

## **RESULTS AND DISCUSSION**

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### Part I

#### I- Effect of GA<sub>3</sub> on the vegetative growth and flowering of Mercedes Roses plants:

##### I-A- Winter flush:

##### I.A.1. Number of leaves per a flower stem:

Data in Table (1) indicated that the different levels of GA<sub>3</sub> increased the number of leaves per flower stem the plants treated with 300 and 200ppm of GA<sub>3</sub> produced, 14.56 and 13.77 Lvs per flower stem respectively compared to the least number as 11.15 Lvs/flower stem with control plants. GA<sub>3</sub> has a regulatory function and can force numerous functional changes in the plant through the indirect activation of plant components.

Data of (1992/93) clear Table (2) appear similar trend of results to those obtained in (1991/92).

In this connection, *Kijuka, (1963)* stated that treatment with GA accelerated the appearance of the leaves at successive internodes of the essential oil bearing rose. *Nanjan and Muthswany, (1975)*, found that the shoots of *Rosa bourboniana* increased by GA at all concentrations. *El-Dabli et al. (1978)* demonstrated that GA was effective in promoting leaf formation. *Pal and Das (1990)* on *Lilium longiflorum*, stated that GA<sub>3</sub> increased the number of leaves/plant.

##### I.A.2. Fresh and dry weights of a flower stem with leaves in Gms:-

Application of GA<sub>3</sub> at 300 ppm was effective in increasing the fresh weight of flower stem with leaves as 40.63 gms. compared to 39.31 and 36.42 gms with 200 and 0.00 respectively. Table (1).

**Table (1): Effect of GA<sub>3</sub> on the vegetative growth and flowering of Mercedes Roses in the Winter flush of the first season (1991/92).**

Concentration of GA <sub>3</sub> ppm.	No. of Lvs. per flower stem	Fresh wt. of flower stem with leaves gm	Dry wt. of flower stem with leaves gm.	No. of flowers per plant	No. of flowers per m <sup>2</sup>	Mean length of flower stem cm	Mean diameter of flower stem cm	Mean diameter of flower cm	Fresh wt. of flower gm	Dry wt. of flower gm
0.0 ppm	11.15	36.42	8.23	3.31	19.86	52.3	0.81	8.12	8.25	2.11
200 ppm	13.77	39.31	9.92	3.92	23.52	58.1	0.99	8.74	9.94	3.61
300 ppm	14.56	40.63	10.13	4.41	26.46	64.7	1.02	8.95	10.26	3.90
L.S.D at 5%	0.95	1.39	0.75	0.59	2.79	1.85	0.09	0.46	0.55	0.21
1 %	1.23	1.50	0.89	0.73	3.02	2.64	0.13	0.68	0.72	0.26

The treatments which increased fresh weights of flower stem with leaves were the same which produced heavy dry weights in the same Table. The differences among the treatments were significant in both seasons.

Similar results were obtained in the data of 1992/93 Table (2).

*El Shafie (1976)* reported that  $GA_3$  increased length, thickness and fresh weight of Mountezuma roses. On Anemone coronaria, L and Ranunculus asiaticus *Hassan et al. (1985)* found that  $GA_3$  increased the fresh and dry weights of plants.

Generally, it may be concluded that the highest concentration 300 ppm increased the vegetative growth of Mercedes plants. Moreover, the untreated plants gave the least vegetative growth.

#### **I.A.3. Number of flowers per plant:**

Data of (1991/92) in Table (1) reveal that  $GA_3$  at 300ppm concentration gave the maximum number of flowers as 4.41 fls/plant compared to 3.92 flower with  $GA_3$  200 ppm and 3.31 with untreated plants.

Statistical analysis showed significant differences among these treatments during the two seasons concerning number of flower/plant.

Data of (1992/93) in Table (2) reveal that the maximum number of flowers as (4.20 flowers) was obtained with the 200 ppm concentration of  $GA_3$ . The next treatment which gave high number of fls/plant as 3.83 flowers was 300 ppm concentration. The least number of flowers per plant as 2.96 flowers was noticed with control plants.

The results were agree with those obtained by *Van onsen et al. (1962)* who found that the application of  $GA_3$  to tiffany roses accelerated flowering and increased the number of flowers and stem length. *Singh et al. (1991)* found that  $GA_3$  increased the growth, flower yield and number of flower/plant of Tagetes erecta, L.

**Table (2): Effect of GA<sub>3</sub> on the vegetative growth and flowering of Mercedes Roses in the winter flush in the second season (1992/93).**

Concentration of GA <sub>3</sub> ppm.	No. of Lvs. per flower stem	Fresh wt. of flower stem with leaves gm	Dry wt. of flower stem with leaves gm.	No. of flowers per plant	No. of flowers per m <sup>2</sup>	Mean length of flower stem cm	Mean diameter of flower stem cm	Mean diameter of flower cm	Fresh wt. of a flower gm	Dry wt. of flower gm
0.0 ppm	11.74	34.17	7.13	2.96	17.76	54.90	0.85	8.40	7.92	2.46
200 ppm	12.89	35.89	7.18	4.20	25.20	59.40	1.01	8.81	8.73	3.17
300 ppm	13.92	36.74	7.41	3.83	22.98	66.80	1.06	9.09	9.19	3.37
L.S.D at 5%	0.73	0.79	N.S.	0.77	2.37	1.27	0.10	0.39	0.41	0.12
1 %	1.05	1.10	N.S.	1.06	3.09	2.19	0.17	0.61	0.58	0.18

#### I.A.4. Number of flowers per m<sup>2</sup>:

In Table (1) for first season it is clearly noticed that the concentration of GA<sub>3</sub> at 300 ppm increased the number of flower/m<sup>2</sup> as 26.46 fls/m<sup>2</sup>. While the next treatment which gave high number of flowers/m<sup>2</sup> as 23.52 was 200 ppm of GA<sub>3</sub> concentration. The least number was 19.86 fls/m<sup>2</sup> with untreated plants.

In the second season data in Table (2) indicate also that the number of flowers of Mercedes rose significantly increased over the control as a result of GA<sub>3</sub> treatment especially; at 200 ppm with the mean 25.20 fls/m<sup>2</sup>. While the least value resulted from the control treatment which gave 17.76 fls/m<sup>2</sup>. In the meantime the GA<sub>3</sub> at 300 ppm gave the next value reached to 22.98 fls/m<sup>2</sup>. The differences among treatments were significant in both seasons.

#### I.A.5. Mean length of a flower stem in cms:

Data in Table (1) for the first season (1991/92) clear that the GA<sub>3</sub> at 300 ppm significantly increased the length of the flower stem to 64.7 cms compared to 52.3 cm for control plants. The next treatment which gave a longest length of a flower stem as 58.1 cm with GA<sub>3</sub> at 200 ppm concentration.

Results of (1992/93) in Table (2) appear similar results to those obtained in (1991/92). The lowest value was 54.9 cm for the length of a flower stem when the plants were untreated by GA<sub>3</sub> Table (3).

Statistical analysis showed significant differences among the treatments during the two seasons.

According to (*Kogl and Elemo, 1960*). GA may cause cell elongation by the induction of enzymes that weaken the cell walls. Also, the mechanism by which gibberellins might stimulate cell elongation is that the hydrolysis of starch resulting from the production of GA-induced  $\alpha$ -amylase which might increase the concentration of sugar, thus raising the

osmotic pressure in the cell so that water enters the cell and tends to stretch.

#### **I.A.6. Mean diameter of a flower stem. in cms:**

The thickness diameter of a flower stem (1.02 cm) resulted from GA<sub>3</sub> at 300 ppm. While GA<sub>3</sub> at 200 ppm gave the next diameter of a flower stem as 0.99 cms. Control plants produced the thinner diameter of a flower stem as 0.81 cm Table (1). Data in the second season (1992/93) shown in Table (2) appear similar trend of results to those obtained in the first season (1991/92).

Statistical analysis showed significant differences among these treatment during the two seasons.

The results agree with those reported by *Mohamed (1988)* and *El-Shafie (1979)* on roses who found that GA treatment increased the flower stem thickness.

#### **I.A.7. Mean diameter of a flower in cms:**

In Tables (1 and 2) for first and second seasons, it is clearly noticed that the GA<sub>3</sub> at 300 ppm increased the diameter of flowers during the two seasons as 8.95, 9.09 cms, respectively.

The next treatment which gave large diameter of a flower as 8.74 and 8.81 cms was 200 ppm of GA<sub>3</sub> concentration for first and second one respectively.

The least value of flower diameter was 8.12 and 8.40 cm with the control plants in both seasons. The differences among treatments were significant in both seasons. On carnation plants *Amitaba (1990)* reported that GA<sub>3</sub> increased the flower diameter.

### **I.A.8. Fresh and dry weight of a flower in Gms:**

The fresh and dry weights of a flower were also affected with the different concentrations of  $GA_3$  since the heaviest fresh weight of a flower as 10.26 gms/flower was produced with  $GA_3$  at 300 ppm. While 200 ppm gave the next value as 9.94 gms. The least fresh weight as 8.25 gms was noticed with untreated plants. The same trend was observed with the dry matter (Table 1).

Statistical analysis showed significant differences among these treatments during the two seasons.

Table (2) appears similar results of 1992/93 to those obtained in 1991/92. The heaviest fresh and dry weights (9.15 and 3.37 gms) respectively were obtained from plants treated with 300 ppm.

Gibberellins play a role in flowering, probably it is further elaborated into florigen by the plant. Hence, gibberellin can not be the same substance as the florigen but at least it may act as its precursor.

The profounder of "florigen concept", florigen is made up two substances, namely gibberellins and anthesins. The latter are considered to be nitrogen rich compounds.

The accelerating and increasing effect on flowering induced by  $GA_3$  has been shown by many workers such as *El-Shafie et al (1979)* on Queen Elizabeth and Baccara rose Varieties and *Mohamed (1988)* on Roug Meiliand and Baccara roses Varieties. Also *Singh et al (1992)* on *Tagetes erecta* found that  $GA_3$  increased flower yield, flower weight.

### **I.B- Spring flush:**

#### **I.B.I. Number of leaves per a flower stem:**

results in Table (3) indicate that highest concentration of  $GA_3$  at 300 ppm produced that highest number of leaves as 12.47 Lvs/flower the stem. The next treatment-which gave higher number of Lvs as 11.19 Lvs/flower stem was 200 ppm in the meantime control produced only 10.28 Lvs.plant.



**Table (3): Effect of GA<sub>3</sub> on the growth and flowering of Mercedes Roses in the spring flush in the first season (1991/92).**

Concentration of GA <sub>3</sub> ppm.	No. of Lvs. per flower stem	Fresh wt. of flower stem with leaves gm	Dry wt. of flower stem with leaves gm.	No. of flowers per plant	No. of flowers per m <sup>2</sup>	Mean length of flower stem cm	Mean diameter of flower stem cm	Mean diameter of flower cm	Fresh wt. of flower gm	Dry wt. of flower gm
0.0 ppm	10.28	27.25	5.45	3.79	22.74	50.1	0.75	7.93	7.69	2.01
200 ppm	11.19	28.99	5.82	5.91	35.46	54.7	0.88	8.18	8.22	2.95
300 ppm	12.47	30.01	6.05	4.58	27.48	62.9	0.98	8.62	8.71	3.12
L.S.D at 5%	0.81	1.04	0.45	0.51	3.01	1.94	N.S.	0.53	0.43	0.19
1%	1.17	1.33	0.69	0.73	3.93	2.73	N.S.	N.S.	0.58	0.24

Results of second season (1992/93) in Table (4) cleared that the plants which applicated  $GA_3$  at 300, 200 and 00 ppm concentration gave 11.93, 10.12 and 9.31 Lvs/flower stem respectively. Statistical analysis showed significant differences among these treatments during two seasons.

