

Economic and Numerical Evaluation of Some Date Palm Cultivars Grown in El-Wadi El-Jadid Governorate

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Abstract: Six date palm cultivars i.e Madjool, Segae Khadari, Anbara, Ajwa Al Madina and, Khalas in comparison with the commercial cultivar Sewy grown in El-Wadi El- Jadid Governorate through 2017 and 2018 seasons. Date of flowering, fruit color of khalal stage, initial fruit set % and fruit retention %, yield per palm as well as physical and chemical properties of fruit and economic and numerical were recorded calculated for some tested date palm cultivars. Data of fruit set percentage and fruit retention %, showed differences of some tested cultivars. Palm of Anbara CV, produced the highest yield palm (80& 80.68kg) while the lowest yield (65 & 60 kg) was recorded of, Ajwa Al Madina in both tested seasons. Among the physical fruit characteristics are, fruit weight (28.0 & 24.38 gm) pulp % (95.85 & 93.19) were the highest in the Madjool, Anbra and Segae cvs. gave the ideal valued of chemicals fruit properties gave the highest values of T.S.S and total sugar % and the lowest values of acidity and total soluble tannins. The economic and numerical evaluation of some tested date palm cvs. Showed that they were ranked as follows Anbara, Madjool , Khadari, Segae, Khalas, Ajwa Al Madina and Sewy cultivars. Generally, the obtained herein results proved that Anbara, Madjool Khadari and Segae performed better and it be grown in the El-Wadi El- Jadid Governorate for its high in yield and fruit quality comparing to the other tested date palm cultivars.

Key words: Date palm • Economic evaluation • Numerical evaluation • Cultivars • El-Wadi El-Jadid

INTRODUCTION

Phoenix dactylifera L. commonly known as date or date palm, is a flowering plant species in the palm family, Arecaceae, cultivated for its edible sweet fruit [1]. The total annual world production of dates amounts to 8.5 million metric tons, countries of the Middle East and North Africa being the largest producers. Egypt is the first top ten date producers [2]. Many varieties of dates are available and being marketed at various price ranges [3]. Dates considered one of the important fruits for domestic consumption as well as for export. The decrement of superior cultivars number, especially those of semi-dry group considered one of the most important factors leads to improve dates exportation [4]. In Egypt there are about 13, 618, 173 female palm trees produced about 1, 549, 260 ton [5]. It can grow well under drastic environmental

conditions that may be not suitable for other fruit species [6]. Date palm is the most common fruit tree grown in semiarid and arid- regions it plays an important role in the protection of interplant cropping systems and the stabilization of the ecological system [7]. Date palm is major and most important fruit crop grown in Toshki region, where high temperature and poor soil quality profound [8]. For this reason date palm is considered one of the suitable trees which could be cultivated in the new reclaimed desert regions. Date palm fruits are one of the most important export fruit crops in Egypt, where they are harvested and marketed at three stages of their development. The three stages are khalal (biser), rutab and tamar [9].

There is a high potential for increasing the production area of date palm to fulfill local consumption in the whole country and to produce date fruits for export purposes.

Presently, the Egyptian Government and private sector are convinced of the potential of date production and are striving to establish commercial date plantations and promote viable date production [10]. date palm cultivars grows successfully all over Egypt [11-16].

Currently, there is no established scientific method available for pricing and grading DPF except an examination of the external physical characteristics. Moreover, there has been a lack of scientific data regarding the physiochemical, nutritional quality and phytochemical composition of DPF and the association of these characteristics with the marketed price.

Therefore, this study was carried out by focusing on Date Palm Fruits (DPF) for six selected date palm cultivars and local semi-dry cultivar grown in El Wady El- Jadid Governorate, Madjool, Segae, Khadari, Anbara, Ajwa Al Madina, Khalas and Sewy (local cultivar), for listed these cultivars based on their marketed prices; from the least to most expensive. The details on the prices are available in Table 8 in the Paper.

