Fruiting of Zaghloul date palms in response to foliar application of the antioxidant glutathione

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ABSTRACT

This study was investigated during 2011 and 2012 seasons to examine the effect of foliar application of the antioxidant Glutathione at 0.0, 0.025, 0.05, 0.1 and 0.2 % on fruiting of Zaghloul date palms grown under Minia region. The selected palms received four sprays.

An obvious promotion on the leaf area, total chlorophylls, leaf content of N, P, K, yield, bunch weight and fruit quality of Zaghloul date palm was observed with using Glutathione at 0.025 to 0.2 %. The promotion was associated with increasing concentrations. A slight stimulation was observed among the higher two concentrations.

Four sprays of Glutathione at 0.1 % to Zaghloul date palms was beneficial for enhancing yield and fruit quality under Minia region.

Key words: Glutathione – Zaghloul date palms – yield – fruit quality.

INTRODUCTION

Yield decline of Zaghloul date palms grown under Minia region can be solved as previously mentioned by many authors by using the important antioxidant namely Glutathione. It is the most important non- protein thiol present in the plants. It is very essential in producing antioxidant defense systems in plants that can protect the plants from reactive oxygen species. It is also important for increasing the tolerance of plants to all stresses and promoting metabolism of sulfur. Reduced Glutathione is considered the major water soluble antioxidant in photosynthetic and non- photosynthetic tissues. It is also enhances cell division and increasing the integrity of cell structure (Levitt, 1980; Rennenberg, 1982; Meister and Anderson, 1983; Dekok and Stulen, 1993; Jorge *et al.,* 1993; Foyer *et al.,* 1997; Noctor and Foyer, 1998; Tausz and Grill, 2000; Kocsy *et al.,* 2001 and Mullineaux and Rausch, 2005). Recently, Abd El-aal et al, (2012) emphasized the beneficial of Glutathione on yield as well as physical and chemical characteristics of Taimour mango fruits.

The target of this study was elucidating the effect of different concentrations of Glutathione on fruiting of Zaghloul 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 Zaghloul 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 the antioxidant Glutathione.

The present study included five treatments from five concentrations of the antioxidant Glutathione namely 0.0, 0.025, 0.05, 0.1 and 0.2 %. Each treatment was replicated three times, two palms per each. Therefore, the total uniform

in vigour palms that selected to achieve this exported was 30 palms. Randomized complete block design was adopted. Glutathione was sprayed four times at growth start (last week of April), just after fruit setting (last week of Mar.) and at one month intervals (last week of April and May). Triton B as a wetting agent was added to all Glutathione concentrations (from 0.0 to 0.2 % at 0.05 %). Spraying was done till runoff.

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

- Leaf area (m^2) (Ahmed and Morsy, 1999).
- Total chlorophylls (a + b) as (mg/ g^{-1} F.W) (Moran, 1949 and Wettstein, 1957).
- Percentages of N, P, K and Mg in the dried leaves according to Piper (1950); Chapman and Pratt (1965) and Wilde *et al.,* (1985).
- Bunch weight (kg.).
- Yield/ palm (kg.) at the first week of September.
- 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 was also calculated, 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 % (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:

It is clear from the data in Table (1) that foliar application of Glutathione at 0.025 to 0.2 % significantly stimulated the leaf area of Zaghloul date palms in relative to the check treatment. The promotion was associated with increasing concentrations. Increasing concentrations of Glutathione from 0.1 to 0.2 % failed significantly to show significant promotion on the leaf area. Significant differences were recorded between most concentrations on leaf area. Treating the palms four times with Glutathione at 0.2 % gave the maximum values. Untreated palms produced the minimum values. These results were true during both seasons.

2. Total chlorophylls and percentages of N, P and K in the leaves:

As shown in Table (1), total chlorophylls and percentages of N, P and K in the leaves were significantly increased in response to foliar application of Glutathione at 0.025 to 0.2 % in relative to the check treatment. There was a gradual and significant stimulation on these parameters with increasing concentrations. Meaningless promotion was observed between the higher two concentrations. Using Glutathione at 0.2 % gave the maximum values. The lowest values were detected on untreated palms. Similar results were announced during both seasons.

3. Bunch weight and yield per palm:

It can be stated from the date in Table (2) that spraying Glutathione at 0.025 to 0.2 % four times significantly was accompanied with improving bunch weight and yield per palm rather than non- application. The promotion was significantly associated with increasing concentrations of Glutathione. A slight and unsignificant promotion on the bunch weight and yield was observed among the higher two concentrations, therefore the recommended concentration from economical point of view was 0.1 % Glutathione. The best results with regard to bunch weight and yield were obtained when the palms received four sprays of Glutathione at 0.1 %. Under such promised treatment, yield per palm reached 178.4 and 192.0 kg during both seasons, respectively comparing with the yield of the untreated palm which reached 148.0 and 147.2 kg. The percentage of increase on the yield due to using the promised treatment in relative to the check treatment reached 20.5 and 30.4 % during both seasons, respectively. Similar results were announced during 2011 and 2012 seasons.

