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EFFECT OF SOME GROWTH REGULATORS UNDER DIFFERENT PLANTING DATES ON GROWTH AND YIELD OF COTTON

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ABSTRACT

This study was carried out at the Experiment and Research Station, Faculty of Agriculture, Cairo University, Giza in two growing seasons (2010 and 2011) to study the effect of three sowing dates; (25 March, 25 April, and 25 May) and some growth regulators *i.e.*,(Indole acetic acid (IAA) at the rates of 50, 100 and I50 ppm, Naphthalene acetic acid (NAA) at the rates of 10, 20 and 30 ppm and Mepiquate chloried (Pix) 50, 100 and I50 ppm) on Egyptian cotton cultivar (Giza 92). A split-plot design with three replicates was used, sowing dates were allocated in the main plot while growth regulators in the sub plot. Obtained results could be summarized as follows:-

Sowing date had significant effect on growth characters, yield, yield components and technological properties. Whereas, delayed sowing date tended to increase significantly the plant height, no. of days to 1^{st} bud, 1^{st} flower and 1^{st} open boll. Planting cotton in 25 March was superior in the no. of sympodial branches / plant, seed index, earliness percentage, seed cotton yield /feddan and fiber properties such as fiber length, uniformity ratio, fiber elongation, fiber strength, micronaire reading, brightness and yellowness.

Growth regulators significantly affected all growth and yield characters under study. Use of 50 ppm PIX was superior in the no. of days to 1^{st} bud, 1^{st} flower and 1^{st} open boll, seed index, earliness percentage and seed cotton yield /feddan, while 30 ppm NAA was superior in plant height. Fiber properties were not significantly affected by growth regulators in all characters under study in both seasons.

The interaction between sowing dates and growth regulators significantly affected in most characters under study whereas, the use of 50 ppm PIX and planting in 25 March or 25 April was superior in the no. of sympodial branches / plant, no. of open bolls / plant, seed index, earliness percentage and seed cotton yield /feddan in the first season, while in the second one the use of 50 or 100 ppm PIX with sowing in 25 March gave the best reading in yield and yield components.

Key words:*cotton plant, growth and yield , growth regulators, planting dates.*

1. INTRODUCTION

Cotton (*Gossypium barbadense,* L.) is one of the most important fiber crops all over the world. In Egypt its importance is derived from being one of the main sources of foreign currency as well as the principle raw material for the national textile industry and an important source of edible oil. Sowing date is considered the most important factor among the different critical factors which influence growth and yield of cotton. These effects depend mainly on the weather conditions prevailing, such as temperature, light, relative humidity and other climatic factors. Early sowing has a favorable effect on the yield of cotton compared with the late sowing, having marked effects on growth and development of cotton plant.

Emara *et al.* (2006) found that, number of open bolls per plant, yield / feddan and lint percentage were increased in favour of early sowing, while late sowing increased boll weight and seed index. Zakaria *et al.* (2006) reported the effect of mepiquate chloride at 70 and 95 days after planting and observed increased number of opened bolls per plant, boll weight, seed index, lint yield per plant and lint yield per hectare. Hakoomat *et al*. (2009) used three sowing dates of May 10, June 1 and June 20 during two consecutive crop seasons. Observations were recorded for yield attribute, such as the number of

sympodial branches/plant, the number of bolls/m^2, boll weight, seed index and yield of seed cotton. Hayatullah *et al.* (2011) found that, late sowing consumed more the number of heat units and late planting had the highest the number of heat units and resulted in increasing plant height. Early sowing, (25 April) significantly decreased plant height, increase in earliness percentage and the number of days from sowing to the 1 $^{st.}$ flower and the 1 $^{st.}$ open boll was decreased by delaying sowing dates until 25 May as a result of increasing air temperatures. Zhiguo *et al.* (2011) reported that, early sowing dates significantly increased fiber strength. Wenqing *et al.* (2012) revealed that planting cotton early on (27 April) had significantly increased the number of sympodia on the main-stem, the number of open bolls per plant, boll weight, seed index,, lint percentage, earliness percentage and seed cotton yield, per plant and feddan, as compared with late sowing on (25 May).

Growth regulators are one of the most important factors that affect crop growth and yield. It is well known that vegetative characters, yield and its components and earliness measurements of cotton are governed by many environmental factors such as planting date which ranks high among the important factors affecting cotton production, while growth regulators application to cotton plants can modify some developmental activities such as boll setting in relation to yield and yield components.

Stephen *et al.* (2007) found that the application of mepiquate chloride (PIX) increased the yield and its components, *i.e*, the number of open bolls per plant, boll weight and yield per plant. Emara *et al.* (2009) reported that, the final plant height at harvest, length of internodes, days to appearance of the first flower and first boll were decreased significantly in the case of plant treatment by Mepiquate chloride. While,the number of open bolls per plant, seed cotton yield per plant and per feddan, and micronaire reading were increased significantly by applying Mepiquate chloride, number of fruiting branches and seed index were increased by mepiquate chloride in one season only. The number of nodes per plant, boll weight, number of plants at harvest, lint percentage, uniformity ratio, fiber strength, fiber elongation percentage, reflectance and yellowness were insignificantly affected. Shahzad *et al.* (2012) indicated that PIX and Naphthalene acetic acid significantly affected the volume of bolls and yield of cotton whereas, the use of 50 ppm PIX gave the highest number of open bolls/ plant, boll weight, seed index and earliness percentage.

