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Relation of Fruiting in Seewy Date Palm Cultivar with Spraying Boric Acid and Calcium Nitrate

Amany, O.M. Osman[1]; Ashmawy , M E[1]; Y.M.S. Diab[2]; Wala , A.M. Eid[3]

[1]Tropical Fruits Res. Dep., Hort. Res. Inst., ARC , Giza , Egypt
[2]Central Lab. Date Palm Res. and Develop., ARC , Giza , Egypt
[3]Food Sci. and Tech., New Valley Univ., Egypt

*** Corresponding author**
Amany, O.M. Osman

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ABSTRACT

The objective of this work to study the influence of foliar application of boric acid (0, 125, 250 and 500 ppm) and calcium nitrate (0, 1%, 2% and 3%) on fruit set and yield as well as fruit quality of Seewy date palm cultivar growing in El Dakhla Oasis, New Valley governorate during two successive seasons (2021, 2022), palms were treated with different rates of boric acid (zero, 125, 250 and 500 ppm) and sprayed with calcium nitrate at rates (zero, 1%, 2% and 4%).

Results showed that all studied treatments had significant effect on fruit set and total yield compared with the control treatment in both experimental seasons.

Spraying boric acid at 500 ppm with calcium nitrate at 2% in both seasons gave the best results of fruit set and total yield. In addition, this combination gave the highest T.S.S content, total sugars and reducing sugars; in contrast, the lowest values of total acidity in two studied seasons.

Keywords: Date palm, boric acid, calcium nitrate, fruit set, yield

INTRODUCTION

Date palm (phoenix dactylifera L.) is considered an old fruit in many countries all over the world. It's concerned as one of the important crops in arid and semi-arid regions of the world (Abd El Messeih et al., 2010). Its fruits play an important role in the nutrition pattern of many people, it plays a domestic role in the economic and social life of the population of these countries. Date palm is widely distributed in different districts of Egypt. There are three main types of dates based on fruit moisture content (soft, semi dry and dry). Seewy date palm is one of the most important semi dry varieties that are suitable for packaging and storage, it's considered to be one of the most important varieties for local market and exportation. This cultivar is concentrated in New Valley, Al Bahareya Oasis, Al Fayoum and Al Giza Governorate (Jaradat and Zaid, 2004).

Fertilization is one of the important affecting yield and fruit quality of date palm where foliar spraying micronutrients was used as an alternative or supplementary method (Mengel and Kirkby, 2001).

Boron is one of essential micronutrients for plants (Goldberg, 1997) which is reported to be more important during plant reproductive growth stages (Brown and Shelp, 1997). It has an effect on many functions of the plant such as hormone movement, active salt absorption, flowering and fruiting process and pollen germination especially its effects on the directionally of pollen tube growth (Robbertse et al., 1990; Wojcik and Wojcik, 2003; Baldi et al., 2004; Khayyat et al., 2007; Abd El- Fattah et al., 2008)

Calcium is one of essential nutrients to plants it's required for cell elongation, cell division (Rizzi and Abruzzese, 1990), enzymatic reactions, gives the equilibrium of both anions and cations in the plant and plays a main role in cell membrane stabilization (Stebbins et al., 1972).

This study aims to evaluate the influence of spraying boric acid and calcium nitrate on fruiting, yield and fruit quality of cv. Seewy date palm.

MATERIALS AND METHODS

This investigation was carried out during two successive seasons (2021 and 2022) in a private orchard located at Mut village, El Dakhla Oasis, New Valley governorate, Egypt (latitude 25° and longitude 29°) on 20 years old cv. Seewy date palm (phoenix dactylifera) grown on sandy clay soil. This study was to evaluate the influence of foliar application of boric acid (0, 125, 250 and 500 ppm) and calcium nitrate (0, 1%, 2% and 4%) on fruit set and yield as well as fruit quality of Seewy date palm cultivar. The selected palms were planted at space 8×8 meters apart, and uniform as possible in growth, vigor, height, pollen source and they were subjected to the normal cultural practices. Pollination was carried out by using the same pollen source; the leaf bunch ratio was maintained in both seasons by the end of the blooming season to meet the value of 9:1. The drip irrigation with one line per single row and promising micro flapper emitters were used. each palm received about 60 liters/hour of irrigation water from five drippers.

