

EFFECTS OF TIME OF POLLINATION AND OF POLLEN SOURCE

ON YIELD AND FRUIT QUALITY OF 'NAJDA' DATE PALM CULTIVAR (PHOENIX DACTYLIFERA L.) UNDER DRÂA VALLEY CONDITIONS IN MOROCCO

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Abstract

In its strategy of intensifying and extending date palm cultivation, Morocco has succeeded to select and micro-propagate new date palm genotypes known by their high fruit quality and Bayoud disease resistance. Najda (INRA-3014) is one of these highly interesting selected genotypes that were distributed as vitroplants to farmers. However, as a newly introduced cultivar, most growers still lack suitable agricultural techniques for its cultivation. The determination of 1) the period at which the female flowers of Najda date palm remain receptive for pollination and 2) the most suitable pollinator to induce a metaxenia effect is very important to date palm growers. For this objective, six Najda palm trees, 15 years old and grown in the same environment of the Zagora Date Palm Experimental Station, were carefully chosen and used to study the effects of 3 polliniser cultivars including: The Moroccan selected males NP3 and NP4, and a normal male usually used by local growers. Another six palm trees were used for the study of the effect of pollination time and were therefore pollinated at one, seven, ten and fifteen days from female spathe opening. Both experiments were established in a complete randomized bloc design. Obtained results showed that pollination by NP3 or NP4 pollen enhanced

fruit maturity by 10 days, and significantly improved fruit length by 1 cm, fruit width by 3 mm and fruit weight by 35% compared to the control. Furthermore, pollinating Najda flowers between the 7th and the 10th days after spathe opening induced significant increase in the mean fruit set by 70 % while the mean fruit weight remained acceptable (13,14g). Pollinating earlier or after this period, significantly reduced fruit set which in turn resulted in somewhat higher fruit characteristics. Based on these results, it seems reasonable to conclude that Najda cultivar should be pollinated using NP3 or NP4 pollen, particularly between the 7th and the 10th day after spathe opening.

Key words: Date palm, pollination time, metaxenia, fruit set, fruit quality, yield.

Introduction

Date palm pollination plays a key role on the quantity and quality of the produced dates, and therefore its control is of paramount importance. To achieve adequate pollination, some main conditions must be considered, such as:

a) The Knowledge of the period of female flowers receptivity to pollen grains. The duration of this period varies with cultivars, so that pollination outside this period will not

lead to fertilization and consequently results in heavy drop of unfertilized fruits. The period of receptivity generally reaches its optimum at 3 to 4 days from female spathe opening, and may extend up to 13 days depending on the varieties and the climatic conditions (Zaid and Arias, 2002; Sedra, 2003). After the spathe opening, inflorescences are first white-cream (Stage 1), and due to their gradual exposure to sunlight, they turn to yellow-cream color (Stage 2), and finally to green color (Stage 3). In Morocco, growers usually pollinate the majority of their varieties in stage 2 that is during the week following the opening of the spathe. Some varieties such as Bousekri and Aguellid do not pollinate until the 3rd stage, which usually begins 10 to 12 days after the opening of the spathes. Varieties pollinated at the 1st stage (during the first day after the opening of the spathe), are rare.

b) The use of pollen from a male palm with important characters such as the production of the necessary quantity of pollen grains with high fertilization ability and having metaxenic/xenic effects on fruit quality and maturity. This phenomenon of metaxenia has been defined by Swingle (1928), as the effect of pollen on the morphological and physiological characteristics of fruit tissues and seed. Studying these effects in the date palm, Nixon (1955), has selected a group of male palm trees, among which two palms showed extreme metaxenic/xenic effects: Fard No.4, which induces a remarkable precocity associated with a relatively small fruit size, and the Mosque which, on the contrary, produces large fruits but with late maturity.

The time of floral receptivity and the source of the pollen grains are important factors to consider when choosing a combination of varieties for the creation of a new date palm plantation. These factors are also to be considered during

any introduction of new cultivars, in order to prevent future improper pollination technique that will result in an excessive unfertilized fruits drop and consequently low yields.

This is the case of Morocco who has succeeded to select and micro-propagate new date palm genotypes known by their high fruit quality and resistance to Bayoud disease (*Fusarium Oxysporum albedinis*). 'Najda' cultivar is one of these highly interesting genotypes that was distributed as vitroplants to farmers (Sedra, 1993; Zirari, 1998; Zirari and Outlioua, 2003). As a newly introduced cultivar, most growers have not mastered yet its pollination requirements. The present investigation was carried out to solve this situation and aims therefore to determine:

- 1) The period at which 'Najda' female flowers remain receptive for pollination, and
- 2) A suitable pollinator to induce a metaxenia/xenia effect on Najda fruits.

