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Physiological Response of Growth, Yield and its Quality of Squash (*Cucurbita pepo* L.) to Foliar Application of Some Nutrients

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Abstract: A field experiment was conducted during the two successive seasons of 2006 and 2007 at the experimental station of National Research Centre at Shalakan (Kalubia Governorate) to study the response of squash plant to the foliar spraying (two and three times) of some nutrients (N + Ca, N + K, N + Zn and N only plus control treatments). The three times of foliar application with macro and/or micro-elements gained the vigour plant growth of squash expressed by length of plant, average vines and/or leaves per plant, whole fresh and dry weights of plants and their different organs. Also, the total and early fruits yield as well as its physical properties and chemical nutritional values gained when 3 times of foliar application of nutritional fertilizer were applied. The obtained results reveal that the best plant growth measurements of squash were recorded when nitrogen (urea 1.5 %) + potassium (potassium thio sulphate, 36.5 K_2O) and/or nitrogen + calcium (Calborate, 14 % Ca) were applied as a foliar application. Whereas, the differences within these two treatments were no great to be significant. Also, the total and early fruits yield of squash and its physical properties (fruit length, diameter and weight) as well as the nutritional values of fruits (protein, N, P, K, Fe, Zn Cu and Mn). All of these measurements recorded their highest values when plants were sprayed by nitrogen + potassium and/or nitrogen + calcium.

Key words: Squash, Growth, yield, yield quality, nutrient foliar application.

INTRODUCTION

Squash is one of the important popular vegetable crop grown in Egypt for local consumption and/or for foreign exporting market. Whereas, the total production area increased slowly in past few years, but its yields did not rise by the same degree. However, the fruits yield could be enhanced by improving the agricultural treatments, i.e. following the better application method of fertilizers, or providing the plants by some macro/micro-nutrients, through un-tradition application method i.e., through foliar application. It's known that, rooting media some known and un-known actions affected the solubility and/or availability of most nutrient elements. However, in all types of soil as a general and/or particularly in sandy soil, most soil dressing fertilizers lost with irrigation water, for this main reason, the foliar application of nutrients as an individual method for fertilizer application or as a complete nutrition system is an important to investigate. Whereas Alscher *et al*.[1] added that every plant like any other organism needs certain components for growth and the basic components of living cells are proteins. The main source of protein in plant tissues is urea as a source of nitrogen and/or amino acids. Moreover, nitrogen is the fundamental ingredients for process of protein synthesis. Al-Said and Kamal[2] reported that the important of nitrogen came from widely use for the biosynthesis of large variety of non-protein nitrogenous materials, i.e. pigments, vitamins, coenzymes pyrine and pyrimidine bases. Swiader *et al*.[3] and Abdel-Fattah and Sorial[4] reported that squash is a crop responded strongly to fertilizer, and nitrogen fertilizer has been shown to increase the yield due to an increase in number of fruits per plant. Whereas, Chance *et al*.[5] stated that, the role of potassium is an act as catalyst of activator of Enzyme, promotes overall growth, but, zinc acts as an enzyme activator in protein, hormones synthesis and metabolism. The response of many vegetables to nutritional elements were studied by many investigators [2,6,7,8,9,10,11].

The aim of this study is to investigate the effect foliar application of some nutrient fertilizers for squash plants.

MATERIALS AND METHODS

A field experiment was carried out during the two experimental seasons of 2006 and 2007 at the experimental Farm of National Research Centre in

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Shalakan (Kalubia Governorate) to investigate the influence of treating squash plants by nitrogen as individual and/or companied with Ca, K and Z as foliar application. Each experiment includes 10 treatments as follows:

Methods of Application:
1. Two times of foliar spraying.
2. Tree times of foliar spraying.

Nutrient Treatments:
1. Urea 1.5%.
2. Urea 1.5% + calcium (Calborate, 14% Ca*).
3. Urea 1.5% + potassium (potassium thiosulphate, contained 36.5 K_2O*).
4. Urea 1.5 % + zinc (Agro-Zink, contained 8.5% Z*).
5. Control (without foliar spraying).

