MORPHOPHYSIOLOGICAL STUDIES ON EGYPTIAN COTTON PLANTS. (*Gossypium barbadense* L.)
2-Effect of plant growth regulators and micronutrients on flowering and bolling characteristics , yield, and yield components

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ABSTRACT

The present investigation was carried out at Faculty of Agriculture Farm, during 1999 and 2000 growing seasons, Department of Agric. Botany, Faculty of Agriculture, Kafr El-Sheikh, Tanta University. The main objective of this investigation is: to study the effect of foliar spraying of the three PGRs *i.e.*, Pix, kinetin and Morphactin with two concentrations for each one (low and high) and three micronutrients *i.e.*, iron (Fe), zinc (Zn) and manganese (Mn) with one concentration for each one, and their combinations; on flowering and bolling characteristics ,yield and yield components. The cotton cultivar was devoted in this study is Giza 86 an Egyptian long-staple.

The main obtained results may be summarized as follows:

Pix applications resulted in lower number of total flowers/plant compared to kinetin or morphactin applications. Pix at high concentration (2000 ppm) significantly reduced number of open bolls/plant and decrease boll retention compared to the control. Pix applications significantly reduced both seed cotton yield and lint cotton yield in kentars/feddan compared to the control. Pix applications (1000 and 2000 ppm) significantly reduced lint percentage compared to the control .

Kinetin and Morphactin applications significantly increased the total number of flowers/plant, total number of open bolls/plant,and boll retention compared to the control.. Also Kinetin and morphactin applications significantly increased seed cotton yield and lint cotton yield in kentars/feddan. lint percentage was significantly increased by morphactin and kinetin applications .

Micronutrients applications significantly increased the total number of flowers/plant. Zinc gave the highest production of flowers, also

micronutrients significantly increased number of open bolls/plant compared to the control. Micronutrients applications significantly increased both seed cotton and lint cotton yields/feddan than the control. Micronutrients slightly decreased lint percentage in 2000 season below the control, however, lint percentage was significantly increased in 1999 season over the control.

Combined treatments (PGR + microelement), addition the micronutrients such as Fe, Zn and Mn to PGRs treatments improved the production of flowers on cotton plants and significantly surpassed the control in most cases. The combined treatments significantly increased number of open bolls/plant, and boll retention compared to the control. combined treatments included pix in both seasons gave the lowest both seed cotton and lint cotton yields/ per feddan. Also, these combined treatments including kinetin or morphactin with one microelements improved the lint percentage.

INTRODUCTION

Cotton is one of the most economically important crops in Egypt, supplies the national and international demand with the highest cotton lint quality. It is considered the main cash crop for most growers, besides it is one of the main sources of the hard currency. The cotton crop occupies about 15-20% of the total cultivated area in Egypt during the last decade. Cotton production occupies a very unique position among all other field crops in Egypt. No doubt that cotton production as for other crops could be easily maximized through appropriate nutrition and application of growth regulators.

Plant nutrition of cotton is considered to be one of the most important factors that affects cotton production. Foliar application of micronutrients (Fe,Mn orZn) to cotton plants increased, number of flowers/plant, number of open bolls/plant, and cotton yield. Micronutrient treatments induced significant increased in fruit setting percentage,decreasedshedding percentage and also increased lint percentage, seed cotton yield/plant and /feddan (**El-Sabbagh *et al.*, 2002**).

Morgan (1980) emphasized that application of growth regulators to major field crops is relatively rare and that the beneficial dose not always involve direct increase in yields. The response of a plant or a plant part to plant growth regulators may vary with the type of plant and moreover with the mode of action of such plant growth regulators. **Azab *et al.* (1992)** treated cotton plants (three Egyptian cultivars Giza 77 Giza 75 and Giza 83) with 1000 and 2000 cc Pix/feddan at the start of flowering stage. Pix application increased seed index in 1989 and earliness in both seasons. Seed cotton yield was increased only when Pix application was applied at a concentration of 1000 cc/fed. While it was decreased by using 2000 cc/fed in both seasons. Pix had no significant effect on number of open bolls per plant,and lint percentage.

