International Journal of Agriculture and Environmental Research

ISSN: 2455-6939

Volume:04, Issue:06 "November-December 2018"

INFLUENCE OF GROWTH PROMOTERS (NITROPHENOLATE) ON FLOWERING AND YIELD OF SOME EGYPTIAN COTTON CULTIVARS

Elashmouny. A. Amany

Cotton Research Institute, Agriculture Research Center, Egypt

ABSTRACT

Two field studies were conducted to evaluate cotton yield and its components which response to foliar application of Nitrophenolate (Super tonic) at 2017 and 2018 seasons in Sakha- Kafr – El Shiekh government. Split plot design with three replicates, the main factors were varieties (Giza 94 and Giza 96), sub main plot were four levels of super tonic (0.5, 1, 1.5 and 2.00 cm / liter) compared with untreated plants. The results obtained that, Giza 94 was superior to Giza 96 in some studied characters like (no. of flowers, no. of setting bolls/ plant, chlorophyll a, b, carotenoids, phenols, no. of total open bolls and seed cotton yield per faddan. On the other hand, Foliar application of super tonic at 1.00 cm/ liter gave the highest number of almost of studied characters as, no. of flowers/ plant, total phenols, plant height, no. of fruiting branches, no. of open bolls and seed cotton yield compared with other concentrations. The interactions between varieties and rates of super tonic were significant in almost studied characters. Therefore, foliar application of Giza 94 plants with super tonic at 1.00 cm / liter as combination treatments was highest of most characters that other combinations, at the next foliar application of Giza 96 plants with super tonic at 2.00 cm /liter.

Keywords: Egyptian cotton, Super Tonic, phenols, Flowering and Shedding%.

INTRODUCTION

Egyptian cotton is a strategic crop with glorious history in Egypt. In past, it was accounted as main source of Egyptian economy. Its impact on the economic development of the country is well established and it is rightly known as the white gold in Egypt. It is a strong competitor in the worldwide market against the other types of cotton. Recently, Egyptian cotton has faced serious problems that dramatically affected its production. Nowadays a lot of efforts have been made to get its position back among different cotton types. One of these strategies to improve cotton yield in Egypt is reducing the shedding of flowers and bolls by addition some growth regulators.

ISSN: 2455-6939

Volume:04, Issue:06 "November-December 2018"

Cotton crop potentially produces sufficient number of bolls but the proportion of those, which are carried to maturity, is low and growers rarely harvest 25-30% of the total. The problem is more pronounced in stress conditions either from biotic or abiotic factors. In cotton, fruit drop may be up to 35% to 50% in form of squares and small bolls (**Baloch et al., 2000**). The shedding of fruiting bodies in various cotton cultivars ranged from 31.76 to 43.63% throughout growth season (**Haneef et al., 2001**). It has been estimated that 40% shedding of fruiting forms is due to over production (**Oosterhuis and Jernstedt, 1999**). The physiological based shedding of unopened flowers and bolls in cotton ranged from 7-35 and 32- 44%, respectively (**Goswami and Dayal, 1998**). The shedding of squares and young bolls is self-regulatory because cotton plant is incapable of supplying food to all emerging fruiting structures in field conditions. The formation of shedding layer between plants and fruiting forms initiates the shedding process. Thus, it weakens the peduncle to support the heavy weight bolls. While, the small squares remain attached to fruiting branches. The shedding of bolls and square in cotton is controlled by plant and environmental factors. Hence, plant developmental stage and stressful conditions determines the commencement and progress of shedding. The plant factors include hormonal balance, assimilates supply and plant nutritional status, whereas moisture, temperature and light are major environmental concerns. The article was written with the objective to seek out the plant and environmental stimuli of fruit shedding with an overview of its mechanism and management tools potent to fruit retention. The plant hormones actually coordinate between developmental and environmental stresses through conducting a chemical message within plant. The shedding is regulated by growth hormones and it had been classified that abscisic acid and ethylene are promoters and auxins and indole acetic acid (IAA) are inhibitors while gibberellins and cytokinins had variable effect. The abscicic acid (ABA) has double effect on shedding; it directly increases cellulase activity at shedding zone and indirectly, it hastens the ethylene production and reduces the auxin transport. The gibberellic acid (GA) is not only a promoter of shedding of buds but also inhibits the bolls drop by counteracting the effect of applied ABA, and it was confirmed that application of 100 ppm GA to flowers improved retention (**Walhood, 1958**).

Supertonik, also known as Chap-perone is a synthetic biostimulant. It is a water solution of phenolic compounds: sodium para-nitrophenolate PNP(0.3%), sodium ortho-nitrophenolate ONP (0.2%) and sodium 5-nitroguaiacolate 5NG (0.1%), it has a positive effect on the yield of some important crops including cotton (**Djanaguiraman et al., 2004**), bean and oilseed rape. So far, the mechanism of nitrophenolate–based biostimulant action has not been fullyexplained; however, biomass accumulation and elongated growth observed after its application, are usually linked with an increase of auxin concentration. The foliar application of Supertonik additionally increases the inhibition of IAA oxidase, which ensures a greater activity of naturally-synthesizedauxins and a greater number of high-affinity binding sites of IAA. Studied on Super tonic show positive effects on vegetative growth of seedling, shoots, roots and branches,

ISSN: 2455-6939

Volume:04, Issue:06 "November-December 2018"

reproductive growth in number of flowers and number of fruits and biomass accumulation (both fresh weight and dry matter) and yield .

The objectives of this study therefore were to reducing shedding of squares and bolls which resulted in high surprising temperature, determine the rate of Super Tonic PGR suitable for high yield of two varieties of cotton and determine the combined effects of super tonic rates and varieties on the growth and yield performance of cotton.

MATERIALS AND METHODS

The study was conducted at Sakha station, Kafr El Shiekh government, in two successive seasons, cotton seeds were planted in 23 and 24 April after Egyptian clover in 2017 and 2018 seasons, respectively. Each sub sub plot consisted of five rows, 5 meters long with 0.70 meters apart. The experimental design was split plot design with three replicates.

