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EFFECT OF FOLIAR APPLICATION WITH ASCORBIC ACID ON VEGETATIVE GROWTH AND SOME BIOCHEMICAL CONSTITUENTS OF TOMATO PLANTS

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ABSTRACT

The present investigation was conducted to investigate the possible changes in the growth, photosynthetic pigments and metabolic activities associated with foliar application of ascorbic acid at the concentrations of 0, 200, 400 and 600 mg/l when applied to two cultivars of tomato plants after 4 weeks from transplanting.

Plant height, number of leaves and number of flower per plant were stimulated with lower concentrations of ascorbic acid in both cultivars of tomato plants. The data showed that increasing ascorbic acid concentrations up to 600 mg/l had no significant effect on plant height on both cultivars of tomato plants while dry weight of leaves, stems and roots per plant were significantly decreased. Photosynthetic pigments (chl.a, chl.b and carotenoids) were enhanced as a result of foliar application with ascorbic acid. Moreover, the most effective treatments for enhancing chlorophyll a, b , a + b and carotenoids in leaf tissues was observed at higher concentration of ascorbic acid (600 mg/l) in Ace cultivar and at lower concentrations of ascorbic acid (200 and 400 mg/l) in Castlerock cultivar.

Ascorbic acid treatments tended to decrease carbohydrate fractions in different organs (leaves, stems and roots) of tomato cultivars. Whereas, nitrogen fractions was improved at most treatments of ascorbic acid. The marked increase in the level of photosynthetic pigment contents was accompanied by lower accumulation in dry matter and carbohydrate fractions in different organs of tomato plants, could be due to the effect of ascorbic acid on the utilization and translocation of assimilates into different organs of tomato plants.

Keywords : Tomato, Ascorbic acid, Vegetative growth, Carbohydrates and nitrogen metabolism.

INTRODUCTION

Ascorbic acid is an important antioxidant defense in plant cells (Foyer and Halliwell, 1976). It protects plant cells against damage by oxygen free radicals, which may be produced as a result of a disturbance of electron transfer processes or via autooxidation. It also stimulated respiration activities, cell division and many enzymes activities Reda *et al.*, 1977 (Innocenti *et al.*, 1990; Rautenkranz *et al.*, 1994).

Recently, a great attention has been focused on the possibility of using natural and safety substance i.e. vitamins, amino acids and yeasts in order to improve plant growth, flowering, fruit setting and resistance against unfavourable environmental conditions and pathogens. However, lack of information about the physiological roles of such factors is still exists.

Foliar application of ascorbic acid to different plant species was found to has stimulative effect on the growth, dry matter accumulation and yield components e.g. Agwah, 1990 on lettuce, Arisha, 2000 on potato, Abdel-Halim, 1995, EL- Ghamriny *et al.*, 1999 and Midan, 1986 on tomato and Talaat, 1998 on Lavender.

Ali, (2001) reported the changes occurred on the anatomical structure of the leaves and stems tissues due to foliar application of ascorbic acid on tomato plants where xylem vessels differentiation and development appeared smaller in size and narrow in shape as affected by ascorbic acid on both fascicular and interfascicular cambial activity. Therefore, it is expected that, the effect will be reflected on the translocation and distribution of assimilates.

The aim of the present investigation was to clarify the effect of ascorbic acid on vegetative growth, photosynthetic pigments, carbohydrate and nitrogen metabolites in two cultivars of tomato plants at flowering stage (8-weeks old from transplanting).

MATERIALS AND METHODS

This study was carried out during two successive growth seasons of 1996/1997 and 1997/1998 at the greenhouse of the National Research Center, Giza, Egypt. Seeds of tomato plants (*Lycopersicon esculeutum* Mill.) cv. Ace and cv. Castlerock were obtained from the Horticulture Department, National Research Centre, Giza, Egypt.

