Insight into the Effect of Spraying Amino Acids Enriched with Some Vitamins on Quantitative and Qualitative Fruit Characteristics of Flame Seedless Grapevines

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Abstract: During 2017 and 2018 seasons, Flame seedless grapevines received three sprays of amino acids at 0.1% either alone or in different combinations with vitamins A & B_{12} each at 50 ppm and C at 500 ppm. The objective of this study was examining the effect of amino acid and vitamins on growth, vine nutritional status, yield and berries quality. Using amino acids at 0.1% either singly or in different combinations with vitamins A and B_{12} each at 50 ppm and C at 500 ppm was very effective in improving growth, vine nutritional status, yield, berries colouration % and both physical and chemical characteristics of the berries relative to the control. Combined applications of amino acids and vitamins A, B and C were favourable than using amino acids alone in this respect. Carrying out three sprays at growth start, just after berry setting and at three weeks later of a mixture of amino acids at 0.1% plus vitamins A and B_{12} ppm each at 50 ppm and vit. C at 500 ppm gave the best results with regard to yield and berries quality of Flame seedless grapevines.

[Esraa M. E. Hussein. **Insight into the Effect of Spraying Amino Acids Enriched with Some Vitamins on Quantitative and Qualitative Fruit Characteristics of Flame Seedless Grapevines.** *Stem Cell* 2018;9(4):1-7]. ISSN: 1945-4570 (print); ISSN: 1945-4732 (online). http://www.sciencepub.net/stem. 1. doi:10.7537/marsscj090418.01.

Keywords: vitamins, A, B, B, amino acids, Flame seedless, growth, yield, berries quality

1. Introduction

Recently, many attempts were accompanied for improving yield and fruit quality of olive tree by using non- traditional methods. Out of these methods were the application of vitamins and amino acids.

Vitamins are considered as antioxidants. They play a definite role in protecting the plant cells from senescence and death through preventing the production of free radicals namely reactive oxygen species (ROS) during plant metabolism from oxidation of lipids, the components of plasma membrane which is accompanied with the loss of permeability of cells and death (**Bertschinger and Stadler**).

Recently, it was suggested that vitamins participate a viral role in plant growth and development indirectly by enhancing the endogenous levels of various growth factors such as cytokinins and gibberellins (**Foyer and Lelandias, 1993**). For more than two decades, the role of vitamins in plant has attracted sporadic attention. These studies indicate that various physiological processes such as nutrient uptake, absorption of water, translocation of organic foods, building of natural hormones, respiration, photosynthesis as well as chlorophyll and protein synthesis depend more or less on the availability of vitamins (**Samiullah *et al.,* 1988**). Vitamins with their antioxidantive properties play an important role in plant defense against oxidative stress induced by surfactants and selected pesticides. Application of vitamins is accompanied with enhancing alpha keto glutaric acid biosynthesis which is united with ammonia to form amino acids and proteins. Vitamins are known as important factors responsible for enhancing growth and fruiting of fruit crops. Vitamins have many important functions in plants. It is responsible for protecting cell walls from death and preventing reactive oxygen species (ROS) in favor of prolonging the age of cells, enhancing photosynthesis and the building of most organic foods in the plants.

Amino acids with their antioxidative properties play an important role in plant defense against oxidative stress induced by unfavourable conditions. They are responsible for enhancing protein biosynthesis and stimulating the formation of natural hormones like IAA, ethylene, cytokinins and GA_3, cell division, organic tools, enzymes, DNA and RNA. They protect plant cells from senescence and death and prevent the free radically from oxidation of lipids the components of plasma membrane which is accompanied with the loss of permeability and controlling the incidence of disorders (**Davies, 1985**).

Previous studies showed that application of vitamins (**Ebrahim – Rehab, 2013; Mekawy, 2012; Abdelaal *et al.,* 2013; Al- Wasfy, 2014; Abd El-Latief, 2014; El- Khawaga, 2014; Abdelaal *et al.,* 2014 and Hassan, 2017**) and amino acids (**Ahmed and Abd El-Hameed, 2003; Ahmed *et al.,* 2007; Mohamed, 2014 and Mohamed, 2017**) were very potent in stimulating growth, vine nutritional; status, yield and berries quality of different grapevines cvs.

