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EFFECT OF SOME GROWTH RETARDANT TREATMENTS ON THE PRODUCTIVITY AND QUALITY OF COTTON AT EARLY AND LATE PLANTINGS

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ABSTRACT: *Two separate field experiments were carried out at El-Gemmeiza Agricultural Research Station at El-Gharbiya Governorate, Egypt during 2008 and 2009 seasons to study the effect of growth retardant treatments (topping dates, foliar application with pix or an aqueous filtered solution of P_2O_5 + K_2O) in comparison with untreated plants on growth attributes, yield and fiber quality of Giza 86 cotton cultivar under early planting date (first experiment) and late planting date (second experiment). Each experiment included 8 treatments, i.e. (1) Control "untreated plants", (2) topping plants at the formation of 10 fruiting branches/plant, (3) topping at the formation of 12 fruiting branches/plant, (4) topping at the formation of 14 fruiting branches/plant, (5) application of pix twice at squaring and at flowering stages, (6) application of pix twice at flowering stage and after 2 weeks later, (7) application of pix three times at squaring and flowering stages and after 2 weeks and (8) application of an aqueous filtered solution of P_2O_5 + K_2O three times at squaring and flowering stages and after 2 weeks later.*
The obtained results were as follows:

First experiment (early planting on 1st April):

1) *All growth retardant treatments showed significant increase in all studied growth attributes (dry weight/plant, leaf area/plant, net assimilation rate and crop growth rate) as compared with untreated plants throughout both seasons. In general, plants which sprayed with pix twice (at squaring and flowering stages and after 2 weeks later) gave the highest values of dry weight/plant, net assimilation rate and crop growth rate. While topping plants at the formation of 14 fruiting branches/plant gave the highest leaf area/plant as compared with the other treatments under study in both seasons.*
2) *All tested growth retardant treatments gave significant decrease in plant height and number of fruiting branches/plant and significant increase in seed cotton yield/fed. and its components (number of open bolls/plant, boll weight and seed index) in both seasons and lint percentage in the second season only as compared with untreated plants (control). Results showed that spraying plants with pix three times (at squaring and at flowering stages and after two weeks later) produced the highest significant values of seed cotton yield/fed. and most of the studied yield components followed by topping at the formation of 14 fruiting branches/plant as compared with the other treatments under study in both seasons.*
3) *Results indicated that the studied fiber quality traits (upper half mean length, uniformity index, fiber strength, fiber elongation and micronaire value) insignificantly affected by any growth retardant treatments under study comparing with untreated plants in both seasons.*

Second experiment (late planting on 1st May):

1) *All growth retardant treatments showed significant increase in all studied growth attributes (dry weight/plant, leaf area/plant, net assimilation rate and crop growth rate) as compared with the control treatment in both seasons. Plants which sprayed with pix or an aqueous filtered solution of (5kg calcium superphosphate + 5kg potassium sulphate/fed.) three times (at squaring and at flowering stages and after 15 days later)*

gave the highest values of dry weight/plant at the three growth ages, net assimilation rate and crop growth rate at the first growth stage in both season. Topping plants at the formation of 12 or 14 fruiting branches/plant produced the highest values of net assimilation rate and crop growth rate at the second growth stage in both seasons as compared with the other treatments under study.

2) *All studied growth retardant treatments gave significant decrease in plant height at harvest and number of fruiting branches/plant and significant increases in seed cotton yield/fed. and its components (number of open bolls/plant and boll weight) in both seasons, seed index and lint percentage in the second season only as compared with untreated plants (control). The results indicated that spraying plants with pix three times gave the highest significant values of seed cotton yield/fed. and its components followed by topping plants at the formation of 12 fruiting branches/plant comparing with the other treatments.*

3) *Results indicated that the studied growth retardant treatments gave insignificant effect on fiber quality properties as compared with untreated plants (control) in both seasons.*

Key words: Cotton, Planting Date, Topping, Pix, Growth, Yield, Fiber quality.

INTRODUCTION

In Egypt, Giza 86 cotton variety cultivated in large scale of Delta. Excessive vegetative growth is a frequent trouble observed in cotton fields for this variety that may cause high fruit shedding, late maturity and low cotton yields. Therefore, many efforts have been paid to control the plant vegetative growth and to reduce cotton yield losses with either topping or chemical application treatments. Abd El-Aal, *et al.* (1993) reported that topping plants generally increased number of flowers, boll set and sympodia, seed cotton yield/fed. and yield components, while it decreased plant height. Also Abd El-Aal, *et al.* (1996) indicated that transplanting plants topped at formation of 8 to 10 fruiting branches per plant (13 to 21 July) gave the highest values in the number of open bolls, seed cotton yield per plant and /fed compared with the other dates of topping and control treatment. Moreover, they found that the heavier bolls and shorter plants were obtained by plants topped at formation of 6 fruiting branches per plant. Abdel Malak, *et al.* (1997) stated that late topping at formation of 10 or 12 sympodia/plant decreased plant height, while increased numbers of boll per plant and seed cotton yield/fed. Abou El-Nour, *et al.* (2001) indicated that excessive vegetative growth of plants due to application of high amount of N fertilizer (75 kg N/fed.) can be controlled by foliar application of 15.5% P_2O_5 or topping the plants after 105 days from sowing date and consequently led to a stimulation of yield components characters and caused high seed cotton yield. Liang, *et al.* (2007) showed that the topping increased cotton yield due to the depression of cotton shedding rate. Topping main stem apex is an effective tool to avoid the further development of such trouble but it is a quite difficult practice to be applied at the commercial scale in case of wide cotton areas. Gebaly, *et al.* (2008) found that mechanical topping decreased growth characters. However, the fiber properties were not affected by mechanical topping.

