Egypt. J. Hort. **Vol. 42,** No. 2, pp. 825-838 (2015)

Improving Yield, Fruit Quality and Storability of 'Zaghloul' Date Palm Cultivar by Pre-Harvest Sprays of Some Growth Regulators and Bunch Bagging

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THE PRESENT study was conducted during the two consecutive seasons, 2013 and 2014 on fifteen years old 'Zaghloul' date palm trees (*Phoenix dactylifera* L.) grown in a calcareous soil under flood irrigation system to study the effect of pre-harvest spray of the growth regulators gibberellic acid (GA_3) at 150 mg/l , naphthalene acetic acid (NAA) at 100 mg/l and ethrel at 1000 mg/l and bunch bagging treatments (about 4 weeks from pollination) on bunch weight, fruit physical characteristics, total soluble solids (TSS), acidity and tannins % at harvest and Rutab, weight loss, ascorbic acid, total phenol content and peroxidase activity during cold storage (0 ± 1) °C and 90-95% RH for 15 days. At harvest, all growth regulators increased bunch weight, fruit weight, fruit length and fruit diameter compared to the control except ethrel which had no influence on fruit weight as compared with the control. NAA spray gave the highest bunch weight than the other treatments. A significant increase was obtained in bunch weight and fruit physical characteristics by bunch bagging compared to un-bagged treatment. TSS % and acidity, as well as tannins, were increased by GA_3 and NAA compared with the control. Ethrel spray resulted in higher TSS content and lower acidity and tannins contents compared with control and other growth regulators. Bunch bagging decreased TSS and tannins while it had insignificant effect on acidity. During cold storage, a significant decrease in Rutab% and fruit weight loss was obtained in both seasons by all sprayed growth regulators except ethrel in the first season. Only ascorbic acid, total phenol content and peroxidase activity was significantly higher with GA_3 and NAA treatment compared with ethrel and control. In this respect, ethrel showed the lowest ascorbic acid, total phenol content and peroxidase activity among other growth regulators. The result of both seasons generally indicated that bunch bagging treatment tended to increase Rutab%, ascorbic acid and reduce peroxidase activity while it had no significant effect on weight loss and total phenol content.

Keywords: Growth regulators, Bagging, Rutab, Ascorbic acid, Phenol, Cold storage.

Date Palm (*Phoenix dactylifera* L.), is one of the eldest fruit trees in the world, is deeply rooted in the economy, history and culture of the Middle East countries. Date Palm is thought to have originated in Mesopotamia (which is now Iraq) and its cultivation spread to The Middle East and South Africa (about 5000 years

ago). In 2009, world production of dates was over 7.5 million tons. Egypt is considered one of the top 10 producing countries. Economically, Zaghloul date is the most important soft cultivar grown in Egypt. It is usually harvested and consumed at Khalal stage when fruits reach full maturity and are crunchy and red. Fruit size is one of the most limiting factors affecting in fruit marketing because consumers generally prefer the larger size over small ones (Al-Qurashi & Awad, 2011 and Awad & Al-Qurashi, 2012). Several strategies have been examined to improve bunch weight and fruit quality of date palm, such as a hand or chemical thinning of blossoms and fruits. However, the high cost of hand thinning and low response of some date cultivars to chemical thinning (Hesami & Abdi, 2010 and Awad, 2010) do not allow using those strategies. Growth regulators play an important role in improving quality and productivity of date palms (El-Kosary, 2009) and other fruit species (Agusti *et al*., 2003 and Davis, 2004) probably by increasing cell division and elongation. The application of NAA during Kimri stage cause an increase in fruit size of Zahdi and Sayer cv. (Mohammed and Shabana, 1980). GA_3 application on 'Barhee' at 50, 100 and 150 ppm at 15-16 weeks following pollination increased fruit weight and fruit length and delayed fruit ripening (Awad and Al-Qurashi, 2012). Also, GA_3 spray on Samany and Zaghloul dates at 4 weeks after pollination increased bunch weight, weights of fruit and seed (El-Kosary, 2009). Ethrel application at hababouk and at the end of Kimri stage increased fruit weight, length, and diameter and advanced fruit ripening date of 'Sokary' dates (Kassem *et al*., 2012). Cold storage delayed fruit ripening and extend the shelf life of 'Barhee' dates compared with store at ambient condition (Al-Obeed, 2010). Pre-harvest spray of gibberellic acid, naphthalene acetic acid, benzyl adenine and salicylic acid each at 50 or 100 ppm reduced rutab%, weight loss and delayed fruit maturation and ripening of 'Barhee' dates during cold storage (Mohammed *et al*., 2014). A few date cultivars, such as Hayany, Samany, and Zaghlol, are harvested at the "Khalal" stage (partially-ripe) when they are yellow or red (depending on cultivar), but many consumers find them astringent (due to high tannin content). Ripening of "Khalal" dates can be hastened by bunch bagging during growth. Bunch bagging with different colors after 4 weeks from pollination caused a significant early fruit ripping date, increased fruit weight, fruit length, fruit diameter and yield (Kassem *et al*., 2011). Moreover, Awad and Al-Qurashi (2012) reported that bunch bagging after one month from pollination increased bunch weight, fruit weight, fruit length, flesh/seed ratio and TSS of 'Barhee' dates.

