

Proceedings:

International Conference on
Mango and Date Palm: Culture and Export.
20th to 23rd June, 2005.
Malik *et al.* (Eds), University of Agriculture, Faisalabad.

**EVALUATION OF DATE PALM CULTIVARS IN ARID IRRIGATED REGION
OF PUNJAB**

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ABSTRACT

Date palm (*Phoenix dactylifera*) is a potential palm for the arid-irrigated region within the deserts of the country as the climatic conditions of these areas are congenial for its fruit ripening. Keeping this in view date palm cultivars were planted in Abohar area. The performance of the various cultivars was monitored and evaluation of the cultivars viz., Khadrawi, Shamran, Hillawi, Barhee, Medjool, Zahidi, Deglet Noor, Dayri, Khalasa, Hayani, Thoory and Iteema was undertaken. The studies were conducted at the Regional Fruit Research Station, Abohar, on thirty five year old trees for their vegetative, flowering and fruiting characteristics. The time of spathe emergence was earliest in Iteema followed by Khalasa, Shamran, Thoory, Zahidi, Khadrawi, Deglet Noor, Dayri, Medjool, Hayani, Barhee and Hillawi. The probable period of fruit setting was between first week of April (Iteema) to third week of April (Barhee and Hillawi). Maximum tree spread (841.87 cm) was recorded in Hillawi while maximum trunk girth (170.75 cm) in Iteema and the minimum in cv. Deglet Noor (131.13 cm). However, maximum number of leaves per palm per year (21.87) was in Dayri. Maximum number of spines per leaf was recorded in cv. Deglet Noor i.e., 45.0 per leaf and these were minimum in cv. Khadrawi (16.0). Among the fruit characters, maximum number of berries per strand (21.15) was recorded in Deglet Noor and maximum fruit weight (23.68 g) and seed weight (2.35 g) was in cv. Medjool. Total soluble solids were recorded maximum (27.06 %) in the cv. Hillawi. The cultivars Hillawi and Barhee were good for raw eating at Doka stage and cv. Medjool was best for 'chuhara' making, whereas, cv. Zahidi was good for processing as soft dates.

INTRODUCTION

The fruit of Date palm (*Phoenix dactylifera* L.) is highly nutritious and is known to contain carbohydrates to the extent of 75-80 % of dry matter. Date palm fruit is eaten as raw dates (fresh fruits), dry dates (chuharas) and soft dates (pind khajoor). Date palm is primarily a fruit of deserts of the Middle East. It requires long summer, mild winter, absence of rains at flowering and fruit setting. Well drained sandy loam soil is best suited for its cultivation.

During partition, in 1947, dates growing area went to Pakistan (Kalra and Jawanda, 1972). Following this, ICAR decided to explore the possibilities of growing dates in suitable areas of the Indian Union. Improvement work on date palm cultivation in Northern Punjab began by introducing better cultivars from USA, Pakistan and Middle East countries during 1955 to

1962 at Regional Fruit Research Station, Abohar by ICAR. From 1978, efforts were made for further improvement in quality and to increase area under All India Coordinated Fruit Improvement Project of ICAR with assistance from UNDP at Bikaner & Jodhpur (Rajasthan), Abohar (Punjab), Hissar (Haryana) and Mudra in Kutch (Gujarat).

Out of some 50 date varieties collected from home and abroad, 34 have since been established at Abohar. It was deemed necessary to evaluate the dates germplasm with respect to its vegetative, flowering and fruiting characters under the arid irrigated region of Punjab (India).

MATERIALS AND METHODS

Date palm cultivars viz., Khadrawi, Shamran, Hillawi, Barhee, Medjool, Zahidi, Deglet Nour, Dayri, Khalasa, Hayani, Thoory and Iteema, were selected for varietal evaluation at Regional Fruit Research Station, Abohar (Punjab), India. These varieties were planted in the orchard during the years 1960. Two trees of each cultivar, replicated four times in randomized complete block design, were selected for recording different observations.

