

Yield and Fruit Quality of Zaghoul Date Palms In Relation to Using New Technique of Pollination

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Abstract: During 2011 and 2012 seasons, Zaghoul date palms were pollinated through traditional method or via pollen suspensions at various concentrations (1.0, 2.0, 4.0 or 6.0 g pollens/l water) Pollens were mixed with 2 ml treacle + 2.0 g ascorbic acid + 1.0 g boric acid per each litre of water. Pollination was carried out throughout two days after female spathes cracking at the day time of afternoon by inserting ten fresh male strands / female spathe (traditional method) or with using the four investigated pollen suspensions. The study focused on the effect of this new technique of pollination on yield and fruit quality. Pollination with pollen suspensions containing 1.0 to 6.0 g pollens / litre of suspension caused a considerable promotion on the percentages of initial fruit setting and fruit retention %, yield, bunch weight as well as fruit weight and dimensions and flesh % in relative to pollination with traditional method. All chemical quality characters except total acidity% tended to reduce with carrying out pollination by pollen suspensions comparing with pollination by traditional; methods. In most cases, increasing concentration of pollens in the suspension from 4 to 6 g had no material effect on all the studied parameters. Carrying out pollination by spraying suspension of pollens containing 4.0 g pollens + 2 ml treacle + 2.0 g ascorbic acid + 1.0 g boric acid / 1 liter water through two day after female spathes cracking at the day time of afternoon was responsible for promoting yield and fruit quality of Zaghoul date palms. Therefore, the composting processes could be optimized by the application of the developed simulation model.

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1. Introduction

Pollination process of date palms is considered the most important horticultural practices in date palms orchards for obtaining an economical yield and fruits with better quality. The traditional method of pollination included the use of seven to ten male strands inside each female spathe just it opens. Pollination is repeated and normally carried out at the day time of afternoon. It was carried out by ascending the workers on the female date palms. Since this method is a very dangerous for the workers and need more experience and times especially when the palms are longer. Therefore, trials were made for finding out a new technique for pollination of date palms depends on using suspensions of grains applied by sprayers and did not need ascending the palms.

Previous studied showed that pollination by dusting or spraying pollens mixed with different carriers had an announced effect on yield and fruit quality in various date palm cvs rather than pollination with the traditional method (Mostafa, 1994; El- Kassas *et al.* 1995; El- Khawaga, 1995; El-Shazly, 1999; El- Sese *et al.*, 2000a and 2000b; El- Sese *et al.*, 2001; Hussein and Hassan, 2001; Hammam *et al.* 2002; Soliman and El- Kosary, 2002; Ashour *et al.*, 2004; Ragab *et al.*, 2004; El- Agamy *et al.*, 2008; Abdel – Galil *et al.*, 2008; El- Sese *et al.*, 2010 and Eshmawy, 2010).

The target of this study was adjusting the

optimum concentrations of pollen grains applied with pollen suspension containing 2 ml treacle, 2.0 g ascorbic acid 1.0 g boric acid per one liter water for enhancing pollination efficiency, fruit setting, yield and fruit quality of Zaghoul date palms.

2. Material and Methods

This experiment was carried out during 2011 and 2012 seasons at the experimental Orchard of Qena, Agriculture Faculty, South Valley Univ., Egypt. Fifteen Zaghoul date palms of uniform vigour 16-years old healthy with no visual nutrient deficiency planted in sandy loam soil at 10x 10 meters apart were selected. Number of bunches per palm was adjusting to ten bunches by removing earlier, later and weakened bunches. Leaf bunch ratio was maintained at 8 : 1 according to **Sayed (2002)**. One Zaghoul male date palm was specified to avoid metaxinia phenomenon. All the selected palms were subjected to standard horticultural practices as defined for the particular orchard except of those related to pollination process which was subjected to the study palm.

For prepared of fresh pollen grains, eight fully ripening male spathes were detached and the male strands were excised from them. The pollen grains were extracted by shaking the strands on a white paper sheet. Then, the pollens were separated from other floral parts by using thin silk bolters (Mesh

80). The extracted pollen grains were put in paper sacks till the times of pollination. Pollen viability was tested using the aceto- carmine stain. One drop of 1% aceto- carmine dye was placed on glass slide and then, as small amount of pollens was dispersed. A cover slip was placed on the slide and allowed to stand for few seconds. Finally; the slides were examined under the microscope for pollen viability. Colorless or unstained pollen grains were considered non- viable. Several counts at various fields were examined to determine the percentage of viability (**Al- Taher and Asif, 1985**).

