

UTILIZATION OF WATER MIST TO SIMULATE THE EFFECT OF RAIN ON FRUIT SET OF “LULU” DATE PALM

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ABSTRACT

Spring rain fall is frequent during the period of date palm pollination in many regions of the world even in the Gulf area. Growers are forced to repeat the pollination process even after light rain fall following pollination which adds to the production costs. Moreover, repeating pollination causes more use of high quality pollens which might be rare in some areas. Scant studies are available about the critical time of rain fall after pollination which reduces fruit set. This study was conducted during 2002 and 2003 seasons to utilize fine water mist to simulate the effect of rain on fruit set of “Lulu” date palm cultivar. Rain was simulated by applying water mist for 3 mins at time intervals following pollination which were 2, 4, 6 and 8 hrs. Ahmar date palm cultivar was used for pollination by dusting using a semi-mechanical pollinator. The study revealed that water mist at 2 hrs intervals following pollination up to 8 hrs caused a significant reduction in the number of fruits per strand. Spraying water mist 8 hrs after pollination was also effective on thinning the strand. No remarkable changes occurred in fruit characteristics at the Kimri stage as a result of water mist applications. This study provided evidences that rain fall even after 8 hrs of pollination caused a significant reduction in fruit set. The magnitude of such reduction did not vary if rain fall occurred after 2, 4 or 6 hrs following pollination in both seasons. It is recommended to study the critical period for

each cultivar after which pollination must be repeated if rain fall occurred since 6 hr that was reported in the literature was not a safe period to avoid repeating the pollination process.

INTRODUCTION

Date palm is the most important fruit crop in the Gulf region. The final yield at harvest is affected by early conditions that prevailed during flowering and fruit set. Rain fall following pollination is one of the important environmental conditions that adversely affect fruit set. Light rain could wash away pollens from the stigma or lead to the burst of pollen tubes before egg fertilization which causes strand thinning. Strand thinning was considered as the most effective mean to increase fruit size and to enhance the quality of dates (Nixon and Crawford, 1942; Nixon 1951, 1956). However, the magnitude of such thinning by rain is not predictable and could mean great losses to producers. Date palm growers have been forced to repeat the pollination process if some rain occurred after pollination. Skillful workers must be available at that time which adds to the production costs. Furthermore, additional amounts of high quality pollen grains must be sufficient to accomplish this job. Light rain during spring is a usual event even in some arid regions as in the Gulf States. Poor sets are often blamed on rain during the pollination period. Studies on the effect of rain, following pollination, on fruit set of date palm are very rare. Even though female inflorescences are exposed to rain during the pollination period, no attention has been made to assess this problem. It was reported that 6 hours or more following pollination was the safe period to avoid any adverse effects of rain on fruit set and this period may vary among cultivars (Al-Jabbouri, 1993). Moreover, rain 6 hours before pollination was reported to reduce the set of date fruits by one quarter to one third (Ream and Furr, 1970, Perea-Leroy, 1958).

The objective of this study was to investigate the possibility of using water mist at different intervals following pollination to simulate rain effects on fruit set of "Lulu" date palm cultivar. The use of "Lulu" was a suitable model system to show the responses to water mist treatments since it is a commercial cultivar with heavy load of fruits on each strand.

MATERIALS AND METHODS

This study was conducted during the two successive seasons 2002 and 2003 using “Lulu” date palm cultivar, grown at Al-Oha Research Station, United Arab Emirates University. Trees were twenty years old, uniform, free of defects and under standard cultural practices. The soil was sandy and the Bubbler system was used for irrigation. Each tree had 10 bunches distributed uniformly around the tree head.

Fully mature female inflorescences of Lulu were pollinated on March 15 and Feb. 21 during the two seasons, respectively by using “Ahmar” cultivar as the pollinator. Pollens of "Ahmar" were collected and mixed with flour in ratio of 1: 9 (v/v) then each female inflorescence was dusted by a semi-mechanical pollinator. Rain was simulated by spraying a fine mist of water from a hand sprayer for 3 minutes after ending the pollination by 2 hours, 4, 6 or 8 hrs. The control female inflorescence stayed without any treatment after pollination. Thus five treatments were used in a randomized complete block design. A random sample of 5 strands per bunch was taken during the Kimri stage on June 5 and 23 in two seasons, respectively. Several parameters were taken to assess the effect of simulated rain following pollination which included: the number of fruits per strand, fruiting zone length per strand, fruit weight, fruit size, flesh weight, fruit length and diameter in the first season, in addition to total soluble solids by using a hand refractometer, titratable acidity and vitamin C content in the fruit based on the procedures reported in A.O.A.C (1984). Three replications were used with each treatment where one female inflorescence represented one replication. Statistical analyses to obtain the analysis of variance (ANOVA) were performed by using SAS computer software (2000) while the least significant difference was used to compare the means by the same software.

