

---

## Effect of Some Growth Regulators Application on Fruit Growth and Ripening of Abbodi and Abiad Aswan Fig Cultivars

El-Mahdy, T. K.; M. M. El-Akaad ; F.M. Gouda and Azza S. Hussein  
Hort. Dept. , Fac. of Agric., Assuit University, Assuit, Egypt

---

### Abstract:

This investigation was carried out at the orchard of Faculty of Agriculture, Assuit University during 2012 and 2013 seasons with the objectives of: study the rules and the effects of some plant growth regulators (PGRs) namely gibberellic acid ( $GA_3$ ), benzyl amino-purine (BA), and naphthalene acetic acid (NAA) on the developmental changes on some physical properties as well as fruit ripening of Abbodi and Abiad Aswan fig fruits during its growth. Twelve trees (4 treatments x 3 replication) of both cvs. were used for this study. The PGRs were sprayed at the end of the first period of fruit growth. The result of this study could be summarized as follows:

- The fruit diameter of untreated fruits (control) significantly and very rapid increased during the first period (6 weeks) followed by slow increase for about 4 weeks (period II) and then it was rapidly increased again at the third period and took 7 weeks until maturity.
  - Concerning the effect of the applied growth regulators on the diameter of fig fruits, it was found that,  $GA_3$  at 50 ppm and NAA at 25 ppm significantly increased the fruit diameter as compared with BA treatment at 40 ppm and untreated fruits during all developmental stages. While, the treated fruits with the three growth regulators had significantly smaller diameter comparing with untreated one at the maturity stage in both experimental seasons.
  - The fruit weight and volume of both cultivars took approximately the same trend as diameter concerning the response of applied growth regulators during both studied seasons.
  - $GA_3$  treatment advanced fruit maturity by 4 weeks, on Abiad Aswan and 3 weeks on Abbodi cv. while NAA enhanced fruit maturity of Abiad Aswan cv. by 3 weeks and one week for Abbodi cv. earlier than the control.
- Concerning BA treatment, it advanced fruit maturity by 2 weeks for Abiad Aswan cv. and one week for Abbodi cv. during the two experimental season.

---

**Keywords:** Plant growth regulators,  $GA_3$ , NAA, BA, Fig, *Ficus carica*.

---

**Received on:** 4/4/2015

**Accepted for publication on:** 8/4/2015

**Referees:** Prof. Ahmed M. El-sese

Prof. Ayman K. Ahmed

### Introduction:

*Ficus carica*, L., is known commercially as fig plant and a member of Moraceae family considers an important tree in many countries especially Egypt which is domesticated over 6,000 years ago as one of the most ancient fruit crops. However, it is native to Western Asia but distributed by man throughout the Mediterranean region.

Egypt stands among one of the largest fig producing countries in the world. According to the statistics of Egyptian Ministry of Agriculture (2012), the total area devoted for fig was 69865 feddans, while the fruiting area of it was 68372 which produced about 171 thousand tons with an average of 2.5 tons/feddan. Major main fig area based in western north coast of Egypt which it occupy 93.3% of the total area of fig\*.

Unfortunately, there are many problems on the processing of maturation. For instance, late maturation in some areas and the effects of climate changes on fruits which remains immature until the end of the season, both problems caused in the decrease of the profitability of figs during the early period of the season and therefore, significant reduction in the yield (Mahmoud *et al* 2002).

On the other side, the investigation the effects of exogenous application of plant growth regulators (PGRs) on the endogenous plant hormone contents of fig fruits is valuable to give better understanding of the change of certain physical

characteristics of fruits and its growth curve and maturation (Liu *et al.* 2008, Rastegar *et al.* 2011).

