Trials for Alleviating the Adveres Effects of Soil and Water Salinity on Growth and Tree Nutritional Status of Picual Olive Trees.

Abd El-Hameed, M.M Wassel [1]; Faissal F. ahmed[1]; Mohamed H. E El-Sheikh[2] and Waleed M. E. F. Mohamed[1]

[1]Hort. Dep. Fac. of Agric. Minia Univ. Egypt.
[2]Arid Lands Cultivation Institute, Alex. Egypt
faissalfadel@yahoo.com

Abstract: This study was carried out during 2014, 2015 and 2016 seasons to examine the impact of using the two amino acids namely arginine and glutamic acid, silicon and selenium each at 25 ppm as well as humic acid and effective microorganisms each at 50 ml / tree/year when applied in single or combined applications on alleviating the adverse effects of soil salinity (4.69 mmohs/cm/25 c) and salinized water (3.13 mmohs/cm/25 c) on growth and tree nutritional status of Picual olive trees grown under West Samalout, Minia region. Subjecting the trees grown under saline soil and irrigating with salinized water to the two amino acids namely arginine and glutamic acid each at 25 ppm, silicon and selenium each at 25 ppm as well as humic acid and effective microorganisms each at 50 ml / tree/year either alone or in all possible combinations was favourable for stimulating the leaf area and shoot length, leaf pigments namely total chlorophyll and total carotenoids, N, P, K, Mg, Zn, Fe and Mn and was responsible for reducing Ca, Na and Cl in the leaves of Picual olive trees relative to the control trees (trees subjecting to salinity stress only). Using humic acid and effective microorganisms was superior than using amino acids alone or together in this respect. Using silicon and/or selenium with amino acids or humic acid and effective microorganisms caused outstanding effect on alleviating the adverse effect of salinity stress on growth, leaf pigments and uptake of different nutrients compared to using amino acids or humic acid and effective microorganisms each alone. For alleviating the inferior effects of salinity stress on growth and tree nutritional status of Picual olive trees, it is necessary to add humic+ effective microorganisms each at 50 ml/tree/year via soil plus spraying silicon and selenium each at 25 ppm trees times.

[Abd El-Hameed, M.M Wassel; Faissal F. ahmed; Mohamed H. E El-Sheikh and Waleed M. E. F. Mohamed. **Trials for Alleviating the Adveres Effects of Soil and Water Salinity on Growth and Tree Nutritional Status of Picual Olive Trees..** *N Y Sci J* 2017;10(11):94-105]. ISSN 1554-0200 (print); ISSN 2375-723X (online). http://www.sciencepub.net/newyork. 12. doi:10.7537/marsnys101117.12.

Keywords: Picual olives, arginine, glutamic acid, silicon, selenium, humic acid, effective microorganisms, growth, tree nutritional status.

1. Introduction

Soil salinization is increasing steadily in many parts of the world under global climate change. This situation is aggravated by the development of intensive orchard practice and irrigated lands using poor water quality. Salinity causes serious problems to plant growth and nutritional status which in tern reflected negatively to yield and fruit quality in most fruit crops **(Nikolskii-Gavrilov*et al*., 2015)**. The deleterious effects of salinity on plant growth are associated with low osmoticpotential of the soil solution (water stress), nutritional imbalance, specificion effects (salt stress) or a combination of these factors (**Grattan *et al*., 2015).**

Recently, many attempts were accompanied for counteracting the inferior effects of salinity stress on growth and tree nutritional status of fruit crops by using non- traditional methods. Out of these methods were the application of amino acids, silicon, selenium and organic and biofertilization.

Using amino acids is responsible for enhancing the biosynthesis of proteins, DNA, RNA, enzymes, antioxidants, vitamins, cell division, sugars and natural hormones namely IAA and ethylene. There are very effective in inhibiting the formation of reactive oxygen speeds (ROS) that caused great damage on the permeability of cell walls and the dead of plants. (**Mengel*et al*., 2001**).

Application of silicon was found by **Sauvas*et al*., (2002) and Melo*et al*., (2003)** and **Ma (2004)** as well as selenium as reported by **Zhang and Gladyshev (2009) and Pilon-Smits *et al*. (2009)** to enhance the tolerance of fruit crops to biotic and abiotic stresses, the biosynthesis of most organic foods, uptake of water and nutrients and the formation of natural hormones. Their impact as antioxidants in reducing reactive oxygen speeds (ROS) surely reflected in protecting plant cells from death.

Humic substances have many important roles in plant nutrition and soli fertility. Plants grown in soils which contain adequate humic substances are less subject to stress and are healthier status **Ferrara*et al*., (2001).**

Effective microorganisms (EM) consists of different beneficial microorganisms. It is responsible for plant development and soli fertility as it improves biological activity and availability of nutrients. The occurrence of this microorganisms led to maximize the uptake of nutrients and the release of vitamins B, plant hormones and antibiotics **Kannaiyan, (2002**).

Higher salinity has an obvious inhibition on growth and tree nutritional status in different olive cvs. **(Loreto *et al*., 2003; Chartzoulakis, 2005; Melgar*et al*., 2009 and Gad 2013).**

The results of El-Badway and Abd El-aal (2013), Ahmed *et al*., (2014a & 2014 b), Hassan (2014) and Hassan- Huda (2014) emphasized the beneficial effects of amino acids on stimulating growth characteristics of the fruit crops grown under salinity stress.

Previous studies showed that using silicon **(Gad El-Kareem, 2012; Ahmed *et al*., (2014a & 2014 b); Al-Wasfy, 2013; Abdelaal and Oraby, Mona, 2013; El-khwaga and Mansour, 2014 and Mohamed, 2015)** and selenium (**Gad El-Kareem, *et al*., 2014; Ibrahiem and Al-Wasfy, 2014and Masoud, 2017)** had an announced promotion on growth aspects and tree nutritional status in different crop fruits.

Organic and biofertilization using humic acid **(Moffed, 2009; Youssef- Amal*et al*., 2011; Khaled and Fawy, 2011 and Haggag- Laila*et al*., 2013)** and effective microorganisms (**Kannaiyan, 2002**; Gamal, 2006 and Hassan-Huda, 2014) were favourable in enhancing growth and tree nutritional status in various crop trees.

