

## Insight onto the Effect of Fourteen Plant Extracts on Fruiting of Sakkoti Date Palms

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### ABSTRACT

During 2015 and 2016 seasons, fourteen plant extracts (oils of garlic, onion, moringa, camphor, black cumin, clove, peppermint, anise and flax seed and five extracts namely green tea, red chillies, turmeric, acacia seed and henna leaf) were examined for their effects on vegetative growth aspects palm nutritional status, yield and fruit quality of Sakkoti date palms. The tested palms received four sprays before manual pollination, just after fruit setting and twice at one month intervals. The highest significant values of the total surface area/palm, leaf pigments, N, P and K, yield, bunch weight and both physical and chemical characteristics of the fruits were achieved by treating the palms four times with any one of the five plant oils of garlic, onion, maringa, camphor and black cumin each at 5 % compared to the control and other treatments. Flax seed oil occupied the last position in this respect. From result of this research, it is recommending four sprays of oil of garlic or onion or moringa each at 5% (before manual pollination, just after fruit setting and twice at one month intervals) was responsible for improving yield and fruit quality of Sakkoti date palms.

**Key words:** Plant extracts, Sakkoti date palms, yield, fruit quality

### Introduction

Recently, many attempts were accomplished for using plant extracts instead of chemicals for promoting yield and fruit quality of fruit crops. The higher own content of plant extracts from fatty acids especially Omega 3 & 6 & 9, sulfide components, active ingredients like turemrone menthone, euyenol, theanine, caffeine, inalool and estrugal, nutrients, vitamin K, E, D and A, plant pigments, tannins, amino acids makes then very essential for protecting the plants against fungi and insects. They showed great potential system for reducing the risks of fungicides and insecticides. They are low in toxicity to mammals. These attributes make them a wise and safe choice for pest control in the orchards of fruit crops (Gunstone, 2011 and Robinson, 2011).

Previous studies gave good evidence for the striking impact of different plant extracts on vegetative growth characteristic, nutritional status of the trees, yield as well as physical and chemical characteristics of the fruits (Abd El-Rahman and El-Masry, 2012; Ahmed *et al.*, 2013; Mohamed and Mohamed, 2013; Al-Wasfy *et al.*, 2013; El-Khawaga and Mansour, 2014; Refaai, 2014; Abd El-Rahman, 2015; Hegazy, 2015; Shoug, 2015; Ahmed, 2015; Ahmed, 2016 and Ezz-Thanaa *et al.*, 2015).

The objective of this study was to evaluate the effect of fourteen plant extracts (oils of garlic, onion, moringa, camphor, black cumin, clove, peppermint, anise and flax seed and five extracts namely green tea, red chillies, turmeric, acacia seed and henna leaf) on vegetative growth characteristics, nutritional status of the palms, yield and fruit quality of Sakkoti date palms.

### Materials and Methods

This study was conducted during 2015 and 2016 seasons in a private date palm orchard situated at Kom Ombo, Aswan Governorate on Sakkoti date palms 18-years old, (as dry date palm cv.). These palms produced through conventional propagation by offshoots as well as characterized by regular bearing. The selected palms are uniform in vigour, healthy, good physical conditions, free from

insects, diseases and damages. The palms were planted in clay soil at 7x7 meters apart (86 palms/ feddan). The selected palms are irrigated with Nile water through surface irrigation system.

**Table 1:** Analysis of the tested soil.

Constituents	Values
Sand %	4.0
Silt %	13.0
Clay %	83.0
Texture	Clay
O.M. %	2.41
pH (1:2.5 extract)	7.69
E.C (1: 2.5 extract) (mmhos/ ICM/ 250 C)	0.91
CaCO <sub>3</sub> %	1.55
Total N %	0.09
Available P (ppm/ Olsen)	5.9
Available K (ppm, ammonium acetate)	490

Manual pollination was achieved by inserting five male strands into the center of one female spathe. All the selected Sakkoti date palms received the common and usual horticultural practices that already applied in the orchard except those dealing with the application, of potassium and silicon compounds. Bunches / palm was adjusted to ten bunches.

