



Effect of Some Thinning Practices on Yield and Fruit Quality of Sewi Date Palm Grown in Farafra Region

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Authors' contributions

This work was carried out in collaboration between all authors. Authors HEMEB and SFEG designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Author IAMA managed the analyses of the study and managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

The present study was carried out during two successive seasons (2016 and 2017) at El-Frafra Oasis District, Egypt. Female 'Sewi' date palms of healthy, nearly homogenous in growth, as well as fruiting ability, were selected. The selected palms were pruned after harvesting and leaf bunch ratio was adjusted to 8 leaves per bunch during both seasons of study. The effect number of bunch per palm (8, 10 or 12) and thinning % by cutting out a number of strands from the centre of the bunch enough to remove about (0, 10, 20 and 30%) and their combinations were investigated. Anyhow, the influence was evaluated through the response of the different (productivity, fruit physical and chemical properties) to the specific and interaction effects of both investigated factors. The obtained results revealed the greatest fruit weight per bunch was always in significant concomitant to 8 bunches per palm + zero thinning % during both seasons. Moreover, the highest fruit weight per palm was significantly coupled to 12 bunches/palm + zero thinning level. However, the highest values of fruit weight (g) and fruit dimensions were significantly induced by 8 bunches/palm + 30% thinning %. Anyhow, the heaviest fruit pulp weight was significantly coupled with (8 bunches /palm + 30% thinning) the highest fruit seed weight was exhibited significantly by (8 bunches/palm + 30% thinning level) and (10 bunches/palm + 30% thinning level). Meanwhile, the

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lowest fruit moisture content was significantly coupled with the 8 bunches/palm +30% thinning level. However, the highest value of TSS % and total sugars % was significantly coupled with 8 bunches/palm + 30% thinning. Overall, the use of 8 bunches/palm with 30% thinning level of strands from the center of the bunch was the best in most of the measurements studied.

Keywords: Date palm; Sewi; El-Frafra Oasis; thinning; bunches; fruit quality and yield.

1. INTRODUCTION

Date palm (*Phoenix dactylifera* L.) belongs to the family Palmaceae and it is considered the tree of life in the desert, because it tolerates high temperatures, drought and salinity more than many other fruit crops [1]. Date Palm is one of the most successful and commercially important crop in Egypt. Numbers of date palm trees in Egypt are about 12,827,235 trees producing about 1,465,030 tons/year [2].

Egypt is considered the top ten date palm producers, 'Zaghloul', 'Samany', 'Hayany' and 'Sewi' are the most economically important date palm cultivars grown in Egypt. Presently, the date palm growers are facing many difficulties to produce high quality date fruits for economic reasons and to compete with the international market. One of the most important factor affecting fruit quality and productivity of date palm is fruit thinning. So, it is needed to find the best thinning practices are necessary to increase quantitative, qualitative and economic output of date production in palm growing [3] and [4].

Thinning practice is an important managerial approach in date palm to improve fruit size, fruit weight, fruit quality and reduce chances of bunch breaking and alternate bearing. Several methods were used to thin date palm trees, i.e. bunch thinning, bunch strands thinning and individual fruit removal. Combination of removal of individual fruits and strands had substantially improved fruit quality [5,6,7] and [8]. Flower or fruit thinning is a critical cultural practice in the date palm production chain that affects fruit development, quality, yield and regulate the tree yearly bearing. Thinning process is generally practised either manually or chemically. There is much concern regarding the use of chemicals on the environmental pollution and health aspects. Therefore, development of a more save and economic thinning agent for the date palm is critically required especially under harsh conditions. Fruit thinning treatments may lead to a decrease of the total yield, soluble tannins %, crude fibers % and total acidity % and are responsible for improving the weight, size and

dimensions of fruit, pulp weight %, total soluble solids %, total and sugar contents [9,10] and [11]. Thinning by removing 10-30% of bunches number significantly increased the bunch weight, advancing ripening and best fruit quality compared to un-thinning [5,12,13,14] and [8].

Frafra oasis lies in the Western Desert of Egypt. It is characterised by its excellent cultivars of date palm and olive. These two crops represent the main source of income to the farmers. Generally, date palms of the oasis are divided to three types according to its fruit moisture content, i.e. dry, semi dry and soft [15]. These cultivars are well adapted to the local environmental conditions. Among these cultivars there are two main famous and more frequent ones, i.e., 'Ferehy' (dry) and 'Sewi' (Semi dry). The other seeded palms can have considered as local varieties that are local consumed (although some of them have good fruit characteristics). They are found in very low frequency, and their productions are not enough for external market.

Thus, this study aimed to investigate some thinning practices on yield and fruit quality of 'Sewi' date palm grown in Farafra region.

2. MATERIALS AND METHODS

The present investigation was carried out during two successive seasons (2016 and 2017) at El-Frafra Oasis District, Egypt. Female 'Sewi' date palms of healthy, nearly homogenous in growth, as well as fruiting ability, were selected. The selected palms were pruned after harvesting and leaf bunch ratio was adjusted to 8 leaves/bunch during both seasons of study. The selected 'Sewi' palms were subjected to all horticultural practices applied to the date palms in this region except those ones under study. Anyhow, it was dealing with investigating the response of female 'Sewi' date palms to different thinning treatments.

Thirty-six female date palms cv. 'Sewi' were pollinated by male date palms from El-Farafra Oasis as pollen grain source at suitable time (early) of pollination by using hand pollination

(manual method) during March and April in both seasons and subjected to the specific effect of number of bunch/palm (8, 10 or 12) and thinning % by cutting out a number of strands from the center of the bunch enough to remove about (0, 10, 20 and 30%) and their combinations.

2.1 Data and Measurements

1- Total yield / palm: By weighing all the bunches per the palm (kg).

2- Fruit quality: Samples of 30 date palm fruits were taken randomly from each bunch at picking time for determining the different characteristics after removing their calyxes, wiping, and cleaning from dirty.

2.2 Fruit Physical Properties

Thirty fruits were randomly taken, at harvest time, as a sample for each palm during both seasons of study. Samples fruits were divided into three groups; each of 10 fruits treated as a replicate to determine the following characteristics:

1. Fruit weight (g): It was calculated by weighing each of 10 fruits as a replicate. The average fruit weight, in grams, was tabulated.

2. Flesh weight (g): It was calculated by weighing each of 10 fruits, as a replicate, after removing seeds. The average fruit weight, in grams, was tabulated.

3. Seed weight (g): It was estimated by the differences between fruit weight and flesh fruit weight, and the average seed weight (in grams) was tabulated.

4. Fruit weight/seed weight ratio: It was calculated by dividing the average of fruit weight by the average of seed weight and tabulated.