The target of this study was elucidating the effect of amino acids, silicon, selenium, humic acid and effective microorganisms on alleviating the adverse effects of salinity in the soil and water irrigation on growth and tree nutritional status of Picual olive trees grown under West Samalout, Minia region.

2. Material and Methods

This study was conducted during 2014, 2015 and 2016 seasons on Picual olive trees. The trees of olive were about 12- years old, propagated by leafy cutting and growing in a private orchard located at village (4) west Samalout district, Minia Governorate.

The picual olive cv. were planted at 6x6 meter apart in sand soil under drip irrigation system with the same amount of water and subjected to the regular recommended horticultural practices and free from pathogens and physiological disorders. Soil was washed end of year to ensure soil salinity was stable. Salinity of soil was 3000 ppm and salinity of water was 2000 ppm.

Soil analysis was done according to **Piper (1950), Black (1965) and Evenhuis and Dewaard (1980).**

Table (1): Analysis of the tested soil

Content	Value
Sand %	91.0
Silt %	2.5
Clay	6.5
Texture grade	Sandy
pH (1: 2.5 extract)	7.51
EC (1: 2.5 extract) dsm^{-1})	0.6
Calcium carbonate %	2.5
Total N%	0.08
Available P (Olsen, ppm)	2.1
Available K (ammonium acetate, ppm)	95.0
Available micronutrient (ppm)	-
Zn	1.0
Fe	0.7
Mn	0.8
Cu	0.2

1- Experimental work:

This experiment included seventeen treatments consisted from picual olive cv.

1) Spraying water (control).
2) Spraying L-Arginineamino acid at concentration 25 ppm.
3) Spraying Glutamic amino acid at concentration 25 ppm.
4) Spraying L -Arginineamino acid at 25ppm + Glutamic amino acid at 25ppm.
5) Addition of Humic at rate 50 ml + addition of E.M at rate 50 ml.
6) Spraying L-Arginineamino acid at 25ppm + spraying selenium at 25 ppm.
7) Spraying L -Arginineamino acid at 25ppm + spraying silicon at 25 ppm.
8) Spraying L -Arginineamino acid at 25ppm + spraying selenium at 25 ppm+ spraying silicon at 25 ppm.
9) Spraying Glutamic amino acid at 25 ppm + spraying selenium at 25 ppm.
10) Spraying Glutamic amino acid at 25 ppm + spraying silicon at 25 ppm.
11) Spraying Glutamic amino acid at 25 ppm + spraying selenium at 25 ppm+ spraying silicon at 25 ppm.
12) Spraying L-Arginineamino acid at 25ppm+ Glutamic amino acid at 25ppm + spraying selenium at 25 ppm.
13) Spraying L-Arginineamino acid at 25ppm+ Glutamic amino acid at 25ppm+ spraying silicon at 25 ppm.
14) Spraying L-Arginineamino acid at 25ppm+ Glutamic amino acid at 25ppm + spraying selenium at 25 ppm+ spraying silicon at 25 ppm.

15) Addition of Humic at rate 50 ml + addition of E.M at rate 50 ml + spraying selenium at 25 ppm.

16) Addition of Humic at rate 50 ml + addition of E.M at rate 50 ml + spraying silicon at 25 ppm.

17) Addition of Humic at rate 50 ml + addition of E.M at rate 50 ml + spraying selenium at 25 ppm+ spraying silicon at 25 ppm.

Each treatment was replicated three times, one tree per each.

Humic acid and E.M were added one time at growth start (1st week of Mar.) one time. Spraying of selenium, silicon and amino acids was carried out three times at growth start (1st week of Mar.), just after fruit setting (mid. of Apr.) and at one month later (mid./ of May). Triton B as a wetting agent was added to all selenium, silicon and amino acid solutions at 25 ppm and spraying was done till runoff (10 L / tree). Selenium and silicon were soulbized in ethyl alcohol. Silicon and selenium were applied in potassium silicate and pure selenium forms, respectively. Amino acids, silicon and selenium, humic acid and EM were used at the recommended concentrations (according to **Gad El- Kareem, 2012; El- Sayed- Esraa, 2007 and Gamal, 2006)**.

2- Experimental design:

This study was statistically analyzed using randomized complete block design (RCBD), where the experiment included seventeen treatments from single and combined applications of amino acids, silicon, selenium and humic acid+ EM. Each treatment was replicated three times one tree per each.

3- Different measurements:

3-1 Leaf area:

In mid- October (after 7 months), twenty mature leaves from the middle of every new shoot growth Spring cycle were taken at random from each tree. The leaf area was measured by using the following equation reported by **Ahmed and Morsy (1999)**. Leaf area $(cm)^2 = 0.53$ (length x width) + 1.66

3-2 vegetative growth:

In late March, for each tree, five similarly branches distributed around the tree canopy were labeled in each season. A sample of thirty uniform shoots of the Spring growth cycle was chosen at random and labeled on each tree to measure shoot length (cm).

3-3 - Leaf pigment contents

In all seasons- leaf samples consisting of 20 mature fresh leaves from Spring cycle were selected from the middle of each new shoot and taken in October to determine the leaf chlorophyll a, b and carotenoids content. according to the following method as reported by **Von-Wettstein (1957) and Hiscox and Isralstam (1979)**.

The pigments were extracted by 85 % acetone according to the method described. One gram of leaf discs was wetted and crushed with acetone (85%) using the clean sand (washed by HCL), with a little amount of calcium carbonate, thereafter, 25 ml of acetone (85%) added to give uniformity volume for all samples.

The optical density of chlorophyll a, b and carotenoids were measured calorimetrically at wave length of 662, 644 and 440 mp. respectively.

The determined pigments were expressed as mg-$100g^{-1}$ fresh weight of leaf and calculated according to using the following equations:

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

Chlorophyll (B) = (21.426 x $E._{644}$) (4.65 x$E._{662}$) ($mg.g^{-1}$f.w) Carotenoids = (4.495 x $E._{440}$) - 0.268 (ChlA+Chl B) ($mg.g^{-1}$f.w)

Where:

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

Total chlorophylls were calculated by summation of chlorophylls a and b (mg/ 100 g F.W.)