Many investigators studied the effect of growth regulators on the growth and maturation of fig fruits. The application of GA<sub>3</sub> and IAA was significantly enhanced the fruit maturity more than ethrel (Crane and Noelia 1960, El-Mahdy, 1981; Mahmoud 1991, Mahmoud *et al.* 2002). Moreover, spraying GA<sub>3</sub>, ethrel and IAA at the end of the first period of fig fruit growth increased fruit diameter of fig by progress the fruit age (Mougheith and El Banna 1974, Phad *et al.* 1980; Ito and Iwamoto 1986, Amin, 1987; Mahmoud *et al.* 2002) and on grape fruit cvs., (Louis and Niekell, 1984, Retamales *et al.* 1993; Lee *et al.* 1996, Zahedi *et al.* 2013) and Stone fruit cvs., (Southwick and Yeager 1995, Zhang and Whiting 2011). In additionally the application of GA<sub>3</sub> significantly decreased weight and volume of the mature fig fruits (El-Mahdy *et al.* 1981, Sampaio *et al.* 1983; Mahmoud *et al.* 2002, Crisosto *et al.* 2010), while it increased weight and volume of grape cultivars (Ahmed, 1988; Byun and Kim 1995; Zahedi *et al.* 2013) and Stone fruit cvs., (Southwick and Yeager 1995, Zhang and Whiting 2011).

This study aimed to investigate the rules and the effects of some plant growth regulators (PGRs) namely gibberellic acid (GA<sub>3</sub>), Benzyl amino-purine (BA), and naphthalene acetic acid (NAA) on the developmental changes on some physical properties s well as fruit ripening of Abbodi and Abiad Aswan fig fruits during its growth.

---

\*Yearly Book of Statistics and Agricultural Economic Dept. 2012, Ministry of Agriculture, Cairo, Egypt

## Materials and Methods:

This study was carried out throughout 2012 and 2013 seasons at the experimental orchard, Faculty of Agriculture, Assiut University. Twelve trees (4 treatments x 3 replication) of each Abbodi and Abiad Aswan fig cvs. were selected uniformly in vigor for this study. The chosen trees were planted in clay soil, and received the same horticultural managements.

Three Plant Growth Regulators (PGRs) were used in this study, namely gibberellic acid ( $GA_3$ ), benzyl amino-purine (BA), and naphthalene acetic acid (NAA).

This study was design as a factorial experiment with three replicates in a completely randomized design for each treatment in total of four treatments.

The PGRs were sprayed on leaves and fruits of the chosen trees throughout the two seasons at the end of the first period of fruit rapid growth, on June 30<sup>th</sup> for both cultivars when the fruits reached six weeks old and their size were about 1.55 -1.69 cm based on the following treatments:

- Control (only spraying with distilled water)
- Spraying with 50 ppm of  $GA_3$
- Spraying with 40 ppm of BA
- Spraying with 25 ppm of NAA

The PGRs solutions have been sprayed by using pump sprayer (5 L). Importantly, fruit growth curve, maturation, and its quality were investigated from spraying date of PGRs until fruit maturity.

Ten basal fruits of each replicate (at the same age) were selected to measure fruit diameter at weekly

intervals until the maturity when the untreated fruits were about one week old.

Moreover, other shoots were selected for collecting fruit samples randomly at biweekly interval when the fruits were about six weeks old until maturation to determine the effects of the growth regulators on physical characteristics.

Fruits on the tested cultivar were used in both experimental seasons, starting from the third till the ninth fruit on the selected shoots.

Samples of five fruits (6 weeks-old) from Abbodi and Abiad Aswan cvs. were collected randomly for each replicate (biweekly intervals until maturity stage). The selected fig samples were taken and transferred immediately to the laboratory of Pomology Department, Faculty of Agriculture to determine the effect of the growth regulators ( $GA_3$ , NAA, and BA) on some physical characteristics, as followed:

### 1- Fruit growth:

Determination was based on fruit diameter, fruit-weight and volume.

**1-1 Fruit diameter:** was measured by using a varnier caliper every week.

**1-2 Fruit Weight:** The fruit weight was calculated in grams using sensitive balance.

**1-3 Fruit Volume:** The fruit volume ( $ml^3$ ) was estimated using the water displacement.

### 2- Maturation date:

The fruits were harvested at the ripe stage when its skin color was light yellow and purplish black, while the pulp color was amber and light strawberry for Abiad Aswan and Abbodi cvs., respectively.

### **Statistical analysis:**

Data were statistically analysed as a factorial experiment. Treatment means were compared by using the LSD value at 5% level of the probably according to the method outlined by Snedecor and Cochran (1980).