Materials and methods

The present investigation was carried out at the INRA Date Palm Experimental Station in Zagora, located in the Draa Valley to the South East of Morocco. Twelve (12) 'Najda' palm trees, 15 years old, were carefully selected and all their spathes were bagged using kraft paper bags until their use for the experiment. All the selected palm trees undergo the same cultivation practices applied in the Experimental Station. Because of the unavailability of sufficient number of palm trees with sufficient number of inflorescences, we were obliged to undertake this field experiment in two separate trials:

Trial No. 1: On the Effect of Pollen Source

Six 'Najda' palm trees were used in this trial and their inflorescences were pollinated as follows:

Table 1. Average length and width of produced dates according to the pollen source. Values of the same column followed by different letters are significantly different (LSD at 5%).

Pollen Source	Mean fruit Length (cm)	Mean fruit width (cm)
Control	3,41 a	2,29 a
NP3	4,32 b	2,55 b
NP4	4,42 b	2,68 b

Table 2. Fruit set and average fruit weight depending on time of pollination. Values of the same column followed by different letters are significantly different (LSD at 5%).

Pollination time (Days after spathe opening)	Fruit set (%)	Mean fruit weight (g)
1	49,32 a	12,81 a
7	70,27 b	12,11 b
10	69,23 b	14,18 c
15	39,6 c	14,34 c

- ▶ 2-inflorescences per palm tree were pollinated with pollen from the selected male palm 'NP3'
- ▶ 2-inflorescences per palm tree were pollinated with pollen from the selected male palm 'NP4'
- ▶ 2-inflorescences per palm tree were pollinated with a pollen generally used by farmers of the region (Control)

All inflorescences were pollinated at the intermediate stage 2 that is a week after the opening of spathes. With the 3 above treatments, the trial was established in a Randomized Complete Block Design containing 3 blocks (two palm trees each) and 2 individuals (inflorescences) per experimental unit.

Dates were harvested at 4 successive

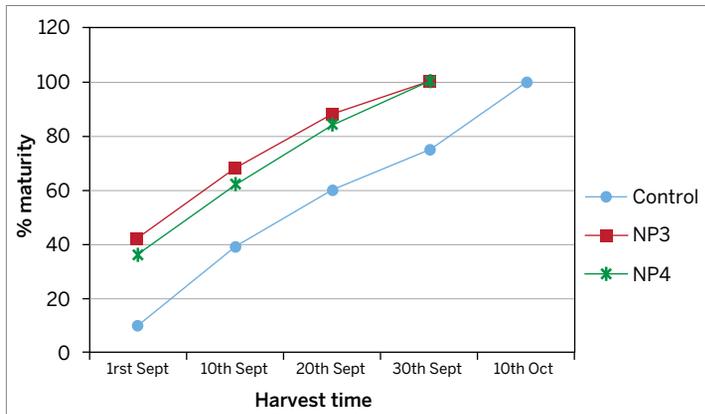


Figure 1. Percentage of stalk maturity as affected by pollen source and harvest time.

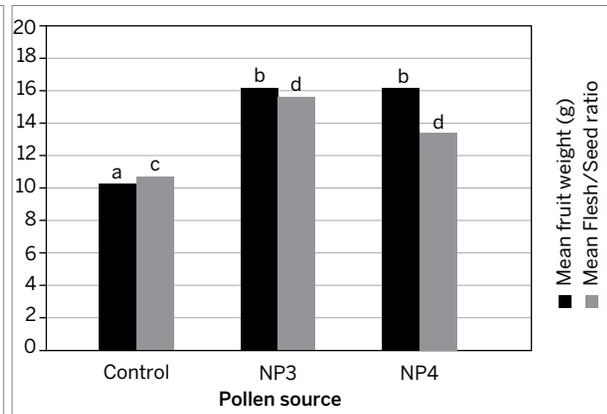


Figure 2. Averages of fruit weight and flesh/seed ratio as affected by the pollen source. Values of column of the same color and followed by different letters are significantly different (LSD at 5%).

periods: 1st, 10th, 20th and 30th of September, as well as the 10th of October of the season. Measured observations concerned the percentage of mature dates in each stalk as well as the length, width and the weight of the fruit. Averages of these parameters were calculated from data of random samples of 100 dates.

