MORPHOPHYSIOLOGICAL STUDIES ON EGYPTIAN COTTON PLANTS (*Gossypium barbadense* L.)

3. Effect of some growth regulators and some micronutrients on anatomical characteristics of cotton plants.

Zayed, E.A., M.M.El-Afry, S.H. Eissa and Samira A.F. El-Okkiah

Tanta University, Faculty of Agriculture, Kafr El-Sheikh, Department of Agric. Botany

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 of each one, and their combinations; on anatomical characteristics of cotton plants. 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, kinetin and morphactin applications significantly increased the stem diameter of cotton plants, thickness of epidermal cells, thickness of cortex layer (collenchyma and parenchyma). Also, significantly increased the diameter of vascular cylinder, thickness of pith, thickness of xylem tissue and No. of vascular bundles compared to the control. Kinetin applications significantly decreased the diameter of stem resulting in thinner stems compared to the control. Also, cortical layer thickness (collenchyma and parenchyma) significantly decreased compared to the control.. pix, kinetin and morphactin singly application significantly increased the thickness of blade and thickness of mesophyll compared to the control. Pix and kinetin singly applications significantly increased No. of vascular/midrib and diameter of xylem vessel, while decreased the thickness of xylem compared to the control. Morphactin applications significantly increased midrib zone thickness and thickness of xylem, while diameter of xylem vessel significantly decreased compared to the control.

Micronutrients applications had no significant effect on root and Leaf anatomy compared to the control. Micronutrients applications

significantly increased the total thickness of cortex layer compared to the control.

combined treatments applications significantly increased diameter of the stem, thickness of cortex layer, thickness of pith, thickness of xylem tissue and diameter of xylem vessel and No. of vascular bundles compared to the control. Combined treatments applications especially included the iron (Fe) significantly increased thickness of blade, thickness of mesophyll, midrib zone thickness, thickness of xylem and diameter of xylem vessel compared to the control.

INTRODUCTION

Cotton in Egypt is considered the most important economical crop and represents the backbone ofAgricultural income, having for many years played an outstanding role in the social economical and even the political life of the country. For this special situation all factors should be taken to improve its yield continuously among different factors affecting cotton yield micronutrients and plant growth regulators are considered most important factors that influences cotton plant performance and determines its yield, micronutrients play an important role in the physiological and metabolic processes in cotton plants during different stages of growth.(**Sharma *et al* 1988)** ,(**Azab *et al* 1992)** and (**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 use of growth retardants such as Pix and Morphactin can cause large, mesophyll cells and elongatied palisade cell and increased the diameter of xylem vessels,number of bundles/midrib. (**Gausman *et al.* 1980),(El-Nady 1994)** and(**Ali 1994)**. Kinetin at (10 mg/L) decreased thickness of the cortex then the stem was thinner of lupine plants but kinetin increased diameter of xylem vessels. (**Ibrahim *et al.* 1990)** Kinetin also decreased diameter of stem, however, the kinetin application also caused thickening of mesophyll tissue due to elongation of palisade cells and size of spongy tissue, on the other hand, kinetin also increased both diameter of xylem vessels in vascular bundles and number of vascular bundles/midrib of pepper plants(**Shabaan 1996)**,. Therefore, the main objective of this investigation are: 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 anatomical characteristics (anatomical studies) for 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 anatomical characteristics of an Egyptian long-staple cotton cultivar, Giza. 86 (*Gossypium barbadense* L.). Cotton seeds were sown on April 18^{th} and April 14^{th} 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.

Table(3) Studies treatments and time of application

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

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. Experiment with three replications. Each plot consisted of five rows 4.5 m in length and 0.6 m in width.

