

PHYSIOLOGICAL STUDY ON THE SEASONAL PRODUCTION OF NEW LEAVES AND INFLORESCENCES OF SOME DATE PALM (*PHOENIX DACTYLIFERA* L.) CULTIVARS, UNDER ASSIUT CONDITIONS, UAR

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Abstract: The study was carried out for three seasons (2001 to 2003) on Zaghloul, Haiany, Sewy and Amry date palm cultivars, grown at the Experimental Orchard, Faculty of Agriculture, Assiut University, Assiut, Egypt. The main objective of this experiment is to find out additional information concerning the seasonal trend of producing new leaves and annual production of inflorescences. The results of this investigation could be summarized as follows:

- Zaghloul, Haiany, Sewy and Amry date palms produced 22.23, 22.53, 23.60 and 20.80 leaves/year, respectively. The higher number of new leaves was produced during March to August, whereas, leaves produced during September to February period recorded the least number.
- The number of annually developed bunches varied according to the cultivars and ranged from (7.40 to 8.20), (7.80 to 10.40), (10.20 to 11.40) and (7.40 to 9.80 bunch/palm/year) for Zaghloul, Haiany, Sewy and Amry cultivars, respectively.

- The maximum number of these inflorescences was bursted from axils of 10 and 12 months old leaves. The percentage of contribution of 10 months old leaves was higher than that of the 12 months old of Sewy date palm. On the contrary, 12 months old leaves of Zaghloul, Haiany and Amry had higher contribution compared to 10 months old leaves.

- Sewy and Zaghloul palms gave their annual yield in regular pattern as compared with Haiany and Amry palms, which showed irregular cropping.

From the results of the present study, it is clear that during April to July there was excessive production of new leaves which subtended by inflorescences in the following season. Subsequently, it is important to carry out the agricultural practices during this period. In addition, removing small spathes in the axils of either 8 or 14 months old leaves of the studied cultivars is recommended to overcome irregular bearing of the date palm.

Key Words: Date Palm, Physiological study, Zaghloul, Haiany, Sewy, Amry cultivars.

Introduction

In Egypt, date palm culture extends from the relatively cold and humid region of the Mediterranean (Latitude 31 North) to the extremely hot and dry region of Aswan (Lat. 22 N). The varieties that grown include, soft, semi-dry and dry dates, according to the prevalent environmental conditions. The number of fruitful female palms is almost ten millions (10735646), planted on approximately 78074 feddans (Annual Statistics of the Ministry of Agriculture, 2003).

The percentage of success of palm growth, yield and fruit quality varied according to the date cultivars, environmental conditions and agricultural practices. Date palm is an arborescent monocotyledonous plant that matures into single stem, due to the strong apical dominance, axial buds do not usually differentiate and grow as branches (Bailey, 1976).

The proximity of the leaf to the fruit stalk is important for fruit production and palm growth. The older leaves would undoubtedly be somewhat less valuable for fruit production than the younger leaves because they are more distant from the point where the fruit stalks emerge on the trunk. The green leaves are the factories in which carbohydrates and other essentials are formed. Thus, an adequate number of leaves per palm is very important for good yield and best

fruit quality (Zearban, 1993 and El-Salhy, 2001).

The number of yearly producing leaves per palm varied according to the cultivar, it is between 16 to 32 leaves (Musa, 1985; El-Khawaga, 1995 and El-Kady, 2004).

As well, the number of bunches per date palm are highly differed according to the cultivar, the nutritional conditions and the vigour of the tree. The average bunches number per palm ranged from 7.1 to 20.0 (Sourial *et al.*, 1983; Godara *et al.*, 1994; El-Khawaga, 1995; Shawky *et al.*, 1999 and El-Kady, 2004). Sewy cv. was leading in producing bunches per palm compared to some Iraqi cultivars, Barhee, Khadrawy, Zahdi, Halawy and Sayer under Egypt conditions (Salem and Hamdy, 1993). There is a positive correlation between the number of leaves either per bunch or per palm and the number of inflorescences during the subsequent season (Ismail, 1994).