It is worthmentiong that the cotton plants grown in fertile soil, well watered and suitable environment produces excessive vegetative growth. Excessive growth reduces seed cotton yields and encourages attack of insect-pests. El-Shahawy (1999) found that spraying Pix (retardant growth regulator) 2 or 4 times with 250 or 500 cm/fed. increased number of sympodia, total dry matter, number of open bolls, boll weight, lint percentage, seed index and seed cotton yield while it decreased plant height compared with

untreated plants. Li and Chen (2000) found that topical spraying of Pix increased boll size and accelerated the maturity of bolls. Thus, spraying may reduce the need for manual topping and increase cotton yield. El-Beily, *et al.* (2001) found that application of pix at a level of 250 or 500 ml/feddan four times significantly reduced plant height, number of fruiting branches per plant, leaf area per plant and leaf area index as compared with untreated plants. El-Tabbakh (2002) found that Pix at concentrations up to 3 liter/ha decreased plant height, number of vegetative branches/plant, lint percentage, while significantly increased the number of fruiting branches/plant, seed cotton yield/ha, number of total bolls/plant, and seed and earliness indices. Kassem and Namich (2003) found that spraying cotton plants with mepiquat chloride decreased plant height and internodes length but increased number of open bolls/plant and seed cotton yield/fed. Buttar and Navneet (2004) found that mepiquat chloride reduce vegetative growth such as plant height, internodal distance but increase number of sympodia/plant, number of bolls/plant, seed index, boll weight and seed cotton yield. Kumar, *et al.* (2005) found that spraying Pix at 90 days on hybrid cotton reduced plant height, leaf area but stimulated the photosynthesis which resulted in higher yield and boll weight. Muhammad, *et al.* (2007) found that application Pix significantly reduced plant height, but increased the number of bolls set, dry weight of stem, branches and roots per plant as well as seed index, number of open bolls and seed cotton yield/fed. However, the number of internodes and fruiting branches, lint % and earliness were not affected by spraying Pix. Therefore, the main purpose of this study was to investigate the efficiency of hand topping, growth regulator (pix) and spraying an aqueous filtered solution of P_2O_5 + K_2O in controlling vegetative growth at early and late planting dates of cotton plant and their reflection on productivity and quality of seed cotton yield.

MATERIALS AND METHODS

Two separate field experiments were conducted in El-Gemmeiza Agricultural Research Station at El-Gharbiya Governorate, Egypt during 2008 and 2009 seasons to study the effect of topping and some chemical application treatments on growth attributes, yield and fiber quality of cotton at early and late plantings.

Each experiment included eight treatments in every season which are follows:

1- Control (untreated plants).
2- Topping plants at the formation of 10 fruiting branches/plant.
3- Topping plants at the formation of 12 fruiting branches/plant.
4- Topping plants at the formation of 14 fruiting branches/plant.
5- Application of pix twice at squaring and flowering stages.
6- Application of pix twice at flowering stage and after 2 weeks later.
7- Application of pix three times at squaring and flowering stages and after 2 weeks later.
8- Application of an aqueous filtered solution of P_2O_5 + K_2O three times at squaring and flowering stages and after 2 weeks later.

The trade name of active ingredient and levels of the tested substances are as follows:

Trade name	Active ingredient	Tested level
Pix	1,1dimethyl piperidinium chloride (mepiquat chloride)	500 cm^3/fed.
Calcium superphosphate (15.5% P_2O_5)	Phosphorus Pentoxide P_2O_5	An aqueous filtered solution of 5 kg calcium super phosphate + 5 kg potassium sulphate/fed.
Potassium sulphate (48% K_2O)	Potassium Oxide K_2O	

The experimental design in each experiment was randomized complete blocks with four replications. The experimental plot included 7 ridges (6.0 m long and 0.70 m apart) occupying an area of 29.4 m^2. Cotton seeds (Giza 86 variety) were planted at two planting dates on 1st of April for early planting and 1st of May for late planting in both seasons. Hills were spaced at 25 cm within rows and seedlings were thinned at 2 plants/hill. Phosphorus fertilizer as ordinary superphosphate (15.5% P_2O_5) at the rate of 22.5 kg P_2O_5/fed. was incorporated during seed bed preparation. Soil analysis of the experimental site in the two seasons is shown in Table (1).

Nitrogen fertilizer in the form of ammonium nitrate (33.5% N) at the rate of 45 kg N/fed. was applied in two equal doses, immediately before the first and the second irrigations. Potassium fertilizer in the form of potassium sulphate (48% K_2O) at the rate of 24 kg K_2O/fed. was side-dressed in a single dose before the second irrigation. Standard agricultural practices were followed throughout the growing seasons. Three samples were taken from each experimental plot at 80, 100 and 120 days after sowing to study the growth attributes. Each sample included four plants of two guarded hills of the middle rows and carefully uprooted and was immediately transferred to the laboratory to determine the following growth attributes:

1. Top dry weight/plant (g).
2. Leaf area (LA), the disc method was used according to Johnson (1967). The cross sectional area of the punch used was 0.015386 dm^2.

   LA/plant (dm^2) = (Leaf dry weight/plant x disc area)/disc dry weight.
3. Net assimilation rate (NAR), the net assimilation rate of plant at an instant in time (t) is defined as the increase of plant material per unit of assimilation surface per unit of time. It was calculated according to the following formula (Thorne, 1960).

   $$NAR\ (g/dm^2/week) = ((W_2 - W_1)(L_nA_2 - L_nA_1))/((A_2 - A_1)(t_2 - t_1)).$$

   Where, W_1, W_2, A_1 and A_2 = Total dry weight/plant (g), leaf area/plant (dm^2) at t_1 and t_2 (date of samples) in weeks, respectively. Ln = The normal logarithm (2.7185).
4. Crop growth rate (CGR), crop growth rate of a unit area of a canopy over at any instant in time (t) is defined as the increase of plant material per unit of time. It was calculated according to the following formula (Watson, 1958).

   CGR = NAR x LAI (g/dm^2/week).

At harvest, ten guarded plants were randomly taken from the central row of each plot to determine plant height (cm), number of fruiting branches/plant, boll weight (g), lint% and seed index (g). Seed cotton yield (ken./fed.) was estimated as the weight of seed cotton yield (kilogram) picked from the five middle rows in each experiment plot collected from two picks, then converted to yield per fedden in kentar (Kentar = 157.5 kg.). The studied fiber quality traits were fiber length parameters (upper half mean length UHM (mm) and uniformity index %), fiber bundle tensile strength (fiber strength g/tex. and fiber elongation %) and micronaire value which were measured by using High Volume Instrument (HVI) according to A.S.T.M. D-4605 (1986). All collected data were subjected to statistical analysis as proposed by Gomez and Gomez (1984) and means were compared by LSD at 5% level of probability.

Table (1): Soil analysis* of the experimental site in the two seasons.