Split plot design with three replications is used in this experiment. The main plots were assigned for calcium nitrate rates; meanwhile subplots were assigned for boric acid rates.

All previous treatments were sprayed three times at full bloom (the last weeks of March, April and May) in two growing seasons.

Fruit set and fruit retention were evaluated one month after pollination stage as well as at harvested stage, respectively. Randomly, 5 female strands per bunch were selected from each replicate. Fruit set percentage and fruit retention was calculated as the following equations:

$$\text{Fruit set}\,(\%) = \frac{\text{Number of fruits per strand}}{\text{Number of fruits set strand} + \text{Number of flower scars}} \text{x}\,100$$

$$\text{Fruit retention } (\%) = \frac{\text{N number of retained fruits}}{\text{Number of retained fruits} + \text{Number of flower scars}} \text{ x } 100$$

Bunch weight (kg) and total yield (kg) per palm were recorded at tamer stage for all treatments.

At the maturity stage, sample of 25 fruits were taken randomly from each treatment to determine some physical properties of fruit such as fruit weight (g), fruit length (cm), fruit width (cm). Total soluble solids% (TS S) in fruit juice was determined by hand refractometer. Total acidity was determined as malic acid percentage **(A.O.A.C., 1995)**. Total and reducing sugars were determined in the methanol extract using the phenol sulphoric acid method and the percentage was calculated on dry weight basis according to **(Dubois *et al*., 1956)**, while non-reducing sugars were calculated as the difference between total sugars and reducing sugars.

Statistical analysis:

Statistical analysis is carried out according to **Snedecor and Cochran (1989)**. Means of treatments were tested for significant differences using the method of New least significant differences (New L.S.D) described by **Waller and Duncan (1969)**.

RESULTS AND DISCUSSION

1-Fruit set and fruit retention:

Spraying calcium nitrate significantly improved fruit set and fruit retention in both seasons (Tables 1and 2).

Data revealed that spraying calcium nitrate at the rate of 2% gave the highest value the fruit set (Table 1). Applying calcium nitrate at the rate of 4% came in the next rank followed by calcium nitrate at rate 1%. On the other hand, the lowest value was recorded by control (spraying with water only).

Data in Table (1) show clearly that there was a significant effect of boric acid rates on fruit set in 2021 and 2022 seasons. Applying boric acid at the rate of 500 ppm gave the highest values of fruit set (66.7 and 67.2%) as compared with all other boric acid treatments in both seasons, respectively. On the contrary, palm treated without boric acid (spraying with water only) gave lowest fruit set (49.6 and 49.2%) in both seasons, respectively.

The positive effect of boric acid was increased with increasing calcium nitrate rates up to 2%. Application of H_3BO_3 at the rate of 500 ppm in combination with Ca $(NO_3)_2$ at the rate of 2% gave the highest values (74.4and 76.2%) of fruit set% followed by boric acid at rate 250 ppm under the same rate of calcium nitrate (72.8 and 73.2%); on the other hand, the lowest values of fruit set% were recorded by control treatment (45.6 and 44.2%) in both seasons, respectively.

Fruit retention was significantly affected by increasing calcium nitrates up to 2%, then it was decreased with increasing calcium nitrate to 4% (Table 2). The highest values (64.6 and 64.8%) of fruit retention were recorded by spraying palms with 2% of Ca $(NO_3)_2$ in both seasons. Meanwhile, the lowest values (45.5 and 45.2%) were observed by applying water only.

The effect of boric acid rates on fruit retention was significant in 2021 and 2022 seasons (Table 2). This character was significantly increased with an increasing boric acid rate in both seasons. Application of the highest rate of boric acid (500 ppm) gave the maximum values (63.6 and 63.7%) of fruit retention as compared with all other boric acid rates. On the other hand, the lowest fruit retention (49.2 and 49.2%) was obtained without boric acid.

The interaction between Ca $(NO_3)_2$ and H_3BO_3 express great and significant effects on fruit retention. In all tested boric acid treatments, calcium nitrate rates produced the highest fruit retention compared with control. The highest values of fruit retention were recorded by palms treated with 2% of Ca $(NO_3)_2$ combine with 500 ppm of H_3BO_3 followed by 1% of Ca $(NO_3)_2$ with the mentioned rate of H_3BO_3 in the first season. Meanwhile, applying H_3BO_3 at the rate of 500 ppm followed by 250 ppm with 2% of Ca $(NO_3)_2$ in the second season. On the contrary, the minimum values were recorded for palms sprayed with water (control).

