

# THE EFFECT OF PLANT GROWTH REGULATORS ON SEED COTTON (*Gossypium spp.* L.) YIELD AND LINT QUALITY UNDER EAST MEDITERRANEAN CLIMATIC CONDITIONS

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## Introduction


- Cotton is an industrial crop which has an important place in the world agriculture and trade.
- A number of researches has been established on cotton which is valuable for many industries besides textile industry depending on requirements of human being and rapid developments in industry.






## Introduction


- The cotton plant is a perennial with an indeterminate growth habit, and reputed to have the most complex growth habit of all major row crops. Furthermore it is very responsive to management and changes in the environments. Cotton producers and researchers have, therefore, used plant growth regulators (PGR' s) and other cultural practices as a means to manage the balance between vegetative and reproductive growth for efficient cotton production (Oosterhuis and Robertson, (2000).



## Introduction


- The most important PGR used on cotton production in the world is Mepiquat chloride. It is a syntetic plant growth regulator that manage vegetative growth of cotton (Shumway, 1997; according to Haliloğlu, 2010).
- Applications of mepiquat chloride results in reduced internode elongation and plant height (Nutı et al., 2006 ; Reddy et al., 1990; Zhao and Oosterhuis, 2000; according to Dodds et al.,2010).





## Introduction


- Mepiquat chloride is an inhibitor of gibberellic acid that is absorbed by green parts of plant and it limits excessive elongation of plant by obstructing cell elongation (York, 1983; according to Haliloğlu, 2010).
- PGR's promote plant growth and yield on cotton. Some researchers reported that PGR's especially mepiquat chloride (Pix) provide earliness beside of yield increasing.
- But, generally it is reported that mepiquat chloride don't affect fiber quality traits.



## Introduction

- In this study carried out under east Mediterranean region conditions (Kahramanmaraş-Turkey) it was investigated the effect of different plant growth regulators on:
  - seed cotton yield,
  - yield components,
  - lint quality.





## Material and Methods

- Kahramanmaraş is a province placed in the east Mediterranean region of Turkey and it has typical Mediterranean climatic properties which are hot and dry in summers and warm and rainy in winters.








Figure 1. Location of Kahramanmaraş province in Turkey map.



## Introduction


- In Turkey cotton sowing area is 542.000 ha,
- seed cotton production is 2.580.000 tones,
- lint cotton production is 954.600 tones,
- seed cotton yield is 4.760 kg/ha and
- Lint yield is 1.760 kg/ha.


(Anomymous, 2011)



## Introduction



- Kahramanmaras province is in the east Mediterranean region of Turkey
- In Kahramanmaras cotton sowing area is 9.059.2 ha,
- seed cotton production is 32.046 tones,
- lint cotton production is 11.857 tones,
- seed cotton yield is 3.540 kg/ha and
- lint yield is 1.310 kg/ha (Anonymous, 2011).






## Material and Methods


- **Plant Material**
- In this study cotton varieties of Agdas-3, Agdas-17, Maras-92 (*G. hirsutum* L.) and Agdas-21 (*G. barbadense* L.) were used as plant material.  
Agdas varieties were developed by Prof. Dr. Sefer Mustafayev in Azerbaijan and they were brought in 1996 from Azerbaijan to Kahramanmaraş Sutcu Imam University by Professor Mustafayev.


## Material and Methods

- **PGR's:**
- Pix (50 g lt<sup>-1</sup> Mepiquat Chloride)
- Turbonik 6SL (Na derivatives) (Na ortho-nitrophenolate + Na para-nitrophenolate + Na nitro-5-nitroguaiacolate) (2+3+1 g lt<sup>-1</sup>)
- Cytokin (0.1 mg lt<sup>-1</sup> Kinetin)
- were used as commercial preparation of plant growth regulators and there were control (untreated) plots.






