Influence of Some Amino Acids Enriched With Boron, Zinc and Iron on Productivity of Sultani Fig Trees

Moustafa S. M. Kasem[1], and Heba F. S. Ibrahiem[2]

ABSTRACT

During 2018 and 2019 seasons, Sultani fig trees were sprayed three times (at growth start, just after fruit setting and at one month late) with some amino acids namely (tryptophane, methionine and cysteine) enriched with three micronutrients namely boron, zinc, iron percentages concentration 0.05 to 0.8 %. The study focused on the influence of these micronutrients on some growth and fruiting characteristics of Sultani fig cv.

Spraying Sultani fig cv. with any of these nutrients three times each at 0.05 to 0.8 % considerably enhanced all growth characters, percentages of N, P, K, Mg and Ca, yield and fruit quality in relative to the check treatment. In ascending order, spraying boron, zinc, iron and amino acids was accompanied with enhancing growth, nutritional status, yield and fruit quality.

The best results with regard to yield and fruit quality of Sultani fig cv. were obtained with spraying amino acids enriched with boron, zinc and iron three times at 0.8 %.

Key words: Sultani fig cv., micronutrients, boron, zinc, iron, amino acids, growth and productivity.

INTRODUCTION

The decline in the yield of fig trees cultivated in the condition of Upper Egypt is a serious and major problem that facing fig trees growers. Recently, it was suggested that certain amino acids and micronutrients participate in plant growth flowering and fruit development through their positive action in promoting the biosynthesis of natural hormones, nutrient uptake, photosynthesis, biosynthesis of plant pigments and sugars and protecting the plant from biotic and abiotic stresses, since they enhance micronutrients and antioxidant defense systems and decrease reactive oxygen species (Klesiig *et al*., 2000 and Rao *et al*., 2000). Therefore, the idea of using certain amino acids enrich boron, zinc as well as iron for improving the yield of Sultani fig cv.

Many fig growers overlook the importance of spraying amino acids and trace elements to enhance the vegetative growth, flowering and fruit quality (Milineaux and Rausch, 2005).

Amino acids and micronutrients are precursors and component of proteins, which are important for the stimulation of cell growth. Spraying amino acids like tryptophane, methionine and cysteine are proven to be very helpful in promoting growth and fruiting of various fruit crops (Abd El- aal *et al*., 2012).

Amino acids and micronutrients are responsible for promoting physical and chemical parameters of the fruits as well as enhancing the productivity of trees (Datir. *et al*., 2012). The spraying with amino acids led to increased leaf containing from growth regulators cytokinin's (Cks).

Boron was found to enhance growth and fruiting of fruit crops (Abd- Allah, 2006 and Ebeid- Sanaa, 2007).

However, micronutrient namely (Zn, B, Fe) spraying can influence Physical and chemical properties of fig fruits, such as fruit weight, size and fruit contents and percentages of total chlorophylls, TSS of fruits & and total sugars as well as reduced total acidity (Taheri and Talai 2001).

Previous studies showed that using some micronutrients, amino acids as well as antioxidants in different fruit crops was very effective in improving growth and fruiting (Gamal, 2006; Mahfouz, 2007 and Al- Wasfy, 2013).

The target of this study was testing the influence of some amino acids enriched with some micronutrients on growth, fruit nutritional status, improving yield quantitively and qualitatively of sultani fig cv. grown under Asiut Gov. region conditions.

MATERIALS AND METHODS

This study was conducted during 2018 and 2019 seasons in a private Sultani fig trees situated at Ali No'man Soliman in Sahel Selim district - Assiut Gov. on 18 trees 7- years old Sultani fig cv. These trees were selected by uniform in vigor, healthy with good physical conditions, free from insects, diseases and damages. They were planted at 5 × 5 meters apart (168 fig trres/ feddan). The selected fig trees were irrigated with Nile water through traditional surface irrigation system.

Soil analysis:

DOI: 10.21608/ASEJAIQJSAE.2021.149101

[1]Olive Res. Dept. Hort. Res., Instit. ARC, Giza, Egypt.

[2]Hort. Dept., Fac. of Agric. Minia Univ. Egypt.

Received January 06, 2020, Accepted, February 16, 2020.

Physical and chemical properties of the tested soil at 0.0 to 90 cm. depth are presented in Table (1). Analysis was done according to the procedures that outlined by Wild *et al*., (1985).