(Boquet and Coco 1993) found that Pix did not affect on lint yield, seed yield or lint seed ratio.While**(Ali and El-Sayed 2001)** reported that Pix treatment resulted in higher number of open bolls, seed index and seed cotton yield. On the other hand the effect of foliar application of Kinetin increased number of flowers, number of open bolls/plant, seed index, seed cotton yield/plant and seed cotton, lint yield/plot and decrease shedding percentage.this results were obtained by, **Sawan *et al.*,(2000)and Wassel (2001).**

El-Shourbagy *et al.* (1983)) found that foliar application of Morphactins such as TIBA increased 100-seed weight in the second season than the application after 60 days from sowing. TIBA applications generally decreased shedding percentage and increased seed cotton yield feddan in the two seasons as well as lint percentage in the second seasons.

(Sawan *et al.* 1997) reported that Alar (B9) gave the highest seed cotton yield/plant. Also, increased number of flowers/plant and number of setting boll. Alar had no effect on lint percentage. Alar (daminozide) significantly increased seed index and increased seed weight of cotton plants. Therefore, the main objective of this investigation is: to study the foliar spraying effect with some plant growth regulators; PGRs (Pix, Kinetin and Morphactin), micronutrients (Fe, Zn, and Mn) and their combinations on flowering and bolling characteristics, yield and yield components characteristics, of an Egyptian long-staple cotton cultivar, Giza 86 (*Gossypium barbadense* L.) during 1999 and 2000 growing seasons..

MATERIALS AND METHODS

The present investigation was conducted at the Faculty of Agriculture Farm, throughout the Department of Agricultural Botany, Faculty of Agriculture, Kafr El-Sheikh, Tanta University, during the two successive growing seasons 1999 and 2000. The study includes the effect of three plant growth regulators (PGRs) as well as three micro-elements and all possible combinations of them with different concentrations and various times of application on flowering and bolling characteristics , yield and yield componentsof an Egyptian long-staple cotton cultivar, Giza. 86 (*Gossypium barbadense* L.). Cotton seeds were sown on April 18th and April 14th in 1999 and 2000seasons, respectively. Mechanical analysis and chemical composition of the soil of the experiment are presented in Table (1) and (2).

Table (1): Mechanical and chemical analysis of soil sample of the experiment during 1999 and 2000 growing seasons.

Seasons	Soil mechanical analysis			pH	Water table (cm)
	Sand	Silt	Clay		
1999	23.40	35.50	41.10	8.0	85
2000	24.10	35.20	40.70	7.8	87

Soil chemical analysis 1999

Depth (cm)	Anions (meq/L)				Cations (meq/L)				EC dS m^{-1}
	CO_3^{--}	HCO_3^-	Cl^-	SO_4^{--}	Ca^{++}	Mg^{++}	Na^+	K^+	
0-30	-	2.40	90.68	76.94	42.08	39.52	88.00	0.42	12.00
30-60	-	2.60	23.25	40.05	12.38	14.02	39.25	0.25	5.20
60-90	-	1.60	34.88	88.39	29.70	27.90	67.00	0.27	8.80
90-120	-	1.80	32.55	47.12	14.75	16.35	50.00	0.27	6.40

Soil chemical analysis 2000

Depth (cm)	Anions (meq/L)				Cations (meq/L)				EC dS m^{-1}
	CO_3^{--}	HCO_3^-	Cl^-	SO_4^{--}	Ca^{++}	Mg^{++}	Na^+	K^+	
0-30	-	3.10	25.74	42.17	17.29	10.93	39.25	0.44	7.12
30-60	-	2.40	10.89	56.41	12.74	11.44	45.25	0.27	5.81
60-90	-	2.00	13.86	81.14	20.02	13.18	63.50	0.30	7.56
90-120	-	1.50	15.35	69.29	20.39	8.95	56.00	0.26	7.66

- EC = Electrical conductivity.