### **Results and Discussion:**

#### **1- Fruit growth**

##### **1-1 Fruit diameter**

The effect of the three growth regulators on growth of fig fruit were presented in Tables (1, 2, 3 and 4). These Tables showed the developmental changes in fruit diameter of Abbodi and Abiad Aswan fig cultivars in response to GA<sub>3</sub> (50 ppm), NAA (25 ppm) and BA (40 ppm) applications during 2012 and 2013 seasons. The typical growth curve of the fig fruit of both studied cultivars was a double sigmoid. Generally the length of the three growth periods I, II and III of untreated fruits (control) were approximately 16 weeks from the date of fruit set until maturity for both cultivars and seasons. The obtained data showed that the response of fig fruits to the used growth regulators took approximately similar trend in both experimental seasons. The results generally revealed that the growth of untreated fruits (control) as measured by fruit diameter showed three different periods of growth (I, II and III). During the first growth period (I) the rate of diameter increasing was very rapid and took about five weeks in Abbodi and Abiad Aswan fig cvs., followed by the second growth period (II), which had slow rate of diameter increasing

and took four weeks in the two cultivars, whereas the third period (III) had more rapid increasing rate in diameter growth till the fruit reached its maturity and took seven weeks in untreated fruits (control) of Abbodi and Abiad Aswan fig cultivars. About 43.34% and 42.30% in Abbodi and 52.84% and 51.01% in Abiad Aswan of the growth rate from the final diameter was achieved during the first growth period (I) on 2012 and 2013 respectively. Whereas in the second growth period (II), about 15.27% and 15.73% in Abbodi and 5.68% and 8.10% in Abiad Aswan of the final diameter was occurred, at last about 41.31% and 41.95% in Abbodi and 41.47% and 40.87% in Abiad Aswan of the final, diameter was achieved during the third growth period (III), in 2012 and 2013 seasons, respectively.

Concerning the effect of the applied growth regulators on the diameter of fig fruits, it is clear to notice that, GA<sub>3</sub> at 50 ppm and NAA at 25 ppm significantly increased the fruit diameter as compared with BA treatment at 40 ppm and untreated fruits during all developmental stages in both experimental seasons 2012 and 2013. On the other side, the treated fruits with the three growth regulators had significantly smaller diameter comparing with untreated one at the maturity stage during both seasons.

The obtained results in the present study are in harmony with those reported by (Phad *et al.*, 1980; Amin, 1987 and Mahmoud *et al.*, 2002).

**Table (1): Developmental changes in fruit diameter (cm) of “Abbodi “ fig cv. in response to GA<sub>3</sub> (50 ppm, NAA (25 ppm) and BA (40 ppm) applications through season 2012.**

Fruit age (week)	Treatment Means			
	Control	GA <sub>3</sub>	NAA	BA
1	0.43	-	-	-
2	0.85	-	-	-
3	0.97	-	-	-
4	1.13	-	-	-
5	1.25	-	-	-
6	1.59	1.67	1.65	1.61
7	1.62	1.78	1.69	1.65
8	1.67	1.81	1.75	1.71
9	1.69	1.96	1.81	1.78
10	1.97	2.22	2.09	1.95
11	2.05	2.36	2.14	2.01
12	2.15	2.41	2.23	2.11
13	2.17	2.75	2.24	2.19
14	2.25	-	2.31	2.22
15	2.49	-	2.62	2.57
16	2.88	-	-	-

L.S.D.0.05:  
 Treatment (T) = 0.02  
 Period (P) = 0.09  
 P x T = 0.05

**Table (2): Developmental changes in fruit diameter (cm) of “Abbodi “fig cv. in response to GA<sub>3</sub> (50 ppm), NAA (25 ppm) and BA (40 ppm) applications through season 2013.**

Fruit age (week)	Treatment Means			
	Control	GA <sub>3</sub>	NAA	BA
1	0.41	-	-	-
2	0.82	-	-	-
3	0.95	-	-	-
4	1.10	-	-	-
5	1.21	-	-	-
6	1.55	1.65	1.60	1.58
7	1.60	1.74	1.67	1.63
8	1.62	1.80	1.71	1.68
9	1.66	1.93	1.83	1.77
10	1.95	2.11	1.99	1.97
11	2.01	2.36	2.26	2.21
12	2.19	2.58	2.41	2.33
13	2.21	2.77	2.58	2.40
14	2.31	-	2.42	2.43
15	2.49	-	2.60	2.55
16	2.86	-	-	-

