EFFECT OF LEAF /BUNCH RATIO ON PRODUCTIVITY OF ZAGHLOUL AND HAIANY DATE PALM CULTIVARS UNDER UPPER EGYPT CONDITIONS.

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Abstract: This study was carried out through the two successive seasons 2005 and 2006 on Zaghloul and Haiany date palms at the orchard of Faculty of Agriculture, Qena , South Valley University, Egypt. The aim of this study was to find out an additional information of Zaghloul and Haiany date palms as a soft type grown under Qena conditions to certain treatments of number of leaves per bunch (leaf/ bunch ratio). Four levels of leaf to bunch ratios(6, 8, 10 and 12: 1) were used. The results could be summarized as follows:

There are significant differences in bunch weight, yield/ palm and fruit quality due to varying the level of leaf / bunch ratio. Initial and horticultural fruit set and consequently bunch weight significantly increased as well as level of leaf/ bunch ratio increased. On other hand, yield/ palm was significant reduced with level of leaf / bunch ratio increased. Physical and chemical fruit properties were improved as well as level of leaf / bunch ratio increased. Pruning by level eight leaves per bunch gained the highest score recorded (96.7& 96.2 units) in Zaghloul and Haiany cvs, respectively comparing with other leaf/bunch ratio evaluation.

In general, medium level of leaf / bunch ratio (8 or 10 :1) gave the best effect on yield and fruit quality.

These results are important for economic and horticultural point view. It could be concluded that pruning to leave about 70 leaves with 8 to 10 bunches was the most suitable pruning treatments for Zaghloul and Haiany date palms cultivars grown under Upper Egypt conditions, since improving the yield and fruit quality.

Key words : Leaf / bunch ratio, productivity, date palm, pruning.

Introduction

The date Palm (*Phoenix dactylifera,L.*) is of great importance now for its highly nutrition fruits and could grow under unfavorable conditions, where many other fruit trees fail to grow. Date fruits can be considered as a complete diet since they contain all the necessary

ingredients required for human body and they are recognized as an energy rich food (Mertz, 1981). Zaghloul and Haiany dates are the most important cultivar of soft dates and are very demanded in Egyptian market. The income from such cultivars are mainly dependent on fruit quality. Recently such cultivars were successfully cultivated in upper Egypt (El-kassas et al., 1995). It is important for date plans growers to increase yield and improve fruit quality to gain premium price. The degrees of success of palm grow , yield and fruit quality are according to date cultivars, environmental conditions and agricultural practices. Pruning alters the balance between roots and leaves. So, the modifying leaf to bunch ratio has the potential to improve palm dates yield and quality (Zearban 1993, Ismail 1994 and El-Salhy 2001).

The green leaves are the factories in which carbohydrate and other essentials are formed. Thus, an adequate number of leave per palm is very important for good yield of best fruit quality. The highest leaf embracing the female inflorescences occur when the leaves are 9-12 month old, whereas the least ones occur when these leaves are of one year old.

So, the old leaves are less active than the younger ones, as such , removing the old leaves has no harmful effect on palm tree productivity and to determine the appropriate leaf / bunch ratio to improve the yield and quality (Abdalla et al.,1982, Zearban 1993, El-salhy 2001, Mahmoud et al., 2003 and Mahmoud 2005).

Date palm leaf / bunch ratio could be manipulated through pruning to achieve many desired physiological responses. Important consequences of pruning include changes in hormone levels especially cytokinins, energy supply, carbohydrate assimilation and water relations (Hussein et al., 1984, Zearban 1993, El-Salhy 2001, and Soliman and Osman, 2001).

The importance of leaf area or leaf / bunch ratio for dates production and quality has been emphasized by numerous investigators. The attempts have been made to Adjust the leaf / bunch ratio which varied with the used cultivars and environmental conditions. Studies on Samany and Zaghloul date palms recommended a wide range (4- 8 leaves per bunch) as a suitable ratio (Bakr et al., 1976 and khalifa et al., 1984).whereas, pruning level at 8 leaves / bunch increased yield and dates quality over those maintained under the ratio 6:1 especially with Zaghloul cultivars (Abdaulla et al., 1982, Hassaballa et al., 1983, Zearban 1993, El-Salhy 2001 and Mahmoud

et al., 2003). Meanwhile, 9- 10 leaves per bunch was reported for Zaghloul as the most beneficial ratio (Khalifa et al., 1984 and Harhash et al., 1998).