Treatments consisted of supertonic was applied at two times at beginning of squaring and beginning of flowering). Main plot was the two varieties cultivar (Giza 94 and 96 cultivar) , Sub main plot was spraying of supertonic at rates (0,0.50,1.00,1.50 and 2.00 cm/ litre). Phosphorus fertilizer in the form of superphosphate (15.5% P_20_5) at the rate of 31 kg P_20_5/fed. was applied during land preparation. Nitrogen fertilizer in the form of ammonium nitrate (33.5% N) at the rate of 75 kg N/fed. was applied in two equal doses, the first dose after thinning and before the second irrigation, the second dose before the third irrigation. Potassium fertilizer as potassium sulfate (48% K_2O) at the rate of 48 Kg K_2O/fed.The cotton cultivars, insect control, weed control, growth mangment and defoliation were standard for the respective location.

Table 1: Chemical composition and physical properties of Supertonic plant stimulant.

Chemical composition	
5- Nitroguaiacol Sodium	17 %
O-Nitrophenolate Sodium	33 %
P- Nitrophenolate Sodium	50 %
Physical properties	
Appearance	Reddish-brown
Melting point	105-106o C
Solubility	Easily soluble in water and solvents
Stability	Stable under normal conditions

ISSN: 2455-6939

Volume:04, Issue:06 "November-December 2018"

I- production and shedding of flowers and bolls:-

In the experiment, during flowering period, five plants were marked at random at each plot in the field. The following data was recorded on the main stem and branches per each marked plant.

1) Number of flowers/plant.
2) Number of setting bolls / plant.

The number of flowers and setting bolls were measured during the flowing period of 6 days intervals beginning the blooming of the first flower until the end of the flowering period then, the flowering and bolling curves were done:-

3) Shedding squares / plant % =

$$\frac{\text{No. of squares/ plant} - \text{No. of setting bolls / plant}}{\text{No. of squares / plant}} \times 100$$

4) Shedding bolls / plant %

$$\frac{\text{No. of setting bolls / plant} - \text{No. of bolls at harvest}}{\text{No. of setting bolls / plant}} \times 100$$

5) Total shedding % =

$$\frac{\text{No. of squares/ plant} - \text{No.of bolls at hervest / plant}}{\text{No. of squares / plant}} \times 100$$

Table 2: Critical temperature ranges for different processes of cotton

Plant parameters/processes	OptimalTemperature (°C)	References
Leaf area, intermodal distance	27-30	Reddy et al. (1997)
Young bolls shedding	32	Reddy et al. (1996)
Pollen tube growth	28-32	Burke et al. (2004)
Pollen germination	28	Burke et al. (2004)
Fruit efficiency	>29	Reddy et al. (1996)
Stem growth	30	Hodges et al. (1993)
Square and flower drop	>30	Reddy et al. (1992)

ISSN: 2455-6939

Volume:04, Issue:06 "November-December 2018"

Table 3: Range and mean values of the weather variables recorded during the growing seasons (May-October).

Weather variables	Season I		Season II		Overall date (Two seasons)	
Max Temp [˚C]	20.8 - 44.0	32.6	24.6 - 43.4	32.70	20.8 - 44.0	32.6
MinTemp [˚C]	10.4 - 24.5	19.4	12.0 - 24.3	19.30	10.4 - 24.5	19.3
Max –Min Temp [˚C]	4.7 - 23.6	13.2	8.5 - 26.8	13.40	4.7 - 26.8	13.3
Sunshine [h·d−1]	0.3 - 12.9	11.1	1.9 - 13.1	11.20	0.3 - 13.1	11.1
Max Hum [%]	48.96	79.5	46 – 94	74.7	46 - 96	77.2
Min Hum [%]	6-48	30.1	8-50	33.0	6 - 50	31.5
Wind speed [m·s−1]	0.9-11.1	5.2	1.3 - 11.1	5.0	0.9 - 11.1	5.1

II- Physiological data

Chlorophyll a and b content. Leaves samples (100mg/sample) were each immersed in 4 ml of 95% acetone and incubated at 6-8°C for 24 hrs. and determined by spectrophotometer measuring the absorbance (optical density-OD) at 662 and 644 nm respectively. The concentrations of Chlorophyll a and Chlorophyll b (µg. g-1FW) in leaf tissues were calculated using the following equations (**Cha-Um et al., 2006**):

Chlorophyll a= $9.784*D_{662}- 0.99*D_{644}$
Chlorophyll b= $21.426*D_{644}- 4.65*D_{662}$

Where Di is an optical density at the wavelength i.

Determination of total phenolic compounds (TPC). The content of total phenolics was determined using the Folin- Ciocalteau reagent (**Singleton and Rossi, 1965**). To 0.5 mL of the sample, 0.5 mL of H2O and 2 mL of Folin-Ciocalteau reagent (1:5H2O), and after 3 min, 10 mL of 10% Na2CO3 were added and the contents were mixed and allowed to stand for 30 min. Absorbance was measured at 725 nm using a UV–vis spectrophotometer. The content of total phenolics was calculated as a gallic acid equivalent (GAE) in mg per g of dry matter (DM).

ISSN: 2455-6939

Volume:04, Issue:06 "November-December 2018"

III- Yield and its components.

At the picking time, the following characters were recorded:-

1- Plant height(cm)
2- Number of fruiting branches / plant
3- Number of open bolls / plant
4- Boll weight (g)
5- Seed cotton yield / feddan in kentar

Statistical Analysis:-

Data obtained for the cotton seed yield and seed weight were statistically analyzed as a Split plot design experiment following the procedure outlined by **Snedecor and Cochran (1967)** and the least significant difference (LSD) was used to determine the significance of differences between treatment means. As for the chemical properties considered in the study, the f-test computed in accordance with standard deviation was utilized to verify the significance between treatments means.

RESULTS AND DISCUSSION

I- Production and shedding of flowers and bolls:

Two cotton cultivars and the treatments with super tonic regardless of the concentration and cultivar had a positive effect on cotton plants during the two growing seasons. Giza 94 was superior to other studied variety (Giza 96) in the no. of flowers and no. of setting bolls in the first and second seasons. On the other hand, among between Supertonic treatments, application at 1.00 cm / liter resulted in the highest percentage of productive flowers and bolls. These results may be due to that the Auxin (IAA) usually inhibits abscission. Treatment with super tonic prevents an increase in the specific cellulose that causes abscission (**Abeles 1998; Ratner et al. 1999; Leigh and Varner 2000**), Factors that slow the movement of IAA to the abscission zone tend to promote abscission (**Morgan and Durham 1999**). In comparing the applications with no Super tonic, the least percentage of productive flowers and bolls were produced by cotton plants where no Super Tonic application was made (control). Also, there were significant variety x Super Tonic interactions for the number of flowers and bolls (Table 4). Giza 94 sprayed with Super Tonic at 0.50 and 1.00 cm / liter produced the greatest number of flowers and setting bolls, significantly higher than all other combinations.

