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FLORAL CHARACTERISTICS OF THE DIFFERENT MALE DATE PALMS AND THEIR RESPONSE TO FRUIT SETTING AND YIELD OF CV DHAKKI

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ABSTRACT: Fifteen different male palms were selected from wild grooves for studying their floral characteristics and their effect on fruit yield of Dhakki. The male palms differed significantly in days to spathe opening. The M_6 took significantly maximum time for spathe opening while the least time was noticed in M_{13}. The significantly longest spathes were found in M_{10} whereas the M_{12} possessed spathes of maximum width. The greatest flower spike length was observed in M_8. Male palms did not differ significantly in number of strands as well as number of flowers per spathe. The maximum number of flowers per spathe was recorded in M_{11} while minimum number of flower per spathe was found in M_2. Significantly maximum number of flowers per strand was recorded in M_6, the M_5 possessed significantly highest viability of 95.67%. Pollination with different males on Dhakki females resulted significant variation in fruit set. The highest fruit set occurred due to M_5 pollens. Fruit yield per bunch was significantly affected due to different male palms. The highest fruit yield per bunch was obtained by fertilization of M_5 pollens.

Key Words: Palms; Cultivar; Floral Characteristics;Pollination; Fruit; Flower; Yield; Pakistan.

INTRODUCTION

Artificial pollination is considered the most important factor for fruit set and consequently yield (Hussain et al., 1979). Male palms play an important role in increasing yield of highest economic return in dates. In this area mostly male seedlings are in wild grooves. Farmers use the pollen grains from these males for pollination. They are unaware of the role of male that play in fruit setting. Seedling males vary in floral characters and fruit setting behaviour. Nasr et al. (1986) reported that male differed in their floral characters, number of flowers per strand and quantity of pollen grains. Some males produce more pollen grains with high viability while other possess incompatible pollens. Al-Ghamadi et al. (1988) Ibrahim et al. (1996) Marzouk et al. (2002) and Iqbal et al. (2004). Al-Hamoudi et al. (2006) reported that pollen grain significantly effect on fruit set and yield. Similary Muhtaseb and Ghnaim (2007) investigated that pollen source had significant effect on productivity and fruit quality of date. In this area the information about the productive males is lacking, therefore, this experiment was designed to figure out the best male for obtaining maximum production in Dhakki date.

MATERIALS AND METHODS

Different male palms irrespective of age were selected from different wild grooves of the area for studying their growth characteristics and their effect on fruit setting and yield. The male palms were designated as M_1 to M_{15} and were considered as treatments. The experiment was conducted in RCBD with 15 treatments and three replications. Besides studying the floral characters, the pollens from these males were dusted on 15 female plants of Dhakki for fruit set and yield. After pollination the pollinated spathes were bagged to avoid natural pollination.

The methodologies used for recording

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the individual trait are as follows:

The number of days was counted from spathe emergence to opening of three spathe of each male tree and then mean was calculated.

The lengths of five spathes were measured with the help of meter rod and then mean was calculated.

Widths of five spathes were measured with the help of measuring tape and then mean was calculated.

The protective sheaths of five spathes were removed and lengths of spikes were measured with the help of measuring tape and mean was computed.

The strands were removed from the five spathes and was counted then mean was calculated.

Three strands lengths were taken with the help of measuring tape and aver age was reported.

Total number of flowers present on the five strands was counted and then mean was calculated.

Pollen grains extracted from flower were placed in desiccators for 24h for absorption of moisture and then weighed with the help of electronic bal ance and then mean was calculated.

Pollen viability was determined by staining techniques (Moreira and Gurgel, 1941). A small amount of pollen grains was placed on slide and 1-2 drop of 1% acetocarmine solution was added. The slides were placed for few minutes on a hot plate. The viability of pollen grains was examined under a microscope at 200x magnifying power Model BHTUOSK13819. A slide was prepared from each male and pollen grains of four fields on each slide were tested.Pollen grains that stained red were considered viable whereas the colorless pollen grains were considered non-viable, and then percent viability was calculated.

