

**PHYSICO-CHEMICAL CHARACTERISTICS OF FRUITS AND  
PITS OF SOME DATE PALM CULTIVARS  
AS AFFECTED BY CULTIVARS AND SEASONS**

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**ABSTRACT**

This work was carried out on four Egyptian date palm cultivars in order to study the changes in the physical and chemical characteristics of the fruit during the growing season. The results of the present study showed that Samany cultivar has the highest fruit yield. It was noticed that fruit fresh weight increased rapidly throughout the growing season. The average fruit dry weight, length and diameter varied from one cultivar to another. Also, sugars, tannins and mineral contents of the fruit varied from one cultivar to another and throughout the season. Almost the same trends were noticed with the studied traits of pits.

**INTRODUCTION**

Date palm (*Phoenix dactylifera* L.) is one of the most important fruit crops. It is especially so in Arab region and the area bordering the Mediterranean Coast. Date palm has been cultivated since the prehistoric time in Egypt. Due to the nutritional value of the fruits, Egypt as well as many other countries exited great offers for increasing the date plantations. According to the statistical records of 1998, the total number of fruiting female trees reached about 7.951 millions which produce 741,000 tons of fruits in 1997. There is a distinct lack of information on the physical and chemical changes that occur during development and ripening of fruits of the four cultivars. Therefore, the present study was undertaken to provide more knowledge of physical and chemical characteristics of fruits and pits of some important Egyptian date palm cultivars (Zaghloul, Samany Bent Aisha and Halawy).

## MATERIALS AND METHODS

The work reported in this paper was conducted during two successive seasons of 1997 and 1998 in El-Bosiley Horticultural Experimental Station, Behera Governorate, Egypt. Four Egyptian date palm cultivars namely; Zaghoul, Samany (fruits consumed at Khalal stage), Bent Aisha and Halawy (fruits consumed at Rutab stage). The palms of the four cultivars were about 36-years-old and planted at 10 meters apart. Five palms of each cultivar, as uniform as possible, were selected for this study. All samples of fruits were picked at two-week intervals from June, 1<sup>st</sup> to October, 15<sup>th</sup>. Fruit samples were collected at three different stages of development and maturity; Hababouk, Kimri and Khalal. The number of fruits per sample for each replicate varied according to the stage of maturity ranging from about 50 fruits during the early stage development and decreased gradually to 20 for the last stage of maturity. In addition, yield (kg/palm) at the end of Khalal stage (at harvest) was determined for all replicates of the studied cultivars. Pits were separated from the fruit samples taken at the last sampling dates (on October, 15<sup>th</sup>). Samples were washed thoroughly with tap and distilled water, oven-dried at 70°C to a constant weight. Total sugars were determined according to Malik and Singh (1980), while tannins and crude fats were estimated according to A.O.A.C. (1980). Nitrogen and phosphorus were determined colorimetrically according to Evenhuis (1976) and Murphy and Rily (1962), respectively. Potassium was determined by Flame Photometer, calcium was determined by versenate method (Cheng and Bray, 1951), while iron and zinc were determined by Perkin Elmer Atomic Absorption Spectrophotometer. The experiment was randomized split plot design and the obtained data were statistically analyzed according to Snedecor and Cochran (1972).

It is worth mentioning that the data in Tables (1, 2 and 3) represent the values of three dates; June, 15<sup>th</sup> (Hababouk), July, 15<sup>th</sup> (Kimri) and October, 15<sup>th</sup> (Khalal).

## RESULTS AND DISCUSSION

### Physical characteristics:

Results presented in Table (1) show that, in all cultivars, the average fresh and dry weight, length and diameter of the fruit ranged from 0.60 to 32.86 gm, 0.12 to 6.33 gm, 1.29 to 5.92 cm and 0.98 to 3.47

cm, respectively. It was noticed that the average values of previous characters increased gradually through the maturation period. This increase from the beginning of the experiment, early during the green stage (Hababouk), until the fruit reached the fully coloured stage (Khalal). Similar findings were also reported by Attalla *et al.* (1988), Sharaan (1990) and Al-Hooti *et al.* (1997).

### **Chemical constituents:**

Data in Table (1) showed the seasonal changes in total sugars and tannins content in fruits of the tested date cultivars. The average contents of fruit sugar and tannins ranged from 8.29 to 81.87% and 0.79 to 3.91%, respectively. The obtained data indicated that the percentages of fruit sugars increased rapidly as the fruit growth advanced during Hababouk to Khalal stage (October, 15<sup>th</sup>). On the contrary, the percentages of fruit tannins decreased rapidly as the fruit growth advanced (during Hababouk to Khalal stage). The present results are in line with those reported by Sourial *et al.* (1986 b), Al-Hooti *et al.*(1997) and Attalla and Warrag (1999).