The present study was initiated to measure the seasonal trend of producing new leaves and inflorescences of Zaghoul, Haiany, Sewy and Amry date palm cultivars under Assiut conditions.

Materials and Methods

The experiment was carried out at the Experimental Orchard, of the Faculty of Agriculture, Assiut University, Assiut, Egypt, during three successive growing seasons

i.e. 2001, 2002 and 2003. Zaghoul, Haiany, Amry and Sewy were represented by six palms for each cultivar. The palms of the four cultivars were in good physical conditions, free of insects, damage and/or diseases. All cultivars were grown on clay loam soil. Zaghoul and Haiany palms were 13 years old, while those of Sewy were 25 years old and those of Amry were 17 years old.

Cultivars were arranged in split-plot randomized complete block design with six replications of one palm each. Regular agricultural practices were done for the studied palm trees during

all seasons and the measurements were taken as follows:

1. **The net increment of new leaves** was counted and tagged every 2-month interval starting on Feb. 1st along the year till Dec. 1st. Thus, the final count represents total leaves counted every 2 months through the year. The purpose of such counts is to determine the rate of producing new leaves along the year.

2. **The percentage of leaves subtended** by inflorescences relative to the total number of leaves of the same age could be estimated as follows:

$$\frac{\text{No. of leaves subtended by inflorescences} \times 100}{\text{Total number of leaves of the same age}}$$

3. **The percentage of contribution of productive leaves** of different ages in the final production of

inflorescences per palm. This could be determined as follows:

$$\frac{\text{No. of inflorescences produced from leaves of a given age} \times 100}{\text{No. of total number of inflorescences per palm}}$$

4. **Biennial bearing index.**

Biennial bearing index was determined as follows:

$$\frac{\text{Differences between successive seasons of inflorescences number} \times 100}{\text{Sum of successive seasons of inflorescences number}}$$

All the obtained data were tabulated and analyzed by the proper statistical analysis according to Gomez and Gomez (1984) and Snedecor and Cochran

(1990) using L.S.D. test for distinguishing the significance differences among various treatments means.

Results and Discussion

1- Seasonal and annual net increment of new leaves:

Data present in Table (1) show that the recorded number of annual development of new leaves were 22.23, 22.53, 23.60 and 20.80 leaves/palm as the average of the three studied seasons of Zaghloul, Haiany, Sewy and Amry date palms, respectively. The maximum number of new leaves for all varieties were produced during May and June (5.11) whereas the least number of leaves occur during January and February (1.70).

Moreover, the highest number of leaves was 14.46, 15.03, 14.80 and 13.90 leaves/palm/year as the average of three studied seasons produced during six-month period, which extended from March to August of the studied cultivars, respectively. While, the remainder number of yearly leaves was 7.77, 7.50, 8.80 and 6.90 leaves, respectively, which were produced during the next 6-months period, from September to February. The corresponding percentage values were 65.05, 66.71, 62.71 and 66.83% of annual new leaves during the first period compared to 34.95, 33.29, 37.29 and 33.17% produced during the second period, as an average of the three studied seasons on Zaghloul, Haiany, Sewy and Amry date palms, respectively. Such findings might be attributed to the cold weather, during the second period, that may

lead to a decrease in the photosynthesis and uptake of elements, thereby both the rate of growth and the vegetative growth were decreasing.

Sewy date palm produced the highest number of leaves yearly, whereas, Amry date palm was the lowest ones compared to the other studied cultivars.

The obtained results coincided with those of Nixon and Carpenter (1978), El-Khawaga (1995) and El-Kady (2004).

2- Distribution of leaves and inflorescences in response to the leaf ages:

According to the data in Table (2), it is apparent that the leaf numbers at the age of ten months were higher in comparison with other ages of leaves. Such finding might be due to the improvement of the weather conditions and growth factors during late spring season that is resulted in an increase of the new leaves. On the contrary, the leaf numbers at the age of 14-months were lowest in comparison with other age of leaf. These findings might be due to the cold weather in winter season.