The dates quality of Barhi date palm grown in Saudi Arabia, tended to increase as the number of leaves per bunch increased. The total yield per bunch and the percentage of fruit in grade 1 increased significantly with increasing leaves / bunch ratio up to 12 leaves / bunch (Hussein et al., 1977).

Removal of old senescing leaves was successfully used with "Zahdi" dates to improve the quality while severe pruning was damaging, so, 7-8 leaves/ bunch was recommended (Hussein et al., 1984).

The moderate pruning (10-12 leaves / bunch) of bartamoda, Gondaila and Dagana date palms under conditions of Aswan governorate and other regions with similar conditions is recommended (Hussein et al., 1998 and Soliman and Osman, 2001). Hence, there is a need for more elaborated studies to define a narrower range of leaf/ bunch ratio in date palm that could recommend for date growers. We also need to define the ratio that could damage fruit growth and quality.

The objective of the present work is to maximize the yield and improve the fruit quality of Zaghloul and Haiany dates by modifying the leaf /bunch ratio.

Materials and Methods

This experiment was conducted at the Experimental Orchard of Faculty of Agriculture, Qena, South Valley University, Egypt on Zaghloul and Haiany date palm cultivars during the two successive seasons 2005 and 2006.

Twelve date palm trees each cultivar of uniform vigour, 10 years-old - planted in sandy calcareous soil at 8 meter apart were selected . Also, they were selected according to their bearing of approximately the same number of spathes and leaves. Pollination was achieved by using pollen grains from the same male palm in both seasons, in the latest week of march. The male strands used in pollination were obtained from local, selected and famous male date palm tree because of its pollen availability. The involved palm trees were received the regular horticulture practices.

The palm trees were classified at random into four treatments on bunch /leaves ratio (1:6, 1:8, 1:10 and 1:12). Each treatment consisted of three replicates. Each date palm tree was considered a replicate. The number of inflorescences per palm was adjusted to 6,7,9 and 12 by removing excess earliest, latest and smallest clusters. The retained bunches were thinned to constant

number of strands. The experiment was arranged in a complete randomized block design including four treatments. After one month from pollination and just before harvest five female strands per bunch were randomly selected from each replication. The number of setting fruit were recorded , then initial fruit set and horticultural fruit set percentages were calculated. The fruit set percentage calculated as following equation :

Initial fruit set%= number of fruit strands/(number of fruit + number of flowers scars) x 100

Horticultural fruit set% = number of retained fruit /(number of retained fruit + number of flower scars)x 100

All bunches were harvested when they reached to commercially derived color. Bunch as weights were recorded, then the yield per palm was determined. Consequently, 100 fruits were picked at random from each palm (replicate) for the determination of physical and chemical fruit properties as outlined in A.O.A.C method (1985).

To general evaluation of tested bunch /leaf ratio effects, hundred unit were shared between the following eight main characteristics, bunch weight, yield/palm, total soluble solids and total sugars (15 units for each) as well as initial fruit set fruit weight , fruit height. flesh

weight, (10 units). Within each of these parameters, the treatment that recorded the upper most values received all the units specified for it. The following equation was used to determine these characters. Characters $=\Sigma \, ^B_A \, X(10 \text{ or } 15)$

A= the highest value recorded for studied character among all treatments.

B= value recorded for the specific character for considered treatment.

All data were subjected to statistical analysis according to the procedure reported by Gomez and Gomez (1984) and Snedecor and Cochran (1990). Treatments means were compared by the test significant difference test (L.S.D) at the 5% level of probability in the two seasons of experimentation.