### **Fruit yield:**

Data concerning the annual yield/palm of the studied cultivars are presented in Table (1). The averages fruit yield/palm (kg) for Zaghloul, Samany, Bent Aisha and Halawy were 142.84, 308.16, 146.34 and 145.42 and 138.5, 287.4, 171.2 and 109.22 kg/palm for 1997 and 1998, respectively. In both seasons Samany had the highest value of fruit yield. The data of the present study seemed to be in line with those reported by Al-Saeid *et al.*(1986) and Abd El-Hameed (1997).

### **Fruit mineral content:**

The mineral analysis data in Table (2) indicated that levels of the various elements like nitrogen, phosphorus, potassium, calcium and zinc decreased progressively as the fruit matured progressed (from Hababouk to Khalal stage). However, no constant trends were, generally, found in the four studied cultivars regarding the contents of fruit iron. These results agreed with those reported by Al-Juburi *et al.*(1994) and Al-Hooti *et al.* (1997). According to these researchers, the mineral content of the date fruit may be influenced by the level of soil fertility as well as by the amount of fertilizers applied to the trees.

### **Physical and chemical characteristics of pits:**

Regarding the physical and chemical characters of the pits of four selected date cultivars, it is evident that the ranges were as follows: fresh weight, 1.48-2.78 gm; total sugars, 2.22-3.99%; tannins, 1.51-2.84% and crude fat, 7.9-11.31%. It is also evident that there were significant differences observed among the pits of the studied cultivars in most cases (Table 3).

The elemental composition of the pits of four selected date cultivars is presented in Table (3). It is evident that there were significant differences in nutrient elemental composition between one cultivar and another in most cases. The obtained results have also shown that the nutrient concentration ranges in the pits were as follows: N, 0.84-1.28%; P, 0.13-0.29%; K, 0.26-0.30%; Ca, 0.19-0.42%; Fe, 96-182 ppm and Zn, 4-6 ppm. The variation in the contents of nitrogen, phosphorus, potassium, calcium, iron and zinc among the studied cultivars are in agreement with those reported by Attalla and Harraz (1996) and Abdel-Nabey (1999).

It could be concluded that the physiological parameters such as fruit weight, length and diameter of the four cultivars studied were maximum in the Khalal stage. As the fruit matured from the Hababouk to Khalal stages, the sugar contents increased but tannins content decreased. Date fruits were found to be a reasonably good source of most the macro- and micro-elements. Also, the pits of the studied cultivars are rich in some minerals specially iron content, total sugars and crude fats. Therefore, they can be used for feeding livestock or mixed with other forages or fodder crops.

Table (1): Physical and chemical characteristics of the fruits and yield (kg/palm) of the studied date palm cultivars in 1997 and 1998 seasons.

Cultivar	Stage of maturity	Date of picking	Fresh weight (gm)		Dry weight (gm)		Fruit length (cm)		Fruit diameter (gm)		Sugars (%)		Tannins (%)		Yield (kg/palm)	
			97	98	97	98	97	98	97	98	97	98	97	98	97	98
Zaghloul	Hababouk	June,15	0.83	1.71	0.32	0.13	1.31	1.79	1.01	1.34	8.29	8.82	3.52	3.91	142.84	138.50
	Kimri	July,15	7.97	12.86	0.61	0.77	3.17	3.85	2.02	2.33	20.87	19.80	2.02	2.60		
	Khalal	Oct.,15	25.93	25.15	3.95	5.00	5.92	5.83	2.77	2.93	70.64	70.63	1.09	1.09		
Samany	Hababouk	June,15	0.60	0.81	0.15	0.12	1.29	1.41	0.98	1.09	13.11	15.78	3.27	3.71	308.16	287.40
	Kimri	July,15	8.09	7.48	0.99	0.91	3.27	3.19	2.33	2.22	33.17	32.10	1.93	2.77		
	Khalal	Oct.,15	32.86	30.65	5.83	6.26	5.62	5.55	3.47	3.32	79.74	81.87	0.84	0.79		
Bent Aisha	Hababouk	June,15	0.72	0.98	0.22	0.14	1.39	1.41	1.07	1.06	14.18	15.24	3.69	3.51	146.34	171.20
	Kimri	July,15	6.06	4.85	0.73	0.76	2.88	2.53	1.88	1.85	32.90	31.03	1.86	2.79		
	Khalal	Oct.,15	17.18	15.46	5.93	5.53	4.24	4.31	2.51	2.59	72.78	73.57	1.06	0.98		
Halawy	Hababouk	June,15	1.42	2.92	0.42	0.31	1.69	1.84	1.41	1.54	15.78	16.85	3.39	3.48	145.42	109.22
	Kimri	July,15	8.76	8.22	1.18	1.22	3.34	3.23	2.28	2.23	36.65	31.57	1.86	2.59		
	Khalal	Oct.,15	24.05	18.06	6.33	4.15	4.69	4.71	3.07	2.86	77.33	79.73	1.02	0.83		
L.S.D <sub>0.05</sub>			0.88	1.26	0.24	0.30	0.20	0.33	0.13	0.15	5.77	4.56	0.20	0.18	40.63	33.30