Table (2):Chemical analysis of experimental soil sample for microelements during 1999 and 2000 growing seasons.

Season	Depth	Micronutreints of soil profiles (ppm)		
		Fe	Zn	Mn
1999	0-30	12.50	2.35	31.00
	30-60	14.00	2.85	32.30
	60-90	12.50	3.35	35.15
	90-120	14.00	1.10	33.85
2000	0-30	8.46	0.44	7.02
	30-60	7.27	0.29	7.97
	60-90	5.83	0.32	7.71
	90-120	8.58	0.34	9.52

- Field Drainage Res. Dept., Sakha Agric. Res. Sta.

The experiment included 28 treatments as follows in Table(3) The treatments were randomly distributed in 28 experimental plots in each replicate of the randomized complete block.

Table(3) Studies treatments and time of application

Treatment	Concentration	Time of Application
Control (Water)	0	
PGRs:-		
Pix1 (P1)	1000 ppm	PGRs were sprayed twice.
Pix2 (P2)	2000 ppm	The first spray was at 75 days from sowing.
Kinetin 1 (k1)	25 ppm	The second at 105 days from sowing.
Kinetin 2 (k2)	50 ppm	
Morphactin1(Mor.1)	10 ppm	
Morphactin 2(Mor. 2)	20 ppm	
Micronutrients:-		Micronutrients were sprayed three times:-
Fe	2000 ppm	The first spray was at 75 days from sowing.
Zn	1500 ppm	The second spray at 90 days from sowing.
Mn	1000 ppm	The third spray at 105 days from sowing.
PGRs+Micro.comb.		
P1+ Fe		
P1 + Zn		
P1 + Mn		*Sowing date in 1999 season:-April,18.
P2 + Fe		*Sowing date in 2000 season:-April,14.
P2 + Zn		
P2 + Mn		
k1 + Fe		
k1 + Zn		
k1 + Mn		
k2 + Fe		
k2 + Zn		
k2 + Mn		
Mor.1 + Fe		
Mor.1 + Zn		
Mor.1 + Mn		
Mor.2 + Fe		
Mor.2 + Zn		
Mor.2 + Mn		

Each plot consisted of five rows 4.5 m in length and 0.6 m in width.. All the agricultural practices were carried out as recommended in the farm. Nitrogen used was urea (46% N) at the rate of 60 kg N/feddan. Nitrogen was splitted into two equal doses. The first dose was added after thinning (before the first irrigation), whereas the second dose was applied before the second irrigation.Phosphorus was added during seed-bed preparation in the form of super-phosphate (15.5% P_2O_5) at the rate of 100 kg super phosphate/faddan.

Characters studied:

Flowering and bolling characteristics:

The inner row (3rd row) was chosen in each treatment to collect the following data:

1. **Total number of flowers per plant:** was measured by recording the daily flower production on a certain number of plants during flowering period and the total number of flowers/plant was calculated as follows:

$$\frac{\text{No. of total flowers on a certain number of plants}}{\text{No. of plants}}$$

2.umber of open bolls/plant: was estimated by counting the daily open bolls production on a certain number of plants during bolling period as follows:

$$\frac{\text{No. of total open bolls on a certain number of plants}}{\text{No. of plants}}$$

3.Boll setting percentage: was calculated by using the following formula:

$$\frac{\text{Total number of bolls on a certain number of plants}}{\text{Total number of flowers on the same number of plants}} x100$$

Yield and yield components characteristics:

At the harvest time and picking the yield, the following characteristics were recorded as follows:

Seed cotton yield in kentars per faddan.

Lint cotton yield in kentars per faddan.

Lint percentage: The ratio of lint to seed cotton expressed as a percentage using the following formula:

$$\text{Lint \%} = \frac{\text{Weight of lint}}{\text{Weight of seed coton}} x100$$

The data were taken and computed as outlined by **Snedecor and Cochran (1982)**. The differences between the different treatments combinations were tested using the Duncan's Multiple Range method outlined by **Leclerg *et al.* (1962)**.

