on chemical composition, productivity and water use efficiency of cotton Giza 70 cultivar. Minufiya J., Agric, Res. 25 (2): 339-370.

استجابة صنف القطن جيزة ٨٨ لمعاملة الرش بالبورون والبوتاسيوم ومنظم النمو الطبيعى SGA-1

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أجريت تجربتان حقليتان فى مركز بسيون محافظة الغربية خلال الموسمين المتتاليين ٢٠٠٣ ، ٢٠٠٤ لتقييم تأثير الرش مرتين بحامض البوريك بتركيزين ٠,١٥ % ، ٠,٣% فى كل رشة وبسلفات البوتاسيوم بتركيزين ١% ، ٢ % أكسيد بوتاسيوم فى كل رشة وبمنظم النمو الطبيعى SGA-1 بتركيزين ٠,٢ % ، ٠,٤ % فى كل رشة مقارنة بعدم المعاملة (الرش بالماء) ككنترول على محتوى الورقة من العناصر الغذائية وصفات النمو ودلائل العقد والتبكير ومحصول القطن الزهر ومكوناته لصنف القطن فائق الطول جيزة ٨٨

ويمكن تلخيص النتائج فيما يلى :

أعطت المعاملات المختبرة تأثيراً معنوياً على محتوى الورقة من النيتروجين والفوسفور والبوتاسيوم والكالسيوم فى حين أعطت تأثيراً غير معنوياً على محتوى الورقة من المنجنيز وذلك فى الموسمين وتم الحصول على أعلى القيم لمحتوى الورقة من النيتروجين والفوسفور من الرش الورقى بمنظم النمو الطبيعى

SGA-1 سواء عند المستوى المنخفض أو العالى يليه المستوى العالى من البورون والبوتاسيوم بينما أقل القيم تم الحصول عليها من المستوى المنخفض من البورون أو البوتاسيوم ومن معاملة المقارنة

وقد أعطى الرش الورقى بالبوتاسيوم سواء عند المستوى العالى أو المنخفض أعلى محتوى للورقة من البوتاسيوم يليها منظم النمو الطبيعى SGA-1 سواء عند المستوى العالى أو المنخفض والمستوى العالى من البورون بينما أقل محتوى تم الحصول عليه من المستوى المنخفض من البورون ومن معاملة المقارنة

فى حين أعطى الرش الورقى بالتركيز العالى من البورون أعلى محتوى للورقة من الكالسيوم يليه التركيز المنخفض ثم التركيز العالى من منظم النمو الطبيعى SGA-1 ثم التركيز المنخفض من منظم النمو الطبيعى على التوالى بينما أقل القيم تم الحصول عليها من التركيز العالى من البوتاسيوم ثم التركيز المنخفض ثم من معاملة المقارنة

- تأثر محتوى الورقة من البورون والحديد والمنجنيز والزنك معنوياً بالمعاملات المختلفة بينما لم يتأثر محتوى الورقة من النحاس وذلك فى موسمى الدراسة

تم الحصول على أعلى محتوى للورقة من البورون من التغذية الورقية بالبورون سواء عند المستوى المنخفض أو العالى يليهما معاملات البوتاسيوم والمستوى العالى من منظم النمو الطبيعى SGA-1 بينما أقل القيم تم الحصول عليها من المستوى المنخفض من منظم النمو ومن معاملة المقارنة .

كما أعطت المعاملة بمنظم النمو الطبيعى SGA-1 سواء عند المستوى المنخفض أو المرتفع أعلى القيم لمحتوى الورقة من الحديد والمنجنيز والزنك يليهما المستوى العالى من البورون أو البوتاسيوم بينما اقل القيم تم الحصول عليها من المستوى المنخفض من البورون أو البوتاسيوم ومن معاملة المقارنة

- أعطت المعاملات المختبرة تأثيراً معنوياً على طول النبات عند الجنى وعدد الأفرع الثمرية على النبات فى الموسمين حيث تم الحصول على أعلى القيم من معاملات منظم النمو ثم التغذية الورقية بمعاملات البورون والبوتاسيوم فى حين تم الحصول على أقل القيم من معاملة المقارنة
- أثرت المعاملات المختبرة معنوياً على عدد الأزهار الكلية وعدد اللوز الكلى على النبات و النسبة المئوية للعقد والنسبة المئوية للتبكير لصالح الرش الورقى بـ ٠,٤%SGA-1 ، ٠,٢% SGA-1 ، ٠,٣% حمض البوريك ، فى حين أقل القيم لهذه الصفات تم الحصول عليها من معاملة المقارنة
- أعطت المعاملات المختبرة تأثيراً معنوياً على عدد اللوز المتفتح على النبات ، وزن اللوزة ، محصول القطن الزهر للنبات ، معامل البذرة فى الموسمين لصالح الرش الورقى بـ ٠,٤%SGA-1 ، ٠,٢% SGA-1 ، ٠,٣% حمض البوريك ، ٠,١٥ % حمض بوريك ، ٢% أكسيد بوتاسيوم ، ١% أكسيد بوتاسيوم على التوالى فى حين أقل القيم لهذه الصفات تم الحصول عليها من معاملة المقارنة بينما لم تعطى المعاملات المختبرة تأثيراً معنوياً على تصافى الحليج
- أيضاً أعطت المعاملات المختبرة تأثيراً معنوياً على محصول القطن الزهر للفدان فى الموسمين وكانت النسبة المئوية للزيادة عن معاملة المقارنة كالتالى :-

٢٢,٨٩ ، ٢٨,١٥ ، ١٨,٧٣ ، ٢١,٦٩ ، ٥,٨١ ، ١٥,٦٦ فى الموسم الأول ، ١٥,٩٣ ، ٢٣,٦٦، ١٠,٩٥، ١٣,٠٠ ، ٥,٦٧ ، ٧,٧٢فى الموسم الثانى وذلك عند الرش الورقى بـ ٠,٢% ، ٠,٤% -SGA-1 ، ٠,١٥ % ، ٠,٣٠ % حمض بوريك ، ١% ، ٢% أكسيد بوتاسيوم على التوالى

وتوضح نتائج الدراسة أن معاملة الرش مرتين بمنظم النمو الطبيعى SGA-1 عند بداية التزهير ثم بعد ١٥ يوم بمعدل ٠,٤% فى كل رشة تعتبر أفضل معاملة للنمو الجيد والإنتاجية العالية لصنف القطن فائق الطول جيزة ٨٨ تحت الظروف المقامة بها التجربة

كذلك يمكن استخدام التغذية الورقية مرتين بالبورون فى صورة حمض البوريك بتركيز ٠,٣% أو البوتاسيوم كسلفات بوتاسيوم بتركيز ٢% أكسيد بوتاسيوم للحصول على إنتاجية عالية