#### **I.B.2. Fresh and dry weights of a flower stem with leaves in Gms:**

It is clear from Table (3) that the fresh weight of flower stem with leaves was heavier with plants treated by 300 ppm concentration as compared with other treatment. Also  $GA_3$  at 200 ppm increased fresh weight of flower stem with leaves as 28.99 gms compared with 27.25 gms for control.

Also, the treatments which increased fresh weight of leaves was the same which produced heaviest dry weight since the concentrations 300, 200, 00 ppm gave 6.05, 5.82 and 5.45 gms dry weight of flower stem with leaves respectively.

Generally, it may be concluded that the highest concentration as 300 ppm produced the best vegetative growth of Mercedes Rose plants. While the control plants gave the least vegetative growth.

Similar results were obtained in the data of (1992/93) Table (4). Statistical analysis showed significant differences among these treatments during both seasons.

#### **I.B.3. Number of flowers per plant:**

Data of number of flowers per plant in 1991/92 Table (3) revealed that  $GA_3$  concentration of 200 ppm gave the maximum number of flowers as compared to other treatments. The number of flowers in this case was 5.91 fls/plant compared to 4.58 flowers with 300 ppm concentration and the least number as 3.79 resulted with the untreated plants. Statistical analysis showed significant differences among these treatments during the two seasons.

Generally, it could be mentioned that using GA<sub>3</sub> at 200 ppm was better than any concentration when the number of flowers were under comparisons.

Data of 1992/93 in Table (4) revealed that maximum number of flowers as 5.32 fls/plant was obtained with the 200 ppm concentration. This moderate concentration was more effective in the first and second season to give maximum number of flowers as compared to other treatments. The result agree with those obtained by *Syamal et al. (1990)* found that increased number of flower/plant of marigold and china aster.

#### **I.B.4. Number of flowers per m<sup>2</sup>:**

Results of season (1991/92) as tabulated in Table (3) show that the concentration of GA<sub>3</sub> at 200 ppm increased the number of flowers per m<sup>2</sup> during the first season as 35.46 fls/m<sup>2</sup>. The least number of flowers/m<sup>2</sup> was 22.74 with the control plants.

The differences among treatments were significant in both seasons and data of second season in Table (4) appear similar results to those obtained in the first season.

The results were agree with those obtained by *Mohamed (1988)* on *Rouge Maland* and *Baccara rose*, *Hassan et al. (1985)* on *Anemone coronaria* and *Ranunculus asiaticus* and *Singh et al. (1992)* on tagetes.

#### **I.B.5. Mean length of a flower stem in cms:**

It is evident from the data presented in Table (1) that GA<sub>3</sub> as 300 ppm treatment recorded significant increase in the length of a flower stem to give 62.9 cm compared to 54.7 and 50.1 cms for 200ppm and control treatments respectively.

Data of (1992/93) in Table (4) appear similar results to those obtained in 1991/92. The longest flower stem (64.1 cms) was obtained from plants treated with GA<sub>3</sub> 300 ppm. While the plants treated

**Table (4): Effect of GA<sub>3</sub> on the vegetative growth and flowering of Mercedes Roses plant in the spring flush of second season (1992/93).**

Concentration of GA <sub>3</sub> ppm.	No. of Lvs. per flower stem	Fresh wt. of flower stem with leaves gm	Dry wt. of flower stem with leaves gm.	No. of flowers per plant	No. of flowers per m <sup>2</sup>	Mean length of flower stem cm	Mean diameter of flower stem cm	Mean diameter of flower cm	Fresh wt. of flower gm	Dry wt. of flower gm
0.0 ppm	9.31	26.53	5.30	2.96	17.76	51.6	0.79	7.14	7.15	2.27
200 ppm	10.12	28.89	5.74	5.32	31.92	57.8	0.90	7.73	8.65	2.79
300 ppm	11.93	30.11	6.02	4.81	28.86	64.1	1.01	8.61	8.93	3.09
L.S.D at 5%	0.66	1.26	0.32	1.08	3.96	1.89	N.S.	0.75	0.36	0.13
1%	1.01	1.54	0.69	1.25	4.31	3.18	N.S.	0.91	0.64	0.18

with 200 ppm gave 57.8 cms length of flower stem whereas control gave only 51.6 cms.

The results agree with those reported by *Hassan et al.* (1980) who found that GA<sub>3</sub> increased flower stem length of roses also *Mohamed* (1988) on Baccara and Rouge Meiliand roses who found that GA<sub>3</sub> increased the flower stem length.

#### **I.B.6. Mean diameter of a flower stem in cms:**

GA<sub>3</sub> treatments as shown in Tables (2 and 4) slightly affected the diameter of flower stem especially with 300 ppm concentration. Control plants were the least treatment in concern. Statistical analysis among these treatments were insignificant.

The results agree with those reported by *El-Shafie* (1979) on Mountezuma roses and *Mohamed* (1988) on Baccara and Rouge Meiliand roses.

#### **I.B.7. Mean diameter of a flower in cms:**

Data in Tables (3 and 4) show that the different levels of GA<sub>3</sub> , during (1991/92 and 1992/93) increased the diameter of flower comparing with control plants. The untreated plants produced 7.93 cms diameter of flower stem while GA<sub>3</sub> at 200 or 300 ppm gave 8.18 and 8.62 cms of diameter of a flower, respectively.

#### **I.B.8. Fresh and dry weights of a flower in Gms:**

Results of season (1991/92) as tabulated in Table (3) show that the heaviest fresh and dry weights of flowers were produced by the concentration of GA<sub>3</sub> at 300 ppm as 8.71, 3.12 gms for fresh and dry respectively, and at 200 ppm gave the fresh and dry weight as 8.22, 2.95 gms. The least ones were noticed with control plants.

Statistical analysis showed significant differences among these treatments during the two seasons.

Results of (1992/93) Table (4) season were in harmony with those of (1991/93) Table (4).

The results are in agreement with those reported by *Zieslin et al.* (1974) who found that GA application increased flower weights of Baccara rose and *Mahamed* (1988) on Baccara and Rouge Meliand Roses.

## **II- Effect of kinetin on the vegetative growth and flowering of Mercedes Roses plants:**

### **II- A- Winter flush:**

#### **II. A.1. Number of leaves per a flower stem:**

The number of leaves per a flower stem was affected by the different rates of kinetin sprayed on plants in both seasons. Since the mean number of leaves per flower stem was 14.31, 14.79 for plants treated with 100 and 200 ppm respectively compared with 11.15 for control plants in the first season Table (5) and it was 13.89, 14.01 for planted treated with 100 and 200 ppm respectively compared with 11.74 for untreated plants in the second season Table (6).

All treatments gave more leaves than control and in most cases the differences were significant at 0.05 and 0.01 levels. It is obvious that kinetin has promoting effect on leaves number which may be due to stimulating of cell division especially on flower stem which give leaves.

Cytokinins have their effects on synthesis of DNA, mRNA and tRNA, since it has a direct effect on regulation of nuclear activity and protein function on the other side, cytokinins control directly enzyme

Table (5): Effect of kintin on the vegetative growth and flowering of Mercedes Roses in the winter flush in the first season (1991/92).

Concentration of kintin ppm.	No. of Lvs. per flower stem	Fresh wt. of flower stem with leaves gm	Dry wt. of flower stem with leaves gm.	No. of flowers per plant	No. of flowers per m <sup>2</sup>	Mean length of flower stem cm	Mean diameter of flower stem cm	Mean diameter of flower cm	Fresh wt. of flower gm	Dry wt. of flower gm
0.0 ppm	11.15	36.42	8.23	3.31	18.86	52.30	0.81	8.12	8.25	2.11
100 ppm	14.31	40.94	10.81	4.22	25.32	56.90	1.09	9.23	9.71	3.89
200 ppm	14.79	41.39	11.23	4.73	28.38	63.10	1.23	9.95	10.60	4.03
L.S.D at 5%	1.02	0.95	0.59	0.88	3.68	1.52	0.26	0.81	0.61	0.26
1 %	1.31	1.18	0.80	1.01	4.37	2.38	0.43	1.09	0.83	0.37

function which reflects on stimulation of cell division with consequence increasing of cell number in tissues.

The above mentioned results agree with those reported by *Idem* (1981) on carnations *El-Kayet* (1987) on marigold plants and *Essa* (1992) on Baccara and Eiffel tower Roses.

## **II.A.2. Fresh and dry weights of a flower stem with leaves in Gms:**

The fresh weight of stem increased by spraying kinetin at different concentrations and the increases were significant with height and moderate concentrations of 100 and 200 ppm in the two seasons of experiment. It is clear also from the data presented in Table (5) that the increase in fresh weight of flower stem and leaves were proportion with the increase of kinetin concentration. So the highest concentration of kinetin resulted in the highest fresh and dry weights. Also similar trend of results was obtained in the second season. Table (6).

It is clear from the results shown in Table (5,6) that kinetin had effect on the dry weight of leaves with flower stem however, the 200 ppm concentration gave the heaviest dry weight of leaves with flower stem as compared to 100 ppm concentration. While the control plants produced the least dry weight of flower stem with leaves. This proves that kinetin may affect the weight through increasing cell division and the assimilation of cell components.

Similar results were obtained in the second season showing a trend of high increases in the dry weight of flower stem with leaves due to the application of kinetin at 200 ppm.

The results agree with those reported by *Essa* (1992) on Baccara and Eiffel Tower roses.



**Table (6):** Effect of kinetin on the vegetative growth and flowerin of Mercedes Roses in the winter flush in the second season (1992/93).

Concentration of kinetin ppm.	No. of Lvs. per flower stem	Fresh wt. of a flower stem with leaves gm	Dry wt. of flower stem with leaves gm.	No. of flowers per plant	No. of flowers per m <sup>2</sup>	Mean length of a flower stem cm	Mean diameter of flower stem cm	Mean diameter of a flower cm	Fresh wt. of a flower gm	Dry wt. of flower gm
0.0 ppm	11.74	34.17	7.13	2.96	17.76	54.9	0.85	8.40	7.92	2.46
100 ppm	13.89	37.03	7.82	4.05	24.30	57.6	1.11	9.65	9.15	3.23
200 ppm	14.01	38.99	8.11	4.91	29.46	64.5	1.27	10.12	9.42	3.91
L.S.D at 5%	1.21	2.09	0.41	0.92	2.81	1.23	0.30	0.76	0.62	0.17
1%	1.97	2.73	0.57	1.04	4.07	1.95	0.45	1.09	0.81	0.28

### II. A.3. Number of flowers per plant:

In the first season, data in Table (5) indicate that number of flowers was increased by the applied concentrations of kinetin; the 200 ppm produced highest number of flowers. The flower number of this case was 42.90% over control, whereas, the 100 ppm concentration gave the next value in this concern as 4.22 fls/plant. The maximum increase due to 200 ppm application was also noticed in the second year, and the results take the similar trend Table (7). These results were with those reported by *Ziestin and Halvey (1976)* *Essa (1992)* on Baccara and Eiffel town roses they found that treatment roses with kinetin increased the development of flowering and blind shoots also, increased breaking of axillary buds and the number of atrophied flower buds.

