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PRODUCTIVITY OF SWEET POTATO PLANTS GROWN IN SANDY SOIL AS AFFECTED BY SPRAYING WITH SOME VITAMINS AND SALICYLIC ACID

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ABSTRACT

This work was carried out during summer seasons of 2008 and 2009 at El-Kassasin Horticultural Research Station, Hort. Res. Inst., Agric. Res. Center, Ismailia Governorate, to study the effect of foliar spray with Vitam. C, Vitam. B_1 and salicylic acid (SA) on nutrient uptake, photosynthetic pigments, dry weight and consequently, yield and quality of tuber roots of sweet potato grown in sandy soil.

Spraying of sweet potato plants grown in sandy soil with Vitam. C and Vitam. B_1 at 100 ppm of each or with Vitam. C, Vitam. B_1 and SA at 100 ppm of each increased N, P and K contents and uptake as well as total uptake by leaves and branches. Whereas, Vitam. C, Vitam. B_1 and SA at 100 ppm of each increased chlorophyll a, b, total (a+b), as well as, carotenoids in leaf tissues, dry weight of leaves, branches and vine/ plant, reducing , non-reducing and total sugars, TSS, Vitam. C, carotene, starch and crude fiber content in tuber roots. Foliar spray with Vitam. C, Vitam. B_1 and SA in different combinations at 100 ppm of each, was the best treatment for enhancing total yield/fed. comparing with the foliar spray with Vitam. C, Vitam. B_1 and SA each alone.

Keywords: Sweet potato, vitamins, salicylic acid, yield, tuber root quality.

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INTRODUCTION

Sweet potato *(Ipomoea batatas* (L.) Lam.) is very important crop in tropical and subtropical regions overall the world. It is a popular vegetable crop in Egypt. The chief use of sweet potato is for human consumption and for starch production. In Egypt, it is grown in summer season where its area reached about 24,000 fed. with an annual production about 265,000 tons for 2009 (FAO, 2009). One traditional crop in tropical countries is sweet potato, which originated from central America. China is the largest producer of sweet potato in the world. It produces about 80.5 million tonnes (75.5%) of the total world production of 106.5 million tonnes (FAO, 2009).

Vitamin C (ascorbic acid) is an organic compound in higher plants which is required in trace amount to maintain normal growth (Oertli, 1987). Ascorbic acid eliminates reactive oxygen species (ROS) through multiple mechanisms. Ascorbic acid has the capacity to directly eleminate several different ROS including singlet oxygen, superoxide, and hydroxyl radicals (Podh, 1990). It also maintains the membrane-bound antioxidant α-tocopherol in the reduced state (Liebler *et al.*, 1986) and indirectly eliminates H_2O_2 through the activity of ascorbic acid peroxidase (Asada, 1992).

Ascorbic acid has a key role in photoprotection. In addition to its role in protection against photo-oxidative stress through the activity of ascorbate peroxidase. Ascorbic acid levels increase in plant grown under high light and ascorbic acid is a cofactor utilized in the xanthophyll cycle (Eskling *et al.*, 1997).

Thiamin (Vitam. B_1) is a co-factor in the decarboxylation of pyruvate (Oertli, 1987). It is known that some phenolic compounds like salicylic acid (SA) retard senescence (Knypl, 1970). Of these reasons, SA especially is accepted as a natural plant growth regulators (Raskin, 1992), which increases immunity in plants against infections (Sakhabutdinova, *et al.*, 2003) and inhibits ethylene and jasmonic acid biosynthesis (Pena-Cartes *et al.*, 1993).

Foliar spray of plants with Vitam. C at 100 or 200 ppm enhanced chlorophyll a, b, total (a+b), as well as, carotenoids and N,P and K uptake by different plant parts (El-Ghamriny *et al.*,

1999 on tomato; Bardisi, 2004a on garlic), total dry weight/plant (Midan, 1986 on tomato; Arisha, 2000b on potato), and total yield (Bardisi, 2004b on garlic).

Spraying of pea plants with Vitam. B_1 had a significant effect on number of pods/plant, yield/ plant and total yield/fed. The affected characters were significantly increased with increasing Vitam.B_1 concentration up to 100 ppm without significant differences between 100 and 200 ppm of Vitam. B_1 (Arisha, 2000a).