Properties	2008 season	2009 season
Texture	Clay loam	Clay loam
Ph	7.6	7.5
EC mmhos/ cm.	0.27	0.48
EC Salts %	0.09	0.15
$CaCO_3$ %	1.2	1.7
Cations Meq/L		
Ca	0.8	1.0
Mg	0.36	0.4
Na	1.5	3.5
K	0.2	0.12
Anions Meq/L		
CO_3	-	-
HCO_3	0.8	0.7
Cl	0.6	1.4
SO_4	1.4	2.7
Available N (ppm)	18	30
Available P (ppm)	16	15
Available K (ppm)	360	354
Available Fe (ppm)	16	44.0
Available Mn (ppm)	18	23.0
Available Zn (ppm)	2.4	1.3
Available Cu (ppm)	4.0	3.9

*Optimizing of Fertility Laboratory of Damanhour, El- Behira Governorate.

RESULTS AND DISCUSSION

First experiment (early planting date)

Growth attributes:

Dry weight/plant at 80, 100 and 120 days after sowing was significantly affected by the tested treatments in both seasons (Table 2). The highest values were obtained from spraying pix twice (at squaring and flowering stages) at 80 days old and from spraying pix three times at 100 and 120 days old, while the lowest values were obtained from topping at the formation of 10 fruiting branches at 80 and 100 days in both seasons and at 120 days old in the first season and from untreated plants at 120 days in the second season.

Leaf area/plant at the three plant ages was significantly affected by the tested treatments in both seasons (Table 2), in favour of topping plants at the formation of 14 fruiting branches/plant and the control treatments, while in general the lowest values of this trait was obtained from topping plants at the formation of 10 fruiting branches/plant.

Table (2): Effect of some growth retardant treatments on dry weight (g/plant) and leaf area (dm^2/plant) of cotton during 80, 100 and 120 days after sowing in 2008 and 2009 seasons at early planting.

Treatments	Dry weight (g/plant)			Leaf area (dm^2/plant)		
	80 days	100 days	120 days	80 days	100 days	120 days
Season 2008						
Control (untreated)	43.00	61.43	104.27	22.33	26.08	27.67
Topping at 10 fruiting branches/plant	42.77	59.47	101.43	21.61	23.77	26.18
Topping at 12 fruiting branches/plant	43.10	62.07	108.43	22.11	25.01	26.76
Topping at 14 fruiting branches/plant	43.00	62.20	109.63	22.82	26.85	27.82
Pix twice (Squaring + flowering)	52.10	73.80	120.77	20.86	25.96	27.00
Pix twice (Flowering + 2 weeks later)	43.03	69.27	114.57	22.14	26.00	27.12
Pix 3 times (Squaring + Flowering + 2 weeks later)	51.60	74.97	123.70	21.62	25.48	26.75
P_2O_5+ K_2O three times	50.27	71.63	115.23	21.92	26.86	27.50
LSD at 0.05	1.43	2.10	2.35	0.85	0.95	1.05
Season 2009						
Control (untreated)	42.17	59.99	99.65	20.67	25.20	26.55
Topping at 10 fruiting branches/plant	41.43	58.73	101.68	19.02	23.55	25.35
Topping at 12 fruiting branches/plant	41.70	60.13	109.37	19.82	24.00	25.12
Topping at 14 fruiting branches/plant	41.24	60.06	110.20	20.92	26.15	28.66
Pix twice (Squaring + flowering)	47.93	71.90	105.47	19.76	24.32	25.86
Pix twice (Flowering + 2 weeks later)	41.55	67.32	107.01	20.12	24.74	25.26
Pix 3 times (Squaring + Flowering + 2 weeks later)	47.70	72.55	118.50	19.75	23.68	25.21
P_2O_5+ K_2O three times	45.69	70.31	110.17	20.22	24.15	26.24
LSD at 0.05	1.39	1.24	1.61	0.72	0.95	0.75

Net assimilation rate was significantly affected by the tested treatments in both seasons at the two growth stages (Table 3), in favour of spraying pix twice at flowering stage and 2 weeks later at the first growth stage in both seasons. However, the highest values at the second growth stage were obtained from spraying Pix three times and when topping was done at the formation of 12 fruiting branches/plant in 2008 and 2009 seasons, respectively. Reversely, the lowest values of that trait were obtained from the control treatment at the first stage in the second season and at the second growth stage in the first season and from topping plants at the formation of 10 fruiting branches/plant in the first season at the first growth stage or spraying pix twice at the second stage in second season.

Crop growth rate was significantly affected by the tested treatments in both seasons at the two growth stages (Table 3). At the first growth stage, the highest values (1.001 and 0.994 g/dm^2/week) were obtained from spraying pix twice (at flowering stage and two weeks later) in

the first and second seasons, respectively. While, the lowest values (0.638 and 0.661 g/dm^2/week) were obtained from topping plants at the formation of 10 fruiting branches /plant treatment in the first and second seasons, respectively. At the second growth stages, the highest values (1.854 and 1.915 g/dm^2/week) were obtained from spraying pix three times and from topping plants at the formation of 14 fruiting branches /plant in the first and second seasons, respectively. However, the lowest values (1.602 and 1.280 g/dm^2/week) were obtained from spraying pix twice (at squaring and flowering stages) treatment in the first and second seasons, respectively.

Table (3): Effect of some growth retardant treatments on net assimilation rate/plant (g/dm^2/week) and crop growth rate/plant (g/dm^2 /week) during the period of 80-120 days after sowing, as well as plant height (cm) and no. of fruiting branches/plant at harvest of cotton in 2008 and 2009 seasons at early planting.

Treatments	Net assimilation rate /plant (g/dm^2/week)		Crop growth rate/ plant (g/dm^2/week)		Plant height at harvest (cm)	No. of fruiting branches/plant (at harvest)
	First stage (80-100 days)	Second stage (100-120 days)	First stage (80-100 days)	Second stage (100-120 days)		
Season 2008						
Control (untreated)	0.254	0.532	0.702	1.633	174.00	18.50
Topping at 10 fruiting branches/plant	0.246	0.561	0.638	1.602	109.67	10.00
Topping at 12 fruiting branches/plant	0.269	0.597	0.725	1.767	121.00	12.00
Topping at 14 fruiting branches/plant	0.258	0.579	0.733	1.809	130.67	14.00
Pix twice (Squaring + flowering)	0.310	0.592	0.829	1.794	156.67	15.83
Pix twice (Flowering + 2 weeks later)	0.364	0.569	1.001	1.727	165.67	17.50
Pix 3 times (Squaring + Flowering + 2 weeks later)	0.331	0.621	0.890	1.854	140.33	16.67
P_2O_5+ K_2O three times	0.293	0.536	0.817	1.664	165.67	18.33
LSD at 0.05	0.02	0.04	0.06	0.18	3.50	0.48
Season 2009						
Control (untreated)	0.259	0.511	0.672	1.497	160.25	16.45
Topping at 10 fruiting branches/plant	0.272	0.586	0.661	1.638	112.38	10.05
Topping at 12 fruitlng branches/plant	0.281	0.670	0.704	1.879	120.50	12.02
Topping at 14 fruiting branches/plant	0.268	0.611	0.721	1.915	133.25	14.02
Pix twice (Squaring + Flowering)	0.363	0.446	0.915	1.280	135.50	15.23
Pix twice (Flowering + after 2 weeks)	0.384	0.529	0.994	1.526	138.38	15.43
Pix 3 times (Squaring + Flowering+after2 weeks)	0.382	0.627	0.949	1.752	125.38	15.35
P_2O_5+ K_2O three times	0.371	0.528	0.940	1.521	151.88	16.40
LSD at 0.05	0.04	0.08	0.10	0.24	7.18	0.73