* = Source: Agrico International (www.agricointernational.com)

The experimental soil was clay in texture with 7.82 pH, 1.6 EC and contained 822, 170 and 162 mg/100 g dry soil of N, P and K respectively. The design of each experiment was split-plot system with three replicates, where the methods of application were arranged within the main plots, the nutrient treatments were distributed randomly within the sub-plots. Each sub-experimental plot area was 12.8 m² consisted of 4 ridge) each was 0.8 m in width and 4 m in length. Seeds of squash (*Cucurbita pepo* L. cv. Eskandarani) were seeded on the 1st week of April month in 2006 and 2007 seasons. The seeds were sown at 30 cm apart on one side of the ridge. All experimental treatments received phosphorus fertilizer at the form of super-phosphate at rate of 100 kg/fed., and nitrogen at the form of ammonium sulphate (20.6 % N) at rate of 200 kg/fed., but potassium fertilizer added at rate of 100 kg/fed. of potassium sulphate. Whereas, all quantities of phosphorus were added during preparing the soil for sowing, but nitrogen rates divided into two half's, first added 3 weeks old and second half of nitrogen plus all rate of potassium were added at 30 days old. The foliar treatments of nitrogen started 40 days old with interval of one week. The normal other cultural practices commonly used for growing i.e., irrigation, pest and diseases control, etc. of squash plant were followed. Vegetative samples of squash plant at 2 months old were taken to recorded the vegetative growth parameters (length of plant, average number of leaves and/or shoots, fresh and dry weight of whole squash plant and its different organs as g/plant. Squash fruits were harvested twice weekly, where the early fruits yield (collection of the 3 first harvestings) as well as the total yield (all harvesting recorders) as tons/fed., were accounted. However, samples of squash fruits in mid harvesting season were taken and some physiological parameters such as length, diameter and weight of fruit were recorded. In oven dry samples of squash fruit, some nutritional values were determined, where TSS % (using a hand refrectometer), nitrogen, phosphorus, potassium (according to methods of Pregle[12], Troug and Mayer[13] and Brown and Lilleland[14] respectively). Also, Fe, Zn, Mn and Cu were analyzed using flame ionization atomic absorption, spectrometer model 1100 B of Perkin Elmer according to the method of Champman and Pratt[15]. All the recorded data were statistically analysed according to Gomez and Gomez[16].

RESULTS AND DISCUSSION

Plant Growth Characteristics: Squash plant growth characters as expressed by plant height, average number of leaves and shoots, fresh and dry weight of whole plant and its leaves and shoots as influenced by the application of some nutrients are shown in Tables (1 and 2) for the two experimental seasons. Foliar application of Z, Ca, K and N as 3 sprayings starting 30 days old and by 10 days intervals resulted the tallest plants and that which carried the highest number and weights of leaves and shoots compared with that plants no treated (control). Moreover, the statistical analysis of the obtained data reveals that the differences within varies application method of nutrients were great enough to reach 5% level of significant. These findings are in good accordance for the two experimental seasons, except average shoots number in 1st season as well as fresh weight of whole plants and its shoots in 2nd season. It could be concluded that, the 3 times of foliar spraying for the studied treatments caused an enhancement in plant growth parameters of squash plant compared to that plants which treated twice.

Also, the presented data in Tables (1 and 2) show clearly that, all nutrients which used in this study caused a promotion effect on plant growth of squash plant if compared with that plants which no treating (control). Moreover, within the 4 treating nutrients used, that plants which applied by nitrogen + potassium resulted the vigor plant growth, followed in decreasing order by that plants treated by nitrogen + calcium. The statistical analysis of the collected data reveals that the differences within the all used treatments were great enough to be significant at 5 % level. These findings were true in both seasons except average number of shoots only in 1st season.