MATERIALS AND METHODS

This investigation was carried out in El-Dakhala Oasis, El-Wadi El- Jadid Governorate, Egypt (latitude 25° and longitude 29°) field work of this study was conducted during 2017 and 2018 on six date palm cultivars which chosen for their best fruits qualities in addition to the commercial cultivar “Sewy” as standard. All tested palms including “Sewy” cv. belong to semi- dry date’s group and were in production stage and planted in sandy soil and received the same horticultural practices and pollinated by using pollen grains from the same parent in both seasons. Average maximum temperatures as well as relative humidity percentage for El-Wadi El- Jadid Governorate during 2017 & 2018 years are shown in Table (1) and soil characteristics are shown in Table (2).

The following topics were studied and recorded: Date of flowering, fruit color of khalal stage, initial fruit set (%) and fruit retention (%) Fruit set %: Number of set fruits per stalks was recorded 30 days after pollination; 50 attached stalks on 5 bunches per palm were used for purpose. The percentage of fruit set was calculated using the following equation.

Yield and Bunch Characteristics: The harvest took place when the fruits reached the tamar stage, the following data were recorded: Number of bunches/ palm, bunch weight (kg) and yield (kg).

Physical and Chemical Properties of Fruit: Representative fruit sample 30 fruits collected at ripening stage, tamar stage from each palm and divided into three replicates each of ten fruits. Fruit evaluation included fruit weight (gm), fruit pulp weight (gm), seed weight. (gm), pulp percentage (%), fruit length (cm²) and fruit diameter (cm²).

Moisture and total soluble solids (T.S.S) contents were determined according to the method described in the A.O.A.C. [17], reducing, non-reducing and total sugars content were determined according to the method of Lane and Eynon as described in the A.O.A.C. [17]. Also; total soluble tannins content was determined by using standard curve of tannic acid and expressed as mg tannins/g. f. wt. as described by Resenabatt and Pelluso [18].

General Evaluation of the Tested Trees of Palms: The final evaluation of any tested trees of palms was calculated on the basis of 100 units which were shared between palm yield (30 units) and fruit quality (70 units) according to Mousa [19] and Hamed [20] the latter units were divided on the basis of 10 units for the percent of each tendency to produce stable yield, total sugars, T.S.S.

Table 1: Average temperature relative humidity and possible sunshine duration for El-Wadi El- Jadid Governorate during two experimental seasons. According to Meteorological Authority in agriculture

Months	First season 2017				Second season 2018			
	Mean Temp.(°C)	Max. Temp.(°C)	Mini Temp.(°C)	Mean humidity%	Mean Temp.(°C)	Max. Temp.(°C)	Mini Temp.(°C)	Mean humidity %
May	29.7	38.6	20.1	28.0	29.5	38.5	19.5	29.0
June	33.3	42.9	24.0	26.8	31.5	40.1	22.1	29.5
July	32.4	40.7	23.6	31.4	32.8	41.3	23.7	29.9
Aug.	32.0	40.0	23.6	33.4	32.3	40.2	24.1	32.4
Sep.	29.1	36.8	21.5	37.2	29.7	38.1	21.2	35.5
Oct.	26.4	33.4	19.4	42.3	24.3	32.7	16.1	43.4

Table 2: Soil characteristics of date palm farm at the beginning of the experiment

Properties	Depth (cm)		
	0 – 40 cm	40 – 80 cm	80 – 120 cm
Clay %	19.00	21.00	23.40
Silt%	53.00	46.40	40.00
Send %	28.00	32.60	36.6
Texture	Clay Loam	Clay Loam	Clay Loam
PH	7.97	8.00	7.91
EC	0.77	0.84	0.89
CaCO ₃ %	1.10	1.30	1.30
Na mg/L	3.11	2.84	2.24
K mg/L	0.04	0.04	0.04
Ca mg/L	1.92	1.94	1.99
Cl mg/L	1.14	1.00	1.21
So ₄ mg / L	0.97	0.95	0.94

and tannins content, beside the fruit weight and flesh weight % and 5 units for each of fruit length and fruit diameter. Each palm that gave the best results in any property took the full mark specified for this property, while each of the other tested palms took lower units equal to their quality.

