



Influence of Leaf/ Bunch Ratio on Yield and Fruit Quality of “Zaghloul” Dates



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DIFFERENT pruning patterns of leaves in relation to a number of bunches (leaf/bunch ratio) during the 2018 and 2019 seasons were applied to uniform 12 adults of 17-year-old ‘Zaghloul’ date palm females grown on sandy soil under drip irrigation in Belbis district, Sharkia Governorate, Egypt. Three levels of leaf/bunch ratios at 6:1, 8:1, and 10:1 plus the control treatment (only dead leaves were cut) were investigated. The tested physical characteristics were yield, weight of bunch, fruit and fruit flesh, as well as fruit length and diameter, and dry weight of flesh of date fruits. In addition, the total soluble solids content and Tannins as chemical characteristics of date fruits were measured. All pruning treatments increased the yield/palm in comparison with the control. The leaf/bunch ratio at 10:1 achieved the highest yield (182.06 and 184.50 kg/palm) in the two seasons, respectively. The palm yield of check treatment was lower with results of 135.22 and 136.00 kg/palm in the studied seasons, respectively. Palms in all levels of leaf/bunch ratios recorded the highest of the bunch weight and fruit weight of dates in comparison with those in palms had no pruning. Generally, all applied leaf/bunch ratios had a positive effect on other measured physical properties of ‘Zaghloul’ date palm fruits. The total soluble solids content was higher in pruned palms, however, the tannins percentage was lower in the same palms. The leaf/bunch 10:1 ratio gave the best results regarding the tested characteristics of ‘Zaghloul’ date palms under the studied region.

Keywords: Zaghloul, Date Palm, Leaf/bunch ratio, Quality, Pruning, Yield.

Introduction

Date palm (*Phoenix dactylifera* L.) is one of the most cultivated horticultural crops in Arab countries. It plays an important role in the human history through the economical and social life of the people and considered a symbol of life in desert in Egypt (El-Salhy et al., 2017). Date palm can grow and yielded under different types of soil starting from light sandy to heavy clay soil. In addition, it can grow healthy under stress conditions, such as salinity, drought and harsh weather (Lunde, 1978 and Daillo, 2005). Egypt climate is quite convenient for the date palm cultivation (Ibrahim and Khalifa, 1998). The date palm distribution in Egypt covers a great area extending for the far south to north and the far

east to west (Al-Wasfy and Mostafa, 2008), with the total production of 1590414 ton (18% of the global date production). The national project for the date palm cultivation had been announced in 2018. The project aims to increase million palms from different date palm cultivars. The project will release date palm fruits more than the local market consumption. Consequently, it is necessary to devote the excess of dates for foreign markets which clearly require 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).

The quality standards of date palm fruits can be enhanced by several agricultural practices such

as enhancing the nutritional status (Al-Qurashi et al., 2015 and El-Salhy et al., 2017), adjusting irrigation programs (Al-Omran et al., 2019), the pruning (Nixon, 1957) and the flower and fruit thinning (Akl et al., 2004, El-Assar, 2005, Al-Wasfy & Mostafa, 2008 and Mostafa & El Akkad, 2011).

Moreover, the leaf/bunch ratio is one of the most significant practices affecting the fruit quality (Hussein and Abdalla, 1973). Since old leaves on the palm do not give the same nutritional efficiency for palm trees (Khalifa et al., 1987). So, the investigation of number of leaves in relation with bunches on the palm by removing some of old leaves are crucial practice. Proper leaf/bunch ratio in different date palm varieties resulted in big bunches and good quality dates as reported by several studies, Nixon (1957) on 'Deglet Noor', Abdulla et al (1982) on 'Hayany' date palms, Khalifa et al (1987) on the 'Zaghloul' date, Hussein and Abdalla (1973) on 'Sakkoti' dates, and Omar et al (2013) on Barhi. The leaf/bunch ratios are varied according to the cultivar, 8:1 in 'Khalas' and 'Sewy' (Al-Salman et al., 2012 and El-Salhy et al., 2017), 9:1 in Sakkoti and 'Zaghloul' (Hussein and Abdalla, 1973 and Harhash et al., 1998), 10:1 in 'Samany' and 'Barhi' (Shaaban et al., 2006 and Omar et al., 2013) and 12:1 in 'Gondaila' and 'Dagana' (Soliman and Osman, 2001).

