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Effect of Foliar Application of Urea and Amino Acids Mixtures as Antioxidants on Growth, Yield and Characteristics of Squash

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Abstract: Two field experiments were conducted out during the seasons of 2006 and 2007 at the experimental station of Ministry of Agriculture at Baramoon Farm, Dakahlia Governorate, Egypt, to study the response of squash plant to the foliar application by some chemical materials (urea at rate of 1% an 2%, Amino-mix at rate 500ppm and 1000ppm and amino-vit plus at rate 500 and 1000ppm) as an antioxidants. Generally, the foliar application by urea as antioxidant resulted in vigor squash plant as expressed by plant length, average leaves and/or shoots number per plant as well as the fresh and dry weight of whole plant and its leaves and shoot compared with the foliar application by other Antioxidant materials. Moreover, the significant heaviest tons and best fruit properties of total and early yield were recorded with urea application. Applied antioxidants gave more vigor plant growth and yield of squash in comparison with the control treatment (No antioxidant). The foliar application by amino-vit plus material caused an enhancement effect on squash plant growth and its fruits yield, this effect was less than that obtained when urea applied, but was more than that which result when amino-mix. The statistical analysis of the obtained data reveals that, there were no great differences within used the amino-mix and/or amino vit plus regarding to their effects on growth yield and its parameters.

Key words: Squash, foliar application, urea, amino acids, antioxidants.

INTRODUCTION

Squash (*Cucurbita pepo* L.) is one of the most popular vegetable crops in Egypt. It grown as at all four seasons. The total grown area amounted by 91 thousands fed., produced about 699 thousands ton and by average 7.67 tons/fed[1]. Recently great attention has been focused on natural and safety antioxidants substances, which have the ability Quench to free radicals and thereby form a protective screen around plant cells and hence increasing plant resistance to stress, moreover, antioxidants provide adequate protection against the deleterious effect of activated oxygen species[2] on sweet pea. The same authors added that every plant like any organism needs certain components for growth, whereas, the basic components of living cells is proteins. The main source of protein in plant tissues is urea as source of nitrogen, and/or the amino acids. The requirement of nitrogen of amino acids in essential quantities is well known as a mean to increase growth and yield for all crops. Furthermore, nitrogen and/or amino acids are the fundamental ingredients for the process of protein synthesis. The important of nitrogen or amino acids came from their widely use for the biosynthesis of large variety of non protein nitrogenous materials i.e., pigments, vitamins, coenzymes, Purine and pyrimidine bases[3]. Studies have proved that amino acids can directly or indirectly influences the physiological activities in plant growth and development. Many studies reported that, the foliar application of amino acids caused an enhancement in plant growth, fruits yield and its components[4] on cucumber[5] on garlic[6] on potato and[3] on sweet pepper. Also, the previous studies indicated that, the foliar spraying by urea as a source of nitrogen for many vegetables resulted a great influence on plant growth, fruits yield as well physical and chemical fruits quality[7] on cucumber[8] on cucumber[9] on okra and[10] on pea. On the other side, the foliar application of vitamins for vegetables caused a promotion effect on the plant productivity as reported by many workers[11,12,13].

The objective of this study is to evaluate the response of squash plant to some antioxidants (urea, amino mix, amino vit plus at different concentrations) as foliar application on growth, fruits yield and yield properties of squash.

MATERIALS AND METHODS

During the two successive seasons of 2006 and 2007, two field experiments were conducted out at the Agricultural Experiment station of El-Baramoon Dakahlia Governorate, Egypt to study the effect foliar

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spraying by some Antioxidant (urea, aminomix and/or Amino-vit plus) substances on the vegetative growth, fruits yield and its some physical and chemical properties of squash plants. The foliar application of antioxidant treatments were as follows:

Urea at a rate 1%.
Urea at a rate 2%.
Amino vit plus at 1000ppm.
Amino vit plus at 500ppm.
Amino mix at 1000ppm.
Amino mix at 500ppm.
Control (water foliar spraying).

The chemical constituents of both amino mix and Amino vit plus compounds, were shown in Table (1).

B- Amino-vit-plus: The chemical composition of amino vit-plus contains the same above mentioned materials plus some other amino acids, i.e. asparagine, Orinithine, G-amino-Butric and B-amino-Butric and/or vitamins like of vit-E as well as contains some plant promoters such as auxins, cytokinins. Source: Agrico international www.agricointernational.com.