The tree characters viz., tree height, tree spread, trunk girth, number of leaves per palm, leaf length, length of mid-rib, number of spines per leaf and number of berries per strand were recorded during the months of January–February, 1996–2000. The time of start and end of spathe emergence was recorded in each cultivar along with date of fruit set. Samples were collected for recording the fruit characters viz., average fruit weight, average fruit size, average seed weight and total soluble solids at the Doka stage.

RESULTS

The vegetative, flowering and fruiting characters of the varieties under study are described as under:

Khadrawi

The suckers of this variety were obtained from Bahadurgarh, Patiala. Trees are relatively less vigorous. The average height of the plant is 1220.6 cm. The average trees spread is 723.13 cm, trunk girth is 143.75 cm. It bears 17.75 leaves per palm per year and 16.0 spines per leaf.

The spathe emergence starts on 12th February and continues upto 25th March for about 42 days depending upon the weather conditions and mid April is the probable period of its fruit set. It bears 15.88 berries per strand. The average fruit size is 3.4 cm x 2.4 cm and average fruit weight is 15.20 g. The average seed weight is 1.48 g. The total soluble solids are 20.47 % at Doka stage. The total sugar content of this cv. is 59.92 %, on dry weight basis. This variety is suitable for preparation of both soft dates and dry dates and is an early ripening variety. The average yield of this variety is 78.5 Kg/palm.

Shamran

It is a vigorous variety with a tree height of 932.5 cm and a tree spread of 816.25 cm and trunk girth of 148.13 cm. It bears 21.50 leaves per palm with an average leaf length of 384.43 cm. The length of mid rib with spines is 88.0 cm and it bears 17.0 spines per leaf. The number of berries per strand is 16.97. The time of spathe emergence falls between 11th February and 26th March, with third week of April as the period of fruit set.

The average fruit size is 4.4 cm x 2.3 cm with an average berry weight of 12.08 g and seed weight of 1.38 g. The reducing and non-reducing sugar content of this variety is 53.07 % and 10.08 %, respectively on dry weight basis. This variety has high TSS content (25.93 %) at Doka stage. The fruits are astringent at Doka stage and this variety is suitable for dry date and soft date. It is a high yielding variety (92.3 Kg/palm).

Hillawi

This variety originally belongs to Iraq where it is a leading date variety. It is a soft date and is relished both at the Doka and Dang stages. The tree height of this variety is 1295.0 cm and it is vigorous with good tree spread (841.87 cm) and trunk girth is 136.25 cm. It bears 19.37 leaves per palm with a leaf length of 370.63 cm and length of mid rib with spines is 83.75 cm with an average of 19 spines per leaf. It bears 14.25 berries per strand. The time of spathe emergence is between 25th February and 28th March and the probable period of fruit set is third week of April.

This variety has low astringency with TSS 27.06% at Doka stage. The average berry size is 4.3 cm x 2.3 cm and average berry weight is 12.80 g with average seed weight of 1.43 g. This variety contains 58.91 % total sugar content on dry weight basis. It is an early ripening variety and yields about 94.3 Kg/palm. This variety is best for raw eating at 'Doka' stage.

Barhee

It is a soft date from Iraq and its suckers were imported at the Research Station from Iraq. The variety is a vigorous one. The tree height of this cv. is 1200.6 cm. The tree spread is 787.50 cm and trunk girth is 142.0 cm. It bears 19.50 leaves per palm with an average leaf length of 415.0 cm. The average length of mid rib with spines is 82.25 cm and number of spines per leaf are 24.0. The number of berries per strand is 16.93.

