

Improving of Fruit Quality and Yield of Barhi Date Palm Cultivar (*Phoenix dactylifera* L.) by Thinning Practices

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Abstract

An experiment of Barhi date palm cultivar was conducted during two successive seasons, 2016, and 2017, to compare between the different thinning of strands, 1/3 shortening of the total strands from the tips, 1/3 removal of the central strands, 1/3 shortening plus 1/3 removal of central strands. All the thinning treatments improved the fruit quality with respect to fresh fruit weight, fruit flesh weight, reducing sugar and non-reducing sugar contents as compared to the control treatment. Among the various thinning treatments, (combination of 1/3 shortening and 1/3 removal of central strands) produced the best fruit weight, flesh percentage, reducing and non-reducing sugars contents of date fruit. Whereas the total date palm yield and bunch weight were significantly reduced by the same treatment (combination of the shortening and central removal of strands). However, the date fruit quality was identical for (1/3 shortening of total strands from terminal tips) and (1/3 removal of the central strands) (i.e., 1/3 removal of central strands and 1/3 shortening of total strands) treatments. There was no significant difference of date palm yield and bunch weight obtained in control treatment than that of strands removing and shortening treatments

Key words: Barhi date palm, Thinning, Fruit quality, Yield

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Introduction

Strand thinning is one of the main cultural practices of date palm farming that helps to reduce the compactness of fruit bunches, enhance yield and fruit quality, and reduces the incidence of alternate bearing and ensures adequate flowering in the following year. Such results can be obtained either by reducing the number of fruits per bunch or by reducing the number of bunches per palm. Thinning begins early during the stage of young (1/4 fruit size) and green fruit. Farmers' preference for a specific thinning method and time of thinning depends on the date palm cultivar. Presently, the date growers in Khartoum state are facing many difficulties to produce high quality date fruit for economic reasons and to compete with the international market. Among the different date growing management practices, 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 Dawoud (1997);(Ibrahim and Khalif,1998; Ali-Dinar *et al.*, 2002). Several methods were used to thin date palm trees, namely: bunch thinning (Ali-Dinar *et al.*, 2002), bunch strands thinning (Nixon and Carpenter, 1978) and individual fruit removal (Osman and Abdulrida, 1989). Combination of removal of individual fruits and strands had substantially improved fruit quality in Majdool date palm (Osman and Abdulrida, 1989). In early studies, Nixon (1940, 1956) found that thinning improved fruit weight and quality; however, severe thinning should be avoided in certain cultivars due to possible occurrence of physiological and black nose diseases (Nixon,

1956; Nixon and Carpenter, 1978). In Sewi date palm fruit physical and chemical characteristics were substantially improved with thinning by progressive removal of strands while bunch and palm yields were reduced (Mustafa, 1993). Removing 30% of entire spikelets from bunch center was the most promising treatment, which gave a reasonable yield and the best fruit quality of (2003) concluded that bunch thinning by heading back of strands for Khadrawi cultivar at chemiry stage was useful to produce high quality dates. The main objective of this study was to provide knowledge on thinning effects, on the yield and fruit quality of 'Barhi' dates, which are considered to be one of the most important introduced promising date cultivars in Sudan

Materials and methods

The present investigation was carried out in two successive years 2016 and 2017 on Barhi date palm cultivar (*Phoenix dactylifera* L.) grown in Private orchard at El Seliat North, Khartoum. 12 years old, the trees were of nearly similar vigor, height and fruiting capacity in the preceding years. All the selected palms were subjected to the same cultural practices and received optimum management practices such as irrigation water and fertilizer etc. Thinning practices were applied few days after pollination and proper fruit setting. Thinning treatments were as followed.

