Behaviour of Balady Mandarin Trees to Some Yeast, Amino Acid and Salicylic Acid Treatments

Faissal. F. Ahmed[1]; Ahmed H. Abdel aal[2]; Ahmed A. E. Mohamed[2] and Mobarak A. Shoug[2]

[1]Hort. Dept. Fac. of Agric. Minia Univ., Egypt.
[2]Hort. Dept. Fac. of Agric. El Azhar Univ. (Assiut branch). Egypt
Faissalfadel@yahoo.com

Abstract: During 2016 and 2017 seasons Balady mandarin trees grown under Minia region treated four times at growth start (1st week of March), just after fruit setting (mid of April) and at two months intervals with yeast via soil at 2.5 to 10 g/tree and via leaves at 0.25 to 1.0% and amino acids at 0.5% and/ or salicylic acid at 50 ppm as a trial for improving leaf area, tree nutritional status as well as productivity of the trees. Treating the trees with yeast via soil at 2.5 to 10.0 g/tree or via foliage at 0.25 to 1.0% and amino acids at 0.5% and/ or salicylic acid at 50 ppm significantly stimulate, leaf area, total chlorophylls, N, P, K (as %) and Zn (as ppm) in the leaves and promoted yield expressed in weight and improved fruit quality in terms of increasing fruit weight, T.S.S %, total sugars %, and decreasing total acidity % over the check treatment. Using yeast via soil materially favourable than using yeast via leaves in all parameters. Spraying amino acids was remarkably superior to using salicylic acid. Treating Balady mandarin trees grown under Minia region conditions four times with yeast via soil at 5.0 g/tree plus carrying out four sprays of amino acids at 0.5% and salicylic acid at 50 ppm gave the best results with regard to yield and fruit quality.

[Faissal. F. Ahmed; Ahmed H. Abdel aal; Ahmed A. E. Mohamed and Mobarak A. Shoug. **Behaviour of Balady Mandarin Trees to Some Yeast, Amino Acid and Salicylic Acid Treatments.** *N Y Sci J* 2018;11(3):9-19]. ISSN 1554-0200 (print); ISSN 2375-723X (online). http://www.sciencepub.net/newyork. 2. doi:10.7537/marsnys110318.02.

Keywords: Balady mandarin, yeast, amino acids, salicylic acid, vegetative growth characteristics, tree nutritional status, yield.

1. Introduction

Recently, many attempts were accompanied for improving yield and fruit quality of Mandarin trees by using non- traditional methods. Out of these methods were the application of yeast, amino acids and salicylic acid.

Yeast is very beneficial and essential for the synthesis of amino-linolenic acid (AA) and is necessary for the formation of protoprphyrin, the precursor of chlorophyll. It aids in activating photosynthesis process through enhancing the release of carbon dioxide **(N.R.P 1977 and Barnett *et al.*, 1990).**

Amino acids as organic nitrogenous compounds are the building blocks in the synthesis of proteins, which are formed by as process in which ribosomes catalyze the polymerization of amino acids (**Davies, 1982 and Raskin, 1992**). Several hypothesis have been proposed the explain for the role of amino acids in plant. Available evidence suggests several alternative routes of IAA and ethylene synthesis in plants, starting from amino acids (**Hashimoto and Yamada, 1994**). In this respect, **(Waller and Nowaki, 1978**) suggested that the regulatory effect of certain amino acids like phenylalanine and ornithine in plant development appeared through their influence on the biosynthesis of gibberellins.

Recently, SA has received a particular attention because it is a key signal molecule for expression of multiple modes of plant stress resistance. Although the focus has been mainly on the roles of SA on biotic stresses several studies also support major roles of salicylates in modulation of the plant response to several abiotic stresses, such as Uv light, drought, salinity, chilling stress and heat shock (**Ding *et al.*, 2001 and Ding and Wang, 2003**).

The evidence indicates that salicylic acid together with oxygen reactive species which accumulate in stresses cells are essential signals to trigger local defense response or to activate transpiration of stress defense genes. Salicylic acid seems to have a strong influence on cellularredox homeostasis (**Lobez- Deglado *et al.*, 2007**).

Previous studies showed that using yeast (**Ebrahiem *et al.*, 2000; Ahmed, 2001**; **El-Shammaa, 2001; Merwad; 2001; Mustapha and El- Hosseiny 2001; Sheta, 2002**; **Ahmed *et al.*, 2003; Mouftah, 2007; Mohamed *et al.*, 2008**; **Abd El- Motty- Elham *et al.*, 2010; Abdelaal *et al.*, 2012** and **Mahmoud, 2012)**; amino acids (**Sayed *et al.*, 2002; Gamal, 2006; Yousef- Amal *et al.*, 2011; El- Badawy and Abd El- aal, 2013; Fathalla, 2013; Ibrahiem *et al.*, 2013; Ahmed *et al.*, 2014b**; **Hassan, 2014**; **Hassan-Huda, 2014**; **Rabeh *et al.*, 2014**; **Sayed – Ola, 2014** and **Ahmed, 2016)** and

salicylic acid (**Eshmawy, 2010; Ahmed *et al.*, 2010; Kassem *et al.*, 2011; Ahmed, 2011; Karmi *et al.*, 2012; Osman, 2014 and Abd El- Megeed, 2015**) was very effective in improving growth, yield and fruit quality of fruit crops.

The target of this study was elucidating the effect of single and combined applications of yeast, amino acids and salicylic acid on leaf area, leaf chemical composition, yield and fruit quality of Balady mandarin trees growing under Minia region.

2. Material and Methods

This study was conducted during 2016 and 2017 seasons on 84 nearly uniform and similar in vigour 15- years old Balady mandarin trees (Citrus reticulata L. Blanco) budded on sour orange rootstock in a private orchard located at El- Shorafa village at eastern bank of Minia city, Minia Governorate where the soil is silty clay and well drained and with a water table not less than two meters deep. The selected trees planted at 4x4 meters apart. Surface irrigation system was followed.

Horticultural practices such as fertilization with 10 tons F.Y.M. 700 kg ammonium nitrate (33.5 % N), 200 kg potassium sulphate (48 % K_2O) and 200 kg calcium superphosphate (15.5 % P_2O_5 per feddan), irrigation, hoeing as well as pest and fungi management were carried out as usual. Farmyard manure (F.Y.M.) was added once at the mid. of Jan. Mineral N was divided into three equal batches applied at the first week of March, May and July. Potassium fertilizer was added at two equal batches before first bloom (mid. Mar.) and just after fruit setting (mid. May). The trees received two equal additions of phosphate fertilizer, the first with F.Y.M. addition and the second just after fruit setting (mid. May).

Table (1): Analysis of the tested soil:

Constituents	Values
Particle size distribution	
Sand %	4.7
Silt %	60.0
Clay %	35.3
Texture %	Silty clay
pH (1: 2.5 extract)	7.92
E.C. (1: 2.5 extract) mmhos/ cm/ 25^oC	1.72
O.M. %	1.42
$CaCO_3$ %	2.22
Total N %	0.09
Available P (ppm, Olsen)	5.2
Available K (ppm, ammonium acetate)	402.2

Analysis of the tested soil at 0.0 to 90 cm depth was carried out according to the procedures that outlined by **Chapman and Pratt (1965**) and the obtained data are shown in Table (1).