Ten strands per spathe were selected for recording of abnormal and normal fruit set. Fruit setting percentage was calculated as:

$$\frac{\text{Total number of normal fruit set-Number of abnormal fruit set}}{\text{Total number of fruits}} \times 100$$

Five bunches from each treatment were harvested; the fruits were picked and weighed. The mean weight of fruits per bunch was calculated.

All the data recorded were subjected to the analysis of variance techniques appropriate for the design. F-test was applied to determine the significance of treatment effects. Duncan's Multiple Range Test (DMRT) was used to compare treatment means (Duncan 1955; Steel and Torrie, 1984).

RESULTS AND DISCUSSION

The male palms differed significantly ($P< 0.05$ %) in days to spathe opening (Table 1). The M_6 took maximum time (38.0 days) to spathe opening, which differed significantly from all other males. The least time taken for spathe opening was observed in M_{13}(13.67 days). Days to spathe opening of males were divided into three groups viz., early season flowering males during December-January mid season flowering males during February and late season flowering males during March and some times extended to 1st week of April. During spathe opening of these males the maximum temperature was 18-19 ^{0}C and rainfall was 69 mm. These factor delayed the spathe opening. In mid season flowering males (February) the days to spathe opening were minimum than early males and it ranged from 21 to 27. The males included in this category were M_4, M_5, M_{11} M_2, and M_8. During flowering season of these males the maximum temperature was 21^{0}C and rainfall was 8 mm. In late flowering season (March and 1st week of April) the minimum days to spathe opening ranged from 14 to 21 days. During the opening of spathe of these males, maximum temperature was 27^{0}C and rainfall was 5 mm and such factors hastened the spathe opening. It was also observed that spathe opening time varied from male to male. These results are in line with the findings of Nasr et al. (1986) and Iqbal et al. (2004) who reported that males differed in number of days taken to spathe opening.

Table 1. Days to spathe opening, spathe length, spathe width, flower spike length and number of strand per spathe

Male	Days to spathe opening	Spathe length (cm)	Spathe width (cm)	Flower spike length (cm)	No. of strand per spathe
M_1	26.67 bc	66.30 de	10.67 c-f	43.00 cd	110.30 f
M_2	24.00 cd	48.67 f	9.66 d-f	43.33 cd	80.67 h
M_3	25.00 b-d	48.67 f	9.33 c-f	31.33 e	61.67 j
M_4	27.00 b-d	58.83 c-f	8.33 f	39.33 d	94.00 g
M_5	25.00 b-d	51.67 f	10.67 ab	37.67 d	100.00 fg
M_6	38.00 a	98.67 ab	12.33 ab	51.00 ab	127.00 e
M_7	31.00 b	105.00 ab	14.00 ab	46.67 bc	244.00 a
M_8	21.00 de	98.67 ab	11.67 bc	55.33 a	246.00 a
M_9	17.00 ef	63.67 cd	11.67 bc	29.00 e	147.70 d
M_{10}	16.00 ef	108.70 a	13.00 a-c	53.67 ab	176.70 c
M_{11}	24.67 b-d	62.33 cd	9.33 ef	50.00 ab	185.70 c
M_{12}	14.00 f	7.00 cd	14.67 a	50.33 ab	220.30 b
M_{13}	13.67 f	79.00 c	12.33 ab	41.00 d	182.70 c
M_{14}	16.00 ef	69.67 de	10.00 d-f	55.00 a	144.30 d
M_{15}	14.00 f	90.67 b	12.33 ab	55.00 a	183.00 c
LSD	6.73	10.56	2.97	5.75	11.95

Means followed by same letters do not differ significantly (P < 0.05)

Male palms were significantly (P<0.05 %) different in their spathe length (Table 1). The longest spathes were found in M_{10} (108.7 cm) followed by M_7 (105.00 cm) and M_6 (98.67 cm). However, no significant difference was observed among all these male palms. The significantly shortest spathes were recorded in M_2 and M_3 (48.67 cm), which were at par with M_5 (51.67 cm) and M_4 (58.35 cm). Spathe length is associated with early, mid and late flowering behaviour of the male palm. The longest spathe of 108.70 cm was found in late flowering males which took least days (16) to spathe opening. This may be due to rise in temperature. The growth was rapid and took least time. It is concluded that low temperature has slow effect on spathe length while high temperature results in rapid growth of spathe. Marzouk et al. (2002) also reported varying spathe length amongst different males.