The main objective of this study was to investigate the effect of different sowing dates and some growth regulators on growth and earliness traits, yield and fiber properties of Giza 92 cotton cultivar.

2. MATERIALS AND METHODS

Two field experiments were carried out at the Agriculture Experiment and Research Station, Faculty of Agriculture, Cairo University, Giza for two seasons (2010 and 2011), to study the effect of three sowing dates (25 March, 25 April, and 25 May) and three growth regulators; Indole acetic acid (IAA) at the rates of 50, 100 and I50 ppm, Naphthalene acetic acid (NAA) at the rates of 10, 20 and 30 ppm and Mepiquate chloride (PIX) at the rates 50, 100 and I50 ppm on growth, yield and fiber quality. The spraying time was at pine head square, at the beginning of flowering and after flowering by two weeks on the Egyptian cotton variety (Giza 92). The experimental design was a split-plot with three replicates with sowing date in the main plots and growth regulators in the sub plots. Sub plot consisted of 6 ridges 60 cm apart and 4 meters long (14.4 m^2). All cultural practices were done as recommended for the region. Nitrogen (60 kg N/ fed) as ammonium nitrate (33.5%N) and potassium (48 kg K_2O / fed) as potassium sulphate (48% K_2O) were side dressed before the first and the second irrigations. Phosphorus (30 kg P_2O_5/fed) as super phosphate (15.5% P_2O_5) was broadcasted during seedbed preparation. The preceding crop was berseem in both seasons. Analysis of variance of different traits was preceded and the treatment means were compared by LSD as outlined by Sndecor and Cochran (1981). Ten plants were taken at random from each plot at 105 days from sowing to determine growth attributes and some yield components while seed cotton yield / feddan was determined on the basis of the yield per plot.

2.1.Recorded data:

2.1.1.Growth attributes

2.1.1.1.Plant height (cm).

2.1.1.2. Phenological stages, the number of days to the 1st bud, 1st flower and 1st open boll.

2.1.2. Yield and yield components

2.1.2. 1- Number of sympodial branches/plant.

2.1.2. 2- Number of open bolls / plant.

2.1.2. 3- Boll weight (gm): the average of 50 bolls weight picked at random from each plot.

2.1.2. 4- Seed index: as the weight of 100 seeds.

2.1.2. 5. Earliness percentage: percentage of seed cotton yield at the first pick to the total seed cotton yield / plot.

$$\text{Earliness \%} = \frac{\text{Seed cotton yield at first pick (kg)}}{\text{Total seed cotton yield (kg)}} \times 100$$

2.1.2. 6. Seed cotton yield / feddan: Determined from the three central ridges of each plot in kentar / fed. (Kentar = 157.50 kg.) .

2.1.3. Fiber properties

The following fiber properties were measured using Instrument (HVI).High volume fiber test system according to (A.S.T.M: D 46050 – 1998).

2.1.3. 1. Fiber length at upper half mean (U.H.M) mm.

2.1.3. 2. Fiber uniformity index (U.I).

2.1.3. 3. Fiber strength in gram / tex.

2.1.3. 4. Fiber elongation %.

2.1.3. 5. Fiber fineness. (micronair).

2.1.3. 6. Color attributes values.

All fiber tests were performed at the laboratories of the Cotton Research Institute, Agricultural Research Center, under constant conditions of temperature (70^{o}f ± 2) and relative humidity (65 % ± 2%).

3. RESULTS AND DISCUSSION

3.1.Effect of sowing date and growth regulators on

3.1.1. Growth attributes

3.1.1.1. Plant height

Data in Tables (1, 2 and 3) showed that, plant height in both seasons was significantly affected by sowing date. The shortest plants were produced by early planting, whereas the tallest plants were recorded by late sowing and the plant height tended to increase by delay planting date. The results indicated that late sown plants grew faster than early sown ones, which is evident that high temperature provided by late sowing enhanced stem elongation of cotton plants. Similar results were reported by El-Sayed (2005), Abd El-Twab (2006), Hakoomat *et al*. (2009) and Hayatullah *et al.* (2011). On the contrary, Ali and El-Sayed (2001), Munk (2001) and Wrather *et al*. (2008) reported that plant height was not significantly affected by planting date. Also, the present data showed that plant heights over the two seasons were significantly affected by growth regulator PIX at 150 ppm gave the shortest plants, whereas the tallest plants were recorded by the promising at 30 ppm NAA. The interaction between planting dates and growth regulators had a significant effect on plant height in both seasons where, the planting date in 25 May (late) and 30 ppm NAA gave the highest values of plant height in both seasons.