The leaf/bunch ratio of date palm cultivars is greatly influenced by the cultivation region (Soliman, 2006 and Simozag et al., 2016). A Leaf/ bunch ratio of 'Zaghloul' date palms was observed in some parts of Egypt, in Alexandria (Khalifa et al., 1987), Assuit (Harhash et al., 1998 and El-Salhy 2001), and Nubaria (Abdel-Hamid, 2000). Thus, the ratios in 'Zaghloul' date palms in present study region are required to be investigated.

The target of this study is to determine the proper leaf/bunch ratio and its effect on the productivity and fruit quality of 'Zaghloul' date palm trees grown in Belbis district, Sharkia Governorate.

Materials and Methods

Plant materials

This research was carried out through 2018 and 2019 seasons on 12 adult of 17-year-old of 'Zaghloul' date palm trees grown in sandy soil under drip irrigation system in Belbis district, Sharkia Governorate, Egypt. The considered *Egypt. J. Hort.* **Vol. 48**, No. 2 (2021)

palms were nearly equal in size and vigor and exposed to the normal horticultural practices. Pollination of the experimental palms was performed in respect of method, source, rate and date. Pollination of the experimental palms was performed in respect of method, source, rate and date

The treatments description

Such date palms were distributed at random among 4 different treatments each of 3 replicate palms as follows:

- Three untreated date palms as replicates of a general control (only dead leaves were removed, Mid of September).
- Nine date palms were distributed randomly in 3 treatments of different leaf/bunch ratios. The numbers of both bunches and leaves per palm were reduced at different rates to maintain the leaf/bunch ratio at 6:1, 8:1 and 10:1 for treatments. The retained bunches was thinned to a constant number of strands.

Measurements

For all treatments, bunches were picked at harvest date (when dates reached the known commercial color) where the weight of fully developed fruits per bunch was determined to calculate yield (kg)/ palm, and bunch weight (kg)/ palm. Consequently, three samples each of 100 date fruits were taken randomly from each replicate as well as control trees for determination of fruit weight and flesh weight/ fruit. Fruit dimensions (fruit length and diameter) were measured in fruits of each replicate by using a Vernier caliper. Total soluble solids (TSS) was determined as Brix % in fruit juice using a digital refractometer (DR 6000, A. Kruss Optronik GmbH, Hamburg, Germany) as well as tannins and the dry weight percentage were determined in the fruit flesh as described (A.O.A.C., 2006).

Statistical analysis

The obtained data were statistically analyzed according to Snedecor and Cochran (1982) differences between means were compared using the least significant differences (LSD) at level 5%.

Results

Yield (kg/palm)

As shown in Table 1 all patterns of leaf/bunch ratio in 'Zaghloul' date palm trees gave a statistically enhancement in the total yield (kg/palm) than the check treatment in both 2018

and 2019 seasons. The highest yield/palm was obtained by leaf/bunch ratio at 10:1 (182.06 and 184.50 kg/tree in the first and second season, respectively), while the control trees had the lowest yield/palm recording 135.22 and 136.00 kg/palm in both seasons respectively.

Bunch Weight

The bunch weight (kg) was positively increased due to the increasing number of leaves for a bunch in both studied seasons (Table 1). Ratios of 6:1 and 8:1 failed to show significant differences between them in bunch weight trait, however, both ratios gave heavier bunches than the control in both seasons. The heaviest bunches were collected from 'Zaghloul' date palms which had leaf/bunch ratio at 10:1.

Fruit weight

Also, data in Table 1 clear that the average weight of fruit was morally increased in the two seasons in relation with pruning treatments. The lightest fruits were resulted from the control (23.03 and 23.08 g/fruit), while the heaviest fruits were harvested from trees pruned with 10:1 leaf/bunch

Fruit flesh weight (g)

A flesh weight of fruits under the experiment was gradually improved accompanied with

increasing the number of leaf/bunch from 6:1 to 10:1 (Table 1). The same result trend was found in both seasons 2018 and 2019. The untreated palms had the lowest values of fruit flesh weight (21.30 and 21.38 g/fruit) in both seasons respectively. The highest values of flesh weight (30.10 and 30.38 g/fruit in the two seasons, respectively) were detected in trees pruned with leaf/bunch ratio with 10:1.

Fruit length

In Table 2, the results of fruit length were statistically differed due to the variation of leaf/bunch ratio during the both seasons. Generally, all pruning treatments increased the fruit length of 'Zaghloul' dates than the control. The highest average of fruit length was 6.53 and 6.50 cm resulted from the application of leaf/bunch ratio 10:1 in the two seasons, respectively.