The goal of this study was testing the effect of amino acids enriched with different vitamins on growth, vine nutritional status, yield and berries quality of Flame seedless grapevines.

2. Materials and Methods

This study was carried out during 2017 and 2018 seasons on fifty four, 10 – years old uniform in vigour Flame seedless grapevines grown on own roots in a private vineyard located at Souhage district, Souhage Governorate where the soil texture is clay and well drained and water table is not less two meters deep. Vines are spaced at 2x3 meters apart. The selected vines (54 vines) were pruned during the last week of Dec. in both seasons. Using spur pruning and Gabel supporting system. Vine load was adjusted to 72 eyes for all the selected vines (on the basis of 20 fruiting spurs x three eyes plus six replacement spurs x two eyes). Surface irrigation system was followed using Nile water.

All the investigated vines (54 vines) were subjected to the common agricultural and horticultural practices that already applied in the vineyard except those dealing using amino acids and vitamins application.

This experiment included the following nine treatments.

1- Control.
2- Spraying amino acids alone at 0.1% (1 g L).
3- Spraying amino acids + vitamin A at 50 ppm.
4- Spraying amino acids + vitamin B at 50 ppm.
5- Spraying amino acids + vitamin C at 500 ppm.
6- Spraying amino acids + vitamins A + B.
7- Spraying amino acids + vitamins A + C.
8- Spraying amino acids + vitamins B + C.
9- Spraying amino acids + vitamins A + B+ C.

Each treatment was replicated three times, two vines per each. Both amino acids (tryptophane, methionene and cysteine) and vitamins A, B and C were sprayed three times at growth start (1st week of Mar.), just after berry setting (Mid of Apr) and three weeks later (1st week of May). Triton B as a wetting agent was added at 0.05 to all solutions and spraying was done till run off. Randomized complete block design (R.CBD) was used.

During both seasons, the following measurements were recorded:

1- Leaf area (cm^2) (**Ahmed and Morsy, 1999**).

2- Leaf chemical components namely chlorophylls a & b and total chlorophylls (mg/ g F.W.) (**Von-Wettstein, 1957 and Hiscox and Isralstam, 1979**), N, P, K, Mg, Ca, S, Zn, Fe, Mn and B (**Black, 1965, Chapman and Pratt, 1965, Evenhuis and Dewaard, 1980, Cottenie *et al.*, 1982 and Summer, 1985)**.

3- Percentage of berry setting and yield expressed in weight (kg.) and number of clusters / vine.

4- Cluster aspects namely weight (g.) length and shoulder (cm).

5- Percentage of colouration.

6- Physical and chemical characteristics of the berries namely berry weight (g.), T.S.S. % reducing sugars % (**Lane and Eynon, 1965 and A.O.A.C, 2000**), total acidity % (as g tartaric acid / 100 ml juice), (**A.O.A.C., 2000**) and total anthocyanins (**Fulcki and Francis, 1968**).

Statistical analysis was alone (according to **Mead *et al.*, 1993**). Treatment means were compared using new L.S.D. at 5%.

3. Results and Discussion

1- Leaf area and its chemical components

Data in Tables (1 to 3) clearly show that treating Flame seedless grapevines with amino acids at 0.1% singly or in combinations with vitamins A & B & C significantly resulted in great promotion on the leaf area and chemical components namely chlorophylls a & b, total chlorophylls, N, P, K, Mg, Ca, S, Zn, Fe, Mn and B relative to the control. Combined applications of amino acids at 0.1% and vitamins A and B each at 50 ppm and vit. C at 500 ppm was significantly superior than using amino acids alone in improving the leaf area and its chemical components. The best vitamins in this respect were A & B & C in ascending order. Significant differences on these parameters were recorded between the nine treatments. The maximum values were recorded on the vines that received three sprays of a mixture of amino acids at 0.1% plus vitamins A +B + C at 50, 50 and 500 ppm, respectively. The untreated vines produced the minimum values. These results were true during both seasons.