5. Fruit dimensions: Fruit length and diameter were measured using individual fruits of each replicate (10 fruits) by using Vernier caliper. In addition, fruit length (L) per fruit diameter (D) was calculated as L/D ratio for each palm tree.

6. Fruit firmness: It was estimated by using pressure tester apparatus (kg/cm^2) (drill diameter, 0.3 cm) for the individual 10 fruits of each replicate per date palm tree in both seasons. The average fruit firmness was calculated.

2.3 Fruit Chemical Properties

Thirty fruits were randomly taken at harvest time as a sample for each palm during both seasons of the study. Samples fruits were divided into three groups (10 fruits of each). Each group was treated as a replicate to determine the following characteristics.

1. Total soluble solids (T.S.S. %): It was determined in fruit juice using Carl Zeiss Refractometer as described in [16].

2. Fruit acidity percentage: It was determined as described in [16] and the titratable acidity was calculated as malic acid according to [17].

3. Total sugars content: It was determined according to [16]. In the methanol extract using the phenol sulfuric acid method and the concentration was calculated as g/100 g fresh weight.

4. Reducing sugars content: It was determined in the methanol extract according to [16] and the percentage was calculated as g /100 g fresh weight.

5. Non-reducing sugars content: It was determined by differences between total and reducing sugars.

6. Moisture percentage: Fruits were cleaned then seeds were removed, fruit flesh was dried at 60 - 65 °C for 48 hours according to [16] method and moisture percentage was calculated.

2.4 Statistical Analysis

All data obtained during both seasons were subjected to analysis of variance and significant differences among means were determined according to [18]. Capital and small letters were used for distinguishing between means of the specific effect of two investigated factors and interaction between them, respectively, according to [19].

3. RESULTS AND DISCUSSION

3.1 Fruits Weight/Bunch (kg)

3.1.1 Specific effect

With regard to the specific effect of number of bunches per palm it is quite evident as shown

from tabulated data in Table 1 that three investigated numbers (8,10 and 12) were significant as compared each other. Hence, the greatest values of fruit weight/bunch were significantly coupled with 8 bunches/ palm followed by 10 and 12 bunches per palm, respectively. Such trend was true during 2016 and 2017 seasons.

Referring the specific effect of thinning % (0, 10, 20 and 30%), Table 1 display obviously that the highest fruit weight per palm was significantly in concomitant to zero thinning percentage during both seasons of study, significantly followed in an ascending order by 10, 20 and 30%, respectively during 2016 and 2017 seasons.

3.1.2 Interaction effect

As for the interaction effect of different combinations between two studied factors, i.e., (3 number of bunches per palm x thinning %), data obtained during two seasons as shown in Table 1 and revealed obviously that each investigated factor reflected clearly its own specific effect on their various combinations. Anyhow, the greatest fruit weight per bunch was always in significant concomitant to 8 bunches per palm +zero thinning percentage during 2016 and 2017 seasons, whereas, the lowest values of fruit weight per bunch was exhibited by 12 bunches per palm +30% thinning level during both seasons of study.

The present results go parallel in the line of those found by [20] on 'Hayany' dates, [21] on

'Zaghloul' dates, [22] and [23] on 'Sewy' dates, [24] on 'Nabtet Ali' dates. They mentioned that fruit thinning substantially decreased the total yield as compared with the control (no thinning). Besides that, [25] found that cutting back 25% of strands significantly reduced yield per palm of 'Zaghloul' cultivar as compared with the control. Moreover, [26] on 'Haiany' and 'Halawy' date cultivars, stated that 20% removal of total number of bunch strands by either thinning out or cutting back before pollination was beneficial method to regulate the yield. Meanwhile, the reduction in yield increased by increasing of the thinning degree, that when done 30 days after pollination of 'Khalas' [27] and 'Succary' [28]. In addition, [29] studied the effect of different thinning ways 30 days after hand pollination on bunch weight and yield of 'Segae' date palm cultivar by removing (10 and 20 cm) of strands length per bunch, the middle of the bunch, middle of the bunch + removing 10 cm of strands length per bunch and control treatment (no thinning). They indicated that all thinning ways significantly decreased bunch weight and yield than the control in second season. Also, thinning ways by removing the middle of the bunch and 10 cm of strands length per bunch gave the highest values of bunch yield compared with either the other ways.

On the contrary, [30] revealed that bunch thinning for 'Zaghloul' dates by removing 20% from the tips of strands after pollination significantly increased bunch weight and yield/palm comparing with control.

Table 1. Fruit weight / bunch of 'Sewi' date palm as influenced by specific and interaction effects of number of bunches /palm and thinning % during 2016 and 2017 seasons

Thinning (%)	Fruits weight/bunch (kg)				
	No. of bunch/palm	8	10	12	Mean**
First season: 2016					
0		15.18a	14.80b	14.57c	14.85A
10		14.70bc	14.33d	13.93e	14.32B
20		13.81e	13.33f	13.07g	13.40C
30		13.38f	12.65h	11.68i	12.57D
Mean*		14.27A	13.78B	13.31C	
Second season: 2017					
0		12.61a	12.39a	12.10b	12.37A
10		12.04bc	11.81c	11.54d	11.80B
20		11.52de	11.28e	10.65fg	11.15C
30		10.72f	10.61fg	10.40g	10.58D
Mean*		11.72A	11.52B	11.17C	

*and ** refer to specific effect of number of bunches /palm and thinning %, respectively.

Means of specific and interaction effects followed by the same capital and small letters, respectively did not significantly differ at 5% level

3.2 Fruits Weight (g) per Palm

3.2.1 Specific effect

With regard to the specific effect of number of bunches per palm, it is quite clear as shown from Table 2 that highest values of fruits weight per palm was significantly increase with 12 bunches per palm both seasons. The reverse was true with 8 bunches per palm in this concern. Such trend was true during 2016 and 2017 seasons.

Referring the specific effect of thinning percentage. Table 2 display that zero thinning percentage gave significantly the highest values of fruits weight per palm during 2016 and 2017 seasons. Whereas, 30% thinning percentage had significantly the lowest weight of fruits per palm during both seasons of study.

3.2.2 Interaction effect

Table 2 display obviously that interaction effect of two investigated factors on fruit weight per palm is a real reflection of their specific effect in this respect. Anyhow, the highest fruit weight per palm was significantly coupled to 12 bunches/palm + zero thinning level, descendingly followed by 12 bunches/palm and 10% thinning level, 12 bunches per palm + 30% thinning level, respectively. Such trend was true during both 2016 and 2017 seasons. On the contrary, 8 bunches/palm + 30% thinning level ranked

statistically last in this concern during both seasons of study.