Economic evaluation of some date palm cultivars as average during two experimental seasons.

Statistical Analysis: The obtained data were subject to analysis of variance in randomized complete block design according to Snedecor and Cochran [21]. The averages were compared by using the method of new least significant differences (New L. S. D.) described by Waller and Duncan [22].

RESULTS AND DISCUSSION

The current study aimed to assess the variations in the quality of some Arabian and local semi-dry date palm cultivars grown in El-Wadi El- Jadid Governorate through 2017 and 2018 seasons based on flowering, physical, Chemicals fruit properties and general score evaluation of these cultivars. Which ultimately is reflected in determining the economic return for each cultivar.

Date of flowering, fruit color of khalal stage, initial fruit set (%) and fruit retention (%) were assessed. These data were tabulated in Table 1. It is clear that under condition of El-Wadi El- Jadid Governorate date of flowering of all cultivars under evaluation start of flowering in duration of 10th Feb. to 20th Feb. and ended in duration of 5th Mar. to 6th Apr. through the two seasons under investigation.

In respect of fruit color during khalal stage evaluation observed that Segae, Khalas and Sewy had the same fruit yellow color. Khadari, Anbara and Ajwa Al Madina had the same fruit red color while Madjool had fruit ranged from Orange-yellow color. According to Biglari *et al.* [23], the difference in colors of the dates is mainly due to genetic variations.

The value of average fruit set % was varied among these cultivars of dates. As Madjool cultivar showed the highest value of fruit set (94-90 %) in tested two seasons. The lowest value was observed for Ajwa Al Madina cultivar (60-65 %, respectively). The remainder date palm cvs. had an intermediate value of fruit set percentage. Similar results were obtained by Abou Rekab [24] and Hamed [20].

The fruit retention (%) value was observed a slight variation among these cultivars of dates. As Khadari , Sewy and Madjool cultivars showed the highest values while, Ajwa Al Madina showed the lowest value through the two seasons.

Data presented in Table 4 show the average bunches number, average bunch weight (kg) and fruit yield weight (kg) of cultivars under evaluation. Year variability pronounced in the number of bunches/palm. In general the number of yearly developed bunches / palm ranged between 9.5 & 10.33 bunches /palm produced by Madjool and Khadari cultivars through the first season. 9.7&10.2 bunches /palm produced by Ajwa Al Madina and Khadari cultivars through the second season. In respect of bunch weight (kg) Anbara produced the highest bunch weight 8.0 & 8.95 (kg)/palm in the two seasons. While, Ajwa Al Madina cultivar produced the lowest values (5.5 & 6.18 kg) in the two tested seasons. The highest fruit yield weight (kg) was produced from the local semi-dry cultivar Anbara through the two seasons. Ajwa Al Madina cultivar gave the lowest bunch weight and total yield through the two seasons under investigation. These results are in agreement with those reported by Khan *et al.* [14]; Iqbal *et al.* [15] and Hamed [20] whose stated that there was a wide and great variations on fruiting behavior of most date palm.

The physical characteristics of the date palm fruits were assessed in the current study (Table 5). In the first season Madjool cultivar had the biggest dates (28.1& 24.38 gm) with highest pulp weight (27.1 & 23.13 gm) in the two seasons. Sewy cultivar date had the biggest seed weight (2.0 & 1.84 gm) with lowest pulp % . The diameter and length of these cultivars were cleared that date of Anbara cultivar was the tallest and nearly the biggest date size among the cultivars examined. Anbara was the superior cultivar which date had the highest physical fruit properties.