RESULTS AND DISCUSSION

1. Flowering and bolling characteristics

Table (4) presented the data on flowering and bolling characteristics as influenced by foliar spraying treatments with PGRs, micronutrients and their combinations during 1999 and 2000 seasons. Data showed that all the studied treatments had significant effect on flowering and bolling characteristics.

1 .1.1 Effect of Pix

Results shown in Table (4) indicated thatPix applications resulted in lower number of total flowers/plant compared to kinetin or morphactin applications. Pix at high concentration (2000 ppm) significantly reduced number of open bolls/plant by about 33.4% and 25.6% less than the control in 1999 and 2000 growing seasons, respectively. Also pix applications at high concentration increased number of total flowers/plant,and decreased boll retention compared to the control. The reduction in total number of open bolls/plant in case of Pix application may be due to the reduction in number of sympodia/plant, reduction in their length and decline in number of flowers on each sympodium, as well as, increasing squares and buds shedding percentages Similar results in this respect were obtained by **Ali and El-Sayed (2001)**

The reduction in boll retention percentage especially, with high concentration of Pix may be due to the reduction in leaf area and leaf size, which led to lower net photosynthetic rates, this could be related to the reduction in boll retention. Similar results in this respect were obtained **Wassel (2001).**

1 .1.2 Effect of Kinetin:

Results shown in Table (4) indicated that Kinetin applications (25 and 50 ppm) significantly increased the total number of flowers/plant, total number of open bolls/plant, and boll retention,while it reduced boll shedding percentages compared to the control. This finding could be attributed to that kinetin reduce flower bud and young boll shedding and promoted fruit growth These results were in agreement with those obtained by **Wassel (2001).**

Cytokinins are synthesized in root tips and are active in the maintenance of ongoing processes and nutrient mobilization in the shoot, thus they inhibit shedding by stimulating auxin production. It is hoped that if the endogenous concentration of cytokinin can be increased by exogenous application, it may reduce the undesirable shedding of squares and young bolls which may lead to decrease percentage of boll shedding per plant **Zhao and Oosterhuis (2000)**

Table (4): Flowering and bollingof cotton plants characteristics as influenced by folair spraying treatments with PGRs, micronutrients and their combinations during 1999 and 2000 growing seasons.