2- Percentage of berry setting, yield and cluster weight

It is evident from the data in Table (3) that percentage of berry setting, yield expressed in weight and number of clusters / vine and cluster weight were significantly improved in response to spraying the vines with amino acids either alone or in combinations with vitamins A & B and C relative to the control. Combined applications were significantly favourable than using amino acids alone in improving these parameters. The maximum yield (10.0 & 15.6 kg) was observed on the vines that received three sprays of a mixture amino acids at

0.1% and vitamins A & B and C each at 50, 50 and 500 ppm, respectively during both seasons, respectively. The untreated vines produced the minimum values (7.9 & 8.6 kg) during both seasons, respectively,. These results were true during both seasons.

3-Percentage of berries colouration.

As shown in Table (4) spraying amino acids at 0.1% either singly or in combinations with vitamins A & B & C significantly improved the percentage of berries colouration relative to the control. The best vitamins applied with amino acids in ascending order were vitamins A & B and C. Combined applications were significantly favourable in improving berries colouration than using amino acids alone. The best berries colouration (90.0 & 90.5 %) were recorded on the vines that treated with amino acids and vitamins A + B + C during both seasons, respectively. The untreated vines produced the minimum values (71.8 and 75.1%) during both seasons, respectively.

4-Some physical and chemical characteristics of the berries

Data in Table (4) clearly show that treating the vines with amino acids alone or in combinations with vitamins A & b & C significantly was very effective in improving fruit quality in terms of increasing berry weight, T.S.S. %, reducing sugars % and total anthocyanins and decreasing total acidity relative to the control. Combined applications were favourable than using amino acids alone in improving quality of the berries. The best results with regard to berries quality were obtained with using a mixture of amino acids at 0.1% and vitamins A & B and C. The untreated vines produced unfavourable effects. These results were true during both seasons.

Table (1): Effect of spraying some amino acids alone or in various combinations with some vitamins on the leaf area, pigments and percentages of N and P in the leaves of Flame seedless grape vines during 2017 and 2018 seasons.

	Leaf area $(cm)^2$		Chlorophyll a (mg/ g F.W.)		Chlorophyll b (mg/ g F.W.)		Total Chlorophylls (mg/ g F.W.)		Leaf N %		Leaf P %	
	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018
Control	110.0	110.8	6.1	5.9	2.9	2.1	9.0	8.0	1.55	1.58	0.121	0.121
Amino acids alone at 0.1%	111.9	112.9	6.6	6.5	3.3	3.4	9.9	9.9	1.62	1.64	0.141	0.139
Amino acids + vit. A at 50 ppm	113.0	113.9	7.2	7.1	3.7	3.8	10.9	10.9	1.70	1.69	0.151	0.149
Amino acids + vit. B at 50 ppm	115.0	115.8	8.0	7.8	4.0	4.1	12.0	11.9	1.77	1.76	0.161	0.159
Amino acids + vit. C at 500 ppm	119.1	118.0	8.7	8.5	4.4	4.5	13.1	13.0	1.84	1.85	0.171	0.170
Amino acids + vit. A+ B	119.0	119.8	7.5	9.0	4.7	4.8	14.2	13.8	1.91	1.92	0.181	0.180
0.200Amino acids + vit. A+ C	121.0	121.9	10.0	9.6	5.0	5.1	15.0	14.7	1.99	2.01	0.201	0.200
Amino acids + vit. B + C	122.7	123.6	10.6	10.2	5.3	5.3	15.9	15.5	2.06	2.06	0.212	0.211
Amino acids + vit. A+ B+ C	124.0	124.8	11.2	10.7	5.6	5.5	16.8	16.2	2.14	2.16	0.225	0.224
New L.S.D. at 5%	1.1	0.9	0.5	0.4	0.3	0.2	0.5	0.4	0.06	0.04	0.005	0.007

Table (2): Effect of spraying some amino acids alone or in various combinations with some vitamins on the leaf content of K, Mg, Ca, and S (as %) and Fe and Mn (as ppm) of Flame seedless grape vines during 2017 and 2018 seasons.