3.3 Fruit Weight (g)

Nevertheless, fruit weight of Sewi date palm in response to specific effect and interaction effect of two investigated factors (number of bunches /palm and thinning level) and their combinations, data obtained during both 2016 and 2017 seasons are tabulated in Table 3.

3.3.1 Specific effect

Referring the specific effect of number of bunches per palm, data obtained during both 2106 and 2017 seasons declared that the greatest fruit weight of 'Sewi' date palm was recorded (10.98 and 11.33g), followed by 10 bunches per palm was recorded (10.65 and 10.82 g). Such trend was true during both 2016 and 2017 seasons.

Concerning, the specific effect of thinning % on fruit weight, Table 3 display clearly that the highest values of fruit weight (g) (11.26 and 11.56 g) was exhibited by 30% thinning level, followed by 20% thinning level (10.80 and 10.96 g) which ranked statistically second. Such trend was true during both seasons of study. Meanwhile, zero % thinning level (10.18 and 10.31 g) came statistically last in this concern during 2016 and 2017 seasons.

Table 2. Fruit weight/palm (kg) of 'Sewi' date palm as influenced by specific and interaction effects of No. of bunches /palm and thinning % during 2016 and 2017 seasons

		Fruit weight/palm (kg)			
		8	10	12	Mean**
Thinning (%)	No. of bunch/palm				
	First season: 2016				
0		121.5i	146.3d	174.8a	147.5A
10		117.6j	143.3e	167.2b	142.7B
20		110.5k	133.3g	148.8c	130.9C
30		107.1l	126.5h	140.1f	124.6D
Mean*		114.1C	137.4B	157.7A	
Second season: 2017					
0		100.9i	123.9e	144.8a	123.2A
10		96.35j	118.1f	138.4b	117.6B
20		92.19k	112.8f	131.8c	112.3C
30		86.27l	106.1h	124.8d	105.7D
Mean*		93.92C	115.2B	134.9A	

**and ** refer to specific effect of number of bunches /palm and thinning %, respectively.*

Means of specific and interaction effects followed by the same capital and small letter/s, respectively did not significantly differ at 5% level

3.3.2 Interaction effect

Table 3 display that the specific effect of each investigated factor (number of bunches/palm and thinning %) was reflected on their combination effect (interaction) whereas the highest values (11.64 and 12.22 g) of fruit weight (g) was significantly induced by 8 bunches / palm + 30 thinning %) followed in an ascending order by those subjected to (8 bunches/palm + 20 % thinning level in the first season and (10 bunches/palm + 30 5 thinning level in the second season, Meanwhile, differences were significant as the various combinations of number of bunches per palm and thinning levels were compared to each other during both seasons of study. In addition, (12 bunches per palm + zero thinning %) ranked statistically last in this concern. Such trend was true during 2016 and 2017 seasons.

Anyhow, the earlier findings of several investigators gave support to our results pertaining the increase of fruit weight exhibited by the two investigators gave support to our results pertaining the increase of fruit weight exhibited by the two investigated factors and their interactions effects. Many investigators, [31, 32] and [22] working on several date palm cultivars, found that the fruit properties either physical or chemical properties of thinned palm trees were significantly higher than un-thinned ones. In this regard, fruit thinning of several date palm cultivars in the opinion of many investigators was found to greatly improve and

increase the fresh weight of date fruit [33] and [34]. Also, [35] and [36] on 'Zaghoul' date palms, [37,38] and [39] on 'Succary' date, [40] on 'Khadrawi', [27] on 'Khalas' date palms. They observed that bunch thinning treatments significantly increased fruit weight as compared with control treatment. Additionally, [41] studied the effect of strand thinning on yield of 'Kur' date palm cultivar. Four treatments were applied such as T1: control (without thinning), T2: removing 10% of strands, T3: 25% and T4: 50% randomly from total strands number per bunch after 5 weeks from pollination. The results showed that all strand thinning treatments significantly increased fruit weigh as compared to control. Maximum fruit weight was obtained at 50% strand thinning, followed by the treatment where 25% strands were removed.

On the contrary, [7] reported that all thinning treatments at 6 weeks after pollination of 'Barhee' date grown in Khouzesan province in Iran had no significant effect on fruit weight compared to control.

3.4 Fruit Length (cm)

3.4.1 Specific effect

With respect to specific effect of number of bunches per palm data obtained during both seasons declared that fruit length of 'Sewi' date palm followed typically the same trend previously detected with the average fruit weight. Such trend was true during 2016 and 2017 seasons.

Table 3. Fruit weight (g) of 'Sewi' date palm as influenced by specific and interaction effects of number of bunches/palm and thinning % during 2016 and 2017 seasons

Thinning (%)	Fruit weight (g)			
	No. of bunch/palm 8	10	12	Mean**
First season: 2016				
0	10.50g	10.16i	9.87j	10.18D
10	10.73f	10.43h	10.13i	10.43C
20	11.06c	10.86e	10.48gh	10.80B
30	11.64a	11.15b	10.99d	11.26A
Mean*	10.98A	10.65B	10.37C	
Second season: 2017				
0	10.62e	10.31g	10.01i	10.31D
10	11.01d	10.59e	10.21h	10.60C
20	11.48b	11.01d	10.39f	10.96B
30	12.22a	11.38c	11.08d	11.56A
Mean*	11.33A	10.82B	10.42C	

*and ** refer to specific effect of No. of bunches /palm and thinning %, respectively.
Means of specific and interaction effects followed by the same capital and small letter/s, respectively did not significantly differ at 5% level

Concerning, the specific effect of thinning % (0,10, 20 and 30%) increased significantly fruit length, followed by 20% thinning which ranked statistically second during two seasons of study.

3.4.2 Interaction effect

Concerning the inter action effect of various combinations between the investigated two factors (3 number of bunches /palm x 4 thinning level) on fruit length of date palm 'Sewi' cv. Table (4) shows obviously that the trend of response followed typically the same trend previously discussed with average fruit weight. Herein, the tallest fruit length was always closed relationship to those 'Sewi' date palm treated with (8 bunches /palm +30% thinning), followed in an ascending order by (8 bunches / palm + 20% thinning), (8 bunches /palm +10% thinning) and (10 bunches /palm + 30% thinning level) during both 2016 and 2017 seasons.

3.5 Fruit Diameter (cm)

3.5.1 Specific effect

As for the specific effect of number of bunches /palm, Table 5 reveals obviously that the fruit diameter increased significantly by 8 bunches/palm which gave statistically the highest values of fruit diameter during two seasons of study. Meanwhile, 12 bunches/palm ranked statistically last in this concern during both seasons.