3.1.1.2. Days to first bud, flower and open boll

The data obtained in Tables (1, 2 and 3) revealed that, days from planting to the first bud, flower and open boll, were significantly affected by sowing dates, growth regulators and their interaction. Late planting brought the appearance of the first bud, first flower and first open boll early in the two growing seasons as compared to middle and early planting. This might be due to relatively low night temperature of early planting date at the beginning of the season which prolonged the period of the appearance of the first bud, flowering and bolling. Similar results were obtained by Emara *et al.* (2006), Abd El-Twab (2009) and Wenqing *et al.* (2012). Data also showed that the mean performance of PIX growth regulators at 50 ppm was superior in phenologyical stage which gave the best reading in all No. of days to 1^{st} bud, 1^{st} flower and 1^{st} open boll (23.11, 26.18), (43.37, 45.59) and (90.04, 95.44) in 2010 and 2011 seasons, respectively, Similar results were obtained by El-Sayed (2006) Zakaria *et al.* (2006) and Stephen *et al.* (2007). The differences between the use of 50 ppm PIX or 50 ppm IAA the not significant in the $1^{st.}$ open boll in the second season only. Use of 50 ppm PIX with sowing at 25 March decreased No. of days to appearance of the 1^{st} bud, the 1^{st} flower and the 1^{st} open boll in both seasons.

3.1.2. Yield and yield component

3.1.2.1. Number of sympodial branches/plant

Data in Tables (4, 5 and 6) showed that, the number of sympodial branches/plant was significantly affected by sowing date, growth regulators and the interaction between them. Early planting dates (25 March) increased the number of sympodial branches/plant as compared to middle and late planting. Similar results were obtained by William *et al.* (2012), Hakoomat *et al*. (2009) and Abd El-Twab (2009). Data also show that the growth regulator PIX at 50 ppm exhibited high value of the number of sympodial branches/plant followed by IAA at 50 ppm in the first season, while in the second season the use of 50 ppm IAA or 50 ppm PIX did not differ significantly in the value of the No. of sympodial branches/plant. While the growth regulator NAA at 30 ppm exhibited low value of mean performance of number of sympodial branches/plant in both seasons. The obtained results are in agreement with those recorded by Shahzad *et al.* (2012), Emara *et al.* (2009), Elayan. (2008 b), Sawan and

Table (1): Main effects of sowing dates and growth regulator treatments on plant height and some phenologycal stages of cotton during 2010 & 2011 seasons.

Main effects	Plant height (cm)		Days to first					
			Bud		Flowers		Open boll	
	1st Season	2nd Season	1st Season	2nd Season	1st Season	2nd Season	1st Season	2nd Season
A- Sowing dates								
25- Mar.	124.07	129.73	26.34	27.94	48.49	50.36	92.31	97.22
25-Apr.	131.59	135.07	28.31	29.56	51.70	53.37	96.43	99.96
25- May	137.46	143.22	29.71	33.00	55.71	57.53	99.13	102.33
L.S.D. 0.05	2.16	2.19	0.41	0.55	0.70	0.90	1.10	1.21
B- Growth regulators								
IAA 50 ppm	130.31	135.22	30.52	30.22	51.00	52.82	91.75	94.11
IAA 100 ppm	134.39	139.67	31.04	30.53	52.81	54.54	95.01	97.44
IAA 150 ppm	142.09	146.89	31.58	31.07	55.03	56.20	98.77	101.67
NAA 10 ppm	132.22	137.29	27.42	31.91	55.28	57.42	94.23	97.78
NAA 20 ppm	137.67	142.89	29.11	32.78	57.94	59.34	99.24	103.00
NAA 30 ppm	146.07	149.44	29.81	33.65	59.89	61.54	105.20	107.00
PIX 50 ppm	124.52	131.11	23.11	26.18	43.37	45.59	90.04	95.44
PIX 100 ppm	119.62	127.44	25.11	27.01	45.12	47.22	93.91	99.22
PIX 150 ppm	112.48	120.96	25.37	28.02	47.25	49.10	95.46	102.89
L.S.D. 0.05	1.47	1.51	1.10	1.21	1.30	1.37	1.23	1.53

Sakr. (2008). The planting date in 25 March (early) and growth regulator (PIX) at 50 ppm gave (early) and growth regulator (PIX) at 50 ppm gave the highest values in the first season only, while in the second season planting in 25 March and the use of 50 ppm IAA gave the highest value on the No. of sympodial branches/plant. These results are rather expected as the seed cotton yield / plant was increased by early planting.

3.1.2.2. Number of open bolls per plant

Data presented in Tables (4, 5 and 6) revealed that sowing date and growth regulators exerted significant effects on the number of open bolls/ plant in both seasons. There was a tendency of increasing the number of bolls per plant in favour of early planting as compared to middle and late plantings. Similar results were obtained by Zhiguo *et al*. (2011), Abd El-Twab (2009) and Elayan *et al.* (2006). The results indicted that the use of 50 ppm PIX exhibited the highest values of the number of bolls per plant (16.84, 17.41) (2010 and 2011 seasons), while NAA 30 ppm exhibited the lowest value of mean performance of the number of open bolls per plant. The obtained results are in agreement with those of Sawan and Sakr (2008), Jonathan and Stewart (2006) and Stephen *et al.* (2007). Early sowing (25 March) with 50 ppm PIX or 100 ppm PIX did not significantly differ in the No. of open bolls/ plant in the second season only, while in the first season the use of 50 ppm PIX with 25 March was superior in this trait.

