Assessing the Efficiency of Sponge and Traditional Methods of Pollination in Date Palm

Abdallah Ben Abdallah1, 2, Nabeel Ali Al-Wusaibai1 and Youssef Al-Fehaid1
1. Date Palm Research Centre, Al-Hassa 31982, Saudi Arabia
2. FAO Project (UTFN/SAU/043/SAU), DPRC, Al-Hassa 31982, Saudi Arabia

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Abstract: In date palm Phoenix dactylifera L. male (pollen bearing) and female (fruit bearing) inflorescences are on separate palms. To ensure good fertilization and better yield, artificial pollination is carried out in date plantations, where pollen harvested from male flowers are used for artificial pollination which is usually done manually. Often, the availability of male flowers becomes scarce due to the high demand to take up pollination during the short period of time when the female flowers are receptive. We assessed the comparative efficiency of using pollen to manually pollinate female date palm flowers in the field using sponge pieces charged with harvested pollen as compared to the traditional practice of the farmers using male inflorescences. Results revealed that fruit set (%), fructification (%), yield per bunch (kg) besides fruit weight, length and breadth were statistically similar in the two pollination methods evaluated. The sponge method of manual pollination can therefore serve as a viable alternative to the traditional method of pollination with the possibility of using stored pollen especially where male palms are scarce and pollen is difficult to obtain.

Key words: Date palm, manual pollination, sponge technique, fruit set, fructification.

1. Introduction

Date palm Phoenix dactylifera L. is the most important fruit crop in the Arabian Peninsula, closely associated with the life of the people in the region since ancient times. The date industry is rapidly growing at the Arabian Peninsula. According to the Food and Agriculture Organization (FAO) of the United Nations, the global date production has increased from just 1.8 million tons in 1962 to 7 million tons in 2010. The Kingdom of Saudi Arabia is among the world’s leading producer of dates producing 1.3 million tones of dates annually, accounting for 17% of the global date production [1].

Date palm is a dioecious crop where male (pollen bearing) and female (fruit bearing) inflorescences are on separate palms [2]. To ensure good fertilization, traditionally female inflorescence is usually manually pollinated by inserting male flowers between female flower clusters during the first few days of its opening when the female flowers are receptive [3]. This overcomes disadvantages of dichogamy besides enhancing fruit set and sustaining yield levels.

The most common manual technique of pollination in date palm is to cut the strands of male flowers from a freshly opened male spathe and place two to three of these strands, lengthwise and in an inverted position, between the strands of the female inflorescence [4]. Mechanical pollination in date palm using pollen dusters is also known since late 1960s [5] but not common among farmers.

Often the availability of male flowers becomes scarce due to the high demand to take up pollination during the short period of time when the female flowers are receptive. Pollen can therefore be stored and used to pollinate female flowers [5] when required without depending on the availability of strands of male flowers during the season. Efficiency of pollen is...
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also known to increase when mixed with wheat flour [5]. Although sponge pieces charged with date pollen have been used to manually pollinate female inflorescences in date palm [6], there is no data to quantify its impact in terms of fruit set and subsequent yield. During 2013, studies were carried out in the date palm oasis of Al-Hassa (25°19’60” N latitude and 49°37’60” E longitude) in Saudi Arabia to assess the efficiency of the sponge and traditional techniques of manual pollination in date palm.

2. Materials and Methods

Field studies were conducted by the Date Palm Research Centre, Al-Hassa during 2013 to test the efficiency of two pollination techniques (sponge and traditional). The trial was carried out in Wuziah village in the Al-Hassa oasis. Two blocks (Table 1) of date palms (Khalas cultivar) were pollinated using the sponge technique (T1) where in strips of sponge (25 cm long, 1.5 cm thick and 3 cm wide) charged with freshly extracted date pollen mixed with wheat flour in the ratio of 1:4 were used to pollinate the female inflorescence by inserting 1-3 pollen charged sponge pieces between female inflorescences. In another two blocks of the same plantation, pollination was carried out using the traditional method (T2) of pollination practiced by farmers where in 2-3 male flower strands (staminate inflorescences) harvested from male date palms were placed between female flower clusters. The number of pollen charged sponge pieces and male flower strands used for pollination depended on the size of the female inflorescences. To ensure fertilization and good fruit set, in both T1 and T2 the female inflorescences were loosely tied with twine to secure the pollen charged sponge pieces and male flower strands within the female flowers. Pollination was carried out during February 2013 by using pollen (T1) and male flowers (T2) from the same male date palms.

Five palms were marked in each experimental block (10 palms/treatment) to record observations on fruit set and fructification. Observations on fruit set in each of the five sample palms were recorded at the khalal fruit stage in three bunches (five strands/bunch). As regards fructification, observations in each of the five sample palms were recorded at the tamar stage in four bunches (five strands/bunch) on the following parameters: (1) fructification (%) and (2) yield per bunch (kg).

The physical characters of fruits (weight and size: length & width) were also recorded at the tamar stage in 100 fruits per palm. Data on all the above parameters were subjected to two sample T test ($P = 0.05$). Results on the above parameters with respect to the sponge and traditional methods of pollination are presented and discussed below.

3. Results and Discussion

Results revealed that fruit set (%) at the khalal fruit stage in both T1 (sponge) and T2 (traditional) were 67.03 and 69.10, respectively and statistically similar (Fig. 1). Results on fructification (%) (56.95 and 54.48, respectively) and yield per bunch (7.32 kg and 6.31 kg, respectively) at the tamar stage were also statistically similar (Figs. 2 and 3). Further, fruit weight (9.54 g and 9.05 g, respectively), width (20.51 mm and 20.70 mm, respectively) and length (39.91 mm and 36.85 mm, respectively) were also similar in the two pollination methods (Figs. 4-6).

Timely pollination when the female flowers are most receptive is crucial to sustain yield levels in date palm. Delaying pollination beyond the seventh day of spathe cracking in Egypt resulted in significant reduction in initial fruit set and bunch weight [7]. It is recommended [8] that the stored pollen first be tested for viability then mixed with filler (e.g., wheat flour,
工业化的非香型滑石粉等。混合物必须在授粉前立即配制。在巴基斯坦，对不同授粉方法（洒粉、雄花套袋、液态授粉以及自然授粉（对照））对日期无花果（Khalas cv）的影响进行了比较。结果显示，放置雄花套袋的方法获得的果实率最高 [9]，这与本研究的传统方法一致。来自沙特阿拉伯的报告指出，手动授粉方法在Khalas品种中产生的果实率优于机械授粉 [10]。我们的结果表明，就果实率、结果发现和其它参数而言，将雄花花丝放置在雌花序中（传统方法）与海绵技术在这些手工授粉方法之间的差异不显著。

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![Graph showing yield/bunch comparison]

**Fig. 3** Effect of pollination method on yield/bunch in date palm (Khalas cv).

![Graph showing fruit weight comparison]

**Fig. 4** Effect of pollination method on fruit weight in date palm.

![Graph showing fruit width comparison]

**Fig. 5** Effect of pollination method on fruit width in date palm.
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4. Conclusions

Based on the results presented above, it is concluded that there is no difference between the sponge and traditional methods of pollination in terms of fruit set, yield and fruit attributes tested in date palm. Therefore, the sponge method of pollination can serve as a viable alternative to the traditional method of pollination especially where male palms are scarce and pollen is difficult to obtain.

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