Treatments	Total No. of flowers/plant		No. of open bolls/plant		Boll retention %	
	1999	2000	1999	2000	1999	2000
PGRs						
Pix1	32.40 d-g	31.57 ghi	20.33 ij	21.13 f	62.73 i	66.93 g
Pix2	30.27 e-h	31.57 ghi	13.10 lm	15.50 g	43.60 k	49.03 j
Kinetin1	37.77 a	32.63 c-i	30.33 ab	26.43 b-e	80.33 ab	80.93 ab
Kinetin2	33.37 d-f	35.80 a-f	27.17 a-e	29.67 ab	81.43 a	82.87 a
Morphactin1	37.67 a	35.13 a-g	30.50 a	28.80 abc	81.03 a	81.97 ab
Morphactin2	34.57 a-d	36.60 a-e	28.00 a-d	30.03 a	81.07 a	82.07 ab
Micronutrients						
Fe	33.67 b-f	33.40 c-i	26.07 c-f	26.60 b-e	77.43 a-d	79.57 a-d
Zn	31.38 d-h	38.87 a	25.33 c-g	28.47 a-d	70.10 fgh	73.23 f
Mn	34.00 a-e	37.10 abc	24.27 e-h	27.80 a-d	71.40 e-h	74.90 ef
PGRs + Micro. Comb.						
P1 + Fe	26.27 ij	34.07 c-h	13.40 lm	19.10 f	51.07 j	56.13 h
P1 + Zn	37.17 ab	35.37 a-g	18.87 jk	19.20 f	51.00 j	54.30 hi
P1 + Mn	29.30 ghi	32.80 d-i	16.17 kl	18.67 f	55.03 j	56.90 h
P2 + Fe	23.47 j	36.83 a-d	11.77 m	18.97 f	50.17 j	51.40 ij
P2 + Zn	26.20 ij	30.13 i	11.50m	15.10 g	44.07 k	50.03 j
P2 + Mn	28.20 hi	34.93 a-g	12.07m	15.87 g	42.87 k	44.83 k
K1 + Fe	36.67abc	35.00 a-g	28.77 abc	27.93 a-d	78.43 a-d	79.83 abc
K1 + Zn	29.87 f-i	34.60 b-h	21.87 g-j	26.57 b-e	73.17 d-g	76.67 cde
K1 + Mn	36.40 abc	36.17 a-f	28.70 abc	29.27 ab	78.93 abc	80.90 ab
K2 + Fe	34.60 a-d	35.07 a-g	25.87 c-f	27.13 a-e	74.73 b-f	77.40 cde
K2 + Zn	30.17 e-h	36.80 a-d	22.03 g-j	28.20 a-d	73.10 d-g	76.47 c-f
K2 + Mn	33.97 a-e	37.27 abc	23.27 f-i	28.40 a-d	68.43 gh	76.17 def
Mor1 + Fe	31.37 d-h	38.17 ab	23.97 e-h	30.17 a	76.37 a-e	79.23 bcd
Mor1 + Zn	32.70 c-g	33.67 c-i	24.93 d-h	26.67 b-e	76.13 a-e	79.20 bcd
Mor1 + Mn	29.30 ghi	35.40 a-g	21.53 hij	27.13 a-e	73.50 c-g	76.97 cde
Mor2+ Fe	34.13 a-e	32.30 f-i	26.97 b-e	25.47 de	79.43 ab	82.90 a
Mor2 + Zn	32.70 c-g	30.13 i	24.73 d-h	25.63 cde	75.70 a-f	78.67 bcd
Mor2 + Mn	30.40 e-h	30.80 hi	23.10 f-i	24.20 e	75.93 a-e	78.63 bcd
Water (Control)	27.57 hi	30.77 hi	19.67 j	20.83 f	67.07 hi	67.70 g
Mean	31.98	34.39	22.30	24.61	68.37	71.60

Means designed by the same letter at each cell are not significantly different at the 5% level according to duncan's multiple rang test

1 .1.3 Effect of Morphactin :-

Results shown in Table (4) and illustrated by indicated that Morphactin applications (10 and 20 ppm) significantly resulted in higher number of flowers/plant, and increased boll production/plant compared to the control.The high production of flowers ,and boll production cotton plants treated with Morphactin, may be due to that Morphactin enhances organs and flower formation, a marked increase in the number of flower buds was associated with an induced increase in branching and increase photosynthetic activity of leaves following application of these substance These results are in accordance with those obtained by(**Sawan, 1997**).Also morphactin applications significantly increased boll retention/plant. It significantly reduced boll shedding compared to the control. These results were in agreement with those obtained by**El-Asdoudi (1993)** reported that Morphactin increased fruit set percentage of pepper.

1 .1.4 Effect of Micronutrients:-

Results shown in Table (4) indicated that Micronutrients applications significantly increased the total number of flowers/plant. Zinc gave the highest production of flowers, also micronutrients significantly increased number of open bolls/plant and reduced boll shedding compared to the control. The increase in number of flowers and bolls may be due to the increase in number of sympodia/plant and/or the increase in number of flowers and bolls/sympodia and to the activation roles in physiological and metabolic processes in cotton plants at bud initiation period caused by the microelement. These results are in harmony with those obtained by **Wassel *et al.* (2000) and (El-sabbagh *et al.* 2002).**

1 .1.5 Effect of PGRs + micronutrients combinations:-

Results shown in Table (4) indicated that PGRs + micronutrients combinations addition the micronutrients such as Fe, Zn and Mn to PGRs treatments improved the production of flowers on cotton plants and significantly surpassed the control in most cases. The combined treatments significantly increased number of open bolls/plant, and boll retention compared to the control. This may be due to the important role of these elements in the activation of physiological and metabolic processes in cotton plants in flowering and bolling stage. These results are in accordance with those obtained by **Wassel (2001).**

2.Yield and yield components characteristics:

2. 1.lint percentage:

As shown from the data in Table (5), the PGRs, micronutrients and their combinations had a significant effect on lint percentage in both seasons.

