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Effect of Date Palm Thinning Applications on Chemical Properties of Barhi Cultivar in Ripening Stage

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ABSTRACT

This investigation was carried out during the two consecutive seasons, 2023 and 2024 respectively on date palm trees (*Phoenix dactylifera* L.) cv. Barhi grown in a private orchard at Belbis region, Sharkia Governorate, Egypt to evaluate the impact of thinning applications by bunches number and thinning levels using exclusive tools on the yield and fruit quality. Fortyfive date palm trees (fifteen treatments with three replicates for each treatment) were selected in both studied seasons. In a sandy soil and irrigated with drip irrigation system. Date Palm trees were 10-year-old, planted at 8*8m space.

Chemical content of Carotenoids of Barhi date palm was affected markedly by thinning methods during the two seasons researches at ripening stage, which raised the dry matter and moisture especially when used 8 bunches/palm in the two seasons. Interaction between bunches number and thinning methods of pincers treatment in 10 bunches/ palm gave the highest value 53.6% in the second season as compared to control palm gave the minimum values 34.5 and 35.3 % in both seasons respectively. Also bunches number on dry matter showed maximum values (59.5 and 58.4 %) by used 8 bunches / palm in the two seasons respectively. Carotenoids content was affected by bunches number at ripening stage markedly in the first season only. Moreover, thinning methods of comb showed maximum values (8.38 and 9.30 mg) in the both seasons, while the control palm showed the lowest results (4.63 and 5.17mg) in both seasons,respectively.Total chlorophyll at ripening stage of Barhi date palm revealed that maximum values were affected by bunches number in 10 bunches/ palm in both seasons. While 10 bunches/palm gave the lowest results (2.8 and 2.7 mg) in both seasons. Total tannins at ripening stage of Barhi date palm wasaffected by bunches number,whichgave the minimum values by 12 bunches/palm in the two seasons ,while the maximum results showed in 8 bunches/palm in the two seasons, respectively. Also thinning methods showed the lowest content of total tannins with central strands in the first season, however the highest content showed by control palm in the two seasons respectively. Pincers thinning methods gave the greatest results of TSS (34.0) in the first season also comb thinning gave the same trend of TSS in the second season.

The acidity at ripening stage of Barhi date palm gave the lowest values by 8 bunches/palm in the two seasons of study. Pincers thinning method showed the least values of total acidity at ripening stage during the two studied seasons. The interaction between bunches number and thinning methods revealed the lowest by pincers+10 bunches/palm during both seasons. While control palm+12 bunches/palm treatment showed vice versa in this concern. TSS/Acid ratio of Barhi date palm at ripening stage showed a maximum valuesby pincers thinning method during the two seasons, while the lowest values revealed by control palm in both seasons. Vitamin C content of Barhi date palm at ripening stage showed the highest values (3.68 and 3.80 mg) when used 10 bunches/ palm in both seasons. While the least values (3.20 and 3.54 mg) revealed by 12 bunches/palm during two seasons. Howeverpincers thinning methods gave the greatest values (3.70 and 4.05 mg) in both seasons, respectively. The control palm had vice versa in this respect.

Bunches number was affected on reducing sugars at ripening stage of Barhi date palm, which gave the maximum values (44.4 and 43.6 %) by used 8 bunches/ palm in the two seasons. Thinning methods affected on reducing sugars especially pincers treatment gave the highest value (41.3%) during the first season. Additionally control palm showed the lowest values (33.6 and 33.0 %) during the two seasons, respectively. Non-reducing sugars was affected by bunches number markedly in the first season only. Howeverthinning methods especially pincers thinning method showed the greatest values (4.84 and 4.98 %) in the two seasons. Total sugars content % at ripening stage was affected by bunches number / palm which eight bunches/palm showed the highest values (48.3 and 47.2 %) in both seasons. Also thinning methods affected on total sugars by pincers treatment during the two seasons, respectively.

