

Evaluation of Sewy Date Palm Productivity under Different Climatic Conditions

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Received on: 11/1/2018

Accepted for publication on: 16/1/2018

Abstract

This study was carried out during three successive seasons of 2015, 2016 and 2017 to evaluate yield and fruit quality of Sewy date palm cultivar grown under Aswan, El-Kharga, Assiut and Al-Dakhla climatic conditions. The data revealed that, Sewy cultivar grown in El-Kharga and Al-Dakhla which had higher temperature and lower relative humidity (R.H.) gave the higher bunch weight and total yield compared with those grown in Assiut which had lower temperature and higher R.H.

High temperature and low R.H. from March to October caused earlier fruit maturity in Aswan and El-Kharga with about three to four weeks than in Assiut, whereas the earlier harvest date under Al-Dakhla about two weeks than in Assiut.

Fruit dimensions, weight and flesh percentage recorded the greatest values in Assiut and Al-Dakhla as compared with other studied locations. At high temperature and low R.H. under Aswan and El-Kharga conditions, the pulp of Sewy dates had higher TSS and total sugar content whereas it had less moisture content than pulp of those produced in the other localities.

No significant differences were observed in chemical fruits quality that produced under El-Kharga and Al-Dakhla locations. It is evident from the foregoing results that the climatic conditions of Al-Dakhla and El-Kharga are ideal climatic conditions for the cultivation and production of Sewy date palm.

Keywords: Date palm, Evaluation, Climatic conditions, Yield, Fruit quality.

Introduction

Date palm (*Phoenix dactylifera* L.) is considered an old fruit tree in many countries all over the world. Dates are a high energy food and rich with carbohydrate (60-70% sugar, mainly glucose and fructose) serve as an important food (Wrigley, 1995). Date palm fruits had a stable food for the population of the Middle East and North Africa for thousands of years. Date palm grows successfully throughout Egypt from the relatively cool coast of the Mediterranean Sea up to the burning heat of Aswan Governorate.

Date palm fruits are one of the most important export fruit crops in Egypt, where they are harvested and marketed at three stages are Khalal (biser), Rutab and Tamar (Kassem 2012). Date palm cultivars are of three main types according to its fruit moisture content and they are classified soft, semi-dry and dry cultivars (Selim *et al.*, 1968). Sewy dates is one of the important semi dry variety that's suitable for packaging, processing and storage, it is considered to be one of the most important varieties for local market and export. It is located in New Valley, Al Bahareya

Oasis, Al Fayoum and Al Giza Governorates (Jaradat and Zaid, 2004).

The yield and dates quality are variable due to various factors such as cultivar, region, climate, fertilization and cultural practices. Climatic adaptations are of primary importance. The perspective date growers should give careful attention to the selection of cultivars likely to succeed in his locality (Rygg 1971, Nixon 1978, Abdalla *et al.*, 1991 & 1996 and Al-Rawahi *et al.*, 2005). Several investigators studied the effect of agro-climatic conditions on yield and date quality (Rygg 1971, Abdalla *et al.*, 1990, 1991, 1996, Mohamed *et al.*, 2004). Such study will help to choose regions that are characterized by climatic conditions suitable for the highest productivity.

Therefore, the main objective of this current study is to evaluate the effect of various climatic conditions on fruiting of Sewy date palm, to select the best producing area.

Materials and methods

The present study was carried out during the three successive seasons of 2015, 2016 and 2017 on Sewy date palm grown at four different regions in Upper Egypt. These regions included Aswan, El-Kharga Oasis, Assiut and Al-Dakhla Oasis.

Climatic condition, especially temperature degree and relative humidity are known in Table (1).

Each region was represented by 5 palms at the same age nearly and in full production stage. Bunches were thinned to 10 per palm by removing excess earliest, latest and smallest ones. The inflorescences of the palms under this study were manually pollinated by one source of pollen. They were pollinated during first week of March in all seasons of study at Aswan followed by El-Kharga and Al-Dakhla Oasis of the third week of March, while in Assiut pollination was carried out on first week of April.