Spraying garlic plants with SA at 50 ppm recorded a maximum values of total dry weight/plant, N, P and K uptake by leaves and bulb and total uptake by plant, total yield, as well as, exportable and marketable yield (Bardisi, 2004a and b).

Therefore, the aim of this work was to improve the productivity and quality of sweet potato plants grown in sandy soil by spraying with some Vitamins and salicylic acid.

MATERIALS AND METHODS

This work was carried out during summer seasons of 2008 and 2009 at El-Kassasin Horticultural Research Station, Hort. Res. Inst., Agric. Res. Center, Ismailia Governorate, to study the effect of foliar spray with Vitam. C, Vitam. B_1 and salicylic acid on nutrient uptake, photosynthetic pigments, dry weight and consequently yield and quality of tuber roots of sweet potato plants grown in sandy soil.

The physical and chemical properties of the experimental soil are shown in Table 1.

This experiment included eight treatments as follows: control (spraying with tap water), Vitam. C, Vitam. B_1 and SA at 100 ppm of each, Vitam. C and Vitam. B_1 at 100 ppm of each, Vitam. C and SA at 100 ppm of each, Vitam. B_1 and SA at 100 ppm of each and Vitam. B_1, Vitam. C and SA at 100 ppm of each.

These treatments were arranged in a complete randomized block design with three replicates. The sweet potato cultivar A-193 was used. The source of cultivar was El-Baramon Hort. Res. Station, Dakahlyia Governorate.

Planting was done on 20th April in both growing seasons, sweet potato transplants were planted on one side of the row at 25 cm apart. Plants were sprayed three times at 45, 60 and 75 days after planting with Vitam. C, Vitam. B_1 and SA solutions alone or in combinations

Table 1. The physical and chemical properties of the experimental soil

Properties	2008 season	2009 season
Physical properties		
Sand (%)	91.17	92.11
Silt (%)	6.47	5.46
Clay (%)	2.36	2.43
Texture	Sand	Sand
Chemical properties		
Organic matter (%)	0.06	0.04
pH	8.00	7.98
E.C. (dSm^{-1})	1.88	1.93
Total N (%)	0.11	0.11
Available N (ppm)	13.74	13.07
Available P (ppm)	12.65	12.14
Available K (ppm)	65.00	68.00

using spreading agent in all treatments (solutions of Vitam. C, Vitam. B_1 and SA was separately sprayed without mixing). The untreated plants (control) were sprayed with tap water and spreading agent.

The sources of thiamine (Vitam. B_1), ascorbic acid (Vitam. C) and salicylic acid (SA) were from Sigma Chemical Co. (USA)

Plot area was $8.4m^2$. It contained three rows with 4m long and 70 cm wide. One row was used for samples to measure dry weight and plant chemical analyses and the other two rows were used for yield determination. In addition, one row was left between each two experimental units as a guard row to avoid the overlapping of spraying solutions. The irrigation system was surface irrigation.

All experimental units received equal amounts of FYM at 30 m^3/fed. Also, it received 200 kg/fed., ammonium sulphate (20.6%

N), 150 kg/fed. calcium superphosphate (15.5% P_2O_5) and 150 kg/fed. potassium sulphate (48% K_2O). One third of these fertilizers was added at soil preparation and the rest was divided into five equal portions and added as soil application at 30, 45, 60, 75 and 90 days from transplanting.

The other normal agricultural treatments for growing sweet potato plants were practiced.

Data Recorded

Photosynthetic Pigments

Disks from sweet potato leaves were obtained from every plot at 100 days after transplanting to determine chlorophyll a, b, total (a+b) and carotenoids according to the method described by Wettestein (1957).

Contnet and Uptake of N, P and K

They were determined in dried leaves and branches, according to the method described by A.O.A.C. (1990) in the first season, then N, P and K uptake and total uptake were calculated.

Dry Weight

A sample of three plants from every plot was randomly taken after 100 days from transplanting, dried at 70°C till constant weight and dry weight of leaves, branches and total/plant (leaves + branches) were recorded.

Yield and Its Components

At harvesting time (150 days after transplanting) tuber roots of every plot were harvested counted and weighed, and the following data were recorded: Average number of tuber roots/ plant, average weight of tuber roots, yield/ plant and total yield/ feddan.