This study consisted from the followed five treatments from different pollination treatments:

- 1- Carrying out hand pollination by traditional methods by inserting ten male strands / female spathe.
- 2- Carrying out pollination by spraying pollen suspension containing 1.0 g pollens/ I water.
- 3- Carrying out pollination by spraying pollen suspension containing 2.0 g pollens/ I water.
- 4- Carrying out pollination by spraying pollen suspension containing 4.0 g pollens/ I water.
- 5- Carrying out pollination by spraying pollen suspension containing 6.0 g pollens/ I water.

Each treatment was replicated three times, one palm per each. The investigated pollen suspension contains 2 ml treacle + 2.0 g ascorbic acid + 1.0 g boric acid per one liter water besides the four amounts of pollen namely 1.0, 2.0, 4.0 or 6.0 pollens. Pollination with traditional method or with spraying pollen suspensions was carried out throughout two days after female spathes cracking at the day time of afternoon (according to **Omar, 2007**). Pollination was repeated as long as the female spathes opens. After pollination ended, all the bunches were tied to the nearest leaf and covered with a marked paper sack. The paper sacks were removed after four weeks of pollination and the bunch was marked with the treatment number (**Osman, 1979**).

The experiment was arranged in a randomized complete block design (RCBD) with three replications, one palm per each.

Initial fruit setting was determined in three labeled bunches six weeks after carrying out pollination. Five strands were randomly marked on each bunch and then percentage of initial fruit setting was calculated by dividing number of fruits by number of total flowers and multiplying the product x 100. One week before harvesting, the five marked. Strands were collected from each bunch. Then, the number of fruits was counted and the percentage of fruits retention was estimated by dividing number of fruits just before harvesting date by the number of total flowers and multiplying the product x 100.

At ripening stage, when 3-4 fruits on each

bunch were reached softening stage, yield expressed in weight (kg) was recorded. Bunch weight (kg.) was estimated by dividing yield by 10 (number of bunches/ palm). Fifty fruits from each bunch were randomly selected to determine the averages fruit weight (g.) and dimensions(length and width in cm.), average flesh weight, then the percentage of flesh weight was calculated, T.S.S.% using handy refractometer. Total and reducing sugars as well as total acidity % (as g malic acid /100 g pulp) were also determined according to **A.O.A.C. (1995)**.

Statistical analysis was done according to **Mead et al. (1993)** using new L.S.D. at 5% for comparing among different treatment means.

3. Results and Discussion

1- Fruit setting, yield and bunch weight:

Data in table (1) clearly show that carrying out pollination with different pollen suspensions containing 1.0 to 6.0 g pollens/ I water significantly improved the percentages of initial fruit setting and fruit retention, yield and bunch weight comparing with pollination by conventional methods. The promotion was significantly associated with increasing the amount of pollens in the suspension. Increasing the amounts of pollens in the suspension from 4.0 to 6.0 had no significant effect on these parameters. The maximum values were recorded on the palms that pollinated with pollen suspension containing 6.0 g pollen/ I water, but since no significant differences on these parameters among pollination using 4.0 or 6.0 g pollens/ I water, the recommended concentrations was using 4.0 g pollens in one litre water. Pollination with the traditional method gave the minimum values. These results were true during both seasons.

2- Fruit quality:

Data in Tables (2 & 3) clearly show that conducting pollination by using pollen suspensions containing 1 to 6 grains/ I water was significantly accompanied with improving fruit quality in terms of increasing fruit weight and dimensions, flesh weight %, T.S.S. %, total and reducing sugars % and decreasing total acidity % in relative to pollination with the conventional method. There was a gradual promotion on all physical characters of the fruits (fruit weight & dimensions and flesh weight %) with increasing concentrations of pollen grains from 1.0 to 6.0 / I water. However, the vice versa was detected concerning chemical quality parameters. Increasing concentrations of pollens in the pollen suspension was significantly followed by a gradual reduction on T.S.S. % as well as total and reducing sugars and promotion on total acidity. Increasing concentrations of pollen in the suspension from 4 to 6 g / I water failed significantly to show measurable effect on both

physical and chemical characteristics of the fruits. Using pollen suspension containing 4.0 g pollen for

pollination is considered important from economical point of view in this respect.

Table (1): Effect of different concentration of pollen grains on the suspension / I water on the percentages of initial fruit setting and fruit retention, yield / palm bunch weight (kg.) of Zaghoul date palms during 2011 and 2012 seasons.

