

# The promotive effects of seaweed extract on fruiting of Zaghoul date palms grown under Minia region

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## ABSTRACT

**This study was initiated during 2011 and 2012 seasons to elucidate the effect of spraying seaweed extract at five concentrations namely 0.0, 0.05, 0.1, 0.2 and 0.4 % on fruiting of Zaghoul date palms. Number of sprays was four.**

**Carrying out four sprays of seaweed extract at 0.05 to 0.4 % succeeded in improving the leaf area, leaf content of total chlorophylls, percentages of N, P and K, yield and fruit quality in relative to the check treatment. The promotion was in proportional to the increase in concentrations. Meaningless promotion was detected among the higher two concentrations (0.2 and 0.4 %). The best results with regard to yield and fruit quality were obtained with spraying Zaghoul date palms four times with seaweed extract at 0.2 %.**

**Key words:** Zaghoul date palms, seaweed extract, yield and fruit quality.

## INTRODUCTION

Poor cropping is considered to be a serious and major problem that faces Zaghoul date palm growers in middle Egypt. Using natural exudates and extracts of biofertilizers namely seaweed extract (extract of *Ascophyllum nodosum*) instead of chemical materials could be the way to improve yield and quality of fruit crops. Previous studies showed that using seaweed extract is favourable in enhancing uptake of nutrients, the resistance of plants to the unfavourable stresses, soil fertility, fruit setting % and activity of microorganisms.

It uses as chelated compounds, substitute for organic fertilizers as soil conditioners (Norric *et al.*, 2002 and Aziz *et al.*, 2003). It is a natural source of organic and material fertilizers. It contains more than 60 nutrients and 21 amino acids, natural hormones namely IAA, GA3 and cytokinins and some organic acids (Tung- Yunn *et al.*, 2003).

Previous studies showed that application of seaweed extract was very effective in enhancing growth, nutritional status of the trees, yield and fruit quality of evergreen fruit crops (Gobara, 2004; El- Sawy, 2005; Hegab *et al.*, 2005; Gamal, 2006; Ebeid- Sanaa, 2007; Mouftah, 2007; Ahmed *et al.*, 2008; Hassan- Hoda, 2008; Mohamed *et al.*, 2008; El-Sayed- Esraa, 2010; Mahmoud, 2012 and Mabrouk, 2013).

The target of this study was examining the effect of various concentrations of seaweed extract on fruiting of Zaghoul date palms grown under Minia region.

## MATERIALS AND METHODS

This study was carried out 2011 and 2012 seasons in a private orchard situated at Maghagha district, Minia Governorate on thirty 20- years old Zaghoul date palms. Soil texture is silty clay and the palms are planted at 7 × 7 meters apart. The selected palms were irrigated through surface system. Pruning was carried out to maintain leaf bunch ratio at 8: 1 (according to Sayed, 2002). Number of female spathes per each palm was adjusted to ten spathes. Artificial pollination was achieved by inserting five male strands into the female bunch using known high activating pollen source throughout 2 – 3 days after female spathe creaking followed by bagging (Omar, 2007). Each selected palm received the common horticultural practices that are already applied in the orchard except those dealing with using seaweed extract.

This study included the five treatments from five concentrations of seaweed extract namely 0.0, 0.05, 0.1, 0.2 and 0.4 %. Each treatment was replicated three times, two palms per each (30 Zaghoul date palms/ experiment). Randomized complete block design was followed. Seaweed extract (Table 1) was sprayed four times at growth start, just after fruit setting and at one month intervals.

Triton B as a wetting agent was used with all solutions at 0.05 % and the spray was done till runoff (5 L/ palm). The control palms received tap water mixed with Triton B at 0.5 %.

During both seasons, the following parameters were carried out:-

1. Leaf area (m<sup>2</sup>) (Ahmed and Morsy, 1999).
2. Total chlorophylls (a + b) as (mg/ g-1 F.W) (Moran, 1949 and Wettstein, 1957).
3. Percentages of N, P, K and Mg in the dried leaves according to Piper (1950); Chapman and Pratt (1965) and Wilde *et al.*, (1985).
4. Bunch weight (kg.).
5. Yield/ palm (kg.) at the first week of September.
6. Some physical and chemical characteristics of the fruits namely fruit weight (g.) and dimensions (length and width, cm.) as well as percentages of pulp and seeds, pulp/ seed, total soluble solids %, total and non- reducing sugars % (A.O.A.C., 1995), total acidity % (as g malic acid/ 100 g pulp) according to A.O.A.C., (1995); fibre crude % and total soluble tannins % were determined (A.O.A.C., 1995).