The experiment was arranged in a complete randomized block design including four treatments (regions) with five replications, one palm each. For yield, bunch and fruit characteristics, the harvest took place at the peak of full color stage (before it's quite ripe). Fruit retention, the average bunch weight and yield per palm were recorded. The percentage of fruit retention was calculated using the following equation:

$$\text{Fruit retained\%} = \frac{\text{Total number of retained fruits/strand}}{\text{number of retained fruit/strand and number of flower scars}} \times 100$$

Table 1. Average high temperature and high relative humidity in Aswan, El-Kharga, Assiut and Al-Dakhla in 2015, 2016 and 2017.

Region		Aswan			El-Kharga			Assiut			Al-Dakhla		
Month		2015	2016	2017	2015	2016	2017	2015	2016	2017	2015	2016	2017
Mar.	Temp.	31.12	31.83	29.67	29.12	29.90	27.67	26.90	27.80	25.06	23.64	29.77	27.43
	R.H.	34.25	39.41	38.96	40.41	45.80	51.00	58.93	65.74	67.83	61.09	56.12	61.64
April	Temp.	33.23	37.80	35.80	31.53	36.63	34.40	29.30	34.73	31.06	29.26	36.20	33.46
	R.H.	28.23	26.06	28.93	32.33	28.46	33.70	42.53	60.96	58.70	49.53	42.83	49.61
May	Temp.	39.06	40.03	40.32	37.48	38.54	38.77	35.32	35.90	36.06	37.19	38.22	38.6
	R.H.	23.90	23.67	25.87	24.83	26.67	24.77	47.00	51.61	52.48	41.93	38.00	42.95
June	Temp.	40.73	44.03	42.46	38.56	42.63	40.36	36.40	40.40	37.20	39.23	42.60	40.36
	R.H.	28.26	21.93	25.10	25.16	23.06	26.23	61.70	50.63	52.93	39.86	35.63	39.67
July	Temp.	41.93	41.70	42.74	40.38	40.38	41.67	38.35	37.06	38.87	40.48	40.54	41.70
	R.H.	25.29	26.90	26.90	29.25	29.16	26.06	61.48	62.32	48.51	38.93	41.64	40.46
Aug.	Temp.	44.25	41.80	42.80	42.51	40.03	40.54	39.90	36.96	37.41	42.83	39.70	39.60
	R.H.	27.29	28.16	28.45	27.48	31.16	31.03	64.41	60.25	58.83	39.83	40.96	41.82
Sep.	Temp.	41.90	39.93	40.23	40.50	37.76	38.33	38.33	34.80	35.06	40.26	36.76	37.78
	R.H.	32.46	34.60	35.23	31.33	38.53	33.66	60.50	69.00	70.50	43.13	46.03	48.49
Oct.	Temp.	38.00	37.38	34.54	35.00	34.16	37.69	32.67	32.51	29.96	34.77	32.67	33.45
	R.H.	46.35	39.96	41.25	38.80	46.48	34.59	75.87	81.51	69.67	49.22	50.03	51.72
Mean	Temp.	38.78	39.31	38.57	36.89	37.50	37.39	34.65	35.02	33.84	35.96	37.06	36.55
	R.H.	30.75	30.09	31.34	31.20	33.67	32.35	59.05	62.75	59.93	45.44	43.91	47.05

According to Meteorology Organization

Samples of 50 fruits were picked at random from each palm to determine some physical and chemical fruit properties (fruit weight, flesh percentage, fruit length and fruit diameter).

Dates moisture content was determined by drying the samples at 70°C until constant weight according to AOAC, (1985). The moisture content percentage was calculated using the following equation:-

Moisture % =

$$\frac{\text{weight before drying} - \text{weight after drying}}{\text{weight before drying}} \times 100$$

Sugar contents, were determined according to the methods of AOAC, (1985). Total soluble solids (TSS) were estimated using a hand refractometer.

Total phenols: date fruits (1/2 gram) were extracted by 30 ml etha-

nol and water (1:1 v/v). The mixture was stirred for three hrs. at room temperature and then centrifuged at 3000 rpm. The supernatant was collected and filtered. Total phenols of date fruits were determined using Folin-Ciocalteu reagent according to Velioglu *et al.*, (1998). Absorbance was measured at 725 nm using a UV-vis spectrophotometer. The blank contains ethanol and water (1:1v/v) and the reagents. The calibration curve was prepared by measuring the absorbance of known concentration of Gallic acid. Total phenolic contents were expressed as Gallic acid equivalent (mg/100g) on dry weight basis (Asami *et al.*, 2003).

