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EFFECT OF SOME GROWTH REGULATORS ON SQUASH GROWTH, YIELD AND CHEMICAL CONTENTS

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ABSTRACT

The present study was conducted on squash plants during the summer of 2006 and 2007 seasons at the Experimental Farm, Faculty of Agriculture, Suez Canal University, Ismailia governorate to study the effects of foliar spray with vit. C, IBA, BA, kinetin and Isatin at various concentrations on squash vegetative growth, leaf pigments, leaves chemical composition, yield and its components and fruit quality under sandy soil condition. Foliar spray with 50, 100 or 150 ppm Isatin gave rise to the highest values of plant length, number of leaves, fresh weight of leaves, fresh weight of stem, total plant fresh weight, dry weight of leaves, dry weight of stem, total dry weight as per plant basis, as well as N, P and K contents. In addition foliar spray with 100 and 150ppm Isatin gave the greatest contents of chlorophyll a, b and total chlorophyll as well as carotenoids. Moreover, 150ppm Isatin gave the highest values of number of fruits per plant, marketable and unmarketable yields and total yield. Foliar spray with vit. C at the concentrations of 150 and 300ppm gave the greatest vit. C content of fruits while Isatin at the concentration of 50, 100 or 150ppm gave the greatest carbohydrate content of fruits. Furthermore, irrespective of substrate concentration. Application of vit. C, BA, kinetin or Isatin gave higher values of the previous characters than foliar spray with disttield water (control).

INTRODUCTION

Squash or summer squash (*Cucurbita pepo* L.) is one of the most popular, oldest and widely used vegetable crops in the world as well as in Egypt.

Vitamin C (ascorbic acid) is an organic compound in higher plants which is required in trace amount to maintain normal growth (Ortli, 1987). The functions of vit. C are reversal of stress effects (temperature and poisons), antioxidants protection of chloroplast and electron transport system. It also, stimulates respiration activities, cell division and many enzymes activities (Ortli, 1987). He also, mentioned that spraying plants with vit. C at 100ppm stimulated plant height and branching of chickpea, cassava and muskmelon and at 20ppm increased plant height and branching of soybean. Spraying tomato plants with vit. C increased number of branches per plant and total dry weight per plant (Midan, 1986). Treating potato tuber with vit. C had significant effect on number of leaves per plant and dry weight per plant (El-Sayed, 1991). Also, foliar spray of tomato plants with vit. C enhanced number of leaves per plant, chlorophyll a, b, total (a + b) as well as carotenoids and N, P and K uptake by different plant parts except P uptake by roots (El-Ghamriny *et al*. 1991).

Indolbutyric acid (IBA) is a synthetic auxin. Isatin (indole-2,3-dione) ($C_8H_5O_2N$) an auxin precursor is slowly converted to an active auxin (Kaur Sawhney *et al*., 1996).

Auxins are involved many physiological processes in plant, such as cellular elongation, phototropism, geotropism, apical dominaceae, root initiation ethylene production, fruit development, pathenocarpy, abscission and sex expression (Arteca, 1995). Amin *et al*. (2006) showed that foliar application of IBA on maize plants had significant effect in increasing plant height, number of leaves per plant, total dry weight per plant and photosynthetic pigments. Yield and total carbohydrate content were significantly increased by increasing IBA concentration up to 100 ppm compared with untrated plants.

Benzyladenine (BA) and kinetin are two major cytokinins involved in many physiological processes in plants such as cell division, organ formation, cell and organ enlargment, retardation of chlorophyll breakdown, and chloroplast development (Arteca, 1995). Vani *et al*. (2004) reported that foliar spray of baby corn with BA increased number of leaves and enhanced yield compared with the control. Foliar spray with kinetin has a considerable effect on increasing number of leaves per plant of cucumber (Das *et al*., 2001), chlorophyll content of cucumber (Plotnikova and Zaitseva, 1986) and yield of eggplant (Gavaskar and Anburani, 2004).

Information on the effects of foliar application with vit. C, IBA, BA kinetin and Isatin on squash growth, yield and its components and fruit quality are limited.

Therefore, this study was conducted to investigate the effects of foliar spray with vit. C, IBA, BA, kinetin and Isatin at various concentrations on squash growth, leaf pigments, leaf chemical composition, yield and its components and fruit quality.