The seeds of tomato plants were sown in beds at 15th of November in the two successive seasons. After 5 – weeks, uniform seedlings were transplanted to earthen pots (30 cm diameter), each filled with about 12 kg clay loam soil mixed with 5 g of calcium superphosphate (15.5 % P_2 O_5). Two weeks later the seedlings were thinned to two uniform plants in each pot then after 4 – weeks from transplanting (9 – weeks old) the plants were foliarly sprayed with ascorbic acid (vitamin C) . Ascorbic acid concentrations (0, 200, 400 and 600 mg/l) were freshly prepared, in distilled water. The volume of ascorbic acid solution was maintained just to cover plant foliage completely to runoff by using handheld sprayer, while the control plants were foliarly sprayed with distilled water.

The plants were irrigated as needed and each pot was fertilized twice, with 3g ammonium nitrate (33.5 % N) and 2 g of potassium sulphate (48 % K_2O) after 3 and 7-weeks from transplanting.

The experiment included eight treatments, which were the combinations of two cultivars, i.e., Ace and Castlerock and four levels of ascorbic acid (200, 400 and 600 mg/l). The treatments were arranged in complete randomized block design with three replicates and each replicate was represented by three pots.

Samples were collected after 4 – weeks from treatments at flowering stage (8-weeks old from transplanting) to study the following morphological growth characters, i.e. plant height (cm), number of leaves and flowers per plant and dry weights of leaves, stems and roots (g) per plant.

The contents of photosynthetic pigments (chl.a, chl.b and carotenoids) were determined in freshly collected leaves using the methods described by Metzner *et al.*, (1965).

The dried tissues (leaves, stem and roots) at 70 °C were estimated for the determination of carbohydrates and nitrogenous constituents. Total sugars and total soluble sugars were carried out according to Dubois *et al.*, (1956), and by subtracting the total soluble sugar from total sugar gave of non-soluble sugar. Total-N and total soluble-N were determined by the conventional micro-kjeldhah method (Naguib, 1969) subtracting the total soluble- N from the total- N gave of protein- N.

All data were statistically analyzed according to Snedecor and Cochran (1982). The combined analysis of the data of the two growing seasons were done and the treatments means were compared by LSD test at the 5% level of probability.

RESULTS AND DISCUSSION

Effect of ascorbic acid on the morphological growth parameters of tomato plants:

Vegetative growth:-

The data presented in Table (1) showed that, there was no significant differences between the two cultivars of tomato plants in plant height and number of leaves / plant at flowering stage (8- weeks after transplanting. The interaction between tomato cultivars and ascorbic acid concentrations was only significant in case of plant height. The data also indicated that, foliar application of ascorbic acid at the concentrations of 200 and 400 mg/l to Castlerock cultivar and with 200 mg/l to Ace cultivar stimulated growth parameters plant height and number of leaves of both cultivars as compared to untreated plants. Such stimulatory effect was more pronounced at 200 mg/l than at 400 mg/l of ascorbic acid.

Table (1): Effect of ascorbic acid on vegetative growth characters and number of flowers of two cultivars of tomato plants. 4 weeks after treatments and 13 weeks old(average of 1996/1997 and 1997/1998 growth seasons).

Cultivars	Ascorbic acid Conc. (mg/l)	Plant height (cm)	No. of leaves /plant	dry weight (g)/plant of vegitative organs			No. of flowers /plant
				Leaves	Stems	Roots	
Ace	Control	40.00	9.00	1.67	2.57	0.90	9.67
	200	49.67	11.67	1.53	2.10	0.40	15.67
	400	41.00	9.00	1.40	1.83	0.50	21.00
	600	40.67	8.00	1.47	1.27	0.40	14.00
Mean		42.84	9.42	1.52	1.94	0.55	15.09
Castlerock	Control	36.67	9.67	2.40	1.67	0.70	13.33
	200	58.67	13.00	2.47	1.70	0.70	15.00
	400	52.67	11.67	1.67	1.77	0.63	15.67
	600	35.67	8.00	1.30	1.57	0.43	11.33
Mean		45.92	10.56	1.96	1.68	0.62	13.83
Means of ascorbic acid concentrations	Control	38.34	9.34	2.03	2.12	0.80	11.50
	200	54.17	12.34	2.00	1.90	0.55	15.34
	400	46.84	10.34	1.54	1.80	0.57	18.34
	600	38.17	8.00	1.39	1.42	0.42	12.67
L. S. D. at 5 % level for							
Cultivar (C)		N.S	N.S	0.34	0.25	N.S	N.S
Ascorbic acid conc. (V)		5.18	2.29	0.48	0.36	0.25	3.36
Interaction (C x V)		7.32	N.S	N.S	0.50	N.S	N.S

