Current Science International Volume : 06 | Issue : 04| Oct.- Dec. 2017
ISSN: 2077-4435 Pages**:** 976-992

Improving the Fruit Quality Characteristics of Zaghloul and Samani Date Palm Cultivars by Spraying Cytophex (CPPU)

Hossam Ali Ali Metwally [1,2]

[1]*The Central Laboratory for Date Palm Researches and Development, ARC, Giza, Egypt*
[2]*The Arab Center for the Studies of Arid Zones and Dry Lands (ACSAD), Damascus, Syria.*

Received: 10 Sept. 2017 / Accepted: 15 Nov. 2017 / Publication date: 30 Dec. 2017

ABSTRACT

This investigation was carried out at public orchard in Tafahna El Ashraf region, Dakahlia Governorate, Egypt, during two consecutive successful seasons, in order to study the efficient of spraying palm spathes by a chemical compound (Cytophex "CPPU" 2-chloro-4-pyridyl phenyl urea) at concentrations 0.0, 25, 50, 75ppm after 7, 14 and 21days from pollination for enhancing fruit quality of two date palm cultivars (Zaghloul and Samani). The obtained results revealed that, spraying bunches with 75ppm CPPU after 21days from pollination gave the lowest fruit set percentages for Zaghloul cv. (18.02 %) and Samani cv. (25.75%). Meanwhile, it gave the highest fruit weight, flesh weight and fruit volume (31.40 g., 29.26 g., 35.49 cm³, respectively) for Zaghloul cv. and (40.77 g., 37.74 g., 37.02 cm³, respectively) for Samani cv. Also. It gave the highest fruit length and diameter for Zaghloul cv. (6.32 and 3.26cm, respectively) and fruit diameter of Smani Cv. (5.08cm), while, the highest Smani Cv. fruit length (6.11cm) was obtained by using 75ppm CPPU after 14 days from pollination. Also, using 75ppm CPPU after 21days from pollination recorded the lowest fruit moisture and acidity contents (61.79% and 0.07% for Zaghloul and 62.62% and 0.06% for Samani cv., respectively), Meanwhile, it gave the highest fruit total soluble solids (T.S.S), total soluble sugars, reducing sugars, non-reducing sugars contents (39.45, 39.30, 6.52 and 32.79 %, respectively for Zaghloul cv. and 39.00, 43.87, 8.08 and 35.79 %, respectively for Samani cv.) and gave the highest fruit content of both pigments of Zaghloul and Samani cvs. (Anthocyanin 0.39 % and Carotene 0.51%). Generally, Spraying Cytophex in different concentrations and different spraying dates significantly affected on fruit set percentages, fruit physical and chemical properties of Zaghloul and Samani cvs. in both investigation seasons, and the best treatment was 75ppm after 21 days from pollination which significantly enhanced fruit quality.

Key words: Cytophex (CPPU), improving, fruit quality, date palm.

Introduction

Date palm tree (*Phoenix dactylifera*. L.) is one of the oldest cultivated fruit trees in the world. In addition, it is a very important crop in the Middle East especially Arab country. In several Arab countries, palm trees can survive without horticultural services, but its productivity will severely affected and its fruits will be poor in quality. The palm in order to bear negligence and be a producer of an economic crop with good fruit specifications need to various horticultural services. Yield is the result of many agricultural operations carried out on trees during the growing season that directly related to the crop and the quality characteristics of the date fruit. There are many agricultural operations carried out on palm trees to achieve this goal, i.e. efficiency of horticultural practices and suitable fertilization program.

Improving fruit quality (physical and chemical fruit characteristics) is an important factor to consequently the grade of superior fruits for native markets and exportation. Several efforts have been accomplished by numerous researchers to improve date palm production through facing production problems and improving agricultural practices espicialy horticultural practices program. Plant growth regulators play an important and major role in regulating fruit growth and development. Some of these substances were used for improving the fruit quality, which act for increasing the income and the revenues of farmers (Kassem *et al.,* 2011). The promotion effect of CPPU on yield as well as date fruit physical and chemical properties of some palm cultivars was emphasized by Mougheith and Hassaballa (1979), El-Kassas (1983), Soliman (2007), Tahany (2008), El-Kosary (2009) and Al-Qurashy *et al*. (2012).

Corresponding Author: Hossam Ali Ali Metwally, The Central Laboratory for Date Palm Researches and Development, ARC, Giza, Egypt. E-mail: hossamaliali@gmail.com

Thus, the present investigation aimed to study the efficient of enhancing fruit quality of two date palm cultivars (Zaghloul and Samani) by spraying palm spathes with Cytophex ("CPPU" 2-chloro-4-pyridyl phenyl urea) at concentrations 0.0, 25, 50, 75ppm after 7, 14 and 21days from pollination.

Materials and Methods

This investigation was carried out at public orchard in Tafahna El Ashraf region, Dakahlia Governorate, Egypt, during two consecutive successful seasons 2015 and 2016, through co-operation between The Central Laboratory for Date Palm Researches and Development, ARC, Egypt and the Arab center for the studies of arid zones and dry lands (ACSAD) in order to study the efficient of enhancing fruit quality by spraying palm spathes with Cytophex ("CPPU" 2-chloro-4-pyridyl phenyl urea) at concentrations 0.0, 25, 50, 75ppm after 7, 14 and 21days from pollination. Two date palm cultivars Zaghloul and Samani (Nine female palms of each cultivar of 20 years old, similar in growth, each represent one replicate) were used for this investigation.

Palm trees were pruned at 8:1 leaf/bunch ratio (El-Shazly, 1999), for each palm, twelve bunches were left. The palms were received the same agricultural practices, and pollinated by the same source of pollen grains just after spathe cracking in both seasons.

All spathes were covered before and after spraying with CPPU to stopping the interaction between the chemical and its concentrations. Fruit physical characteristics and its content of chemical compounds were studied at harvest.

Each palm was sprayed with cytophex (0.0, 25, 50, 75 ppm) at either three dates after pollination (7, 14, and 21 days), Twelve bunches for each palm were divided into 3 groups, each group of 3 bunches were sprayed with either concentrations of the above mentioned, between each group of bunches, one bunch was sprayed with water as control. The individual bunches were covered before and after treatments by tissue paper, to stopping the interaction between the chemical and its concentrations. Fruit physical characteristics and its content of chemical compounds were studied at harvest.

Samples of thirty fruits were divided into three replicates each of ten date fruits that were randomly picked from each bunch, samples were studied in the laboratory and the physical characteristics determine as follow:

Fruit set percentage was calculated at harvest using the equation:

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

Fruit physical characteristics:

Fruit flesh, seed weights were determined in 5 fruits of each replicate for each treatment and the mean of weight was calculated in grams. In addition, fruit weight/seed weight ratio was calculated.

Fruit dimensions (length and diameter) were measured using individual fruits of each replicate (10 fruits) by using vernier caliper. Also fruit length / diameter ratio was calculated.

Fruit volume was measured by replacement of water in a graduated jar and calculated in cm^3.

Fruit firmness was estimated using pressure tester apparatus (Kg/cm^2) (drill diameter, 0.3 cm) for the individual 5 fruits of each replicate per treatment.

Fruit content of chemical compounds

Moisture content: fruit samples were cleaned and date flesh was cut into pieces and dried at (60-65 ◦c) for 48 hours (Abd-El-Rahman, 1974 and Mawlood, 1980).

Acidity content was determined by using 5ml of fruit juice, titrated against sodium hydroxide, using phenolphthalein as indicator according to the official Methods (A.O.A.C 1995) and the titratable acidity was calculated as citric acid percentage (Ranganns, 1978 and Mawlood, 1980).

Total Soluble solids (T.S.S) content was determined in fruit juice using a hand refractometer (A.O.A.C, 1995).

Total Soluble sugars content and reducing sugars content percentages were determined in juice according to the method of Lane and Eynon as described by the A.O.A.C (1995), and the non-reducing sugars percentage were calculated from the difference between total and reducing sugars.

Total Indol content were determined in the ethanolic extract using P-dimethyl amino benzaldhyde (PDAB, 1g was dissolved in 50ml HCl conc. and 50ml ethanol 95%) test according to Larsen *et al*. (1962). A stable pink colour would be formed. Pure indole acetic acid was used as standard. Total indols were expressed on fruit dry weight basis as mg/100g d.wt.

Fruit content of pigments, i. e., chlorophylls a, b, and anthocyanen (Zaghloul cv.) or carotene (Samani cv.) were determined according to Wettstein (1957). The sample was taken from cortex of fruit using 5 fruits of each replicate. The data were calculated as % by mg pigment /100 g fresh weight.

Statistical analysis:

The randomized complete block design method with three replicates was followed. Statistical analysis of the obtained data was carried according to (Snedecor and Cochran, 1972). L.S.D. test was used for comparing the data at the 5 % level of probability. Also, the percentages were transformed to the arcsine to find the binomial percentage according to Steel and Torrie (1980).

Results

Fruit set percentage affected by spraying Cytophex.

