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Thinning Methods Effect on Yield and Fruit Quality of Date Palm Cv. Saqei

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ABSTRACT

Thinning fruit is regarded as one of the most important horticultural activities related to fruit size and quality. The experiment was carried out during two (2020 and 2021) seasons at the Training and Research Station, King Faisal University, (KSA) to evaluate the impact of thinning applications on the yield and fruit quality cv. Saqei. A factorial experiment laid-out in a randomized completely block design with three replicates was conducted. The first factor was thinning date, which includes two levels (after one or two months after pollination, i.e., April 1st using comb-1, and May 1st by comb-2). The second factor was thinning methods: without thinning, thinning once or twice with a comb, removing alternative fruit of the strand, and removing the entire central strands). All thinning methods reduced yield per palm and bunch weight compared to the control. Fruit thinning methods significantly increased all physical characteristics such as fruit weight, diameter, length, flesh weight, seed weight, and pulp/ seed ratio. These parameters were highest in the alternative fruit-removing method (11.05g, 22.6mm, 40.5mm, 10.2g, 0.86g and 12.0, respectively), followed by the method of removing the central strand, comb-2, and comb-1 methods. Removing the central strand and removing alternative fruit were also significantly increased in TSS%, followed by the comb-2 method. In conclusion the method of removing alternative fruits or removing the central strands yielded the best results. Additionally, thinning by a comb came in the second rank, as the technique had promising results, saving time and labour costs compared to other methods.

Keywords: Date palm, thinning, comb, yield, fruit quality.



INTRODUCTION

The date palm (*Phoenix dactylifera* L.) is the main fruit crop in Saudi Arabia (KSA) which is adapted to desert conditions and is grown on 75% of the country's total area under permanent crops. In Saudi Arabia, there are approximately 31,234,155 million date palm trees (General Authority for Statistics, KSA, 2019). A 152705 hectares of date palms is cultivated, yielding 1,541,769 tons (FAO, 2020). Appropriate fruit thinning is a key component of effective orchard management strategies because it provides the retaining fruits a better chance to develop, increase in size, and improve in quality. Additionally, it provides better quality and reduced compactness among set fruits within the bunch. Thinning fruit is regarded as one of the most important horticultural activities related to fruit size and quality since large-size fruits with higher quality have a higher marketability. In date palms cultivation, fruit thinning is frequently practiced, where 50 to 80% of the fruits are removed (Morton, 1987). There are many methods to remove inflorescences or bunches, shorten of stands or remove a part of the bunch, removal individual fruits, or adjust the ratio of bunch:leaves (Ben Salah *et al.*, 1998). Based on bunch and palm weight, the majority of research concluded that thinning treatments resulted in a considerable drop in yield (Barreveld, 1993; Al Saikhan and Sallam, 2015; Elbadawy *et al.*, 2018; Ahmed *et al.*, 2019; Moustafa *et al.*, 2019; Mukhtar and Ali, 2019 and Ahmed, 2022). The mode of action of the favored impact of the thinning practices is significantly influenced by the timing of the thinning application. It is noteworthy that the Hababouk stage's thinning produced better effects than the

Kemri stage's treatments (Ahmed *et al.*, 2019). According to Marzouk *et al.* (2007), Al-Wasfy and Mostafa (2008), Soliman and Harhash (2012), Soliman *et al.* (2011), Bashir *et al.* (2014), Madani *et al.* (2021), and Ahmed (2022), thinning by removing 30% of the strands from the center resulted in a significant decrease in yield and a significantly improved fruit quality.

Due to bunch thinning, the physical characteristics of date palm fruits is improved. Elbadawy *et al.* (2018), Moustafa *et al.* (2019), Mukhtar and Ali, (2019), and Ahmed (2022) found that the thinning applications considerably increased the highest fruit weight, pulp weight, fruit length, fruit diameter, and first grade of fruit percentage. Additionally, according to a number of studies, bunch thinning also enhanced the characteristic properties of date palm fruits. Chemical attributes, such as TSS, reducing and total sugars were improved by strand thinning treatments compared to the control (Moustafa *et al.*, 2019; Mukhtar and Ali, 2019 and Ahmed, 2022). Based on the aforementioned issues, the current study aims to develop, design, and validate an effective, affordable, and farmer-adaptable tool for the fruit thinning of cv. Saqei. The study also includes to assess the effectiveness of comb tools compared to manual thinning techniques.