Table 1. Analysis of the soil at the trial location

Constituents	Values
Sand %	: 6.7
Silt %	: 13.8
Clay %	: 79.5
Texture	: Clay
pH (1:2.5 extract)	: 8.06
Organic matter %	: 2.35
E.C (1: 2.5 extract) (mmhos/ 1 cm 25° C)	: 0.91
$CaCO_3$ %	: 1.28
Total N %	: 0.11
Available P (Olsen method, ppm)	: 6.1
Available K (ammonium acetate, ppm)	: 492

All the selected Sultani fig trees received common horticultural practices that already applied in the orchard except those dealing with application of amino acids enriched with some micronutrients namely boron, zinc as well as iron (Biokemet company).

These practices included the use of triple calcium superphosphate, (37.5% P2O5) at 250 kg and 300 kg potassium sulphate (48% K2O2) per feddan annually were added as recommended by Ministry of Agricultural. Phosphate fertilizer was added twice. The first dose with Farmyard manure (3rd week of Jan) and the second one done at (1st week of June), Potassium fertilizer was added twice just after at first of fruit and at one month later.

The present experiment included the following six treatments:

1. Control (untreated fig trees).
2. Spraying a mixture of amino acids and mineral nutrients at concentration of 0.05%.
3. Spraying a mixture of amino acids and mineral nutrients at concentration of 0.1%.
4. Spraying a mixture of amino acids and mineral nutrients at concentration of 0.2 %.
5. Spraying a mixture of amino acids and mineral nutrients at concentration of 0.4%.
6. Spraying a mixture of amino acids and mineral nutrients at concentration of 0.8 %. Horticultural practices

Each treatment was replicated three times, one fig tree per each. Therefore, eighteen uniform in vigor Sultani fig cv. were selected for achieving of this study. The three amino acids used were (tryptophane, methionine and cysteine). All micronutrients were sprayed three times at growth start (1st week of Mar.), after fruit setting (last week of Apr.) and at one month later (last week of May). Triton B as a wetting agent was applied at 0.05 % for all antioxidant solutions. Spraying of the fig trees was done till runoff (5 L water/ tree). Untreated trees received water containing Triton B.

During both seasons, the following parameters were recorded: -

The following vegetative growth, plant pigments, leaf mineral contents, yield as well as physical and chemical characteristics of the fruits were measured during both experimental seasons:

Measurement vegetative growth characteristics:

Four branches, one year old were chosen on each tree. One toward each direction and labeled to stimulated the three growth characters namely main shoot length (cm.), number of leaves/ shoot and leaf area (cm^2). At the end of the growing season (last week of July.) the length of ten shoots distributed around the tree was measured then deliver the arrange of them. Also, number of leaves in these shoots was counted. Twenty mature leaves in the middle current shoots per tree were picked and leaf area calculated of the outlined by Ahmed and Morsy (1999) and Ibrahim (2010),

Leaf area $(cm)^2 = 0.3 (0.79 \times diameter^2) + 76.71$

Measurement of leaf pigments:

Measurement of leaf pigments homogenized and extracted by 25 % acetone in the presence of little amounts of Na2CO3 then fertilized. The residue was washed several times with acetone until the filtrate become colorless. The extract was completed to known volume (20 ml.) with acetone 85 %. A portion of this extract was taken for measurement (as mg/ 100 g. F.W.) and acetone (85 % V.V) was used as blank. The optical density of the filtrate was determined at the wave length of 662, 664 and 440 nm. to determine chlorophyll A, B as well as total carotenoids respectively, concentration of each pigment was calculated by using of the following equations according to Ward and Johnston (1962), as illustrated in (Ibrahim, 2010)

Chlorophyll (A) = (9.784 x E.662) - (0.99 xE.644) ($mg.g^{-1}$ f.w)

Chlorophyll (B) = (21.426 x E.644) (4.65 xE.622) ($mg.g^{-1}$ f.w)

Carotenoids = (4.495 x E.440) - 0.268 (Chl a + Chl b) ($mg.g^{-1}$ f.w)

Where: E = Optical density at given wave length (γ).

Total chlorophylls were estimated by summation of chlorophylls a and b ($mg.g^{-1}$ f.w). Then the leaves content of total chlorophylls ($mg.g^{-1}$ f.w) were mathematically calculated.

Determination of N, P, K, Mg, Fe, Zn and B content in the leaves:

Percentages of N, P, K, Mg, Fe, Zn and B in the leaves Chapman and Pratt., (1975) and Wilde *et al*., (1985). A suitable sample (0.5 g) was taken from each dried leaf and wet digested using a mixture of perchloric acid: sulphuric acid (1:4 v/v) (Piper, 1950) until clear solution. 4- 4-Measurement of yield, physical properties of fruits.