The effect of growth regulators and micronutrients on the anatomical structure of leaves, stem and root were studied after 80 days after sowing. Specimens 1 cm long were taken from the fourth upper internode and the fourth upper leaf including the midrib. The different samples were fixed 48 hours in FAA (10 ml formaline, 5 ml Glacial acid, 50 ml ethyl alcohol absolute and 35 ml distilled water). Dehydrated and cleared in a tertiary butyl series,and embedded in paraffin wax 56 c m.p. Sections (20 microns thick) were cut using a Rotary Microtom (AO Rotary Microtom Model 820 apparatus,stainedwith safranine-Light green and mounted in Canda Balsam(**Ghamrawy and Zaher, 1953)**

The Statistical analysis of variance for randomized complete block design was carried out for each character in each season as outlined by Snedecor and Cochran (1980). The differences between the different treatment combinations were tested using the Duncan's Multiple Range method outlined by **(Leclerg *et al.* 1962).**

RESULTS AND DISCUSSION

1.Anatomical studies:

1.1Effect on the stem structure:

The micrographs in Fig. (1) and the data in Table (4) showed that foliar spraying treatments with PGRs, micronutrients and their combinations had a significant effect on stem anatomy of cotton plant and there were significant differences between these treatments and the control.

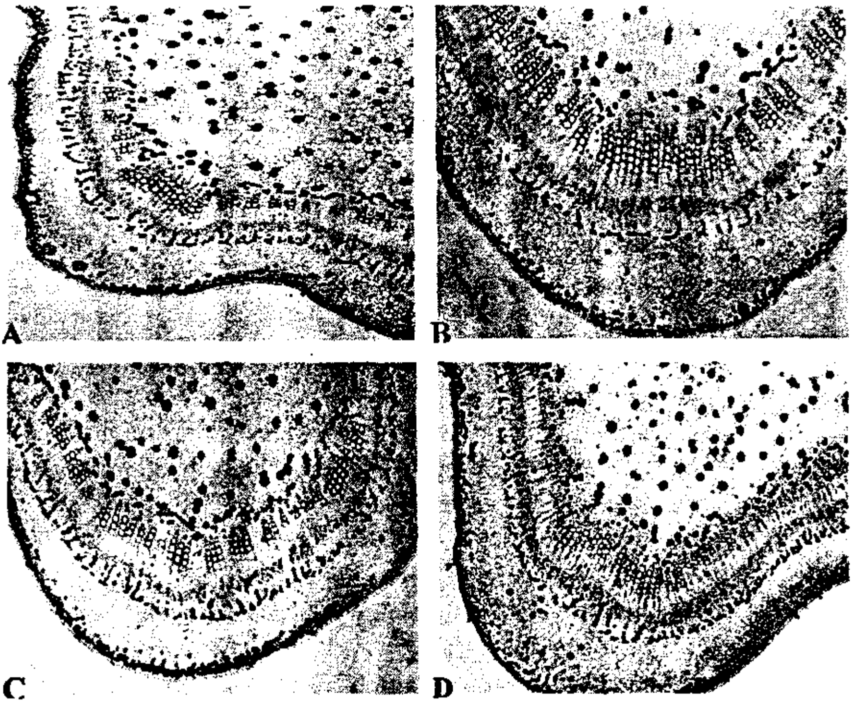
1.1.1Effect of Pix:

In cross sections all pix treatments (1000 and 2000 ppm) significantly increased the stem diameter of cotton plants as compared to the control. Thickness of epidermal cells show a tendency to slight increase at the low concentration of pix (1000 ppm) as compared to the control. It is also clear from the data (Table 4) and the micrographs in Fig. (1) that increasing pix concentration significantly increased diameter of stem and thickness of epidermal cell.

Table (5): Stem structure (x 100) of cotton plants as influenced by foliar spraying treatments with PGRs, micronutrients and their combinations.

