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Effect of Spraying Some Amino Acids, Vitamin B Complex and Boron on Growth and Vine Nutritional Status of Superior Grapevines

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ABSTRACT

The effect of single and combined application of one of the three amino acids namely (glutamic, glycine and aspartic acid) at 250 ppm from each, vitamin B complex (B_1 + B_2+ B_6 + B_{12}) at 100 ppm and boric acid at 0.05 % on yield and berry quality of Superior grape cv. were investigated during 2017 and 2018 seasons. Results showed that, single and combined applications of one of three amino acids as well as vitamin B complex and boric acid were very effective on improving main shoot length, number of leaves/ shoot, leaf area, wood ripening coefficient, pruning wood weight / vine, cane thickness, chlorophyll A, chlorophyll B, total chlorophylls, total carotenoids, N, P, K, Mg, Zn, Fe and Mn of Superior grapevines comparing with untreated vines. The application of amino acids was more effective than the application of vitamin B and boric acid in this respect AT three sprays (at growth start, just after berry setting and one month later) with a mixture containing 250 ppm glutamic acid plus 100 ppm vitamin B complex and 0.05% boric acid proved to be very effective in enhancing growth and vine nutritional status of Superior grapevine.

Keywords: amino acids, vitamin B complex, boric acid, growth, vine nutritional status

1. Introduction

An outstanding effect on growth and vine nutritional status was noticed in Superior grapevines due to using some amino acids, vitamin B and boron. This is due to the positive effect of some amino acids, vitamin B complex and boron on growth and vine nutritional status.

Amino acids as organic nitrogenous compounds are the building blocks in the synthesis of proteins, which are formed by as process in which Ribosome's catalyze the polymerization of amino acids Davies, 1982 and Raskin (1992). Several hypotheses have been proposed explain for the role of amino acids in plant. Available evidence suggests several alternative routes of ethylene and IAA synthesis in plants, starting from amino acids Hashimoto and Yamada (1994); Ahmed and Abd El-Hameed (2003) Ahmed *et al.,* 2007; Amin (2007); Seleem- Basma and Abd El-Hameed (2008) and Sayed- Heba (2010).

Vitamin B is responsible for enhancing amino acids biosynthesis, carbohydrates, plant pigments and cell division. Those vitamins B are responsible for enhancing uptake of water and nutrient and increasing tolerance of plant to all stresses. Using vitamins especially vitamin B was very effective in enhancing growth and vine nutritional status in different grapevine cvs. (Samiullah *et al.,* 1988; El-Kady- Hanaa, 2011; Madian and Refaai, 2011; Uwakiem, 2011; Abd El-Hameed, 2012; Abdelaal, 2012 ; Ahmed *et al.,* 2012 and Ibrahiem- Rehab, 2012).

Boron plays an important role in the extension of plant cell walls through its association with cell wall pectin's (Banik and Sen, 1997 and Perica *et al.,* 2001). It is also known that the role of boron in

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plant metabolism including many physiological aspects such as nucleic acid metabolism, protein and natural hormone biosynthesis, building and translocation of carbohydrates, photosynthesis, cell division, cell wall synthesis, membrane function and water uptake and pollen germination (Pibleam and Kirkby 1983; Gupta *et al.,* 1985; Blevins and Lukaszweski, 1998) Previous studies supported the beneficial effect of using boron via chelated or sulphate form on growth and vine nutritional status in different grapevine cvs (Amin, 2007; Ahmed, *et al.,* 2007; Abd El-Gaber- Nermean , 2009; El- Sawy, 2009; Abd El-Wahab, 2010; El- Kady- Hanaa, 2011; Abdelaal, 2012; Nikkah *et al.,* 2013 and Mohamed, 2014b).

The target of this study was examining the effect of spraying three amino acids namely (glutamic acid, glycine and aspartic acid) vitamin B complex (B_1 + B_2+ B_6 + B_{12}) and boron on growth traits and vine nutritional status of Superior grapevines.

2. Material and Methods

This study was carried out during 2017 and 2018 seasons on 90 uniform in vigour 6- years old Superior grapevines grown in a private vineyard located at Talla village, Minia district, Minia Governorate where soil texture is clay, well drained and water table was not less than two meters deep.