Yield as well as physical and chemical characteristics of the fruits namely fruit weight (kg.), average fruit weight (g.). Average fruit length without neck (cm.) Average fruit diameter (cm.)

Measurement of chemical characteristics on the yield:

10 fruits from each replicate were randomly chosen from homogenized sample, passed by Electric Extractor for extracting the juice after dilution at 1:1 with dictated water, the following chemical characteristics were determined:

- Percentage of total soluble solids (T.S.S. %) were determinate in juice obtained from each replicated by using a hand refractometer at 20° C and expressed as percentage (Brix) according to Ranganna (1977).
- Percentage of total titratable acidity (T.A. %), expressed in (g.) citric acid/ 100 g. of juice by titration against with 0.1 N NaOH, using 1 ml. diluted juice in 10 ml. distilled H_2O, the results expressed as (g.) citric acid1 100 g. of fresh juice, according to Ranganna (1977).
- Reducing and total sugar determined by using Lane and Eynone voltametric method Lane and Eynone., (1965)

Experiments were performed using a randomized complete block design (RCBD) with three replications, one fig tree per each, statistical analysis were performed with (SPSS Inc. Chicago, USA). The data were analyzed by done way ANOVA. using the statical package MSTATC program. Means of treatments were compared using New L.S.D. test, differences at $p < 0.05$ were considered as significant (Sendecor and Cochran (1980).

RESULTS AND DISCUSSION

1-Influence of spraying some amino acids enriched with some micronutrients on some vegetative growth characteristics on Sultani fig trees,

It is clear from the data in Tables (2) that influence application of spraying some amino acids namely (tryptophane, methionine and cysteine) enriched with some micronutrients namely (boron, zinc as well as iron) three times at growth start (1st week of Mar.), after fruit setting (last week of Apr.) and at one month later (last week of May) were significantly stimulated the seven growth characters namely main shoot length (cm.), No. of leaves/ shoot, leaf area (cm^2.) chlorophylls a & b, total chlorophylls as well as total carotenoids (mg/ 100 g. F.W.) in relative to the check treatment. Treating the fig three times with some amino acids enriched with some micronutrients at 0.8% gave the maximum values. The untreated fig trees gave the lowest values during both seasons.

Influence some amino acids enriched with some micronutrients a naturally occurring plant hormones acting as an important signaling molecule adds to tolerance against abiotic stress Vazirimeh and Rigi (2014) and Youssef-Nashwa *et al*., (2017). Amino acids enriched with some micronutrients plays a vital role in plant growth, ion uptake a transport, thermogenesis, flower induction. It affects ethylene biosynthesis, stomatal movement and also, reverses the effects of ABA on leaf abscission. In addition to this, it also, enhances the level of photosynthetic pigments, photosynthetic rate and modifies the activity of some of the important enzymes as well.

Amino acids enriched with some micronutrients have been established as an important regulator of photosynthesis, water balance relations and metabolic aspects of plants, depending on its analogues, concentrations, mode of application and plant type, amino acids enriched with some micronutrients were known to affect leaf and chloroplast structure (Uzunova and Popova 2000). Chlorophyll and carotenoid content (Faridduddin *et al*., 2003) and the activity of photosynthesis enzymes such Rubisco (ribulose- 1, 5 bisphosphate carboxylase/ oxygenase) and carbonic anhydrase (Slaymaker *et al*., 2002; Hayat *et al*., (2012) and Youssef-Nashwa *et al*., 2017). The results of above studies, which was mentioned in previous lines may be explained the positive effect of influence application of spraying of some amino acids enriched with some micronutrients on leaf pigments which was found in present study.

Table 2. Influence of spraying some amino acids enriched with boron, zinc, and iron on productivity on some vegetative growth and leaf pigment characteristics of Sultani fig trees during 2018 and 2019 seasons.