Therefore, the objective of this investigation was to study the effect of NAA, GA_3 and ethrel spray at the Kimri stage and bunch bagging on yield, fruit quality and storability of 'Zaghloul' dates under Egypt condition.

Materials and Methods

The present study was conducted during the two consecutive seasons, 2013 and 2014 at a private farm in Mariot region (30^{o} 55′ 33.34″ N and 29^{o} 46′ 31.81″ E)

at Alexandria Desert Road, Egypt (on fifteen years old 'Zaghloul' date palm trees (*Phoenix dactylifera* L.) grown in a calcareous soil under flood irrigation. All palms received normal horticultural practices. The experiment was designed as randomized complete block design with four replicates for each treatment. One bunch per palm (replicate) was used for each treatment. At late March of both experimental seasons, the selected date palm trees were hand pollinated with the same male palm by placing eight fresh male strands on female bunches (flower cluster) center. After fruit set, the number of bunches per palm was adjusted to 8 bunches. About 4 weeks from pollination, 4 bunches per tree were bagged with blue polyethylene perforated bags till the end of the season. At kimri stage (15 weeks from pollination) four un-bagged bunches and four bagged bunches on each tree were marked and one bunch on each tree was subjected to 150 mg/l (GA_3), 100 mg/l (NAA) and 1000 mg/l ethrel. One bunch from the four previously bagged bunches and one bunch from the four un-bagged was sprayed only with water as control. The bunches were sprayed with a hand sprayer and each one received about 300 ml. Anon ionic wetting agent (Tween 20 surfactant) at 0.01% was included in all treatments. In both seasons when the fruits for each treatment reached full maturity and red color (commercial harvest date), all bunches on each tree were harvested and each bunch weight was recorded.

Fruit physical characteristics

A sample of 25 fruit per bunch at Khalal stage was randomly collected in both seasons in order to determine the following physical characteristics. Fruit weight (g), fruit length (cm) and fruit diameter (cm) were recorded.

Fruit chemical characteristics

Another representing sample of 25 fruit per replicate at Khalal stage was randomly collected in both seasons for measuring total soluble solids (TSS), acidity, and total soluble tannins. In the juice, TSS were measured as % using a hand refractometer (ATC-1E, Atago, Japan), titratable acidity was measured by titration with 0.1N NaOH according to A.O.A.C. (1995). Soluble tannins were determined in each sample by Swain and Hillis (1959) method.

At harvest, additional fruit samples (100 fruit each) were collected to study the effect of treatments on fruit storage ability by measuring Rutab percentage, fruit weight loss, ascorbic acid, Total phenols, and peroxidase. The fruits were kept in perforated plastic boxes in a refrigerator (0 ± 1) °C and 90-95% RH for 15 days.

