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GROWTH, CHEMICAL COMPOSITION, YIELD AND FRUIT QUALITY OF TOMATO PLANTS AS AFFECTED BY DIFFERENT PESTICIDES

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ABSTRACT: *Two field experiments were performed during the two seasons of 2002 and 2003, to study the effect of different pesticides (insecticide, acaricide and fungicide) on the growth, physiological behavior, yield and fruit quality of tomato (Lycopersicon esculentum Mill L. Supper strain B) plants. The obtained results indicated that, the greatest values for the growth characters represented by plant height and leaf area were obtained with samples taken 35 days after the pesticide treatments. Spraying tomato plants with all of the pesticides significantly decreased growth characters. The highest reduction in plant height and leaf area was achieved by the application of trebon (insecticide). The acaricide (sanmite) and the two fungicides (topsin-M and cupro-antracol) showed respectively higher values with the same growth parameters.*

A highly significant decrease in the concentration of photosynthetic pigments was observed in response to all pesticide treatments. In this respect trebon (insecticide) had a more inhibitory effect than the other pesticides, in addition, there were no significant differences in the effect of both fungicides (topsin-M and cupro-antracol) on photosynthetic pigments concentration.

Total yield and fruit quality as represented by total soluble sugar concentration, total soluble solids (%), total acidity (%), ascorbic acid concentration, carotenoids concentration, dry matter (%), iron, manganese and calcium concentrations significantly decreased as a result of spraying tomato plants with different pesticides. The greatest reduction in yield and fruit quality of tomato plants was caused by treatment with the insecticide (trebon). The acaricide (sanmite) and the two fungicides caused respectively higher yield and fruit quality. The application of different pesticides enhanced the pH value of tomato fruit compared with untreated plants. The highest increment in pH value was observed with the usage of cupro-antracol (fungicide).

Key words: *Tomato plants, pesticides, insecticides, plant height, sanmite, yield, fruit quality, total soluble solids, ascorbic acid.*

INTRODUCTION

Pollution due to toxic chemicals has increasingly become one of the greatest environmental problems of recent times.

The use of pesticides in agriculture to protect crops against insects, plant diseases and pests is currently considered one of the common sources of environmental pollution in Egypt which causes several agricultural problems. Pesticide application can lead to unavoidable inhibition of plant growth. Furthermore, the quality of the agricultural products can also be influenced via pesticides effects.

The intensive application of pesticides may cause even more pronounced adverse effects upon the growth and quality parameters of the field crops and vegetables and may accumulate in plants causing plant toxicity and vegetation damage. These unavoidable effects have attracted the attention of many investigators (Rouchaud *et al.*, 1984; Villanueva *et al.*, 1985 and El-Shahaat, 1993).

Methods of pesticide application which are meant for crop protection may allow considerable amounts of the pesticide chemicals to reach irrigation and drainage water systems e. g., spray drift and arial spraying. These chemicals produce stable residues that can persist or accumulate in the environment, and can also enter plants as polluting chemicals in various ways. Furthermore, when plant foliage is sprayed with organic pesticides, some of these compounds are absorbed into the leaves and may still be present when the crop is harvested for animal or human food. These chemicals may cause diseases and/or changes in fertility and hormones as well as enzymes action in humans (Dix, 1981).

Several investigators studied the effect of pesticides on growth, physiological and chemical characters as well as yield and its composition. Senesi and Loffredo (1994) found that pesticides decreased root length and caused large morphological alterations to roots in pea. Soliman *et al.* (1998) observed that pesticides had a significant effect in decreasing the number of branches in faba bean plants. El-Sherief *et al.* (1999) indicated that insecticides decreased plant height, dry matter percentage and leaf area significantly in okra plants. Many reporters noticed the harmful effect of pesticides on chemical composition of plants such as Zdzislaw and Grzegorz (1989) who stated that pesticides reduced the total protein concentration in potato tubers. El-Shahaat (1993) revealed that insecticides reduced chlorophyll content in cotton plants. Salem (1994) reported that pesticides significantly reduced calcium and magnesium concentrations in bean. Saafan and Mostafa (1995) observed that pesticides decreased growth activators, i.e., cytokinins, auxins and gibberellins, meanwhile increased growth inhibitors, i.e., abscisic acid. Caseley *et al.* (1996) pointed out that pesticides inhibited the activity of some enzymes. El-Sherief *et al.* (1999) noticed that insecticides decreased the concentration of total carbohydrates in okra plants. The negative effect of pesticides on total yield and its

attributes was observed by Henderson and Webber (1993) on bean, Soliman (1995) and Ismail (2000) on wheat; Soliman *et al.* (1998) on faba bean and El-Sherief *et al.* (1999) on lettuce.

