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**EFFECT OF DIFFERENT POLLINATION METHODS ON FRUIT SET,  
POMOLOGICAL CHARACTERS AND YIELD OF DATE PALM (*Phoenix  
dactylifera* L.) CV. DHAKKI UNDER THE AGRO-CLIMATIC CONDITIONS OF  
DERA ISMAIL KHAN**

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**ABSTRACT**

To determine the effectiveness of different pollination methods i.e. T<sub>1</sub> (control), T<sub>2</sub> (dusting), T<sub>3</sub> (placement), T<sub>4</sub> (liquid spray) on fruit set, yield and yield contributing traits of cv. Dhakki, an experiment was conducted during two successive seasons in 2001 and 2002. Results showed that different methods of pollination significantly affected the fruit set percentage. The highest fruit set (89.28% and 88.85%) was recorded in T<sub>3</sub> (placement) method. While the lowest fruit set was observed in T<sub>1</sub> (control). The fruit developed by placement method had the maximum fruit weight, fruit length, and pulp and seed weight at maturity stage. The highest fruit yield per bunch was also recorded in placement method, while it was lowest in control. It can be concluded that placement method is important for improving fruit set, fruit quality and bunch yield of cv. Dhakki under the agro-climatic condition of Dera Ismail Khan.

**Key words:** Date palm, pollination methods, yield, quality

**INTRODUCTION**

In case of failure of natural pollination, parthenocarpic fruits are developed that cause low yield in Dhakki date due to following factors:

1. Dioecious nature of plant.
2. Ratio of males in orchard.
3. Incompatibility in flowering times of male and female flower.
4. Natural pollinating agents (insects) during date flowering time mostly visit the mustard crop due to its attractive yellow color and pollen mobility is affected by low temperature and cold wind.
5. That is why artificial pollination plays an important role. Pollination is either performed manually or mechanically. In this area our farmers mostly use hand pollination techniques by different ways. They are unaware of the best techniques of pollination, which may be easiest and most convenient. So it was realized to study the pollination technique.

## REVIEW OF LITERATURE

Attalla et al. (1998) compared standard pollination techniques for date palm (5 male spikelets, placed in each female spathe) to dust pollens using the cultivars Sukari and Helwa Qassim. Dusting on female spathe with 10% pollen powder, or with 5 and 15% pollen powder significantly increased the average fruit set percentage compared to the other treatments.

Shaheen et al. (1989) pollinated the flowers of cultivars Sledge, Sakhi, Khudari and Nebut-Saif by hand pollination from 16 males for two successive years. The pollen source had metaxinic effects on those components but the responses differed between the two years of study. The inconsistency of the results may be attributed partially to the environmental conditions and alternate bearing.

Haffar et al. (1997) mechanically pollinated cv. Khalas using a mechanical duster to apply pollen to the female flower bunches. They reported that mechanical pollination had a significant effect on yield and fruit quality

Ghanmer et al. (1999) reported that artificial pollination of fruit trees could help in improving yield and quality.

Aziz et al. (1983) reported that un-pollinated spadix treated once or twice with 50 and 100 ppm GA<sub>3</sub> produced seedless fruits. Fruits treated with GA<sub>3</sub> were lighter in average fruit weight and flesh weight while in case of hand pollination the fruit weight was more and fruits were seeded.

El-Kassas and Mahmoud (1986) compared hand pollination with mechanical pollination. The mechanical pollination gave good results in term of fruit yield as compared with hand pollination, and about 50% reduction in labor for hand pollination was estimated.

Ibrahim and Haggag (1993) reported that dusting pollination with diluted pollen gave a good yield, saved the quantity of pollen, decreased the pollination time and increased the workers productivity.

Shukar et al. (1988) conducted the pollination studies on 14 female date palms of cv. Zaidi. The prophylls of two inflorescences on each palm were opened manually and treated with (i) fresh pollen from the male cultivar Simaismi; (ii) heat killed pollen; (iii) pollen extracted by soaking fresh pollen in distilled water; (iv) no pollen, the inflorescence of one tree being sprayed with distilled water. A third inflorescence on each palm was retained to be wind pollinated under natural conditions (control). All the remaining inflorescence and any produced thereafter were removed to minimize the nutritional competition compared with standard hand pollination treatment (i) all other normal treatments resulted in marked reduction in fruit set. The fruit set in wind-pollinated inflorescence was 33% and that in hand pollinated spadix about 96% of fruit produced by hand pollination was fully seeded, ripe and good quality.

Khan and Ghaffoor, 1993 reported that hand pollination gave good results in fruit setting and yield over the control of Dhakki date variety.

Hamood et al. (1986) reported that date palms were mechanically pollinated (with the Anter 70 pollinator) 3, 4 or 7 times with Ghannami Ahmer pollen concentrations of 8 or 16%, or hand pollinated, or naturally pollinated. No differences in fruit set occurred between mechanical pollination 4 or 7 times at both pollen concentrations and hand pollination. The highest yield was obtained with hand pollination 7 times at both pollen concentrations or 4 times at 8% concentration.