## Material and Methods




- **Methods**
- This study carried out in 2010 in the experimental field of Kahramanmaraş Sutcu Imam University, Faculty of Agriculture was established according to experimental design of split plots with three replications.
- Cotton varieties were in main plots, plant growth regulators were in subplots.
- The seeds of cultivars were sown by experimental mechanical planter in four-row plots of 10 m length at a planting space of 70 cm on 12 May 2010.








### Material and Methods




- In this study there was three different plant growth regulators and control (untreated).
- 1. **Pix**: 100 cc/da at the beginning of flowering was applied .
- 2. **Turbonik**: 75 cc/da at the beginning of flowering + 75 cc/da 10 days after first treatment was applied .
- 3. **Cytokin** : 60 cc/da at the beginning of flowering + 60 cc 10 days after first treatment was applied .
- 4. **Control (untreated)**: Only water was sprayed to thees plots.






## Material and Methods





- Before harvesting the samples of 25 bolls were taken at random from two rows in the middle of each plot when 50-70 % of bolls opened (Efe, 2000).
- Plants were harvested on 30 September and 15 October from two rows in the middle of each plot as two times by hand.
- Seed cotton yield, yield components and important lint quality traits were investigated.
- After ginning of the boll samples, fiber properties were determined by using HVI (High Volume Instruments) Instrument.




## Material and Methods

- The data obtained were analysed according to experimental design of split plots with three replications by using the SPSS statistical package program (Efe et al., 2000) and the means were compared by using Tukey multiple comparison test (Bek and Efe, 1995).



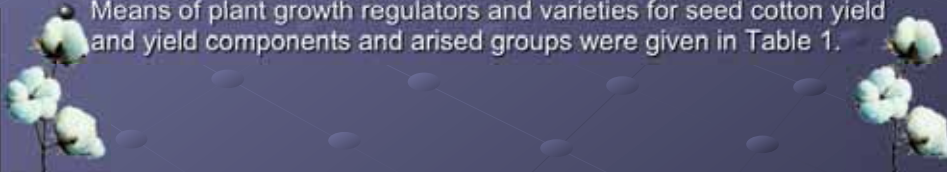





## Results and Discussion


- Statistically differences were determined among different plant growth regulators for ginning outturn and fiber strength ( $P < 0.05$ ).
- For seed cotton weight per boll, seed cotton yield, ginning outturn, fiber length and reflectance degree statistically differences were determined among varieties ( $P < 0.01$ ).
- For fiber strength ( $P < 0.05$ ) and elongation ( $P < 0.01$ ) PGR treatment x variety interaction was statistically significant.

Means of plant growth regulators and varieties for seed cotton yield and yield components and arised groups were given in Table 1.


**Table 1. Means of plant growth regulators (PGRs) and varieties for seed cotton yield and yield components and arised groups**


	Plant height (cm)	Sympodial Number	Boll Number Per Plant	Seed Cotton Weight Per Boll (g)	Seed Cotton Yield (kg ha <sup>-1</sup> )	Ginning Outturn (%)
<b>Means of PGR Treatments</b>						
Pix	104.8 a	14.9 a	9.6 a	5.0 a	3363.3 a	40.3 ab
Turbonik	106.7 a	15.6 a	9.5 a	4.9 a	3137.6 a	38.9 ab
Cytokin	107.1 a	15.2 a	9.5 a	4.9 a	3315.1 a	42.2 a
Control	105.3 a	15.0 a	9.5 a	5.0 a	3115.2 a	38.3 b
<b>Means of Varieties</b>						
Agdas-3	104.7 a	15.6 ab	10.9 a	5.5 a	3373.8 b	38.9 bc
Agdas-17	105.1 a	16.1 a	10.3 a	5.4 a	3599.0 ab	42.9 a
Agdas-21	107.5 a	14.3 b	8.6 b	3.2 b	2107.6 c	36.4 c
Maras-92	106.5 a	14.6 b	8.3 b	5.7 a	3850.8 a	41.4 ab



## Results and Discussion


- From Table 1, plant height means of varieties varied between 104.7 cm (Agdas-3) and 107.5 cm (Agdas-21).
- Means of plant height for plant growth regulators varied between 104.8 cm (Pix) and 107.2 cm (Cytokin).
- The highest sympodia number was taken from Agdas-17 (16.1) and Agdas-3 (15.6) followed this.
- Agdas-21 and Maras-92 had the lowest means of sympodia number.
- Means of sympodia number for plant growth regulator varied between 14.9 (Pix) and 15.6 (Turbonic).





