A Comparative Study on Response of Samany Date Palms to Manual Removal, Ethephon and Naphthalene Acetic Acid as Fruit Thinning Practices

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ABSTRACT

This investigation was carried out during 2009, 2010 and 2011 seasons on Samany date palms grown in El-Boseely orchard, El-Behira Governorate, Agric. Research Center, Egypt to compare among seven different treatments of fruit thinning in veiw of their effect on alternate bearing problem and fruit quality. The seven treatments were: control (unthinning), manual removal of 15% & 25% of entire strands from the bunch center, ethephon at 250 & 500 ppm and NAA at 30 & 40 ppm. The seven thinning treatments were preformed just after fruit set. The experimental palms were treated during on-year and left without treatments during off-year to study the effect of such treatments on alternate bearing phenomen in terms of number of spathes/palm and yield/palm. However, fruit quality traits were studied during on-year.

The obtained results showed that all thinning treatments significantly decreased yield/ palm during on-year "the year of treated palm", whereas, during the second year (off-year or the year of untreated palms), all fruit thinning treatments significantly increased number of spathes/palm as well as yield/palm. Ethephon at 500 ppm was the most effective thinning treatment in increasing and regulating palm productivity. All fruit thinning treatments also improved physical and chemical properties of Samany date palm fruits. Treatment of Ethephon at 500 ppm was the most effective in improving fruit length, weight, flesh weight, TSS%, acidity, total & reducing sugars and soluble tannins. While, the treatment of manual thinning at 25% significantly improved fruit diameter and carotene of fruit peel as compared with other treatments and control.

Therefore, under the condition of this study and resembling conditions, spraying bunches by ethephon at 500 ppm, four weeks after pollination in (on-year) consedered a good recommendation for fruit thinning of Samany date palms in order to obtain regular bearing with best fruit quality.

Keywords: Samany date palms, Fruit thinning, Ethephon, NAA.

INTRODUCTION

Samany date palms cultivar is a popular and prime cv. . Its palm has a strong growth and has bearing high yield in "on-years". In Samany orchards such as in Idko and Rasheed (the concentrated areas of Samany plantation, El-Behira Governorate, Egypt), the palms are suffering violently from alternate bearing. Where, their fruit yield records in some years over 250 - 300 kg/palm. The high fruit setting cleary observed in Samany palms is considered to be the main reason in producing a lot of small size fruits with poor quality that are unmarketable or are sold only at a reduced price. In addition, such heavy crops of Samany palms are destructive to the health of trees.

Fruit thinning is one of the most important cultural practices which help avercoming alerternate bearing (Hussein *et al.*, 1979; El-Hammady *et al.*, 1983; El-Shazly, 1999 and Amin *et al.*, 2007). Thus fruit thinning done in on-year stimulates floral initiation in the next year (off-year) which leads to increase yield (Abd El-Mgeed, 2007 and Abd El-Kader *et al.*, 2008). Fruit thinning also forms uncompact banches, so it reduces fruit diseases, increases yield, fruit size, improves colour and chemical constituents of fruits (Hussein *et al.*, 1976; Sharples, 1968; El-Kassas, 1986; Al-Ghamdi *et al.*, 1993; Al-Mughrabi *et al.*, 1993; El-Hammady *et al.*, 2002; Al-Obeed *et al.*, 2003; Aboutalebi & Behroznam, 2006 and Abo-Rawash & Mustafa, 2007).

Fruit thinning could be achieved either by hand or chemically (El-Kassas, 1983). Hand thinning procedures are different from cultivar to anthor according to the shape and compctness of bunch and the weather conditions. It can be done by removal of bunches or strands or by shortening of strands (Westwood, 1978; Abdulla *et al.*, 1983; Hassaballa *et al.*, 1983; Khalifa *et al.*, 1987; Mustafa, 1993; El-Kassas *et al.*, 1995; El-Makhtoun *et al.*, 1995; Ali-Dinar *et al.*, 2002; Ashour, 2003 and Abdalla *et al.*, 2009).