All the obtained data were tabulated and subjected to the proper statistical analysis using new L.S.D at 5 % according to Mead *et al.*, (1993).

## RESULTS AND DISCUSSION

### 1- Leaf area and its content of total chlorophylls and N, P and K:

It is clear from the data in Table (1) that treating Zaghoul date palms four times with seaweed extract at 0.05 to 0.4 % significantly was followed by enhancing the leaf area as well as total chlorophylls and percentages of N, P and K in leaves in relative to the check treatment. The promotion was significantly associated with increasing concentrations of seaweed extract from 0.0 to 0.2 %. Increasing concentrations from 0.2 to 0.4 % failed significantly to promote these parameters. Spraying the palms with seaweed extract at 0.4 % gave the maximum values. Untreated palms produced the lowest values. These results were true during both seasons.

### 2- Bunch weight and yield per palm:

It is evident from the data in Table (2) that spraying seaweed extract at 0.05 to 0.4 % significantly stimulated bunch weight and yield per palm in relative to the check treatment. There was a gradual promotion on bunch weight and yield per palm with increasing concentrations of seaweed from 0.0 to 0.4 %. Increasing concentrations from 0.2 to 0.4 % had no significant promotion on bunch weight and yield per palm, therefore, from economical point of view, it is suggested to use 0.2 % seaweed extract. Using seaweed extract at 0.2 % four times produced the highest yield from economical point of view. Under such promised treatment, yield per palm reached 188 and 192 kg during 2011 and 2012 seasons. The untreated palms produced 148.8 and 152.0 kg in both seasons, respectively. The percentage of increase due to application of the promised treatment over the check treatment reached 26.3 % during both seasons.

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

It is clear from the data in Tables (2 & 3) that foliar application of seaweed extract at 0.05 to 0.4 % significantly improved fruit quality of Zaghoul date palms in terms of increasing fruit weight and dimensions (length & width); pulp %, pulp/ seed, T.S.S % as well as total and reducing sugars % and decreasing seed %, total acidity %, total soluble tannins and total crude fibre % in relative to the check treatment. The promotion on fruit quality was significantly associated with increasing seaweed extract concentrations. No significant differences were observed on fruit quality among the higher two concentrations of seaweed extract. The best results were obtained due to spraying the palms four times with 0.2 % seaweed extract (since no significant differences were observed among 0.2 and 0.4 concentrations). The untreated palms produced unfavourable effects on fruit quality. These results were true during both seasons.

## DISCUSSION

The previous benefits of seaweed extract on growth, nutritional status, yield as well as physical and chemical characteristics of the fruits of Zaghoul date palms might be attributed to the higher own content of essential and on seaweed extract from essential amino acids, minerals, vitamins, organic foods, amino acids and natural plant hormones namely IAA, GA3 and cytokinins (Aziz *et al.*, 2003). It has positive effect on enhancing soil fertility and activity of soil microorganisms (Tung- Yunn *et al.*, 2003). These results are in agreement with those obtained by Gamal (2006); Hassan- Hoda (2008); El- Sayed- Esraa (2010); Mahmoud (2012) and Mabrouk (2013).

## CONCLUSION

Treating Zaghloul date palms with seaweed extract four times at 0.2 % gave the best results with regard to yield and fruit quality.