ISSN: 2455-6939

Volume:04, Issue:06 "November-December 2018"

Table 4: Effect of different rates of nitrophenolate (Super tonic) on number of flowers, setting bolls / plant and their shedding percentage of two varieties of cotton during 2017 and 2018 seasons.

Characters / treatments	No. of flowers / plant	No. of setting bolls/plant	Shedding of squares %	Shedding of bolls %	Total shedding %
Main plot (A)	**2017 season**				
Giza 94	43.04 a	38.60 a	10.33 a	11.28 b	16.23 a
Giza 96	40.63 b	36.54 b	9.97 a	12.16 a	17.15 a
L.S.D at 5%	**3.23 ***	**0.70 ****	**N.S**	**33.49 ***	**N.S**
Sub main plot (B)					
Control(untreated plants)	39.38 c	34.70 b	12.35 a	11.21 a	21.34 a
Super tonic at 0.5	42.70 ab	37.79 a	11.52 ab	11.00 a	18.76 ab
Super tonic at 1.00	43.40 a	37.96 a	11.68 ab	9.46 a	18.65 ab
Super tonic at 1.50	41.86 b	38.41 a	8.15 bc	9.29 a	15.68 b
Super tonic at 2.00	41.83 b	39.00 a	7.07 c	9.09 a	15.86 b
L.S.D at 5%	**1.26 ****	**1.21 ***	**3.90 ****	**N.S**	**4.28 ***
Interaction (AxB)					
Giza 94 x Control	41.12 b	36.12 c	10.15	13.44 a	20.18 a
Giza 94 x Tonic 0.5	42.52 ab	37.23 b	10.33	12.14 c	20.00 a
Giza 94 x Tonic 1.00	44.20 a	.3859 a	10.52	12.65 b	18.16 c
Giza 94 x Tonic 1.50	43.00 a	38.35 a	11.00	13.00 a	18.63 c
Giza 94 x Tonic 2.00	42.60 ab	38.00 a	11.42	12.36 c	19.12 b
Giza 96 x Control	40.30 c	35.75 d	11.12	14.23 a	19.36 b
Giza 96 x Tonic 0.5	41.21 b	36.82 c	10.98	13.52 a	18.23 c
Giza 96 x Tonic 1.00	42.00 ab	37.00 b	10.66	13.00 b	19.27 b
Giza 96 x Tonic 1.50	43.15 a	37.18 b	10.87	12.69 b	18.70 c
Giza 96 x Tonic 2.00	44.00 a	37.95 a	10.86	12.20 c	17.63 d
L.S.D at 5%	**2.13 ****	**1.72 ***	**N.S**	**2.25 ***	**2.87 ***

ISSN: 2455-6939

Volume:04, Issue:06 "November-December 2018"

Table 4: Cont…

Characters / treatments	No. of flowers / plant	No. of setting bolls/plant	Shedding of squares %	Shedding of bolls %	Total shedding %
	2018 season				
Main plot (A)					
Giza 94	41.83a	37.18 a	11.00 a	10.94 a	20.01 a
Giza 96	40.76 b	36.04 a	10.62 a	10.13 a	21.69 a
L.S.D at 5%	**0.70 ***	**N.S**	**N.S**	**N.S**	**N.S**
Sub main plot (B)					
Control(untreated plants)	38.33 c	35.25 c	9.19 a	10.18 ab	23.84 a
Super tonic at 0.5	41.36 b	36.61 ab	10.84 a	8.74 b	19.00 cd
Super tonic at 1.00	43.06 a	37.03 ab	11.92 a	9.59 b	18.20 d
Super tonic at 1.50	41.21 b	36.41 b	11.65 a	10.47 ab	21.22 bc
Super tonic at 2.00	42.51 a	37.5 a	10.45 a	11.70 a	22.01 ab
L.S.D at 5%	**0.75 ** **	**0.91 ** **	**N.S**	**1.90 ***	**2.44 ** **
Interaction (AxB)					
Giza 94 x Control	39.25 d	36.23	12.30	11.25	22.36 ab
Giza 94 x Tonic 0.5	43.55 a	39.53	11.15	9.25	21.54 b
Giza 94 x Tonic 1.00	44.16 a	39.78	10.32	8.56	20.56 c
Giza 94 x Tonic 1.50	42.65 b	38.54	11.45	9.36	18.65 d
Giza 94 x Tonic 2.00	42.00 b	38.00	10.98	10.21	19.74 c
Giza 96 x Control	39.00 d	36.45	13.14	12.36	24.45 a
Giza 96 x Tonic 0.5	41.45 c	37.65	12.36	10.65	19.54 c
Giza 96 x Tonic 1.00	41.03c	37.00	12.00	9.63	20.36 c
Giza 96 x Tonic 1.50	42.00 b	37.24	12.35	10.35	19.88 c
Giza 96 x Tonic 2.00	42.15 b	39.25	12.00	9.25	19.65 c
L.S.D at 5%	**6.56 ** **	**N.S**	**N.S**	**N.S**	**7.24 ***

Flowering, bolls and shedding %:-

1-Total number of squares and setting bolls.
2- Shedding of flowers, bolls and total shedding%.