MATERIALS AND METHODS

Studies were carried out in the orchards of the Date Palm Research Center of Excellence, which is situated at King Faisal University in Al-Ahsa, KSA (Latitude: 25.27 °N, Longitude: 49.71 °E). Date palm cultivar Saqei was selected for the experiment, which was conducted in the

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growing seasons of 2020 and 2021. Thirty, 9-year-old date palm trees were selected for thinning treatments and were planted in sandy soil with drip irrigation. The same horticultural practices were applied to all experimental palms, and the same pollen sources were used for pollination on March 1. The excess early, late, and small sized bunches were removed before the trials started, bringing the number of spathes per palm reduced to six.



Comb-1



Comb-2

Fig 1. Comb tools for immature date fruit thinning at different stages of development.

Experimental Design

A factorial experiment was used in a randomized completely block design with tree replicates. The treatments were as follows:

- I. First factor was two thinning dates: (1) April 1 (one month after pollination) for comb-1 and (2) May 1 (two months after pollination) for comb-2.
- II. Second factor was five thinning methods: (1) Without thinning (control), (2) Fruit thinning using the comb once along the strands from top to bottom, (3) Fruit thinning using the comb twice along the strands from top to bottom, (4) Alternative fruit removal from a strand (50% thinning), and (5) 15-18 central strands removal (30% thinning).

Evaluation of thinning percentage in different comb tools

Twenty strands from each bunch were selected to study various parameters. After counting the number of fruits and nodes, the percentage of thinning was determined using the following equation:

$$\text{Thinning percentage (\%)} = \frac{\text{Nodes number (empty fruit scars on strand)} * 100}{\text{Fruits retained number plus nodes number on strand}}$$

Therefore, while employing combs 1 and 2, the thinning percentages were 51.7 and 61.6%, respectively.

Data collection

1. Bunch weight and fruits yield per palm (kg):

At the end of the ripening stage (harvest time between August 20 and September 10), average bunch weight (kg) and yield per tree (kg), i.e., bunches number x average bunch weight, were recorded.

2. Fruit qualities

a. **Fruit physical characteristics:** Following harvest, a sample of 30 fruits was taken randomly from each replicate to assess the physical characteristics of date fruits, including weight of fruit (g), fruit diameter and

Design of the thinning tool

The most promising dates thinning tool was the comb, which was further assessed and set to the test in the field. Several dates thinning tools were modified, designed, and tested. Comb-1 had eight plastic-covered nails spaced 4.0 mm apart, while comb-2 had four plastic-covered nails spaced 15.0 mm apart, as illustrated in Figure (1). According to the size of the developing date fruits, the varying numbers of nails were adjusted.

length (mm), flesh weight (g), seed weight (g), and pulp / seed ratio.

b. **Fruit chemical characteristics:** Total soluble solids (TSS) and fruit moisture percentages were determined using A.O.A.C. standard methods (A.O.A.C., 2016) The sugar content in dates was estimated using chromatographic method. The HITACHI HPLC (model L-2130) solvent delivery group and L-2200 autosampler (HITACHI VWR) was used. A PDA detector, an HITACHI detector, and an L-2490 RI detector were also used in the system. For isocratic elution, the nucleated-Sil sugar column was used with an acetonitrile-water (75:25) mobile phase and 1.5 mL/min of fluid was flowing. RI was carried out at room temperature (Yuan & Chen, 1999).

Statistical analysis

According to statistical analysis method stated by Gomez and Gomez (1984), the data were subjected to calculate the analysis of variance. According to Waller and Duncan (1969), the least significant differences test (LSD) was used to assess treatment mean differences at 5% probability. Statistix 8.1 was used to conduct all statistical analyses (Analytical Software, 2005).