The objective of this study was to evaluate the effect of different pesticides (insecticide, acaricide and fungicide) on growth characters, chemical parameters, yield and fruit quality in tomato plants.

MATERIALS AND METHODS

Two field experiments were conducted in the reclaimed agricultural soil in Banger El-Sukkar region at the north-western coast of Alexandria Governorate, during the two successive seasons of 2002 and 2003, to investigate the influence of different pesticides (insecticide, acaricide and fungicide) on the growth characters, chemical composition, yield and fruit quality of tomato (*Lycopersicon esculentum* Mill L. Supper strain B) plants.

Four different pesticides were tested in these experiments:

1- **Etofenprox (trebon) 30% E. C.:** 2-(4-ethoxy phenyl)-2-methyl propyl 3-phenoxy benzyl ether as an insecticide, supplied by Mitsui ToaTsu Chemicals, INC.
2- **Pyridaben (sanmite) 20% W. P.:** 2- tert-butyl-5-(4-tert-butyl benzyl thio)-4-chloropyridazin-3 (2H) one, as an acaricide, supplied by Nissan Chemical Industries Co, Ltd.
3- **Propineb + copper oxychloride (cupro-antracol) 55% W. P.:** [(C1-methyl-1,2-ethanediyl) bis (carbamodthioato) (2-)] = zinc homopolymer, as a fungicide, supplied by Bayer Co, Germany.
4- **Thiophanate-methyl (topsin-M) 70% W. P.:** Dimethyl 4,4-o-phenylene bis (3-thio-allophonate), as a fungicide, supplied by Nippon Soda Co, Ltd of Japan.

The experiments included five treatments:

1- Control.
2- Trebon (insecticide).
3- Sanmite (acaricide).
4- Topsin-M (fungicide).
5- Cupro-antracol (fungicide).

Tomato plants were sprayed after 28 days from planting using 62 ml, 75 g, 300 g and 60 g/100 litres of water for the four tested pesticides, respectively. Spraying was accomplished using a knapsack sprayer equipped with one nozzel.

Tomato seeds were sown on March 6, 2002 and March 3, 2003 in the first and second seasons, respectively. The experiments were distributed in a complete randomized block design with five replicates. The experimental block's area was 1/100 feddan. Soil texture and certain properties of the soil were analyzed according to Page *et al.* (1982) and data are presented in Table

(1). The normal agricultural practices commonly used in growing tomato i.e., irrigation and fertilization were followed.

Table (1): Physical and chemical properties of the soil in the Banger El-Sukkar region

Particle size:	
Sand %	74
Silt %	17
Clay %	9
Soil texture	Sandy loam
EC (dsm^{-1})	1.56
PH	8
Soluble cations (meq/l)	
Ca^{+2}	3.26
Mg^{+2}	2.74
Na^{+}	7.15
Soluble anions (meq/l)	
CO_3^{-2}	2.76
HCO^{-3}	3.14
Cl^{-}	3.11
SO_4^{-2}	10.22
Total carbonate (%)	6.14

After 7, 21 and 35 days from treatment, samples were taken randomly from each of three replicate plants and the following data were recorded :

1-Growth Characters:

Plant height (cm) and leaf area $(m)^2$.

2-Chemical Analysis:

The same above mentioned samples, were used for determination of photosynthetic pigments in the fresh leaves according to Grodzinsky and Grodzinsky (1973), then calculated as mg/100 g fresh weight.

3-Yield and Fruit Quality:

At harvesting time (marketable stage) the tomato fruits were harvested and the total yield was recorded as ton/fed. Twelve ripe tomato fruits from each replicate were taken randomly to estimate:

- Total soluble sugar (mg/100 g fresh weight) as described by Dubois *et al.* (1956).
- Total soluble solids (%) using a hand refractometer.
- Total acidity (%) by the method described by Radwan (1988).
- The pH value of the fruit juices by using pH meter.
- Ascorbic acid concentration (mg/l) according to the method described by Pearson (1970).
- Carotenoids concentration (mg/l) by the method of Ranganna (1978).