3-4- Leaf nutrient contents

During late September of both seasons, 30 mature leaves were taken from the third leaf of labeled fruit shoot base from current season, leaf samples were cleaned with tap water, and then rinsed three times with deionized water, thereafter, leaves were prepared and dried in an electric oven at 70°C until constant weight then ground for determination of different nutrients.

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.

The digested materials were transferred quantitatively to 50 ml volumetric flask, and raised up to the uniformity volume using the deionized water. Thereafter, in each leaf sample the mineral content was determined as follows:

3-4--1 Nitrogen content (%)

It was determined using the micro kjeldahl method as described by **Peach and Tracy (1968)**.

3-4-2 Phosphorus content (%)

It was determined colorimetically using the Spectro-photometer (Model 1600 Jenway Co.) according to **Wilde *et al.*, (1985)**.

3-4-3 Potassium contents (%)

It was determined using the flame photometer according to **Cottonie*et al.*, (1982)**.

3-4-4 Magnesium, Chlorine, Calcium, Sodium, Manganese, Zinc and Iron contents

They were determined using the Atomic Absorption Spectrophotometer (Perkin-Elme,- Model 305B) (**Chapman and Pratt, 1965)**.

4.- Statistical analysis

Each treatment had three replicates with one tree per a replicate. The trees of control treatment were

sprayed with tap water. The results in this study were exposed to proper statistical analysis of variance for a randomized complete block design (RCBD). New L.S.D. test at 5% was used for making all various treatment comparison between means **(Snedecor and Cochran, 1980 and Mead *et al.*, 1993).**

3. Results and Discussion

Table (2): Effect of spraying of silicon, selenium, l-arginine acid, glutamic acid and addition of Humic and E.M on leaf area of Picual olive cv. during 2014, 2015 and 2016 seasons.

Treatments	2014	2015	2016
Control	3.95	4.01	3.99
Arginine	4.01	4.05	4.04
Glutamic	4.10	4.14	4.13
Arginine.+ Glutamic	4.12	4.16	4.17
Humic acid.+EM	4.16	4.20	4.19
Arginine +Se	4.29	4.27	4.26
Arginine +Si	4.31	4.38	4.36
Arginine +Se+ Si	4.36	4.37	4.36
Glutamic +Se	4.28	4.28	4.27
Glutamic +Si	4.45	4.42	4.41
Glutamic +Se+Si	4.46	4.44	4.45
Arginine + Glutamic +Se	4.40	4.52	4.50
Arginine +Glutamic.+Si	4.29	4.41	4.39
Arginine +Glutamic +Se +Si	4.40	4.48	4.47
Humic +EM+ Se	4.40	4.48	4.47
Humic +EM+ Si	4.51	4.48	4.51
Humic +EM +Se+ Si	4.64	4.55	4.53
LSD at 0.05	**0.23**	**0.25**	**0.22**

EM: Effective microorganisms Se: Selenium Si: Silicon

Table (3): Effect of spraying of silicon, selenium, l-arginine acid, glutamic acid and addition of Humic and E.M on shoot length of Picual olive cv. during 2014, 2015 and 2016 seasons.

Treatments	2014	2015	2016
Control	14.90	15.10	15.05
Arginine	15.55	15.80	15.70
Glutamic	16.51	16.82	16.72
Arginine.+ Glutamic	16.87	17.03	16.98
Humic acid.+EM	17.64	17.86	17.81
Arginine +Se	18.71	18.29	18.19
Arginine +Si	18.84	19.23	19.13
Arginine +Se+ Si	19.63	20.07	19.81
Glutamic +Se	19.73	20.09	19.85
Glutamic +Si	20.57	20.97	20.67
Glutamic +Se+Si	21.07	21.09	20.94
Arginine + Glutamic +Se	21.40	22.13	21.98
Arginine +Glutamic.+Si	21.34	22.08	21.93
Arginine +Glutamic +Se +Si	22.28	22.78	22.68
Humic +EM+ Se	22.59	23.20	23.05
Humic +EM+ Si	22.90	23.56	23.31
Humic +EM +Se+ Si	23.77	23.66	23.36
LSD 0.05	**1.02**	**1.18**	**1.26**

EM: Effective microorganisms Se: Selenium Si: Silicon

1. Leaf area and shoot length

It is clear from the obtained data in Tables (2 & 3) that subjecting Picual olive trees growing under salinity stress (caused by soil and water salinization) to the two amino acids namely arginine and glutamic acid, silicon (Si) and selenium (Se) each at 25 ppm and humic acid plus effective microorganisms (EM) each at 50 ml/tree/year in most cases significantly stimulated the leaf area and shoot length compared to those trees grown under salinity stress alone. Using humic acid + EM slightly superior than using arginine and/or glutamic acid in enhancing such growth aspects. Using any amino acids as well as humic acid + EM with Si and/or Se significantly was superior than using amino acids or humic acid + EM alone in enhancing the leaf area and shoot length. Supplying the trees with Si besides amino acids and organic and biofertilization significantly enhanced such two growth traits relative to the application of Se. Combined applications of Si and Se along with amino acids and humic acids + EM significantly enhanced the leaf area and shoot length than using Si and / or Se alone. Supplying the trees with humic acid+ EM plus Si and/or Se gave the highest values than using amino acids with Si and/or Se. The maximum values of leaf area (4.64 & 4.55 & 4.53 cm2) and shoot length (23.77 & 23.66 & 23.36 cm) during the three seasons, respectively were recorded in the trees under salinity and received humic + EM+ Si+ Se. Subjecting the trees to salinity stress alone (control trees) gave the lowest values. These results were true during the three seasons.

2. Leaf pigments

Table (4): Effect of spraying of silicon, selenium, l-arginine acid, glutamic acid and addition of Humic and E.M on total chlorophyll in the leaves (mg/1g FW) of Picual olive cv. during 2014, 2015 and 2016 seasons.

