



**EFFECT OF SOME AGRICULTURAL TREATMENTS ON
GROWTH, YIELD AND FRUIT QUALITY OF SUMMER
TOMATOES UNDER MIDDLE EGYPT CONDITIONS**

**A: EFFECT OF 4 - CPA LEVELS ON THE FLOWERING AND
FRUITING STAGE OF GROWTH ON TWO TOMATOES
HYBRIDS**

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Received: 1 Feb. (2016)

Accepted: 7 April (2016)

ABSTRACT

This study was carried out during the two late summer seasons of 2014 and 2015 at the Research Farm of the Faculty of Agriculture, Minia University, Minia/ Egypt. The purpose of the study was to evaluate the effect of 4-chlorophenoxy acetic acid (4-CPA) at four levels i.e.; Zero (control), 40, 80 and 120 ppm on the flowering and fruiting stage of growth for two tomato hybrids (Nema 1400 and Pelateniom 5043). 4-CPA was sprayed twice, the first one at the initial flower clusters and the second one three days later. Data were collected twice during was sprayed twice, the first one at the initial flower clusters and the second one three the flowering and fruiting stage, the first one at full blooming and the second one after fruit maturity.

In general, obtained results could be summarized as follow:

1. The two hybrids of tomatoes showed only significant increase on average No. of fruits/plant and average weight / fruit. Nema 1400 was significantly more superior on the average No. of fruits / plant than Pelateniom 5043, whereas Pelateniom 5043 was significantly higher on the average weight / fruit than Nema 1400, in both seasons.
2. Application of 4-CPA at 120 ppm had significantly increased the percentages of mean No. of flower clusters / plant by 72.6 and 93

and the percentages of mean No. of flowers /plant by 110 and 113, as well as increasing the percentages of mean total yield / fed. by of average weight / fruit by 30.4 and 26.9 as compared with control plants in the first and second seasons, respectively. Although, 4-CPA at 120 ppm had significantly increased average early yield /fed., No. of fruits / plant , fruit length and diameter but their values were lower than that obtained with 4 – CPA at 80 ppm, in both seasons.

3. The interactions of both hybrids with 4- CPA rate at 120 ppm showed the most significant increases with insignificant differences between the mean values of both hybrids on No. of flower clusters / plant , No. of flowers / plant as well as total yield/fed, average length and diameter / fruit , in both seasons. Whereas, the interaction between Nema 1400 and 80 ppm 4 CPA was significantly more superior on the average number of fruits / plant than Pelateniom 5043, in the meantime Pelateniom 5043 with 80 ppm 4 –CPA was significantly higher on the average weight / fruit than Nema 1400 with 80 ppm 4 -CPA, in both seasons. The interactions of the two hybrids with 4-CPA concentrations showed in fruit juice unclear effect on TSS and pH but insignificant effect on Vit.C, in both seasons.

Therefore, it could be concluded that spraying the flower clusters of tomato twice at initial flowering stage and three days later with 4 – CPA at 120 ppm had stimulated the highest total yield and increased early yield with better fruits quality of tomato grown on late summer season and it is recommended for applications under quite similar environmental conditions.

Keywords: Tomato – 4-chlorophenoxy acetic acid – 4-CPA

INTRODUCTION

Tomato is one of the most important vegetable crops grown all over the world. It belongs to the family Solanaceae. Tomato has a significant role in human nutrition because of its rich source of lycopene, minerals and vitamins such as ascorbic acid and b-carotene which are anti-oxidants and promote good health (Wilcox *et al.*, 2003). Tomato plants can grow under a wide range of climatic conditions,

but extremely sensitive to hot and wet growing conditions (Ahmad, 2002). Abdulla and Verkerk., (1968) indicated that high temperature (both day and night) is one of the most limiting factor for tomato production. Picken.,(1984) reported that high day and night temperature above 32°C and 21°C, respectively, was the limiting factor to fruit-set due to an impaired complex of physiological process in the pistil, which results in floral or fruit abscission and poor pollination

