

Effects of several Plant Growth Regulators on the Yield and Fiber Quality of Cotton (*Gossypium hirsutum* L.)

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Abstract

Plant growth regulators (PGR) are used in cotton (*Gossypium hirsutum* L.) production to balance vegetative and reproductive growth, as well as to increase seed cotton yield and lint quality. Field experiments were conducted with some PGRs to determine their effects on yield and yield components of cotton using cv. 'Stoneville 453'. The study was conducted at Harran University Agricultural Research and Application Center located in Şanlıurfa, Turkey in 2004 and 2005. Seven commercial PGRs (Pix, Bigtonik, Biozyme® TF, K-Humate, Maxicrop and Biogibb) were sprayed at recommended doses and application time during the study. Experiments were arranged as randomized complete plot design with three replications. Experimental plots consisted of 12 meter long with six rows, 0.70 m row spacing and 0.20 m plant-spacing on row. The results showed that the applied PGRs (except pix) had significant positive effects on the seed cotton yield, plant height, average number of open bolls, number of sympodia, boll weight, lint percentage and seed index and decreased the earliness index. However, fiber length, fiber fineness, fiber strength and fiber uniformity were not affected by the treatments. Higher yields were obtained in Maxicrop, Biozyme® TF and Biogibb treated plots. Therefore, PGRs might be considered a component of cotton growth management to provide higher seed cotton yields.

Keywords: PGRs, cotton, *Gossypium hirsutum* L., yield, fiber quality

Introduction

In Turkey, approximately 500.000 tons of lint cotton is produced annually, 50% of which is produced in the South-eastern Anatolia Region (Mert and Çopur, 2010). Cotton (*Gossypium hirsutum* L.) grown in the South-eastern Anatolian Region is one of the most important agricultural crops for Turkey. The region has 3.2 million ha of land fit for the culture of crops such as cotton, cereal, lentil, corn, sesame and fruits (Polat *et al.*, 2006). One of the main problems limiting cotton production in this region is poor growth resulting from high temperature and, in turn, low seed cotton yield per unit area. In addition to the research conducted to develop heat-tolerant cultivars, artificial plant growth regulators are also used to support plant growth and seed cotton production.

Climatic factors such as high temperature, length of daytime and relative humidity can have negative effects on the synthesis of some plant hormones (abscisic acid, gibberellic acid and cytokinins). This directly affects physiological processes of the plant and, as a result, growth potential is limited. However, external application of synthetic plant growth regulators can have such similar functions and effects as some phytohormones, thereby allow physiological processes to continue at their normal pace (Güllüoğlu, 2004). Chemicals that are synthesized within the plant are called phytohormones, while chemicals that are artificially synthesized but have similar functions are

called plant growth regulators (Kurt *et al.*, 1994). Plant growth regulators that promote plant growth and development are widely used in a number of commercial crops, including cotton.

The main factors affecting development of cotton plant include climate (temperature, humidity, wind and sun time etc.) and cultivation techniques. These factors can affect the optimal balance between vegetative and generative growth in cotton. This balance depends on the environmental conditions. Excessive irrigation and fertilization can distort the balance of plant development, thereby, delay both plant maturation and harvesting. For a specific environment, optimum production can be achieved by establishing a balance between vegetative and generative growth (Kerby *et al.*, 1993). Plant growth regulators control the undesired vegetative development and increase the number of sympodia, and can contribute to the increase in seed cotton yield.

Pix (mepiquat chloride) is a plant growth regulator widely used in inhibiting gibberellic acid formation and plant height. Plant growth regulators such as Pix and Turbopamuk increase seed cotton yield, but do not affect fibre quality (Gencsoylu, 2009). However, there are also some findings supporting that Pix decreases seed cotton yield (O'Berry *et al.*, 2009). Plant growth regulators Atonik, Recine and Cytozyme increase seed cotton yield (Pothiraj *et al.*, 1995). Abro *et al.* (2004) reported that naphthalene

delay maturing and increase plant height, number of boll and seed cotton yield.