Table (1): Effect of calcium nitrate and boric acid on fruit set (%) of Seewy date palm.

2021						2022					
Calcium nitrate	Boric acid				Mean	Calcium nitrate	Boric acid				Mean
	(b1) zero	(b2) 125 ppm	(b3) 250 ppm	(b4) 500 ppm			(b1) zero	(b2) 125 ppm	(b3) 250 ppm	(b4) 500 ppm	
(a1) zero	45.6	50.2	50.8	51.9	49.6	(a1) zero	44.2	49.7	51.2	51.8	49.2
(a2) 1%	54.5	64.1	72.3	70.7	65.4	(a2) 1%	55.3	64.2	72.8	70.4	65.7
(a3) 2 %	56.2	67.5	72.8	74.4	67.7	(a3) 2 %	55.7	68.4	73.2	76.2	68.4
(a4) 4%	55.7	68.3	70.2	69.8	66	(a4) 4%	54.6	69.3	70.8	70.4	66.3
Mean	53	62.5	66.5	66.7	62.2	Mean	52.5	62.9	67	67.2	62.4
New LSD 0.05 Calcium nitrate					0.04	New LSD 0.05 Calcium nitrate					0.07
New LSD 0.05 Boric acid					0.04	New LSD 0.05 Boric acid					0.04
New LSD 0.05 Interaction					0.09	New LSD 0.05 Interaction					0.08

Table (2): Effect of calcium nitrate and boric acid on fruit retention (%) of Seewy date palm.

2021						2022					
Calcium nitrate	Boric acid				Mean	Calcium nitrate	Boric acid				Mean
	(b) zero	(b_2) 125 ppm	(b_3) 250 ppm	(b_4) 500 ppm			(b_1) zero	(b_2) 125 ppm	(b_3) 250 ppm	(b_4) 500 ppm	
(a_1) zero	40.6	46.2	46.4	48.8	45.5	(a_1) zero	39.4	45.6	46.7	49.2	45.2
(a_2) 1%	50.4	61.8	68.7	70.2	62.8	(a_2) 1%	51.2	62.2	68.5	69.7	62.9
(a_3) 2 %	52.3	64.4	69.8	71.9	64.6	(a_3) 2 %	51.9	64.3	70.6	72.4	64.8
(a_4) 4%	53.6	63.5	64.1	63.3	61.1	(a_4) 4%	54.1	64.2	65.3	63.4	61.8
Mean	49.2	59	62.3	63.6	58.5	Mean	49.2	59.1	62.8	63.7	58.7
New LSD 0.05 Calcium nitrate					0.04	New LSD 0.05 Calcium nitrate					0.07
New LSD 0.05 Boric acid					0.04	New LSD 0.05 Boric acid					0.05
New LSD 0.05 Interaction					0.07	New LSD 0.05 Interaction					0.09

These results may be attributed to the improving nutritional status, pollen grains germination and pollen tube elongation due to boron nutrition due to boron and calcium nutrition (**Qin, 1996; Hassan, 2000; Nijjar, 1985**).

Abdel Hafeez *et al.* (2010) and Taylor *et al.* (1994) reported Similar results, they found that boron played an important role in maintaining high pollen viability and germination.

2- Bunch weight and total yield:

Calcium nitrate significantly affect the bunch weight and total yield (Tables 3 and 4). Foliar application of Ca $(NO_3)_2$ at rates 2% and 1% resulted in significantly higher bunch weight and total yield compared to the other Ca $(NO_3)_2$ treatments. The highest bunch weight and total yield were obtained from palms treated with 2% of Ca $(NO_3)_2$, followed by palms sprayed with 1% of Ca $(NO_3)_2$. On the other hand, spraying palms with water only (control) gave significantly lower values of bunch weight and total yield.