### Results and Discussion


- Seed cotton yields of tested varieties varied between 3850.8 kg ha<sup>-1</sup> and 2107.6 kg ha<sup>-1</sup>.
- The highest seed cotton yield was taken from cv. Maras-92.
- Agdas-17 and Agdas-3 followed it (3588.0 kg ha<sup>-1</sup> and 3373.8 kg ha<sup>-1</sup> respectively).
- Agdas-21 had the lowest seed cotton yield (2107.6 kg ha<sup>-1</sup>).






## Results and Discussion

- Ginning outturn values of tested varieties varied between 42.9 % (cv. Agdas-17) and 36.4 % (cv. Agdas-21).
- The highest ginning outturn was taken from cv. Agdas-17 (42.9 %), cv. Maras-92 (41.4 %) and cv. Agdas-3 (38.9 %) followed it. The lowest ginning outturn was taken from cv. Agdas-21 (36.4 %).
- For major lint quality trait means of plant growth regulators and varieties and arised groups were given in Table 2.



**Table 2. Means of plant growth regulators (PGRs) and varieties for major lint quality traits and arised groups**

	Fiber length (mm)	Fiber Fineness (Micronaire)	Fiber Strength (g tex <sup>-1</sup> )	Fiber Uniformity (%)	Elongation (%)	Spinning Consistency Index (SCI)
<b>Means of PGR Treatments</b>						
Pix	27.8 a	4.4 a	31.6 ab	84.7 a	5.7 a	158.0 a
Turbonik	28.5 a	4.5 a	29.2 b	84.6 a	5.7 a	151.3 a
Cytokin	28.5 a	4.5 a	32.4 a	85.3 a	5.6 a	153.1 a
Control	28.2 a	4.5 a	30.7 ab	85.3 a	5.8 a	158.0 a
<b>Means of Varieties</b>						
Agdas-3	27.4 b	4.4 ab	30.3 b	85.0 a	5.7 ab	155.0 b
Agdas-17	27.1 b	4.7 b	28.7 b	85.7 a	5.7 ab	149.5 b
Agdas-21	30.6 a	4.2 a	34.9 a	84.0 a	5.9 a	169.5 a
Maras-92	27.8 b	4.4 ab	30.1 b	85.1 a	5.4 b	156.5 ab




## Results and Discussion


- Fiber length values of tested varieties varied between 27.1 mm (cv. Agdas-17) and 30.6 mm (cv. Agdas-21).
- For fiber length and fiber fineness the PGR's were similar each other. The all means took place at the same group.
- The finest fibers were taken from cv. Agdas-21 (4.2 mic.) and cv. Agdas-3 and cv. Maras-92 (4.4 mic.) followed it. The tickest fibers were taken from cv. Agdas-17 ( 4.7 mic.).



## Results and Discussion


- Fiber strength values of tested varieties were 28.7 g tex-1 (cv. Agdas-17) and 34.9 g tex-1 (cv. Agdas-21).
- Agdas-21 has the most strength fibers. The other three varieties were similar means for this trait.
- Means of fiber strength for plant growth regulators varied between 29.2 g tex-1 and 32.4 g tex-1. The highest fiber strength was taken from Cytokin (32.4 g tex-1) and Pix (31.6 g tex-1) and control (30.7 g tex-1) followed it and the lowest fiber strength was taken from Turbonik (29.2 g tex-1).





