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Effect of Number of Bunches and Leaf : Bunch Ratios on Fruiting of Saiedy Data Palms

2: Fruit Chemical Parameters

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Abstract: Date palm cultivar selected for this trial was "Saiedy" of the same age 10 years old and size at El-Dakhla Oasis, New Valley Governorate, Egypt. The experiment was repeated for two successive years (2019 and 2020). Palms in good physical condition, devoid of pest damage and diseases grown on sandy loam soil and drip irrigation were selected for each treatment. The trials were set up in a three-replication with randomized complete block statistical design (one palm tree for each replication). Both leaves and bunches were pruned to achieve a specific bunch/palm and leaves /bunch ratio, and date palms were randomly assigned to 7 different treatments as follows; Control (only the dead leaves were discarded), 9 bunch/palm + 8 leaves / bunch, 9 bunch/palm + 9 leaves / bunch, 9 bunch/palm + 10 leaves / bunch,10 bunch/palm + 8 leaves / bunch, 10 bunch/palm + 9 leaves / bunch and 10 bunch/palm + 10 leaves / bunch. Results indicated that; fruit chemical parameters as: moisture content (%), total soluble solid (TSS%), fruit acidity, sugar content (reducing, non-reducing and total sugar%), phenols and total antioxidant activity. Generally, all applied leaf/bunch ratios had a positive effect on the measured chemical properties of "Saiedy" date palm fruits in comparison with control. The ratio 10 bunch/palm + 9 leaves / bunch gave the best results regarding the tested characteristics of 'Saiedy date palms under the studied region except with total acidity which decreased with increasing ratio of leaves and bunches and the highest values was associated with the control.

Key words: Saiedy, date palm, chemical parameters and bunch/palm and leaves/ bunch ratio.

INTRODUCTION

The date palm (*Phoenix dactylifera* L.) is one of the world's oldest cultivated fruits and considered one of the most widely grown horticulture crops in Arab countries. It is regarded a symbol of life in Egypt's desert and plays an essential part in the people's economic and

social lives (**El-Salhy *et al*. 2017**). In Egypt, date palm ranked the third crop after orange and grape, and the total area represented in 2020 was (117073 fed.), fruitful palm (14,379,648) female tree which produced (1,644,417) tonnes according to the latest statistics from the **Ministry of Agriculture and Land Reclamation (2020)**. The date palm can grow and produce in a variety of soil types, from light sandy to deep clay. It also has a great tolerance for stress, since it can withstand excessive salinity, drought, and harsh weather (**Daillo, 2005 and El-Salhy *et al*. 2017**).

In 2018, the government established a countrywide project to cultivate date palms. The goal of the initiative is to grow a million palms from various date palm cultivars. The initiative will produce more date palm fruits than are consumed in the local market. As a result, excess dates must be allocated to foreign markets, which obviously demand high-quality dates. Despite Egypt is ranked the top date producer in the world, Egypt export contribution to the international date market is low due to a lack of international quality standards (**FAO, 2019**).

For commercial reasons and to compete with the international market, date palm growers are currently experiencing numerous challenges in producing high-quality date fruits. Fruit thinning is one of the most critical factors impacting date palm fruit quality and yield. So, in order to maximize the quantitative, qualitative, and economic output of date production in palm growth, the optimum thinning procedures must be discovered (**El-Salhy *et al*. 2010 and Iqbal *et al*. 2010**).

Fruit thinning, strand thinning, chemical thinning, and spathe removal are all examples of thinning techniques. Removal of spathes is the simplest of the treatments, but strand thinning produces the finest fruit quality. Many previous findings imply that the plant responds differently depending on the leaf: bunch ratio, notably in terms of fruit and yield characteristics, and that a higher number of productive leaves results in superior performance (**Harhash *et al*. 1998; Al-Salman *et al*. 2012 and Omar *et al*. 2013**). The date palm's bearing capacity and fruit quality appear to be proportional to the green leaf surface. Too much fruit for the tree's leaf area diminishes fruit size and quality, and alternating bearing occurs (**El-Salhy, 2001 and Hegazi *et al.* 2008**). One of the most important behaviors determining fruit quality is the leaf/bunch ratio (**Hussein and Abdalla, 1973**). Because old palm leaves do not provide the same nutritional value to palm trees (**Khalifa *et al.* 1987**). As a result, removing some of the old leaves and examining the number of leaves in relation to bunches on the palm is an important procedure. The proper leaf/bunch ratio in different date palm varieties resulted in large bunches and high-quality dates. According to various studies, on Barhi, as indicated by **Omar *et al.* (2013**). The leaf/bunch ratios vary by cultivar, with 8:1 in 'Khalas' and 'Sewy' (**Al-Salman *et al.* 2012 and El-Salhy *et al*. 2017**), 9:1 in Sakkoti and 'Samany' and 'Barhi' (**Shaaban *et al.*, 2006 and Omar *et al.*, 2013**), and 12:1 in ‘Gondaila’ and ‘Dagana’ (**Soliman and Osman, 2001**).