that followed by poor fertilization. Shemu *et al.*, (2014) used four levels of 4-CPA (zero, 10, 20 and 30 ppm) on tomatoes and reported a significant difference between plants that received 4-CPA and control plants, on the No. of flower clusters/plant, the highest No. was gained by 4-CPA at 20 ppm. Sasaki *et al.*, (2005) found that synthetic auxin 4-CPA (at 20 ppm reduced pre-harvest fruit drop, increased the No. of fruits / plant and yield. Gemici *et al.* (2006) reported that application of 4-CPA at 5.103 ppm was effective on increasing both yield and quality of tomato. Poliquit and Diputadu (2007) observed that application of 4-CPA at 75 ppm on tomato was more affective during anthesis period than one week after anthesis with increasing the yield and yield components of tomato. Baliyan *et al.*, (2013) used four concentrations of 4-CPA (0, 15, 45 and 75 ppm) on tomato plants and showed that the level of 75 ppm had increased the total yield of plants. Sanada *et al.*, (2011) showed that 4-CPA was applied as a supplement to overcome disadvantages faced tomatoes growers such as reduction in yield and fruits quality. There are significant difference between plants that received 4-CPA at 20 ppm and control plants, 4-CPA had increased the No. of flowers or fruits / plant and total yield compared to control plants as reported by (Shemu *et al.*, 2014 and Rahman *et al.*, 2015), While, Karim *et al.*, (2015) used four doses of 4-CPA (control, 20, 40 and 60 ppm) and found the same results with

4-CPA at 60 ppm than other concentrations. Mahmood and Bahar., (2008) used four levels of 4-CPA (0, 25, 50 and 100 ppm) and reported that 50 ppm dose had increased the average No. of flowers / plant in tomato plants while 100 ppm had increased average No. of fruits and average fruit weight. Also, the individual fruit weight had increased by using 4-CPA at 20 ppm than control (Shemu *et al.*, 2014 and Rahman *et al.*, 2015). Nandwani., (2015) mentioned that there are significant difference between treated and non-treated plants, 4-CPA at 20 ppm had increased the average fruit weight and total yield, whereas fruit juice acidity (pH) did not show any significant difference between those treated with 4-CPA and control plants. Shemu *et al.*, (2014) reported that significant difference between plants that had received 4-CPA at 20 ppm and control plants, on fruit length and fruit diameter. Özgüven *et al.*, (1998) used five different concentrations of 4-CPA (zero, 15, 30, 60 and 90 ppm) and found that the highest yield / plant and good quality fruits were obtained from plants that treated with 4-CPA at 60 ppm. Das *et al.*, (2015) found that 4-CPA at 2000 ppm had increased No. of flowers, total yield, No. of fruits, averages of fruit weight, length and diameter in pepper plants.

Therefore, this study was undertaken to evaluate the impact of 4-CPA at 4 concentrations on the flowering and fruiting parameters of

two tomato hybrids i.e.; (Nema 1400 and Pelateniom 5043), plants grown under high temperature during the late summer seasons at Minia Governorate, Egypt.

MATERIALS AND METHODS

This experiment was carried out at the Research Farm of the Faculty of Agriculture, Minia University, Minia Governorate, Egypt. The study was conducted during the two late summer seasons of 2014 and 2015. Two tomato hybrids i.e.; (Nema 1400 and Pelateniom 5043) were selected for this study.

4- Chlorophenoxy acetic acid (4-CPA) was applied at four concentrations i.e. Control, 40, 80 and 120 ppm on the two tomato hybrids. The two factors of the experiment were laid out in Randomized Complete Block Design (RCBD) in split plot arrangement with three replicates. Each plot area was ~14 m² with three ridges (1.15m width and 4m length) and the spacing was maintained within plant to plant 40 cm. All other agricultural practices of tomato production other than the applied treatments were done as recommended by the Egyptian Ministry of Agriculture

4-CPA was sprayed twice on each flower clusters in two applications for each plant. The first application was applied at the initial stage of flowering and the second one was done three days later. Sprayed was done early in the morning to avoid

rapid drying of the spray solution due to evaporation.

Data were collected from five randomly taken plants from each plot. The productive parameters of growth; viz., No. of flower clusters / plant, No. of flowers / plant, early yield / plant (gm), and / feddan (ton), total yield/ plant (gm), and / feddan (ton), average No. of fruits / plant, average weight / fruit (gm), average length / fruit (mm), and average diameter / fruit (mm). Vitamin c content (mg/100g), pH and total soluble solids (TSS) in the fruit juice were measured.