-Dry matter (%).

-Iron, manganese and calcium concentrations (mg/l) using the atomic absorption spectrophotometer according to Prasad and Spiers (1978).

The collected data of the two seasons were statistically analyzed using Costat Software (1985). Treatment means were compared based on the revised L. S. D. test at the 0.05 level (Snedecor and Cochran, 1981).

RESULTS AND DISCUSSION

1- Growth Characters:

Data presented in Table (2) indicated that the highest value for plant height was observed with samples taken 35 days after spraying tomato plants with pesticides.

The usage of pesticides significantly decreased the height of tomato plants compared with the control plants. The highest decrease was observed on plants treated with trebon (insecticide). Sanmite (acaricide) showed a less enhanced inhibitory effect. Height reduction caused by trebon reached 19.49% and 15.24 % in the first and second seasons, respectively, compared with the control plants. These results showed that tomato plants were more sensitive to the insecticide (trebon), the acaricide (sanmite) then the fungicides in a descending order. In this connection, Verma *et al.* (1992) working with soybean; El-Sherief *et al.* (1999) with okra and El-Sherief *et al.* (1999) with lettuce found that insecticides had a significant decreasing effect on plant height when compared with untreated plants. Moreover, Hershenhorn *et al.* (1998) as well as Selim and Attalla (2001) pointed out that the height of tomato plants significantly decreased in response to pesticide application. In addition, Soliman *et al.* (1998) mentioned that pesticides decreased plant height in faba bean plants.

Results in Table (3) clearly showed that leaf area of tomato plants was significantly increased with plant age. The samples, which were taken 35 days after pesticide application showed the highest value of leaf area in both seasons.

The usage of the various pesticides under study significantly decreased leaf area compared with the control treatment. In this concern, Selim and Attalla (2001) mentioned that higher rate of pesticide decreased leaf area of tomato plants sharply.

Spraying tomato plants with trebon (insecticide) showed the highest reduction in leaf area. This reduction reached 32.26 % and 27.27 % in the first and second seasons, respectively, compared with the control plants. These results are in full agreement with those achieved by El-Sherief *et al.* (1999) who reported that insecticide treatments significantly decreased leaf area in okra in both seasons.

Table (2): Effect of tested pesticides on the height (cm) of tomato plants measured at different times after pesticide application in two seasons.

Treatments	2002 season				2003 season			
	Days after application				Days after application			
	7	21	35	Mean	7	21	35	Mean
Control	33.05	44.88	54.71	44.22a	36.88	49.76	58.65	48.43a
Trebon	26.23	37.25	43.32	35.60c	30.76	44.25	48.15	41.05c
Sanmite	28.18	39.22	48.33	38.58bc	32.86	45.84	51.86	43.52bc
Topsin-M	31.55	44.12	51.98	42.55ab	34.15	47.33	52.36	44.61abc
Cupro-antracol	32.18	43.15	55.98	43.77 a	36.25	48.14	53.41	45.93ab
Mean	30.29 c	41.73b	50.86 a		34.18c	47.06b	52.89a	
L.S.D. 0.05 (A): between treatments = 4.22527 L.S.D. 0.05 (B): between intervals = 3.27311					L.S.D. 0.05 (A): between treatments = 4.381567 L.S.D. 0.05 (B): between intervals = 3.393946			

Table (3): Effect of tested pesticides on leaf area $(m)^2$ of tomato plants measured at different times after pesticide application in two seasons.

Treatments	2002 season				2003 season			
	Days after application				Days after application			
	7	21	35	Mean	7	21	35	Mean
Control	0.50	0.64	0.72	0.62 a	0.62	0.83	0.94	0.77 a
Trebon	0.36	0.43	0.48	0.42 c	0.44	0.60	0.63	0.56 c
Sanmite	0.40	0.46	0.53	0.46 c	0.47	0.63	0.68	0.59 c
Topsin-M	0.45	0.57	0.64	0.55 b	0.55	0.72	0.78	0.68 b
Cupro-antracol	0.46	0.58	0.65	0.56 b	0.57	0.74	0.80	0.70 b
Mean	0.43 c	0.54 b	0.60 a		0.53 c	0.70 b	0.75 a	
L.S.D. 0.05 (A):between treatments = 0.0493546 L.S.D. 0.05 (B):between intervals = 0.0382299					L.S.D. 0.05 (A):between treatments = 0.053820 L.S.D. 0.05 (B):between intervals = 0.041689			

Data presented in the same Table indicated that there were no significant differences between insecticide and acaricide and among the two fungicides in leaf area value. These results were true in both seasons.