In view of chemical fruit thinning, it has less costs and saving labour and time. In addition, the investigations indicated that many advances could achieved for improving yield and fruit quality by use of certain growth regulators for thinning date fruits such as ethephon and NAA (El-Nabawy *et al.*,

1977; Khalifa *et al.*, 1984; Hussein *et al.*, 1993 a&b; Bassal & El-Deeb, 2002; Al-Juburi & El-Masry, 2003; Tavakkoli *et al.*, 2006 and Bakr *et al.*, 2007).

Rare reports were found in the literature concerning the effect of thinning methods on Samany date palm which consedered the most suffering cultivar from surplus bearing problems.

Therefore, the main aim of the present study is to compare among some fruit thinning methods, i.e., hand thinning, ethephon and naphthalene acetic acid in view of their effect on alternate bearing and fruit quality of Samany date palms.

MATERIALS AND METHODS

This study was carried out during 2009, 2010 and 2011 seasons on Samany date palms (26 years old) grown at El-Boseely orchard-Agric. Research Center (Rasheed region, El-Behira Governorate). The experimental soil was analyzed at the beginning of study and the data are presented in Table (1). In this study, twenty eight female palms in their on-year were carefully selected and leaf/bunch ratio 10: 1 was imposed (Hassan, 1993) and ten spathes were retained per palm (El-Hammady *et al.*, 1983). All palms received the normal agricultural practices. They were pollinated by the same source of pollen grains at 4 days after spathe cracking during the mid of April in both seasons.

The selected palms were divided into seven treatments as follow:-

1- Unthinned palms (control).
2- Hand thinning by removing 15% of entire strands from the bunch center.
3- Hand thinning by removing 25% of entire strands from the bunch center.
4- Spraying bunches by ethephon at 250 ppm.
5- Spraying bunches by ethephon at 500 ppm.
6- Spraying bunches by naphthalene acetic acid at 30 ppm.
7- Spraying bunches by naphthalene acetic acid at 40 ppm.

The experimental treatments were arranged in a complete randomized block design with four replicates, one palm each i.e. 7 treatments × 4 replicates (palms) = 28 experimental palms.

All treatments started just after fruit set (four weeks after pollination). Other similar twenty eight palms (also, in their on-year) were subjected to the same seven treatments in the second season, to examine the effects of treatments on alternate bearing habit in terms of number of bunches per palm and yield per palm of these palms during the following year (off-year or untreating season, El-Hammady *et al.*, 1983).

For determination the effect of such treatments on fruit quality, sample of a hundred fruits was randomaly harvested from each treated palm (on- year palms) at maturity in the first of October in both seasons and the following characteristics were studied:-

1- Fruit physical properties, i.e., fruit weight, flesh weight, seed weight, fruit diameter and fruit length.
2- Fruit chemical constituents including total soluble solids (TSS), total acidity and total & reducing sugars which were determined according to the standard method outlined in A.O.A.C. (1995). In addition, total carotene of fruit peel was determined according to Roysell *et al.* (1978) and total soluble tannins of fruit pulp were determined according to Swain and Hillis (1959).

To evaluate the general effects of tested thinning treatments on alternate bearing and fruit quality, hundred units were shared between the following ten main characteristics, i.e., number of bunches/palm, yield/palm, fruit diameter, length & weight and flesh weight, as well as, total soluble solids (TSS), total carotene, total sugars and soluble tannins (10 units for each). Within each of these parameters, the treatment that recorded the upper most values received all the units specified for it, except within, soluble tannins whereas the treatment which recorded the lower most value received all the specified units for it. Relative values due to the other tested treatments were calculated according to Al-Wasfy & El-Khawaga (2008) and Moustafa & Abdel-Aal (2009) using the following equation :-

$$\text{Character} = \sum \frac{B}{A} \times 10$$

Whereas: A= the highest value recorded for studied character among all treatments.

B= value recorded for the specific character for considered treatment.

The obtained data were statistically analysed according to Mead *et al.* (1993) using L.S.D. test at 5% to define the significance of the differences among various treatments.