Conclusively: from this resultsof research, improving of fruits chemical properties by thinning methods especially pincers and comb tools in Barhi date palm.

Keywords: Atopic Dermatitis, Endotype, Precision Medicine, Biomarker, T2-High, Barrier-Defective, Th17, Th22, IL-4, IL-13, JAK-STAT, Dupilumab, JAK Inhibitors

1. INTRODUCTION

Date palm trees (*Phoenix dactylifera* L.) are regarded as one of the major widely cultivated horticulture fruit crops and the world's oldest fruits in the Arab world. It is considered the symbol of the life in Egypt's deserts and has a great part in the social lives and people's economic **(El-Salhy *et al.* 2017).**

Barhi date palm cultivar is considered the best fresh date's cultivars. It is favored to the Egyptian consumers. The thinning of fruits is an extremely significant practices for date palm trees to improve fruits quality (physical and chemical properties) for helping in decreasing the bunches breaking, in reducing the bunches compactness and regulating of the fruits alternate bearing. There are a lot of methods for carrying out the thinning, for example, the removal of total bunch or thinning of strands/bunch and the thinning of fruits individually (alternative removal) according to **(El-Assar, 2005;Mostafa and El-Akkad, 2011).**

The chemical attributes, as TSS, total and reducing sugars were developed by thinning of strands methods compared to control palm trees **(Moustafa *et al*., 2019; Mukhtar and Ali, 2019; Ahmed 2022).**

Additionally, alternative fruits removing developed the chemical characteristics as total sugars and TSS %. Central strands removal about (30%) was adopted to be the next option of thinning, this is followed by comb one- or two-times thinning technique. The thinning using comb also proved a promising result, which used to save effort and costs compared with alternative fruits removing **(Sallam 2023).**

El -Hussein *et al.* (1992) reported that TSS and total sugars were significantly developed by the increasing of fruit thinning levels in Samany dates palm.

Additionally, the main objective of the current study is to investigate the effect of different thinning methods on fruit quality of Barhi date palms; such practices might be very necessary for the date palm trees growers. Consequently, the aim of this study showing the effectiveness of thinning methods by bunches or strands removal and its effect on the fruits quality of Barhi cultivar.

The current study was planned to improve chemical fruits quality as (TSS, acidity, TSS/Acid ratio, vitamin C content, fruit carotenoids (mg/100g), total tannins percentage, moisture content, dry matter percentage, total chlorophyll, reducing, non-reducing and total sugars content) of Barhi date palms using different thinning methods as (comb, pincers, alternative and bunch center removal thinning) at Hababouk stage under Belbis region ,Sharkia Governorate, Egypt.

This study included to estimate effectiveness of comb and pincers thinning tools comparing to techniques of other manual thinning.

2. MATERIALS AND METHODS:

This investigation was carried out during the two consecutive seasons (2023 and 2024) respectively on date palm trees (*Phoenix dactylifera* L.) cv. Barhi grown in a private orchard at Belbis region ,Sharkia Governorate ,Egypt to evaluate the impact of thinning applications by bunches number and thinning levels using exclusive tools on the yield and fruit quality. In a sandy soil and irrigated with drip irrigation system. Date Palm trees were 10-year-old, planted at 8*8m space. Forty five date palm trees (fifteen treatments with three replicates for each treatment) were selected in both studied seasons. A factorial experiment was used in a randomized complete block design. Moreover, the trees were uniform and healthy in vigor and size. The same horticultural practices were applied to all experimental palms .The same pollen sources were used for pollination on March till mid of April. The excess early, late and small sized bunches were removed before the trials started. After pollination all bunches were covered with paper bags, its length was 57cm and its width was 33cm.All thinning treatments were at Hababouk stage about forty five days after fruit set. At the end of the ripening stage at harvest time on September about fifteen dates from each replicate were taken randomly to determine fruit quality.