Table (2): Mineral composition (on dry weight) in the fruits of the studied date palm cultivars in 1997 and 1998 seasons.

Cultivars	Stage of maturity	Date of picking	Nitrogen		Phosphorus		Potassium		Calcium		Iron		Zinc	
			%								ppm			
			97	98	97	98	97	98	97	98	97	98	97	98
Zaghloul	Hababouk	June,15	2.16	3.10	0.23	0.28	1.6	1.5	1.08	1.08	78	78	72	66
	Kimri	July,15	2.53	2.98	0.19	0.29	1.4	1.3	0.89	1.03	88	77	57	61
	Khalal	Oct.,15	1.79	1.57	0.12	0.17	1.3	0.8	0.76	0.81	55	60	23	27
Samany	Hababouk	June,15	2.16	2.53	0.22	0.26	1.5	1.5	0.97	0.98	96	89	71	76
	Kimri	July,15	2.47	2.05	0.20	0.24	1.0	1.3	0.86	0.96	87	86	39	47
	Khalal	Oct.,15	1.56	1.56	0.16	0.17	0.9	0.9	0.71	0.81	77	75	27	23
Bent Aisha	Hababouk	June,15	2.54	2.31	0.19	0.25	1.3	1.4	1.08	0.98	98	94	74	75
	Kimri	July,15	2.16	1.86	0.16	0.21	1.0	1.1	1.00	0.94	45	46	43	39
	Khalal	Oct.,15	1.34	0.74	0.10	0.13	0.8	0.6	0.80	0.81	66	66	30	27
Halawy	Hababouk	June,15	2.47	2.91	0.21	0.28	1.1	1.1	0.99	0.99	97	96	56	59
	Kimri	July,15	2.02	2.01	0.19	0.24	1.2	1.3	1.01	1.00	52	56	44	36
	Khalal	Oct.,15	1.12	1.04	0.12	0.19	0.8	0.6	1.00	0.81	73	74	33	43
L.S.D <sub>0.05</sub>			N.S	0.56	0.03	0.03	N.S	N.S	0.09	N.S	7.0	4.0	10	6

Table (3): Physical and chemical characteristics of the pits (at harvest) of the studied date palm cultivars during 1997 and 1998 seasons.

Characters		Zaghloul		Samany		Bent Aisha		Halawy		L.S.D <sub>0.05</sub>	
		1997	1998	1997	1998	1997	1998	1997	1998	1997	1998
Pit weight	gm	2.19	2.09	2.78	2.56	2.20	2.06	1.57	1.48	0.38	0.31
Total sugars	%	3.99	3.85	3.02	2.94	3.45	3.67	2.22	2.62	0.21	0.31
Tannins	%	2.37	2.27	1.66	1.51	2.40	2.84	1.78	2.00	0.17	0.17
Crude fat	%	8.62	7.90	8.39	8.62	11.17	10.97	11.25	11.31	1.26	1.57
Nitrogen	%	1.28	0.84	1.04	0.93	0.96	1.07	1.07	1.26	N.S	0.13
Phosphorus	%	0.19	0.22	0.29	0.28	0.24	0.23	0.13	0.16	0.03	0.02
Potassium	%	0.26	0.29	0.30	0.29	0.27	0.30	0.28	0.26	0.02	N.S
Calcium	%	0.28	0.27	0.40	0.42	0.20	0.19	0.27	0.25	N.S	0.05
Iron	ppm	122	162	125	182	106	153	96	137	4	3
Zinc	ppm	5.0	4.0	6.0	5.0	5.0	5.0	6.0	5.0	0.3	0.5

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