Tuber Root Quality at Harvesting Time

Reducing, non reducing and total sugars (%)

They were determined in dry tuber root tissues according to the method described by Forsee (1938).

Starch (%)

It was determined in dried tuber roots according to the method described by A.O.A.C. (1990).

Total soluble solids (T.S.S.%)

It was determined in tuber roots of flesh juice by Carle Zeis refractometer.

Ascorbic acid (Vitam. C mg/ 100 gm FW)

It was determined in fresh sample of tuber roots using 2, 6-Dichlorophenol indophenols dye

according to the method described by A.O.A.C. (1990).

Carotenoids (mg/gm FW)

They were determined in fresh tuber root tissues according to the method reported by A.O.A.C. (1990).

Crude fibers (%)

They were determined in dry tuber root tissues according to the method reported by A.O.A.C. (1990).

Statistical Analysis

The obtained data were subjected to statistical analysis of variance according to Snedecor and Cochran (1980) and means separation was done according to LSD at 5% level of probability.

RESULTS AND DISCUSSION

N, P and K Content and Uptake

Concerning N,P and K contents, data in Table 2 illustrate that spraying sweet potato plants with Vitam. C, Vitam. B_1 and SA (salicylic acid) alone or in combinations at 100 ppm of each showed a significant effect on N, P and K contents in leaves and branches, except P content in branches. The plants which sprayed with Vitam. C, Vitam. B_1 and SA at 100 ppm of each gave the highest N, P and K contents in both leaves and branches with no significant difference when compared to the plants sprayed with Vitam. C and Vitam. B_1 at 100 ppm of each, regarding N and K content in leaves and N, P and K contents in branches.

With respect to the uptake and total uptake of N,P and K, data presented in Tables 3 and 4 show clearly that spraying sweet potato plants with Vitam. C, Vitam. B_1 and SA alone or in combinations significantly increased N, P and K uptake and total uptake by leaves and branches compared to the sprayed with tap water (control). The plants sprayed with Vitam. C and Vitam. B_1 at 100 ppm of each or with Vitam. C, Vitam. B_1 and SA at 100 ppm of each were the best treatments for enhancing the uptake of N, P and K by leaves and branches and total uptake of N, P and K by shoots.

These results agree with those reported by El-Ghamriny *et al.*, 1999 on tomato with respect to Vitam. C and Bardisi 2004a on garlic with respect to Vitam. C and SA.

Photosynthetic Pigments

Presented data in Table 5 indicate that foliar spray of sweet potato

Table 2. Effect of foliar spray with Vitam. C, Vitam. B_1 and SA on N, P and K contents (%) in leaves and branches of sweet potato plants grown in sandy soil during summer season of 2008

Treatments	Mineral Contents (%)					
	Leaves			Branches		
	N	P	K	N	P	K
Control (Tap water)	2.34	0.333	2.19	2.24	0.317	2.09
Vitam. C at 100 ppm	3.28	0.370	2.31	2.56	0.337	2.20
Vitam. B_1 at 100 ppm	3.31	0.393	2.33	2.61	0.353	2.30
SA at 100 ppm	3.57	0.383	2.35	2.53	0.323	2.30
Vitam. C and Vitam. B_1 at 100 ppm of each	3.73	0.410	2.43	2.86	0.400	2.38
Vitam. C and SA at 100 ppm of each	3.53	0.363	2.39	2.57	0.350	2.31
Vitam. B_1 and SA at 100 ppm of each	3.60	0.393	2.42	2.59	0.377	2.37
Vitam. C,Vitam. B_1 and SA at 100 ppm of each	3.90	0.433	2.45	3.01	0.413	2.39
LSD at 5 % level	0.27	0.021	0.05	0.28	0.026	0.03

SA: Salicylic acid

Table 3. Effect of foliar spray with Vitam. C, Vitam. B_1 and SA on N,P and K uptake (mg/ organ) by leaves and branches of sweet potato plants grown in sandy soil during summer season of 2008

