

EFFECT OF NAA ON FRUIT SETTING, BUNCH WEIGHT AND FRUIT CHARACTERISTICS OF SAMANI AND ZAGHLOUL DATE PALM CULTIVARS

Bakr, E. I.¹; S. El-Kosary¹; A. El-Bana² and H. S. Ghazawy²

1- Pomology Dept., Faculty of Agriculture, Cairo University.

2-Central Laboratory for Date Palm Researchs and Development.

ABSTRACT

This study was carried out in 2003 and 2004 seasons in the Experimental Orchard of the Faculty of Agriculture, Cairo University, Giza, Egypt, to study the effect of fruit thinning using NAA at different concentrations spraying on Samani and Zaghloul date palm cultivars. Fruit set was decreased when NAA sprayed at 7 or 21 days from pollination especially at 100 or 150 ppm for both cultivars in the two seasons. Also, Samani and Zaghloul fruit physical characteristics i.e. (fruit weight, flesh weight, seed weight, fruit dimensions and fruit size) were enhanced with 100 or 150 ppm of NAA. In addition, Samani and Zaghloul fruit contents of TSS, total soluble sugars, reducing sugar and non-reducing sugars were increased with spraying 100 ppm NAA in the two seasons especially 7 days after pollination.

Keywords: Samani- Zaghloul- NAA- fruit characters – fruit thinning -Date palm cultivar.

INTRODUCTION

Date palm (*Phoenix dactylifera*, L.) has a great economical importance and agricultural uses throughout human's history. Also, it is one of the oldest cultivated fruit trees in the world. Date palm is a very important crop in the Middle East, since it can grow well in both semi-dry desert areas and the newly cultivated land. The date production of Arab world is about 80% of the total production of the world.

Fruit thinning of date palms is an important factor in improving fruit quality (physical and chemical fruit characteristics), consequently the grade of superior fruits for internal marketing and exportation. Also it reduces the alternate bearing of some date palm cultivars.

The effect of NAA at 30, 60 and 90 ppm on fruit of Zaghloul and Samani dates were studied. It was clearly noticed that bunch weight was decreased in all treatments comparing with the untreated bunches. In addition, the average yield per bunch was reduced due to the concentration of (NAA). On the other hand, untreated palms (control) gave the maximum bunch weight comparing with the treated palms. (Abd-El Rahman, 1974; Benjmin *et al.*, 1976; Moustafa *et al.* 1993; Kamal 1995 and Bassal, 2002). Also, spraying NAA at 60 ppm after 10 days from pollination was the best treatment that increased quality of date palm fruits. (Abdalla *et al.*, 1993; El-Makhtoun *et al.*, 1995 a; Bassal, 2002 and Al-Obeed *et al.* 2002). In another study, NAA sprayed at 15, 25, 35 and 45 ppm significantly affected (TSS) percentage of Zaghloul date fruits. Moreover, 35 and 45 ppm of NAA significantly increased (TSS) content in Zaghloul fruits than control in both seasons. El-Makhtoun *et al.*,1995 a and Al-Obeed *et al.*,2002). Also, spraying

NAA at 30, 60 and 90 ppm of Zaghloul and Samani date palm cultivars increasing fruit total sugars of Zaghloul and Samani in both seasons. The increase in fruit total sugars was proportional to the concentration of growth regulators. Kamal, 1995 and Bassal (2002).

Thus, the present investigation is planned to study the effect of NAA or GA₃ at different concentrations of each on the fruit thinning of both Samani and Zaghloul date palm cvs, aiming to improve their fruit physical and chemical characteristics.

MATERIALS AND METHODS

The present study was carried out during two successive seasons (2003 and 2004), at the Experimental Research Station, Faculty of Agriculture, Cairo University, Giza Governorate. Samani and Zaghloul date palm cultivars were used in this investigation. Female palms of both cultivars (15 years old) were pruned at 8:1 leaf /bunch ratio. The palms were received normal agricultural practices. Samani and Zaghloul palm cultivars were pollinated by using the same source of pollen grains just after fourth days of spathe cracking in both seasons.

Experimental design: Six palms of each cultivar were used in this experiment. Twelve bunches were left on each palm and were divided into four groups, each group of 3 bunches (replicate). Four concentrations of NAA, i.e. (0,50,100 and150 ppm) were used in this trial and the last group was sprayed by water as control. Each of the studied concentrations was sprayed on three bunches (replicate) for the two cultivars. Therefore, the studied concentrations were sprayed on three of the chosen palms. The individual bunches were covered before and after treatments by tissue paper. The aforementioned treatments were applied at two dates, the first was done at 7 days from pollination and the second was done at 21 days from pollination. Samples of 30 date fruits were randomly picked from each bunch for the determination of fruit physical and chemical properties. Samples (30 fruits from each replicate) were taken every 15 days from pollination towards the end of the study.

Statistical analysis: The obtained data were subjected to analysis of variance. The mean values were compared using LSD method at 5% level. The data were tabulated and statistically factorial analysed according to the randomized complete block design (Snedecor and Cochran,1972). Also, the percentages were transformed to the arcsine to find the binomial percentages according to steel and Torrie (1980) .

The yield of fruits for this experiment was harvested at the second week of September in both seasons for both cultivars (Samani and Zaghloul cvs); and the following data were recorded:

- 1- Bunch weight was estimated as Kg.
- 2- Fruit set percentage was calculated at harvest using this equation:

$$\text{Fruit set \%} = \frac{\text{Total number of setting fruits per bunch}}{\text{Total scares number per bunch}} \times 100$$

- 3- fruit physical properties: Samples were taken from four replicates, each replicate of 20 fruits taken randomly from each bunch to determine fruit weight, flesh weight, seed weight, fruit dimensions (length and diameter), fruit size and fruit firmness.
- 4- Fruit dry weight percentage was calculated as described in A.O.A.C. (1980).
- 5- Total soluble solids content (TSS) percentage was determined in juice fruit as described in A.O.A.C (1980).
- 6- Fruit acidity percentage was determined as described in A.O.A.C (1980) and the titratable acidity was calculated as citric acid (Ranganna, 1978 and Mawlood, 1980).
- 7- Total soluble sugars were determined according to Dubois *et al.* (1956) in the methanol extract using the phenol sulfuric acid method and the concentration was calculated as g/100 g dry weight.
- 8- Reducing soluble sugars were determined in the methanol extract according to Nelson (1944) as described in A.O.A.C (1980) and the percentage was calculated as g/100 g dry weight.

RESULTS AND DISCUSSION

1-Bunch weight (Kg):

Samani and Zaghoul bunch weight was significantly affected by different concentrations of NAA sprayed at different times, while, time of spraying was not significant in both seasons with Samani cultivar and second season with Zaghoul cultivar. Concerning the effect of different concentrations of NAA; 0.0 NAA (control) gave the highest Samani fruit bunch weight (10.92, 10.8 kg in both seasons, respectively) than other concentrations used of NAA. Also, the same trend was recorded with Zaghoul bunch weight in both seasons.

Concerning the interaction between concentrations and time of spraying, untreated Samani bunches recorded the highest weight which treated at 21 days after pollination (10.92 kg) followed by that sprayed by 100, 50, 150 ppm of NAA (9.65, 8.73 and 8.05 kg, respectively) and the same trend was also noticed in the second season. Also, Zaghoul bunch weight which sprayed at 21 days after pollination (9.20 kg) followed by that sprayed by 100, 50, 150 ppm of NAA (8.70, 7.03 and 6.66 kg, respectively) and the same trend was also noticed in the second season (Table 1).

2-Fruit set percentage:

Samani and Zaghoul fruit set percentages were significantly affected by different concentrations of NAA sprayed at different times during fruit development in both seasons. Samani fruit set recorded higher percentages when sprayed within 7 days from pollination than those sprayed within 21 days from pollination. while Zaghoul fruit set did not give clear trend in this respect.

Concerning the effect of different concentrations of NAA, control treatment gave the highest Samani and Zaghoul fruit set percentage followed by 50, 100 and 150 ppm of NAA in both seasons which was less than control ones.

Table (1): Effect of spraying time and different concentrations of NAA on Samani and Zaghoul bunch weight during 2003-2004 seasons.

Season	Spraying time	Samani				Mean	Zaghoul				Mean
		0.0	50	100	150		0.0	50	100	150	
Season 2003	7 days after pollination	10.92	8.46	9.43	7.66	9.12	9.20	6.51	7.56	6.20	7.31
	21 days after pollination	10.92	8.73	9.85	8.05	9.34	9.20	7.03	8.70	6.66	7.90
Mean		10.92	8.60	9.54	7.85	-----	9.20	6.77	8.13	6.34	-----
Season 2004	7 days after pollination	10.80	8.53	9.53	8.36	9.30	8.20	6.51	7.18	6.25	7.03
	21 days after pollination	10.80	8.43	8.83	8.20	9.06	8.20	7.08	7.40	6.50	7.29
Mean		10.80	8.48	9.18	8.27	-----	8.20	6.80	7.29	6.37	-----

LSD at 5% for:

	Samani		Zaghoul	
	2003	2004	2003	2004
Spraying time (A)	= N.S	= N.S	= 0.28	= N.S
Concentration of NAA (B)	=0.28	=0.32	=0.47	=0.41
(AxB)	=0.39	=0.46	=0.66	=0.58

Concerning the interaction between concentrations and time of spraying, 50 ppm NAA gave the highest Samani fruit set percentage when it was sprayed after 7 days from pollination (54.55%) than fruits sprayed after 21 days from pollination (53.67%) in the first season followed by 100, 150 of NAA in the first season (49.23% & 48.07 %), respectively. The same trend was found in the second season. Moreover, NAA sprayed at 50 ppm gave the highest value in both seasons with Zaghoul fruit set percentage (43.51% & 41.82%) sprayed after 7 days and 21 days from pollination, respectively.