Rutab percentage and weight loss

At the end of the storage period, the number of Rutab fruit was recorded and expressed as a percentage. Fruit that showed softening more than 10% (visually estimated) of its total area was considered Rutab/ripe. The percent of weight loss was calculated on an initial weight basis.

Ascorbic acid content

Ascorbic acids were determined using 2, 6 Dichlrophenol indophenols for the titration of juice and presented as mg/100 g fresh weight (Ranganna, 1979).

Soluble tannins content

The soluble tannins were measured by the Folin–Denis method (Taira, 1996). A quantity of Five grams of the sample were placed directly into a solution of 25 mL of methanol 80% and homogenized in a blender. Thereafter, samples were filtered and centrifuged at 14000 rpm for 20 min at 4 ºC, and the supernatant was reserved. More supernatant was extracted from the precipitant with methanol 80% and added to the first. The total supernatant was brought to 100 ml with distilled water. One ml of this sample solution and 6 ml of distilled water were mixed. Thereafter, 0.5 ml of 1 N phenol reagent (Folin- Ciocalteau reagent) was added and shaken thoroughly. After 3 min, 1 mL of saturated Na_2CO_3 was added, vortex, and 1.5 mL of distilled water was added. The absorbance was measured after 1 h at 750nm, soluble tannins were calculated as mg gallic acid equivalents per gram of fresh weight basis.

Total phenols content

A quantity of 5 g of fruit tissue was homogenized in 15 ml ethanol 95% and boiled for 15 minutes. The homogenate was filtrated through Whatman No.1 filter paper (Whatman Laboratory Division, Springfield Mill, England). A quantity of 0.5 ml Folin-Denis reagent was added to 1 ml of the alcoholic extract and after 5 minutes, 7 ml saturated sodium carbonate solution was added, shaken and left for 0.5 h. Optical density was measured at 750 nm and total phenols were calculated from a standard curve of gallic acid. These data were expressed as the mg gallic acid equivalents per gram of fresh weight basis according to (Slinkard and Singleton, 1977).

Peroxidase activity

Peroxidase activity was carried out according to Miranda et al. (1995). The reaction mixture containing in one ml: 0.1ml crude extract, 40 mM guaiacol, 8 mM H_2O_2, 50 mM sodium acetate buffer, pH 5.5. The change in absorbance at 470 nm due to guaiacol oxidation was followed for 1 min using a spectrophotometer. One unit of peroxidase activity was defined as the amount of enzyme which increases the O.D. 1.0 per hour under standard assay conditions.

Statistical analysis

The data obtained were statistically analyzed according to the analysis of variance as described by Snedecor and Cochron (1990). The statistical analysis was performed using CoStat software package for Windows. Comparisons between means were made by *F*-test and least significant differences (LSD) at *P*=0.05, 0.01 and 0.001.

Results

Bunch weight

Data of both seasons presented an increase in bunch weight by all sprayed growth regulators compared to the control (Table 1). In 2013 season, NAA had higher bunch weight followed by GA_3 and ethrel. However, in the second season, spraying NAA and GA_3 increased bunch weight compared with the control, with no significant difference between them obtained. Also, in both seasons bunch bagging significantly increased bunch weight than the control (without bagging).

Physical characteristics of fruits

The effect of different treatments on fruit weight, fruit length, and fruit diameter are presented in Table 1. A significant increase in fruit weight was recorded by spraying NAA and GA_3 in both seasons. On the other hand, ethrel spray did not affect fruit weight as compared with the control.

Longer fruits than the control were obtained by all sprayed substances. The longest fruits were obtained by GA_3 in both seasons with insignificant differences from remaining treatments. All sprayed growth regulators increased significantly the fruit diameter as compared with the control, with no difference among them was recorded (only ethrel in the first season decreased significantly the fruit diameter compared with both GA_3 and NAA treatments). Fruit weight, length, and diameter were significantly increased by bunch bagging treatment when compared with control (without bagging).