Plant height and number of fruiting branches/plant at harvest were significantly affected by the tested treatments in both seasons (Table 3). The highest values of those traits were obtained from the control treatment followed by spraying an aqueous filtered solution of P_2O_5 + K_2O three times, while the lowest values were obtained from topping at the formation of 10 fruiting branches/plant.

Yield and its components:

Data in Table (4) showed that the tested treatments gave a significant effect on number of open bolls/plant, boll weight, seed index and seed cotton yield/fed. in both seasons and lint % in the second season only.

Table (4): Effect of some growth retardant treatments on seed cotton yield and yield components in 2008 and 2009 seasons at early planting.

Treatments	No. of open bolls/plant	Boll weight (g)	Seed index (g)	Lint (%)	Seed cotton yield (kentar/fed.)
Season 2008					
Control (untreated)	18.17	2.76	10.37	39.17	9.65
Topping at 10 fruiting branches/plant	20.73	2.85	10.48	39.27	11.20
Topping at 12 fruiting branches/plant	21.83	2.90	10.38	39.67	11.94
Topping at 14 fruiting branches/plant	22.18	2.95	10.81	39.27	12.40
Pix twice (Squaring + flowering)	20.87	2.87	10.67	39.43	11.86
Pix twice (Flowering + 2 weeks later)	19.03	2.83	10.61	39.37	11.04
Pix 3 times (Squaring + Flowering + 2 weeks later)	22.73	2.98	10.93	39.70	12.82
P_2O_5 + K_2O three times	22.00	2.90	10.65	39.27	11.96
LSD at 0.05	0.42	0.06	0.10	N.S	0.12
Season 2009					
Control (untreated)	18.02	2.74	11.07	38.25	9.26
Topping at 10 fruiting branches/plant	21.39	2.94	11.37	38.85	10.46
Topping at 12 fruiting branches/plant	21.60	3.00	11.10	39.35	11.30
Topping at 14 fruiting branches/plant	22.02	3.00	11.70	39.27	11.50
Pix twice (Squaring + flowering)	20.08	2.90	11.53	39.20	10.36
Pix twice (Flowering + 2 weeks later)	19.24	2.90	11.47	38.93	10.26
Pix 3 times (Squaring + Flowering + 2 weeks later)	22.32	3.00	11.80	39.80	11.80
P_2O_5 + K_2O three times	21.70	2.96	11.50	39.13	11.08
LSD at 0.05	0.05	0.02	0.25	0.32	0.16

Applying pix three times gave the highest number of open bolls/plant (22.73 and 22.32 bolls) followed by topping plants at the formation of 14 fruiting branches/plant which gave (22.18 and 22.02 bolls) in the first and second seasons, respectively. Also, the former treatment gave the heaviest bolls (2.98 and 3 g) and seed index (10.93 and 11.80 g) followed by the later treatment which gave boll weight (2.95 and 3.0g) and seed index (10.81 and 11.70 g) in the first and second seasons, respectively, without any significant differences among those two treatments. However, the lowest number of open bolls (18.17 and 18.02 bolls) and lowest values of boll weight (2.76 and 2.74 g) and seed index (10.37 and 11.07 g) were obtained from untreated plants in the first and second seasons, respectively.

Applying pix three times gave the highest values of seed cotton yield/fed. (12.82 and 11.80 kentar) followed by topping plants at the formation of 14 fruiting branches per plant which gave (12.40 and 11.50 kentar) in the first and second seasons, respectively. While the lowest values (9.65 and 9.26 kentar) were obtained from untreated plants in the first and second seasons, respectively.

Fiber quality:

Table (5) shows that the tested treatments gave insignificant effect on fiber traits under study in both seasons.

Table (5): Effect of some growth retardant treatments on cotton fiber quality in 2008 and 2009 seasons at early planting.

Treatments	Fiber length parameters		Fiber bundle tensile		Mic. Reading
	Upper half mean (mm)	Uniformity index (%)	Strength (g/tex)	Elongation (%)	
Season 2008					
Control (untreated)	32.03	87.37	43.10	7.77	4.60
Topping at 10 fruiting branches/plant	32.67	86.67	44.10	7.73	4.67
Topping at 12 fruiting branches/plant	32.90	86.43	44.00	7.13	4.70
Topping at 14 fruiting branches/plant	32.40	86.17	44.10	7.77	4.73
Pix twice (Squaring + flowering)	32.60	86.30	44.80	7.80	4.73
Pix twice (Flowering+2 weeks later)	32.73	87.10	44.30	7.30	4.73
Pix 3 times (Squaring + Flowering +2 weeks later)	32.87	86.83	45.40	7.93	4.77
P_2O_5+ K_2O three times	32.70	86.70	46.70	7.83	4.80
LSD at 0.05	N.S	N.S	N.S	N.S	N.S
2009 seasons					
Control (untreated)	33.53	88.07	43.73	7.47	4.80
Topping at 10 fruiting branches/plant	33.57	86.57	43.43	7.33	4.83
Topping at 12 fruiting branches/plant	33.33	87.30	44.37	7.20	4.73
Topping at 14 fruiting branches/plant	33.80	86.73	43.67	7.26	4.83
Pix twice (Squaring + flowering)	33.33	85.93	43.70	7.37	4.87
Pix twice (Flowering + 2 weeks later)	34.03	86.77	43.83	7.60	4.83
Pix 3 times (Squaring + Flowering + 2 weeks later)	33.73	86.97	43.70	7.43	4.77
P_2O_5+ K_2O three times	33.47	85.97	45.03	7.43	4.70
LSD at 0.05	N.S	N.S	N.S	N.S	N.S

Second experiment (late planting date) Growth attributes:

Data in Table (6) showed that the tested treatments gave a significant effect on dry weight/plant at the different growth stages in both seasons. The highest values of dry weight/plant at the first and third growth ages were produced from plants which were sprayed with pix three times. Also this treatment ranked the second with regard to dry weight/plant at the second growth age after the treatment which receiving an aqueous filtered solution of P_2O_5 + K_2O three times, while the lowest values were produced from plants which topped at the formation of 10 or 12 fruiting branches/plant or from untreated plants at the first and second growth ages. However, at the third growth age the lowest dry weight/plant was obtained from untreated plants or plants topped at the formation of 10 fruiting branches/plant. Data in table (6) showed that the tested treatments gave significant effect on LA/plant at the three growth ages in both seasons, where the highest values of this trait was obtained from untreated plants and from plants which topped at the formation of 14 fruiting branches /plant or spraying with an aqueous filtered solution of P_2O_5 + K_2O three times, where the differences among these three treatments were insignificant except at the third growth age in the second season where the first and third treatments significantly increased the second treatment with regard to LA/plant, while the lowest values were obtained from plants which topped early at the formation of 12 fruiting branches /plant or form spraying pix three times.

Table (6): Effect of some growth retardant treatments on dry weight (g/plant) and leaf area (dm^2/plant) of cotton during 80, 100 and 120 days after sowing in 2008 and 2009 seasons at late planting.

Treatments	Dry weight (g/plant)			Leaf area (dm^2/plant)		
	80 days	100 days	120 days	80 days	100 days	120 days
Season 2008						
Control (untreated)	45.27	64.34	114.57	21.55	26.00	26.00
Topping at 10 fruiting branches/plant	44.81	64.52	114.99	20.60	24.18	24.18
Topping at 12 fruiting branches/plant	45.12	68.24	124.16	20.81	25.90	25.90
Topping at 14 fruiting branches/plant	44.87	68.25	124.13	21.92	26.12	26.12
Pix twice (Squaring + flowering)	51.15	80.67	120.25	20.96	26.00	26.00
Pix twice (Flowering + 2 weeks later)	45.83	74.35	121.84	21.12	25.92	25.92
Pix 3 times (Squaring + Flowering + 2 weeks later)	52.11	83.03	136.04	20.82	25.18	25.18
P_2O_5+ K_2O three times	49.46	84.75	124.77	21.70	26.40	26.40
LSD at 0.05	1.35	1.44	2.31	0.91	0.45	0.45
Season 2009						
Control (untreated)	46.57	67.53	115.73	21.55	27.78	27.78
Topping at 10 fruiting branches/plant	46.33	63.20	116.37	20.43	26.81	26.81
Topping at 12 fruiting branches/plant	46.28	67.60	122.00	20.77	26.90	26.90
Topping at 14 fruiting branches/plant	46.50	67.66	123.37	21.18	27.12	27.12
Pix twice (Squaring + flowering)	53.19	82.54	119.24	20.58	27.00	27.00
Pix twice (Flowering + 2 weeks later)	46.65	77.46	120.10	20.62	26.80	26.80
Pix 3 times (Squaring + Flowering + 2 weeks later)	53.97	85.88	138.14	20.12	26.72	26.72
P_2O_5+ K_2O three times	53.51	87.04	123.04	21.32	27.60	27.60
LSD at 0.05	1.24	1.79	1.58	0.74	0.44	0.44

Table (7): Effect of some growth retardant treatments on net assimilation rate/plant (g/dm^2/week) and crop growth rate/plant (g/dm^2 /week) during the period of 80-120 days after sowing, as well as plant height (cm) and no. of fruiting branches/plant at harvest of cotton in 2008 and 2009 seasons at late planting.

Treatments	Net assimilation rate/plant (g/dm^2/week)		Crop growth rate/plant (g/dm^2/week)		Plant height at harvest (cm)	No. of fruiting branches/plant (at harvest)
	First stage (80 - 100 days)	Second stage (100-120 days)	First stage (80-100 days)	Second stage (100-120 days)		
Season 2008						
Control (untreated)	0.282	0.676	0.727	1.916	183.33	18.50
Topping at 10 fruiting branches/plant	0.307	0.726	0.752	1.924	130.33	10.00
Topping at 12 fruiting branches/plant	0.353	0.764	0.882	2.131	136.67	12.00
Topping at 14 fruiting branches/plant	0.344	0.753	0.893	2.135	144.67	14.00
Pix twice (Squaring + flowering)	0.447	0.538	1.126	1.509	168.33	17.67
Pix twice (Flowering + 2 weeks later)	0.433	0.651	1.085	1.810	171.67	17.33
Pix 3 times (Squaring + Flowering + 2 weeks later)	0.476	0.740	1.180	2.020	157.33	16.67
P_2O_5 + K_2O three times	0.519	0.534	1.344	1.527	171.33	16.83
LSD at 0.05	0.04	0.04	0.07	010	4.96	0.46
Season 2009						
Control (untreated)	0.299	0.606	0.799	1.839	169.50	16.70
Topping at 10 fruiting branches/plant	0.256	0.706	0.644	2.030	120.38	10.00
Topping at 12 fruiting branches/plant	0.314	0.704	0.813	2.073	122.38	12.00
Topping at 14 fruiting branches/plant	0.304	0.708	0.809	2.124	130.67	13.97
Pix twice (Squaring + flowering)	0.431	0.470	1.123	1.398	136.38	14.83
Pix twice (Flowering + 2 weeks later)	0.451	0.549	1.177	1.625	136.75	15.03
Pix 3 times (Squaring + Flowering + 2 weeks later)	0.477	0.679	1.219	1.989	126.75	14.35
P_2O_5 + K_2O three times	0.477	0.450	1.283	1.372	152.63	14.40
LSD at 0.05	0.05	0.03	0.101	0.35	4.43	0.47

Net assimilation rate was significantly affected by the tested treatments at the two growth stages in both seasons (Table 7). At the first growth stage, the highest values (0.519 and 0.477 g/dm^2/week) were obtained from spraying an aqueous filtered solution of P_2O_5 + K_2O three times in both seasons. However, the lowest values were obtained from the control and topping plants at the formation of 10 fruiting branches/plant in the first and second seasons respectively.

Table (8): Effect of some growth retardant treatments seed cotton yield and yield components in 2008 and 2009 seasons at late planting.