### II.A.4. Number of flowers per m<sup>2</sup>:

Data presented in Table (5) indicate that the number of flowers per m<sup>2</sup> increased with spraying Mercedes plants with kinetin at different concentration. Kinetin of 100 and 200 ppm resulted in significant increases of the mean number of flowers per m<sup>2</sup> over control. The number of flower per m<sup>2</sup> increased as the kinetin concentration increased. The highest number of flowers per m<sup>2</sup> was obtained with the highest concentration of kinetin 200 ppm. These results come with the same trend to vegetative growth results, since the high concentrations of kinetin produced the plants with high fresh and dry weights.

In the second season data in Table (6) indicate also that the number of flowers/m<sup>2</sup> of Mercedes increased significantly over the control as a result of kinetin treatments especially at 200 ppm with the mean 29.46 fls/m<sup>2</sup>. While the least value resulted from the control treatment which gave 17.76 fls/m<sup>2</sup>.

#### II.A.5. Mean length of flower stem in Cms:

Data in Tables (5,6) clear that kinetin treatments significantly increased flower stem length generally in both seasons due to concentration used which gave more lengths gradually. Generally, the high concentration showed higher length of flower stem. The tallest flower stem length was obtained from treating plants with the high concentration of 200 ppm with the mean of 63.1 and 64.5 cms in both seasons, respectively. While the control gave only 52.3 and 54.9 cms in both seasons respectively. On the other hand, 100 ppm of kinetin produced the next value in this concern as 56.9, 57.6 cms in the first and second season respectively.

Similar results were reported by *Essa (1992)* *Abou-zide and Shereif (1978)* on *Gladiolus*, *Fikry (1983)* on chrysanthemum and *Essa (1992)* on Baccara and Eiffel Tower roses.

#### II.A.6. Mean diameter of flower stem in cms:

The results in Table (5,6) of mean diameter of flower stem was influenced by kinetin and the differences in this respect were significant. The highest concentration 200 ppm gave the maximum diameter of a flower stem as 1.23 cm, whereas, 100 ppm gave the next value in this concern as 1.09 cm compared to control plants which gave the least diameter as 0.81 cm.

Similar trend of results was noticed in the second season although the differences between the results were significant, Table (6).

These effect on the size may be due to many physiological roles of kinetin in plant, the most important one is the stimulation of cell division in apical meristems, cambium and mature tissues such as cortex and pith of intact plant. Also kinetin is thought to increase the synthetic of DNA and mRNA. Similar effects was described by *Catarino (1965)* on *Bryophyllum diagremetianum*, *Poole (1965)* on apple and *Ahmed (1983)* on *Matricaria*

chamomilla who found that kinetin application increased the mean thickness of shoots.

#### **II.A.7. Mean diameter of flower in cms:**

In both seasons data in Table (5 and 6) show that spraying with kinetin at 200 ppm level increased the diameter of a flower over other treatments. The diameter of a flower in this case was 9.95 cms compared to 9.23cm with 100 ppm and the minimum 8.20 resulted with the untreated plants.

Similar results were obtained in the second season, showing a trend similar to first season of kinetin at 200 ppm. And the differences among the results were significant in both seasons.

These effects on the diameter of flower may be due to the increase in petal area and/or the increase in the number of primary petals produced as a physiological phenomenon.

The obtained results are in agreement with many workers as *Jeffcoat (1977)* on carnation and chrysanthemum, *Idem (1981)*, and *Abou El-Ghait* in (1985) carnation. They all found that kinetin treatments increased the flower diameter.

#### **I.A.8. Fresh and dry weights of a flower in Gms:**

It is clear from the results shown in Table (5) that kinetin has an effect on the fresh weight of flowers, however the 200 ppm concentration gave heavier flowers as compared to control. While 100 ppm concentration produced the next value in this respect as 9.71 gms. The control plants gave the least fresh weight of flower as 8.25 gms. This proves that kinetin may affect the weight through increasing cell division and the assimilation of cell components. The statistical analysis prove significance in this respect.

In the second season the fresh weight of flowers increased with kinetin at 200 ppm as 9.42 gms, while 100 ppm produced the next value as 9.15 gms. Also control plants gave the minimum fresh weight of flowers as 7.92 gms and the differences in this respect were significant. Table (6).

As for dry weight of flowers, data in Tables (5,6) illustrated that 200 ppm of kinetin produced the maximum dry weight of flowers as 4.03 gms in the first season. Also in the second season, 200 ppm of kinetin gave the largest dry weight of flower as 3.91 gms. Control plants gave the least dry weight of flower as 2.11 and 2.46 in the first and second season, respectively. The difference among the results were significant in both season.

These effects of cytokinin may be due to the physiological roles in the plants especially, the increasing of cell division and the assimilation of cell components.

Similider trend of results was obtained by *Abdalla et al. (1985)* on *Adonis autumnalis* and *El-Khayat (1987)* on *Tagetes* spp. They all mentioned that the fresh and dry weights of flowers were increased by kinetin application.

## II.B. Spring flush:

### II.B.1. Number of leaves per a flower stem:

Generally, the data on Tables (7,8) show that kinetin at rate of 100 or 200 ppm increase the number of leaves per flower stem as 12.01 and 13.15 Lvs respectively. The control plants produced the lowest number of leaves per flower stem as 10.28 Lvs.

From the above mentioned data it is clear that kinetin has stimulating effect on leaves of Mercedes plants. Data of the next season showed similar trend. These differences among treatments were significant in both seasons. The results obtained are in agreement with those obtained by *Roychoudhuri et al. (1985)* on *Gladiolus* and *Kandeel (1987)* on *Ocimum basilicum*.

Table (7): Effect of kinetin of the vegetative growth and Flowering of Mercedes Roses in the spring flush in the first searon (1991/92).

Concentration of kinetin ppm.	No. of Lvs. per flower stem	Fresh wt. of flower stem with leaves gm	Dry wt. of flower stem with leaves gm.	No. of flowers per plant	No. of flowers per m <sup>2</sup>	Mean length of flower stem cm	Mean diameter of flower stem cm	Mean diameter of flower cm	Fresh wt. of flower gm	Dry wt. of flower gm
0.0 ppm	10.28	27.25	5.45	3.79	22.74	50.1	0.75	7.93	7.69	2.01
100 ppm	12.01	30.16	6.03	5.56	33.36	53.8	1.03	8.48	8.83	2.92
200 ppm	13.15	32.93	6.61	6.48	38.88	60.4	1.16	9.21	9.41	3.43
L.S.D at 5%	0.98	1.14	0.36	0.91	3.89	2.39	0.25	0.43	0.29	0.27
1 %	1.22	1.39	0.57	1.05	4.71	3.25	0.39	0.69	0.51	0.49

### II.B.2. Fresh and dry weights of a flower stem with leaves in Gms:

The data recorded for the fresh weight of Mercedes leaves with flower stem are given in Tables (7,8). The obtained results show clearly that the mean fresh weight was increased significantly by kinetin using in both seasons. In this respect the increase over control plants were 10.67% and 20.84% for 100 and 200 ppm of kinetin respectively in the first season. Data of the next season showed similar trend.

Concerning the dry weight in the same Tables, data demonstrate that the treatments which increased fresh weight of leaves and flower stem were, the same which gave the heaviest dry weight. While the untreated plants produced the least dry weight of leaves with flower stem as 5.45 and 5.03 gms for first and second season, respectively. This differences among treatments were significant in both seasons.

The results are in accordance with those reported by *Al-Badawy (1982)* on *Adonis autumnalis*, *Fikry (1983)* on *Chrysanthemum morifolium* and *Tawfik (1986)* on *Andropogon citratus*. In the meantime *Letham (1967)* reported that exogenously supplied cytokinins affected the transport, accumulation and retention of metabolites in tissues and organs in many plants, and its could induce movement of phosphates from leaf to bud via the phloem. In addition, promotion of nutrients transport in seedling stems was reported by *Seth and Wareing (1964)*. These biochemical effects induced by exogenous cytokinins in leaf and leaf disks included promotion of protein, RNA lipid and starch synthesis as mentioned by *Mothes (1964)*.

### II.B.3. Number of a flowers per plant:

Results of number of flowers per plant in the first season Table (7) mentioned that the concentration of kinetin at 200 ppm gave the maximum number of flowers as 6.48 fls/plant compared to 5.56 flowers with 100 ppm of kinetin. While the control plants produced the minimum as 3.79

**Table (8):** Effect of kinetin on the vegetative growth and flowering of Mercedes Roses in the spring flush in the second season (1992/93).

Concentration of kinetin ppm.	No. of Lvs. per flower stem	Fresh wt. of flower stem with leaves gm	Dry wt. of flower stem with leaves gm.	No. of flowers per plant	No. of flowers per m <sup>2</sup>	Mean length of flower stem cm	Mean diameter of flower stem cm	Mean diameter of a flower cm	Fresh wt. of flower gm	Dry wt. of flower gm
0.0 ppm	9.31	26.53	5.30	3.91	23.46	51.6	0.79	7.14	7.15	2.27
100 ppm	10.78	29.99	6.01	5.69	34.14	55.7	1.05	8.19	8.92	3.01
200 ppm	12.34	31.35	6.39	6.71	40.26	62.9	1.18	9.05	9.13	3.52
L.S.D at 5%	0.79	1.01	0.39	0.89	4.13	1.24	0.21	0.61	0.54	0.29
1%	1.03	1.31	0.68	1.02	5.79	2.11	0.38	0.86	0.76	0.40



fls/plant. Similar data were obtained in the results of second season Table (8). Statistical analysis showed significant differences among these treatments during the first and second seasons.

These results are in agreement with those reported by *El-Khayat (1987)*, *Radwan (1988)* on *Tagetes erecta*. They found that kinetin treatments caused an increment in the mean number of flowers which may be due to that kinetin had a promoting effect on branching due to stimulating the cell division; especially, on lateral shoots which gave more flowers. On the other hand that may be also attributed to some retardation of the apical dominance; hence, the lateral buds which usually remain arrested were pushed to develop shoot flowers as been suggested by *Parups (1970)*.

#### **II.B.4. Number of flowers per m<sup>2</sup>:**

In (1991/92), data in Table (7) indicate that the number of flowers per m<sup>2</sup> was increased by the applied concentrations of kinetin the 200 ppm produced highest number of flowers per m<sup>2</sup>. The flower number in this case was 38.88 whereas, the 100 ppm gave 33.36 fls/m<sup>2</sup>. While control plants produced the least number of flowers/m<sup>2</sup> as 22.74.

Results in the second season illustrated that kinetin at 200 ppm produced the highest number of flowers per m<sup>2</sup>.

The flower number with the 300 ppm treated plants 71.61% over control whereas, the 100 ppm concentration produced 45.51% over untreated plants.

The differences among treatments were significant in both seasons.