Effect of Pix:

Data in Table (5) showed that Pix applications significantly reduced lint percentage compared to the control in both seasons. No obvious trend was noticed for such characters regarding the different concentrations of Pix and the years. Similar results in this respect were obtained by **El-Kashlan *et al.* (1990)** who reported that lint percentage was not significantly affected by Pix applications.

Effect of kinetin:

Data in Table (5) show that lint percentage were significantly affected by kinetin applications in both seasons. the highest kinetin application (50 ppm) significantly increased lint percentage compared to the lowest kinetin application and the control in both seasons. In this respect, similar results were obtained by **Sawan *et al.* (2000)** who stated that kinetin applications did not cause any significant changes in lint percentage. **Wassel (2001)** mentioned that lint percentage was not significantly affected by kinetin application.

Effect of Morphactin:

Data in Table (5) indicated that lint percentage, was significantly affected by Morphactin applications (10 and 20 ppm).. Close results were recorded on cotton using some PGRs as retardants; Alar, TIBA and CCC, these results were obtained by **El-Shourbagy *et al.* (1983).**

Effect of micronutrients:

The results in Table (5) appeared that lint percentage slightly decreased in 2000 season below the control, however, that lint percentage was significantly increased in 1999 season over the control. These results were in general agreement with those obtained by **Wassel *et al.* (2000) and El-Sabbagh *et al.* (2002).**

Effect of PGRs + micronutrients combinations:

Data in Table (5) showed that most combined treatments especially including kinetin or Morphactin with micronutrients improved the averages of lint percentage in both seasons.. These results were in line with those obtained by **Bauer and Cothern (1990)**

Table (5): yield and yield components characteristics as influenced by foliar spraying treatments with PGRs, micronutrients and their combinations during1999 and 2000 growing seasons.