Fruit chemical properties:

1- Moisture content (%):

Moisture content % was estimated as percentage according to AOAC standard methods **(AOAC, 2016).**

Moisture content % =

$$\frac{\text{Average of dates dry weight}}{\text{Average of dates fresh weight}} \times 100$$

2- Dry matter percentage (%):

Dry matter percentage = (100 - moisture content values)

3- Fruit carotenoids (mg/100g):

This was measured by **(AOAC, 2016)** as (mg /100 g peel fresh weight) by 80 % acetone extract was chromatically assayed at 440 nm for carotene using Spectrophotometer.

4- Total chlorophyll (mg/100g):

This was estimated by **(AOAC, 2016)** as (mg /100 g peel fresh weight) by 80 % acetone extract was chromatically assayed at 652 nm for total chlorophyll using Spectrophotometer.

5- Total tannins (%):

Total tannins were calculated as percentage according to **(AOAC, 2016).**

6 - Total soluble solids:

TSS was measured according to **(AOAC, 2016)** using a hand refractometer ATAGO, Japan.

7- Fruit acidity (%):

Juice samples was filtered to estimate total acidity by the titration method against NAOH (0.1 N) with phenol phethalein, as an indicator, according to **(Chen and Mellenthin 1981)**.

8 -TSS/ acid ratio:

Calculated by divided the values of TSS/ acid ratio.

9- Vitamin C content (mg/100ml):

This was defined in pure juice samples as mg/100ml juice by **(AOAC, 2016)** using 5 ml juice sample and 5 ml of oxalic acid solution (2%), then titrated against 2,6-dichlorophenolendophenol dye to the end point to determine vitamin C .

10- Total, reducing and non-reducing sugars (%):

Total, reducing and non-reducing sugars were calculated as percentage according to **Dubois *et al*, (1956).**

3. 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. Statistics 8.1 was used to conduct all statistical analyses **(Analytical Software, 2005).**

4. RESULTS AND DISCUSSION:

1- Effect of bunches number/palm, thinning methods and their interaction on moisture %, dry matter %, Carotenoids(mg/100g) and total chlorophyll (mg/100g) at ripening stage are shown in Table (1) during two seasons of study (2023 and 2024) respectively.

1-1- Main effect of bunches number on moisture % at ripening stage, treatment of 12 bunches/palm recorded the highest values (44.9 and 45.6 %) during both seasons respectively. Moreover, eight bunches/palm revealed the least results (41.0 and 41.6 %) in two seasons of study.

Main effect of thinning methods on moisture % at ripening stage, the greatest value (45.9%) showed by central strands removal in first season but alternative fruit removal exhibited the highest result (47.7%) in the second season of study. In addition control palm gave the lowest values (36.0 and 36.6 %) in both seasons respectively.

Interaction between bunches number and thinning methods, thinning method of central +12 bunches/palm illustrated the greatest result (52.1%) in the first season but pincers+10 bunches/palm treatment recorded the highest value (53.6%) during the second season. Otherwise, control palm+8 bunches revealed minimum values (34.5 and 35.3%) in both seasons of experiment.

These results are agreement with Shaaban *et al* .(2019) , Radwan *et al.*(2022), El-Kosary *et al.*(2023) and Ghazzawy *et al.*(2023) .

The current results obtained are contradictory to the findings of **Madani *et al.* (2021) and Sallam (2023)** who revealed that dates moisture % content hadn't affected significantly by experiment of thinning treatments.

1-2- Main effect of bunches number on dry matter % at ripening stage, maximum values (59.5 and 58.4 %) showed by 8 bunches/ palm within two seasons respectively. Furthermore, 12 bunches/ palm treatment showed minimum value (55.1 %) during first season but 10 bunches/ palm gave the least (53.9%) in the second season.

Main effect of thinning methods on dry matter % at ripening stage of control palm illustrated the greatest result (64.1 and 63.4 %) during both studied seasons.Additionally, central strands thinning recorded the least (54.1%) in the first season while alternative thinning method revealed the lowest (52.3%) in the second season.