This study included the following fifteen treatments from spraying different plant extracts at 5% arranged as follows:

1. Control (palms were sprayed with water).
2. Garlic oil.
3. Onion oil.
4. Moringa oil.
5. Camphor oil.
6. Black cumin oil.
7. Green tea extract.
8. Red chillis extract.
9. Turmeric extract.
10. Clove oil.
11. Peppermint oil.
12. Acacia seed extract.
13. Henna leaf extract.
14. Anise oil.
15. Flax seed oil.

Plant extracts were sprayed four times (oils of garlic, onion, moringa, camphor, black cumin, clove, peppermint, anise and flax seed and five extracts namely green tea, red chillies, turmeric, acacia seed and henna leaf) in addition to the control treatment before manual pollination, just after fruit setting and twice at one month intervals.

The pure tested nine oils were bought from National Research Center, Dokki, Cairo. The five plant extracts namely turmeric, green tea, moringa, red chillies and henna leaf were dried in the shade and washed with distilled water. They were finely grinded to powder. Fifty grams of each plant material of powder form was homogenized by laboratory blender in 200 ml of methanol (96%) and distilled water (20:80 v/v) for 10 min, and then left in dark glass bottles for 72 h for complete extraction. The five extracts were filtered through thin cheesecloth sheets. The final extracts were collected separately in other dark glass bottles and exposed to 60°C in water bath for 30 min for methanol evaporation. The collected extracts were then stored in a refrigerator at 5°C until needed (Ezz-Thanaa *et al.* 2015). Triton B as a witting agent was added to all plant extracts before application to facilitate the solubility of these plant extracts. Manual sprayers were used. Spraying was done till run off.

Randomized complete block design (RCBD) was followed in which this experiment included fifteen treatments, each included three replicates, one palm per each.

During both seasons, the following parameters were recorded;

- 1- Vegetative growth characteristics namely total surface area / palm (Ahmed and Morsy 1999) by multiplying the leaf area of whole leaf by total numbers of the leaves/palm.

- 2- Leaf chemical composition namely chlorophylls a, b and total carotenoids (mg/ g F.W.) (Von-Wettstein 1957), as well as leaf content of N, P and K (Cottenie *et al.* 1982).
- 3- Bunch weight (kg.) and yield/ palm.
- 4- Physical and chemical characteristics of the fruits namely weight (g.), percentages of stone and flesh, flesh/stone, T.S.S. % total and reducing sugars % (Lane and Eynon, 1965), titratable acidity %, crude fiber % and total soluble tannins % (A.O.A.C. 2000).

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

## Results

### 1- Total surface area per palm:

Data in Table (2) show that total surface area / palm was clearly stimulated owing to using any one of the fourteen extracts (nine oils of garlic, onion, moringa, camphor, black cumin, clove, peppermint, anise and flax seed and five extracts namely green tea, red chillies, turmeric, acacia seed and henna leaf) each at 5% compared to the control treatment. Clear differences were observed on these growth traits among the fourteen plant extracts. The best plant extract in this respect was garlic oil followed by onion oil. Flax seed oil occupied the last position in this respect. The highest values were recorded on the palms that received four sprays of garlic oil at 5% (210.0 and 211.2 m<sup>2</sup>) in two seasons. The untreated palms had the lowest values in both seasons.

### 2- Chemical components:

It is evident from the data in Table (2) clear that treating Sakkoti date palms with any one of the fourteen plant extract (nine oils of garlic, onion, moringa, camphor, black cumin, clove, peppermint, anise and flax seed and five extracts namely green tea, red chillies, turmeric, acacia seed and henna leaf) each at 5% was very effective in enhancing chlorophylls a and b, total carotenoids as well as percentages of N, P and K in the leaves compared to the control treatment. The beneficial effects of these natural extracts in this respect could be arranged as follows in descending order: nine oils of garlic, onion, moringa, camphor, black cumin, clove, green tea, red chillis, turmeric, peppermint, acacia seed, henna leaf each at 5%. These results were nearly the same during both seasons.