Table (2): Chemical analysis of the used yeast extract (according to **Abou- Zaid, 1984).**

characters	values
a- Amino acids (mg/ 100 d d.w)	
Arginine	: 1.99
Histidine	: 2.63
Isoleucine	: 2.31
Leucine	: 3.09
Lycine	: 2.95
Methionine	: 0.72
Phenyl alanine	: 2.01
Threonine	: 2.09
Tryptophan	: 0.45
Valine	: 2.19
Glutamic acid	: 2.00
Serine	: 1.59
Aspartic acid	: 1.33
Cystine	:0.23
Proline	: 1.53
Tyrosine	: 1.49
b- Carbohydrates (mg/ 100 g d.w)	
Carbohydrates%	: 23.2
Glucose %	: 13.33
c- Vitamins (mg/ 100 g d.w)	
B_1	: 2.23
B_2	: 1.33
B_6	: 1.25
B_{12}	: 0.15
Thiamin	: 2.71
Riboflavin	: 4.96
Ensitol	: 0.26
Biotin	: 0.09
Nicotinic acid	: 39.88
Panthothenic acid	: 19.56
Pamino benzoic acid	: 9.23
Folic acid	: 4.36
Pyridoxine	: 2.90
d- N %	: 7.3
e- Fats %	: 3.5
f- Ash %	: 6.7

The present experiment included the following twenty-eight treatments from two factors (A & B). The first factor (A) comprised from seven concentrations of yeast. The following seven yeast treatments a1control, a2 yeast at 0.25 %, a3 yeast at 0.50 %, a4 yeast at 1%, a5 yeast at 2.5 g /tree, a6 yeast at 5 g /tree and a7 yeast at 10 g /tree. The second factor (B) contained four amino and salicylic acids as follows: b1 (control), b2 (amino acids at 0.5%), b3 (salicylic acid at 50 ppm) and b4 (amino

acids at 0.5%+ salicylic acid at 50 ppm). Therefore, this experiment included twenty-eight treatments. Each treatment was replicated three times, one tree per each. Salicylic acid (SA) solutions were adjusted to pH 6 by using Ion H2SO4 for facilitating of solubility. Soil addition of yeast and spraying of yeast, amino acids (tryptophan, methionine and cysteine) and salicylic acid were done four times at growth start (1st week of March), just after fruit setting (mid of April) and at two months intervals. Triton B as a wetting was added to all solutions of potassium silicate and salicylic acid at 0.05%. The untreated trees received water containing Triton B.

Randomized complete block design (RCBD) in split plot arrangement was followed. The seven treatments of yeast occupied the whole plots and the four treatments from amino and salicylic acids ranked the subplots.

During both seasons the following measurements were recorded:

1- Leaf area (cm^2) (**Ahmed and Morsy, 1999**) in the Spring growth cycle.

2- Leaf pigments namely chlorophyll a & b and total chlorophylls (mg/ 1 g F.W.) (**Hiscox and Isralstam, 1979**).

3- Percentages of N, P, K and leaf content of zinc as (ppm) (**Chapman and Pratt, 1965; Peach and Tracey, 1968; Summer, 1985 and Wilde *et al.*, 1985**).

4- Yield expressed in weight (kg.).

5- Percentage of preharvest fruit dropping.

6- Fruit quality characters namely fruit weight (g.), T.S.S. %, total sugars (**Lane and Eynon, 1965 and A.O.A.C., 2000**) and total acidity % (as g. citric acid / 100 ml juice) (**A.O.A.C., 2000**).

Statistical analysis was done (**Mead *et al.*, 1994**). Treatment means were compared using new L.S.D. at 5%.

3. Results and Discussion

1-Leaf area:

It is clear from the data in Table (3) that treating the trees with yeast via soil at 2.5 to 10.0 g/tree or via foliage at 0.25 to 1.0% significantly stimulated the leaf area relative to the control. The promotion was associated with increasing levels of yeast from 2.5 to 10.0 g/ tree and concentrations from 0.25 to 1%. Increasing levels of yeast from 5 to 10 g/tree and concentrations of yeast from 0.50 to 1.0% had no significant stimulation on leaf area. Using yeast via soil at 2.5 to 10 g/tree was significantly favourable than using yeast via spraying at 0.25 to 1.0% in enhancing leaf area. The maximum values of leaf area were recorded on the trees that received yeast via soil at 10 g/tree. Untreated trees produced the minimum values. Similar trend was noticed during both seasons.

It is revealed from the obtained data that treating Balady mandarin trees with amino acids at 0.5% and/or salicylic acid at 50 ppm significantly was responsible for stimulating leaf area relative to the control. Using amino acids at 0.5% was significantly superior to using salicylic acid at 50ppm in enhancing leaf area. Combined application of amino acids at 0.5% and salicylic acid at 50 ppm significantly was preferable than using each material alone in enhancing leaf area. The maximum values were recorded on the trees that received amino acids plus salicylic acid together. The lowest values were recorded on untreated trees.

Leaf area was significantly enhanced in response to all investigated interactions among the yeast, amino acids and salicylic acid. The maximum values of leaf area **(10.5 & 10.7 cm^2)** were recorded on the trees that received yeast via soil at 10 g/tree, amino acids at 0.5% and salicylic acid at 50 ppm during both seasons, respectively. The untreated trees produced the lowest values. These results were true during both seasons.

2- Leaf chemical composition:

It is clear from the data in Tables (4 to 8) that treating Balady mandarin trees with yeast via soil at 2.5 to 10.0 g/tree or via foliage at 0.25 to 1.0% significantly was accompanied with enhancing total chlorophylls, N, P, K and Zn in the leaves relative to the control. There was a gradual promotion on these total chlorophylls and nutrients in the leaves with increasing levels and concentrations of yeast. Increasing levels from 5 to 10 g/tree and concentrations from 0.50 to 1.0% of yeast had negligible promotion on these total chlorophylls and nutrients. Using yeast via soil at 2.5 to 10 g/tree was significantly superior to using yeast via leaves at 0.25 to 1.0% in enhancing these total chlorophylls and nutrients. Treating the trees with yeast via soil at 10 g/tree maximized the total chlorophylls and nutrients. The lowest values were recorded on untreated trees. Similar trend was noticed during both seasons.

Varying amino acid and salicylic acid treatments had significant effect on total chlorophylls, N, P, K and Zn. Single and combined applications of amino acids at 0.5% and salicylic acid at 50 ppm had significant promotion on total chlorophylls and nutrients in the leaves relative to the control. The promotion was significantly associated with using amino acids than using salicylic acid. Using both materials together significantly surpassed the application of each material alone in this connection. The maximum values were recorded on the trees that received both

materials together. The untreated trees produced the lowest values. These results were true during both seasons.

The interactions between yeast, amino acids and salicylic acid had significant effect on total chlorophylls and nutrients in the leaves of Balady mandarin trees. Treating the trees with yeast via soil at 10 g/tree, amino acids at 0.5% and salicylic acid at 50 ppm gave the maximum values of total chlorophylls **(12.0 & 12.4 mg/ 1g F.W)**, N **(2.10 & 2.11%)**, P **(0.178 & 0.190%)**, K **(1.61 & 1.59%)** and Zn **(72.5 & 73.4 ppm)** during both seasons, respectively. The untreated trees produced the lowest values. These results were true during both seasons.