RESULTS AND DISCUSSION

1. Fruits yield/palm, weights of bunch and fruit:

The effect of thinning dates on yield/palm (kg), bunch weight (kg), and weight of fruit (g) are shown in Table (1) during two seasons (2020 and 2021). The results revealed a significant impact in the previous traits as affected with thinning date since the first time gave the heaviest fruit weight. The palm yield of Saqei was significantly affected by thinning methods ($P \leq 0.05$). The control (without thinning) showed the highest palm yield in 2020 and 2021 (41.5 and 38.5 kg, respectively) and bunch weight (6.92 and 6.42 kg, respectively) compared to the

other methods. The alternative fruit removal technique showed the lowest values in this respect. In addition, removing central strands and thinning two times with a comb came in the second position without any significant differences. On the other side, the alternative fruit removal technique also produced the heaviest value of fruit weight (10.83 and 11.27 g), followed by removing central strands and thinning twice-time treatments. Regarding the interaction between study factors in the experiment significant effect was noticed. The control treatment produced the highest palm yield and bunch weight at 1st and

2nd thinning dates during the two seasons. At the same time, thinning treatments increased the fruit weight.

Thinning treatments decreased fruit yield because of using bunch-thinning methods. It might be due to the reduced number of fruits compared to un-thinned bunches. The results of our study were attained by the above outcomes of Al Saikhan and Sallam (2015); Elbadawy *et al.* (2018); Ahmed *et al.* (2019); Moustafa *et al.* (2019); Mukhtar and Ali, (2019) and Ahmed (2022). They stated that fruit thinning reduced the bunch weight and yield per palm. Moreover, they cleared that the thinning applications considerably increased the highest values of fruit weight.

Table 1. Effect of thinning dates and methods on bunch weight, yield/palm (kg) and fruit weight of Saqei cv. date palm during 2020 and 2021 seasons.

Characters Treatments	Yield/palm (kg)		Bunch weight (kg)		Fruit weight (g)	
	2020	2021	2020	2021	2020	2021
A: Thinning dates:						
1 st April (comb-1)	33.6 ^b	31.1 ^b	5.60 ^b	5.18 ^b	9.60 ^a	10.00 ^a
1 st May (comb-2)	34.3 ^a	32.8 ^a	5.72 ^a	5.46 ^a	9.00 ^b	9.59 ^b
B: Thinning methods:						
Control	41.5 ^a	38.5 ^a	6.92 ^a	6.42 ^a	7.07 ^d	7.95 ^d
Comb one time	32.9 ^b	32.4 ^b	5.49 ^b	5.39 ^b	9.02 ^c	9.60 ^c
Comb two times	32.6 ^{bc}	30.5 ^{bc}	5.42 ^{bc}	5.08 ^{bc}	9.61 ^b	9.89 ^{bc}
Alternative fruit removal	30.9 ^d	28.6 ^c	5.15 ^d	4.77 ^c	10.83 ^a	11.27 ^a
Central strands removal	31.8 ^{cd}	29.6 ^c	5.30 ^{cd}	4.94 ^c	9.97 ^b	10.27 ^b
Interaction (AxB):						
Control	41.7 ^a	37.2 ^a	6.95 ^a	6.20 ^a	7.20 ^f	7.97 ^e
1 st April (comb-1)	31.7 ^{de}	30.6 ^{cde}	5.28 ^{de}	5.11 ^{ede}	9.17 ^{de}	9.57 ^{cd}
Comb one time	30.8 ^e	28.0 ^{ef}	5.13 ^e	4.66 ^{ef}	10.26 ^{bc}	10.45 ^{bc}
Comb two times	30.9 ^e	28.3 ^{ef}	5.16 ^e	4.72 ^{ef}	11.06 ^a	11.56 ^a
Alternative fruit removal	32.8 ^{cd}	31.4 ^{cd}	5.46 ^{cd}	5.23 ^{cd}	10.31 ^b	10.45 ^{bc}
Central strands removal	32.8 ^{cd}	31.4 ^{cd}	5.46 ^{cd}	5.23 ^{cd}	10.31 ^b	10.45 ^{bc}
Control	41.3 ^a	39.9 ^a	6.89 ^a	6.64 ^a	6.93 ^f	7.93 ^e
1 st May (comb-2)	34.2 ^{bc}	34.1 ^b	5.70 ^{bc}	5.68 ^b	8.87 ^e	9.63 ^{cd}
Comb one time	34.3 ^b	33.0 ^{bc}	5.71 ^b	5.50 ^{bc}	8.97 ^{de}	9.33 ^d
Comb two times	34.3 ^b	33.0 ^{bc}	5.71 ^b	5.50 ^{bc}	8.97 ^{de}	9.33 ^d
Alternative fruit removal	30.9 ^e	29.0 ^{def}	5.14 ^e	4.83 ^{def}	10.60 ^{ab}	10.98 ^{ab}
Central strands removal	30.9 ^e	27.9 ^f	5.14 ^e	4.65 ^f	9.63 ^{cd}	10.10 ^{bcd}

Similar letter(s) in the same column (in group internal) are non-significant statistically at 0.05 level of probability.