Interaction between bunches number and thinning methods, the highest values (65.5 and 64.7 %) showed by control palm +8 bunches treatment within two seasons. In addition, central +12 bunches/palm treatment showed the lowest (47.9%) in the first season while pincers +10 bunches/ palm treatment gave minimum value (46.4%) in the second study.

These findings are in agreement with Dawoud and Fatima (2021) and Kazem and Al-Asadi (2024).

1-3- Main effect of bunches number on carotenoids content at ripening stage, data recorded significant variances in the first season only.

Main effect of thinning methods on carotenoids content at ripening stage of comb thinning method showed maximum values (8.38 and 9.30 mg) during the two seasons of study respectively. Additionally, control palm illustrated the lowest results (4.63 and 5.17mg) in both seasons respectively.

Interaction between bunches number and thinning methods, results gave non-significant differences in both studied seasons.

1-4- Main effect of bunches number on total chlorophyll at ripening stage, treatment of 10 bunches/palm revealed maximum values (3.79 and 3.49 mg) in both studied seasons. Moreover, 12 bunches/palm showed the lowest results (2.89 and 2.79 mg) during both seasons.

Main effect of thinning methods on total chlorophyll at ripening stage, results showed significant differences in the first season only.

Interaction between bunches number and thinning methods of pincers+10 bunches /palm thinning method gave maximum result (4.55 mg) in the first season while comb+10 bunches/palm treatment showed the best (4.31 mg) in the second season. Otherwise, central +12 bunches/ palm thinning method recorded minimum values (1.42 and 2.18 mg) during the two seasons of study, respectively.

These results are according to **Harhash *et al.* (2020)** who recorded that minimum result was 0.25 mg/100g and the highest value was 2.35 mg/100g.

Table 1 : Effect of bunches number/palm, thinning methods and their interaction of Barhi cv. date palm on means of moisture %, dry matter %, Carotenoids(mg/100g) and total chlorophyll (mg/100g) at ripening stage during 2023 and 2024 seasons.

Characters Season Treatments	Moisture % at ripening		Dry matter % at ripening		Carotenoids (mg/100g) at ripening		Total chlorophyll (mg/100g) at ripening	
	2023	2024	2023	2024	2023	2024	2023	2024
A-Bunches no./palm								
8	41.0	41.6	59.0	58.4	8.12	7.90	3.46	3.42
10	42.4	46.1	57.6	53.9	7.07	7.60	3.79	3.49
12	44.9	45.6	55.1	54.4	6.98	7.83	2.89	2.79
LSD at 5%	1.1	1.5	1.1	1.6	0.67	N.S.	0.27	0.41
B: Thinning methods								
Control	36.0	36.6	64.1	63.4	4.63	5.17	3.41	2.97
Comb	43.8	46.8	56.2	53.2	8.38	9.30	3.72	3.64
Pincers	43.5	47.3	56.5	52.7	8.30	8.69	4.23	3.25
Alternative fruit removal	44.7	47.7	55.3	52.3	7.99	7.38	2.93	3.30
Central strands removal	45.9	43.7	54.1	56.3	7.65	8.34	2.60	3.02

LSD at 5%		1.4	1.9	1.4	2.1	0.86	0.78	0.34	N.S.
C: Interaction A X B									
8	Control	34.5	35.3	65.5	64.7	4.00	4.95	3.21	3.62
	Comb	45.2	43.6	54.8	56.4	9.70	9.49	3.36	4.13
	Pincers	42.1	44.9	57.9	55.1	9.12	8.49	3.93	4.03
	Alternative	42.5	42.8	57.5	57.2	8.86	8.13	4.27	2.60
	Central	40.8	41.3	59.2	58.7	8.93	8.43	2.52	2.74
10	Control	36.9	36.7	63.1	63.3	5.16	4.80	3.58	2.53
	Comb	42.3	46.5	57.7	53.5	7.44	8.98	3.86	4.31
	Pincers	44.8	53.6	55.2	46.4	8.40	8.46	4.55	2.82
	Alternative	43.2	47.5	56.8	52.5	7.20	7.78	3.08	3.64
	Central	44.9	46.0	55.1	54.0	7.15	7.99	3.87	4.15
12	Control	36.5	37.9	63.5	62.1	4.72	5.76	3.43	2.76
	Comb	43.9	50.2	56.2	49.8	8.01	9.43	3.93	2.47
	Pincers	43.6	43.5	56.4	56.5	7.39	9.11	4.23	2.89
	Alternative	48.5	52.7	51.5	47.3	7.93	6.24	1.45	3.66
	Central	52.1	43.9	47.9	56.1	6.87	8.62	1.42	2.18
LSD at 5%		2.4	3.4	2.4	3.6	N.S.	N.S.	0.59	0.91

