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Evaluation of Performance of different Varieties of Date palm (*Phoenix dactylifera* L.) under Ambient Storage conditions

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ABSTRACT: Fruits of *Doka (Khalal)* of ten varieties of date palm were stored under ambient temperatures to evaluate shelf life, quality and pattern of post-harvest changes occurring in the fruits. Observations on various physical parameters like Physiological loss in weight, rotting, sensory attributes like visual appearance and organoleptic performance of an edible *doka* stage fruits of different varieties of date palm were recorded at every 3rd day interval up to a storage period of a month. At ambient temperature, fruits were found completely rotten on 9th day of storage, so no observations were recorded after 9th day of storage. Physiological loss in weight, Per cent rotting increased with increasing storage period whereas sensory attributes like organoleptic evaluation and visual appearance of fruits decreased with the storage period. PLW was recorded minimum in Khuneizi (13.91%) followed by Barhee (14.47%) and least decay was observed in Zahidi (17.43%) followed by Khuneizi (18.78%). Organolepticscores was recorded maximum in Khunezi (8.35) followed by Barhee (8.29) and recorded minimum in Nagal (6.21) followed by Shamran (6.53) and visual appearance was maximum in Khunezi (8.35) followed by Zahidi (8.26) and minimum in Nagal (6.17) followed by Shamran (6.38) at ambient temperature.
Keywords: *Doka*, PLW, Organoleptic Evaluation, Visual Appearance.

INTRODUCTION

Date Palm (*Phoenix dactylifera* L.) commonly known as*Khajoor* or *Kharek* belongs to family Arecaceae (Palmaceae) is one of the world's oldest cultivated fruit trees. Date palm, a monocotyledonous and dioecious species was first domesticated in Mesopotamian Region (Zohary and Hopf 2000). It was believed to be originated from Iraq and considered to be most widely cultivated fruit tree in Middle East and African countries. Major Date palm producing countries in world are Iraq, Saudi Arabia, Iran, Egypt, Pakistan, Morocco and Algeria. Besides these countries- Libya, Tunisia, Sudan, Muscat, Oman, Aden, United States of America and Bahrain also produce dates in substantial quantities.

In India, date palm was first introduced in Indus valley region around 4th century B.C. by soldiers of Alexander. A large number of seedlings date palm exists in the *Kachchh* region of Gujarat (Johnson *et al.*, 2013). In Rajasthan, date palm was first introduced by the ruler Ganga Singh ji in the erstwhile Bikaner state. In India, total area under date palm is about 25,000 ha with production of 2,00,000 tonnes (Singh, 2018). In India, date palm is grown in Kachchh region of Gujrat, western Rajasthan and certain parts of Punjab, Haryana and Tamilnadu. Out of the total area under cultivation, majority of area under date palm cultivation is occupied in state of Gujarat which is about 17658 ha with production of 165632 tonnes. Rajasthan occupies total area of about 850 ha and produces 800 tonnes of date fruits. In Rajasthan, date palm is grown in districts of Bikaner, Jaisalmer, Sriganganagar, Hanumangarh, Barmer, Jodhpur, Nagaur, Jalore, Pali, Sirohi and Jhunjhunu (Singh, 2018).

Fruits are often eaten as fresh at hard ripe stage or as dried *Chhuhara* or soft dates referred to as *Pind Khajoor*. Different processed products like sugar, starch, vinegar, juice, toffees, wine, chutney, jam, pickles etc. can be prepared from date fruits. Fruits of date palm have high calorific value (3150 calories/ kilogram of fresh fruits) and are highly nutritious, contains 60-65% sugar, fair amount of fibres (2.5%), protein (2%), less than 2 per cent fat, minerals up to 2 per cent *i.e.* iron, potassium, calcium, copper, magnesium, chloride, sulphur and phosphorus etc. (Gopalan *et al*., 1985). Fruits of date palm fruits are highly perishable in nature, especially at an edible *doka* stage and have very short shelf life, post harvest losses in date fruits are also very high. Post harvest loss in date palm at edible *doka* stage accounts about 32-40 per cent, which might go even higher. Urgent need was felt to prevent such losses and ensure proper storability of fruits and envisage such methods which prolong the shelf life of fruits. Temperature is one important factor which greatly influenced the quality and shelf life of date fruits. Temperature low but not as low enough to cause chilling injury are effective for preservation as they slow down the physiological activities resulting in prolonging the shelf life of the fruits (Ismail *et al.*, 2008). In India, limited studies have been done on storage, shelf life and quality of date fruits especially at edible *doka* stage, therefore urgent need was felt to study storage behaviour, post harvest changes in date