Data were statistically analyzed with the help of MSTAT-C program to find out the statistical significance of the experimental results. The mean values of all parameters were separated by Duncan's Multiple Range Test (DMRT) at 5% probability.

RESULTS AND DISCUSSION

No. of flower clusters / plant and No. of flowers/ plant.

Data in Table (1) showed insignificant differences between the two hybrids of tomatoes on mean number of flower clusters and number of flowers/ plant, in both seasons. This may be due to its genetic components.

Application of 4- CPA significantly increased the mean number of flower clusters and number of flowers/ plant as compared to control plants, in both seasons. Increasing 4 – CPA concentrations up to the highest level showed the most significant increases on the two parameters, in both seasons

Application of 4-CPA at 120 ppm had significantly increased the percentages of mean number of flower clusters / plant by 72.6 and 93 and the percentages of mean number of flowers /plant by 110 and 113 in the first and second seasons, respectively.

The interactions of the two hybrids and the four levels of 4 – CPA showed significant increases on the two parameters, in both seasons. The most significant increases were obtained from the interaction of both hybrids and 120 ppm 4 –CPA on mean number of flower clusters and number of flowers/ plant in the two seasons. Insignificant differences between their mean values, in both seasons. The interaction of hybrid Nema 1400 with 120 ppm 4 – CPA had increased the percentages of mean number of flower clusters by 69.6 and 85.7 whereas the interaction of hybrid Pelateniom 5043 with 120 ppm 4 –CPA had increased the percentage of this parameter by 75.7 and 100.8 in the first and second seasons, respectively. Meanwhile, the interaction of hybrid Nema 1400 with 120 ppm 4 – CPA had increased the percentages of mean number of flowers / plant by 104 and 100.3, whereas the interaction of hybrid Pelateniom 5043 with 120 ppm 4 – CPA had increased the percentage of this parameter by 115.6 and 126.0 in the first and second seasons, respectively. These results are in harmony with those obtained by shemu *et al.*, 2014, Karim *et al.*, 2015 and Rahman *et al.*, 2015.

Early yield per plant and per feddan.

Data in Table (2) indicated insignificant differences between the two hybrids of tomatoes on mean early yield per plant and per feddan, in both seasons.

Application of 4- CPA significantly increased the mean weight of early yield per plant and per feddan as compared to control plants, in both seasons. Application of 4-CPA at 80 ppm had the most significant increases on early yield, in both seasons. The percentages increases on mean early yield per plant were 51.1 and 79, and per feddan were 50.3 and 78.7 as compared to control plants in the first and second seasons, respectively.

The interactions between two hybrids and the four concentrations of 4 – CPA showed significant increases on the early yield, in both seasons. The most significant increases were obtained from the interaction between both hybrids and 80 ppm 4 –CPA with insignificant differences between their mean values, in both seasons. The interaction between hybrid Nema 1400 and 80 ppm 4 – CPA had increased the percentages of mean early yield per plant by 54.3 and 75.8 whereas the interaction between hybrid Pelateniom 5043 with 80 ppm 4 –CPA had increased the percentage of this parameter by 47.5 and 82.7 in the first and second seasons, respectively. Meanwhile, the interaction between hybrid Nema 1400 and 80 ppm 4 – CPA had increased the percentages of

mean early yield per feddan by 53.3 and 74.9 whereas the interaction between hybrid Pelateniom 5043 with 80 ppm 4 –CPA had increased the percentage of this parameter by 47.5 and 82.7 in the first and second seasons, respectively. The obtained results are in line with Picken.,(1984) who reported that high day and night temperature was the limiting factor to fruit-set due to an impaired complex of physiological process in the pistil, which results in floral or fruit abscission and poor pollination that followed by poor fertilization.

Total yield per plant and per feddan.

Data in Table (3) show insignificant differences between the two hybrids of tomatoes on mean weight of total yield per feddan in the first season. On the contrary, significant difference was obtained between the two hybrids in the second season. This result may be due to variation on some environmental factors between the two seasons which affected the gene expression of the two hybrids.

Application of 4- CPA significantly increased the mean weight of total yield per plant and per feddan as compared to control plants, in both seasons. Increasing 4 – CPA concentrations up to the highest level had increased this parameter, in both seasons. Application of 4-CPA at 120 ppm had increased the percentages of mean total yield per plant by 45.9 and 58.8 and the percentages of mean total

yield per feddan by 45.9 and 58.8 in the first and second seasons, respectively.