Table (1) indicated that Zaghloul and Samani cvs. fruit set percentages was significantly affected by spraying cytophex in different concentrations and different spraying dates in both seasons. Respecting CPPU concentration, it was clearly noticed that, highest concentration produced the lowest Zaghloul and Samani cvs. fruit set percentages in both seasons. Moreover, 75 ppm cytophex gave the lowest fruit set percentage with Zaghloul and Samani cvs. (18.78 and 26.21 %, respectively). Regarding to the effect of spraying date, spraying at 21 days from pollination recorded the lowest Zaghloul and Samani cvs. fruit set percentages (21.25 % & 27.12 %, respectively) as average the two seasons followed by ascending 14 and 7 days after pollination. A same trend was observed in the both season.

Fruit set percentages of Zaghloul cv. was strongly significantly affected by spraying CPPU (21.82 %) more than Samani cv. (27.35 %), as average the two seasons.

The lowest fruit set percentages was obtained when spraying bunches with 75ppm CPPU after 21 days from pollination for Zaghloul cv. (18.02 %) and Samani cv. (25.75 %).

Table 1: Effect of Cytophex in different concentrations on fruit set percentage of Zaghloul and Samani date palm cultivars after 7, 14 and 21 days from pollination.

Seasons	Date of spraying	Zaghloul cultivar Cytophex concentrations				Mean	Samani cultivar Cytophex concentrations				Mean	General mean
		0.0	25	50	75		0.0	25	50	75		
2015	7	28.41	22.85	20.30	19.28	22.71	28.25	28.18	27.21	26.81	27.61	25.16
	14	28.41	21.32	19.57	18.63	21.98	28.25	27.73	26.14	26.03	27.04	24.51
	21	28.41	20.64	18.84	17.43	21.33	28.25	27.43	26.55	25.28	26.88	24.10
	Mean	28.41	21.60	19.57	18.45	22.01	28.25	27.78	26.63	26.04	27.18	24.59
2016	7	26.36	21.74	20.57	19.59	22.07	28.94	28.21	27.68	27.02	27.96	25.01
	14	26.36	21.24	19.83	19.15	21.65	28.94	27.64	26.55	25.91	27.26	24.45
	21	26.36	20.31	19.42	18.61	21.18	28.94	27.14	27.18	26.21	27.37	24.27
	Mean	26.36	21.10	19.94	19.12	21.63	28.94	27.66	27.14	26.38	27.53	24.58
Combined	7	27.39	22.30	20.44	19.44	22.39	28.60	28.20	27.45	26.92	27.79	25.09
	14	27.39	21.28	19.70	18.89	21.81	28.60	27.69	26.35	25.97	27.15	24.48
	21	27.39	20.48	19.13	18.02	21.25	28.60	27.29	26.87	25.75	27.12	24.19
	Mean	27.39	21.35	19.76	18.78	21.82	28.60	27.72	26.89	26.21	27.35	24.59

LSD at 0.05 :

Concentration (A): 0.428	Cultivar (C): 0.3026	A X B X C: 1.0484	B X D: 0.5242
Time of spraying (B): 0.3707	A X C: 0.6053	Season (D): 0.3026	C X D: 0.428
A X B: 0.7413	B X C: 0.5242	A X D: 0.6053	A X B X C X D: 1.4827

Fruit physical characteristics affected by spraying Cytophex.

Generally, all tested physical characteristics of Zaghloul and Samani cvs. were significantly affected by spraying cytophex in different concentrations and different spraying dates in both seasons.

Fruit weight (g):

As shown in table (2), the highest CPPU concentration produced the heavest Zaghloul and Samani cvs. fruits in both seasons, where, 75 ppm cytophex gave the highest fruit weight of cvs. Zaghloul (29.85 g.) and Samani (39.22g.), folowed by the lower concentrations 50, 25 and 0.0 ppm. (27.98, 25.54 and 21.63 g., respectively) for Zaghloul and (35.71, 34.64 and 30.54 g., respectively) for Samani cv.

Spraying CPPU at 21 days from pollination gave the heaviest fruit (31.65g) as average the two seasons, ascending followed by 14 and 7 days from pollination (30.77and 29.49 g., respectively)

Regarding to the interaction between CPPU concentration, spraying dates and cultivars, results declared that, the heaviest fruit was obtained when spraying bunches with 75 ppm CPPU after 21 days from pollination for Zaghloul cv. (31.40 g.) and Samani cv. (40.77 g.).

Table 2: Effect of Cytophex in different concentrations on fruit weight (g) of Zaghloul and Samani date palm cultivars after 7, 14 and 21 days from pollination.

Seasons	Date of spraying	Zaghloul Cultivar Cytophex concentrations				Mean	Samani Cultivar Cytophex concentrations				Mean	General mean
		0.0	25	50	75		0.0	25	50	75		
2015	7	20.76	23.84	25.30	27.64	24.38	30.37	35.05	35.87	40.47	35.44	29.91
	14	20.76	25.67	29.02	29.18	26.16	30.37	36.24	36.07	41.56	36.06	31.11
	21	20.76	27.48	29.31	31.27	27.21	30.37	37.39	38.39	43.18	37.33	32.27
	Mean	20.76	25.66	27.88	29.36	25.92	30.37	36.23	36.78	41.74	36.28	31.10
2016	7	22.49	24.41	26.74	29.24	25.72	30.70	31.74	32.50	34.79	32.43	29.08
	14	22.49	25.44	28.08	30.22	26.56	30.70	33.79	35.77	36.94	34.30	30.43
	21	22.49	26.41	29.40	31.53	27.46	30.70	33.65	35.64	38.36	34.59	31.02
	Mean	22.49	25.42	28.07	30.33	26.58	30.70	33.06	34.64	36.70	33.77	30.18
Combined	7	21.63	24.13	26.02	28.44	25.05	30.54	33.40	34.19	37.63	33.94	29.49
	14	21.63	25.56	28.55	29.70	26.36	30.54	35.02	35.92	39.25	35.18	30.77
	21	21.63	26.95	29.36	31.40	27.33	30.54	35.52	37.02	40.77	35.96	31.65
	Mean	21.63	25.54	27.98	29.85	26.25	30.54	34.64	35.71	39.22	35.03	30.64

LSD at 0.05 :

Concentration (A): 0.704	Cultivar (C): 0.498	A X B X C: 1.725	B X D: 0.863
Time of spraying (B): 0.61	A X C: 0.996	Season (D): 0.498	C X D: 0.704
A X B: 1.22	B X C: 0.863	A X D: 0.996	A X B X C X D: 2.44

Flesh weight (g):

Data presented in table (3), spraying CPPU at the highest concentration 75ppm produced the highest flesh weight of Zaghloul and Samani cvs. fruits, (27.87 g. and 36.08 g., respectively) compared with control (0.0) (19.81 and 27.80 g., respectively) in both seasons

Spraying CPPU at 21 days from pollination gave the highest fruit flesh weight (29.19 g) as average the two seasons, followed by 14 and 7 days from pollination (28.39 and 27.19 g., respectively).

Regarding to the interaction between CPPU concentration, spraying dates and cultivars, results declared that, spraying bunches with 75 ppm CPPU after 21 days from pollination gave the heighist flesh weight of Zaghloul and Samani cvs. fruits (29.26 and 37.74 g., respectively).

Seed weight (g):

Table (4) appeared that, spraying CPPU at the highest concentration (75 ppm) produced the highest seed weight of Zaghloul and Samani cvs. fruits as average two studied seasons, (1.97g. and 3.14 g., respectively) compared with control (1.83 and 2.75 g., respectively).

Spraying CPPU at 21 days from pollination gave the highest fruit seed weight (3.0g) as average the two seasons, followed by 14 and 7 days from pollination (2.95 and 2.78 g., respectively).

Table 3: Effect of Cytophex in different concentrations on flesh weight (g) of Zaghloul and Samani date palm cultivars after 7, 14 and 21 days from pollination.

Seasons	Date of spraying	Zaghloul cultivar Cytophex concentrations				Mean	Samani cultivar Cytophex concentrations				Mean	General mean
		0.0	25	50	75		0.0	25	50	75		
2013	7	18.76	22.04	23.30	25.75	22.46	27.83	32.52	33.53	37.34	32.81	27.63
	14	18.76	23.43	27.13	27.22	24.14	27.83	33.28	33.42	38.33	33.22	28.68
	21	18.76	25.55	27.34	29.44	25.27	27.83	34.44	34.44	40.11	34.21	29.74
	Mean	18.76	23.67	25.92	27.47	23.96	27.83	33.41	33.80	38.59	33.41	28.68
2014	7	20.85	22.73	25.03	27.27	23.97	27.76	28.99	29.63	31.63	29.50	26.74
	14	20.85	23.97	26.48	28.47	24.94	27.76	30.71	32.87	33.71	31.26	28.10
	21	20.85	25.01	28.10	29.08	25.76	27.76	30.48	32.41	35.37	31.51	28.63
	Mean	20.85	23.90	26.54	28.27	24.89	27.76	30.06	31.64	33.57	30.76	27.82
Combined	7	19.81	22.39	24.17	26.51	23.22	27.80	30.76	31.58	34.49	31.15	27.19
	14	19.81	23.70	26.81	27.85	24.54	27.80	32.00	33.15	36.02	32.24	28.39
	21	19.81	25.28	27.72	29.26	25.52	27.80	32.46	33.43	37.74	32.86	29.19
	Mean	19.81	23.79	26.23	27.87	24.42	27.80	31.74	32.72	36.08	32.08	28.25

LSD at 0.05 :

Concentration (A): 0.689	Cultivar (C): 0.487	A X B X C: 1.687	B X D: 0.844
Time of spraying (B): 0.597	A X C: 0.974	Season (D): 0.487	C X D: 0.689
A X B: 1.193	B X C: 0.844	A X D: 0.974	A X B X C X D: 2.386

Table 4: Effect of Cytophex in different concentrations on seed weight (g) of Zaghloul and Samani date palm cultivars after 7, 14 and 21 days from pollination.