In this work the application of pesticides especially the insecticide caused harmful effect on growth of tomato plants. This negative effect of pesticides on growth may be due to their inhibitory effects on the growth-hormones especially the percentage of gibberellins and auxins in plant tissues (Saafan and Mostafa, 1995) which may be responsible for the inhibition of cell division and/or cell elongation.

2- Chemical Analysis:

Data recorded in Table (4) showed that increasing plant age significantly increased total chlorophyll concentration in all tested treatments in both seasons. These results are in accordance with those reported by El-Sherief *et al.* (1999) who indicated that total chlorophyll concentration in lettuce leaves was increased with increasing time of evaluation.

Results in the same Table revealed that total chlorophyll concentration was significantly decreased in response to the application of all pesticide treatments in both seasons. In this concern, Santakumar and Dass (1983) reported that pesticides decreased chloroplast constituents including chlorophyll in pea and millet. Similar results were obtained by Salem (1994) who found that the concentration of total chlorophyll in bean plants was reduced by using pesticides. In addition, Selim and Attalla (2001) reported that using pesticide sharply decreased total chlorophyll in tomato plants.

Spraying tomato plants with trebon (insecticide) gave the highest significant reduction in total chlorophyll concentration followed by sanmite (acaricide). This highest decrease was 23.16 % and 22.12 % in the first and second seasons, respectively, compared to untreated plants. These results confirmed those reported by Nassef *et al.* (1982 and 1986) on cotton, cowpea and cucumber; El-Shahaat (1993) on cotton and El-Shahaat and Edrisha (1993) on cabbage. All of those studies found that insecticides caused highly decrease in chlorophyll content. Moreover, Abd El-Reheem *et al.* (1991) pointed out that insecticides treated soybean plants showed a significant reduction in net photosynthesis and a consequent decrease in chlorophyll and carotenoids. El-Sherief *et al.* (1999) working with okra and El-Sherief *et al.* (1999) working with lettuce indicated that the total chlorophyll content was decreased by using insecticides.

Results in the same Table indicated that there were no significant differences between both fungicides (topsin-M and cupro-antracol) in their effect on total chlorophyll concentration. The same trend was observed in the second season.

Table (4): Effect of tested pesticides on total chlorophyll concentration (mg/100g fwt.) of tomato leaves measured at different times after pesticide application in two seasons.

Treatments	2002 season				2003 season			
	Days after application				Days after application			
	7	21	35	Mean	7	21	35	Mean
Control	46.25	57.58	66.25	56.60 a	57.56	68.33	78.62	68.17 a
Trebon	34.88	43.25	52.33	43.49 d	44.75	53.18	61.33	53.09 d
Sanmite	38.33	47.44	56.25	47.31 c	48.25	54.26	65.48	55.99 c
Topsin-M	41.18	50.98	60.35	51.17 b	52.66	60.66	72.18	61.83 b
Cupro-antracol	42.02	51.66	61.66	51.78 b	53.58	61.88	73.36	62.94 b
Mean	40.51 c	50.78 b	59.37 a		51.36 c	59.66 b	70.19 a	
L.S.D. 0.05 (A): between treatments = 3.376107 L.S.D. 0.05 (B): between intervals = 2.615121					L.S.D. 0.05 (A): between treatments = 1.87787 L.S.D. o.05 (B): between intervals = 1.45459			

The negative influence of pesticides on chlorophyll concentration may be due to the inhibition of the biosynthesis of aminolevulinic acid or protochlorophyllide reductase as a result of their inhibitory effect on the biosynthesis of gibberellins and cytokinins (Arteca, 1996).