fruits. Therefore, research was undertaken with objective to study storage behaviour and quality of fruits of different date palm varieties under different storage temperature to evaluate performance and their suitability for storage.

MATERIAL AND METHODS

Fruits of ten varieties of date palm*viz.*, Halawy, Barhee, Khalas, Khuneizi, Khadrawy, Zahidi, Shamran, Medjool, Khasab and Nagal were harvested from Date palm research station, SKRAU, Bikaner when they turned hard, mature, fully ripe, and reach edible edible *doka* stage in months of June to August. Two replications are taken for each treatment and 500 g fruits were taken from which 100 g were kept separately and used for physiological loss in weight (PLW). The fruits were stored at room temperature in polyethylene film bags of 23×10 cm size. All the dirt, dust and other extrageneous material from the fruits were removed by washing them thoroughly under tap water.

RESULT AND DISCUSSION

Perusal of data presented in Table 1 revealed physiological loss in weight (%) of different varieties of date palm at ambient temperature. Observations were recorded from 3rd to 9th day of storage. Thereafter, no further observations were taken as fruits were found completely rotten after 9th day of storage. Physiological loss in weight increased with advancement of storage period due to loss in moisture as affected by physiological processes like respiration and transpiration. Similar findings of increase in PLW with advancement of storage period was reported in Apple (Kishor *et al.*, 2018), Ber (Tembo *et al.*, 2008), Litchi (Molla *et al.*, 2017) and Strawberry (Rahman *et al.*, 2014).

Significant variation in per cent physiological loss in weight was observed in different varieties of date palm during storage at ambient temperature. Mean physiological loss in weight (PLW) was recorded maximum in Medjool (18.12%) followed by Nagal (17.80%) and minimum in Khuneizi (13.91%) followed by Barhee (14.47%)**.** At ambient temperature, on 9th day of storage, maximum PLW was recorded in Medjool (19.87%) followed by Nagal (19.22%) and minimum PLW was recorded in Khuneizi (14.81%) followed by Barhee (15.36%). Variation in physiological loss in weight among different cultivars was attributed to genetic, textural and skin characteristics. Similar findings of variation on PLW was reported in Aonla (Singh *et al*., 2003; Singh *et al*., 2005 and Kumari *et al.*, 2017), Mango (Hooda *et al.*, 2000) and Strawberry (Rahman *et al.*, 2014).

Table 1: Physiological loss in weight (%) in *doka* (*Khalal*) stage fruits of different varieties of date palm stored at ambient temperature.

Symbols	Varieties	Storage duration (days)			Mean
		3	6	9	
V_1	Halawy	14.26	15.36	16.75	15.46
V_2	Barhee	13.41	14.64	15.36	14.47
V_3	Khalas	14.94	15.81	17.34	16.03
V_4	Khuneizi	12.94	13.97	14.81	13.91
V_5	Khadrawy	14.98	16.81	17.96	16.58
V_6	Zahidi	13.82	14.98	16.24	15.01
V_7	Medjool	16.21	18.28	19.87	18.12
V_8	Shamran	15.31	17.28	18.84	17.14
V_9	Nagal	16.08	18.11	19.22	17.80
V_{10}	Khasab	14.71	15.97	17.67	16.12
Mean		14.67	16.12	17.41	16.06
SEm±		0.15 (V)	0.08 (S)	0.26 (VxS)	
C.D. at 0.05		0.44	0.24	NS	

Observations taken on per cent rotting in fruits in different varieties of date palm during storage at ambient temperature were presented in Table 2. Data revealed that per cent rotting in fruits increased with increasing storage period in all varieties of date palm. Similar results of increase in rotting with increasing period of storage were also reported in literature in Guava (Bishnoi and Sharma 2015), Litchi (Panday and Lal 2014) and Mango (Hooda *et al.*, 2000).