It is clear from the columns that, the process of shedding commences due to the formation of abscission layer. Heavy boll load under conditions of optimum canopy production leads to inter and intra competition amongst the developing organs for current photosynthetic. This condition

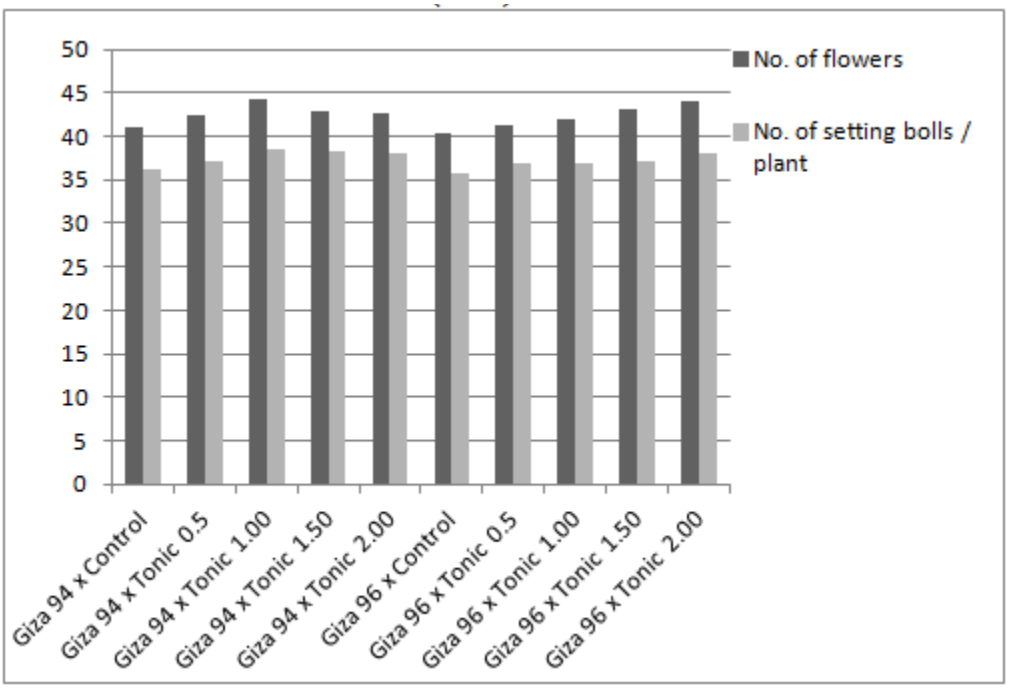
ISSN: 2455-6939

Volume:04, Issue:06 "November-December 2018"

may increase shedding of fruiting forms, if the demand is not immediately met with. Several environmental and biological (physiological and entomological) events have a direct bearing on boll retention. Environmental conditions which influence the shedding of fruiting parts in cotton are low light, high temperature, drought, waterlogging, cloudy weather etc. These factors affect assimilate translocation to the developing reproductive sinks leading to abscission. Other major causes of abscission are lack of pollination due to very high temperature and insects that feed or oviposit on the fruiting forms.

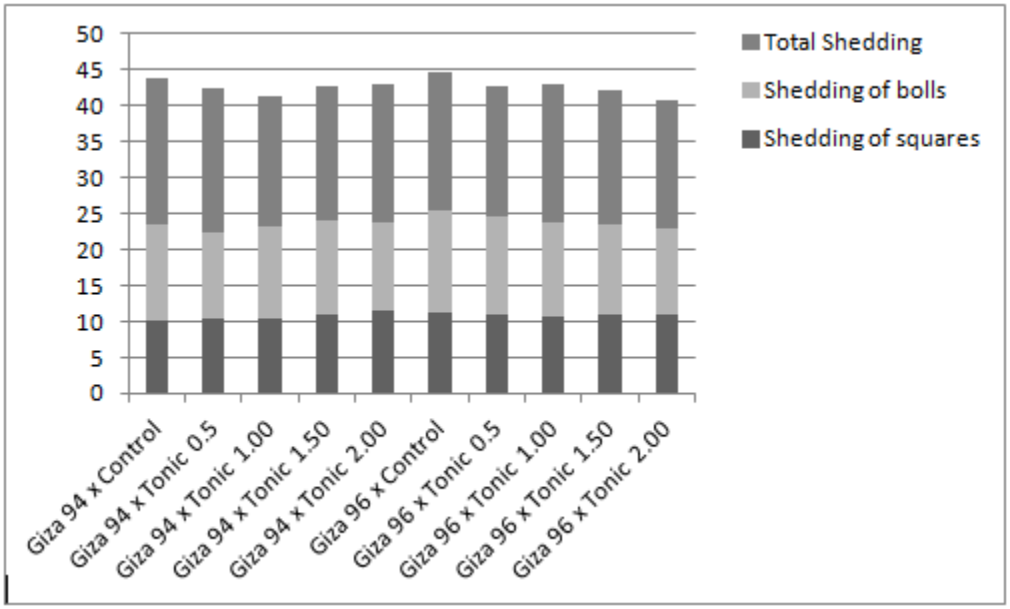
Figure 1: Columns observes the seasonal changes of the number of squares, bolls and shedding through 2017 and 2018 seasons.

First season (2017)

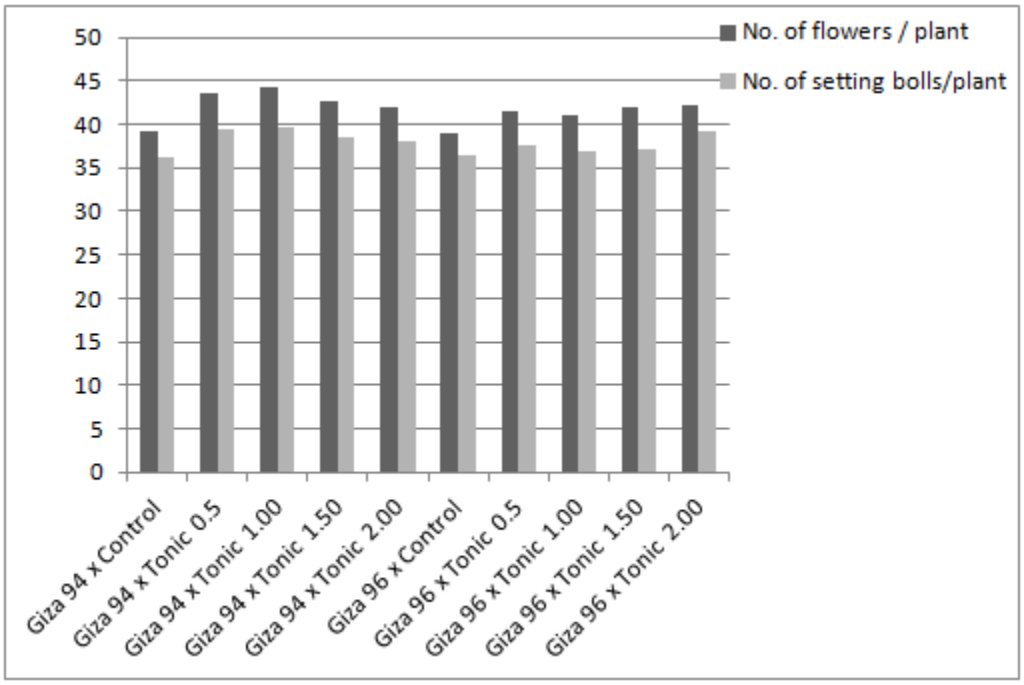


ISSN: 2455-6939

Volume:04, Issue:06 "November-December 2018"