L.S.D.0.05:  
 Treatment (T) = 0.02  
 Period (P) = 0.03  
 P x T = 0.05

**Table (3): Developmental changes in fruit diameter (cm) of “Abiad Aswan “fig cv. in response to GA<sub>3</sub> (50 ppm), NAA (25 ppm) and BA (40 ppm) applications through season 2012.**

Fruit age (week)	Treatment Means			
	Control	GA <sub>3</sub>	NAA	BA
1	0.48	-	-	-
2	0.83	-	-	-
3	0.99	-	-	-
4	1.26	-	-	-
5	1.58	-	-	-
6	1.69	1.74	1.72	1.71
7	1.71	1.95	1.81	1.77
8	1.73	2.16	1.94	1.81
9	1.75	2.34	2.27	1.93
10	2.11	2.45	2.29	2.17
11	2.21	2.67	2.40	2.38
12	2.67	2.81	2.66	2.62
13	2.71	-	2.72	2.71
14	2.82	-	-	2.77
15	2.91	-	-	-
16	2.99	-	-	-

L.S.D.0.05:  
 Treatment (T) = 0.02  
 Period (P) = 0.09  
 P x T = 0.05

**Table (4): Developmental changes in fruit diameter (cm) of “Abiad Aswan “fig cv. in response to GA<sub>3</sub> (50 ppm), NAA (25 ppm) and BA (40 ppm) applications through season 2013.**

Fruit age (week)	Treatment Means			
	Control	GA <sub>3</sub>	NAA	BA
1	0.47	-	-	-
2	0.81	-	-	-
3	0.96	-	-	-
4	0.22	-	-	-
5	0.51	-	-	-
6	1.68	1.73	1.71	1.69
7	1.70	1.76	1.75	1.72
8	1.74	1.85	1.81	1.79
9	1.75	2.11	2.05	1.98
10	2.05	2.36	2.27	2.21
11	2.18	2.51	2.46	2.39
12	2.55	2.75	2.61	2.55
13	2.68	-	2.72	2.65
14	2.81	-	-	2.79
15	2.88	-	-	-
16	2.96	-	-	-

L.S.D.0.05:  
 Treatment (T) = 0.02  
 Period (P) = 0.09  
 P x T = 0.05

### 1-2 Fruit Weight

The effect of GA<sub>3</sub>, NAA and BA on Abbodi and Abiad Aswan fruit weight are presented in Tables (5, 6, 7 and 8). In general, the rate of growth in fruit weight during the two studied seasons took the same trend throughout the different developmental stages (I, II and III) as diameter growth for both investigated cultivars. The obtained results indicated that the increase in weight of untreated fruits (control) had two stages of rapidly and significantly growth (period I and III) separated by very slow growth stage (period II). All treatments of GA<sub>3</sub>, NAA and BA significantly increased the average weight of Abbodi and Abiad Aswan fruits during period II and III in both tested seasons as compared with untreated one (control). The opposite trend was found at maturity stage,

these the untreated ripe fruits (control) had the highest values of average weight for Abbodi cv. (60.66 – 59.40 gm) and Abiad Aswan cv. (65.23 – 63.12 gm) during both 2012 and 2013 seasons, respectively, as compared with other fruits treated with growth regulators. In addition, GA<sub>3</sub> treatment gave the highest values of average fruit weight (55.13 and 54.23 gm for Abbodi cv.) and (56.15 and 56.26 for Abiad Aswan) in both seasons, respectively, followed by NAA treatment while BA spraying produced the lowest fruit weight for both cultivars during the two studied seasons.

These results are in agreement with the findings obtained by (El-Mahdy, 1981; Sampaio *et al.*, 1983; Amin, 1987; Mahmoud, 1991; Mahmoud *et al.*, 2002 and Crisosto *et al.*, 2012).