RESULTS AND DISCUSSION

I- Alternate bearing habit :-

a- Number of spathes per palm.

Data concering the effect of different fruit thinning methods on number of spathes per palm are illustrated in Tables (2&3). It is quite clear that in the years of fruit thinning treatments, there were 10 spathes left on each palm. Then, in the following years when all tested palms left without further fruit thinning treatments, the number of spathes/ palm values approach to that of the proceeded year for most treatments. However, the number of spathes/palm of control was sharply reduced in the following years than that similar in the previous year.

Table 1: Physical and chemical analysis of the soil at the experimental site.

Soil depth (cm)	EC dS/m	PH	Soluble cations and anions (meq/L.)							Particle-size distribution (%)			Texture class
			Ca^{2+}	Mg^{2+}	K^{+}	Na^{+}	HCO_3^-	Cl^-	SO_4^{2-}	Sand	Silt	Clay	
0-30	2.86	8.2	3.45	2.24	0.09	10.61	5.09	3.61	7.40	51.6	28.4	20.0	Sandy
30-60	2.23	8.2	3.47	2.49	0.07	12.24	5.71	4.30	8.25	46.7	27.6	25.7	Sandy
60-90	2.14	7.9	2.81	2.33	0.06	12.29	6.03	3.59	7.86	47.5	31.2	21.3	Sandy

b- Yield per palm.

Data regarding the effect of different fruit thinning methods on yield per palm are mentioned in Tables (4&5). It was apparent that palms treated with different fruit thinning methods produced nearly regular crop for both treating and untreating years. While the yield/palm in untreated palms of control showed severe crop reduction during the following year than that of the previous season.

In the meantime, the obtained results in Tables (2,3,4&5) indicated that treatment no.5 (ethephon at 500 ppm) significantly produced the highest number of spathes/palm and yield/palm than those of other treatments, followed by treatment no.3 (hand thinning 25%). On the other hand, control treatment produced the lowest number of spathes/palm and yield/palm.

Hence, ethephon application at 500 ppm directly after fruit set was significantly effective in reducing the alternate bearing habit and producing regular yield of Samany date palms.

The vital importance of fruit thinning in order to overcome the alternate bearing may be due to saving food material (carbohydrates) in (on-year) to help in flowering formation in the following year (off-year) by better supply of the reserved carbohydrates. Mustafa and Abdel-Aal (2009) reported that the positive effect of fruit thinning to balance and improve the tree food material surely reflected on increasing the floral bud formation, consequently improved the fruits number and yield/treated tree. These results were in accordance with those obtained by Hussein *et al.* (1979); Abdula *et al.* (1993); El-Kassas *et al.* (1995); El-Shazly (1999) and Tavakkoli *et al.* (2006). They stated that fruit thinning reduced yield/ palm in different date palm varieties. Additionally, El-Hammady *et al.* (1983) on Zaghloul dates and Amin *et al.* (2007) on Hayany and Halawy dates, reported that ethephon at 400 ppm or hand thinning at 20% of bunch strands was beneficial to regulate yield of dates.

Table 2: Effect of different fruit thinning treatments on number of spathe/palm of Samany date palms in 2009 and 2010 seasons

Treatments	Seasons	
	2009 "on-year"*	2010 " off-year"**
1- Unthinning (control)	10.00	3.00^{g}
2- Hand thinning 15%	10.00	4.75^{f}
3- Hand thinning 25%	10.00	7.33^{b}
4- Ethephon at 250 ppm	10.00	6.55^{cd}
5- Ethephon at 500ppm	10.00	8.65^{a}
6- NAA at 30 ppm	10.00	6.00^{e}
7- NAA at 40 ppm	10.00	6.73^{c}
L.S.D. at 5%	—	0.32

* The year of fruit thinning treatments for its palms.
** The year without fruit thinning treatments for the same palms.
- The values per column followed by the same letter are not satisticaly different at 5% level.