TABLE 1. Effect of growth regulators and bunch bagging on bunch weight, fruit weight, fruit length and fruit diameter of Zaghloul date palm cultivar at harvest during 2013 and 2014 seasons.

Treatments	Bunch weight (Kg)		Fruit weight (g)		Fruit length (cm)		Fruit diameter (cm)	
	2013	2014	2013	2014	2013	2014	2013	2014
Growth regulators (G)								
Control (water)	18.50d	20.35c	21.93b	22.04b	4.05b	4.13b	2.62c	2.57b
GA_3	23.05b	22.80a	24.12a	24.55a	5.67a	5.95a	3.07a	3.18a
NAA	24.85a	23.25a	24.69a	25.63a	5.42a	5.57a	3.20a	3.36a
Ethrel	20.40c	21.60b	21.28b	21.40b	5.36a	5.29a	2.87b	2.95a
F-test	***	***	***	***	N.S	N.S	***	
LSD (0.05)	1.46	1.16	1.46	1.09	0.97	0.73	0.16	**
Bagging (B)								
Without bagging	21.40b	22.12b	22.19b	22.47b	5.31b	5.42b	2.86b	2.81b
With bagging	22.50a	23.87a	23.82a	24.34a	6.10a	5.95a	3.05a	3.10a
F-test	***	***	***	**	NS	NS	**	NS
LSD (0.05)	1.03	0.82	1.03	0.77	0.69	0.51	0.11	0.26
GXB								
F-test	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S

Means within each column followed by the same letter are not significantly different at level P≤0.05. (**) and (***), significantly at level P≤0.01 and 0.001, respectively, (NS), not significant.

Chemical characteristics of fruits

The effect of the different treatments on fruit chemical characteristics at harvest is presented in Table 2. A significant increase in total soluble solids (TSS) concentrations in comparison with the control was obtained in both seasons by all sprayed growth regulators. Ethrel spray resulted in higher TSS content than GA_3 and NAA. However, no significant differences were obtained among ethrel and NAA in fruit TSS concentrations in both seasons. Moreover, the data obtained showed that fruit acidity was significantly increased by spraying GA_3 and NAA as compared with the control and ethrel treatment in both seasons. No significant differences between GA_3 and NAA were obtained in the first season. Ethrel resulted in the lowest fruit acidity content compared to all other treatments and the control in both seasons. In addition, the total soluble tannins percentage was also increased by GA_3 and NAA as compared with the control and ethrel in both seasons. No significant differences were found between GA_3 and NAA in the first season. The results also showed that the ethrel treatment had the lowest fruit soluble tannins percentage as compared to control, GA_3, and NAA. As for the effect of bagging treatment on fruit chemical characteristics, the data in Table 2 showed that bunch bagging had no significant effect on acidity concentrations in both seasons. However, during both seasons bunch bagging decreased TSS and total soluble tannins concentrations compared to the control.

TABLE 2. Effect of growth regulators and bunch bagging on TSS%, Acidity and Tannins of Zaghloul date palm cultivar at harvest during 2013 and 2014 seasons.

Treatments	TSS (%)		Acidity (%)		Tannins (mg/g fw)	
	2013	2014	2013	2014	2013	2014
Growth regulators (G)						
Control (water)	25.48c	26.32c	0.12b	0.12c	4.9b	4.20c
GA_3	26.59b	27.10b	0.15a	0.14b	6.2a	6.1a
NAA	27.27a	27.97a	0.15a	0.14a	6.1a	4.9b
Ethrel	28.27a	28.04a	0.11c	0.11d	3.8c	3.4d
F-test	***	***	***	***	***	***
LSD (0.05)	1.02	0.80	0.006	0.006	0.4	0.4
Bagging (B)						
Without bagging	31.14a	30.83a	0.13a	0.12a	0.58b	0.50b
With bagging	29.00b	28.24b	0.13a	0.12a	0.47a	0.43a
F-test						
LSD (0.05)	**	**	NS	NS	***	***
GxB	2.04	1.01	0.004	0.004	0.58	0.02
F-test	NS	NS	NS	NS	NS	NS

Means within each column followed by the same letter are not significantly different at level P≤0.05. (**) and (***), significantly at level P≤0.01 and 0.001, respectively, (NS), not significant.