The interactions between the two hybrids and the four concentrations of 4 – CPA show significant increases on this parameter, in both seasons. The most significant increases are obtained from the interaction between both hybrids and 120 ppm 4 –CPA on mean total yield, in the two seasons. Insignificant differences between their mean values of this character, in both seasons. The interaction between hybrid Nema 1400 and 120 ppm 4 – CPA had increased the percentages of mean total yield per plant by 47.6 and 67.1 whereas the interaction between hybrid Pelateniom 5043 with 120 ppm 4 –CPA had increased the percentage of this parameter by 44.2 and 50.6 in the first and second seasons, respectively. Meanwhile, the interaction between hybrid Nema 1400 and 120 ppm 4 – CPA had increased the percentages of mean total yield per feddan by 47.7 and 67.1, whereas the interaction between hybrid Pelateniom 5043 with 120 ppm 4 –CPA had increased the percentage of this parameter by 44.1 and 50.6 in the first and second seasons, respectively. These results are compatible with Baliyan *et al.*,(2013) who found that application of 4-CPA at high grade has increased the total yield of tomato and noted that with increasing the 4-CPA concentration, the tomato yield had increased

Average number of fruits per plant and average weight per fruit.

Data in Table (4) indicated significant differences between the two hybrids of tomatoes on average number of fruits per plant and average weight per fruit, in both seasons. Nema 1400 was significantly more superior on the average number of fruits per plant than Pelateniom 5043, whereas, Pelateniom 5043 was significantly higher in the average weight per fruit than Nema 1400, in both seasons.

Application of 4-CPA significantly increased the average number of fruits per plant and average weight per fruit as compared to control plants, in both seasons. Application of 4-CPA at 80 ppm had the most significant increases on the average number of fruits per plant, in both seasons. On the other hand, application of 4-CPA at 120 ppm had the most significant increases on the average weight per fruit. The percentages increases on the average number of fruits per plant with 120 ppm CPA were 21.4 and 42.00 and on the average weight per fruit were 30.4 and 26.9 as compared to control plants in the first and second seasons, respectively.

The interactions between the two hybrids and the four concentrations of 4-CPA showed significant increases on the two parameters, in both seasons. The most significant increases were obtained from the interaction between both hybrids and 80 ppm 4-CPA on the average number of fruits per plant with insignificant differences between their mean values, in both

seasons. In the meantime the interaction between both hybrids and 120 ppm 4-CPA resulted on the highest significant increases on the average weight per fruit with insignificant differences between their mean values, in both seasons. The interaction between hybrid Nema 1400 and 80 ppm 4-CPA had increased the percentages of average number of fruits per plant by 23.3 and 38.8 whereas the interaction between hybrid Pelateniom 5043 with 80 ppm 4-CPA had increased the percentage of this parameter by 18.7 and 46.8 in the first and second seasons, respectively. Meanwhile, the interaction between hybrid Nema 1400 and 120 ppm 4-CPA had increased the percentages of mean average weight per fruit by 35.8 and 35.0, whereas the interaction between hybrid Pelateniom 5043 with 120 ppm 4-CPA had increased the percentages of this parameter by 26.5 and 22.1 in the first and second seasons, respectively. Mahmood and Bahar., (2008) reported that 4-CPA at 100 ppm had increased the average fruits number per plant and average fruit weight of tomato plants. At the same time Das *et al.*,(2015) agreed with these results on pepper plants with application of 2000 ppm 4-CPA.

Average length and diameter per fruit.

Data in Table (5) showed inconsistent results on average length / fruit and average diameter / fruit between the two hybrids of tomatoes, in both seasons. Average length / fruit

showed significant difference in the second season whereas, average diameter / fruit showed significant difference in the first season. This contradictory may be due to any variation in some environmental factors between the two seasons.

Application of 4- CPA significantly increased the average length and diameter per fruit as compared to control plants, in both seasons. Increasing 4 – CPA concentrations up to 120 ppm had significantly increased the average length / fruit, in both seasons. Whereas, this result was true for average diameter / fruit in the first season, Meanwhile 4-CPA at 80 ppm had the most significant increases on this character in the second season.