Treatments	Minerals uptake (mg/organ)					
	Leaves			Branches		
	N	P	K	N	P	K
Control (Tap water)	850.82	121.08	796.28	469.08	66.28	437.02
Vitam. C at 100 ppm	1727.03	194.62	1215.06	736.63	96.72	631.40
Vitam. B_1 at 100 ppm	2038.42	241.54	1432.02	756.90	102.37	667.00
SA at 100 ppm	1655.88	177.48	1088.99	909.07	114.76	817.19
Vitam. C and Vitam. B_1 at 100 ppm of each	2694.34	295.90	1753.73	1202.91	168.24	1001.03
Vitam. C and SA at 100 ppm of each	1832.34	188.07	1238.26	937.53	127.68	842.69
Vitam. B_1 and SA at 100 ppm of each	2476.70	269.87	1661.81	740.40	107.63	676.64
Vitam. C,Vitam. B_1 and SA at 100 ppm of each	2776.05	307.95	1742.44	1130.04	154.71	895.29
LSD at 5 % level	177	11.86	39.04	155	16.62	42.01

SA : Salicylic acid

Table 4. Effect of foliar spray with Vitam. C, Vitam. B_1 and SA on total uptake by sweet potato vine (leaves + branches) grown in sandy soil during summer season of 2008

Treatments	Total uptake (mg/vine)		
	N	P	K
Control (Tap water)	1319.90	187.36	1233.30
Vitam. C at 100 ppm	2463.66	291.34	1846.46
Vitam. B_1 at 100 ppm	2795.32	343.91	2099.02
SA at 100 ppm	2564.96	292.24	1906.18
Vitam. C and Vitam. B_1 at 100 ppm of each	3897.26	464.14	2754.76
Vitam. C and SA at 100 ppm of each	2769.88	315.75	2080.95
Vitam. B_1 and SA at 100 ppm of each	3217.09	377.51	2338.45
Vitam. C,Vitam. B_1 and SA at 100 ppm of each	3906.09	462.66	2637.73
LSD at 5 % level	180	39.73	234.99

SA : Salicylic acid

Table 5. Effect of foliar spray with Vitam. C, Vitam. B_1 and SA on photosynthetic pigments in leaves of sweet potato plants grown in sandy soil during summer seasons of 2008 and 2009

Treatments	Chlorophyll (mg/ gm DW)						Carotenoids (mg/gm DW)	
	Chl. a		Chl. B		Total chl. (a+b)			
	2008 season	2009 season	2008 season	2009 season	2008 season	2009 season	2008 season	2009 season
Control (Tap water)	1.524	1.440	2.081	1.843	3.605	3.283	0.578	0.473
Vitam. C at 100 ppm	1.586	1.873	2.186	2.267	3.772	4.140	0.608	0.683
Vitam. B_1 at 100 ppm	1.651	1.637	2.433	1.967	4.084	3.603	0.576	0.650
SA at 100 ppm	1.668	1.807	2.403	2.480	4.071	4.287	0.654	0.600
Vitam. C and Vitam. B_1 at 100 ppm of each	1.664	1.743	2.361	2.267	4.025	4.010	0.623	0.523
Vitam. C and SA at 100 ppm of each	1.776	1.537	2.332	2.313	4.108	3.850	0.596	0.593
Vitam. B_1 and SA at 100 ppm of each	1.602	1.610	2.141	2.767	3.742	4.377	0.639	0.720
Vitam. C,Vitam. B_1 and SA at 100 ppm of each	1.597	1.960	2.155	2.707	3.752	4.667	0.612	0.780
LSD at 5 % level	NS	0.037	0.230	0.041	0.324	0.064	NS	0.041

SA : Salicylic acid

individually or in combinations increased the concentrations of chlorophyll a, b, total chlorophyll (a+b) and carotenoids in leaf tissues compared to the control treatment (spraying with tap water), except chlorophyll a and carotenoids in the 1st season. Sweet potato plants which were sprayed with Vitam. C, Vitam. B_1 and SA at 100 ppm of each and also SA at 100 ppm recorded the maximum concentration of chlorophyll a, b and total chlorophyll (a+b) as well as, carotenoids in leaf tissues in the 2nd season.

Li *et al.* (1992) established that SA inhibited the actiVitamy of 1-aminocyclopropane-1-carboxylic acid (ACC) synthase enzyme, preventing formation of ethylene and chlorophyll loss. Consequently, one can emphasize that SA at 100 ppm concentration applied here individual or in combinations with Vitam. C and Vitam. B_1 at 100 ppm of each prevented loss of chlorophyll, and even retarded related senescence by promoting chlorophyll biosynthesis.