Storability

The effect of different growth regulators treatment on fruit storage ability expressed as fruit rutab percentage, fruit weight loss, ascorbic acid, total phenol content, peroxidase activity is presented in Table 3. The data showed that Rutab

percentage during 15 days of storage at (0 ± 1) °C was significantly reduced by all growth regulators.

TABLE 3. Rutab percentage, weight loss, peroxidase, ascorbic acid and phenol of 'zaghloul' dates during storage at (0 ± 1) °C as affected by pre-harvest spray of some growth regulators and bunch bagging, season 2013 and 2014.

Treatments	Rutab (%)		Weight loss (%)		Peroxidase U/h/g fw		Ascorbic acid mg/100 g fw		Phenol mg/g fw	
	2013	2014	2013	2014	2013	2014	2013	2014	2013	2014
Control (B_0)	15.13a	16.50b	3.40b	4.00a	340g	350e	2.00d	2.16e	1.59bc	2.16bc
(B_1)	17.06a	18.50a	4.00ab	3.80a	350f	342e	2.70c	3.10d	1.36c	1.83c
GA_3 (B_0)	5.29cd	6.71e	2.48c	2.25cd	484a	487a	4.25a	4.00b	2.05bc	2.30b
(B_1)	8.54b	10.46d	2.50c	2.46cd	465b	478a	4.20a	4.69a	2.86a	2.88a
NAA (B_0)	3.61d	5.20f	2.16c	2.56c	400c	446b	3.21b	4.00b	2.87a	2.80a
(B_1)	6.50c	6.00ef	2.26c	2.07d	398cd	407c	4.03a	4.11b	2.20ab	2.53ab
Ethrel (B_0)	10.07 b	11.90c	4.30a	3.22b	392de	402c	2.60c	3.21d	1.63bc	2.22bc
(B_1)	16.96a	19.29a	3.50b	3.60ab	386e	379d	2.50c	3.60c	1.63bc	2.22bc
Analysis of variance (F-test)										
Growth reg. (G)	***	***	***	***	***	***	***	***	***	***
Bagging (B)	**	***	NS	NS	*	***	**	**	NS	NS
GxB	**	***	*	*	***	*	**	**	*	*

Means within each column followed by the same letter are not significantly different at level P≤0.05. (**) and (***), significantly at level P≤0.01 and 0.001, respectively, (NS), not significant.
(B_0) = without bagging, (B_1) = with bagging.

The lowest fruit rutab percentages were obtained by spraying NAA followed by GA_3 and ethrel. As for the effect of different growth regulators treatment on fruit weight loss during storage, the data in Table 3 revealed that a significant decrease in fruit weight loss was obtained in both seasons by all sprayed growth regulators except ethrel in the first season. NAA and GA_3 had similar and significantly lower fruit weight loss compared with ethrel and control.

Regarding the effect of bunch bagging treatment on fruit Rutab percentage and fruit weight loss at 15 days of cold storage, data in Table 3 showed that while bunch bagging treatment had no significant effect on fruit weight loss during both seasons, it tended to increase fruit Rutab percentage in compared with the control (without bagging). Ascorbic acid, total phenol content, and peroxidase activity were significantly higher at GA_3 and NAA treatment than ethrel and control (Table 3). In this respect, ethrel showed the lowest ascorbic acid, total phenol content and peroxidase activity among growth regulators treatment. The effect of bunch bagging on ascorbic acid, total phenol content and peroxidase activity is shown in (Table 3). The result of both seasons, generally indicated that bunch bagging treatment tended to increase ascorbic acid and

reduce peroxidase activity while had no significant effect on total phenol content. GA_3 alone or with bunch bagging had similar and significantly higher peroxidase and ascorbic acid than all other treatments. Furthermore, higher phenol content than all other treatments was obtained by NAA and GA_3 with bunch bagging.