Seasons	Date of spraying	Zaghloul cultivar Cytophex concentrations				Mean	Samani cultivar Cytophex concentrations				Mean	General mean
		0.0	25	50	75		0.0	25	50	75		
2015	7	2.01	1.80	2.00	1.89	1.93	2.54	2.52	2.35	3.13	2.64	2.64
	14	2.01	2.23	1.95	1.95	2.04	2.54	2.95	2.65	3.23	2.84	2.84
	21	2.01	1.93	1.97	1.83	1.94	2.54	2.95	3.15	3.06	2.93	2.93
	Mean	2.01	1.99	1.97	1.89	1.97	2.54	2.81	2.72	3.14	2.80	2.80
2016	7	1.64	1.68	1.70	1.98	1.75	2.95	2.75	2.87	3.16	2.93	2.93
	14	1.64	1.47	1.60	1.75	1.62	2.95	3.15	2.90	3.24	3.06	3.06
	21	1.64	1.34	1.30	2.44	1.68	2.95	3.16	3.22	2.99	3.08	3.08
	Mean	1.64	1.50	1.53	2.06	1.68	2.95	3.02	3.00	3.13	3.02	3.02
Combined	7	1.83	1.74	1.85	1.94	1.84	2.75	2.64	2.61	3.15	2.78	2.78
	14	1.83	1.85	1.78	1.85	1.83	2.75	3.05	2.78	3.24	2.95	2.95
	21	1.83	1.64	1.64	2.14	1.81	2.75	3.06	3.19	3.03	3.00	3.00
	Mean	1.83	1.74	1.75	1.97	1.82	2.75	2.91	2.86	3.14	2.91	2.91

LSD at 0.05 :

Concentration (A): 0.1659	Cultivar (C): 0.1173	A X B X C: 0.4063	B X D: 0.2031
Time of spraying (B): 0.1436	A X C: 0.2346	Season (D): 0.1173	C X D: 0.1659
A X B: 0.2873	B X C: 0.2031	A X D: 0.2346	A X B X C X D: 0.5746

Seed / fruit weight ratio

Results in table (5) cleared that, a gradual increase in Seed/fruit weight ratio was noticed in both Zaghloul and Samani cvs. by increasing the concentrations spraying of CPPU from 0.0, 25 to reach the highest value at 50 ppm (12.86, 15.54 and 16.52, respectively for Zaghloul and 11.18, 12.17 and 12.66, respectively for Samani), then, tend to decrease at concentration (75 ppm) recorded (15.74 for Zaghloul and 12.51 for Samani).

Spraying CPPU at 21 days from pollination gave the highest fruit Seed/fruit weight ratio (14.03) as average the two seasons.

Regarding to the interaction between CPPU concentration, spraying dates and cultivars, results declared that, spraying bunches with 50 ppm CPPU after 21 days from pollination gave the highest Seed / fruit weight ratio of Zaghloul (18.81), while, using 75 ppm CPPU after 21 days from pollination gave the highest Seed / fruit weight ratio of Samani (13.42).

Fruit length (cm)

As shown in table (6), the highest CPPU concentration (75 ppm) produced the highest fruit length as average two seasons for Zaghloul and Samani cvs. (6.23 cm and 6.01 cm, respectively), compared with control (0.0 ppm) which recorded the lowest values (5.58 and 5.32 cm, respectively).

Spraying CPPU at 21 days from pollination gave the highest fruit length (5.93cm) as average the two seasons, ascending followed by 14 and 7 days from pollination (5.86 and 5.79 cm, respectively).

Regarding to the interaction between CPPU concentration, spraying dates and cultivars, results indicated that, the highest fruit length was obtained when spraying bunches with 75 ppm CPPU after 21 days from pollination for Zaghloul cv. (6.32 cm), while, using 75 ppm CPPU after 14 days from pollination gave the highest fruit length of Samani (6.11 cm).

Table 5: Effect of Cytophex in different concentrations on seed / fruit weight ratio of Zaghloul and Samani date palm cultivars after7, 14 and 21 days from pollination.

Seasons	Date of spraying	Zaghloul cultivar Cytophex concentrations				Mean	Samani cultivar Cytophex concentrations				Mean	General mean
		0.0	25	50	75		0.0	25	50	75		
2015	7	10.36	13.38	12.80	14.74	12.82	11.94	13.88	15.29	12.93	13.51	13.17
	14	10.36	11.65	15.18	15.04	13.06	11.94	13.39	13.62	12.86	12.95	13.01
	21	10.36	14.37	14.98	17.10	14.20	11.94	12.68	12.18	13.98	12.70	13.45
	Mean	10.36	13.13	14.32	15.63	13.36	11.94	13.32	13.70	13.26	13.05	13.21
2016	7	15.35	16.11	18.49	15.81	16.44	10.42	11.63	11.40	11.02	11.12	13.78
	14	15.35	17.88	15.01	17.64	16.47	10.42	10.75	12.41	11.41	11.25	13.86
	21	15.35	19.82	22.63	14.12	17.98	10.42	10.67	11.04	12.85	11.25	14.61
	Mean	15.35	17.94	18.71	15.86	16.96	10.42	11.02	11.62	11.76	11.20	14.08
Combined	7	12.86	14.75	15.65	15.28	14.63	11.18	12.76	13.35	11.98	12.31	13.47
	14	12.86	14.77	15.10	16.34	14.76	11.18	12.07	13.02	12.14	12.10	13.43
	21	12.86	17.10	18.81	15.61	16.09	11.18	11.68	11.61	13.42	11.97	14.03
	Mean	12.86	15.54	16.52	15.74	15.16	11.18	12.17	12.66	12.51	12.13	13.64

LSD at 0.05 :

Concentration (A): 1.195	Cultivar (C): 0.845	A X B X C: 2.928	B X D: 1.464
Time of spraying (B): 1.035	A X C: 1.69	Season (D): 0.845	C X D: 1.195
A X B: 2.07	B X C: 1.464	A X D: 1.69	A X B X C X D: 4.14

Table 6: Effect of Cytophex in different concentrations on fruit length (cm) of Zaghloul and Samani date palm cultivars after 7, 14 and 21 days from pollination

Seasons	Date of spraying	Zaghloul cultivar Cytophex concentrations				Mean	Samani cultivar Cytophex concentrations				Mean	General mean
		0.0	25	50	75		0.0	25	50	75		
2015	7	5.42	5.55	6.00	6.14	5.78	5.11	5.58	5.51	5.82	5.51	5.64
	14	5.42	5.72	6.02	6.11	5.82	5.11	5.67	5.82	5.91	5.63	5.72
	21	5.42	5.79	6.16	6.22	5.90	5.11	5.85	5.89	5.61	5.62	5.76
	Mean	5.42	5.69	6.06	6.16	5.83	5.11	5.70	5.74	5.78	5.58	5.71
2016	7	5.73	5.92	6.10	6.18	5.98	5.52	5.96	6.00	6.08	5.89	5.94
	14	5.73	5.99	6.16	6.28	6.04	5.52	5.94	6.10	6.31	5.97	6.00
	21	5.73	6.15	6.32	6.42	6.16	5.52	6.18	6.23	6.33	6.07	6.11
	Mean	5.73	6.02	6.19	6.29	6.06	5.52	6.03	6.11	6.24	5.97	6.02
Combined	7	5.58	5.74	6.05	6.16	5.88	5.32	5.77	5.76	5.95	5.70	5.79
	14	5.58	5.86	6.09	6.20	5.93	5.32	5.81	5.96	6.11	5.80	5.86
	21	5.58	5.97	6.24	6.32	6.03	5.32	6.02	6.06	5.97	5.84	5.93
	Mean	5.58	5.85	6.13	6.23	5.95	5.32	5.86	5.93	6.01	5.78	5.86

LSD at 0.05 :

Concentration (A): 0.0785	Cultivar (C): 0.0555	A X B X C: 0.1922	B X D: 0.0961
Time of spraying (B): 0.068	A X C: 0.111	Season (D): 0.0555	C X D: 0.0785
A X B: 0.1359	B X C: 0.0961	A X D: 0.111	A X B X C X D: 0.2718

Fruit diameter (cm)

Results tabulated in table (7) showed that, spraying CPPU concentration (25 ppm) produced the highest fruit diameter as average two seasons for Zaghloul cv. (3.22 cm), while Samani cv. produced the highest fruit diameter (4.96 cm), at concentration (75 ppm) compared with control (0.0 ppm) which recorded the lowest values (2.85 cm and 4.36 cm, respectively).