Results and Discussion

1- yield parameters:

According to table (1), initial and horticultural fruit set percentage as well as bunch weight and yield per palm reacted almost similarly taking the same trend in both two studied cultivars and two experimental seasons. It could be shown that the initial fruit set, horticultural fruit and bunch weight significantly increased towards maximum values as the number of expanded leaves per bunch was increased. Thus, it could be concluded that there is a positive relation between number of

Table (1): Effect of leaf/bunch ratio treatments on yield parameters of Zaghloul and Haiany date palms during 2005 and 2006 seasons

Treatment Characteristics	A- Zaghloul leaf / bunch ratio									
	6 : 1		8 : 1		10 : 1		12 : 1		L.S.D	
	2005	2006	2005	2006	2005	2006	2005	2006	2005	2006
Initional fruit set	43.50	41.50	49.60	50.10	53.40	50.80	52.80	49.95	5.10	64.00
Horticultural fruit set	31.70	30.65	38.50	35.80	39.43	36.10	39.60	3.90	4.85	35.90
Bunch weight	10.80	10.50	13.43	13.50	13.90	13.80	14.20	14.70	2.70	3.20
Yield / palm	129.60	126.0	120.9	121.5	97.30	96.60	85.20	84.60	11.48	10.83

Treatment Characteristics	B- Haiany leaf / bunch ratio									
	6 : 1		8 : 1		10 : 1		12 : 1		L.S.D	
	2005	2006	2005	2006	2005	2006	2005	2006	2005	2006
Initional fruit set	42.8	40.30	48.4	46.30	50.8	48.60	50.6	48.00	6.20	4.40
Horticultural fruit set	28.30	31.30	40.30	38.90	41.80	40.10	42.00	41.00	12.40	5.80
Bunch weight	10.80	11.35	13.90	13.66	14.50	14.60	15.10	14.80	1.85	2.90
Yield / palm	129.60	136.20	125.10	122.90	101.50	102.20	91.80	88.80	8.67	13.30

leaves per bunch and their fruits number and weights. High level of leaf /bunch ratio (10 or 12:1), gave the highest fruit set and bunch weight in comparison with the lower level (6:1). However, increasing the leaf/bunch up 8 failed to show any significant effect on such studied parameters.

The obtained initial fruit set were (43.50, 49.60, 53.40&52.80% and 41.50, 50.10, 50.80& 49.95% in Zaghloul cv.) meanwhile it was ((42.80, 48.40, 50.80& 50.60 and 40.30, 46.30, 48.60, &48.00% in Haiany cv.) due to leaf/bunch ratio 6, 8, 10 and 12 during two studied seasons, respectively.

The corresponding values of bunches weight were attained (10.80, 13.43, 13.90 & 14.20 and 10.50, 13.50, 13.80 & 14.70 Kg in Zaghloul cv.) as well as (10.80, 13.90, 14.50 & 15.10 and 11.35, 13.66 , 14.60 & 14.80 kg in Haiany cv.) respectively.

Increasing the fruit set and bunch weight towards the higher number of leaves/bunch may be attributed to the highest concentrations of carbohydrates which transported from these leaves. The results emphasized the vital importance of adequate leaves in order to improve fruit set and its growth and consequently heavy bunch weight could be obtained at harvest.

Contrarily, low leaf/bunch ratio resulted in significantly higher yield per palm, where wide level tended to reduce the yield per palm. The yield per palm was significantly decreased by increasing the leaf/ bunch ratio. Moreover, increase such ratio from either 6 or 8 leaves faild to show any significantly decreased on the yield per palm. The recorded yield /palm were (129.60, 120.90, 97.30 & 85.20 and 126.0, 121.50, 96.60 & 84.60 Kg/ Zaghloul date palm) due to leaf /bunch ratio 6,8,10 and 12 during two studied seasons, respectively. The corresponding yield/ Haiany date palm were (129.60, 125.10, 101.50 & 91.80 and 136.20, 122.90, 102.20 & 88.80 Kg /palm) in two studied seasons, respectively.

These results due to increase the bunches number per palm when used the low level of leaf/ bunch ratio. In line with , Bakr et al., (1976) and El-Salhy (2001) who recorded that the average yield per palm increased with increasing of bunch number retained on it.

These results are in agreement with those reported by Hassaballa et al., (1983), Khalifa et al., (1984), Zearban (1993), Ismail (1994), El-Salhy (2001) and Mahmoud et al., (2003) who found that the fruit set percentage and bunch weight were increased as the leaf number per bunch were increased in respective cultivars used in their studies.

In addition, they concluded that 6 to 8 leaves for each bunch was suitable to improve the yield per Zaghloul date palm.