3.1.2.3. Boll weight

Data presented in Tables (4, 5 and 6) showed that, boll weight was not significantly affected by sowing date, growth regulators in the two growing seasons. Delayed planting date from 25 March to 25 May decreased the boll weight. This could be due to that early sown plants were shorter than late sown ones and hence could partition more available photosynthetic, for boll growth and hence weight. Early sown plants also, afforded longer vegetative duration as was expressed in the larger number of days to flowering, therefore, more active photosynthates could have been preformed with relatively lower night temperature as well lower heat unit by early sown plants than by the late sown ones. Shorter plants are always having lower maintenance respiration than longer ones. The obtained results are in agreement with those recorded by Reddy *et al.* (1999), El-Sayed (2005), Emara *et al.* (2009) and Wenqing *et al.* (2012) and in disagreement with Boquet *et al.*

Table (2): The interactions between sowing dates and growth regulator treatments on plant height and some phenologycal stages of cotton during 2010 season.

Treatments		Plant height (cm)	No. of Days to		
Sowing dates(A)	Growth regulators (B)		1st Bud	1st Flower	1st Open boll
25-Mar.	IAA 50 ppm	122.61	29.34	47.20	88.13
	IAA 100 ppm	129.45	28.23	49.01	92.26
	IAA 150 ppm	137.75	28.00	51.56	95.30
	NAA 10 ppm	125.12	27.15	53.12	92.46
	NAA 20 ppm	132.15	26.52	55.10	97.10
	NAA 30 ppm	141.21	27.13	57.24	102.25
	PIX 50 ppm	116.03	22.52	40.00	84.71
	PIX 100 ppm	110.10	24.88	41.20	88.41
	PIX 150 ppm	102.22	23.30	42.00	90.16
25-Apr.	IAA 50 ppm	132.07	30.11	51.45	92.00
	IAA 100 ppm	133.26	31.36	52.23	95.33
	IAA 150 ppm	142.00	32.01	53.81	99.00
	NAA 10 ppm	133.13	26.56	54.50	94.11
	NAA 20 ppm	136.44	29.10	57.30	98.48
	NAA 30 ppm	145.00	30.11	59.25	105.00
	PIX 50 ppm	125.00	23.71	42.10	91.71
	PIX 100 ppm	122.33	25.25	45.00	95.00
	PIX 150 ppm	115.11	26.55	49.66	97.23
25-May	IAA 50 ppm	136.25	32.10	54.36	95.11
	IAA 100 ppm	140.46	33.52	57.20	97.45
	IAA 150 ppm	146.51	34.74	59.73	102.00
	NAA 10 ppm	138.41	28.54	58.22	96.11
	NAA 20 ppm	144.43	31.70	61.43	102.15
	NAA 30 ppm	152.00	32.20	63.17	108.36
	PIX 50 ppm	132.53	23.10	48.01	93.70
	PIX 100 ppm	126.43	25.21	49.17	98.33
	PIX 150 ppm	120.11	26.25	50.10	99.00
L.S.D. 0.05		2.75	1.02	1.25	2.33

Table (3): The interactions between sowing dates and growth regulator treatments on plant height and some phenologycal stages of cotton during 2011 season.

Treatments		Plant height (cm)	No. of Days to		
Sowing dates (A)	Growth regulators (B)		1^{st} Bud	1^{st} Flower	1^{st} Open boll
25-Mar.	IAA 50 ppm	129.67	27.75	49.66	92.00
	IAA 100 ppm	136.33	28.10	50.22	95.00
	IAA 150 ppm	143.33	29.16	52.20	98.00
	NAA 10 ppm	133.20	30.10	55.25	95.00
	NAA 20 ppm	138.00	30.85	57.14	99.67
	NAA 30 ppm	145.67	31.25	59.31	104.67
	PIX 50 ppm	120.33	24.15	42.14	94.00
	PIX 100 ppm	113.67	24.90	43.10	96.33
	PIX 150 ppm	107.33	25.20	44.20	100.33
25-Apr.	IAA 50 ppm	134.67	30.78	52.00	93.67
	IAA 100 ppm	136.00	30.00	54.10	97.33
	IAA 150 ppm	146.00	29.80	55.17	102.67
	NAA 10 ppm	136.00	31.41	57.00	97.67
	NAA 20 ppm	141.00	32.15	58.33	103.33
	NAA 30 ppm	146.67	33.40	60.27	107.00
	PIX 50 ppm	130.00	25.15	45.13	95.67
	PIX 100 ppm	127.00	26.20	48.20	99.33
	PIX 150 ppm	118.33	27.11	50.10	103.00
25-May	IAA 50 ppm	141.33	32.12	56.80	96.67
	IAA 100 ppm	146.67	33.50	59.31	100.00
	IAA 150 ppm	151.33	34.25	61.22	104.33
	NAA 10 ppm	141.67	34.23	60.00	100.67
	NAA 20 ppm	149.67	35.36	62.55	106.00
	NAA 30 ppm	156.00	36.30	65.03	109.33
	PIX 50 ppm	143.00	29.23	49.50	96.67
	PIX 100 ppm	131.33	30.22	50.35	102.00
	PIX 150 ppm	127.00	31.75	53.00	105.33
L.S.D. 0.05		2.93	1.22	1.37	2.50

