

See discussions, stats, and author profiles for this publication at: <https://www.researchgate.net/publication/305328112>

Morphological Characterization of Date Fruits at Different Growth Stages Under Hot Arid Conditions

Article · November 2016

CITATIONS

0

READS

105

6 authors, including:



Muralidhara Bm

Indian Institute of Horticultural Research

10 PUBLICATIONS 1 CITATION

[SEE PROFILE](#)



R.s. Singh

24 PUBLICATIONS 15 CITATIONS

[SEE PROFILE](#)



Veena G L Gowda

Central Institute for Subtropical Horticulture

7 PUBLICATIONS 3 CITATIONS

[SEE PROFILE](#)



Mahanthi Kishore

IIHR-Central Horticultural Experiment Statio...

17 PUBLICATIONS 2 CITATIONS

[SEE PROFILE](#)

Some of the authors of this publication are also working on these related projects:



Phenological Studies in Fruit Crops for finger printing climate change impact [View project](#)



Standardization of nursery techniques in poly embryonic varieties of mango [View project](#)

All content following this page was uploaded by [Mahanthi Kishore](#) on 15 July 2016.

The user has requested enhancement of the downloaded file.

Morphological Characterization of Date Fruits at Different Growth Stages Under Hot Arid Conditions

B. M. Muralidhara, R. S. Singh, R. Bhargava,
G. L. Veena, Mahanthi Kishor Kumar

Received 15 May 2015; Accepted 27 June 2015; Published online 20 July 2015

Abstract The date palm (*Phoenix dactylifera* L.; Family- Arecaceae) is one of the most important and highly nutritive fruit crops which can be grown in hot arid regions of the India. The present investigation was undertaken with the view to assess the changes in fruit characters and TSS content during the development stages of fruits in 10 cultivars viz. Zahidi, Braim, Chip Chap, Khalas, Medjool, Shamran, Dayari, Khadrawy, Halawy and Khuneizi at different fruit development stages i.e. *Kimri or gandora, pre doka, doka or khalal* and *pind* or tamer stages. The results showed significant differences among the cultivars at different stages of fruit development. The increasing values were observed for the characters like fruit weight (2.81–11.0 g), fruit length (1.20–4.11 cm) and

fruit diameter (1.41–2.63 cm) from *kimri* stage to *doka* stage then slightly decreasing values were observed in *pind* stage. The pulp to stone ratio varies from 4.55–18.38 in different cultivars at different stages. The maximum pulp to stone ratio was observed in *pind* stage in cultivar Khunezi. The total soluble solids were increased sharply from *doka* to *pind* stage and the maximum TSS was observed in cultivar Khadrawy (68.45 °B) followed by Medjool (63.95 °B) and minimum was in cultivar Khalas (44.25 °B) at *pind* stage.

Keywords Date cultivars, Growth stages, Arid region.

Introduction

Date palm (*Phoenix dactylifera* L.) is one of the most successful and extremely important subsistence crop in most of the hot arid regions of India. Date fruit is a high-energy food of high sugar content, a good source of iron, potassium, and iodine, as well as low in fats. The date fruit is listed in folk remedies for the treatment of various infectious diseases and cancer. Under Indian conditions dates are harvested mainly at, *doka* and half *pind* stage, but more than 90% of dates are harvested at *doka* or *khalal* stage due to early rains which affects the whole productivity of the crop. Under dry hot conditions during July month, some date varieties maturities reached up to *pind* i.e. full ripe stage. The fruit morphology of dates varies from cultivar to cultivar and to some extent with environ-

B. M. Muralidhara*, G. L. Veena
Scientist, ICAR-Central Institute for Sub-tropical Horticulture, Rehmankhera, Lucknow

R. S. Singh, R. Bhargava
Principal Scientist, ICAR-Central Institute for Arid Horticulture, Bikaner 334006, India

M. K. Kumar
Scientist, ICAR-National Research Center for Banana, Tiruchirappalli, Tamil Nadu, India
e-mail: rssingh1@yahoo.com, rbciah@gmail.com

*Correspondence

Table 1. Effect of fruit growth stages on fruit weight, stone weight and pulp to stone ration indifferentdate cultivars.

