

Effect of GA3 on yield and fruit characteristics of Sakkoty date palm under Aswan conditions

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ABSTRACT

Different GA3 concentrations (0, 50, 100 and 150 ppm) were sprayed on Sakkoty date palm cultivar to study their effect on yield and fruit characteristics. Bunch weight was increased with 100 ppm in both seasons. GA3 applications at the higher concentrations to pollinated fruits, 50 days after full bloom, increased average fruit weight, flesh weight, fruit length, fruit diameter and fruit moisture content percentage in both seasons. GA3 applications at the different concentrations caused a slight reduction regarding total soluble solids percentage, reducing sugars percentage and total sugars percentage and increase of total acidity percentage during the two seasons.

It could be concluded that GA3 at concentrations 100 and 150 p.p.m. gave the highest yield with best quality and fruit characteristics.

Key Word: *Date palm, fruit characteristics, GA3, Phoenix dactylifera, quality, yield.*

Introduction

Certain chemicals, extractable from plant tissues, cause significant deviations in growth and development when applied in relatively minute quantities to whole plants. These are the natural or endogenous growth regulators. At present, five groups of substances are generally recognized: auxins, gibberellins,

cytokinins, abscisic acid, and ethylene. Also, there are various natural growth inhibitors.

No plant process stands isolated from all the other processes; it may be a system, but it also forms part of the overall system of plant growth and development. Plant growth regulators may be defined as substances capable of controlling key points in a living plant

system so that the natural course of development is modified.

From some physiological effects cell elongation, Apical dominance, Parthenocarpy, Abscission, Respiration, Bolting and Flowering.

Sakkoty are the most important of dry-date cultivars in Upper Egypt. The Effect of gibberellic acid (GA3) on fruit characteristics of dates was reported by Hussein *et al.*, 1976; El-Nabawy *et al.* (1977); Mougheithe and Hasaballa (1979); Abou Aziz *et al.*, 1982; Asif *et al.*, (1983); Hassaballa *et al.*, (1984); El-Kassas 1986; Mohamed *et al.*, (1986); Tafazoli (1991), Hussein *et al.*, (1992), El-Hodairi *et al.*, (1994) and Abo El-Ez *et al.*, (2002).

The present investigation was to study the effect of four different concentrations from gibberellic acid (GA3) on yield and fruit characteristics of Sakkoty date palm cultivar under Aswan conditions.

Materials and Methods

This study was carried out during two successive seasons 2004 and 2005 at Kom-Ombo, Aswan Governorate. Sakkoty date palm cultivars were used in this trial. Twelve date palm trees

were selected similar in growth, vigor, height, age (30 years old), grown on a clay soil and moderate pruning (10: 1 leaf/bunch ratio, Hussein *et al.*, (1998). Only 15 bunches were left on each experimental tree. Normal cultural practices were carried out as usual used for date palms. Pollination was achieved by using pollen grains from the same male palm grown in the same rigon in both seasons, and pollinated applied at first week of March in the first season but it was applied at first half of March in the second season.

Saprayed treatments by gibberellic acid were carried out 50 days after full bloom in both seasons as follows: (A) sprayed with 50 ppm GA3, (B) sprayed with 100 ppm GA3, (C) sprayed with 150 ppm GA3, and (D) control [0 p.p.m water spray].

The obtained data was subjected to analysis of variance. Treatment means were compared using the Duncan (1955) Multiple range test 5% level of probability in both seasons of experimentation. The data were tabulated and statistically analysed according to the randomized complete blocks design method Sandecor and Cochran, (1980).

The yield of fruits for this experiment was harvested at the latest week of October in the first season and mid October in the second season and the following characters were determined.