- 1- (Control) T1
- 2- (1/3 shortening of total strands from terminal tips) T2
- 3- (1/3 removal of the central strands) T3
- 4- (1/3 shortening and 1/3 removal of total strands) T4

At harvesting time in first weeks of July when fruits reach khalal (bisir) stage (fully mature, crunchy and yellow in color, fifty fruits from each replicate were randomly harvested at the end of khalal (bisir) stage for determination of the following physical and chemical parameters. i.e., fruit weight (g), fruit number/kg, fruit size (cm³), Fruit length (cm), fruit diameter (cm), Fruit pulp weight at maturity (g) The total sugars content was analyzed in flesh according to AOAC (1995) and the results were computed on a dry weight basis. The titratable acidity (citric acid), Tannins and vitamin C content (mg/100ml) were determined in date juice according to Ranganna (1979). The average fruit yield/tree was recorded in kilograms.

The experiment was designed in randomized complete block design (RCBD) with 4 replications and 3 trees per plot. Means were compared with using Duncan's multiple range tests at 5% level.

Results and discussion

Fruit weight

Data in table (1) indicated that: fruit weight ranged between 13.8-18.5g per fruit in different treatment of fruit bunch thinning. Mean fruit weight was significantly more in different thinning treatments than the control. The fruit weight was significantly higher in T4 (1/3 shortening and 1/3 removal of total strands) than other thinning treatments but the difference in weight was not significant between (1/3 shortening of total strands from terminal tips) T2 and (1/3 removal of the central strands) T3. Similar results were reported by Dawoud (1997) they concluded that under New Hafa and Khartoum, Mishriq Wad Laggia and Khatiab date

palm fruit physical and chemical characteristics were substantially improved with thinning by progressive removal of strands while bunch and palm yields were reduced. Also, El-Shazly (1999) stated that by removing 30% of entire spikelet from bunch center was the most promising treatment which gave a reasonable yield and the best fruit quality of Nabtet Ali cultivar as compared with the other treatments.

Fruit length (cm)

Data regarding fruit length were shown in table (1) mean of fruit length ranged between 3.35-4.41cm under different thinning treatments. Mean fruit length was significantly affected by different thinning treatments the longest fruits produced from treatment of (1/3 shortening and 1/3 removal of total strands) T4 and the shortest fruits were produced from control treatment, these findings in line with Dawoud (1997) and El-Shazly (1999) when worked on Nabtet Ali date palm cultivar

Fruit diameter (cm)

Data of fruit diameter, in table (1) mean of fruit diameter ranged between 2.12 -2.60 cm under different thinning treatments shown the same trend of fruit length the widest fruit diameter produced from sever treatment of thinning T4 (1/3 shortening and 1/3 removal of total strands). These findings in line with the results obtained by (Ali-Dinar *et al.*, 2002) and (Hammam *et al.*, 2002)

Bunch weight

Data in table 1 showed the mean date fruit bunch weight ranged between 15.0-13.3 kg per tree under different thinning treatments. Mean bunch weight was significantly affected by different thinning treatments. The mean fruit bunch weight was significantly less in T4 (1/3 shortening and 1/3 removing strands) than other treatments. The highest bunch weight was produced from T1 Control there is a negative correlation between the thinning practices and bunch weight. These results were identical to those of Tavakkoli *et al.*, (2006) on Shahani date cultivar and Dawoud (1997). Because developing fruits normally act as strong sink to tree nutrient sources (Leopold, 1964). Several studies have demonstrated that less date fruits in proper managed trees have always better chances to increase size, weight and other fruit quality variables (El-Hamady *et al.*, 1983; El-Gassas, 1986). This is mainly due to abundance of photosynthates to remaining fruits (Ali-Dinar *et al.*, 2002).

Fruit yield

The data regarding fruit yield were shown in table (1) mean of fruit yield ranged between 140-81kg per tree under different thinning treatments. Mean fruit yield was significantly affected by different thinning treatments. The lowest fruit yield was produced from T4 (1/3 shortening and 1/3 removal of total strands) than other treatments. While the highest fruit yield was produced from T1 (control), these could be attributed to the removal of sizable number of fruit bunches that makes up the total fruit yield. The results were identical to those

reported by Dawoud (1997) they reported that severe thinning led to great reduction in date palm yield and bunch weight.