Table 3: Effect of different fruit thinning treatments on number of spathes/palm of Samany date palms in 2010 and 2011 seasons

Treatments	Seasons	
	2010 "on-year"*	2011 "off-year"**
1- Unthinning (control)	10.00	3.67^{g}
2- Hand thinning 15%	10.00	4.33^{f}
3- Hand thinning 25%	10.00	8.00^{b}
4- Ethephon at 250 ppm	10.00	6.34^{cd}
5- Ethephon at 500ppm	10.00	9.00^{a}
6- NAA at 30 ppm	10.00	5.66^{e}
7- NAA at 40 ppm	10.00	6.68^{c}
L.S.D. at 5%	—	0.46

* The year of fruit thinning treatments for its palms.
** The year without fruit thinning treatments for the same palms.
- The values per column followed by the same letter are not satisticaly different at 5% level.

Table 4: Effect of different fruit thinning treatments on yield/palm of Samany date palms in 2009 and 2010 seasons

Treatments	Seasons	
	2009 * "on-year"	2010 ** "off-year"
1- Unthinning (control)	190.5_b	49.4_f
2- Hand thinning 15%	184.2_f	89.4_b
3- Hand thinning 25%	166.1_d	143.0_d
4- Ethephon at 250 ppm	176.8_g	120.5_a
5- Ethephon at 500ppm	161.5_c	149.1_e
6- NAA at 30 ppm	180.0_e	100.8_c
7- NAA at 40 ppm	169.9	133.2
L.S.D. at 5%	2.1	2.8

* The year of fruit thinning treatments for its palms.
** The year without fruit thinning treatments for the same palms.
- The values per column followed by the same letter are not satisticaly different at 5% level.

Table 5: Effect of different fruit thinning treatments on yield/palm (kg) of Samany date palms in 2010 and 2011 seasons

Treatments	Seasons	
	2010 * "on-year"	2011 ** "off-year"
1- Unthinning (control)	187.2_b	56.5_f
2- Hand thinning 15%	177.6_g	105.8_b
3- Hand thinning 25%	162.4_d	153.8_d
4- Ethephon at 250 ppm	172.3_f	132.3_a
5- Ethephon at 500ppm	163.8_c	156.1_e
6- NAA at 30 ppm	175.0_e	122.2_c
7- NAA at 40 ppm	167.1	147.7
L.S.D. at 5%	1.9	2.2

* The year of fruit thinning treatments for its palms.
** The year without fruit thinning treatments for the same palms.
- The values per column followed by the same letter are not satisticaly different at 5% level.

II- Physical fruit properties :-

Data concering physical fruit characters of Samany date palms as influenced by tested fruit thinning treatments during 2009 and 2010 seasons are mentioned in Table (6). The data declared that fruit dimensions, weight and flesh weight were positively affected with the different fruit thinning treatments compared to unthinned ones (control). Where, the results cleared that ethephon at 500 ppm (treatment no.5) significantly produced the highest fruit length, weight and flesh weight in both seasons comparing with all remained treatments. However, hand thinning at 25% of bunch strands (treatment no.2) significantly gave the highest fruit diameter values than other treatments.

On the other hand, unthinned palms (control treatment) significantly gave the lowest such physical characters. At the same time, all studied treatments did not affect seed weight in both experimental seasons.

The significant effect of fruit thinning treatments on fruit diameter and length may be attributed to their effect on positive role on number and elongations of cells, Sharples (1968); Westwood (1978) and Ashour (2003). They all reported that thinning of apple fruit clusters stimulated cell division and cell expansion of the fruits that remained on the tree and consequently increased their size at harvest time.

The increment in fruit weight, which occurred by fruit thinning treatments may be due to the reduction in fruit number, which prevents their accumulation within bunch, consequently, it permits the fruits to take sufficient amount of carbohydrates, water and nutrients which finally caused the increase in fruit weight as compared with control palms which had highest yield and smallest fruit weight (Abdallah *et al.*, 2009). Frurthermore, the insignificant effect of such treatments on seed weight explained that the increase in fruit weight by thinning treatments could be mainly attributed to the increase in flesh weight. These results are in coincidence with those illustrated by El-Kassas *et al.* (1983); Hassaballa *et al.* (1983); Khalifa *et al.* (1987); Abdulla *et al.* (1993); Al-Mughrabi *et al.* (1993); Al-Obeed *et al.* (2003); Al-Juburi *et al.* (2003); Aboutalebi & Behroznam (2006); Abou Rawash & Mustafa (2007) and Bakr *et al.* (2007) on several date palm cultivars.