4. Physical and chemical characteristics of the fruits:

One can state from the date in Tables (1 & 2) that treating Zaghloul date palms four times with Glutathione at 0.025 to 0.2 % caused a significant promotion on fruit quality in terms of increasing berry weight and dimensions (length & width), pulp %, pulp/ seed & T.S.S %, total and reducing sugars % and reducing total acidity %, total soluble tannins % and total crude fibre % in relative to the control treatment. The promotion was in proportional to the increase in Glutathione concentrations. Significant differences on quality parameters were observed between most concentrations except between the higher two concentrations, therefore the best treatment in this respect was the application of Glutathione at 0.1 %. Untreated palms produced unfavourable effects on fruit quality. The same trend was noticed during both seasons.

DISCUSSION

The promotive effects of Glutathione on growth, nutritional status, yield and fruit quality of Zaghloul date palms might be ascribed to its positive action on enhancing the tolerance of palms to all unfavourable conditions around the palms, uptake of nutrients especially sulfur, cell division, the biosynthesis of most organic foods and antioxidant defense systems that were responsible for protecting the

trees from reactive oxygen species (Tausz and Grill, 2000; Kocsy *et al.,* 2001 and Mullineaux and Rausch, 2005). These results are in agreement with those obtained by Noctor and Foyer (1998) and Abd El-aal *et al.,* (2012).

CONCLUSION

For enhancing growth, nutritional status, yield as well as physical and chemical characteristics of the fruits in Zaghloul date palms, it is advised to spray the palms four times with Glutathione at 0.1 %.

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Table (1): Effect of different concentrations of Glutathione on leaf area, total chlorophylls & percentages of N, P and K in the leaves, yield, bunch weight as well as fruit weight and dimensions of Zaghloul date palms during 2011 and 2012 seasons.

Concentrations of Glutathione	Leaf area (m2)		Total chlorophylls (mg/ g-1 F.W)		Leaf N %		Leaf P %		Leaf K %	
	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012
0.0 %	2.01	2.10	10.11	10.45	1.69	1.74	0.15	0.19	1.29	1.30
0.025 %	2.19	2.27	10.41	11.00	1.79	1.85	0.22	0.27	1.39	1.40
0.05 %	2.21	2.30	11.00	11.49	1.91	1.97	0.26	0.31	1.45	1.46
0.1 %	2.41	2.50	11.50	11.96	1.99	2.02	0.29	0.34	1.59	1.61
0.2 %	2.42	2.53	11.55	11.97	2.01	2.04	0.30	0.35	1.60	1.63
New L.S.D at 5 %	**0.05**	**0.06**	**0.21**	**0.31**	**0.06**	**0.05**	**0.02**	**0.03**	**0.05**	**0.05**
Character	**Bunch weight (g.)**		**Yield/ palm (kg.)**		**Fruit weight (g.)**		**Fruit length (cm.)**		**Fruit width (cm.)**	
0.0 %	18.5	18.4	148.0	147.2	21.0	21.9	5.37	5.41	2.67	2.71
0.025 %	19.6	19.9	156.8	159.2	23.3	24.1	5.50	5.55	2.72	2.75
0.05 %	20.9	21.9	167.2	175.2	25.0	25.5	5.64	5.67	2.80	2.83
0.1 %	22.3	24.0	178.4	192.0	27.3	27.0	5.70	5.74	2.95	2.99
0.2 %	22.5	24.2	180.0	193.6	27.5	27.7	5.72	5.75	2.96	3.00
New L.S.D at 5 %	**1.0**	**1.1**	**2.9**	**3.0**	**1.0**	**1.1**	**0.07**	**0.06**	**0.03**	**0.03**

Table (2): Effect of different concentrations of Glutathione on some physical and chemical characteristics of the fruits of Zaghloul date palms during 2011 and 2012 seasons.

Concentrations of Glutathione	Pulp %		Seeds %		Pulp/ seed		T.S.S %		Total sugars %	
	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012
0.0 %	77.1	77.8	22.9	22.2	3.37	3.50	26.5	27.2	20.1	20.3
0.025 %	79.4	80.1	20.6	19.9	3.85	4.03	27.6	28.4	20.8	21.0
0.05 %	81.5	82.3	18.5	17.7	4.41	4.65	28.9	29.6	21.6	22.0
0.1 %	83.4	84.1	16.6	15.9	5.02	5.29	29.8	30.5	22.0	22.9
0.2 %	83.5	84.2	16.5	15.8	5.06	5.33	30.0	30.6	22.2	23.0
New L.S.D at 5 %	**1.1**	**1.0**	**0.9**	**1.0**	**0.21**	**0.18**	**0.7**	**0.8**	**0.5**	**0.6**

Concentrations of Glutathione	Pulp %		Seeds %		Pulp/ seed		T.S.S %		Total sugars %	
	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012
Character	Reducing sugars %		Non- reducing sugars %		Total acidity %		Total soluble Tannins %		Total crude fibre %	
0.0 %	14.0	14.2	6.1	6.1	0.401	0.396	0.71	0.74	0.69	0.71
0.025 %	14.6	15.0	6.2	6.0	0.380	0.371	0.60	0.62	0.58	0.59
0.05 %	15.3	15.5	6.3	6.5	0.350	0.350	0.41	0.40	0.37	0.37
0.1 %	16.0	16.0	6.0	6.9	0.322	0.318	0.35	0.33	0.30	0.31
0.2 %	16.2	16.1	6.0	6.9	0.320	0.316	0.34	0.32	0.29	0.30
New L.S.D at 5 %	**0.4**	**0.3**	**NS**	**NS**	**0.020**	**0.018**	**0.03**	**0.04**	**0.03**	**0.04**