Cultivars	Kimri	Fruit weight (g)				Stone weight (g)				Pulp : Stone		
		Pre doka	Doka	Pind	Chimri	Pre doka	Doka	Pind	Chimri	Pre doka	doka	Pind
Zahidi	3.04	7.01	8.25	7.29	0.67	1.35	1.16	0.68	4.55	5.21	7.40	10.72
Braim	3.32	8.52	8.82	8.43	0.70	1.31	1.02	0.87	4.58	6.49	8.65	9.66
Chip Chap	2.81	7.27	8.47	8.13	0.61	1.31	1.08	0.89	4.63	5.56	7.83	9.18
Khalas	4.15	9.76	10.26	9.49	0.47	1.03	0.92	0.84	8.91	9.51	11.18	11.34
Medjool	5.59	8.89	11.0	9.37	0.49	1.24	1.08	0.94	11.50	7.19	9.79	10.02
Shamran	3.15	6.95	8.25	7.75	0.48	1.26	0.95	0.84	6.58	5.50	8.70	9.25
Dayari	6.22	9.23	9.77	8.92	0.72	1.43	1.40	1.22	8.65	6.45	6.97	7.33
Khadrawy	4.51	7.34	9.64	8.44	0.53	1.15	1.08	0.91	8.45	6.41	8.95	9.25
Halawy	4.85	6.01	8.57	7.20	0.70	1.31	1.29	0.96	6.93	4.59	6.65	7.50
Khuneizi	3.93	7.69	10.60	10.67	0.52	0.98	0.88	0.58	7.58	7.82	12.69	18.38
CD(0.01)	0.39	0.48	0.49	0.46	0.05	0.09	0.07	0.07	0.80	0.47	0.95	0.98

mental conditions. Since date is exotic fruit species and introduced crop to India, the availability of literature on fruit morphology at different growth stages is very meager. Therefore, this study was undertaken by using ten commercially growth date cultivars to know the changes which occur from *kimri* to *pind* stage with regard to fruit morphology.

Materials and Methods

The present study was carried out during 2014 at ICAR-Central Institute for Arid Horticulture Bikaner, Rajasthan by using ten commercial date cultivars viz., Zahidi, Braim, Chip Chap, Khalas, Medjool, Shamran, Dayari, Halawy, Khadrawy and Khuneizi. The fruits were collected at different stages for morphological characterisation i.e., *Kimri* or *gandora* (green color pea size fruit), *doka* (fruits attained full color yellow or red) and *pind* stage (fully ripe stage). The growth characteristics determined were fruit weight (g), length (cm), diameter (cm), stone weight (g), pulp to stone ratio and total soluble solids ($^{\circ}$ B). The TSS was measured by using hand refractometer and pulp to stone ratio was calculated by using the formula

$$\text{Pulp : Stone} = \frac{\text{Fruit weight}}{\text{Stone weight}}$$

Statistical analysis

The experimental values were analyzed statistically by using completely randomized design (CRD) with three replication of each cultivar. Means were com-

pared using WASP (WEB Agri Stat Package ICAR Research Complex Goa) test at 1% level of significance.