Concerning the cultivars, data indicate that Sewy palm produced the highest yearly leaves, whereas, Amry produced the least ones comparing with the other cultivars. In addition, data of the interaction showed that the leaf number of 10-months were higher in all the

studied cultivars comparing with other ages of leaves.

The inflorescences number and distribution in the different seasons are shown in Table (3). It is apparent that the inflorescences number was different with the difference of cultivar or leaf age. The number of inflorescences in different varieties was 7.80, 8.90, 10.10 and 8.46 inflorescences/palm (average of the three studied seasons) of Zaghloul, Haiany, Sewy and Amry date palms, respectively. The inflorescences number (as an average of the three studied seasons) were 0.76, 3.50, 3.74 and 1.06 emerged in the axils of 8, 10, 12 and 14 month-old leaves, respectively. No difference could be noticed among inflorescences number, which bursted in either 10 or 12 months old leaves or 8 and 14 months old leaves.

Data of the interaction indicated that inflorescences number which bursted in the axils of 10 and 12 months old leaves were higher in all the studied cultivars comparing with either in the axils of 8 or 14 months-old leaves. In addition, the inflorescences number which bursted in any leaf axils age are highest in Sewy date palm comparing to Zaghloul, Haiany and Amry date palm cvs.

3- Percentage of leaves subtended by female inflorescence and contribution of

different leaf ages in their final number per palm:

It is clear from Table (4) that the percentage of leaves subtended by inflorescences were influenced by leaf age. Regardless, to the type of the cultivars, the percentage of leaves subtended by female inflorescences attained to 15.28, 67.72, 79.14 and 54.61% (calculated as an average of the three studied seasons) when leaves are 8, 10, 12 and 14 months old, respectively. In addition, data of interaction between cultivars and leaf age, indicated that a high percentage of leaves subtended by inflorescences when the leaves were 12 months old in all the studied cultivars. Moreover, the percentage of Sewy leaves subtended by inflorescences at any comparative age was highest in comparison to the other studied cultivars.

The leaves of 10 and 12 months old were formed during spring seasons, which induce the accumulation of carbohydrates creating favorable conditions and better nutritional status of palm. The improvement of the nutritional status of palm could be reflected on the increasing the flower bud in the axils of these formed leaves. On the other hand, the leaves of 8 months old were formed during summer seasons, which are characterized with less accumulation of carbohydrates. Carbohydrates are utilized for the formation of new leaves, induction

Table (3): Inflorescences no. produced at different leaf ages of some date palm cultivars during 2001,2002 and 2003 seasons.

Year		2001					2002					2003							
Leaf ages	Cvs	Zagh.	Haia.	Sewy	Amry	M	Zagh.	Haia.	Sewy	Amry	M	Zagh.	Haia.	Sewy	Amry	M			
8 months		0.80	0.80	1.30	0.50	0.85	0.40	0.90	1.20	1.00	0.88	0.50	0.40	0.80	0.50	0.55			
10 months		3.20	3.40	4.10	3.40	3.53	2.80	4.00	4.80	3.60	3.80	3.00	2.60	3.80	3.30	3.18			
12 months		3.40	3.80	4.00	3.60	3.70	3.20	4.40	4.40	4.20	4.05	3.10	3.40	4.20	3.20	3.48			
14 months		0.80	0.80	1.10	0.70	1.05	1.00	1.10	1.00	1.00	1.03	1.20	1.20	1.40	0.60	1.10			
Mean		2.05	2.20	2.63	2.05	--	1.85	2.60	2.85	2.45	---	1.95	1.90	2.55	1.85	--			
L.S.D. 0.05		A:0.30		B:0.39		AB:0.66		A:0.35		B:0.38		AB:0.64		A:0.28		B:0.43		AB:0.74	

A: cvs
B: leaf ages
AB:(cvs x leaf ages)

Table (4): The percentage of leaves subtended by inflorescences in response to leaf ages of some date palm cultivars during 2001,2002 and 2003 seasons.