#### **II.B.5. Mean length of a flower stem in cms:**

It is obvious from the results in Tables (7,8) that plants which were sprayed with kinetin at all concentrations gave significantly taller flower stem length as compared with untreated plants. Application of kinetin at

200, 100 or 0.0 produced 62.9, 55.7 and 51.6 cms of flower stem length, respectively in the first season.

Data of (1992/93) shown in Table (8) appear similar trend of results to those obtained in 1991/92. The differences among treatments were also significant in.

Some investigators stated that kinetin had clear influence on stem elongation through its action on cell division, cambial activity in the stem and stem growth; as *Abou-Zide and El-Shereef (1978)* on *Gladiolus* *Fikry (1983)* on chrysanthemum and *El-Khayat (1987)* on *Tagetes* spp. mentioned.

#### **II.B.6: Mean diameter of a flower stem in cms:**

Kinetin application as shown in Tables (7,8) has a effected treatly the diameter of flower stem. Kinetin at 200 ppm produced the largest diameter of a flowers stem as 1.16, 1.18 cm while kinetin at 100 ppm produced the next value as 1.03, 1.05 cm, of the first and also control plants gave the least diameter of a flower stem as 0.75, 0.79 cms in the first and second season, respectively. Statistical analysis among these treatments were significant in both seasons.

The results herein are harmony with those obtained by *Catarino (1964)* on *Bryophyllum diagelessianum*, *Poole (1965)* on apple and *Ahmed (1983)* on *Matricaria chamomilla*.

#### **II.B.7. Mean diameter of a flower in cms:**

Results in Tables (7,8) show that the different concentrations of kinetin during both seasons increased the diameter of flower comparing with untreated plants. Kinetin at 100 or 200 ppm produced 8.48, 9.21 cm of diameter of a flower respectively while the control plants gave 7.93 cm in the first season.

Data in the second season shown in Table (8) appear similar trend of results to those obtained in the first one. The differences among the treatments were significant in both seasons. Similar effect was described by *El-kahyat (1987)*, *Das et al. (1975)*. On *Tagete erecta* and *Accat et al. (1979)* on carnation.

#### **II.A.8. Fresh and dry weights of a flower in Gms:**

Data in the first season as tabulated in Table (7) show that the heaviest fresh and dry weights of flower were gave by kinetin treated plant at 200 ppm as 9.41, 3.43 gms respectively while kinetin at 100 ppm produced the second value as 8.83, 2.92 for fresh and dry weights of flower respectively, on the other hand control plants gave the minimum fresh and dry weights as 7.69, 2.01 gms respectively. Statistical analysis showed significant differences among these treatments during the first and second season.

Data of (1991/92) season were in harmony with those (1992/93) Table (8).

This proves that kinetin may affect the weight through increasing cell division and the assimilation of cell components.

The results agree with those reported by *Essa (1992)* on Baccara and Eiffel tower roses *El-Kayet (1987)* on *Tagetes* sp. and *Reda (1982)* on *Ammi visnaga*.

### **III:Effect of Pacrobutrazol on the vegetative growth and flowering of Mercedes Roses plants:**

#### **III.A. Winter flush:**

##### **III.A.1. Number of leaves per a flower stem:**

The results in Table (9,10) cleared that the number of leaves per flower stem increased by treating with medium concentration of 100 ppm than any other treatments in both seasons with the means of 12.98, 12.76 leaves per flower stem in the two seasons, respectively.

Table (9): Effect of Pacrobutrazol on the vegetative growth and flowering of Mercedes Roses in Winter fush in the first season (1991/92).

Concentration	No. of Lvs. per : flower stem	Fresh wt. of flower stem with leaves gm	Dry wt. of flower stem with leaves gm.	No. of flowers per plant	No. of flowers per m <sup>2</sup>	Mean length of. flower stem cm	Mean diameter of : flower stem cm	Mean diameter of a flower cm	Fresh wt. of flower gm	Dry wt. of flower gm
0.0 ppm	11.15	36.42	8.23	3.31	19.86	52.30	0.81	8.12	8.25	2.11
100 ppm	12.98	37.52	8.81	4.80	28.80	53.20	1.15	9.64	10.03	3.93
200 ppm	12.07	38.79	9.12	5.17	31.02	50.60	1.29	10.08	10.72	4.31
L.S.D at 5%	0.99	1.02	0.29	0.71	1.28	0.86	0.16	0.39	0.43	0.27
1%	1.28	1.23	0.55	0.89	1.97	1.09	0.33	0.65	0.69	0.38

The next treatment was 200 ppm with the means of 12.07 leaves in the first season and 11.85 leaves per flower stem in the second one. While the control plants gave lower values than the other treatments with the mean of 11.15 and 11.74 leaf per flowers stem in the two seasons, respectively as shown in Tables (9,10). The differences among the treatments were significant. The results in the study were in harmony with those mentioned by *Essa (1992)* on Baccara and Eiffel Tower roses, *Rusch et al. (1987)* on *Hydrangea macrophylla*. They all found that Paclobutrazol application at 100 ppm increased the leaf production.

### III.A.2. Fresh and dry weights of a flowers stem with leaves in Gms:

Tables (9,10) summarized the average changes in the fresh weight of Mercedes rose leaves with lower stem by using Paclobutrazol which was significantly increased by increasing the level in both seasons. The high concentration gave the highest value with the means of 38.79 gms in the first season and 37.01 gms in the second one. While the untreated plants gave only 36.42 and 34.17 gms in the two seasons, respectively. The differences between the treatments and the control was significant in both seasons. The above mentioned results are in agreement with *Essa (1992)* on Baccara and Eiffel Tower roses who found that paclobutrazol at 200 ppm increased the fresh weight of leaves. Also *Mohamed and El-Desouky (1992)* on *chlorophytum comosum* and *Pepromia clustiifolia*, they found) that PP<sub>333</sub> increased the fresh weight of vegetative growth.

It is clear from the obtained data in tables (9,10) that the dry weight of Mercedes rose leaves with flower stem was markedly increased by Paclobutrazol treatments in both seasons of study. The highest value was obtained by spraying the plants with 200 ppm in both seasons. The mean were 9.12 and 8.07 gms in the first and second one, respectively. While the treatment 100 ppm gave the medium value in this respect. The means were 8.8, 7.41 gms in two seasons compared with 8.23, 7.13 gms for

**Table (10): Effect of Pacrobutrazol on the vegetative growth and flowering of Mercedes Roses in the winter flush in the second season (1992/93).**

Concentration	No. of Lvs. on flower stem	Fresh wt. of flower stem with leaves gm	Dry wt. of flower stem with leaves gm.	No. of flowers per plant	No. of flowers per m <sup>2</sup>	Mean length of flower stem cm	Mean diameter of flower stem cm	Mean diameter of flower cm	Fresh wt. of flower gm	Dry wt. of flower gm
0.0 ppm	11.74	34.17	7.13	2.96	17.76	54.1	0.85	8.40	7.92	2.46
100 ppm	12.76	35.09	7.41	4.29	25.74	55.6	1.19	10.09	9.49	3.87
200 ppm	11.85	37.01	8.01	5.32	31.92	51.8	1.32	10.25	9.93	4.18
L.S.D at 5%	0.53	0.60	0.19	0.82	4.01	0.67	0.17	0.75	0.42	0.30
1 %	0.84	0.81	0.38	1.01	5.49	0.88	0.34	1.01	0.68	0.4

control in first and second season, respectively the differences among the treatments were significant.

Similar findings were reported by *Essa (1992)* on Baccara and Eiffel Tower roses, *Sansavini and Bonomo (1986)* on apple trees. They found that pp 333 caused an increase in the dry matter.

### II.A.3: Number of flowers per plants:

The obtained data in Tables (9,10) show that the paclobutrazol treatments markedly increased the number of flowers per plant by increasing the concentration in the first and second seasons. The highest mean number was flower/ plant obtained from Plants treated with the high concentration of 200 ppm, which reached means were 5.17 and 5.32 flowers per plant in both seasons respectively. While, the other treatments at 100 ppm gave the means numbers of 4.80, 4.29 flowers in the two seasons. In the meantime the control plant gave which were the lowest values to 3.31 and 2.96 flowers per plant in the two seasons.

Many investigators such as *Essa (1992)* on Baccara and Eiffel Tower rose, *Kim et al. (1986)*, *Tymoszuk and Mike (1986)* on apple, *Stamps and Henny (1986)* on Episica and *Wilkinson and Richards (1987)* on *Bauvardia humboldt*, they found that paclobutrazol increased the number of flowers per plant.

### III.A. 4. Number of flower per m<sup>2</sup>.

The results in Tables (9,10) cleared that the average of flowers per m<sup>2</sup> had been responded significantly to the concentration of paclobutrazol application. The highest values were obtained when treating the plants with the highest concentration in both seasons. The values in the concern were 31.02 flowers/m<sup>2</sup> in the first season and 31.92 flowers in the second. While the control plants gave value the means of 19.86 and 17.76 flower only in the first and second seasons, respectively.

### III.A.5: Mean length of a flower stem in cms:

Tallest flower stem length was obtained from plants treated with the lower concentration of paclobutrazol. The means lengths 53.6 cm in the first season and 55.6 cm in the second one Tables (9,10). On the other side, the shortest shoots were resulted from the high concentration of 200 ppm of paclobutrazol with mean of 50.6 and 51.8cm in the first and second seasons respectively. The mean length of the Flower stem of the control plant was 52.3 & 54.1 cm in the first and second seasons respectively. The differences among the treatments were significant.

Generally, it can be said that the flower stem length of Mercedes rose decreased with increasing the paclobutrazol concentration. The above mentioned results are in harmony with those obtained by *Rusch et al. (1987)* on *Hydrangea macrophylla* and *Rusch et al. (1990)* on *Fuchsia* and *Tibouchina*. They all found that application of paclobutrazol reduced the length of flower stem especially with the high concentration.

### III.A.6: Mean diameter of flowers stem in cms:

From the results of the winter flush that shown in Tables (9,10) the application of PP<sub>333</sub> at all concentration increased the thickness of flower stem than control. The highest value was obtained from treating plants with 200 ppm with the mean of 1.29 and 1.32 cm in the first and second seasons, respectively. In the meantime the control plants gave only 0.81 and 0.85 cm in the first and the next seasons, respectively. The differences among the testaments were significant in both seasons.

The result herein are in harmony with those obtained by *Welker (1986)* on some *Azalea* cultivars who found that paclobutrazol at 20, 25 and 30 ml/liter increased the diameter of shoot. *Mohamed and Desukey (1992)* on *chlorophytum comosum* and *pepromia clustufolia* recorded similar results.



### III.A.7. Mean diameter of flowers in cms:

It is clear from the results shown in Tables (9,10) that paclobutrazol had noticeable effect on the flower diameter. Highest diameter was obtained from treating plants with 200 ppm with mean of 10.08 cm in the first and 10.25 in the second season. The obtained results indicate that the flower diameter was increased by increasing the concentration of paclobutrazol. While the control plants gave only 8.12 cm in the first season and 8.40 cm in the second one.

Similar results were obtained by *Essa (1992)* on Baccara and Eiffel tower rose who found that the diameter of flower was significantly increased as a result of PP<sub>333</sub> especially with 200 ppm.

Also, *Roberts et al. (1990)* on Fuchsia and Tubouchina and *Maghazy (1991)* on Viola odorata, they found that PP<sub>333</sub> treatments increase the diameter of flowers.

