

Effect of Spraying Some Micronutrients via Normal versus Nano Technology on Fruiting of Sakkoti Date Palms

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Abstract: This study was conducted during 2017 and 2018 seasons to test the effect of spraying normal Zn Fe Mn B at 0.05% and nano ZnFeMnB each at 0.005% to 0.004% on growth, palm nutritional status, yield and fruit quality of Sakkoti date palms. The selected palms received three sprays before hand pollination, just after fruit setting and one month later. Spraying the palms with normal ZnFeMnB at 0.05 % and nano ZnFeMnB at 0.005 to 0.04% three times resulted in an obvious promotion on all growth aspects, photosynthetic pigments, nutrients, yield and fruit quality relative to the control. Using nano ZnFe MnB at 0.005 to 0.04% was superior than using normal Zn Fe Mn B at 0.05 % in this respect. Using nano ZnFeMn B at 0.1% three times gave the best results with regard to yield and fruit quality of Sakkoti date palms.

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1. Introduction

Nanotechnology is a promising field of interdisciplinary research. It opens up a wide array of opportunities in various fields like medicine, pharmaceuticals, electronics and agriculture. The current global population is nearly 7 billion with 50% living in Asia (FAO, 2015). A large proportion of those living in developing countries face daily foods shortages as a result of environmental impacts or political instability, while in the developed world there is surplus of food. For developing countries, the drive is to develop drought and pest resistant crops, which also maximize yield. The potential of nanotechnology to revolutionize the health care, textile, materials, information and communication technology, and energy sectors has been well publicized (FAO, 2015). The application of nanotechnology to agriculture and food industries is also getting attention nowadays. Investments in agriculture and food nanotechnologies carry increasing weight because their potential benefits range from improved food quality and safety to reduced agricultural inputs and improved processing and nutrition (Liu *et al.*, 2006 and Rai *et al.*, 2012). While most investment is made primarily in developed countries, research advancements provide glimpses of potential applications in agricultural, food and water safety that could have significant impacts on rural populations in developing countries (FAO, 2015). This study is concentrated on modern strategies and potential of nano- materials in sustainable agriculture management as modern approaches of nanotechnology. (Sultan *et al.*, 2009; Prasad *et al.*, 2014 and Mukhopudhyay, 2014 and Mahjunatha *et al.*, 2016).

Using fertilizers via nano system enhances the efficiency of nutrient uptake (Jinhua, 2004; Al-Amin Sadek and Jayasuriya, 2007; and Derosa *et al.*, 2010).

Using nutrients via normal method was found by El- Sayed –Esraa (2010) and Ahmed (2014) to improve the yield of Ewaise and Keitte mango trees, respectively.

Previous studies showed that using fertilizers via nano technology was superior than using via normal methods in improving growth, yield and fruit quality of different fruit crops (Sabir *et al.*, 2014; Refaai, 2014; Roshdy and Refaai, 2016; Wassel *et al.*, 2017; Mohamed *et al.*, 2017; Ahmed, 2018; Abou- Bakr- Basma, 2018 and Abdalla, 2018).

The present study aimed to throw some lights on the effect of ZnFeMnB fertilizers applied via nano technology on fruiting of Sakkoti date palms.

2. Materials and Methods

This study was conducted during 2017 and 2018 seasons in a private date palm orchard situated at Kom Ombo district, Aswan Governorate on eighteen 20- years old Sakkoti date palms produced from offshoot propagation. The selected palms are uniform in vigour, healthy, good physical conditions, free from insects, disease and damages. They planted at 7x7 meters apart (86 palms/ fed.) and irrigated with Nile water via surface irrigation system. The texture of the soil is silty clay. Hand pollination was achieved by inserting five fresh male strands into the center of one female spathe using the same source of pollens to avoid residues of metaxenia. Pollination was carried out throughout two days after female spathes cracking at the day time of afternoon. Every

bunch was bagged by white paper bags and ties at the ends using a piece of cotton for aeration and the bags were removed after one month. Number of bunches per palm was adjusted to 10 bunches and leaf/ bunch ratio was maintained at 8:1.