Therefore, the main objective of the current study is to investigate the effect of different methods of thinning on yield and fruit quality of Saiedy date palms; such practices might be very essential and of great importance for palm growers. So, the purpose of the study to determine the proper leaf/bunch ratio and its effect on the productivity and fruit quality of Saiedy cultivars grown under El-Dakhla Oasis, New Valley conditions.

MATERIAL AND METHODS

Data palm cultivar selected for this trial was “Saiedy” of the same age 10 years old and size at El-Dakhla Oasis, New Valley Governorate, Egypt. The experiment was repeated for two successive years (2019 and 2020).

Palms in good physical condition, devoid of pest damage and diseases grown on sandy loam soil and drip irrigation were selected for each treatment. Analysis of some physical and chemical properties of the soil was done according to **Wilde *et al*. (1985**). The soil described as; 7.89 pH, 0.65 EC/dsm^{-1} and 0.80 g.kg^{-1} organic matter, 2.25% $CaCO_3$ and total N was 1.82%

Each palm was fertilized with 25 Kg FYM contain (9% OM, 0.32% N, 1.2 % P_2O_5 and 1.55% K_2O) and 1.0 kg calcium superphosphate once a year in the winter (15.5 % P_2O_5). At 1.0 and 3.0 kg/palm,

potassium sulphate and ammonium nitrate, respectively, were administered. Ammonium nitrate was added in three equal batches before spathes bursting, immediately after fruit setting, and 45 days later, while potassium sulphate was treated twice before fruit setting and before coloring began. Other agricultural procedures were used as usual, including irrigation, hoeing, and fungal and insect management. Throughout the two experimental seasons, the tested palms were pollinated by a known high activity pollen grain source from the same male.

The trials were set up in a three-replication with randomized complete block statistical design (one palm tree for each replication). Both leaves and bunches were pruned to achieve a specific bunch/palm and leaves /bunch ratio, and date palms were randomly assigned to 7 different treatments as follows:

1. Control (only the dead leaves were discarded) (T1).
2. 9 bunch/palm, 8 leaves bunch (T2).
3. 9 bunch/palm, 9 leaves / bunch (T3).
4. 9 bunch/palm, 10 leaves / bunch (T4).
5. 10 bunch/palm, 8 leaves / bunch (T5).
6. 10 bunch/palm, 9 leaves / bunch (T6).
7. 10 bunch/palm, 10 leaves / bunch (T7).

During the first half of September, chemical parameters of 10 date fruits were determined using a random sampling method according to **A.O.A.C. (1995)** as: moisture content (%), total soluble solid (TSS%), fruit acidity, sugar content (reducing, non-reducing and total sugar%), phenols according to **Amerine and Ough (1980)** and total antioxidant activity according to the procedure described by **Prieto *et al.* (1999)**.

The collected data from the two seasons were statistically analyzed using the analysis of variance technique (ANOVA). According to **Gomez and Gomez (1984**), Mstate computer software program was employed to examine differences among mean of various treatment combinations using the LSD test at ($P > 0.05$) levels.

RESULTS AND DISCUSSION

Effect of number of bunches and leaf: bunches ration on fruit chemical parameters of Saiedy cultivar grown under El-Dakhla Oasis, New Valley conditions during 2019 and 2020 seasons.

Fruit moisture%

In terms of the effect of the number of bunches/palm and leaves /bunch as presented in Table (1), data obtained during both seasons of 2019 and 2020 declared that fruit moisture% of "Saiedy" fruits increased significantly with increasing number of bunch and leaves. The highest moisture content was shown to be substantially correlated with treatment T5 (10 bunch/palm + 9 leaves / bunch) during both seasons was 21.64 and 21.97 %, while the lowest values were 19.64 and 19.49% connected with control. In the same line, **Soliman *et al.* (2011**) reported that removing 30% of the total leaves from the bunch center gave the highest moisture content comparing to the other treatments and control. Also, **Omar *et al.* (2013**) indicates that greater fruit moisture percentages with (10 leaves/bunch).

Total soluble solids (TSS%)

Regarding the investigated treatments, different ratio of bunch/palm and leaves /bunch treatments significantly increased TSS% in fruit than the control during both seasons of the experiments (Table 1). The most effective treatment in such concern was treatment contain (10 bunch/palm + 9 leaves /bunch) and recorded 78.67 and 79.21%, respectively in 2019 and 2020. The increase in TSS% may be due to as the fruit ripens, more leaf area is used for the synthesis of photosynthetic materials, soluble carbohydrates, and soluble solids, resulting in an increase in TSS due to pruning (**Moustafa *et al.*, 2019**).