The enhancement of tomato growth in terms of plant height and number of leaves / plant were observed in the present investigation as a result of foliar application with relatively low levels of ascorbic acid especially 200 mg/l. However, the opposite was true with increasing level of ascorbic acid to 600 mg / l. These results are in accordance with those obtained by Abdel- Halim (1995) and El- Ghamriny *et al.*, (1999) on tomato plants and Arisha (2000) on potato plants. They reported a beneficial effect of low levels of ascorbic acid on growth parameters.

These results could be explained on the basis that, ascorbic acid might be regulate cell wall expansion and cell elongation through it's action in cell vacuolarization as reported by Arrigoni, (1994); Gonzalez – Reyes *et al.*, (1994); Cordoba *et al.*, (1996) and Navas and Gomez – Diaz (1995).

Dry weight of vegetative organs:

The results in Table (1) showed that, the dry weight of leaves and roots/plant on both cultivars of tomato plants was not significantly responded to ascorbic acid treatments. However, stem dry weight/plant was negatively responded to foliar application with ascorbic acid concentrations. The reduction on stem dry matter accumulation was observed with increasing ascorbic acid concentration up to 600 mg/l on Ace cultivar. However there were no significant effect due to foliar spray with 200 and 400 mg/l of ascorbic acid on stem dry weight of Castlerock cultivar.

The present results showed no simulative effect on dry matter accumulation in the different organs (leaves, stems and roots) of the two cultivars of tomato plants, due to foliar application with ascorbic acid concentrations. Dry matter accumulation in the different organs of tomato plants appeared to depend mainly on the concentrations used of ascorbic acid. These results were consistent with those obtained by Abdel-Halim (1995) who found that, foliar application with ascorbic acid at the concentrations of 100 and 200 ppm to tomato plants promoted growth criteria and shoot dry weight per plant, the most effective treatment was 100 ppm, then increasing ascorbic acid to 200 ppm led to decrease in growth parameters and dry matter accumulation. Furthermore, Talaat (1998) showed that, foliar spray of ascorbic acid at the concentrations of 100 and 200 mg/l to lavender plants recorded highest value in fresh and dry weights of herb at treatment with 200 mg/l; Also, El-Ghamriny *et al.*, (1999) concluded that, ascorbic acid at treatment with 100 ppm was most effective in increasing dry matter accumulation in different organs (leaves, stems and roots) of tomato plants, while insignificant response was observed at treatment with 200 mg/l. Arisha (2000) indicated that, increasing ascorbic acid concentrations to 200 ppm increased shoots, roots, tubers and total plant dry weight of potato plants. Furthermore increasing ascorbic acid concentration up to 400 ppm did not affect dry matter accumulation.

Number of flowers / plant

The data illustrated in Table (1) showed that, there was no significant effect on the number of flowers/plant for both cultivars of tomato plants. However, the interaction between ascorbic acid treatments and tomato cultivars reflected insignificant favourable effect on the number of flowers / plant with all the concentrations used of ascorbic acid on both cultivars of tomato plants, except treatment with the higher concentration used of ascorbic acid (600 mg/l) in Castlerock cultivar which did not show any effect in this respect.

Effect of ascorbic acid on photosynthetic pigment contents.

Data in Table (2) revealed significant differences between the two cultivars of tomato plant regarding the photosynthetic pigment contents. Relatively higher accumulation of photosynthetic pigment contents was observed in leaves of Ace cultivar in comparison with Castlerock cultivar.

Table (2): Effect of ascorbic acid on photosynthetic pigment contents (mg/g fresh weight) in leaves of two cultivars of tomato plants. 4 weeks after treatments and 13 weeks old (average of 1996/1997 and 1997/1998 growth seasons).

