

Response of Wonderful Pomegranate trees to foliar application of Amino Acids, Vitamins B and Silicon

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Abstract: This investigation was carried out during 2013 and 2014 seasons to examine the effect of spraying amino acids namely (methionine, cysteine and tryptophan) at 250 ppm, vitamins B (B₁+B₂+B₆+B₁₂) at 50 ppm and potassium silicate at 0.1% on wonderful pomegranate trees either separately or in combinations. Spray was applied three times annually at growth starting, after fruit set and at one month later. The following parameters were measured (main shoot length (cm), number of leaves /shoot, leaf area (cm²), primary and finally fruit set, number of fruits/tree, yield/tree (Kg), weight per fruit (g), percentages of juice, grain, pomace and edible/non edible. Moreover, total acidity%, T.S.S, tannins and reducing sugar were estimated. The best results for all parameters were obtained due to using a mixture of amino acids at 250 ppm, vitamins B at 50 ppm and potassium silicate at 0.1%.

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1. Introduction

Using nontraditional horticultural practices such as application of amino acids, vitamins B and silicon for controlling some drawbacks were arised. Amino acids are thought to be responsible for enhancing protein contents, cell division, plant pigments and natural hormones such as IAA, GA₃ and ethylene (Davies, 1982). Ahmed and Abd El-Hameed, 2003; Amin (2007); Ahmed *et al.*, (2007, 2014) and Madian and Refaai 2011, found the beneficial effects of using amino acids on growth and fruiting of grapevines.

Using vitamins B is might be responsible for improving the tolerance of plants to stresses, photosynthesis, cell division and pigments b (Samiullah, 1988). The results of Ahmed and Abd El-Hameed, 2004; Ahmed and Seleem-Basma, 2008; Abd El-Kareem (2009); Ibrahim-Rehab, 2012; Abdelaal *et al.*, (2013, 2014) and El-Khawaga (2014) emphasized the positive effects of using vitamins B on growth and fruiting of grapevines.

Alwasfy (2014) and Ahmed *et al.* (2015) stated that application of silicon is beneficial in increasing the tolerance of plants to stresses as well as enhancing photosynthesis and leaf water potential (Epstein, 1999). Previous studies showed that application of silicon was very effective in promoting growth and fruiting of fruit crops. This Study was carried out on wonderful pomegranate to investigate the effect of amino acids at 250 ppm, vitamins B at 50 ppm and potassium silicate at 0.1% on vegetative growth and yield under Minia governorate conditions, Egypt.

2. Material and Methods

This study was carried out during 2013 and 2014 seasons on twenty-four wonderful pomegranate trees grown in a private orchard situated at Hawarta village, El Miniadistrict, Minia Governorate. The trees are planted in heavy clay soil at 4*4 meters apart. Surface irrigation system using Nile water was adopted. The experiment was designed to study the effect of amino acids, vitamins B and silicon as well as possible combinations on wonderful pomegranate. For achieving the previous goal the following eight treatments were carried out:

- 1-Control (untreated trees).
- 2-Spraying amino acids at 250 ppm.
- 3- Spraying vitamins B at 50 ppm.
- 4- Spraying potassium silicate at 0.1%.
- 5- Spraying amino acids at 250 ppm + vitamins B at 50 ppm.
- 6- Spraying amino acids at 250 ppm + potassium silicate at 0.1%.
- 7- Spraying vitamins B at 50 ppm + potassium silicate at 0.1%.
- 8- Spraying amino acids at 250 ppm + vitamins B at 50 ppm + potassium silicate at 0.1%.

Every treatment was replicated three times, one tree per each. The three chemicals were sprayed three times annually at growth start, just after fruit setting and one month later. The experiment was arranged in a randomized complete block design (RCBD). During both seasons, the following parameters were measured main shoot length (cm), number of leaves /shoot, leaf area (cm²), number of fruits/tree and yield/tree (Kg),primary and finally fruit set, weight per fruit (g), percentages of juice, grain and pomace,edible/non edible, total acidity%, T.S.S, tannins and reducing sugar. Statistical analysis was

done according to **Mead *et al.* (1993)** New L.S.D at 5% test was used to compare the differences between different treatment means.

3. Results and Discussion

Results in table (1) showed that all treatments increased all the vegetative growth characters (shoot length, number of leaves per shoot and leaf area) compared with the control.

The results also indicated that potassium silicate was more effective in increasing the length shoot, number of leaves per shoot and leaf area followed by amino acids then by vitamin B. Results in the same table (Table 1) indicated that combination treatments were of more pronounced effect than that of any one alone. One can declare from the results in the same table that potassium silicate, amino acids and vitamins B affect in descending order the shoot length, number of leaves per shoot and leaf area.

Moreover, using all chemicals in one treatment presented the highest numbers of all studied characters.