The perusal of data shows that spathe widths of 15 male palms was different significantly (P<0.05%). It ranged from 8.33 cm to 14.67 cm. The M_{12} possessed spathes of maximum width whereas M_4 produced spathes of minimum width. The M_7 ranked second in terms of spathes width (14.20 cm) followed by M_{10} (13.00 cm). The M_6, $M_{10,}$ M_{13} and M_{15} produced 12.33 cm wide spathe. These results are in agreement with the findings of Nasr et al. (1986) who reported that male palms differed from one another in terms of spathe width.

Male palms differed significantly (P<0.05 %) with regards to flower spike length (Table 1). The maximum flower spike length was recorded in M_8 (55.33 cm), closely followed by M_{14} and M_{15} (55.00 cm). However, all the three males were statistically similar. The shortest flower spikes were noted in M_9 (29.00 cm). From the result, it is concluded that flower spike length was different in various males. These results collaborate with the findings of Al-Ghamadi (1988), who stated that male palms varied from one another with respect to spike length.

The data regarding number of strands per spathe show that male palms were statistically (P< 0.05 %) different in number of strands per spathe (Table 1). It varied from 61.67 to 244.00, being lowest in M_3 and highest in M_7. The M_7 was significantly superior to all other males. It was followed

by M_{12} (220.3), M_{11} (185.7), M_{15} (183.00), M_{13} (182.7) and M_{10} (176.7). Among these, the M_{12} differed significantly from other male palms, while others were statistically at par. Variation in numbers of strand per spathe was reported by El Sabrout (1979) and Hamady (1982), who stated that there was significant differences in number of strand per spathe of each male palm.

The male palms differed significantly ($P<0.05$ %) from each other regarding length of strand (Table 2). The significantly longest strands of 25 cm were found in M_6 followed by M_4 and M_1, which possessed strands of 22.33 cm and 22 cm, respectively. The significantly shortest strands of 11.33 cm were recorded in M_5. It contained strands of statistically similar length to M_{15} (12.33 cm), M_{10} (13.33 cm) and M_9 (15.00 cm). Variability in length of strands of different males depends on genetic makeup. These results are in line with findings of Al-Tahir and Asif (1983) who reported that male palms differ significantly in length of strands.

The male palms included in this study contained significantly different numbers of flowers per strand (Table 2). The maximum numbers of flowers per strand (104.7) were noticed in M_6 followed by M_{11} (96.33) and M_1 (89.33). All the three males were significantly similar. The minimum number of flowers per strand (48.00) was observed in M_9, M_3, M_4, M_2, M_5, M_7 and M_{12} The number of flowers per stands are variable in different males due to genetic makeup of the plant. These results are in accordance with the findings of Nasr et al. (1986b), Marzouk et al. (2002) Iqbal et al. (2004) who reported that males differ regarding the number of flowers per strand.

The pollens collected from different male palms was weighed. It ranged from 5 to 27 g. The M_7 carried pollens of maximum weight (27g). The M_8 was statistically similar to M_7 whereas M_6 possessed pollens of statistically lower weight. The M_3's pollen weight was the lowest (5 g) but contained significantly similar pollen weight as that of M_{14} (6 g) and M_2 (7 g). Variation in weight of pollen grain per spathe depends upon number of flower per spathe and size of the anther in the flower. These results are in agreement with the results reported by Nasr et al. (1986) and El-Salhy et al. (1997), who stated that various male differed with respect to pollen weight per spathe.

The data revealed that male pollens varied significantly due to pollen viability (Table 2). The maximum viability of pollens (95.67%) was recorded in M_5, which differed significantly from all other palms. It was followed by M_4 (91.67%) and M_9 (90.67%). However, all the three palms were statistically similar. The minimum pollens viability was observed in M_1 (30.00%). Variation in viability of pollen is due to genetic characters of the male. These results agree with the findings of Nasr et al. (1986) who reported that males differed greatly in pollen viability percentage.