All the selected vines are planted at 1.5 x 3.0 meters apart. The chosen vines (90 vines) were pruned during the last week of December in both seasons using cane pruning method with the assistance of Gable supporting system. Bud load / vine were 96 buds for all the selected vines on the basis of eight fruiting cans x ten buds plus eight renewal spurs x two buds. Except those vines dealing with the present treatments foliar application of amino acids, vitamin B and boric acid. All selected vines (90 vines) received the recommended horticultural practices which are commonly used in the vineyard.

This study included fifteen treatments containing single of combined application of three amino acids (i.e., glutamic acid, glycine and aspartic acid), vitamin B complex (B_1 + B_2+ B_6 + B_{12}) and boron acid in additions to the untreated vines (control).

1- Untreated vines (Control).
2- Spraying 250 ppm glutamic acid.
3- Spraying 250 ppm glycine.
4- Spraying 250 ppm aspartic acid.
5- Spraying 100 ppm vitamin B (B_1 + B_2 + B_6 + B_{12}).
6- Spraying 0.05% boric acid.
7- Spraying a mixture of 250 ppm glutamic acid + 100 ppm vitamin B complex.
8- Spraying a mixture of 250 ppm glycine + 100 ppm vitamin B complex.
9- Spraying a mixture of 250 ppm aspartic acid + 100 ppm vitamin B complex.
10- Spraying a mixture of 250 ppm glutamic acid + 0.05% Boric acid.
11- Spraying a mixture of 250 ppm glycine + 0.05% Boric acid.
12- Spraying a mixture of 250 ppm aspartic acid + 0.05% Boric acid.
13- Spraying a mixture of 250 ppm glutamic acid + 100 ppm vitamin B complex + 0.05% Boric acid.
14- Spraying a mixture of 250 ppm glycine acid + 100 ppm vitamin B complex + 0.05% Boric acid.
15- Spraying a mixture of 250 ppm aspartic acid + 100 ppm vitamin B complex + 0.05% Boric acid.

The experiments were conducted as complete randomized block design (Rangaswamy, 1995) was followed where the experiment consisted of fifteen treatments and each treatment was replicated on 6 vines.

The selected vines received three sprays during the growth season. The 1st time at 1st week of March, just after berry setting, the 2nd time during the 1st week of April and the 3rd time was one month later (1st week of May).

Triton B as a wetting agent was added to all spraying solutions at 0.05%. Spaying was done till run off (2 liters/ vine). Control treatment was carried out by spraying water only.

During both of studied seasons, the following measurements were recorded:

1- Vegetative growth characteristics namely main shoot length (cm), number of leaves/ shoot, leaf area $(cm)^2$ (Ahmed and Morsy, 1999) wood ripening coefficient (Bourad, 1966), wood weight (kg.) and cane thickness (cm)
2- Leaf chemical components namely chlorophyll A, chlorophyll B, total chlorophylls, total carotenoids (mg/ g F.W.) (Von – Wesststein 1957), N, P, K, Mg (as %) Zn, Fe and Mn (as ppm) in leaves (Cottenie *et al.,* 1982 and Summer, 1985).

Statistical analysis.

The obtained data were tabulated and statistically analyzed according to (Snedecor and Cochran, 1967 and Mead *et al.,* (1993). Differences between treatment means were compared by revised L.S.D. test at 5% level of probability according to Steel and Torrie, (1984).

3. Results

3.1. Vegetative growth characteristics:

Data in Table (1) clearly show that single and combined application of some amino acids (glutamic acid, glycine and aspartic acid), vitamin B complex (B_1 + B_2+ B_6 + B_{12}) and boron acid on the six growth traits of Superior grapevines during 2017 and 2018 seasons. It is clear from obtained data that single and combined applications of the amino acids namely 250 ppm glutamic acid, 250 ppm glycine and 250 ppm aspartic acid, 100 ppm vitamin B complex and 0.05 % boric acid significantly stimulated the six growth characteristics namely (main shoot length, number of leaves shoot, leaf area, wood ripening coefficient, pruning wood weight and cane thickness) comparing with the check treatment.