Treatments	No. of open bolls/plant	Boll weight (g)	Seed index (g)	Lint (%)	Seed cotton yield (kentar/fed.)
Season 2008					
Control (untreated)	15.70	2.74	10.42	39.20	7.67
Topping at 10 fruiting branches/plant	18.80	2.86	10.72	39.43	9.73
Topping at 12 fruiting branches/plant	20.01	2.89	10.80	39.63	10.66
Topping at 14 fruiting branches/plant	17.83	2.85	10.87	39.67	9.49
Pix twice (Squaring + flowering)	19.96	2.89	10.66	39.43	10.28
Pix twice (Flowering + 2 weeks later)	19.57	2.87	10.63	39.20	9.78
Pix 3 times (Squaring + Flowering + 2 weeks later)	20.42	2.94	10.87	39.57	11.26
P_2O_5 + K_2O three times	19.70	2.89	10.80	39.47	10.00
LSD at 0.05	0.63	0.08	N.S	N.S	0.14
Season 2009					
Control (untreated)	14.32	2.68	10.73	37.95	7.50
Topping at 10 fruiting branches/plant	16.17	2.84	10.90	39.60	9.24
Topping at 12 fruiting branches/plant	19.42	2.90	11.20	39.93	9.90
Topping at 14 fruiting branches/plant	15.68	2.82	11.47	40.15	9.12
Pix twice (Squaring + flowering)	18.82	2.90	11.07	39.13	9.70
Pix twice (Flowering + 2 weeks later)	18.00	2.84	10.83	38.65	9.32
Pix 3 time (Squaring + Flowering + 2 weeks later)	19.88	2.96	11.53	40.35	10.42
P_2O_5 + K_2O three times	18.35	2.88	11.17	39.85	9.35
LSD at 0.05	0.35	0.03	0.17	0.32	0.03

At the second growth stage, the highest values (0.764 and 0.708 g/dm^2/week) were obtained from topping plants at the formation of 12 and 14 fruiting branches/plant in the first and second seasons respectively. However, the lowest values (0.534 and 0.450 g/dm^2/week) were obtained from spraying an aqueous filtered solution of P_2O_5 + K_2O three times in the first and second seasons, respectively.

Crop growth rate was significantly affected by the tested treatments at the two growth stages in both seasons (Table 7). At the first growth stage, the highest values (1.344 and 1.283 g/dm^2/week) were obtained from spraying an aqueous filtered solution of P_2O_5 + K_2O three times in the first and second seasons, respectively While, the lowest values (0.727 and 0.799 g/dm^2/week) were obtained from the control in the first and second seasons, respectively. At the second growth stage, the highest values (2.135 and 2.124 g/dm^2/week) were obtained from topping plants at the formation of 14 fruiting branches/plant in the first and second seasons, respectively. However, the lowest values (1.509 and 1.372 g/dm^2/week) were obtained from spraying pix twice (at squaring and flowering stages) and an aqueous filtered solution of P_2O_5 + K_2O three times in the first and second seasons, respectively.

Data in Table (7) showed that the tested treatments gave a significant effect on plant height and number of fruiting branches/plant in both seasons. Untreated plants produced the taller plants and the highest number of fruiting branches/plant, while the plants which

were topped at the formation of 10 fruiting branch/plant gave the shorter plants and the lowest number of fruiting branches/plant.

Yield and its components:

Data in Table (8) show that, the tested treatments had a significant effect on number of open bolls/plant and boll weight in both seasons. Seed index and lint % were significantly affected in the second season only.

From Table (8) it could be noticed that spraying pix three times gave the highest values of number of open bolls/plant, boll weight and seed cotton yield/fed. in both seasons, as compared with the others treatments. This treatment significantly increased seed cotton yield/fed. by 46.81, 15.72, 5.63, 18.65, 9.53, 15.13 and 12.6% in the first season and by 38.93, 12.77, 5.25, 14.25, 7.42, 11.80 and 11.44% in the second season over that of the control treatment, topping plants after the formation of 10, 12, 14 fruiting branches/plant, spraying pix twice at squaring and flowering stages or at flowering stage and 15 days later and spraying an aqueous filtered solution of P_2O_5 + K_2O three times, respectively.

Also, topping plants after formation of 12 fruiting branches/plant significantly increased seed cotton yield/fed. by 38.98, 9.56, 12.33, 3.70, 9.00 and 6.6% in the first season and by 32, 7.14, 8.55, 2.06, 6.22 and 5.88% in the second season as compared with the control, topping plants after the formation of 10 or 14 fruiting branches/plant, spraying pix twice at squaring and flowering stages or at flowering stage and 15 days later and spraying an aqueous filtered solution of P_2O_5 + K_2O three times, respectively.

Fiber quality:

Table (9) shows that the tested treatments gave insignificant effect on fiber traits under study in both seasons.

Table (9): Effect of some growth retardant treatments on cotton fiber quality in 2008 and 2009 seasons at late planting.

Treatments	Fiber length parameters		Fiber bundle tensile		Mic. Reading
	Upper half mean (mm)	Uniformity index (%)	Strength (g/tex)	Elongation (%)	
Season 2008					
Control (untreated)	32.87	86.40	46.03	7.83	4.80
Topping at 10 fruiting branches/plant	33.13	87.70	43.73	7.87	4.77
Topping at 12 fruiting branches/plant	33.27	85.67	44.33	7.63	4.77
Topping at 14 fruiting branches/plant	32.97	86.90	45.70	7.83	4.63
Pix twice (Squaring + flowering)	33.50	87.13	44.13	7.90	4.77
Pix twice (Flowering + 2 weeks later)	33.37	87.37	44.90	7.33	4.70
Pix 3 times(Squaring+Flowering+2 weeks later	33.20	86.27	43.90	7.70	4.77
P_2O_5+ K_2O three times	33.47	88.27	45.40	7.60	4.80
LSD at 0.05	N.S	N.S	N.S	N.S	N.S
2009 seasons					
Control (untreated)	33.90	87.07	45.00	7.23	4.83
Topping at 10 fruiting branches/plant	34.10	87.33	45.07	7.30	4.73
Topping at 12 fruiting branches/plant	34.20	86.97	44.77	7.33	4.77
Topping at 14 fruiting branches/plant	33.36	86.23	44.37	7.53	4.77
Pix twice (Squaring + flowering)	33.23	86.60	44.60	7.33	4.70
Pix twice (Flowering + 2 weeks later)	34.03	87.00	44.53	7.27	4.77
Pix 3 times(Squaring+Flowering+2 weeks later	33.80	86.97	45.43	7.33	4.80
P_2O_5+ K_2O three times	33.53	87.27	44.57	7.30	4.83
LSD at 0.05	N.S	N.S	N.S	N.S	N.S

DISCUSSION

1- Effect of topping:

Topping stimulated the lateral branches to grow and consequently increased the boll sets on these branches. In this concern Liang, *et al.* (2007) reported that topping increased cotton yield due to decreased cotton shedding rate. Topping main stem apex is an effective tool to avoid the further development of such trouble but it is a quite difficult practice to be applied at the commercial scale in case of wide cotton areas.