Increasing boric acid rates from 0 to 500 ppm significantly increased fruit set and fruit retention in both seasons as shown in Tables (3 and 4). Foliar application of H_3BO_3 at the rate of 500 ppm gave the highest bunch weight and total yield as compared with all other boric treatments in 2021 and 2022 seasons,

respectively. Meanwhile, the lowest bunch weight and total yield were obtained without boric treatment.

Data illustrated that treating palms with boric acid and calcium nitrate increased bunch weight and total yield as compared to the control treatment in both seasons. The highest values of bunch weight (10.2 and10.3 kg) and total yield (99.7 and 100.1 kg) were obtained from spraying boric acid at the rate of 500 ppm combined with calcium nitrate at rate 2%, followed by treatment contained on boric acid at the rate of 250 ppm mixed with calcium nitrate at rate 2% (9.9 and 9.8 kg) for bunch weight and (99.0 and 98.0 kg) for total yield in both seasons, respectively. On the other hand, the lowest bunch weight (6.5 and 6.7 kg) and total yield (65.0 and 67.0 kg) were recorded by control treatment (sprayed palms with water only) in both seasons, respectively. Increasing bunch weight and total yield due to boric acid and calcium nitrate may be attributed to their effect on increasing fruit set. In addition, it may be attributed to the role of boron in enhancing many metabolic processes such as carbohydrate transport **(Marschner, 1995; Mengel and Kirkby, 2001)**. These results are in harmony with those obtained by **Al-Hamoudi (2006)**; **Etman *et al.* (2007)**; **Atalla *et al.* (2007)**; **Desouky *et al.* (2007)**; **Harhash and Abd El-Nasser (2010)**, reported that potassium and boron fertilization increased yield of date palm. In this context, boron and calcium have a significant effect in increasing fruit set and total yield of date palm.

Table (3): Effect of calcium nitrate and boric acid on bunch weight (kg) of Seewy date palm.

2021						2022					
Calcium nitrate	Boric acid					Calcium nitrate	Boric acid				
	(b_1) zero	(b_2) 125 ppm	(b_3) 250 ppm	(b_4) 500 ppm	Mean		(b_1) zero	(b_2) 125 ppm	(b_3) 250 ppm	(b_4) 500 ppm	Mean
(a_1)zero	6.5	7.2	8	8.3	7.5	(a_1)zero	39.4	45.6	46.7	49.2	45.2
(a_2) 1%	7.3	8	8.6	9.8	8.4	(a_2) 1%	6.7	7.3	8.1	8.1	7.6
(a_3) 2 %	8.6	9.5	9.9	10.2	9.6	(a_3) 2 %	7.5	8	8.5	9.7	8.4
(a_4) 4%	8.4	8.9	9	9.7	9	(a_4) 4%	8.5	9.6	9.8	10.3	9.6
Mean	7.7	8.4	8.9	9.5	8.6	Mean	8.3	8.9	9	9.6	9
New LSD 0.05 Calcium nitrate					0.05	New LSD 0.05 Calcium nitrate					0.04
New LSD 0.05 Boric acid					0.05	New LSD 0.05 Boric acid					0.04
New LSD 0.05 Interaction					0.1	New LSD 0.05 Interaction					0.08

Table (4): Effect of calcium nitrate and boric acid on total yield (kg/palm) of Seewy date palm.

2021						2022					
Calcium nitrate	Boric acid					Calcium nitrate	Boric acid				
	(b_1) zero	(b_2) 125 ppm	(b_3) 250 ppm	(b_4) 500 ppm	Mean		(b_1) zero	(b_2) 125 ppm	(b_3) 250 ppm	(b_4) 500 ppm	Mean
(a_1)zero	65	72	80	81	74.5	(a_1)zero	67	73	80	83	75.8
(a_2) 1%	72	80	96	97	86.3	(a_2) 1%	75	80	85	97	84.3
(a_3) 2 %	80	95	99	99.7	93.4	(a_3) 2 %	85	96	98	100.1	94.8
(a_4) 4%	84	88	89	95.7	89.2	(a_4) 4%	82	88	89	95	88.5
Mean	75.3	83.8	91	93.3	85.8	Mean	77.3	84.3	88	93.8	85.8
New LSD 0.05 Calcium nitrate					0.78	New LSD 0.05 Calcium nitrate					0.27
New LSD 0.05 Boric acid					0.43	New LSD 0.05 Boric acid					0.32
New LSD 0.05 Interaction					0.85	New LSD 0.05 Interaction					0.63

3- Fruit physical characteristics:

The effect of different rates of calcium nitrate on fruit weight, fruit width and fruit length are presented in Tables (5, 6 and 7). Presented data reveal that fruit weight, fruit width and fruit length tended to increase with increasing Ca $(NO_3)_2$ rates. The highest values of mentioned traits were recorded by palms treated with Ca $(NO_3)_2$ at rate 2%. Whereas, the lowest value of untreated palms observed previous traits.