Producers tend to use commercially available plant growth regulators to increase yield per unit area; however, there are some problems regarding the selection of plant growth regulators. Therefore, information is needed on the effects of commercially available plant growth regulators on seed cotton yield and fibre quality properties.

The objective of this study was to evaluate the effects of some PGRs (Pix, Bigtonik, Biozyme® TF, K-Humate, Maxicrop, Biogibb) on growth, yield, yield components, and fibre properties of cotton, in order to identify PGR treatments that may improve growth, yield, and quality.

Materials and methods

Field trials were carried out on a clay-textured soil (vertic calciorthid aridisol) during the 2004 and 2005 cotton-growing seasons at Faculty of Agriculture Research and Application Centre of Harran University located in Sanliurfa, Turkey. The experimental site is located in Harran Plain (altitude: 465 m; 37° 08' North and 38° 46' East), close to the Turkish-Syrian border. The soil texture was of clay loam-type. Average field capacity, permanent wilting point, dry bulk density and pH of the site at 90 cm soil depth were 32%, 22%, 1.41 g cm⁻³ and 7.2, respectively (Tab. 1). The average air temperatures were in 21°C-32°C range during the cotton growing season, while relative

humidity was below 50% in June, July and August for the both treatment years (Tab. 2). In the scope of the study, the cotton variety cv. 'Stoneville-453' was used as a plant material, a material widely cultivated in southeast of Turkey.

The experiments were carried out in a randomized complete block design with three replications. The plots consisted of six rows, 12 m in length with inter-row spacing of 0.70 m; oriented in south-north direction; and hand-thinned to 5 to 6 plants per meter row when the seedlings had approximately three true leaves. The cotton was planted in each plot at 40-50 mm depth by an experimental driller on 6 May 2004, and 2 May 2005, respectively. Pre-plant fertilizer was applied at a rate of 70 kg N ha⁻¹ and 70 kg P ha⁻¹ as 20-20-0 fertilizer and followed by 90 kg ha⁻¹ N as 33% ammonium nitrate applied at the initiation of flowering. K₂O was not applied due to its abundance in the soil. Soil tillage and other cultural practices (hoeing, weeding, pest management and irrigation) were used, as needed, according to recommendations of the regional agricultural experimental station.

A 2 m border spacing was left between blocks to reduce edge effects. The treatments consisted of control and commercial PGRs, namely Pix (BASF distributor Istanbul, Turkey), Biozyme® TF and K-Humate (HEKTAŞ Chemical Company, Istanbul), Maxicrop (Koyuncular Agriculture A.S, Konya), Bigtonik (Fertil Chemical Company, Konya), and Biogibb (KORUMA Agriculture, İzmit)

Tab. 1. Several soil properties of the study area (Research Station of Harran University, Sanliurfa, Turkey)

Depth (cm)	BD (g cm ⁻³)	OM (%)	Soil Particle Distribution (%)			pH	N (kg ha ⁻¹)	P ₂ O ₅ (kg ha ⁻¹)	K ₂ O (kg ha ⁻¹)	FC (%)	PWP (%)
			Sand	Silt	Clay						
0-30	1.37	1.2	7	34	59	7.3	25	27	1280	31.5	22.2
30-60	1.40	0.8	17	25	58	7.2	12	20	900	31.8	22.6
60-90	1.43	0.6	20	21	59	7.2	6	17	810	32.3	21.5
90-120	1.43	0.5	19	20	62	7.2	-	-	-	32.5	21.5

BD: bulk density, OM: organic matter, FC: field capacity, PWP: permanent wilting point

Tab. 2. Climatic data of the study area during cotton crop growing season for 2004 and 2005 years