The determination of total flavonoids was performed according to the colorimetric assay and the results were expressed as mg Catechin equivalents (CEQ)/100g sample according to Kim *et al.*, (2003).

General evaluation of Sewy date palm in the tested localities was calculated on the basis of 100 units which were divided among the various yield and fruit properties according to El-Salhy *et al.*, (2016) with simple modification as follows: 20 units for fruit retention, 20 units for bunch weight, 10 units for fruit weight, 10 units for flesh percentage, 10 units for total soluble solids, 10 units for moisture content, 10 units for harvesting date and finally 10 units for total phenols. Each location that gave the best results in any character was given the full mark specified for this character, while each of other tested palms took lower units equal to their quantities.

Data were subjected to statistical analysis according to the procedure reported by Gomez and Gomez, (1984) and Snedecor and Cochran, (1990). Treatments mean were compared by the least significant difference test (L.S.D.) at the 5% level of probability in the three studied seasons.

Results and Discussions

Yield parameters:

Data presented in Table (2 & 3) show fruit retention, bunch weight, yield per palm and the harvesting date of Sewy date palm grown under Aswan, El-Kharga, Assiut and Al-Dakhla climatic conditions during 2015, 2016 and 2017 seasons. It is obvious from the data that the results took similar trend during the three studied seasons.

Data declared that great variability in the fruit retention percentage, bunch weight, yield/palm and harvesting date due to different fruiting location. Results revealed that Al-

Dakhla recorded the highest fruit retention percentage, bunch weight and yield per palm (75.58%-12.34Kg-123.37Kg) while, Assiut recorded lower fruit retention, bunch weight and yield per palm compared to other studied localities. No significant differences were recorded for fruit retention between Al-Dakhla and El-Kharga. The recorded fruit retention could be arranged in descending order as follow 75.58, 72.82, 65.70 and 61.15% as an average in the three studied seasons for Al-Dakhla, El-Kharga, Aswan and Assiut area, respectively.

The obtained yield per palm was (116.63, 106.77, 123.37 and 97.83 Kg as an average in the three studied seasons) for Aswan, El-Kharga, Al-Dakhla and Assiut area, respectively. The increment percentage of yield attained (18.80, 8.94, 25.54% as an average in the three studied seasons) due to those grown in Aswan, El-Kharga and Al-Dakhla, respectively, compared to Assiut climatic conditions.

Regarding the harvesting date, the obtained data clearly show that there was a wide variation on harvest date between the tested localities. The fruits started to ripe from the end of August and continued up to the end of September. Data showed that El-Kharga and Aswan had been harvested earlier at the end of August, while at Al-Dakhla; the fruit was harvested about two weeks later than El-Kharga. On the other hand Assiut was the latest to be harvested during the three studied seasons; such findings could be attributed to the variation on climatic conditions between these localities.

Table 2. Fruit retention and harvesting date of Sewy date palm under Aswan, El-Kharga, Assiut and Al-Dakhla conditions in 2015, 2016 and 2017 seasons.

Charac Region	Fruit retained%				Harvesting date				
	2015	2016	2017	Mean	2015	2016	2017	Mean	Earliest
Aswan	67.75	63.85	65.52	65.70	3/9	28/8	1/9	1/9	23
El-Kharga	72.69	73.10	72.66	72.82	28/8	26/8	20/8	25/8	30
Assiut	60.26	61.08	62.11	61.15	21/9	25/9	26/9	24/9	00
Al-Dakhla	75.14	76.16	75.45	75.58	8/9	10/9	12/9	10/9	14
L.S.D. at 5%	3.23	3.11	2.89	—	—	—	—	—	—

Table 3. Bunch weight and Yield per palm of Sewy date palm under Aswan, El-Kharga, Assiut and Al-Dakhla conditions in 2015, 2016 and 2017 seasons.