These results agree with those reported by El-Ghamriny *et al.* (1999), who found that spraying tomato plants with Vitam. C at 100 ppm enhanced chlorophyll a, b, total chlorophyll and carotenoids in leaf tissues.

Dry Weight

It is evident from data in Table 6 that sweet potato plants which were sprayed with Vitam. C, Vitam..B_1 and SA alone or in combinations increased dry weight of leaves, branches and shoots plant compared to plants sprayed with tap water (control). Also, spraying with Vitam. C and Vitam. B_1 at 100 ppm of each and with Vitam. C, Vitam. B_1 and SA at 100 ppm of each recorded the maximum values of dry weight of leaves/ plant, whereas spraying with Vitam. C and Vitam. B_1 at 100 ppm of each recorded the maximum values of dry weight of branches and shoots/ plant, followed by spraying with Vitam. C, Vitam. B_1 and SA at 100 ppm of each in both growing seasons.

The increases in shoot dry weight/plant were about 56.96 and 42.15 g/plant for Vitam. C and Vitam. B_1 at 100 ppm of each and 51.31 and 30.24 g/plant for Vitam. C, Vitam. B_1 and SA at 100 ppm of each over the control (spraying with tap water) in the 1st and 2nd seasons, respectively.

The stimulative effect of Vitam. C and Vitam. B_1 on growth of sweet potato may be due to that Vitam. C is required in trace amount to maintain normal growth (Oertli, 1987).

Table 6. Effect of foliar spray with Vitam. C, Vitam. B_1 and SA on dry weight of sweet potato plants grown in sandy soil during summer seasons of 2008 and 2009

Treatments	Dry weight (gm/plant)					
	Leaves		Branches		Vine	
	2008 season	2009 season	2008 season	2009 season	2008 season	2009 season
Control (Tap water)	36.36	33.21	20.91	17.81	57.27	51.03
Vitam. C at 100 ppm	52.60	42.30	28.70	29.33	81.30	71.64
Vitam. B_1 at 100 ppm	61.46	48.80	29.00	22.70	90.46	71.50
SA at 100 ppm	46.34	39.54	35.53	26.57	81.87	66.12
Vitam. C and Vitam. B_1 at 100 ppm of each	72.17	55.02	42.06	38.15	114.23	93.18
Vitam. C and SA at 100 ppm of each	51.81	32.18	36.48	27.04	88.29	59.23
Vitam. B_1 and SA at 100 ppm of each	68.67	46.77	28.55	25.98	97.22	72.75
Vitam. C,Vitam. B_1 and SA at 100 ppm of each	71.12	51.352	37.46	29.92	108.58	81.27
LSD at 5 % level	5.58	4.03	3.39	2.66	4.38	3.25

SA : Salicylic acid , vine: (leaves +branches)

Growth in higher plants is the result of two different processes, cell proliferation and cell elongation. Both ascorbic acid and the enzyme ascorbate oxidease have been directly and indirectly implicated in the modulation of both (Davey *et al.*, 2000; Conclin, 2001). Ascorbic acid levels are, generally, found to be high in meristematic tissue and very low zones little active cell division (Simironaff, 1996).

Similar findings were reported by Midan, 1986 on tomato, Arisha 2000b on potato and Bardisi 2004a on garlic.

Yield and Its Components

It is obvious from the data in Table 7 that spraying sweet potato plants with Vitam. C, Vitam. B_1 and SA single or in combinations increased the average tuber root weight, yield/plant and total yield/ fed. in both seasons compared with the control (spraying with tap water). Also, the plants which were sprayed with Vitam. C and Vitam. B_1 at 100 ppm of each or which sprayed with Vitam. C, Vitam. B_1 and SA at 100 ppm of each significantly increased the average tuber root weight (342 and 356 gm for Vitam. C and Vitam. B_1 at 100 ppm of each and 370 and 360 gm for Vitam. C, Vitam. B_1

Table 7. Effect of foliar spray with Vitam. C, Vitam. B_1 and SA on yield and its components of sweet potato plants grown in sandy soil during summer seasons of 2008 and 2009