Fruit pulp weight

Data in table (2) illustrated the mean fruit pulp ranged between 12.8-14.9g in different thinning treatments. The fruit pulp percentage was higher in T4 (1/3 shortening and 1/3 removal of total strands). While the lowest fruit pulp ranged produced from T1 control. These findings in agreement with Similar results of Nixon and Carpenter (1978), Ali-Dinar *et al.* (2002) and Hammam *et al.*, (2002) who concluded that increase of fruit and pulp weights in treatments of strands removing and tips thinning may be attributed to an internal adjustment mechanism that makes the remaining fruits capable to efficiently use assimilates and improve their chemical and physical qualities in reduced competitive environments

Vitamin C

The data regarding Vitamin C were shown in table (2) mean of Vitamin C ranged between 6.1-12.9 mg./100ml juice of fruits under different thinning treatments. Mean of Vitamin C was significantly affected by different thinning treatments. The highest ascorbic acid produced from sever thinning T4 (1/3 shortening and 1/3 removal of total strands), while the lowest vitamin C content produced from control treatment. These findings in line with the results obtained by Ali-Dinar *et al.* (2002) and Hammam *et al.*, (2002)

Tannins%

Data concerning tannins were shown in table (2) the mean fruit tannins (expressed on percent basis relative to control treatment) ranged between 0.36-0.20% in different thinning treatments. The fruit tannins percentage was significantly higher in control as compared to the other treatment. The sever thinning produced low tannins fruits these results confirmed by Dawoud (1997) they reported that severe thinning led to lowest tannins % in Mishriq Wad Laggia and Khatiab date palm fruits i.e. there is a positive correlation between tannins % and thinning practices.

Acidity (The titratable acidity)

The data regarding Acidity were shown in table (2) indicated that, mean of Acidity ranged between 14.9-12.4%. Mean of Acidity was significantly affected by different thinning treatments. The lowest Acid fruits were produced from sever thinning practices T4 (1/3 shortening and 1/3 removal of total strands), while the highest acid fruits were produced from control treatment. These results were identical to those of (Tavakkoli *et al.*, 2006) on Shahani date cultivar.

Dry matter %

Data concerning dry matter percent were shown in table (2) illustrated that, the mean fruit dry matter (expressed on percent basis relative to control treatment) ranged between 0.26-0.36 percent in different thinning treatments. The fruit dry matter was significantly lowest in control as compared to the other treatment. The sever thinning T4 (1/3 shortening and 1/3 removal of total strands), produced high dry matter fruits than other treatments ,these results

were in line with Tavakkoli *et al.*, (2006) on Shahani date cultivar, also Ali-Dinar *et al.* (2002) and Dawoud and Fatima (1997).

Reducing and non-reducing sugar contents of fruit

Data in Table (2) showed the mean sugar contents of date fruit ranged between 46.3-48.7 and 20.9-23.0% for reducing and non-reducing sugar, respectively in different thinning treatments. The sugar contents were significantly affected by different thinning treatments. The difference in both the sugar contents (reducing and non-reducing) were significant among different thinning treatments and increased in ascending order from (Control) to T4 (1/3 shortening and 1/3 removal of total strands) treatments. The higher sugar contents in (1/3 shortening and 1/3 removal of total strands) could be attributed to overall low total fruit yield in T4 (1/3 shortening and 1/3 removal of total strands) than other treatments that might have caused concentration factor in total sugar accumulation. The increases of sugar contents in treatments of strands removing and tips thinning may be attributed to an internal adjustment mechanism that makes the remaining fruits capable to efficiently use assimilates and improve their chemical and physical qualities in reduced competitive environments (Nixon and Carpenter, 1978; Dawoud (1997); Ali-Dinar *et al.*, 2002; Hammamet *et al.*, 2002). It is quite obvious that a balanced removal of bunch strands reduces the inter competition between the remaining fruits for nutrients and assimilates.