- A. The average yield and bunch weight was estimated by Kg.
- B. Fruit physical characters samples of three replicates, each of 10 fruits were taken randomly from each bunch to determine fruit size and fruit dimensions (length and diameter, in cm), fruit weight, fruit flesh weight and seed weight (in grams).
- C. Fruit chemical characters:
 - Moisture content: According to A.O.A.C. (1995).
 - Total soluble solids: the percentage of TSS was determined in the fruit juice using zice refractometer (A.O.A.C., 1995).
 - Fruit acidity: Fruit acidity was determined according to A.O.A.C. (1995) and the titrable acidity was calculated as citric acid (Mawlood, 1980).
 - Total soluble sugars: It was determined according to Smith *et al.*, (1956) in the methanolic extract using the

phenol sulphuric acid method and the percentage was calculated per dry weight.

- Reducing soluble sugars: It was determined in the methanolic extract according to Nelson & Somogy (1944) and A.O.A.C. (1995). The percentage was calculated per dry weight.
- Non-reducing sugars: It was determined by the difference between total and reducing sugars.

Results and Discussion

Yield per palm (Kg):

Data presented in Table (1) show the average yield of Sakkoty date palm.

Significant difference was detected in yield in first and second seasons of study. Yet, treatment (B) gave the highest yield (108.45 and 106.95 Kg) as compared with treatment (A, C) and control in the first and second seasons, respectively.

Average bunch weight:

Concerning the average bunch weight (Table 1) indicated that different concentration from gibberelic acid significantly affected bunch weight in both seasons. All treatments gave the

Table (1): The effect of GA3 sprays on the fruit physical characteristics of Sakkoty date palm during 2004 and 2005 seasons.

Treatment	2004								2005							
	Yield for palm (kg)	Av. bunch weight (kg)	Av. fruit weight (g)	Av. seed weight (g)	Av. flesh weight (g)	Av. fruit size (cm)	Av. fruit length (cm)	Av. fruit diameter (cm)	Yield for palm (kg)	Av. bunch weight (kg)	Av. fruit weight (g)	Av. seed weight (g)	Av. flesh weight (g)	Av. fruit size (cm)	Av. fruit length (cm)	Av. fruit diameter (cm)
GA3 spray at 50ppm	91.50b	6.10b	10.44ab	1.33a	9.21c	10.4ab	5.17b	1.89b	97.50b	6.50b	10.80b	1.31a	9.496	10.23a	5.00a	2.00b
GA3 spray at 100 ppm	108.45a	7.23a	10.19b	1.15b	9.79b	11.33a	5.20b	2.07a	106.95a	7.13a	10.71b	1.19b	9.52b	11.30a	5.10ab	2.07a
GA3 spray at 150 ppm.	79.95c	5.33c	11.35a	1.17b	10.18a	10.63a	5.03c	2.02a	83.40c	5.56b	11.60a	1.21b	10.39a	11.00a	5.27a	2.17a
Water spray (control)	78.75c	5.25c	9.00c	1.24a	7.76b	9.50b	5.03c	1.96b	82.50c	5.50b	10.54b	1.29a	9.25b	9.37c	4.72b	1.95b

Table (2): The effect of GA3 sprays on the fruit chemical characteristics of Sakkoty date palm during 2004 and 2005 seasons.

Treatment	2004						2005					
	Moisture content (%)	Total soluble solids (TSS%)	Total acidity (%)	Reducing sugars (%)	Non-reducing sugars (%)	Total sugars (%)	Moisture content (%)	Total soluble solids (TSS%)	Total acidity (%)	Reducing sugars (%)	Non-reducing sugars (%)	Total sugars (%)
GA3 spray at 50 ppm	15.8ab	54.7b	0.0217b	76.5b	6.7b	83.2a	17.9ab	55.2b	0.0225ab	73.6ab	3.6b	77.2a
GA3 spray at 100 ppm	16.5ab	52.7c	0.0228a	72.9c	8.2a	81.1b	20.2a	60.0a	0.0237ab	71.5b	3.9b	75.4ab
GA3 spray at 150 ppm.	17.1a	50.0d	0.0226a	63.8d	7.3a	71.1c	21.3a	61.1a	0.0246a	67.8c	5.2a	73.0b
Water spray (control)	15.3b	61.7a	0.0207c	81.2a	3.2c	84.4a	16.4b	63.4a	0.0214b	75.5a	2.6c	78.1a

highest bunch weight than the control. Treatment (B) gave the highest bunch weight, 7.23 & 7.13 Kg followed by treatment (A and C, respectively) 6.10 & 6.50 kg and 5.33 & 5.56 Kg in both seasons. These findings are in accordance with reports by many investigators such as El-Salhy (1975), Mougheith & Hassaballa (1979), Abo-Aziz *et al.*, (1982), Tafazoli (1991), Hussein *et al.*, (1992) and Abo-El-Ez *et al.*, (2002). They found that GA3 increased the weigh of fruit and yield.