2- Fruit physical traits:

The effect of thinning dates on the physical traits are presented in Table 2. The results showed a significant effect

on fruit diameter, length, and flesh weight, whereas it was non-significant regarding weight of seed and pulp/seed ratio.

Table 2. Effect of thinning dates and methods on fruit physical traits of Saqei cv. date palm during 2020 and 2021 seasons.

Characters Treatments	Fruit length (mm)		Fruit diameter (mm)		Pulp weight (g)		Seed weight (g)		Pulp / seed ratio	
	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021
A: Thinning dates:										
1 st April (comb-1)	36.5 ^a	39.3 ^a	21.0 ^a	21.8 ^a	8.86 ^a	9.13 ^a	0.74 ^a	0.87 ^a	12.0 ^a	10.5 ^a
1 st May (comb-2)	34.2 ^b	37.1 ^b	19.2 ^b	21.2 ^b	8.27 ^b	8.74 ^b	0.72 ^a	0.85 ^a	11.5 ^a	10.3 ^a
B: Thinning methods:										
Control	29.1 ^e	34.1 ^d	16.7 ^d	19.8 ^c	6.40 ^d	7.19 ^d	0.67 ^c	0.76 ^c	9.6 ^b	9.5 ^d
Comb one time	35.6 ^c	39.6 ^b	20.2 ^c	21.8 ^b	8.23 ^c	8.71 ^c	0.78 ^a	0.88 ^{ab}	10.6 ^b	9.9 ^c
Comb two times	34.4 ^d	37.4 ^c	20.4 ^{bc}	21.5 ^b	8.87 ^b	9.05 ^{bc}	0.74 ^{ab}	0.84 ^b	12.0 ^a	10.8 ^{bc}
Alternative fruit removal	40.0 ^a	41.0 ^a	22.3 ^a	22.9 ^a	10.05 ^a	10.34 ^a	0.78 ^a	0.93 ^a	12.9 ^a	11.1 ^a
Central strands removal	37.7 ^b	38.8 ^b	21.0 ^b	21.6 ^b	9.28 ^b	9.39 ^b	0.69 ^{bc}	0.88 ^{ab}	13.4 ^a	10.7 ^{ab}
Interaction (AxB):										
Control	30.0 ^a	35.0 ^a	17.5 ^a	20.0 ^a	6.52 ^a	7.19 ^a	0.69 ^a	0.78 ^a	9.4 ^a	9.2 ^a
1 st April (comb-1)	36.8 ^a	40.8	21.1 ^a	22.1 ^a	8.38 ^a	8.68 ^a	0.80 ^a	0.90 ^a	10.5 ^a	9.6 ^a
Comb one time	35.8 ^a	38.8 ^a	21.1 ^a	21.6 ^a	9.50 ^a	9.60 ^a	0.76 ^a	0.86 ^a	12.5 ^a	11.2 ^a
Comb two times	41.0 ^a	42.0 ^a	23.4 ^a	23.4 ^a	10.30 ^a	10.65 ^a	0.76 ^a	0.91 ^a	13.6 ^a	11.7 ^a
Alternative fruit removal	38.8 ^a	39.8 ^a	21.8 ^a	21.8 ^a	9.61 ^a	9.56 ^a	0.70 ^a	0.89 ^a	13.7 ^a	10.7 ^a
Central strands removal	38.8 ^a	39.8 ^a	21.8 ^a	21.8 ^a	9.61 ^a	9.56 ^a	0.70 ^a	0.89 ^a	13.7 ^a	10.7 ^a
Control	28.2 ^a	33.2 ^a	15.8 ^a	19.5 ^a	6.28 ^a	7.19 ^a	0.65 ^a	0.74 ^a	9.7 ^a	9.7 ^a
1 st May (comb-2)	34.4 ^a	38.4 ^a	19.3 ^a	21.5 ^a	8.09 ^a	8.75 ^a	0.77 ^a	0.87 ^a	10.5 ^a	10.1 ^a
Comb one time	33.0 ^a	36.0 ^a	19.6 ^a	21.3 ^a	8.24 ^a	8.50 ^a	0.73 ^a	0.83 ^a	11.3 ^a	10.2 ^a
Comb two times	33.0 ^a	36.0 ^a	19.6 ^a	21.3 ^a	8.24 ^a	8.50 ^a	0.73 ^a	0.83 ^a	11.3 ^a	10.2 ^a
Alternative fruit removal	39.0 ^a	40.0 ^a	21.2 ^a	22.4 ^a	9.80 ^a	10.03 ^a	0.79 ^a	0.94 ^a	12.4 ^a	10.7 ^a
Central strands removal	36.5 ^a	37.8 ^a	20.1 ^a	21.3 ^a	8.96 ^a	9.23 ^a	0.67 ^a	0.86 ^a	13.4 ^a	10.7 ^a

