

INFLUENCE OF NUTRIENTS SPRAY APPLICATION ON THE YIELD AND FRUIT QUALITY OF "ZAGHLOUL" DATE PALM CULTIVAR

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ABSTRACT

This experiment was conducted during the two successive seasons (2009 and 2010 years) on 30 years old "Zaghloul" date palms grown in calcareous soil. Labeled female uniform date palms were submitted to the usual farm management such as irrigation, pollination, pruning and soil fertilization with both mineral (N, P, K and S) and organic (animal manure) fertilizers to investigate the influence of spraying some macro and micro- elements on the yield and their fruit physical and chemical quality characteristics. Fruit bunches were sprayed two times with N (250 & 500 ppm), K (500 & 1000 ppm), B (1000 & 2000 ppm) and Zn (250 & 500 ppm) at Kimri stage for the first time and at Khalal stage for the second time. The obtained results indicated that all the studied treatments significantly improved the yield of "Zaghloul" date palms, however both of boron and nitrogen treatments were superior. Fruit weight and flesh/seed ratio significantly were improved especially with zinc, that resulted in increasing flesh weight. Meanwhile, potassium, boron and zinc treatments improved both of the TSS (%) and total sugars (%) while decreased fruit juice acidity (%) and soluble tannins (%).

Key words: Date palm, spray application, macro and micro- elements.

INTRODUCTION

Date palm "*Phoenix dactylifera* L." is the tree of life and one of the oldest fruit crops known around the world. It has been considered one of the most important fruits not only in the Arab countries but also in other Middle Eastern/North African countries. The date palm can grow well in harsh environmental conditions, such as drought, salinity, high temperature, and poor soils. Date palm is the most successful and important subsistence crop in most of the hot arid desert regions (Botes and Zaid, 1999).

Dates have been used as a major/main staple food for several thousands of years. Their high energy value and good store-ability make dates a wise choice of crop in places where they can be grown. Date palm cultivation has been expanding all over Egypt. In Egypt, dates are important traditional crops. According to FAO (2009), Egypt ranks the first country of the top ten date producers (1,130,000 tones). Economically, "Zaghloul" date is the most important soft cultivar grown in Egypt. It is usually harvested and consumed at Khalal stage when fruits reach full maturity and are crunchy and red in color. As date palm is considered one of the suitable trees for the new reclaimed desert regions, most of the date palms produced in Egypt are grown in sandy, loam and sandy loam or even in a carbonate rich soil. These types of soils may become deficient in N, P, K, Mg and B (Tisdale and Nelson, 1978). It has also been reported that large amounts of macro and microelements are depleted annually from the soil as a result of high crop yields and pruning of leaves (El-Shurafa, 1984). Several investigations have been studied the fruit physical and chemical properties of various date palm cultivars; and the factors that affected their composition. But little investigations searching the nutrient spray applications to avoid soil in the extend regions.

Nourish effect of macro and micro elements had important role in fruit set, retention development and lead to increasing yield and improving fruit quality. While soil application can supply enough nutrients to improve plant production, it also causes world-wild concerns about environmental contamination for nutrients leaching

into ground water (Dinnes et al., 2002). Thus, the objective of this study was to examine the effect of foliar application on yield and fruit quality of "Zaghloul" date palm.

MATERIALS AND METHODS

This experiment was conducted in two successive growth seasons (2009 and 2010 years), at Nubaria Horticulture Research Station orchard under the calcareous soil conditions on 30 years old date palm trees "Zaghloul cv.". Labeled female uniform date palm trees were submitted to the usual farm management such as irrigation, soil fertilization pollination and pruning. The organic fertilizer (animal manure) was added at winter (mid of December) as one dose while the mineral fertilizer (Ammonium sulphate 500 g plus potassium sulphate 250 g) was added on two doses (the 1st dose was mixed with organic fertilizer in winter and the 2nd dose was added at the end of May (during fruit growth period). Thus, each palm received 1000 g of rock phosphate and 500 g of mineral sulphur at the time of animal manure addition. The experimental treatments were as follows: (1) distilled water (control), (2) nitrogen (250 ppm), (3) nitrogen (500 ppm), (4) potassium (500 ppm), (5) potassium (1000 ppm), (6) boron (1000 ppm), (7) boron (2000 ppm), (8) zinc (250 ppm) and (9) zinc (500 ppm). Nitrogen was added in the form of Urea (46%), while potassium was added as potassium sulphate (K_2SO_4) (49%), boron was added as boric acid (H_3BO_3) and zinc was added as zinc sulphate ($ZnSO_4$). The applied chemical solutions were provided with wetting agent (Tween-20) to reduce the surface tension and increase the contact angle of droplets. Selected palms were thinned to eight bunches after Hababouk stage. Fruit bunches were sprayed twice, at Kimri stage for the first time and at Khalal stage for the second time. Samples were collected at harvest stage (The first week of October). The obtained data were tabulated and analyzed using Completely Randomized Block Design (CRBD) with 9 treatments and four replications according to Steel and Torrie (1980). Yield of studied palms was expressed as kg per palm at harvest. Furthermore, physical fruit characteristics such as fruit weight (g), length and diameter (cm), flesh weight (g), seed weight (g) and flesh/ seed ratio were determined. Fruit chemical characteristics were determined as follows:

total soluble solids percentage (TSS%) in fruit juice was measured using hand refract-meter, juice acidity percentage (as malic acid) was titrated (A.O.A.C., 1995), total sugars percentage was determined in dried fruit flesh under 56 Co in an oven until constant weight (Malik and Singh1980), total protein (%) according to Jackson (1967) and dry matter percentage was taken after drying fruit flesh samples under 65 Co until constant weight.

RESULTS AND DISCUSSION

1- Yield of palm (kg / palm):

Data of Table (1) indicated that yield of palm statistically was affected by experimental treatments. Yield of control treatment was significantly lower in the two studied seasons (78.3 and 79.1 kg/ palm for 1st and 2nd seasons, respectively) as compared with those of all other treatments. Yield of boron at 2000 (ppm) treatment significantly was superior but without significant difference as compared with yield of nitrogen at 500 (ppm) treatment in the 1st and 2nd seasons (130 and 126 kg/ palm for 1st season; 133 and 133 kg/ palm for the 2nd season, respectively). Yield of potassium treatments at (500 and 1000 ppm) and zinc treatments (250 and 500 ppm) have no significant differences in the 1st study season (99.2 and 99.8 kg/palm; 93.9 and 99.1 kg/palm, respectively). However, yield of boron 2000 (ppm) treatment was significantly superior the yield of both zinc treatments in the two seasons of study, Table (1). These results were in line with those of El-Sayed El-Badawy and El-Dengawy (2001) on Hayany cv. date palm, Khayyat et al. (2007) on Shahany cv. date palm and El-Sehrawy (2008) on Anna apple trees. But, Yogaratnam and Greenham (1982) have shown that urea spray on apple trees did not increase the yield.

2- Fruit weight (g):

Table (1) indicated that, fruit weight of control treatment significantly was lower than that of all other studied treatments (20.3 and 21.3 g for the 1st and 2nd seasons, respectively). In addition, fruit weight of both nitrogen and boron treated fruits significantly was superior all other studied treatments without significant differences for the two studied seasons. As for the potassium and zinc treatments, fruit weight values were significantly medium without significant

differences. These results were in agreement with those of El-Sayed El-Badawy and El-Dengawy (2001) on Hayany cv. date palm and Mengel (2002) on gases plants.

3- Seed weight (g):

Data tabulated in Table (1) indicated that differences among values of seed weight were not significant. It means that seed weight trait was not significantly affected by all experimental factors in the two seasons of study. Likewise, the differences were found among the fruit weights were due to flesh weight differences not due to seed weight differences. These results were in harmony with those of El-Assar and El-Kouny (2010) on Zaghoul cv. date palm.

4- Flesh/ seed (ratio):

Data of Table (1) cleared that flesh/ seed ratio of the control significantly was the lowest in comparison with those of other treatments in the two studied seasons (7.25 and 7.34 for 1st and 2nd seasons, respectively). This could be explained on the basis that fruit weight of control significantly was lowest, regardless the seed weight trait. On the other hand, flesh/ seed ratio for nitrogen (250 & 500 ppm), boron (1000 & 2000 ppm) and zinc (250 & 500 ppm) treatments significantly were greater than that of potassium (500 & 1000 ppm) concentrations without significant differences in the two seasons of study. These results were in line with those of El-Sayed El-Badawy and El-Dengawy (2001) on Hayany cv. date palm and Khayat et al (2007) on Shahany cv. date palm.

Table (1): The effect of experimental treatments on yield, fruit and seed weight as well as flesh/ seed ratio traits of "Zaghloul" date palm cultivar in 2009 and 2010 years.