3- Total Yield:

Data presented in Table (5) illustrated that spraying tomato plants with different pesticides negatively affected the total yield of tomato plants compared with untreated plants in both seasons. These results confirmed those reported by Henderson and Webber (1993) who reported that pesticides reduced bean yield by 20% - 35%. McKenzie *et al.* (1991) who revealed that pesticides reduced seed yield of *Phaseolus vulgaris*. Soliman (1995); Ismail (2000) and El-Sherief (2002), all working with wheat, found that pesticides decreased kernels weight. Moreover, Soliman *et al.* (1998) showed that pesticides significantly decreased the yield of faba bean. In addition, Selim and Attalla (2001) reported that total tomato yield was significantly reduced by 50.96% as a result of applying pesticides.

Table (5): Total yield of tomato plants as affected by different pesticides in two seasons.

Treatments	Total yield (ton/fed)	
	2002 season	2003 season
Control	12.98 a	13.94 a
Trebon	9.12 b	9.68 c
Sanmite	10.48 ab	11.44 bc
Topsin-M	11.08 ab	12.08 ab
Cupro-antracol	12.06 a	13.02 ab
L.S.D. 0.05	2.394279	2.09312698

Spraying tomato plants with trebon (insecticide) showed the highest significant decrease in total yield, this decrease was 29.74 % and 30.56 % in the first and second seasons, respectively, compared with untreated plants. In this concern, El-Sherief *et al.* (1999) pointed out that using insecticide significantly decreased total yield of lettuce plants. In addition, Verma *et al.* (1992) mentioned that insecticide decreased the yield of soybean.

Results in the same Table revealed that there were no significant differences in total yield between untreated plants and plants sprayed with acaricide (sanmite) and the two fungicides (topsin-M and cupro-antracol) in the first season. On the other hand, there were no significant differences between control plants and plants sprayed with the two fungicides only in the second season.

4- Quality of Tomato Fruits:

Results recorded in Table (6) indicated that the quality of tomato fruits was significantly affected by all pesticide treatments tested in this work.

It was obvious that the total soluble sugar concentration was reduced significantly with the use of all pesticides. In this context, Ismail (2000) indicated that pesticides decreased total soluble sugars and starch concentration of wheat grains.

The obtained results showed that the highest reduction in total soluble sugar concentration was observed by spraying tomato plants with trebon (insecticide) followed by sanmite (acaricide) and the two fungicides. This highest decrease reached 18.60% and 18.20% in the first and second seasons, respectively, compared with the control plants.

These results may be due to the fact that free pesticides were applied on the plants (ionized form at the surface of plants). When translocated within the plant they would affect the bio-process of nutrients uptake in the different parts of the plant (Salem, 1994 and 1997). Moreover, some nutritional cycles responsible for the nutrient uptake and transport may be inhibited as a result of pesticide interference (Thomas, 1986 and Nofal *at al.*, 1988 and 1993).

The results recorded in Table (6) indicated that total soluble solids (%) was negatively affected by all the tested pesticides. Applying the insecticide (trebon) showed the highest significant decrease in total soluble solids (%). The reduction reached about 12.78% and 15.22% in the first and second seasons, respectively compared with untreated plants. In addition, there were no significant differences between the two tested fungicides (topsin-M and cupro-antracol) in this parameter.

Data in the same Table showed that total acidity (%) was severely inhibited in response to all tested pesticides, especially trebon (insecticide) which caused a reduction of about 42.02% and 41.27% in the first and second seasons, respectively, compared with the control plants. These results are in agreement with those recorded by Harris (1986) on grape vine.

Results presented in the same Table also revealed that spraying tomato plants with different pesticides increased the pH value of tomato fruit juices compared with the control plants. The highest increase (20.21%) was achieved by the application of cupro-antracol followed by topsin (18.35%) (fungicides). There were no significant differences between insecticide and acaricide in pH value. These results were true in both seasons.

Data recorded in Table (6) showed that ascorbic acid concentration was significantly decreased in tomato plants treated with the different pesticides under study. In this connection, Selim and Attalla (2001) observed that pesticide treatment caused a 9.1% decrease in ascorbic acid concentration of tomato fruit.

The obtained results indicated that tomato plants sprayed with trebon (insecticide) showed the highest significant decrease in ascorbic acid concentration. This reduction was 16.33% and 17.74% in the first and second seasons, respectively, compared with untreated plants. Similar results were obtained by El-Sherief *et al.* (1999) on lettuce. They reported that ascorbic acid concentration was decreased by the use of insecticides.