Fruit diameter

Results in Table 2 show that the three levels of leaf/bunch ratios (6:1, 8:1 and 10:1) gave the best values of fruit diameter than the control in both seasons. Whereas, the results of fruit diameter among the differences between these three levels of leaf/bunch were not significant in both seasons of the study.

TABLE 1. Effect of leaf/ bunch ratio on yield, bunch weight, fruit weight and flesh weight of 'Zaghloul' date palm fruits during 2018 and 2019 seasons

Treatments (leaf/bunch ratio)	Yield (kg/palm)	Bunch weight (kg)	Fruit weight (g)	Flesh weight (g)
Control	135.22	16.25	23.03	21.30
6:1	161.17	19.47	28.17	26.07
8:1	166.17	20.60	29.53	27.20
10:1	182.06	22.60	32.17	30.10
LSD at 5%	1.10	1.34	1.88	0.36
Second season (2019)				
Control	136.00	17.17	23.08	21.38
6:1	161.56	20.40	28.10	26.47
8:1	168.00	22.00	29.58	27.50
10:1	184.50	23.17	32.55	30.68
LSD at 5%	1.51	1.71	1.73	0.33

Fruit flesh dry weight (%)

It is quite evident from Table 2 that, all pruning treatments significantly affected dry flesh weight percentage than the untreated palm in both seasons. Meantime, palms pruned with 6:1 leaf/bunch ratio showed the highest dry weight percentage as compared with other pruning's (8:1 and 10:1) in both seasons.

Soluble Solids Content (TSS %)

Data in Table 2 indicate that different treatments of leaf/bunch ratio had increased TSS % of fruits in first season than the control treatment. The highest values of TSS (25.27%) were obtained from the palms treated with 8:1 of leaf/bunch ratio in the first season only, while the differences between all treatments were negligible in the second season.

Tannins (%)

In general, all levels of leaf/bunch ratios significantly decreased tannins % in fruits of 'Zaghloul' dates than the check in both seasons (Table 2). Differences between the three levels of leaf/bunch ratios were non-significant on tannins % in both seasons. The greatest tannins % was observed in check treatments (0.29 and 0.25 % in both seasons, respectively).

Discussions

Generally, in this study, significant differences in either physical or chemical parameters of 'Zaghloul' date palm fruits in response to leaf/bunch ratio treatments (Tables 1 and 2). The balance between leaves and bunches with 10:1 leaf/bunch ratio increased about 34% yield and about 39% bunch weight of 'Zaghloul' date palms than the control (only dead leaves were cut) in both 2018 and 2019 seasons. In addition, the yield's parameters were affected by leaf/bunch ratio, including the weight of each the fruit and flesh, fruit length and diameter as well as flesh dry weight percentage in both studied seasons (Tables 1 and 2). These results are in harmony with previous studies (El-Makhtoon et al., 1990, Harhash et al., 1998, Abdel-Hamid, 2000, El-Salhy, 2001, Shaaban et al., 2006, Hegazi et al., 2008 and Al-Salman et al., 2012). They suggested that 6 to 8 leaves (young and green) for each retentive bunch were suitable to get high yield with good yield parameters. The yield and its parameters in plants are determined by improved cultural practices that affect photosynthesis accumulation (Gifford and Jenkins, 1982). The neglected date palm trees, which usually received no pruning, have too much leaves on tree head,

TABLE 2. Effect of leaf/ bunch ratio on fruit dimensions, dry weight of fruit flesh, TSS and tannins of 'Zaghloul' date palm fruits during 2018 and 2019 seasons

Treatments (leaf/bunch ratio)	Fruit length (cm)	Fruit diameter (cm)	Dry weight of fruit flesh (%)	TSS (%)	Tannins (%)
Control	5.73	2.47	26.77	22.37	0.29
6:1	6.23	2.73	27.47	24.37	0.27
8:1	6.33	2.77	25.60	25.27	0.26
10:1	6.53	2.77	25.50	24.73	0.26
LSD at 5%	0.09	0.09	0.12	0.32	0.01
Second season (2019)					
Control	5.63	2.53	28.77	24.87	0.25
6:1	6.267	2.87	29.90	25.30	0.23
8:1	6.30	2.83	29.43	25.57	0.22
10:1	6.50	2.93	27.57	25.87	0.23
LSD at 5%	0.15	0.11	0.11	NS	0.01

resulting in shaded tree canopies. The shaded tree canopies receive a little sunlight on the bottom leaves in the tree, as reflected in photosynthesis accumulation (Heuvelink, 2005). Lombardine et al (2009) reported that light saturation points were lower for shade leaves than sun leaves. Yield showing at higher light objection can be reduced because of over dense leaves on the tree head, and transition effects on flowering and/or fruit growth (Heuvelink, 2005). In addition, the proper of the leaf-to-fruit ratio increases the accumulation of reserves in the permanent structures (Zufferey et al., 2015 and Rossouw et al., 2017).