## MATERIALS AND METHODS

To determine the effectiveness of different pollination techniques on yield and yield contributing traits of Date cv. Dhakki, an experiment was laid out in a private orchard at village Mithapur Kalan, District D. I. Khan in Randomized Complete Block Design (RCBD) with four

treatments representing pollination techniques viz. control, dusting, placement and liquid spray of pollen, repeated six times. Pollens of second whorl of  $M_1$  were used in this study. In liquid spray, one gram of pollens was diluted in one standard spray (liter) pump. Each treatment was consisted of one spathe, thus a total of 24 spathes from 4 plants of 20 years age with vigorous growth were selected for the study. The experiment was conducted during two seasons in 2001 and 2002. The parameters were recorded as under:

### 1. Fruit Set Percentage

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

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

### 2. Fruit drop percentage

Fruit drop percentage was calculated by using formula:

$$\text{Fruit drop \%age} = \frac{\text{Number of fruit dropped}}{\text{Total number of fruit set}} \times 100$$

3. At maturity, 20 fruit from each spathe were selected randomly for: a) fruit weight b) fruit length (cm) c) weight of pulp (g) d) weight of seed (g).

### 4. Bunch Weight (kg)

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

The data were statistically analyzed by computing Analysis of Variance and employing DMRT for comparison of treatment means using "MSTATC" computer program.

## RESULTS AND DISCUSSION

### Fruit setting percentage

The data regarding fruit set percentage during 2001 and 2002 are presented in Table 1. The results suggest that different methods of pollination significantly affected the fruit set percentage in both years. The significantly highest fruit set (89.28% and 88.85%) was recorded in placement method ( $T_3$ ) during both years which differed significantly from all other methods. It was followed by  $T_2$  dusting (81.26%) and  $T_4$  viz. liquid spray (69.267%) during 2001. The placement methods ( $T_3$ ) and dusting ( $T_2$ ) were statistically similar, whereas  $T_2$  and  $T_4$  (liquid spray) were significantly at par with each other. During 2002,  $T_3$  was succeeded by  $T_4$  (64.07%) and  $T_2$  (51.95%). However,  $T_4$  and  $T_2$  were statistically identical. The lowest fruit set of 26.067% and 41.20% were observed in control treatment during 2001 and 2002 respectively. These results are in accordance with the findings of Khan and Ghafoor (1993) who reported that maximum fruit set was obtained with adopting of placement method for pollination of cv. Dhakki date. Similarly the findings were reported by Attalla et al. (1998) who worked on different pollination techniques on the Sukari and Hillawi cv. of date palm and recorded lowest fruit set in control. Shakur et al. (1988) tested four pollination techniques on 14 female date palm of cv. Zahidi viz. fresh pollen from male, heat killed pollen, soaking fresh pollen in distilled water and no pollen in control. They found 60-90% fruit in three methods against 33% in control.

### Fruit drop percentage

The percent fruit drop data are presented in Table 1. The data reveal that different pollination techniques significantly affected the fruit drop during both years. The significantly highest fruit drop (74.35 and 61.18%) occurred in control trees in both years. It was followed by  $T_2$  (dusting) and  $T_4$  (liquid spray) which were statistically at par during 2001. Almost 58.20% and 48.41% fruit drop was recorded in these treatments respectively. The significantly lowest fruit drop of 44.86% was observed in male spathe placement method which proved effective in the control of fruit drop. During 2002, like first year, the maximum fruit drop of 61.183% was

recorded in control trees where no artificial pollination was done. It was followed by T<sub>4</sub> (liquid spray) and T<sub>2</sub> (dusting) in which 55.10 and 45.61% fruit drop was reported. However, all the three treatments were statistically similar. The fruit drop in trees pollinated by dusting of pollens (T<sub>2</sub>) and male spathe placement (T<sub>3</sub>) was also significantly at par. The significantly minimum fruit drop of 31.833% was noticed in T<sub>3</sub> which differed significantly from all other treatments. Khan and Ghafoor (1993) also reported minimum fruit drop in placement method. Similarly, Haffer et al. (1997) reported that different pollination techniques helped in increasing the yield and lowering the fruit drop.

#### **Weight of fruit (g) at maturity stage**

No significant difference in average weight of fruit was observed due to different pollination techniques as shown in Table 1. However, during both years, the maximum fruit weight of 15.38 g and 16.71g were recorded in fruits developed from pollination with male spathe placement method (T<sub>3</sub>) in 2001 and 2002 respectively. It was followed by T<sub>2</sub> (dusting of pollens) and T<sub>4</sub> (liquid spray of pollens) during two successive study years. The minimum fruit weight of 13.25g and 14.65g was recorded in fruits developed from natural pollination (control). These results are in accordance with the findings of Hamood and Malwod (1986). They noticed no significant difference in fruit weight among different methods of pollination. Attalla et al. (1998) also observed similar results.

