Bunch Thinning Improves Yield and Fruit Quality of Omraheem Date Palm Cultivar (*Phoenix dactylifera* L.)

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Abstract :

Bunch thinning as illustrated by removal of bunches to represent fixed leaf/ bunch ratios: no thinning (control), 6:1, 8:1, 10:1 and 12 leaves:1 bunch; was found to differentially affect yield components and fruit quality of 'Omraheem' date palm cultivar. Bunch, fruit and seed weight as well as flesh/ seed ratio were significantly affected by thinning practices. Ratios of leaf:bunch which are 10:1 and 12:1 produced the highest bunch , fruit and fruit edible flesh weight. Reducing and non reducing sugars were significantly improved, while fruit moisture content was not affected by increasing leaf:bunch ratio. Improvement of fruit chemical constituents was attributed to possible abundance of assimilates with relatively high leaf : bunch ratio.

Key words :
Date palm, thinning, leaves : bunch ratio, yield, fruit quality

Introduction :

Date palm (*Phoenix dactylifera* L.) represents the major economical fruit crops in Kingdom of Saudi Arabia. It occupies approximately 72% of the total area under permanent crops in the Kingdom. The estimated annual production of dates in Saudi Arabia is 830000 tons occupying an area of 140000 hectares (FAO, 2004). The annual production is expected to reach over million tons over the next coming years. Despite the importance and dominance of this crop in the agricultural sector, its marketing faces many problems (Annual Report, Ministry of Agriculture and Water, Kingdom of Saudi Arabia, 2004). Many producing areas of date palm in the world have enhanced their marketing capabilities by improving fruit quality (Al-Khateeb and Ali-Dinar, 2002). Cultivation of high fruit quality date cultivars coupled to proper cultural and thinning practices were conventionally used to improve fruit quality and maturity of date palm (Ali-Dinar *et al*., 2002; EL-Kassas, *et al*., 1995; Al-Khateeb, *et al*., 1993; Bacha

and Shaheen, 1986 and Godara, *et al*. 1990). Thinning practices can positively regulate bearing patterns of date trees and reduce alternate bearing phenomenon (Ibrahim and Khalif, 1998). Several thinning methods were used in the past that included; removal of spathes, cutting of bunch strands, manual and chemical fruit removal (Hussein and Abdalla, 1973; Hussein *et al*., 1976; Khalifa *et al*., 1987; Maghrabi *et al*., 1992 and Ali-Dinar *et al*., 2002). Hassan (1993) reported that the best leaf:bunch ratio to effectively improve fruit quality was 10:1 for 'Samani' and 'Zagloul' and 8:1 for 'Alhayani' cultivars. Fruit size and total soluble solids were substantially improved by bunch thinning while acidity and fruit fresh weight were not affected. In another studies Al-Khateeb *et al*. (1993) demonstrated that fruit thinning of date at spathe opening (flowering) increased fruit volume and improved fruit quality of 'Khalas' cultivar. Thinning practices have been found to reduce effects of alternate bearing and ensure adequate flowering (Ibrahim and Khalif, 1998). In recent years, plant growth regulators have been used for thinning and proved to be effective in improving fruit quality (El-Hamady, *et al*., 1992). NAA and 2,4-D were the major plant growth regulators used for thinning (El-Kassas, 1986). Nixon (1951), however, illustrated that the choice of the proper method for thinning was often related to date cultivars. He indicated that removal of strands or individual fruits rather than whole bunches was much better in small-fruit date palm cultivars. It is quite probable that several physiological factors may influence such differential responses between date palm cultivars. Further studies to determine the interrelated factors affecting these differences seem to be imperative. The present study was conducted to determine the effects of removing some of the bunches to certain leaf:bunch ratios, on the yield and fruit quality of 'Omraheem' date palm cultivar.

Materials and Methods :

The thinning studies were conducted during 2001/ 2002 at the Date Palm Research Center at Al-Hassa region, Kingdom of Saudi Arabia.