Charac. Region	Bunch weight (kg)				Yield per palm (kg)			
	2015	2016	2017	Mean	2015	2016	2017	Mean
Aswan	11.78	11.65	11.56	11.66	117.80	116.50	115.60	116.63
El-Kharga	10.97	10.53	10.53	10.68	109.70	105.30	105.30	106.77
Assiut	9.85	9.95	9.55	9.78	98.50	99.50	95.50	97.83
Al-Dakhla	12.38	12.43	12.20	12.34	123.80	124.30	122.00	123.37
L.S.D. at 5%	0.38	0.31	0.28	—	4.63	5.11	4.82	—

Fruit characteristics:**1- Fruit physical characteristics:**

Data of various fruit physical characteristics of Sewy date palm grown under Aswan, El-Kharga, Assiut and Al-Dakhla climatic conditions during 2015, 2016 and 2017 seasons are represented in table (4 & 5). Data revealed that there were significant differences in weight and dimension of fruit and flesh percentage due to different agriculture area. Fruits under Assiut conditions had the heaviest and biggest ones, while Sewy date palm grown under El-Kharga conditions gave the lightest and smallest fruit in the three studied seasons. The other two localities (Al-

Dakhla and Aswan) were moderate in fruit weight and size.

Also data indicated that there were significant differences in flesh % and moisture content due to those grown under Aswan, El-Kharga, Assiut and Al-Dakhla climatic conditions. Since Aswan recorded the lowest flesh % and moisture content percentage, while Assiut recorded the highest of them.

On the other hand, there was no significant difference in flesh % of fruits of Sewy date grown under Assiut, El-Kharga and Al-Dakhla climatic conditions. Results indicated that flesh % exhibits a similar trend as fruit moisture content due to different agricultural area.

The fruit dimension exhibits a similar trend as fruit weight. The recorded fruit weight could be arranged in descending order as follow 14.59, 12.69, 9.64 & 8.39 g as an av. In the three studied seasons, due to grow in Assiut, Al-Dakhla, Aswan and El-Kharga area, respectively. Then the increment percentage of fruit weight attained 73.89, 51.25 and 14.89% due to grow under Assiut, Al-Dakhla and

Aswan climatic conditions, respectively, compared to El-Kharga climatic conditions.

These results are due to the different climatic conditions of the agricultural areas, where Assiut characterized by an increase in relative humidity and low heat compared to Aswan region where high temperature and low relative humidity.

Table 4. Fruit weight, length and diameter of Sewy date palm under Aswan, El-Kharga, Assiut and Al-Dakhla conditions in 2015, 2016 and 2017 seasons.

Charac Region	Fruit weight (g)				Fruit length (cm)				Fruit diameter (cm)			
	2015	2016	2017	Mean	2015	2016	2017	Mean	2015	2016	2017	Mean
Aswan	8.90	9.59	10.44	9.64	3.23	3.28	3.30	3.27	1.90	2.06	2.04	2.00
El- Kharga	8.45	7.78	8.93	8.39	3.12	3.09	3.19	3.13	1.81	1.71	1.93	1.82
Assiut	13.47	16.62	13.68	14.59	3.59	3.63	3.67	3.63	2.13	2.29	2.23	2.22
Al- Dakhla	10.92	14.36	12.80	12.69	3.46	3.48	3.44	3.46	1.98	2.15	2.12	2.08
L.S.D. at 5%	0.28	0.29	0.39	–	0.09	0.10	0.12	–	0.05	0.06	0.06	–

Table 5. Moisture content % and flesh percentage of Sewy date palm under Aswan, El-Kharga, Assiut and Al-Dakhla conditions in 2015, 2016 and 2017 seasons.

Charac Region	Moisture content %				Flesh %			
	2015	2016	2017	Mean	2015	2016	2017	Mean
Aswan	14.62	14.75	13.64	14.34	83.23	83.75	82.55	83.18
El- Kharga	15.54	15.33	14.25	15.04	85.38	86.07	84.78	85.41
Assiut	24.83	23.67	24.11	24.20	87.68	87.27	87.31	87.42
Al- Dakhla	17.31	16.88	15.83	16.67	87.22	87.60	85.96	86.93
L.S.D. at 5%	0.67	0.54	0.48	–	2.34	2.65	2.53	–

2- Fruit chemical constituents:

Data presented in tables (6 & 7) show some chemical properties i.e. TSS, sugar contents, total phenols and total flavonoids of Sewy date palm grown under Aswan, El-Kharga, Assiut and Al-Dakhla conditions during 2015, 2016 and 2017 seasons.