Treatments	2014	2015	2016
Control	5.33	5.92	5.64
Arginine	6.01	6.21	6.12
Glutamic	6.16	6.40	6.30
Arginine.+ Glutamic	6.18	6.41	6.32
Humic acid.+EM	6.30	6.45	6.40
Arginine +Se	6.54	6.43	6.38
Arginine +Si	6.43	6.64	6.57
Arginine +Se+ Si	6.74	6.74	6.73
Glutamic +Se	6.76	6.76	6.74
Glutamic +Si	7.10	7.23	7.13
Glutamic +Se+Si	7.16	7.24	7.15
Arginine + Glutamic +Se	7.30	7.58	7.51
Arginine +Glutamic.+Si	7.06	7.53	7.37
Arginine +Glutamic +Se +Si	7.31	7.75	7.58
Humic +EM+ Se	7.35	7.89	7.68
Humic +EM+ Si	7.61	8.12	7.90
Humic +EM +Se+ Si	7.96	8.29	8.00
LSD 0.05	0.71	0.68	0.57

EM: Effective microorganisms Se: Selenium Si: Silicon

Table (5): Effect of spraying of silicon, selenium, l-arginine acid, glutamic acid and addition of Humic and E.M on carotenoids in the leaves (mg/1g FW) of Picual olive cv. during 2014, 2015 and 2016 seasons.

Treatments	2014	2015	2016
Control	1.38	1.42	1.40
Arginine	1.44	1.54	1.49
Glutamic	1.56	1.64	1.60
Arginine.+ Glutamic	1.55	1.67	1.62
Humic acid.+EM	1.63	1.74	1.69
Arginine +Se	1.73	1.79	1.73
Arginine +Si	1.77	1.90	1.85
Arginine +Se+ Si	1.85	1.94	1.89
Glutamic +Se	1.88	2.02	1.95
Glutamic +Si	2.00	2.14	2.06
Glutamic +Se+Si	2.12	2.22	2.15
Arginine + Glutamic +Se	2.17	2.36	2.28
Arginine +Glutamic.+Si	2.17	2.42	2.32
Arginine +Glutamic +Se +Si	2.25	2.57	2.43
Humic +EM+ Se	2.27	2.62	2.46
Humic +EM+ Si	2.36	2.76	2.57
Humic +EM +Se+ Si	2.46	2.89	2.63
LSD 0.05	**0.17**	**0.21**	**0.22**

EM: Effective microorganisms Se: Selenium Si: Silicon

Data in Tables (4 & 5) clearly show that most amino acid, Si, Se, humic acid + EM treatments caused significant promotion in total chlorophylls and total carotenoids in the leaves of the trees growing under salinization conditions relative to the control treatment. Application of both amino acids together was superior than using each amino acids alone in this respect. Application of amino acids as well as humic acid + EM in combined with Si and/or Se significantly gave the maximum values than using amino acids and humic acid+ EM alone. The values of such two leaf pigments were maximized with using Si besides the other materials compared with the used of Se with the same materials. Using Si and Se together was significantly favourable than using each element alone in enhancing leaf pigments. Supplying the trees via soil with humic acid + EM+ spray Si and /or Se gave the highest values compared with the other treatments. Treating the tree with humic acid + EM+ Se+ Si gave the maximum values of total chlorophylls (7.96 & 8.29 & 8.00 mg/1g FW) and total carotenoids (2.46 & 2.89 & 2.63 mg/1g FW) during the three seasons, respectively. The minimum values were recorded on untreated trees. This results were nearly the same during the three seasons.

3. Leaf nutrient contents

Table (6): Effect of spraying of silicon, selenium, l-arginine acid, glutamic acid and addition of Humic and E.M on percentage of N of Picual olive cv. during 2014, 2015 and 2016 seasons.

Treatments	2014	2015	2016
Control	1.53	1.64	1.59
Arginine	1.59	1.72	1.65
Glutamic	1.70	1.80	1.76
Arginine.+ Glutamic	1.72	1.80	1.76
Humic acid.+EM	1.78	1.95	1.87
Arginine +Se	1.89	2.03	1.93
Arginine +Si	1.92	2.18	2.06
Arginine +Se+ Si	2.00	2.23	2.11
Glutamic +Se	2.03	2.26	2.14
Glutamic +Si	2.15	2.42	2.27
Glutamic +Se+Si	2.18	2.49	2.32
Arginine + Glutamic +Se	2.24	2.64	2.46
Arginine +Glutamic.+Si	2.25	2.60	2.45
Arginine +Glutamic +Se +Si	2.39	2.72	2.57
Humic +EM+ Se	2.41	2.82	2.64
Humic +EM+ Si	2.49	2.91	2.71
Humic +EM +Se+ Si	2.61	2.93	2.73
LSD 0.05	**0.27**	**0.23**	**0.33**

EM: Effective microorganisms Se: Selenium Si: Silicon

Table (7): Effect of spraying of silicon, selenium, l-arginine acid, glutamic acid and addition of Humic and E.M on percentage of P in the leaves of Picual olive cv. during 2014, 2015 and 2016 seasons.

Treatments	2014	2015	2016
Control	0.20	0.21	0.21
Arginine	0.21	0.22	0.22
Glutamic	0.22	0.23	0.23
Arginine.+ Glutamic	0.22	0.23	0.23
Humic acid.+EM	0.23	0.24	0.24
Arginine +Se	0.24	0.24	0.24
Arginine +Si	0.25	0.26	0.25
Arginine +Se+ Si	0.26	0.26	0.26
Glutamic +Se	0.27	0.27	0.27
Glutamic +Si	0.28	0.28	0.28
Glutamic +Se+Si	0.28	0.29	0.29
Arginine + Glutamic +Se	0.29	0.31	0.30
Arginine +Glutamic.+Si	0.29	0.31	0.30
Arginine +Glutamic +Se +Si	0.30	0.32	0.31
Humic +EM+ Se	0.30	0.32	0.31
Humic +EM+ Si	0.32	0.33	0.32
Humic +EM +Se+ Si	0.33	0.33	0.34
LSD 0.05	0.07	0.06	0.07

EM: Effective microorganisms Se: Selenium Si: Silicon

It is evident from the listed data in Tables (6-15) that supplying the trees growing under saline stress with the two amino acids, Si, Se and humic + EM alone or in combinations in most treatments significantly enhanced N, P, K, Mg, Zn, Fe and Mn while reduced Ca, Cl and Na in the leaves relative to the control 9trees under salinity stress alone). Glutamic acid was favourable than using arginine in enhancing all nutrients except Ca, Cl and Na. Combined applications of amino acids significantly enhanced most nutrients except Ca, Cl and Na relative to the application of each amino acid alone. Using Si and/or Se with amino acids and humic acid+ EM significantly enhanced N, P, K, Mg, Zn, Fe and Mn and reduced Ca, Cl and Na rather than using amino acids orusing humic acid+ EM alone. Using Si+ Se gave higher values than using each element alone. The maximum values were recorded on the trees that received humic acid+ EM+ Si+ Se. The trees growing under salinity stress without any treatment gave the lowest values of N, P, K, Mg, Zn, Fe and Mnand the highest reduced Ca, Cl and Na in the leaves. Similar results were announced during the three seasons.