Table (4): Main effects of sowing dates and growth regulator treatments on yield and yield component characters in 2010 &2011 seasons.

Main effects	Number of sympodial branches /plant		Number of open bolls /plant		Boll weight (gm.)		Seed index (gm.)		Earliness (%)		Seed cotton yield (Ken./fed)	
	1st Season	2nd Season	1st Season	2nd Season	1st Season	2nd Season	1st Season	2nd Season	1st Season	2nd Season	1st Season	2nd Season
A- Sowing dates												
25- Mar.	15.36	16.54	15.26	16.17	2.37	2.48	11.86	12.44	62.44	64.14	11.68	12.37
25-Apr.	13.62	15.93	13.07	14.08	2.30	2.42	11.04	11.43	61.37	62.78	11.12	11.54
25- May	11.59	12.74	11.52	12.45	2.26	2.37	10.37	10.95	59.95	61.39	10.54	11.00
L.S.D. 0.05	0.46	0.52	1.61	1.73	N.S.	N.S.	1.43	1.55	0.62	0.74	0.55	0.68
B- Growth regulators												
50 ppm	15.32	17.18	15.86	16.95	2.44	2.55	11.33	11.97	62.64	64.27	11.83	12.62
IAA 100 m	13.87	15.53	13.35	14.33	2.24	2.38	10.81	11.27	61.4	62.98	10.99	11.5
150 ppm	11.89	13.71	10.87	12.19	2.15	2.25	10.16	10.53	59.48	61.29	10.60	10.73
10 ppm	14.59	16.04	13.94	15.35	2.32	2.47	10.76	11.26	61.32	63.61	11.04	11.53
NAA 20 pm	11.86	14.29	12.39	13.32	2.14	2.36	10.02	10.72	59.83	61.5	10.31	10.83
30 ppm	10.52	12.72	10.25	11.22	2.03	2.11	9.64	10.18	58.50	60.44	9.60	10.32
50 ppm	16.37	17.14	16.84	17.41	2.58	2.65	12.72	13.55	60.04	65.08	12.72	13.32
PIX 100 ppm	14.60	15.38	13.94	14.66	2.48	2.61	12.06	12.74	62.84	63.96	11.86	12.34
150 ppm	12.67	13.65	12.09	12.67	2.39	2.48	11.75	12.24	61.21	61.83	11.07	11.51
L.S.D. 0.05	0.39	0.47	1.55	1.67	N.S.	N.S.	1.85	1.96	0.33	0.47	0.44	0.61

Table (5): The interactions between sowing dates and growth regulator treatments on yield and yield component characters 2010 season.

Treatments		Number of sympodial branches /plant	Number of open bolls /plant	Boll weight (gm.)	Seed index (gm.)	Earliness (%)	Seed cotton yield (Ken./fed)
Sowing dates (A)	Growth regulators (B)						
25-Mar.	IAA 50 ppm	17.10	18.43	2.52	11.83	63.80	12.55
	IAA 100 ppm	16.30	15.11	2.29	11.35	62.17	11.27
	IAA 150 ppm	13.81	12.23	2.18	10.52	60.63	10.92
	NAA 10 ppm	16.50	16.13	2.38	11.50	62.25	11.24
	NAA 20 ppm	13.05	14.61	2.17	10.20	61.17	10.89
	NAA 30 ppm	11.70	11.72	2.07	10.00	59.67	10.09
	PIX 50 ppm	18.45	19.50	2.68	13.76	65.50	13.45
	PIX 100 ppm	17.10	16.21	2.56	13.10	64.10	12.87
	PIX 150 ppm	14.23	13.44	2.44	12.86	62.63	11.89
25-Apr.	IAA 50 ppm	15.75	15.46	2.41	11.17	62.67	11.89
	IAA 100 ppm	13.88	13.30	2.23	10.89	61.93	11.15
	IAA 150 ppm	11.77	10.86	2.14	10.01	59.36	10.77
	NAA 10 ppm	14.56	13.53	2.31	10.95	61.40	11.00
	NAA 20 ppm	12.31	12.23	2.14	10.30	60.07	10.10
	NAA 30 ppm	10.85	10.41	2.02	9.93	58.50	9.80
	PIX 50 ppm	16.33	16.51	2.56	12.55	64.23	12.85
	PIX 100 ppm	14.45	13.46	2.46	12.01	62.97	11.70
	PIX 150 ppm	12.67	11.83	2.39	11.51	61.20	10.79
25-May	IAA 50 ppm	13.11	13.70	2.38	11.00	61.47	11.04
	IAA 100 ppm	11.43	11.65	2.20	10.20	60.10	10.56
	IAA 150 ppm	10.10	9.51	2.12	9.96	58.43	10.12
	NAA 10 ppm	12.72	12.15	2.26	9.84	60.32	10.89
	NAA 20 ppm	10.22	10.33	2.12	9.55	58.27	9.93
	NAA 30 ppm	9.00	8.63	2.00	9.00	57.33	8.91
	PIX 50 ppm	14.34	14.52	2.50	11.85	62.40	11.87
	PIX 100 ppm	12.26	12.15	2.42	11.08	61.47	11.00
	PIX 150 ppm	11.12	11.00	2.35	10.89	59.80	10.53
L.S.D. 0.05		0.78	1.35	0.22	1.35	3.70	1.80