### 3- Bunch weight and yield / palm:

It is evident from the data in Table (3) that treating Sakkoti date palms with any one of the fourteen plant extract (nine oils of garlic, onion, moringa, camphor, black cumin, clove, peppermint, anise and flax seed and five extracts namely green tea, red chillies, turmeric, acacia seed and henna leaf) each at 5% was very effective in enhancing bunch weight and yield / palm compared to the control treatment. The beneficial effects of these natural extracts in this respect could be arranged in descending order as follows: nine oils of garlic, onion, moringa, camphor, black cumin, clove, green tea, red chillis, turmeric, peppermint, acacia seed, henna leaf each at 5%. The maximum values of yield/palm and relative yield % (157.0 & 170.0 kg and 178.41 & 204.82 %) were recorded on the palms treated three times with garlic oil at 5% during both seasons, respectively. The untreated palms produced the minimum values (88.0 & 83.0 kg) during both seasons, respectively. The uppermost percentage of increment on the yield due to application of garlic oil at 5% over the check treatment reached 78.4 and 104.8 % during both 2015 and 2016 seasons, respectively.

### 4- Physical and chemical characteristics of the fruits:

Data in Tables (3 & 4) clearly that the effect of different plant extracts at 5 % produced significant effect on fruit quality in terms of increasing fruit weight as well as percentages of flesh, T.S.S., total and reducing sugars and decreasing sugars, titratable acidity, total crude fiber and total soluble tannins, compared to the control treatment. Treating the palms with garlic oil at 5% gave the best results. An acceptable finding on both physical and chemical characteristics were observed.

**Table 2:** Effect of spraying some plant extracts at 5% on the total surface area per palm, leaf pigments and percentages of N, P and K in the leaves of Sakkoti date palms during 2015 and 2016 seasons

Plant extract treatments	Total surface area/palm (m <sup>2</sup> )		Chlorophyll a (mg/ g F.W)		Chlorophyll b (mg/ g F.W)		Total carotenoids (mg/ g F.W)		Leaf N %		Leaf P %		Leaf K %	
	Seasons													
	1 <sup>st</sup>	2 <sup>nd</sup>	1 <sup>st</sup>	2 <sup>nd</sup>	1 <sup>st</sup>	2 <sup>nd</sup>	1 <sup>st</sup>	2 <sup>nd</sup>	1 <sup>st</sup>	2 <sup>nd</sup>	1 <sup>st</sup>	2 <sup>nd</sup>	1 <sup>st</sup>	2 <sup>nd</sup>
Control	171.0	171.6	4.1	4.0	1.1	1.0	1.1	1.2	1.69	1.71	0.111	0.115	1.19	1.24
Garlic oil	210.0	211.2	11.4	12.6	4.6	4.7	4.6	5.2	2.53	2.55	0.215	0.220	1.91	2.05
Onion oil	206.9	208.0	11.0	11.6	4.4	4.4	4.4	5.0	2.46	2.50	0.205	0.212	1.85	1.99
Moringa oil	204.0	205.9	10.5	11.0	4.2	4.1	4.1	4.7	3.41	2.44	0.190	0.189	1.80	1.93
Camphor oil	201.0	202.5	9.9	10.5	4.0	3.8	3.8	4.4	2.36	2.40	0.181	0.182	1.73	1.87
Black cumin oil	198.0	199.6	9.4	10.0	3.6	3.5	3.5	4.1	2.30	2.31	0.172	0.174	1.67	1.81
Green tea extract	195.0	196.6	9.0	9.2	3.4	3.2	3.2	3.8	2.23	2.20	0.166	0.166	1.62	1.75
Red chillis extract	192.0	194.0	8.3	8.6	3.2	3.0	3.0	3.5	2.18	2.12	0.160	0.160	1.57	1.68
Turmeric extract	188.9	191.5	7.7	8.0	3.0	2.7	2.8	3.2	2.11	2.06	0.155	0.155	1.53	1.62
Clove oil	186.0	188.5	7.1	7.5	2.7	2.4	2.5	2.9	2.06	2.00	0.149	0.150	1.48	1.55
Peppermint oil	183.5	186.0	6.6	7.0	2.4	2.1	2.3	2.6	2.00	1.95	0.142	0.144	1.43	1.48
Acacia seed extract	181.1	182.9	6.1	6.3	2.1	1.9	2.1	2.2	1.93	1.89	0.136	0.138	1.39	1.42
Henna leaf extract	179.0	180.0	5.6	5.7	1.9	1.7	1.8	1.9	1.86	1.85	0.130	0.132	1.34	1.46
Anise oil	176.2	177.0	5.1	5.2	1.6	1.5	1.6	1.7	1.80	1.81	0.121	0.127	1.29	1.38
Flax seed oil	174.0	173.8	4.6	4.6	1.4	1.2	1.3	1.5	1.75	1.76	0.115	0.122	1.25	1.30
New L.S.D at 5%	2.1	2.4	0.04	0.05	0.02	0.02	0.02	0.03	0.05	0.04	0.003	0.005	0.04	0.06