Spraying CPPU at 14 days from pollination gave the highest fruit diameter (3.97 cm) as average the two seasons, ascending followed by 21 and 7 days from pollination (3.93 and 3.82 cm, respectively) without significant differences among them.

Regarding to the interaction between CPPU concentration, spraying dates and cultivars, results observed that, spraying bunches with 75ppm CPPU after 21days from pollination gave the highest fruit diameter of Zaghloul and Samani cvs. fruits (3.26 and 5.08 cm, respectively).

Table 7: Effect of Cytophex in different concentrations on fruit diameter (cm) of Zaghloul and Samani date palm cultivars after 7, 14 and 21 days from pollination.

Seasons	Date of spraying	Zaghloul cultivar Cytophex concentrations				Mean	Samani cultivar Cytophex concentrations				Mean	General mean
		0.0	25	50	75		0.0	25	50	75		
2015	7	2.89	2.79	3.05	3.07	2.95	3.20	3.43	3.52	3.64	3.45	3.20
	14	2.89	2.80	2.74	3.18	2.90	3.20	3.54	3.47	3.58	3.45	3.18
	21	2.89	2.91	3.10	3.23	3.03	3.20	3.55	3.58	3.82	3.54	3.29
	Mean	2.89	2.83	2.96	3.16	2.96	3.20	3.51	3.52	3.68	3.48	3.22
2016	7	2.81	2.93	3.10	3.13	2.99	5.52	5.96	6.00	6.08	5.89	4.44
	14	2.81	4.91	3.29	3.28	3.57	5.52	5.94	6.10	6.31	5.97	4.77
	21	2.81	2.99	3.31	3.29	3.10	5.52	6.18	6.23	6.33	6.07	4.58
	Mean	2.81	3.61	3.23	3.23	3.22	5.52	6.03	6.11	6.24	5.97	4.60
Combined	7	2.85	2.86	3.08	3.10	2.97	4.36	4.70	4.76	4.86	4.67	3.82
	14	2.85	3.86	3.02	3.23	3.24	4.36	4.74	4.79	4.95	4.71	3.97
	21	2.85	2.95	3.21	3.26	3.07	4.36	4.87	4.91	5.08	4.80	3.93
	Mean	2.85	3.22	3.10	3.20	3.09	4.36	4.77	4.82	4.96	4.73	3.91

LSD at 0.05 :

Concentration (A): 0.2538	Cultivar (C): 0.1794	A X B X C: 0.6216	B X D: 0.3108
Time of spraying (B): 0.2198	A X C: 0.3589	Season (D): 0.1794	C X D: 0.2538
A X B: 0.4395	B X C: 0.3108	A X D: 0.3589	A X B X C X D: 0.8791

Fruit length / diameter ratio

Results in table (8) declared that, spraying CPPU concentration (25ppm) produced the highest fruit length/diameter ratio as average two seasons for Zaghloul and Samani cvs. (2.02), while Samani cv. produced the highest fruit diameter (1.69), when spraying CPPU concentration (50 and 75 ppm), regarding to Zaghloul cv. CPPU in concentration (50 and 75 ppm) produced the lowest values (1.94) lower than control (1.96), compared with Samani cv., which control (0.0 ppm) recorded the lowest significant values (1.63).

Spraying CPPU at 7 and 21 days from pollination gave the highest fruit length/ diameter ratio (1.82) as average the two seasons, followed 14days from pollination (1.81) without significant differences.

Regarding to the interaction between CPPU concentration, spraying dates and cultivars, spraying bunches with 25ppm CPPU after 21days from pollination gave the highest fruit length/diameter ratio without significant differences for Zaghloul and Samani cvs. fruits (2.02 and 1.70, respectively).

Fruit volume (cm³)

Table (9) showed that, spraying CPPU concentration (75 ppm) produced the highest fruit volume as average two seasons for Zaghloul and Samani cvs. (34.55 and 36.18 cm³, respectively), compared with control (0.0 ppm) which recorded the lowest values (25.83 and 30.27 cm³, respectively).

Using CPPU at 21 days from pollination gave the highest fruit volume (32.73 cm³) as average the two seasons, ascendingly followed by 14 and 7 days from pollination (32.07 and 31.57 cm³, respectively) with significant differences.

Regarding to the interaction between CPPU concentration, spraying dates and cultivars, results declared that, spraying bunches with 75 ppm CPPU after 21 days from pollination gave the highest fruit volume of Zaghloul and Samani cvs. fruits (35.49 and 37.02 cm³, respectively).

Fruit firmness (kg/cm²).

As shown in table (10) that, there were a gradual decrease in fruit firmness for both Zaghloul and Samani cvs. by increasing the concentrations spraying of CPPU from 0.0 to reach the lowest value at 75 ppm (5.43, 5.03, 4.85 and 4.71 kg/cm^2, respectively) for Zaghloul cv. and (6.39, 6.19, 6.14 and 6.05 kg/cm^2, respectively) for Samani cv.

Table 8: Effect of Cytophex in different concentrations on fruit length / diameter ratio of Zaghloul and Samani date palm cultivars after 7, 14 and 21 days from pollination.

Seasons	Date of spraying	Zaghloul cultivar Cytophex concentrations 0.0	25	50	75	Mean	Samani cultivar Cytophex concentrations 0.0	25	50	75	Mean	General mean
2015	7	1.88	1.99	1.97	2.00	1.96	1.59	1.62	1.56	1.60	1.59	1.78
	14	1.88	2.04	1.96	1.89	1.94	1.59	1.59	1.67	1.65	1.63	1.78
	21	1.88	1.97	1.98	1.92	1.94	1.59	1.65	1.64	1.55	1.61	1.77
	Mean	1.88	2.00	1.97	1.94	1.95	1.59	1.62	1.62	1.60	1.61	1.78
2016	7	2.04	2.02	1.96	1.97	2.00	1.66	1.79	1.76	1.73	1.74	1.87
	14	2.04	2.06	1.87	1.91	1.97	1.66	1.63	1.77	1.80	1.72	1.84
	21	2.04	2.06	1.91	1.95	1.99	1.66	1.74	1.74	1.79	1.73	1.86
	Mean	2.04	2.05	1.91	1.94	1.99	1.66	1.72	1.76	1.77	1.73	1.86
Combined	7	1.96	2.01	1.97	1.99	1.98	1.63	1.71	1.66	1.67	1.66	1.82
	14	1.96	2.05	1.92	1.90	1.96	1.63	1.61	1.72	1.73	1.67	1.81
	21	1.96	2.02	1.95	1.94	1.96	1.63	1.70	1.69	1.67	1.67	1.82
	Mean	1.96	2.02	1.94	1.94	1.97	1.63	1.67	1.69	1.69	1.67	1.82

LSD at 0.05 :

Concentration (A): 0.03729	Cultivar (C): 0.02637	A X B X C: 0.09134	B X D: 0.04567
Time of spraying (B): 0.03229	A X C: 0.05273	Season (D): 0.02637	C X D: 0.03729
A X B: 0.06459	B X C: 0.04567	A X D: 0.05273	A X B X C X D: 0.12917

Table 9: Effect of Cytophex in different concentrations on fruit volume (cm^3) of Zaghloul and Samani date palm cultivars after 7, 14 and 21 days from pollination.

Seasons	Date of spraying	Zaghloul cultivar Cytophex concentrations 0.0	25	50	75	Mean	Samani cultivar Cytophex concentrations 0.0	25	50	75	Mean	General mean
2015	7	26.18	32.52	34.89	35.75	32.34	29.19	31.26	32.26	36.40	32.28	32.31
	14	26.18	31.44	35.17	36.41	32.30	29.19	33.28	34.44	36.31	33.31	32.80
	21	26.18	31.78	36.27	37.76	33.00	29.19	33.66	35.54	36.89	33.82	33.41
	Mean	26.18	31.91	35.44	36.64	32.54	29.19	32.73	34.08	36.53	33.13	32.84
2016	7	25.48	27.67	31.32	32.56	29.26	31.34	31.63	32.53	34.19	32.42	30.84
	14	25.48	28.09	30.25	31.60	28.86	31.34	33.34	34.35	36.17	33.80	31.33
	21	25.48	28.67	31.52	33.22	29.72	31.34	34.14	34.88	37.14	34.38	32.05
	Mean	25.48	28.14	31.03	32.46	29.28	31.34	33.04	33.92	35.83	33.53	31.41
Combined	7	25.83	30.10	33.11	34.16	30.80	30.27	31.45	32.40	35.30	32.35	31.57
	14	25.83	29.77	32.71	34.01	30.58	30.27	33.31	34.40	36.24	33.55	32.07
	21	25.83	30.23	33.90	35.49	31.36	30.27	33.90	35.21	37.02	34.10	32.73
	Mean	25.83	30.03	33.24	34.55	30.91	30.27	32.89	34.00	36.18	33.33	32.12

LSD at 0.05 :

Concentration (A): 0.698	Cultivar (C): 0.494	A X B X C: 1.71	B X D: 0.855
Time of spraying (B): 0.605	A X C: 0.987	Season (D): 0.494	C X D: 0.698
A X B: 1.209	B X C: 0.855	A X D: 0.987	A X B X C X D: 2.419

Table 10: Effect of Cytophex in different concentrations on fruit firmness (kg/cm^2) of Zaghloul and Samani date palm cultivars after 7, 14 and 21 days from pollination.