Treatments	Diameter of Stem (µ)	Thickens of epidermal cell (µ)	Thickness of cortex layer (µ)			Diameter of vascular cylinder (µ)	No. of vascular bundles	Xylem tissue	
			Collenchyma tissue	Parenchyma tissue	Total			Thickness	Diameter of vessel (µ)
PGRs									
Pix 1	4936.67 cd	20.0 fgh	225.0 gh	182.33 abc	406.67 m	4083.33bc	20.33 d-g	216.67 ef	35.00 a-d
Pix 2	5106.67 bc	25.00 a	256.67 efg	180.0 abc	436.67 j	4183.33 b	22.33 bc	235.00 b-e	35.33 abc
Kinetin 1	3240.00 m	20.00 fgh	250.00 fgh	100.00 k	350.0 r	2500.0 op	16.00 j	190.00 gh	33.33 b-e
Kinetin 2	3256.67 m	20.00 fgh	225.00 gh	133.33 hij	385.33 op	2500.00 op	18.67 gh	175.00 hi	35.00 a-d
Morphactin 1	4862.67 d	23.00 bc	258.33 efg	150.00 e-h	408.33 m	4000.0 c	17.67 hij	246.67 b	23.33 f
Morphactin 2	5068.33 bc	25.00 a	271.67 b-f	175.00 a-d	446.67 g	4125.0 bc	22.00 bcd	276.67 a	25.00 f
Micro-nutrients:									
Fe	3781.33 jk	19.00 gh	275.00 b-f	138.33 hij	413.33 l	2916.67 kl	17.67 hij	181.67 ghi	31.67 de
Zn	3818.00 jk	19.00 gh	281.67 a-f	150.00 e-h	431.67 k	2916.67 kl	17.33 hij	193.33 gh	32.33 cde
Mn	3745.00 k	18.33 h	291.67 a-e	150.00 e-h	441.67 h	2825.0 lm	19.00 fgh	186.67 gh	31.67 de
PGRs + Micro. comb.									
P_1 + Fe	4331.67 gh	20.00 fgh	273.33 b-f	185.00 ab	458.33 f	3375.0 fg	21.00 cde	223.33 de	33.33 b-e
P_1 + Zn	4375.00 fgh	22.33 bcd	255.00 ef	160.00 de	415.00 l	3500.0 ef	22.00 bcd	253.33 b	36.67ab
P_1 + Mn	4212.33 h	22.00 cde	278.33 b-f	160.00 de	438.33 ij	3291.67 gh	20.00 efg	225.00 cde	33.33 b-e
P_2 + Fe	5208.33 b	25.00 a	308.33 ab	175.0 a-d	483.33 c	41981.67 b	21.33 cd	238.33 bcd	35.00 a-d
P_2 + Zn	5405.00 a	25.00 a	300.00 a-d	190.0 a	490.00 b	4375.0 a	24.00 a	250.0 b	38.33 a
P_2 + Mn	4228.00 h	24.00 b	275.00 b-f	156.67 d-g	431.67 k	3316.67 gh	20.67 c-f	240.00 bcd	35.00 a-d
K_1 + Fe	3490.00 l	20.00 fgh	250.00 fgh	104.33 k	354.33 q	2750.0 mn	17.67 hij	193.33 gh	33.33 b-e
K_1 + Zn	3782.33 jk	22.00 cde	216.67 h	131.67 hij	348.33 r	3041.67 jk	17.67 hij	200.00 fg	38.33 a
K_1 + Mn	3208.67 m	20.00 fgh	225.0 gh	130.0 ij	355.00 q	2455.33 p	16.67 ij	190.00 gh	31.67 de
K_2 + Fe	3931.67 ij	20.00 fgh	241.67 fgh	141.67 f-i	383.33 p	3125.0 ej	17.67 hij	166.67 i	33.33 b-e
K_2 + Zn	4045.00 i	20.00 fgh	256.67 efg	141.67 f-i	398.33 m	3208.33 hi	21.00 cde	196.67 g	36.00 ab
K_2 + Mn	3853.00 jk	19.00 gh	265.00 def	121.67 j	386.67 no	3041.67 jk	18.00 hi	193.33 gh	33.33 b-e
Mor_1 + Fe	4517.00 ef	23.00 bc	306.67 abc	158.33 def	465.00 d	3541.67 e	21.00 cde	250.00 b	30.00 e
Mor_1 + Zn	4640.00 e	21.00 def	300.0 a-d	140.0 g-j	440.00 hi	3750.0 d	21.33 cde	273.00 a	30.00 e
Mor_1 + Mn	4456.67 fe	23.00 bc	291.67 a-e	170.0 bcd	461.67 e	3500.0 ef	21.67 b-e	243.33 bc	30.00 e
Mor_2 + Fe	4971.67 cd	20.33 efg	281.67 a-f	163.33 cd	445.00 g	4041.67 bc	17.33 hij	246.67 b	30.00 e
Mor_2 + Zn	5038.33 bc	25.00 a	320.0 a	175.0 a-d	495.00 a	4041.67 bc	21.33 cde	285.00 a	30.67 e
Mor_2 + Mn	4987.67 cd	23.33 a	275.00 b-f	183.33 ab	458.33 f	4025.0 bc	23.33 ab	250.00 b	30.00 e
Water (control)	3724.67 k	19.00 gh	266.67 c-f	141.67 f-i	408.33 m	2870.0 l	18.00 hi	196.67 g	30.00 e
Mean	4295.44	21.55	268.63	153.13	422.74	3403.39	19.74	222.02	32.54