**Table (5): Developmental changes in fruit weight (g) of “Abbodi “fig cv. in response to GA<sub>3</sub> (50 ppm), NAA (25 ppm) and BA (40 ppm) applications through season 2012.**

Fruit age (week)	Treatment Means			
	Control	GA <sub>3</sub>	NAA	BA
6	15.34	17.50	16.76	15.93
8	18.50	20.66	19.73	18.96
10	20.96	29.80	27.53	22.23
12	36.33	55.13	52.23	51.66
14	50.80	-	-	52.50
16	60.66	-	-	-

L.S.D.0.05:  
 Treatment (T) = 0.08  
 Period (P) = 0.07  
 P x T = 0.16

**Table (6): Developmental changes in fruit weight (g) of “Abbodi “fig cv. in response to GA<sub>3</sub> (50 ppm), NAA (25 ppm) and BA (40 ppm) applications through season 2013.**

Fruit age (week)	Treatment Means			
	Control	GA <sub>3</sub>	NAA	BA
6	14.91	17.21	16.91	15.55
8	17.95	20.22	19.11	18.90
10	20.76	28.83	27.00	21.55
12	32.13	54.23	51.50	48.66
14	49.25	-	-	50.66
16	59.40	-	-	-

L.S.D.0.05:  
 Treatment (T) = 0.16  
 Period (P) = 0.18  
 P x T = 0.31

**Table (7): Developmental changes in fruit weight (g) of “Abiad Aswan “fig cv. in response to GA<sub>3</sub> (50 ppm), NAA (25 ppm) and BA (40 ppm) applications through season 2012.**

Fruit age (week)	Treatment Means			
	Control	GA <sub>3</sub>	NAA	BA
6	16.13	18.73	17.66	16.55
8	20.73	23.88	22.80	21.91
10	32.93	41.86	36.33	34.40
12	42.20	56.15	53.03	44.50
14	56.13	-	-	51.63
16	65.23	-	-	-

L.S.D.0.05:  
 Treatment (T) = 0.15  
 Period (P) = 0.21  
 P x T = 0.30

**Table (8): Developmental changes in fruit weight (g) of “Abiad Aswan “fig cv. in response to GA<sub>3</sub> (50 ppm), NAA (25 ppm) and BA (40 ppm) applications through season 2013.**

Fruit age (week)	Treatment Means			
	Control	GA <sub>3</sub>	NAA	BA
6	15.86	18.25	17.50	16.13
8	20.21	23.50	22.13	21.66
10	30.67	40.33	35.50	31.17
12	40.16	56.26	52.83	44.43
14	54.13	-	-	51.13
16	63.12	-	-	-

L.S.D.0.05:  
 Treatment (T) = 0.09  
 Period (P) = 0.10  
 P x T = 0.18

### 1-3 Fruit volume

Data in Tables 9, 10, 11 and 12 show the effect of GA<sub>3</sub>, NAA and BA application on fruit volume of Abbodi

and Abiad Aswan fig fruits during 2012 and 2013 seasons. The obtained data indicated that, the fruit volume gradually and significantly increased



by fruit age advancement for both investigated cultivars in 2012 and 2013 seasons. It is also clear to mentioned that, the increment of fruit volume was very rapid during period III of growth and slow during stage II, meaning that a positive correlation was occurred between the growth of diameter, weight and volume of the tested fig cultivars. Moreover, similar trend was observed concerning the response of fig fruits volume to the applied growth regulators as diameter and weight. GA<sub>3</sub>, NAA and BA treatments significantly increased fruit volume of both cultivars during the developmental stages as

compared with untreated fruits (control). At the ripe stage, it is clear to notice that, the untreated fruits (control) had the highest values of average volume (71.21 and 70.66 cm<sup>3</sup>) for Abbodi cv. and (75.50 and 73.00 cm<sup>3</sup>) for Abiad Aswan cv. followed by GA<sub>3</sub> treatment (55.21 and 54.11 cm<sup>3</sup>) and (65.31 and 64.71 cm<sup>3</sup>) for both cultivars during the two studied seasons, respectively. In addition, BA treatment produced the lowest values of average volume comparing with other treatments. The obtained results are in agreement of those found by (El-Mahdy, 1981 and Crisosto *et al.*, 2010).