The present results are agreement with those obtained by **Ahmed and Abd El-Hameed (2004)**; **Ahmed *et al.* (2014)**; **Ahmed and Seleem Basma (2008)**; **Abd El Kareem (2009)**; **El-kady –Hanaa (2011)** and **Alwasfy (2014)** on grapevines.

Results in table (2) showed the effect of different treatment on primary and finally fruit set as well as number of fruits and the yield per tree.

It is clear from the obtained data that potassium silicate, amino acids and vitamins B presented higher primary and finally fruit set in the two experimental seasons. The difference between any of these treatments and the control was significant. Results further showed that the combined treatments were more effective than using any of them alone. Moreover, the highest treatment affected primary and finally fruit set was that including the three chemicals in combination.

Results in the same table also indicated the effect of the different treatments on number of fruits per tree was similar to their effect of primary and finally fruit set. Thereby, the increasing on number of fruits per tree might be due to the increasing presented in primary and finally fruits set. The yield per tree took a similar trend to that of number of fruits per tree or primary or finally fruit set.

The present results are in line with those **Ahmed and Abd El-Hameed (2003)**; **Amin (2007)**; **Madian and Refaai (2011)**; **Ahmed and Seleem Basma (2008)**; **El-Khawaga (2014)** and **Alwasfy (2014)** on grapevines.

Juice %, pomace %, grain % and edible/non edible % as affected by amino acids, vitamins B and potassium silicate are presented in table (3).

The positive effect of the previous chemicals is not similar, since potassium silicate is more effective than amino acids and vitamins B on the prementioned characteristics. In addition results declared that any combination used is preveable than using any of them on all the studies characters. Results in the two years of the experiment took a similar trend concerning the influence of these chemicals on juice %, pomace %, grain % and edible/non edible %. The present results are in accordance to those of **Ahmed and Abd El-Hameed (2003)**; **Madian and Refaai (2011)**; **Ahmed *et al.*, (2012a)**; **El-Khawaga (2014)**; **Abd El-latief (2014)**; **Gad El- Karim and Abada (2014)** on grapevines and **Ahmed *et al.* (2015)** on pomegranate

It is worth to mention that amino acids, vitamins B and potassium silicate increased the total soluble solids and reducing sugar than those of the control (**Table 4**), simulteneously decreased the total acidity and tannins. This was also extended to the effect of the combination treatments on the studied parameters. In other words, the control fruits were of less T.S.S and reducing sugar than any other treatment. Moreover, total acidity and tannins percentages of the control fruits overcome those of any of the used treatment. The differences between any two treatments were proved statistically in the two experimental seasons.

The prementation results are in agreement with the findings of **Seleem Basma and Abd El-Hameed (2008)**; **Abd El-Kareem (2009)**; **El-Kady-Hanaa (2011)**; **Abdelaal (2012)**; **Gad El-Karim and Abada (2014)** and **Alwasfy (2014)**.

As a conclusion the peremention results can be under stood in the light of the role of amino acids in the plant can illustrate their previous effect on the studied parameters, since all organic foods in the plant were formed by the assistance of amino acids. Formation of vitamins and enzymes largely depended on the occurrence of amino acids. Also, they are responsible for prolonging shelf life of cells and delaying aging of them (**Waller and Nowaki, 1978**).

The action of vitamins B on the vegetative characters and the yield as well as physical and chemical characteristics of the fruits might be attributed to their positive action on avoiding all active oxygen species from reducing cell senscences and destroying all cell membrances as well as enhancing cell division, the biosynthesis of plant pigments and organic foods, the resistance of plant to unfavourable conditions beyond the trees, the biosynthesis of natural hormones, building of amino acids and proteins and uptake of water and different nutrients. These merits were happened through the effect of these vitamins on preventing the oxidation

of lipids and death of cells. **Robinson, (1973) and Samiullah, (1988).**

Silicon is known to reduce the formation of reactive oxygen species that oxidizes photosynthetic pigments, membranes lipids, proteins and nucleic acid. Previous studies showed that silicon increases

the activities of antioxidant enzymes in the leaves that protect plant tissues from oxidative damage under unfavorable conditions. Silicon is responsible for maintaining plant water balance as well as stimulating water transport and root growth. (**Levitt, 1980).**

Table (1): Effect of amino acids (methionine, cysteine and tryptophan), vitamins B (B1, B2, B6 and B12) and potassium silicate on the shoot length, number of leaves / shoot and leaf area of wonderful pomegranate trees during 2013 and 2014 seasons.