Table 3: Date of flowering, fruit color of khalal stage, initial fruit set (%) and fruit retention (%) of some date palm cultivars grown in El-Wadi El- Jadid Governorate through 2017 and 2018 seasons

Date palm cultivars	Date of flowering (start-end)	Fruit color of khalal stage	Initial fruit set (%)	Fruit retention (%)	Date of flowering (start-end)	Fruit color of khalal stage	Initial fruit set (%)	Fruit retention (%)
First season 2017				Second season 2018				
Madjool	20 th Feb. - 28 th Mar.	Orange-yellow	94.0	70.0	15 th Feb. - 22 th Mar.	Orange-yellow	90.0	75.0
Segae	1 st Mar. - 6 th Apr.	yellow	70.0	55.0	5 nd Mar. - 1 st Apr.	Yellow	65.0	50.0
Khadari	1 st Mar. - 1 st Apr.	Red	85.0	74.0	7 th Mar. - 27 th Mar.	Red	82.0	70.0
Anbara	10 th Feb. - 10 th Mar.	Red	89.0	70.0	14 th Feb. - 3 th Mar.	Red	85.0	65.0
Ajwa Al Madina	15 th Feb. - 10 th Mar.	Red	60.0	52.0	20 th Feb. - 12 th Mar.	Red	65.0	50.0
Khalas	10 th Feb. - 15 th Mar.	yellow	75.0	65.0	18 th Feb. - 17 th Mar.	Yellow	80.0	70.0
Sewy	10 th Feb. - 5 th Mar.	Yellow	82.0	72.0	15 th Feb. - 8 th Mar.	Yellow	80.0	75.0
New L.S.D at 5%	----	----	3.94	4.21	----	----	3.86	4.34

Table 4: Average bunches number, average bunch weight (kg) and fruit yield weight (kg) of some date palm cultivars grown in El-Wadi El- Jadid Governorate through 2017 and 2018 seasons

Date palm cultivars	No. of Bunch / palm	Bunch weight(kg)	Fruit yield weight (kg)	No. of Bunch / palm	Bunch weight (kg)	Fruit yield weight (kg)
First season 2017			Second season 2018			
Madjool	9.50	7.5	72.0	10.11	7.02	70.99
Segae	10.22	7.63	78.0	10.0	7.26	72.67
Khadari	10.33	6.77	70.0	10.2	6.29	72.67
Anbara	10.0	8.00	80.0	9.8	8.95	80.67
Ajwa Al Madina	10.0	6.5	65.0	9.7	6.18	60.0
Khalas	10.0	7.4	74.0	10.0	7.4	74.0
Sewy	10.3	7.28	75.0	10.0	7.8	78.0
New L.S.D at 5%	N.S	1.20	3.40	N.S	1.10	3.01

Table 5: Physical fruit properties of some date palm cultivars grown in El-Wadi El- Jadid Governorate through 2017 and 2018 seasons

Date palm cultivars	Fruit wt. (gm)	Pulp wt. (gm)	Seed wt. (gm)	Pulp percentage (%)	Fruit length (cm ²)	Fruit dimeter (cm ²)
First season 2017						
Madjool	28.1	27.1	1.0	95.85	4.7	2.80
Segae	24.6	23.4	1.2	94.17	4.4	2.90
Khadari	17.1	16.6	0.5	96.18	4.3	2.60
Anbara	25.4	24.4	1.0	95.32	6.7	2.80
Ajwa Al Madina	14.1	13.3	0.7	92.07	3.4	2.41
Khalas	14.0	13.2	0.8	92.00	4.0	2.21
Sewy	15.2	13.2	2.0	82.14	3.4	2.34
New L.S.D at 5%	0.461	0.234	0.172	2.34	0.291	0.193
Second season 2018						
Madjool	24.38	23.13	1.25	93.19	5.0	2.43
Segae	24.40	23.34	1.06	94.23	4.6	2.53
Khadari	20.52	19.35	1.17	91.94	4.5	2.40
Anbara	25.46	24.04	1.42	92.70	6.33	2.60
Ajwa Al Madina	15.37	14.04	1.33	85.80	3.28	2.32
Khalas	16.30	15.53	0.77	92.52	3.0	2.05
Sewy	16.24	14.4	1.84	82.03	3.4	2.28
New L.S.D at 5%	0.825	0.343	0.15	2.51	0.262	0.174

Significant differences were observed in chemical fruits quality (Table 6) that produced from different cultivars grown in El-Wady El-Jadid Governorate through 2017 and 2018 seasons. It is evident from the foregoing

results that the Madjool, Anbara, Segae cultivars gave the ideal values of chemical fruit properties gave the highest values of T.S.S and total sugars % and the lowest values of acidity and total soluble tannins.