Physical characters:

Fruit weight (g):

Data presented in Table (1) indicated that all different treatments from gibberellic acid significantly increased the average fruit weight for Sakkoty cv. in both seasons. Treatment (C) gave the highest fruit weight followed by treatment (A, B) and control in the first and second seasons.

The results are in agreement with those reported by Abo-Aziz *et al.*, (1982), El-Hodairi *et al.*, (1991), Hussein *et al.*, (1992) and Abo-El-Ez *et al.*, (2002). They found that the different concentration from GA3 increased the fruit weight.

Seed weight (g):

Results tabulated in table (1) indicted that seed weight significantly affected by different treatments under study in both seasons. Treatment (B and C) gave the lowest seed weight as compared with (A and D) in both season.

Fruit flesh weight (g):

Data depicted in table (1) clearly indicated the all different treatments significantly affected the fruit flesh weight in both season. Treatment (C) gave the highest fruit flesh weight than treatment (A, B and D) in the tow seasons. These data are in agreement with those Maximos *et al.*, (1980), El-Kassas (1983), El-Hodairi (1991) and Hussein *et al.*, (1992).

Fruit size:

Data presented in Table (1) clearly indicated that fruit size of Sakkoty cultivar were significantly affected by different concentration from gibberellic acid in both season. It was clearly noticed that treatment (B) gave the highest fruit size than treatment (A, C) and control in both seasons.

Fruit dimensions:

Data in Table (1) indicated that all different concentration

from gibberellic acid significantly affected on the average fruit length and diameter for Sakkoty date in both season. Treatment (B) gave the highest fruit length and diameter followed by treatment (A, C) and control in the first season, while treatment (C) gave the highest fruit length and diameter followed by treatment (A, B) and control.

These results might be attributed to the effects of gibberellic acid on growth as it stimulated both cell division and cell enlargement. Also, it was observed that, some physical properties that were determined in this study significantly increased by increasing the concentration gibberellic acid, the highest values were obtained by using gibberellic acid, similar observation were reported by many investigators, Mougheit and Hassaballa (1979), Maximos *et al.*, (1980), El-Kassas (1983), Abo-Aziz *et al.*, (1982), Hussein *et al.*, (1987), El-Hodairi *et al.*, (1991) Hussein *et al.*, (1992) and Abo-El-Ez *et al.*, (2002). They found that fruit dimensions were increased when fruits received gibberellic acid treatment.

Chemical characters:

Moisture content percentage:

Moisture content percentage of Sakkoty fruit was significantly affected by all different GA3 treatments in both seasons (Table 2). Treatment (A) gave the lowest fruit moisture content as compared with the treatment (B & C) in the both seasons. Data clearly indicated that increased fruit moisture content by increasing the concentration level of GA3. These findings might be due to the effect on GA3 on increasing fruit weight and size as well as to increase the moisture content. The results are in line with Ab-Aziz *et al.*, (1982) and Hussein *et al.*, (1992).

Total soluble solids (TSS%):

Data presented in table (2) showed that GA3 caused a slight reduction regarding total soluble solids during the two seasons. The highest contents of total soluble solids in juice were in the treatment of no GA3 (0 ppm). Similar results were reported by many authors such as El-Kassas (1983), Hussein *et al.*, (1992) and Abo-El-Ez *et al.*, (2002). They found that the total soluble solids decreased by treating with GA3.