Table 2 revealed per cent rotting in fruits of different date varieties at ambient temperature. Observations were recorded from 3rd to 9th day of storage. Thereafter, no further observations were taken as fruits were found completely rotten on 9th day of storage. Increase in rotting with increasing period of storage were also reported in literature in Aonla (Gangwar *et al.*, 2012), Guava (Bishnoi and Sharma 2015), Litchi (Panday and Lal 2014); Papaya (Shamim *et al.*, 2011); Peach (Gupta and Jawandha 2010); Sapota (Praveena *et al.*, 2013). Different varieties of date palm showed variation in rotting (%) during storage at ambient temperature. Variation in rotting in different varieties of date palm might be due to varietal characteristics. Similar findings were also reported by Date palm (Lal and Dhaka 2003), Mango (Hooda *et al*., 2000) and Strawberry (Rahman *et al*., 2014)

Mean rotting (%) was found maximum in Khadrawy (32.22%) followed by Nagal (29.47%) and minimum in Zahidi (17.43%) followed by Khuneizi (18.78%). On 9thday of storage, maximum rotting (%) was recorded in Khadrawy (52.00%) followed by Nagal (48.33%) and rotting% was observed minimum in Zahidi (35.38%) followed by Khuneizi (36.36%). Per cent rotting in different varieties of date palm showed significant variation with respect to storage days. Mean Rotting (%) on 3rd day was 10.53% which increased to 42.36% on 9th day of storage at ambient temperature.

Table 2: Rotting (%) of *doka* (*Khalal*) stage fruits of different varieties of date palm stored at ambient temperature.

Symbol	Varieties	Storage duration (days)			Mean
		3	6	9	
V_1	**Halawy**	8.12	14.37	38.12	20.20
V_2	**Barhee**	7.33	13.99	36.66	19.33
V_3	**Khalas**	13.33	21.66	45.83	26.94
V_4	**Khuneizi**	6.36	13.63	36.36	18.78
V_5	**Khadrawy**	16.66	28.00	52.00	32.22
V_6	**Zahidi**	3.84	13.07	35.38	17.43
V_7	**Medjool**	14.00	23.00	48.00	28.33
V_8	**Shamran**	8.46	15.38	40.76	21.53
V_9	**Nagal**	15.80	24.27	48.33	29.47
V_{10}	**Khasab**	11.42	17.14	42.13	23.56
Mean		10.53	18.45	42.36	23.78
SEm±		0.25 (V)	0.14 (S)	0.43 (VS)	
C.D. at 0.05		0.72	0.40	1.25	

Organoleptic evaluation of different varieties of date palm during storage at ambient temperature were generally based on aroma, flavour, texture and taste of the fruits and decreased with advancement of storage period. This might be due to loss of moisture and rotting resulting in shrinkage of fruits. Similar findings were also recorded in Apple (Kishor *et al.*, 2018) and Date palm (Lal and Dayal 2014; Meena *et al.*, 2017).

Table 3 revealed organoleptic scores of different varieties of date palm at ambient temperature. Organoleptic scores of different varieties of date palm were recorded from 3rd to 9th day of storage, further no observations were taken after 9th day of storage as fruits were found completely rotten at this temperature. Organoleptic scores of different varieties of date palm decreased with advancement of storage period. Mean organoleptic score was recorded maximum in Khunezi (8.35) followed by Barhee (8.29) and recorded minimum in Nagal (6.21) followed by Shamran (6.53). On 3rd day of storage at ambient temperature, organoleptic score was recorded maximum in Khuneizi (8.77) followed by Barhee (8.71) and minimum in Nagal (6.67) followed by Shamran (6.88). On 9th day of storage, similar trend was observed, organoleptic score was observed maximum in Khuneizi (7.94) followed by Barhee (7.88) and minimum in Nagal (5.55) followed by Shamran (6.16). Organoleptic scores of different varieties of date palm showed significant variation with respect to storage days. Mean organoleptic score recorded on 3rd day was 7.76 which decreased to 7.04 on 9th day of storage at ambient temperature.