The increase in the number of open bolls/plant may be attributed to that topping stimulated the lateral branches to grow and consequently increased the boll sets on these branches. Previous finding of Kittock and Fry (1977) support our present results where they found that topping increased boll set on top fruiting branches, and resulted in additional branch nods on top fruiting branches. Plants topped 17 July produced 300% 100% and 60 % more bolls on the first, second and third branch, respectively, below the point of topping than did the check plants. Also, Rahman, *et al.* (1991) reported that the yield increased from topping was caused by increased growth and boll production on sympodial branches. Lint % was significantly affected by topping date in one season only in early or late planting dates. Moreover, seed index was significantly affected by topping date in two seasons at the early planting date and in one season only at the late planting date. On the contrary, Kittock and Fry (1977) and Wassel (1990) found that lint % and seed index were not affected by topping.

2- Effect of pix:

The reduction in plant height due to pix application mainly due to reduction of internode length and this reduction might be due to the inhibitory effect of pix on the synthesis of gibberellins which have a role in all division and cell expansion (Reddy, *et al.* 1990) and Ahmed (1994). This effect may be attributed to that auxin may catalyze the hardening of the cell wall thus leading to a shorter cell duration growth and a shorter final cell wall length (Girgis, *et al.* 1993).

Ibrahim and Moftah (1997) reported that the ability of pix to counteract the apical dominance which could be due to the reduction in auxin transport to bud sites caused by increasing cytokinin concentration which restricted transport of auxin to axillary buds and subsequent bud out growth has been demonstrated for cotton.

The increment of dry matter is attributed to the effect of pix in delaying leaf chlorophyll degradation and increasing its content in cotton leaf which enhances photosynthesis rate, (Gausman, *et al.* 1981). The increment in seed cotton yield of pix-treated plants than untreated ones was mainly due to the higher number of open boll/plant which may be due to increasing boll retention per plant, where pix acting as a reducer to abscisic acid and a stimulator to IAA and cytokinin (Ibrahim and Moftah, 1997).

The significant increments of seed cotton yield/fed. and its components due to foliar application of pix three times as compared with other treatments may be due to (1) pix enhancement of boll retention and weight in the lower and middle parts of cotton plants (Ibrahim and Moftah, 1997)., (2) increasing dry weight/plant which consequently led to higher plant production, boll retention, boll weight and number of open bolls/plant. in this concern. El-Beily, *et al.* (2001) found that application of pix four times increased significantly dry weight/plant number of total and open bolls/plant and seed cotton yield/fed. but reduced significantly plant height, number of fruiting branches/plant, leaf area/plant and leaf area index in the two seasons of study as compared with pix untreated plants. Abdel Aal, *et al.* (2011) found significant increase in number of sympodial branches/plant, total dry weight/plant, number of open bolls/plant,

boll weight, seed index, earliness and seed cotton yield/fed. due to foliar application of pix at the rate of 1 ml/liter twice at start of flowering and 30 days later compared to untreated plants which produced the lowest values in the two seasons.

3- Effect of spraying an aqueous filtered solution of $K_2O + P_2O_5$:

Potassium is an essential macro element for all living organisms and is required in large amounts for normal plant growth and development. The positive effect of foliar feeding 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). Although the level of available K in the experimental soil sites (Table 1) 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 K may occur. Yet, there was a significant yield increase due to foliar feeding with $K_2O + P_2O_5$ as compared with the control. Foliar feeding with superphosphate can be control the excessive vegetative growth of cotton plants (El-Shahawy, *et al.* 2000). Improves plant metabolism which increases boll setting and encourages plant to accumulate more of its total dry weight in fruiting parts (i.e. fruiting branches and fruiting organs). In this concern Abdel Aal, *et al.* (2011) found that foliar application of macronutrients, i.e. P and K significantly increased number of sympodial branches/plant and total dry weight/plant as well as yield and its components (number of open bolls/plant, boll weight, seed index, earliness and seed cotton yield /fed.) compared to untreated plants which produced the lowest values in two seasons.

The positive increases in seed cotton yield/fed. and its components i.e. boll weight and number of open bolls/plant of foliar feeding with an aqueous filtered solution of $P_2O_5 + K_2O$ may be due to that (1) a very large proportion of P in mature plants in located in seeds and fruits which affects boll development and formation (Mayer and Anderson,1960). Also P is involved in energy transfer processes in both photosynthesis and respiration (Hearn, 1981). Foliar feeding with P control the excessive vegetative growth of cotton plants and consequently led to increase stimulation of yield components characters and caused high seed cotton yield. (2) major role of K is in photosynthesis (Huber, 1985) by directly increasing leaf growth, leaf area index and therefore CO_2 assimilation (Wolf, *et al.* 1976). In this concern Abd El-Aal, *et al.* (1995) found that seed cotton yield/fed. and most of its attributing variables were increased by soil and foliar nutrition wit potassium as compared with the control treatment. Etidal, *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. due to the increased in number of open bolls/plant and boll weight.

Conclusion

It can be concluded that the application of pix at the level of 500 cm^3/fed. three times (at squaring stage, flowering stage and 15 days later) at early planting on (1^{st} April) and late planting date on (1^{st} May)., or topping cotton plants at the formation of 14 fruiting branches/plant at early planting or topping of plants at the formation of 12 fruiting branches/plant at late planting., for obtained high productivity of cotton (Giza 86 variety), under Gemmeiza location at El-Gharbiya Governorate.