3- Yield / tree:

It is clear from the obtained data in Table (9) that using yeast via soil at 2.5 to 10.0 g/tree or via spraying at 0.25 to 1.0% had significant promotion on yield expressed in weight over the control. There was a progressive promotion on the yield with increasing levels and concentrations of yeast. Using yeast via soil at 2.5 to 10 g/tree was significantly favourable than using yeast via leaves at 0.25 to 1.0% in improving yield expressed in weight (kg). No significant promotion was observed among the higher two levels and concentrations of yeast. The maximum values were recorded on the trees that treated with yeast via soil at 10 g/tree, but from economical point of view, it is advised to use yeast via soil at 5.0 g/tree. The untreated trees produced the lowest values. These results were true during both seasons.

Treating the trees with amino acids at 0.5% and/or salicylic acid at 50ppm significantly was very effective in improving yield expressed in weight relative to the control. Using amino acids at 0.5% was significantly superior to using salicylic acid in improving the yield expressed in weight. Combined applications were significantly favourable than using each material alone in this connection. The maximum values were recorded on the trees that received both materials together. The untreated trees produced the lowest values. These results were true during both seasons.

The interactions between yeast, amino acids and salicylic acid applications had significant effect on the yield expressed in weight. From economical point of view, the maximum yield/tree **(61.6 & 65.9 kg)** was recorded on the trees that received yeast via soil at 5.0 g/tree, amino acids at 0.5% and salicylic acid at 50 ppm during both seasons, respectively. The untreated trees produced the lowest values **(39.9 & 38.8 kg)** during both seasons, respectively. The percentage of increment on the yield due to using the previous promised treatment (yeast via soil at 5.0 g/tree+ amino acids at 0.5% + salicylic acid at 50 ppm) over the control treatment reached **54.4 and 69.8%** during both seasons, respectively. These results were true during both seasons.

4. Percentage of preharvest fruit dropping

It is clear from the data in Table (10) that percentage of preharvest fruit dropping was significantly controlled by using yeast via soil at 2.5 to 10.0 g/tree or via foliage at 0.25 to 1.0% over the control. There was a gradual reduction on the percentage of preharvest fruit dropping with increasing levels and concentrations of yeast. Using yeast via soil at 2.5 to 10.0 g/tree significantly was superior to using yeast via leaves in controlling preharvest fruit dropping. Increasing levels from 5.0 to 10.0 g/tree and concentrations of yeast from 0.5 to 1.0% had no significant reduction on the percentage of preharvest fruit dropping. The great reduction was recorded on the trees that received yeast via soil at 10 g/tree. The untreated trees produced the highest values. Similar trend was noticed during both seasons.

A significant reduction on the percentage of preharvest fruit dropping was observed due to treating the trees with amino acids at 0.5% and/or salicylic acid at 50ppm relative to the control. Using amino acids at 0.5% was significantly preferable than using salicylic acid in reducing the percentage of preharvest fruit dropping. Using amino acids in combined with salicylic acid significantly surpassed the application of each material alone in controlling the percentage of preharvest fruit dropping. The lowest values were recorded on the trees sprayed with both materials together. The highest values were recorded on the untreated trees. These results were true during both seasons.

The lowest values of preharvest fruit dropping **(22.0 & 21.0%)** were recorded on the trees that treated with yeast via soil at 5.0 g/tree+ amino acids at 0.5%+ salicylic acid at 50 ppm during both seasons, respectively. The highest values **(41.9 & 40.7%)** of preharvest fruit dropping were recorded on untreated trees during both seasons, respectively. These results were true during both seasons.

5- Fruit quality:

It is clear from the obtained data in Tables (11 to 14) that subjecting Balady mandarin trees to yeast via soil at 2.5 to 10.0 g/tree or via leaves at 0.25 to 1.0% significantly was very effective in improving fruit quality in terms of increasing fruit weight, T.S.S %, total sugars % and decreasing total acidity % over the check treatment. The promotion on fruit quality was significantly related to the increase in the levels and concentrations of yeast. Using yeast via soil significantly favourable than using yeast via leaves in improving quality of the fruits. No significant promotion on fruit quality was observed with

increasing levels from 5.0 to 10.0 g/tree and concentrations from 0.5 to 1.0% of yeast. The best treatment was the application of yeast via soil at 5.0 g/tree (since no significant effect on quality was detected among the use of 5.0 and 10.0 g yeast/tree). Unfavourable effects on fruit quality were observed on untreated trees. Similar trend was noticed during both seasons.

Spraying the trees with amino acids at 0.5% and/or salicylic acid at 50ppm significantly succeeded in improving quality of the fruits in terms of increasing fruit weight, T.S.S %, total sugars % and decreasing total acidity % relative to the check treatment. Spraying amino acids was significantly superior to using salicylic acid in enhancing fruit quality. Combined applications were significantly favourable than using each material alone in enhancing fruit quality. The best results with regard to fruit quality were recorded on the trees sprayed with both materials together. The untreated trees produced unfavourable effects on fruit quality. These results were true during both seasons.

The best results with regard to fruit quality were observed on the trees that treated with yeast via soil at 5.0 g/tree+ amino acids at 0.5%+ salicylic acid at 50 ppm, from economical point of view.

Table (3): Effect of single and combined applications of yeast, salicylic and amino acids on the leaf area (cm^2) in the spring growth cycle of Balady mandarin trees during 2016 /2017

Yeast Treatments (A)	Salicylic and amino acid Treatments (B)									
	2016					2017				
	b_1 Control	b_2 Amino acids 0.5%	b_3 SA 50 ppm	b_4 SA + Amino acids	Mean (A)	b_1 Control	b_2 Amino acids 0.5%	b_3 SA 50 ppm	b_4 SA + Amino acids	Mean (A)
a_1 Control	7.0	8.0	7.5	8.4	**7.7**	6.9	8.0	7.6	8.5	**7.8**
a_2 Yeast at 0.25 %	7.5	8.4	8.0	9.0	**8.2**	7.6	8.5	8.1	9.1	**8.3**
a_3 Yeast at 0.50 %	8.0	8.5	8.6	9.6	**8.8**	8.0	9.0	8.7	9.7	**8.8**
a_4 Yeast at 1%	8.1	9.0	8.7	9.7	**8.9**	8.2	9.0	8.7	9.8	**8.9**
a_5 Yeast at 2.5 g /tree	8.6	9.6	9.1	10.0	**9.3**	8.7	9.7	9.1	10.1	**9.4**
a_6 Yeast at 5 g /tree	9.1	10.0	9.6	10.5	**9.8**	9.2	10.1	9.7	10.6	**9.9**
a_7 Yeast at 10 g /tree	9.2	10.0	9.7	10.5	**9.9**	9.2	10.1	9.8	10.7	**10.0**
Mean (B)	**8.1**	**9.1**	**8.7**	**9.7**		**8.3**	**9.2**	**8.8**	**9.8**	
NEW L.S.D at 5 %		A	B	AB			A	B	AB	
		0.4	**0.3**	**0.8**			**0.4**	**0.4**	**1.1**	

Table (4): Effect of single and combined applications of yeast, salicylic and amino acids on total chlorophylls (mg/ 1.0 F.W) in the leaves of Balady mandarin trees during 2016 /2017.