The pollens of male palms included in the study were collected and dusted on female palms of cv. Dhakki. The data also showed that significant variation in fruit setting percentage existed due to fertilization by pollens of different male palms(Table 2). The highest fruit set (88.33%) occurred due to dusting of M_5 pollens. It was significantly similar to M_4, with 83.33% fruit set. The results suggest that different male pollens have different capacity for fruit set which may be due to variation in genetic make up of male palms. The fruit behaviour of different males depends upon incompatibility factors which may be due to effect on cell number in the early cell division stage of fruit set, which ultimately results in cell multiplication and normal fruit setting occur. Similarly, a significant effect of males on fruit set was also reported by Rahemi (1998) and Iqbal et al. (2004).

The fruit yield data of female palms of cv. Dhakki as affected by different pollen sources indicated that different male palms produced significantly different yield (Table 2). The highest yield of 7.66 kg fruits per bunch was obtained by dusting pollens of M_5 male palm which differed significantly from all other male palms except M_4, M_{11}, M_{14} and M_{12}. These were statistically at par by producing 7.00, 6.66, 6.33 and 6.00 kg

Table 2. Strand length, number of flower per strand, weight of pollen per spathe, pollen viability %age, fruit setting %age and fruit yield

Male	Length of strand (cm)	No. of flower per strand	Weight of pollen per spathe (g)	Pollen viability (%)	Fruit setting (%)	Fruit yield per bunch (kg)
M_1	22.00 a-c	89.33 ab	20.00 c	30.00 g	23.33 f	3.10 f
M_2	19.67 bc	54.67 d	7.00 fg	31.67 g	24.33 f	3.26 ef
M_3	16.00 e-g	49.33 d	5.00 g	61.67 c-e	36.67 ef	3.33 ef
M_4	22.33 ab	51.33 d	10.00 ef	91.67 ab	83.33 a	7.00 ab
M_5	11.33 h	55.00 d	10.00 ef	95.67 a	88.33 a	7.66 a
M_6	25.00 a	104.70 a	21.00 bc	39.00 fg	34.67 f	3.33 ef
M_7	18.33 ef	57.33 d	27.00 a	40.67 e-g	50.67 c-e	3.66 d-f
M_8	17.67 d-f	64.00 cd	24.00 ab	73.67 bc	64.33 bc	4.70 c-f
M_9	15.00 f-h	41.00 d	12.00 de	90.67 ab	49.67 de	5.66 a-d
M_{10}	13.33 gh	66.33 cd	13.00 de	45.67 b-g	60.33 b-g	5.33 b-e
M_{11}	15.67 fg	96.33 ab	12.00 de	65.33 cd	60.00 b-d	6.66 a-c
M_{12}	16.00 e-g	58.33 d	15.00 d	61.00 c-e	57.00 b-d	6.00 a-c
M_{13}	17.67 d-f	62.22 cd	13.00 de	56.00 c-f	65.67 b	5.00 b-f
M_{14}	20.33 b-d	79.67 bc	6.00 g	61.67 c-e	34.67 f	6.33 a-c
M_{15}	12.33 gh	62.00 cd	15.00 g	48.67 d-g	52.33 b-d	4.66 c-f
LSD	3.86	19.51	3.53	21.83	14.60	2.15

Means followed by same letters do not differ significantly (P < 0.05)

fruits per bunch. The lowest fruit yield of 2.100 kg per bunch was obtained when M_1 pollens were applied. From the results obtained for fruit yield and other plant characters it can be assumed that different male palms possess different genetic makeup. The highest fruit set was obtained from M_5 and M_4. Consequently the yield were also maximum from these males. Hence the M_5 and M_4 pollen are recommended for getting highest fruit set and yield of Dhakki date palm. These results are in agreement with those reported by Ghalib et al. (1987) El-Makhtoun and Abdel Kader (1990), who reported significant difference in fruit bunch weight due to different pollen source used in pollination.

It is thus, concluded that male varied in floral characteristics. The maximum pollen viability percentage, fruit set percentage and yield in kg bunch^{-1} was produced by the M_5. Hence M_5 is recommended for getting maximum fruit sets and yield for Dhakki dates.

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