2- Effect of bunches number/palm, thinning methods and their interaction on total tannins%, TSS , fruit acidity % and TSS/acid ratio at ripening stage are illustrated in Table (2) during both seasons of study (2023-2024) respectively.

2-1-Main effect of bunches number on total tannins% at ripening stage, the minimum values (0.71 and 0.68 %) recorded by 12 bunches/ palm during two consecutive seasons. On the other hand maximum results (1.52 and 1.41 %) revealed by 8 bunches /palm in two studied seasons.

Main effect of thinning methods on total tannins% at ripening stage showed that central strands thinning method gave the lowest result (0.93%) during the first season while alternative thinning treatment showed the least value (0.79%) in the second season . However, the highest results (1.20 and 1.12 %) illustrated by control palm in the two studied seasons.

Interaction between bunches number and thinning methods, the lowest values (0.51 and 0.43%) recorded by alternative +12 bunches/palm treatment in the both seasons. Additionally, control palm+8 bunches/ palm showed the highest results (1.68 %) in first season while comb+8 bunches/palm treatment revealed by maximum value (1.50%) in the second season.

These results are according to Ahmed *et al.*(2019) , El-Dengawy *et al.*(2019), Dawoud and Fatima (2021) and Radwan *et al.*(2022).

The current results obtained are contradictory to the findings of **Moustafa *et al.* (2019)** who observed that tannins content of dates on rutab stage hadn't showed any significant differences among experiment thinning methods.

2-2- Main effect of bunches number on TSS at ripening stage showed significant differences in the first season only.

Main effect of thinning methods on TSS at ripening stage, the greatest result (34.0) gave by pincers thinning method in the first season while comb thinning method recorded the highest value (34.3) during the second season. On the other hand the least results (29.1 and 30.1) showed by control palm in both seasons.

Interaction between bunches number and thinning methods, data exhibited non-significant variances in both seasons of study.

2-3- Main effect of bunches number on fruit acidity % at ripening stage, the least results (0.171 and 0.167%) gave by 8 bunches/ palm during the two seasons of study. The greatest results (0.185 and 0.174%) gave by 12 bunches/palm during the two studied seasons.

Main effect of thinning methods on fruit acidity % at ripening stage, the lowest results (0.145 and 0.142%) illustrated by pincers thinning method during two studied seasons respectively. However, the highest values (0.202 and 0.198 %) recorded by control palm in both seasons.

Interaction between bunches number and thinning methods, the lowest values (0.141 and 0.137 %) revealed by pincers+10 bunches/palm treatment during both seasons. Moreover, maximum results (0.218 and 0.205%) recorded by control palm +12 bunches/palm treatment during both seasons respectively.

The previous findings are according to El-Badawy *et al*.(2018), Ahmed *et al*.(2019), El-Dengawy *et al*.(2019) , Dawoud and Fatima (2021) and Radwan *et al.*(2022)

The current results obtained are contradictory to the findings of **Soliman *et al.* (2011)** who found that acidity percentage of fruits hadn't significantly affected with the experiment methods of thinning in seasons of study, **Moustafa *et al. (*2019), Atawia *et al.* (2020), Ahmed (2022) and Ghazzawy *et al.*(2023)** who showed that there weren't a significant differences in fruits acidity % between bunches thinning levels.