Regarding the interactions between concentrations, spraying time and sampling date on fruit set percentage; Samani fruit set percentage sprayed by 50 ppm NAA after 7 days from pollination recorded 22.46 % at 191 days of fruit age (at harvest) followed by 50 ppm NAA sprayed after 21 days from pollination (21.37%) in the first season, while in the second season 50 ppm NAA sprayed after 7 days from pollination gave the highest Samani fruit set percentage (21.21%) at harvest followed by 50 ppm NAA sprayed after 21 days from pollination (19.63%). On the other hand, Zaghoul fruit set percentage at harvest sprayed by 50 ppm NAA after 7 days from pollination gave the highest set percentage (18.83%) followed by 150 ppm NAA sprayed after 7 days from pollination in the first season, respectively. While in the second season, 50 ppm NAA sprayed after 21 days from pollination gave the highest Zaghoul fruit set percentage (12.48%) followed by 50 ppm NAA sprayed after 7 days from pollination (11.89%), respectively (Table 2).

Table (2): Effect of spraying time and different concentrations of NAA on Samani and Zaghoul fruit set percentage during 2003-2004 seasons.

Sparing time	Samani cultivar.						Zaghoul cultivar.													
	Season2003			Season2004			Season2003			Season2004										
	NAA (ppm)	Mean	SD	NAA (ppm)	Mean	SD	NAA (ppm)	Mean	SD	NAA (ppm)	Mean	SD								
25	92.81	89.52	86.67	85.46	88.62	92.57	85.93	76.54	77.45	83.12	86.95	87.03	58.81	59.34	88.03	86.99	70.36	65.46	65.07	71.97
29	85.92	77.50	70.97	69.56	75.99	81.14	78.16	70.58	70.70	75.14	82.92	82.66	57.17	57.28	85.00	81.71	56.98	54.16	53.65	61.63
57	74.08	63.35	58.06	58.27	63.44	71.65	61.27	58.74	57.87	62.38	76.13	57.69	49.17	52.45	58.86	70.33	87.52	60.40	59.76	64.50
92	57.74	52.93	47.91	46.37	51.24	53.15	58.82	51.64	51.07	56.17	52.83	59.77	35.91	36.91	41.36	45.34	38.88	33.88	33.51	37.90
127	45.69	43.61	37.02	36.11	40.61	50.41	43.23	36.75	35.74	41.53	41.40	37.43	27.83	29.11	33.94	25.72	18.21	14.84	14.79	18.39
155	38.70	32.51	26.39	24.75	30.59	31.91	27.42	24.20	22.56	25.03	19.92	20.18	23.54	18.51	16.03	12.46	11.65	14.66		
Harvest	26.08	22.46	17.61	15.97	20.53	24.68	21.21	15.8	14.16	18.96	23.44	18.83	14.81	15.70	18.20	15.65	11.99	09.07	8.73	11.34
Mean	60.14	54.55	49.23	48.07	53.00	59.36	53.77	47.47	46.83	51.86	56.10	44.06	37.66	38.71	44.13	49.18	39.98	35.73	35.31	40.05
25	92.81	81.55	76.47	74.53	81.34	92.57	87.16	80.12	79.67	84.88	86.95	75.23	68.05	85.84	74.02	88.99	71.14	65.64	64.77	72.14
29	85.92	74.67	67.22	66.14	73.49	81.14	77.34	73.47	72.89	76.21	82.92	84.14	54.11	54.84	64.00	81.71	59.84	54.03	53.62	62.30
57	74.08	65.88	58.25	56.86	63.77	71.65	68.24	61.21	59.52	65.16	76.13	54.09	41.73	41.34	53.32	70.33	57.29	50.03	48.27	56.48
92	57.74	57.18	46.70	45.62	51.81	63.15	47.46	37.38	37.35	46.34	52.83	40.42	36.39	36.34	41.50	45.34	47.41	40.72	39.59	43.27
127	45.69	43.51	37.71	36.38	40.82	50.41	36.61	31.04	29.63	36.92	41.40	30.27	25.12	24.67	30.37	25.72	36.55	28.91	27.52	29.68
155	38.70	31.52	27.13	26.22	30.89	31.91	25.36	19.41	18.31	23.75	29.02	20.95	17.10	16.49	20.89	18.51	20.92	14.36	14.6	17.10
Harvest	26.08	21.37	15.38	14.63	19.37	24.68	19.63	13.89	12.65	17.71	23.44	15.56	12.35	11.98	15.83	15.65	12.48	9.62	9.31	11.72
Mean	60.14	53.67	46.98	45.77	51.64	59.36	51.68	45.22	44.29	50.14	56.10	42.95	36.40	35.84	42.82	49.18	43.66	37.62	36.81	41.82
General mean	60.14	54.11	48.11	46.92	59.36	52.72	46.34	45.56	56.10	43.51	37.30	37.28	49.18	41.82	36.67	36.06				
LSD at 5% level for:	Samani						Zaghoul													
Season	2003			2004			2003			2004										
Spraying time (A)	= 0.29			= 0.80			= N.S			= 0.69										
Concentration of NAA (B)	= 0.49			= 0.50			= 1.07			= 0.57										
(AxB)	= 0.69			= 0.71			= 1.61			= 0.81										
Sampling date (C)	= 0.65			= 0.67			= 1.42			= 0.76										
(AxC)	= 0.92			= 0.94			= 2.01			= 1.07										
(BxC)	= 1.30			= 1.34			= 2.84			= 1.52										
(AxBxC)	= 1.84			= 1.89			= 4.02			= 2.16										

3-Fruit weight (g):

Samani and Zaghoul fruit weight was significantly affected by different concentrations of NAA sprayed at different times during fruit development in both seasons.

Concerning the effect of different concentrations of NAA, 150 ppm gave the highest Samani fruit weight (31.25 g in the first and 31.13 g in the second season) followed by 100, 50 and 0.0 which recorded 30.55, 28.20 and 25.17 g in the first and 30.55, 28.16 and 25.61 g in the second season, respectively. The same results were observed with Zaghoul fruit in this regard except that in the first season as 100 ppm of NAA recorded the highest fruit weight (29.23 g) than 150 ppm, which gave 28.62 g. The interaction between concentrations and time of spraying, 150 ppm NAA gave the highest Samani fruit weight when it was sprayed after 7 days from pollination (31.48 g) than those sprayed after 21 days from pollination (31.01 g) in the first season followed by 100, 50 and 0.0 of NAA at the two spraying times, respectively. Similar trend was noticed in the second season. Moreover, NAA sprayed at 100 ppm gave the highest value in both seasons with Zaghoul fruit weight (29.76 & 29.00g) sprayed after 7 days from pollination, respectively. While, 150 ppm NAA recorded the highest value in this respect when it was treated at 21 days after pollination.

Regarding the interactions between concentrations, spraying time and sampling date on fruit weight, Samani fruit weight sprayed by 150 ppm NAA after 7 days from pollination recorded 37.00 g at 191 days of fruit age (at harvest) followed by 150 ppm NAA sprayed after 21 days from pollination (36.36 g) in the first season, while in the second season 100 ppm NAA sprayed after 7 days from pollination gave the highest Samani fruit weight (36.20 g) at harvest followed by 150 ppm NAA sprayed after 21 days from pollination (35.45 g). On the other hand, Zaghoul fruit weight at harvest that sprayed by 100 ppm NAA after 21 days from pollination had the highest weight (35.71 g) followed by 100 ppm NAA sprayed after 7 days from pollination in the first season, respectively. While in the second season, 100 ppm NAA sprayed after 7 days from pollination gave the highest Zaghoul fruit weight (37.03 g) followed by 150 ppm NAA sprayed after 21 days from pollination (34.89 g), respectively (Table 3).

4-Fruit flesh weight (g):

Samani and Zaghoul fruit flesh weight was significantly affected by different concentrations of NAA sprayed at different times during fruit development in both seasons.

Concerning the effect of different concentrations of NAA, 150 ppm gave the highest Samani fruit flesh weight (29.26 g in the first season and 29.15 g in the second season) followed by 100, 50 and 0.0 (28.57, 26.22 and 23.20 g in the first season and 28.59, 26.19 and 23.47 g in the second season), respectively. The same results were also observed with Zaghoul fruit in this regard.