Seasons	Date of spraying	Zaghloul cultivar Cytophex concentrations 0.0	25	50	75	Mean	Samani cultivar Cytophex concentrations 0.0	25	50	75	Mean	General mean
2015	7	5.73	5.17	4.93	4.63	5.12	6.47	6.29	6.18	6.17	6.28	5.70
	14	5.73	5.27	4.97	4.67	5.16	6.47	6.25	6.22	6.20	6.29	5.72
	21	5.73	4.90	4.87	4.63	5.03	6.47	6.15	6.19	6.18	6.25	5.64
	Mean	5.73	5.11	4.92	4.64	5.10	6.47	6.23	6.20	6.18	6.27	5.69
2016	7	5.13	5.00	4.87	4.87	4.97	6.31	6.22	6.20	5.99	6.18	5.57
	14	5.13	4.97	4.73	4.80	4.91	6.31	6.21	6.16	6.03	6.18	5.54
	21	5.13	4.87	4.73	4.63	4.84	6.31	6.00	5.89	5.70	5.98	5.41
	Mean	5.13	4.95	4.78	4.77	4.91	6.31	6.14	6.08	5.91	6.11	5.51
Combined	7	5.43	5.09	4.90	4.75	5.04	6.39	6.26	6.19	6.08	6.23	5.64
	14	5.43	5.12	4.85	4.74	5.03	6.39	6.23	6.19	6.12	6.23	5.63
	21	5.43	4.89	4.80	4.63	4.94	6.39	6.08	6.04	5.94	6.11	5.52
	Mean	5.43	5.03	4.85	4.71	5.00	6.39	6.19	6.14	6.05	6.19	5.60

LSD at 0.05 :

Concentration (A): 0.0672	Cultivar (C): 0.0475	A X B X C: 0.1646	B X D: 0.0823
Time of spraying (B): 0.0582	A X C: 0.095	Season(D): 0.0475	C X D: 0.0672
A X B: 0.1164	B X C: 0.0823	A X D: 0.095	A X B X C X D: 0.2327

Spraying CPPU at 7 days from pollination gave the highest fruit firmness (5.64 kg/cm^2) followed by 14 (5.63 kg/cm^2) without significant differences between them, followed by spraying CPPU at 21 days from pollination (5.52 kg/cm^2) with significant differences among them, as average the two seasons.

Regarding to the interaction between CPPU concentration, spraying dates and cultivars, results stated that, spraying bunches with 75ppm CPPU after 21days from pollination gave the lowest fruit firmness for Zaghloul and Samani cvs. fruits (4.63 and 5.94 kg/cm^2, respectively), compared with control (0.0 ppm) which recorded the highest values (5.43 and 6.39 kg/cm^2, respectively).

Fruit chemical content affected by spraying Cytophex.

All tested chemicals content of Zaghloul and Samani cvs. fruits were significantly affected by spraying cytophex in different concentrations and different spraying dates in both seasons.

Moisture content %

Data in table (11) appeared that, there were a gradual decrease in fruit moisture content for both Zaghloul and Samani cvs. by increasing the concentrations spraying of CPPU from 0.0 to reach the lowest value at 75 ppm (75.91, 69.17, 66.05 and 64.27 %, respectively for Zaghloul cv. and 71.52, 67.21, 65.09 and 63.74 %, respectively for Samani cv.).

Spraying CPPU at 7 days from pollination gave the highest fruit moisture content (69.28 %) followed by 14 and 21 days from pollination (67.61 and 66.72 %, respectively), with significant differences among them, as average the two seasons.

Regarding to the interaction between CPPU concentration, spraying dates and cultivars, results showed that, spraying bunches with 75 ppm CPPU after 21 days from pollination recorded the lowest fruit moisture content for Zaghloul and Samani cvs. (61.79 and 62.62 %, respectively), compared with control (0.0 ppm) which recorded the highest values (75.91 and 71.52 %, respectively).

Table 11: Effect of Cytophex in different concentrations on fruit moisture content percentage of Zaghloul and Samani date palm cultivars after 7, 14 and 21 days from pollination.

Seasons	Date of spraying	Zaghloul cultivar Cytophex concentrations				Mean	Samani cultivar Cytophex concentrations				Mean	General mean
		0.0	25	50	75		0.0	25	50	75		
2015	7	79.19	78.83	72.30	70.04	75.09	71.87	68.03	65.00	64.18	67.27	71.18
	14	79.19	70.61	67.96	65.55	70.83	71.87	67.42	66.00	63.46	67.19	69.01
	21	79.19	69.13	62.98	62.12	68.36	71.87	68.00	66.07	63.89	67.46	67.91
	Mean	79.19	72.86	67.75	65.90	71.42	71.87	67.82	65.69	63.84	67.31	69.36
2016	7	72.63	66.76	65.32	64.11	67.21	71.16	68.12	65.75	65.20	67.56	67.38
	14	72.63	64.83	63.30	62.35	65.78	71.16	66.24	64.80	64.39	66.65	66.21
	21	72.63	64.85	64.42	61.46	65.84	71.16	65.43	62.93	61.34	65.22	65.53
	Mean	72.63	65.48	64.35	62.64	66.27	71.16	66.60	64.49	63.64	66.47	66.37
Combined	7	75.91	72.80	68.81	67.08	71.15	71.52	68.08	65.38	64.69	67.41	69.28
	14	75.91	67.72	65.63	63.95	68.30	71.52	66.83	65.40	63.93	66.92	67.61
	21	75.91	66.99	63.70	61.79	67.10	71.52	66.72	64.50	62.62	66.34	66.72
	Mean	75.91	69.17	66.05	64.27	68.85	71.52	67.21	65.09	63.74	66.89	67.87

LSD at 0.05 :

Concentration (A): 0.98	Cultivar (C): 0.693	A X B X C: 2.401	B X D: 1.2
Time of spraying (B): 0.849	A X C: 1.386	Season (D): 0.693	C X D: 0.98
A X B: 1.698	B X C: 1.2	A X D: 1.386	A X B X C X D: 3.395

Acidity content %

Table (12) declared that, a gradual decrease in fruit acidity content for both Zaghloul and Samani cvs. was noticed by increasing the concentrations spraying of CPPU from 0.0 to reach the lowest value at 75ppm (0.11, 0.10, 0.08 and 0.07%, respectively for Zaghloul cv. and 0.12, 0.07, 0.07 and 0.06%, respectively for Samani cv.).

Spraying CPPU at 21 days from pollination gave the lowest fruit acidity content (0.08 %) compared with spraying CPPU at 7 and 14 days from pollination which gave the same result (0.09%), as average the two seasons.

Table 12: Effect of Cytophex in different concentrations on fruit acidity content percentage of Zaghloul and Samani date palm cultivars after 7, 14 and 21 days from pollination.

Seasons	Date of spraying	Zaghloul cultivar Cytophex concentrations				Mean	Samani cultivar Cytophex concentrations				Mean	General mean
		0.0	25	50	75		0.0	25	50	75		
2015	7	0.12	0.12	0.09	0.09	0.11	0.10	0.08	0.07	0.06	0.08	0.09
	14	0.12	0.10	0.08	0.08	0.10	0.10	0.06	0.06	0.05	0.07	0.08
	21	0.12	0.09	0.07	0.07	0.09	0.10	0.06	0.05	0.05	0.07	0.08
	Mean	0.12	0.10	0.08	0.08	0.10	0.10	0.07	0.06	0.05	0.07	0.08
2016	7	0.10	0.08	0.08	0.07	0.08	0.14	0.09	0.08	0.07	0.10	0.09
	14	0.10	0.09	0.08	0.07	0.09	0.14	0.08	0.08	0.08	0.10	0.09
	21	0.10	0.09	0.06	0.06	0.08	0.14	0.06	0.06	0.06	0.08	0.08
	Mean	0.10	0.09	0.07	0.07	0.08	0.14	0.08	0.07	0.07	0.09	0.09
Combined	7	0.11	0.10	0.09	0.08	0.09	0.12	0.09	0.08	0.07	0.09	0.09
	14	0.11	0.10	0.08	0.08	0.09	0.12	0.07	0.07	0.07	0.08	0.09
	21	0.11	0.09	0.07	0.07	0.08	0.12	0.06	0.06	0.06	0.07	0.08
	Mean	0.11	0.10	0.08	0.07	0.09	0.12	0.07	0.07	0.06	0.08	0.08

LSD at 0.05 :

Concentration (A): 0.00776	Cultivar (C): 0.00549	A X B X C: 0.019	B X D: 0.0095
Time of spraying (B): 0.00672	A X C: 0.01097	Season (D): 0.00549	C X D: 0.00776
A X B: 0.01344	B X C: 0.0095	A X D: 0.01097	A X B X C X D: 0.02688

Total Soluble solids (T.S.S) content %

Results in table (13) showed that, there were a gradual increase in fruit T.S.S content as average the two seasons for both Zaghloul and Samani cvs. by increasing the concentrations spraying of CPPU from 0.0 (26.96 & 26.91 %) to reach the highest value at 75 ppm (37.05 & 38.16 %) for Zaghloul & Samani cvs., respectively, with significant differences.