### III.A.8. Fresh and dry weights of a flowers in Gms:

Concerning the effect of paclobutrazol treatments it produced a significant increase in the fresh weight of flowers by the increase in the concentration. The highest value was obtained from treating plants with 200 ppm in both seasons, with means of 10.72 and 9.93 gms in both seasons, respectively, as shown in Tables (9,10). It is obvious from the results that the mean fresh weight of flowers was increased by using paclobutrazol.

The results were in accordance with those obtained by *Maghazy (1991)* on viola odorata who found that PP<sub>333</sub> application increased the fresh weight of the flower and the increase over the control valued 26%. Also *Essa (1992)* on Baccara and Eiffle Tower rose who found that paclobutrazol treatments increased the fresh weight of the flower especially with 200 ppm treatment.

As regards to the dry weight of flowers, it is clear from the data in Tables (9,10) that the best results were obtained from treating plants with the high rate (200 ppm), with means of 4.31 and 4.18 gms in both seasons, respectively. On the other hand, control plants gave the lowest value in both seasons, the means were 2.11 and 2.46 gms, respectively.

Generally, the treatments which increased the fresh weights of flowers were the same that produced the high values of dry weight of flowers.

Similar results were obtained by *Essa (1992)* on Baccara and Eiffel tower rose and *Maghazy (1991)* on *Viola odorata*.

### **III.B. Spring Flush:**

#### **III.B.1: Number of leaves per a flower stem:**

The paclobutrazol treatments gave different results in both seasons. The treatment 100 ppm in the first season and treatment 200 ppm in the second, gave the maximum values with means of 11.36 and 10.47 leaves per flower stem, respectively. While control plants gave lower values than other treatments with means of 10.28 and 9.31 leaf per flower stem in the two seasons, respectively, as shown in Tables (11,12).

The differences among the treatments and the control plants were significant especially with the treatment of 100 ppm in the first season insignificant in the second one.

Generally, it can be said that the number of leaves with Marcedes rose has been slightly affected with low concentration of 100 ppm while the most retarding effect was due to the 200 ppm paclobutrazol application. These results are in agreement with those reported with Baceora and *Essa (1992)* who found tower rose had been slightly effected by the low concentrations of 50 and 100 ppm while 200ppm caused a slight decrease in leaf production.

**Table (11): Effect of Pacrobutrazol on the vegetative growth and flowering of Mercedes Roses with spring flush in the first season (1991/92).**

Concentration of Pac.	No. of Lvs. per flower stem	Fresh wt. of flower stem with leaves gm	Dry wt. of flower stem with leaves gm.	No. of flowers per plant	No. of flowers per m <sup>2</sup>	Mean length of flower stem cm	Mean diameter of flower stem cm	Mean diameter of a flower cm	Fresh wt. of flower gm	Dry wt. of flower gm
0.0 ppm	10.28	27.25	5.45	3.79	22.74	50.1	0.75	7.93	7.69	2.01
100 ppm	11.36	28.32	5.86	4.89	29.34	51.2	1.14	9.42	8.01	2.70
200 ppm	10.94	29.51	5.92	6.08	36.48	47.9	1.25	9.56	8.93	3.39
L.S.D at 5%	0.61	0.84	0.21	0.83	3.11	0.79	0.24	0.51	N.S.	0.23
1%	0.90	1.05	0.40	1.02	4.32	1.01	0.31	0.77	N.S.	0.35

### III. B.2 Fresh and dry weights of flower stem with leaves in Gms:

Data in Tables (11,12) of the two seasons, show that the fresh weight flower stem with of leaves was significantly affected by paclobutrazol spraying. Generally, PP333 increased the fresh weight. The higher values were obtained from using 200 ppm. giving the values of 29.51 and 30.01 gms in the two seasons. In the same time, the control gave only 27.25 gms in the first season, and 26.53 gms in the second.

These results are in agreement with *Essa (1992)* on Baccara rose and Eiffel tower rose who mentioned that paclobutrazal at all concentrations increased the fresh weight leaves.

As for dry weight of flower stem with leaves, the results are in accordance with those obtained by fresh weights. The treatments which increased the fresh weight of shoots are the same that produced the high values of dry weight of shoots.

### III.B.3: Number of a flower per plant:

Data in Tables (11,12) show that the paclobutrazol applications increased the number of flower/plant. The maximum number of flowers was produced from using the high concentration of 200 ppm. The means were 6.08, 6.87 fls/plant in the first and second seasons, respectively. While the concentration of 100 ppm gave the next value in this concern as 4.89 and 5.93 flower/plant in the first and second season, respectively. Control plants produced the minimum value in this connection as 3.79 and 3.91 flowers/plant in the first and second season, respectively. The differences between the treatments were significant with all cases.

Similar results were obtained by *Essa (1992)* on Baccara and Eiffel Tower roses, *Tymoswk and Mike.(1986)* on apple tress.

**Table (12): Effect of Pacrobutrazol on the vegetative growth and flowering of Mercedes Roses in the spring flush in the second season (1992).**

Concentration	No. of Lvs. on flower stem	Fresh wt. of flower stem with leaves gm	Dry wt. of flower stem with leaves gm.	No. of flowers per plant	No. of flowers per m <sup>2</sup>	Mean length of flower stem cm	Mean diameter of flower stem cm	Mean diameter of flower cm	Fresh wt. of flower gm	Dry wt. of flower gm
0.0 ppm	9.31	26.53	5.30	3.91	23.46	51.6	0.79	7.14	7.15	2.27
100 ppm	9.98	29.09	5.82	5.93	35.58	52.5	1.19	8.31	8.70	3.02
200 ppm	10.47	30.01	6.01	6.87	41.22	46.1	1.31	9.07	9.31	3.66
L.S.D at 5%	N.S.	0.71	0.17	0.75	3.75	0.87	0.12	0.50	0.35	0.22
1%	N.S.	0.90	0.32	0.93	4.23	1.10	0.29	0.76	0.61	0.34

### III.B.4. Number of flower per m<sup>2</sup>:

The obtained results in Tables (11,12) show that the highest means were produced by applying the plants with 200 ppm in both seasons. And the 100 ppm of PP333 gave the next value in this respect. While the untreated plants gave the lowest number of flowers per meter<sup>2</sup>. The differences between the treatments were significant in both seasons.

### III.B.5: Mean length of a flower stem in cms:

The treatments of 100 ppm (lowest rate) gave highest values then it was followed by the control plants. Whereas, the treatment of 200 ppm (high rate) gave the lowest value compared to any other treatment in both seasons. The differences between the treatments were significant in the first and second seasons.

It is obvious from the results that the flower stem length was reduced with increasing the concentration as shown in Tables (10,12) in both seasons.

Generally it can be said that flower stem length decreased with increasing the paclobutrazol concentration. The present results mostly agree with those of *Rusch et al. (1987)* on *Hydrangea macrophyll* and *Roberts et al. (1987)* on *Fuchsia* and *Tibouchina*. They found that application of paclobutrazol reduced length of stem flower, especially, with the high concentration. This effect of paclobutrazol may be due to its effect on subapical meristems and inhibits gibberellin production by inhibiting the oxidation of kaurene to kaurenoic acid.

### III. B.6. Mean diameter of a flower stem in cms:

Regarding the effect of paclobutrazol treatments as shown in Tables (11,12). The highest values of mean diameter of a flower were obtained from treating with highest rate in both seasons. The means were 1.25 cm in

the first season and 1.31 cm in the second one. While the control plants gave only 0.75 and 0.79 in the first and second seasons respectively. Whereas PP333 at 100 ppm gave the next value in this respect.

Similar results were obtained by *Welker (1986)* on some Azalea cultivars, he found that Paclobutrazol at 20, 25 and 30 ml/liter increased the diameter of shoot.

### **III.B.7. Mean diameter of a flower in cms:**

Data also clear that the highest flower diameter was obtained from spraying plants with 200 ppm in both seasons. The values were 9.56 cm in the first season and 9.07 cm in the second one.

While, the untreated plants gave the lowest values with the means of 7.93 and 7.14 cm in the same period. Whereas paclobutrazol at 100 ppm gave the next value in this respect as 9.42 and 8.31 cm in the first and second seasons, respectively. The differences between the treatments and the control were significant in both season Tables (11,12). These results were confirmed by many investigators for example, *Roberts et al. (1990)* on Fuchsia and Tubouchina also *Maghazy (1991)* on *Viola odorata*.

It can be concluded from the above mentioned results that there was a clear relationship between the flower diameter and the concentration of different treatments of Paclobutrazol.

### **III. B.8. Fresh and dry weights of a flower in Gms:**

Regarding the effect of paclobutrazol it produced significant increase in the fresh weight of flowers by treating plants with 200 ppm in both seasons the means were 8.93 gm in the first and 9.31gm in the second. In the same time, the untreated plants gave only 7.69 and 7.15 gm in the two seasons, respectively as shown in Tables (11, 12).

The results were in agreement with those obtained by *Maghazy (1991)* on *Viola odorata* and *Essa (1992)* on Baccara and Eiffel tower roses.

As for dry weight of a flower, data in K Tables (11,12) show that highest values were produced from treating plants by 200 ppm in both seasons with the average of 3.39 and 3.66 gms in both seasons, respectively. In the same time, PP<sub>333</sub> at 100 ppm produced the next value in this concern as 2.70 and 3.02 gm in the first and second season, respectively. While the untreated plants gave only 2.01 gms and 2.27 gms in both seasons, respectively. The differences between the treatments were insignificant in the first season and significant in the second one.

Similar results were obtained by *Maghazy (1991)* on *Viola odorata* and *Essa (1992)* on Baccara and Eiffel Tower roses.

It can be concluded from the above mentioned results that there was a clear relationship between the dry weight of flowers of Mercedes Rosa and the concentration of PP<sub>333</sub>; the treatments increased the dry weight especially at the high level of paclobutrazal.

#### **IV: Effect of Ethrel on vegetative growth and flowering of Mercedes Roses plants:**

##### **IV.A. Winter Flush:**

##### **IV.A.I. Number of leaves per flower stem:**

Data in Tables (13,14) showed that the highest value of leaves number per flower stem was resulted from 100 ppm followed by untreated plants with the means of 12.01 and 11.15 respectively in the first season. In the meantime, the treatment 200 ppm gave the lowest number; with the mean of 9.83 Lvs. in; the first season and 10.16 in the second one.

Generally the lowest concentration gave the maximum number of leaves per flower stem than any other treatments. The differences among the treatments were significant in both seasons. These results were in agreement with the findings of *El-Beltagy and Hall (1974)* on *Vicia faba*.



Table (13): Effect of Ethrel on the vegetative growth and flowering of Mercedes Roses in Winter flush in the first seson (1991/92).

Concentration of Ethglen.	No. of Lvs. on a flower stem	Fresh wt. of a flower stem with leaves gm	Dry wt. of a flower stem with leaves gm.	No. of flowers per plant	No. of flowers per m <sup>2</sup>	Mean length of a flower stem cm	Mean diameter of a flower stem cm	Mean diameter of a flower cm	Fresh wt. of a flower gm	Dry wt. of a flower gm
0.0 ppm	11.15	36.42	8.23	3.31	19.86	52.30	0.81	8.12	8.25	2.11
100 ppm	12.01	37.31	8.57	3.92	23.58	48.20	1.04	8.91	8.74	3.87
200 ppm	9.83	34.39	6.88	3.29	18.54	42.30	0.99	8.24	7.85	2.09
L.S.D at 5%	0.85	0.58	0.31	N.S.	1.30	1.25	0.22	N.S.	0.41	0.25
1 %	1.12	0.79	0.57	N.S.	N.S.	1.48	N.S.	N.S.	0.67	0.36

They meantioned that treating by ethrel increased the number of leaves, especially with low concentration.