It was obvious from the data that results took similar trend during the three studied seasons.

As a general view, data indicated that there are significant differences in TSS, sugar contents, total phenols and flavonoids in different agricultural areas. The highest total soluble solids and sugar contents were recorded on fruits of date palm grown under Aswan conditions. On

the other hand, the lowest values were recorded on fruits of date palm grown under Assiut climatic conditions. However, no significant differences were recorded due to grow the Sewy date palm under Aswan, El-Kharga and Al-Dakhla climatic conditions. The recorded TSS could be arranged in descending order as follow 70.84, 68.86, 67.94 and 64.49% as an average of the three studied seasons for fruits from Aswan, El-Kharga, Al-Dakhla and Assiut climatic conditions, respectively. The increment of TSS attained 9.85, 6.78 and 5.35% due to their production under Aswan, El-Kharga and Al-Dakhla climatic conditions compared to these under Assiut climatic conditions, respectively. Sugar content exhibit similar trend to the total soluble

solids, that is due to the effect of different production localities.

On the other hand, the obtained results indicated that there were significant differences in total phenols and flavonoids content among studied localities during the three studied seasons. Assiut recorded the highest total phenolic content during the three studied seasons, while El-Kharga recorded the highest flavonoids content. On the other hand, Aswan recorded the lowest value of total phenolic and flavonoid content during the three studied seasons. These results are due to the different climatic conditions of the agricultural areas, where Assiut characterized by an increase in relative humidity and low heat compared to Aswan region where high temperature and low relative humidity are present.

Table 6. Total soluble solids, total phenols and total flavonoides of Sewy date palm under Aswan, El-Kharga, Assiut and Al-Dakhla conditions in 2015, 2016 and 2017 seasons.

Charac Region	TSS %				Total phenols (mg/100g)				Total Flavonoides(mg/100g)			
	2015	2016	2017	Mean	2015	2016	2017	Mean	2015	2016	2017	Mean
Aswan	69.12	71.18	72.23	70.84	297.82	323.65	286.84	302.77	178.48	188.78	177.18	181.48
El- Kharga	67.54	68.83	70.22	68.86	332.35	346.78	321.08	333.40	185.63	198.11	180.41	188.05
Assiut	63.48	64.80	65.20	64.49	346.12	335.28	340.27	340.56	158.94	168.77	156.51	161.41
Al- Dakhla	66.42	67.90	69.51	67.94	338.56	345.72	325.28	336.52	183.63	189.14	178.35	183.71
L.S.D. at 5%	2.11	2.38	2.19	—	11.89	10.96	9.74	—	7.35	8.14	7.59	—

Table 7. Total sugars (%), reducing sugars (%) and non -reducing sugars (%) of Sewy date palm under Aswan, El-Kharga, Assiut and Al-Dakhla conditions in 2015, 2016 and 2017 seasons.

Charac Region	Total sugars %				Reducing sugars %				Non- reducing sugars %			
	2015	2016	2017	Mean	2015	2016	2017	Mean	2015	2016	2017	Mean
Aswan	62.59	63.83	64.62	63.68	51.15	52.36	53.40	52.30	11.44	11.47	11.22	11.38
El- Kharga	60.89	61.83	62.78	61.83	50.37	51.47	51.86	51.23	10.52	10.36	10.92	10.60
Assiut	52.68	54.82	54.73	54.08	43.75	45.58	45.52	44.95	8.93	9.24	9.21	9.13
Al- Dakhla	60.57	61.18	61.80	61.18	50.19	51.46	51.05	50.90	10.38	9.72	10.75	10.28
L.S.D. at 5%	1.68	1.55	1.78	—	0.96	0.89	1.15	—	0.38	0.46	0.36	—

C- General evaluation:

Data in Table (8) show the numerical evaluation of Sewy date palm

under Aswan, El-Kharga, Assiut and Al-Dakhla conditions. The evaluation showed that Al-Dakhla recorded the

highest units (91.39) of the total score, while Assiut recorded the lowest score of yield and fruit quality as follow: Al-Dakhla (91.39), El-Kharga (91.14), Aswan (88.94) and finally Assiut (77.06).