Table (8): Effect of spraying of silicon, selenium, l-arginine acid, glutamic acid and addition of Humic and E.M on percentage of K in the leaves of Picual olive cv. during 2014, 2015 and 2016 seasons.

Treatments	2014	2015	2016
Control	1.26	1.28	1.27
Arginine	1.32	1.37	1.35
Glutamic	1.40	1.44	1.42
Arginine.+ Glutamic	1.42	1.47	1.45
Humic acid.+EM	1.49	1.57	1.53
Arginine +Se	1.57	1.59	1.55
Arginine +Si	1.55	1.71	1.64
Arginine +Se+ Si	1.67	1.77	1.71
Glutamic +Se	1.69	1.77	1.73
Glutamic +Si	1.81	1.90	1.85
Glutamic +Se+Si	1.85	1.92	1.87
Arginine + Glutamic +Se	1.99	2.08	2.06
Arginine +Glutamic.+Si	1.98	2.14	2.09
Arginine +Glutamic +Se +Si	2.08	2.24	2.18
Humic +EM+ Se	2.11	2.31	2.24
Humic +EM+ Si	2.22	2.42	2.34
Humic +EM +Se+ Si	2.32	2.46	2.39
LSD 0.05	0.56	0.47	0.51

EM: Effective microorganisms Se: Selenium Si: Silicon

Table (9): Effect of spraying of silicon, selenium, l-arginine acid, glutamic acid and addition of Humic and E.M on percentage of Mg in the leaves of Picual olive cv. during 2014, 2015 and 2016 seasons.

Treatments	2014	2015	2016
Control	0.59	0.61	0.60
Arginine	0.64	0.68	0.66
Glutamic	0.69	0.73	0.71
Arginine.+ Glutamic	0.73	0.77	0.75
Humic acid.+EM	0.78	0.83	0.81
Arginine +Se	0.83	0.87	0.84
Arginine +Si	0.84	0.92	0.88
Arginine +Se+ Si	0.90	0.97	0.93
Glutamic +Se	0.93	1.00	0.96
Glutamic +Si	1.00	1.08	1.04
Glutamic +Se+Si	1.04	1.12	1.07
Arginine + Glutamic +Se	1.08	1.20	1.15
Arginine +Glutamic.+Si	1.05	1.22	1.15
Arginine +Glutamic +Se +Si	1.10	1.29	1.21
Humic +EM+ Se	1.12	1.34	1.24
Humic +EM+ Si	1.17	1.39	1.29
Humic +EM +Se+ Si	1.21	1.41	1.39
LSD 0.05	0.21	0.24	0.19

EM: Effective microorganisms Se: Selenium Si: Silicon

Table (10): Effect of spraying of silicon, selenium, l-arginine acid, glutamic acid and addition of Humic and E.M on percentage of (Cl) in the leaves of Picual olive cv. during 2014, 2015 and 2016 seasons.

Treatments	2014	2015	2016
Control	0.85	0.82	0.84
Arginine	0.83	0.81	0.82
Glutamic	0.81	0.79	0.80
Arginine.+ Glutamic	0.75	0.73	0.74
Humic acid.+EM	0.72	0.68	0.70
Arginine +Se	0.70	0.65	0.66
Arginine +Si	0.65	0.61	0.63
Arginine +Se+ Si	0.62	0.58	0.60
Glutamic +Se	0.53	0.49	0.51
Glutamic +Si	0.51	0.48	0.49
Glutamic +Se+Si	0.49	0.43	0.46
Arginine + Glutamic +Se	0.44	0.41	0.43
Arginine +Glutamic.+Si	0.40	0.38	0.39
Arginine +Glutamic +Se +Si	0.39	0.34	0.37
Humic +EM+ Se	0.37	0.32	0.35
Humic +EM+ Si	0.37	0.30	0.34
Humic +EM +Se+ Si	0.38	0.29	0.33
LSD 0.05	**0.20**	**0.20**	**0.27**

EM: Effective microorganisms Se: Selenium Si: Silicon

Table (11): Effect of spraying of silicon, selenium, l-arginine acid, glutamic acid and addition of Humic and EM on percentage of (Ca) in the leaves of Picual olive cv. during 2014, 2015 and 2016 seasons.

Treatments	2014	2015	2016
Control	2.10	2.10	2.11
Arginine	1.98	1.94	1.98
Glutamic	1.93	1.93	1.94
Arginine.+ Glutamic	1.82	1.80	1.81
Humic acid.+EM	1.75	1.75	1.76
Arginine +Se	1.88	1.63	1.76
Arginine +Si	1.77	1.61	1.73
Arginine +Se+ Si	1.72	1.57	1.67
Glutamic +Se	1.63	1.48	1.57
Glutamic +Si	1.62	1.46	1.56
Glutamic +Se+Si	1.56	1.39	1.48
Arginine + Glutamic +Se	1.50	1.41	1.50
Arginine +Glutamic.+Si	1.40	1.30	1.38
Arginine +Glutamic +Se +Si	1.39	1.28	1.37
Humic +EM+ Se	1.34	1.25	1.32
Humic +EM+ Si	1.32	1.22	1.29
Humic +EM +Se+ Si	1.30	1.15	1.22
LSD 0.05	0.54	0.53	0.60

EM: Effective microorganisms Se: Selenium Si: Silicon

Table (12): Effect of spraying of silicon, selenium, l-arginine acid, glutamic acid and addition of Humic and EM on percentage of (Na) in the leaves of Picual olive cv. during 2014, 2015 and 2016 seasons.