MATERIAL AND METHODS

Two field experiments were carried out during the summer seasons of 2006 and 2007 at the Experimental Research Farm, Faculty of Agriculture, Suez Canal University, Ismailia governorate.

The physical and chemical properties of the experimental soil were: 94.15% and 94.63% sand, 2.26% and 2.77% silt, 3.59% and 2.60% clay, 8.37 and 8.40 pH, 2.10 and 2.19 mmhose/cm, 0.06% and 0.05% OM, 4.22 and 3.89 ppm available N, 4.21 and 4.05 ppm P, 10.77 and 10.40 ppm K in the first and second seasons, respectively.

The experimental design was complete randomized blocks with 3 replicates. The experimental plot area was 12.8m^2 which contained 4 ridges, each was 0.8m in width and 4.0 meter in length. The distance between plants was 30cm. Seeds of Iskandarani cv. were sown in hills on March 15th and 17th of 2006 and 2007 seasons, respectively; then thinned to leave one plant per hill on one side of the ridge. These experiments included 12 treatments i.e vit. C (150 and 300ppm), IBA (50 and 100ppm), BA (25 and 50ppm), Kinetin (25 and 50ppm) and Isatin (50, 100 and 150 ppm) beside a control (distilled water).

Farmyard manure at the rate of 30m^3/fed was added at preparing the soil for plantation. Nitrogen, phosphorus and potassium were added in the

form of ammonium sulphate (20.5% N), Calcium superphophate (15.5% P_2O_5) and potassium sulphate (48% K_2O) at the rate of 500 kg, 350kg and 175kg/fed, respectively. Calcium superphosphate was added at the time of soil preparation with FYM. Amonium sulphate and potassium sulphate were added in three doses at 15, 30 and 45 days after planting. Surface irrigation was applied every two days. The other normal agricultural treatments for growing squash plants were practiced.

Data Recorded:

The following data were recorded during the plant growth and harvesting periods.

1- Vegetative growth characters:

Five plants from each plot were randomly taken at 50 days after sowing and the following data were recorded: plant length, number of leaves per plant, both fresh weight of leaves and stem per plant, total fresh weight of plant. Leaves and stem were dried in an oven for 72hr at 60°C until reaching constant weight for dry weight determination.

2- Leaf pigments:

Disks samples from the fourth upper leaves were taken from each plot at 40 days after sowing to determine chlorophyll a, chlorophyll b and total chorophyll (a + b) as well as carotenoids, according to the methods described by Wettestein (1957).

3- Leaves chemical composition:

The dried leaves were finely ground and digested and total nitrogen was determined according to Bremner and Mulvaney (1992). Phosphorus was estimated colorimetrically according to Olsen and Sommers (1982). Potassium was also determined flame photometrically due to the methods described by Jackson (1970).

4- Yield and its components:

The fruits were harvested at 47 and 50 days after sowing in the first and second season, respectively and at two days intervals. The following parameters were determined: Fruit yield per plant, number of fruits per plant, marketable and unmarketable yields and total yield. Fruit length and diameter were measured in a random samples (10 fruits) from each plot.

5- Fruit quality:

a) Ascorbic acid

2, 6 dichorophenol endophenol titration method was used to determine ascorbic acid in fruits according to the method of A.O.A.C (1970).

b) Total carbohydrate

Fruit carbohydrate was determined following the methods described by Mazumdar and Majumder (2003).

c) TSS

TSS was determined as described by hand refreactometer in 10 fruits per plot.

Statistical Analysis:

Data recorded were subjected to statistical analysis of variance according to Sendecor and Cochran (1980) and means separation were done according to Duncan (1958).

RESULTS AND DISCUSSION

1- vegetative Growth Characters:

Data in Tables (1 and 2) show that foliar spray with Isatin at the concentration of 50, 100 or 100ppm gave the highest values of plant length, number of leaves per plant, fresh weight of leaves per plant, fresh weight of stem, total fresh weight per plant, dry weight of leaves per plant, dry weight of stem and total dry weight per plant in both growing seasons. Also, data in the same tables indicate that, irrespective of spread substance concentrations, folair spray with vit. C, BA, Kinetin or Isatin gave higher values of the previous parameters than the control.

The increasing in vegetative growth parameter of squash with foliar spray with Isatin may be due to its role as an auxin precursor (Kaur Sawbney *et al*., 1996). Auxins are involved in cell elongation, root initiation (Arteca, 1995).