	May	June	July	August	September	October
	2004					
Min. air temp. (°C)	15.6	21.8	25.6	23.6	20.7	16.5
Max. air temp. (°C)	33.4	35.7	39.7	38.1	35.3	28.7
Average air temp. (°C)	21.9	29.0	32.8	30.8	27.3	21.7
Relative humidity (%)	48.9	35.5	27.0	40.7	34.8	48.7
Wind speed (ms ⁻¹)	2.5	3.0	2.5	2.5	2.0	1.7
Solar radiation (cal cm ⁻²)	562.0	642.0	621.5	561.9	463.9	314.9
	2005					
Min. air temp. (°C)	16.3	20.4	25.6	24.6	19.8	13.2
Max. air temp. (°C)	29.9	34.3	40.3	39.2	33.6	25.5
Average air temp. (°C)	23.1	27.4	33.0	32.1	26.3	18.6
Relative humidity (%)	41.4	35.9	32.8	44.7	46.0	52.9
Wind speed (ms ⁻¹)	2.3	2.6	2.8	1.7	1.5	1.3
Solar radiation (cal cm ⁻²)	544.3	594.7	602.7	529.4	438.5	343.4

Tab. 3. Trade names, compounds, application periods and recommended rates of plant growth regulators

PGR Code Names	Active Ingredient l ¹	Application Periods	Rates (cc ha ⁻¹)*
Control	no PGR's		
Pix	Mepiquad chloride (50 g l ¹)	FF ¹ +after two week	500+500
Bigtonik	Na 5 nitroguaiacolate (1 g l ¹)	PHS ² +FF	500+500
	Na ortho-nitrophenolate (2 g l ¹)		
	Para nitrophenolate (3 g l ¹)		
Biozyme [®] TF	Giberellic acid 32.20 ppm	PHS+FF	500+500
	IAA 32.20 ppm Zeatin and Trace elements (Fe, Zn, Mg, Mn)		
K-Humate	Humic acid (55%)	PHS+FF	400+400
	Fulvic acid (30%)		
	Potassium hydroxide (8%)		
Maxicrop	Seaweed extracts	FTFL ³ +PHS+FF	300+400+500
Biogibb	Giberellic acid (GA3)	PHS+FF	300+300

*For each application period, ¹first flower, ²pinhead square, ³first true-five leaves

(Tab. 3). PGRs mixed with in a water carrier were sprayed via a CO₂ pressurized backpack sprayer at 750 l ha⁻¹, using Tee-jet nozzle tips; the pressure was set at 207 kPa (Tab. 3). Only water was sprayed to a control plot. All chemicals were sprayed in 17.00-18.00 hour range and under wind-free conditions.

Seed cotton samples were hand-harvested from all plants, from 10 m sections of the four middle rows in each 6-row plot. The first hand-picking was done on September 24, 2004 and September 21, 2005, and the second hand-picking was done on October 14, 2004 and October 20, 2005. The yield was normalized or converted to total seed cotton yield (SCY) in kg ha⁻¹.

In both years, 10 plants were randomly chosen from the four middle rows of each plot to determine number of bolls per plant (NOB), number of sympodia per plant (NOS) and plant height (PH). Earliness index (EI) was calculated as the percentage of the first harvest. PH was measured from the cotyledonary node to the plant terminal on 22 October 2004 and 2005. Thirty bolls were collected to calculate average boll weight (BW). Approxi-

mately a 300 g seed cotton sample collected from each plot was ginned to determine lint percentage (LP: %) and seed index (SI: g 100 seed⁻¹). Fibre tests were conducted at a relative humidity of 65 ± 2% and a temperature of 20 ± 1°C to determine fibre length (FL: mm) in terms of 2.5% span length, fibre fineness (FF: micronaire), fibre strength (FS: g tex⁻¹) and Fiber uniformity (FU: %) as measured by High Volume Instrument (HVI-990A) test device.

Statistical analysis was performed using the MSTATC statistical program (Michigan State University, East Lansing, MI). Means were separated using Fisher's protected least significant differences (LSD) test and P= 0.05 denotes the level of significance.