Total acidity percentage:

Results in Table (2) indicated that total fruit acidity percentage was significantly affected by different treatments of GA3. Treatment (B) gave the highest fruit acidity percentage than those treatment (A, C) and control in the first season. Treatment (C) gave the highest fruit acidity percentage as compared with the treatment (A, B) and control during the second season. These results are in agreement with the trend reported by Abo-Aziz *et al.*, (1982) on Sewy dates.

Reducing sugars percentage:

Reducing sugars percentage was significantly affected by different treatments from GA3 in both seasons (Table 2). Treatment D (control) gave the highest fruit content of reducing sugars percentage followed by treatments (A, B and C) in two seasons, respectively.

Non-reducing sugars percentage:

Data in table (2) indicated that fruit content at non-reducing sugars was affected significantly by different treatments from GA3 in both seasons. Treatment (B) gave the highest fruit content of non-reducing sugars percentage followed by treatment

(C, A) and control in the first season. Treatment (C) gave the highest fruit content of non-reducing sugars percentage followed by treatment (A, B) and control in the second season.

Total sugars percentage:

Results in Table (2) indicated that fruit content of total sugars percentage was affected significantly by different treatments from GA3 in both seasons. Treatment D (control) gave the highest fruit content of total sugars percentage as compared with (A, B and C) in both seasons, respectively. GA3 caused a slight reduction regarding reducing and total sugars percentage in both seasons.

The highest contents of reducing and total sugars in juice were in the treatment of no GA3 (0 p.p.m.). similar results were reported by many authors such as Abo-Aziz (1982), El-Kassas (1983) and Abo-El-Ez *et al.*, (2002).

References

Hussein, F.; S. Moustafa, and El-Samaraie (1976). Effect of gibberellic acid on yield, ripening and fruit quality of "Barhi" dates grown in Saudi Arabia. Egyptian Journal of

- Horticultur. 3(2): 197-207. 1976. Hort. Abst. 47(11): 10894, 1977.
- El-Nabawy, S.M.; A.M. El-Hammady; N.S. Marie; and A.Z. Bondok (1977). Effect of some growth regulators on growth and development of "Samani" date fruits. Research Bulletin, Faculty of Agriculture, Ain-Shams University. No. 729, 23, 1977. Hort Abst. 51(5): 4071, 1981.
- Mougheith, M.G. and I.A. Hassaballa (1979). Effect of pre-harvest spray of some growth regulating substances on yield and fruit characteristics of Hayany date cultivar. Research Bulletin, Faculty of Agriculture, Ain-Shams University, No. 1073, 1979. Hort Abst. 50(12): 9595, 1980.
- Asif, M.I.; O.S. Al-Tahir and Y.M. Maki (1983). Effect of some growth chemicals on fruit morphological characteristic of Gur and Khalas dates. In proceedings of the first symposium on the Date palm in Saudi Arabia. Al-Hassa, Saudi Arabia; King Faisal University. 270-275, 1983. Hort Abst. 55(5): 3921, 1985.
- Hassaballa, I.A.; E.Youssef; M.A. Khamis; M.M. Ibrahim and S.E. Khalifa (1984). Effect of some growth regulators on fruit chemical constituents of Zaghoul date. Annuals of Agricultural Science, Moshtohor. 20(2): 335-346, 1984. Hort Abst 55(3): 2231, 1985.
- El-Kassas, El.Sh (1986). Effect of some growth regulators on the yield fruit quality of Zaghoul Date Palm. Hort. Dep., Faculty of agric, Assiut Univ, Egypt. The Second symposium on the Date Palm in Saudi Arabia. March, 3-6, 1986; vol.1.
- Mohamed, S; H.R. Shabana and N.D. Benjamin (1986). Response of date fruit to gibberellic acid application during slow period of fruit development. Tropical Agric. 63(3): 198-200, 1986. Hort Abst. 56(12): 10096, 1986.
- Tafazoli, E. (1991). Effects of growth regulators on Shahani date in relation to producing seedless fruits. Tropical Sci. 31(2): 171-176, 1991. Hort Abst. 63(5): 3841, 1993.
- El-Hodairi, M.H.; A.A. El-Barkouli and O. Baula (1991). The effects of some growth regulatours on fruit set of date palm (*Phoenix dactylifera* L.) Trees. In International