The interactions between the two hybrids and the four concentrations of 4 – CPA showed significant increases on the two parameters, in both seasons. In general, the most significant increases were obtained from the interaction between both hybrids and 80 ppm 4 –CPA on the average length and average diameter per fruit in the two seasons. Insignificant differences between their mean values, in both seasons. These results are in agreement with Sakar *et al.*, (2014) and Choudhury *et al.*, (2013).

Average T.SS and pH of fruits.

Data in Table (6) show insignificant differences between the

two hybrids of tomatoes in TSS and pH of tomato juice, in both seasons. Application of 4-CPA had significantly increased the mean values of TSS and pH, only in the second season.

On the other hand, the interactions between the two hybrids and the four concentrations of 4 – CPA show significant increases on the two parameters, in both seasons. It seems that 4-CPA at 40 ppm show the most significant increases on the two parameters, in both seasons. This results are on the same approach with the results obtained by YoungHah *et al.*,(2009) and Nandwani.,(2015) .

Average vitamin C.

Data in Table (7) did not show any significant differences between the two hybrids of tomatoes, and the four concentrations of 4-CPA as well as the interaction between the two hybrids with the 4 concentrations of 4- CPA on mean vitamin C, in both seasons.

4-CPA as a promotor growth regulators caused natural sinks for the sprayed parts i.e: the initial flowers, the flower clusters and early fruits, which tends to strengthen these parts in relation to those that unsprayed. Then the movement of assimilation i.e: sugars and amino acids as well as some inorganic ions will more preferentially in the plant toward the sprayed parts which caused sinks for these substances and increased the early yield and the total yield.

Table 1: Effect of applied 4-chlorophenoxy acetic acid (4-CPA) at four concentrations on number of flower clusters / plant and number of flowers / plant on both tomato hybrids grown under the two summer seasons conditions of 2014 and 2015.

Treatments	No. of flower clusters/ plant						No. of flowers /plant					
	2014		mean B	2015		mean B	2014		mean B	2015		mean B
	hybrid1	hybrid2		hybrid1	hybrid2		hybrid1	hybrid2		hybrid1	hybrid2	
Control	21.33b	20.58b	20.96 B	19.75d	19.17d	19.46 C	90.58d	90.92d	90.75 D	91.00de	83.17e	87.08 D
4-CPA 40 ppm	22.33b	25.17b	23.75 B	22.00cd	22.67cd	22.33 C	106.8cd	121.5c	114.2 C	106.3cd	112.00c	109.2 C
4-CPA 80ppm	35.00a	32.50a	33.75 A	29.67bc	26.67cd	28.17 B	183.3a	156.2b	169.8 B	159.8b	154.00b	156.9 B
4-CPA 120ppm	36.17a	36.17a	36.17 A	36.67ab	38.50a	37.58 A	185.2a	196.00a	190.6 A	182.3a	188.00a	185.2 A
mean A	28.71A	28.60A		27.02A	26.75A		141.5A	141.1A		134.9A	134.3A	
LSD A	■	■		■	■		■	■		■	■	
LSD B		NS			NS			NS			NS	
LSD AB		4.792			5.205			14.26			13.84	
		6.777			7.360			20.17			19.57	

Table 2: Effect of applied 4-chlorophenoxy acetic acid (4-CPA) at four concentrations on early yield / plant and early yield / feddan on both tomato hybrids grown under the two summer seasons conditions of 2014 and 2015.

Treatment s	early yield /plant (gm.)						early yield / feddan (ton)					
	2014		mean	2015		mean	2014		mean	2015		mean
	hybrid1	hybrid2	B	hybrid1	hybrid2	B	hybrid1	hybrid2	B	hybrid1	hybrid2	B
Control	1903e	1955e	1929 C	1888de	1789e	1838 D	13.46e	13.68e	13.57 C	13.26de	12.52e	12.89 D
4-CPA 40 ppm	2572c	2293d	2432 B	2096d	2670c	2383 C	18.0bc	16.05d	17.03 B	14.67d	18.69c	16.68 C
4-CPA 80ppm	2946a	2883ab	2915 A	3314a	3269a	3291 A	20.62a	20.18ab	20.40 A	23.19a	22.88a	23.04 A
4-CPA 120ppm	2688bc	2857ab	2773 A	2992b	2939b	2966 B	18.82bc	20.00ab	19.41 A	20.95b	20.57b	20.76 B
mean A	2527A	2497A		2572A	2667A		17.73A	17.48A		18.02A	18.67A	
LSD A	■	■		■	■		■	■		■	■	
LSD B		NS			NS			NS			NS	
LSD AB		158.3			177.8			1.138			1.230	
		223.9			251.5			1.610			1.739	