RESULTS AND DISCUSSION

The effect of water mist at time intervals after pollination on the number of fruits per strand at the Kimri stage was shown in Tables 1 and 2. The data revealed that all water mist treatments caused a significant reduction in the number of fruits per strand as compared with the control in both seasons. The magnitude of the reduction caused by spraying water mist after 2, 4, and 6 hours after pollination did not significantly vary among treatments. Even water spray after 8 hours of pollination caused higher reduction in the number of fruits per strand than that obtained with 6 hours interval in the first season and tended to further reduce such number in the second season. Thus, with Lulu female inflorescence, exposure to water mist even after more than 6 hours of pollination was still able to markedly reduce the number of fruits on the strand in both seasons.

The length of the fruiting zone on the strand was measured as an indicator to the distribution of the fruits on the same strand. The data in Tables 1 and 2 showed that even though the number of fruits per strand was reduced by water mist treatments following pollination, but set fruits were distributed over a similar distance to that found in the control. This indicated that formed fruits were sparsely distributed which improved ventilation around them. The only significant reduction in the fruiting zone was obtained with water mist after 8 hours of pollination in the second season.

Fruit weight, size and flesh weight, generally, did not change significantly as a result of spraying water mist after pollination especially when spraying was done after 6 and 8 hours in both seasons. A considerable increase in these physical fruit parameters was found only in the first season.

Fruit length of the control and treatments did not significantly vary at the beginning of Kimri stage in both seasons. Even different spray intervals did not lead to any significant change in fruit length at this stage of fruit development (Tables 1 and 2).

Fruit diameter was not, generally, affected by spraying water mist following pollination since there was no consistent trend in both seasons. However, water mist after 6 and 8 hours of pollination tended to give higher values of fruit diameter.

In addition to the determined physical parameters of the fruit at the beginning of the Kimri stage, some chemical parameters were taken in the second season (Table 2). The data showed that there were no significant differences between the TSS of the control fruits and those of various water mist intervals. Moreover, none of the treatments was superior in TSS value when compared with others.

Fruit acidity, however, significantly decreased by water mist treatments applied after pollination by 4, 6, or 8 hours as compared with that of the control.

Vitamin C content in the fruit at this stage of development was not affected by any of the mist intervals following pollination. Even with these intervals, no appreciable influence was found on vitamin C as compared with others.

The present study provided evidence that exposing pollinated female inflorescence to simulated rain at different time intervals caused a significant reduction in fruit set of Lulu dates whether applied pollens were exposed to water mist after 2, 4, 6, or 8 hours after pollination (Fig. 1). Poor sets are often blamed on rain during pollination since it washes away much of the pollen previously applied or causes the burst of pollen tubes (Frag, 2005). Zaid and De Wet (2002) also reported that rain takes away most of the applied pollens and may also reduce fruit set in date palm by lowering the temperature.

Péreau-Leroy (1958) after exposing female inflorescence to simulated rain at intervals of 2 hours after pollination found no effect on fruit set after 6 hrs or more. Similar conclusion was reached by Zaid and De Wet (2002) who reported that any pollination operation immediately preceded or followed by rain on date palm (4 to 6 hours) must be repeated. However, 6 hours was not a safe period, in this study, since a significant reduction in fruit set occurred when water mist was applied after 8 hrs of pollination.

Thus, it is important for date palm growers to keep in mind that cultivars may vary in their response to rain following pollination. In this respect, Ream and Furr (1970) found that under conditions favoring rapid drying of water mist after pollination, application of such mist even 60 mins after pollination did not reduce fruit set. Furthermore, Nixon and Carpenter (1978) considered that the amount of any particular rain is of less importance than the conditions under

which it occurs. They reported that a light shower accompanied by prolonged period of cloudy weather and high relative humidity may cause more damage than heavy rain followed by clear weather and dry wind.

This study provided evidence that fruit set of Lulu date palm cultivar was adversely affected by simulated rain even after more than 6 hours of pollination and the reduction in the number of fruits per strand due to that could range from about 37 to 52 %. Meanwhile, rain after 6 hours of pollination must not be considered as a safe period for all date palm cultivars with regard to its effect on fruit set.

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Fig.1. A photograph of Lulu strands taken early at the Hababouk stage showing the effect of simulated rain after 4 hrs of pollination on fruit set as compared with the control (no rain).

Table 1. Number of fruits per strand and some fruit characteristics of Lulu dates at the Kimri stage as influenced by spraying fine mist at intervals following pollination during 2002 season.