#### IV.A.2. Fresh and dry weight of flower stem with leaves in Gms:

As regard to ethrel sprays it is clear that the mean fresh weight of flower stem and leaves decreased by increasing the concentration in both seasons. The highest value was obtained from treating plants with the lowest concentration. The means were 37.31 and 35.62 gms in both seasons, Tables (13,14), respectively.

, In the mean time the 200 ppm treatment reduced the fresh weight as it gave only 34.39 gm while control plants gave 36.42 gms. Generally, it can be said that the fresh weight of shoots reduced by increasing the ethrel concentration. The differences between treatments were significant in both seasons. The above mentioned results are in agreement with many workers as *Essa (1992)* on Baccar rose , *Semeniuk and Carleson (1970)* on Geranium seedlings and *Ohpanayikool et al. (1974)* on poinsettia. They found that the high concentration of ethrel application reduced the fresh weight of shoots.

The results also revealed that the dry weight of leaves was increased by decreasing the rate in the two seasons as shown in Tables (13,15). Higher dry weight of shoots was obtained by treating the plants with 100 ppm. The means were 8.57 and 7.48 gms in both seasons respectively. While, the untreat plants gave the next value as 8.23 and 7.13 gms in the first and second one, respectively whereas, the least dry weight of shoots was produced by treating the plants with 200 ppm. The means were 6.88 and 6.46 gms in both seasons.

The results here in agrement with many other workers as *Essa (1992)* on Baccara and Eiffel tower roses, *Hassan et al. (1976)* on *Rouge Mailland rose* and *Ma et al. (1985)* on Rose. They found that ethral treating caused in an increase in the dry weight of leaves especially with the low levels.

Table (14): Effect of ethrel on the vegetative growth and flowering of Mercedes Roses in Winter flush in the second season (1992/93).

Concentration of ethglen.	No. of Lvs. on a flower stem	Fresh wt. of a flower stem with leaves gm	Dry wt. of a flower stem with leaves gm.	No. of lowers per plant	No. of flowers per m <sup>2</sup>	Mean length of a flower stem cm	Mean diameter of a flower stem cm	Mean diameter of a flower cm	Fresh wt. of a flower gm	Dry wt. of a flower gm
0.0 ppm	11.74	34.17	7.13	2.96	17.76	54.90	0.81	8.40	7.92	2.46
100 ppm	12.43	35.62	7.48	3.87	23.22	51.30	1.11	8.65	8.56	2.89
200 ppm	10.16	32.28	6.46	3.12	20.52	50.80	1.01	8.01	7.64	2.25
L.S.D at 5%	0.64	0.59	0.28	0.40	1.49	0.48	0.19	N.S.	0.27	0.17
1%	0.96	0.80	0.54	0.61	2.62	0.72	N.S.	N.S.	0.53	0.28

#### IV.A.3. Number of flowers per plant:

It is clear that the overage number of flowers was slightly increased when using the lowest level of ethrel Tables (13,14). The better values were obtained from treatment 100 ppm in both seasons the means were 3.92 flowers in the first season and 3.87 in the second one. When ethrel was used at the high rate of 200 ppm it reduced the mean number which reached to 3.29 and 3.12 flowers per plant in both of the two seasons respectively as shown in Tables (13,14). The differences between treatments in the first season were insignificant whereas it was significant in the second season.

The results obtained due to ethrel treatment are in agreement with those obtained by *Carpenter (1975)*, *Hassan et al. (1976)*, *Marczynsky et al. (1979)* and *Ma et al. (1985)* on Rose plant. They found that ethrel treatments increased the flowering. This increasing was due to that ethrel had a promoting effect on branching.

#### IV.A.4. Number of flowers per m<sup>2</sup>:

The results in Tables (13,14) cleared that the average of flowers per m<sup>2</sup> had been responded significantly to the concentration of ethrel application. The best values were obtained when treating the plants with the lowest concentration in both seasons. The means were 23.58 flowers per m<sup>2</sup> in the first seasons and 23.22 flowers in the second, the differences between treatments were significantly in both seasons.

#### IV.A.5. Mean length of a flower stem in cms:

In Tables (13,14) it is shown a reduction in the flower stem length of Mercedes rose when using ethrel. The tallest flower stem length was obtained from untreating plants. The means were 52.3 and 54.9 cms in both season, respectively.

While ethrel at 100 ppm produced the next value in this concern as 48.2 and 51.3 cms for the first and second seasons, respectively, whereas the highest concentration of ethrel as 200 ppm gave the least flower stem length in both seasons as 42.3 and 50.6 cms for the first season and second one respectively. The differences between treatments were significant.

Generally it can be said that the flower stem length decreased with increasing the ethrel concentration.

The results obtained due to ethrel treatments are in agreement with *Kher (1973)*, *Quinn et al. (1977)* on Chrsanthemum, *Carpenter and Carlson (1970)* on Geranium, and *Dicks and Ress (1972)* on Lilies; who found that high concentrations of ethrel reduced flower stem.

#### IV.A.6. Mean diameter of a flower stem in cms:

In the first season of (1991/92) data in Table (13) indicate that the diameter of flower stem was slightly decreased by increasing the concentration of ethrel due to the differences among the treatments. The 100 ppm produced the highest diameter of flower stem with the mean of 1.04 cm. In the meantime the 200 ppm produced 0.99 cm diameter of flower stem. While the control plants gave the lowest diameter of a flower stem as 0.81 cm.

The results in the second season behaved similarly as in former season. The data given in Table (14) indicate that ethrel at 100 ppm resulted in larger thickness with the mean 1.11 cms compared with the mean 0.81 cms for the untreated plants. The differences between the control plants and the treatments were significant in the first and second seasons.

These results are in agreement with those of *Jaworski et al. (1980)* on Tomato, *Tayama and Carver (1990)* on Geranium. They found that ethrel treatments lead to an increase in the mean thickness of shoots.

#### IV.A.7. Mean diameter of a flower in Cms:

The results also reveal that the flower diameter was increased by decreasing the concentration in the two seasons. Higher diameter was obtained by treating plants with 100 ppm (lowest level). The averages were 8.91 cms in the first season and 8.65 cms in the second. In the meantime, the untreated plants resulted only 8.12 and 8.40 for the first and second season, respectively. The differences between treatments were insignificant in both seasons Tables (13,14).

These results agree with those reported by *Johanson (1973)* on carnation. He found that the high concentration of ethrel reduced flowers size.

#### IV.A.8. Fresh and dry weights of a flower in Gms:

In the previous Tables (13,14) it is clear that the fresh weight of flowers was significantly increased by decreasing the concentration. The maximum value was obtained from treating plants by 100 ppm ethrel in both seasons. The averages were 8.74 gms in the first seasons and 8.56 gms in the second. While, the untreated plants gave 8.25 and 7.92 gms in the first and second season respectively. Whereas the plants were sprayed at 200 ppm of ethrel gave the least fresh weight of a flower as 7.85 and 7.64 Gms in both seasons respectively. The differences among the treatments were significant in both seasons.

Similar results were obtained by *Hassan et al (1976)* on Rouge Miellond Roe, *Ma et al (1985)* on Rose and *Essa (1992)* on Baccara Rose the found that low concentrations of ethrel caused an increase in the fresh weight of the flowers than the other treatments.

As for dry weight, the lowest concentration gave the heaviest results with the means of 3.87 gms in the first season and 2.89 gms in the second. While they control plants gave the next value in this concern as 2.11 and 2.46 gms of the first and second seasons, respectively. Whereas the

highest concentration (200 ppm) of ethrel gave only 2.09 and 2.25 gms in both seasons, respectively, Tables (13,14). The differences among the results were significant in both seasons.

The results were with those obtained by *Hassan et al.* (1976) on *Rouge Meilland Rosa*, *Ma et al.* (1985) on Rose plants and *Essa* (1992) on Baccara Rosa.

#### IV.B. Spring flush:

##### IV.B.1. Number of leaves per a flower stem:

In Tables (15,16), data cleared that ethrel treatment at 100 ppm resulted in the highest value than any other treatment with the mean of 10.75 leaves in the first season and 9.42 leaves per flower stem in the second. While the control plants gave 10.28 and 9.31 leaves in the two seasons, respectively, the differences between treatments were significant in the first season and insignificant in the second one.

Generally, the results clear that the number of leaves per flower stem were increased by the low concentration of ethrel in opposite of the high rates.

The results obtained are similar to those obtained by *Choma and Himelrick* (1982) on strawberry, the reported that low concentration of ethrel increased the number of leaves.

##### IV.B.2. Fresh and dry weight of a flower stem with leaves in Gms:

The obtained data in Tables (15,16) show that the low concentration of ethrel resulted in an increase in the fresh weight of leaves and flower stem of Mercedes rose. But the high concentration reduced it than the other treatments. The highest value was obtained from treating plants with 100 ppm with the averages of 28.19 gms in the first season and 27.37 gms in the second one. While, the treatment of 200 ppm gave only 25.07 and 24.18 gms in both seasons, respectively. On the other side, the control

Table (15): Effect of ethrel on the vegetative growth and folwering of Mercedes Roses in the spring flush in the first season (1991/92).

Concentration of ethglen.	No. of Lvs. per flower stem	Fresh wt. of a flower stem with leaves gm	Dry wt. of a flower stem with leaves gm.	No. of flowers per plant	No. of flowers per m <sup>2</sup>	Mean length of flower stem cm	Mean diameter of flower stem cm	Mean diameter of a flower cm	Fresh wt. of a flower gm	Dry wt. of flower gm
0.0 ppm	10.28	27.25	5.45	3.79	22.74	50.10	0.75	7.93	7.69	2.01
100 ppm	10.75	28.19	5.61	5.02	30.12	51.90	1.02	8.13	8.20	2.32
200 ppm	9.21	25.07	4.97	4.63	27.78	43.10	0.91	8.01	7.03	1.98
L.S.D at 5%	0.44	0.70	0.14	0.78	2.16	1.17	0.23	N.S.	0.48	0.21
1%	0.76	0.91	0.40	0.97	3.29	1.38	N.S.	N.S.	0.74	0.33



plants produced 27.25 and 26.53 gms in the first and second season, Respectively. The differences among the treatments were significant in both seasons.

Similar findings were obtained by *Shank (1968)* on chrysanthemum, *Semeniuk and Carlson (1970)* on Geranium and *Bisari (1979)* on okra.

Regarding the effect of ethrel treatments on dry weight of leaves with flower stem as shown in Tables (15,16), it is quite clear that the dry weight of Mercedes flower stem with leaves was significant by increased by treating with 100 ppm with the means 5.61 gm in first season and 5.48 gms in the next season. While the treatment 200 ppm resulted in the lowest of value with the averages of 4.97 and 4.53 gms in both seasons, respectively. But the control plants gave 5.45 gms in the first season and 5.30 in the second one.