## References

- Ahmed, F. F and Morsy, M. H. (1999): A new method for measuring leaf area in different fruit species. *Minia. J. Agric. Res. & Dev.* 19: 97 – 105.
- Ahmed, F. F.; Gobara, A. A.; Abo El- Komsan, E. E. and Gamal, A. F. (2008): Growth and fruiting of Washington Navel orange trees as affected by some antioxidant and Algae extract treatments. *Inter. Conf. for Environ. Studies, Menufia Univ.* pp 200 – 220.
- A. O. A. C. (1995): Official Methods of Analysis 16th Ed, A.O.A.C Benjamin Franklin Station, Washington, D.C, U.S.A. pp 490 – 510.
- Arnon, D.L. (1949): Copper enzymes in isolated chlorophyll polyphenol oxidase in *Beta vulgaris*. *Plant physio*, 24: 1-15.
- Aziz, A.; Poinsot, B; Daire, X; Adrian, M ; Bezier, A.; Lambert, B; Joubert, J.M and Pugin, A. (2003) : La minarin elicits defense responses in grapevine and induces protection against *Botrytis cinerea* and *plasmopara viticola* . *Molecular Plant Microbe Interactions* 16 (12) :1118- 1128.
- Ebeid- Sanaa, A. (2007): The promotive effect of seaweed extract and boron on growth and fruiting of Hindy Bisinnara mango trees. *Minia J. of Agric. Res.& Develop.* Vol. (27) No. 3 pp 579 – 594.
- Chapman, H.D. and Pratt, P.F. (1965): Methods of Analysis for Soils, Plants and Water. Univ. of California . Division of Agric., Sci. 172-173.
- El- Sawy, Y. A. E. (2005): Studies on the effect of some organic fertilizer, ammonium nitrate and the biofertilizer (Algae extract) on growth and productivity of Williams banana (*Musa Cavendishii* L.). M. Sc. Thesis Fac. of Agric . Minia Univ. Egypt.
- El- Sayed- Esraa, M. H. (2010): Behaviour of Ewaise mango trees to foliar application of some nutrients and seaweed extract. Ph. D. Thesis Fac. of Agric. Minia Univ. Egypt.
- Gamal, A. F. (2006): Response of Washington Navel orange trees to some antioxidants and biofertilization treatments. M. Sc. Thesis, Fac. of Agric. Minia Univ., Egypt.
- Gobara, A. A. (2004): Effect of Algae extract and yeast on fruiting of Zaghloul date palms. *J. agric. Sci. Mansoura Univ.*, 29 (9): 5209 – 5220.
- Hassan-Hoda, M. I. (2008): Effect of algae extract on productivity of Balady orange trees. M. Sc. Thesis Fac. of Agric. Minia Univ. Egypt.
- Hegab, M. Y. and Shaarawy, A. M. A. and El- Saida, S. A. G (2005): Effect of Algae extract and mono potassium phosphate on growth and fruiting of Balady orange trees. *Bull. Fac. of Agric Cairo. Univ.* 56: 107 – 120.
- James, B. (1994): Chapters from life. *Ann. Rev. Physio. Plant. Mol. Biolog.* 45: 1-23.
- Mabrouk, S. A. (2013): Effect of bio and mineral nitrogen fertilization on growth and productivity of mango trees (Zabda cv.). M. Sc. Thesis. Fac. of Agric. Minufya Univ. Egypt.
- Mahmoud, Kh, M. H. (2012): Reducing inorganic N fertilizer in Balady mandarin orchard through application of extracts of yeast, seaweed and farmyard manure. M. Sc. Thesis. Fac of Agric. Minia univ. Egypt.
- Mead, R.; Currow, R. N. and Harted, A. M. (1993): Statistical Methods in Agricultural and Experimental Biology. Second Ed. Chapman & Hall London. pp 10 - 44.
- Mohamed, M. A.; Gobara, A. A.; Ragab, M. A. and Mouftah, R. T. (2008): Response of Taimour and Zebda mango trees to application of organic and biofertilization along with seaweed extract. 1st Inter. Conf. for Environ. Studies & Res. 7 – 9 April. Menufia Univ. Sadat branch. pp 28 – 38.
- Moran, R. (1949): Formula determination of chlorophylls pigments extracted with N-N -dimethyl-Formamide. *Plant Physiol.*, 69: 1376 – 1381.
- Mouftah, R. T (2007): Physiological studies on biofertilization of mango trees cvs Taimour and Zebda. Ph. D. Thesis Fac. of Agric. Minia Univ. Egypt.
- Norric, J.; Branson, T. and Keathley, P. E (2002): Marin plant extracts impact on grape yield and quality. *Acta Hort. J.* 91: 93 – 100.
- Omar. M. G. (2007): Effect of some pollination treatments on yield and fruit quality of Sewy date palms grown under El- Farafra Oasis conditions. M. Sc. Thesis Fac. of Agric. Minia Univ.
- Piper, C. D. (1950): Soil and Plant Analysis. *Inter. Sci.*, New York pp 48 – 110.
- Sayed, E. F. (2002): The productive capacity of Sewy date palms grown under New Valley conditions in response to leaves/ bunch ratio. M. Sc. Thesis Fac. Agric. Mnia Univ.

Tung – Yunn, H. O.; Quigg, A.; Finkel, Z. V.; Milligan, A. J.; Wgman, K.; Falkowski, P. G. and Morel, F. M. M. (2003): The elemental composition of some marine phytoplankton. *J. of Phycology* Vol. 39 No. 1; 10 – 20.

Wettstein, D. V. C. (1957): Clatale und der Sumbmikro Skopisne Formwechsel de Plastids. *Experimental Cell Research*, 12: 427.

Wilde, S. A.; Corey, R. B.; Layer, J. G. and Voigt, G. K. (1985): *Soils and Plant Analysis for Tree Culture*. 3rd Ed. Oxford and IBH publishing Co., New Delhi, India. pp. 529 – 546.