Table (1). Effect of bunches and leaf: bunches ration on fruit moisture and TSS% of "Saiedy" data palm fruit during 2019 and 2020

Treatments	Fruit moisture %		TSS%	
	2019	2020	2019	2020
Control (T1)	19.64	19.49	58.48	56.75
T2	20.03	19.91	59.40	62.29
T3	20.22	20.36	63.92	64.98
T4	21.02	21.26	68.85	69.74
T5	21.33	21.63	74.54	74.47
T6	21.64	21.97	78.67	79.21
T7	20.53	20.57	65.61	66.44
LSD $_{at\ 0.05}$	**0.13**	**0.19**	**1.52**	**0.79**

T1: control
T2: 9 bunch/palm + 8 leaves / bunch.
T3: 9 bunch/palm + 9 leaves / bunch.
T4: 9 bunch/palm + 10 leaves / bunch.
T5: 10 bunch/palm + 8 leaves / bunch.
T6: 10 bunch/palm + 9 leaves / bunch.
T7: 10 bunch/palm + 10 leaves / bunch.

Sugar contents

Reducing sugars (%)

Concerning the effect of bunch/palm and leaves /bunch ratio on reducing sugar%. Table 2, revealed obviously that the highest reducing sugars % induced significantly by increasing bunch/palm and leaves /bunch ratio treatments comparing to the control (un-thinning). The highest mean value of reducing sugar was (66.13 and 69.74%, for both seasons respectively) which associated with treatment of (10 bunch/palm + 9 leaves / bunch).

Non-reducing Sugars (%)

With respect to the effect of bunch/palm and leaves /bunch ratio on non- reducing sugar%, data in the same table obtained during both seasons declared that non-reducing sugars (%) of "Saiedy" data palm fruit typically, the non- reducing sugar% follows the same pattern as previously mentioned with reducing sugar%. Meanwhile, the highest mean values indicated with the treatment of (10 bunch/palm + 9 leaves / bunch) comparing with the other treatments and the control.

Total sugar%

The obtained results in Table (2), indicated that the total sugars% was significantly affected by the ratio of bunch/palm and leaves /bunch. Increasing bunch/palm and leaves /bunch ratio increased significantly the content of total sugar% comparing to the control. This mean that treatment of (10 bunch/palm + 9 leaves / bunch) recorded the highest mean value of total sugar content % during both seasons and control recorded the lowest one.

The increase in the number of bunches or leaves removed was linked to an improvement in fruit chemical quality. Sugar content increases when leaves are removed and bunch are thinned, which may be due to an internal adjustment mechanism that allows the remaining fruits to more efficiently absorb assimilates and improve their chemical and physical properties in less competitive surroundings (**Ali-Dinar *et al*. 2002 and Hammam *et al*. 2002**). As a result, it's decided that removing leaves from fruit is more beneficial than removing bunches in terms of boosting fruit weight and size, as well as chemical contents. These findings could be explained by the availability of sufficient carbohydrates and other essential foods for the remaining fruits, which raised fruit maturity and sugar content (reducing, non-

reducing and total). Furthermore, fruit thinning substantially reduced rivalry between fruits, resulting in higher sugar content for each fruit. In general, these findings about the response of Saiedy fruit chemical properties to different fruit pruning methods are consistent with those found by **Soliman *et al*. (2011); Omer *et al.* (2013); El-Salhy *et al.* (2017**) and **Ahmed *et al*. (2019**) they all mentioned that thinning increased average reducing sugars, non-reducing sugars, total sugars, and total soluble solids.

Table (2). Effect of bunches and leaf: bunches ration on sugar contents% of "Saiedy" data palm fruit during 2019 and 2020

Treatments	Reduce sugar (%)		Non-reduce sugar (%)		Total sugar (%)	
	2019	2020	2019	2020	2019	2020
Control (T1)	46.44	47.40	11.74	11.12	58.18	58.52
T2	50.36	48.75	9.96	11.17	60.32	59.92
T3	53.80	52.91	9.22	9.94	63.02	62.85
T4	56.68	58.85	8.58	7.92	65.26	66.77
T5	59.71	61.57	10.27	8.18	69.98	69.75
T6	66.13	69.74	10.93	8.40	77.06	78.14
T7	63.97	67.64	8.96	7.18	72.93	74.82
LSD $_{at\ 0.05}$	**0.11**	**0.11**	**0.16**	**0.17**	**0.17**	**0.16**

T1: control
T2: 9 bunch/palm + 8 leaves / bunch.
T3: 9 bunch/palm + 9 leaves / bunch.
T4: 9 bunch/palm + 10 leaves / bunch.
T5: 10 bunch/palm + 8 leaves / bunch.
T6: 10 bunch/palm + 9 leaves / bunch.
T7: 10 bunch/palm + 10 leaves / bunch.