Fruit properties:

A. physical characteristics:

Table (2) shows the effect of leaf / bunch ratio on some physical fruit properties of Zaghloul and Haiany dates during the present study. As a general overlook at the data, it was showed that fruit dimension and flesh weight reacted almost similarly and taking the same trend of fruit weight in response to effect of investigated leaf/bunch ratio during the two experimental seasons. The leaf/bunch ratio 12:1 gave the heaviest fruit weight compared to other treatments. On the other hand, leaf/bunch ratio 6:1 gave the lowest fruit weight for Zaghloul and Haiany cvs in the two studied seasons.

The improvement of such traits were associated with increasing the leaf/bunch ratio. Increasing the leaf/bunch ratio up 8:1 had a slight and insignificantly increased on such fruit properties. Hence, the pruning level at 8 leaves per bunch was the most suitable ratio for Zaghloul and Haiany cultivar under Qena conditions to improve the physical quality of dates.

Such finding might be due to better supply of food material carbohydrates that are manufactured in the leaves. The previous results agree with what reported by Bakr et al., (1976), Abdalla et al., (1982), Hassaballa et al., (1983), Khalifa et al., (1984), Zearban (1993), Ismail (1994), Hussein et al (1998), Harhash et al., (1998), El-Salhy (2001), Soliman and Osman (2001) and Mahmoud et al., (2003), all found that weight, length and flesh weight of fruit were increased as the number of leaves per bunch were increased in respective cultivars used in their studies.

B. Fruit chemical constituents:

Data presented in Table (3) show the effect of four leaf/bunch ratio on some chemical constituent juice of Zaghloul and Haiany dates in 2005 and 2006 seasons. It is obvious from the obtained data that sugar contents reacted almost similarly and taking the same total soluble solids in response to the effect of investigated the leaf/bunch ratio during the two studied seasons. Data explained that total soluble solids, total sugars and reducing sugar contents tended to increase significantly with increasing leaf/bunch ratio from 6 to 12 leaves per bunch. Increasing the leaf /bunch ratio up 8 leaves had insignificantly increased the chemical fruit properties. The increment in total soluble solids and sugar contents might be due to improve of photosynthesis efficiency which supplied the fruits with more sugars.

Table (2): Effect of leaf/bunch ratio treatments on physical fruit quality of Zaghloul and Haiany date palms during 2005 and 2006 seasons

Treatment Characteristics	A- Zaghloul leaf / bunch ratio									
	6 : 1		8 : 1		10 : 1		12 : 1		L.S.D	
	2005	2006	2005	2006	2005	2006	2005	2006	2005	2006
Fruit weight	16.50	17.21	19.35	21.89	19.85	21.95	20.10	22.08	1.53	2.40
Seed weight	1.95	2.03	2.03	2.08	2.21	2.310	2.27	2.38	N.S	0.52
Fruit height	5.40	5.20	6.00	5.80	5.90	5.70	6.10	5.80	0.53	0.26
Fruit diameter	2.18	2.38	2.48	2.53	2.53	2.60	2.60	2.53	0.28	0.17
Flesh weight	14.55	15.18	17.32	19.81	17.64	19.64	17.83	19.70	0.18	0.21

Treatment Characteristics	B- Haiany leaf / bunch ratio									
	6 : 1		8 : 1		10 : 1		12 : 1		L.S.D	
	2005	2006	2005	2006	2005	2006	2005	2006	2005	2006
Fruit weight	16.20	17.40	21.80	22.62	21.95	22.80	22.15	22.90	3.40	1.90
Seed weight	1.93	2.05	2.00	2.31	2.14	2.38	2.28	2.53	N.S	N.S
Fruit height	5.03	5.23	5.50	5.60	5.50	5.70	5.40	5.60	0.37	0.16
Fruit diameter	2.40	2.47	2.40	2.53	2.60	2.53	2.60	2.63	0.27	0.11
Flesh weight	14.27	15.35	19.80	20.31	19.81	20.24	19.87	20.37	0.13	0.19

Table (3): Effect of leaf/bunch ratio treatments on chemical fruit quality of Zaghloul and Haiany date palms during 2005 and 2006 seasons