TSS % was greatly enhanced in trees adjusted with 8:1 leaf/bunch ratio in 2018 season (Table 2). On the other hand, tannins % was significantly reduced by all leaf/bunch ratios after the pruning treatment in both seasons (Table 2). These results were confirmed by those gained with (Harhash et al., 1998, Abdel-Hamid 2000, El-Salhy, 2001, Hegazi et al., 2008 and Al-Salman et al., 2012). These finds may attribute to the excessively leaf area in un-pruned palms caused inner shading of fruiting sites that require perfect exposure for high quality. Suitable light distribution within the tree canopy is further significant to secure high fruit quality, because shade causes a reducing in fruit chemical properties.

Conclusion

The obtained results concerning the leaf/bunch ratio application in 'Zaghloul' date palms orchard located in Belbis district, Sharkia Governorate, Egypt, indicated that keeping 10 leaves to a bunch (10:1) was responsible for increasing the yield and date fruit quality.

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Conflict of interest

No conflicts of interest during this research

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تأثير نسبة الورقة/ السوباطة علي محصول وجودة ثمار بلح الزغول

محمد محمود إبراهيم^١ و عبد الرحمن مصطفى عبد الوهاب محمد^٢^١ قسم البساتين – كلية الزراعة – جامعة الزقازيق – مصر.^٢ قسم البساتين – كلية الزراعة – جامعة المنيا – مصر.

تم دراسة مستويات مختلفة من تقليم الاوراق وعلاقتها بعدد السوباتات (نسبة الأوراق/السوباتة) خلال موسمي ٢٠١٨ و ٢٠١٩ على ١٢ نخلة بالغة صنف الزغول بعمر ١٧ عام نامية في تربة رملية تحت نظام الري بالتنقيط في مركز بلبيس، محافظة الشرقية، مصر. تم فحص ثلاث مستويات من نسب الأوراق/السوباتة وهي ١:٦ و ١:٨ و ١:١٠ بالإضافة إلي معاملة الكنترول (قص الاوراق الميتة فقط). كانت الصفات الفيزيائية المختبرة هي المحصول ووزن السوباتة ووزن الثمرة ووزن اللحم وطول الثمرة وقطر الثمرة والوزن الجاف من الوزن الطازج للثمار. بالإضافة، تم قياس المحتويات الصلبة الذائبة والتانينات كصفات كيميائية للثمار البلح. وصممت التجربة بنظام قطاعات تامة العشوائية. أدت جميع معاملات التقليم إلي زيادة محصول كل نخلة بالمقارنة بمعاملة الكنترول. وحققت النسبة ١:١٠ أوراق/سوباتة أعلى محصول (١٨٢,٠٦ و ١٨٤,٥٠ كجم/ نخلة) في الموسمين، على التوالي. كانت أقل قيم المحصول في معاملة الكنترول بقيم ١٣٥,٢٢ و ١٣٦,٠٠ كجم/ نخلة في موسمي الدراسة، على التوالي. وقد زاد كل من وزن السوباتة ووزن الثمار في النخيل المعامل مقارنة بالنخيل غير المقلم. بوجه عام، أدت جميع نسب الورقة/السوباتة إلي حدوث تأثير ايجابي على جميع الصفات الفيزيائية المقاسة الأخرى لثمار نخيل بلح الزغول. وكانت المحتويات الصلبة الكلية زائدة في النخيل المقلم، بينما كانت نسبة التانينات أقل لنفس النخيل. وأعطت نسبة ١:١٠ أوراق/سوباتة أفضل النتائج للصفات المدروسة لنخيل البلح الزغول في منطقة الدراسة.

الكلمات الدالة: الزغول ، نخيل البلح، نسبة الورقة/ السوباتة ، الجودة ، التقليم ، المحصول.