Amino acids enriched with (Bo, Zn, Fe) treatments	Main shoot length (cm.)		No. of leaves/ shoot		Leaf area (cm^2.)		Chlorophyll a (mg/ 100 g. F.W.)		Chlorophyll b (mg/ 100 g. F.W.)		Total chlorophylls (mg/ 100 g. F.W.)		Total carotenoids (mg/ 100 g. F.W.)	
	2018	2019	2018	2019	2018	2019	2018	2019	2018	2019	2018	2019	2018	2019
Control (untreated fig trees)	76.3	82.1	12.0	13.0	210.2	213.8	8.1	8.2	2.3	2.5	10.4	10.7	5.4	5.7
Spraying A. A. enriched with (Bo, Zn, Fe) at 0.05 %	80.0	83.2	13.0	14.0	215.3	219.0	9.1	9.5	2.6	2.8	11.7	12.3	6.8	7.1
Spraying A. A. enriched with (Bo, Zn, Fe) at 0.1 %	81.2	86.5	14.0	15.0	226.2	232.4	10.5	10.8	3.0	3.2	13.5	14.0	7.6	8.2
Spraying A. A. enriched with (Bo, Zn, Fe) at 0.2 %	83.1	88.9	14.0	15.0	233.1	239.8	10.8	11.1	3.4	3.7	14.2	14.8	8.3	9.1
Spraying A. A. enriched with (Bo, Zn, Fe) at 0.4 %	90.1	97.0	14.0	16.0	242.3	252.1	11.2	12.4	3.6	3.9	14.8	16.3	9.1	10.0
Spraying A. A. enriched with (Bo, Zn, Fe) at 0.8 %	97.2	103.6	16.0	17.0	249.5	258.3	12.7	13.5	3.9	4.4	16.6	17.9	9.7	10.6
New L.S.D at 5 %	1.0	1.1	1.0	1.1	1.3	1.1	0.4	0.5	0.4	0.4	0.5	0.6	0.3	0.2

As A. A= Amino Acids namely (tryptophane, methionine and cysteine) enriches with boron, zinc & iron three times at growth start (1st week of Mar.), after fruit setting (last week of Apr.) and at one month later (last week of May).

2- Influence of spraying some amino acids enriched with some micronutrients on leaf content of N, P, K, Mg, Fe, Zn and Mn:

Data presented in Tables (3 & 4) clearly reveal that the seven nutrients N, P, K, Mg, Fe, Zn and Mn in the leaves were significantly enhanced in response to application influence of spraying some amino acids namely (tryptophane, methionine and cysteine) enriched with some micronutrients namely (boron, zinc as well as iron) three times at growth start (1st week of Mar.), after fruit setting (last week of Apr.) and at one month later (last week of May) concentration at 0.05 to 0.8 % three times and the best treatment were adjusted at 0.8% of all materials in relative to the check treatment. The promotion was associated with using some amino acids enriched with some micronutrients in at 0.8 % ascending order. Increasing concentrations of each of some amino acids enriched with some micronutrients from concentration of 0.05 to 0.8% failed significantly to promote these nutrients. The maximum values were recorded on the fig trees that treated three times with some amino acids enriched with some micronutrients at 0.8%. The control fig trees produced the minimum values. These results were true during both seasons.

Amino acids enriched with some micronutrients has an essential function in regulating plant developmental processes that effect of nutrient uptake and their status, i.e., vascular differentiation. Stem elongation, leaf development and senescence (Raskin, 1992). A clear involvement of amino acids enriched with some micronutrients in the control of nutrient assimilation might be expected. Moreover, amino acids enriched some micronutrients contributes in the control redox status of plants, most likely by regulating the synthesis of the antioxidant glutathione, which protects plant against oxidative stress that follows many nutritional deficiencies (Freeman *et al*., 2005 and Shao *et al*., 2007). There are experimental evidence points to establish a relationship between amino acids signaling and the control of nutrient homeostasis. Also, comparisons among genes that respond to N, P, K or S increased growth conditions with those altered by amino acids enriched with some micronutrient's treatment. The previous findings can be explained the stimulation as effect of influence of some amino acids enriched with some micro nutrients on N, P, K, Fe, Mn and Zn which founded in our study.

3- Influence of some chemical leaf content and some physical fruit characteristics:

Table (4) shows that influence application of spraying some amino acids enriched with some micronutrients each at 0.05 to 0.8% significantly was accompanied with improving fruit No./tree, fruit weight (g.), yield/ tree (kg.), fruit diameter (cm.) as well as fruit height (cm.) on Sultani fig trees in comparison with the control treatment. The best results obtained with influence application of spraying some amino acids enriched with some micronutrients each at 0.8%. Negligible promotion on fruit weight (g.) and yield per fig tree (kg.) was observed among the high concentration of each of influence of application of spraying some amino acids enriched with some micronutrients each at 0.8%. Therefore, the recommended concentration from economical point of view for each of influence application of spraying some amino acids enriched with some micronutrients each at 0.8%. Economically point of view, treating Sultani fig. trees three times with application of influence spraying of some amino acids namely (tryptophane, methionine and cysteine) enriched with some micronutrients namely (boron, zinc as well as iron) three times at growth start (1st week of Mar.), after fruit setting (last week of Apr.) and at one month later (last week of May) concentration at 0.05 to 0.8 % gave the good results with regard to yield. Under such promised treatment, yield reached 23.85 and 34.53 (kg.) while the yield of the control palms was 20.31 and 23.72 (kg.) during both seasons, respectively. The percentage of yield increase due to using the promised treatment over the check treatment reached 35.3 and 68.7 % during both seasons, respectively. Similar trend was observed during both seasons.