Results and discussion

The means and LSD groupings of the measured characteristics are given in Tab. 4, 5, 6 and 7.

The effect of plant growth regulators on seed cotton yield, earliness index and plant height are presented in Tab. 4.

Tab. 4. Mean values of seed cotton yield, earliness index and plant height and LSD grouping of PGR treatments in 2004 and 2005 years

Treatments	(SCY) (kg ha ⁻¹)		(EI) (%)		(PH) (cm)	
	2004	2005	2004	2005	2004	2005
Control	4287.83 bc*	4347.00 de	79.12 ab	74.44 bc	73.70 e	74.07 c
Pix	4072.93 c	4124.47 e	84.46 a	82.05 a	65.00 f	66.47 d
Bigtonik	4406.57 b	4448.10 cd	78.51 bc	73.85 bc	79.10 bc	74.20 c
Biozyme [®] TF	4917.03 a	4938.13 b	77.50 bc	76.15 abc	77.70 cd	78.00 bc
K-Humate	4432.83 b	4662.77 bc	76.72 bc	78.18 ab	74.83 de	79.60 b
Maxicrop	4905.83 a	5254.30 a	73.08 c	70.03 c	82.40 b	86.10 a
Biogibb	4837.40 a	4712.37 bc	66.06 d	69.97 c	92.77 a	90.47 a
Grand Means	4551.49	4641.02	76.50	74.95	77.93	78.41
LSD (0.05)	234.9	309.00	5.48	6.50	3.67	4.61
CV (%)	2.9	3.74	4.03	4.88	2.65	3.31

*: Different letters in each column indicates that the means differ significantly (p<0.05).

Seed Cotton Yield (SCY)

Average seed cotton yield varied in 4072.93 kg ha⁻¹ and 4917.03 kg ha⁻¹ range in 2004 and grand mean yield was 4551.49 kg ha⁻¹. In 2005, the yield varied in 4124.47 kg ha⁻¹ and 5254.30 kg ha⁻¹ range and grand mean yield was 4641.02 kg ha⁻¹ (Tab. 4). As shown in Tab. 4, the highest average seed cotton yield was obtained in Maxicrop and Biozyme® TF application in both years, and the lowest seed cotton yield was obtained in Pix application. The LSD test indicated that, in both years, there was a statistically significant difference between plant growth regulator applications, and that all PGRs apart from Pix increased the seed cotton yield when compared to control plot.

Pix application is recommended to slow plant growth and to promote fruit formation especially in areas where the plant grows taller. In plots where Pix was applied, it was found that plant height was reduced and therefore the number of sympodia and number of bolls decreased. These results are consistent with the findings of O'Berry *et al.* (2009), but differ from the findings of Oosterhuis and Robertson (2000). This difference may result from the climatic conditions and different cotton cultivars used in experiments.

Maxicrop and Biozyme® TF and Biogibb ensure strong root growth and enable plants to make better use of water and soil nutrients. They accelerate chlorophyll formation in the plants and increase vegetative sections, thereby, increase the synthesis of substances such as carbohydrates, protein, sugar, oil etc., and result in increased seed cotton yield. Therefore Maxicrop, Biozyme® TF and Biogibb can be recommended as plant growth regulators in cotton production.

Earliness Index (EI)

Tab. 4 shows that average earliness index varied in 66.06% and 84.46% range and grand mean EI was 76.50% in 2004 and varied in 69.97% and 82.05% range and grand mean was 74.95% in 2005. In both years, the highest average earliness index was obtained in the Pix application, and the lowest earliness index was obtained in the Maxicrop and Biogibb applications. The LSD test indicated that there were different earliness index groups in terms of application of plant growth regulators and that earliness index generally decreased (excluding Pix). Maxicrop and Biogibb applications showed notably increased plant growth and delayed maturation of plants, and thus, earliness index decreased. However in Pix plots, increase of earliness caused reduced plant height and accumulation of the biomass mostly in sympodia and in the leaves, thus, provided the plants with a compact structure (Sawan *et al.*, 2006). This ensured an improved microclimate, and, in particular, better light conditions that result in earlier maturity.