## Results and Discussion

- As seen in Table 2 means of fiber uniformity for PGR' s and varieties were not statistically significant and took place at the same group.
- Elongation values of tested varieties varied between 5.4 % and 5.9 %. The most elongation value was taken from cv. Agdas-21 (5.9 %).
- cv. Agdas-3 and cv. Agdas-17 (5.7 %) followed it and the least elongation value was taken from Maras-92 (5.4 %).
- Means of elongation for PGR' s were not statistically significant and took place at the same group.



## Results and Discussion

- Spinning consistency index values of tested varieties varied between 169.5 and 149.5. The most spinning consistency index value was taken from cv. Agdas-21 (169.5) followed by Maras-92 (156.5).
- cv. Agdas-3 (155.0) and cv. Agdas-17 (149.5) followed them.
- Means of spinning consistency index for PGR' s were not statistically significant and took place at the same group.



**Table 3. Means of plant growth regulator (PGR) treatment x variety interaction for seed cotton yield and yield components and arised groups**

Means of PGR Treatment x Variety Interaction	Plant height (cm)	Sympodial Number	Boll Number Per Plant	Seed Cotton Weight Per Boll (g)	Seed Cotton Yield (kg ha <sup>-1</sup> )	
<b>Pix</b>	<b>Agdas-3</b>	103.7 a	15.2 a	11.6 a	5.9 a	3724.3 ab
	<b>Agdas-17</b>	103.1 a	15.6 a	10.2 ab	5.2 a	3488.3 ab
	<b>Agdas-21</b>	105.4 a	14.2 a	8.6 ab	3.4 b	2110.3 cd
	<b>Maras-92</b>	106.9 a	14.6 a	8.0 b	5.7 a	4130.3 a
<b>Turbonik</b>	<b>Agdas-3</b>	105.1 a	15.8 a	10.4 ab	5.6 a	2973.0 bcd
	<b>Agdas-17</b>	108.2 a	16.7 a	10.3 ab	5.5 a	3650.3 ab
	<b>Agdas-21</b>	106.4 a	14.5 a	8.3 ab	2.9 b	2161.7 cd
	<b>Maras-92</b>	107.1 a	15.4 a	9.0 ab	5.7 a	3765.3 ab
<b>Cytokin</b>	<b>Agdas-3</b>	106.0 a	16.1 a	11.1 ab	5.0 a	3573.3 ab
	<b>Agdas-17</b>	105.5 a	16.6 a	10.6 ab	5.6 a	3650.3 ab
	<b>Agdas-21</b>	108.9 a	14.2 a	8.4 ab	3.2 b	2158.3 cd
	<b>Maras-92</b>	107.9 a	14.1 a	7.9 b	5.8 a	3993.3 ab
<b>Control</b>	<b>Agdas-3</b>	103.9 a	15.4 a	10.7 ab	5.6 a	3224.7 abc
	<b>Agdas-17</b>	103.8 a	15.7 a	9.9 ab	5.4 a	3722.0 ab
	<b>Agdas-21</b>	109.5 a	14.5 a	9.0 ab	3.3 b	2000.3 d
	<b>Maras-92</b>	104.1 a	14.5 a	8.4 ab	5.9 a	3514.0 ab


**Results Discussion**

- Agdas-3 variety treated Pix formed 11.6 bolls per plant. Maras-92 variety treated Cytokin gave 7.9 bolls per plant.
- Maras-92 variety treated Pix gave 4130.3 kg ha<sup>-1</sup> seed cotton yield. Agdas-21 untreated (control) gave 2000.3 kg ha<sup>-1</sup> seed cotton yield.
- Agdas-21 treated Turbonik and control have the highest fiber length (30.9 mm and 31.0 mm respectively). The lowest fiber length was taken from Agdas-17 treated Pix (26.0 mm).