**Table 3:** Effect of spraying some plant extracts at 5% on bunch weight, yield and some physical characteristics of the fruits of Sakkoti date palms during 2015 and 2016 seasons

Plant extract treatments	Bunch weight (kg.)		Yield/palm (kg.)		Relative yield %		Fruit weight (g)		Flesh/seeds		Cured fiber %	
	Seasons											
	1 <sup>st</sup>	2 <sup>nd</sup>	1 <sup>st</sup>	2 <sup>nd</sup>	1 <sup>st</sup>	2 <sup>nd</sup>	1 <sup>st</sup>	2 <sup>nd</sup>	1 <sup>st</sup>	2 <sup>nd</sup>	1 <sup>st</sup>	2 <sup>nd</sup>
Control	8.8	8.3	88.0	83.0	100	100	8.85	8.90	10.6	10.8	1.95	1.92
Garlic oil	15.7	17.0	157.0	170.0	178.41	204.82	10.30	10.15	17.4	17.7	1.00	1.02
Onion oil	15.6	16.9	156.0	169.0	177.27	203.61	10.25	10.14	17.0	17.1	1.11	1.09
Moringa oil	15.5	16.8	155.0	168.0	176.14	202.41	10.23	10.13	16.9	16.8	1.15	1.11
Camphor oil	15.3	16.7	153.0	167.0	173.86	201.20	10.21	10.12	16.9	16.4	1.18	1.15
Black cumin oil	15.2	16.6	152.0	166.0	172.73	200.00	10.09	10.11	16.6	16.0	1.22	1.30
Green tea extract	14.7	15.8	147.0	158.0	167.05	190.36	9.92	10.0	16.0	15.5	1.31	1.36
Red chillis extract	14.1	15.0	141.0	150.0	160.23	180.72	9.80	9.88	15.2	15.0	1.50	1.45
Turmeric extract	13.5	14.1	135.0	141.0	153.41	169.88	9.69	9.76	14.6	14.3	1.60	1.55
Clove oil	12.8	13.3	128.0	133.0	145.45	160.24	9.57	9.62	14.0	13.8	1.65	1.60
Peppermint oil	12.1	12.5	121.0	125.0	137.50	150.60	9.46	9.50	13.2	13.4	1.70	1.65
Acacia seed extract	11.5	11.7	115.0	117.0	130.68	140.96	9.34	9.36	12.6	13.0	1.75	1.70
Henna leaf extract	10.8	10.9	108.0	109.0	122.73	131.33	9.22	9.24	12.0	12.5	1.80	1.74
Anise oil	10.1	10.0	101.0	100.0	114.77	120.48	9.10	9.11	11.8	12.1	1.85	1.80
Flax seed oil	9.5	9.1	95.0	91.0	107.95	109.64	8.96	9.00	11.2	11.5	1.90	1.84
New L.S.D at 5%	0.6	0.8	4.1	4.8	-	-	0.11	0.09	0.6	0.7	0.04	0.03