With regard to the specific effect of thinning level. Table 5 display that 30% thinning ranked statistically the first in this concern, followed by 20% thinning while ranked statistically the second. Such trend was during 2016 and 2017 seasons.

3.5.2 Interaction effect

Table 5 display that the specific effect of each factor was reflected on their combination effect interaction whereas the highest values of fruit diameter was significantly induced by (8 bunches/palm + 30% thinning) and (8 bunches/palm +20% thinning) they ranked statistically second, third and fourth, respectively. On the other hand, (12 bunches / palm + zero thinning %) ranked statistically last in this concern. Such trend was true during 2016 and 2017 seasons.

3.6 Fruit Shape Index

3.6.1 Specific effect

Data obtained during both seasons revealed obviously that the response to specific effect of number of bunches per palm was not so pronounced, where differences in most cases were not only too slight to reach level of significance. However, it could be safely concluded that 8 bunches/palm increased it slightly during 2016 and 2017 seasons.

Table 4. Fruit length (cm) of 'Sewi' date palm as influenced by specific and interaction effects of number of bunches /palm and thinning % during 2016 and 2017 seasons

Thinning (%)	Fruit length (cm)			
	No. of bunch/palm 8	10	12	Mean**
First season: 2016				
0	3.62de	3.53h	3.46i	3.54D
10	3.66c	3.55g	3.53h	3.58C
20	3.71b	3.62e	3.57f	3.63B
30	3.84a	3.64d	3.64d	3.71A
Mean*	3.71A	3.58B	3.55C	
Second season: 2017				
0	3.61e	3.53f	3.45g	3.53D
10	3.68d	3.61e	3.52f	3.60C
20	3.79b	3.69d	3.60e	3.70B
30	3.89a	3.74c	3.68d	3.77A
Mean*	3.74A	3.64B	3.57C	

*and ** refer to specific effect of number of bunches /palm and thinning %, respectively.

Means of specific and interaction effects followed by the same capital and small letter/s, respectively did not significantly differ at 5% level

Table 5. Fruit diameter (cm) of 'Sewi' date palm as influenced by specific and interaction effects of number of bunches/palm and thinning % during 2016 and 2017 seasons

Thinning (%)	Fruit diameter (cm)			
	No. of bunch/palm 8	10	12	Mean**
First season: 2016				
0	2.18e	2.13f	2.07g	2.13D
10	2.23cd	2.19e	2.10f	2.17C
20	2.26bc	2.23cd	2.18e	2.22B
30	2.30a	2.28b	2.22d	2.27A
Mean*	2.24A	2.21B	2.14C	
Second season: 2017				
0	2.20d	2.13e	2.11f	2.15D
10	2.25c	2.20d	2.21d	2.22C
20	2.30b	2.23c	2.23c	2.26B
30	2.33a	2.29b	2.25c	2.29A
Mean*	2.27A	2.22B	2.20C	

*and ** refer to specific effect of number of bunches /palm and thinning %, respectively.

Means of specific and interaction effects followed by the same capital and small letter/s, respectively did not significantly differ at 5% level

As for the specific effect of thinning %, it was quite clear that differences in most cases were not only too slight to reach level of significance. Moreover, zero thinning % was the superior in this concern during two seasons of study.

3.6.2 Interaction effect

It was so clear no firm trend could be detected with date palm 'Sewi'. Herein, difference was completely absent from statistical point of view. Anyhow, the present results regarding the slight response of fruit shape index to various investigated combination could be logically explained upon the parallel rate of response exhibited in both fruit diameters (length and diameter) by a given treatment.

The present results on fruit dimensions and fruit shape index goes partially with the finding of [33], [42] and [34]. They found that fruit thinning increased the average fruit length and diameter as compared with the control. Moreover, [43] found that removing of 25% strands/bunch treatment produced the highest increase in fruit length and diameter than the control and other thinning treatments for 'Sakkot', 'Shamaia' and 'Balady' date cultivars in both seasons. Also, [37] thinned bunch of 'Succary' date cultivar with shortening or removal of strands. They observed that bunch thinning treatments at pollination time led to significant increase in length and diameter as compared with control treatment. Moreover, shortening 20 and 40% of strands gave the highest values in this concern as compared with

removal of the strands. In addition, [40] when thinned the bunches of date palm 'Khadrawy' by removing 10,20,30 and 40% of total number of strands from the center of each bunch after pollination, found that fruit size improved with thinning practices over control. Thinning at the rate of 40% was the best treatment in this regard.

3.7 Fruit Pulp Weight (g)

3.7.1 Specific effect

Concerning the specific effect of No. of bunches/palm on fruit pulp weight, Table 7 reveals obviously that the heaviest pulp weight induced significantly by 8 bunches/palm, descendingly followed by 10 bunches/palm and 12 bunches/palm during first and second seasons, respectively.

Concerning the fruit pulp weight in response to specific effect of thinning %, data obtained during 2016 and 2017 seasons as shown in Table 7 display obviously that 30% thinning surpassed statistically the other thinning levels, followed by 20% thinning level and 10% thinning during 2016 and 2017 seasons, respectively.

3.7.2 Interaction effect

With regard to the interaction effect of two investigated factors on average pulp weight date palm 'Sewi' cv., it is quite clear that specific effect of each factor was reflected directly on its own combinations. Anyhow, the heaviest fruit pulp

weight was significantly coupled with (8 bunches /palm + 30% thinning). On the contrary, the lightest average fruit pulp weight was always in significant concomitant with (12 bunches/palm + zero thinning %). In addition, other combinations were in between the abovementioned two extents. Such trend was so firm and true during 2016 and 2017 seasons for 'Sewi' date palm.

3.8 Fruit Pulp Weight (%)

3.8.1 Specific effect

As for the specific effect of No. of bunches/palm, Table 8 reveals that the response followed typically the same trend previously discussed with the average pulp weight during two seasons for 'Sewi' date palm. Herein, 8 bunches/palm were significantly the superior in this concern than the others.

Concerning the specific effect of deferential investigated thinning levels. It is so clear that 30% thinning level was statistically the superior in this concern during both seasons followed by 20% thinning level in the first season and 10% thinning in the second season.

3.8.2 Interaction effect

Concerning the interaction effect of two studied factors (number of bunches/palm x thinning

levels), it was so obvious that (8 bunches/palm + 30% thinning levels) had generally the highest fruit pulp weight percentage, discendingly followed by (10 bunches / palm + 20% thinning level) and (8 bunches/palm + zero thinning level), which ranked second, third and fourth from the statically point of view respectively. On the contrary, (12 bunches /palm + zero thinning level) which statistically the inferior combinations and exhibited generally the least fruit pulp percentage during 2016 and 2017 seasons. In addition, other combinations were in between the aforesaid two extremes.