2-4- Main effect of bunches number on TSS/Acid ratio at ripening stage showed significant differences in the first season of study only.

Main effect of thinning methods on TSS/Acid ratio at ripening stage, maximum values (235.4 and 232.1) illustrated by pincers thinning method during two seasons .While, the lowest results (144.8 and 152.1) revealed by control palm in both seasons respectively.

Interaction between bunches number and thinning methods of pincers +10 bunches/ palm treatment recorded the greatest values (260.9 and 250.7) within two consecutive seasons. Furthermore control palm +12 bunches/palm showed the lowest results (122.2 and 146.3) in both studied seasons respectively.

The reached results are in agreement with **El-Badawy *et al*.(2018)** who recorded that the greatest values of TSS/acid ratio had showed by 30% thinning then arranged ascending thinning methods of 20, 10 and zero%. and **Ahmed *et al*.(2019)** who noticed that the greatest results of TSS/acid ratios recorded by treatment of thinning about 25% of the strands length /bunches in stage of Hababouk comparable to other experiment thinning treatments.

Table 2: Effect of bunches number /palm, thinning methods and their interaction of Barhi cv. date palm on means of total tannins%, TSS , fruit acidity % and TSS/acid ratio at ripening stage during 2023 and 2024 seasons.

Characters / Season / Treatments	Total tannins% at ripening		TSS at ripening		Fruit acidity % at ripening		TSS/Acid ratio at ripening	
	2023	2024	2023	2024	2023	2024	2023	2024
A-Bunches no./palm								
8	1.52	1.41	32.6	32.8	0.171	0.167	192.9	199.7
10	0.85	0.77	33.4	32.0	0.172	0.173	199.5	190.3
12	0.71	0.68	30.9	32.7	0.185	0.174	173.2	191.9
LSD at 5%	0.003	0.05	1.7	N.S.	0.003	0.007	11.1	N.S.
B: Thinning methods								
Control	1.20	1.12	29.1	30.1	0.202	0.198	144.8	152.1
Comb	1.09	1.03	33.9	34.3	0.189	0.176	179.2	195.9
Pincers	0.99	0.86	34.0	32.9	0.145	0.142	235.4	232.1
Alternative fruit removal	0.94	0.79	32.1	33.7	0.176	0.169	187.4	202.0
Central strands removal	0.93	0.97	32.3	31.4	0.166	0.171	196.0	187.6
LSD at 5%	0.004	0.07	2.2	1.9	0.003	0.009	14.4	16.3
C: Interaction A X B								
8 Control	1.68	1.47	30.7	29.7	0.189	0.193	162.7	153.5
Comb	1.64	1.50	33.7	34.3	0.183	0.168	184.4	204.4
Pincers	1.35	1.28	32.3	33.7	0.149	0.152	216.1	222.9

	Alternative	1.42	1.31	34.0	35.0	0.178	0.155	190.8	226.9
	Central	1.51	1.47	32.3	31.3	0.154	0.164	210.6	190.7
10	Control	1.02	0.99	30.0	30.7	0.201	0.196	149.5	156.5
	Comb	0.77	0.89	34.7	33.0	0.187	0.171	185.4	192.8
	Pincers	0.99	0.76	36.7	34.3	0.141	0.137	260.9	250.7
	Alternative	0.87	0.63	32.7	32.0	0.143	0.159	227.9	202.6
	Central	0.59	0.60	33.0	30.0	0.190	0.202	173.8	148.9
12	Control	0.90	0.89	26.7	30.0	0.218	0.205	122.2	146.3
	Comb	0.85	0.70	33.3	35.7	0.199	0.187	167.7	190.3
	Pincers	0.62	0.55	33.0	30.7	0.144	0.138	229.2	222.7
	Alternative	0.51	0.43	29.7	34.0	0.207	0.193	143.3	176.7
	Central	0.68	0.83	31.7	33.0	0.155	0.148	203.8	223.4
LSD at 5%		0.007	0.12	N.S.	N.S.	0.006	0.015	24.9	28.3

3- Effect of bunches number/palm, thinning methods and their interaction on vitamin C (mg/100ml), reducing sugars% , non-reducing sugars% and total sugars % at ripening stage are revealed in Table (3) during both consecutive seasons (2023 and 2024).