**Table 3. Means of plant growth regulator (PGR) treatment x variety interaction for major lint quality traits and arised groups**


Means of PGR Treatment x Variety Interaction		Fiber length (mm)	Fiber Fineness (Micronaire)	Fiber Strength (g tex <sup>-1</sup> )	Fiber Uniformity (%)	Elongation (%)	Spinning Consistency Index (SCI)
Pix	Agdas-3	27.2 b-d	4.5 a	31.1 bc	84.7 a	5.6 a-c	155.6 a
	Agdas-17	26.0 d	4.6 a	29.2 bc	85.9 a	5.6 a-c	151.1 a
	Agdas-21	29.9 a-c	4.2 a	33.7 a-c	84.8 a	6.2 ab	168.8 a
	Maras-92	28.2 a-d	4.3 a	32.4 a-c	83.4 a	5.2 c	156.4 a
Turbonik	Agdas-3	27.5 a-d	4.6 a	29.5 bc	84.3 a	6.0 a-c	148.4 a
	Agdas-17	28.0 a-d	4.7 a	27.7 c	85.7 a	5.8 a-c	149.7 a
	Agdas-21	30.9 a	4.2 a	30.5 bc	83.5 a	5.5 a-c	155.0 a
	Maras-92	27.4 a-d	4.4 a	29.2 bc	84.8 a	5.4 a-c	152.3 a
Cytokin	Agdas-3	27.4 a-d	4.4 a	31.0 bc	85.7 a	5.8 a-c	161.0 a
	Agdas-17	27.9 a-d	4.7 a	31.0 bc	85.6 a	5.2 bc	156.2 a
	Agdas-21	30.7 ab	4.4 a	39.3 a	83.3 a	5.4 a-c	178.1 a
	Maras-92	28.0 a-d	4.5 a	28.1 c	86.4 a	5.8 a-c	156.9 a
Control	Agdas-3	27.5 a-d	4.3 a	29.4 bc	85.2 a	5.4 a-c	154.8 a
	Agdas-17	26.6 cd	4.9 a	26.9 c	85.6 a	6.2 a-c	140.9 a
	Agdas-21	31.0 a	4.1 a	35.9 ab	84.4 a	6.3 a	175.9 a
	Maras-92	27.6 a-d	4.4 a	30.6 bc	85.8 a	5.2 c	160.4 a







## Results Discussion

- Agdas-21 treated Cytokin had the most fiber strength (39.3 g tex-1). Agdas-17 treated Turbonik (27.7 g tex-1) and control (26.9 g tex-1) and Maras-92 treated Cytokin (28.1 g tex-1) had the least fiber strength.
- Agdas-21 untreated had the most elongation value (6.3 %) and Maras-92 treated Pix and control had the lowest elongation values (5.2 %).






## Conclusion




- In conclusion, it was determined that PGR's did' nt affect yield and yield components except ginning outturn.
- While PGR' s had not an effect on lint quality traits except fiber strength.
- The best values were taken from cytokin treatment for ginning outturn and fiber strength.
- PGR treatment x variety interaction was statistically significant for fiber strength ( $P<0.05$ ) and elongation ( $P<0.01$ ).




## Conclusion

- This study was carried out during one year. In order to obtain better results it is necessary to be repeated more than one year and number of PGR' s and varieties should increase.



In memorium of Prof. Dr. Sefer Mustafayev

Thank You For Your Attention



The slide features a dark blue background with a subtle pattern of white dots. At the top left and right corners are circular logos for 'SARAY FAKULTESI' and 'SARAY UNIVERSITESI'. The central text is white. Below the text is a large photograph showing a man in a grey coat and white hat walking through a field of green plants, likely a vineyard, with mountains in the background.

Thank You for Your Attention



The slide features a dark blue background with a subtle pattern of white dots. At the top center is the text 'Thank You for Your Attention'. Below the text is a collage of images. The largest image is a photograph of a large university building with a blue roof and red accents, set against a backdrop of mountains. To the left of this image is a circular logo for 'SARAY FAKULTESI'. Below the main image are four smaller images: a tractor in a field, people working in a field, rows of plants in a field, and a person working in a field. At the bottom of the collage is a large photograph of a field with rows of plants, likely a vineyard, with a dirt road and a tractor in the background.