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تأثير بعض معاملات محددات النمو على إنتاجية وجودة القطن فى الزراعات المبكرة والمتأخرة

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الملخص العربي

أجريت تجربتان حقليتان بمحطة البحوث الزراعية بالجميزة بمحافظة الغربية خلال موسمى ٢٠٠٨ و٢٠٠٩ لدراسة بعض المعاملات المحددة للنمو (التطويش، الرش بمادة البكس، الرش بمنقوع سلفات البوتاسيوم والسوبر فوسفات) بهدف ايجاد انسب معاملة للتحكم فى سلوك ونمو نبات القطن (صنف جيزة ٨٦) وذلك للحصول على اعلى محصول وافضل صفات جودة للزراعات المبكرة (اول ابريل) والمتاخرة (اول مايو). حيث زرعت تجربة في ميعاد الزراعة المبكر (أول أبريل) وتجربة أخري في ميعاد الزراعة المتأخر (أول مايو) فى كل موسم وقد اشتملت كل تجربة على ثمان معاملات هى الكنترول (بدون معاملة)، تطويش عند تكون ١٠ افرع ثمرية على النبات، تطويش عند تكون ١٢ فرع ثمري على النبات، تطويش عند تكون ١٤ فرع ثمري على النبات، رش البكس مرتين (وسواس + تزهير)، رش البكس مرتين (تزهير + بعده باسبوعين)، رش البكس ثلاث مرات (وسواس + تزهير + بعده باسبوعين)، رش منقوع سوبر فوسفات + سلفات بوتاسيوم (٥ كجم لكل مادة ثلاث مرات) هذا وقد استخدم تصميم القطاعات الكاملة العشوائية فى كلا التجربتين ويمكن ايجاز اهم النتائج المتحصل عليها فيما يلى.

اولاً التجربة الاولى (الزراعة المبكرة فى اول ابريل):

١-اظهرت جميع معاملات الحد من النمو الخضرى زيادة معنوية فى صفات النمو (الوزن الجاف للنبات، مساحة اوراق النبات، الكفاءة التمثيليه للنبات وسرعة نمو النبات) مقارنة بالنباتات الغير معاملة وذلك خلال موسمى النمو. هذا وقد اعطت النباتات التى تم رشها بالبكس مرتين (وسواس + تزهير) او بالبكس ثلاث مرات (وسواس + تزهير + بعد التزهير باسبوعين) اعلى القيم بصفة عامة لكل من الوزن الجاف للنبات والكفاءة التمثيلية وسرعة نمو النبات بينما اعطى تطويش القمه النامية عند وجود ١٤ فرع ثمرى على النبات اكبر مساحة اوراق على النبات وذلك مقارنة بباقى المعاملات تحت الدراسة فى موسمى النمو.

٢-ادى استخدام جميع معاملات الحد من النمو الخضرى المدروسة لنقص معنوى فى طول النبات وعدد الافرع الثمرية بينما ادى الى زيادة معنوية فى محصول القطن الزهر للفدان ومكوناته (عدد اللوز المتفتح على النبات، ووزن اللوزة ودليل البذرة) خلال موسمى الزراعة ونسبة الشعر فى الموسم الثانى وذلك مقارنة بالنباتات غير المعامله (الكنترول). هذا وقد اوضحت النتائج ان رش النباتات بمادة البكس ثلاث مرات (وسواس + تزهير + بعد التزهير باسبوعين) قد اعطى اعلى القيم المعنوية لمحصول القطن الزهر

ومعظم مكونات المحصول المدروسة يليها معاملة التطويش عند وجود ١٤ فرع ثمرى على النبات وذلك مقارنة بباقى المعاملات الاخرى تحت الدراسة فى موسمى الزراعة.

٣-تشير النتائج بان صفات جودة التيلة المدروسة (طول الشعرة، دليل الانتظام، المتانة، الاستطالة %، وقراءة الميكرونير) لم تتاثر معنوياً بمعاملات الحد من النمو الخضرى المدروسة مقارنة بالنباتات الغير معاملة (الكنترول) وذلك خلال موسمى النمو.

ثانياً التجربة الثانية (الزراعة المتاخرة فى اول مايو):

١-اظهرت جميع معاملات الحد من النمو الخضرى زيادة معنوية فى صفات النمو المدروسة (الوزن الجاف للنبات، مساحة اوراق النبات، الكفاءة التمثيليه للنبات وسرعة نمو النبات) مقارنة بمعاملة الكنترول وذلك خلال موسمى النمو. هذا وقد اعطت النباتات التى تم رشها بالبكس او بمنقوع سوبر فوسفات وسلفات البوتاسيوم ثلاث مرات (عند مرحلة الوسواس ومرحلة التزهير ثم بعد ١٥ يوم) اعلى القيم لكل من الوزن الجاف للنبات عند اعمار النمو الثلاثة والكفاءة التمثيلية وسرعة نمو النبات فى مرحلة النمو الاولى فى الموسمين وقد اعطى التطويش عند تكون ١٢ و١٤ فرع ثمرى اعلى القيم للكفاءة التمثيلية وسرعة نمو النبات فى مرحلة النمو الثانية فى الموسمين وذلك مقارنة بباقى المعاملات تحت الدراسة.

٢-ادى استخدام جميع معاملات الحد من النمو الخضرى المدروسة الي نقص معنوى فى طول النبات وعدد الافرع الثمرية على النبات عند الحصاد والي زيادة معنوية فى محصول القطن الزهر للفدان ومكوناته (عدد اللوز المتفتح على النبات، ووزن اللوزة) فى الموسمين ومعامل البذرة ونسبة الشعر فى الموسم الثانى فقط مقارنة بالنباتات غير المعاملة (الكنترول) هذا وقد اوضحت النتائج ان رش النباتات بالبكس ثلاث مرات قد اعطى اعلى القيم المعنوية لمحصول القطن الزهر ولمكوناته يليها معاملة التطويش عند تكون ١٢ فرع ثمرى على النبات وذلك مقارنة بباقى المعاملات الاخرى.

٣-لم يكن لمعاملات الحد من النمو الخضرى المدروسة اى تاثير معنوى على صفات جودة التيلة المدروسة مقارنة بالنباتات الغير معاملة (الكنترول) وذلك خلال موسمى النمو .

ثالثاً التوصية العامة:

يمكن التوصية للحصول علي أعلي إنتاجية لمحصول القطن (صنف جيزة ٨٦) برش النباتات بمركب البكس بمعدل ٥٠٠ سم^{3}/فدان ثلاث مرات (عند مرحلة الوسواس، التزهير، بعد التزهير بـــ ١٥ يوم) وذلك في كل من الزراعات المبكرة (أول أبريل) والزراعات المتأخرة (أول مايو). أو بإجراء تطويش النباتات عند تكوين ١٤ فرع ثمري علي النبات في الزراعات المبكرة أو بإجراء تطويش النباتات عند تكوين ١٢ فرع ثمري علي النبات في الزراعات المتأخرة وذلك تحت ظروف تلك التجارب بمنطقة الجميزة ،محافظة الغربية.