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



Fig(1)Cross sections of cotton stem illustrating the effect of pix, kintineAnd morphactin(x100)

A-control B-pix(2000ppm)
C-kinetin(50ppm) D-morphactin(20ppm)

Concerning the cortical layers thickness, it is apparent that the Collenchyma tissue is represented by 55.24% of the cortex layer at the low concentration of pix (1000 ppm), while it is represented by 58.78% of the cortex layer at the higher concentration of pix (2000 ppm), compared to 65.31% for Collenchyma layer in the control. This indicates that pix applications (1000 and 2000 ppm) compressed the outer Collenchyma region by about 10.07% and 6.53% less than the control, respectively, but increased the size of cortex layer cells in high pix application compared to the (control). Similar results were obtained by **Gausman (1986)** on cotton and **El-Nady (1994)** on eggplants.

Also, pix applications (1000 and 2000 ppm) significantly increased the diameter of vascular cylinder, No. of vascular bundles, thickness of xylem tissue and diameter of vessel as compared to the control.

1.1.2Effect of kinetin:

The micrographs in Fig. (1) and the data in Table (4) showed that kinetin applications (25 and 50 ppm) significantly decreased the diameter of stem resulting in thinner stems compared to the non-kinetin-treated cotton plants (control). Thickness of epidermal cells show a tendency to slight increase at the two concentrations of kinetin as compared to the control. It is also clear that cortical layer thickness including both Collenchyma and Parenchyma tissues significantly decreased compared to the control. Also, kinetin applications significantly reduced the diameter of vascular cylinder, No. of vascular bundles in low concentration only and thickness of xylem tissue. On the other hand, xylem vessel significantly increased compared to the control,these results are in agreement with those obtained by **Ibrahim *et al.* (1990)** on lupine and **Ateya (2001)** on soybean. The decrease of stem diameter may be due to that kinetin may increase elongation of cell wall modification (increased plasticity) and decrease diameter of cell.

1.1.3Effect of morphactin:

As shown from the micrographs in Fig. (1) and the data in Table (4) morphactin treatments significantly increased stem diameter, thickness of epidermal cells, thickness of cortex layer including both Collenchyma and Parenchyma tissues, diameter of vascular cylinder, No. of vascular bundles and thickness of xylem tissue as compared to the non-morphactin treated plants (control). Visually, the morphactin and non-morphactin treatments were easily distinguishable by the swollen stems in the first case.

Concerning the diameter of xylem vessel, it appeared more narrower than the control. These results were in harmony with those obtained by **Dierig and Backhans (1990)** on Guayule (Rubber), **Ali *et al.* (1994)** on *vicia faba*, **El-Nady (1994)** on eggplant and **Shabaan (1996)** on sweet pepper.

1.1.4Effect of micronutrients:

Table (4) showed that the micronutrients applications did not significantly differ from the control with regard to stem diameter, thickness of epidermal cells, diameter of vascular cylinder, No. of vascular bundles, thickness of xylem tissues and diameter of xylem vessels.