Analysis of the tested soil was carried out according to **Wilde *et al.*, (1985)** and the obtained data are shown in Table (1).

Table (1): Analysis of the tested soil

Parameter	Values
Particle size distribution	
Sand %	7.5
Silt %	61.0
Clay %	31.5
Texture	Silty clay
pH (1: 2.5 extract)	8.80
E.C. (1: 2.5 extract) mmhos /cm / 25°C	0.75
O.M. %	2.25
Total CaCO ³ %	1.95
Total N ppm	8.0
Available P ppm	6.0
Available K ppm	420.0
DPTA extractable micronutrients (ppm)	
Zn	5.2
Fe	6.1
Mn	4.2
Cu	0.6

All the selected Sakkoti date palms received the same agricultural and horticultural practices that already applied in the vineyard except those dealing with application of micronutrients.

This experiment included the following six treatments:

- 1- Control.
- 2- Spraying normal Zn Fe Mn B at 0.05 %.
- 3- Spraying nano Zn Fe Mn B at 0.005 %.
- 4- Spraying nano Zn Fe Mn B at 0.01 %.
- 5- Spraying nano Zn Fe Mn B at 0.02 %.
- 6- Spraying nano Zn Fe Mn B at 0.04 %.

Each treatment was replicated three times, one palm per each. Normal and Nano ZnFeMnB were sprayed three times before hand pollination (2nd week of Feb.), just after fruit setting (Last week Mar.) and at one month later. Triton B as a wetting agent was applied at 0.05% and spraying was one till runoff. The control palms were sprayed with water containing Triton B.

Randomized complete block design (RCBD) was followed in which this study included six treatments and each treatment was replicated three times, one palm per each.

During both seasons, the following measurements were recorded:

1- Leaflet (cm)², and leaf area (m)² (according to **Ahmed and Morsy, 1999**).

2- Photosynthetic pigments namely chlorophylls a & b, total chlorophylls and total carotenoids (mg/ g F.W.) (according to **Von-Wettstein, 1957**).

3- Percentages of N, P and K (**Chapman and Pratt, 1965 and Summer, 1985**).

4- Percentage of fruit retention, yield/ palm and bunch weight (kg.).

5- Some physical and chemical; characteristics of the fruits namely weight (g), height and diameter of fruit (cm), percentages of fruit seed and flesh weights, edible to non- edible portions of fruit, T.S.S. %, total and reducing sugars %, total acidity % (as malic acid/ 100 g pulp), crude fibre % and total soluble tannins % (**A.O.A.C., 2000**).

Statistical analysis was done and treatment means were compared using New L.S.D. at 5% (**Mead *et al.*, 1993**).

3. Results

1- Area of leaflet and leaf

Data in Table (2) clearly show that treating the palms three times with normal and nano ZnFeMnB significantly stimulated the area of leaflet and leaf relative to the control. The promotion was in proportional to the increase in concentrations of Nano ZnFeMnB fertilizers. Using nano ZnFeMnB at 0.005 to 0.04% was significantly superior than using normal ZnFeMnB in stimulating these growth aspects. Using Nano at concentrations higher than 0.01 % resulted in meaningless promotion on such two growth aspects. The highest values were recorded on the palms that treated with Nano ZnFeMnB at 0.04% three times. The untreated palms produced the minimum values. These results were true during both seasons.

2- Leaf chemical components:

Data in Table (2) clearly show that chlorophylls a & b, total chlorophylls, total carotenoids, N, P and K in the leaves of Sakkoti date palms were significantly increased in response to treating the palms with Normal and Nano ZnFeMnB relative to the control. There was a gradual increase in these pigments and nutrients with increasing concentrations of Nano ZnFeMnB from 0.005 to 0.04%. Using Nano ZnFeMnB was significantly preferable than using Normal ZnFeMnB in enhancing these chemical components. A slight promotion on these parameters was observed with using Nano ZnFeMnB at concentrations higher than 0.01%,. The maximum values were recorded on the palms that received Nano ZnFeMnB at 0.04%. The

lowest values were recorded on untreated palms. These results were true during both seasons.