Total acidity (%)

Data obtained during both seasons of 2019 and 2020 in Table (3) revealed obviously that the response of fruit titratable acidity % to the ratio of bunch/palm and leaves /bunch was significantly decreased with increasing bunch/palm and leaves /bunch ratio. The greatest total acidity in Saiedy fruit was associated in check treatment (0.226 and 0.237%), while increasing bunch/palm and leaves /bunch recorded lower value comparing to the control and the lowest value recorded with treatment of (10 bunch/palm + 9 leaves / bunch). These results were confirmed by those gained with **Al-Wasfy and Mostafa, (2008**) and **Hegazi *et al*. (2008)** they mentioned that increasing leave/bunch ratio decreased acidity comparing to the control.

Phenols content

Data in Table (3), resulted the effect of bunch/palm and leaves /bunch ratio on the phenolics content in Saiedy data palm fruit. It's obvious from the data that phenols content increased significantly with increasing bunch/palm and leaves /bunch ratio and the highest mean value observed with the treatment of (10 bunch/palm + 9 leaves / bunch) followed by 10 bunch/palm + 8 leaves / bunch, in compared with the lowest value which indicated with control during both seasons.

Total antioxidant activity

Regarding the content of antioxidant in Saiedy fruits in the same table, the result indicated a significant difference during 2019 and 2020 seasons. The same trend mentioned with phenol associated with antioxidant activity, which mean that the treatment of 10 bunch/palm + 9 leaves / bunch gave the highest value of antioxidant activity comparing with the control which observed the lowest one.

Table (3). Effect of bunches and leaf: bunches ration on total acidity, phenols and total antioxidant of "Saiedy" data palm fruit during 2019 and 2020

Treatments	Total acidity (%)		Phenols (mg/100g)		Total antioxidant activity (%)	
	2019	2020	2019	2020	2019	2020
Control (T1)	0.226	0.237	1.55	1.60	32.05	37.73
T2	0.215	0.224	1.61	1.70	33.37	38.43
T3	0.202	0.213	1.69	1.83	35.04	39.78
T4	0.186	0.198	1.85	2.04	36.26	41.26
T5	0.163	0.174	1.91	2.16	39.64	44.01
T6	0.152	0.165	1.98	2.26	41.16	45.37
T7	0.175	0.184	1.76	1.91	37.99	42.55
LSD at 0.05	**0.006**	**0.007**	**0.07**	**0.06**	**0.50**	**0.64**

T1: control
T2: 9 bunch/palm + 8 leaves / bunch.
T3: 9 bunch/palm + 9 leaves / bunch.
T4: 9 bunch/palm + 10 leaves / bunch.
T5: 10 bunch/palm + 8 leaves / bunch.
T6: 10 bunch/palm + 9 leaves / bunch.
T7: 10 bunch/palm + 10 leaves / bunch.

The amounts of phenolic compounds in date fruit affects the antioxidant qualities of the fruit (**Hussain *et al*. 2016**). Dates' antioxidant capabilities are mostly due to phenolic substances. They exhibit a range of biological effects such as the prevention of nucleic acid damage. The potential of antioxidants to scavenge free radicals linked with various diseases has sparked a growing interest in the issue of antioxidants (**Aleid, 2014)**. As a result, dates can be employed as antioxidative food components (**Aleid, 2014**). **Al-Turki *et al.* (2010)** found that different date palm cultivars have varying total phenolic contents and antioxidant activity in their fruit. Little research exists on the effects of bunch thinning on total antioxidant and total phenolics of date palm. **Hussain *et al*. (2016**) stated that thinning treatments of 'Hillawi' and 'Khadrawi' increased total phenolics in comparison with the control, probably because of a greater light exposure to the fruit in response to less fruit density in each bunch. Indeed, light plays an important role in processes that are responsible for the accumulation of phenolic compounds. On the other hand, in fruit of the control group, there were lower amounts of light and air circulation available to the fruit, thereby affecting the rate of photosynthetic carbon assimilation rate and total phenolics (**Hussain *et al.*, 2016**). These results are the same recorded by **Madani *et al.* (2021**) who resulted that, date palm fruit thinning increased the total antioxidant activity and total phenol content as compared to the control

In general, it can be recommended that 10 bunch/palm and 9 leaves/ bunch was the most suitable pruning treatment for Saiedy data palm fruit measurements studied under El-Dakhla Oaisis, New valley Governorate.

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