Yeast Treatments (A)	Salicylic and amino acid Treatments (B)									
	2016					2017				
	b_1 Control	b_2 Amino acids 0.5%	b_3 SA 50 ppm	b_4 SA + Amino acids	Mean (A)	b_1 Control	b_2 Amino acids 0.5%	b_3 SA 50 ppm	b_4 SA + Amino acids	Mean (A)
a_1 Control	5.2	7.1	6.1	8.6	**6.8**	5.0	7.2	6.1	8.6	**6.7**
a_2 Yeast at 0.25 %	6.1	8.1	7.1	9.4	**7.7**	6.2	8.2	7.1	9.5	**7.8**
a_3 Yeast at 0.50 %	7.0	8.9	7.9	10.1	**8.5**	7.1	9.0	7.9	10.3	**8.6**
a_4 Yeast at 1%	7.2	9.1	8.0	10.2	**8.6**	7.1	9.1	7.9	10.4	**8.6**
a_5 Yeast at 2.5 g /tree	8.1	10.0	8.8	11.1	**9.5**	8.3	10.3	9.0	11.6	**9.8**
a_6 Yeast at 5 g /tree	9.0	10.9	9.8	12.0	**10.4**	9.3	11.3	10.1	12.4	**10.8**
a_7 Yeast at 10 g /tree	9.1	10.9	9.8	12.0	**10.5**	9.3	11.3	10.1	12.4	**10.8**
Mean (B)	**7.4**	**9.3**	**8.2**	**10.5**		**7.5**	**9.5**	**8.3**	**10.7**	
NEW L.S.D at 5 %		A	B	AB			A	B	AB	
		0.6	**0.5**	**1.3**			**0.7**	**0.6**	**1.6**	

Table (5): Effect of single and combined applications of yeast, salicylic and amino acids on the percentage of N in the leaves of Balady mandarin trees during 2016 /2017.

Yeast Treatments (A)	Salicylic and amino acid Treatments (B)									
	2016					2017				
	b_1 Control	b_2 Amino acids 0.5%	b_3 SA 50 ppm	b_4 SA + Amino acids	Mean (A)	b_1 Control	b_2 Amino acids 0.5%	b_3 SA 50 ppm	b_4 SA + Amino acids	Mean (A)
a_1 Control	1.59	1.72	1.66	1.80	**1.69**	1.60	1.73	1.67	1.81	**1.70**
a_2 Yeast at 0.25 %	1.66	1.79	1.73	1.87	**1.76**	1.66	1.80	1.93	1.88	**1.77**
a_3 Yeast at 0.50 %	1.74	1.87	1.81	1.95	**1.84**	1.75	1.88	1.81	1.95	**1.85**
a_4 Yeast at 1%	1.75	1.88	1.81	1.95	**1.85**	1.75	1.88	1.81	1.95	**1.84**
a_5 Yeast at 2.5 g /tree	1.82	1.95	1.88	2.02	**1.92**	1.84	1.97	1.90	2.04	**1.95**
a_6 Yeast at 5 g /tree	1.90	2.03	1.96	2.10	**2.00**	1.92	2.05	1.98	2.11	**2.01**
a_7 Yeast at 10 g /tree	1.91	2.03	1.97	2.10	**2.00**	1.92	2.05	1.98	2.11	**2.01**
Mean (B)	**1.77**	**1.89**	**1.83**	**1.97**		**1.78**	**1.91**	**1.84**	**1.98**	
NEW L.S.D at 5 %		A	B	AB			A	B	AB	
		0.06	**0.05**	**0.13**			**0.05**	**0.04**	**0.11**	

Table (6): Effect of single and combined applications of yeast, salicylic and amino acids on the percentage of P in the leaves of Balady mandarin trees during 2016 /2017.

Yeast Treatments (A)	Salicylic and amino acid treatments (B)									
	2016					2017				
	b_1 Control	b_2 Amino acids 0.5%	b_3 SA 50 ppm	b_4 SA + Amino acids	Mean (A)	b_1 Control	b_2 Amino acids 0.5%	b_3 SA 50 ppm	b_4 SA + Amino acids	Mean (A)
a_1 Control	0.111	0.129	0.120	0.139	**0.125**	0.109	0.130	0.119	0.141	**0.125**
a_2 Yeast at 0.25 %	0.120	0.138	0.129	0.148	**0.134**	0.120	0.141	0.130	0.152	**0.136**
a_3 Yeast at 0.50 %	0.129	0.147	0.138	0.156	**0.142**	0.130	0.151	0.140	0.165	**0.147**
a_4 Yeast at 1%	0.130	0.148	0.139	0.157	**0.143**	0.131	0.151	0.141	0.166	**0.147**
a_5 Yeast at 2.5 g /tree	0.140	0.158	0.149	0.167	**0.153**	0.141	0.161	0.151	0.179	**0.158**
a_6 Yeast at 5 g /tree	0.150	0.168	0.159	0.177	**0.163**	0.151	0.171	0.161	0.189	**0.168**
a_7 Yeast at 10 g /tree	0.151	0.169	0.160	0.178	**0.165**	0.151	0.171	0.161	0.190	**0.168**
Mean (B)	**0.133**	**0.151**	**0.142**	**0.160**		**0.133**	**0.154**	**0.163**	**0.169**	
NEW L.S.D at 5 %		A	B	AB			A	B	AB	
		0.005	**0.004**	**0.011**			**0.006**	**0.005**	**0.013**	

Table (7): Effect of single and combined applications of yeast, salicylic and amino acids on the percentage of K in the leaves of Balady mandarin trees during 2016 /2017.

Yeast Treatments (A)	Salicylic and amino acid treatments (B)									
	2016					2017				
	b_1 Control	b_2 Amino acids 0.5%	b_3 SA 50 ppm	b_4 SA + Amino acids	Mean (A)	b_1 Control	b_2 Amino acids 0.5%	b_3 SA 50 ppm	b_4 SA + Amino acids	Mean (A)
a_1 Control	1.11	1.23	1.17	1.30	**1.20**	1.04	1.18	1.11	1.25	**1.15**
a_2 Yeast at 0.25 %	1.17	1.29	1.23	1.37	**1.27**	1.12	1.26	1.19	1.33	**1.18**
a_3 Yeast at 0.50 %	1.24	1.36	1.29	1.44	**1.33**	1.20	1.34	1.27	1.41	**1.31**
a_4 Yeast at 1%	1.25	1.36	1.30	1.45	**1.34**	1.20	1.34	1.28	1.41	**1.31**
a_5 Yeast at 2.5 g /tree	1.33	1.44	1.38	1.53	**1.42**	1.28	1.42	1.36	1.50	**1.39**
a_6 Yeast at 5 g /tree	1.41	1.52	1.46	1.61	**1.50**	1.36	1.50	1.44	1.58	**1.47**
a_7 Yeast at 10 g /tree	1.41	1.52	1.46	1.61	**1.50**	1.37	1.51	1.45	1.59	**1.48**
Mean (B)	**1.27**	**1.19**	**1.33**	**1.47**		**1.22**	**1.36**	**1.30**	**1.44**	
NEW L.S.D at 5 %		A	B	AB			A	B	AB	
		0.04	**0.03**	**0.08**			**0.05**	**0.04**	**0.11**	

Table (8): Effect of single and combined applications of yeast, salicylic and amino acids on the leaf content of zinc (as ppm) of Balady mandarin trees during 2016 /2017.