Spraying CPPU at 21 days from pollination gave the highest fruit T.S.S content as average the two seasons (34.68 %) followed by 14 and 7 days from pollination (33.13 and 32.35 %, respectively), with significant differences.

Regarding to the interaction between CPPU concentration, spraying dates and cultivars, results showed that, spraying bunches with 75ppm CPPU after 21days from pollination recorded the highest fruit T.S.S content for Zaghloul and Samani cvs. (39.45 and 39.00 %, respectively).

Table 13: Effect of Cytophex in different concentrations on fruit T.S.S content percentage of Zaghloul and Samani date palm cultivars after 7, 14 and 21 days from pollination.

Seasons	Date of spraying	Zaghloul cultivar Cytophex concentrations				Mean	Samani cultivar Cytophex concentrations				Mean	General mean
		0.0	25	50	75		0.0	25	50	75		
2015	7	25.09	30.53	32.49	36.36	31.12	26.70	32.09	36.02	36.85	32.92	32.02
	14	25.09	31.54	32.53	37.54	31.68	26.70	35.44	36.98	37.98	34.28	32.96
	21	25.09	34.28	36.13	38.85	33.59	26.70	36.59	37.73	38.77	34.95	34.27
	Mean	25.09	32.12	33.72	37.58	32.13	26.70	34.71	36.91	37.87	34.05	33.09
2016	7	28.28	31.44	33.49	34.75	31.99	27.12	32.03	36.88	37.49	33.38	32.69
	14	28.28	31.44	33.49	34.75	31.99	27.12	34.75	37.67	38.65	34.55	33.27
	21	28.28	34.47	37.63	40.04	35.11	27.12	34.83	39.06	39.22	35.06	35.08
	Mean	28.28	32.45	34.87	36.51	33.03	27.12	33.87	37.87	38.45	34.33	33.68
Combined	7	26.69	30.99	32.99	35.56	31.55	26.91	32.06	36.45	37.17	33.15	32.35
	14	26.69	31.49	33.01	36.15	31.83	26.91	35.10	37.33	38.32	34.42	33.13
	21	26.69	34.38	36.88	39.45	34.35	26.91	35.71	38.40	39.00	35.01	34.68
	Mean	26.69	32.28	34.29	37.05	32.58	26.91	34.29	37.39	38.16	34.19	33.38

LSD at 0.05 :

Concentration (A): 0.777	Cultivar (C): 0.55	A X B X C: 1.904	B X D: 0.952
Time of spraying (B): 0.673	A X C: 1.099	Season (D): 0.55	C X D: 0.777
A X B: 1.347	B X C: 0.952	A X D: 1.099	A X B X C X D: 2.693

Total Soluble sugars content %

Data in table (14) revealed that, there were a gradual increase in fruit total sugars as average the two seasons for both Zaghloul and Samani cvs. by increasing the spraying of CPPU in concentrations from 0.0 (25.54 & 32.30%) to reach the highest value at 75ppm (38.95 & 42.37 %) for Zaghloul & Samani cvs., respectively, with significant differences.

Spraying CPPU at 21days from pollination gave the highest fruit total sugars content as average the two seasons (37.48%) followed by 14 and 7days from pollination (36.61 and 35.09 %, respectively), with significant differences.

Concerning the interaction between CPPU concentration, spraying dates and cultivars, results showed that, spraying bunches with 75ppm CPPU after 21days from pollination recorded the highest fruit total soluble sugars content for Zaghloul and Samani cvs. (39.30 and 43.87%, respectively).

Table 14: Effect of Cytophex in different concentrations on fruit total soluble sugars content percentage of Zaghloul and Samani date palm cultivars after 7, 14 and 21 days from pollination.

Seasons	Date of spraying	Zaghloul cultivar Cytophex concentrations				Mean	Samani cultivar Cytophex concentrations				Mean	General mean
		0.0	25	50	75		0.0	25	50	75		
2015	7	26.21	32.71	35.37	39.05	33.34	31.12	34.57	37.59	40.36	35.91	34.63
	14	26.21	36.20	37.12	39.44	34.75	31.12	37.66	38.80	42.28	37.47	36.11
	21	26.21	36.78	37.70	39.42	35.03	31.12	41.13	41.45	44.10	39.45	37.24
	Mean	**26.21**	**35.23**	**36.73**	**39.31**	**34.37**	**31.12**	**37.79**	**39.28**	**42.25**	**37.61**	**35.99**
2016	7	24.86	33.50	34.03	38.18	32.65	33.48	39.26	39.45	41.45	38.41	35.53
	14	24.86	37.14	38.67	38.39	34.77	33.48	40.35	41.52	42.38	39.44	37.11
	21	24.86	38.07	38.22	39.18	35.09	33.48	41.15	42.98	43.64	40.32	37.71
	Mean	**24.86**	**36.24**	**36.98**	**38.59**	**34.17**	**33.48**	**40.26**	**41.32**	**42.49**	**39.39**	**36.78**
Combined	7	25.54	33.11	34.70	38.62	33.00	32.30	36.92	38.52	40.91	37.17	35.09
	14	25.54	36.67	37.90	38.92	34.76	32.30	39.01	40.16	42.33	38.45	36.61
	21	25.54	37.43	37.96	39.30	35.06	32.30	41.14	42.22	43.87	39.89	37.48
	Mean	**25.54**	**35.74**	**36.86**	**38.95**	**34.28**	**32.30**	**39.03**	**40.30**	**42.37**	**38.50**	**36.39**

LSD at 0.05 :

Concentration (A): 0.633	Cultivar (C): 0.447	A X B X C: 1.55	B X D: 0.775
Time of spraying (B): 0.548	A X C: 0.895	Season (D): 0.447	C X D: 0.633
A X B: 1.096	B X C: 0.775	A X D: 0.895	A X B X C X D: 2.192

Reducing sugars content %

Table (15) cleared that, a gradual increase in fruit reducing sugars as average the two seasons for both Zaghloul and Samani cvs. was appeared by increasing the spraying of CPPU in concentrations from 0.0 to reach the highest value at 75 ppm (6.18 & 7.69 %) for Zaghloul & Samani cvs., respectively, with significant differences.

Spraying CPPU at 21days from pollination gave the highest fruit reducing sugars content as average the two seasons (6.41%), with significant differences.

Concerning the interaction between CPPU concentration, spraying dates and cultivars, results showed that, spraying bunches with 75ppm CPPU after 21days from pollination recorded the highest fruit reducing sugars content for Zaghloul and Samani cvs. (6.52 and 8.08%, respectively).

Table 15: Effect of Cytophex in different concentrations on fruit reducing sugars content pecentage of Zaghloul and Samani date palm cultivars after 7, 14 and 21 days from pollination.

Seasons	Date of spraying	Zaghloul cultivar Cytophex concentrations				Mean	Samani cultivar Cytophex concentrations				Mean	General mean
		0.0	25	50	75		0.0	25	50	75		
2015	7	3.97	4.64	4.93	5.40	4.74	4.32	5.72	6.51	6.70	5.81	5.27
	14	3.97	5.30	5.78	6.08	5.28	4.32	5.83	6.51	6.96	5.91	5.59
	21	3.97	5.97	6.29	6.47	5.68	4.32	6.05	7.03	7.72	6.28	5.98
	Mean	3.97	5.30	5.67	5.98	5.23	4.32	5.87	6.68	7.13	6.00	5.62
2016	7	5.25	5.57	6.10	6.26	5.80	6.15	6.61	7.88	8.07	7.18	6.49
	14	5.25	6.33	6.21	6.30	6.02	6.15	6.73	7.79	8.26	7.23	6.63
	21	5.25	6.38	6.34	6.56	6.13	6.15	7.25	8.39	8.44	7.56	6.85
	Mean	5.25	6.09	6.22	6.37	5.98	6.15	6.86	8.02	8.26	7.32	6.65
Combined	7	4.61	5.11	5.52	5.83	5.27	5.24	6.17	7.20	7.39	6.50	5.88
	14	4.61	5.82	6.00	6.19	5.65	5.24	6.28	7.15	7.61	6.57	6.11
	21	4.61	6.18	6.32	6.52	5.90	5.24	6.65	7.71	8.08	6.92	6.41
	Mean	4.61	5.70	5.94	6.18	5.61	5.24	6.37	7.35	7.69	6.66	6.13

LSD at 0.05 :

Concentration (A): 0.4853	Cultivar (C): 0.3431	A X B X C: 1.1887	B X D: 0.5943
Time of spraying (B): 0.4203	A X C: 0.6863	Season (D): 0.3431	C X D: 0.4853
A X B: 0.8405	B X C: 0.5943	A X D: 0.6863	A X B X C X D: 1.681

Non-reducing sugars content %

Table (16) appeared that, a gradual increase in fruit non-reducing sugars as average the two seasons for both Zaghloul and Samani cvs. happened when used CPPU concentrations increased from 0.0 (20.88 & 23.54%) to reach the highest value at 75ppm (32.77 & 34.68 %) for Zaghloul & Samani cvs., respectively, with significant differences.