Table 6: Chemicals fruit properties of some date palm cultivars grown in El-Wadi El- Jadid Governorate through 2017 and 2018 seasons

Date palm cultivars	Moisture %	TSS %	Acidity %	Reducing Sugar %	Non Reducing Sugar %	Total Sugars %	Total Soluble Tannins
First season 2017							
Madjool	24.0	71.0	0.19	45.0	23.0	68.0	0.17
Segae	20.0	65.0	0.25	42.0	27.0	69.0	0.21
Khadari	19.0	69.0	0.23	43.0	23.0	66.0	0.17
Anbara	19.0	69.0	0.21	47.0	21.0	68.0	0.19
Ajwa Al Madina	18.0	70.0	0.21	50.0	18.0	68.0	0.15
Khalas	21.0	67.0	0.22	48.0	20.0	68.0	0.19
Sewy	18.0	60.0	0.29	42.0	17.0	59.0	0.21
New L.S.D at 5%	2.431	1.10	0.013	1.67	0.54	1.01	0.013
Second season 2018							
Madjool	23.0	68.0	0.14	44.0	20.0	64.0	0.15
Segae	18.0	60.0	0.16	40.0	26.0	66.0	0.20
Khadari	17.0	65.0	0.18	42.0	23.0	65.0	0.17
Anbara	19.0	66.0	0.13	44.0	21.0	65.0	0.15
Ajwa Al Madina	16.0	67.0	0.16	49.0	17.0	66.0	0.16
Khalas	20.0	61.0	0.15	45.0	20.0	65.0	0.18
Sewy	19.0	65.0	0.20	39.0	14.0	53.0	0.21
New L.S.D at 5%	2.369	1.21	0.016	1.42	0.46	1.06	0.011

Table 7: General score evaluation of some date palm cultivars grown in El-Wadi El- Jadid Governorate through 2017 and 2018 seasons

Index	Units specified	Madjool	Segae	Khadari	Anbara	Ajwa Al Madina	Khalas	Sewy
Frist season (2017)								
Yield Kg	30	27.00	29.25	26.25	30.00	24.37	22.75	28.02
Fruit set %	10	10.00	7.44	9.04	9.46	6.38	7.97	8.72
Fruit weight gm	10	10.00	8.75	6.08	8.87	5.01	4.98	5.40
Pulp %	10	9.96	9.79	10.00	9.03	9.57	9.56	8.54
Fruit length(cm ²)	5	3.50	3.28	3.20	5.00	2.53	2.98	2.53
Fruit dimeter(cm ²)	5	4.82	5.00	4.64	4.82	4.15	3.81	4.03
Seed weight gm	5	2.50	2.08	5.00	2.50	3.57	3.12	1.25
Total sugars%	10	9.79	10.00	9.38	9.79	9.79	9.79	7.34
TSS %	5	5.00	4.40	4.80	4.80	4.90	4.60	3.92
Acidity %	5	5.0	3.80	4.20	4.61	4.60	4.40	2.60
Tannins %	5	5.0	3.80	5.00	4.40	4.70	4.40	3.80
Total scour fruit quality	70	65.57	58.64	61.76	64.31	55.02	55.59	48.13
Total unit yield/palm	100	92.57	87.59	88.01	94.31	79.57	83.34	76.15
Second season (2018)								
Yield Kg	30	26.40	27.02	27.02	30.00	22.31	27.51	29.00
Fruit set %	10	10.00	7.22	9.11	9.44	7.22	8.88	8.88
Fruit weight gm	10	9.62	9.70	8.04	10.00	5.84	6.46	5.99
Pulp %	10	9.88	10.00	9.75	9.83	9.10	9.81	8.70
Fruit length(cm ²)	5	3.94	3.63	3.55	5.00	2.59	2.36	2.68
Fruit dimeter(cm ²)	5	4.67	4.86	4.61	5.00	4.46	3.94	4.38
Seed weight gm	5	1.08	3.11	2.40	0.77	1.36	5.0	1.94
Total sugars%	10	9.58	10.00	9.79	9.79	9.58	9.79	7.29
TSS %	5	5.00	4.20	4.70	4.86	4.90	4.30	3.80
Acidity %	5	4.77	4.30	3.33	5.00	4.30	4.50	2.27
Tannins %	5	5.00	3.33	3.82	5.00	4.60	4.00	3.00
Total scour fruit quality	70	63.54	60.35	59.41	66.63	57.08	55.37	49.67
Total unit yield/palm	100	89.94	87.37	86.12	96.63	79.39	82.88	78.67