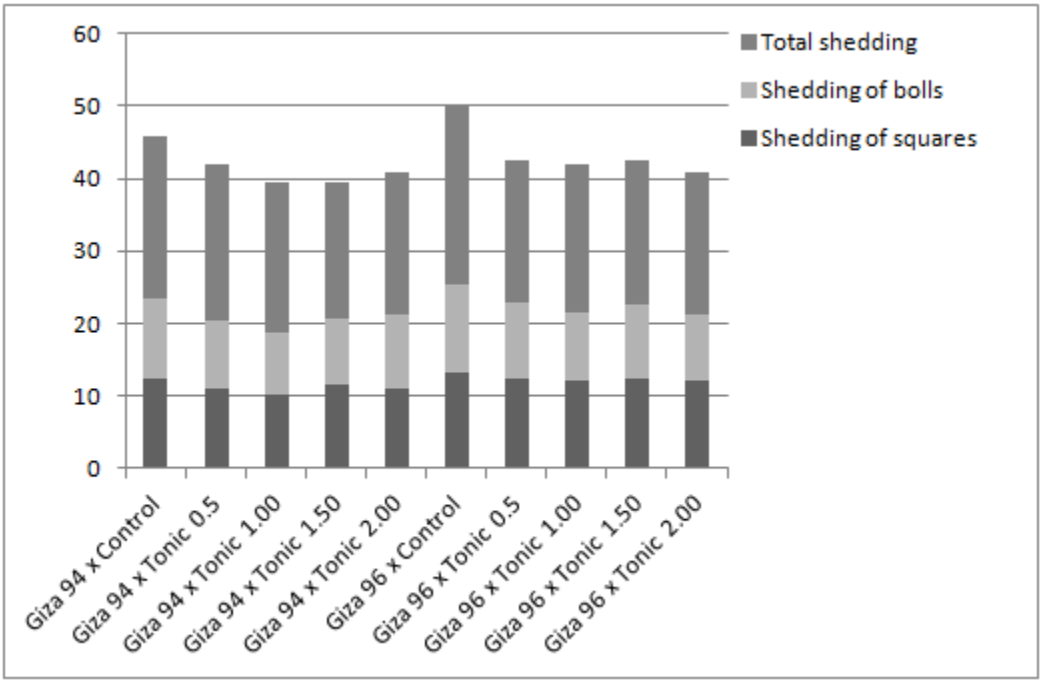


1) Second season (2018)



ISSN: 2455-6939

Volume:04, Issue:06 "November-December 2018"



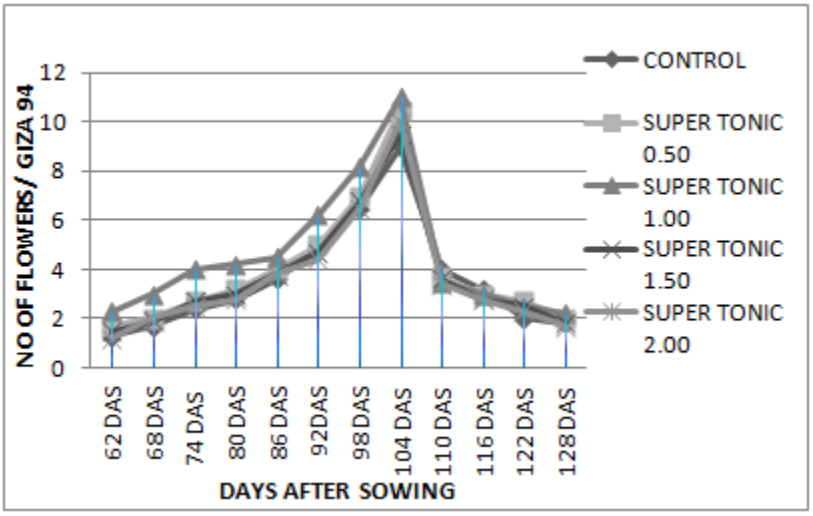
Flowering curves.

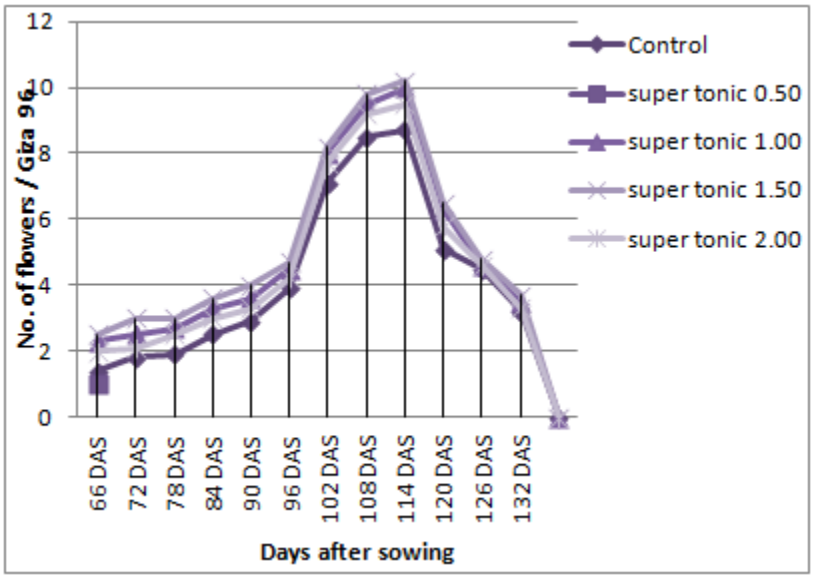
Fig (2) shows the seasonal changes of the number of flowers cotton plant produced every 6 days as affected by cotton variety which spraying with Super tonic. The curves show that the flowering period extended from 62 (production of first flower) in 94 cotton variety to 128 days after sowing (production of the last one). Many factors, i.e. plant age ,cotton variety , treatments and growth season, affected the production and distribution of the total number of flowers. The production of flowers / plant were increased gradually at low rate (0.50 flower / day)during the period from (62-86 days after sowing) , then reach its maximum rate (3.5 flowers / day) during the period from (92-104 DAS) and gradually decreased until the end of flowering stage 110 DAS .It is clear from the previous results that, the most effective stage for increasing the flowers number was in the middle period , (from 86-110 DAS) in G 94 cotton variety and (96-120 DAS) in G 94 cotton variety. Moreover, the highest total number of flowers / plant were obtained by addition of Super tonic at 1.00 cm/liter in G94 and by addition Super tonic at 2.00 cm/liter with G96 in the mean of two seasons.