Regarding the effect of vit. C similar results were obtained by El-Ghamriny *et al*. (1999) on tomato, and Bardisi (2004) on garlic where they stated that vit. C enhanced number of leaves per plant and dry weight of plant compared with control.

The favorable effect of foliar spray with vit. C on vegetative growth may be due to increasing cell division and / or enzyme activities (Ortli, 1987).

Concerning effect of BA on vegetative growth characters, the obtained results are in harmony with those of Vani *et al*. (2004), where they reported that baby corn plants sprayed with BA had higher number of leaves per plant than those sprayed with disttiled water.

Regarding effect of kinetin, the obtained results are in harmony with those of Das *et al*. (2001), where they reported that application of kinetin for cucumber gave higher number of leaves per plant compared with the control. Also, Sanaa *et al*. (2006) reported that foliar spray with kinetin on wheat increased plant dry weight compared with control.

The favorable effect of BA and kinetin on squash vegetative growth may be due to inducing cell division, organ formation, cell and organ enlargement and retardation of chlorophyll breakdown (Arteca, 1995).

2- Leaf Pigments:

Data given in Table (3) show that squash plants leaves sprayed with 100ppm or 150ppm Isatin had the highest chlorophyll a and b as well as carotenoids contents in both growing seasons.

Moreover, data reveal that, irrespective of substance concentration, foliar spray with vit. C, BA, Kinetin and Isatin gave higher cholorophyll a and b as well as carotenoids contents than foliar spray with distilled water.

As for the effect of vit. C on leaf pigments, the obtained results are in accordance with those of Plotnilova *et al*. (1986) on cucumber; El-Ghamriny *et al*. (1999) on tomato and Bardisi (2004) on garlic, where they reported that vit. C increased concentration of chlorophyll a, b, total (a+b) as well as carotenoid in leaf tissues compared with foliar spray with distilled water.

Table (1)

Table (2)

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Regarding effect of BA on leaf pigments, Cag *et al*. (2003) reported that application of BA in cucumber was effective in stimulating chlorophyll biosynthesis compared with the control treatment.

With respect to the effect of kinetin on leaf pigments, similar results were obtained by Plotnikova *et al*. (1986) on cucumber; Das *et al*. (2001) on cucumber and Sanaa *et al*. (2006) on wheat, where they stated that foliar spray with kinetin increased chlorophyll content.

3- Leaves chemical composition:

Obtained results (Table 4) indicate that squash plants leaves sprayed with Isatin at the concentrations of 50, 100, or 150ppm had the highest N, P and K contents while plants sprayed with distilled water (control) had the lowest contents of N, P and K in both growing seasons. Also, the results show that foliar spray with vit. C, BA or kinetin increased N, P and K contents of squash leaves in both growing seasons. With concern to the effect of vit. C on the previous parameter. Similar finding was reported by Bardisi (2004) on garlic.

Table (4): Effect of foliar spray with Vit., C., IBA, BA, Kinetin and Isatin at different concentrations on leaf chemical composition of squash during 2006 and 2007 seasons.

Character	N (%)	P (%)	K (%)	N (%)	P (%)	K (%)
Treatment	2006			2007		
Vit. C 150 ppm	1.33 efg	0.210 de	1.15 cd	1.22 bc	0.200 def	1.11 def
Vit. C 300 ppm	1.47 cde	0.225 cde	1.15 cd	1.30 bc	0.218 def	1.14 de
IBA 50 ppm	1.18 fgh	0.209 de	0.90 de	1.15 bc	0.183 ef	0.85 fg
IBA 100 ppm	1.15 gh	0.202 de	0.94 de	1.13 bc	0.187 ef	0.91 efg
BA 25 ppm	1.74 bc	0.257 bcd	1.43 abc	1.60 abc	0.241 cde	1.40 abcd
BA 50 ppm	1.84 b	0.272 bcd	1.48 ab	1.75 ab	0.255 bcd	1.45 abc
Kinetin 25 ppm	1.44 def	0.248 bcde	1.25 bc	1.35 bc	0.227 de	1.24 cd
Kinetin 50 ppm	1.68 bcd	0.252 bcde	1.38 abc	1.60 abc	0.232 de	1.30 bcd
Isatin 50 ppm	2.25 a	0.303 ab	1.55 a	2.10 a	0.296 abc	1.50 abc
Isatin 100 ppm	2.29 a	0.354 a	1.61 a	2.18 a	0.305 ab	1.58 ab
Isatin 150 ppm	2.32 a	0.359 a	1.65 a	2.25 a	0.322 a	1.60 a
Control	1.00 h	0.1796 p	0.77 p	0.95 c	0.164 f	0.75 g