Discussions

Similar increase in bunch weight and fruit Physical characteristics by different growth regulators sprays was recorded in several studies. (Hesami & Abdi, 2010, Al-Obeed, 2010, Al-Qurashi *et al*., 2012, Kassem *et al*., 2012, Awad & Al-Qurashi, 2012 and El-Kosary (2009) reported an increase in bunch and fruit weight in both 'Zaghloul' and 'Samany' date cultivars by spraying GA_3 and NAA at 4 weeks from pollination. In the current experiment, the application of growth regulators GA_3, NAA and ethrel had no effect on fruit retention and the number of fruit per bunch since the application was in late stage (end of Kimri stage). The increase in bunch weight by the mention substances might be due to that they increased fruit weight. Gibberellins are believed to serve as a mediating process for faster translocation and mobilization of stored metabolites or photosynthates from source to sink and also play significant role in increasing auxin synthesis in ovaries (Looney *et al*., 1992). Sarkar and Ghosh (2005) mentioned that spray application with GA_3 increased fruit weight, volume and length of the fruit. The role of GA3 was to multiply and to lengthen the meristem cells, which results in increase fruit volume and weight. The application of NAA by other researchers have also shown that it increased fruit number, fruit weight, and yield by causing cell elongation by enlargement of vacuoles and loosening of cell wall after increasing cell wall plasticity (Agrawal and Dikshit, 2008). A similar increase in fruit weight and size by pre-harvest ethrel spray was previously reported by Kassem *et al*. (2012) working on Sokry date palm. It is suggested that ethephon application increase size and weight of fruit through stimulating transmission from cell division to cell enlargement. The Obtained enhancement in bunch weight and fruit weight and diameter by bunch bagging goes on line with those reported by Harhash and A-Obeed (2010), Kassem *et al*. (2010 and 2011) and Awad and Al-Qurashi (2012). In the present study, the increase in acidity and soluble tannins concentrations in fruits by GA_3 and NAA application might be due to their influence in delayed fruit ripening process. These results confirm those of Awad and Al-Qurashi (2012) and Al-Obeed (2010) who reported thatGA_3 and NAA spray application on date palm trees increased acidity and soluble tannins concentrations. The increase in TSS concentration by GA_3, NAA and ethrel application is previously stated (Aljuburi *et al*., 2001, Marzouk & Kassem, 2011, Awad & Al-Qurashi, 2012 and Kassem *et al*., 2012). Moreover, Crane (1956) reported that auxins content caused mobilization of soluble carbohydrates into fruits. In this study, bunch bagging decreased TSS concentrations. The slight decrease in TSS by bagging could be attributed to the use of sugar in the respiration processes under the high