Data in Tables (5, 6 and 7) that applications of boric acid at rates 0, 125, 250 and 500 ppm were significantly increased fruit weight and dimensions. Sprayed palms with high rate of boric acid maximized fruit weight (10.91 and 11.04 g), fruit width (2.65 and 2.66 cm) and fruit length (3.64 and 3.66 cm) in 2021 and 2022 seasons, respectively

Combined application of Ca $(NO_3)_2$ and H_3BO_3 improved physical characteristics of date palm fruits in the two studied seasons compared with control treatment. Response of fruit physical characteristics to the boric acid and calcium nitrate combinations was different from one character to another. The best values of fruit weight (11.80 and 11.98 g) were recorded by spraying 500ppm boric acid combined with 2% calcium nitrate, followed by boric acid at the same rate mixed with calcium nitrate at rate 1% which reached (11.50 and 1.54 g) in two successive seasons respectively. The highest values of fruit width (2.77, 2.79 cm) were observed by spraying boric acid at the rate of 500 ppm combined with calcium nitrate at the rate of 2% (2.77 and 2.79 cm) followed by boric acid at rate 500 ppm combined with calcium nitrate at the rate of 4% (2.75 and 2.74 cm) in 2021 and 2022, respectively. The highest values of fruit length (3.99 and 4.00 cm) were obtained by spraying boric acid at the rate of 500 ppm combined with calcium nitrate at the rate of 2%, followed by boric acid at the rate of 250 ppm mixed with calcium nitrate at the rate of 2% (3.95 and 3.96 cm) in two seasons, respectively. Meanwhile, the lowest values of fruit weight (8.27 and 8.39 g), fruit width (2.36 and 2.35 cm) and fruit length (3.12 and 3.15 cm) were observed by control treatment in both seasons, respectively. Improving fruit physical characters may be attributed to the improvement of fruit growth and uptake of both Ca and/or B nutrients that accelerate metabolic processes. **Sarrwy *et al.* (2012)**. reported Similar finding

Table (5): Effect of calcium nitrate and boric acid on fruit weight (g) of Seewy date palm.

2021						2022					
Calcium nitrate	Boric acid				Mean	Calcium nitrate	Boric acid				Mean
	(b_1) zero	(b_2) 125 ppm	(b_3) 250 ppm	(b_4) 500 ppm			(b_1) zero	(b_2) 125 ppm	(b_3) 250 ppm	(b_4) 500 ppm	
(a_1) zero	8.27	9.38	9.87	9.88	9.35	(a_1) zero	8.39	9.35	9.89	10.16	9.45
(a_2) 1%	8.47	10.64	11.2	11.5	10.45	(a_2) 1%	8.52	10.65	11.4	11.54	10.53
(a_3) 2 %	9.44	10.66	11.4	11.8	10.83	(a_3) 2 %	9.34	10.69	11.6	11.98	10.9
(a_4) 4%	9.78	9.88	10.25	10.45	10.09	(a_4) 4%	9.75	9.87	10.3	10.46	10.1
Mean	8.99	10.14	10.68	10.91	10.18	Mean	9	10.14	10.8	11.04	10.24
New LSD 0.05 Calcium nitrate					0.003	New LSD 0.05 Calcium nitrate					0.009
New LSD 0.05 Boric acid					0.004	New LSD 0.05 Boric acid					0.006
New LSD 0.05 Interaction					0.008	New LSD 0.05 Interaction					0.013

Table (6): Effect of calcium nitrate and boric acid on fruit width (cm) of Seewy date palm.