Cultivars	Ascorbic acid concentrations (mg/l)	Chl.a	Chl.b	Chl. (a + b)	Carote-oids	Total pigments
Ace	Control	1.41	0.57	1.98	0.33	2.31
	200	1.58	0.53	2.10	0.78	2.88
	400	1.79	0.49	2.35	0.90	3.25
	600	1.93	0.64	2.57	0.95	3.52
Mean		1.68	0.56	2.25	0.74	2.99
Castlerock	Control	1.17	0.45	1.62	0.32	1.92
	200	1.54	0.62	2.16	0.78	2.94
	400	1.60	0.57	2.17	0.75	2.93
	600	1.24	0.43	1.67	0.55	2.22
Mean		1.39	0.52	1.19	0.6	2.51
Means of ascorbic acid concentrations	Control	1.29	0.51	1.80	0.33	2.13
	200	1.56	0.57	2.13	0.78	2.91
	400	1.70	0.53	2.26	0.83	3.09
	600	1.59	0.54	2.12	0.75	2.87
L. S. D. at 5 % level for						
Cultivar (C)		0.07	0.02	0.09	0.03	0.08
Ascorbic acid conc. (V)		0.10	0.03	0.12	0.04	0.12
Interaction (C x V)		0.15	0.05	0.17	0.06	0.24

Foliar application of ascorbic acid at the concentrations of 200, 400 and 600 mg/l. to Ace cultivar resulted in significant increases in Chl.a, Chl. a+b and carotenoids. Such stimulatory effect was observed among Chl.a, Chl.b, Chl.a+b and carotenoids in leaves of Castlerock cultivar due to increasing ascorbic acid concentrations up to 400 mg/l. The data also indicated that, ascorbic acid concentrations seemed to affect Chl.b, content following a direction opposite on the two cultivars of tomato plants. Furthermore, significant increases were observed in carotenoids contents in leaves of the both cultivars of tomato plants at all the concentrations of ascorbic acid. Such increases in carotenoid content of tomato leaves might have a role in protecting chlorophyll against degradation by photooxidation processes. It could be concluded that, foliar application of ascorbic acid in any of the used concentrations reflected significant favourable effects on chl.a, chl. a+b, carotenoids and total pigment contents in the leaves of tomato plants while, chl.b content was not pronouncedly affected as observed at treatments with 400 and 600 mg/l of ascorbic acid or significantly increased as recorded with 200 mg/l of ascorbic acid. The promotive effect of ascorbic acid on photosynthetic pigment contents of tomato leaves could be due to the role of ascorbic acid as antioxidant, which directly involved in the regulation and protection of photosynthetic processes (Farago and Brunold, 1994). This may explained by the results obtained by Foyer *et al.*, (1990) who pointed out that, antioxidant prevented enzyme inactivation, the generation of more dangerous radicals and allowed flexibility in the production of photosynthetic assimilatory power. Moreover, electron transfer to O_2 prevented over reduction of electron transport chain, which reduced the risk of harmful back reactions within the photosystem.

Effect of ascorbic acid on the carbohydrate contents of tomato plants

It is evident from data presented in Table (3) that, the two cultivars of tomato plants showed significant differences between each other in total sugar, total soluble sugar and non - soluble sugar contents of their corresponding leaves, stems and roots. Ace cultivar attained significantly higher accumulation of carbohydrate content in leaves, stems and roots than Castlerock cultivar, except few treatment.

Regarding the interaction effect between ascorbic acid concentrations and the two cultivars of tomato plants, the data showed that, ascorbic acid at all the concentrations used caused significant decrease in total sugar contents of leaf, stem and root in both cultivars of tomato plants as compared with their corresponding control values. Only treatment with 200 mg/l of ascorbic acid lead to significant increase in leaf total sugar contents of Ace cultivar. Such accumulation in leaf total sugar content was accompanied with similar trend of accumulation in non – soluble sugar contents of leaf and root whereas, it failed to reach the 5 % level of significance in the case of stems.

Total soluble sugar content was significantly decreased in leaves and stems of both cultivars of tomato plants. However, the decrease in stems total soluble sugar of Ace cultivar was not significantly in case of treatments with ascorbic acid at the concentrations of 200 and 400 mg/l. Total soluble sugar contents in roots showed a pronounced effect in the two cultivars of tomato plants, as it was significantly decreased with increasing ascorbic acid concentrations in Ace cultivar and the reverse was obtained in Castlerock cultivar.