Values with the same letters (within a column) do not differ significantly according to Duncan's test

Table 3: Effect of applied 4-chlorophenoxy acetic acid (4-CPA) at four concentrations on total yield (gm) / plant and total yield(ton) / feddan of the both tomato hybrids grown under the two summer seasons conditions of 2014 and 2015.

Treatments	total yield / plant (gm.)						total yield / feddan (ton)					
	2014		mean B	2015		mean B	2014		mean B	2015		mean B
	hybrid1	hybrid2		hybrid1	hybrid2		hybrid1	hybrid2		hybrid1	hybrid2	
Control	2838e	2897e	2867 D	2760e	2800e	2780 D	19.86e	20.28e	20.07 D	19.32e	19.60e	19.46 D
4-CPA 40 ppm	3359d	3661c	3510 C	3535d	3526d	3531 C	23.52d	25.63c	24.57 C	24.74d	24.68d	24.71 C
4-CPA 80ppm	3855b	3981b	3918 B	4379b	4148c	4263 B	26.99b	27.87b	27.43 B	30.65b	29.03c	29.84 B
4-CPA 120ppm	4190a	4176a	4183 A	4613a	4216bc	4415 A	29.33a	29.23a	29.28 A	32.29a	29.51bc	30.90 A
mean A	3561A	3679A	■	3822A	3673B	■	24.92A	25.75A	■	26.75A	25.71B	■
LSD A		NS			59.41			NS			0.4157	
LSD B		90.08			127.4			0.6302			0.8922	
LSD AB		127.4			180.2			0.8913			1.262	

Table 4 :Effect of applied 4-chlorophenoxy acetic acid (4-CPA) at four concentrations on average number of fruits/plant and average weight/fruit of both tomato hybrids grown under the two summer seasons conditions of 2014 and 2015.

Treatments	average No. of fruits / plant						average weight / fruit (gm.)					
	2014		mean B	2015		mean B	2014		mean B	2015		mean B
	hybrid1	hybrid2		hybrid1	hybrid2		hybrid1	hybrid2		hybrid1	hybrid2	
Control	42.97c	31.07f	37.02C	41.60cd	27.60f	34.60C	63.37f	93.27c	78.32C	66.37e	101.6b	83.97B
4-CPA 40 ppm	48.80b	34.40e	41.60B	45.00c	34.87e	39.93B	68.87ef	106.4b	87.65B	78.73d	101.1b	89.93B
4-CPA 80ppm	53.00a	36.87d	44.93A	57.73a	40.53d	49.13A	72.73e	108.0b	90.37B	76.10d	102.4b	89.23B
4-CPA 120ppm	48.73b	35.40de	42.07B	51.53b	34.20e	42.87B	86.07d	118.0a	102.1A	89.60c	123.6a	106.6A
mean A	48.38A■	34.43B■		48.97A■	34.30B■		72.76B■	106.4A■		77.70B■	107.2A■	
LSD A		2.138			2.084			2.500			4.608	
LSD B		1.527			2.966			3.969			6.290	
LSD AB		2.160			2.977			5.614			8.896	

Values with the same letters (within a column) do not differ significantly according to Duncan's test

Table 5: Effect of applied 4-chlorophenoxy acetic acid (4-CPA) at four concentrations on average length(mm)/fruit and average diameter(mm)/fruit of both tomato hybrids grown under the two summer seasons conditions of 2014 and 2015.