2021						2022					
Calcium nitrate	Boric acid				Mean	Calcium nitrate	Boric acid				Mean
	(b_1) zero	(b_2) 125 ppm	(b_3) 250 ppm	(b_4) 500 ppm			(b_1) zero	(b_2) 125 ppm	(b_3) 250 ppm	(b_4) 500 ppm	
(a_1) zero	2.36	2.4	2.46	2.47	2.42	(a_1) zero	2.35	2.44	2.46	2.48	2.43
(a_2) 1%	2.41	2.49	2.49	2.62	2.5	(a_2) 1%	2.42	2.48	2.49	2.63	2.51
(a_3) 2 %	2.49	2.6	2.6	2.77	2.62	(a_3) 2 %	2.49	2.61	2.62	2.79	2.63
(a_4) 4%	2.48	2.59	2.59	2.75	2.6	(a_4) 4%	2.48	2.59	2.58	2.74	2.6
Mean	2.44	2.52	2.54	2.65	2.54	Mean	2.44	2.53	2.54	2.66	2.54
New LSD 0.05 Calcium nitrate					0.002	New LSD 0.05 Calcium nitrate					0.001
New LSD 0.05 Boric acid					0.003	New LSD 0.05 Boric acid					0.001
New LSD 0.05 Interaction					0.005	New LSD 0.05 Interaction					0.002

Table (7): Effect of calcium nitrate and boric acid on fruit length (cm) of Seewy date palm.

2021						2022					
Calcium nitrate	Boric acid				Mean	Calcium nitrate	Boric acid				Mean
	(b_1) zero	(b_2) 125 ppm	(b_3) 250 ppm	(b_4) 500 ppm			(b_1) zero	(b_2) 125 ppm	(b_3) 250 ppm	(b_4) 500 ppm	
(a_1) zero	3.12	3.23	3.33	3.35	3.26	(a_1) zero	3.15	3.29	3.35	3.36	3.29
(a_2) 1%	3.25	3.36	3.5	3.5	3.4	(a_2) 1%	3.26	3.37	3.52	3.54	3.42
(a_3) 2 %	3.35	3.49	3.95	3.99	3.7	(a_3) 2 %	3.36	3.48	3.96	4	3.7
(a_4) 4%	3.36	3.4	3.45	3.71	3.48	(a_4) 4%	3.35	3.42	3.44	3.73	3.49
Mean	3.27	3.37	3.56	3.64	3.46	Mean	3.28	3.39	3.57	3.66	3.47
New LSD 0.05 Calcium nitrate					0.003	New LSD 0.05 Calcium nitrate					0.005
New LSD 0.05 Boric acid					0.003	New LSD 0.05 Boric acid					0.004
New LSD 0.05 Interaction					0.006	New LSD 0.05 Interaction					0.008

4- Fruit chemical characteristics:

Data in Tables (8, 9, 10 and 11) show chemical fruit characteristics of Seewy date palm as TSS, total sugars, reducing sugars and total acidity. These were significant effects of increasing calcium nitrate rates from 0 to 4%. Using this compound at the rate of 3% was superior in increasing TSS (73.9 and 75.3%), total sugar (63.9 and 66.8%) and reducing sugar (29.1 and 30.1%) compared to the other rates. Meanwhile, the same rate gave the minimum content of total acidity (0.258 and 0.289%).

Spraying boric acid at rates of 0, 125, 250 and 500 ppm enhances fruit chemical characteristics. Data reported that 500 ppm of boric acid surpassed other treatments in increasing TSS (74.1 and 75.3%), total sugars (64.1 and 66.3%) and reducing sugars (28.9 and 29.8%) in both seasons. On the other hand, this rate minimized total acidity (0.291%) in the second season.

The combination of boric acid and calcium nitrate increased significantly from previous traits expect total acidity. Date palms that treated with boric acid at rate 500 ppm mixed with calcium nitrate at rate 2% gave the highest T.S.S content (75.4, 77.40 %), total sugars (65.2 and 68.5%) and reducing sugars (30.5 and 31.4%); on contrast, the lowest values of total acidity (0.258 and 0.268%) were observed with

the same combination control treatment in two seasons respectively.

Protein synthesis, transport of sugars and carbohydrates metabolism required for boron **(Hansch and Mendel, 2009)**, while calcium is required for cell elongation and cell division **(Rizzi and Abruzzese, 1990)**.