Concerning the interaction between concentrations and time of spraying, 150 ppm NAA gave the highest Samani flesh weight when it was sprayed after 7 days from pollination (29.51 g) than fruits sprayed after 21

days from pollination (29.02 g) in the first season followed by 100, 50 and 0.0 of NAA in the two dates of spraying, respectively. The same trend was also noticed in the second season. Moreover, NAA sprayed at 100 ppm gave the highest value in both seasons with Zaghoul fruit flesh weight (27.83 & 27.07 g) sprayed after 7 days and 21 days from pollination, respectively.

Regarding the interaction between concentrations, spraying time and sampling date on fruit flesh weight, Samani fruit flesh weight sprayed by 150 ppm NAA after 7 days from pollination recorded 35.00 g at harvest followed by 150 ppm NAA sprayed after 21 days from pollination (34.36 g) in the first season, while in the second season 100 ppm NAA sprayed after 7 days from pollination gave the highest Samani fruit flesh weight (34.20 g) at harvest followed by 150 ppm NAA sprayed after 21 days from pollination (33.50 g). On the other hand, at harvest, Zaghoul fruits sprayed by 100 ppm NAA after 7 days from pollination gave the highest flesh weight (33.11 g) followed by 150, 50 and 0.0 ppm NAA sprayed after 7 days from pollination in the first season, respectively. The same trend was also noticed in the second season. (Table 4).

5-Seed weight (g):

Samani and Zaghoul seed weights were not significantly affected by different concentrations of NAA sprayed at different times of fruit development in both seasons. Also, seed weight in both cultivars in the two seasons did not show clear trend as affected by time of spraying or different concentrations of NAA.

However, the interaction between concentrations and time of spraying showed that 150 ppm NAA relatively increased Samani and Zaghoul seed weight when sprayed after 7 and 21 days from pollination than other concentrations.

Regarding the interactions between concentrations, spraying time and sampling date on seed weight, 100 and 150 ppm NAA after 7 and 21 days from pollination recorded the highest Samani and Zaghoul seeds at harvest than other concentrations used (Table 5).

6-Fruit dimensions (cm):

6-1-Fruit length (cm):

Samani and Zaghoul fruit length was significantly affected by different concentrations of NAA sprayed at different times of fruit development in both seasons. Samani fruit length, which sprayed after 7 days from pollination, recorded the longest fruit length (4.10 cm in the first season and 4.08 cm in the second season) than fruits sprayed after 21 days from pollination (3.88 cm in the first season and 3.89 cm in the second season). Regarding to Zaghoul, this relation was cleared in the second season only.

Regarding the effect of different concentrations of NAA, 100 ppm of NAA gave the highest Samani and Zaghoul fruit length in both seasons followed by 150, 50 and 0.0 of NAA, respectively. In addition, the same trend was noticed clearly as affected by interaction in both seasons for both cultivars.

Table (3): Effect of spraying time and different concentrations of NAA on Samani and Zaghoul fruit weight (g) during 2003-2004 seasons.

Spraying time	Sampling date (days)	Samani cultivar						Zaghoul cultivar													
		Season 2003			Season 2004			Season 2003			Season 2004										
		NAA ppm	50	100	150	Mean	NAA ppm	50	100	150	Mean	NAA ppm	50	100	150	Mean					
7 days after pollination	127	20.36	22.77	24.64	24.95	23.18	21.29	23.03	25.06	25.48	23.72	19.60	23.10	25.98	23.51	23.05	21.25	23.52	24.49	22.20	
	155	23.58	26.57	28.94	28.74	26.96	24.01	26.98	30.30	30.57	27.97	23.61	26.17	27.49	26.00	25.82	21.12	23.68	26.84	26.50	24.54
	179	26.86	31.07	33.85	35.25	31.76	26.92	30.43	32.92	33.97	31.07	26.00	29.13	30.44	29.93	28.88	23.72	27.06	28.62	27.26	26.67
Mean	29.89	33.23	35.69	37.00	33.95	30.22	33.11	36.20	35.79	33.83	31.04	32.29	35.11	34.10	33.14	30.12	32.65	37.03	36.96	34.19	
21 days after pollination	127	25.17	28.41	30.78	31.48	28.96	25.62	28.39	31.12	31.45	29.15	25.06	27.67	29.76	28.38	27.72	23.65	26.16	29.00	28.90	26.91
	155	20.36	23.27	24.54	25.69	23.47	21.29	22.58	23.50	24.60	23.00	19.60	21.79	24.22	23.89	22.37	19.55	20.56	21.56	22.76	21.09
	179	23.58	25.72	28.41	28.83	26.64	24.01	27.47	29.68	29.75	27.73	23.61	24.70	24.59	26.54	24.86	21.12	22.61	24.56	24.97	23.34
Mean	26.86	30.51	32.02	33.16	30.64	26.92	29.11	31.75	33.39	30.30	26.00	26.83	30.26	30.12	28.30	23.72	26.84	28.54	28.95	27.01	
Generalmean	29.89	32.44	36.28	36.36	33.74	30.22	32.60	34.99	35.45	33.32	31.04	32.30	35.71	34.90	33.49	30.12	30.76	34.13	34.89	32.50	
LSD at 5% level for:		25.17	27.99	30.51	31.01	28.67	25.61	27.94	29.98	30.08	28.59	25.06	26.41	28.69	28.86	27.26	23.65	25.19	27.20	27.87	25.99
		25.17	28.20	30.55	31.25	---	25.61	28.16	30.55	31.13	---	25.06	27.04	29.23	28.62	---	23.65	25.68	28.10	28.43	---
Season		Samani						Zaghoul													
Spraying time (A)		2003			2004			2003			2004										
Concentration of NAA (B)		= N.S			= N.S			= N.S			= N.S										
(AXB)		= 0.25			= 0.34			= 0.43			= 0.26										
Sampling date (C)		= 0.35			= 0.48			= 0.62			= 0.37										
(AXC)		= 0.25			= 0.34			= 0.43			= 0.26										
(BXC)		= 0.35			= 0.48			= 0.62			= 0.37										
(AXBXC)		= 0.50			= 0.68			= 0.87			= 0.62										
		= 0.71			= 0.96			= 1.24			= 0.74										

Table (4): Effect of spraying time and different concentrations of NAA on Samani and Zaghoul fruit flesh weight (g) during 2003-2004 seasons.

Spraying time	Sampling date (days)	Samani cultivar.						Zaghoul cultivar.													
		Season 2003			Season 2004			Season 2003			Season 2004										
		NAA (ppm)	Mean	SD	NAA (ppm)	Mean	SD	NAA (ppm)	Mean	SD	NAA (ppm)	Mean	SD								
7 days after	127	18.46	20.85	22.70	23.01	21.25	19.37	21.06	23.07	23.50	21.75	17.67	21.24	24.22	21.65	21.20	17.55	19.25	21.53	22.58	20.23
	155	21.63	24.58	26.89	26.82	24.98	22.00	25.02	28.31	28.59	25.98	21.65	24.15	25.53	24.05	23.65	19.16	21.17	25.03	24.52	22.47
	179	24.87	29.05	31.83	33.20	29.74	24.90	28.46	30.95	31.99	29.08	24.12	27.26	28.45	28.00	26.96	21.77	25.09	26.65	25.36	24.72
Pollination	Harvest	27.85	31.24	33.73	35.00	31.95	28.25	31.15	34.20	33.83	31.86	29.27	30.36	33.11	32.11	31.21	28.23	30.68	35.05	35.03	32.25
	Mean	23.20	26.42	28.78	29.51	26.98	23.63	26.42	29.13	29.48	27.17	23.18	25.75	27.83	26.45	25.08	21.68	24.05	27.07	26.87	24.92
	SD	18.46	21.32	22.62	23.70	21.52	19.37	20.61	21.53	22.62	21.03	17.67	19.99	22.31	21.99	20.49	17.55	18.60	19.68	20.72	19.14
21 days after	127	21.63	23.77	26.47	26.83	24.67	24.90	25.47	27.70	27.79	25.74	21.65	22.74	22.75	24.59	22.93	19.16	20.67	22.60	22.99	21.36
	155	24.87	28.53	30.05	31.20	28.66	28.25	27.15	30.06	31.41	29.21	24.12	24.83	28.83	28.27	26.51	21.77	24.90	26.58	26.96	25.06
	179	27.85	30.47	34.30	34.36	31.74	23.63	30.66	32.98	33.50	30.19	29.27	30.53	30.53	32.94	30.81	28.23	28.82	32.16	32.92	30.54
Pollination	Harvest	23.20	26.02	28.36	29.02	26.65	23.63	25.97	28.06	28.83	26.55	23.18	24.52	26.05	26.94	25.17	21.68	23.24	25.25	25.90	24.03
	Mean	23.20	26.22	28.57	29.26	26.65	23.63	26.19	28.59	29.15	26.69	23.18	25.13	26.94	26.69	25.17	21.68	23.71	26.16	26.38	24.90
	SD	18.46	21.32	22.62	23.70	21.52	19.37	20.61	21.53	22.62	21.03	17.67	19.99	22.31	21.99	20.49	17.55	18.60	19.68	20.72	19.14
General mean		Samani						Zaghoul													
LSD at 5% level for:		2003			2004			2003			2004										
Season		= N.S			= N.S			= N.S			= N.S										
Spraying time (A)		= 0.25			= 0.36			= 0.42			= 0.26										
Concentration of NAA (B)		= 0.36			= 0.50			= 0.60			= 0.37										
Sampling date (C)		= 0.25			= 0.35			= 0.42			= 0.26										
(AXC)		= 0.36			= 0.60			= 0.60			= 0.37										
(BYC)		= 0.51			= 0.71			= 0.85			= 0.62										
(AXBXC)		= 0.73			= 1.00			= 1.20			= 0.74										

Table (5): Effect of spraying time and different concentrations of NAA on Samani and Zaghloul seed weight (g) during 2003-2004 seasons.