Treatments	Average tuber root number/ plant		Average tuber root weight (gm)		Yield / plant (kg)		Total yield of tuber roots (ton /fed.)	
	2008 season	2009 season	2008 season	2009 season	2008 season	2009 season	2008 season	2009 season
Control (Tap water)	2.33	2.26	239	251	0.557	0.568	13.368	13.632
Vitam. C at 100 ppm	2.58	2.40	278	264	0.628	0.634	15.072	15.216
Vitam. B_1 at 100 ppm	2.39	2.46	303	312	0.727	0.769	17.448	18.456
SA at 100 ppm	3.12	3.27	252	241	0.787	0.790	17.888	17.960
Vitam. C and Vitam. B_1 at 100 ppm of each	2.54	2.37	342	356	0.871	0.845	20.904	20.280
Vitam. C and SA at 100 ppm of each	3.12	2.84	282	306	0.880	0.870	19.120	18.880
Vitam. B_1 and SA at 100 ppm of each	2.55	2.80	315	293	0.806	0.823	19.344	19.752
Vitam. C,Vitam. B_1 and SA at 100 ppm of each	2.20	2.36	370	360	0.816	0.850	19.607	20.399
LSD at 5 % level	NS	NS	11	12	0.091	0.145	1.002	1.509

SA : Salicylic acid

and SA at 100 ppm of each) in the 1st and 2nd seasons, respectively.

The increases in total yield/fed. were 7.536 and 6.648 ton/fed. for Vitam. C and Vitam. B_1 at 100 ppm of each, 5.752 and 5.248 ton/ fed. for Vitam. C + SA at 100 ppm of each, 5.976 and 6.120 ton/fed. for Vitam. B_1 +SA at 100 ppm of each and 6.239 and 6.767 ton/fed. for Vitam. C, Vitam. B_1 and SA at 100 ppm of each over the control in the 1st and 2nd seasons, respectively.

These results agree with those reported by Arisha (2000a) on pea with respect to Vitam. B_1, (Bardisi, 2004b) on garlic with respect to Vitam. C and SA.

Tuber Root Quality

Presented data in Tables 8 and 9 show that sweet potato plants which sprayed with Vitam. C, Vitam. B_1 and SA single or in combinations increased reducing, non- reducing and total sugar, TSS, carotenoids, Vitam. C, starch and crude fiber contents in tuber roots in 1st season compared to tuber roots obtained from plants sprayed with tap water (control treatment). Spraying with Vitam. C, Vitam. B_1 and SA at 100 ppm of each or with Vitam. C and SA at 100 ppm of each were the best treatments for enhancing total sugar, TSS, Vitam. C, starch and crude fiber contents with insignificant with Vitam. C+ SA at

Table 8. Effect of foliar spray with Vitam. C, Vitam. B_1 and SA on sugars and TSS in tuber root of sweet potato grown in sandy soil during summer seasons of 2008 and 2009

Treatments	Sugars (%)						TSS %	
	Total		Reducing		Non reducing			
	2008 season	2009 season	2008 season	2009 season	2008 season	2009 season	2008 season	2009 season
Control (Tap water)	8.86	9.59	6.09	6.61	2.77	2.98	6.11	7.08
Vitam. C at 100 ppm	9.37	9.72	6.14	6.40	3.23	3.32	6.34	6.88
Vitam. B_1 at 100 ppm	9.65	10.34	6.16	6.70	3.49	3.64	6.46	6.81
SA at 100 ppm	9.87	10.59	6.22	6.78	3.65	3.81	6.67	6.72
Vitam. C and Vitam. B_1 at 100 ppm of each	9.28	10.94	6.50	6.95	3.18	3.99	6.20	6.38
Vitam. C and SA at 100 ppm of each	10.06	11.34	7.03	7.11	3.03	4.23	6.29	6.51
Vitam. B_1 and SA at 100 ppm of each	9.88	10.83	6.89	6.87	2.99	3.96	6.21	6.06
Vitam. C,Vitam. B_1 and SA at 100 ppm of each	10.50	11.72	7.05	7.27	3.44	4.45	6.79	6.76
LSD at 5 % level	0.08	0.29	0.06	0.19	0.09	0.41	0.05	0.06