Yeast Treatments (A)	Salicylic and amino acid treatments (B)									
	2016					2017				
	b_1 Control	b_2 Amino acids 0.5%	b_3 SA 50 ppm	b_4 SA + Amino acids	Mean (A)	b_1 Control	b_2 Amino acids 0.5%	b_3 SA 50 ppm	b_4 SA + Amino acids	Mean (A)
a_1 Control	51.9	57.0	54.0	60.0	**55.7**	52.1	58.2	55.1	61.3	**56.7**
a_2 Yeast at 0.25 %	55.0	60.0	57.3	62.9	**58.8**	55.1	61.3	58.1	64.3	**59.7**
a_3 Yeast at 0.50 %	57.9	62.9	60.0	66.1	**61.7**	58.1	64.3	61.1	67.6	**62.8**
a_4 Yeast at 1%	58.0	63.0	60.3	66.1	**61.9**	58.2	64.4	61.1	67.7	**62.9**
a_5 Yeast at 2.5 g /tree	61.3	66.0	63.7	69.3	**65.1**	61.4	67.7	64.1	70.2	**65.9**
a_6 Yeast at 5 g /tree	64.3	69.0	67.0	72.4	**68.2**	64.4	71.7	68.1	73.3	**69.4**
a_7 Yeast at 10 g /tree	64.4	69.0	67.0	72.5	**68.2**	64.5	71.8	68.2	73.4	**69.5**
Mean (B)	**59.0**	**63.8**	**61.3**	**67.0**		**59.1**	**65.6**	**62.3**	**68.3**	
NEW L.S.D at 5 %		A	B	AB			A	B	AB	
		2.1	**1.9**	**5.0**			**1.9**	**1.6**	**4.2**	

Table (9): Effect of single and combined applications of yeast, salicylic and amino acids on the yield/ tree (kg) of Balady mandarin trees during 2016 /2017.

Yeast Treatments (A)	Salicylic and amino acid treatments (B)									
	2016					2017				
	b 1	b 2	b 3	b 4	Mean (A)	b 1	b 2	b 3	b 4	Mean (A)
	Control	Amino acids 0.5%	SA 50 ppm	SA + Amino acids		Control	Amino acids 0.5%	SA 50 ppm	SA + Amino acids	
a1 Control	39.9	44.3	41.9	47.3	**43.4**	38.8	44.4	41.6	47.9	**43.2**
a2 Yeast at 0.25 %	42.3	46.9	44.6	50.0	**45.9**	42.4	38.3	45.5	51.9	**47.0**
a3 Yeast at 0.50 %	44.8	49.5	47.3	52.8	**48.6**	45.4	51.3	48.3	55.1	**50.0**
a4 Yeast at 1%	45.2	49.9	47.3	52.9	**48.8**	45.5	51.4	48.4	55.2	**50.1**
a5 Yeast at 2.5 g /tree	48.1	53.0	50.3	56.9	**52.1**	49.0	55.2	52.3	60.1	**54.2**
a6 Yeast at 5 g /tree	51.3	56.9	54.2	61.6	**56.0**	53.1	60.4	57.7	65.9	**59.3**
a7 Yeast at 10 g /tree	51.6	57.4	54.5	62.0	**56.4**	53.2	60.6	57.8	66.5	**59.5**
Mean (B)	**46.2**	**51.1**	**48.6**	**54.8**		**46.8**	**53.1**	**50.2**	**57.5**	
NEW L.S.D at 5 %		A	B	AB			A	B	AB	
		2.0	**1.8**	**4.8**			**2.1**	**2.0**	**5.3**	

Table (10): Effect of single and combined applications of yeast, salicylic and amino acids on the percentage of preharvest fruit dropping of Balady mandarin trees during 2016 /2017.

Yeast Treatments (A)	Salicylic and amino acid treatments (B)									
	2016					2017				
	b 1	b 2	b 3	b 4	Mean (A)	b 1	b 2	b 3	b 4	Mean (A)
	Control	Amino acids 0.5%	SA 50 ppm	SA + Amino acids		Control	Amino acids 0.5%	SA 50 ppm	SA + Amino acids	
a1 Control	41.9	38.0	40.0	35.0	**38.7**	40.7	37.0	39.0	34.0	**37.7**
a2 Yeast at 0.25 %	39.9	36.0	38.0	33.0	**35.2**	38.9	34.9	37.0	32.0	**35.7**
a3 Yeast at 0.50 %	38.0	34.0	35.9	31.0	**34.7**	37.0	33.9	34.9	30.0	**34.0**
a4 Yeast at 1%	37.9	33.9	35.6	30.9	**34.6**	36.7	33.8	34.6	30.0	**34.0**
a5 Yeast at 2.5 g /tree	33.0	28.9	30.0	25.0	**29.2**	32.0	28.4	30.0	24.0	**28.6**
a6 Yeast at 5 g /tree	30.0	25.9	27.0	22.0	**26.2**	29.0	25.0	27.0	21.0	**25.5**
a7 Yeast at 10 g /tree	29.9	25.9	26.9	21.9	**26.2**	28.8	24.9	26.9	21.0	**25.4**
Mean (B)	**35.8**	**31.8**	**33.3**	**28.4**		**34.7**	**31.1**	**32.9**	**27.4**	
NEW L.S.D at 5 %		A	B	AB			A	B	AB	
		1.1	**1.0**	**2.7**			**1.2**	**1.0**	**2.7**	

Table (11): Effect of single and combined applications of yeast, salicylic and amino acids on the average fruit weight (g) of Balady mandarin trees during 2016 /2017.

Yeast Treatments (A)	Salicylic and amino acid treatments (B)									
	2016					2017				
	b 1	b 2	b 3	b 4	Mean (A)	b 1	b 2	b 3	b 4	Mean (A)
	Control	Amino acids 0.5%	SA 50 ppm	SA + Amino acids		Control	Amino acids 0.5%	SA 50 ppm	SA + Amino acids	
a1 Control	105.0	111.0	108.0	114.0	**109.5**	104.9	111.0	108.0	114.0	**109.5**
a2 Yeast at 0.25 %	108.0	114.0	111.5	117.0	**112.6**	108.8	114.9	112.4	117.9	**113.5**
a3 Yeast at 0.50 %	111.0	117.0	114.3	120.0	**115.6**	112.0	118.0	115.0	121.0	**116.5**
a4 Yeast at 1%	111.5	117.3	114.5	120.0	**115.8**	112.0	118.0	115.0	121.0	**116.5**
a5 Yeast at 2.5 g /tree	114.5	120.4	118.0	125.0	**119.5**	115.0	121.0	118.5	126.0	**126.1**
a6 Yeast at 5 g /tree	118.0	125.0	123.0	131.3	**124.3**	118.0	125.9	124.0	132.0	**125.0**
a7 Yeast at 10 g /tree	118.3	125.3	123.3	131.3	**124.6**	118.0	126.0	124.0	133.0	**125.3**
Mean (B)	**112.3**	**118.6**	**116.1**	**122.6**		**112.7**	**119.3**	**116.7**	**123.6**	
NEW L.S.D at 5 %		A	B	AB			A	B	AB	
		2.9	**2.8**	**7.4**			**3.0**	**2.9**	**7.7**	

Table (12): Effect of single and combined applications of yeast, salicylic and amino acids on the percentage of total soluble solids in the fruits of Balady mandarin trees during 2016 /2017.