4- Yield and its components

Data recorded in Tables (5 and 6) illustrate that squash plants sprayed with 150ppm Isatin had the highest values of yield per plant, marketable yield, unmarketable yield and total yield, in both seasons. Moreover, data show that there were no significant differences among the treatments concerning fruit length, fruit diameter and number of fruits per plant in both seasons. 150ppm Isatin increased total yield by 35.78% and 48.02% over the control in the first and second seasons, respectively. In general, data show than vit. C, BA, kinetin and Isatin gave higher total yield than distilled water (control). The stimulatory effects of these substance on total yield were previously reported by El-Ghamrint *et al*. (1999) on tomato, Vani *et al*. (2004) on baby corn, Upadhyah *et al*. (2002) on chick pea; Vani *et al.* (2004) on baby corn and Jat and Pushpondra- Singh (2006) on Indian mustared.

Table (5): Effect of foliar spray with Vit., C., IBA, BA, Kinetin and Isatin at different concentrations on yield and its components of squash during 2006 season.

Character / Treatment	Fruit length (cm)	Fruit diameter (cm)	Yield per plant (g)	Number of fruits Per plant	Yield (ton/fed)		
					Marketable	Unmarketable	Total
Vit. C 150 ppm	11.00 a	2.23 a	373.05 b	6.99 a	4.75 cde	0.77 fg	5.53 bc
Vit. C 300 ppm	11.26 a	2.23 a	391.79 ab	7.29 a	4.62 cde	1.16 b	5.79 bc
IBA 50 ppm	10.44 a	2.18	340.39 b	6.63 a	3.98 f	1.09 bc	5.07 bc
IBA 100 ppm	10.78 a	2.21 a	346.92 b	6.63 a	4.14 ef	0.97 bcde	5.12 bc
BA 25 ppm	12.01 a	2.28 a	402.38 ab	7.55 a	5.05 bcd	0.89 defg	5.94 abc
BA 50 ppm	12.25 a	2.29 a	418.29 ab	7.85 a	5.11 bc	1.07 bcd	6.18 abc
Kinetin 25 ppm	11.30 a	2.26 a	394.46 ab	7.16 a	5.01 bcd	0.83 efg	5.84 bc
Kinetin 50 ppm	11.95 a	2.27 a	400.83 ab	7.33 a	4.94 bcd	0.96 cdef	5.90 abc
Isatin 50 ppm	12.33 a	2.48 a	487.03 ab	7.73 a	5.33 bc	0.97 bcde	6.30 abc
Isatin 100 ppm	12.51 a	2.51 a	444.42 ab	8.12 a	5.55 ab	1.07 bcd	6.62 ab
Isatin 150 ppm	12.64 a	2.66 a	504.37 a	9.16 a	6.10 a	1.36 a	7.46 a
Control	10.17 a	2.05 a	341.07 b	6.65 a	4.30 def	0.74 g	5.04 c

Table (6): Effect of foliar spray with Vit., C., IBA, BA, Kinetin and Isatin at different concentrations on yield and its components of squash during 2007 season.

Character / Treatment	Fruit length (cm)	Fruit diameter (cm)	Yield per plant (g)	Number of fruits Per plant	Yield (ton/fed)		
					Marketable	*Unmarketable*	Total
Vit. C 150 ppm	12.01 a	2.75 a	447.93 ab	8.14 a	5.60 cd	1.04 cd	6.64 b
Vit. C 300 ppm	12.28 a	2.77 a	470.79 ab	8.66 a	5.82 bc	1.14 bcd	6.96 ab
IBA 50 ppm	12.28 a	2.56 a	411.00 b	7.85 a	4.87 d	1.21 bc	6.05 b
IBA 100 ppm	11.63 a	2.62 a	413.29 b	7.88 a	4.84 d	1.25 b	6.09 b
BA 25 ppm	12.29 a	2.79 a	483.57 ab	8.89 a	6.04 abc	1.12 bcd	7.16 ab
BA 50 ppm	15.52 a	2.82 a	505.08 ab	9.24 a	6.24 abc	1.22 bc	7.46 ab
Kinetin 25 ppm	12.30 a	2.91 a	474.71 ab	8.63 a	5.79	1.24 bc	7.03 ab
Kinetin 50 ppm	12.45 a	2.91 a	486.49 ab	8.86 a	6.17 abc	1.01 d	7.18 ab
Isatin 50 ppm	12.62 a	2.94 a	515.69 ab	9.37 a	6.31 abc	1.32 b	7.63 ab
Isatin 100 ppm	12.78 a	2.99 a	543.16 a	9.84 a	6.48 ab	1.52 a	8.03 ab
Isatin 150 ppm	12.95 a	3.08 a	550.75 a	10.02 a	6.64 a	1.55 a	8.16 a
Control	12.24 a	2.50 a	405.38 b	7.62 a	4.8 d	1.21 bc	6.01 b