In general view data indicated that Sewy date palm that grown under

El-Kharga climatic conditions recorded the highest yield parameters unites (46.58), followed by Al-Dakhla (44.67 units), moreover, under Al-Dakhla climatic conditions recorded the highest fruit quality (46.72 units) compared to other studied localities.

Table 8. General evaluation of Sewy cultivar grown under different climatic conditions as average of the studied seasons.

Characters	Yield components				Fruit quality						G. total
	Fruit retention	Bunch weight (kg)	Harvesting date	Total	Fruit weight (g)	Flesh (%)	Moisture content (%)	TSS	Total phenols	Total	
Score units	20	20	10	50	10	10	10	10	10	50	100
Aswan	17.38	18.89	7.67	43.94	6.60	9.51	10.00	10.00	8.89	45.00	88.94
El-Kharga	19.27	17.31	10.00	46.58	5.75	9.77	9.53	9.72	9.79	44.56	91.14
Assiut	16.18	15.85	0.00	32.03	10.00	10.00	5.93	9.10	10.00	45.03	77.06
Al- Dakhla	20.00	20.00	4.67	44.67	8.70	9.94	8.60	9.59	9.89	46.72	91.39

These results might be attributed to differences in climatic conditions (temperature and relative humidity) between the tested localities. In Aswan where high temperature and low relative humidity are present, the T.S.S. and total sugars recorded the highest values (70.84, 63.68), while moisture content % recorded the lowest one (14.34). On the other hand, Assiut (lower temperature and higher R.H.) recorded the lowest values of T.S.S. (64.49), total sugars (54.08%) and the highest value of moisture content % (24.20). These results are in harmony with those obtained by El-Said Samra 1978, Nour 1986, Abdalla *et al.*, (1990, 1991 and 1996), Hussein *et al.*, 2001, Soliman 2002 and El-Salhy *et al.*, (2004).

Abdalla *et al.*, (1996) stated that climatic conditions temperature and relative humidity were the most important factors affecting fruiting of date palms.

As is evident from the foregoing results, the climatic conditions of Al-

Dakhla and El-Kharga Oasis are ideal climatic conditions for the cultivation and productions of Sewy date palm.

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تقييم انتاجية نخيل البلح السيوي تحت ظروف مناخية مختلفة

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الملخص

أجريت هذه الدراسة خلال ثلاثة مواسم متتالية (٢٠١٥-٢٠١٦-٢٠١٧) لتقييم المحصول وخصائص الثمار لنخيل البلح السيوي النامي تحت الظروف المناخية لمحافظة أسوان – الخارجة – أسيوط - الداخلة.

وقد أوضحت النتائج التالي:

- أن نخيل البلح السيوي النامي تحت ظروف كلا من الخارجة والداخلة والتي تتميز بإرتفاع درجات الحرارة وإنخفاض الرطوبة النسبية أعطت أعلى وزن للسوباطة وكذلك أعلى وزن للمحصول مقارنة بأسيوط والتي تتميز بدرجات حرارة أقل ورطوبة نسبية أعلى.
- أدى إرتفاع درجات الحرارة وإنخفاض الرطوبة النسبية من مارس حتي أكتوبر إلي تبكير نضج الثمار في أسوان والخارجة حوالي ٣-٤ اسابيع بينما كان التبكير في الداخلة حوالي أسبوعين مقارنة بأسيوط.
- سجلت أسيوط والداخلة أعلى قراءة لأبعاد الثمار ووزنها ونسبه اللحم مقارنة بالمواقع الأخرى محل الدراسة.
- سجلت ثمار البلح السيوي أعلى نسبة من المواد الصلبة الذائبة الكلية ومحتوى السكريات و أقل نسبة من الرطوبة تحت الظروف المناخية لأسوان والخارجة مقارنة بثمار المناطق الأخرى محل الدراسة.
- لم تسجل فروق معنوية في صفات الثمار الكيميائية تحت ظروف واحتي الداخلة والخارجة بل كانت ثمار الداخلة أفضل.
- ومن النتائج السابقة يوصي بالتوسع في زراعة نخيل البلح السيوي تحت الظروف المناخية لواحتي الداخلة والخارجة حيث يؤدي ذلك لإنتاج محصول عال ذو خصائص ثمريه جيده للسوق المحلي والتصدير.