SA : Salicylic acid

Table 9. Effect of foliar spray with Vitam. C, Vitam. B_1 and SA on carotene, Vitam.. C, starch and fiber contents in tuber root of sweet potato grown in sandy soil during summer seasons of 2008 and 2009

Treatments	Carotenoids (mg/gm FW)		Vitam. C (mg/100 gm FW)		Starch (%)		Crude fiber (%)	
	2008 season	2009 season	2008 season	2009 season	2008 season	2009 season	2008 season	2009 season
Control (Tap water)	0.73	0.73	29.21	30.22	39.03	40.36	5.17	4.78
Vitam. C at 100 ppm	0.78	0.74	29.37	30.31	40.03	40.13	5.36	4.93
Vitam. B_1 at 100 ppm	0.84	0.85	29.63	30.32	39.47	40.80	5.47	5.29
SA at 100 ppm	0.82	0.91	30.33	30.61	40.13	43.42	5.78	5.45
Vitam. C and Vitam. B_1 at 100 ppm of each	0.90	0.88	31.17	31.38	40.41	45.65	6.75	6.76
Vitam. C and SA at 100 ppm of each	0.67	0.67	32.46	31.60	48.06	46.06	8.10	8.09
Vitam. B_1 and SA at 100 ppm of each	0.62	0.60	29.99	39.65	42.16	42.75	7.96	6.96
Vitam. C,Vitam. B_1 and SA at 100 ppm of each	0.97	0.93	35..08	33.60	48.52	47.62	10.03	8.26
LSD at 5 % level	0.03	0.03	0.10	0.19	0.16	0.70	0.06	0.10

SA : Salicylic acid

100 ppm of each with respect to reducing and non-reducing sugars in tuber roots in both seasons, except non reducing sugar in the first season.

Finally, it could be concluded that, foliar spray of sweet potato plants with Vitam. C, Vitam. B_1 and SA in different combinations at 100 ppm of each were the best treatments for enhancing total yield/fed. Compared to foliar spray with Vitam. C, Vitam. B_1 and SA each alone.

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تأثير الرش ببعض الفيتامينات وحمض الساليسيلك على إنتاجية نباتات البطاطا النامية فى الأراضى الرملية

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أجرى هذا البحث خلال صيف موسمى ٢٠٠٨، ٢٠٠٩ فى مزرعة محطة بحوث البساتين بالقصاصين، معهد بحوث البساتين- مركز البحوث الزراعية، محافظة الإسماعلية، بهدف دراسة تأثير الرش الورقى بفيتامين ج، و فيتامين ب ١، وحمض الساليسيلك منفردا أو فى توليفات على الممتص من النتروجين والفوسفور والبوتاسيوم، ومحتوى الورقة من صبغات التمثيل الضوئى، الوزن الجاف، وكذلك المحصول وجودة الجذور المتدرنة للبطاطا المنزرعة فى الأرض الرملية.

أدى رش نباتات البطاطا بكل من فيتامين ج وفيتامين ب ، بتركيز ١٠٠ جزء فى المليون لكل منهما أو فيتامين ج، و فيتامين ب ،، وحمض الساليسيلك بتركيز ١٠٠ جزء فى المليون لكل منها إلى زيادة محتوى الأوراق والأفرع من النيتروجين والفوسفور والبوتاسيوم والممتص الكلى منها بواسطة المجموع الخضرى، بينما سجلت معاملة الرش بكل من فيتامين ج و فيتامين ب، وحمض الساليسيلك بتركيز ١٠٠ جزء فى المليون لكل منها أعلى القيم لمحتوى أنسجة الورقة من كلوروفيل أ، ب والكلوروفيل الكلى (أ + ب) والكاروتينويدات، وكذلك الوزن الجاف للمجموع الخضرى، ومحتوى الجذور المتدرنة من كل من السكريات المختزلة وغير المختزلة، والسكريات الكلية، والألياف الخام.

كانت أفضل المعاملات لزيادة المحصول الكلى للبطاطا هى رش النباتات بكل من فيتامين ج وفيتامين ب ، وحمض الساليسيلك بتركيز ١٠٠ جزء فى المليون لكل منها بتوليفاتها المختلفة مقارنة برش كل منها بصورة منفردة.