temperature inside the bags (Awad, 2007). Soluble tannins are responsible for the sensory astringency in dates (Serrano *et al*., 2001 and Pesis, 2005). In the current study, bunch bagging decreased the soluble tannins concentration. In contrast to our results, bunch bagging during the first 4 weeks after pollination until harvest remarkably increased soluble tannins concentration in 'Barhee' dates (Awad and Al-Qurashi, 2012). Consistent with our results, the previous study suggested that Bunch bagging decreased soluble tannins concentration through increased respiration rate and CO_2 production leading to an increase in acetaldehyde production and removal of astringency (Awad, 2007). In this study, during cold storage, GA_3 and NAA significantly decreased rutab percentage compared to ethrel treatment and control. This result is in conformity with similar results were reported by numerous investigators (Al-Obeed, 2010 and Kassem *et al*., 2011) they all found that pre-harvest spray of GA_3 and NAA decreased Rutab percentage of 'Barhee' dates during 30 and 45 days of cold storage compared to control. This partially contradicts with what was observed by Mohamed *et al*. (2014) who found that NAA at 50 and 100 ppm decreased Rutab percentage whereas GA_3 at 50ppm significantly increased Rutab percentage. Besides, Mohamed *et al.* (2014) mentioned that the decrease in Rutab percentage by NAA treatment during cold storage might be attributed to an increase in antioxidant activity of treated dates. Moreover, the reduction of Rutab percentage might be due to the effect of GA_3 and NAA on slowing down fruit senescence through its effect on regulating ethylene production or action (Al-Obeed, 2010). Ethylene is known as the major trigger and coordinator of the ripening process (Abeles *et al*., 1992). Zaghloul date palms might follow an ethylene-independent ripening process, however they respond to exogenous ethylene pre-harvest treatments (Kassem *et al*., 2011) therefore pre-harvest ethrel application would increase ethylene content in the fruit, accelerate fruit maturity and ripening process leading to increasing Rutab percentage. The ripening response observed in this study as a result of ethrel application agrees with those of Awad (2007) and Kassem *et al*. (2011). Weight loss is one of the most important factors affecting postharvest life during storage. In our study, GA_3 and NAA decreased weight loss than ethrel and control. This is in contrast to what observed by Mohamed *et al*. (2014) who found that weight loss of 'Barhee' dates was significantly higher at 50 and 100ppm of GA_3 and NAA compared to control. The reduction of weight loss might be due to the effect of sprayed substances on maintaining and slowing down water loss (Lester and Grusak, 2004, Mahajan and Dhatt, 2004). Fruit ripening has been described as an oxidative phenomenon (Jimenez *et al*., 2002). All growth regulators increased ascorbic acid, phenol content, and peroxidase activity during cold storage this could be attributed to its ability to decrease oxidative stress (ripening). Awad *et al*. (2011) reported that dates ripening process might involve a decrease in the antioxidant system with an oxidative stress. Our results showed that, during cold storage, Rutab percentage was significantly higher by bunch bagging treatment compared to the control. This result confirm that of Kassem *et al*. (2011) who found that bunch bagging with blue polyethylene bags even at Khalal stage had

the highest Rutab percentage after 15 or 30 days from cold storage as compared to the control. In the present investigation, vitamin C increased by bunch bagging treatment. These results were in agreement with those found by many investigators such as: Awad (2007), and Awad and Al-Qurashi (2012). They all reported that bunch bagging tended to increase vitamin C in the date palm fruit. However, the regulatory mechanisms of such increase in vitamin C by bunch bagging remain elusive. Literature reveals that the effects of bagging on phenolic compounds of fruits have given contradictory information, which may reflect differences in cultivar, bagging material, date of bagging, period of bagging, date of bag removal and climatic conditions (Sharma *et al*., 2013). For example, Xu *et al*. (2010) reported that the total phenolic content in loquat was decreased by bagging treatments. In contrast, Sharma *et al*. (2013) reported that bagged apples contained higher levels of phenolics (9.3 mg gallic/100g pulp) and exhibited higher antioxidant activity at harvest, which decreased during storage but the level was higher in bagged fruits. Consistent with our results, Awad *et al*. (2012) reported that bagging did not affect total phenol content of 'Barhee' date palm. In addition, Wang *et al*. (2010) reported that bagging did not affect chlorogenic acid and catechol contents of either fruit peel or flesh in "Wanmi" peach. In conclusion, pre-harvest application of growth regulators and bunch bagging treatment at kimri stage of fruit growth had a positive influence in increasing bunch weight and improving fruit quality of 'zaghloul' date palm cultivar. GA_3 and NAA decreased Rutab (softening) and weight loss during cold storage which could be used for extending the storability life of dates.

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(*Received* 14/ 6/ 2015;
accepted 18/10/ 2015)

تحسين المحصول وجودة الثمار والقدرة التخزينية لثمار البلح صنف زغلول برش بعض منظمات النمو ومعاملة التكييس