3-1- Main effect of bunches number on vitamin C mg at ripening stage of ten bunches/palm recorded the highest results (3.68 and 3.84 mg) during the both seasons of study. However, the least values (3.20 and 3.54 mg) revealed by 12 bunches/palm in two studied seasons.

Main effect of thinning methods on vitamin C mg at ripening stage of pincers thinning method showed the greatest values (3.70 and 4.05 mg) in both seasons of experiment. On the other hand the lowest values (3.01 and 3.13 mg) showed by the control palm within the seasons of experiment respectively.

Interaction between bunches number and thinning methods, results recorded significant differences in the first study of experiment only.

The present results go parallel in the line of **Ahmed *et al.* (2019), Madani *et al.*(2021) and Dawoud and Fatima (2021)** they showed that the content of fruits vitamin C had influenced significantly with experiment thinning methods.

3-2- Main effect of bunches number on reducing sugars% at ripening stage, maximum values (44.4 and 43.6 %) illustrated by 8 bunches/palm during the seasons of study. Furthermore, minimum results (34.2 and 35.8%) gave by 12 bunches/palm within the two studied seasons respectively.

Main effect of thinning methods on reducing sugars% at ripening stage, the greatest result (41.3%) recorded by pincers treatment during the first season while central strands removing method revealed the highest value (42.9%) in the second season. Additionally, control palm showed the lowest values (33.6 and 33.0%) during two studied seasons.

Interaction between bunches number and thinning methods of alternative thinning method+8 bunches/palm showed the greatest result (46.3%) in the first season of study but central +8 bunches/palm treatment illustrated the highest value (47.5%) in the second season. Moreover, the least results (27.0 and 27.9%) gave by control +12 bunches/palm treatment within both seasons respectively.

3-3- Main effect of bunches number on non- reducing sugars % at ripening stage, there were significant variances between results in the first season only.

Main effect of thinning methods on non-reducing sugars % at ripening stage, the greatest values (4.84 and 4.98 %) recorded by pincers thinning method during the two seasons of study respectively. In addition, comb thinning method revealed the least value (3.31%) in the first study while central strands removal showed the lowest result (3.16%) in the second study.

Interaction between bunches number and thinning methods of Pincers +8 bunches/palm treatment showed the greatest value of non- reducing sugars % (5.51%) during the first season while pincers+10 bunches/palm thinning method exhibited the maximum result (5.20%) in the second study. On the other hand comb +8 bunches treatment illustrated the lowest result (2.44%) in the first season but alternative +10 bunches/palm gave the least value (2.10%) in the second season.

3-4- Main effect of bunches number on total sugars% at ripening stage of eight bunches/palm recorded the highest values (48.3 and 47.2%) in both studied seasons. While, 12 bunches/palm showed the least results (38.1 and 39.6%) during two studied seasons, respectively.

Main effect of thinning methods on total sugars% at ripening stage, the maximum values (46.2 and 47.5 %) revealed by pincers thinning method during two consecutive seasons .However, the minimum results (37.5 and 36.6%) exhibited by control palm in both seasons respectively.

Interaction between bunches number and thinning methods of alternative+8 bunches/palm treatment recorded the highest value (50.2%) in the first season also central +8 bunches treatment illustrated the greatest result (50.3%) in the second season of study. While, the lowest values (31.1 and 31.7%) showed by control+12 bunches/palm during the two seasons of study respectively.

The reached results of total, reducing and non-reducing sugars are in harmony with Ahmed *et al.*(2019), Ghazzawy *et al.*(2019), Moustafa *et al.(*2019), Shaaban *et al* .(2019), Atawia *et al.*(2020), Dawoud and Fatima (2021), Hosny *et al.*(2022), Radwan *et al.*(2022) , El-Kosary *et al.*(2023) ,Sallam (2023).