Table 1: Effect of single and combined of applications of some amino acids (glutamic acid, glycine and aspartic acid), vitamin B (B_1 + B_2 + B_6 + B_{12}) and boric acid on some vegetative growth characteristics of Superior grapevine during 2017 and 2018 seasons

Treatments	Main shoot length (cm)		No. of leaves / shoot		Leaf area (cm)2		Wood ripening coefficient		Pruning wood weight (kg.)		Cane thickness (cm)	
	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018
1-Control	115.0	116.0	17.0	17.0	98.5	99.0	0.67	0.68	1.95	1.98	1.05	1.08
2-Glutamic acid at 250 ppm	118.0	118.5	21.0	22.0	103.8	104.2	0.80	0.82	2.18	2.20	1.16	1.17
3- Glycine at 250 ppm	117.5	118.0	20.0	21.0	102.0	103.5	0.77	0.80	2.10	2.15	1.14	1.15
4-Aspartic acid at 250 ppm.	117.0	117.5	19.0	20.0	101.2	102.0	0.75	0.77	2.06	2.09	1.13	1.14
5- Vitamin B at 100 ppm	116.2	117.0	18.0	19.0	100.5	101.0	0.70	0.72	2.00	2.05	1.11	1.12
6- Boric acid at 0.05%	115.6	116.3	18.0	19.0	99.2	99.8	0.68	0.70	1.98	2.00	1.09	1.10
7-Glutamic acid + vitamin B	127.0	128.2	26.0	27.0	111.5	113.0	0.87	0.88	2.38	2.40	1.25	1.26
8- Glycine + vitamin B	125.0	126.5	25.0	26.0	110.0	111.0	0.86	0.87	2.35	2.37	1.22	1.24
9-Aspartic acid + vitamin B	124.0	125.0	24.0	25.0	108.4	109.0	0.85	0.86	2.32	2.35	1.21	1.22
10-Glutamic acid + Boric acid	122.0	124.0	23.0	24.0	107.0	107.8	0.83	0.85	2.29	2.32	1.20	1.21
11- Glycine + Boric acid	121.0	122.2	22.0	23.0	105.2	106.0	0.81	0.83	2.25	2.30	1.18	1.20
12-Aspartic acid + Boric acid	118.8	119.2	21.0	22.0	104.0	105.0	0.81	0.82	2.20	2.22	1.17	1.18
13-Glutamic acid + vitamin B + Boric acid	133.0	134.2	29.0	31.0	114.8	116.0	0.92	0.93	2.44	2.48	1.30	1.31
14- Glycine + vitamin B + Boric acid	130.5	132.6	27.0	29.0	113.0	114.0	0.90	0.92	2.41	2.43	1.29	1.30
15-Aspartic acid + vitamin B + Boric acid	129.0	131.0	26.0	27.0	112.0	113.5	0.89	0.90	2.39	2.41	1.27	1.28
New L.S.D at 5%	0.9	1.1	1.0	1.0	1.1	1.2	0.02	0.03	0.06	0.07	0.04	0.05

Application of amino acids namely (glutamic acid, glycine and aspartic acid) each at 250 ppm in the same order was significantly superior than using 100 ppm vitamin B superior than 0.05% boric acid. In enhancing these growth characteristics. Combined application of Amino acids, vitamin B and boric acid were significantly favorable than using each item separately. The maximum values were recorded on the vines that received three sprays of a mixture of 250 ppm glutamic acid, 100 ppm vitamin B complex and 0.05 % boric acid. The lowest values were recorded on the untreated vines. These results were true during 2017 and 2018 seasons.