Table (6): The interactions between sowing dates and growth regulator treatments on yield and yield component characters 2011 season.

Treatments		Number of sympodial branches /plant	Number of open bolls /plant	Boll weight (gm.)	Seed index (gm.)	Earliness (%)	Seed cotton yield (Ken./fed)
Sowing dates (A)	Growth regulators (B)						
25-Mar.	IAA 50 ppm	19.43	19.80	2.62	12.85	65.50	13.22
	IAA 100 ppm	18.25	17.10	2.42	11.75	64.07	12.35
	IAA 150 ppm	15.70	14.71	2.29	11.10	62.03	11.11
	NAA 10 ppm	18.41	17.13	2.56	11.92	64.83	12.33
	NAA 20 ppm	16.36	15.56	2.41	11.00	63.80	11.56
	NAA 30 ppm	14.27	12.36	2.14	10.52	61.70	10.92
	PIX 50 ppm	17.73	19.15	2.72	14.85	66.40	14.10
	PIX 100 ppm	15.52	16.30	2.67	14.10	65.20	13.10
	PIX 150 ppm	13.20	13.45	2.52	13.85	63.77	12.60
25-Apr.	IAA 50 ppm	17.80	16.33	2.54	11.86	64.30	12.84
	IAA 100 ppm	16.12	13.33	2.37	11.10	63.00	11.40
	IAA 150 ppm	14.32	11.82	2.25	10.38	61.43	10.98
	NAA 10 ppm	16.25	15.45	2.46	11.00	63.53	11.31
	NAA 20 ppm	14.21	13.16	2.36	10.86	61.43	10.93
	NAA 30 ppm	13.45	11.81	2.11	10.02	60.90	10.20
	PIX 50 ppm	18.55	17.86	2.64	13.50	65.47	13.01
	PIX 100 ppm	17.16	14.52	2.60	12.25	63.90	12.10
	PIX 150 ppm	15.48	12.46	2.48	11.87	61.07	11.07
25-May	IAA 50 ppm	14.31	14.73	2.48	11.20	63.00	11.80
	IAA 100 ppm	12.22	12.57	2.34	10.95	61.87	10.75
	IAA 150 ppm	11.11	10.05	2.21	10.10	60.40	10.10
	NAA 10 ppm	13.45	13.46	2.38	10.86	62.47	10.95
	NAA 20 ppm	12.30	11.24	2.31	10.30	59.27	10.01
	NAA 30 ppm	10.44	9.50	2.07	10.00	58.73	9.85
	PIX 50 ppm	15.13	15.21	2.60	12.30	63.37	12.86
	PIX 100 ppm	13.45	13.15	2.55	11.86	62.77	11.81
	PIX 150 ppm	12.27	12.10	2.43	11.00	60.67	10.86
L.S.D. 0.05		0.97	1.20	0.41	1.51	3.92	1.93

Table (7): Main effects of sowing dates and growth regulator treatments on fiber properties of cotton during 2010 & 2011 seasons.

Main effects		Fiber length UHM (mm)		Uniformity ratio (%)		Fiber elongation (%)	
		1st Season	2nd Season	1st Season	2nd Season	1st Season	2nd Season
A- Sowing dates							
25- Mar.		32.73	33.80	86.55	87.24	42.36	43.83
25-Apr.		31.90	32.85	85.33	85.99	41.72	41.95
25- May		30.94	31.83	84.96	85.31	40.73	41.08
L.S.D. 0.05		0.53	0.67	1.20	1.32	0.44	0.51
B- Growth regulators							
IAA	**50 ppm**	32.27	31.90	86.40	85.30	41.11	39.67
	100 ppm	31.90	32.13	85.31	85.33	40.23	41.80
	150 ppm	31.31	31.80	86.06	85.57	42.00	40.87
NAA	**10 ppm**	31.81	31.47	85.04	85.27	42.47	40.12
	20 ppm	32.00	31.90	86.26	85.20	40.31	40.80
	30 ppm	31.86	32.47	85.79	85.67	41.22	42.53
PIX	**50 ppm**	31.98	31.23	85.50	85.10	43.77	41.90
	100 ppm	31.81	32.30	85.07	85.47	41.29	41.93
	150 ppm	31.97	31.26	85.11	84.90	42.01	40.12
L.S.D. 0.05		N.S.	N.S.	N.S.	N.S.	N.S.	N.S.