The vigor squash plants that resulted when nitrogen + K and/or N + Ca nutrients were applied might be attributed to that nitrogen elements must be

Table 1: Effect of the foliar application of some nutrients on growth characteristics of squash plant during the experimental season of 2006.

Application methods	Foliar fertilizers	Plant length	No/plant		Fresh wt (g/plant)			Dry wt (g/plant)		
			Leaves	Shoots	Leaves	Shoots	Whole plant	Leaves	Shoots	Whole plant
Twice	Control	40	23	1.67	81.67	32	113.67	17	12.33	29.33
	N+Zn	44.67	24.67	2	85	44.33	129.33	23.67	13.88	37.55
	N	50	25.33	2.33	99.67	50	149.67	23.67	15.73	39.4
	N+Ca	51	25.67	2	104.67	70.67	175.33	26.33	15.9	42.23
	N+K	53.67	28.33	2	127.33	81.33	208.67	25.67	16.89	42.56
	Mean	47.87	25.4	2	99.67	55.67	155.33	23.27	14.95	38.22
Three times	Control	41.33	24.67	1.33	83.33	42.33	125.67	17.67	13.67	31.33
	N+Zn	55	26.67	2.33	94.33	77.67	172	27.33	17.96	45.3
	N	57	28.67	3	127.33	91.33	218.67	34	18.82	52.82
	N+Ca	60	32.33	2.67	130	98.33	228.33	34.33	20.59	54.92
	N+K	61.33	30.67	2.67	154	96.67	250.67	37.33	22.18	59.51
	Mean	54.93	28.6	2.4	117.8	81.27	199.07	30.13	18.64	48.78
Averages	Control	40.67	23.83	1.5	82.5	37.17	119.67	17.33	13	30.33
	N+Zn	49.83	25.67	2.17	89.67	61	150.67	25.5	15.92	41.42
	N	53.5	27	2.67	113.5	70.67	184.17	28.83	17.28	46.11
	N+Ca	55.5	29	2.33	117.33	84.5	201.83	30.33	18.25	48.58
	N+K	57.5	29.5	2.33	140.67	89	229.67	31.5	19.54	51.04
L.S.D. at 5%	Application methods	3.19	3.02	N.S.	16.52	15.76	21.22	4.61	2.96	5.22
	Foliar fertilizers	3.06	1.94	N.S.	21.48	11.62	23.91	4.12	1.39	4.53
	Interaction	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	6.4

N.S: Not significant

Table 2: Effect of the foliar application of some nutrients on growth characteristics of squash plant during the experimental season of 2007.

Application methods	Foliar fertilizers	Plant length	No/plant		Fresh wt (g/plant)			Dry wt (g/plant)		
			Leaves	Shoots	Leaves	Shoots	Whole plant	Leaves	Shoots	Whole plant
Twice	Control	38	22	2.16	87	44.33	131.33	14.16	14.13	28.29
	N+Zn	40.33	23.33	2.3	103	59.67	162.67	28.11	15.73	43.84
	N	41.67	23.67	2.84	114.33	73.67	188	29.77	16.1	45.87
	N+Ca	41.33	32.33	3.18	122.33	64.67	187	31.32	16.33	47.65
	N+K	46.33	24	3.19	130.67	75.33	206	32.57	16.9	49.47
	Mean	41.53	25.07	2.73	111.47	63.53	175	27.18	15.84	43.02
Three times	Control	40.33	23	2.27	87.33	57.33	144.67	16.14	15.33	31.47
	N+Zn	48.33	34.67	3.22	128	84.67	212.67	32.88	17.4	50.28
	N	52.33	33.67	3.31	133.33	97.33	230.67	32.87	18.13	51.01
	N+Ca	57.33	41.33	3.45	113.67	102	215.67	37.65	18.63	56.29
	N+K	59	47.33	3.83	150	104.67	254.67	40.93	19.2	60.13
	Mean	51.47	36	3.22	122.47	89.2	211.67	32.1	17.74	49.84