Treatments	2014	2015	2016
Control	0.59	0.57	0.58
Arginine	0.57	0.54	0.56
Glutamic	0.54	0.52	0.53
Arginine.+ Glutamic	0.50	0.49	0.49
Humic acid.+EM	0.49	0.46	0.48
Arginine +Se	0.47	0.41	0.43
Arginine +Si	0.44	0.40	0.42
Arginine +Se+ Si	0.40	0.38	0.39
Glutamic +Se	0.38	0.34	0.36
Glutamic +Si	0.37	0.32	0.35
Glutamic +Se+Si	0.35	0.30	0.32
Arginine + Glutamic +Se	0.33	0.31	0.32
Arginine +Glutamic.+Si	0.32	0.29	0.31
Arginine +Glutamic +Se +Si	0.32	0.29	0.31
Humic +EM+ Se	0.31	0.28	0.29
Humic +EM+ Si	0.30	0.27	0.29
Humic +EM +Se+ Si	0.31	0.26	0.28
LSD 0.05	0.17	0.18	0.19

EM: Effective microorganisms Se: Selenium Si: Silicon

Table (13): Effect of spraying of silicon, selenium, l-arginine acid, glutamic acid and addition of Humic and E.M on leaf Zn content (ppm) of Picual olive cv. during 2014, 2015 and 2016 seasons.

Treatments	2014	2015	2016
Control	49.90	50.53	50.38
Arginine	51.97	52.25	52.19
Glutamic	53.25	53.81	53.71
Arginine.+ Glutamic	53.38	54.35	53.96
Humic acid.+EM	55.41	55.99	55.89
Arginine +Se	57.95	56.35	56.20
Arginine +Si	57.71	59.29	58.78
Arginine +Se+ Si	59.39	60.80	59.98
Glutamic +Se	59.59	59.98	59.59
Glutamic +Si	62.83	62.61	62.41
Glutamic +Se+Si	63.11	62.67	62.47
Arginine + Glutamic +Se	63.00	65.08	64.66
Arginine +Glutamic.+Si	63.92	65.34	65.29
Arginine +Glutamic +Se +Si	66.33	67.83	67.53
Humic +EM+ Se	67.19	68.70	68.41
Humic +EM+ Si	69.10	70.67	70.13
Humic +EM +Se+ Si	72.32	70.79	70.48
LSD 0.05	3.14	4.31	3.70

EM: Effective microorganisms Se: Selenium Si: Silicon

Table (14): Effect of spraying of silicon, selenium, l-arginine acid, glutamic acid and addition of Humic and E.M on leaf Fe content (ppm) of Picual olive cv. during 2014, 2015 and 2016 seasons.

Treatments	2014	2015	2016
Control	60.20	59.39	60.01
Arginine	61.40	61.41	61.51
Glutamic	63.42	63.64	63.74
Arginine.+ Glutamic	63.25	63.26	63.36
Humic acid.+EM	65.08	66.02	65.78
Arginine +Se	68.12	66.57	66.22
Arginine +Si	66.78	68.35	67.89
Arginine +Se+ Si	69.46	70.23	69.72
Glutamic +Se	69.95	69.87	69.68
Glutamic +Si	72.86	72.34	72.24
Glutamic +Se+Si	73.24	72.86	72.57
Arginine + Glutamic +Se	73.90	75.68	75.53
Arginine +Glutamic.+Si	73.62	75.83	75.50
Arginine +Glutamic +Se +Si	76.23	78.36	77.82
Humic +EM+ Se	77.26	78.90	78.61
Humic +EM+ Si	79.00	80.84	80.20
Humic +EM +Se+ Si	81.60	79.99	79.59
LSD 0.05	3.67	3.38	4.00

EM: Effective microorganisms Se: SeleniumSi: Silicon

Table (15): Effect of spraying of silicon, selenium, l-arginine acid, glutamic acid and addition of Humic and E.M on leaf Mn content (ppm) of Picual olive cv. during 2014, 2015 and 2016 seasons.

Treatments	2014	2015	2016
Control	46.30	47.41	47.00
Arginine	47.26	48.52	47.96
Glutamic	48.32	50.67	49.65
Arginine.+ Glutamic	48.15	50.69	49.53
Humic acid.+EM	49.83	53.48	51.87
Arginine +Se	51.75	53.20	51.60
Arginine +Si	52.82	56.07	54.69
Arginine +Se+ Si	54.66	57.29	55.85
Glutamic +Se	54.86	57.04	55.77
Glutamic +Si	57.76	60.50	58.83
Glutamic +Se+Si	58.49	60.39	59.07
Arginine + Glutamic +Se	59.90	63.34	62.21
Arginine +Glutamic.+Si	59.27	62.57	61.55
Arginine +Glutamic +Se +Si	62.27	64.41	63.77
Humic +EM+ Se	63.15	65.60	64.82
Humic +EM+ Si	65.90	67.85	67.11
Humic +EM +Se+ Si	68.34	68.61	67.44
LSD 0.05	2.90	3.15	3.12

EM: Effective microorganisms Se: Selenium Si: Silicon

4. Discussion

The deleterious effects of salinity on plant growth are associated with low osmoticpotential of the soil solution (water stress), nutritional imbalance, specificion effects (salt stress) or a combination of these factors (**Grattan *et al*., 2015).**

Using amino acids is responsible for enhancing the biosynthesis of proteins, DNA, RNA, enzymes, antioxidants, vitamins, cell division, sugars and natural hormones namely IAA and ethylene. There are very effective in inhibiting the formation of reactive oxygen speeds (ROS) that caused great damage on the permeability of cell walls and the dead of plants. (**Mengel*et al*., 2001**).

Application of silicon was found by **Sauvas*et al*., (2002) and Melo*et al*., (2003)** and **Ma (2004)** as well as selenium as reported by **Zhang and Gladyshev (2009) and Pilon-Smits *et al*. (2009)** to enhance the tolerance of fruit crops to biotic and abiotic stresses, the biosynthesis of most organic foods, uptake of water and nutrients and the formation of natural hormones. Their impact as antioxidants in reducing reactive oxygen speeds (ROS) surely reflected in protecting plant cells from death.