5- Fruit quality:

Data in Table (7) reveal that foliar spray with 50, 100 and 150ppm Isatin gave the greatest total carohydrate percentage in both seasons. Also, foliar spray with 150ppm or 300ppm vit. C gave the highest vitamin C content in the first season. However, there were no significant differences among the treatments concerning TSS % in both seasons and vit. C content in the second season.

As for vit. C application on fruit quality, the results are in harmony with those of Arisha (2000) on potato, where he reported that vit. C had no significant effect on TSS of tuber. Concerning effect of BA on fruit quality, the obtained results are in harmony with those of Vani *et al*. (2004) on baby corn,

where they reported that ascorbic acid content was not significantly affected by the treatment.

Table (7): Effect of foliar spray with Vit., C., IBA, BA, Kinetin and Isatin at different concentrations on fruit quality of squash during 2006 and 2007 seasons.

Character / Treatment	Total Carbohydrate (%)	Vit. C mg/100g Fresh weight	TSS (%)	Total Carbohydrate (%)	Vit. C mg/100g Fresh weight	TSS %)
	2006			2007		
Vit. C 150 ppm	4.06 c	6.65 a	3.65 a	4.70 c	5.80a	4.35 a
Vit. C 300 ppm	4.33 bc	6.67 a	3.62 a	4.82 bc	5.98 a	4.35 a
IBA 50 ppm	3.81 c	4.55 cd	3.69 a	4.22 cd	4.33 a	4.62 a
IBA 100 ppm	3.88 c	4.79 bcd	3.68 a	4.53 c	4.35 a	4.45 a
BA 25 ppm	5.73 a	6.07 abc	3.37 a	5.12 bc	5.01 a	4.18 a
BA 50 ppm	5.73 a	6.25 ab	3.32 a	5.44 bc	5.01 a	4.05 a
Kinetin 25 ppm	5.46 a	6.25 ab	3.59 a	5.00 bc	4.86 a	4.16 a
Kinetin 50 ppm	5.59 a	5.89 abc	3.40 a	5.12 bc	4.96 a	4.10 a
Isatin 50 ppm	6.00 a	6.14 ab	3.26 a	6.15 ab	5.11 a	4.08 a
Isatin 100 ppm	6.26 a	6.26 ab	3.24 a	6.62 a	5.30 a	4.02 a
Isatin 150 ppm	6.58 a	6.43 a	3.20 a	6.87 a	5.38 a	3.85 a
Control	2.61 d	4.26 d	3.70 a	3.19 d	4.11 a	4.65 a

Regarding effect of kinetin, similar results were obtained by Sanaa *et al*. (2006) on wheat, where they stated that kinetin at the concentration of 25 and 50ppm increased carbohydrate content of fruit as compared with control.

The favorable effect of 50, 100 or 150ppm Isatin on total yield could be explained through the role of Isatinin in enhancing plant growth (Table 1 and 2). In addition, it has an indispendable role in photosynthetic pigments formation (Table 3). This in turn, stimulates the net assimilation rate and increase total yield.

In conclusion, the present investigation demonstrated that foliar spray of squash plants with growth promoting substances, especially Isatin at the concentration of 150ppm gave the highest values of plant growth and total yield.