Table (1): Improving yield of Barhi date palm cultivar by thinning practices (mean of 2016 and 2017)

Treatments	Fresh Fruit Weight (g)	Fruit length (cm)	Fruit diameter (cm)	Bunch weight/kg	Fruit yield/kg
Control(T1)	13.8c	3.35d	2.12d	15.0a	140a
1/3 shortening of total strands from terminal tips (T2)	16.8b	3.98c	2.32c	14.9a	94a
1/3 removal of the central strands (T3)	16.8b	4.10b	2.41b	14.5a	94a
1/3 shortening and 1/3 removal of total strands (T4)	18.5a	4.41a	2.60a	13.3a	81b

Means followed by different letter shows significant result at 5% level of significance

Table (2): Improving of Fruit Quality of Barhi Date Palm Cultivar by Thinning Practices (mean of 2016 and 2017)

Treatments	Fruit pulp weight at maturity (g)	Sugar%		Vitamin C. mg./100 ml juice	Tannins %	Acidity %	Dry Matter%
		Reducin g	Non reducing				
Control (T)	12.8d	46.3d	20.9d	6.1c	0.36a	14.9a	0.26d
1/3 shortening of total strands from terminal tips(2)	13.4c	47.3b	21.3c	10.3b	0.30b	14.1b	0.30c
1/3 removal of the central strands (3)	14.1b	47.1c	21.5b	10.6b	0.29b	12.4c	0.33b
1/3 shortening and 1/3 removal of total strands(4)	14.9a	48.7a	23.0a	12.9a	0.21c	10.2d	0.36a

Means followed by different letter shows significant result at 5% level of significance

Conclusion

Mean date fresh fruit weight, fruit flesh percent, reducing and non-reducing sugars increased with thinning treatments. Besides, total date fruit and individual date fruit bunch yield reduced significantly with application of various thinning treatments. In conclusion, application of thinning practices in date palm production seems to play a significantly in improving date fruit quality. Based on the study results, it was found that thinning 1/3 of bunch strands from tips and 1/3 removal of the central bunch strands are appropriate approaches to improve Barhi date palm fruit quality and ensures reasonable incomes to date growers. The study provided an excellent potential for the application of thinning practices to produce high quality dates under Khartoum condition. Further studies are required to study in detail all the physical and chemical characteristics of date fruit under different managing practices. Summary Compared to the control, all thinning treatments improved yield and fruit quality of 'Barhi' dates. Severe thinning led to a reduction in bunch weight and fruit number per bunch, but increased average fruit weight due to the reduction in fruit compactness within the bunch that gives more room for the fruit to grow. The increase in chemical compositions is attributed to an internal adjustment that makes the remaining fruits capable of using assimilate efficiently due to change in source to sink ratio. This thinning effect may need to be adjusted based on the cultivar and geographical location of the production site.

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تحسين جودة ثمار وإنتاجية نخيل البلح صنف البرحي من خلال عمليات الخف المختلفة

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الملخص العربي

أجريت التجربة في بستان نخيل في مشروع السليت شمال الخرطوم علي أشجار نخيل صنف البرحي بأعمار ١٢ سنة وذلك في عامي ٢٠١٦ و٢٠١٧ علي التوالي للمقارنة بين طرق خف ثمار نخيل البلح البرحي. تم تطبيق كل الممارسات البستانية التقليدية والمجازة حديثا من هيئة البحوث الزراعية علي بستان التجربة من تسميد وري وخلافه كما إحتوت التجربة علي المعاملات التالية (١- تقصير شماريخ العنق بنسبة ٣/١ من طول الشمرخ. ٢- إزالة ٣/١ من شماريخ وسط العنق. ٣- المعاملتين الأولى + الثانية. ٤- كنترول أي بدون معاملة). كل المعاملات أدت الي تحسين وزن الثمار وتحسين جودة الثمار عن الكنترول وكانت أجود المعاملات هي المعاملة الثالثة وهي تقصير ٣/١ أطوال شماريخ العنق + إزالة ٣/١ شماريخ وسط العنق)

الكلمات الدالة: نخيل البلح صنف البرحي، الخف، جودة الثمار، المحصول.