Fifteen trees of 'Omraheem' cultivar with approximately uniform size and age were selected for imposing the treatments of the experiment. All trees received similar cultural practices. The experiment was laid out as a complete block design with three replicates. Pollination of all trees was carried out during March/ April each year. The thinning treatments included the following leaf:bunch ratios: No thinning (control), 6:1, 8:1, 10:1 and 12:1. The leaf:bunch ratios were obtained by the removal of early, late or small bunches, and excess old leaves after fruit set according to Mahmoud *et al*., 2003.

Date fruits were harvested during July/ August 2001/ 2002. Yield components were expressed by determining bunch weight, number of fruits/strand, fruit weight and flesh percentage. A sample of 25 fruits was collected from each experimental tree to determine total soluble solids (TSS), reducing and non-reducing sugars and fruit moisture content (Lane and Eynon, 1975).

The data were statistically analyzed according to the technique of analysis of variance (ANOVA) for the randomized complete block design as published by Gomez and Gomez (1984). The treatment means were compared using least significant difference (LSD) at 5 % level of probability according to Waller and Duncan (1969). All statistical analysis was performed using the facility of computer and SAS software package (SAS, 2001).

Results and Discussion :

The data presented in Table (1) show the effect of leaf:bunch ratio on the bunch weight, fruit weight, seed weight and flesh weight of Omraheem date palm cultivar. This data indicated that, bunch weight, fruit weight and flesh weight tented to respond positively to bunch thinning. On the contrary, the seed weight did not affect significantly by 6:1 and 8:1 ratios whereas, the 10:1 and 12:1 ratios showed a significant decrease. These results came in the same line with Khalifa *et al*. (1987), Hussein *et al*. (1992) and Hegazi and Sallam (2007. Bunch weight represents the major part of the yield components. Many interrelated factors impose their impact on yield in such a way that may often overshadow the effects individual factors and lead to conflicting results. Shortage of water and drought for example may have direct effects on individual spathe flowers which are directly related to bunch fruiting irrespective of leaf:bunch ratio (Nixon and Carpenter, 1978).

Table (1)

Effect of leaf: bunch ratio on bunch, fruit, seed and fruit flesh weights of 'Omraheem' date palm cultivar (over the two seasons 2001 and 2002).

Leaf/bunch ratio	Bunch wt. (kg)	Fruit wt. (g)	Seed wt. (g)	Flesh wt. (g)
No thinning (control)	16.5 c	13.3 c	1.6 a	11.7 c
6: 1	17.2 bc	15.4 c	1.4 a	14.0 b
8:1	17.9 b	18.8 bc	1.5 a	17.3 b
10:1	19.5 a	22.5 a	1.2 b	21.3 a
12:1	19.1 a	23.6 a	1.2 b	22.4 a

Means followed by different letters in the same column are significantly different at 5% probability.

The effect of bunch thinning rates on the fruit flesh and seed percentage as well as flesh/seed ratio are presented in Table (2). The data generally, showed that the bunch thinning treatments tended to increase the fruit flesh percentage and flesh/seed ratio. The ratios 10:1 and 12:1 recoded the highest values in this respect with no significantly differences. Meanwhile, the seed percent was significantly decreased by the 10:1 and 12:1 ratios only.

Increasing leaf:bunch ratio under optimum management practices, environmental and palm conditions are expected to assist the tree photosynthetic process to efficiently and abundantly provide the fruits with photosynthesis. Despite this assumption, fruit parameters in many similar studies were not affected (Bacha *et al*. 1986, and Godara, *et al*. 1990). Hussein *et al*. 1992, however, showed that thinning practices could improve fruit weight and size. The improvement of fruit flesh was also supported by a reduced seed weight (Table 2). It seem that the source sink trend of photosynthesis in addition to the support of the seed reserves favour the growth of fruit flesh more than the seed component. The comparable increase in flesh ratio is well favored in fruit since it adds to the edible portion and improves its eating quality. Flesh:seed ratio was significantly improved with manual and chemical thinning (El-Kassas, 1986). Also, Mahmoud *et al*. (2003) found that the leaf :bunch ratio improved the quality of Zaghloul fruits.

Table (2)

Effect of leaf: bunch ratio on fruit flesh and seed percentages and flesh seed ratio of 'Omraheem' date palm cultivar (over the two seasons 2001 and 2002).