Table 2: Continue

Averages	Control	39.17	22.5	2.22	87.17	50.83	138	15.15	14.73	29.88
	N+Zn	44.33	29	2.76	115.5	72.17	187.67	30.49	16.57	47.06
	N	47	28.67	3.08	123.83	85.5	209.33	31.32	17.12	48.44
	N+Ca	49.33	36.83	3.32	118	83.33	201.33	34.49	17.48	51.97
	N+K	52.67	35.67	3.51	140.33	90	230.33	36.75	18.05	54.8
L.S.D. at 5%	Application methods	8.19	3.86	0.21	10.92	N.S.	N.S.	4.69	1.08	5.74
	Foliar fertilizers	5.74	2.97	0.34	18.36	24.34	28.84	3.13	1	3.64
	Interaction	N.S.	4.2	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.

N.S: Not significant

directly involved in plant metabolism (structure, constituent, enzyme activator, etc.). It is known that, if elements have been identified as essential for plant growth and the plant cannot complete its life cycle without the element. However, nitrogen is part of nucleic acid, chlorophyll and protein. Potassium acts as a catalyst or activator of enzymes, promotes growth[17]. Now it could be concluded that, the vigor of squash plant which received nitrogen + potassium might be attributed to their major roles in plant metabolism.

The response of vegetable plants to macro or micro nutrients were studied by many workers such as Chance *et al*.[5], Bavalda, *et al*.[18], Kolota and Osinska[19] on squash and Adam *et al*.[20] on cantaloupe, Rafque and Muhsi[21] and Shaheen *et al*.[11] on okra and Yrildirim *et al*.[22] on broccoli. Whereas the obtained results in this script are in good accordance with the findings of the above mentioned investigators. Moreover, the interaction effect within the application methods and some nutrients as foliar application gained no enough differences to be significant regarding all plant growth measurements in both experimental seasons except dry weight of whole plant in 1st season and average number of leaves in 2nd season. It means that each factor of the interaction act independently on plant growth characters of squash plant. Generally, it could be abstracted that, treating squash plants by nutrients caused an enhancement in plant growth if compared with control plants. Moreover, foliar spraying of nitrogen + potassium resulted the best plant growth followed in descending order nitrogen + calcium treatments. These might be attributed to the major role of nitrogen or potassium and/or calcium in plant metabolism.

Fruits Yield and its Physical Properties: Tables (3 and 4) shows clearly that, the foliar application of some promotion substances such as N + K, N +Ca and N + Zn and /or N only as foliar applications 3 times resulted the more total and early fruits yield (as tons/fed.) if compared to the twice foliar application. Whereas, the total fruits yield increased by 29.3 % in 1st season and by 8.2 % in 2nd one, but the early fruits yield increased by 48.8 % in 1st and by 57.6 % in 2nd season. Moreover, the fruits yield as gram and/or number per plant followed the same pattern of change i.e., increased when the foliar applied as 3 times compared with that plants which supplied nutrition substances at twice.

Regarding the physical properties of squash fruit (length, diameter and average weight) the obtained results indicated that the better fruits was correlated with that plants received nutrients 3 times of applications. It could be concluded that, the higher total and early fruits yield with the better physical quality gained when the nutrition substance are used as 3 application times. These findings are in accordance for the two experimental seasons. Also, the presented date in Tables (3 and 4) showed that, within the foliar nutrition substances which used the foliar application of nitrogen + calcium and/or nitrogen + potassium recorded the heaviest total and early squash yield.

The physical properties of squash fruit followed the same pattern of change like that mentioned before. Whereas, the statistical analysis recorded no great differences within the two mentioned nutrients. These results were true in both experimental seasons. It could be summarized that, the foliar application of squash plant by nutrients i.e., nitrogen + potassium and/or nitrogen + calcium recorded the heaviest total and early yield as well as the best physical fruit quality. This might be attributed to the chemical constituents of the two nutrients. Whereas, nitrogen, potassium and/or calcium plays a major role in plant metabolism and reflected on the plant growth and hence on fruits yield and its physical quality. The previous literature which reported by Al-Saied and Kamal[2], Shaheen *et al*.[8] Shaheen *et al*.[11], Shaheen[23], Saleh *et al*.[24] who reveal that vegetable plants responded positively by the application of some macro and/or micro-elements, as well as the obtained results are in the same line of their direction.