Spraying time	Sampling date (days)	Samani cultivar.						Zaghloul cultivar.								
		Season 2003			Season 2004			Season 2003			Season 2004					
		NAA (ppm)			NAA (ppm)			NAA (ppm)			NAA (ppm)					
0.0	50	100	150	Mean	0.0	50	100	150	Mean	0.0	50	100	150	Mean		
7 days after	127	1.90	1.95	1.95	1.94	1.94	1.93	1.96	1.99	1.98	1.97	1.93	1.86	1.77	1.86	1.86
	155	1.94	1.98	2.06	1.92	1.98	1.96	1.97	1.99	1.99	1.99	1.97	2.02	1.97	1.95	1.98
	179	1.93	2.02	2.02	2.05	2.01	1.98	1.97	1.97	1.97	1.99	1.88	1.87	1.98	1.93	1.92
Pollination	Harvest	2.04	1.99	1.97	2.00	2.00	2.00	1.96	2.00	1.96	1.97	1.77	1.93	2.00	1.98	1.92
	Mean	1.97	1.99	1.97	1.98	1.98	1.97	1.96	1.93	1.98	1.97	1.89	1.92	1.93	1.93	1.92
	Mean	1.90	1.96	1.92	1.99	1.94	1.93	1.97	1.97	1.98	1.96	1.93	1.80	1.91	1.90	1.89
21 days after	127	1.94	1.95	1.95	2.00	1.96	1.96	2.00	1.98	1.96	1.99	1.97	1.97	1.83	1.94	1.93
	155	1.93	1.97	1.97	1.96	1.96	1.98	1.96	1.68	1.98	1.92	1.88	1.99	1.85	1.85	1.89
	179	2.04	1.98	1.98	1.99	2.00	2.00	1.94	2.01	1.95	1.97	1.77	1.77	1.81	1.96	1.83
Pollination	Harvest	1.97	1.96	1.95	1.99	1.97	1.97	1.97	1.91	1.93	1.96	1.89	1.88	1.85	1.92	1.89
	Mean	1.97	1.98	1.98	1.98	1.98	1.97	1.97	1.95	1.99	1.99	1.89	1.90	1.89	1.92	1.89
	General mean	1.97	1.98	1.98	1.98	1.98	1.97	1.97	1.97	1.99	1.99	1.89	1.90	1.89	1.92	1.89

Statistical analysis for data was not significant for both cultivar in two seasons.

Table (6): Effect of spraying time and different concentrations of NAA on Samani and Zaghoul fruit length (cm) during 2003-2004 seasons.

Spraying time	Sampling date (days)	Samani cultivar.						Zaghoul cultivar.													
		Season 2003			Season 2004			Season 2003			Season 2004										
		NAA (ppm)	100	150	Mean	NAA (ppm)	100	150	Mean	NAA (ppm)	100	150	Mean								
7 days after pollination	127	2.67	3.23	3.43	3.18	2.97	3.23	3.57	3.50	3.32	2.77	3.27	3.37	3.27	3.47	3.33	3.28				
	155	3.57	3.73	4.17	4.00	3.43	3.70	3.93	3.83	3.72	3.37	3.53	3.77	3.63	3.80	4.07	3.87	3.85			
	179	4.10	4.30	4.77	4.46	4.13	4.33	4.57	4.37	4.35	3.97	4.23	4.47	4.37	4.47	4.80	4.73	4.45			
Mean	Harvest	4.60	4.90	5.03	4.97	4.88	4.77	4.87	5.03	4.97	4.91	4.80	4.80	5.20	4.87	5.00	5.43	5.13			
		3.73	4.04	4.35	4.26	4.10	3.83	4.03	4.28	4.15	4.08	3.73	3.96	4.20	4.03	3.98	4.44	4.28	4.20		
21 days after pollination	127	2.67	2.90	3.10	3.03	2.93	2.97	3.07	3.27	3.12	2.77	3.23	3.43	3.30	3.18	3.07	3.13	3.30	3.20		
	155	3.57	3.63	3.83	3.70	3.68	3.43	3.53	3.70	3.67	3.58	3.37	3.73	4.10	4.03	3.81	3.67	3.53	3.77	3.64	
	179	4.10	3.97	4.33	4.20	4.15	4.13	4.00	4.23	4.07	4.11	3.97	4.53	4.77	4.67	4.49	4.17	3.93	4.17	4.09	
Mean	Harvest	4.60	4.70	4.97	4.80	4.77	4.77	4.77	4.87	4.63	4.76	4.80	5.20	5.43	5.20	5.16	4.87	4.90	5.40	5.27	5.09
		3.73	3.80	4.06	3.93	3.88	3.83	3.84	4.02	3.88	3.89	3.73	4.18	4.43	4.30	4.16	3.94	3.88	4.16	4.05	4.01
General mean		3.73	3.92	4.20	4.10	—	3.83	3.94	4.15	4.03	—	3.73	4.07	4.32	4.17	—	3.94	4.00	4.30	4.16	

LSD at 5% level for:																						
Season					2003																	2004
Spraying time (A)					= 0.12																	=0.16
Concentration of NAA (B)					= 0.14																	=0.13
(AXB)					= 0.16																	=0.15
Sampling date (C)					= 0.14																	=0.13
(AXC)					= 0.16																	=0.15
(BXC)					= 0.18																	=0.17
(AXBXC)					= 0.22																	=0.20

Regarding the interactions between concentrations, spraying time and sampling date on fruit length, Samani fruit length sprayed by 100 ppm NAA after 7 days from pollination recorded at harvest 5.03 cm and after 21 days from pollination (4.97 cm) in the first season. The same trend was also noticed in the second season as well as Zaghoul fruit length in both seasons (Table 6).

6-2-Fruit diameter (cm):

Samani and Zaghoul fruit diameter was significantly affected by different concentrations of NAA sprayed at different times of fruit development in both seasons. While, the effect of spraying time was similar statistically in both seasons with the two cultivars.

Regarding the effect of different concentrations of NAA, 50 ppm of NAA gave the highest Samani fruit diameter (2.56 cm in the first season and 2.63 cm in the second season) followed by 150, 100 and 0.0 (2.46, 2.44 and 2.24 cm in the first season and 100, 150 and 0.0 ppm (2.48, 2.44 and 2.27 cm in the second season), respectively. The same results were observed with Zaghoul fruit in this regard in both seasons.

Concerning the interaction between concentrations and time of spraying, 50 ppm NAA gave the highest Samani fruit diameter when it was sprayed after 7 days from pollination (2.57 cm) than fruits sprayed after 21 days from pollination (2.56 cm) in the first season followed by 150, 100 and 0.0 of NAA in the first season (2.49 and 2.45 cm) while in the second season it was followed by 100, 150 and 0.0 ppm (2.43 and 2.24 cm), respectively. Moreover, NAA sprayed at 50 ppm gave the highest value in both seasons with Zaghoul fruit diameter (2.58 & 2.55 cm) when it was sprayed after 21 days and 7 days from pollination, respectively.

Regarding the interactions between concentrations, spraying time and sampling date on fruit diameter, Samani fruit diameter sprayed by 50 ppm NAA after 7 days from pollination recorded 3.13 cm at harvest followed by 50 ppm NAA sprayed after 21 days from pollination (3.07 cm) in the first season, while in the second season 50 ppm NAA sprayed after 21 days from pollination gave the highest Samani fruit diameter (3.27 cm) at harvest followed by 50 ppm NAA sprayed after 7 days from pollination (3.17 cm). On the other hand, Zaghoul fruit diameter sprayed by 50 ppm NAA after 7 days from pollination gave the highest diameter (3.23 cm) at harvest followed by 100 ppm NAA sprayed after 7 days from pollination in the first season, respectively. While in the second season, 50 ppm NAA sprayed after 7 days from pollination gave the highest Zaghoul fruit diameter (3.27 cm) followed by 50 ppm NAA sprayed after 21 days from pollination (3.23 cm), respectively (Table 7).

7-Fruit size:

Samani and Zaghoul fruit size was significantly affected by different concentrations of NAA sprayed at different times of fruit development in both seasons. While, the effect of spraying time was statistically similar in both seasons with the two cultivars.

Table (7): Effect of spraying time and different concentrations of NAA on Samani and Zaghoul fruit diameter (cm) during 2003-2004 seasons.