Table (6): Effect of tested pesticides on quality parameters of tomato fruits in two seasons.

Treatments	Total soluble sugar (mg/100g fwt.)		Total soluble solids (%)		Total acidity (%)		pH value		Ascorbic acid concentration (mg/l)		Carotenoids concentration (mg/l)		Dry matter (%)	
	2002	2003	2002	2003	2002	2003	2002	2003	2002	2003	2002	2003	2002	2003
Control	240.4 a	252.9 a	5.71 a	6.44 a	1.19 a	1.26 a	3.76 b	4.08 c	286.33 a	298.56 a	112.56 a	124.25 a	6.54 a	7.76 a
Trebon	195.7 e	206.9 c	4.98 b	5.46 c	0.69 c	0.74 d	4.25 ab	4.44 b	239.58 c	245.60 d	88.18 e	99.86 c	4.12 d	5.23 c
Sanmite	199.8 d	210.0 c	5.12 ab	5.66 c	0.76 bc	0.83 cd	4.34 ab	4.56 b	246.18 c	250.38 d	92.56 d	103.32 c	4.98 c	5.38 c
Topsin-M	208.5 c	220.5 b	5.34 ab	6.08 b	0.88 bc	0.94 bc	4.45 a	4.66 a	268.66 b	282.75 c	103.60 c	118.44 b	5.56 b	6.98 b
Cupro-antracol	212.6 b	223.9 b	5.40 ab	6.18 ab	0.95 b	0.99 b	4.52 a	4.72 a	272.75 b	288.66 b	106.88 b	122.85 ab	5.96 b	7.33 ab
L.S.D. 0.05	2.81	7.20	0.60	0.26	0.13	0.13	0.66	0.13	8.83	5.75	2.63	5.42	0.52	0.73

Data in Table (6) indicated that carotenoids concentration in tomato fruits was significantly reduced by treatment with all tested pesticides. Trebon (insecticide) led to the highest significant decrease in carotenoids concentration (21.66%) compared to the control plants followed by sanmite (acaricide) which caused a reduction of about (17.77%). The second season showed the same trend.

Results recorded in Table (6) showed the effect of pesticides on the dry matter (%) of tomato fruit. It is clear that dry matter (%) was significantly decreased as a result of treating tomato plants with different pesticides. The treatment with trebon (insecticide) caused the highest significant reduction in dry matter (%) compared with untreated plants. This reduction was 37% and 32.60% in the first and second seasons, respectively, compared to the control. There were no significant differences between the two tested fungicides topsin-M and cupro-antracol in their effect on dry matter (%) of tomato fruits.

It was obvious from the results presented in Table (7) that all tested pesticides had a harmful effect on iron (Fe), manganese (Mn) and calcium (Ca) concentrations in tomato fruits. The application of trebon (insecticide) showed the highest significant decrease in the above mentioned elements. The reduction was about 17.47%, 11.61% and 17.73% for iron, manganese and calcium, respectively, in the first season and about 15.22%, 8.37% and 18.74% in the second one compared with untreated plants. Data also revealed that the fungicide (topsin-M) had a more pronounced negative effect on iron, manganese and calcium concentrations in fruits of tomato when compared with the other fungicide (cupro-antracol) under study.

Table (7): Effect of different pesticides on iron, manganese and calcium concentrations in tomato fruits in two seasons.

Treatments	Iron concentration (mg/l)		Manganese concentration (mg/l)		Calcium concentration (mg/l)	
	2002	2003	2002	2003	2002	2003
Control	148.12 a	155.18 a	31.88 a	33.46 a	388.56 a	409.52 a
Trebon	122.25 e	131.56 e	28.18 c	30.66 b	319.65 d	332.76 d
Sanmite	128.33 d	137.33 d	29.33 ab	31.58 ab	336.18 c	356.25 c
Topsin-M	136.56 c	148.18 c	30.26 abc	32.18 ab	358.31 b	382.56 b
Cupro-antracol	140.88 b	151.66 b	31.08 ab	33.22 ab	369.49 b	398.98 a
L.S.D. 0.05	3.7442	2.68788	2.08511	2.76749	13.11933	13.76581

The deleterious effect of pesticides on the total yield and fruit quality of tomato plants may be due in part to their influence on growth parameters and biosynthesis of photosynthetic pigments as shown in Tables 2, 3 and 4. In addition, they can be also attributed to the pesticide inhibitory effects on the uptake and translocation of nutrients such as phosphorus (Hanker *et al.*, 1977) as well as on the activity of some metabolic enzymes (Monssa *et al.* 1990 and Caseley *et al.*, 1996).