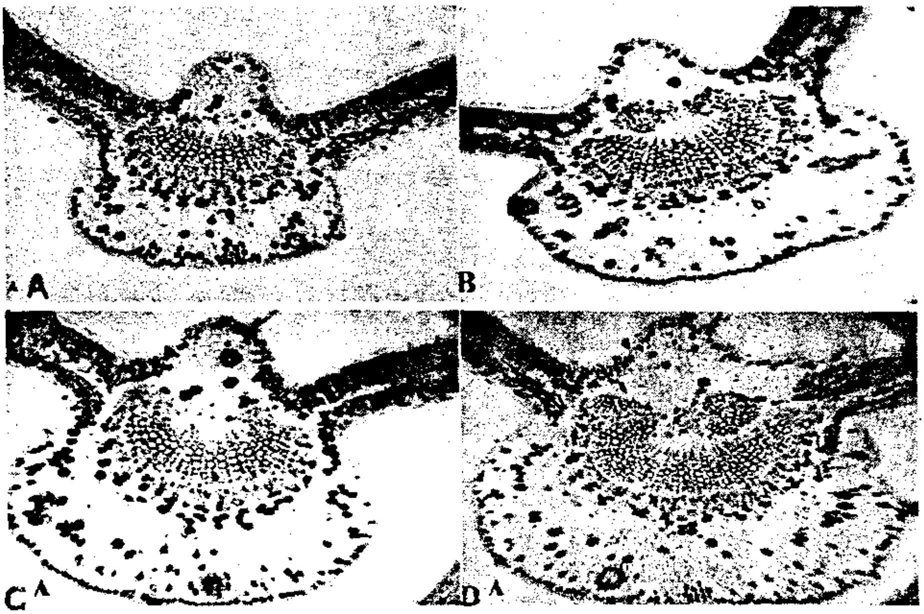
1.1.5Effect of PGRs + micronutrients combinations:

As shown from the data in Table (4) all combined treatments including pix or morphactin or kinetin at high concentration (some cases) plus one microelements (Fe, Zn, or Mn) significantly increased diameter of stem, thickness of cortex layer including both Collenchyma and Parenchyma, diameter of vascular cylinder, No. of vascular bundles, thickness of xylem tissue and diameter of xylem vessels. The highest values of stem anatomy were in favour of the combined treatment any PGR plus Zn.

1.2 Effect on the leaf structure:

1.2.1 Effect of pix:

As shown from the micrographs in Fig. (2) and the data in Table (5), it is apparent that pix applications (1000 and 2000 ppm) significantly increased the thickness of blade, thickness of mesophyll tissues compared to the control. Cross section and the data also showed that pix applications significantly increased No. of vascular/midrib and diameter of xylem vessel, while decreased the thickness of xylem. Similar results were reported by **Gausman *et al.* (1980)** on vicia faba and **El-Nady (1994)** on eggplant.



Fig(2)Cross sections of cotton leaf illustrating the effect of pix, kintine And morphactin(x100)

A-control B-pix(2000ppm)
C-kinetin(50ppm) D-morphactin(20ppm)

Table (6):Leaf structure (x 100) of cotton plants as influenced by foliar spraying treatments with PGRs, micronutrients and their combinations