Spraying time	Sampling date (days)	Zaghoul cultivar.														
		Samani cultivar.						Zaghoul cultivar.								
		Season 2003		Season 2004		Mean		Season 2003		Season 2004		Mean				
NAA (ppm)		NAA (ppm)		NAA (ppm)		NAA (ppm)		NAA (ppm)		NAA (ppm)		NAA (ppm)				
0.0		50		100		150		0.0		50		100		150		
7 days after	127	1.63	1.93	1.83	1.87	1.82	1.67	1.97	1.80	1.77	1.80	1.53	1.83	1.80	1.73	1.71
	155	2.07	2.33	2.23	2.27	2.23	2.07	2.43	2.30	2.30	2.28	1.97	2.23	2.17	2.13	2.04
	179	2.47	2.87	2.73	2.77	2.71	2.47	2.87	2.73	2.67	2.69	2.53	2.83	2.73	2.70	2.74
Pollination	Harvest	2.80	3.13	3.00	3.07	3.00	2.87	3.17	2.97	2.83	2.96	2.97	3.23	3.13	3.10	3.00
	Mean	2.24	2.57	2.45	2.49	2.44	2.27	2.61	2.45	2.39	2.43	2.25	2.55	2.46	2.42	2.39
	127	1.63	1.97	1.87	1.87	1.84	1.67	2.00	1.90	1.80	1.84	1.53	1.90	1.80	1.87	1.78
21 days after	155	2.07	2.33	2.23	2.27	2.23	2.07	2.27	2.13	2.15	1.97	2.33	2.23	2.20	2.18	1.87
	179	2.47	2.87	2.73	2.77	2.71	2.47	3.03	2.87	2.90	2.82	2.53	2.97	2.90	3.00	2.68
	Harvest	2.80	3.07	2.87	2.83	2.89	2.87	3.27	3.10	3.10	3.08	2.97	3.13	3.10	3.07	3.08
Mean	2.24	2.56	2.43	2.43	2.42	2.27	2.64	2.50	2.48	2.47	2.25	2.58	2.51	2.53	2.47	2.35
	2.24	2.56	2.44	2.46	2.44	2.27	2.63	2.48	2.44	2.44	2.25	2.56	2.48	2.48	2.36	
	2.24	2.56	2.44	2.46	2.44	2.27	2.63	2.48	2.44	2.44	2.25	2.56	2.48	2.48	2.36	
LSD at 5% level for:		Samani						Zaghoul								
Season		2003						2004								
Spraying time (A)		= N.S						= N.S								
Concentration of NAA (B)		= 0.13						= 0.13								
(AXB)		= 0.14						= 0.15								
Sampling date (C)		= 0.13						= 0.13								
(AXC)		= 0.14						= 0.15								
(BXC)		= 0.16						= 0.17								
(AXBXC)		= 0.17						= 0.17								

Regarding the effect of different concentrations of NAA, 150 ppm of NAA gave the highest Samani fruit size (29.26 cm³ in the first and 29.15 cm³ in second season) followed by 100, 50 and 0.0 of NAA (28.57, 26.22 & 23.20 cm³ in the first and 28.59, 26.19 and 23.63 cm³ in the second seasons, respectively). The same results were observed with Zaghloul fruit in this regard in both seasons.

Concerning the interaction between concentrations and time of spraying, 150 ppm NAA gave the highest Samani fruit size when it was sprayed after 7 and 21 days from pollination (29.51 and 29.02 cm³ respectively) than fruits sprayed by other concentrations of NAA and control. Also, the same trend was noticed with Zaghloul cultivar in both seasons.

Regarding the interactions between concentrations, spraying time and sampling date on fruit size, Samani fruit size sprayed by 150 ppm NAA after 7 days from pollination recorded (35.00 cm³) followed by 150 ppm NAA sprayed after 21 days from pollination (34.36 cm³) in the first season, while in the second season 100 ppm NAA sprayed after 7 days from pollination gave the highest Samani fruit size (34.20 cm³) at harvest followed by 150 ppm NAA sprayed after 21 days from pollination (33.50 cm³). On the other hand, harvested Zaghloul fruit, sprayed by 100 ppm NAA after 7 days from pollination gave the highest fruit size followed by 150 ppm NAA which sprayed 21 days from pollination in both seasons.(Table 8).

8-Fruit firmness (Lb./sq.inc.):

Samani and Zaghloul fruit firmness was significantly affected by different concentrations of NAA sprayed at different times of fruit development in both seasons (Table 9). Samani and Zaghloul fruit firmness was higher with spraying at 21 days from pollination than 7 days in the first season and the opposite was stated in the second season.

Regarding the effect of different concentrations of NAA, 100 ppm of NAA recorded the lowest Samani and Zaghloul fruit firmness in the first season, while 150 ppm recorded the lowest value in the second season than other concentrations. Also, it was clearly noticed that fruit firmness was significantly decreased by fruit development for both cultivars in the two seasons.

Concerning the interaction between concentrations and time of spraying, 100 and 150 ppm NAA reduced Samani and Zaghloul fruit firmness in both seasons at the two spraying times than 50 ppm NAA and control treatment. Moreover, the interaction between time of spraying, concentrations of NAA and sampling date showed that firmness of Samani and Zaghloul fruit were the lowest at harvest during the two seasons (Table 9).

9-Fruit moisture:

Samani and Zaghloul fruit moisture content was significantly affected by the interaction between concentrations of NAA, sprayed time and fruit development in both seasons. On the opposite, there is no significant differences were noticed due to the effect of spraying time, different concentrations and interaction between them.

Table (8): Effect of spraying time and different concentrations of NAA on Samani and Zaghoul fruit size (cm³) during 2003-2004 .

Spraying time	Sampling date (days)	Samani cultivar.						Zaghoul cultivar.													
		Season 2003			Season 2004			Season 2003			Season 2004										
		NAA (ppm)		Mean	NAA (ppm)		Mean	NAA (ppm)		Mean	NAA (ppm)		Mean								
0.0	50	100	150	0.0	50	100	150	0.0	50	100	150	0.0	50	100	150						
7 days after	127	18.46	20.85	22.70	23.01	21.25	19.37	21.06	23.07	23.50	21.75	17.67	21.24	24.22	21.65	21.19	17.55	19.25	21.53	22.58	20.23
	155	21.63	24.58	26.89	26.82	24.98	22.00	25.02	28.31	28.59	25.98	21.65	24.15	25.53	24.05	23.84	19.16	21.17	25.03	24.52	22.47
	179	24.87	29.05	31.83	33.20	29.74	24.90	28.46	30.95	31.99	29.08	24.12	27.26	28.45	28.00	26.96	21.77	25.09	26.65	25.36	24.72
Pollination	Harvest	27.85	31.24	33.73	35.00	31.95	28.25	31.15	34.20	33.83	31.86	29.27	30.36	33.11	32.11	31.21	28.23	30.68	35.05	33.03	31.74
Mean		23.20	26.42	28.78	29.51	26.98	23.63	26.42	29.13	29.48	27.17	23.18	25.75	27.83	26.45	25.80	21.67	24.04	27.07	26.37	24.79
21 days after	127	18.46	21.32	22.62	23.70	21.52	19.37	20.61	21.53	22.62	21.03	17.67	19.99	22.31	21.99	20.49	17.55	18.60	19.68	20.72	19.14
	155	21.63	23.77	26.47	26.83	24.67	22.00	25.47	27.70	27.79	25.74	21.65	22.74	22.75	24.59	22.93	19.16	20.67	22.60	22.99	21.36
	179	24.87	28.53	30.05	31.20	28.66	24.90	27.15	30.06	31.41	29.21	24.12	24.83	28.83	28.27	26.51	21.77	24.90	26.58	26.96	25.05
Pollination	Harvest	27.85	30.47	34.30	34.36	31.74	28.25	30.66	32.98	33.50	30.19	29.27	30.53	30.53	32.94	30.81	28.23	28.82	32.16	32.92	30.53
Mean		23.20	26.02	28.36	29.02	26.65	23.63	25.97	28.06	28.83	26.54	23.18	24.52	26.05	26.94	25.17	21.67	23.25	25.26	25.90	24.02
General mean		23.20	26.22	28.57	29.26	26.65	23.63	26.19	28.59	29.15	27.15	23.18	25.13	26.94	26.69	25.17	21.67	23.71	26.16	26.38	24.02
LSD at 5% level for:		Samani						Zaghoul													
Season		2003			2004			2003			2004										
Spraying time (A)		= N.S			= N.S			= N.S			= N.S										
Concentration of NAA (B)		= 1.27			= 1.69			= 1.21			= 1.38										
(AXB)		= 1.80			= 2.39			= 1.71			= 1.96										
Sampling date (C)		= 1.27			= 1.69			= 1.21			= 1.38										
(AXC)		= 1.80			= 2.39			= 1.71			= 1.96										
(BXC)		= 2.65			= 3.38			= 2.42			= 2.76										
(AXBXC)		= 3.60			= 4.47			= 3.42			= 3.91										

Table (9): Effect of spraying time and different concentrations of NAA on Samani and Zaghloul fruit firmness (kg/sq inch) during 2003- 2004 seasons.