III- Fruit chemical constituents :-

Data regarding fruit chemical constituents of Samany date palms as influenced by the studied fruit thinning methods during 2009 and 2010 seasons are presented in Table (7). It was evident that all thinning treatments (except treatment no.2), caused a significant increase in fruit total soluble solids (TSS%) content as compared with control treatments.

Table 6: Effect of different fruit thinning treatments on fruit physical properties of Samany date palms in 2009 and 2010seasons *.

Treatments	Fruit diameter (cm)		Fruit length (cm)		Fruit weight (gm)		Flesh weight (gm)		Seed weight (gm)	
	2009	2010	2009	2010	2009	2010	2009	2010	2009	2010
1- Unthinning (control)	3.18^{g}	3.25^{g}	5.16^{g}	5.09^{g}	31.81^{g}	32.17^{g}	29.14^{g}	29.17^{g}	2.49	2.40
2- Hand thinning 15%	3.21^{f}	3.39^{f}	5.17^{f}	5.21^{f}	32.94^{f}	33.24^{f}	29.77^{f}	30.17^{f}	2.54	2.46
3- Hand thinning 25%	3.56^{a}	3.85^{a}	5.64^{b}	5.71^{b}	37.40^{f}	37.63^{b}	33.84^{b}	34.07^{b}	2.69	2.71
4- Ethephon at 250 ppm	3.28^{d}	3.48^{d}	5.37^{d}	5.45^{d}	35.15^{d}	35.43^{d}	31.78^{d}	32.02^{d}	2.58	2.63
5- Ethephon at 500ppm	3.37^{b}	3.72^{b}	5.76^{a}	5.84^{a}	38.52^{a}	38.76^{a}	34.90^{a}	35.12^{a}	2.75	2.73
6- NAA at 30 ppm	3.25^{e}	3.39^{e}	5.28^{e}	5.32^{e}	34.05^{e}	34.33^{e}	30.84^{e}	31.16^{e}	2.56	2.54
7- NAA at 40 ppm	3.33^{c}	3.57^{c}	5.51^{c}	5.58^{c}	36.28^{c}	36.51^{c}	32.85^{c}	33.01^{c}	2.62	2.70
L.S.D. at 5%	0.03	0.05	0.09	0.11	1.10	1.06	0.61	0.83	N.S.	N.S.

* In both seasons, experimental palms were in (on-year) and subjected to the mentioned treatments.
- The values per column followed by the same letter are not satisticaly different at 5% level.

Table 7: Effect of different fruit thinning treatments on fruit chemical constituents of Samany date palms in 2009 and 2010 seasons *.