Plant Height (PH)

Plant height is an important vegetative factor affecting seed cotton yield. High plant height is associated with a higher number of nodes and sympodia. It was observed in the present study that, in both years, the highest plant height was obtained in Biogibb application, followed by Maxicrop. The lowest plant height was obtained in Pix application (Tab. 4). The LSD test indicated that in 2004 and 2005 there were different plant height groups. Biogibb and Maxicrop chemicals promote gibberellic acid concentration in the plant cells and might increase plant height. In addition, these chemicals accelerate blossoming and fruit formation (Önder, 1985). Therefore, Biogibb and Maxicrop applications increased plant height in this study, when compared to the control plot. However, Pix application decreased plant height when compared to the control plot. This decrease was caused by reduced Gibberellic acid (GA) concentration in the plant (Yang *et al.*, 1996). Low GA concentration causes hardening of the cell wall and reduced flexibility. With the increase of hardness between the cells, the extension and reproduction ability of the cells are inhibited. Therefore, plant height decreases (Biles and Cothren, 2001). Pix is particularly recommended to inhibit vegetative growth, particularly in case of excessive fertilization.

The effect of plant growth regulators on number of boll, number of sympodia and boll weight are shown in Tab. 5.

Number of Boll (NOB)

As indicated in Tab. 5, average number of bolls varied in 12.23 plant⁻¹ and 19.23 plant⁻¹ range and grand mean was 15.85 plant⁻¹ in 2004. Average number of bolls varied in 13.07 plant⁻¹ and 21.27 plant⁻¹ range and grand mean was 17.58 plant⁻¹ in 2005. In both years, the highest average number of boll was obtained from Maxicrop and Biogibb

Tab. 5. Mean values of boll number, number of sympodia and boll weight and LSD grouping of PGR treatments in 2004 and 2005 years

Treatments	NOB (plant ⁻¹)		NOS (plant ⁻¹)		BW (g)	
	2004	2005	2004	2005	2004	2005
Control	14.17 d*	17.33 b	13.40 cd	15.33 cd	5.66 c	5.71 d
Pix	12.23 e	13.07 c	12.73 d	13.77 e	5.66 c	5.86 cd
Bigtonik	15.60 cd	16.93 b	13.57 cd	14.47 de	6.04 ab	6.12 abc
Biozyme® TF	16.47 bc	17.40 b	13.83 c	15.93 bc	6.12 a	6.27 ab
K-Humate	15.43 cd	17.33 b	13.03 cd	14.40 de	5.71 bc	5.90 bcd
Maxicrop	19.23 a	21.27 a	16.90 a	18.20 a	6.16 a	6.30 a
Biogibb	17.80 ab	19.73 a	15.23 b	16.67 b	6.03 ab	6.17 abc
Grand Means	15.85	17.58	14.10	15.54	5.91	6.05
LSD (0.05)	1.87	1.72	1.00	1.03	0.37	0.38
CV (%)	6.64	5.49	3.83	3.73	3.53	3.50

*: Different letters in each column indicates that the means differ significantly (p<0.05)

application, while the lowest number of boll was obtained in Pix application. According to the LSD test, there were different number of boll groups and the number of boll was significantly increased when compared to the control plot. The increased number of bolls in the plots, where plant growth regulators were applied, can result from an increased number of flowers and boll formation, depending on the increased photosynthetic activity (Sawan *et al.*, 2006). In addition, it was found that the number of bolls decreased in the plot where Pix was applied. These findings are consistent with those of Zhao and Oosterhuis (2000).