The time of spathe emergence is between 23rd February and 1st April and it starts to set fruit during third week of April. The average fruit size is 3.4 cm x 2.6 cm with average fruit weight of 12.88 g and seed weight of 1.33 g. The TSS content of this variety is 23.70 % and the total sugar content was 59.51 % on dry weight basis. The fresh fruit has a very pleasant taste because of low astringency. This is a raw eating variety. It is one of the late ripening varieties. Being a late ripener, it coincides with the onset of rains, which causes berry splitting.

Medjool

It is soft date variety of Morocco. It is one of the popular date varieties with height of 1385.0 cm. The average tree spread is 752.50 cm and the trunk has slender growth i.e. 134.0 cm. It bears 18.45 leaves per palm with a leaf length of 362 cm and length of mid rib with spines is 74.35 cm. It bears 27.0 spines per leaf.

The fruit is large sized (4.3 cm x 3.1 cm) with average fruit weight of 23.68 g and seed weight of 2.35 g. The size of the fruit is very attractive; the yield is medium (83.2 Kg/palm). As the fruit is astringent, it cannot be eaten at Doka stage. The time of spathe emergence is 18th February and ends on 27th March. The probable period of fruit set is mid April. The variety bears fruits of attractive golden yellow colour with 24.73 % total soluble solids at Doka stage. The reducing and non-reducing sugars of this cv. are 48.63 % and 11.66 % respectively on dry weight basis. It is an early to mid season ripening variety.

Zahidi

It is semi-dry date but have high fruit yield (91.2 Kg/palm). It is semi vigorous variety having tree height of 1160.5 cm, tree spread of 766.25 cm and trunk girth of 161.12 cm. It bears 20.87 leaves per palm with an average leaf length of 405.75 cm. The length of mid rib with spines is 70.63 cm and bears 21.0 spines per leaf. The number of berries per strand is 14.80. The date of spathe emergence lies between 12th February and 28th March with the probable date of fruit set during the third week of April, which may vary from season to season.

The berries of this variety are medium having an average fruit size (4.1 cm x 2.4 cm) with an average berry weight of 13.65 g and seed weight of 1.45 g. It also has moderate TSS (22.93 %). Fruits usually ripen during the first week of August. It is suitable for preparation of soft dates.

Deglet Noor

This date variety is less vigorous with a height of 1198.0 cm. The tree spread of this variety is 701.25 cm with a trunk girth of 131.13 cm. It bears 19.37 leaves per palm with an average leaf length of 403.5 cm. The length of mid rib with spines is 94.75 cm The number of

spines per leaf (45.0) and the number of berries per strand (21.15) were maximum. The time of spathe emergence falls between 16th February and 27th March and it starts fruit setting during mid April.

It has an average fruit size (3.8 cm x 2.0 cm) with an average berry weight of 11.35 g and seed weight of 1.23 g. It also has moderate TSS (22.0 %) at Doka stage. It is low yielding (60.0 Kg/palm) and an uneven ripening variety.

Dayri

The tree height of this cv. is 1042.0 cm with a tree spread of 741.12 cm and trunk girth of 145.38 cm. It bears 21.87 leaves per palm with an average leaf length of 404.25 cm. The length of mid rib with spines is 85.63 cm bearing 21.0 spines per leaf. The number of berries per strand is 14.03. The spathe emergence begins on 16th February and gets completed on 19th March with mid April as the period of fruit set.

The average fruit size is 4.4 cm x 2.1 cm with an average berry weight of 12.03 g and seed weight of 1.53 g. The average TSS of this variety is 23.93 % at Doka stage. The average yield of this cultivar is 71.4 Kg/palm.

Khalasa

It is semi vigorous with a tree height of 1201.5 cm, tree spread of 768.75 cm and trunk girth of 148.25 cm. It bears 21.63 leaves per palm with an average leaf length of 395.63 cm. The length of mid rib with spines is 92.50 cm and bears 22.0 spines per leaf. The number of berries per strand are few i.e. 10.58. The time of spathe emergence is between 10th February and 26th March with mid April as the likely period of fruit set which may vary from season to season.