These results are in accordance with those obtained by *Hassan et al. (1976)* on Rouge Mielland Rose *Ma et al. (1985)* on Rose and *Essa (1992)* on Eiffel Tower Rosa. They found that the mean dry weight of leaves increased by low concentration of ethrel.

#### IV.B.3. Number of flowers per plant:

Data in Tables (15,16) cleared that the average of flowers per plant increased significantly by decreasing the concentration. Data were announced especially the treatment at 100 ppm that produced the higher mean in both seasons. The mean number of flowers were 5.02 flowers in the first season and 4.05 flowers per plant in the second one. While the control gave only 3.79 and 2.96 flowers in both seasons, respectively.

In the meantime, the treatment at 200 ppm produced the next value in this concern as 4.63 flower in the first season and 3.91 flowers per plant in the second season.

The results in this study were in harmony with the finding of *Hassan et al. (1976)*, *Marczynski et al. (1979)*, *Haenchen (1984)*, *Ma et*

**Table (16): Effect of ethrel on the vegetative growth and flowering of Mercedes Roses in spring flush in the second season (1991/93).**

Concentration of ethglen.	No. of Lvs. on flower stem	Fresh wt. of a flower stem with leaves gm	Dry wt. of flower stem with leaves gm.	No. of flowers per plant	No. of flowers per m <sup>2</sup>	Mean length of flower stem cm	Mean diameter of flower stem cm	Mean diameter of a flower cm	Fresh wt. of flower gm	Dry wt. of flower gm
0.0 ppm	9.31	26.53	5.30	2.96	17.76	51.60	0.79	7.14	7.15	2.27
100 ppm	9.42	27.37	5.48	4.05	24.30	52.50	1.08	7.89	7.92	2.61
200 ppm	8.79	24.18	4.53	3.91	23.46	47.70	0.98	7.35	7.46	2.03
L.S.D at 5%	N.S.	0.62	0.16	0.71	2.07	0.87	0.18	N.S.	0.39	0.24
1%	N.S.	0.83	0.42	0.92	3.20	1.10	0.23	N.S.	0.65	0.34

*al.* (1985) and *Essa* (1992) on Rose. They all mentioned that the addition of ethrel increased the number of flowers.

#### **IV.B.4. Number of flowers per m<sup>2</sup>:**

Data in Table (15) for the spring flush clear that the highest number was resulted from treating Mercedes rose with ethrel at 100 ppm followed by 200 ppm with the means of 30.12 and 27.78 flowers per m<sup>2</sup>, respectively. While the untreated plants gave only 22.74 flowers per m<sup>2</sup>.

The results in the second season were in harmony with those obtained in the first one Table (16).

#### **IV.B.5. Mean length of a flower stem in cms:**

Concerning the ethrel treatments it is shown that the stem length was reduced by increasing the concentration. The high concentration (200 ppm) gave shortest flower stem length as 43.1 cms in the first season and 47.7 cms in the second one. Whereas, the lower concentration gave longer flower stem. The means were 51.9 and 52.5 cms in the two seasons, respectively. While the control plants produced the next value as 50.1 and 51.6 for the first and second season respectively, as shown in Tables (15,16). The differences among the results were significant in both seasons.

These results were with those reported by carpenter and *Carlson* (1970) on Geranium and *Dicks and Ress* (1972) on Lillies. They stated that the high concentration of ethrel reduced the flower stem.

#### **IV.B.6. Mean diameter of a flower stem in cms:**

As shown in Table (15) the treatments of ethrel showed that the highest values were obtained from treating plants with the lowest level of 100 ppm which produced 1.02 cms in the first season and 1.08 in the

second one. In the meantime, the control plants gave the least value with the average of 0.75 cms in the first season and 0.79 cms in the second. While the maximum level of ethrel (200 ppm) gave the next value in this concern as 0.91 and 0.98 cms for the first and second seasons, respectively. The differences between the treatments were significant in both seasons.

These results are in agreement with those of *Essa (1992)* on Eiffel Tower rose, *Tayama and Carver (1990)* on Geranium. They found that ethrel treatments caused an increase in the mean thickness of the shoots.

#### **IV.B.7: Mean diameter of a flower in cms:**

In Tables (15,16), the results also show that the highest flower diameter was obtained when the plants were sprayed with the level of 100 ppm in both seasons. The means were 8.13 cm in the first season and 7.89 cms the second one. In the same time, control plants gave the lowest values with 7.93 and 7.14 cms in first and second seasons, respectively. The differences between the control and other treatments were insignificant in both seasons.

Similar results were obtained by *Johanson (1973)* on carnation. He found that the high concentration of ethrel reduced flower size.

#### **IV.B.8. Fresh and dry weights of a flower in Gms:**

In the previous Tables (15,16), it is clear that the fresh weight of a flower was significantly increased by decreasing the concentration. The heaviest value was obtained from treating plants by 100 ppm ethrel in both seasons. The means were 8.20 gm in the first season and 7.92 in the next season. In the meantime, the untreated plants produced only 7.69 and 7.15 gms in both seasons, respectively. While, the 200 ppm gave 7.03 gm in the first season and 7.46 gms in the second seasons.

Similar results were obtained by *Hassan et al. (1976)* on Roug Mielland, *Ma et al. (1985)* and *Essa (1992)* on Rose. They found that the

low concentrations of ethrel caused an increase in the fresh weight of the flowers than the high concentrations.

As for dry weight of a flower, data in the same tables, clear that the best results were obtained from using the lower rate of 100 ppm with the average of 2.32 gms in the first season and 2.61 gms in the second. In the same time the untreated plants gave the next value in this concern as 2.01 and 2.27 gms for the first and second season, respectively. Whereas 200 ppm of ethrel produced the least value as 1.98 gms in the first season and 2.03 gms in the second one. The differences between the treatments were significant in both seasons.

The results were in agreement with that stated by *Hassan et al.* (1976), *Ma et al.* (1985) and *Essa* (1992) on Rose plant.

## **V- Effect of growth regulators on the chemical composition:**

### **VA- Nitrogen content:**

#### **V- A.1- GA<sub>3</sub>.**

Data in Table (17) indicate that GA<sub>3</sub> treatments led to an increase in the total nitrogen content in Mercedes rose leaves. The higher nitrogen value resulted from spraying plants with the high concentration of 200ppm in the two seasons with the means of 22.09 and 23.15 mg/gm dry matter in the first and second seasons, respectively.

The results here are in harmony with those reported by *Mohamed* (1988) on Baccara and Rouge Meill Roses *Hassan et al.* (1984) on Anemone and Ranunculus and *Mohamed* (1992) on white godth and Osker gladiolus cvs., who demonstrated that GA<sub>3</sub> increased nitrogen content in vegetative growth.

#### **V.A.2 Kinetin:**

Data in Table (17) clear that treating plants with different levels of kineten increased the total nitrogen content in Mercedes leaves during the two

Table (17): Effect of growth regulators on the chemical composition

Season	Growth Regulators	Nihogen content mg/gm		Total carbohydrate mg/gm		Chloophyll "A" mg/gm		Chlorophyll "B" mg/gm	
		First season	Second season	First season	Second season	First season	Second season	First season	Second season
	Control 0.00	19.50	22.00	187.00	201.25	5.06	4.57	4.69	4.92
	GA <sub>3</sub> 200	21.71	22.37	206.13	211.30	4.98	4.41	4.54	4.76
	300	22.09	23.13	209.71	214.85	4.75	4.35	4.47	4.68
	Kinetin 200	22.60	23.50	205.00	212.50	6.13	5.60	5.91	5.63
	300	24.00	24.35	208.30	215.80	6.17	6.08	6.35	6.08
	PP 333 200	22.10	24.15	207.95	219.20	5.76	5.45	5.46	5.66
	300	23.15	25.20	210.70	22.310	6.10	5.89	6.05	6.17
	Ethrel 200	21.00	24.05	211.50	213.80	4.81	4.48	4.28	4.67
	300	19.55	23.01	197.10	204.20	4.79	4.32	4.13	4.43

seasons of study. However, the highest value was obtained when the plants were sprayed with 200 ppm. The means were 24.00 mg/gm in the first season and 24.35 mg/gm in the second one. On the other hand, the untreated plants gave only 19.50 and 22.00 mg/gm. dry matter in both season, respectively.

The results were with those obtained by *Essa (1992)* on Baccara and Eiffel Tower Roses, *El-Sherbiny (1987)* and *Kandecl (1987)* on *Ocimum basilicum* and *Rodwan (1988)* on *Togetes erecta*. They found that the total nitrogen percentage was increased by different treatments of kinetin.

### VA.3. Paclobutrazol:

The results in Table (17) clear that the total nitrogen content was increased with the different concentrations in both seasons. However, the highest value of nitrogen percentage was obtained from treating plants at 200 ppm with the means of 23.15 mg/gm in the first season and 25.20 mg/gm in the second. In the meantime, the control plants resulted in 19.50 and 22.00 mg/gm dry matter in the two seasons respectively.

These results were agree with those obtained by *Essa (1992)* on Baccara and Eiffel tower roses *Mohamed and El-Desouky (1992)* on *Chlorophyllum comosum* and *Pepromia clurtiffalia*. They found that the total nitrogen percentage increased often spraying with poclobutrazol.

### V.A.4. Ethrel:

From the above data, the results also reveal that the total nitrogen content was increased with the low level of ethrel in both seasons. The best value resulted from spraying the plants with 100 ppm were 21.00 and 24.05 mg/gm in the first and second seasons, respectively. While the high concentration (200 ppm) produced only 19.55 and 23.01 mg/gm dry matter in the two seasons, respectively.

The results obtained are in agreement with *Essa (1992)* on Baccara and Eiffel tower Roses and *Hassan et al. (1976)* on Rouge Meilland Rose *Mohamed (1992)* on white godth and Oskar gladiolus cvs who found that ethrel application due to nearly the concentration used in this work led to an increase the total nitrogen content.

#### V.B. Total Carbohydrate;

##### V.B. 1. GA<sub>3</sub>:

As shown in Table (17) it is clear that content of total carbohydrate was increased in the leaves of Mercedes rose especially with the high concentration of GA<sub>3</sub>. The obtained values show that the higher value was 209.71 in the first season and 214.85 mg/gm in the second one, when sprayed with 300 ppm GA<sub>3</sub>, while; the untreated plants gave only 187.00 and 201.25 mg/gm dry mater in the first and second season, respectively.

Similar results were obtained by *Mohamed et al. (1992)* on *Alpinia nutans*. They found that GA<sub>3</sub> treatments 200, 300 ppm increased total carbohydrates percentage in alpinia leaves.

##### V. B.2- Kinetin:

Sprays with kinetin caused an increase in the content of total carbohydrate at any concentration than the control plants. The highest value was obtained at 200 ppm kinetin with the means of 24.00 in the first season and 24.35 mg/gm in the second. While, the lowest values resulted from control plants. Whereas kinetin at 100 ppm gave the next value in this concern with the means of 22.60 and 23.15 mg/gm dry mater in the two seasons, respectively in Table (17).

The results were agree with those obtained by *Essa (1992)* on Baccar Roses, *Mohamed (1992)* and *Abou El-Ghait (1985)* on *Dianthus caryophyllus*, *El-Khyat (1987)* on togetes sp. and *Almulla (1989)* on croton plants. They all found that kinetin application due to nearly the



concentration used in this study led to an increase in the content of the total carbohydrate.