Spraying CPPU at 14 days from pollination gave the highest fruit non-reducing sugars content as average the two seasons (29.99%).

Concerning the interaction between CPPU concentration, spraying dates and cultivars, results showed that, spraying bunches with 75ppm CPPU after 21days from pollination recorded the highest fruit non-reducing sugars content for Zaghloul and Samani cvs. (32.79 and 35.79%, respectively).

Table 16: Effect of Cytophex in different concentrations on fruit non-reducing sugars content percentage of Zaghloul and Samani date palm cultivars after 7, 14 and 21 days from pollination.

Seasons	Date of spraying	Zaghloul cultivar Cytophex concentrations				Mean	Samani cultivar Cytophex concentrations				Mean	General mean
		0.0	25	50	75		0.0	25	50	75		
2015	7	22.24	28.07	30.44	33.65	28.60	26.80	28.85	31.08	33.65	30.10	29.35
	14	22.24	30.89	30.38	33.36	29.22	26.80	31.84	32.29	35.33	31.57	30.39
	21	22.24	30.81	31.41	32.95	29.35	26.80	35.07	34.42	36.38	33.17	31.26
	Mean	22.24	29.92	30.74	33.32	29.06	26.80	31.92	32.60	35.12	31.61	30.33
2016	7	19.51	27.94	27.93	31.92	26.83	27.33	32.65	31.57	33.39	31.24	29.03
	14	19.51	30.81	32.46	32.09	28.72	27.33	33.62	33.73	34.11	32.20	30.46
	21	19.51	31.69	31.88	32.62	28.93	27.33	34.90	34.58	35.19	20.79	24.86
	Mean	19.51	30.15	30.76	32.21	28.16	20.27	24.51	33.29	34.23	28.08	28.12
Combined	7	20.88	28.01	29.19	32.79	27.71	23.54	30.75	31.33	33.52	29.79	28.75
	14	20.88	30.85	31.42	32.73	28.97	23.54	32.73	33.01	34.72	31.00	29.99
	21	20.88	31.25	31.65	32.79	29.14	23.54	21.16	34.50	35.79	28.75	28.95
	Mean	20.88	30.04	30.75	32.77	28.61	23.54	28.21	32.95	34.68	29.85	29.23

LSD at 0.05 :

Concentration (A): 0.825	Cultivar (C): 0.583	A X B X C: 2.021	B X D: 1.01
Time of spraying (B): 0.714	A X C: 1.167	Season (D): 0.583	C X D: 0.825
A X B: 1.429	B X C: 1.01	A X D: 1.167	A X B X C X D: 2.857

Chlorophyll A & B content (mg /100 g f. w.)

Tables (17&18) cleared that, there were a gradual decrease in fruit content of both Chlorophyll A & B as average the two seasons for both Zaghloul and Samani cvs. by increasing the spraying of CPPU in concentrations from 0.0 to reach the lowest value at 75 ppm (0.41 & 0.24 mg/100g/f.w.) for Chlorophyll A and (0.49 & 0.48 mg/100g/f.w.) for Chlorophyll B, respectively, for Zaghloul & Samani cvs., with significant differences.

Table 17: Effect of Cytophex in different concentrations on fruit chlorophyll "A" content (mg /100 g f. w.) of Zaghloul and Samani date palm cultivars after 7, 14 and 21 days from pollination.

Seasons	Date of spraying	Zaghloul cultivar Cytophex concentrations				Mean	Samani cultivar Cytophex concentrations				Mean	General mean
		0.0	25	50	75		0.0	25	50	75		
2015	7	0.75	0.65	0.55	0.50	0.61	0.53	0.36	0.30	0.28	0.37	0.49
	14	0.75	0.55	0.49	0.49	0.57	0.53	0.34	0.28	0.24	0.35	0.46
	21	0.75	0.48	0.44	0.39	0.52	0.53	0.34	0.26	0.23	0.34	0.43
	Mean	0.75	0.56	0.49	0.46	0.57	0.53	0.35	0.28	0.25	0.35	0.46
2016	7	0.46	0.53	0.43	0.44	0.47	0.57	0.31	0.25	0.23	0.34	0.41
	14	0.46	0.49	0.37	0.34	0.42	0.57	0.29	0.25	0.22	0.33	0.38
	21	0.46	0.47	0.37	0.31	0.40	0.57	0.27	0.23	0.21	0.32	0.36
	Mean	0.46	0.50	0.39	0.36	0.43	0.57	0.29	0.24	0.22	0.33	0.38
Combined	7	0.60	0.59	0.49	0.47	0.54	0.55	0.34	0.28	0.26	0.35	0.45
	14	0.60	0.52	0.43	0.42	0.49	0.55	0.32	0.27	0.23	0.34	0.42
	21	0.60	0.48	0.41	0.35	0.46	0.55	0.31	0.25	0.22	0.33	0.40
	Mean	0.60	0.53	0.44	0.41	0.50	0.55	0.32	0.26	0.24	0.34	0.42

LSD at 0.05 :

Concentration (A): 0.0242	Cultivar (C): 0.01711	A X B X C: 0.05927	B X D: 0.02963
Time of spraying (B): 0.02095	A X C: 0.03422	Season (D): 0.01711	C X D: 0.0242
A X B: 0.04191	B X C: 0.02963	A X D: 0.03422	A X B X C X D: 0.08381

Table 18: Effect of Cytophex in different concentrations on fruit chlorophyll "B" content (mg /100 g f. w.) of Zaghloul and Samani date palm cultivars after 7, 14 and 21 days from pollination.

Seasons	Date of spraying	Zaghloul cultivar Cytophex concentrations					Samani cultivar Cytophex concentrations					General mean
		0.0	25	50	75	Mean	0.0	25	50	75	Mean	
2015	7	0.72	0.65	0.63	0.57	0.64	1.08	0.73	0.65	0.58	0.76	0.70
	14	0.72	0.64	0.60	0.51	0.62	1.08	0.70	0.59	0.51	0.72	0.67
	21	0.72	0.63	0.54	0.47	0.59	1.08	0.61	0.62	0.37	0.67	0.63
	Mean	0.72	0.64	0.59	0.52	0.62	1.08	0.68	0.62	0.49	0.72	0.67
2016	7	0.72	0.67	0.56	0.51	0.62	1.15	0.73	0.61	0.57	0.77	0.69
	14	0.72	0.62	0.51	0.45	0.58	1.15	0.65	0.52	0.48	0.70	0.64
	21	0.72	0.50	0.49	0.41	0.53	1.15	0.48	0.42	0.35	0.60	0.57
	Mean	0.72	0.60	0.52	0.46	0.57	1.15	0.62	0.52	0.47	0.69	0.63
Combined	7	0.72	0.66	0.60	0.54	0.63	1.12	0.73	0.63	0.58	0.76	0.70
	14	0.72	0.63	0.56	0.48	0.60	1.12	0.68	0.56	0.50	0.71	0.65
	21	0.72	0.57	0.52	0.44	0.56	1.12	0.55	0.52	0.36	0.64	0.60
	Mean	0.72	0.62	0.56	0.49	0.60	1.12	0.65	0.57	0.48	0.70	0.65

LSD at 0.05 :

Concentration (A): 0.0203	Cultivar (C): 0.01435	A X B X C: 0.04973	B X D: 0.02486
Time of spraying (B): 0.01758	A X C: 0.02871	Season (D): 0.01435	C X D: 0.0203
A X B: 0.03516	B X C: 0.02486	A X D: 0.02871	A X B X C X D: 0.07032

Spraying CPPU at 21days from pollination gave the lowest fruit Chlorophyll A & B content as average the two seasons (0.40 and 0.60 mg/100g/f.w.), compared with spraying CPPU at 7days (0.45 and 0.49 mg/100g/f.w.) and 14 days (0.42 and 0.48 mg/100g/f.w.), as average the two seasons, with significant differences.

Concerning the interaction between CPPU concentration, spraying dates and cultivars, results showed that, spraying bunches with 75ppm CPPU after 21days from pollination recorded the lowest fruit Chlorophyll A&B content (0.35 and 0.44 mg/100g/f.w., respectively) for Zaghloul cv. and (0.22 and 0.36 mg/100g/f.w., respectively) for Samani cv.

Indol content (mg/100g d.wt.)

Data in table (19) showed that, a gradual decrease in fruit Indol as average the two seasons for both Zaghloul and Samani cvs. was noticed by increasing concentrations of spraying CPPU from 0.0 (2.22 & 3.90 mg/100g d.wt.**)** to reach the lowest value at 75 ppm (1.67 & 3.04 mg/100g d.wt.**)** for Zaghloul & Samani cvs., respectively, with significant differences.

Spraying CPPU at 7 days from pollination gave the highest fruit Indol content as average the two seasons (2.83 mg/100g d.wt.**)** followed by 14days from pollination (2.66 mg/100g d.wt.**)**, while, Spraying CPPU at 21 days from pollination gave the lowest fruit Indol content (2.48 mg/100g d.wt.**)**, with significant differences.