Number of Sympodia (NOS)

It was found that the average number of sympodia varied in 12.73 plant⁻¹ and 16.90 plant⁻¹ range and grand mean was 14.10 plant⁻¹ in 2004. In 2005, average number of sympodia varied in 13.77 plant⁻¹ and 18.20 plant⁻¹ range and grand mean was 15.54 plant⁻¹ (Tab. 5). It was observed that the number of sympodia was high in all plots, excluding Pix, when compared to the control plot. In both years, the highest NOS was obtained in Maxicrop application and the lowest value was obtained in Pix. According to the LSD test, there were different groups between the applications. This may be a result of the excessive assimilates concentration in the plant, depending on the application of plant growth regulators. Number of sympodia is one of the factors affecting seed cotton yield. The fact that the highest number of sympodia was obtained from the plot with the highest seed cotton yield supports our findings. Güllüoğlu (2004) reported similar findings in a study on soybean.

Boll Weight (BW)

Boll weight is an important agronomic characteristic affecting seed cotton yield by unit area. Boll weight is a yield component that is positively or negatively affected by plant growth regulators. Tab. 5 indicates that, in both years, the lowest boll weight was obtained in control plot and Pix application plots, while the highest value was obtained in Maxicrop, Biozyme® TF and Biogibb applications. According to the LSD test, in both years, there were statistically significant differences in boll weight between groups. This might result from increased photosynthetic activity and the increase of dry matter concentration by the plant growth regulator, depending on the increase of photosynthetic pigments (Wu *et al.*, 1994). This process increases boll formation and boll weight (Sawan *et al.*, 2006).

The effect of plant growth regulators on lint percentage, seed index and fiber length are shown in Tab. 6.

Lint Percentage (LP)

Average LP (%) varied in 38.24% and 41.26% range in 2004 and grand mean was 40.11%. In 2005, the LP varied in 38.46% and 40.63% range and grand mean was 39.57% (Tab. 6). Tab. 6 shows that the highest LP was obtained

Tab. 6. Mean values of lint percentage, seed index and fibre length and LSD grouping of PGR treatments in 2004 and 2005 years

Treatments	LP (%)		SI (g)		FL (mm)	
	2004	2005	2004	2005	2004	2005
Control	38.24 d*	38.53 c	8.21 c	8.90 b	29.17	29.73
Pix	40.16 bc	38.46 c	9.33 ab	10.10 a	30.03	30.77
Bigtonik	40.43 abc	39.49 b	9.33 ab	9.98 a	30.10	29.73
Biozyme® TF	40.96 ab	40.21 ab	9.48 ab	10.32 a	30.70	30.07
K-Humate	39.70 c	39.70 b	9.28 ab	10.53 a	29.43	30.20
Maxicrop	41.26 a	40.17 ab	9.62 a	10.30 a	30.63	30.63
Biogibb	40.03 c	40.63 a	9.06 b	10.27 a	30.97	30.17
Grand Means	40.11	39.57	9.19	10.06	30.15	30.19
LSD (0.05)	0.83	0.80	0.47	0.71	ns	ns
CV (%)	1.16	1.14	2.85	3.96	2.51	3.03

*: Different letters in each column indicates that the means differ significantly ($p < 0.05$). ns: non-significant

in Maxicrop application in 2004 and the lowest value was obtained in a control plot. In 2005, the highest value was obtained in Biogibb application and the lowest value was obtained in Pix application. In both years, the LSD test indicated that there were different LP groups. It was found that Maxicrop and Biozyme® TF applications had a positive impact on LP. These findings are consistent with those of Zibdieh *et al.* (1998).

Seed Index (SI)

According to Tab. 6, SI values were found to be in 8.21-9.62 g range in 2004, and in 8.90-10.53 g range in 2005. The SI grand mean was 9.19 g in 2004 and 10.06 g in 2005. SI values of PGRs in 2005 were slightly higher than those in 2004. This may result from the variations in climatic factors and ambient conditions. It can be concluded from Tab. 6 that PGRs significantly increased seed index compared with the untreated cotton plots in both years. It was reported that bolls on cotton plants treated with PGRs have larger photosynthetic sinks for carbohydrates and other metabolites than control plot bolls (Zhao and Oosterhuis, 1999).