Yeast Treatments (A)	Salicylic and amino acid treatments (B)									
	2016					2017				
	b 1	b 2	b 3	b 4	Mean (A)	b 1	b 2	b 3	b 4	Mean (A)
	Control	Amino acids 0.5%	SA 50 ppm	SA + Amino acids		Control	Amino acids 0.5%	SA 50 ppm	SA + Amino acids	
a1 Control	11.3	11.9	11.6	12.2	**11.8**	11.3	11.9	11.6	12.2	**11.8**
a2 Yeast at 0.25 %	11.6	12.2	11.9	12.5	**12.1**	11.6	12.2	11.9	12.5	**12.1**
a3 Yeast at 0.50 %	11.9	12.5	12.2	12.8	**12.4**	11..9	12.5	12.2	12.9	**12.4**
a4 Yeast at 1%	12.0	12.6	12.3	12.9	**12.5**	12.1	12.7	12.4	13.0	**12.6**
a5 Yeast at 2.5 g /tree	12.4	13.0	12.7	13.3	**12.9**	12.5	13.1	12.8	13.4	**13.0**
a6 Yeast at 5 g /tree	12.6	13.2	12.9	13.6	**13.1**	12.7	13.2	13.0	13.6	**13.1**
a7 Yeast at 10 g /tree	12.7	13.3	13.0	13.7	**13.2**	12.7	13.3	13.1	13.6	**13.2**
Mean (B)	**12.1**	**12.7**	**12.4**	**13.0**		**12.1**	**12.7**	**12.4**	**13.0**	
NEW L.S.D at 5 %		A	B	AB			A	B	AB	
		0.2	**0.2**	**0.5**			**0.2**	**0.2**	**0.5**	

Table (13): Effect of single and combined applications of yeast, salicylic and amino acids on the percentage of total sugars in the fruits of Balady mandarin trees during 2016 /2017.

Yeast Treatments (A)	Salicylic and amino acid treatments (B)									
	2016					2017				
	b 1	b 2	b 3	b 4	Mean (A)	b 1	b 2	b 3	b 4	Mean (A)
	Control	Amino acids 0.5%	SA 50 ppm	SA + Amino acids		Control	Amino acids 0.5%	SA 50 ppm	SA + Amino acids	
a1 Control	7.0	8.0	7.5	8.4	**7.7**	6.9	7.9	7.4	8.4	**7.7**
a2 Yeast at 0.25 %	7.5	8.4	8.0	8..7	**8.2**	7.4	8.3	7.9	8.6	**8.1**
a3 Yeast at 0.50 %	7.9	8.8	8.4	9.1	**8.6**	7.8	8.7	8.3	9.1	**8.5**
a4 Yeast at 1%	8.0	8.9	8.5	9.2	**8.7**	8.0	8.9	8.5	9.2	**8.7**
a5 Yeast at 2.5 g /tree	8.4	9.3	9.0	9.6	**9.0**	8.5	9.3	9.0	9.6	**9.1**
a6 Yeast at 5 g /tree	8.8	9.7	9.4	10.0	**9.5**	8.8	9.7	9.4	10.0	**9.5**
a7 Yeast at 10 g /tree	8.8	9.7	9.7	10.0	**9.6**	8.9	9.8	10.0	10.5	**9.8**
Mean (B)	**8.1**	**9.0**	**8.6**	**9.3**		**8.0**	**8.9**	**8.6**	**9.3**	
NEW L.S.D at 5 %		A	B	AB			A	B	AB	
		0.5	**0.4**	**1.1**			**0.5**	**0.4**	**1.1**	

Table (14): Effect of single and combined applications of yeast, salicylic and amino acids on the percentage of total acidity in the fruits of Balady mandarin trees during 2016 /2017.

Yeast Treatments (A)	Salicylic and amino acid treatments (B)									
	2016					2017				
	b 1	b 2	b 3	b 4	Mean (A)	b 1	b 2	b 3	b 4	Mean (A)
	Control	Amino acids 0.5%	SA 50 ppm	SA + Amino acids		Control	Amino acids 0.5%	SA 50 ppm	SA + Amino acids	
a1 Control	1.419	1.385	1.400	1.370	**1.394**	1.490	1.360	1.380	1.340	**1.372**
a2 Yeast at 0.25 %	1.400	1.370	1.380	1.350	**1.375**	1.390	1.340	1.360	1.320	**1.353**
a3 Yeast at 0.50 %	1.380	1.340	1.360	1.330	**1.353**	1.370	1.320	1.340	1.300	**1.333**
a4 Yeast at 1%	1.379	1.339	1.359	1.329	**1.351**	1.369	1.319	1.339	1.299	**1.331**
a5 Yeast at 2.5 g /tree	1.360	1.320	1.340	1.310	**1.332**	1.350	1.300	1.319	1.260	**1.307**
a6 Yeast at 5 g /tree	1.340	1.300	1.320	1.390	**1.313**	1.330	1.280	1.300	1.240	**1.288**
a7 Yeast at 10 g /tree	1.338	1.299	1.318	1.288	**1.311**	1.329	1.279	1.300	1.240	**1.287**
Mean (B)	**1.373**	**1.336**	**1.354**	**1.324**		**1.364**	**1.314**	**1.334**	**1.286**	
NEW L.S.D at 5 %		A	B	AB			A	B	AB	
		0.011	**0.010**	**0.027**			**0.012**	**0.011**	**0.029**	

4. Discussion

Clean cultivation can also be achieved by using yeast *Saccharomyces cerevisiae,* which contains IAA and cytokinin which effectively promote growth in plants and delays leaf aging. In addition, it contains 93 % dry matter, 44.4 % protein, 2.19 % arginine, 2.09 % glycine, 1.07 % histidine, 2.14 % isoleucine, 3.19 % leucine, 3.23 % lysine, 0.70 % methionine,

0.50 % cysteine, 1.18 % phenylalanine, 1.49 % tyrosine, 2.06 % threonine, 0.19 % tryptophan and 2.32 % vitamins B. Also, it contains 7.5 - 8.5 % N, 2.6 % fat, 8 - 9.5 % ash, 6 - 12 % nucleic acid and 45 - 51 % crude protein. Other constituents of yeast are glutathione, lecithin, enzymes and co-enzymes. Furthermore, yeast contains vitamin B, (thiamin), B6 (pyridoxine) and, glycine (**Abou-Zaid, 1984).** Yeast is very beneficial and essential for the synthesis of amino-linolenic acid (AA) and is necessary for the formation of protoprphyrin, the precursor of chlorophyll. It aids in activating photosynthesis process through enhancing the release of carbon dioxide **(N.R.P 1977 and Barnett *et al.,* 1990).**