Year		2001					2002					2003							
Leaf ages	Cvs	Zagh.	Haia.	Sewy	Amry	M	Zagh.	Haia.	Sewy	Amry	M	Zagh.	Haia.	Sewy	Amry	M			
8 months		15.09	17.02	24.53	11.62	17.07	8.69	18.00	23.53	22.22	18.33	8.93	7.84	13.79	11.11	10.42			
10 months		62.75	69.38	80.39	69.38	70.47	56.00	72.73	87.27	75.00	73.79	59.60	49.06	63.33	66.00	58.89			
12 months		70.83	76.00	83.33	78.26	77.11	76.19	100.0	95.65	91.30	91.01	62.00	65.38	79.24	69.57	69.18			
14 months		40.00	50.00	61.11	43.75	48.72	55.56	64.71	55.56	62.50	59.54	60.00	63.16	63.64	33.33	55.56			
Mean		47.17	53.10	62.34	50.75	--	47.44	63.41	67.06	63.14	--	43.50	43.38	53.13	46.48	--			
L.S.D. 0.05		A:4.08		B:5.52		AB:8.62		A:4.28		B:4.95		AB:8.22		A:3.96		B:5.49		AB:9.10	

A: cvs
B: leaf ages
AB:(cvs. x leaf ages)

and differentiation of flower buds as well as growth and development of fruits.

These findings emphasized that the important agricultural practices must be done throughout April to June, to improve the production of new leaves, which are subtended by inflorescences in the following season.

Also, the data in Table (5) showed that the percentage of contribution of 10 months old leaves was higher than 12-months old of Sewy date palm. On the contrary, 12 months-old leaves of Zaghoul, Haiany and Amry had higher contribution compared with 10 months-old. In addition, 8-months old leaves had lower contribution comparing with 14 months old leaves of all the studied cultivars. These percentages of contribution were 7.20, 7.72, 10.24 and 7.69% (calculated as an average of the three studied seasons) in Zaghoul, Haiany, Sewy and Amry date palms, respectively, in contrast to 12.88, 11.82, 10.98 and 8.95% when leaves age was 14 months, respectively.

These results are in agreement with those reported by Hilgeman (1951) and Chandler (1958). They found that the number of differentiated buds seem to be influenced by the accumulation of carbohydrates in the palm between June to October. If the crop is heavy in proportion to photosynthetic capacity, a smaller

percentages of buds will produce inflorescences and vice versa.

In addition, El-Khawaga (1995) and El-Kady (2004) stated that the percentage of contribution of 10 and 12 months old leaves of Zaghoul, Haiany and Halawy date palms were higher than that of other leaf age.

4 – Biennial bearing index:

Data in Table (6) showed that the biennial bearing index was statistically influenced by both the cultivar and leaf ages. Sewy and Zaghoul palms gave their annual yield in regular pattern as compared with Haiany and Amry palms which showed alternation of cropping. The biennial bearing index could be arranged in ascending order as follows: the first season was 6.02, 13.35, 15.38 and 16.13 in Sewy, Zaghoul, Amry and Haiany date palms, respectively. Whereas, such index in the second season was 6.31, 12.65, 19.33 and 19.88 in Zaghoul, Sewy, Haiany and Amry date palms, respectively. The least value of such index was observed when the bunches were found in axils of 12 months old leaves of Zaghoul, Haiany and Sewy date palms and of 10 months old leaves of Amry date palm.

These findings emphasized that the important agricultural practices must be done during April to June to improve the production of new leaves which subtended by inflorescences in the following

Table (5): The percentage of inflorescences per palm in response to different leaf ages of some date palm cultivars during 2001, 2002 and 2003 seasons

Year	2001					2002					2003							
	Leaf Cvs ages	Zagh.	Haia.	Sewy	Amry	M	Zagh.	Haia.	Sewy	Amry	M	Zagh.	Haia.	Sewy	Amry	M		
8 months	9.76	9.09	12.36	6.10	9.33	5.41	8.85	10.53	10.20	8.75	6.42	5.21	7.84	6.76	6.56			
10 months	39.02	38.64	38.97	41.46	39.52	37.84	38.46	42.11	36.73	38.79	38.46	34.22	40.25	41.89	38.71			
12 months	41.46	43.18	38.02	43.90	41.64	43.24	42.31	38.60	42.86	41.75	39.74	44.75	38.18	43.24	41.48			
14 months	9.76	9.09	10.46	8.54	9.46	13.51	10.58	8.77	10.20	10.77	15.38	15.80	13.73	8.11	13.25			
Mean	25.00	25.00	25.00	25.00	--	25.00	25.00	25.00	25.00	--	25.00	25.00	25.00	25.00	--			
L.S.D. 0.05	A:N.S		B: 4.83		AB:8.03		A:N.S		B:5.12		AB:8.39		A:N.S		B:6.71		AB:11.16	