The detected trends regarding the effect of different treatments on fruit pulp weight and fruit pulp % are supported by several investigators. In this respect findings of [42] on 'Zaghloul' dates and [22] on 'Sewi' dates. They, observed that pulp weight of fruits and flesh percentage were increased in thinned bunch compared with unthinned bunches of 'Zaghloul' date palm. These effects might be due to more accumulation of carbohydrates and other substances in bunches that were treated with thinning [21]. Moreover, [37] thinned bunch of 'Succary' date cultivar with shortening or removal of strands. They observed that bunch thinning treatments at pollination time led to significant increase in flesh % as compared with control treatment. Moreover, shortening 20 and 40% of strands gave the highest values in this concern as compared with removal of the strands.

Table 6. Fruit shape index of 'Sewi' date palm as influenced by specific and interaction effects of number of bunches/palm and thinning % during 2016 and 2017 seasons

		Fruit shape index			
		8	10	12	Mean**
Thinning (%)	No. of bunch/palm				
	First season: 2016				
0		1.661a-c	1.657b-d	1.671ab	1.663A
10		1.641e-g	1.621fg	1.681a	1.648B
20		1.642e-g	1.623fg	1.638e-g	1.634C
30		1.670ab	1.596h	1.640d-f	1.635C
Mean*		1.653A	1.625B	1.657A	
Second season: 2017					
0		1.643a-c	1.655ab	1.636bc	1.645A
10		1.638bc	1.637bc	1.596d	1.624B
20		1.647ab	1.654ab	1.616cd	1.639A
30		1.668a	1.632bc	1.639bc	1.646A
Mean*		1.649A	1.644A	1.622B	

*and ** refer to specific effect of number of bunches /palm and thinning %, respectively.

Means of specific and interaction effects followed by the same capital and small letter/s, respectively did not significantly differ at 5% level

Table 7. Fruit pulp weight (g) of 'Sewi' date palm as influenced by specific and interaction effects of number of bunches/palm and thinning % during 2016 and 2017 seasons

		Fruit pulp weight (g)			
		No. of bunch/palm 8	10	12	Mean**
Thinning (%)					
First season: 2016					
0		9.11g	8.80i	8.42k	8.78D
10		9.30f	9.000h	8.68j	8.99C
20		9.60c	9.40e	8.99h	9.33B
30		10.13a	9.69b	9.49d	9.77A
Mean*		9.53A	9.22B	8.90C	
Second season: 2017					
0		9.27d	8.93e	8.64f	8.95D
10		9.61c	9.22d	8.87e	9.23C
20		10.01b	9.57c	8.36g	9.32B
30		10.75a	9.95b	9.62c	10.11A
Mean*		9.91A	9.42B	8.88C	

*and ** refer to specific effect of number of bunches /palm and thinning %, respectively.

Means of specific and interaction effects followed by the same capital and small letter/s, respectively did not significantly differ at 5% level

Table 8. Fruit pulp weight (%) of 'Sewi' date palm as influenced by specific and inter action effects of number of bunches /palm and thinning % during 2016 and 2017 seasons

		Fruit pulp weight (%)			
		No. of bunch/palm 8	10	12	Mean
Thinning (%)					
First season: 2016					
0		86.73a-c	86.64bc	85.37f	86.25B
10		86.70a-c	86.26d	85.75e	86.23B
20		86.80ab	86.56b-d	85.76e	86.37B
30		87.03a	86.91ab	86.38cd	86.77A
Mean*		86.81A	86.59B	85.81C	
Second season: 2017					
0		87.27bc	86.55ef	86.38f	86.73C
10		87.29bc	87.01cd	86.91c-e	87.07B
20		87.23bc	86.93c-e	80.50g	84.88D
30		87.97a	87.49b	86.83de	87.43A
Mean*		87.44A	86.99B	85.15C	

*and ** refer to specific effect of number of bunches /palm and thinning %, respectively.

Means of specific and interaction effects followed by the same capital and small letter/s, respectively did not significantly differ at 5% level

3.9 Fruit Seed Weight (g)

3.9.1 Specific effect

Data obtained during both 2016 and 2017 seasons in Table 9 revealed obviously that the response of fruit seed weight to the specific effect of No. of bunches/palm was not so pronounced, where differences in most cases were not only to slight to reach level of significance. Such trend was true during 2016 and 2017 seasons. As for the specific effect of thinning levels or %, it was quite clear that (30% thinning) was exhibited statistically the highest

values of seed weight during two experimental seasons of study. Descendingly followed by (20% thinning) and (10% thinning level), respectively. during both seasons, meanwhile (zero thinning) ranked statistically last in this concern during two seasons.

3.9.2 Interaction effect

Table 9 shows clearly that the seed weight of 'Sewi' data palm responded significantly to the various investigated treatments (3 number of bunches/palm x 4 thinning levels). Herein, the highest fruit seed weight was exhibited

significantly by (8 bunches/palm +30% thinning level), (10% bunches/palm +30% thinning level) and (12 bunches/palm +30% thinning level). Such trend was true during 2016 and 2017 seasons, respectively. Moreover, (8 bunches/palm + 20% thinning) ranked statistically the second followed by (10 bunches/palm + 20% thinning level) which ranked statistically the third in this concern. On the contrary, (12 bunches/palm + zero thinning level) came statistically last in this regard during 2016 and 2017 seasons.

3.10 Fruit Seed Weight (%)

3.10.1 Specific effect

With regard to the specific effect of number of bunches/palm Table 10 display that 12 bunches/palm was significantly the superior, discendingly followed by 10 bunches/palm and 8 bunches \palm. Such trend was true during both seasons of study.

As for the specific effect of thinning level, it is quite evident that zero thinning level was significantly higher than the other thinning level in this concern during the two seasons. On the contrary, 30% thinning level ranked statistically last in this concern during 2016 and 2017 seasons.

3.10.2 Interaction effect

The response of seed weight percentage to the interaction effect of two investigated factors was clearly showed in Table 10. Herein, the highest

values of seed weight percentage were exhibited significantly by (12 bunches/palm + zero thinning %), discendingly followed by (12 bunch/palm +10% thinning percentage) during 2016 and 2017 seasons. The reverse was true with (8 bunches/palm +30% thinning level) which ranked statistically last in this concern during both seasons of study. Moreover, the present result goes parallel in the line of those founded by [44] on 'Zaghloul' dates. Who found that bunch thinning treatments of 'Zaghloul' dates, increased pulp/seed ratio. The fresh weight of seed and seed percent appeared to decrease. Additionally, strand tips removal was better than an equivalent amount of thinning by removing entire strands from the center. Also, [42] observed that all bunch thinning treatments increased flesh/seed weight ratio of 'Zaghloul' date cultivar. Thinning by removing 25% of the number of strands from the center plus cutting back strand tips to remove 25% of their fruits was the most promising thinning treatment.