**Table (9): Developmental changes in fruit volume (cm<sup>3</sup>) of “Abbodi “fig cv. in response to GA<sub>3</sub> (50 ppm), NAA (25 ppm) and BA (40 ppm) applications through season 2012.**

Fruit age (week)	Treatment Means			
	Control	GA <sub>3</sub>	NAA	BA
6	14.50	16.85	15.95	14.66
8	16.66	18.13	17.21	16.77
10	20.00	30.16	26.65	23.33
12	33.33	55.21	51.66	46.66
14	51.50	-	-	53.13
16	71.21	-	-	-

L.S.D.0.05:  
 Treatment (T) = 0.03  
 Period (P) = 0.03  
 P x T = 0.05

**Table (10): Developmental changes in fruit volume (cm<sup>3</sup>) of “Abbodi “fig cv. in response to GA<sub>3</sub> (50 ppm), NAA (25 ppm) and BA (40 ppm) applications through season 2013.**

Fruit age (week)	Treatment Means			
	Control	GA <sub>3</sub>	NAA	BA
6	14.12	16.75	15.83	14.50
8	15.98	18.66	17.11	16.50
10	19.66	29.75	25.50	21.66
12	33.00	54.11	50.47	46.33
14	51.33	-	-	52.66
16	70.66	-	-	-

L.S.D.0.05:  
 Treatment (T) = 0.08  
 Period (P) = 0.10  
 P x T = 0.02

**Table (11): Developmental changes in fruit volume (cm<sup>3</sup>) of “Abiad Aswan“ fig cv. in response to GA<sub>3</sub> (50 ppm), NAA (25 ppm) and BA (40 ppm) applications through season 2012.**

Fruit age (week)	Treatment Means			
	Control	GA <sub>3</sub>	NAA	BA
6	16.05	18.31	17.61	16.72
8	20.91	23.11	22.66	21.50
10	23.33	40.25	33.33	26.66
12	41.66	65.31	61.66	50.33
14	61.13	-	-	61.50
16	75.50	-	-	-

L.S.D.0.05:

Treatment (T) = 0.03

Period (P) = 0.03

P x T = 0.05

**Table (12): Developmental changes in fruit volume (cm<sup>3</sup>) of “Abiad Aswan“ fig cv. in response to GA<sub>3</sub> (50 ppm), NAA (25 ppm) and BA (40 ppm) applications through season 2013.**

Fruit age (week)	Treatment Means			
	Control	GA <sub>3</sub>	NAA	BA
6	15.33	18.25	17.71	16.66
8	20.25	23.03	22.11	21.00
10	22.33	38.95	32.66	25.13
12	40.53	64.71	60.25	50.25
14	60.00	-	-	61.66
16	73.00	-	-	-

L.S.D.0.05:

Treatment (T) = 0.03

Period (P) = 0.03

P x T = 0.05

## 2- Maturation date

Data in the Tables from 1 to 12 showed the periods of fruit growth and maturation date. The typical growth curve of the fig fruit of both studied cultivars was a double sigmoid. The ripe fruits of untreated trees (control) were harvested on the first week of September during both experimental seasons for both cultivars. In addition, all applied growth regulators GA<sub>3</sub>, NAA and BA stimulated fruit growth and shortened the maturity period. GA<sub>3</sub> treatment had the highest significantly effect on enhancing fruit maturity comparing

with other treatments and control. The treated figs with GA<sub>3</sub> were ripe in 4 weeks on Abiad Aswan cv. and 3 weeks for Abbodi cv. earlier than of untreated fruits (control). Moreover, NAA application advanced fruit maturity of Abiad Aswan cv. 3 weeks and one week for Abbodi cv. as compared with control during both tested seasons. Concerning BA treatment, it reduced the growth period and enhanced fruit maturity of Abiad Aswan cv. 2 weeks and one week of Abbodi cv. comparing with untreated fruits during 2012 and 2013 seasons.

The obtained results of the present study are in accordance of those reported by (El-Mahdy, 1981; Mahmoud *et al.*, 2002 and Crisosto *et al.* 2010).