Treatments	Thickness of blade µ	Thickness of mesophyl tissue µ		Vascular bundle		
		Palisade	Spongy	No. of vascular/ midrib	Thickness of xylem µ	Diameter/ Vessel µ
PGRs						
Pix 1	271.67 ab	110.00 ab	118.33 abc	21.67 b-e	170.00 gh	30.00 bcd
Pix 2	271.67 ab	100.00 c-f	121.67 a	22.67 bc	163.33 hui	36.67 a
Kinetin 1	230.00 gkl	90.00 g-j	108.33 de	16.33 klm	171.67 gh	30.00 bcd
Kinetin 2	243.33 g-j	90.00 g-j	111.67 bcd	19.33 fgh	155.00 lj	33.33 ab
Morphactin 1	251.67 e-h	95.00 d-h	100.0 ef	19.00 f-i	203.33 def	25.00 e
Morphactin 2	251.67 e-h	93.33 f-i	123.33 a	25.00 a	196.67 ef	26.67 de
Micro-nutrients:						
Fe	215.00 mn	83.33 jkl	96.67 f	16.00 lm	176.67 g	30.00 bcd
Zn	213.33 mn	76.67 l	100.00 ef	15.33 m	165.00 hi	30.00 bcd
Mn	213.33 mn	80.00 kl	98.33 f	16.67 j-m	17167 gh	30.00 bcd
PGRs + Micr. comb.						
P_1 + Fe	270.00 abc	113.33 a	125.00 a	16.00 lm	203.33 def	31.67 bc
P_1 + Zn	240.00 h-k	90.00 g-j	110.00 cd	17.67 h-l	198.33 ef	33.33 ab
P_1 + Mn	256.67 c-g	98.33 d-g	118.33 abc	16.33 klm	200.0 def	30.00 bcd
P_2 + Fe	276.67 a	115.00 a	121.67 a	19.67 e-h	203.33 def	31.67 bc
P_2 + Zn	246.67 f-i	90.00 g-j	116.67 ad	16.00 lm	195.00 f	31.67 bc
P_2 + Mn	270.0 abc	100.00 c-f	121.67 a	18.33 g-k	206.67 cde	31.67 bc
K_1 + Fe	223.33 lm	86.67 h-k	110.00 cd	20.00 d-g	150.00 j	30.00 bcd
K_1 + Zn	203.33 n	76.67 l	96.67 f	17.00 i-m	125.00 k	33.33 ab
K_1 + Mn	223.33 lm	93.33 f-i	108.33 de	20.33 d-g	180.00 g	33.33 ab
K_2 + Fe	256.67 c-g	98.33 d-g	116.67 a-d	23.00 b	161.67 hi	31.67 bc
K_2 + Zn	228.33 kl	85.00 i-l	108.33 de	19.00 f-i	128.33 k	33.33 ab
K_2 + Mn	253.33 d-h	98.33 d-g	116.67 a-d	22.00 bcd	200.00 def	33.33 ab
Mor_1 + Fe	263.33 a	96.67 efg	120.00 ab	23.00 b	220.00 ab	25.00 e
Mor_1 + Zn	236.67 i-l	85.0 i-l	108.33 de	17.67 h-l	203.33 def	28.33 cde
Mor_1 + Mn	258.33 b-f	95.00 e-h	118.3 abc	20.67 c-f	225.00 a	28.33 cde
Mor_2 + Fe	266.00 a-d	108.33 abc	121.67 a	22.00 bcd	210.00 bcd	26.67 de
Mor_2 + Zn	265.00 a-e	106.67 a-d	121.67 a	18.67 f-j	200.00 def	26.67 de
Mor_2 + Mn	266.67 a-d	103.33 be	125.00 a	23.00 b	215.00 abc	28.33 cde
Water (control)	210.0 m	80.00 kl	95.00 f	15.00 m	176.67 g	30.00 bcd
Mean	245.57	94.23	112.80	19.54	183.04	30.36

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

1.2.2 Effect of kinetin:

The micrographs in Fig. (2) and the data in Table (5) showed that kinetin applications had a significant effect on the cotton leaf anatomy. It is clear that kinetin significantly increased the thickness of blade as a result of increasing the thickness of mesophyll tissue, No. of vascular/midrib and diameter of xylem vessel only in case of high concentration of kinetin (50 ppm) as compared to the control. Thickness of xylem significantly decreased by using the two kinetin concentration compared to the control. These results are in opposite with those obtained by **Gassman *et al.* (1980) and Ateya (2001).**

1.2.3 Effect of morphactin:

As shown from the micrographs in Fig. (2)and the data in Table (5) it is obvious that morphactin applications significantly increased the thickness of blade, palisade tissue thickness, spongy tissue thickness, midrib zone thickness, thickness of xylem. While diameter of xylem vessel significantly decreased compared to the control.Cross section and the data revealed that palisade tissue thickness at low pix concentration was significantly higher (95 μ) than high concentration (93.33 μ), while spongy tissue thickness behaved an opposite trend where, it was thicker at higher morphactin concentration (123.33 μ) than low one (100.0 μ). The increases on midrib zone thickness compared to the control, this may be attributed to shrinked and contract sample of mesophyll tissue on the lower surface of the main vein. These results are in parallel with those obtained by **Ali *et al.* (1994)** on *vicia faba* and **Abd El-Aziz (2003)** on *vicia faba.*

1.2.4 Effect of micronutrients:

Table(5) showed that micronutrients applications insignificantly affected the leaf anatomy. All leaf anatomy characteristics did not significantly differ from the control.