3.11 Fruit Moisture (%)

3.11.1 Specific effect

Referring the specific effect of number of bunches/palm, data obtained during both seasons declared that fruit moisture percentage of 'Sewi' date palm fruits decreased significantly by decreasing number of bunches\palm. Herein, the highest moisture content was significantly coupled with (12 bunches/palm) during 2016 and 2017 seasons.

Table 9. Fruit seed weight (g) of 'Sewi' date palm as influenced by specific and interaction effects of number of bunches/palm and thinning % during 2016 and 2017 seasons

Thinning (%)	Fruit seed weight (g)				
	No. of bunch/palm	8	10	12	Mean**
First season: 2016					
0		1.43bc	1.41c	1.42bc	1.42B
10		1.44bc	1.42bc	1.43bc	1.43B
20		1.47a-c	1.46a-c	1.47a-c	1.47A
30		1.50a	1.48ab	1.50a	1.49A
Mean*		1.46A	1.44A	1.46A	
Second season: 2017					
0		1.38f	1.39f	1.39ef	1.39D
10		1.41de	1.42d	1.39f	1.41C
20		1.47b	1.45c	1.41de	1.45B
30		1.50a	1.48ab	1.49ab	1.49A
Mean*		1.44A	1.44A	1.42B	

*and ** refer to specific effect of number of bunches /palm and thinning %, respectively.

Means of specific and interaction effects followed by the same capital and small letter/s, respectively did not significantly differ at 5% level

Table 10. Fruit seed weight (%) of 'Sewi' date palm as influenced by specific and interaction effects of number of bunches/palm and thinning % during 2016 and 2017 seasons

Fruit seed weight (%)				
Thinning (%) \ No. of bunch/palm	8	10	12	Mean**
First season: 2016				
0	13.61b-d	13.88bc	14.39a	13.96A
10	13.42cd	13.61b-d	14.12ab	13.72AB
20	13.29de	13.44cd	14.02ab	13.58B
30	12.88e	13.27de	13.65b-d	13.27C
Mean*	13.30C	13.55B	14.04A	
Second season: 2017				
0	12.96de	13.48bc	13.92a	13.45A
10	12.80e	13.44bc	13.58b	13.27B
20	12.83e	13.19cd	13.57b	13.20B
30	12.25f	13.01de	13.42bc	12.89C
Mean*	12.71C	13.28B	13.62A	

*and ** refer to specific effect of number of bunches /palm and thinning %, respectively.

Means of specific and interaction effects followed by the same capital and small letter/s, respectively did not significantly differ at 5% level

Concerning, the specific effect of thinning levels, Table 11 displays clearly that fruit moisture content decreased significantly by increasing thinning level. Anyhow, the lowest moisture content (%) was exhibited by 30% thinning during both seasons of study. On the other hand, the highest moisture content was recorded by zero thinning level during 2016 and 2017 seasons. However, the other thinning levels were in between the aforesaid extremes.

3.11.2 Interaction effect

Table 11 reveals that the interaction effect of different combinations between two investigated

factors was real reflection to the abovementioned two discussed trends of the response for each factor. Anyhow, the lowest fruit moisture content was significantly coupled with the 8 bunches/palm + 30% thinning level, followed in an ascending order by those subjected to 8 bunches /palm +20% thinning level, 10 bunches/palm + 30% thinning level, 8 bunches/palm + 10% thinning level, 10 bunches /palm + 20 thinning level and 10 bunches/palm +10 thinning level. Such trend was true during 2016 and 2017 experimental seasons. The reverse was true with (12 bunches/palm + zero thinning level) which induced the highest fruit moisture content (%) during both seasons of study.

Table 11. Fruit moisture (%) of 'Sewi' date palm as influenced by specific and inter action effects of number of bunches /palm and thinning % during 2016 and 2017 seasons

Fruit moisture (%)				
Thinning (%) \ No. of bunch/palm	8	10	12	Mean**
First season: 2016				
0	13.16c	13.23b	13.31a	13.23A
10	13.00f	13.02e	13.05d	13.02B
20	12.73i	12.76h	12.87g	12.79C
30	12.55k	12.61j	12.62j	12.59D
Mean*	12.86C	12.90B	12.96A	
Second season: 2017				
0	13.15d	13.27b	13.40a	13.27A
10	13.01f	13.19c	13.25b	13.15B
20	12.84i	13.01f	13.12e	12.99C
30	12.61j	12.92h	12.95g	12.84D
Mean*	12.91C	13.10B	13.18A	

*and ** refer to specific effect of number of bunches /palm and thinning %, respectively.

Means of specific and interaction effects followed by the same capital and small letter/s, respectively did not significantly differ at 5 % level

3.12 Total Soluble Solids (TSS%)

3.12.1 Specific effect

With regard to the specific effect of two investigated factors (number of bunches/palm and thinning %), as well as interaction of their possible combinations on TSS % of 'Sewi' date palm, data obtained during 2016 and 2017 seasons are presented in Table 12. With regard to the specific effect of number of bunches/palm it is quite clear that a negative relationship was obviously detected between number of bunches per palm and TSS %. Anyhow, the highest values of TSS % were recorded with 8 bunches / palm which statistically ranked the first. Moreover, 10 bunches/ palm and 12 bunches/palm ranked statistically second and third respectively during 2016 and 2017 seasons.

Referring the specific effect of thinning level on TSS % Table 12 display clearly that the highest TSS % was exhibited by 20% thinning in the first season and 30% thinning in the second season. Meanwhile, the lowest TSS % was by zero thinning level during both seasons of study.

3.12.2 Interaction effect

The response of TSS % to the interaction effect of two investigated factors followed typically the contrary trend previously discussed with fruit

moisture %. Hence the highest value of TSS % was significantly coupled with 8 bunches/palm + 30% thinning level during 2016 and 2017 seasons, followed descendingly by 10 bunches/palm + 30% thinning level, 12 bunches/palm + 30% thinning level and 8 bunches/palm + 20% thinning level. Such trend was true during both seasons of study. On the contrary, 12 bunches/palm + zero thinning level and 12 bunches/palm + 10 %thinning level ranked statistically last in this concern during two seasons.