Visual appearance of *doka* stage fruits of different varieties of date palm decreased with the advancement of storage period. Fruits showed good value for appearance at initial days of storage which declined with progression of storage days. With advancement of storage period, there is a loss in quality of fruits due to moisture loss, shrinkage and rotting, as a result there is decrease in visual scores with respect to storage days. Similar results were also obtained in Ber (Tembo *et al*., 2008), date palm (Meena *et al*., 2017) and Guava (Silip and Hazar 2005).

Table 4 revealed visual appearance of date palm varieties at ambient temperature. Observations were recorded from 3rd day to 9th day of storage, further no observations were taken at ambient temperature as fruits were rotten after 9th day of storage. At ambient temperature, mean scores for visual appearance was found maximum in Khunezi (8.35) followed by Zahidi (8.26) and minimum in Nagal (6.17) followed by Shamran (6.38). On 3rd day of storage, visual appearance was observed maximum in Khuneizi (8.87) followed by Barhee (8.84) and minimum in Nagal (6.66) followed by Shamran (6.84). On 9th day of storage, visual appearance was recorded maximum in Khuneizi (7.91) followed by Zahidi (7.84) and minimum in Nagal (5.57) followed by Shamran (5.94).

Table 3: Organoleptic evaluation of *doka* (*Khalal*) stage fruits of different varieties of date palm stored at ambient temperature.

Symbol	Varieties	Storage duration (days)			Mean
		3	6	9	
V_1	**Halawy**	7.77	7.42	7.17	7.45
V_2	**Barhee**	8.71	8.28	7.88	8.29
V_3	**Khalas**	7.96	7.57	7.34	7.62
V_4	**Khuneizi**	8.77	8.34	7.94	8.35
V_5	**Khadrawy**	7.17	6.94	6.54	6.88
V_6	**Zahidi**	8.66	8.21	7.84	8.24
V_7	**Medjool**	7.36	7.17	6.91	7.15
V_8	**Shamran**	6.88	6.55	6.16	6.53
V_9	**Nagal**	6.67	6.41	5.55	6.21
V_{10}	**Khasab**	7.66	7.22	7.07	7.32
Mean		7.76	7.41	7.04	7.40
SEm±		0.07 (V)	0.04 (S)	0.1258(VS)	
C.D. at 0.05		0.21	0.11	NS	

Table 4: Visual appearance of *doka* (*Khalal*) stage fruits of different varieties of date palm stored at ambient temperature.

Symbol	Varieties	Storage duration (days)			Mean
		3	6	9	
V_1	Halawy	7.61	7.14	6.86	7.20
V_2	Barhee	8.84	8.04	7.77	8.22
V_3	Khalas	7.91	7.48	7.21	7.53
V_4	Khuneizi	8.87	8.26	7.91	8.35
V_5	Khadrawy	7.17	6.91	6.22	6.77
V_6	Zahidi	8.76	8.18	7.84	8.26
V_7	Medjool	7.24	7.07	6.57	6.96
V_8	Shamran	6.84	6.36	5.94	6.38
V_9	Nagal	6.66	6.28	5.57	6.17
V_{10}	Khasab	7.84	7.36	7.16	7.45
Mean		7.77	7.31	6.90	7.33
SEm±		0.07 (V)	0.04 (S)	0.12 (VS)	
C.D. at 0.05		0.21	0.11	NS	

Visual appearance of different varieties of date palm showed significant variation with respect to storage days. Mean visual appearance recorded on 3rd day (7.77) decreased to (6.90) on 9th day of storage. Similar findings for variation in visual scores in different varieties of date palm was reported by Meena *et al.* (2017); Araiza *et al.* (2005) in Mango.

CONCLUSION

Among the different varieties of date palm, Khuneizi performed best followed by Barhee and Zahidi at ambient storage condition and recorded least physiological loss in weight, secured maximum scores for overall acceptance, sensory characteristics and visual appearance.

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