Humic substances have many important roles in plant nutrition and soli fertility. Plants grown in soils which contain adequate humic substances are less subject to stress and are healthier status **Ferrara*et al*., (2001).**

Effective microorganisms (EM) consists of different beneficial microorganisms. It is responsible for plant development and soli fertility as it improves biological activity and availability of nutrients. The occurrence of this microorganisms led to maximize the uptake of nutrients and the release of vitamins B, plant hormones and antibiotics **Kannaiyan, (2002**).

These results regarding the adverse effects of soil and water salinity on growth and tree nutritional status are in agreement with those obtained by **Loreto *et al*., (2003); Chartzoulakis, (2005); Melgar*et al*., (2009) and Gad (2013). of El-Badway and Abd El-aal (2013), Ahmed *et al*., (2014a & 2014 b), Hassan (2014) and Hassan- Huda (2014)** emphasized the beneficial effects of amino acids on stimulating growth characteristics of the fruit crops grown under salinity stress.

Previous studies showed that using silicon **(Gad El-Kareem, 2012; Ahmed *et al*., (2014a & 2014 b); Al-Wasfy, 2013; Abdelaal and Oraby, Mona, 2013; El-khwaga and Mansour, 2014 and Mohamed, 2015)** and selenium (**Gad El-Kareem, *et al*., 2014; Ibrahiem and Al-Wasfy, 2014and Masoud, 2017)** had an announced promotion on growth aspects and tree nutritional status in different crop fruits.

Organic and biofertilization using humic acid **(Moffed, 2009; Youssef- Amal*et al*., 2011; Khaled and Fawy, 2011 and Haggag- Laila*et al*., 2013)** and effective microorganisms (**Kannaiyan, 2002**; Gamal, 2006 and Hassan-Huda, 2014) were favourable in enhancing growth and tree nutritional status in various crop trees.

Conclusion

For alleviating the inferior effects of salinity stress on growth and tree nutritional status of Picual olive trees, it is necessary to add humic+ effective microorganisms each at 50 ml/tree/year via soil plus spraying silicon and selenium each at 25 ppm trees times.

References

1. Abdelaal, A.M.K. and Oraby- Mona, M.M. (2013): Using silicon for increasing the mango cv Ewaise transplants to drought. World Rural Observations 5(2): 36-40.
2. Ahmed, F. F. and Morsy, M. H. (1999): A new method for measuring leaf area in different fruit species. Minia J. of Agric. Res. & Develop. (19) pp 97-105.
3. Ahmed, F.F.; Gad El- Kareem, M. R. and Oraby-Mona MM. (2013b): Response of Zaghloul date palms tospraying boron, silicon and glutathione. Stem Cell 4(2):29-34.
4. Ahmed, F.F.; Mansour, A.E.M.; Mohamed, A.Y.; Mostafa, E.A.M. and Ashour, N.E. (2013a): Using silicon and salicylic acid for promoting production of Hindy Bisinnara mango trees grown under sandy soil. Middle East J. of Agric. Res. 2 (2): 51-55.
5. Ahmed, F.F.; Ali, A.H.S.; Sayed, E.S. and Sayed- Ola, M.O. (2014a): Using some amino acids enriched with certain nutrients for improving productivity of El-Saidy date palms World Rural Observations. 6(2)20-27.
6. Ahmed, F.F.; Mohamed, M.A.; Hussien, Y.A. and Hassan, H.S. (2014b): Attempts for reducing alternate bearing in Balady mandarin trees by spraying some amino acids and vitamins. Stem cell. 5(2): 14-20.
7. Al- Wasfy, M.M.M. (2013): Response of Sakkoti date palms tofoliar application of royal jelly, silicon and vitamins B.Nature of Sci. 9 (5): 315-321.
8. Association of Official Agricultural Chemists (2000): Official Methods of Analysis of. A.O.A.C. international 17th Ed. Published by O. A. C. international U. S. A.