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اجري هذا البحث خلال موسمين متتاليين ٢٠١٣ و ٢٠١٤ وذلك لدراسة تأثير رش بعض منظمات النمو ومعاملة التكييس علي المحصول وجودة الثمار والقدرة التخزينية لثمار البلح صنف زغلول . وقد استخدم لإجراء هذا البحث أشجار نخيل عمرها ١٥ سنة نامية في ارض جيرية تحت نظام الري بالغمر وذلك في مزرعة خاصة بمنطقة مريوط الزراعية في الكيلو ٤٥ من طريق إسكندرية الصحراوي.
بعد أربعة أسابيع من اجراء التلقيح بلقاح من نفس الصنف تم اجراء معاملة التكييس لعدد اربع سوباطات / نخلة وتركت حتي نهاية الموسم وتم تحديد اربع سوباطات / نخلة تركت بدون تكييس كمعاملة كنترول. بعد ١٥ أسبوع من عملية التلقيح (خلال مرحلة القمري) تم المعاملة بمنظمات النمو وهي الجبريليك أسيد بتركيز ١٥٠ ملليجرام / لتر، نفثالين أسيتيك أسيد بتركيز ١٠٠ملليجرام/لتر، اثريل بتركيز ١٠٠٠ملليجرام/ لتر ، الماء كمعاملة كنترول وقد تم رش هذه المعاملات علي سوباطات تم تكييسها وسوباطات تركت بدون تكييس. عند الحصاد تم تقدير وزن السوباطات وقد تم دراسة الخواص الفيزيائية (وزن الثمرة، طول الثمرة، قطر الثمرة) وكذلك الخواص الكيميائية (نسبة السكريات، الحموضة، التانينات الذائبة الكلية) للثمار. عند الحصاد تم أخذ عينة من الثمار وتم تخزينها علي درجة الصفر درجة مئوية ورطوبة ٩٠-٩٥٪ لمدة ١٥ يوم لدراسة تأثير المعاملات علي القدرة التخزينية للثمار، وفي نهاية فترة التخزين تم تقدير (نسبة الفقد المائي، نسبة الثمار الرطب، محتوي الثمار من كل من الاسكوربيك أسيد، التانينات الذائبة الكلية، الفينولات الكلية، نشاط إنزيمات البيروكسيديز. وقد أوضحت النتائج أن جميع منظمات النمو أدت الي زيادة وزن السوباطة، وزن الثمرة، طول الثمرة، قطر الثمرة بالمقارنة بمعاملة الكنترول ماعدا المعاملة بالأثريل لم يكن لها اي تأثير معنوي علي وزن الثمرة بالمقارنة بمعاملة الكنترول. أدت المعاملة بالنفثالين أسيتيك أسيد لأعلي وزن السوباطة بالمقارنة بباقي المعاملات. أدت معاملة التكييس لزيادة وزن السوباطة وكذلك تحسين الخواص الفيزيائية للثمار. أدت المعاملة بالجبريلليك أسيد ونفثالين أسيتيك أسيد الي زيادة نسبة السكريات والحموضة والتانينات في الثمار بالمقارنة بمعاملة الكنترول ، كما أدت المعاملة بالاثريل لأعلي محتوي لنسبة السكر وأقل نسبة حموضة وتانينات بالمقارنة بمعاملة الكنترول والجبريليك والنفثالين أسيتيك أسيد. أدت معاملة التكييس الي نقص نسبة السكريات والتانينات في الثمار ولكن لم يكن لها تأثير معنوي علي نسبة الحموضة. اما من ناحية تأثير المعاملات علي الثمار بعد ١٥ يوم من التخزين المبرد، فقد أدت جميع منظمات النمو الي انخفاض نسبة ثمار الرطب ونسبة الفقد في الوزن ماعدا المعاملة بالاثريل خلال الموسم الاول. كان محتوي الثمار من كل من الاسكوربيك أسيد ، الفينولات الكلية، إنزيم البيروكسيديز اعلي في الثمار المعاملة بالجبريلليك أسيد والنفثالين أسيتيك أسيد وذلك بالمقارنة بمعاملة الكنترول والاثريل. أدت معاملة التكييس الي زيادة نسبة الثمار الرطب ونسبة حامض الاسكوربيك بينما أدت الي تخفيض نشاط إنزيم البيروكسيديز بينما لم يكن هناك اي تأثير معنوي لمعاملة التكييس علي نسبة الفقد في الوزن وكذلك الفينولات الكلية.