## Tables

**Table (1):** Analysis of seaweed extracts (According to James, 1994)

Character	Values
Moisture	6 %
O.M.	45 - 60 %
Inorganic matter	45 - 60 %
Protein	6 - 8 %
Carbohydrates	35 - 50 %
Alginic acid	10 - 20 %
Mannitol	4 – 7 %
Total N	1.0 - 1.5 %
Phosphorus	0.02 - 0.05 %
Potassium	10 - 12 %
Calcium	0.2 - 1.5 %
Sulphur	3 - 9 %
Magnesium	0.5 - 0.9 %
Copper	1 - 6 ppm
Iron	50 – 200 ppm
Manganese	5 – 12 ppm
Zinc	10 – 100 ppm
Boron	20 – 100 ppm
Molybdenum	1 – 5 ppm
Cytokinins	0.02 %
IAA	0.03 %
ABA	0.01 %

**Table (2):** Effect of different concentrations of seaweed extract on leaf area, total chlorophylls & percentages of N, P and K in the leaves, yield, bunch weight and some physical characters of the fruits of Zaghoul date palms during 2011 and 2012 seasons.

Concentrations of seaweed extract	Leaf area (m <sup>2</sup> )		Total chlorophylls (mg/ g <sup>1</sup> F.W)		Leaf N %		Leaf P %		Leaf K %	
	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012
0.0 %	1.94	2.01	10.1	10.5	1.82	1.91	0.16	0.18	1.39	1.44
0.05 %	2.01	2.08	10.8	11.2	1.52	1.60	0.21	0.23	1.49	1.52
0.1 %	2.25	2.31	12.0	12.3	1.66	1.74	0.25	0.30	1.60	1.64
0.2 %	2.41	2.50	12.6	13.0	1.79	1.87	0.29	0.35	1.68	1.73
0.4 %	2.45	2.51	12.7	13.1	1.82	1.88	0.30	0.36	1.70	1.74
New L.S.D at 5 %	0.05	0.06	0.4	0.5	0.06	0.07	0.03	0.04	0.04	0.05
Character	Yield/ palm (kg.)		Bunch weight (g.)		Fruit weight (g.)		Fruit length (cm.)		Fruit width (cm.)	
	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012
0.0 %	148.8	152.0	18.6	19.0	22.1	22.4	5.50	2.51	2.51	2.53
0.05 %	160.0	162.4	20.0	20.3	24.5	24.8	5.62	2.60	2.60	2.61
0.1 %	172.0	176.0	21.5	22.0	27.0	27.3	5.71	2.69	2.69	2.70
0.2 %	188.0	192.0	23.5	24.0	28.5	28.7	5.81	2.75	2.75	2.77
0.4 %	188.8	193.6	23.6	24.2	28.7	28.9	5.82	2.76	2.76	2.78
New L.S.D at 5 %	1.4	1.5	1.1	1.2	1.1	1.2	0.07	0.06	0.05	0.04

**Table (3):** Effect of different concentrations of seaweed extract on some physical and chemical characteristics of the fruits of Zaghloul date palms during 2011 and 2012 seasons.

Seaweed extract	Pulp %		Seeds %		Pulp/ seed		T.S.S %		Total sugars %	
	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012
0.0 %	80.0	80.7	20.0	19.3	4.0	4.2	26.0	26.5	19.8	20.1
0.05 %	81.9	82.6	18.1	17.4	4.5	4.7	27.1	27.5	20.8	21.0
0.1 %	83.7	84.5	16.3	15.5	5.1	5.5	28.0	28.4	22.0	22.2
0.2 %	85.0	85.8	15.0	14.2	5.7	6.0	29.2	29.5	23.1	23.3
0.4 %	85.2	86.0	14.8	14.0	5.8	6.1	29.3	29.6	23.2	23.5
New L.S.D at 5 %	1.1	1.0	0.9	1.0	0.3	0.4	0.7	0.6	0.5	0.4
Character	Reducing sugars %		Non- reducing sugars %		Total acidity %		Total soluble Tannins %		Total crude fibre %	
	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012
0.0 %	14.0	14.5	5.8	5.6	0.401	0.396	0.69	0.71	0.71	0.70
0.05 %	14.6	15.1	6.2	5.9	0.369	0.360	0.60	0.61	0.51	0.48
0.1 %	15.2	15.8	6.8	6.4	0.330	0.329	0.41	0.38	0.38	0.35
0.2 %	16.0	16.4	7.1	6.9	0.301	0.300	0.30	0.31	0.29	0.20
0.4 %	16.1	16.5	7.1	7.0	0.300	0.299	0.29	0.29	0.28	0.18
New L.S.D at 5 %	0.4	0.3	NS	NS	0.028	0.025	0.03	0.04	0.04	0.05