This impact of enhancing yield per tree was associated with the improvement of leaf stimulatory effect on photosynthetic pigment biosynthesis as well as net photosynthetic rate (Sadeghipour and Aghaei., 2012). The obtained results were according with those (Hayat *et al*., (2012); Ali and *et al*., (2014) and Supapvanich *et al*., (2017 a& b).

4- Influence of some physical and chemical characteristics of fruits:

Data presented in Tables (5) the results showed that the spraying some amino acids enriched with some micronutrients each at 0.05 to 0.8% observed of increment on the yield due to application of the recommended treating 0.8 % with all amino acids + all micronutrients under study over the control treatment during the two seasons.

The recommended treatment with influence with application spraying some amino acids enriched with some micronutrients at 0.8 % were significantly as well as very effective in improving fruit quality in terms of increasing fruit weight and dimensions (length & height), T.S.S. as well as total and reducing sugars % and decreasing reducing the total acidity % as compared with the check treatment.

Table 3. Influence of spraying some amino acids enriched with boron, zinc and iron on productivity on total carotenoids (mg / 100 g. F.W.)& some chemical leaf content characteristics of Sultani fig trees during 2018 and 2019 seasons.

Amino acids enriched with	N %		P %		K %		Mg %		Fe ppm		Zn ppm		Mn ppm	
(Bo, Zn, Fe) treatments	2018	2019	2018	2019	2018	2019	2018	2019	2018	2019	2018	2019	2018	2019
Control (untreated fig trees)	1.47	1.52	0.16	0.17	1.41	1.44	1.13	1.14	117	120	41	44	31	33
Spraying A. A. enriched with (Bo, Zn, Fe) at 0.05 %	1.53	1.59	0.18	0.19	1.47	1.51	1.18	1.19	125	129	43	46	34	37
Spraying A. A. enriched with (Bo, Zn, Fe) at 0.1 %	1.66	1.75	0.22	0.24	1.60	1.65	1.21	1.23	131	133	48	51	38	41
Spraying A. A. enriched with (Bo, Zn, Fe) at 0.2 %	1.69	1.79	0.25	0.27	1.66	1.72	1.24	1.29	141	145	53	55	42	45
Spraying A. A. enriched with (Bo, Zn, Fe) at 0.4 %	1.86	1.96	0.29	0.31	1.75	1.79	1.32	1.35	143	149	57	59	46	49
Spraying A. A. enriched with (Bo, Zn, Fe) at 0.8 %	2.04	2.18	0.33	0.38	1.93	2.03	1.40	1.46	148	153	62	65	51	55
New L.S.D at 5 %	0.05	0.06	0.02	0.02	0.05	0.04	0.049	0.048	9.2	8.8	3.5	2.7	2.9	3.4

As A. A= Amino Acids namely (tryptophane, methionine and cysteine) enriches with boron, zinc & iron three times at growth start (1st week of Mar.), after fruit setting (last week of Apr.) and at one month later (last week of May).

Table 4. Influence of spraying some amino acids enriched with boron, zinc and iron on productivity on some chemical leaf content and some physical fruit characteristics of Sultani fig trees during 2018 and 2019 seasons.