Similar letter(s) in the same column (in group internal) are non-significant statistically at 0.05 level of probability.

The first date of thinning (April 1st) with comb-1 was recorded the highest values in this respect (21.0 mm, 36.5 mm, 8.86 g and 21.8 mm, 39.3 mm, 9.13 g during the 2020 and 2021 seasons, respectively) compared with the second date used comb-2. All thinning methods caused values significantly increase in all physical characters, i.e., fruit length & diameter, pulp weight, seed weight, and pulp: seed ratio comparison with those without thinning (control), as shown in Table (2). The lowest values were obtained from the control (31.6 mm, 18.3 mm, 6.8 g, 0.72 g, and 9.55, as the average over two seasons, respectively). In contrast, the alternative fruit removal technique produced the highest values compared to the other methods (22.6 mm, 40.5 mm, 10.2 g, 0.85 g, and 12.0, respectively), followed by the removal of central strands thinning treatment, and using the comb once or twice. There is no significant effect between thinning dates and methods on physical characteristics.

These results followed the same trend regarding the thinning dates, i.e., the first date (April 1st) with comb-1 and different thinning methods recorded the highest values in this respect. It indicated that the early thinning treatment on April 1st gave better values due to enhancement in the net photosynthesis than late thinning. Our results coincide with Ahmed *et al.* (2019), who found that the Hababouk stage gave good results than in kemri stage. The improvement in physical fruit characters may be due to the reducing number of fruits per bunch. Similar trend and findings were stated by Elbadawy *et al.* (2018); Moustafa *et al.* (2019); Mukhtar and Ali (2019), and Ahmed (2022). They found that the fruit's physical characteristics improved by thinning application.

3- Fruit chemical traits:

Fruit chemical parameters as affected by thinning treatments are founded in Table (3) of two seasons. The

results showed a non-significant effect in fruit chemical traits (moisture, TSS, glucose, and sucrose percentages) except fructose and total sugars percentages due to thinning dates. The first date (1st April) with comb-1 showed a significant increase in fructose (29.3 and 32.9%) during two seasons and in total sugar was 60.4 and 61.9, respectively. The results clear that treated with different thinning methods was non-significant for moisture and sucrose percentages. Regarding the influence of thinning methods on TSS, the results showed in Table (3) clearly showed that the alternative fruit removal technique and removing central strands (30%) were associated with a significant increase (58.5 and 59.4% over two seasons, respectively), followed by thinning used comb two times (56.3%).

All thinning methods produce the highest values in fructose, glucose and total sugar compared with un-thinned treatment during two seasons. Thinning with comb two times was superior in the above parameters. There was a non-significant effect between thinning dates and methods on moisture, sucrose, and total sugars. Regarding the interaction between the two factors, data show significant effects in TSS, fructose, and glucose percentages. Thinning methods applied on 1st May by alternative fruit removal technique or removing central strands gave the highest values compared with the 1st April. Meanwhile, thinning techniques on 1st April produced the highest values of glucose and fructose percentages. The obtained results may be due to the high rate of net photosynthesis and other metabolites in the fruits. Similar results were found by Moustafa *et al.* (2019), Mukhtar and Ali (2019), and Ahmed (2022), they stated that thinning practices improved the chemical traits such as TSS and sugars.