ISSN: 2455-6939

Volume:04, Issue:06 "November-December 2018"

Fig 2: Flowering curves, shows the seasonal changes of the number of flowers cotton plant produced every 6 days as affected by cotton varieties spraying super tonic at different rates (0,0.50,1.00,1.50 and 2.00 cm) through 2017 and 2018 seasons (means of the two seasons).





II- Chemical contents:-

Results in Table (6) clear that cotton variety and spraying plants with Super tonic in different rates significantly effect on total chlorophyll, chlorophyll a %, chlorophyll b %, poly-phenols, mono-phenols, total phenols in both seasons. The results generally indicated that, there were no differences between the two cotton varieties on studied characters, chlorophyll a, chlorophyll b

ISSN: 2455-6939

Volume:04, Issue:06 "November-December 2018"

percentages and total chlorophyll contents were significantly increased by spraying cotton plants with Super tonic at rate (1 cm/liter) comparing with other concentrations and untreated plants. Consider to the interaction between varieties and treatments, foliar application of 94 cotton variety with 1 cm / liter was superior than other combinations. In this respect, **Czeczko and Mikos-Bielak (2004)** found that Atonik caused an increase of total phenolics in potato and tomato but decrease their content in onion.so it can be noticed that , Optimization of Atonik application (concentration, frequently and number of spraying) is a very important issue and strongly determines the final.

Table 4: Effect of foliar application of Super tonic concentrations on two cotton varieties and its combinations on chemical constituents in leaves during 2017 and 2018 seasons.

Characters / Treatments	chlorophyll (a) mg/g fresh Wt.	chlorophyll (b) mg/g fresh Wt.	Total Chlorophyll Mg/g fresh wt.	Mono phenol mg/g dry wt.	Poly Phenol mg/g dry wt.	Total phenol mg/g dry wt.
	2017 season					
Main plot (A)						
Giza 94	5.12	3.64	9.00 a	17.54 a	10.2 a	30.78 a
Giza 96	5.16	3.00	8.62 b	17.00 b	9.18 b	28.00 b
L.S.D at 5%	**N.S**	**0.70 ***	**0.51 ***	**0.50 ***	**1.00 ****	**2.15***
Sub main plot (B)						
Control(untreated plants)	4.65 d	2.74 d	7.58 d	15.80 c	10.00 c	29.32 b
Super tonic at 0.5	5.00 b	2.90 c	8.13 b	16.23 b	10.32 b	27.00 d
Super tonic at 1.00	5.42 a	3.50 a	9.12 a	17.60 a	10.65 a	31.25 a
Super tonic at 1.50	5.17 b	3.00 c	8.30 b	16.66 b	10.30 b	28.65c
Super tonic at 2.00	4.86 c	3.20 b	8.00 c	16.00 c	10.00 c	30.54 a
L.S.D at 5%	**0.60 ****	**0.75 ****	**0.36 ***	**1.85 ***	**0.40 ****	**1.70 ***
Interaction (AxB)						
Giza 94 x Control	4.20 d	3.26	7.84 d	17.20 c	10.21	29.57
Giza 94 x Tonic 0.5	4.86 b	3.30	8.24 c	16.90 d	10.17	28.16
Giza 94 x Tonic 1.00	5.13 a	3.64	8.79 a	18.00 a	10.23	30.14
Giza 94 x Tonic 1.50	4.65 c	3.35	8.45 b	17.35 c	10.00	29.45
Giza 94 x Tonic 2.00	4.86 b	3.27	8.19 c	17.63 b	9.87	28.44
Giza 96 x Control	4.97 b	3.42	8.46 b	17.00 c	9.90	28.56
Giza 96 x Tonic 0.5	4.83 b	3.19	8.00 d	16.98 d	10.21	28.65
Giza 96 x Tonic 1.00	5.00 a	3.33	8.42 b	17.00 c	9.87	29.45
Giza 96 x Tonic 1.50	4.35 c	3.47	7.96 d	17.45 b	10.00	29.23
Giza 96 x Tonic 2.00	5.00 a	3.58	8.64 a	17.90 a	10.30	29.85
L.S.D at 5%	**1.14 ***	**N.S**	**0.30 ****	**0.40 ****	**N.S**	**N.S**

ISSN: 2455-6939

Volume:04, Issue:06 "November-December 2018"

Second season (2018) cont ……

Characters / treatments	chlorophyll (a) mg/g fresh Wt.	chlorophyll (b) mg/g fresh Wt.	Total Chlorophyll Mg/g fresh wt.	Mono phenol mg/g dry wt.	Poly Phenol mg/g dry wt.	Total phenol mg/g dry wt.
	2018 season					
Main plot (A)						
Giza 94	5.95 a	3.42 a	8.67 a	17.74 a	10.34 a	30.54
Giza 96	5.50 b	2.94 b	8.44 b	16.34 b	9.74 b	29.23
L.S.D at 5%	**0.42 ***	**1.12 ****	**0.23 ***	**2.03 ***	**0.75 ***	**3.54 ****
Sub main plot (B)						
Control(untreated plants)	4.86 c	3.00	7.90	16.23 c	9.45 c	27.45 c
Super tonic at 0.5	5.12 b	3.00	8.23	17.00 b	10.87 a	29.85 a
Super tonic at 1.00	5.33 a	3.25	8.62	17.54 a	10.98 a	30.45 a
Super tonic at 1.50	5.10 b	3.56	8.74	17.12 b	10.12 b	29.78 a
Super tonic at 2.00	5.10 b	3.35	8.51	16.48 c	10.00 b	29.00 b
L.S.D at 5%	**0.20 ***	**N.S**	**N.S**	**1.16 ****	**2.15 ****	**3.12 ***
Interaction (AxB)						
Giza 94 x Control	5.12	2.74 c	7.90 b	16.32 d	10.00	28.12 b
Giza 94 x Tonic 0.5	5.23	2.65 c	7.94 b	17.00 b	10.87	29.36 a
Giza 94 x Tonic 1.00	4.78	3.45 a	8.34 a	17.45 a	10.94	29.45 a
Giza 94 x Tonic 1.50	5.00	2.87 c	7.94 b	16.74 b	10.23	28.14 b
Giza 94 x Tonic 2.00	5.32	3.00 b	8.46 a	17.00 b	10.54	29.65 a
Giza 96 x Control	5.41	2.98 b	8.45 a	16.60 c	10.00	28.74 b
Giza 96 x Tonic 0.5	5.00	2.70 c	7.85 b	16.62 c	10.12	28.41 b
Giza 96 x Tonic 1.00	4.95	3.00 b	8.00 b	16.90 b	10.32	28.65 b
Giza 96 x Tonic 1.50	4.87	3.12 a	8.00 b	16.95 b	10.45	28.47 b
Giza 96 x Tonic 2.00	4.65	3.23 a	7.93 b	17.20 a	10.35	29.41 a
L.S.D at 5%	**N.S**	**0.48 ***	**1.45 ***	**0.30 ****	**N.S**	**1.65 ***