The obtained results are contradictory to **Ahmed (2022)** who showed that there weren't any significant differences had observed by the values of non-reducing sugars content under thinning methods and zero thinning palm.

Improvement of Dates sugars content might be due to increasing of nutrients concentrations in the retained fruits/ strands.

Table 3 : Effect of bunches number/palm, thinning methods and their interaction of Barhi cv. date palm on means of ascorbic acid (V.C)(mg/100ml), reducing sugars% , non-reducing sugars% and total sugars % at ripening stage during 2023 and 2024 seasons.

Characters / Season / Treatments		V.C(mg/100ml) at ripening		Reducing sugars% at ripening		Non-reducing sugars% at ripening		Total sugars % at ripening	
		2023	2024	2023	2024	2023	2024	2023	2024
A-Bunches no./palm									
8		3.45	3.59	44.4	43.6	3.82	3.56	48.3	47.2
10		3.68	3.84	36.5	38.3	3.74	3.74	40.2	42.1
12		3.20	3.54	34.2	35.8	3.95	3.78	38.1	39.6
LSD at 5%		0.005	0.16	0.1	1.0	0.16	N.S.	0.1	1.0
B: Thinning methods									
Control		3.01	3.13	33.6	33.0	3.88	3.60	37.5	36.6
Comb		3.43	3.65	37.3	37.9	3.31	3.40	40.6	41.3
Pincers		3.70	4.05	41.3	42.5	4.84	4.98	46.2	47.5
Alternative fruit removal		3.46	3.67	39.0	39.9	3.42	3.32	42.4	43.2
Central strands removal		3.62	3.78	40.6	42.9	3.72	3.16	44.3	46.0
LSD at 5%		0.007	0.20	0.2	1.3	0.20	0.33	0.1	1.3
C: Interaction A X B									
8	Control	3.02	3.15	43.3	39.4	4.18	3.50	47.5	42.9
	Comb	3.46	3.62	45.6	43.6	2.44	3.04	48.0	46.7
	Pincers	3.71	4.11	41.3	42.6	5.51	4.59	46.8	47.2
	Alternative	3.46	3.47	46.3	44.8	3.90	3.84	50.2	48.6

	Central	3.62	3.61	45.6	47.5	3.09	2.81	48.7	50.3
10	Control	3.22	3.20	30.6	31.6	3.42	3.51	34.0	35.1
	Comb	3.71	3.83	36.8	38.6	3.53	4.01	40.3	42.6
	Pincers	3.94	4.25	41.0	41.5	4.42	5.20	45.4	46.7
	Alternative	3.58	3.76	31.6	34.5	2.84	2.10	34.4	36.6
	Central	3.96	4.14	42.4	45.4	4.48	3.88	46.9	49.3
12	Control	2.80	3.04	27.0	27.9	4.04	3.78	31.1	31.7
	Comb	3.13	3.51	29.4	31.5	3.96	3.14	33.4	34.6
	Pincers	3.45	3.78	41.6	43.3	4.60	5.17	46.2	48.5
	Alternative	3.36	3.78	39.2	40.4	3.53	4.04	42.7	44.5
	Central	3.28	3.59	33.6	35.6	3.60	2.78	37.2	38.4
LSD at 5%		0.01	N.S.	0.3	2.2	0.35	0.57	0.2	2.2

5. CONCLUSION:

Under the conditions of this experiment, this study was planned to improve fruits chemical properties as (TSS, acidity, TSS/Acid ratio, vitamin C content, fruit carotenoids (mg/100g), total tannins percentage, moisture content**,** dry matter percentage, total chlorophyll, reducing, non- reducing and total sugars content) in Barhi date palm cultivar. The current study included to estimate effectiveness of pincers and comb thinning tools comparing to techniques of other manual thinning.

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