Table 3. Effect of thinning dates and methods on fruit chemical traits of Saqei cv. date palm during 2020 and 2021 seasons.

Characters Treatments	Moisture %		TSS %		Fructose %		Glucose %		Sucrose %		Total sugar %		
	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021	
A: Thinning dates:													
1 st April (comb-1)	17.6 ^a	18.1 ^a	57.4 ^a	52.7 ^a	29.3 ^a	32.9 ^a	30.4 ^a	28.2 ^a	0.75 ^a	0.67 ^a	60.4 ^a	61.9 ^a	
1 st May (comb-2)	18.8 ^a	15.3 ^a	58.1 ^a	53.4 ^a	28.2 ^b	31.8 ^b	29.1 ^a	27.5 ^a	0.74 ^a	0.66 ^a	58.0 ^b	60.0 ^b	
B: Thinning methods:													
Control	17.0 ^a	16.0 ^a	52.4 ^c	50.4 ^c	26.6 ^c	31.6 ^b	24.2 ^d	27.6 ^{ab}	0.82 ^a	0.72 ^a	51.7 ^b	59.9 ^c	
Comb one time	19.9 ^a	18.7 ^a	53.4 ^c	49.4 ^c	27.5 ^{bc}	32.0 ^b	32.5 ^a	28.5 ^{ab}	0.70 ^a	0.60 ^a	60.7 ^a	61.1 ^{ab}	
Comb two times	17.5 ^a	16.0 ^a	58.8 ^b	53.8 ^b	28.6 ^b	32.1 ^{ab}	32.4 ^{ab}	28.9 ^a	0.73 ^a	0.65 ^a	61.8 ^a	61.9 ^a	
Alternative fruit removal	17.9 ^a	16.1 ^a	62.1 ^a	54.9 ^{ab}	30.9 ^a	33.4 ^a	29.7 ^c	27.2 ^b	0.81 ^a	0.72 ^a	61.4 ^a	61.3 ^{ab}	
Central strands removal	18.6 ^a	16.5 ^a	62.1 ^a	56.7 ^a	30.0 ^a	32.7 ^{ab}	29.8 ^{bc}	27.1 ^b	0.68 ^a	0.63 ^a	60.5 ^a	60.8 ^b	
Interaction (AxB):													
1 st April (comb-1)	Control	15.8 ^a	16.8 ^a	52.9 ^d	50.9 ^{cd}	26.1 ^{de}	31.1 ^{de}	27.1 ^b	28.8 ^{ab}	0.83 ^a	0.73 ^a	54.0 ^a	60.6 ^a
	Comb one time	19.0 ^a	19.8 ^a	54.9 ^{cd}	50.9 ^{cd}	29.6 ^b	34.1 ^{ab}	30.8 ^{ab}	26.8 ^{bc}	0.70 ^a	0.60 ^a	61.1 ^a	61.5 ^a
	Comb two times	16.7	17.2 ^a	56.9 ^c	51.9 ^c	27.8 ^{cd}	31.3 ^{cde}	34.1 ^a	30.6 ^a	0.78 ^a	0.70 ^a	62.8 ^a	62.6 ^a
	Alternative fruit removal	16.9 ^a	17.1 ^a	60.2 ^b	53.0 ^{bc}	32.5 ^a	35.0 ^a	29.6 ^b	27.1 ^{bc}	0.79 ^a	0.70 ^a	62.9 ^a	62.8 ^a
1 st May (comb-2)	Control	18.2 ^a	15.2 ^a	51.9 ^d	49.9 ^{cd}	27.1 ^{de}	32.1 ^{cd}	21.4 ^c	26.4 ^c	0.80 ^a	0.70 ^a	49.3 ^a	59.2 ^a
	Comb one time	20.8 ^a	17.6 ^a	51.9 ^d	47.9 ^d	25.4 ^e	29.9 ^e	34.2 ^a	30.2 ^a	0.70 ^a	0.60 ^a	60.3 ^a	60.7 ^a
	Comb two times	18.4 ^a	14.9 ^a	60.7 ^b	55.7 ^{ab}	29.5 ^{bc}	33.0 ^{bc}	30.7 ^{ab}	27.2 ^{bc}	0.68 ^a	0.60 ^a	60.8 ^a	60.8 ^a
	Alternative fruit removal	19.0 ^a	15.2 ^a	63.9 ^a	56.7 ^a	29.3 ^{bc}	31.8 ^{cd}	29.7 ^b	27.2 ^{bc}	0.82 ^a	0.73 ^a	59.8 ^a	59.8 ^a
Central strands removal	17.7 ^a	13.7 ^a	61.9 ^{ab}	56.5 ^a	29.7 ^b	32.4 ^{bcd}	29.4 ^b	26.7 ^{bc}	0.72 ^a	0.67 ^a	59.9 ^a	59.8 ^a	