The results in Table (3) also indicated that, the values of non-soluble sugar determined in the leaves, stems (treated with 200 and 600 mg/l of ascorbic acid) and roots treated with 200 and 400 mg/l of ascorbic acid for Ace cultivar were higher than those of untreated control. This might indicate that, the accumulation of non – soluble sugars was more rapid than their utilization in the growth, and this, in turn, could inhibited the catabolism of carbohydrate / or their utilization in growth. On the other hand, the values of non soluble sugar determined in leaves stems and roots of Castlerock cultivar were significantly decreased in response to ascorbic acid treatments. These results could be attributed by the anatomical changes reported by Ali (2001). From above mentioned results carbohydrate contents in the leaf, stem and root were in general decreased by ascorbic acid treatments. The decrease in carbohydrate contents could be explained on the fact that, the used concentrations of ascorbic acid impaired the utilization of carbohydrates, through its effect on conductive elements in leaves and stems tissues , so that a reduction in the translocation of assimilates towards different organs of tomato plants (leaves , stems and roots) could be occurred .

Table 3 : Effect of ascorbic acid on carbohydrate contents (mg/g dry weight) in two cultivars of tomato plants, 4 weeks after treatments and 13 weeks old (Average of 1996 and 1997 growth seasons).

Cultivars	Ascorbic acid concentration (mg/l)	Total sugars			Total soluble sugars			Non - soluble sugars		
		Leaves	Stems	Roots	Leaves	Stems	Roots	Leaves	Stems	Roots
Ace	Control	139.27	172.24	163.17	74.50	58.60	67.63	59.77	113.64	95.53
	200	175.10	162.83	152.60	61.60	56.13	35.30	113.50	106.70	117.30
	400	101.97	140.30	133.63	39.00	53.27	16.33	62.97	87.03	117.30
	600	115.15	126.50	106.17	15.02	9.60	11.50	100.13	116.90	94.67
Mean		132.87	150.47	138.89	48.78	44.40	32.69	84.09	106.07	106.20
Castlerock	Control	143.04	204.37	152.73	68.37	74.50	28.13	74.67	129.87	124.60
	200	78.57	95.07	88.40	42.30	42.83	35.90	36.27	52.27	54.83
	400	66.70	105.50	95.60	47.90	25.83	39.70	18.80	79.67	55.90
	600	84.37	114.94	122.40	55.70	10.50	63.00	28.67	104.44	59.40
Mean		93.17	129.97	114.28	53.25	38.42	41.68	39.60	91.56	73.68
Means of ascorbic acid concentration	Control	141.15	188.31	157.95	73.93	66.55	47.88	67.22	121.76	110.07
	200	126.83	128.95	120.50	51.95	49.48	35.60	74.88	79.48	86.07
	400	84.33	122.90	114.62	43.45	39.55	28.02	40.88	83.35	86.60
	600	99.76	120.72	114.28	35.36	10.50	37.25	64.40	110.67	77.03
L. S. D. at 5 % level for										
Cultivar (C)		5.28	2.80	2.89	3.25	2.64	2.31	6.54	3.83	3.38
Ascorbic acid conc. (V)		7.46	3.95	4.09	4.60	3.74	3.27	9.25	5.41	4.78
Interaction (C x V)		10.56	5.59	5.78	6.51	5.29	4.63	13.07	7.65	6.76

Effect of ascorbic acid on the nitrogenous constituents of tomato plants:

The results in Table (4) showed that, total-N content in the leaves and stems of tomato plants cv. Ace foliarly sprayed with ascorbic acid at the concentrations of 200 and 400 mg/l was less than the corresponding control value. However, the same concentrations of ascorbic acid resulted in higher accumulation in root total-N content. This pattern of results was run parallel with similar changes in total soluble-N and protein-N contents of leaves, stems and roots. On the contrary, higher concentration of ascorbic acid (600 mg / l) favoured accumulation of total-N in leaves, decreased it in roots, whereas total-N content in stem was almost unchanged. This promotion or reduction in total-N content of leaves and roots was accompanied mainly with similar change in protein – N content rather than soluble-N content of both plant organs.

Table 4 : Effect of ascorbic acid on nitrogenous constituents (mg/g dry weight) in two cultivars of tomato plants, 4 weeks after treatments and 13 weeks old (Average of 1996/1997 growth seasons).