Spraying time	Sampling date (days)	Samani cultivar.						Zaghloul cultivar.													
		Season 2003			Season 2004			Season 2003			Season 2004										
		NAA (ppm)	0.0	50	100	150	Mean	NAA (ppm)	0.0	50	100	150	Mean								
7 days after	127	12.87	11.97	11.76	11.93	12.13	13.43	12.08	11.60	11.80	12.41	12.63	11.70	10.73	10.93	11.50	13.50	12.53	11.90	11.50	12.36
	155	10.77	9.80	9.83	9.93	10.08	11.63	11.07	10.73	10.87	11.07	10.93	10.70	10.13	10.20	10.49	11.73	10.53	9.97	9.80	10.51
	179	8.77	7.53	7.80	8.03	8.03	9.17	8.80	8.07	8.23	8.57	8.83	8.17	7.63	8.00	8.15	8.69	8.84	7.97	8.07	8.43
Pollination	Harvest	7.50	6.63	6.23	7.23	6.90	7.70	7.37	6.77	7.00	7.21	7.80	6.87	6.20	6.27	7.28	8.83	8.00	7.73	7.77	8.08
Mean		9.98	8.98	8.88	9.28	9.28	10.48	9.83	9.29	9.48	9.78	10.05	9.36	8.67	8.85	9.23	10.85	9.86	9.39	9.28	9.85
21 days after	127	12.87	11.93	11.43	11.50	11.93	13.43	10.77	9.93	10.00	11.03	12.63	12.1	11.47	11.40	11.90	13.50	12.13	11.50	10.73	11.97
	155	10.77	9.93	9.37	10.20	10.07	11.63	8.67	8.07	8.33	9.18	10.93	10.33	10.03	11.00	10.57	11.73	9.77	8.67	8.80	9.74
	179	8.77	7.90	7.97	8.10	8.19	9.17	8.13	7.77	8.10	8.29	8.83	8.00	7.50	7.47	8.18	9.33	7.83	7.07	7.20	7.86
Pollination	Harvest	7.50	7.60	7.23	7.37	7.43	7.70	7.00	6.13	6.30	6.78	7.80	7.53	6.67	6.60	7.15	8.83	7.53	7.00	7.03	7.60
Mean		9.98	9.34	9.00	9.30	9.41	10.48	8.64	7.98	8.18	8.82	10.05	9.49	8.92	9.12	9.45	10.85	9.32	8.56	8.44	9.29
General mean		9.98	9.16	8.94	9.29	—	10.48	9.33	8.63	8.83	—	10.05	9.43	8.80	8.98	—	10.85	9.59	8.98	8.86	—
LSD at 5% level for:		Samani						Zaghloul													
Season		2003			2004			2003			2004										
Spraying time (A)		=0.18			=0.14			=N.S			=0.18										
Concentration of NAA (B)		=0.11			=0.20			=0.19			=0.13										
(AXB)		=0.15			=0.14			=0.27			=0.18										
Sampling date (C)		=0.11			=0.20			=0.19			=0.13										
(AXC)		=0.16			=0.29			=0.27			=0.18										
(BXC)		=0.22			=0.41			=0.38			=0.26										
(AXBXC)		=0.31			=0.41			=0.55			=0.36										

Regarding the interactions between concentrations, spraying time and sampling date on fruit moisture content, harvested Samani and Zaghloul fruit moisture content showed the highest value with 100 ppm of NAA at 7 and 21 days from pollination than other concentrations. (Table 10).

10- Fruit total soluble solids:

Samani and Zaghloul fruit content of TSS was significantly affected by different concentrations of NAA sprayed at different times from pollination day in both seasons (Table 11). Samani fruit TSS, which sprayed after 21 days from pollination, recorded the higher fruit content of TSS (24.07 % in the first season and 25.64 % in the second season) than fruits sprayed after 7 days from pollination (23.35 % in the first season and 22.45 % in the second season). Regarding to Zaghloul cv., the same trend was also noticed in both seasons.

Regarding the effect of different concentrations of NAA, 100 ppm of NAA gave the highest content of TSS in Samani and Zaghloul fruit followed by 150, 50 ppm NAA and control treatment in both seasons. Moreover, the same trend in this regard was also noticed as affected by interaction between concentrations and time of spraying for Samani and Zaghloul fruit content of TSS in the two seasons.

Regarding the interactions between concentrations, spraying time and sampling date on fruit TSS, Samani fruit content of TSS sprayed by 100 ppm NAA after 21 days from pollination recorded 35.07% at harvest followed by 100 ppm NAA sprayed after 7 days from pollination (34.67%) in the first season, The same trend was found in the second season. On the other hand, Zaghloul fruit content of TSS at harvest sprayed by 100 ppm NAA after 7 days from pollination gave the highest TSS percentage (35.27%) followed by 100 ppm NAA sprayed after 21 days from pollination (33.87%) in the first season. While in the second season, 100 ppm NAA sprayed after 21 days from pollination gave the highest Zaghloul fruit content of TSS (36.01%) followed by 50 ppm at 21 days (35.00%) and 100 ppm NAA sprayed after 7 days from pollination (32.97%).

11- Fruit content of total soluble sugars (%):

Table (12) indicate that Samani and Zaghloul fruit content of total soluble sugars was significantly affected by different concentrations of NAA spraying at different times from pollination day in both seasons. While, spraying time did not develop any significant difference within the two cultivars in both seasons.

Regarding the effect of different concentrations of NAA, 50 ppm of NAA raised the fruit content of total sugars (20.47 % in the first and 20.70 % in the second season) followed by 150, 100 and 0.0 (19.55%, 18.89 % and 17.47 % in the first season, respectively, while followed by 100, 150 and 0.0 (19.88%, 19.11 % and 18.17 % in the second season, respectively). Also, the highest total soluble sugars content was obtained with Zaghloul fruits when they were sprayed by 100 ppm NAA (20.71% at 1st and 21.55 at 2nd season) followed by 150, 50 ppm NAA and control treatment.

Table (10): Effect of spraying time and different concentrations of NAA on Samani and Zaghloul fruit moisture content during 2003-2004 seasons.

Spraying time	Sampling date (days)	Samani cultivar.						Zaghloul cultivar.									
		Season 2003			Season 2004			Season 2003			Season 2004						
		NAA (ppm)			NAA (ppm)			NAA (ppm)			NAA (ppm)						
		0.0	50	100	150	Mean	0.0	50	100	150	Mean	0.0	50	100	150	Mean	
7 days after pollination	127	80.99	82.65	83.12	82.66	82.36	80.89	81.39	81.85	81.31	81.36	83.34	85.30	85.46	85.00	85.28	85.33
	155	79.66	79.58	79.61	79.30	79.54	79.44	79.45	79.46	79.62	79.49	83.52	84.50	76.99	84.37	82.34	84.26
	179	71.21	71.00	71.61	71.30	71.28	70.36	70.93	72.02	71.72	71.26	70.21	70.96	71.51	71.07	70.94	71.49
	Harvest	62.19	62.62	63.03	62.47	62.58	62.32	62.42	62.80	62.14	62.42	62.30	62.89	63.53	63.04	62.94	63.00
	Mean	73.51	73.96	74.34	73.93	73.94	73.25	73.55	74.03	73.7	73.63	75.34	75.91	74.37	75.87	75.37	75.99
21 days after pollination	127	80.99	81.32	82.04	81.46	81.45	80.89	81.01	81.54	81.10	81.14	85.34	85.51	85.28	85.29	85.36	85.70
	155	79.66	79.38	79.47	79.20	79.43	79.44	79.14	79.62	79.15	79.34	83.52	84.51	85.34	85.00	84.59	84.48
	179	71.21	71.00	71.66	71.44	71.08	70.36	70.60	71.12	71.04	70.78	70.21	70.25	71.12	70.80	70.60	70.67
	Harvest	62.19	62.2	63.00	62.92	62.58	62.32	62.67	63.04	62.14	62.54	62.30	62.91	63.04	63.04	62.82	62.34
	Mean	73.51	73.48	74.04	73.76	73.64	73.25	73.36	73.83	73.36	73.45	75.34	75.79	76.19	76.03	75.84	75.73
	General mean	73.51	73.72	74.19	73.84	-----	73.52	73.45	73.93	73.53	-----	75.34	75.85	75.28	75.95	-----	75.98

LSD at 5% level for:

Season	2003	2004
Spraying time (A)	= N.S	= N.S
Concentration of NAA (B)	= N.S	= N.S
(A)X(B)	= N.S	= N.S
Sampling date (C)	= 1.23	= 1.18
(A)X(C)	= 1.32	= 1.25
(B)X(C)	= 1.46	= 1.36
(A)X(B)X(C)	= 1.65	= 1.51

Zaghloul

2003

2004

2003

2004

2003

2004

2003

2004

Table (11): Effect of spraying time and different concentrations of NAA on Samani and Zaghoul fruit TSS content (%) during 2003-2004.