Table (8): Effect of calcium nitrate and boric acid on TSS (%) of Seewy date palm.

2021						2022					
Calcium nitrate	Boric acid				Mean	Calcium nitrate	Boric acid				Mean
	(b1) zero	(b2) 125 ppm	(b3) 250 ppm	(b4) 500 ppm			(b1) zero	(b2) 125 ppm	(b3) 250 ppm	(b4) 500 ppm	
(a1) zero	68.8	70.7	72	72.3	70.9	(a1) zero	69.1	70.9	72.3	72.6	71.2
(a2) 1%	69.9	71.7	73.7	73.8	72.3	(a2) 1%	70.3	72	74	74	72.6
(a3) 2 %	71.6	73.3	75.3	75.4	73.9	(a3) 2 %	72.3	74.3	77.3	77.4	75.3
(a4) 4%	71.3	73	75.3	75	73.7	(a4) 4%	72.3	74	77	77.1	75.1
Mean	70.4	72.2	74.1	74.1	72.7	Mean	71	72.8	75.2	75.3	73.6
New LSD 0.05 Calcium nitrate					0.16	New LSD 0.05 Calcium nitrate					0.06
New LSD 0.05 Boric acid					0.14	New LSD 0.05 Boric acid					0.04
New LSD 0.05 Interaction					0.37	New LSD 0.05 Interaction					0.08

Table (9): Effect of calcium nitrate and boric acid on total sugar (%) of Seewy date palm.

2021						2022					
Calcium nitrate	Boric acid				Mean	Calcium nitrate	Boric acid				Mean
	(b_1) zero	(b_2) 125 ppm	(b_3) 250 ppm	(b_4) 500 ppm			(b_1) zero	(b_2) 125 ppm	(b_3) 250 ppm	(b_4) 500 ppm	
(a_1) zero	59.6	60.8	62	63.3	61.4	(a_1) zero	60.3	61.4	62.6	62.8	61.8
(a_2) 1%	60.5	62.5	62.9	63	62.2	(a_2) 1%	61.9	64	65.3	65.4	64.2
(a_3) 2 %	62.4	63	65	65.2	63.9	(a_3) 2 %	64.2	65.9	68.4	68.5	66.8
(a_4) 4%	62.3	62.7	64.9	65	63.7	(a_4) 4%	63.7	65.7	68.3	68.4	66.5
Mean	61.2	62.2	63.7	64.1	62.8	Mean	62.5	64.3	66.2	66.3	64.8
New LSD 0.05 Calcium nitrate					0.11	New LSD 0.05 Calcium nitrate					0.14
New LSD 0.05 Boric acid					0.08	New LSD 0.05 Boric acid					0.1
New LSD 0.05 Interaction					0.16	New LSD 0.05 Interaction					0.21

Table (10): Effect of calcium nitrate and boric acid on reducing sugar (%) of Seewy date palm.

2021						2022					
Calcium nitrate	Boric acid				Mean	Calcium nitrate	Boric acid				Mean
	(b_1) zero	(b_2) 125 ppm	(b_3) 250 ppm	(b_4) 500 ppm			(b_1) zero	(b_2) 125 ppm	(b_3) 250 ppm	(b_4) 500 ppm	
(a_1) zero	25	25.7	26.4	26.5	25.9	(a_1) zero	25.4	26.1	26.9	27	26.4
(a_2) 1%	26	27	28	28.3	27.3	(a_2) 1%	26.3	28	29	29.3	28.2
(a_3) 2 %	27.3	28.3	30.3	30.5	29.1	(a_3) 2 %	28.3	29.3	31.3	31.4	30.1
(a_4) 4%	27	28	30	30.3	28.8	(a_4) 4%	28	29	30.7	31.3	29.7
Mean	26.3	27.3	28.7	28.9	27.8	Mean	27	28.1	29.5	29.8	28.6
New LSD 0.05 Calcium nitrate					0.09	New LSD 0.05 Calcium nitrate					0.17
New LSD 0.05 Boric acid					0.06	New LSD 0.05 Boric acid					0.14
New LSD 0.05 Interaction					0.13	New LSD 0.05 Interaction					0.31

Table (11): Effect of calcium nitrate and boric acid on total acidity (%) of Seewy date palm.