Studied treatments	Yield (kg/palm)		Fruit weight (g)		Seed weight (g)		Flesh/seed (ratio)	
	2009	2010	2009	2010	2009	2010	2009	2010
Control	78.3	79.1	20.3	21.3	2.8	2.9	7.25	7.34
N (250 ppm)	115	119	29.6	29.8	2.9	2.9	10.21	10.28
N (500 ppm)	126	133	30.1	31.4	3.0	3.1	10.03	10.13
K (500 ppm)	99.2	98.9	25.4	25.2	2.9	2.8	8.76	9.00
K (1000 ppm)	99.8	102	25.7	26.4	2.8	2.9	9.18	9.10
B (1000 ppm)	121	129	28.8	30.5	2.7	2.8	10.67	10.89
B (2000 ppm)	130	133	30.2	32.1	2.8	2.9	10.79	11.07
Zn (250 ppm)	93.9	92.8	25.5	25.6	2.4	2.5	10.63	10.24
Zn (500 ppm)	99.1	96.9	27.1	26.6	2.5	2.5	10.84	10.64
LSD (0.05)	6.5	5.9	1.9	1.7	N.S	N.S	0.85	0.95

5- Total soluble solids percentage (TSS %):

Total soluble solids percentage values significantly were affected by the various treatments in the two seasons when compared with each other. Data in Table (2) showed that TSS (%) values related with potassium (500 ppm), potassium (1000 ppm), boron (1000 ppm) and boron (2000 ppm) treatments significantly were higher than all other TSS (%) values in the 1st study season without significant differences (24.15, 24.75, 24.15 and 24.85 %, respectively). TSS (%) values of both zinc treatments (250 and 500 ppm) came second

without significant difference (23.00 and 23.10 %) followed by both nitrogen treatments (250 and 500 ppm) without significant difference (20.55 and 20.75 %) while TSS (%) of control treatment significantly was the lowest value (18.20 %). TSS (%) values of all treatments had taken the same significant trend in the 2nd season (Table 2). These results were in line with those of Basha and Shaheen (1986) on Nebut Seif and Ruzeizi cvs. date palm, El-Sayed El-Badawy and El-Dengawy (2001) on Hayany cv. date palm and El-Sehrawy (2008) on Anna apple trees. While Khayyat et al. (2007) on Shahany cv. date palm reported that TSS (%) property not significantly affected by similar treatments.

6- Fruit acidity (%):

Fruit juice acidity percentage values significantly were affected by all the experimental treatments during the two seasons, Table (2). Data indicated that both of zinc concentrations (250 & 500 ppm) tended to cause relatively greater juice acidity percentage than other treatments in the two seasons (1.41 and 1.38 (%) for the 1st season; 1.39 and 1.35 (%) for the 2nd season, respectively). Values of studied criterion related with nitrogen (250 & 500 ppm), and boron (1000 & 2000 ppm) treatments significantly ranked second without significant differences between the two levels of each factor (1.48, 1.45, 1.50 and 1.48 (%) for the 1st season, respectively and 1.48, 1.44, 1.51 and 1.48 (%) for the 2nd season, respectively). Meanwhile, juice acidity (%) which related with both of potassium treatments (500 & 1000 ppm) significantly ranked third without significant difference, (Table 2). Always, control treatment leads to absolute highest value of fruit juice acidity (1.80 and 1.78 (%) for the 1st and the 2nd seasons, respectively). Bacha and Abo-Hassan (1983) on Khudari cv. date palm, El-Kouny *et al.* (2004) on Zaghoul cv. date palm and El-Assar (2005) on Zaghoul cv. date palm studied the mineral and organic fertilization and found similar results. Also, these results agree with those of El-Sehrawy (2008) who studied the influence of mineral, bio and organic fertilization on Anna apple trees. Bacha *et al.* (1995) reported similar results on grape with zinc foliar application.

7- Total sugars percentage (%):

Data of Table (2) cleared that this parameter significantly had affected by the studied factors. Boron (1000 & 2000 ppm) and nitrogen (500 ppm) treatments significantly caused the high total sugars (%) values in comparison with all other studied treatments and levels in the two seasons of study without significant differences (80.45, 80.45 and 80.35 (%), respectively for the 1st season; and 80.75, 80.65 and 80.75 (%), respectively for the 2nd season). Data tabulated in Table (2) illustrated that no significant difference was found between related trait values of either two boron levels or two zinc levels in the two studied seasons. Low significant value of total sugar (%) was related with control treatment in the two seasons of study (70.25 and 70.15 (%)) for the 1st and 2nd season, respectively). Marzouk and Kassem (2011) found similar results when studied the application of organic and/or mineral fertilizers to improving fruit quality, nutritional value and yield of "Zaghloul" dates. On the other side, El-Sehrawy (2008) found that both of the used treatments of organic and bio fertilization significantly increased the total sugar (%) of Anna apple fruits as compared with those of mineral.

8- Soluble tannins percentage (%):

Results reported in Table (2) showed that soluble tannins (%) values significantly affected by the studied treatments in the 1st season. Whereas, all studied factors and their levels have absolute low soluble tannins (%) values without significant differences as compared with control treatment's value. While, no significant differences have noticed among values related with all the studied factors, levels and control treatments in the 2nd season. These results are in line with those of El-Sayed El-Badawy and El-Dengawy (2001) on Hayany cv. date palm and those of El-Assar and El-Kouny (2010) on Zaghloul cv. date palm.