A: cvs

B: leaf ages

AB: (cvs. x leaf ages)

Table (6): Biennial bearing index in response to the date palm cultivar and leaf age during 2002 and 2003 seasons.

Year	Leaf Cvs ages	2002					2003						
		Zagh	Haia.	Sewy	Amry	M	Zagh	Haia.	Sewy	Amry	M		
8 months		33.33	33.33	6.67	33.33	26.67	11.11	38.46	20.00	33.33	25.85		
10 months		6.66	8.11	7.87	2.86	6.38	3.45	21.21	11.63	7.69	10.99		
12 months		3.03	7.30	4.76	7.69	5.69	1.59	12.82	2.33	13.5	7.56		
14 months		11.11	15.79	4.76	17.65	12.33	9.09	4.35	16.67	25.00	13.78		
Mean		13.53	16.13	6.02	15.38	--	6.31	19.33	12.65	19.88	--		
L.S.D. 0.05		A: 5.38		B: 7.15		AB: 11.88		A: 6.83		B: 8.35		AB: 13.78	

A: cvs

B: leaf ages

AB: (cvs. x leaf ages)

seasons. Also, the small spathes in the axils of 8 or 14 months old leaves of studied cultivars must be removed to overcome the alternate bearing and improve the fruit quality.

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دراسة فسيولوجية على الإنتاج السنوي من الأوراق والأغاريض لبعض أصناف نخيل البلح تحت ظروف أسيوط - جمهورية مصر العربية

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أجريت هذه الدراسة على نخيل البلح الأصناف الزغلول والحياى والسيوى والعمرى المنزرعة بمزرعة كلية الزراعة جامعة أسيوط خلال مواسم 2001 ، 2002 ، 2003 . وبهدف دراسة إنتاج النخلة من الأوراق والأغاريض السنوية ومدى تأثير عمر الأوراق على إنتاج النورات السنوية وانتظام الحمل . وتوضح نتائج هذه الدراسة فيما يلى :

تنتج نخلة البلح الزغلول والحياى والسيوى والعمرى فى المتوسط (22.53 ، 22.23 ، 23.60 ، 20.80 ورقة / سنة) على التوالي . وقد أعطت الفترة من مارس حتى أغسطس أعلى معدل للأوراق بينما أعطت الفترة من سبتمبر حتى فبراير نسبة أقل .

متوسط عدد الأغاريض السنوية لأشجار نخيل البلح الزغلول ، الحياى والسيوى والعمرى تحت ظروف أسيوط هى (7.4-8.20) ، (7.8-10.40) ، (10.20-11.40) و (7.40-9.80) سباطة / نخلة / سنة على التوالي .

تعتبر أوراق نخيل البلح السيوى عمر 10 شهور الأكثر كفاءة فى حمل الأغاريض الزهرية بينما كانت فى نخيل البلح الزغلول والحياى والعمرى عمر 12 شهرا .

تعطى شجرة نخيل الزغلول والسيوى عدد منتظم من الأغاريض السنوية مقارنة بأشجار نخيل الحياى والعمرى التى تميل للمعاومة .

من هذه الدراسة يتضح أن فترة النمو من أبريل حتى يوليو هى فترة إنتاج الأوراق التى تحمل فى أباطها النورات الزهرية للموسم التالى ولذا ينصح بالاهتمام بالعمليات الزراعية خلال تلك الفترة مع إزالة النورات الزهرية التى تحمل فى أباط الأوراق عمر 8 ، 14 شهرا وذلك للتغلب على مشكلة تبادل الحمل .