Trial No. 2: On the Effect of Time of Pollination:

Six 'Najda' palm trees were used in this trial and their inflorescences were pollinated as follows:

- ▶ 2-inflorescences per palm tree were pollinated at the 1st day after the spathe opening (Stage 1)
- ▶ 2-inflorescences per palm tree were pollinated at the 7th day after the spathe opening
- ▶ (Stage 2)
- ▶ 2-inflorescences per palm tree were pollinated at the 10th day after the spathe opening
- ▶ (Stage 3)
- ▶ 2-inflorescences per palm tree were pollinated at the 15th day after the spathe opening (Stage 4)

Pollen from 'NP3' selected male palm was used in this trial. With the 4 above treatments, the trial was established in a Randomized Complete Block Design containing 3 blocks (Two palm trees each) and 2 individuals (inflorescences) per experimental unit. Fruit harvested was performed on September 20th of the season.

Collected observations concerned the mean percentage of fruit set and the average fruit weight, calculated from data of random samples of 100 dates.

Data statistical analysis of both trials was performed using ANOVA test at 5%, while the means comparison was performed using Fisher's least significant difference at 5%.

Results

The present field investigation showed that both Pollen source and Time of pollination significantly affected the maturity, the dimensions (length and width), and the weight of the produced dates.

Effect of Pollen Source

By using the control pollen, the percentages of mature dates from each of the five harvests times (1st, 10th, 20th, 30th of September and

10th October) were always lower than those obtained with 'NP3' or 'NP4' pollen, and that no significant differences were obtained between these two pollens (Figure 1). Stalk pollinated with 'NP3' or 'NP4' pollen, reached full maturity (more than 80% of mature dates) at 20th of September, whereas those pollinated by control pollen have reached this stage after 30th September, that is 10 days later.

The differences obtained at the stalk full maturity were followed by significant differences in the mean sizes and weights of the produced dates. Analysis of Table 1 shows that the lowest fruit dimensions were obtained when pollination was performed with the control pollen. With inflorescences pollinated using 'NP3' or 'NP4' pollen, the average length and width of the produced dates were higher by more than 1 cm and 3 mm respectively, than the control. However, no significant differences were observed between these two types of pollen; NP3 and NP4.

Parallel to the obtained improvement in fruits dimensions, there was also a marked increase in the average

weight and average flesh/seed ratios of the produced dates. Figure 2 shows that by using the control pollen, the average weight and average flesh/seed ratios were always lower than those obtained when pollination was performed with 'NP3' or 'NP4' pollen, and that no significant differences were obtained between these two pollen types. By using 'NP3' or 'NP4' pollen, we could harvest dates over 16 g of average weight, that is an increase in fruit weight of about 35% compared to the control. In addition, dates from pollination with 'NP3' or 'NP4' pollen got flesh/seed ratios between 14 and 16, which is an improvement of about 28% compared to the control.

Effect of Time of Pollination

The analysis of Table 2 shows that the fruit set percentages and the average weights of produced dates vary depending on the time of pollination. The highest fruit set percentages, 70.27% and 69.23%, were obtained when pollination was performed at the 7th day and 10th day after the spathes opening respectively. Concerning the average fruit weight, the greatest values, 14.18 g and 14.34 g, were obtained when pollination was performed at the 10th and 15th day after spathes opening respectively.

Discussion

The present investigation clearly demonstrated that a significant improvement in dates maturity and size can be achieved through the control of the pollination technique. Our results showed that the maturity and size of 'Najda' date palm cultivar fruits can be significantly improved through the use, at pollination time, of pollen from 'NP3' or 'NP4' selected male palms. Stalks pollinated using these pollens, reached 100% maturity 10 days earlier than those pollinated by the control pollen. Average length and width of the produced dates increased by more than 1 cm and 3 mm respectively, while their average weight increased by more than 35% and their flesh/seed ratio increased

by almost 28%. Dates harvested from stalks pollinated with 'NP3' or 'NP4' pollen were clearly larger and fleshier than those from the control. Such results are comparable to those reported by Nixon (1955), Pereaue-Leroy (1958), and Sedra and Zirari (1998).

The present results also showed that dates size of 'Najda' date palm cultivar can be significantly improved if inflorescences are pollinated at the 7th and the 10th day after spathes opening. Inflorescences pollinated 7 days after the spathe opening resulted in higher rate of fruit set (over 70%) but with relatively lower fruit weights, whereas those pollinated on the 10th day after spathe opening has resulted in greater average fruit weight (over 14 g) however with lower fruit set. These results confirm the fact that good fruit set often results in lower fruit weight, while a low fruit set would generally lead to better fruit weight. Consequently, it became necessary to find a reasonable balance between the fruit set and the average weight of produced dates. To this end, it seems reasonable to conclude that for the Moroccan 'Najda' date palm cultivar, best results for both fruit set percentage and average weight/Size of produced dates can be obtained when pollination is performed between the 7th and the 10th day after spathe opening. Such outcomes on 'Najda' cultivar are similar to those obtained by Chafik (1985) on Mejhouli, Tademamt and Aguellid varieties.

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