Concerning the interaction between CPPU concentration, spraying dates and cultivars, results showed that, spraying bunches with 75ppm CPPU after 21days from pollination recorded the lowest fruit Indol for Zaghloul and Samani cvs. (1.53 and 2.64 mg/100g d.wt., respectively), compared with control treatment (0.0) which recorded the highest values (2.22 and 3.90 mg/100g d.wt., respectively).

Fruit content of Anthocyanin (Zaghloul cv.) and Carotene (Samani cv.) (mg /100 g fresh weight)

Data in table (20) declared that, a gradual increase in both pigments as average the two seasons was happened by increasing concentrations of spraying CPPU from 0.0 to reach the highest value at 75ppm (0.36 & 0.48 mg/100g f.w.) for Anthocyanin and Carotene, respectively, with significant differences.

Spraying CPPU at 21 days from pollination gave the highest fruit content of both pigments (Anthocyanin and Carotene), as average the two seasons (0.44 mg/100g f.w.), with significant differences.

Concerning the interaction between CPPU concentrations, spraying dates for both Zaghloul and Samani cvs., results showed that, spraying bunches with 75ppm CPPU after 21days from pollination recorded the highest fruit content of both pigments (Anthocyanin and Carotene) for both cultivars (0.39 and 0.51 mg/100g f.w., respectively), compared with control treatment (0.0) which recorded the lowest values (0.29 and 0.36 mg/100g f.w., respectively).

Table 19: Effect of Cytophex in different concentrations on fruit Indol content of Zaghloul and Samani date palm cultivars after 7, 14 and 21 days from pollination (mg/100g d.wt.).

Seasons	Date of spraying	Zaghloul cultivar Cytophex concentrations				Mean	Samani cultivar Cytophex concentrations				Mean	General mean
		0.0	25	50	75		0.0	25	50	75		
2015	7	2.21	1.93	1.83	1.79	1.94	3.99	3.91	3.89	3.29	3.77	2.86
	14	2.21	1.91	1.78	1.63	1.88	3.99	3.23	3.14	3.07	3.36	2.62
	21	2.21	1.79	1.62	1.50	1.78	3.99	3.00	2.92	2.48	3.10	2.44
	Mean	2.21	1.88	1.74	1.64	1.87	3.99	3.38	3.32	2.95	3.41	2.64
2016	7	2.23	2.17	1.85	1.83	2.02	3.80	3.58	3.51	3.47	3.59	2.81
	14	2.23	1.99	1.82	1.72	1.94	3.80	3.50	3.42	3.14	3.47	2.70
	21	2.23	1.85	1.76	1.56	1.85	3.80	3.41	2.78	2.80	3.20	2.52
	Mean	2.23	2.00	1.81	1.70	1.94	3.80	3.50	3.24	3.14	3.42	2.68
Combined	7	2.22	2.05	1.84	1.81	1.98	3.90	3.75	3.70	3.38	3.68	2.83
	14	2.22	1.95	1.80	1.68	1.91	3.90	3.37	3.28	3.11	3.41	2.66
	21	2.22	1.82	1.69	1.53	1.82	3.90	3.21	2.85	2.64	3.15	2.48
	Mean	2.22	1.94	1.78	1.67	1.90	3.90	3.44	3.28	3.04	3.41	2.66

LSD at 0.05:

Concentration (A): 0.1939	Cultivar (C): 0.1371	A X B X C: 0.4749	B X D: 0.2374
Time of spraying (B): 0.1679	A X C: 0.2742	Season (D): 0.1371	C X D: 0.1939
A X B: 0.3358	B X C: 0.2374	A X D: 0.2742	A X B X C X D: 0.6716

Table 20: Effect of Cytophex in different concentrations on fruit anthocyanin content of Zaghloul and fruit carotene content of Samani date palm cultivars after 7, 14 and 21 days from pollination.

Seasons	Date of spraying	Fruit anthocyanin content of Zaghloul cv. (mg /100 g fresh weight) Cytophex concentrations				Mean	Fruit carotene content of Samani cv. (mg /100 g fresh weight) Cytophex concentrations				Mean
		0.0	25	50	75		0.0	25	50	75	
2015	7	0.30	0.31	0.33	0.35	0.32	0.37	0.41	0.43	0.47	0.42
	14	0.30	0.30	0.31	0.34	0.31	0.37	0.38	0.43	0.48	0.42
	21	0.30	0.34	0.35	0.38	0.34	0.37	0.43	0.46	0.52	0.45
	Mean	0.30	0.32	0.33	0.36	0.33	0.37	0.41	0.44	0.49	0.43
2016	7	0.28	0.30	0.32	0.34	0.31	0.35	0.39	0.41	0.45	0.40
	14	0.28	0.33	0.34	0.35	0.33	0.35	0.39	0.42	0.46	0.41
	21	0.28	0.35	0.36	0.40	0.35	0.35	0.41	0.46	0.50	0.43
	Mean	0.28	0.33	0.34	0.36	0.33	0.35	0.40	0.43	0.47	0.41
Combined	7	0.29	0.31	0.33	0.35	0.32	0.36	0.40	0.42	0.46	0.41
	14	0.29	0.32	0.33	0.35	0.32	0.36	0.39	0.43	0.47	0.41
	21	0.29	0.35	0.36	0.39	0.35	0.36	0.42	0.46	0.51	0.44
	Mean	0.29	0.32	0.34	0.36	0.33	0.36	0.40	0.44	0.48	0.42

LSD at 0.05 :

Concentration (A): 0.0252	Season (C): 0.01782	A X B XC: 0.06173
Time of spraying (B): 0.02182	A X C: 0.0356	
A X B: 0.044	B X C: 0.031	

Discussion

The present investigation aimed to study the efficient of enhancing fruit quality of two date palm cultivars using Cytophex in various concentrations at different dates depending on the many researches, which approved that, plant growth regulators play an important role in regulating fruit growth and development. Some of these substances were used in controlling ripening date (delayed ripening) as well as improving the fruit quality (Kassem *et al*., 2011). In this respect, CPPU considered as plant growth regulator, which exhibits cytokinin-like properties when applied to plants, has significant physiological activity on many fruits. The primary physiological effects of CPPU involve the regulation of fruit set, fruit growth and development. CPPU can be used without any health or environmental hazards (Nickell, 1985, Dokoozlian *et al.,* 1994, Abdul *et al.,* 1998 and Sourial *et al.,* 2004). The effectiveness of growth regulators was associated with methods of applications, the type of desired response, the developmental stage of the plant at time of application and other variables (Nickell, 1985 and Ogata *et al*., 1988).

Our results are in agreement with the finding of many researchers who working on various fruit trees, Concerning fruit set and yield, Tahany (2008), El Kosary (2009) and El-Salhy *et al.,* (2016) reported that, the date palm fruit set and fruit retention percentage were significantly decreased due to spray CPPU compared to unsprayed one (control). In addition, using CPPU caused an increase in the

average date palm bunch weight; meanwhile, increasing the concentrations of CPPU caused a decrease in bunch weight. The finding of Greene (2001) who used CPPU with apple in the same line, also, when Abdel-Fattah *et al.*, (2010) sprayed grape with CPPU at full bloom, he had the highest grape cluster traits. The obtained results of our study agree with the opinion of El-Salhy *et al.* (2016), who suggested that such treatment are very important target than total yield due to the improving of physical fruit traits induce an increase in packable yield.

The obtained results of the present investigation in the same line with the results of numerous investigations which reported that, spraying CPPU alone or combination with other substances had positive influences in palm yield and improved the fruit quality of date palm. In this concern, Mougheith and Hassaballa, (1979), El-Nabawy *et al.* (1981), Abou-Aziz *et al*., (1982), Asif *et al*. (1985), Galal (1991), Soliman (2007), Al-Obeed (2010), Kassem *et al*. (2011), Ghazzawy (2013), Merwad *et al.* (2015) and El-Salhy *et al.* (2016) concluded from their studies on different date palm cultivars that, spraying bunches with CPPU as well as GA_3 were increased bunch weight and yield/palm as well as improving the physical and chemical properties of date fruit.

On the other hand, our results are in agreement with the finding of many researchers who working on different fruit trees, where, Ismail *et al.,* (2014) studied the effect of treating peaches with CPPU and they found that, CPPU treatments significantly increased yield increment percentage and improved the most fruit physical characteristics, i.e., fruit weight, size, dimensions, and firmness as well as the chemical fruit characteristics, i.e., T.S.S%, total acidity% and total sugar%, compared with the control. Also, Stino *et al,* (2010) studied the effect of treating peaches with CPPU and they stated that, the usage of CPPU successfully enhanced the yield and the majority of fruit characteristics. In addition, the finding of Strydom (2013) who studied the effect of treating grapes with CPPU, stated that, CPPU could be included in combination with GA_3, as part of a berry enlargement programee for 3 grapes verities.

Conclusion

From the obtained results, we can conclude that, spraying Cytophex in different concentrations and different spraying dates significantly affected on fruit set percentages, fruit physical and chemical properties of Zaghloul and Samani cvs. in both investigated seasons, and the best treatment was spraying CPPU in concentration 75ppm after 21 days from pollination which significantly enhanced fruit quality.

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