1.2.5 Effect of PGRs + micronutrients combinations:

As shown from data in Table (5), it is clear that all combined treatments including one PGR + one microelement significantly increased thickness of blade, thickness of mesophyll (palisade and spongy tissue), midrib zone thickness, thickness of xylem and diameter of xylem vessel, with an exception of low kinetin application (25 ppm) + zinc. However, this treatment gave higher value of xylem diameter vessel compared to the control.

REFERENCES

Abd El-Aziz, Kh.A. (2003). Morphophysilogical studies on *Orobanche* spp. plants. M.Sc. Thesis, Fac. Agric., Tanta Univ

Ali, S.A.; E.R. El-Desoki; R.R. El-Masry and S.I. Omara (1994). Effect of Morphactin CF 125 on the anatomical structure of *Vicia faba* L. Annals Agricultural Science, Moshtohor, 32(2): 875-888.

Ateya, A.G.E. (2001). Morphophysiological studies on soybean (*Glycine max* Merill) plants. M.Sc. Thesis, Fac. Agric., Tanta Univ..

Azab, A.S.M.; M.A. Eweida and A.W. Shalaby (1992a). Response of two long staple cultivars of Egyptian cotton to foliar application with some micronutrients. Zagazig. J. Agric. Res. Vol. 19(1); 49-60

Dierig, D.A. and R.A. Backhaus (1990). Effects of morphactin and DCPTA on stem growth and Bioinduction of rubber in Guayule. HortScience. 25(5): 531-533..

El-Nady, M.F. (1994). Effect of some growth regulators on eggplant *Solanum melongena* L. growth. M.Sc. Thesis, Fac. Agric., Kafr El-Sheikh, Tanta Univ.

Gausman, H.W. (1986). Onion bioregulators including Pix and cycocel and their biorelevancy. West Printing. Lubbock, Tx.

Gausman, H.W.; J. Stabenow; F.R. Rittig; D.E. Escobar; M.V. Garz and M. Abdel-Rahman (1980). Mepiquat chloride effects on cotton leaf anatomy. Proceeding of the plant growth regulator working group 1980, 8-14, 17 ref.

Ghamrawy, A.K. and A. Zaher (1953). Anatomical studies on Berseem (*Trifolium alexandrinum* L.). 1- The seedling. Cairo Univ., Fac. Agric. bull., 30: 1-14.

Ibrahim, D.N.; M.A. Khafagy and A.M. Abo El-Khaeer (1990). Some growth substances affecting the growth, chemical composition and alkaloidal content of *Lupinus termis* L. Egypt. J. Appl. Sci., 5(7): 367-381.

LeClerg, E.L.; W.H. Leonard and A.G. Clark (1962). Field plot technique. Burges Publishing Company.

Mahmoud, W.Sh. (1987). Effect of growth retardants on tomato structure. Al-Azhar J. Agric. Res., Vol. 7.

Morgan, P. (1980). Synthetic growth regulators: potential for development Botanical Garjette, 141: 337-346

Shabaan, F. M.R. (1996). Morphological and physiological responses of sweet pepper to some growth regulators. M.Sc. Thesis, Fac. Agric., Kafr El-Sheikh, Tanta Univ.

Sharma, J.C.; N.K. Tomar and V.K. Gupta (1988). Effect of levels and methods of zinc application and growth, yield attributes and yield of cotton (*Gossypium hirsutum* L.). Agricultural-Science-Digest-Karnal. 1988, 8: 3, 165-169; 6 ref.