3.13 Fruit Titratable Acidity (%)

3.13.1 Specific effect

Data obtained during both 2016 and 2017 seasons in Table 13 revealed obviously that the response of fruit titratable acidity % to the specific effect of number of bunches/palm was not so pronounced, where differences in most cases were not only to slight to reach level of significance. Such trend was true during 2016 and 2017 seasons. As for the specific effect of thinning levels or %, it was quite clear that (zero % thinning) was exhibited statistically the highest values of fruit titratable acidity % during two experimental seasons of study. Descendingly followed by (10% thinning) and (20% thinning level), respectively, during both seasons. Meanwhile (30% thinning) ranked statistically last in this concern during two seasons.

Table 12. Total soluble solids (TSS) % of 'Sewi' date palm as influenced by specific and interaction effects of number of bunches /palm and thinning % during 2016 and 2017 seasons

Total soluble solids (TSS) %				
No. of bunch/palm	8	10	12	Mean**
Thinning (%)				
First season: 2016				
0	77.39g	77.13h	76.99h	77.17D
10	78.36f	78.53f	77.35g	78.08C
20	79.14d	78.94de	81.52a	79.87A
30	79.84b	79.56c	78.85e	79.42B
Mean*	78.68A	74.54B	78.68A	
Second season: 2017				
0	77.22h	77.05i	76.99i	77.09D
10	77.79f	77.65g	77.32h	77.59C
20	78.55c	78.34d	77.96e	78.28B
30	79.18a	79.03b	78.65c	78.95A
Mean*	78.18A	78.02B	77.73C	

*and ** refer to specific effect of number of bunches /palm and thinning %, respectively.

Means of specific and interaction effects followed by the same capital and small letter/s, respectively did not significantly differ at 5% level

3.13.2 Interaction effect

Table 13 shows clearly that the fruit titratable acidity of 'Sewi' date palm responded significantly to the various investigated treatments (3 number of bunches/palm x 4 thinning levels). Herein, the highest Fruit titratable acidity % were exhibited significantly by (12 bunches/palm + zero % thinning level). Such trend was true during 2016 and 2017 seasons, respectively. Moreover, (12 bunches/palm + 10% thinning) ranked statistically the second followed by (12 bunches/palm + 20% thinning level) which ranked statistically the third in this concern. On the contrary, (12 bunches/palm + 30% thinning level) came statistically last in this regard during 2016 and 2017 seasons.

3.14 TSS/acid Ratio

3.14.1 Specific effect

With regard to the specific effect of number of bunches per palm it is quite evident as shown from tabulated data in Table 14 that three investigated treatments (8,10 and 12) were significant as compared each other. Hence, the greatest values of TSS/acid ratio were significantly coupled with 8 bunches/palm followed by 10 and 12 bunches per palm, respectively. Such trend was true during 2016 and 2017 seasons.

Referring the specific effect of thinning % (0, 10,20 and 30%), Table 14 display obviously that the highest TSS/acid ratio was significantly in

concomitant to 30% thinning percentage during both seasons of study, significantly followed in an ascending order by 20, 10 and zero %, respectively. during 2016 and 2017 seasons.

3.14.2 Interaction effect

As for the interaction effect of different combinations between two studied factors, i.e., (3number of bunches per palm x thinning %), data obtained during two seasons as shown in Table 14 revealed obviously that the greatest TSS/acid ratio was always in significant concomitant to 8 bunches per palm + 30% thinning during 2016 and 2017 seasons, whereas, the lowest values of TSS/acid ratio was exhibited by 12 bunches per palm + zero % thinning level during both seasons of study.

3.15 Specific Effect

As for the specific effect of number of bunches/palm Table 15 reveals that the response followed typically the same trend previously discussed with the TSS % during two seasons for 'Sewi' date palm fruit. Herein, 8 bunches/palm were significantly the highest in this concern as compared with the others (10 and 12 bunch/palm). Such trend was true during both seasons.

Concerning the specific effect of differential investigated thinning levels. It is so clear that 30 % thinning level was statistically the superior in this concern during both seasons followed by 20 % thinning level in both seasons.

Table 13. Fruit titratable acidity (%) of 'Sewi' date palm as influenced by specific and interaction effects of number of bunches /palm and thinning % during 2016 and 2017 seasons

Thinning (%)	Fruit titratable acidity (%)				
	No. of bunch/palm	8	10	12	Mean**
First season: 2016					
0		0.251bc	0.261b	0.279a	0.264A
10		0.230e	0.237c-e	0.259b	0.242B
20		0.189f	0.232de	0.249b-d	0.223C
30		0.189f	0.200f	0.233c-e	0.207D
Mean*		0.215C	0.232B	0.255A	
Second season: 2017					
0		0.274b-d	0.278bc	0.300a	0.284A
10		0.264b-e	0.270b-d	0.282b	0.272B
20		0.261c-e	0.262c-e	0.281b	0.268B
30		0.250e	0.250e	0.259de	0.253C
Mean*		0.262B	0.265B	0.281A	

*and ** refer to specific effect of number of bunches /palm and thinning %, respectively.

Means of specific and interaction effects followed by the same capital and small letter/s, respectively did not significantly differ at 5 % level

Table 14. TSS/acid ratio of 'Sewi' date palm as influenced by specific and interaction effects of number of bunches/palm and thinning % during 2016 and 2017 seasons

Thinning (%)	TSS/acid ratio				
	No. of bunch/palm	8	10	12	Mean**
First season: 2016					
0		308.3h	295.5j	275.9k	293.3D
10		340.7d	331.4f	298.6i	323.6C
20		418.7b	340.3c	327.4g	362.1B
30		422.4a	397.8c	338.4e	386.2A
Mean*		372.5A	341.2B	310.1C	
Second season: 2017					
0		281.8g	277.2h	256.6j	271.9D
10		294.7e	287.6f	274.2i	285.5C
20		301.0c	299.0d	277.4h	292.5B
30		316.7a	316.1a	303.7b	312.2A
Mean*		298.5A	295.0B	278.0C	

*and ** refer to specific effect of number of bunches /palm and thinning %, respectively.

Means of specific and interaction effect effects followed by the same capital and small letter/s, respectively did not significantly differ at 5 % level

3.15.1 Interaction effect

Table 15 concerning the interaction effect of two studied factors (number of bunches/palm x thinning levels), it was so obvious that (8 bunches/palm + 30% thinning levels) had generally the highest Total sugars %, discendingly followed by (10 bunches / palm + 30% thinning level) and (8 bunches/ palm + 20% thinning level), which ranked second and third from the statically point of view, respectively. On the contrary, (12 bunches /palm + zero thinning level) which statistically the inferior combinations and exhibited generally the least total sugars % during 2016 and 2017 seasons.