Similar letter(s) in the same column (in group internal) are non-significant statistically at 0.05 level of probability.

CONCLUSION

The above results indicated that all thinning treatments are essential for enhancing fruit quality by increasing spaces between fruits, reducing number of fruits

and saving net photosynthesis, and avoiding bunch breaking and alternate bearing. All fruit thinning methods in the present study reduced yield per palm and bunch weight compared with the control. Meanwhile, the alternative fruit removal technique showed a significant increase in all

physical characteristics, such as fruit weight, diameter, length, seed weight, pulp weight, and pulp/seed rate. Also, it increased chemical properties such as TSS and total sugars. Removal of the central strands (30%) can be adopted as the second option, followed by using comb one or two times. Thinning by comb also gave promising results, which can be used to save labour costs compared to the alternative fruit removal technique.

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تأثير طرق الخف على محصول وجودة ثمار نخيل التمر صنف صقعي

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المخلص

أجريت التجربة خلال موسمي 2020 و 2021 بمحطة التدريب والأبحاث - جامعة الملك فيصل بالأحساء، المملكة العربية السعودية؛ لتقييم تأثير معاملات الخف على المحصول وجودة ثمار صنف النخيل الصقعي. وتم تنفيذ تجربة عملية في تصميم القطاعات العشوائية الكاملة ذات الثلاثة مكررات لهذه الدراسة. العامل الأول: مواعيد الخف، والذي يتضمن مستويين (بعد شهر واحد من التلقيح، أي أول أبريل باستخدام المشط-1، وبعد شهرين من التلقيح، أي أول مايو بواسطة المشط-2). العامل الثاني: طرق الخف، وقد تضمنت خمسة مستويات (بدون خف، الخف بالمشط مرة واحدة أو مرتين، إزالة الثمار بالتبادل من الشمراخ، إزالة الشمراخ المركزية بأكملها). وقد خفضت جميع طرق الخف محصول / النخلة ووزن السويطة (العنق) مقارنة مع الكنترول. وقد أدت طرق خف الثمار إلى زيادة معنوية واضحة في جميع الخصائص الفيزيائية مثل: وزن الثمرة، وقطرها وطولها ووزن اللب ووزن البذرة، ونسبة اللب / البذرة. وقد سجلت طريقة إزالة الثمار بالتبادل قيمة أعلى مقارنة بالطرق الأخرى (11.05 جرام، 22.6 ملم، 40.5 ملم، 10.2 جرام، 0.86 جرام، 12 على التوالي)، تليها إزالة الشمراخ المركزية ثم طريقة المشط-2، وطريقة المشط-1. كما أدت إزالة الشمراخ وطريقة إزالة الثمار بالتبادل إلى زيادة ملحوظة في نسبة المواد الصلبة الذاتية، تليها طريقة المشط-2. وقد أثرت طرق الخف بشكل كبير على الفركتوز والجلوكوز والسكريات الكلية. ويمكن استنتاج أن طريقة إزالة الثمار بالتبادل أو إزالة الشمراخ المركزية قد أعطت أفضل النتائج. علاوة على ذلك، فقد جاء الخف بالمشط في المرتبة الثانية، حيث حققت هذه التقنية نتائج واعدة، منها: توفر الوقت، تكاليف العمالة مقارنة بالطرق الأخرى.