Treatments	TSS %		Acidity %		Carotene mg/100 gms		Total sugars %		Reducing sugars %		Soluble tannins %	
	2009	2010	2009	2010	2009	2010	2009	2010	2009	2010	2009	2010
1- Unthinning (control)	23.59^{f}	23.36^{f}	0.169^{a}	0.165^{a}	6.189^{e}	5.096^{e}	73.85^{g}	70.72^{g}	50.67^{g}	44.42^{g}	0.479^{a}	0.483^{a}
2- Hand thinning 15%	23.91^{f}	23.58^{f}	0.165^{a}	0.162^{a}	6.227^{e}	5.167^{e}	74.09^{f}	71.91^{f}	51.83^{f}	46.53^{f}	0.470^{a}	0.474^{a}
3- Hand thinning 25%	25.84^{b}	25.49^{b}	0.139^{b}	0.133^{b}	10.915^{a}	9.862^{a}	78.68^{b}	76.57^{b}	59.05^{b}	55.00^{b}	0.462^{a}	0.467^{a}
4- Ethephon at 250 ppm	24.87^{d}	24.48^{d}	0.157^{a}	0.149^{a}	7.498^{d}	6.348^{d}	76.42^{d}	74.24^{d}	56.35^{d}	49.44^{d}	0.421^{d}	0.424^{d}
5- Ethephon at 500ppm	26.35^{a}	25.89^{a}	0.127^{c}	0.120^{c}	9.778^{b}	8.697^{b}	79.81^{a}	77.74^{a}	60.02^{a}	56.28^{a}	0.408^{e}	0.410^{e}
6- NAA at 30 ppm	24.37^{e}	24.08^{e}	0.160^{a}	0.155^{a}	6.362^{e}	5.182^{e}	75.27^{e}	73.08^{e}	54.27^{e}	48.21^{e}	0.435^{c}	0.437^{c}
7- NAA at 40 ppm	25.37^{c}	25.03^{c}	0.152^{a}	0.145^{a}	8.639^{c}	7.526^{c}	77.54^{c}	75.42^{c}	57.95^{c}	51.10^{c}	0.450^{b}	0.447^{b}
L.S.D. at 5%	0.42	0.38	0.010	0.012	1.135	1.163	1.12	1.15	0.95	0.98	0.011	0.010

* In both seasons, experimental palms were in (on-year) and subjected to the mentioned treatments.
- The values per column followed by the same letter are not satisticaly different at 5% level.

Significant differences were also found between different treatments. Experimental palms received ethephon at 500 ppm (treatment no.5) produced significantly higher fruit TSS% than those produced from other treatments.

This result was true in the two seasons. Increment in fruit TSS with thinning treatments may be due to the pronounced effect on supplying carbohydrates and other nutrients from leaves towards the less number of fruits of thinned bunches. These results are confirmed by those of Hussein *et al.* (1976); El-Kassas (1983); Mustafa (1993); Hussein *et al.* (1993); Bakr *et al.* (2007) and Abd-El-Kader *et al.* (2008).

In regard to total acidity of fruit juice, the obtained data showed that there were no significant differences between different thinning treatments, except treatment no.5 (ethephon at 500 ppm) which significantly produced lowest fruit acidity followed by treatment no.2 (hand thinning at 25% of bunch strands). Similar results were reported by Abd El-Kader *et al.* (2008). On the other hand, El-Kassas *et al.* (1993); El-Shazly (1999) and Abdalla *et al.* (2009), they all indicated that fruit thinning treatments did not affect fruit acidity content of different date palm cultivars.

As for fruit peel carotene, the data in Table (7) pointed out that all treatments which included high levels of fruit thinning significantly improved fruit peel carotene. Such treatments could be arranged in descending order as follow :- Hand thinning 25% (treatment no.3), ethephon at 500 ppm (treatment no.5) and NAA at 40 ppm (treatment no.7). In the meantime, there were no significant differences were found among the remained treatments and control. These results were true in both seasons.

Significant increment of fruit carotene may be attributed to the effective role of fruit thinning treatments in enhancing of essential assimilates, i.e., amino acids and carbohydrates in fruit of treated palms which mainly share in caroteniods structure. These results are in harmony with those found by El-Nabawy *et al.* (1977). They reported that ethephon application of Samany fruits increased some amino acids, i.e., α-alanine, tyrosine and valine and enhanced fruit colour development. Bassal & El-Deeb (2002) and Amin (2007) revealed that ethephon and NAA or hand fruit thinning by removal 20% of bunch strands enhanced the colour development of Zaghloul, Hayany and Halawy date palms.

Regarding the effect of different thinning treatments on fruit total and reducing sugars content, data presented in Table (7) showed that all chemical and hand thinning treatments significantly increased fruit total and reducing sugars content in both experimental seasons in comparing to control fruits with significant difference between each other. Fruthermore, it was noticed that ethephon at 500 ppm (treatment no.5) gave the highest total and reducing sugars content in fruits, followed descendingly by hand thinning at 25% (treatment no.3), then NAA at 40 ppm (treatment no.7). While, the remained treatments gave intermediate values of fruit total and reducing sugars.