It can be concluded that the use of pesticides (insecticide, acaricide and fungicide) can be considered as one of the greatest pollution sources in our environment. They have inhibitory effects on plant growth parameters, chemical composition, total yield and fruit quality of tomato plants. The highest significant effects on most of these characters were observed on tomato plants with trebon (insecticide) followed by sanmite (acaricide). The two tested fungicides showed less detrimental effects than the above mentioned pesticides. There were no significant differences between the two fungicides topsin-M and cupro-antracol in most of the above mentioned characters.

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النمو والتركيب الكيماوي والمحصول وجودة الثمار لنباتات الطماطم تحت تأثير مبيدات مختلفة

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الملخص العربى

أجريت هذه الدراسة فى تجربتين حقليتين فى الاراضى المستصلحة الجديدة بمنطقة بنجر السكر بالساحل الشمالى الغربى لمحافظة الاسكندرية خلال الموسمين الزراعيين ٢٠٠٢ و٢٠٠٣ لدراسة تأثير استخدام بعض المبيدات على صفات النمو الخضرى والصفات الكيماوية والمحصول وجودة الثمار لنباتات الطماطم صنف (Supper strain B). وقد تم استخدام أربعة مبيدات مختلفة هى تريبون كمبيد حشرى وسانميت كمبيد أكاروسى وتوبسين وكبروأنتركول كمبيدات فطرية وذلك بالتركيزات الموصى بها من قبل وزارة الزراعة. وقد أوضحت النتائج مايلى:

- تم الحصول على أعلى قيم لصفات النمو الخضرى المتمثلة فى أطوال النباتات وكذلك مساحة الأوراق بعد ٣٥ يوم من المعاملة بالمبيدات.
- أشارت النتائج أن استخدام المبيدات المختلفة أدى الى حدوث نقص معنوى فى أطوال النباتات وكذلك مساحة الأوراق. وقد أعطى رش نباتات الطماطم بالمبيد الحشرى تريبون اعلى معدل نقص فى أطوال النباتات ومساحة الأوراق تليه المعاملة بالمبيد الأكاروسى سانميت ثم بالمبيدات الفطرية توبسين وكبروانتركول.
- أدت زيادة عمر النباتات الى حدوث زيادة معنوية فى تركيز صبغات البناء الضوئىفى أوراق الطماطم فى حين أن استخدام المبيدات المختلفة أظهر نقصا معنويا عاليا فى تركيز هذه الصبغات مقارنة بالنباتات الغير معاملة وكان لاستخدام المبيد الحشرى تريبون تأثير مثبط قوى على تركيز هذه الصبغات مقارنة بالمبيدات الأخرى المستخدمة. كما أوضحت

النـــتائج أنه لا توجد فروق معنوية فى تأثير المبيدات الفطرية توبسين وكبروانتركول على صبغات البناء الضوئى.

- أوضـــحت الدراسة أن جميع المعاملات باستخدام المبيدات المختلفة أدت الى حدوث نقص معـــنوى فى المحصول الكلى لنبات الطماطم وكذلك صفات الجودة للثمار المتمثلة فى تركيز الســـكريات الذائبة الكلية والنسبة المئوية للمواد الصلبة الذائبة والنسبة المئوية للحموضة الكلـــية وتركـــيز حامض الاسكوربيك وتركيز الكاروتينويدات والنسبة المئوية للوزن الجاف وكذلك تركيز كل من الحديد والمنجنيز والكالسيوم. وقد أدى استخدام المبيد الحشرى تريبون الى حدوث أعلى انخفاض فى المحصول الكلى وصفات الجودة لثمار الطماطم.
- أثبتـــت النـــتائج أن المعـــاملات المخـــتلفة باســـتخدام المبيدات سببت زيادة فى قيمة رقم الحموضـــة فـــى ثمار الطماطم مقارنة بالنباتات الغير معاملة وظهرت أعلى زيادة باستخدام المبيد الفطرى كبروانتركول.