Spraying time	Samani cultivar.						Zaghoul cultivar.														
	Season 2003			Season 2004			Season 2003			Season 2004											
	Sampling date (days)	NAA (ppm)	Mean	NAA (ppm)	Mean	NAA (ppm)	Mean	NAA (ppm)	Mean	NAA (ppm)	Mean										
7 days after	127	11.00	13.20	14.50	13.87	13.14	12.06	14.23	16.87	13.73	14.22	10.93	13.53	15.57	14.43	13.62	11.10	17.30	17.83	17.40	15.91
	155	19.10	19.77	21.14	20.13	20.04	21.10	21.40	24.37	15.07	20.49	17.00	18.73	20.57	19.67	18.99	19.73	22.43	23.97	22.53	22.17
	179	25.97	26.77	30.07	27.53	27.59	26.80	28.93	30.93	23.03	27.43	25.70	27.37	29.80	28.07	27.74	26.13	27.93	30.47	29.50	28.51
Pollination	Harvest	30.33	31.80	34.67	33.70	32.63	31.83	32.37	35.73	29.67	32.40	31.17	31.97	35.27	32.00	32.60	30.10	31.60	32.97	32.67	31.84
	Mean	21.60	22.88	25.09	23.81	23.35	22.95	24.23	26.98	20.38	22.63	21.20	22.90	25.30	23.54	23.24	21.77	24.82	26.31	25.52	24.61
	127	11.00	13.57	15.70	14.70	13.74	12.06	14.73	16.43	15.20	14.74	10.93	17.20	17.83	16.57	15.63	11.10	14.97	17.23	16.90	15.05
21 days after	155	19.10	21.53	23.33	22.23	21.55	21.10	22.13	25.30	24.17	23.17	17.00	20.90	23.07	22.30	20.82	19.73	22.93	24.83	23.47	22.74
	179	25.97	27.83	30.10	28.97	28.22	26.80	30.73	33.00	29.57	30.03	25.70	26.83	28.93	26.40	26.97	26.13	28.87	30.80	29.87	28.92
	Harvest	30.33	33.27	35.07	32.33	32.75	31.83	34.20	38.07	35.43	34.88	31.17	32.57	33.87	32.13	32.44	30.10	31.93	36.01	35.00	33.26
Mean	General mean	21.60	24.05	26.05	24.56	24.07	22.95	25.45	28.20	26.09	25.71	21.20	24.38	25.92	24.35	23.96	21.77	24.67	27.24	26.31	25.00
	Season	21.60	23.47	25.57	24.18	---	22.95	24.84	27.59	25.74	---	21.20	23.64	25.61	23.95	---	21.77	24.75	26.77	25.92	---
	LSD at 5% level for:	Samani						Zaghoul													

LSD at 5% level for:

Spraying time (A)	2003	2004
Concentration of NAA (B)	= 0.26	= 0.40
Sampling date (C)	= 0.28	= 0.32
(AXB)	= 0.40	= 0.46
(BXC)	= 0.28	= 0.32
(AXC)	= 0.40	= 0.46
(BXC)	= 0.57	= 0.65
(AXBXC)	= 0.81	= 0.92

2003	2004
= 0.35	= 0.46
= 0.29	= 0.32
= 0.41	= 0.46
= 0.29	= 0.32
= 0.41	= 0.46
= 0.58	= 0.65
= 0.82	= 0.92

2004
= N.S
= 0.33
= 0.46
= 0.33
= 0.46
= 0.66
= 0.93

Table (12): Effect of spraying time and different concentrations of NAA on Samani and Zaghoul fruit total soluble sugars content (%) during 2003-2004.

Spraying time	Sampling date (days)	Samani cultivar.						Zaghoul cultivar.													
		Season 2003			Season 2004			Season 2003			Season 2004										
		NAA (ppm)			NAA (ppm)			NAA ppm			NAA ppm										
		0.0	50	100	150	Mean	0.0	50	100	150	Mean	0.0	50	100	150	Mean					
7 days after	127	8.62	12.22	11.80	11.27	10.98	8.62	9.32	9.07	9.52	9.13	8.93	9.30	10.07	9.62	9.48	9.95	11.23	11.30	10.97	10.86
	155	13.65	15.83	15.40	16.53	15.53	16.25	20.05	18.97	18.00	18.32	13.38	14.33	15.29	14.60	14.40	14.60	17.09	18.68	17.62	17.00
	179	20.93	24.18	22.69	21.68	22.37	21.20	23.48	22.15	21.68	22.13	20.72	23.76	26.09	24.52	23.77	20.61	22.18	24.52	23.58	22.72
Pollination	Harvest	26.68	29.33	28.23	27.23	27.87	26.60	29.93	29.40	27.07	28.25	27.75	28.78	30.82	29.28	29.16	29.05	29.42	30.76	29.83	29.77
Mean		17.47	20.39	19.53	19.18	19.14	18.17	20.70	19.90	19.07	19.46	17.70	19.04	20.57	19.50	19.20	18.55	19.98	21.31	20.50	20.09
21 days after	127	8.62	10.57	10.10	9.617	9.73	8.62	8.90	8.32	8.37	8.55	8.93	10.27	11.53	11.37	10.53	9.95	10.30	11.27	10.47	10.50
	155	13.65	16.27	17.27	16.17	16.34	16.25	19.48	18.51	17.45	17.92	13.38	16.00	17.90	17.09	16.09	14.60	16.73	20.14	18.03	17.38
	179	20.93	23.38	22.49	21.47	22.07	21.20	24.08	22.40	22.55	20.06	20.72	21.23	23.13	22.00	21.77	20.61	23.54	25.59	24.18	23.48
Pollination	Harvest	26.68	30.00	28.43	27.17	28.07	26.60	30.35	29.23	28.25	28.61	27.75	29.97	30.87	29.92	29.63	29.05	29.52	30.15	29.65	29.59
Mean		17.47	20.55	19.57	18.60	19.05	18.17	20.71	17.12	19.16	18.79	17.70	19.37	20.86	20.09	19.51	18.55	20.02	21.79	20.58	20.24
General mean		17.47	20.47	19.55	18.89	—	18.17	20.70	19.88	19.11	—	17.70	19.20	20.71	19.80	—	18.55	20.00	21.55	20.54	—

LSD at 5% level for:

Season	2003	2004
Spraying time (A)	= N.S	=N.S
Concentration of NAA (B)	= 0.21	=0.20
(AXB)	= 0.30	=0.29
Sampling date (C)	= 0.21	=0.20
(AXC)	= 0.30	=0.29
(BXC)	= 0.42	=0.41
(AXBXC)	= 0.60	=0.59

2003	2004
=N.S	=N.S
=0.27	=0.29
=0.38	=0.42
=0.27	=0.29
=0.38	=0.42
=0.56	=0.59
=0.77	=0.84

Zaghoul

Concerning the interaction between concentrations and time of spraying, 50 ppm NAA sprayed at 7 and 21 days from pollination was the superior to enhancing Samani fruit content of total soluble sugars than other concentrations and control in both seasons. Whereas, 100 ppm sprayed at 7 and 21 days from pollination was the winner by the best effect in this respect for Zaghloul fruits followed by 150, 50 ppm of NAA and control treatment in both seasons, respectively.

Regarding the interactions between concentrations, spraying time and sampling date on fruit content of total soluble sugars, Samani fruit content of total soluble sugars sprayed by 50 ppm NAA after 21 days from pollination recorded 30.00 % at harvest followed by 50 ppm NAA sprayed after 7 days from pollination (29.33 %) in the first season and the same trend was found in the second season, respectively. On the other hand, Zaghloul fruit content of total sugars at harvest sprayed by 100 ppm NAA after 7 and 21 days from pollination gave the highest content of total sugars (30.82 and 30.87 % in the first and 30.76 and 30.15 % in the second season, respectively), than other concentrations and control treatment.

The above-mentioned results are coincided with Mostafa et al. (1993) who used various concentrations of NAA (0, 20, 40, and 60 ppm) spraying on Sewi date palm fruits grown in El-Fayoum at 10, 20 and 30 days after fruit set. They found that NAA treatments increased fruit total sugars content. They also concluded that spraying NAA at 60 ppm after 10 days from pollination was the best treatment in this respect. The increase in fruit total sugars was proportional to the concentration used of NAA.

12- Fruit content of reducing sugars (%):

Samani and Zaghloul fruit content of reducing sugars was significantly affected by different concentrations of NAA spraying at different times from pollination day in both seasons. (Table 13) Whowever, spraying time did not show any significant effect in this regard in both seasons.

The effect of different concentrations of NAA on Samani and Zaghloul fruit content of reducing sugars was differed significantly in the second season and comparing with control treatment in both seasons. In addition the same trend was also observed in Samani and Zaghloul fruits content of reducing sugars as affected by interaction between concentration and time of spraying in both seasons.

Regarding the interactions between concentration, spraying time and sampling date on fruit reducing sugars, spraying by 100 ppm NAA after 7 days from pollination recorded the highest value in Samani and Zaghloul fruits at harvest comparing with other concentrations and control in both seasons. The same trend was also obtained from spraying 100 ppm NAA after 21 days with Samani and Zaghloul fruits in this regard comparing with other concentrations and control treatment in both seasons.

13-Fruit non-reducing sugars:

Samani and Zaghloul fruit non-reducing sugars was significantly affected by different concentrations of NAA spraying at different times of fruit development in both seasons (Table 14). While, spraying time did not show any significant effect in this respect.

Table (13): Effect of spraying time and different concentrations of NAA on Samani and Zaghoul fruit reducing sugars content (%) during 2003-2004 seasons.