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تأثير بعض منظمات النمو على النمو الخضرى والمحصول والمحتوى الكيماوى للكوسة

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أجريت هذه التجربة خلال موسمى الصيف 2006 و 2007 بالمزرعة التجريبية لكلية الزراعة – جامعة قناة السويس – محافظة الإسماعيلية لدراسة تأثير الرش بفيتامين ج والاندول بيوتريك أسيد والبنزيل أدنين والكينتين والايزتين بتركيزات مختلفة على نمو نباتات الكوسة وصفات الأوراق والتركيب الكيماوى للأوراق والمحصول ومكونات وجودة الثمار وقد أوضحت الدراسة أن الرش بالايزتين بتركيز 50 أو 100 أو 150 جزء/مليون أعطى القيم العليا من طول النبات وعدد الأوراق للنبات والوزن الطازج للأوراق/ نبات والوزن الطازج للساق والورق الطازج الكلى/نبات والوزن الجاف للأوراق / نبات والوزن الجاف للساق والوزن الجاف الكلى ومحتوى الأوراق من النيتروجين والفوسفور والبوتاسيوم، بينما الرش بالايزتين بتركيز 100 أو 150 جزء/مليون أعطى أعلى محتوى للأوراق من كلورفيل أ وكلوروفيل ب والكلورفيلات الكلية والكاروتينات. كما وجد أن الرش بالايزتين بتركيز 150 جزء/مليون أعطى القيم العليا من عدد الثمار/نبات المحصول الصالح للتسويق والمحصول الغير صالح للتسويق والمحصول الكلى. كما أوضحت الدراسة أن الرش بفيتامين ج بتركيزات 150 أو 300 جزء/مليون أعطى أعلى محتوى للثمار من فيتامين ج بينما الرش بالايزتين بتركيز 50 أو 100 أو 150 جزء/مليون أعطى أعلى محتوى للثمار من الكربوهيدرات. علاوة على ذلك فإنه بغض النظر عن تركيز المادة، فالرش بفيتامين ج والبنزيل أدنين والكينتين والايزتين أعطى أعلى القيم للصفات السابقة بالمقارنة بالكونترول.

Table (1): Effect of foliar spray with Vit., C., IBA, BA, Kinetin and Isatin at different concentrations on vegetative growth characters of squash during 2006 season.

Character / Treatment	Plant Length (cm)	Number of Leaves per plant	Fresh weight of leaves (g)	Fresh weight of stem (g)	Total Fresh weight per plant (g)	Dry weight of leaves (g)	Dry Weight of stem (g)	Total dry weight per plant (g)
Vit. C 150 ppm	51.37 abc	15.17 bc	290.19 cd	38.69 b	328.88 bcd	68.44 b	11.91 b	80.35 bc
Vit. C 300 ppm	53.11 abc	16.00 bc	293.80 bcd	40.14 b	335.94 bcd	68.85 b	12.36 b	81.21 bc
IBA 50 ppm	44.52 c	14.13 bc	270.26 d	37.26 b	307.52 cd	65.88 b	11.25 b	77.73 bc
IBA 100 ppm	45.75 bc	14.43 bc	277.49 d	37.87 b	315.36 bcd	66.49 b	11.89 b	78.38 bc
BA 25 ppm	54.58 abc	16.45 abc	345.09 bcd	55.37 a	400.46 bc	78.66 ab	15.34 a	94.00 abc
BA 50 ppm	57.93 abc	16.79 abc	375.40 b	56.22 a	431.62 ab	83.63 ab	15.91 a	99.54 ab
Kinetin 25 ppm	52.00 abc	15.54 bc	305.53 bcd	57.94 a	363.47 bcd	76.97 ab	16.14 a	93.11 abc
Kinetin 50 ppm	56.58 ab	16.60 abc	365.82 bc	55.61 a	421.43 abc	80.28 ab	15.55 a	95.83 abc
Isatin 50 ppm	58.53 a	17.17 abc	465.27 a	60.65 a	525.92 a	97.19 a	16.56 a	113.75 a
Isatin 100 ppm	59.14 a	18.53 ab	469.86 a	62.11 a	531.97 a	97.22 a	16.99 a	114.21 a
Isatin 150 ppm	61.37 a	20.41 a	426.34 a	62.87 a	539.20 a	98.05 a	17.06 a	115.11 a
Control	44.06 c	13.77 c	265.13 d	36.54 b	301.67 d	63.22 b	11.31 b	74.53 c

Table (2): Effect of foliar spray with Vit., C., IBA, BA, Kinetin and Isatin at different concentrations on vegetative growth characters of squash during 2007 season.