	Leaf K %		Leaf Mg %		Leaf Ca%		Leaf S %		Leaf Fe (ppm)		Leaf Mn ppm)	
	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018
Control	1.11	1.11	0.51	0.50	2.71	2.80	0.35	0.57	51.7	52.2	51.1	52.3
Amino acids alone at 0.1%	1.18	1.17	0.56	0.55	2.81	2.90	0.61	0.61	52.9	55.0	54.1	55.1
Amino acids + vit. A at 50 ppm	1.25	1.24	0.61	0.59	2.91	3.00	0.66	0.65	55.1	57.0	57.1	57.5
Amino acids + vit. B at 50 ppm	1.30	1.29	0.66	0.66	3.02	3.11	0.72	0.70	57.4	59.0	59.6	60.0
Amino acids + vit. C at 500 ppm	1.35	1.33	0.71	0.69	3.12	3.22	0.78	0.75	60.0	61.2	62.9	62.9
Amino acids + vit. A+ B	1.41	1.39	0.76	0.74	3.25	3.31	0.84	0.81	62.5	63.3	66.1	66.1
0.200Amino acids + vit. A+ C	1.49	1.48	0.80	0.79	3.35	3.40	0.88	0.86	65.0	66.0	68.9	69.9
Amino acids + vit. B + C	1.55	1.56	0.84	0.85	3.50	3.49	0.92	0.91	67.9	68.9	71.9	72.5
Amino acids + vit. A+ B+ C	1.60	1.61	0.87	0.88	3.60	3.58	0.97	0.95	70.1	71.2	75.0	75.0
New L.S.D. at 5%	1.04	0.05	0.02	0.03	0.08	0.09	0.04	0.04	2.0	2.0	2.1	2.3

Table (3): Effect of spraying some amino acids alone or in various combinations with some vitamins on leaf Zn and B (as ppm), berry setting %, yield and cluster weight of Flame seedless grape vines during 2017 and 2018 seasons.

	Leaf Zn (ppm)		Leaf B (ppm)		Berry setting %		No. of clusters / vine		Yield / vine (kg.)		Av/ cluster weight (g.)	
	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018
Control	49.1	50.3	0.61	0.59	12.6	12.7	22.0	23.0	7.7	7.8	350.0	341.0
Amino acids alone at 0.1%	51.1	52.5	0.66	0.64	13.8	14.1	22.0	25.0	7.9	8.6	361.0	344.0
Amino acids + vit. A at 50 ppm	53.2	54.6	0.70	0.69	14.9	15.6	23.0	27.0	8.6	9.6	371.9	356.0
Amino acids + vit. B at 50 ppm	55.4	56.7	0.74	0.74	16.0	17.1	23.0	29.0	8.8	10.7	382.0	368.0
Amino acids + vit. C at 500 ppm	58.0	59.0	0.78	0.80	17.2	18.6	23.0	31.0	9.0	11.8	342.0	380.0
Amino acids + vit. A+ B	60.0	61.2	0.82	0.86	18.3	20.0	23.0	32.0	9.2	12.6	402.0	393.0
0.200Amino acids + vit. A+ C	62.1	63.4	0.86	0.91	19.5	21.4	23.0	33.0	9.5	13.4	413.0	406.0
Amino acids + vit. B + C	64.4	66.0	0.90	0.96	20.6	22.8	23.0	35.0	9.8	14.7	434.0	420.0
Amino acids + vit. A+ B+ C	66.9	68.3	0.94	1.01	21.8	24.3	23.0	36.0	10.0	15.6	435.9	434.0
New L.S.D. at 5%	1.8	1.9	0.04	0.05	1.1	1.4	NS	2.0	0.2	0.5	10.1	11.2

Table (4): Effect of spraying some amino acids alone or in various combinations with some vitamins on the percentage of berries colouration, berry weight and some chemical characteristics of Flame seedless grape vines during 2017 and 2018 seasons.