The berries are relatively small in size (3.7 cm x 2.1 cm) with an average berry weight of 12.33 g and seed weight of 1.45 g. Total Soluble Solids are high (23.93 %) at Doka stage. It is suitable for raw eating as well as soft dates. The average yield is about 66.2 Kg/palm.

Hayani

This cv. has a tree height of 1261.0 cm with a tree spread of 800.13 cm and a trunk girth of 158.87 cm. It bears 21.13 leaves per palm with an average leaf length of 409.38 cm. The length of mid rib with spines is 81.88 cm and number of spines per leaf are 19.0. The number of berries per strand is 14.68. The time of spathe emergence begins on 21st February and gets completed on 28th March with mid April as the probable period of fruit set, which may vary from season to season.

It has an average fruit size (4.3 cm x 2.2 cm) with an average berry weight of 16.58 g and seed weight of 1.65 g. It also has very high TSS (26.87 %) at Doka stage. This variety is a moderate fruit yielder (82.0 Kg/palm).

Thoory

It was imported from Algeria. It is a dry date but did not dry very well under Abohar conditions. The tree height of this variety is 1293.0 cm with a tree spread of 822.50 cm and trunk girth of 153.75 cm. It bears 18.13 leaves per palm with an average leaf length of 382.50 cm. The length of mid rib with spines is 93.63 cm and bears 22.0 spines per leaf. The number of berries per strand is 17.80. The time of spathe emergence falls between 12th February and 18th March with second week of April as the period of fruit set which may vary from season to season.

The average fruit size is 3.6 cm x 2.3 cm with small berries having average berry weight of 10.33 g and seed weight of only 1.20 g. This variety has TSS content of 23.20% at Doka stage. The average yield of this variety is 84.2 Kg/palm.

Iteema

This variety has the maximum tree height of 1514.0 cm with a tree spread of 813.00 cm and trunk girth 170.75 cm. It bears 21.45 leaves per palm with an average leaf length of 392.63 cm. The length of mid rib with spines is 87.13 cm and bears 36.0 spines per leaf. The number of berries per strand is 15.73. The time of spathe emergence and fruit set is the earliest among all the varieties evaluated and occurs on 4th February and 6th April respectively.

The average fruit size is 4.0 cm x 2.4 cm with an average berry weight of 12.50 g and seed weight of 1.20 g. This variety has TSS content of 21.73% at Doka stage. It is comparatively low fruit yielding (39.5 Kg/palm) variety.

DISCUSSION

From the data (Tables 1, 2 and 3), it is revealed that tree height is maximum in Iteema, followed by Medjool. The tree spread was maximum in Hillawi followed by Shamran. The number of leaves per palm was recorded maximum in Dayri while minimum in Khadrawi. Maximum leaf length was recorded in Barhee while it was minimum in Medjool. The length of mid rib, number of spines per leaf and number of berries per strand were maximum in Deglet Noor, while tree spread and trunk girth were minimum in Deglet Noor.

Though the time of spathe emergence varies from season to season, the time of spathe emergence and that of fruit set were earliest in Iteema, while spathe emergence was late in Hillawi.

The fruit size, fruit weight and seed weight was maximum in Medjool, while Thoory had minimum fruit and seed weight. Fruit yield and Total Soluble Solids contents were higher in Hillawi at Doka stage while minimum fruit yield was recorded in Iteema.

The cultivars Hillawi and Barhee were good for raw eating at Doka stage, and Zahidi was good for processing as soft date and Medjool for 'chuhara' making. The processing of Doka fruits for chuhara making has earlier been reported by Chohan et al. (1971) and rated best as dry dates.

Evaluation of Date cultivars in the present investigation revealed variations among the different characters. The variations are expected to occur because of their different genotypes. Some varieties bear highly desirable characters and the same are exploited for commercial applications. Similar results regarding variations in fruit characters have earlier been evaluated by Mohammad et al. (1983).