9- Total protein (%):

Table (2) illustrated significant impact of studied treatments on total protein percentage, whereas N at (500 ppm) lead to a significant increase in total protein as compared with other treatments in the two seasons (2.10 and 2.12% for the 1st and 2nd seasons, respectively). Followed by N at (250 ppm) which have significant difference as compared with all other treatments in the two seasons of study (1.99 and 2.00% for the 1st and 2nd seasons, respectively). Control

treatment significantly had the lowest value without significant difference in comparison with K at (500 and 1000 ppm) and B at (100 ppm) in the two studied seasons. Moreover, data of Table (2) indicated that Zn at (500 ppm) lead to the high protein percentage as compared with control, K at (500 and 1000 ppm) and B at (1000 and 2000 ppm) in the two seasons of study beside Zn at (250 ppm) in the 1st season. These results were in line with those of Abd El-Zaher (2008) on Barhee cv. date palm and Soliman and Al-Obeed (2011) on “Khalas” and “Nabut-Sif” date palm cultivars.

Table (2): The effect of experimental treatments on fruit quality traits of "Zaghloul" date palm cultivar in 2009 and 2010 years.

Studied treatments	TSS (%)		Fruit juice acidity (%)		Total sugars (%)		Soluble tannins (%)		Total protein (%)	
	2009	2010	2009	2010	2009	2010	2009	2010	2009	2010
Control	18.20	17.95	1.80	1.78	70.25	70.15	0.26	0.23	1.68	1.72
N (250 ppm)	20.55	20.65	1.48	1.48	79.50	80.10	0.20	0.20	1.99	2.00
N (500 ppm)	20.75	20.95	1.45	1.44	80.35	80.75	0.20	0.19	2.10	2.12
K (500 ppm)	24.15	24.25	1.61	1.60	79.85	79.75	0.20	0.19	1.68	1.69
K (1000 ppm)	24.75	25.15	1.58	1.56	78.75	78.65	0.21	0.20	1.72	1.72
B (1000 ppm)	24.15	24.55	1.50	1.51	80.45	80.75	0.20	0.22	1.68	1.69
B (2000 ppm)	24.85	24.95	1.48	1.48	80.45	80.65	0.21	0.19	1.75	1.76
Zn (250 ppm)	23.00	23.05	1.41	1.39	79.85	79.85	0.19	0.18	1.88	1.90
Zn (500 ppm)	23.10	23.05	1.38	1.35	79.70	79.75	0.19	0.19	1.92	1.92
LSD (0.05)	0.85	0.75	0.03	0.04	0.15	0.15	0.03	N.S	0.07	0.06

CONCLUSION

It can conclude that the spraying of macro and micro-elements on date fruits during mature stages helps the fruits to increase its size and improve its quality.

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الملخص العربي

تأثير معاملات الرش ببعض المغذيات المعدنية الكبرى والصغرى على صفات

محصول نخيل البلح "صنف الزغول"

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أجريت هذه الدراسة بمزرعة محطة بحوث البساتين بالنوبارية (مصر) خلال موسمي النمو 2009 و 2010 على أشجار نخيل البلح " صنف الزغول" بعمر 30 سنة والناميه بالتربه الجيريه. وقد تلقت أشجار النخيل المختارة للدراسة المعاملات البستانيه المعتاده مثل: الري، التلقيح، التقليم، التسميد المعدني (نتروجين، فوسفور، بوتاسيوم وكبريت) والتسميد العضوي (روث حيواني)؛ وذلك لدراسة تأثير رش سباطات الثمار ببعض المغذيات المعدنية الكبرى (نيتروجين و بوتاسيوم) والصغرى (بورون و زنك) بتركيزات مختلفة على صفات المحصول الناتج كما ونوعاً. وقد أجرى الرش مرتين خلال موسم النمو: الأولى في مرحلة "القمرى" والثانيه في مرحلة "الخلال". أوضحت النتائج المتحصل عليها أن كل المعاملات المدروسة قد حسنت محصول النخلة وأن معاملات عنصرى النيتروجين والبورون كانت متفوقة معنوياً. كما تحسنت صفات وزن الثمرة ونسبة اللحم /البذرة، وخاصة لمعاملات عنصر الزنك التي ربما أدت إلى زيادة وزن اللحم. بينما أدت معاملات عناصر البوتاسيوم والبورون والزنك لتحسين النسبة المئوية لكل من المواد الصلبة الذائبة الكلية والسكريات الكلية بجانب تخفيض كل من النسبة المئوية لحموضة عصير الثمار والتانينات الذائبة.