Results and Discussion

The morphological fruit characteristics viz., fruit weight stone weight, fruit length, diameter, pulp to stone ratio and fruit color of different data cultivars are represented in Tables 1 and 2. The significant differences were observed among the different cultivars in all the stages of fruit development. The maximum fruit weight was observed in cultivar Medjool (11.0 g) followed by cultivar Khuncizi (10.60 g) which is at par with Khalas (10.26 g) and minimum was observed in Zahidi (8.25 g) and Shamran (8.25) at *doka* stage. In *pind* stage cultivar khuneizi had maximum fruit weight (10.66 g) followed by cultivar Khalas (9.48 g) at par with Medjool (9.37 g) and minimum was in cultivar Halawy (7.20 g) and zahidi (7.28 g). The fruit growth was increased from *chimri* stage to *doka* stage slow declining trend was observed from *doka* to *pind* stage. The rapid fruit growth from *kimri* to *dola* stage mainly due to faster cell division and elongation process. The decreasing trend was observed from *doka* to *pind* is due to the fruitseizes after attaining full *doka* stage, the results are generally in accordance with earlier reports indate fruits [1, 2].

Stone weight varied significantly in all the stage of fruit development among cultivars. At *doka* stage, less stone weight was observed in cultivar Khuneizi (0.88 g) followed by cultivar Khalas (0.92 g) which is

Table 2. Effect of fruit growth stages on fruit length, fruit diameter and total soluble solids in different datecultivars.

Cultivars	Fruit length (cm)				Fruit diameter 9cm				TSS (^o Brix)			
	<i>Kimari</i>	<i>Pre doka</i>	<i>Doka</i>	<i>Pind</i>	<i>Kimri</i>	<i>Pre doka</i>	<i>Doka</i>	<i>Pind</i>	<i>Kimri</i>	<i>Pre doka</i>	<i>Doka</i>	<i>Pind</i>
Zahidi	1.62	3.15	3.22	2.83	2.07	2.19	2.38	1.99	14.53	17.60	27.40	58.90
Braim	1.66	3.90	3.86	3.80	2.11	2.38	2.40	2.12	13.17	15.95	40.75	52.75
Chip Chap	1.64	3.47	3.45	3.97	1.93	2.08	2.13	3.80	9.77	14.20	19.95	50.70
Khalas	1.52	3.58	3.74	3.50	1.70	2.46	2.61	2.18	13.70	14.00	31.35	44.25
Medjool	1.94	3.32	3.51	3.29	2.24	2.44	2.46	2.29	10.40	14.30	22.65	63.95
Shamran	1.20	3.64	3.82	3.34	1.90	1.89	2.09	2.03	14.03	15.85	46.03	60.00
Dayari	1.82	3.91	4.11	4.03	1.41	2.12	2.30	2.00	14.23	17.75	46.60	61.40
Khadrawy	1.72	2.98	3.42	3.35	1.99	2.38	2.44	2.15	10.77	14.75	45.15	68.45
Halawy	1.79	3.36	3.62	3.05	1.86	2.17	2.63	1.90	12.31	16.20	44.50	58.85
Khuneizi	1.60	3.83	3.51	3.23	1.90	2.17	2.48	2.15	15.83	20.10	30.60	54.90
CD (0.05)	0.08	0.24	0.28	0.13	0.17	0.10	0.20	0.12	0.63	0.42	2.26	0.74

at par with Shamran (0.95 g) and maximum was in cultivar Dayari (1.40 g). The minimum stone weight was observed in cultivar Khuneizi (0.58 g) followed by Zahidi (0.68 g) and maximum was observed in cultivar Dayari (91.22 g) at *pind* stage. The stone weight was increased rapidly from *kimri* stage to *doka* stage and declining trend was observed in *doka* and *pind* stage. The stone weight was more in *gandora* stage because it has attained full size and also due to the presence of high moisture content. In apples and dates it was also reported that the seeds appear to reach their maximum weight before the other parts of the fruit [2, 3, 4].

Pulp to stone ratio was high in cultivar Khuneizi (12.69) followed by cultivar Khalas (11.17) and minimum was observed in cultivar Halawy (6.64) at *doka* stage. The significant differences were also found in *pind* stage, the cultivar Khuneizi recorded the highest pulp to stone ratio (18.38) followed by Khalas (11.34) which is at par with Zahidi (10.71) and minimum was in cultivar Halawy (7.49). The increasing trend was observed in pulp to stone ratio from *kimri* to *pind* stage it is due to the increase in fruit growth and decrease in stone weight. In cultivar Khuneizi, high pulp to stone ratio was noticed due its fruit size and less stone weight at *doka* and *pind* stage. The seed weight increases at faster rate initially compare to pulp after pollination later the opposite trend is noticed. The stone to pulp ratio gradually increases till ripening [2, 5].