Treatments	average length / fruit (mm.)						average diameter / fruit (mm.)					
	2014		mean B	2015		mean B	2014		mean B	2015		mean B
	hybrid1	hybrid2		hybrid1	hybrid2		hybrid1	hybrid2		hybrid1	hybrid2	
Control	49.65d	48.30d	48.97D	52.05f	64.95c	58.50C	49.76f	58.76e	54.26D	50.59d	53.58c	52.08C
4-CPA 40 ppm	52.98c	54.11c	53.54C	54.97ef	70.20b	62.59B	53.43f	67.68c	60.56C	54.23bc	54.21bc	54.22B
4-CPA 80ppm	58.60a	56.51b	57.55B	56.70e	71.72b	64.21B	60.61de	73.14b	66.87B	57.19ab	57.43ab	57.31A
4-CPA 120ppm	60.33a	59.42a	59.87A	60.77d	79.03a	69.90A	63.88cd	77.78a	70.83A	58.17a	57.05ab	57.61A
mean A	55.39A■	54.58A■		56.12B■	71.47A■		56.92B■	69.34A■		55.04A■	55.57A■	
LSD A		NS			3.900			3.694			NS	
LSD B		1.396			2.644			3.133			2.100	
LSD AB		1.975			3.740			4.431			2.970	

Values with the same letters (within a column) do not differ significantly according to Duncan's test

Table 6: Effect of applied 4-chlorophenoxy acetic acid (4-CPA) at four concentrations on average TSS and pH in tomato juice of both tomato hybrids grown under the two summer seasons conditions of 2014 and 2015.

Treatments	t.ss (%)						pH (%)					
	2014		mean B	2015		mean B	2014		mean B	2015		mean B
	hybrid1	hybrid2		hybrid1	hybrid2		hybrid1	hybrid2		hybrid1	hybrid2	
Control	3.667a b	3.217b	3.442 A	3.583a b	3.200b	3.392B	4.079a b	3.784b	3.931 A	3.923b b	4.072a	3.997B
4-CPA 40 ppm	3.933a	3.567a b	3.750 A	3.800a b	3.667a b	3.733A B	3.945a b	4.277a	4.111 A	3.884b	4.154a	4.019B
4-CPA 80ppm	3.800a b	3.867a b	3.833 A	3.700a b	3.933a	3.817A	4.153a b	4.116a b	4.135 A	4.057a b	4.171a	4.114A B
4-CPA 120ppm	3.467a b	3.433a b	3.450 A	3.667a b	3.700a b	3.683A B	4.162a b	4.169a b	4.165 A	4.213a	4.252a	4.233A
mean A	3.717A ■	3.521A ■		3.688A ■	3.625A ■		4.085A ■	4.086A ■		4.019A ■	4.162A ■	
LSD A		NS			NS			NS			NS	
LSD B		NS			0.3938			NS			0.1319	
LSD AB		0.5846			0.5569			0.4247			0.1866	

Table 7: Effect of applied 4-chlorophenoxy acetic acid (4-CPA) at four concentrations on average Vitamin C content in tomato juice of both tomato hybrids grown under the two summer seasons conditions of 2014 and 2015.

Treatments	Vit.C					
	2014		mean	2015		mean
	hybrid1	hybrid2	B	hybrid1	hybrid2	B
Control	30.20a	30.20a	30.20A	34.70a	28.90a	31.80A
4-CPA 40 ppm	28.40a	30.00a	29.20A	32.00a	32.80a	32.40A
4-CPA 80ppm	28.80a	30.00a	29.40A	31.20a	32.40a	31.80A
4-CPA 120ppm	32.00a	31.20a	31.60A	33.20a	29.20a	31.20A
mean A	29.85A■	30.35A■		32.78A■	30.82A■	
LSD A		NS			NS	
LSD B		NS			NS	
LSD AB		NS			NS	

Values with the same letters (within a column) do not differ significantly according to Duncan's test

It is obvious from this study that application of 4 – CPA at 120 ppm significantly overcome the impair effect of high temperature during the late summer season. Therefore, it could be concluded that spraying the flower clusters of tomato twice at initial flowering stage and three days later with 4 – CPA at 120ppm had stimulated the highest total yield as well as early yield with better fruits quality of tomato grown on late summer season and could be recommended to apply under quite similar environmental condition.