reatments	Lint percentage		Seed cotton yield kentar/faddan		Lint cotton yield Kentar/faddan	
	1999	2000	1999	2000	1999	2000
PGRs						
Pix1	32.80 l	32.27 jk	5.86 kl	5.67 gh	6.05 m	5.76 no
Pix2	34.80 j	31.47 m	6.03 k	5.94 fgh	6.61 l	5.89 mn
Kinetin1	38.80 b	36.40 hi	10.09 def	9.34 ab	12.32 d	10.71 gh
Kinetin2	39.57 a	37.20 def	9.83 efg	8.42 c	12.24 de	9.86 i
Morphactin1	38.50 bc	37.50 cd	9.74 fg	8.20 cd	11.59 fg	9.68 i
Morphactin2	38.67 b	36.97 efg	10.34 cd	9.52 ab	12.56 cd	11.09 efg
Micronutrients						
Fe	37.60 efg	35.97 i	9.82 efg	8.31 cd	11.62 fg	9.65 i
Zn	38.00 de	32.57 j	9.30 hi	7.59 d	11.13 hi	7.98 k
Mn	37.45 fgh	36.47 hi	9.74 fg	7.95 cd	11.28 gh	9.13 j
PGRs + Micro. Comb.						
P1 + Fe	33.37 k	31.67 lm	5.89 kl	5.88 fgh	6.19 m	5.86 mn
P1 + Zn	33.57 k	36.71 fgh	8.02 j	6.56 ef	8.48 k	7.58 k
P1 + Mn	32.50 lm	31.47 m	6.14 k	6.34 efg	6.28 lm	6.28 m
P2 + Fe	34.37 j	32.57 j	5.60 l	5.44 h	6.05 m	5.58 no
P2 + Zn	34.77 j	32.00 kl	4.91 m	5.33 h	5.37 n	5.37 o
P2 + Mn	32.17 m	31.40 m	5.91 kl	5.98 fgh	5.99 m	5.84 mn
K1 + Fe	38.40 bcd	38.77 a	10.23 cde	9.40 ab	12.37 d	11.47 de
K1 + Zn	37.60 efg	36.40 hi	10.33 cd	9.49 ab	12.23 de	10.91 fg
K1 + Mn	38.07 cde	37.73 c	11.46 b	10.04 a	14.12 b	11.93 abc
K2 + Fe	37.67 ef	37.00 d-g	9.62 gh	7.64 d	11.63 fg	8.90 j
K2 + Zn	37.20 ghi	38.67 ab	10.52 c	9.57 ab	12.32 d	12.01 ab
K2 + Mn	38.17 cd	36.10 i	9.90 efg	9.13 b	11.89 ef	10.38 h
Mor1 + Fe	37.97 de	36.70 fgh	9.12 i	6.70 e	10.90 i	7.74 k
Mor1 + Zn	39.47 a	37.03 d-g	11.38 b	10.01 a	13.95 b	11.68 bcd
Mor1 + Mn	36.97 i	37.13 d-g	10.54 c	9.67 ab	12.22 de	11.30 def
Mor2+ Fe	38.70 b	38.27 b	12.01 a	10.07 a	14.63 a	12.13 a
Mor2 + Zn	37.20 ghi	37.27 cde	9.86 efg	9.10 b	11.56fg	10.68 gh
Mor2 + Mn	36.90 i	36.97 efg	11.10 b	9.91 a	12.90 c	11.53 cde
Water (Control)	37.10 hi	36.67 gh	7.84 j	6.55ef	9.16j	7.56 k
Mean	36.73	35.62	8.97	7.99	10.49	9.09

Means designed by the same letter at each cell are not significantly different at the 5% level according to duncan's multiple rang test

2.4.Effect on seed cotton yield (kentar[1]/faddan):

2.5.Effect on lint cotton yield (kentar[2]/faddan):

[1]) One kentar seed cotton = 157.5 kg.

[2]) One kentar lint cotton = 50 kg.

As shown from Table (5), data showed that PGRs, micronutrients and their combinations had a significant effect on both seed cotton yield and lint cotton yield in kentars/faddan in both seasons.

Effect of Pix:

Data in Table (5) showed that both seed cotton yield and lint cotton yield in kentars/faddan were significantly reduced by Pix applications (1000 and 2000 ppm) compared to the untreated cotton plants (control) in both seasons. It is also clear that seed cotton and lint yields slightly increase with increasing Pix concentration in both seasons. Generally, the reduction in yield by Pix application may be due to the reduction number of bolls, reduction in boll retention percentage and yield per plant, reduction in number of sympodia, increasing boll shedding percentage (Tables 4and5). This effect of Pix applications is similar to that reported in several studies which showed that Pix significantly reduced most of yield components characteristics, consequently reduced final yield **(Zhao and Oosterhuis, 2000).**

Effect of kinetin:

Data in Table (5) revealed that kinetin applications (25 and 50 ppm) exhibited significant higher values of seed cotton and lint yields/faddan than the control plants in both seasons. It is obvious that yield decrease as increasing kinetin concentration. Kinetin application (25 ppm) increased seed cotton yield by 28.70% and 42.60% and lint yield by 34.50% and 41.67% of the control treatment in both seasons, respectively. These increases in yield may be due to the increase in number of flowers per plant, number of open bolls per plant,and boll retention percentage. These results were in accordance with those obtained by **Zhao and Oosterhuis (2000)**

Effect of Morphactin:

Data in Table (5). indicated that Morphactin application (10 and 20 ppm) significantly increased seed cotton yield and lint cotton yield compared to the control in both seasons.Increasing Morphactin concentration to (20 ppm) significantly increased both seed cotton and lint yields in both seasons. These increases in yield may be due to increase the number of flowers per plant and number of open bolls per plant as well as increase in boll retention and decrease in boll shedding.. An opposite result was obtained by **El-Shourbagy *et al.* (1983)** who used TIBA on cotton plants.