Amino acids enriched with (Bo, Zn, Fe) treatments	Fruit No./tree		Fruit weight (g.)		Yield/ tree (kg.)		Fruit diameter (cm.)		Fruit height (cm.)	
	2018	2019	2018	2019	2018	2019	2018	2019	2018	2019
Control (untreated fig trees)	244.31	268.21	42.2	39.3	10.31	11.72	3.81	3.87	3.73	3.80
Spraying A. A. enriched with (Bo, Zn, Fe) at 0.05 %	277.00	304.94	44.8	44.5	12.41	13.57	3.87	3.99	3.84	4.25
Spraying A. A. enriched with (Bo, Zn, Fe) at 0.1 %	282.58	302.48	46.5	48.2	13.14	14.58	3.93	4.14	3.98	4.75
Spraying A. A. enriched with (Bo, Zn, Fe) at 0.2 %	285.20	282.61	47.3	51.2	13.49	14.47	3.99	4.24	4.12	5.12
Spraying A. A. enriched with (Bo, Zn, Fe) at 0.4 %	288.61	303.92	49.2	53.5	14.20	16.26	4.08	4.38	4.29	5.32
Spraying A. A. enriched with (Bo, Zn, Fe) at 0.8 %	312.62	298.37	50.7	55.4	15.85	16.53	4.17	4.52	4.51	5.65
New L.S.D at 5 %	N. S	25.5	2.2	1.6	1.45	1.57	0.12	0.18	0.22	0.19

As A. A= Amino Acids namely (tryptophane, methionine and cysteine) enriches with boron, zinc & iron three times at growth start (1st week of Mar.), after fruit setting (last week of Apr.) and at one month later (last week of May).

Table 5. Influence of spraying some amino acids enriched with boron, zinc and iron on productivity on fruit height (cm.) some and chemical yield characteristics of Sultani fig trees during 2018 and 2019 seasons.

Amino acids enriched with	T.S.S %		Total acidity %		Reducing sugars %		Total sugars %	
(Bo, Zn, Fe) treatments	2018	2019	2018	2019	2018	2019	2018	2019
Control (untreated fig trees)	13	12.4	0.232	0.211	9.1	9.3	12.1	12.3
Spraying A. A. enriched with (Bo, Zn, Fe) at 0.05 %	13.7	13.3	0.22	0.201	9.9	10.4	12.5	12.9
Spraying A. A. enriched with (Bo, Zn, Fe) at 0.1 %	14.2	14.1	0.212	0.192	10.2	11.8	12.8	13.4
Spraying A. A. enriched with (Bo, Zn, Fe) at 0.2 %	14.9	14.8	0.198	0.18	11.5	12.7	13	14.1
Spraying A. A. enriched with (Bo, Zn, Fe) at 0.4 %	15.1	15.2	0.187	0.173	12.1	13.5	13.3	15
Spraying A. A. enriched with (Bo, Zn, Fe) at 0.8 %	15.6	15.9	0.181	0.167	12.8	14.6	13.7	15.6
New L.S.D at 5 %	1.1	1.2	0.025	0.018	1.3	1.5	0.5	0.3

As A. A= Amino Acids namely (tryptophane, methionine and cysteine) enriches with boron, zinc & iron three times at growth start (1st week of Mar.), after fruit setting (last week of Apr.) and at one month later (last week of May).

The best treatment in this respect was influence application spraying some amino acids enriched with some micronutrients all at 0.8 % which give the best results. Using influence application of spraying of some amino acids enriched with some micronutrients at 0.8 % three times given the best results with regard to quality from economical point of view. Similar trend was observed due both seasons.

The impact of enhancing yield per tree was associated with the improvement of leaf stimulatory effect on photosynthetic pigment biosynthesis as well as net photosynthetic rate (Fariduddin *et al*., 2003 and Sadeghipour and Aghaei., 2012), whereas their results proved that application of spraying some amino acids enriched with some micronutrients at 0.8 % improved the yield fruit weight and fruit height, yield/ tree, T.S.S %, total sugars % and reducing total acidity which was found in present study.

CONCLUSION

For improving yield and fruit qualitatively and quantitively of Sultani fig trees, it is advised to influence application of spraying some amino acids namely (tryptophane, methionine and cysteine) enriched with some micronutrients namely (boron, zinc as well as iron) three times at growth start (1st week of Mar.), after fruit setting (last week of Apr.) and at one month later (last week of May) all at 0.8 % gave the best results with regard to yield and fruit quality.

REFERENCES

Abd- Allah, A. S. E. 2006. Effect of spraying some macro and micro nutrients on fruit set, yield and fruit quality of Washington Navel orange trees. J. Agric. Appl. Sci. Res. 2 (11): 1059 – 1063.

Abdelaal, A. M. K., A. A. B. Masoud and A. Y. Mohamed. 2012. Response of Taimour mango trees to application of the antioxidant glutathione. Menufiya J. Agric. Res. 37 (3): 603 – 610.

Ahmed, F. F. and M. H. Morsy. 1999. A new method for measuring leaf area in different fruit crops. Minia of Agric. Res. & Develop. 19: 97-105.