Treatment	Initial fruit setting%		Fruit retention %		Yield/ palm (kg.)		Bunch weight(kg.)	
	2011	2012	2011	2012	2011	2012	2011	2012
1- traditional pollination	49.1	50.0	37.1	38.3	195.0	200.0	19.5	20.0
2- Pollination with 1.0 g pollens / I water	53.0	54.0	40.0	41.3	210.0	217.0	21.0	21.7
3- Pollination with 2.0 g pollens / I water	55.0	55.3	44.0	45.0	230.0	235.0	23.0	23.5
2- Pollination with 4.0 g pollens / I water	64.0	64.9	55.8	56.3	249.0	253.0	24.9	25.3
2- Pollination with 9.0 g pollens / I water	65.0	65.3	56.0	56.5	250.0	255.0	25.0	25.5
New L.S.D. at 5%	2.0	1.8	2.1	2.2	4.7	4.9	1.7	1.6

Table (2): Effect of different concentration of pollen grains on the suspension / I water on the some physical characters of the fruits of Zaghoul date palms during 2011 and 2012 seasons.

Treatment	Fruit weight (g.)		Fruit length (cm.)		Fruit width (cm.)		Flesh weight %	
	2011	2012	2011	2012	2011	2012	2011	2012
1- traditional pollination	22.0	22.3	4.7	4.8	2.1	2.2	77.2	77.5
2- Pollination with 1.0 g pollens / I water	23.1	23.3	5.1	5.1	2.4	2.5	79.9	80.2
3- Pollination with 2.0 g pollens / I water	24.7	25.0	5.5	5.5	2.7	2.8	82.3	82.7
2- Pollination with 4.0 g pollens / I water	25.9	26.2	5.8	5.9	2.9	3.0	84.9	85.2
2- Pollination with 9.0 g pollens / I water	26.0	26.3	5.9	6.0	3.0	3.1	85.0	85.3
New L.S.D. at 5%	0.6	6.7	0.3	0.2	0.2	0.2	2.0	1.9

Table (3): Effect of different concentration of pollen grains on the suspension / I water on some chemical characteristics of the fruits of Zaghoul date palms during 2011 and 2012 seasons.

Treatment	T.S.S. %		Total sugars %		Reducing sugars %		Total acidity %	
	2011	2012	2011	2012	2011	2012	2011	2012
1- traditional pollination	51.0	51.6	40.0	40.3	29.1	29.0	0.195	0.194
2- Pollination with 1.0 g pollens / I water	50.0	50.5	38.3	39.0	28.5	28.4	0.220	0.225
3- Pollination with 2.0 g pollens / I water	49.1	49.6	47.0	37.1	27.9	27.7	0.250	0.250
2- Pollination with 4.0 g pollens / I water	48.2	48.8	36.0	36.1	27.0	26.4	0.280	0.281
2- Pollination with 9.0 g pollens / I water	47.1	47.3	35.1	35.3	26.4	26.0	0.301	0.309
New L.S.D. at 5%	0.8	0.9	1.0	1.0	0.5	0.6	0.022	0.025

4. Discussion

The outstanding effect of pollination with using pollen suspensions containing pollens, ascorbic acid, treacle and boric acid on yield and fruit quality of Zaghoul date palms in relative to pollination with the conventional method might be attributed to the promotion on fertilization efficiency as well as the increase in pollens germination. The great effect was attributed to using ascorbic acid and boric acid (Eshmawy, 2008). The promotion on fruiting was associated with increasing pollen concentrations. It is possible for replacing fruit thinning by reducing concentration of pollens in the suspension and at the same time promoting fruit quality (Mostafa, 1994).

These results are in agreement with those

obtained by (El- Kassas *et al.* 1995; El- Khawaga, 1995 ; El-Shazly, 1999; El- Sese *et al.* 2000a and 2000b; El- Sese *et al.* 2001; Hussein and Hassan, 2001; Hammam *et al.* 2002; Soliman and El-Kosary, 2002; Ashour *et al.* 2004; Ragab *et al.* 2004; El- Agamy *et al.* 2008 ; Abdel – Galil *et al.* 2008; El-Sese *et al.* 2010 and Eshmawy, 2010).

Conclusion

For enhancing fruit retention, yield and fruit quality of Zaghoul date palms, it is suggested to carrying out pollination by spraying pollen suspension containing 4.0 g pollen grains + 2ml treacle + 2.0 g ascorbic acid + 1.0 g boric acid per one liter water throughout two days after female spathes cracking at

the day time of afternoon pollination must be repeated when needed.

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