The fruit length was maximum in cultivar Dayari

(4.11 cm) followed by Shamran (3.86 cm) and minimum was in cultivar Zahidi (3.22 cm) at *doka* stage. In *pind* stage the maximum fruit length was observed in cultivar Dayari (4.03 cm) which is at par with Shamran (3.82 cm) and Braim (3.80 cm) and minimum was found in Cultivar Zahidi (2.83 cm). The fruit length was observed in increasing trend up to *doka* stage and little reduction from *doka* to *pind* stage. The maximum fruit diameter was observed in cultivar Halawy (2.63 cm) which was at par with cultivar Khalas (2.61 cm) followed by Khuneizi (2.48 cm) and minimum was in cultivar Shamran (2.03 cm) at *doka* stage. It was noticed that the average values of fruit growth characters increased gradually as such the fruit matures and growth ceases after reaching fully coloured stage. Similar findings were also reported earlier [6, 7].

At *doka* stage the total soluble solids were observed maximum content in cultivar Dayari (46.6 °B) which was at par with Shamran (46.03 °B), Khadrawy (45.15 °B) followed by Halawy (44.5 °B) and minimum was in cultivar Chip Chap (19.95 °B). In *pind* stage the maximum TSS was observed in cultivar Khadrawy (68.45 °B) followed by Medjool (63.95 °B) and minimum was in cultivar Khalas (44.25 °B). The accumulation of TSS increased during development with a vast increase during ripening mainly due to gain in sugars and loss of water [2].

There is no much difference in fruit color during *Kimari* stage. The fruit color is changed during *doka* stage according to be genetics of the cultivar. The cultivars Dayari and Khuneizi are red in color and

remaining cultivars are yellow.

It could be concluded that morphological parameters such as fruit weight, length, diameter and stone weight were increased from *kimri* stage to *doka* stage then slightly decreasing trend was observed in *pind* stage. The maximum pulp to stone ratio was observed in *pind* stage meanwhile the total soluble solids were increased sharply from *doka* to *pind* stage. Thus the results show that variation in morphological characters is mainly influenced by the type of cultivars and different fruit developmental stages.

References

1. Bacha MA, Nasr TA, Shaheen MA (1987) Changes in physical and chemical characteristics of the fruits of four date palm cultivars. *Proc Saudi Biol Soc* 10: 285—295.
2. Adel D Al-Qurashi (2010) Physico-chemical changes during development and ripening of Helali date palm fruit *J Food Agric & envi* 8 : 404—408.
3. Luckwill LC (1948) The hormone content of the seed in relation to endosperm development and fruit drop in the apple *J Hort Sci* 24 : 32—44.
4. Torahi A, Arzani K (2010) Datepalm (*Phoenix dactylifera* L.) fruit growth pattern. *Acta Hort (ISHS)* 864 : 201—205.
5. Sakr MM, Abu Zaid IM, Hassan AE, Baz A-GI, Hassan WM (2010) Identification of some Date Palm (*Phoenix dactylifera* L.) Cultivars by Fruit Characters. *Ind J Sci and Tech* 3 : 338—343.
6. Mohamed A Awad, Adel D Al-qurashi, Sach A Mohamed (2011) Biochemical changes in fruit of an early and a late palm cultivar during development and ripening. *Int J Fruit Sci* 11 : 167—183.
7. Al-Hootie S, Sidhu JS, Qabazard H (1997) Physico-chemical characteristics of five date fruit cultivars grown in the United Arab Emirates. *Pl Foods for Human Nut* 50 : 101—113