Treatment Characteristics	A- Zaghloul leaf / bunch ratio									
	6 : 1		8 : 1		10 : 1		12 : 1		L.S.D	
	2005	2006	2005	2006	2005	2006	2005	2006	2005	2006
TSS	39.40	38.85	42.18	42.40	43.60	43.30	44.00	43.80	2.76	3.20
Acidity%	0.10	0.06	0.09	0.05	0.08	0.03	0.08	0.03	0.008	0.043
Reducing %	19.03	19.40	20.80	22.20	20.80	22.80	21.80	22.00	1.24	1.80
Total sugars	29.13	32.2	32.10	36.40	31.70	36.20	32.81	36.20	2.31	1.60
Non reducing sugar	10.1	12.80	11.30	14.20	10.90	13.40	11.01	14.20	1.08	1.35

Treatment Characteristics	B- Haiany leaf / bunch ratio									
	6 : 1		8 : 1		10 : 1		12 : 1		L.S.D	
	2005	2006	2005	2006	2005	2006	2005	2006	2005	2006
TSS	37.40	40.40	40.80	43.10	41.70	43.80	41.60	43.60	3.20	2.50
Acidity%	0.07	0.07	0.06	0.05	0.09	0.60	0.09	0.06	0.021	0.015
Reducing %	19.40	19.80	19.95	20.63	20.90	21.80	20.80	21.35	1.25	1.62
Total sugars	28.63	28.93	30.80	31.30	31.50	31.70	31.30	31.50	1.95	2.4
Non reducing sugar	9.23	9.13	10.85	10.67	10.60	9.90	10.50	10.15	0.88	1.45

On the other hand, total acidity was decreased very slightly with increasing number of leaves per bunch 6 to 12 leaves. So, it can be said that there was a negative trend between total soluble solids and total acidity. Meaning that as total soluble solids increased, total acidity decreased when leaf/ bunch ratio increased from 6 to 12:1 treatments.

These results are in line with those of Abdalla et al., (1982), Khalifa et al., (1984) Zearban (1993), Ismail (1994) Harhash et al., (1998), El-Salhy (2001) and Mahmoud et al., (2003), they found that 6 to 8 active leaves for each retentive bunch was suitable per each tree of Zaghloul and Haiany dates. Using a lower leaf/bunch ratio(3- 1) caused an adverse effect on some fruit characteristics such as fruit weight, length, total soluble solids and sugar contents.

General evaluation of leaf/bunch ratio level.

It is quite evident from Table (4) that general evaluation of the studied leaf /bunch ratio according to yield parameters and fruit quality emphasize the pre-mentioned trend. Since pruning by leave eight leaves per bunch gained the highest score recorded (96.7 & 96.2 and 96.5 and 95.9 units) in Zaghloul and Haiany cvs, during the two studied seasons, respectively. Such treatment recorded approximately similar

effect on yield component and physical and chemical fruit properties (37.9 , 29.5 & 29.4) in Zaghloul date cv. and (36.8?, 29.75 &29.50 units in Haiany date cv. av. the two studied seasons) due to yield parameter and physical and chemical fruit quality, respectively. The least total scores recorded as use the leaf /bunch ratio was 6:1 (86.9 and 85.65 units as av. two seasons) in Zaghloul and Haiany cvs. respectively.

These findings attributes to the effect of increased number of active leaves per bunch on improving the yield components as well as fruit quality, such improvement previously explanation.

Such data provide a background for the formulation of leaf/bunch ratio and a criterion for evaluation of leaf pruning practices with the date palm. Photosynthetic rate increased until the young leaves reached full maturity the first year, then there was a consistent reduction. The differences are not significant between six months and there year. In addition under favorable condition the recorded new growth of Zaghloul and Haiany date palms is only about 22-24 leaves per year (Mahmoud, 2005).

So, it could be concluded that pruning leave to about 70 leaves with 8 to 10 bunches was the most suitable pruning treatment for Zaghloul and Haiany date palm

Table(4): General evaluation of leaf/bunch ratio according yield components and fruit quality of zaghloul and Haiany date palms average of two studied seasons.