Treatments	Characters	Shoot length (cm)		Number of leaves / shoot		Leaf area (cm ²)	
		2013	2014	2013	2014	2013	2014
1- Control		66.00	71.00	47.00	57.00	5.24	5.44
2-Amino acids at 250 ppm		71.90	77.30	57.00	67.00	7.00	7.21
3-Vitamin B at 50 ppm		68.73	74.00	51.00	62.00	6.11	6.30
4-K-silicate at 0.1%		74.30	80.00	61.00	72.00	7.55	7.74
5-Amino acids + vit. B		77.80	86.00	67.00	78.00	8.00	8.18
6-Amino acids +K-silicate		86.30	104.60	75.00	86.00	8.62	8.80
7-Vit.B + K-silicate		81.70	99.00	71.03	81.00	8.40	8.61
8-Treat.(2,3 and 4)		90.03	111.00	84.00	97.00	8.99	9.17
New L.S.D at 5%		1.96	1.09	1.02	3.10	0.17	0.25

Table (2): Effect of amino acids (methionine, cysteine and tryptophan), vitamins B (B1, B2, B6 and B12) and potassium silicate on the primary and finally fruit set, number of fruits/tree and yield/tree (kg) of wonderful pomegranate trees during 2013 and 2014 seasons.

Treatments	Characters	Primary fruit set%		Finally fruit set %		Number of fruits/tree		Yield/tree (kg)	
		2013	2014	2013	2014	2013	2014	2013	2014
1- Control		38.76	44.06	29.00	30.03	33.00	44.00	11.70	16.70
2-Amino acids at 250 ppm		55.30	59.00	42.93	44.00	38.00	56.00	15.20	24.10
3-Vitamin B at 50 ppm		48.00	52.00	40.03	41.00	35.00	50.00	13.10	20.06
4-K-silicate at 0.1%		61.00	62.96	46.00	47.16	41.00	60.00	17.63	27.66
5-Amino acids + vit. B		66.00	69.00	48.96	50.03	44.00	66.00	19.96	32.53
6-Amino acids +K-silicate		73.96	78.00	55.46	56.00	50.00	89.00	26.96	43.76
7-Vit.B + K-silicate		69.00	73.00	53.00	53.00	45.00	74.00	22.96	38.46
8-Treat.(2,3 and 4)		79.93	81.10	58.56	59.93	54.00	94.00	28.46	53.56
New L.S.D at 5%		5.95	0.83	0.77	3.04	2.86	5.43	2.81	2.65

Table (3): Effect of amino acids (methionine, cysteine and tryptophan), vitamins B (B1, B2, B6 and B12) and potassium silicate on the percentages of juice, pomace, grain and edible/non edible of wonderful pomegranate trees during 2013 and 2014 seasons.

Treatments	Characters	Juice %		Pomace %		Grain %		Edible/non edible%	
		2013	2014	2013	2014	2013	2014	2013	2014
1- Control		35.00	34.30	33.40	32.70	68.40	67.00	2.16	2.04
2-Amino acids at 250 ppm		39.00	38.30	35.00	37.70	74.00	76.00	2.86	3.17
3-Vitamin B at 50 ppm		37.00	36.20	35.00	37.80	72.00	74.00	2.63	2.86
4-K-silicate at 0.1%		41.00	40.20	36.00	38.80	77.00	79.00	3.38	3.76
5-Amino acids + vit. B		42.00	42.20	36.10	39.80	78.10	82.00	3.77	4.60
6-Amino acids +K-silicate		47.00	46.40	37.00	39.60	84.00	86.00	5.52	6.16
7-Vit.B + K-silicate		45.00	44.30	37.00	39.70	82.00	84.00	4.56	5.36
8-Treat.(2,3 and 4)		48.10	47.40	37.80	40.40	85.90	87.80	6.11	7.23
New L.S.D at 5%		1.28	0.71	3.59	2.00	3.42	2.28	1.07	0.64

Table (4): Effect of amino acids (methionine, cysteine and tryptophan), vitamins B (B1, B2, B6 and B12) and potassium silicate on the T.S.S, reducing sugar %, total acidity % and tannins % of wonderful pomegranate trees during 2013 and 2014 seasons.

Treatments	T.S.S		Reducing sugar %		Total acidity %		Tannins %	
	2013	2014	2013	2014	2013	2014	2013	2014
1- Control	14.00	14.00	9.11	8.87	3.11	3.00	1.11	1.19
2-Amino acids at 250 ppm	14.70	14.60	9.61	9.51	3.05	2.81	0.96	1.05
3-Vitamin B at 50 ppm	14.40	14.30	9.41	9.11	3.08	2.90	1.00	1.11
4-K-silicate at 0.1%	15.00	15.00	9.82	9.82	2.92	2.76	0.90	0.94
5-Amino acids + vit.B	15.26	15.20	10.01	10.00	2.90	2.70	0.80	0.85
6-Amino acids +K-silicate	15.70	15.70	10.60	10.50	2.80	2.64	0.66	0.70
7-Vit.B + K-silicate	15.63	15.50	10.40	10.20	2.81	2.65	0.74	0.79
8-Treat.(2,3 and 4)	15.90	16.00	10.80	10.71	2.71	2.61	0.59	0.57
New L.S.D at 5%	0.37	0.46	0.12	0.09	0.02	0.02	0.05	0.05

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