- Symposium on tropical fruit frontier in tropical fruit research, Pattaya City, Thailand, 20-24 May. Acta Hort 1992 No. 321, 334-342. Hort Abst 64(12): 9913, 1994.
- Abou Aziz, A.B; S.S. Maximous; I.A. Desouky and N.R.E. Samra (1982). Effect of GA3 and hand pollination on the yield and quality of Sewy dates. Botany Laboratory. National Research Center, Dokki, Cairo, Egypt. The first symposium on the Date Palm in Saudi Arabia. Al-Hassa, Saudi Arabia; King Faisal University.
- Abo-El-Ez, A.T.; Z.H. Behairy and A.M. Ahmed (2002). Bunch weight and fruit quality "Samani" date palm (*Phoenix dactylifera* L.) as affected by som growth regulators. J. Agric Sci. Mansoura Univ., 27(1): 517-524.
- Maximos, S.E.; A.B.A. Aziz; I.M. Desouky and N.S. Antoun (1980). Effect of GA3 and ethephon on the yield and quality of Seewy date fruits. Annals of Agric. Sci., Moshthor 12, 251-262.
- Snedecor, G.W. and W.G. Cochran (1980). "Statistical Methods" Oxford and J.B.H. Publishing Com. 6th edition.
- Duncan, D.B. (1955). Multiple range and multiple F. testes. Biometrics, 11: 1-24.
- Association of Official Agricultural Chemists (1995): "Official Methods of Analysis" 15th ed. Published by A.O.A.C. Washington, D.C. (U.S.A.).
- Mawlood, E.A. (1980). Physiological studies on fruit development of Samani and Zaghlool date palm cultivars. Ph.D. Thesis, Fac. Agric., Cairo University.
- Smith, F., Gilles, M.A., Hamilton, J.K. and Godess, P.A. (1956). Colorimetric method for determination of sugars related substances. Anal. Chem. 28, 350.
- Nelson, N and Somogy, I. (1944). Colourimetric method for determination of reducing sugars related substances. J. Bio.m Chem. 153, 375 (Manual of analysis of fruit and vegetable products. 1978, 9-17).
- El-Salhy, K.J. (1975). Physiological studies on the use of some growth regulators in some date palm varieties *Phoenix dactylifera* L. M.Sc. Degree, Fac. Of agric. Baghdad University.

تأثير الجبرالين على المحصول وصفات ثمار نخيل البلح السكوتى تحت ظروف أسوان"

سعيد سعد سليمان

قسم تكنولوجيا الحاصلات البستانية

المركز القومى للبحوث - الجيزة - مصر

أجريت هذه الدراسة خلال عامى 2004، 2005 على نخيل البلح السكوتى المنزرع فى كوم أمبو - محافظة أسوان وذلك لتحسين المحصول والصفات الطبيعية والكيميائية للثمار بواسطة حمض الجيريليك واستخدم لذلك أربعة تركيزات وهى (صفر جزء فى المليون "كنترول" و 50، 100، 150 جزء فى المليون). وقد أظهرت النتائج المتحصل عليها ما يلى:

- زاد متوسط وزن السوباطة عند استخدام تركيز 100 جزء فى المليون فى الموسمين.
- أعطى التركيز 100، 150 جزء فى المليون أقل وزن للبذور فى الموسمين.
- زاد متوسط حجم الثمرة عند استخدام تركيز 100 جزء فى المليون فى الموسمين.
- زاد متوسط وزن الثمرة واللحم ومتوسط طول وقطر الثمرة وكذلك النسبة المئوية لرتوبة الثمار بزيادة تركيز حمض الجيريليك.
- أدى استخدام حمض الجيريليك إلى نقص طفيف فى المواد الصلبة الذائبة الكلية والسكريات المختزلة والكلية مع ارتفاع فى الحموضة الكلية للثمار فى الموسمين.