Table 3: Effect of the foliar application of some nutrients on yield and quality of squash plant during the experimental season of 2006.

Application methods	Foliar fertilizers	Physical fruit quality			Fruit yield/plant		Fruit yield (ton /fed)	
		Length (cm)	Diameter (cm)	Average wt (g)	Numbers	Weights (g)	Early	Total
Twice	Control	15.1	2.17	54.4	3.4	261.73	0.581	1.955
	N+Zn	16.57	2.27	67.23	3.5	287.33	0.721	2.179
	N	16.9	2.3	68.6	3.6	296.1	0.853	2.466
	N+Ca	17.63	2.43	72.9	3.7	301.37	1.357	3.188
	N+K	17.1	2.5	77.2	4.07	313	1.15	2.748
	Mean	16.66	2.33	68.07	3.65	291.91	0.929	2.507
Three times	Control	15.67	2.07	54	3.5	314.57	0.645	2.118
	N+Zn	17.8	2.5	74.63	4.53	332.67	1.281	3.215
	N	16.87	2.53	75.83	4.6	324.33	1.228	2.779
	N+Ca	18.4	2.53	83.87	4.63	361.33	2.093	4.511
	N+K	18.67	2.57	82.03	5	415.57	1.665	3.583
	Mean	17.48	2.44	74.07	4.45	349.69	1.383	3.241
Averages	Control	15.38	2.12	54.2	3.45	288.15	0.604	2.037
	N+Zn	17.18	2.38	70.93	4.02	310	1.001	2.697
	N	16.88	2.42	72.22	4.1	310.22	1.041	2.622
	N+Ca	18.02	2.48	78.38	4.17	331.35	1.725	3.85
	N+K	17.88	2.53	79.62	4.53	364.28	1.407	3.166
L.S.D. at 5%	Application methods	0.31	0.03	4.25	0.47	35.53	0.078	0.079
	Foliar fertilizers	0.38	0.16	7.37	0.28	49.28	0.096	0.222
	Interaction	0.54	N.S.	N.S.	0.4	N.S.	0.136	0.314

N.S: Not significant

Table 4: Effect of the foliar application of some nutrients on yield and quality of squash plant during the experimental season of 2007.

Application methods	Foliar fertilizers	Physical fruit quality			Fruit yield/plant		Fruit yield (ton /fed)	
		Length (cm)	Diameter (cm)	Average wt (g)	Numbers	Weights (g)	Early	Total
Twice	Control	15.13	2.17	41.84	3.76	247.77	1.164	3.264
	N+Zn	16.4	2.23	49.49	4.29	289.4	1.427	3.806
	N	17.17	2.3	52.49	4.27	292.66	1.423	3.719
	N+Ca	17.27	2.4	54.49	5.25	305.85	1.438	3.756
	N+K	17.23	2.33	60.57	4.72	357.12	1.478	3.502
	Mean	16.64	2.29	51.78	4.46	298.56	1.386	3.61
Three times	Control	15.5	2.2	45.01	3.91	261.62	1.362	3.241
	N+Zn	17.7	2.53	60.63	5.97	385.99	1.812	4.044
	N	17.8	2.57	63	7.21	401.69	1.818	3.856
	N+Ca	18.07	2.63	63.72	7.89	411.71	1.843	3.919
	N+K	18.23	2.67	68.37	8.71	421.06	2.184	4.469
	Mean	17.46	2.52	60.15	6.74	376.41	1.804	3.906