Character / Treatment	Plant Length (cm)	Number of Leaves per plant	Fresh weight of leaves (g)	Fresh weight of stem (g)	Total Fresh weight per plant	Dry weight of leaves (g)	Dry Weight of stem (g)	Total dry weight per plant (g)
Vit. C 150 ppm	39.30 bcd	14.01 ab	276.64 bc	36.87 bc	313.51 cdef	66.39 bcd	11.63 bcde	79.02 bc
Vit. C 300 ppm	38.53 cd	14.45 ab	278.26 bc	37.73 bc	315.99 cde	66.74 bcd	11.81 bcd	78.55 abc
IBA 50 ppm	34.42 d	13.15 b	241.50 c	33.46 c	244.96 cf	58.71 d	10.89 de	63.60 c
IBA 100 ppm	34.51 d	13.37 ab	250.73 c	34.55 c	285.28 ef	61.07 cd	11.09 cde	72.16 bc
BA 25 ppm	42.76 abc	14.86 ab	312.41 b	49.33 a	366.74 cd	75.19 abcd	13.94 ab	89.13 abc
BA 50 ppm	44.25 ab	15.54 ab	330.35 b	49.85 a	380.2 cd	77.45 abc	14.52 abcd	91.97 abc
Kinetin 25 ppm	40.53 bc	14.68 ab	244.92 c	47.00 ab	291.92 def	72.66 abcd	13.42 abcd	86.08 abc
Kinetin 50 ppm	42.56 ab	14.75 ab	330.63 b	49.27 a	379.9 bc	75.74 abcd	13.81 abc	89.55 abc
Isatin 50 ppm	44.58 ab	15.57 ab	397.15 a	52.16 a	449.31 ab	84.63 ab	14.60 ab	99.23 ab
Isatin 100 ppm	44.91 ab	16.67 ab	404.03 a	54.04 a	458.07 a	86.25 a	15.34 a	101.59 ab
Isatin 150 ppm	47.44 a	17.42 a	427.21 a	55.54 a	483.25 a	89.67 a	15.70 a	105.37 a
Control	33.64 d	12.72 b	233.89 c	32.15 c	266.04 f	56.16 d	10.73 e	66.89 c

Table (3): Effect of foliar spray with Vit., C., IBA, BA, Kinetin and Isatin at different concentrations on leaf pigments (mg/g fresh matter) of squash during 2006 and 2007 seasons.

Character	Chl. (a)	Chl. (b)	Total Chl.	Carotenoids	Chl. (a)	Chl. (b)	Total Chl.	Carotenoids
Treatment	**2006**				**2007**			
Vit. C 150 ppm	3.635 c	1.548 d	5.203 abc	0.325 cde	3.152 ab	1.327 c	4.479 ab	0.244 defg
Vit. C 300 ppm	3.691 c	1.573 d	5.264 abc	0.344 bcde	3.188 ab	1.343 bc	4.531 ab	0.256 cdefg
IBA 50 ppm	3.584 c	1.481 d	5.065 bc	0.296 de	2.939 ab	1.310 c	4.249 ab	0.222 fg
IBA 100 ppm	3.589 c	1.503 d	5.087 bc	0.309 cde	3.064 ab	1.318 c	4.382 ab	0.226 efg
BA 25 ppm	3.882 ab	1.640 bcd	5.522 abc	0.402 abc	3.418 ab	1.382 abc	4.736 ab	0.270 bcdef
BA 50 ppm	4.006 ab	1.695 abcd	5.701 abc	0.402 abc	3.524 ab	1.403 abc	4.927 ab	0.290 abcd
Kinetin 25 ppm	3.701 bc	1.621 cd	5.396 abc	0.371 abcd	3.353 ab	1.368 abc	4.721 ab	0.261 cdefg
Kinetin 50 ppm	3.734 bc	1.633 bcd	5.367 abc	0.390 abcd	3.403 ab	1.391 abc	4.794 ab	0.282 abcde
Isatin 50 ppm	4.515 ab	1.905 abc	6.420 ab	0.431 ab	3.613 ab	1.620 ab	5.233 ab	0.310 abc
Isatin 100 ppm	4.600 a	1.921 ab	6.521 a	0.456 a	3.737 ab	1.629 ab	5.366 ab	0.326 ab
Isatin 150 ppm	4.667 a	1.935 a	6.602 a	0.461 a	3.755 a	1.641 a	5.396 a	0.334 1
Control	3.494 c	1.425 d	4.919 c	0.273 e	2.851 b	1.307 c	4.158 b	0.208 g