(2003). The present data also show that the growth regulator PIX at 50 ppm followed by IAA 50 ppm exhibited high value and did not differ significantly in the mean performance of boll weight (2.58 ,2.65) and (2.44 ,2.55) in (2010 and 2011), respectively, while NAA at 30 ppm exhibited lower value of mean performance of boll weight. Similar results were obtained by Zakaria *et al.* (2006), Sawan and Sakr (2008) and Emara *et al.* (2009).The planting date in 25 March (early) and 50 ppm PIX gave the highest values of this character.

3.1.2.4. Seed index

Data in Tables (4, 5 and 6) showed that, the seed index was significantly affected by sowing date, growth regulators and the interaction between them in the two seasons. Delaying planting from 25 March to 25 May decreased seed index, where early planting gave the highest values of seed index as compared tO middle and late plantings. Seeds in early planting had more available photosynthates to filling than late sown ones. Similar results were obtained by Abd El-Twab (2009), Hakoomat *et al*. (2009) and Zhiguo *et al.* (2011). Data also show that the growth regulator PIX at 50 ppm followed by IAA at 50 ppm exhibited the highest values of mean performance of seed index, while NAA at 30 ppm exhibited lower value of mean performance of seed index. The obtained results are in agreement with those of Emara *et al.* (2009) and Shahzad *et al.* (2012). Use of 50 ppm PIX with 25 March or 25 April did not differ significantly in both seasons and gave the highest values in this character.

3.1.2.5. Earliness percentage

Data in Tables (4, 5 and 6) showed that, earliness % was significantly affected by sowing date, growth regulators and their interaction;

earliness percentage was decreased by delaying the date of planting. This might be due to early flowering and hence early boll maturity which was expressed in fewer numbers of days to flowering and to first open boll compared to late planted cotton. Similar results were obtained by Hayatullah *et al.* (2011), Zhiguo *et al*. (2011), and Wenqing *et al.* (2012). Concerning growth regulators, the data showed that, use of 50 ppm PIX was superior in earliness (%) in the second season only, while the use of 100 ppm PIX was

Table (8): Main effects of sowing dates and growth regulator treatments on fiber properties of cotton during 2010 & 2011 seasons.

Main effects	Fiber strength (gem/ tex)		Microniare reading		Values of color			
					Brightness		Yellowness	
	1st Season	2nd Season	1st Season	2nd Season	1st Season	2nd Season	1st Season	2nd Season
A- Sowing dates								
25- Mar.	7.38	7.48	3.00	2.78	71.46	73.71	9.04	8.41
25-Apr.	6.94	7.21	3.27	3.07	71.20	73.60	9.45	8.92
25- May	6.73	7.07	3.40	3.26	69.12	70.61	9.91	9.53
L.S.D. 0.05	0.12	0.14	0.26	0.37	0.11	0.45	0.23	0.30
B- Growth regulators								
50 ppm	7.22	7.40	3.32	3.15	70.74	72.55	9.54	8.82
IAA 100 ppm	7.25	6.50	3.15	3.17	70.53	72.98	9.32	8.62
150 ppm	6.14	7.67	3.22	3.20	69.78	73.57	9.69	8.92
10 ppm	7.01	6.10	3.21	3.20	70.63	72.36	9.37	8.99
NAA 20 ppm	7.36	7.63	3.33	3.07	71.00	73.52	9.65	9.18
30 ppm	7.08	7.05	3.20	3.94	70.60	72.29	9.30	9.05
50 ppm	7.24	7.00	3.16	3.27	70.70	72.61	9.51	8.86
PIX 100 ppm	6.94	7.03	3.22	3.22	70.31	71.31	9.29	9.07
150 ppm	6.92	7.22	3.22	3.17	71.04	72.57	9.53	9.04
L.S.D. 0.05	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.

superior in the first season. Use of 50 ppm PIX with sowing at 25 March did not differ significant with sowing at 25 April in this trait in both seasons.

Similar results were obtained by Zakaria *et al.* (2006), Elayan (2008 b) and Shahzad *et al.* (2012). The planting date in 25 March (early) and PIX at 50 ppm growth regulator gave the highest values of this character.

3.1.2.6. Seed cotton yield per feddan

Data in Tables (4, 5 and 6) showed that, seed cotton yield per feddan was significantly affected by sowing date, growth regulators and the interaction between them. Early planting dates increased seed cotton yield per feddan. This increase is mainly due to the increase of the number of open bolls per plant and increase in boll weight. Increased yield was recorded at early planting date as compared to middle and late planting. Similar results were obtained by Abd El-Twab (2009), Wenqing *et al.* (2012) and William *et al.* (2012). Data also show that the growth regulator PIX at 50 ppm gave the highest value of seed cotton yield /fed., in both seasons followed by IAA at 50 ppm, while the growth regulator NAA at 30 ppm exhibited a lower value of mean performance of seed cotton yield /fed. The obtained results are in agreement with those recorded by Stephen and Hensley (2007), Emara *et al.* (2009) and Shahzad *et al.* (2012). The planting date in 25 March (early) and growth regulator PIX at 50 ppm gave the highest values in this character in the first season, while in the second season the use of 50 ppm PIX with sowing at 25 March did not differ significantly with sowing at 25 April. These results are rather expected as the seed cotton yield / plant was increased by early planting.