Table 8: Economic evaluation of some date palm cultivars grown in El-Wadi El- Jadid Governorate as average during two experimental seasons

Date palm cultivars	Total return (E.P./ fed)		Price /kg	Total income	Operation cost of management	Net income
	Average fruit yield weight (kg/ tree)	Average fruit yield weight (Ton/fed)				
Madjool	71.49	4.57	80	366	1000	356
Segae	75.33	4.82	60	289	1000	279
Khadari	71.33	4.56	60	273	1000	263
Anbara	80.33	5.14	80	411	1000	401
Ajwa Al Madina	62.50	4.0	60	240	1000	239
Khalas	74.0	4.73	50	236	1000	226
Sewy	76.5	4.59	20	98	1000	88

Results shown in indicated that there are significant differences in moisture content between the tested cultivars. The moisture content was high in Madjool cultivar (24.0 and 23.0%, respectively), followed in a descending order by those of by Ajwa Al Madina cultivar (18.0 and 16.0 %), respectively through the two seasons under investigation.

Numerical Evaluation

Total Score for Yield and Fruit Quality (100 Unit):

Data pertaining the general evaluation of different cultivars, Table (7) reveals that Anbara cultivar seemed to be the superiors cv. in yield and fruit quality as it attained the uppermost score units (94.31 & 96.63 unit) as compared with Sewy cv. (local semi-dry date palm) (76.15 & 78.67 unit) in both tested seasons. As ranked the first position for fruit length and second position for five of concerned 7 fruit properties i.e. Fruit set percentage, fruit weight, fruit diameter, total sugars and acidity content. In other words, Anbara ranked the second in total score units for yield and the first position for total score units of fruit quality.

Madjool cv. seemed to be the second superior’s cv. in yield and fruit quality as it attained the nearly uppermost score units (92.57 & 89.94 unit, respectively) as compared with Segae and Khadari cultivars ranked the third in total score units for yield and the fruit quality in both evaluation seasons.

The tested cvs could be arranged descending based on total score (70) for fruit quality as follows: Madjool (65.57 & 63.54 unit), Anbara (64.31 & 66.63 unit), Khadari (61.76 & 59.41 unit), Segae (58.64 & 60.35 unit), Ajwa Al-Madina (55.20 & 57.08 unit), Khalas (55.59 & 55.73 unit), Sewy (48.13 & 49.67 unit) in both tested seasons. In harmony with the present results those obtained by El-Shibli [25]; Hamed [20] and Ibrahim *et al.* [26] reported that Madjool cv. is the most commercial and popular date cultivar.

Generally, the obtained herein results proved that Anbara, Madjool, Khadari and Segae performed better and could be recommended to be grown in the El-Wady El-Gaded Governorate for its high in yield and fruit quality comparing to the other tested date palm cultivars.

Economic evaluation of some date palm cultivars grown in El-Wady El-Jadid Governorate as average during two experimental seasons (Table 8) it is obvious that net income in some cultivars can be arranged discerningly as follows Anbara, Madjool, Segae, Khadari, Ajwa Al-Madina, Khalas and Sewy. The minimum value of net income in Sewy and Khalas cvs. While the maximum value in Anbara and Madjool cvs.

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