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TABLES

Table 1: Evaluation of date palm cultivars for vegetative characters (1996-2000)

Variety	Tree height (cm)	Tree spread (cm)	Trunk girth (cm)	No. of spines per leaf	No. of leaves per palm	Leaf length (cm)	Length of mid rib (cm)
Khadrawi	1220.6	723.13	143.75	16.0	17.75	395.00	93.75
Shamran	932.5	816.25	148.13	17.0	21.50	384.43	88.00
Hillawi	1295.0	841.87	136.25	19.0	19.37	370.63	83.75
Barhee	1200.6	787.50	142.00	24.0	19.50	415.00	82.25
Medjool	1385.0	752.50	134.00	27.0	18.45	362.00	74.35
Zahidi	1160.5	766.25	161.12	21.0	20.87	405.75	70.63
Deglet Noor	1198.0	701.25	131.13	45.0	19.37	403.50	94.75
Dayri	1042.0	741.12	145.38	21.0	21.87	404.25	85.63
Khalasa	201.5	768.75	148.25	22.0	21.63	395.63	92.50
Hayami	1261.0	800.13	158.87	19.0	21.13	409.38	81.88
Thoory	1293.0	822.50	153.75	22.0	18.13	382.50	93.63
Iteema	1514.0	813.00	170.75	36.0	21.45	392.63	87.13
CD (p=0.05)	----	58.71	8.97	4.25	NS	NS	NS

Table 2: Evaluation of date palm cultivars for flowering and fruiting characters (1996-2000)

Variety	Time of initiation of spathe emergence	Time of end of spathe emergence	Time of fruit set per strand	Berries length (cm)	Fruit size		Fruit weight (g)	Seed weight (g)	TSS (%)	Yield (kg/palm)
					Breadth (cm)	Weight (g)				
Khdrawi	12 th February	25 th March	8 th April	15.88	3.4	2.4	15.20	1.48	20.47	78.5
Shamran	11 th February	26 th March	20 th April	16.97	4.4	2.3	12.08	1.38	25.93	92.3
Hillawi	25 th February	28 th March	22 nd April	14.25	4.3	2.3	12.80	1.43	27.06	94.3
Barhee	23 rd February	1 st April	22 nd April	16.93	3.4	2.6	12.88	1.33	23.70	86.1
Medjool	18 th February	27 th March	10 th April	10.28	4.3	3.1	23.68	2.35	24.73	83.2
Zahidi	12 th February	28 th March	20 th April	14.80	4.1	2.4	13.65	1.45	22.93	91.2
Deglet Noor	16 th February	27 th March	16 th April	21.15	3.8	2.0	11.35	1.23	22.00	60.0
Dayri	16 th February	19 th March	12 th April	14.03	4.4	2.1	12.03	1.53	23.93	71.4
Khalasa	10 th February	26 th March	12 th April	10.58	3.7	2.1	12.33	1.45	23.93	66.2
Hayami	21 st February	28 th March	12 th April	14.68	4.3	2.2	16.58	1.65	26.87	82.0
Theory	12 th February	18 th March	10 th April	17.80	3.6	2.3	10.33	1.20	23.20	84.2
Iteema	4 th February	10 th March	6 th April	15.73	4.0	2.4	12.50	1.20	21.73	39.5
CD (p=0.05)	--	--	--	5.32	NS	NS	2.65	0.34	NS	10.3

Table 3: Total sugars of important date palm cultivars (1996-2000)

Varieties	Moisture (%)	Percentage sugars (dry weight basis)		
		Reducing	Non-reducing	Total
Khdrawi	63.62	50.12	09.80	59.92
Shamran	59.36	53.07	10.08	63.15
Hillawi	70.12	52.13	06.78	58.91
Barhee	67.84	46.89	12.62	59.51
Medjool	65.28	48.63	11.66	60.29