3.1.3. Fiber properties

Fiber characters include length measurements fiber length (UHM) and uniformity index, fiber bundle tensile properties (fiber strength and elongation) micronaire reading and color attribute values (Rd% and +b). The mean values of sowing date and growth regulators in the two seasons 2010 and 2011 are presented in Tables (7 and 8). Sowing date had a significant effect on fiber properties whereas planting cotton in early date (25 March) gave the highest values in fiber length, uniformity ratio, fiber elongation, fiber strength

and the best in micronire reading in both seasons. Fiber properties were decreased by delaying planting date. Similar results were obtained by Emara *et al.* (2006), Elayan *et al.* (2008 a), Zhiguo *et al.* (2011) and Wenqing *et al.* (2012). Data also showed that growth regulators had no significant effect on fiber properties in the two seasons. Similar results were obtained by Wahdan (2000), Frank *et al.* (2005), El-Sayed (2006), David and James (2008), Sawan and Sakr (2008), Emara *et al.* (2009) and Shahzad *et al.* (2012) and on the contrary, Steve *et al.* (2003) and Johnson (2005) indicated that mepiquate chloride increased fiber length, fiber elongation, maturity ratio and micronaire reading.

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تأثير بعض منظمات النمو تحت مواعيد زراعة مختلفة علي النمو و المحصول فى القطن

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ملخص

أجري هذا البحث بمحطة التجارب و البحوث الزراعية بكلية الزراعة جامعة القاهرة خلال موسمي (2010- 2011) لدراسة تأثير م يعاد الزراعة (25 مارس ، 25 ابريل ، 25 مايو) و بعض منظمات النمو (أندول أستيك أسيد (IAA) بمعدل 50، 100 ، 150 جزء في المليون ، نفثالين أستيك أسيد (NAA) بمعدل10، 20 ، 30 جزء في المليون، المبيكوات كلوريد (PIX) بمعدل 50 ، 100 ، 150 جزء في المليون) وتم رش النباتات في مرحلة ظهور الوسواس و عند بداية التزهير وبعد التزهير بأسبوعين لصنف القطن المصري (جيزة 92) . و كان التصميم المستخدم هو القطع المنشقة في 3 مكررات حيث وضعت مواعيد الزراعة في القطع الرئيسية و منظمات النمو في القطع المنشقة . و كانت أهم النتائج المتحصل عليها فيما يلي:-

أثر ميعاد الزراعة معنويا في كلا من الصفات الخضرية و المحصول و مكوناته و الصفات التكنولوجية حيث ادي تأخير ميعاد الزراعة الي زيادة معنوية في طول النبات وعدد الأيام اللازمة لظهور أول برعم ، زهرة ، لوزة متفتحة.

تفوق ميعاد الزراعة المبكر (25 مارس) في عدد الافرع الثمرية / النبات و عدد اللوز المتفتح علي النبات و دليل البذرة و نسبة التبكير و محصول القطن الزهر للفدان.كما أثر ميعاد الزراعة المبكر في طول التيلة، نسبة الانتظام في الطول و المتانة و الاستطالة و درجة بياض اللون و درجة الاصفرار في كلا الموسمين.

اثرت منظمات النمو معنويا علي الصفات الخضرية و المحصولية حيث تفوق المبيكوات كلوريد (PIX) بمعدل 50 جزء في المليون في محصول القطن الزهر للفدان و أعطاء أقل عدد أيام لازمة لظهور أول برعم ، زهرة ، لوزة في الموسمين وكذلك تفوق أيضا في دليل البذرة و نسبة التبكير بينما تفوق نفثالين أستيك أسيد NAA بمعدل 30 جزء في المليون في طول النبات .و لم تتأثر الصفات التكنولوجية بمنظمات النمو المختلفة حيث كانت الاستجابة غير معنوية.

كان التفاعل بين مواعيد الزراعة و منظمات النمو ذو تأثير معنوي علي معظم قيم الصفات التي تخت الدراسة حيث تفوق استخدام 50 جزء في المليون من الـ PIX و الزراعة في 25 مارس ، 25 ابريل علي باقي معاملات منظمات النمو في صفات عدد الافرع الثمرية ، عدد اللوز ، دليل البذرة ، نسبة التبكير و محصول القطن الزهر / فدان في الموسم الاول بينما في الموسم الثاني تفوقت معاملة 50 جزء في المليون من الـ PIX أو 100 جزء في المليون من الـ PIX مع الزراعة في 25 مارس و اعطت احسن القراءات للمحصول و مكوناتة.