Snedecor, G.W. and W.G. Cochran (1982). Statistical methods. The Iowa State University Press. 7th Edit. 2nd Printing. 507 pp.

دراسات مورفوفسيولوجية على نباتات القطن المصرى"

ثالثا: تأثير بعض منظمات النمو والعناصر الصغرى على الصفات التشريحية لنبات القطن

ا.د السيد عبد السلام زايد ا.د محمد مبروك العافرى ا.د سعيد حافظ عيسى سميره احمد فؤاد العكيه

جامعة طنطا- كلية الزراعة كفرالشيخ. ـ قسم النبات الزراعى

الملخص العربى

تم إجراء هذا البحث فى مزرعة كلية الزراعة خلال مواسم ١٩٩٩م ، ٢٠٠٠م ـ قسم النبات الزراعي ـ كلية الزراعة الزراعة كفرالشيخ ـ جامعة طنطا. وكان الهدف الأساسى لهذا البحث هو دراسة تأثير ثلاثة منظمات نمو هى البيكس والكينتين والمورفاكتين بتركيزين لكل منهما (منخفض وعال) وثلاثة عناصر صغرى هى الحديد والزنك والمنجنيز بتركيز واحد لكل منهما والتوافيق الممكنة لكل من منظمات النمو مع العناصر الصغرى على الصفات التشريحية لنبات القطن وكان صنف القطن المستخدم فى هذه الدراسة هو جيزه ٨٦ وهو صنف مستنبط حديثا من طبقة الأقطان الطويلة .

ويمكن تلخيص النتائج المتحصل عليها فيما يلى:

- أدت المعاملة بكل من البيكس أو المورفاكتين منفردا إلى زيادة معنوية فى قطر الساق لنباتات القطن وسمك خلايا البشرة وسمك طبقة القشرة (النسيجين الكولنشيمى والبارانشيمى) أيضا أدت نفس المعاملة إلى زيادة معنوية فى قطر الأسطوانة الوعائية وسمك نسيج الخشب وعدد الحزم الوعائيةأما من حيث المعاملة بالكينتين فقد أدت إلى نقص معنوى فى قطر الساق معطية سيقان نباتات رفيعة مقارنة بالنباتات الغير معاملة كما أدت هذه المعاملة إلى نقص معنوى فى سمك طبقة القشرة (النسيجين الكولنشيمى والبارانشيمى) وقللت معنويا من قطر الأوعية الأسطوانية وسمك النخاع وسمك النسيج الخشبى. أدت المعاملة بكل من البيكس أو الكينتين أو المورفاكتين منفردا إلى زيادة معنوية لكل من سمك نصل الورقة وسمك نسيج الميزوفيل مقارنة بالنباتات الغير معاملة فى حين أدت معاملات البيكس أو الكينتين إلى زيادة معنوية فى عدد أوعية العرق الوسطى وسمك أوعية الخشب فى حين قللت من سمك الخشب مقارنة بالكنترول. أما المعاملة بالمورفاكتين فقد أدت إلى زيادة معنوية فى سمك

منطقة عرق الورقة وسمك الخشب. بينما قطر أوعية الخشب نقص معنويا مقارنة بالنباتات الغير معاملة (الكنترول).

- لم تتأثر الصفات التشريحية للورقة بالمعاملة بالعناصر الصغرى ولم تختلف كثيرا عن الكنترول و أدت المعاملة بالعناصر الصغرى إلى زيادة معنوية فى السمك الكلى لطبقة القشرة مقارنة بالكنترول. كذلك أعطت المعاملات المشتركة زيادة معنوية فى قطر الساق وسمك طبقة القشرة وسمك أنسجة الخشب وقطر الأوعية الخشبية وعدد الحزم الوعائية مقارنة بالكنترول.و أدت المعاملات المشتركة إلى زيادة معنوية فى سمك نصل الورقة وسمك الميزوفيل ومنطقة عرق الورقة وسمك الخشب وقطر الأوعية الخشبية مقارنة بالنباتات الغير معاملة (الكنترول).