Al- Wasfy, M. M. 2013. Response of Sakkoti date palms to foliar application of royal jelly, silicon and vitamins B. J. of Amer. Sci. 9 (5): 315 – 321.

Ali, I. L., A. N. Abbasi and I. A. Hafiz. 2014. Physiological response and quality attributed of Peach cv. Florida King affected by different treatments of calcium chloride, putrescine and salicylic acid. Paq. J. Agric. Sci. 51 (1): 33 – 39.

Chapman, H. D. and P. F. Pratt. 1975. Methods of analysis for soils, plants and waters, 1 – 6. Riverside, CA: University of California, Division of Agricultural Sci.

Datir, R. B., B. J. Apparao and S. L. Laware. 2012. Application of amino acid chelated micronutrients for enhancing growth and productivity in chili (Fig trees) Fruit Sci. Feed. 2(7): 100-105.

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.& Dev. 27 (3): 579 – 594.

Fariduddin, Q., S.Hayat and A.Ahmed. 2003. Salicylic acid influences net photosynthetic rate, carboxylation efficiency, nitrate reductase activity and seed yield in *Brassica junces*. Photosynthetica. 41: 281 – 284.

Freeman, J. L., D.Garcia, D.Kim, A.Hopf and D. E. Salt. 2005. Constitutively elevated salicylic acid singles glutathione – mediated nickel tolerance in Thlaspi nickel hyper accumulators. Plant Physiology. 137:1082 – 1091.

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.

Hayat, Q., S.Hayat, M. Alyemini and A. Ahmad. 2012. Salicylic acid mediated changes in growth, photosynthesis, nitrogen metabolism and antioxidant defense system in (*Ciicer arietinum* L.) Plant Soil Environ. 58:417 – 423.

Ibrahim, H. I. M. 2010. Plant samples, collection and analysis. 1st Ed. Dar El- Fagr, Cairo, Egypt.

Klesiig, D. F., J.Durner, R.Noad, D. A.Navarre, D.Wendhenme, D.Kumar, J. M.Zhuu, J.Shah, S. Zhang, P. Kachroo, Y.Triaf, D.Pontier, E. Lam and H. Silvo. 2000. Nitric oxide and salicylic acid signaling in plant defense. Proc. Natl. acad. Sci., U. S. A. 97: 8849 – 8855.

Lane, J. H. and L.Eyon. 1965. Determination of reducing sugars of means of Fehlings solutions with methylene blue as indicator A. O. A. C. Washington D. C., U.S.A.

Mahfouz, M. S. 2007. Response of Williams banana to application of ascorbic acid and some nutrients. M. Sc. Thesis, Fac. of Agric. Minia Univ., Egypt.

Millineaux, P. M. and T. Rausch. 2005. Glutathione, photosynthesis and the redox regulation of stress responsive gen expression photosynthesis. Res. 47: 459 – 474.

Piper, C. S. 1950. Soil and Plant Analysis. Inter. Sci. New York pp. 48 – 110.

Ranganna, S. A. 1977. Manual analysis of fruit and vegetable products: ED. Tata Mc. Grow – Hill Pupl. Co. New Delhi, India. 634 p.

Rao, M. V., J. R. Koch and K. R. Davis. 2000. Ozone a total for robbing programmed cell death in plants. Plant Mol. Bid. 44: 346 – 358.

Raskin, I. L. 1992. Role of salicylic acid in plants. Ann. Rev. Plant Physiol.& Plant Mol. Bio. 43: 439 – 463.

Sadeghipour, O. and P. Aghaei. 2012. Response of common bean (*Phaseolus valgaris* L.) to exogenous application of salicylic acid (SA) under water stress conditions. Adv. In Environ. Bio. 6:1160 – 1168.

Sendecor, G. W. and W. G. Cochran. 1980. Statistical Method. Oxford and J. B. publishing Co. 6th edition.

Shao, L., Z. Shu, S. L. Sun, C. L. Peng, X. J. Wang and Z. F. Lin. 2007. Antioxidation of anthocyanins in photosynthesis under high temperature stress. J. of Int. Plant Biology. 49:1341 – 1351.

Slaymake, D. H., D. A.Navarre, D. P. Clark, O. S. Del-Pozo, G. B. Martin and D. F. Klessing. 2002. The tobacco salicylic acid binding protein 3 (SABP3) is the chloroplast carbonic anhydrase, which exhibits antioxidant activity and plays a role in the hypersensitive defense response. 2 salicylic Acid: physiological Role in Plants 29 Pro. of National Acad. Of Sci. of U.S.A. 99: 11640 – 11645.