These results are in concordance with those obtained by **Ahmed, (2001)**; **El- Shammaa, (2001); Merwad; (2001); Mustapha and El- Hosseiny (2001); Sheta, (2002)**; **Ahmed *et al*., (2003); Mouftah, (2007); Mohamed *et al*., (2008)**; **Abd El-Motty- Elham *et al*., (2010); Abdelaal *et al*., (2012)** and **Mahmoud, (2012).**

Amino acids as organic nitrogenous compounds are the building blocks in the synthesis of proteins, which are formed by as process in which ribosomes catalyze the polymerization of amino acids (**Davies, 1982 and Raskin, 1992**). Several hypothesis have been proposed the explain for the role of amino acids in plant. Available evidence suggests several alternative routes of IAA and ethylene synthesis in plants, starting from amino acids (**Hashimoto and Yamada, 1994**). In this respect, **(Waller and Nowaki, 1978**) suggested that the regulatory effect of certain amino acids like phenylalanine and ornithine in plant development appeared through their influence on the biosynthesis of gibberellins.

This results regarding the effect of amino acids in improving growth, yield and fruit quality of Balady mandarin trees are in agreement with those obtained by **Yousef- Amal *et al.,* (2011); El-Badawy and Abd El- aal, (2013); Fathalla, (2013); Ibrahiem *et al.,* (2013); Ahmed *et al.,* (2014b)**; **Hassan, 2014**; **Hassan-Huda, (2014**); **Rabeh *et al.,* (2014**); **Sayed – Ola, (2014)** and **Ahmed, (2016)**.

The important roles of salicylic acid in enhancing the tolerance of the trees to abiotic stress, the synthesis of protective compounds, the antioxidative capacity of the trees, building of natural hormones, photosynthesis, uptake and transport of nutrients, the tolerance of the trees to pathogens, the inhibition of reactive oxygen species (ROS) namely catalase and ascorbate peroxidade that capable of stimulating ROS accumulation during various biotic and abiotic stresses. Evidence indicates that salicylic acid together with oxygen reactive species which accumulate in the stresses cells are essential signals to trigger local defense response or to activate transpiration of stress defense genes (**Janda *et al.,* 2007**) could explain the promoting effect of salicylic acid on growth and fruiting of Balady mandarin trees.

The results of **Eshmawy (2010) Ahmed *et al.,* (2010); Kassem *et al.,* (2011) Ahmed (2011), Karmi *et al.,* (2012) Osman (2014) and Abd El-Megeed (2015)** supported the presents results concerning the effect of salicylic acid on improving growth, tree nutritional status, yield and quality of the fruits of Balady mandarin trees.

5. Conclusion

Treating Balady mandarin trees grown under Minia region conditions four times with yeast via soil at 5.0 g/tree plus carrying out four sprays of amino acids at 0.5% and salicylic acid at 50 ppm gave the best results with regard to yield and fruit quality.

References

1. Abd El- Megeed, M.M.H. (2015): Response of Sakkoti date palms to spraying salicylic acid under Aswan region conditions. M.Sc. Thesis Fac. of Agric. Minia Univ. Egypt.
2. Abd- El- Motty- Elham, Z.; Shahin, M. F. M.; El- Shiekh, M. H. and Abd El- Migeed, M. M. M. (2010): Effect of Algae extract and yeast application on growth, nutritional status, yield and fruit quality of Keitte mango trees. Agric. Biol. J. N. Am. (3): 421 – 429.
3. Abdelaal, A. M. K.; Ahmed, F. F. and Mahmoud, Kh. M. H. (2012): Partial replacement of chemical N fertilizers in Balady mandarin orchards through application of extracts of yeast, seaweed and farmyard manure. Minia J. of Agric. Res. & Develop. Vol. (32) No. 1 pp 129 – 148.
4. Abou-Zaid, M., (1984): Biochemical studies on fooder yeast. Ph. D. Thesis Fac. of Agric. Cairo Univ. Egypt.
5. Ahmed, A. M. (2001): Studies for controlling malformation and improving yield and fruit quality of Hindy Bissinara mangoes by using active dry yeast, ascorbic acid and sulphur. Minia J. of Agric. Res. & Develop. Vol. (21): No. 2 pp. 219-233.
6. Ahmed, E.F.S (2011): Response of Sakkoti date palms to foliar application of salicylic acid. Minia J. of Agric. Res. & Dev. 21 (2): 305-316.
7. Ahmed, F. F and Morsy, M. H. (1999): A new method for measuring leaf area in different fruit species. Minia. J. of Agric. Rec. & Dev.19: 97 - 105.
8. Ahmed, F. F.; Abdalla, A. S. and Sabour-Asmaa, M. T. (2003): Growth and fruiting of