These results might be due to the adequate carbohydrates and other metabolites for supplying the remained fruits, consequently enhanced the fruit sugars content. Similar findings were reported by many investigators, i.e., El-Kassas (1986); Hussein *et al.* (1993b); El-Makhton *et al.* (1995); El-Kassas *et al.* (1995); Ali-Dinar *et al.* (2002) and Amin *et al.* (2007). They all indicated that either chemical or hand fruit thinning increased fruit total and reducing sugars content in different date palm cvs.

In regard to the effect of studied thinning treatments on fruit tannins content, the data listed in Table (7) showed that chemical fruit thinning treatments of ethephon and NAA significantly reduced fruit tannins content as compared with other treatments and control. While, hand fruit thinning treatments did not affect fruit tannins. At the same time, the data cleared that ethephon at 500 ppm (treatment no.5) gave the minimum value of tannins content than those of other treatments followed by ethephon at 250 ppm (treatment no. 4).

These results are closely in agreement with those found by El-Nabawy *et al.* (1977); El-Hammady *et al.* (1983); Khalifa *et al.* (1984); Bassal & El-Deeb (2002); Bakr *et al.* (2007) and Abd El-Kader *et al.* (2008) as they reported that fruit chemical thinning significantly reduced tannins content of date palm fruits. On the other hand, Khalifa *et al.* (1987); El-Makhtoun *et al.* (1995); El-Shazly (1999); El-Hammady *et al.* (2002) and Abdallah *et al.* (2009). They all reported that no significant effect of hand thinning of date palm fruits was noticed in fruit tannins content.

IV- General evaluation of the tested fruit thinning treatments :-

As general, evaluation of the studied fruit thinning treatments as average of the experimental seasons according to alternate bearing and fruit quality components, data in Table (8) emphasized the prementioned trends. Since fruit thinning by either ethephon at 500 ppm (treatment no.5) or hand thinning 25% of bunch strands (treatment no.3) recorded the highest score (98.3 and 96.5 total units, respectively). Descendingly, followed by NAA at 40 ppm (treatment no.7), ethephon at 250 ppm (treatment no.4) and NAA at 30 ppm (treatment no.6) which were near each other of total units i.e. 92.2, 89.9 and 86.5, respectively. The least total scores were 80.3 and 83.4 units which were recorded by control (treatment no.1) and hand thinning 15% (treatment no.2), respectively.

Table 8: General evaluation of different fruit thinning treatments effect on alternate bearing and fruit quality of Samany date palms (as average of studied seasons for each treatment).

Characters	Alternate bearing			Fruit quality									Total
	No. of spathes/ palm	Yield/ Palm	Total	Fruit diameter (cm)	Fruit length (cm)	Fruit weight (gm)	Flesh weight (gm)	TSS (%)	Total carotene mg/100gm	Total sugars (%)	Soluble tannins (%)	Total	
Treatments	Score (units)												
	10	10	20	10	10	10	10	10	10	10	10	80	100
1- Unthinning (control)	6.9	7.6	14.5	8.6	8.8	8.2	8.3	8.9	5.4	9.1	8.5	65.8	80.3
2- Hand thinning 15%	7.7	8.7	16.4	8.9	8.9	8.5	8.5	9.0	5.4	9.2	8.6	67.0	83.4
3- Hand thinning 25%	9.3	9.8	19.1	10.0	9.7	9.7	9.6	9.8	10.0	9.8	8.8	77.4	96.5
4- Ethephon at 250 ppm	8.7	9.5	18.2	9.1	9.3	9.1	9.1	9.4	6.6	9.5	9.6	71.7	89.9
5- Ethephon at 500ppm	10.0	10.0	20.0	9.5	10.0	10.0	10.0	10.0	8.8	10.0	10.0	78.3	98.3
6- NAA at 30 ppm	8.4	9.1	17.5	8.9	9.1	8.8	8.8	9.2	5.5	9.4	9.3	69.0	86.5
7- NAA at 40 ppm	8.8	9.7	18.5	9.3	9.5	9.4	9.4	9.6	7.7	9.7	9.1	73.7	92.2

As a general of evaluation of treatments, the results revealed that ethephon at 500 ppm treatment gained the highest total score record (98.3 units, followed by manual thinning 25% (96.3 units), However, control treatment recorded the lowest score (80.3 units), whereas other treatments were inbetween.