(delta), beta elemene,  $\alpha$ - himachalene, gamma- himachalene,  $\alpha$ - amorphane, (e)- methylisoeugenol,  $\alpha$ - zingiberene,  $\beta$ -himachalene,  $\alpha$ - muurolene,  $\beta$ -bisabolene, beta-sesquiphellandrene (ullah *et al.*, 2014). acacia seed from proteins .fibre , ash amino acids, arginine, histidine, leucine, lysine, methionine, cysteine, phenylalanine, tyrosine, threonine, tryptophan, valine, alanine, aspartic acid, glutamic acid, proline, serine, nutrients, calcium, inorganic phosphorus, potassium, magnesium, sodium, iron, copper, zinc, tannins (Kumaresan *et al.* 1984); camphor from tricyclene,  $\alpha$ -thujene,  $\alpha$ -pinene, camphene, sabinene,  $\beta$ -pinene, myrcene,  $\alpha$ -phellandrene, isosylvestrene,  $\alpha$ -terpinene, p-cymene, limonene, cineol-1,8, (z)- $\beta$ -ocimene, (e)- $\beta$ -ocimene,  $\gamma$ -terpinene, cis-sabinene hydrate, terpinolene, trans-sabinene hydrate  $\alpha$ -campholenal, camphor, isoborneol, borneol, terpin-4-ol,  $\alpha$ -terpineol, eugenol,  $\alpha$ -copaene,  $\beta$ -cubenene,  $\beta$ -elemene,  $\alpha$ -gurjunene,  $\beta$ -caryophyllene,  $\beta$ -copaene,  $\alpha$ -humulene,  $\gamma$ -muurolene, cubebol,  $\delta$ -cadinene, spathulenol, caryophyllene oxide, globulol, cubenol,  $\alpha$ -cadinol, total identified (Joshi *et al.* 2013), black cumin from myristic acid, palmitic acid, palmatolic acid, stearic acid, oleic acid , linoleic acid, linolenic, archaic acid, saturated fatty acid, unsaturated fatty acid, moisture, proteins, ash (Bourgou *et al.* 2010) and henna leaf from linalool<sup>M</sup>,  $\alpha$ -terpineol<sup>M</sup>, etherphenylvinyl<sup>A</sup>, 1,3-indandione<sup>A</sup>, eugenol<sup>A</sup>, cis-hexahydro-8a-methyl1,8-[2H,8H], naphthalenedione<sup>K</sup>, oxirane-tetradecyl<sup>E</sup>, hexadecanoic acid<sup>E</sup>, phytol<sup>O</sup> (Kidane *et al.* 2013).

The rich in nutrients and antioxidants of these plant extracts surely reflected on protecting the plant cells from senescence and disorders as well as enhancing cell division, the biosynthesis of natural hormones such IAA and ethylene, nutrient and water uptake, photosynthesis, building of plant pigments and proteins, amino acids and plant metabolism. These important functions of vitamins were surely reflected on enhancing growth and vine nutritional status in favour of enhancing yield and fruit quality. (Robinson 2011) as well as enhancing cell division, photosynthesis and most organic foods (Nijjar 1985).

These results are in harmony with those obtained by Abdelaal and Aly (2013); Ahmed *et al* (2013); Abada (2014); Ahmed and Gad El-Kareem (2014); Uwakiem, (2014); Ahmed (2015); Ahmed (2016); Abada *et al* (2017); Ibrahim-Asmaa (2017) and Farag-Rana (2017) on different fruit crop species.

## Recommendation

The results of the present work recommend using four sprays of any oils garlic or onion or moringa each at 5% (mid of Apr., May, June and July) is responsible for improving yield and fruit quality of Sakkoti date palms.

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