Williams banana as affected by some antioxidant and biofertilizer treatments. Minia J. of Agri. Res. & Develop. Vol (23) No. 1 pp. 51 – 68.
9. Ahmed, F.F.; Abd El- Aziz, F. H. and Abd El-Kariem A. M. (2010): Relation of fruiting in Crimson seedless grapevines to spraying some antioxidants. Proceeding Minia 2nd Conference of Agric. & Environ. Sci. Agric. & Develop. Scopes. March 2-24 pp. 103 - 112.
10. Ahmed, F.F.; Abdelaal, A.H.M.; El- Masry, S.E.M.A. and Farag, W.B.M.M. (2014b): Response of Superior grapevines to foliar application of some micronutrients, calcium, amino acids and salicylic acid. World Rural Observations. 6 (3): 57-64.
11. Ahmed, M.A.M. (2016): Physiological studies on the effect of some silicon, boron and amino acid treatments on some olive cvs.. Ph. D. Thesis Fac. of Agric. of Al -Azhar Univ. (Assiut branch).
12. Association of Official Agricultural Chemists (2000): Official Methods of Analysis A. O. A. C. 17th Ed Published by A. O. A. C. Washington, D. C. (U.S.A.). pp. 490-510.
13. Barnett, J.A.; Payne, R.W. and Yarrow, D. (1990): Yeast, characteristics and identification. Cambridge University Press, London, 999 pp.
14. Chapman, H.D. and Pratt, P.E. (1965): Methods of Analysis for Soil, Plant and Water. Univ. California, Div. Agric. Sci. 172-173.
15. Davies, D.D. (1982): Physiological aspects of protein tumour. Encycl. Plant physiol. New series (nucleic acids and proteins, structure, biochemistry and physiology of proteins). Springer Verla, Berlin, New York, pp. 190-228.
16. Ding, C.K. and Wang, C.Y. (2003): The dual effects of methyl salicylate on ripening and expression of ethylene biosynthetic genes in tomato fruit. Plant Science. 164, 589-596.
17. Ding, C.K.; Wang, C.Y.; Gross, K.C. & Smith, D.L. (2001): Reduction of chilling injury and transcript accumulation of heat shock protein genes in tomatoes by methyl jasmonate and methyle salicylate. Plant Science, 161, 1153-1159.
18. Ebrahiem, T. A.; Ahmed, F. F. and Abo El-Komsan, E. A. (2000): Response of Balady mandarin trees grown in sandy soil to spraying active dry yeast and some macronutrients. Assiut. J. of Agric Sci. Vol. 31, No. (5): 200 – 221.
19. El- Badawy, H.E.M. and Abd El- aal, M.M. (2013): Physiological response of Keitte mango *(Mangifera indica* L.) to Kinetin and tryptophan J. of Applied Science Res. Co. 11(2): 14-22.
20. El- Shammaa, M. S. (2001): Effect of biofertilizers on growth and yield of banana plants (Williams cv.) Assiut J. Agric., Sci. 32 (1): 157-166.
21. Eshmawy, E.M.S. (2010): Effect of some antioxidants and different pollination methods on fruiting of Sewy date palms. M. Sc. Thesis Fac. of Agric. Minia Univ. Egypt.
22. Fathalla, A.M. (2013): Physiological studies on some mango cultivars. Ph. D. Thesis Fac. of Agric. Menufiya Univ. Egypt.
23. Gamal, A. F. O. (2006): Response of Washington Navel orange trees to some antioxidant and biofertilization treatments. M. Sc. Thesis Fac. of Agric. Minia Univ. Egypt.
24. Hashimoto, T. and Yamada, Y. (1994): Alkaloid biosynthesis Molecular aspects. Ann. Res. Plant. Physiol. Plant. Md. Biol. Pp.243-257.
25. Hassan- Huda, M. (2014): Impact of effective microorganisms and amino acids enriched with some nutrients on growth and fruiting of Valencia orange trees. Ph. D. Thesis Fac. of Agric. Minia Univ. Egypt.
26. Hassan, H.S.E. (2014): Attempts for rliefying alternate bearng in Balady mandarin trees by spraying some amino acids and vitamins. M. Sc. Thesis Fac. of Agric. Minia Univ. Egypt.
27. Hiscox, A. and Isralstam, B. (1979): A method for the extraction of chlorophyll from leaf tissue without maceration. Can. J. Bot.57: 1332-1334.
28. Ibrahiem, H.I.M.; Ahmed, FF.; Akl, A.M.M.A. and Eizk, M.N.S. (2013): Improving yield quantitively and qualititaively of Zaghloul date palms by using some antioxidants. Stem Cell. Vol. (4): No.1, 35-40.
29. Janda, T., Harvath, E.; Szalai, G. and Faldi, E. (2007): Role of salicylic acid in the induction of abiotic stress tolerance, Hayat S. and Ahmed, A. (eds.) salicylic acid a plant hormone chapter 5 pp. 91- 105.
30. Karmi, H.R.; Sevandi- Nasab, S. and Roosta, H.R. (2012): The effect of salicylic acid and potassium on some characteristics of nut and physiological parameters of pistachio trees cv. Owhadi. J. of Nuts 3(3): 21-26.
31. Kassem, H.A.; Al- Obeed, R.S. and Soliman, S.S. (2011): Improving yield, quality and profitability of Flame seedless grapevine grown under arid environmental by growth regulators pre- harvest applications. Middle- East J. of Sci. Res. 8 (1): 165-172.
32. Lane, J. H. and Eynon, L. (1965): Determination of reducing sugars by means of

Fehling's solution with methylene blue as indicator A.O.AC. Washington D.C.U.S.A. pp. 100-110.
33. Lobez- Delgado, H.A.; Scott, I,.M. and Mora-Herrera, M.E. (2007): Stress and antistress effects of salicylic acid and acetyl salicylic acid on potato culture technology. From Hayat, S and Ahmad (eds.) salicylic acid. A plant hormone, Springer pp. 1632-195.
34. 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.
35. Mead, R.; Currnow, R.N. and Harted, A.M. (1993): Statistical Methods in Agricultural and Experimental Biology. Second Ed. Chapman & Hall. London, pp. 10- 44.
36. Merwad, M. M. A. (2011): Effect of nitrogen sources, rates, some biostimulants and antioxidants on growth and productivity of banana plants. Ph. D. Thesis, Fac. of Agric. Zagazig, Univ. Egypt.
37. 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. Menufiya Univ. pp 250-280.
38. Mouftah, R.T. (2007): Physiological studies on biofertilization of mango trees cvs Taimour and Zebda. Ph.D. Thesis Fac. Agric. Minia Univ. Egypt.
39. Moustaffa, M.F. and E1- Hosseiny, A.A. (2001): Influence of spraying active dry yeast solution on growth, yield, fruit quality and leaf NPK content of Washington Navel orange trees. J. Agric. Sci. Mansoura Univ. 26 (10): 6293- 6305.
40. N.R.P (1977): Nutrient Requirements of Domestic Animals No.1 7th Rev. Ed., National Academy of Sci., Washington, D.C.U.S.A.
41. Osman, M.M. (2014): Response of Superior grapevines grown under hot climates to rest breakages. M. Sc. Thesis Fac. of Agric. Minia Univ., Egypt. .
42. Peach and Tracey, I.M.V. (1968): Modern Methods of plant Analysis, Vol. 11 p. 3 6-38.
43. Rabeh, M.R.M.; Ahmed, S.A.; Kassem, A.A.; Hassan, A.E. and Fattahallah, A.M. (2014): Effect of some foliar application substances on growth, yield and fruit quality of Keitte mango cultivar. Menufiya J. Agric. Res. 9 (2): 215-229.
44. Raskin, I. (1992): Role of salicylic acid in plant. Ann. Rev. Plant Physiol. Plant Mol. Biol. 43:439-463.
45. Sayed- Ola, M.O. (2014): Effect Of certain amino acids enriched with some nutrients on growth and fruiting of El- Saidy date palms growing under new valley governorate climatic conditions. M.Sc. Thesis Fac. of Agric. Minia Univ. Egypt.
46. Sayed, R. A. Soliman, B. M. and Abo- El-Komsan, E. Q. (2002): Effect of foliar sprays of some mineral nutrients, GA and biostimulant on yield and quality of Valencia orange trees grown in sandy "Egypt J. Appi. Sci: 222 -238.
47. Sheta, A. A. H. (2002): Effect of mycorrhizae and some amendment agents on growth and yield of Washington Navel orange. M. Sc. Thesis Fac. Agric. Tanta Univ. Egypt.
48. Summer, M.E. (1985): Diagnosis and Recommendation Integrated System (DRIS) as a guide to orchard fertilization. Hort. Abst. 55 (8): 7502.
49. Waller, R. and Nowaki, E.K. (1978): Alkalod, Biology and 7 Metabolism in Plants Press, New York pp: 85-247.
50. Wilde, S. A.; Corey, R. B.; Layer, J. G. and Voigt, G. K. (1985): Soils and Plant Analysis for Tree Culture. Oxford and IBH publishing Co., New Delhi, India. pp. 10-120.
51. Yousef- Amal, R.M.; Eman-Hala and Salehm M.M.S. (2011): Olive seedless growth as affected by humic acids, macro and trace elements. Appli Agric. And Biology. J. of North 2(7):-1401-1.107.

3/3/2018