III- Yield and its components.

The results presented in Table (5) clearly indicated that application of Super tonic had a significant influence on all growth characters i.e, plant height, no. of fruiting branches, no. of opening bolls / plant, boll weight and seed cotton yield / kentar in both seasons. It could noticed that foliar application of super tonic at 1.00 cm^3/liter increased yield and its components (plant height , no. of fruiting branches, no. of open bolls and seed cotton yield) compared with other

ISSN: 2455-6939

Volume:04, Issue:06 "November-December 2018"

treatments in both seasons. This result may be due to the important role in secondary metabolism, defense mechanisms, mechanical support and alelopathy. The positive effect of Super tonic on reducing total abscission which resulted in high yield and its components. In this respect, **Djanaguiraman et al., 2005b** found that, the application of Supertonik increased also the number of bolls in cotton, increasing in plant height over the study period. These findings were in close agreement with the results of **Subbaih and Mittra (1997)** and **Dunand (1998)** who also reported of significant increases in plant height and stem elongation in rice when plant growth regulators were applied. The increase in plant height could be the result of an enhanced vegetative growth emanating from active cells division, cells enlargement and cells elongation **(Pareek et al. 2000)**, **Peng et al. (1999)** reported that application of PGR increased root biomass and root activity.

Table 5: Comparison of cotton yield of two cotton varieties response to application of different rates of nitrophenolte (Super tonic) at 2017 and 2018 seasons.

Characters / treatments	Plant height (cm)	No. of fruiting branches / plant	No. of open bolls / plant	Boll weight (g)	Seed cotton yield / kentar
	2017 season				
Main plot (A)					
Giza 94	168.82 a	17.65 a	34.50 a	3.18 a	9.82 a
Giza 96	166.08 a	17.39 a	34.18 a	3.16 a	9.57 b
L.S.D at 5%	**N.S**	**N.S**	**N.S**	**N.S**	**0.23 ***
Sub main plot (B)					
Control(untreated plants)	166.76 b	16.38 b	30.86 b	3.05 b	8.95 c
Super tonic at 0.5	168.2 ab	18.06 a	34.70 a	3.20 ab	9.73 b
Super tonic at 1.00	169.1 a	17.78 a	35.55 a	3.15 ab	10.13 a
Super tonic at 1.50	166.36 b	17.46 ab	35.25 a	3.20 ab	9.8 ab
Super tonic at 2.00	166.85 b	17.91 a	35.33 a	3.28 a	9.86 ab
L.S.D at 5%	**1.97 ** **	**1.18 ***	**1.17 ***	**0.18 ***	**0.34 ***
Interaction (AxB)					
Giza 94 x Control	166.15	16.33 c	30.00 d	3.05	8.50 d
Giza 94 x Tonic 0.5	167.23	17.15 b	35.56 b	3.20	9.40 b
Giza 94 x Tonic 1.00	169.35	18.00 a	36.12 a	3.30	10.35 a
Giza 94 x Tonic 1.50	168.15	17.36 b	34.56 c	3.12	9.65 b
Giza 94 x Tonic 2.00	169.00	17.65 ab	35.00 b	3.17	9.32 c

ISSN: 2455-6939

Volume:04, Issue:06 "November-December 2018"

Giza 96 x Control	168.36	16.00 c	30.12 d	3.00	8.32 d
Giza 96 x Tonic 0.5	167.96	16.53 bc	34.20 c	3.23	9.65 b
Giza 96 x Tonic 1.00	166.25	17.45 ab	34.44 c	3.19	9.21 c
Giza 96 x Tonic 1.50	168.45	17.55 ab	35.69 b	3.14	9.00 c
Giza 96 x Tonic 2.00	170.00	17.98 a	36.00 a	3.25	10.00 a
L.S.D at 5%	**N.S**	**2.14 ***	**6.32 ****	**N.S**	**2.15 ****

Table (5) : Cont …

Characters / treatments	**Plant height (cm)**	**No.of fruiting branches / plant**	**No. of open bolls / plant**	**Boll weight (g)**	**Seed cotton yield / kentar**
Main plot (A)	**2018 season**				
Giza 94	168.31 a	19.16 a	33.06 a	3.46 a	10.50 a
Giza 96	167.85 a	17.23 b	32.24 b	3.37 a	9.45 b
L.S.D at 5%	**N.S**	**1.21 ****	**1.19 ****	**N.S**	**1.02 ****
Sub main plot (B)					
Control(untreated plants)	166.41 b	16.91 c	31.33 c	3.26 b	9.95 c
Super tonic at 0.5	169.31 a	18.70 a	33.41 ab	3.43 a	10.50 ab
Super tonic at 1.00	169.03 a	18.95 a	34.22 a	3.40 a	10.66 a
Super tonic at 1.50	167.66 ab	17.21 b	32.34 b	3.48 a	10.50 ab
Super tonic at 2.00	167.98 ab	18.02 ab	32.00 b	3.50 a	10.33 b
L.S.D at 5%	**1.98 ****	**0.86 ***	**0.81 ***	**0.10 ***	**0.17 ****
Interaction (AxB)					
Giza 94 x Control	166.25	17.00 b	30.15 e	3.00 c	9.50 e
Giza 94 x Tonic 0.5	167.54	18.90 a	32.45 d	3.42 a	10.12 c
Giza 94 x Tonic 1.00	167.88	19.02 a	35.12 a	3.58 a	10.75 a
Giza 94 x Tonic 1.50	168.31	18.00 ab	34.50 ab	3.22 ab	10.20 b
Giza 94 x Tonic 2.00	168.00	18.75 a	34.00 ab	3.15 b	10.00 c
Giza 96 x Control	167.85	18.12ab	30.00 e	3.17 b	9.32 f
Giza 96 x Tonic 0.5	167.36	18.63 a	32.15 d	3.35 a	9.98 d
Giza 96 x Tonic 1.00	166.85	18.54 a	33.65 b	3.10 b	9.57 e
Giza 96 x Tonic 1.50	166.87	18.00 ab	33.00 c	3.00 c	10.00 c