#### References:

- Ahmed, F.F., 1988. Effect of gibberellic acid concentrations, number of application and time of spraying on yield and ripening "Banaty Seedless" grapes (*Vitis vinifera* L.) . Minia J. Agric. Res. & Dev. 10 (2): 791-810.
- Amin, K.A. 1987. Effect of planting density and application of certain growth regulators on the fruit quality and storage ability of "Sultani" fig cultivar (1-Fruit quality) . Assiut Journal of Agricultural Sciences. 18(4): 155-165.
- Byun, J.K. and Kim, J.S., 1995. Effects of GA<sub>3</sub>, thidiazuron and ABA on fruit set and quality of "Kyoho" grapes. Journal of the Korean Society for Horticultural Sciences . (c. f. Hort. Abst. 65 (10): 5793, 1995).
- Crane, J.C. and G. Noelia. 1960. Fruit and vegetative responses of the Missen fig to Gibberellin. Proc. Amer. Soc. Hort. Sci., 76: 139-145.
- Crisosto, C.H., V. Bremer, L. Ferguson and G.M. Crisosto. 2010. Evaluating Quality Attributes of Four Fresh Fig (*Ficus carica* L.) Cultivars Harvested at Two Maturity Stages. Hortscience, 45(4):707–710.
- El-Mahdy, T.K. 1981. The effect of some growth regulators on fruit development of "Sultani" fig "Ficus carica". M. Sc. Thesis, Fac. of Agric., Assiut Univ., A.R.E.
- Ito, H. and Iwamoto, S. 1986. Studies on the transport of figs, 1- Changes in constituents and characteristics of fruit during maturation after ethephon treatment. Research Bulletin of the Alchi-Ken Agricultural Res. Center, Japan, No. 18, 205-212. (Hort. Abst. Vol. 59 (5): 3651).
- Lee, Ch.H., Donghyeon, H.V. and Kim Sungbook, 1996. Effects of GA<sub>3</sub> and Fulmet (K-30) on fruit set and quality in "Kyoho" grapes. Journal of the Korean Society for Horticultural Science. (c.f. Hort. Abs. 67 (3): 2018, 1997).
- Liu, X., M. Liao, G. Deng, S. Chen, Y. Ren. And W. Liu, 2008. Changes in endogenous hormones and polyamines of fruit during growth and development of pear fruits. World J. Agric. Sci., 4: 40-47.
- Louis, G. and Nickell, 1984. Concepts and practice of use of plant growth regulating chemicals in viticulture. Plant Growth Regulating Chemicals, Volume 1, pp. (156-161).
- Mahmoud, R.I.S. 1991. The effect of some growth regulators on growth, maturation and quality of "Sultani" fig fruit (*Ficus carica*, L.). M.Sc. Thesis, Fac.of Agric., Alexandria Univ., A.R.E.
- Mahmoud, H.M., T.K., El-Mahdy and F.M. Gouda. 2002. Effects of some growth regulators on developmental changes of some fig cultivars grown under Assiut