The soil of experimental filed was clay loam in texture with E.C. 2.3 mmhos.cm, and pH 7.80 available N was 141 meq/l. P 4.9 meq/l. and exchangeable K was 0.32 meq/l. The Antioxidant treatments were sprayed three times at 25 days old with 10 days interval. Treatments were arranged in complete random Block system. Each experimental plot area was 12.8 m² consisted of four ridges each was 0.8 m in width and 4 m in length. Seeds of squash (*Cucurbita pepo* L. cv. Eskandarani) were sown on 25th and 23rd of March in 2006 and 2007 season, respectively. The seeds were sown at 30 cm apart on one side of the ridge. A random sample of 3 plants were taken from every experimental plot at 50 days after seeds sowing to determine, the vegetative growth characters i.e., length of plant, number of leaves/plant, fresh and dry weight of whole plant and its shoots and leaves. Fruits were harvest at 3 days intervals in both seasons. Total yield and its components i.e., early yield as tons/fed., length, diameter of fruit as cm and average weight of fruit as g., all of them were recorded. Samples of squash fruits in mid of harvesting season were taken for chemical determination, whereas, total soluble solids (TSS %) were determined by using abbe refractometer, nitrogen, phosphorus and potassium were analysed in dry matter according to the methods of Pregl[14], Troug and Mayer[15] and Brown and Lilleland[16] respectively. Also, Fe and Zn content were determined using flame ionization atomic absorption, Spectrometer model 1100 B of Perkin Elmer as according to the method of Chapman and Pratt[17]. All the obtained data were statistically analyzed according to Gomez and Gomez[18].

RESULTS AND DISCUSSION

Plant Growth Characters: The presented data in Table (2) show clearly that, the plant growth measurements of squash as expressed by length, leaves and shoots number, fresh and dry weight of whole plant and its leaves and shoots are influenced by urea, and amino acids mixture treatments. Whereas, the vigor squash plant growth was obtained when urea used as foliar application if compared by that plants which received Amino mix and/or amino vit plus as well as that plants no treated (control). Moreover, within the above mentioned treatments, the obtained data indicate that, using higher level resulted in the better growth than using the lower level. Generally, it could be concluded that, using urea had the best plant growth followed in descending order by that plants sprayed by amino-vit plus, then by amino mix, but the lowest values were correlated with the control plants (water spraying). The previous data were true in both experimental seasons. The statistical analysis of the obtained data reveals that the differences within different foliar spraying treatments were enough to reach the 5% level of significance except fresh and dry weight of leaves in two seasons as well as dry weight of whole squash plant and its shoots only in 2nd season.

Fruits Yield and its Physical Properties: Total and early fruits yield as tons/fed., as well as the some physical quality of squash fruits as affected by the foliar spraying by urea, and/or some compounds which contains amino acids, as individual or contains amino acids plus vitamins are presented in Table (3). It clear that, the heaviest total and early fruits are associated with that plants which sprayed by urea, followed in descending order by that plants sprayed with amino- vit plus and lastly that plants which received amino mix. Moreover, it could be noticed that, all treated plants resulted the total and early yield over than the control plants (water sprayed). These findings were true in both experimental seasons. Also, the obtained data reveals, that, using the higher level of urea, or amino mex and/or amino- vit plus gained the higher fruit yield if compared with the foliar spraying by the lower level. Finally, it could be concluded that, the heaviest total and early squash fruits were harvested from that plants which sprayed with urea level of 2 %, on the contrary the lowest fruits yield was recorded with that plants no received any nutritional materials (control plants). These were completely similar in the experiments of 2006 and 2007. The statistical analysis of the obtained data indicated that the differences within different treatments were great enough to reach the 5 % level, with except of early yield in 1st season. Concerning the effect of amino acids on the fruits

Table 1: The chemical composition of the amino-mix and amino-vit plus.

A- Amino-mix.

Nutritional elements (g/100 cm^3)		Amino acids				Vitamins (mg/100 cm^3)	
Element	value	Amino acid	value	Amino acid	value	Vitamin	value
Zn	2	Apartic acid	249	Methionine	180	Vitamin B1	0.8
Fe	1.5	Thiamine	45	Isolucine	52	Vitamin B2	2.4
Mn	0.5	Serine	56	Therionine	38	Vitamin B6	1.2
Mg	0.004	Glutamic acid	55	Phenylalanine	22	Vitamin B12	0.82
Cu	0.004	Glysine	50	Histidine	12	Folic acid	4.2
Ca	0.025	Alanine	100	Lucine	40	Pantothinic acid	0.52
Br	0.056	Proline	38	Arginine	20	Niacine	0.14
S	0.01	Valine	68	Tryptophan	20	Ascorbic acid	1.0
Co	0.03	Cysteine	44				

Table 2: Effect of urea and amino acids mixtures as antioxidants on the vegetative growth of squash plant during two seasons of 2006 and 2007.