Cultivars	Ascorbic acid concentration	Total – N			Protein - N		
		Leaves	Stems	Roots	Leaves	Stems	Roots
Ace	Control	73.87	65.63	42.57	46.50	35.40	26.77
	200	66.20	60.00	49.93	43.03	34.73	32.97
	400	71.83	48.87	56.17	50.67	20.10	35.97
	600	79.40	67.17	38.13	54.70	19.73	13.13
Mean		72.83	60.42	46.70	48.72	27.49	27.21
Castlerock	Control	45.83	27.90	27.67	23.73	11.37	16.13
	200	47.97	53.77	48.13	35.33	27.97	41.43
	400	81.00	54.80	50.80	51.07	14.57	42.07
	600	74.23	63.33	53.80	43.40	24.40	46.63
Mean		62.26	49.95	45.10	38.38	19.57	36.57
Means of ascorbic acid concentration	Control	59.85	46.77	35.12	35.12	23.38	21.45
	200	57.08	56.88	49.03	39.18	31.35	37.20
	400	76.42	51.83	53.48	50.87	17.33	39.02
	600	76.82	65.25	45.97	49.05	22.07	29.88
L. S. D. at 5 % level for							
Cultivar (C)		2.94	2.00	N.S	3.61	3.92	2.93
Ascorbic acid conc. (V)		4.16	2.82	4.04	5.11	5.55	4.15
Interaction (C x V)		5.88	4.00	5.75	7.23	7.85	5.87

Furthermore, ascorbic acid at the concentrations of 200 and 400 mg/l was found to reduce the accumulation of total-N content in shoot tissues and increased their accumulation in roots. However, the higher concentration of ascorbic acid (600 mg/l) enhanced accumulation of total-N content in shoots (leaves and stems) and decreased their accumulation in roots. This may be due to the fact that, ascorbic acid as a growth regulating factor could affect acropetal and basipetal transport of nitrogenous metabolites from root to shoot and vise versa. In this regard, Reda *et al.*, (1977) reported the involvement of ascorbic acid in many physiological and biochemical processed such as synthesis of enzyme, nucleic acid and protein as well as it also acted as co – enzyme Also, Gonzalez-Reyes *et al.*, (1994) concluded that ascorbate free radicle, caused hyperpolarization of plasma membrane , and this energization could then facilitate transport processes across plasma membrane.

The result in Table (4) showed a significant increase in the total nitrogen content in the leaves, stems and roots of tomato plants cv. Castlerock in response to foliar application with ascorbic acid concentrations. The magnitude of increase was more pronounced with higher concentrations (400 and 600 mg/l) than with lower concentration (200 mg/l) of ascorbic acid. However, total nitrogen content in leaf was insignificantly responded to treatment with 200 mg/l of ascorbic acid, it could be related to a sharp decrease in the soluble nitrogen content rather than protein nitrogen content in the leaves. the promotion of the total nitrogen content in the leaves, stems and roots of tomato plants cv. Castlerock as a result of foliar application with ascorbic acid concentrations varied relatively in shoot tissues (leaves and stems) rather than that observed in the root tissues. The increase in shoots total nitrogen content was related to significant increase in protein-N and soluble-N contents, However, the increase in root total-N content was mainly due to the increase occurred in root protein-N , despite the total soluble-N which decreased in root tissues .

Previous studies with different concentrations of ascorbic acid and plant species have also shown an increase in the accumulation of total – N content in different plant organs. In this connection, Talaat, (1998) reported that, ascorbic acid application with 200 mg/l increased total nitrogen in Lavandula officinalis herbage. El-Ghamriny *et al.* (1999) also mentioned that, the response of tomato leaves, stems and roots to accumulate total-N content was greater with ascorbic acid at the concentration of 100 ppm than that observed with ascorbic acid at the concentration of 200 ppm. With regard to latter view, Arisha, (2000) found that, foliar application with ascorbic acid at the concentrations of 100, 200 and 400 ppm did not significantly affect total-N accumulation in shoots of two cultivars of potato plants. However, the maximum increase in the accumulation of total-N in shoots of potato plants was observed at treatment with ascorbic acid at the concentration of 100 ppm on both cultivars of potato plants.