3.16 Reducing Sugars (%)

3.16.1 Specific effect

Concerning the specific effect of number of bunches / palm on reducing sugars %, Table 16 reveals obviously that the highest reducing sugars % induced significantly by 8 bunches / palm, discendingly followed by 10 bunches / palm and 12 bunches / palm during 2016 and 2017 seasons, respectively.

Concerning the reducing sugars % in response to specific effect of thinning %, data obtained during 2016 and 2017 seasons as shown in Table 16 display obviously that 30% thinning surpassed statistically the other thinning levels, followed by 20% thinning level and 10% thinning during 2016 and 2017 seasons, respectively.

3.16.2 Interaction effect

With regard to the interaction effect of two investigated factors on reducing sugars % date palm 'Sewi' cv., it is quite clear that specific effect of each factor was reflected directly on its own combinations. Anyhow, the highest reducing sugars % was significantly coupled with (8 bunches /palm +30% thinning). On the contrary, the lightest average fruit pulp weight was always in significant concomitant with (12bunches / palm + zero thinning %). In addition, other combinations were in between the abovementioned two extents during both 2016 and 2017 seasons.

3.17 Non-reducing Sugars (%)

3.17.1 Specific effect

With respect to specific effect of number of bunches per palm, data obtained during both seasons declared that non-reducing sugars (%) of 'Sewi' date palm followed typically the same trend previously discussed with reducing sugars (%) especially in the first season. Meanwhile, the reverse was true in the second season.

Concerning, the specific effect of thinning % (0, 10, 20 and 30%). 30% thinning level increased significantly non-reducing sugars (%) during 2016 and 2017 seasons, followed by 20 % thinning which ranked statistically second during the first season also zero % thinning level ranked statistically second during the second season.

3.17.2 Interaction effect

Concerning the inter action effect of various combinations between the investigated two factors (3 number of bunches /palm x 4 thinning level) non-reducing sugars % of date palm 'Sewi'. Table 17 shows obviously that the trend of response followed typically the same trend previously discussed with reducing sugars % especially in the first season. Meanwhile, the

reverse was true in the second season. Herein, the highest non-reducing sugars (%) was always closed relationship to those 'Sewi' date palm treated with (8 bunches /palm +30% thinning) in the first season and (12 bunches /palm +zero % thinning) in the second season, followed in an ascending order by (10 bunches / palm + 30% thinning) in the first season and (8 bunches /palm +30 %thinning) in the second season.

Table 15. Total sugars (%) of 'Sewi' date palm as influenced by specific and interaction effects of number of bunches /palm and thinning % during 2016 and 2017 seasons

		Total sugars (%)			
No. of bunch/palm		8	10	12	Mean**
Thinning (%)					
First season: 2016					
0		71.15h	71.09i	70.86j	71.03D
10		72.32d	72.23e	71.45g	72.00C
20		73.47c	72.31d	71.71f	72.49B
30		73.74a	73.53b	72.35d	73.21A
Mean*		72.67A	72.29B	71.59C	
Second season: 2017					
0		70.99i	71.06h	70.59j	70.88D
10		71.12h	71.56g	71.10h	71.26C
20		72.57d	72.05e	71.68f	72.10B
30		73.31a	73.14b	72.70c	73.05A
Mean*		72.00A	71.95B	71.52C	

*and ** refer to specific effect of number of bunches /palm and thinning %, respectively.
Means of specific and interaction effects followed by the same capital and small letter/s, respectively did not significantly differ at 5% level

Table 16. Reducing sugars (%) of 'Sewi' date palm as influenced by specific and interaction effects of number of bunches/palm and thinning % during 2016 and 2017 seasons

		Reducing sugars (%)			
No. of bunch/palm		8	10	12	Mean**
Thinning (%)					
First season: 2016					
0		60.87i	60.77j	60.69k	60.78D
10		61.69f	61.53g	61.49h	61.57C
20		62.66a	61.89d	61.76e	62.10B
30		62.67a	62.46b	62.33c	62.49A
Mean*		61.97A	61.66B	61.57C	
Second season: 2017					
0		61.44g	61.31j	59.91k	60.89D
10		61.40h	61.43gh	61.37i	61.40C
20		62.62d	62.58e	61.47f	62.22B
30		63.04a	62.90b	62.66c	62.87A
Mean*		62.13A	62.06B	61.35C	

*and ** refer to specific effect of number of bunches /palm and thinning %, respectively.
Means of specific and interaction effects followed by the same capital and small letter/s, respectively did not significantly differ at 5% level

Table 17. Non-reducing sugars (%) of 'Sewi' date palm as influenced by specific and interaction effects of number of bunches /palm and thinning % during 2016 and 2017 seasons

Thinning (%)	Non-reducing sugars (%)				
	No. of bunch/palm	8	10	12	Mean**
First season: 2016					
0		10.28e	10.32e	10.17f	10.26C
10		10.63c	10.70c	9.96g	10.43B
20		10.81b	10.41d	9.95g	10.39B
30		11.07a	11.07a	10.02g	10.72A
Mean*		10.69A	10.63B	10.02C	
Second season: 2017					
0		9.55h	9.75g	10.68a	9.99B
10		9.72g	10.13d	9.72g	9.86C
20		9.95f	9.47i	10.21c	9.87C
30		10.26b	10.24bc	10.04e	10.18A
Mean*		9.87C	9.90B	10.16A	

*and ** refer to specific effect of number of bunches /palm and thinning %, respectively.

Means of specific and interaction effects followed by the same capital and small letter/s, respectively did not significantly differ at 5% level

Anyhow, the total soluble solids, total sugars and reducing sugar contents were also increased as a result of fruit thinning on 'Amhat' dates [45], 'Zaghloul' dates [44] and [42]. Moisture content was decreased in 'Barhi' dates and 'Samani' dates [46], while acidity content did not affect by fruit thinning in 'Shaman' date fruit [33]. As well as, [22] thinned 'Seewy' bunches with different thinning degrees at various times. Results indicated that thinning treatments improved and increased significantly TSS % than the control. Meanwhile, the best treatment was thinning 30% of the total number of strands from the center of bunches, 4 weeks after pollination. Beside, [41] found that removing 10% of strands, 25% and 50% randomly from total strands number per bunch of 'Kur' date palm cultivar after 5 weeks from pollination, significantly increased TSS content as compared to control. Also, the highest value was obtained by thinning at 50%, followed by 25 and 10% strand removal from the bunch.

4. CONCLUSION

It can be recommended from the results of this study that, the use of 8 bunches/palm with 30% thinning level of strands from the center of the bunch was the best in most of the measurements studied so we recommend the use this treatment on the date palm 'Sewi' under the same conditions.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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