ISSN: 2455-6939

Volume:04, Issue:06 "November-December 2018"

Giza 96 x Tonic 2.00	167.54	18.69 a	33.92 b	3.25 b	10.20 b
L.S.D at 5%	**N.S**	**2.45 ****	**6.15 ****	**0.70 ***	**0.20 ****

REFERENCES

Abeles, F. B. (1998). Role of RNA and protein synthesis in abscission. Plant Physiology 43:1577-1586.

Baloch A.; U.J Arvin and Dayal, J (2000). Effect of salicylic acid (SA) and drought stress

Burke, J. J., Mahan, J. R., Hatfeld, J. L. 1988. Crop-specific thermal kinetic windows in relation to wheat and cotton biomass production. Agronomy Journal, 80:553-556. DOI: 10.2134/agronj1988.00021962008000040001

Burke, J. J., Velten, J., Oliver, M. J. 2004. In vitro analysis of cotton pollen germination. Agronomy Journal, 96:359-368. DOI: 10.2134/agronj2004.0359.

Cha-ums., Supaibulwatanak., Kirdmanee C., (2006): -Water relation, photosynthetic ability and growth of Thai Jasmine rice (Oryza sativa L. ssp. indica cv. KDML 105) to salt stress by application of exogenous glycinebetaine and choline. - J. Agro. Crop Sci., 192(1): 25-36.

Djanaguiraman, M., D. Devi, J. Sheeba, U. Bangarusamy, and R. Babu. 2004. Effect of oxidative stress on abscission of tomato fruits and its regulation by nitrophenols. Trop. Agric. Res. 16:25-36.

Djanaguiraman, M., Sheeba, J.A., Devi, D.D., Bangarusamy, U., 2005b. Effect of Atonik seed treatment on seedling physiology of cotton and tomato. J. Biol. Sci.5 (2), 163–169, http://dx.doi.org/10.3923/jbs.2005.163.169.

Dunand RT (1998) Effects of pre-heading application of gibberellic acid on rice growth and production. Proceedings of the 27th Rice Technical Working group (RTGWG), 1998, Reno, NV, 211-211.

Goswami, C. L., Dayal, J. 1998. Nutritional and hormonal aspect of boll shedding in cotton. 'National Symposium on regulation of growth and differentiation in nature', March 21-23, Chandigarh, Pp 3-4.

Haneef, L.S.; R.P. Waldren and I.D. Teare (2001). Rapid determination of free

Hodges, H. F., Reddy, K. R., McKinnon, J. M., Reddy, Y. R. 1993. Temperature effects on cotton. Mississippi Agri. Forestry Exp. Sta., Mississippi State University, Miss.

Pareek NK, Jat NL, Pareek RG (2000) Response of coriander (Cirriandum sativum) to nitrogen and plant growth regulators, Haryana, Journal of Agronomy, 16:104-109.

Peng J, Richards DE, Hartley NM, Murphy GP, Devos KM (1999) Green revolution gene encodes mutant gibberellin respons modulators. Nature, 400:256-261.

Ratner, A., R. Goren, and S. P. Monselise. (1999). Activity of pectin estrase and cellulase in the abscisison zone of citrus leaf explants. Plant Physiology 44:1717-1723.

Leigh, T. F.• D. W. Grimes and H. Varner. 2000. Insects in cotton as affected by irrigation and fertilization practices. Califomia Agriculture 24(3):12-14.

Stutte, C.A., Clark, T.H., 1990. Radiolabeled Studies of Atonik in Cotton Using HPLCArysta Life Science Report. Altheimer Laboratory, University of Arkansas, Fayetteville, AR.

Reddy, V. R., Reddy, K. R., Hodges, H. F., Baker, D. N. 1996. The effect of temperature on growth, development and photosynthesis of cotton during the fruiting period. Brazilian Society of Plant Growth Regulation, 20:97-110

Reddy, K. R., Hodges, H. F., Mckinion, J. M. 1997. Modeling temperature effects on cotton internode and leaf growth. Crop Science, 37:503-509. DOI: 10.2135/cropsci1997.0011183X003700020032 on growth, bulb yield and allicin content of garlic (Allium sativum) in field. Plant Ecophysiology 2: 73 – 79.

Reddy, K. R., Hodges, H. F., Reddy, V. R. 1997. Temperature effects on cotton fruit retention. Agronomy Journal, 84:26-30. DOI: 10.2134/agronj1992.00021962008400010006 proline for water stress. Plant and Soil, 39: 205 – 207.

Singleton, V., Rossi, J., 1965. Colorimetry of total phenolics with phosphomolybdic-phosphotungstic acid reagents. Am. J. Enol. Vitic. 16,144–158.

Snedecor , G.W. and W.G. Cochran (1967): Statical methods . The Iowa state Univ. Press , Ames, Iowa, USA.

Subbaih G, Mittra BN (1997) Effect of foliar spray of micronutrient in growth and yield of rice. Oryza,26:148-151.

ISSN: 2455-6939

Volume:04, Issue:06 "November-December 2018"

Oosterhuis, D.M., and R.S. Jernstedt. 1999. Increased protein, insect mortality and yield with Chaperone. p. 2249-2254. In Proc. Beltwide Cotton Conf., San Antonio, TX. 5-9 Jan. 2004. Natl. Cotton Counc. Am., Memphis, TN. Available online at http://www.cotton.org/beltwide/proceedings

Walhood, V. T. 1958. Studies on use of FW-450 on cotton at Shafter and Brawley, California, 1957-58. p. 95. In Proc. 11th Annual Cotton Improv. Conf., Houston, TX.