Antioxidant treatments		Plant length (cm)	No/plant		Fresh weight (g/plant)			Dry weight (g/plant)		
			leaves	Shoots	leaves	Shoots	Total	leaves	Shoots	Total
					1st season					
Control		28.10	11.70	1.43	137.8	47.95	185.7	44.00	15.68	59.68
Urea (%)	1	46.03	21.27	2.33	266.2	70.35	336.5	76.61	24.33	100.9
	2	56.27	23.47	2.50	315.3	74.37	389.7	97.00	26.42	123.4
Aminovit Plus (ppm)	1000	45.53	19.03	2.24	238.8	73.81	312.6	74.25	25.23	99.48
	500	34.97	15.40	1.51	175.3	63.00	238.3	52.57	18.43	71.00
Aminomix (ppm)	1000	34.23	12.47	1.45	162.6	48.93	211.5	49.82	16.45	66.27
	500	31.63	11.23	1.34	153.8	45.63	199.4	47.69	15.45	63.3
L.S.D. at 5%		5.07	1.74	0.22	35.69	6.99	41.99	9.49	3.10	12.59
					2nd season					
Control		26.78	12.63	1.64	151.8	48.80	199.8	36.67	10.63	47.2
Urea (%)	1	39.43	16.03	2.03	198.8	60.87	259.7	48.00	19.60	67.6
	2	42.73	18.87	2.14	232.2	77.20	309.4	57.37	24.20	81.5
Aminovit Plus (ppm)	1000	38.30	16.20	2.00	195.5	56.6	252.1	48.70	18.90	67.6
	500	36.00	15.50	1.66	186.3	50.6	232.7	47.47	16.37	63.7
Aminomix (ppm)	1000	34.93	15.13	1.53	182.1	48.17	230.2	45.17	15.03	60.2
	500	34.70	14.13	1.43	168.6	45.57	214.1	42.93	14.60	57.53
L.S.D. at 5%		0.87	0.65	0.08	N.S.	6.91	6.19	N.S.	N.S.	N.S.

yield[5] on garlic[6] on potato[3] on sweet pepper and reported that, the foliar spray of amino acid mixture resulted in heaviest fruits yield as well as it best physical properties. Regarding the physical properties of squash fruits as affected by the different foliar application of some elemental nutritional, the recorded data show that their responses followed absolutely the same trend like that which previously mentioned.

Chemical Properties of Fruits: Table (4) shows that, the chemical properties (N, P, K, Fe, Zn, TSS and Vitamin C) of squash fruits as influenced by the foliar spraying of urea and/or amino acids compounds during the seasons of 2006 and 2007. Whereas, the regurgitated data indicate that, that squash plants which received urea gained the best quality of squash fruit, i.e. the highest values of nutritional elements (N, P, K, Fe, Zn and Vit. C) as well as the highest TSS value, followed in descending order by that plants which sprayed with amino- vit plus, then that of amino mix. Within different foliar application supctances, using the higher concentration resulted in the better fruit quality if compared with the lower one. Generally, it could be summ arized that, the highest nutritional values were

Table 3: Effect of urea and amino acids mixtures as antioxidants on the fruit yield of squash during the two seasons of 2006 and 2007.

Antioxidant treatments		Total yield (ton/Fed.)	Early yield (ton /Fed.)	Fresh weight (g)/plant		
				Length (cm)	Diameter (cm)	Weight (g)
			1st season			
Control		3.90	0.57	9.40	2.50	63.83
Urea (%)	1	5.30	0.74	14.77	3.57	142.17
	2	6.17	0.93	15.00	3.73	183.60
Aminovit Plus (ppm)	1000	4.88	0.65	15.83	3.37	128.90
	500	4.73	0.63	13.83	3.10	128.03
Aminomix (ppm)	1000	4.57	0.65	11.60	3.07	103.67
	500	4.47	0.61	11.00	2.97	90.33
L.S.D. at 5%		0.34	N.S.	3.20	0.60	59.57
			2nd season			
Control		3.43	0.58	8.97	2.77	76.33
Urea (%)	1	4.23	0.75	10.60	3.23	153.33
	2	4.40	0.82	10.97	3.50	161.33
Aminovit Plus (ppm)	1000	4.23	0.69	10.23	3.17	157.33
	500	3.6	0.66	9.70	3.10	157.33
Aminomix (ppm)	1000	3.53	0.63	9.57	3.03	152.00
	500	3.43	0.42	8.97	2.80	147.33
L.S.D. at 5%		0.32	0.21	0.44	0.17	5.24

Table 4: Effect of urea and amino acids mixtures as antioxidants on chemical squash fruit quality during two seasons of 2006 and 2007.