Supapvanich, S., B.Mahasap, P. Boonyarittongchi, C.Techavuthiporn, R.Tepsorn and P. Youryon. 2017a. Salicylic acid immersion maintains physicochemical quality and enhances bioactive compounds in "*Kimju*" guava fruit during cold storage. Emirates J. Food & Agric. 29(8): 620 – 628.

Supapvanich, S., P. Mitsang and P. Youryon. 2017b. Preharvest salicylic acid application of maintains physicochemical quality of "Taaptimjaan" wax apple fruit (*Syzygium samarangenese*) during short-term storage. Sci. Hort. 215: 178-183.

Taheri, M. and A.Talai. 2001. The effects of chemical sprays on the qualitative and quantitative characteristics of "*Zard*" olive fruits. Proc. IV IS on Mineral Nutrition in Fruit. Ed. D & G. Neilsen, Fallahi & Peyyea. Acta Hortic. 564:343–48. Doi:10.17660/ Acta Hortic. 2001. 564.41.

Uzunova, A. N. and L. P. Popova. 2000. Effect of salicylic acid on leaf anatomy and chloroplast ultrastructure of barely plants photosynthetica. 38: 243 – 250.

Vazirimeh, M. R. and K. L. Rigi. 2014. Effect of salicylic acid in agriculture. Int. J. Plant. Animal & Environ. Sci. 4(2): 291 – 296.

Ward, G. M. and F. B. Johnston. 1962. Chemical method of plant analysis. Canada Dept. of Agric., Pup. Pp. 1064.

Wild, S. A., R. R.Corey, J. G. Layer and G. K. Voigt. 1985. Soil plant and Analysis for tree culture. Oxford and IBH publishing Co. New Delhi, India. 10 – 120.

Youssef-Nashwa, S. M., S. A. Abu El- Azem and M. A. Abd El- Hady. 2017. Frequent foliar spraying of salicylic acid with elevated concentrations enhance growth, yield and fruit quality of strawberry (*Fragaria* × *ananassa Duch*. Cv. *Festival*) plants. Egypt . J. Hort. 44(1):61 -74.

الملخص العربي

تأثير بعض الأحماض الأمينية المزودة بعناصر البورون والزنك والحديد على إنتاجية أشجار التين السلطانى

مصطفي صابر محمود قاسم، هبه فوزي سيد ابراهيم

اجريت هذه الدراسة خلال موسمي ٢٠١٨، ٢٠١٩ وذلك على تأثير رش أشجار التين السلطاني بمعدل ثلاث مرات وذلك (عند بداية النمو، بعد عقد الثمار وبعد العقد بشهر) وذلك برش بعض الأحماض الأمينية متمثلة في (التربتوفان والميثيونين والسيستين) والمزودة بثلاث عناصر دقيقة وهي البورون والزنك والحديد وكل منهم بنسب تركيز ٠.٠٥ إلى ٠.٨٪. ركزت الدراسة على تأثير هذه العناصر على بعض خصائص النمو والإثمار لأشجار التين السلطاني.

ان رش التين السلطاني بالأحماض الامينية المزودة ببعض العناصر الصغرى (البورون والزنك والحديد) ثلاث مرات لكل منها عند ٠.٠٥ إلى ٠.٨٪ ادي الي تحسن بشكل واضح في جميع خصائص النمو، والنسب المئوية من عناصر النيتروجين والفوسفور والبوتاسيوم والماغنيسيوم والكالسيوم اضافة الي تعزيز وزيادة العناصر المتاحة من البورون والزنك والحديد وذلك علي زيادة المحصول وجودة الثمار كما ونوعا وذلك مقارنة بمعاملة الكنترول. كلما زاد التركيز من ٠.٠٥٪ حتى يصل الي ٠.٨٪ ادي الي اعطاء أفضل النتائج.

وقد لوحظ ان أفضل النتائج المتحصل عليها كان عند المعاملة بتركيز ٠.٨٪ بالأحماض الامينية المزودة ببعض العناصر الصغرى (البورون والزنك والحديد) ثلاث مرات (عند بداية النمو، بعد عقد الثمار وبعد العقد بشهر).

الكلمات المفتاحية: اشجار التين السلطاني، العناصر الصغرى، البورون، الزنك، الحديد، الأحماض الأمينية، النمو والإنتاجية وخصائص جودة الثمار.