#### **Length of fruit (cm) at maturity stage**

Different pollination techniques did not show any significant effect on average length of fruit at maturity stage Table. The lengthiest fruits (4.93 cm and 5.15 cm) were obtained by male spathe placement method. Dusting of pollens produced the second longest fruits of 4.85 cm and 5.01 cm during 2001 and 2002 accordingly. In both years, the naturally fertilized fruits were shortest in length (4.60 cm and 4.86 cm). These results are in agreement with the findings of Hamood and Malwood (1986). They did not find significant difference among different method of pollination. However, Attalla et al. (1998) reported that fruit length did not significantly affect by various methods of pollination.

#### **Pulp weight of fruit (g) at maturity stage**

Weight of pulp is non-significant in all pollination techniques used as shown in Table 1. It ranged from 12.03-13.36g and 13.18-14.91g during 2001 and 2002, respectively. The maximum pulp weight was noticed in fruits developed by male spathe placement technique (T<sub>3</sub>) while the minimum pulp weight was reported in naturally developed fruits (T<sub>4</sub>) (control). The dusting of pollens and liquid spray of pollens ranked second and third position with regard to pulp weight of fruits. These results are contradictory to the findings of Attalla et al. (1998). They reported that pulp weight was significantly affected by pollination techniques.

#### **Seed weight (g) at maturity stage**

No significant variation in seed weight was observed for different pollination methods during 2001 but it exhibited significant difference in 2002 (Table 1). The heaviest seeds (2.01 g) found in fruits developed by placement of male spathe method (T<sub>3</sub>) during 2001, while in 2002, the fruits fertilized through liquid spray of pollens contained the seeds of maximum weight (1.88 g). Likewise, the seeds possessing minimum weight (1.51g and 1.30g) were obtained from dusting of pollens and natural methods during 2001 and 2002, respectively. The inconsistency of the results may be attributable to difference in climatic conditions.

#### **Yield of fruit (kg) bunch<sup>-1</sup>**

Different pollination techniques exhibited significant effect on yield of fruit per bunch during 2001 while no significant difference was observed in 2002 (Table 1). During 2001, the significantly highest fruit yield per bunch was recorded by male spathe placement method (7.219 kg/ bunch). It was followed by dusting of pollens (6.14 kg) and liquid spray of pollens (5.87 kg) methods. However, all the three methods were at par with regard to fruit yield. The significantly lowest fruit yield of 3.02 kg/bunch was achieved by natural pollination (control), which differed significantly from all other methods. Although no significant variation in fruit yield was observed

during 2002, yet the maximum yield of 7.58 kg/bunch was obtained from male spathe placement method. It was followed by dusting of pollen (6.88 kg/bunch) and liquid spray of pollens (6.70 kg/bunch) techniques. The lowest fruit yield of 4.72 kg/bunch was found in control palms. These findings are in accordance with the findings of Hamoud and Malwood (1986) and Attalla et al. (1998). They reported that fruit yield was increased by various pollination methods than control result.

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**TABLES**

**Table 1:** Effect of different pollination methods on fruit set, pomological characters and yield of date palm cv. Dhakki during the year 2001 and 2002

Pollination Methods		Control (Natural pollination)	Dusting of pollens.	Placement of male spath	Liquid spray of pollens.	LSD @ 0.05 %	C.V. (%)
		T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>		
Fruit setting percentage	2001	26.067 c	81.267 ab	89.283 a	69.267 b	2.752	14.75
	2002	41.200 c	51.950 bc	88.850 a	64.070 b	21.76	13.79
Fruit drop percentage	2001	74.350 a	53.200 b	44.867 c	48.417 b	11.52	11.36
	2002	61.183 a	45.617 ab	31.833 b	55.000a	19.95	22.43
Fruit weight (g) at maturity stage	2001	13.250	14.650	15.383	13.650	NS	14.49
	2002	14.650	15.700	16.717	15.367	NS	13.83
Fruit length (cm) at maturity stage	2001	4.600	4.850	4.933	4.783	NS	8.22
	2002	4.867	5.017	5.150	4.867	NS	5.16
Fruit pulp weight (g) at maturity stage	2001	12.033	11.750	13.362	12.712	NS	13.00
	2002	13.350	14.117	14.917	13.183	NS	13.16
Seed weight (g) at maturity stage	2001	1.617	1.517	2.017	1.933	NS	25.74
	2002	1.300 b	1.600 ab	1.800 ab	1.883 a	0.4930	25.74
Fruit bunch weight (kg)	2001	3.023 b	6.148 a	7.219 a	5.873 a	2.475	24.21
	2002	4.723	6.881	7.581	6.707	NS	28.50