Antioxidant treatments		N (%)	P (%)	K (%)	Fe (ppm)	Zn (ppm)	TSS (%)	Vit. C
					1st season			
Control		0.46	O.99	1.05	100	12	3.00	11.68
Urea (%)	1	0.52	1.08	1.31	112	13	3.93	12.93
	2	0.55	1.13	1.39	117	13	4.00	13.73
Aminovit Plus (ppm)	1000	0.51	1.05	1.33	113	13	3.87	13.13
	500	0.50	1.01	1.02	109	12	3.33	12.77
Aminomix (ppm)	1000	0.48	1.00	1.00	107	11	3.27	12.40
	500	0.48	0.96	0.96	104	11	3.20	12.03
L.S.D. at 5%		0.08	N.S	N.S	1.19	N.S	0.25	0.76
					2nd season			
Control		0.40	0.97	1.08	103	14	2.93	9.90
Urea (%)	1	0.60	1.13	1.22	116	15	3.53	11.77
	2	0.66	1.22	1.42	118	16	4.50	12.10
Aminovit Plus (ppm)	1000	0.56	1.07	1.32	115	13	3.77	10.87
	500	0.53	1.03	1.20	114	13	3.50	10.47
Aminomix (ppm)	1000	0.49	1.00	1.17	108	12	3.47	10.47
	500	0.48	0.97	1.08	106	12	5.60	10.20
L.S.D. at 5%		0.50	N.S	N.S	3.92	N.S	N.S	0.28

associated with that plants which treated with urea at rate of 2%, but, the poorest values were resulted with control plants (no treatments). Moreover, the statistically analysis of the obtained data reveals that the differences within various treatments were great enough to reach the 5 % level of significant with except of values of P, K and Zn. These findings were completely similar in both seasons of 2006 and 2007.

Discussion: The increments in squash plant growth measurements under the foliar application of urea might be attributed to the multiple advantages of foliar spraying methods such as rapid and efficient response to the plant needs, and independence of soil condition. It is also due to the foliar urea fertilization during crop growth can improve the mineral status of plants and increase the vigor of plant[19]. The main reason for that vigoristy of squash due the urea foliar application

compared to the other foliar treatments might be due to the urea contain the most major nutritional element i.e., N which is more needed if compared with the requirements of plant to amino acids and/or vitamins. Urea application as a source of nitrogen fertilizer had a great role in enhancing the metabolism processing due to the importance of nitrogen in building carbohydrates, protein and fats in the plant tissues. Consequently urea as foliar application gained a promotion in vegetative plant growth i.e., plant length, number of shoots and/or leaves per plant, fresh and dry weight of whole squash plant and its different organs. The obtained results are in good agreement with the results of Shaheen[20], Rafque and Muhsi[21], Yildirim *et al*.[22] and Shaheen *et al*.[10].

From other point, the recorded results in Table (2) cleared that, that squash plants which sprayed with amino vit plus resulted the vigor squash plant, i.e. less than that plants received urea, but more that which supplied the amino mix. It could be concluded that, from other point the favourable effect of amino vit-plus might be attributed to that mixture contains more amino acids, vitamin as well as some growth regulators (Table 1). The previous studies have proved that amino acids can directly or indirectly influence the physiological activities of the plant. Amino acids help to increase chlorophyll in the plant[2,4,5]. The response of vegetable plants to the application of amino acids were studies and their results are in good agreement with the obtained ones.

The increment in total and early squash fruits as well as its physical properties might be attributed to that urea resulted a promotion effect on plant growth measurements i.e., plant length, number of leaves and/or shoots as well as whole fresh and dry weight of plant and its different organs. Consequently, these might be reflected on the total and early fruits yield and/or its components (average fruit weight, length and diameter). The results which recorded by many workers are in good accordance with the that obtained here[6,7,8,9,22].

It could be concluded that, foliar application of urea resulted in the highest fruit yield and the best physical and chemical quality, followed by plants supplied by amino vit plus. Previous reports[6,9,21,22] showed that, the urea treatment had an enhancement effect for increasing the elemental nutrition in plant tissues. The foliar application of amino acids caused a promotion effect on increasing the values of N, P, K, and other micro-elements[2,4,5,23].

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