Zaghloul

Characters	Yield components				Physical Fruit quality				Chemical Fruit quality			
Treatment (leaf /bunch ratio)	Initial fruit set	Bunch weight	Yield /palm	total	Fruit weight	Flesh weight	Fruit height	Total	TSS	Total Sugars	Total	G. Total
Score(units)	10	15	15	40	10	10	10	30	15	15	30	100
6:1	8.15	10.05	15.00	34.20	8.00	8.95	8.95	25.90	13.35	13.85	27.20	86.9
8:1	9.60	14.00	14.25	37.90	9.75	9.85	9.90	29.50	14.45	14.95	29.40	96 7
10:1	10.00	14.40	11.40	35.80	9.90	9.90	9.75	29.55	14.85	14.85	14.85	95.60
12:1	9.85	15.00	10.00	34.85	10.00	9.95	10.00	29.95	15.00	15.00	30.00	94.70

Haiany

Characters	Yield components				Physical Fruit quality				Chemical Fruit quality			
Treatment (leaf /bunch ratio)	Initial fruit set	Bunch weight	Yield /palm	total	Fruit weight	Flesh weight	Fruit height	Total	TSS	Total Sugars	Total	G. Total
Score(units)	10	15	15	40	10	10	10	30	15	15	30	100
6:1	8.35	11.10	15.00	34.45	7.45	7.35	9.15	23.60	13.60	13.65	27.25	85.65
8:1	9.50	13.80	13.65	36.80	9.85	10.00	9.90	29.75	14.75	14.75	29.50	96.20
10:1	10.00	14.60	11.45	36.05	9.95	9.95	10.00	29.90	15.00	15.00	30.00	95.95
12:1	9.90	15.00	10.00	34.90	10.00	10.00	9.80	29.80	14.95	14.90	29.85	95.00

cultivars to achieve a beneficial balance for date palm grown under upper Egypt conditions, such ratio gavethe high yield and good quality of production of fruits.

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تاثير نسبة الاوراق إلى الأغاريض على إنتاجية صنفى نخيل البلح الزغلول و الحيانى تحت ظروف مصر العليا

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أجريت هذه الدراسة خلال عامى ٢٠٠٥، ٢٠٠٦ على نخيل البلح الزغلول و الحيانى بمزرعة كلية الزراعة بقنا – جامعة جنوب الوادى مصر– بهدف دراسة تاثير النسب المختلفة لعدد الأوراق إلى عدد السباطات على المحصول و خصائص الثمار لتحديد النسبة الامثل تحت ظروف مصر العليا للأصناف الرطبة – و قد تم استخدام أربعة من النسب و هى (٦، ٨ ، ١٠، ١٢ :١)

و قد اوضحت النتائج ما يلى :

- و جود فروق جوهرية في نسبة العقد الأولي و النهائي و بالتالي وزن السباطات و المحصول /نخلة .

- أدت زيادة نسبة الاوراق / الأغاريض إلى زيادة مؤكدة في نسبة العقد الأولى و العقد البستاني للـثمار و بالـتالى وزن السباطة– بينما حدث نقص مؤكد في وزن المحصول /نخلة بزيادة نسبة الأوراق إلى الاغاريض.

- أدت زيـادة نسـبة الاوراق إلـى الأغاريض إلى تحسين واضح في خواص الثمار الطبيعية و الكيميائية.

- سـجلت النسبة (٨ :١) أعلى الدرجات (٩٦,٧ ، ٩٦,٢ ، وحده) لكل من نخيل البلح الزغلول و الحـيانى علـى التوالى مقارنة بالمعاملات الاخرى في التقييم العام للنسب المستخدمة و عموما كانـت النسب (٨، ١٠ : ١) هى الافضل من حيث المحصول و جودة الثمار مقارنة بالمعاملات الأخرى

- تشـير هـذه الدراسة إلى أن تحوير النسبة بين الأوراق إلى السباطات لها القدرة على تحسين الـثمار و زيادة المحصول في صنفى الزغلول و الحيانى و عليه يمكن التوصية بأن التقليم بترك حوالى ٧٠ ورقة مع ٨- ١٠ سباطة تكون معاملة جيده حيث تؤدى إلى زيادة المحصول مع جودة الثمار لأشجار النخيل الرطب تحت ظروف مصر العليا .