- conditions. Second conference of sustainable agriculture development. 440-455.
- Mougheith, M.G. and El-Banna, G.I. 1974. Effect of Ethrel spray on maturation of Sultani fig fruits. *Annals of Agriculture Science* 2, 109-113. High Polytechnical Institute, Moshtohor, Egypt.
- Phad, V.S., Ballal, A.L. and Patil, V.K., 1980. Development of fruit of fig (*Ficus carica* L.) as influenced by different growth regulators. *Journal of Maharashtra Agricultural Univ.* 5 (2): 142-143. (Hort. Abst. Vol. 51 (5): 3415).
- Rastegar S., M. Rahemi and H. Zargari. 2011. Changes in Endogenous Hormones in Fruit during Growth and Development of Date Palm Fruits. *American-Eurasian J. Agric. & Environ. Sci.*, 11 (2): 140-148
- Retamales, J., Cooper, T., Bangerth, F. and Callejas, R., 1993. Effect of CPPU and GA<sub>3</sub> applications on the development and quality of table grape cv. Sultanina. *Revista Fruticola*. (c.f. Hort. Abst. 65 (11): 9604, 1995).
- Sampaio, V.R., M.A.Matsue, M.P.Colombo, A.F.L.Olitta and D. Barbin. 1983. Application of growth regulators on fig produced out of season. *Anais da Escola Superior de Agricultura "Luiz de Queiroz"* 40(1): 101-108. Brazil (Hort. Abst. Vol. 56(8): 5874.
- Snedecor, G. W. and W.G. Cochran. 1980. *Statistical method* oxford and publishing com. 6th. Edition.
- Southwick, S. M. and Yeager, J.T. 1995. Use of gibberellin formulations for improved fruit firmness and chemical thinning in Patterson apricot. *Acta Horticulturae* No. 384, 425-429.
- Yearly Book of Statistics and Agricultural Economic Dept. 2012. Ministry of Agriculture, Cairo, Egypt.
- Zahedi, M., S. Mortazavi, N. Moallemi and V. Abdossi. 2013. Effect of Pre-Harvest Application of Gibberellic Acid and Ethephon on the Quality of Table Grape. *Journal of Ornamental and Horticultural Plants*, 3 (2): 125-131.
- Zhang, C. and M. Whiting. 2011. Pre-harvest foliar application of Prohexadione-Ca and gibberellins modify canopy source-sink relations and improve quality and shelf-life of 'Bing' sweet cherry. *Plant Growth Regulation*, 65(1): 145-156.

## تأثير استخدام بعض منظمات النمو على نمو الثمار والنضج فى صنفى التين العبودى و أبيض أسوان

طلعت كامل المهدي ، محمد مجدى العقاد ، فاطمه عبد الله جوده ، عزه سامى حسين  
قسم البساتين - كلية الزراعة - جامعة اسيوط - اسيوط - مصر

### المخلص:

أجريت هذه الدراسة على صنفى التين العبودى وأبيض أسوان وذلك بمزرعة أبحاث كلية الزراعة - جامعة اسيوط خلال موسمى ٢٠١٢-٢٠١٣. وتهدف هذه الدراسة إلى تحديد مراحل نمو الثمار فى الأصناف المذكورة وتأثير استخدام بعض منظمات النمو وهى حمض الجبريليك بتركيز ٥٠ جزء فى المليون ونفثالين حمض الخليك بتركيز ٢٥ جزء فى المليون بالإضافة البنزىل أدنين بتركيز ٤٠ جزء فى المليون على الصفات الطبيعية وتكبير نضج الثمار. وقد تم اختيار ١٢ شجرة من كل صنف لاجراء المعاملات عليها بحيث خصصت ثلاثة أشجار متماثلة تقريبا فى الحجم و النمو لكل معاملة وذلك فى تجربة عاملية. وكانت أهم النتائج المتحصل عليها هى:

-أدى الرش بمنظمات النمو الثلاثة إلى زيادة معنوية فى قطر الثمار خلال مراحل النمو المختلفة مقارنة بالثمار الغير معاملة (الكنترول) ، بينما حدث العكس فى مرحلة نضج الثمار حيث وجد أن أكبر قطر كان للثمار الغير معاملة تلتها المعاملة بحمض الجبريليك بينما أدت معاملة الثمار بالبنزىل أدنين إلى إنتاج أقل الثمار قطراً و ذلك خلال موسمى الدراسة.  
-كانت الزيادة فى وزن وحجم الثمار وكذلك إستجابتها للمعاملة بمنظمات النمو مشابهة للقطر تقريبا وذلك خلال موسمى الدراسة .

-أدت المعاملة بحمض الجبريليك إلى التكبير فى نضج الثمار حوالى ٤ أسابيع فى صنف أبيض أسوان وثلاثة أسابيع فى الصنف العبودى ، بينما بكرت المعاملة بنفثالين حمض الخليك نضج الثمار للصنف أبيض أسوان ثلاثة اسابيع و الصنف عبودى اسبوع واحد. أما المعاملة بالبنزىل أدنين فأسرعت من نضج ثمار الصنف أبيض أسوان لمدة أسبوعين والصنف العبودى أسبوع واحد وذلك مقارنة بالثمار الغير معاملة (الكنترول) خلال موسمى ٢٠١٢-٢٠١٣.