Effect of micronutrients:

It is clear, from Table(5) that micronutrients application significantly resulted in higher yields than the control treatment in both seasons. Microelements may have favorably impacted yield components, including number of open bolls per plant and boll weight, leading to higher cotton yield. Similar findings were obtained by **Wassel *et al.* (2000).**

Effect of PGRs + micronutrients combinations:

As shown from the results in Table (5), kinetin and Morphactin PGR, in the combined treatments may have synergistic responses with some microelements which improved their effects on yield and some of its components. It is clear that such combined treatments significantly increased yield compared with the control treatment in both seasons. Similar results in this respect were obtained by **Bauer and Cothren (1990) and Wassel (2001).**

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دراسات مورفوفسيولوجية على نباتات القطن المصري"

٢-تأثير الرش الورقي بمنظمات النمو و العناصر الصغرى على صفات التزهير والتلويزو صفات المحصول ومكوناته

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الملخص العربى

تم إجراء هذا البحث فى مزرعة كلية الزراعة خلال مواسم ١٩٩٩م ، ٢٠٠٠م ــ قسم النبات الزراعي ــ كلية الزراعة كفر الشيخ ــ جامعة طنطا. وكان الهدف الأساسي لهذا البحث هو دراسة تأثير ثلاثة منظمات نمو هي البيكس والكينتين والمورفاكتين بتركيزين لكل منهما (منخفض وعال) وثلاثة عناصر صغرى هي الحديد والزنك والمنجنيز بتركيز واحد لكل منهما والتوافيق الممكنة لكل من منظمات النمو مع العناصر الصغرى على صفات التزهير والتلويز–صفات المحصول ومكوناته لنبات القطن وكان صنف القطن المستخدم في هذه الدراسة هو جيزه ٨٦ وهو صنف مستنبط حديثا من طبقة الأقطان الطويلة التيله

. ويمكن تلخيص النتائج المتحصل عليها فيما يلي:

١–أدت المعاملة بالبيكس إلى نقص واضح فى عدد الأزهار /نبات مقارنة بالكينتين والمورفاكتين. كما أدت المعاملة بالتركيز العالى للبيكس إلى نقص معنوى فى عدد اللوز المتفتح/نبات بالمقارنة بالكنترول فى كلا موسمى الزراعة على التوالى. أيضا أدت المعاملة بالبيكس إلى نقص معنوى فى كل من محصول القطن الزهر قنطار/فدان ومحصول القطن الشعر قنطار/فدان وكذلك نقص معنوى فى نسبة الشعر ٠

٢– أدت المعاملة بالكينتين والمورفاكتين إلى زيادة معنوية فى عدد الأزهار الكلى/نبات وعدد اللوز المتفتح/نبات وعدد اللوز العاقد/نبات بالمقارنة بالنباتات الغير معاملة. وكذلك أظهرت هذه المعاملات أعلى قيم لمتوسطات محصول القطن الزهر قنطار/فدان ومحصول القطن الشعر/فدان مقارنة بالنباتات الغير معاملة (الكنترول).

٣– أدت المعاملة بالعناصر الصغرى إلى زيادة معنوية فى عدد الأزهار/نبات وأدى الزنك إلى أعلى إنتاج من الأزهار مقارنة بالنباتات الغير معاملة (الكنترول).كما أدت المعاملة بالعناصر الصغرى إلى زيادة معنوية فى كل محصولى القطن الزهر والشعر قنطار/فدان وزيادة نسبة الشعر معنويا

٤– أدت المعاملات المشتركة إلى تحسن واضح فى زيادة إنتاج الأزهار على نباتات القطن وتفوقت معنويا على المقارنة (الكنترول) فى كل من عدد اللوز المتفتح/نبات ونسبة اللوز العاقد/نبات.