9. Black, C.A. (1965): Methods of Soil Analysis. Amer. Soc. of Madison, Wisconsin, U.S.A.pp 1-20.
10. Chapman, H.D. and Pratt, P.E. (1965): Methods of Analysisfor Soil, Plant and Water. Univ. of Calif. Division of Agric. Sci. 172- 173.
11. Chartzoulakis, K.S., (2005): Salinity and olive: growth, salt tolerance, photosynthesis and yield. Agric. Water Manag. 78, 108–121.
12. Cottenie, A.; Verloo, M.; Velghe, M. and Camerlynck, R. (1982): Chemical Analysis of Plant and Soil. Ghent, Belgium, Laboratory of Analytical and Agro-chemistry. State Univ. pp. 200-210.
13. El- Badawy, H.E.M. and Abd El- aal, M.M. (2013): Physiological response of Keitte mango *(Mangiferaindica* L.) to Kintein and tryptophan J. of Appleid Science Res. Co. 11(2): 14-22.
14. El- Khawaga, A.S. and Mansour, A.E.A. (2014): Promotingproductivity of Washington Navel orange trees byusing some crop seed sprout extracts, silicon and glutathione. Middle East J. of Applied Sci., 4 (3); 779-785.
15. El-Sayed- Esraa, M. H. (2007): Response of Ewaise mango trees to foliar application of boron. M. Sc. Thesis Fac. of Agric. Minia Univ. Egypt.
16. Evenhuis, B. and Dewaard, P.W. (1980): Principles and Practices in Plant Analysis. F.A.O., Soil Bull. 38: 172- 163.
17. Ferguson, L.; Sibbett, G.S. and Martin, G.C. (1994): Olive production manual. Calif Univ. Division of Agric. and Natural Resources, Oakland, C.A. Publication 3353.160 pp.
18. Ferrara, g., E. Loffredo N. Senesi, (2001); Antimu- tagenic and antitoxic actions of humic substances on seedlings of monocotyledon and dicotyledon plants. In: Humic substances: structures, models and functions (Ghabbour E.A., Davies G., eds). Royal Soc Chem Press, Cambridge, UK. pp: 361-371.
19. Gad A.H. (2013): Effect of irrigation in Desert Land on growth and Productivity of Olive Manzanilo. Ph. D. Thesis. Fac. of Agric., Cairo Univ. Egypt.
20. Gad El- Kareem, M.R. (2012): Improving productivity of Taimour mango trees by using glutatione, silicon andvitamin B. Minia J. of Agric. Res. & Develop 32 (7):1105-1121.
21. Gad El- Kareem, M.R.; Abdelaal, A.M.K. and Mohamed, A.Y. (2014): The synergistic effects of using siliconand selenium on fruiting of Zaghloul date palm *(Phoenicdectylifera* L.) World Academy of Engineering and Technology, Inter. J. of Agric. Biosystems Sci. and Engineering 8(3): 959-964.
22. Gamal, A. F.O. (2006): Response of Washington Navel orangetrees to some antioxidant and biofertilization treatments. M. Sc. Thesis Fac. of Agric. Minia Univ. Egypt.
23. Grattan, S.R., Di´ıaz, F.J., Pedrero, F., Vivaldi, G.A., (2015): Assessing the suitability ofsaline wastewaters for irrigation of Citrus spp.: Emphasis on boron and specific-ion interactions. Agric. Water Manage. 157, 48–58.
24. Haggaga- Laila, P.; Shahin, M.F.M.; Afifi-Maha, AS.; Magdy, H.A. and El- Hady, Eman, S. (2013): Studieson the effect of vinasse, amino acids and humic acidsubstances as soil application on fruit quality andquantity of Aggizi olive trees J. of Applied Sci. Res. (3): 1635-1641.
25. 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.
26. 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.
27. Hiscox, A. and Istalstam, B. (1979): A method for the extraction of chlorophyll from leaf tissue without maceration. Can. Bot. 57:1332-1334.
28. Ibrahiem, H.I.M. and Al- Wasfy, M.M. (2014): Thepromotive impact of using silicon and selenium withpotassium and boron on fruiting of Valencia orangetrees grown under Minia region conditions World Rural Observations Vol. (5) No. (I): p. 1-14.
29. Kannaiyan, S. (2002): Biotechnology of Bio fertilizers. Alpha Sci. Inter. Ltd., P.O. Box 4067 Pang Bourne R.G8, UK. P. 1-375.
30. Khaled, H. and H.A. Fawy, (2011): Effect of different levels of humic acids on the nutrient content, plant growth, and soil properties under conditions of salinity. Soil & Water Res., 6(1): 21-29.
31. Loreto, F., Centritto, M., Chartzoulakis, K., (2003): Photosynthetic limitations in olive cultivars with different sensitivity to salt stress. Plant Cell Environ. 26, 595e601.
32. Ma, J.F. (2004): Role of silicon in enhancing the resistance ofplants to biotic and abiotic stresses. Soil Scr. Plant Nutr.50:11-18.
33. Masoud S. W. (2017): Response of Superior grapevines grown under sandy soil to foliar application of silicon and selenium. Ph.D Thesis Fac of Agric. Minia Univ. Egypt.
34. Mead, R.; Cunjow, R.N. and Harted, A.M. (1993): Statistical Methods in Agricultural and Experimental Biology. Second Ed. Chapman & Hall. London, pp. 10- 44.

35. Melgar, J.C., Guidi, L., Remorini, D., Agati, G., Degl'Innocenti, E., Castelli, S., Baratto, M.C., Faraoni, C., Tattini, M., (2009): Antioxidant defenses and oxidative damage in salt-treated olive plants under contrasting sunlight irradiance. Tree Physiol., doi:10.1093/treephys/tpp047.salinity. Agric. Water Manag. 96, 1105–1113.
36. Melo, S.P.; Kordnarfer, G.H.; Korndarfer, C.M.; lana, R.M.G. and Santaon, D.G. (2003): Siliconaccumulation and water deficient tolerance in grasses. Scientia Agricola 60.-755-759.
37. Mengel, K.E.; Kirkby, E.A.; Kosegarten, H. and Appel, T. (2001): Principles of Plant Nutrition.5th Ed. kluwer Academic publishers Dordecht p. 1-311.
38. Moffeed, A, S. (2009): Effect of Conversion to Organic Farming on Yield Fruits and Oil Quality of Olive, Ph.D. Thesis, Fac. of Agric Ain Shams Univ. Egypt.
39. Mohamed, R.H.M. (2015): Studies on the efefct of spraying potasisum silicate and vitamin B on fruiting of Manfalouty pomegranate trees. M. Sc. Thesis Fac. of Agric. Minia Univ. Egypt.
40. Nikolskii-Gavrilov, I., Landeros-Sanchez, C., Palacios-Velez, O.L., Henandez-Perez, J.M., (2015): Impact of climate change on salinity and drainage of irrigated landsin Mexico. J. Agric. Sci. 7 (8), 197–204.
41. Peach, K and Tracey, I. M.V. (1968): Modern Methods of Plant Analysis. Vol. pp.36 - 38. Inter Sci. New York.
42. Pilon-Smits EAH, Quinn CF, Tapken W, Malagoli M, Schiavon M (2009): Physiological functions of beneficial elements. Curr Opin Plant Biol 12:267–274.
43. Piper, C. S. (1950): Soil and Plant Analysis, Inter Science NewYork pp 48-110.
44. Sauvas, D.; Manos, G.; Kotsiras, A. and Souvaliotis, S. (2002): Effects of silicon and nutrient- induce salicylic on yield. Flower quality and nutrient uptake of gerbera grown in aclosed hydroponic system. J. Appl. Bat. 76: 153-158.
45. Von- Wettstein, D. V. (1957): Chlroophyll-Lethale under submikroshopischeformilkechrel der plastidenceli, prp. Trop. Res. Amer. Soc. Hort. Sci. 20 pp. 427 – 433.
46. Wilde, S.A; Corey, R.B; Layer, J.G and Voigt, G.K. (1985): Soilsand Plant Analysis for Tree Culture. Oxford, IBH, New Delhi, India. pp 1-130.
47. Yousef- Amal, R.M.; Eman-Hala and Salehm M.M.S. (2011): Olive seedless growth as affected by humicacids, macro and trace elements. Appli Agric. And Biology. J. of North 2(7):-1401-1.107.
48. Zhang Y, Gladyshev VN (2009): Comparative genomics of trace elements: emerging dynamic view of trace element utilization and function. Chem Rev 109:4828–4861 encodes selenocysteine in Chlamydomonasreinhardtii glutathione peroxidase. J Biol Chem 277:25983–25991.

11/13/2017