Leaf/bunch ratio	Fruit flesh* (%)	Seed (%)	Flesh /seed ratio
No thinning (control)	87.9 c	12.1 a	7.3 c
6: 1	90.9 b	9.1 a	10.0 bc
8:1	92.0 ab	8.0 ab	11.5 b
10:1	94.7 a	5.3 c	17.8 a
12:1	94.9 a	5.1 c	18.6 a

Means followed by different letters in the same column are significantly different at 5% probability.

* Flesh and seed percentages were determined from weights of each component as a percent of total fruit weight.

Regarding the effect of thinning on fruit sugars content are presented in Table (3). The data generally, indicated that the sugars were differentially affected by thinning treatments. Reducing and non-reducing sugars were substantially improved with increasing leaf:bunch ratio. On the other hand,

the same treatments did not exert any effects on fruit moisture content (Table 3). Both reducing and non-reducing sugar contents were higher in fruits with 10:1 and 12:1 leaf/bunch ratios. This is reasonably expected since the density of tree leaves plays a vital role in availing assimilates to fruits and hence improving their quality. In our study the higher fruit sugar contents were obtained in bunches of trees with optimum or higher leaf:bunch ratio.

Table (3)

Effect of leaf: bunch ratio on reducing and non-reducing sugars and fruit moisture content of 'Omraheem' date palm cultivar (over the two seasons 2001 and 2002).

Leaf/bunch ratio	Reducing sugars (%)	Non-reducing sugars (%)	Fruit moisture content (%)
No thinning (control)	46.6 b	21.4 b	23.4 a
6: 1	46.9 b	22.7 ab	23.1 a
8:1	47.5 ab	23.1 a	23.6 a
10:1	48.9 a	23.9 a	23.3 a
12:1	48.7 a	24.5 a	23.4 a

Means followed by different letters in the same column are significantly different at 5% probability.

An observation which convincingly supports the assumption of assimilates are always abundant to fruits with higher leaf to bunch ratio. However, this can only be held true if leaves are optimally functioning and their photosynthetic efficiency at its best. More than 90% of photosynthetic assimilates consist of organic compounds such as cellulose, starches, lipids and proteins which are directly or indirectly related to photosynthesis (Ali-Dinar *et al*., 2002). The moisture content seemed to hold negative relation with thinning treatments. Previous studies had also reflected similar results (Hassan, 1993 and Ali-Dinar *et al*., 2002). The moisture content as a component of fruit is subjected to so many factors including environmental, tree conditions and management practices. Such complexity of interrelated factors may often eliminate or reduces individual factors effects.

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تحسين المحصول وصفات جودة ثمار نخيل التمر صنف أم رحيم بخف العذوق (*Phoenix dactylifera* L.)

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الملخص :

خف العذوق بإزالة العذوق لتثبيت نسب العذق إلى الأوراق كما يلي: بدون خف (الشاهد)، ١:٦، ١:٨، ١:١٠ و ١ عذق: ١٢ ورقة أدى إلى تأثير مختلف على مكونات المحصول وصفات الثمار لصنف التمر أم رحيم. تأثرت أوزان كل من العذق والثمرة والبذرةَ بالإضافة إلى نسب اللحمِ / بذرةٍ معنويا بعمليات الخف. معاملات الخف ١:١٠ و ١:١٢ أدت إلي زيادة وزن كل من العذوق والثمرة ولحمِ الثمرة الصالح للأكلِ. محتوي الثمار من السكّريات المُختَزلة والغير مختزلة تحسنت معنويا بزيادة نسبة الأوراق إلى العذوق. المحتوى الرطوبيِ للثمرة لم يتأثر بعمليات الخفِ المختلفة . تحسين المحتوى الكيميائيِ للثمرة من السكريات المختزلة والغير مختزلة رجع إلى الوفرةِ التمثيلية بالنسب العالية من الأوراق إلى العذقِ.

الكلمات الدليلية:

نخيل التمر، خف الثمار، نسبة الأوراق إلى العذق، المحصول، جودة الثمار.