3- Percentage of fruit retention, yield and bunch weight:

It is clear from the data in Table (3) that supplying the palms three times with Normal and Nano ZnFeMnB significantly improved fruit retention %, yield and bunch weight over the control. There was a gradual promotion with increasing Nano ZnFeMnB concentrations. Using Nano ZnFeMnB at 0.005 to 0.04% was significantly preferable than using Normal ZnFeMnB at 0.05% in enhancing these parameters. Higher concentrations (above 0.1%) of nano ZnFeMnB failed to show significant promotion on fruit retention %, yield/ palm and bunch weigh. Therefore, from economical point of view, it is recommended to use nano ZnFeMnB at 0.01 % three times. Under such promised treatment, yield/ palm reached 80.0 & 82.0 kg compared with the yield of untreated palms that reached 71.0 & 72.0 kg during both seasons, respectively. The percentage of increment on the yield due to application of the

previous promised treatment over the control reached 12.7 and 13.9% during both seasons, respectively. These results were true during both seasons.

4- Fruit quality:

It is clear from the data in Tables (3 & 4) that supplying palms with Normal and Nano ZnFeMnB was significantly very effective in improving fruit quality in terms of increasing fruit weight and dimensions, flesh %, edible to non- edible portions of fruit, T.S.S. %, total and non reducing sugars % and decreasing fruit seed %, total acidity %, crude fibre % and total soluble tannins relative to the control. The promotion was associated with increasing Nano ZnFeMnB concentration. Using Nano ZnFeMnB at 0.005 to 0.04 % was significantly preferable than using Normal ZnFeMnB at 0.05% in enhancing fruit quality. Using concentrations above 0.01% Nano ZnFeMnB had no significant promotion on fruit quality. The best results with regard to fruit quality were obtained with using Nano ZnFeMnB at 0.01%. These results were true during both seasons.

Table (2): Effect of spraying normal and nano ZnFeMnB fertilizers on some growth aspects, pigments, N, P and K in the leaf of Sakkoti date palms during 2017 and 2018 seasons.

	Leaflet area (cm) ²		Leaf area (m) ²		Chlorophyll a (mg/ g F.W.)		Chlorophyll b (mg/ g F.W.)		Total chlorophylls (mg/ g F.W.)		Total carotenoids (mg/ g F.W.)		Leaf N%		Leaf P %		Leaf K %	
	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018
Control	70.0	69.4	1.16	1.22	6.11	6.00	1.91	1.94	8.02	7.94	1.81	1.79	1.61	1.64	0.14	0.15	1.15	1.20
Normal ZnFeMnB at 0.05%	72.1	72.0	1.30	1.31	6.41	6.30	1.95	1.99	8.36	8.29	1.92	1.94	1.71	1.74	0.20	0.21	1.25	1.26
Nano ZnFeMnB at 0.005%	75.0	74.9	1.41	1.44	6.51	6.41	2.01	2.06	8.52	8.47	1.99	1.99	1.81	1.85	0.24	0.28	1.35	1.33
Nano ZnFeMnB at 0.01%	77.1	76.9	1.52	1.55	6.61	6.55	2.06	2.12	8.67	8.67	2.08	2.10	1.90	1.95	0.29	0.34	1.45	1.73
Nano ZnFeMnB at 0.02%	77.3	77.0	1.55	1.57	6.62	6.56	2.07	2.13	8.69	8.69	2.09	2.11	1.91	1.96	0.30	0.35	1.46	1.44
Nano ZnFeMnB at 0.04%	77.4	77.1	1.56	1.69	6.63	6.57	2.08	2.14	8.71	8.71	2.10	2.12	1.92	1.97	0.31	0.36	1.47	1.45
New L.S.D. at 5%	1.8	2.0	0.08	0.07	0.05	0.06	0.04	0.03	0.06	0.07	0.03	0.04	0.06	0.05	0.05	0.06	0.04	0.05

Table (2): Effect of spraying normal and nano ZnFeMnB fertilizers on some chemical characteristics of the fruits of Sakkoti date palms during 2017 and 2018 seasons.