3.2. Leaf chemical composition;

Data in Tables (2, 3) clearly show that single and combined applications of the amino acids namely (glutamic acid, glycine and aspartic acid) each at 250 ppm, 100 ppm vitamin B complex and 0.05 % boron acid was significantly accompanied with enhancing chlorophylls A, B, total chlorophylls, total carotenoids, N, P, K, Mg, Zn, Fe and Mn in the leaves rather than check treatment. The promotion was significantly associated with using glutamic acid, glycine, aspartic acid, vitamin B complex and boric acid in descending order. Using amino acids significantly superior than vitamin B complex superior than boric acid in descending order in enhancing such leaf chemical composition. Combined application of some, amino acids, vitamin B and boric acid were significantly favorable than using each item separately. The maximum values of chlorophyll A (3.66, 3.70 mg/ g F.W.), chlorophyll B (1.55, 1.60 mg/ g F.W.), total chlorophylls (5.21 , 5.30 mg/ g F.W.), total carotenoids (1.44 , 1.50 mg/ g F.W.), N (2.03, 2.08 %), P (0.30 , 0.31 %) , K (1.40, 1.42 %) , Mg (0.78, 0.80%) , Zn (64.0 , 65.0 ppm), Fe (62.8 , 63.7 ppm), Mn (62.5, 63.0 ppm) were recorded in the leaves of the vines that received three sprays of a mixture of 250 ppm glutamic acid, 100 ppm vitamin B complex and 0.05 % boric acid during 2017 and 2018 seasons, respectively. The lowest values were recorded on untreated vines. These results were true during both two seasons.

Table 2: Effect of single and combined of applications of some amino acids (glutamic acid, glycine and aspartic acid), vitamin B (B_1 + B_2 + B_6 + B_{12}) and boric acid on some photosynthetic pigments and percentages of N and P in the leaves of Superior grapevine during 2017 and 2018 seasons.

Treatments	Chlorophyll A (mg/g F.W.)		Chlorophyll B (mg/g F.W.)		Total chlorophylls (mg/g F.W.)		Total Carotenoids (mg/g F.W.)		Leaf N%		Leaf P%	
	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018
1-Control	2.92	2.99	1.11	1.13	4.03	4.12	1.01	1.02	1.61	1.60	0.14	0.16
2-Glutamic acid at 250 ppm	3.17	3.19	1.29	1.31	4.46	4.50	1.19	1.21	1.77	1.78	0.22	0.23
3- Glycine at 250 ppm	3.13	3.16	1.24	1.28	4.37	4.44	1.14	1.18	1.72	1.75	0.20	0.21
4-Aspartic acid at 250 ppm.	3.10	3.14	1.21	1.24	4.31	4.38	1.11	1.13	1.68	1.69	0.18	0.19
5- Vitamin B at 100 ppm	3.05	3.11	1.18	1.20	4.23	4.33	1.08	1.09	1.66	1.67	0.17	0.18
6- Boric acid at 0.05%	2.98	3.06	1.15	1.18	4.13	4.24	1.04	1.08	1.63	1.64	0.15	0.17
7-Glutamic acid + vitamin B	3.42	3.48	1.45	1.46	4.87	4.94	1.34	1.35	1.91	1.93	0.28	0.29
8- Glycine + vitamin B	3.36	3.40	1.41	1.42	4.77	4.82	1.31	1.32	1.88	1.90	0.27	0.28
9-Aspartic acid + vitamin B	3.32	3.35	1.39	1.40	4.71	4.75	1.29	1.30	1.85	1.87	0.26	0.27
10-Glutamic acid + Boric acid	3.30	3.33	1.35	1.38	4.65	4.71	1.24	1.27	1.84	1.86	0.25	0.26
11- Glycine + Boric acid	3.24	3.27	1.33	1.35	4.57	4.62	1.23	1.24	1.83	1.84	0.24	0.25
12-Aspartic acid + Boric acid	3.20	3.22	1.30	1.32	4.50	4.54	1.20	1.22	1.80	1.81	0.23	0.24
13-Glutamic acid + vitamin B + Boric acid	3.66	3.70	1.55	1.60	5.21	5.30	1.44	1.50	2.03	2.08	0.30	0.31
14- Glycine + vitamin B + Boric acid	3.59	3.61	1.50	1.53	5.09	5.14	1.40	1.43	1.99	2.00	0.29	0.29
15-Aspartic acid + vitamin B + Boric acid	3.50	3.54	1.48	1.50	4.98	5.04	1.38	1.40	1.93	1.95	0.28	0.29
New L.S.D at 5%	0.04	0.05	0.04	0.04	0.06	0.07	0.04	0.03	0.07	0.08	0.01	0.02

Table 3: Effect of single and combined of applications of some amino acids (glutamic acid, glycine and aspartic acid), vitamin B (B_1 + B_2 + B_6 + B_{12}) and boric acid on the leaf content of K and Mg (as %) and Zn, Fe and Mn (as ppm) of Superior grapevine during 2017 and 2018 seasons.