Spraying time	Sampling date (days)	Samani cultivar.						Zaghoul cultivar.								
		Season 2003			Season 2004			Season 2003			Season 2004					
		NAA (ppm)	Mean	SD	NAA (ppm)	Mean	SD	NAA (ppm)	Mean	SD	NAA (ppm)	Mean	SD			
		0.0	50	100	150		0.0	50	100	150		0.0	50	100	150	
7 days after	127	0.18	0.31	0.31	0.31	0.28	0.15	0.31	0.29	0.30	0.26	0.61	0.69	0.70	0.68	0.67
	155	0.85	0.91	0.93	0.91	0.90	0.92	0.96	0.99	0.96	0.96	0.89	0.93	0.97	0.95	0.94
	179	1.17	1.23	1.28	1.26	1.24	1.20	1.24	1.26	1.25	1.24	1.15	1.173	1.22	1.24	1.20
Pollination	Harvest	3.50	4.85	5.17	4.63	4.54	3.78	4.15	4.95	4.78	4.42	2.83	3.13	3.42	3.03	3.10
Mean		1.43	1.82	1.92	1.78	1.74	1.51	1.67	1.87	1.82	1.72	1.37	1.48	1.58	1.48	1.48
21 days after	127	0.18	0.31	0.31	0.30	0.28	0.15	0.28	0.29	0.30	0.26	0.61	0.70	0.73	0.70	0.69
	155	0.85	0.95	0.97	0.96	0.93	0.92	0.97	0.96	0.98	0.96	0.89	0.97	1.05	1.03	0.94
	179	1.17	1.19	1.24	1.20	1.20	1.20	1.22	1.27	1.26	1.24	1.15	1.22	1.25	1.25	1.22
Pollination	Harvest	3.50	3.50	3.93	3.63	3.64	3.78	3.85	4.42	4.10	4.04	2.83	3.28	3.38	3.07	3.14
Mean		1.43	1.49	1.61	1.52	1.51	1.51	1.58	1.74	1.66	1.62	1.37	1.54	1.60	1.51	1.51
General mean		1.43	1.66	1.77	1.65	1.65	1.51	1.62	1.80	1.74	1.62	1.37	1.51	1.59	1.49	1.49
LSD at 5% level for:		Samani						Zaghoul								
Season		2003			2004			2003			2004					
Spraying time (A)		= N.S			= N.S			= N.S			= N.S					
Concentration of NAA (B)		= 0.12			= 0.14			= 0.13			= 0.14					
(AXB)		= 0.18			= 0.16			= 0.15			= 0.16					
Sampling date (C)		= 0.12			= 0.14			= 0.13			= 0.14					
(AXC)		= 0.18			= 0.16			= 0.15			= 0.16					
(BXC)		= 0.25			= 0.19			= 0.17			= 0.19					
(AXBXC)		= 0.36			= 0.23			= 0.20			= 0.23					

Table (14): Effect of spraying time and different concentrations of NAA on Samani and Zaghoul fruit non-reducing sugars content (%) during 2003- 2004 seasons.

Spraying time	Sampling date (days)	Zaghoul cultivar.														
		Season 2003						Season 2004								
		NAA (ppm)		Mean		NAA (ppm)		Mean		NAA (ppm)		Mean				
0.0	50	100	150	0.0	50	100	150	0.0	50	100	150	0.0	50	100	150	
7 days after	127	8.43	11.91	11.49	10.59	10.61	8.46	9.01	8.77	9.21	8.86	8.32	8.61	9.35	8.94	8.81
	155	12.09	14.92	14.47	15.62	14.28	15.33	19.09	17.98	17.04	17.36	12.49	13.40	14.32	13.65	13.47
	179	19.76	22.96	21.41	20.42	21.14	20.00	22.24	20.89	20.44	20.89	19.57	22.59	24.87	23.65	22.67
Pollination	Harvest	23.18	24.96	23.07	22.06	23.33	22.28	25.78	24.45	22.28	23.83	24.92	25.65	27.87	26.25	26.18
Mean		15.86	18.69	17.61	17.18	17.34	16.65	19.03	18.02	17.24	17.74	16.33	17.57	19.11	18.13	17.79
21 days after	127	8.43	10.25	9.79	9.32	9.45	8.463	8.617	8.02	8.06	8.29	8.32	9.57	10.81	10.67	9.84
	155	12.09	17.32	16.29	15.20	15.40	15.33	15.81	17.55	16.47	16.29	12.49	15.03	16.84	16.06	15.11
	179	19.76	22.20	21.25	20.27	20.87	20.00	22.87	22.13	21.29	21.57	19.57	20.01	21.88	20.75	20.55
pollination	Harvest	23.18	26.50	24.50	23.35	24.38	22.28	26.50	24.82	24.15	24.57	24.92	26.68	27.49	26.85	26.48
Mean		15.86	19.07	17.96	17.08	17.54	16.65	19.12	18.13	17.49	17.85	16.33	17.82	19.25	18.58	18.00
General mean		15.86	18.82	17.78	17.24	17.24	16.65	19.08	18.08	17.37	17.37	16.33	17.69	19.12	18.31	17.15

LSD at 5% level for:

Season	2003	2004	2003	2004
Spraying time (A)	= N.S	= N.S	= N.S	= N.S
Concentration of NAA (B)	= 0.22	= 0.21	= 0.26	= 0.29
(AXB)	= 0.32	= 0.30	= 0.38	= 0.41
Samples (C)	= 0.22	= 0.21	= 0.26	= 0.29
(AXC)	= 0.32	= 0.30	= 0.38	= 0.41
(BXC)	= 0.45	= 0.43	= 0.53	= 0.58
(AXBXC)	= 0.64	= 0.60	= 0.76	= 0.82

Regarding the effect of different concentrations of NAA, 50 ppm gave the highest Samani fruit content of non-reducing sugars (18.82 % in the first and 19.08 % in the second season) followed by 100, 150 and 0.0 ppm NAA (17.78 %, 17.24 % and 16.05 % in the first season and 18.08 %, 17.37 % and 16.65 % in the 2nd season); respectively. Whereas, in Zaghloul cultivar, 100 ppm NAA was the superior in this field followed by 150, 50 and 0.0 ppm NAA in both seasons.

Concerning the interaction between concentration and time of spraying, 50 ppm NAA gave the highest Samani fruit content of non-reducing sugars when it was sprayed after 7 or 21 days from pollination followed by 100, 150 and 0.0 ppm NAA in both seasons. In addition, regarding to Zaghloul fruits, 100 ppm NAA sprayed after 7 or 21 days from pollination produced the highest value in this respect followed by 150, 50 and 0.0 ppm NAA in both seasons.

Moreover, harvested Samani fruits which were sprayed by 50 ppm NAA at 7 or 21 days had the highest non-reducing sugars comparing with other treatments in both seasons. On the other hand, harvested Zaghloul fruits had the highest value in this regard when it was sprayed by 100 ppm NAA at 7 or 21 days from pollination comparing with other concentrations in both seasons.

In conclusion and recommendation:

Spraying NAA at different concentrations (0, 50, 100 and 150 ppm) on Samani and Zaghloul date palm cvs. after 7 or 21 days from pollination Fruit set was decreased when NAA sprayed at 7 days from pollination especially at 100 ppm for both cultivars in the two seasons. Also, Samani and Zaghloul fruit physical characteristics i.e. (fruit weight, flesh weight, seed weight, fruit dimensions and fruit size) were enhanced with 100 ppm of NAA. In addition, Samani and Zaghloul fruit contents of TSS, total soluble sugars, reducing sugar, non-reducing sugars and pigments were increased with spraying 100 ppm NAA in the two seasons especially 7 days after pollination.

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تأثير نفتالين حامض الخليك على العقود المحصول و خصائص الثمار لصنفى البلح السمانى و الزغلول

السيد ابراهيم بكر^١، سامى القصرى^١، عبد المنعم البنا^١ وهشام غزاوى^٢

١- قسم الفاكهة - كلية الزراعة - جامعة القاهرة.

٢- المعمل المركزى للابحاث و تطوير نخيل البلح.

اجريت هذه الدراسة خلال موسمى ٢٠٠٢ و ٢٠٠٤ فى محطة البحوث والتجارب الزراعية بكلية الزراعة جامعة القاهرة بالجيزة و ذلك لدراسة تأثير رش نفتالين حامض الخليك (NAA) بتركيزات (١٠٠، ١٥٠، ١٥٠ جزء فى المليون) فى موعدين هما الاول بعد مرور ٧ يوم والثانى بعد ٢١ يوم من إجراء التلقيح على خف ثمار نخيل البلح السمانى والزغلول.

وو جد من الدراسة ان الرش ادى إلى حدوث خف للثمار عند رش NAA بعد ٧ يوم من التلقيح وخاصة مع تركيز ١٠٠ جزء فى المليون مقارنة بالكنترول فى كلا الصنفين فى موسمى الدراسة. وكذلك زادت جودة صفات الثمار الطبيعية مثل وزن الثمرة - وزن اللحم - طول وقطر الثمار وخاصة عند رش NAA بتركيز ١٠٠ جزء فى المليون. كما تحسنت الصفات الكيماوية للثمار (المواد الصلبة الكلية، السكريات الكلية والمختزلة والغير مختزلة) عند رش NAA بتركيز ١٠٠ جزء فى المليون بعد ٧ يوم من التلقيح.