	T.S.S. %		Total sugars %		Reducing sugars %		Non reducing sugars %		Total acidity %		Crude fibre %		Soluble tannins %	
	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018
Control	71.1	72.0	59.3	60.0	11.4	10.2	47.9	49.8	0.300	0.301	1.90	1.80	0.69	0.70
Normal ZnFeMnB at 0.05%	72.9	73.0	60.0	61.0	11.1	10.0	48.9	51.0	0.280	0.280	1.70	1.70	0.64	0.62
Nano ZnFeMnB at 0.005%	75.0	74.5	61.5	61.9	11.5	9.2	50.0	52.5	0.259	0.258	1.49	1.60	0.59	0.57
Nano ZnFeMnB at 0.01%	77.0	75.9	62.9	63.0	11.4	9.1	51.5	53.9	0.239	0.238	1.39	1.49	0.50	0.49
Nano ZnFeMnB at 0.02%	77.1	76.0	63.0	63.1	11.4	9.1	51.6	54.0	0.238	0.237	1.38	1.48	0.49	0.48
Nano ZnFeMnB at 0.04%	77.2	76.1	63.1	63.2	11.4	9.1	51.7	54.1	0.237	0.236	1.35	1.46	0.47	0.47
New L.S.D. at 5%	0.5	0.6	0.4	0.4	NS	NS	0.3	0.4	0.018	0.017	0.07	0.06	0.03	0.03

Table (3): Effect of spraying normal and nano ZnFeMnB fertilizers on the percentage of fruit retention, yield and some physical characteristics of the fruits of Sakkoti date palms during 2017 and 2018 seasons.

	Fruit retention %		Yield / palm (kg.)		Bunch weight (kg.)		Fruit weight (g.)		Fruit height (cm)		Fruit diameter (cm)		Seed weight %		Flesh weight %		Edible to none dibble portions of fruits	
	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018
Control	27.1	28.0	71.0	72.0	7.1	7.2	8.11	8.06	4.27	4.30	1.70	1.69	17.1	17.3	82.9	82.7	4.8	4.8
Normal ZnFeMnB at 0.05%	28.1	29.0	74.0	76.0	7.4	7.6	8.25	8.19	7.37	4.40	1.80	1.79	16.2	16.0	83.8	84.0	5.2	5.3
Nano ZnFeMnB at 0.005%	29.0	30.0	77.0	79.0	7.7	7.9	8.40	8.33	4.47	.50	1.90	1.89	15.1	15.1	84.9	84.9	5.6	5.6
Nano ZnFeMnB at 0.01%	29.9	30.8	80.0	82.0	8.0	8.2	8.55	8.46	4.60	4.60	1.99	1.99	14.1	14.2	85.9	85.8	6.1	6.0
Nano ZnFeMnB at 0.02%	30.0	31.0	81.0	82.0	8.1	8.2	8.56	8.47	4.61	4.61	2.00	2.00	14.0	14.1	86.0	85.9	6.1	6.1
Nano ZnFeMnB at 0.04%	30.3	31.3	81.0	82.0	8.1	8.2	8.57	8.48	4.62	4.62	2.01	2.01	13.9	14.0	86.1	86.0	6.2	6.1
New L.S.D. at 5%	0.6	0.8	2.1	2.0	1.0	0.8	0.11	0.12	0.08	0.09	0.07	0.08	0.3	0.3	1.0	0.8	0.3	0.4

4. Discussion:

The previous beneficial effects of nano technology use of nutrients on fruiting of Keitte mango trees could be explained to its effect in enhancing nutrients use efficiency and preventing the release of fertilizers and their uptake by crops so preventing nutrient losses to soil, water and air and the interaction of nutrients with soil, microorganisms water and air (Derosa *et al.*, 2010).

These results are in harmony with those obtained by Sabir *et al.*, (2014) I; Refaai (2014); Roshdy and Refaai (2016); Wassel *et al.*, (2017); Mohamed *et al.*, (2017); Ahmed (2018); Abou-Bakr Basma (2018) and Abdalla (2018).

5. Conclusion:

The best results with regard to yield and fruit quality of Sakkoti date palms were obtained due to spraying Nano ZnFeMnB at 0.01% three times.

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