Fiber Length (FL)

FL is influenced by both genetics and environmental factors (Meredith and Bridge, 1973). In addition, FL is affected partly or fully by cultural practices and type of PGRs and applications times (Siebert and Stewart, 2006). In this study, FL varied in 29.17 and 30.97 mm range in 2004. In 2005, FL was found to be in 29.73 and 30.77 mm range (Tab. 6). There were no significant differences in FL according to PGRs applications. Similar results were reported by Jost and Dollar (2004) and Gencsoylu (2009).

The effect of plant growth regulators on fibre fineness, fibre strength and fibre uniformity are given in Tab. 7.

Tab. 7. Mean values of fibre fineness, fibre strength and fibre uniformity and LSD grouping of PGR treatments in 2004 and 2005 years

Treatments	FF (micronaire)		FS (g tex ⁻¹)		FU (%)	
	2004	2005	2004	2005	2004	2005
Control	4.50	4.43	29.33	32.03	85.13	85.43
Pix	4.07	4.30	31.93	31.23	86.03	85.43
Bigtonik	4.60	4.60	32.80	32.70	86.57	86.20
Biozyme [®] TF	4.57	4.30	32.00	33.97	84.93	85.83
K-Humate	4.83	4.57	31.87	32.67	84.20	85.47
Maxicrop	4.37	4.63	33.10	33.90	84.50	86.60
Biogibb	4.87	4.43	35.23	32.60	86.37	86.90
Grand Means	4.54	4.47	32.32	32.73	85.39	85.98
LSD (0.05)	ns	ns	ns	ns	ns	ns
CV (%)	6.57	5.60	6.17	4.40	2.33	1.82

ns: non-significant

Fiber Fineness (FF)

FF varied in 4.07 and 4.87 mic. range in 2004. In 2005, it varied in 4.30 and 4.63 mic. range (Tab. 7). Mean FF values were 4.54 mic. and 4.47 mic. in 2004 and 2005, respectively.

Fiber Strength (FS)

FS varied in 29.33 and 35.23 g tex⁻¹ range in 2004. In 2005, it varied in 31.23 and 33.97 g tex⁻¹ range (Tab. 7). The mean FS of different PGRs in 2004 was 32.32 g tex⁻¹ and 32.73 g tex⁻¹ in 2005.

Fiber Uniformity (FU)

FU varied in 84.20 and 86.57% range in 2004 and varied in 85.43 and 86.90% range in 2005, respectively (Tab. 7). Mean FU of treatment PGRs in 2004 was 85.39% and 85.98% in 2005.

From Tab. 7, it can be seen that there were no significant differences for FF, FS and FU in either of the two years. The results of this study support those of Jost and Dollar (2004) and Gencsoylu (2009), who reported that the use of PGRs did not impact the FF, FS and FU.

Conclusions

This study showed that application of PGRs affected the seed cotton yield, earliness index, plant height, number of sympodia, number of bolls, boll weight, lint percentage and seed index. The yield in 2005 was significantly higher than in 2004. This may result from the variations in environmental conditions in the region. The use of Maxicrop, Biozyme[®] TF and Biogibb increased average seed cotton yield, when compared to control plot. Therefore, these plant growth regulators can be recommended to cotton producers to increase seed cotton yield. Pix application decreased plant height. Reduced plant height might result from the inhibition of gibberellic acid (GA) concentration

by Pix. In addition to plant height, Pix also reduced seed cotton yield. This indicates that Pix gave different reactions to varieties and climatic conditions. Therefore, Pix can be recommended in case of excessive nitrogen fertilization and irrigation conditions. The lint quality, including fibre length, fibre fineness, fibre strength and fibre uniformity were not affected by the PGRs.

Maxicrop, Biozyme[®] TF and Biogibb chemicals can be recommended as plant growth regulators to increase seed cotton yield per unit area in the South-eastern Anatolia Region of Turkey.

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