Treatments	Leaf K (%)		Leaf Mg (%)		Leaf Zn (ppm)		Leaf Fe (ppm)		Leaf Mn (ppm)	
	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018
1-Control	1.12	1.13	0.50	0.50	50.5	50.8	49.5	49.8	51.4	51.6
2-Glutamic acid at 250 ppm	1.25	1.26	0.61	0.62	53.0	53.2	52.1	52.3	54.2	54.4
3- Glycine at 250 ppm	1.22	1.24	0.59	0.60	52.0	52.4	51.2	51.3	53.0	53.4
4-Aspartic acid at 250 ppm.	1.19	1.21	0.58	0.59	51.5	51.9	50.6	50.8	52.6	53.0
5- Vitamin B at 100 ppm	1.17	1.19	0.55	0.56	51.0	51.5	50.0	50.4	52.1	52.6
6- Boric acid at 0.05%	1.15	1.17	0.53	0.54	50.8	51.0	49.7	50.1	51.9	52.0
7-Glutamic acid + vitamin B	1.36	1.37	0.70	0.71	58.2	59.0	57.2	58.0	59.3	60.0
8- Glycine + vitamin B	1.33	1.34	0.67	0.68	57.0	58.0	56.1	57.0	58.2	59.1
9-Aspartic acid + vitamin B	1.30	1.31	0.65	0.66	55.4	56.0	54.3	55.0	56.5	57.0
10-Glutamic acid + Boric acid	1.30	1.31	0.65	0.66	55.4	55.6	54.0	54.5	56.0	57.0
11- Glycine + Boric acid	1.27	1.28	0.63	0.65	54.0	54.8	53.1	53.7	55.1	55.8
12-Aspartic acid + Boric acid	1.25	1.27	0.61	0.63	53.4	54.0	53.3	53.0	54.5	55.0
13-Glutamic acid + vitamin B + Boric acid	1.40	1.42	0.78	0.80	64.0	65.0	62.8	63.7	62.5	63.0
14- Glycine + vitamin B + Boric acid	1.39	1.41	0.75	0.77	62.0	63.0	61.0	62.0	61.0	62.1
15-Aspartic acid + vitamin B + Boric acid	1.37	1.38	0.72	0.73	60.0	60.9	59.0	59.8	60.0	60.5
New L.S.D at 5%	0.04	0.05	0.03	0.03	2.0	2.2	2.0	2.1	1.9	2.1

4. Discussion

The promoting effect of amino acids on growth and vine nutritional status of Superior grapevine might be attributed to the favourable effects of these organic substances on enhancing the biosynthesis of proteins through polymerization of amino acids ethylene, GA_3, plant pigments (Davies, 1982).

These results are in concordance with those obtained by (Abdelaal *et al.*, 2013; Gad El-Kareem and Abada , 2014; Mohamed 2014a and El- Khawaga, 2014). The promoting effect of vitamin B and boron on the growth and vine nutritional status could be attributed to their positive action on amending the vines with their requirements from different boron, vitamin B and amino acids. These results regarding the effect of antioxidants are in agreement with those obtained (El-Kady- Hanaa, 2011; Madian and Refaai, 2011, Uwakiem, 2011; Abd El-Hameed, 2012; Abdelaal, 2012; Ibrahiem- Rehab, 2012; Nikkah *et al.,* 2013 and Mohamed , 2014b).

5. Conclusion

Under the conditions of this experiment and the resembling conditions, it is advised to spray Superior grapevine three times at (growth start, just after berry setting and one month later) with a mixture of 250 ppm glutamic acid plus, 100 ppm vitamin B complex plus 0.05% boric acid.

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