The present investigation revealed that, plant height, number of leaves/plant as well as number of flowers/plant were, in general, stimulated by lower concentrations of ascorbic acid up to 200 mg/l. Photosynthetic pigment contents in the leaves were also stimulated by foliar application of ascorbic acid without any favourable reflection on dry matter accumulation in certain organs and carbohydrate fractions in different organs (leaves, stems and roots) of tomato plants. Such effects appeared to be due to the movement of photosynthetic assimilate from leaves probably because of lowering activation, translocation and remobilization. According to the forcited results, it could be concluded that, higher rates of ascorbic acid are not advisable for stimulation of vegetative growth or physiological processes in tomato plants.

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تأثير الرش بحمض الأسكوربيك على النمو الخضرى وبعض المكونات البيوكيمائية فى نباتات الطماطم

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أجري هذا البحث بصوبة المركز القومى للبحوث – الدقى – جيزة – مصر خلال موسمى ١٩٩٦/ ١٩٩٧ ، ١٩٩٧ / ١٩٩٨ وذلك بهدف دراسة تأثير الرش بفيتامين جـ (حامض الأسكوربيك) بالتركيزات صفر ، ٢٠٠ ، ٤٠٠ ، ٦٠٠ ملجم/لتر على النمو ، الأزهار ، صبغات البناء الضوئى والمحتوى الكربوهيدارتى والنيتروجينى فى مختلف أجزاء (أوراق ، سيقان ، جذور) صنفى الطماطم أيس وكاسل روك بعد ٤ أسابيع من المعاملة وعند عمر ١٣ أسبوع من الزراعة طور الإزهار (٨أسابيع من الشتل) وكانت أهم النتائج المتحصل عليها فيما يلى :-

أدى استخدام التركيزات المنخفضة من حامض الأسكوربيك إلى زيادة ملحوظة فى طول النبات وعدد الأوراق لكل نبات فى كلٍ من صنفى الطماطم موضع الدراسة وكانت أفضل النتائج المتحصل عليها مع التركيز ٢٠٠ ملجم / لتر فى الصنف أيس ومع التركيزات ٢٠٠ ، ٤٠٠ ملجم / لتر فى الصنف كاسل روك

أدى استخدام حامض الأسكوربيك إلى نقص ملحوظ فى تراكم المادة الجافة لكلٍ من أوراق ، سيقان ، جذور نباتات الطماطم وذلك عند مقارنتها بالكونترول. حيث كان هذا التأثير غير معنويا بالنسبة لأوراق وجذور صنفى الطماطم بينما كان معنويا فى حالة السيقان خاصة مع التركيزات ٤٠٠ ، ٦٠٠ ملجم / لتر .

وجد أن الرش بالتركيزات المختلفة من حامض الأسكوربيك قد أدى إلى زيادة محتوى أوراق كلا من صنفى الطماطم من كلورفيل أ ، الكاروتين ، الكلورفيلات الكلية وذلك مقارنة بالكونترول .

أظهرت نتائج الدراسة أن استخدام حامض الأسكوربيك بتركيزاته المختلفة قد أدى إلى نقص محتوى الأوراق ، السيقان ، الجذور من السكريات الكلية ، الذائبة والغير ذائبة وذلك باستثناء بعض الحالات القليلة والتى أظهرت تراكما للمواد الكربوهيدراتية خاصة مع التركيزات المنخفضة من حامض الأسكوربيك .

كما أظهرت نتائج الدراسة أن رش نباتات الطماطم صنف كاسل روك بالتركيزات المختلفة من حامض الأسكوربيك قد أدت إلى زيادة ملحوظة فى النتروجين الكلى والتى كانت مصاحبة لزيادة مماثلة فى النيتروجين الذائب والنيتروجين البروتينى أما بالنسبة للصنف أيس فقد كانت الزيادة فى محتوى الأوراق والسيقان من النيتروجين الكلى مصاحبة للتركيزات العالية من حامض الأسكوربيك أما فى الجذور فقد كانت الزيادة مصاحبة للتركيزات المنخفضة من حامض الأسكوربيك .