2021						2022					
Calcium nitrate	Boric acid					Calcium nitrate	Boric acid				
	(b_1) zero	(b_2) 125 ppm	(b_3) 250 ppm	(b_4) 500 ppm	Mean		(b_1) zero	(b_2) 125 ppm	(b_3) 250 ppm	(b_4) 500 ppm	Mean
(a_1) zero	0.391	0.36	0.32	0.329	0.35	(a_1) zero	0.384	0.44	0.328	0.325	0.369
(a_2) 1%	0.36	0.316	0.26	0.279	0.304	(a_2) 1%	0.359	0.323	0.3	0.299	0.32
(a_3) 2 %	0.319	0.279	0.259	0.258	0.279	(a_3) 2 %	0.321	0.299	0.269	0.268	0.289
(a_4) 4%	0.32	0.28	0.26	0.259	0.28	(a_4) 4%	0.322	0.3	0.271	0.27	0.291
Mean	0.348	0.309	0.275	0.281	0.303	Mean	0.347	0.341	0.292	0.291	0.317
New LSD 0.05 Calcium nitrate					0.008	New LSD 0.05 Calcium nitrate					0.031
New LSD 0.05 Boric acid					0.006	New LSD 0.05 Boric acid					0.028
New LSD 0.05 Interaction					0.016	New LSD 0.05 Interaction					0.085

CONCLUSION

Boron and calcium elements are very important for fruit set, fruit retention and Total yield. Based on the results obtained from this study, it's concluded that spraying Seewy with boron and calcium had a positive effect on fruit set, fruit retention, fruit quality and yield, so the promising treatment contains on boric acid at the rate of 500ppm combination with calcium nitrate at the rate of 2% which recorded the highest values concerning fruit characteristics fruit set, fruit retention and yield, Also physical and chemical properties.

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علاقة الإثمار في نخيل البلح السيوى برش حامض البوريك ونترات الكالسيوم

أماني عثمان مصطفى عثمان[1]، عماد محمد عشماوي[1]، يوسف مصطفى سيد دياب[2]، ولاء علي محمود عيد[3]
[1] قسم الفاكهة الاستوائية، معهد بحوث البساتين، مركز البحوث الزراعية، الجيزة، جمهورية مصر العربية
[2] المعمل المركزي لأبحاث وتطوير النخيل، مركز البحوث الزراعية، الجيزة، جمهورية مصر العربية
[3] قسم علوم وتكنولوجيا الصناعات الغذائية، كلية الزراعة، جامعة الوادي الجديد، جمهورية مصر العربية

الملخص العربي

أن الهدف من هذا العمل دراسة تأثير الرش الورقي لحامض البوريك ونترات الكالسيوم على عقد الثمار والمحصول لنخيل البلح السيوى النامي في واحة الداخلة بمحافظة الوادي الجديد خلال موسمين متتاليين (٢٠٢١، ٢٠٢٢)، تم معاملة نخيل التجربة بالرش بأربعة مستويات من حامض البوريك (صفر، ١٢٥، ٢٥٠، ٥٠٠ جزء في المليون)، مع الرش بأربعة تركيزات من نترات الكالسيوم (صفر، ١٪، ٢٪، ٤٪).

أوضحت النتائج المتحصل عليها أن النسبة المئوية لعقد الثمار والمحصول الكلى استجابا لجميع معاملات حامض البوريك ونترات الكالسيوم مقارنة بالكنترول في كلا الموسمين. أفضل النتائج بالنسبة لعقد الثمار والمحصول الكلى كانت مع المعاملة المكونة من (٥٠٠ جزء فى المليون) من حامض البوريك ونترات الكالسيوم بتركيز (٢٪) في موسمي الدراسة. علاوة على ذلك، رش اشجار نخيل البلح بالمعاملة سابقة الذكر لكل من حمض البوريك ونترات الكالسيوم اعطى اعلى قيم لكل من نسبة المواد الصلبة الذائبة الكلية، السكريات الكلية والمختزلة؛ بينما على النقيض اعطت هذه المعاملة اقل قيم للحموضة الكلية في موسمي الدراسة.

الكلمات الدالة: *نخيل البلح، حامض البوريك، نترات الكالسيوم، عقد الثمار، المحصول الكلى*