	Berries colouration %		Berry weight (g.)		T.S.S. %		Total acidity %		Reducing sugars %		Total anthocyanins (mg/ g F.W.)	
	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018
Control	69.9	70.1	4.00	3.98	17.5	17.7	0.701	0.708	15.5	15.6	0.29	0.30
Amino acids alone at 0.1%	71.8	72.1	4.09	4.08	17.8	18.0	0.681	0.688	15.8	15.9	0.35	0.37
Amino acids + vit. A at 50 ppm	73.9	74.1	4.18	4.18	18.2	18.3	0.660	0.668	16.0	16.4	0.41	0.44
Amino acids + vit. B at 50 ppm	76.0	76.3	4.25	4.30	18.2	18.7	0.641	0.645	16.3	16.7	0.48	0.51
Amino acids + vit. C at 500 ppm	78.0	79.0	4.33	4.41	19.0	19.1	0.620	0.622	16.6	17.0	0.55	0.61
Amino acids + vit. A+ B	81.5	81.9	4.40	4.50	19.4	19.5	0.594	0.600	17.0	17.3	0.62	0.67
0.200Amino acids + vit. A+ C	84.4	88.0	4.49	4.61	20.0	19.8	0.575	0.680	17.4	17.5	0.70	0.73
Amino acids + vit. B + C	86.9	87.8	4.57	4.71	20.4	20.1	0.555	0.560	17.8	17.8	0.76	0.84
Amino acids + vit. A+ B+ C	90.0	90.5	4.67	1.79	20.8	20.4	0.539	0.541	18.1	18.0	0.81	0.87
New L.S.D. at 5%	1.4	1.3	0.06	0.08	0.3	0.2	0.015	0.016	0.2	0.2	0.05	0.06

4. Discussion

1-Effect of different vitamins:

The promoting effects of vitamin B and K on growth, nutritional status of the trees, yield as well as both physical and chemical characteristics of the fruits might be attributed to their positive action on enhancing cell division, natural hormones such as IAA, gibberellins and cytokinins, absorption of water root, development, biosynthesis of plant pigment and most organic foods and building of all organic foods. They are played a definition role in protecting the plant cells from senescence and death through preventing the formation of free radicals that are responsible for oxidation of lipids and the loss of permeability of cells (**Foyer and Lelandias, 1993**).

2- Effect of amino acids:

The previous positive action of amino acids on growth, vine nutritional status, yield and berries quality in different grapevines cvs might be attributed to the antioxidative effects of these amino acids which plays an important role in plant defense against oxidative stresses and stimulate the biosynthesis of proteins, natural hormones like IAA, ethylene, cytolinins and GA_3, DNA, RNA, organic foods and plant pigments. Their roles ion enhancing cell division did not neglect (**Davies, 1982**).

The promoting effect of vitamins on growth, vine nutritional status, yield and berries quality was supported by the results of **Ibrahim – Rehab (2012); Mekawy (2012); Abdelaal *et al.*, (2013); Al- Wasfy (2014); Abd El- Latif (2014); El-Khawaga (2014); Abdelaal *et al.*, (2014) and Hassan (2017).**

The results of **Ahmed and Abd El- Hameed (2003); Ahmed *et al.*, (2007); Amin (2007); Mohamed (2014) and Mohamed (2017)** confirmed the beneficial effects of using amino acids on growth, vine nutritional status, yield and berries quality in different grapevines cvs.

Conclusion

Carrying out three sprays at growth start, just after berry setting and at three weeks later of a mixture of amino acids at 0.1% plus vitamins A and B_{12} each at 50 ppm and vit. C at 500 ppm gave the best results with regard to yield and berries quality of Flame seedless grapevines.

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12/1/2018