Table 4: Continue

Averages	Control	15.32	2.18	43.43	3.84	254.69	1.263	3.252
	N+Zn	17.05	2.38	55.06	5.13	337.7	1.62	3.925
	N	17.48	2.43	57.74	5.74	347.17	1.621	3.788
	N+Ca	17.67	2.52	59.11	6.57	358.78	1.641	3.838
	N+K	17.73	2.5	64.47	6.72	389.09	1.831	3.986
L.S.D. at 5%	Application methods	0.52	0.15	2.91	0.09	11.18	0.256	N.S.
	Foliar fertilizers	0.47	0.11	2.88	0.2	14.85	0.238	0.481
	Interaction	N.S.	N.S.	N.S.	0.28	21	N.S.	N.S.

N.S: Not significant

Table 5: Effect of the foliar application of some nutrients on chemical content of squash fruits during the experimental season of 2006.

Application methods	Foliar fertilizers	TSS	%				ppm			
			Protein	N	P	K	Fe	Mn	Zn	Cu
Twice	Control	2.73	4.88	0.78	0.04	0.27	67.67	15.33	16	7.67
	N+Zn	3.1	5.27	0.84	0.05	0.46	70.33	17	22.67	12.67
	N	3.27	5.06	0.81	0.06	0.47	76	19.33	24	13.67
	N+Ca	3.6	5.13	0.82	0.06	0.58	76.33	23.67	25	14
	N+K	3.6	5.23	0.84	0.06	0.59	79.67	27.33	26	15.33
	Mean	3.26	5.11	0.82	0.06	0.48	74	20.53	22.73	12.67
Three times	Control	3.1	5	0.8	0.04	0.42	69	16.67	18.33	8.33
	N+Zn	4.4	5.29	0.85	0.09	0.61	77.33	26.67	26.33	16
	N	4.8	5.5	0.88	0.1	0.66	87.67	28.33	27.67	17
	N+Ca	4.9	5.9	0.94	0.13	0.69	96.33	28.67	28.33	17.33
	N+K	4.9	5.75	0.92	0.09	0.73	95.33	33.33	29	18
	Mean	4.42	5.49	0.88	0.09	0.62	85.13	26.73	25.93	15.33
Averages	Control	2.92	4.94	0.79	0.04	0.35	68.33	16	17.17	8
	N+Zn	3.75	5.28	0.85	0.07	0.54	73.83	21.83	24.5	14.33
	N	4.03	5.28	0.85	0.08	0.56	81.83	23.83	25.83	15.33
	N+Ca	4.25	5.51	0.88	0.1	0.64	86.33	26.17	26.67	15.67
	N+K	4.25	5.49	0.88	0.08	0.66	87.5	30.33	27.5	16.67
L.S.D. at 5%	Application methods	0.36	0.33	0.05	0.01	N.S.	3.52	2.58	1.72	1.74
	Foliar fertilizers	0.42	0.31	0.05	0.02	0.07	6.73	1.98	1.34	1.54
	Interaction	N.S.	N.S.	N.S.	0.02	N.S.	N.S.	2.8	N.S.	N.S.

N.S: Not significant

Table 6: Effect of the foliar application of some nutrients on chemical content of squash fruits during the experimental season of 2007.

Application methods	Foliar fertilizers	TSS	%				ppm			
			Protein	N	P	K	Fe	Mn	Zn	Cu
Twice	Control	2.43	4.69	0.75	0.05	0.33	56	13.33	14.33	7
	N+Zn	2.97	5.27	0.84	0.06	0.44	74	15.33	18.67	8.33