Treatments	Number of Fruits / Strand (cm)	Fruiting Zone / Strand (cm)	Fruit Weight (g)	Fruit Size (cm ³)	Flesh Weight (g)	Fruit Length (cm)	Fruit Diameter (cm)
Control	34.42* a	23.75 a	3.50 c	3.42 b	2.88 c	2.06 a	1.74 c
Water mist (2 h)	21.50 bc	24.33 a	4.05 ab	3.92 ab	3.37 ab	2.17 a	1.86 ab
Water mist (4 h)	21.08 bc	23.50 a	4.31 a	4.17 a	3.61 a	2.21 a	1.89 a
Water mist (6 h)	22.50 b	25.08 a	3.73 bc	3.42 b	3.07 bc	2.15 a	1.81 bc
Water mist (8 h)	16.25 c	21.42 a	3.61 bc	3.50 b	3.01 bc	2.08 a	1.79 bc

* Values, with a column, of similar letters were not significantly different when means were compared by using the least significant difference (LSD) at 0.05 level.

Table 2. Number of fruits per strand and some fruit characteristics of Lulu dates at the Kimri stage as influenced by spraying fine mist at intervals following pollination during 2003 season.

Treat ments	Number of Fruits / Strand	Fruiting Zone / Strand (cm)	Fruit Weight (g)	Fruit Size (cm ³)	Flesh Weight (g)	Fruit Length (cm)	Fruit Diameter (cm)	TSS (%)	Acidity (%)	Vitamin C (mg / 100 ml)
Control	37.64* a	29.07 a	5.40 a	5.83 a	4.40 a	2.58 a	2.00 ab	12.00 a	0.13 a	4.08 a
Water mist (2 h)	25.47 b	26.93 ab	5.60 a	6.33 a	4.56 a	2.52 a	1.96 b	12.00 a	0.11 ab	4.08 a
Water mist (4 h)	26.67 b	30.00 a	5.70 a	5.92 a	4.60 a	2.58 a	2.01 ab	12.50 a	0.11 b	4.08 a
Water mist (6 h)	27.60 b	28.07 ab	6.12 a	6.25 a	4.97 a	2.58 a	2.10 a	13.50 a	0.11 b	4.08 a
Water mist (8 h)	23.70 b	24.27 b	6.13 a	6.17 a	5.01 a	2.64 a	2.06 ab	13.00 a	0.11 b	4.08 a

* Values, with a column, of similar letters were not significantly different when means were compared by using the least significant difference (LSD) at 0.05 level.

الملخص العربي

الاستفادة بالرداذ المائي كوسيلة لمحاكاة أثر الأمطار على عقد ثمار نخيل البلح صنف لولو

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تحدث أمطار الربيع بشكل متكرر أثناء فترة تلقيح الاغاريض المؤنثة لنخيل البلح في مناطق عديدة من العالم وحتى في منطقة الخليج العربي . ويضطر مزارعو النخيل لتكرار عملية التلقيح حتى بعد حدوث الأمطار الخفيفة مما يزيد من تكاليف الانتاج كما تؤدي عملية تكرار التلقيح الى استخدام المزيد من حبوب اللقاح عالية الجودة والتي قد تكون نادرة في بعض المناطق. هناك دراسات قليلة متيسرة حول موضوع الفترة الحرجة لسقوط الأمطار بعد التلقيح والتي تؤدي لتقليل عقد الثمار في نخيل البلح. أجري هذا البحث خلال موسمي 2002 ، 2003 للاستفادة بالرداذ المائي الدقيق لمحاكاة أثر الأمطار على عقد ثمار نخيل البلح صنف لولو ، وتم محاكاة الأمطار عن طريق رش الرداذ المائي لمدة 3 دقائق بعد فترات كانت 2، 4، 6، 8 ساعات من إجراء التلقيح، وقد استخدم الملقح من صنف "أحمر" عن طريق التعفير باستخدام عفارة نصف ميكانيكية. وقد وجد أن الرداذ المائي بعد 2، 4، 6 ساعات كان فعالاً في تقليل عدد الثمار بكل شمراخ وأيضاً الرش المتأخر بعد 8 ساعات من التلقيح أدى لتقليل عدد الثمار معنوياً على الشمراخ، ولم تحدث بصفة عامة تغيرات واضحة في صفات الثمار في تلك الفترة من الطور الكمرى نتيجة معاملات محاكاة الأمطار. أثبتت تلك الدراسة أهمية مراعاة آثار الأمطار بعد التلقيح حتى لو حدث بعد 8 ساعات للصنف لولو حيث تقلل العقد بشكل معنوي كما لم يختلف قدر هذا الانخفاض اذا كان سقوط الأمطار بعد 2، 4 أو 6 ساعات في كلا الموسمين. ويوصى بدراسة الفترة الحرجة لكل صنف والتي نحتاج بعدها لاعادة التلقيح اذا هطلت الأمطار حيث أن ماقررته المراجع بست ساعات لم تكن كافية في حالة الصنف لولو.