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الملخص العربي

تأثير بعض المعاملات الزراعية علي النمو والمحصول وصفات الثمار علي الطماطم الصيفي

تحت ظروف مصر الوسطي

1- تأثير معدلات الفور كلوروفينوكسي حمض الخليك علي مرحلة النمو الزهري والثمري في اثنين من هجن الطماطم

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أجريت هذه التجربة بالمزرعة البحثية بكلية الزراعة جامعة المنيا / المنيا - مصر خلال موسمي الصيفي المتأخر 2014 - 2015. الغرض من هذه الدراسة تقييم تأثير أربعة تركيزات من الفوركلوروفينوكسي حمض الخليك (صفر و 40 و 80 و 120 جزء في المليون) علي مرحلة النمو الزهري والثمري لاثنتين من هجن الطماطم (نيما 1400 و بلاتينيوم 5043). تم رش الفوركلوروفينوكسي حمض الخليك علي دفتين ، الأولي عند بداية ظهور العناقيد الزهرية والثانية بعد 3 أيام. تم جمع البيانات علي

- مرحلتين خلال مرحلة الأزهار والثمار ، الأولي في طور الازهار الكامل والثانية بعد نضج الثمار . وعموما يمكن تلخيص النتائج المتحصل عليها كالآتي:-
- 1- أظهر كلا من هجيني الطماطم زيادة معنوية علي متوسط عدد الثمار / نبات ومتوسط وزن الثمرة فقط . وقد تفوق النيماتا 1400 علي البلانتينيوم 5043 في متوسط عدد الثمار / نبات بينما زاد وزن الثمرة زيادة معنوية في البلانتينيوم 5043 عن وزن الثمره في النيماتا 1400 لكلا الموسمين .
 - 2- أدي استخدام الفوركلوروفينوكسي حمض الخليك عند 120 جزء في المليون في الموسم الأول والثاني بالترتيب لزيادة النسبة المئوية لمتوسط عدد العناقيد الزهرية / نبات ل 72.6 و 93 وكذلك النسبة المئوية لمتوسط عدد الازهار / نبات ل 110 و 113 زيادة معنوية ، بالإضافة إلي زيادة النسبة المئوية لمتوسط المحصول الكلي / فدان ل 45.9 و 58.8 ، وكذلك زيادة النسبة المئوية لمتوسط وزن الثمرة ل 30.4 و 26.9 مقارنة بنباتات الكنترول. ورغم أن الفور كلوروفينوكسي حمض الخليك عند 120 جزء في المليون أدي لزيادة المحصول المبكر / فدان وعدد الثمار / نبات وطول وقطر الثمرة إلا أن قيم ذلك كانت أقل من المتحصل عليه من الفور كلوروفينوكسي حمض الخليك عند 80 جزء في المليون في كلا الموسمين .
 - 3- وقد أظهر التفاعل بين الهجينين و الفوركلوروفينوكسي حمض الخليك عند 120 جزء في المليون في كلا الموسمين زيادة معنوية علي متوسط عدد العناقيد الزهرية / نبات وعدد الازهار / نبات بالإضافة إلي المحصول الكلي ومتوسط طول وقطر الثمرة لكلا الهجينين . في حين كان التفاعل بين النيماتا 1400 و الفوركلوروفينوكسي حمض الخليك عند 80 جزء في المليون متفوق بشكل أكثر ملاحظه من البلانتينيوم 5043 علي متوسط عدد الثمار / نبات ، وفي نفس الوقت كان البلانتينيوم 5043 والفور كلوروفينوكسي حمض الخليك عند 80 جزء في المليون معنويا أكثر من النيماتا 1400 والفوركلوروفينوكسي حمض الخليك عند 80 جزء في المليون علي متوسط وزن الثمرة. ولم يؤثر التفاعل بين الهجينين وتركيزات الفوركلوروفينوكسي حمض الخليك بوضوح علي T.SS و pH بينما لم يتأثر محتوى الثمار معنويا من فيتامين C في عصير الثمار معنويا في كلا الموسمين .
- وبناء عليه يمكن أن نستنتج أن رش العناقيد الزهرية للطماطم بالفوركلوروفينوكسي حمض الخليك عند 120 جزء في المليون علي مرتين ، عند مرحلة بداية ظهور العناقيد الزهرية وبعدها بثلاثة أيام حدث أعلى زيادة في المحصول الكلي و المحصول المبكر مع تحسن في جودة الثمار للطماطم المنزرعة في الموسم الصيفي المتأخر ، ونوصي بتطبيقها تحت الظروف البيئية المشابهه تماما .