On the account of the present findings, it can be concluded that fruit thinning by ethephon at 500 ppm, four weeks after pollination in (on-year) was the best economic treatment and easy technique for fruit thinning of Samany date palms to overcome the alternate bearing and obtain regular yield with good quality under resemble conditions.

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الملخص العربى

دراسة مقارنة على إستجابة نخيل البلح السمانى لكل من الإزالة اليدوية، الأيثيفون، ونفثالين حامض الخليك كطرق لخف الثمار

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أجرى هذا البحث خلال مواسم ٢٠٠٩ و٢٠١٠ و٢٠١١ على نخيل البلح السمانى النامى فى مزرعة البوصيلى بمحافظة البحيرة- مصر والتابعة لمركز البحوث الزراعية. بغرض المقارنة بين سبع معاملات لخف الثمار من ناحية تأثيرها على مشكلة المعاومة وعلى جودة الثمار.

وكانت المعاملات هى:- معاملة المقارنة(بدون خف)، الخف اليدوى بإزالة شماريخ كاملة من السباطة بنسبة ١٥% و٢٠%، رش الإيثيفون بتركيزىّ ٢٥٠ و ٥٠٠ جزء فى المليون، نفثالين حامض الخليك بتركيزىّ ٣٠ و ٤٠ جزء فى المليون. وقد أجريت المعاملات السبع بعد عقد الثمار مباشرة على أشجار نخيل فى سنة الحمل الغزير (On-year) بينما كانت تترك تلك الأشجار بدون معاملات فى سنة الحمل الخفيف (off-year) وذلك لمعرفة تأثير هذه المعاملات على ظاهرة المعاومة من خلال دراسة كل من عدد أغاريض النخلة، محصول النخلة.

وتمت دراسة تأثير هذه المعاملات على جودة الثمار فى سنة الحمل الغزير فقط (سنة المعاملات).

وقد أوضحت النتائج المتحصل عليها أن كل معاملات خف الثمار المستخدمة قد أدت إلى نقص محصول النخلة في سنة الحمل الغزير (سنة إجراء المعاملات) بينما خلال سنة الحمل الخفيف (بدون معاملات) زاد كل من عدد الأغاريض/نخلة والمحصول/نخلة. وكانت معاملة الإيثيفون بتركيز ٥٠٠ جزء فى المليون أكثر المعاملات تأثيراً فى زيادة إنتظام محصول النخلة.

كذلك فإن كل معاملات الخف المدروسة قد أدت إلى تحسين الخواص الطبيعية والكيميائية للثمار. وكانت معاملة إيثيفون بتركيز ٥٠٠ جزء فى المليون أكثر المعاملات تأثيراً فى تحسين طول ووزن الثمرة ووزن لحم الثمار وزيادة كل من المواد الصلبة الذائبة الكلية والسكريات المختزلة والكلية وتقليل الحموضة والتانينات الذائبة. بينما أدت معاملة الخف اليدوى بنسبة ٢٥% إلى تحسين قطر الثمرة ونسبة الكاروتين فى قشرة الثمار مقارنة بباقى المعاملات.

لذلك فإنه تحت ظروف هذه الدراسة والظروف المشابهة فإن معاملة الرش بالإيثيفون بتركيز ٥٠٠ جزء فى المليون بعد شهر من التلقيح فى سنة الحمل الغزير تعتبر توصية جيدة لخف ثمار البلح السمانى وبالتالى الحصول على حمل منتظم مع أفضل جودة للثمار.