Table 6: Continue

	N	3.63	5.29	0.85	0.07	0.5	75.67	18.67	19.33	9.67
	N+Ca	3.73	5.35	0.86	0.08	0.52	84.67	19.33	20.67	12
	N+K	3.73	5.38	0.86	0.09	0.54	87.33	20	22	15.33
	Mean	3.3	5.2	0.83	0.07	0.47	75.53	17.33	19	10.47
Three times	Control	3.5	4.85	0.78	0.05	0.34	62.67	15	15.67	8.33
	N+Zn	3.83	5.77	0.92	0.09	0.55	89	20.33	23	15.33
	N	3.83	5.83	0.93	0.11	0.59	95.33	23.33	25.33	14.33
	N+Ca	3.87	5.96	0.95	0.12	0.64	97	21.67	26.33	18
	N+K	3.73	6.04	0.97	0.1	0.66	97.67	27	26.67	18.67
	Mean	3.75	5.69	0.91	0.09	0.56	88.33	21.47	23.4	14.93
Averages	Control	2.97	4.77	0.76	0.05	0.34	59.33	14.17	15	7.67
	N+Zn	3.4	5.52	0.88	0.07	0.49	81.5	17.83	20.83	1 1 . 8 3
	N	3.73	5.56	0.89	0.09	0.55	85.5	21	22.33	12
	N+Ca	3.8	5.66	0.91	0.1	0.58	90.83	20.5	23.5	15
	N+K	3.73	5.71	0.91	0.1	0.6	92.5	23.5	24.33	17
L.S.D. at 5%	Application methods	0.4	0.12	0.02	0.02	0.05	4.89	3.38	0.99	1.15
	Foliar fertilizers	0.44	0.25	0.04	0.02	0.05	4.97	2.03	2.03	1.29
	Interaction	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	1.83

N.S: Not significant

The interaction within the two factors i.e., application methods with the foliar nutrition substances, the obtained data showed that, the three times of foliar spraying by nitrogen + potassium recorded the heaviest total and early fruits yield as well as the best physical measurements. The statistical analysis of the obtained data reveals that there no great differences within all the interaction treatments. It might be due to that the two interaction factors act independently.

Nutritional Values: Foliar spraying 3 times with some plant growth nutrition substances for squash plants caused an enhancement in the nutritional values of fruit during the two experiments of 2006 and 2007 as shown in Tables (5 and 6). Whereas, the statistical analysis of the obtained results showed that, the differences within the two application method of foliar sprayings were great enough to reach the 5 % level of significant for all nutritional value measurements except that of Fe content during the 2007 season. It could be concluded that, increasing the number of foliar spraying from 2 up to 3 times resulted the higher chemical content of protein, N, P, K, Fe, Mn, Zn, Cu as well as TSS values. Also, the presented data in Tables (5 and 6) clearly indicate that foliar spraying of some nutrition substances i.e., nitrogen as such or mixed with Ca or K and Zn caused increased the nutritional value of squash fruit compared with the corresponding controls. However, the best values were obtained with that squash plants which sprayed with nitrogen + potassium, followed with descending order by that plants 1 410 sprayed N + Ca and/or nitrogen as individual and lastly by that which supplied by N + Z. It could be concluded that treating squash plant as foliar application by nitrogen + potassium and/or nitrogen + calcium substances resulted the best chemical quality of fruit yield. Whereas, the differences within different treatments of growth promoting substances were significantly at 5% level. The before mentioned results were true in both experimental seasons for all elements of nutritional values. Many other investigators such as Adam *et al*.[20], Faten and Shafeek[25], Yrildirim *et al*.[22] and Al-Said and Kamal[2] who indicated that the application of nutrient elements for some vegetable plants gained an enhancement in mineral uptake, consequently increased its concentrations in plant tissues.

The interaction between application method and treatments of nutritional substances and their effect on the nutritional values of squash fruit during the two experiments of 2006 and 2007 are shown in Tables (5 and 6). Whereas, the response of all nutritional elements (protein, N, P, K, Fe, Mn, Zn and Cu as well as TSS values) recorded no significant variation in both seasons except Cu (1st season) and P and Mn (2nd season).

Generally, in spite the no significant correlation, but the resulted data reveals that, when squash plants were sprayed by nitrogen + potassium and/or nitrogen + calcium at 3 times gave the highest values of all nutritional values.

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