#### ***V.B.3. Paclobutrazol:***

Results show that the carbohydrate content was affected by different concentrations in both seasons, Table (17). The maximum value of total carbohydrate content was 210.70 in the first season and 223.10 mg/gm resulted from treatment 200 ppm in the two seasons respectively. While the control plants gave only 187.00 and 201.25 mg/gm dry matter in the same season's as shown in Table (17).

These results are in agreement with those obtained by *Essa (1992)* and *Steffens et al. (1985)* and *Wang et al. (1986)* on apple trees. They all found that the content of total carbohydrate increased after treating with paclobutrazal.

#### ***V.B.4. Ethrel:***

The results reveal also that the total carbohydrate content was affected in both seasons. The best value resulted from spraying plants with 100 ppm of ethrel with the average of 211.50 in the first season and 213.80 mg/gm in the second. While highest concentration of ethrel (200 ppm) gave the least value of 197.10 and 204.20 mg/gm for the first and second seasons, respectively. In the same time the untreated plants gave only 187.00 and 201.25 mg/gm dry matter in both season.

Similar results were obtained by *Essa (1992)* on Eiffel tower Rose, *Hassan et al. (1976)* on Rouge Meilland rose and *El-Zeftawi (1978)* on Valencia orange, who found that the treating by ethrel increased the carbohydrate content.

### V.C. Chlorophyll "A":

#### V. C.1. GA<sub>3</sub> :

The results obtained showed that the chlorophyll "A" content in Mercedes rose leaves, decreased by increasing the GA<sub>3</sub> level in the two seasons but this decrease was small compared with the control. The higher value of chlorophyll A as 5.06 and 4.57 mg/gm for the first and second season, respectively were obtained from untreated plants. While, GA<sub>3</sub> at 100, 200 ppm produced only 4.98 and 4.41 mg/gm in the first season, respectively Table (17).

The results were agree with those obtained by *Mohamed (1992)* on *Dahlia pinnata*, L. (winter flowering type) who found that GA<sub>3</sub> at 100, 150 or 200 ppm decreased the chlorophyll content in leaves but this decrease was least compared with control plants.

#### V. C. 2.kinetin:

Data presented in Table (17) cleared that chlorophyll "A" content in Mercedes rose leaves increased by increasing the kinetin level in the two seasons. The highest value of chlorophyll "A" as 6.17 and 6.08 mg/gm were obtained from treating plants with 200 ppm in the two seasons, respectively. In the sametime, kinetin at 100 ppm gave the next value in this concern as 6.13 mg/gm fresh weight of leaves in the first season. While the lowest value of 5.06 and 4.57 mg/gm resulted from the control plants in the first and second seasons, respectively.

The results herein are in harmony with those reported by *Mohamed (1992)* on *Dahlia pinnata* (winter flowering type), *Ben (1986)* on *Apple* ; and *Tawfik (1986)* on *Andropogon citratus*. They found that kinetin treatment increased chlorophyll "A" content of leaves. Whereas *Buschmann (1980)* found that kinetin not only induce a higher accumulation of chlorophyll and protochlorophyllide but also changed the

amount of *vivo* chlorophyll forms which led to more effective photosynthetic activity.

### V. C. 3. Paclobutrazol:

The results in Table (17) showed that the leaf chlorophyll "A" content of Mercedes rose was increased when applied with high concentration of paclobutrazal in two seasons. However, application with 200 ppm gave the highest values of 6.10 and 5.89 mg/gm as compared to the other treatments in both seasons. While, the control gave the lower means of 5.06 and 4.57 in the first and second season, respectively.

These results were agree with *Mohamed and El-Desauky (1992)* on *chlorophytum comosum* and *Pepromia clustiffus Steffens et al. (1983)* on apple, *Steffens and Wang (1984)* on the same plants, *Lecain et al. (1986)* on *Ficus benjamina* and *Archbold and Houtz (1988)* on strawberry. All found that applying paclobutrazl caused an increased in the leaf chlorophyll content per unit area.

### V.C.4. Ethrel:

Results in the same table show that the chlorophyll "A" content of Mercedes leaves decreased by increasing the concentration. The lower values 4.79 mg/gm fresh weight leaves in the first season and 4.32 mg/gm in the second one were obtained from treating plants with 200 ppm in the two seasons. While the control gave 5.06 and 4.57 mg/gm in the same time.

The obtained results are in agreement with *Mohamed (1992)* on *Dahlia pinnata* (winter flowering) who found that the amount of chlorophyll "A" in the leaves was decreased with ethrel applications (100, 150, 200 ppm).

### V.D. Chlorophyll "B":

It is obvious from the results of chlorophyll "B" content in the leaves of Mercedes rose were similar to those obtained as the previous results of chlorophyll "A" content. This was clearly shown in Table (17).

#### V. D. 1. GA<sub>3</sub> :

Data in Table (17) clear that chlorophyll "B" content in Mercedes leaves was decreased by increasing the GA<sub>3</sub> level in two seasons, the lowest values of chlorophyll "B" as 4.54 mg/gm fresh weight leaves in the first season and 4.68 mg/gm in the second, when plants were sprayed with the high level of 300 ppm.

Mean while, the control plants gave the high values with the means of 4.69 and 4.92 mg/gm in both season, respectively *Marth et al. (1956)*, *Bech (1958)* and *Hentig (1959)* reported that GA<sub>3</sub> decreased chlorophyll content.

#### V. D.2. Kinetin:

Results in Table (17) show that chlorophyll "B" content in leaves of Mercedes plants was increased by increasing the kinetin concentration in both years, the maximum values of chlorophyll "B" as 6.35 mg/gm fresh weight in the first year and 6.08 mg/gm in the next year, when plants treated with the high concentration (200 ppm). However, 100 ppm of kinetin produced the next value in this respect as 5.91 and 5.63 mg/gm fresh weight for the first and second seasons, respectively. At the same time, the control plants gave the lowest value with the means of 4.69 and 4.92 mg/gm fresh weight of leaves in the first and second year respectively.

Similar results were found by *Esse (1992)* on Baccara and Eiffel Tower roses, *Mohamed (1992)* on *Dahila pinnata* and *El-Khyat (1987)* on

Tagetes spp. They stated that kinetin treatments increased chlorophyll "B" content.

### V.C.3. Paclobutrazal:

As for the results in Table (17), it is shown that chlorophyll "B" content at leaves was increased with the increase in the rate of paclobutrazal. The best content of chlorophyll "B" with the averages of 6.05 and 6.17 mg/gm resulted when pp<sub>333</sub> applied at 200 ppm in the first and second seasons, respectively. Also, the content of chlorophyll "B" with 100 ppm of paclobutrazal was 5.46 and 5.66 mg/gm fresh weight in the first and second seasons, respectively. While the control plants produced the low value in this concern as 4.69 and 4.92 mg/gm fresh weight in both seasons, respectively.

The results agree with *Essa (1992)* on *Baccara rose*, *Mohamed (1992)* on *Dahlia pinnata* and *Lecain (1986)* on *Ficus benjamina*. They reported that the chlorophyll content in leaves was increased with paclobutrazol application.

### V. C.4. Ethrel:

Results in the same table cleared that the chlorophyll "B" content was decreased by different concentration of ethrel than untreated plants. The high concentration of ethrel caused in a reduction in chlorophyll "B" content. The results show that foliar application of ethrel at the low concentration of 100 ppm resulted in the highest decreased values with the means of 4.28 and 4.67 mg/gm fresh weight of leaves in the first and second seasons, respectively. While, the high concentration of 200 ppm resulted in the lowest values with the means of 4.13, 4.43 mg/gm in the first season and in the second one, respectively.

Similar results were found by *Essa (1992)* *Mohamed (1992)* on *Dahlia pinnata* L. and *El-Zeftawi (1985)* on *Imperial mandarine*. They stated that the application of ethrel reduced chlorophyll "B" content.

## Part II

### I- Effect of plant density on vegetative growth and flowering of Marcedes. Roses during 1991/92 and 1992/1993 seasons.

#### A- Winter flush:

##### 2.A.1. Number of leaves per flower stem:

In both seasons, statistical analysis of the data in Tables (18,19) indicated that number of leaves per flower stem had response to plant density, density, 10 plants/m<sup>2</sup> gave 22.6, 21.9 Lvs/flower stem compared with 20.4, 18.9 Lvs/ flower stem for 24 plants/m<sup>2</sup> in the first and second seasons, respectively. All differences were significant in both seasons. these results agree with those obtained by *Mohamed (1988)* on Rouge Maliand and Baccara roses who found that, plant density as 6 plants/m<sup>2</sup> increased the number of leaves on flower stem with winter crop than 3 plants/m<sup>2</sup>.

##### 2.A.2. Fresh and dry weights of flower stem with leaves in Gms:

The data in Table (18,19) indicated that 10 plants/m<sup>2</sup> significantly increased the fresh weight-of leaves per flower stem in both seasons, while 20 plants/m<sup>2</sup> in the first and second seasons produced the next value in this concern. On the other side, 24 plants/m<sup>2</sup> gave the least fresh weight in both seasons.

As for dry weight of flower stem with leaves, 10 plants/m<sup>2</sup> gave the heaviest dry weight as 13.41 and 12.93 gms for first and second seasons respectively, compared to other treatments. While 16 plants/m<sup>2</sup> gave the next value in the first season or 20 plants/m<sup>2</sup> in the second season. Tables (18,20). The differences among these treatments were significant in both seasons.

**Table (18):** Effect of plant density on the vegetative growth and flowering of Mercedes Roses in the winter flush during the first season 1991/92.

Number of plants/m <sup>2</sup>	No. of Lvs. per flower stem	Fresh wt. of a flower stem with leaves gm	Dry wt. of flower stem with leaves gm	No. of flowers per plant	No. of flowers per m <sup>2</sup>	Mean length of flower stem cm	Mean diameter of flower stem cm	Mean diameter of a flower cm	Fresh wt. of flower gm	Dry wt. of flower gm
10 Plants/m <sup>2</sup>	22.60	39.1	13.41	2.02	20.20	65.30	0.91	10.70	12.80	3.51
16 plants/m <sup>2</sup>	21.20	35.6	12.53	2.80	44.80	77.60	0.90	10.30	11.50	3.01
20 plants/m <sup>2</sup>	20.30	37.3	11.98	3.01	60.20	80.20	0.92	9.80	10.60	2.80
24 plant/m <sup>2</sup>	20.40	34.9	10.71	2.10	50.40	78.30	0.90	9.70	10.90	2.63
L.S.D at 5%	0.85	0.76	0.87	N.S	7.11	1.23	N.S	0.39	0.32	0.40
1%	1.03	0.99	1.04	N.S	8.26	1.96	N.S	N.S	0.49	N.S

Generally, it appears that plant population as 10 plants/m<sup>2</sup> resulted in an increase in both fresh and dry weights of flower stem with leaves per plant.

Such result might be attributed to the favourable opportunity of plants for suitable conditions of light and minerals in case of plants density (10 plants/m<sup>2</sup>), which in turn, increased the plant capacity in building metabolites and resulted in more vegetative growth. These results were in agreement with those obtained *Aoki and Yoshion (1984)* on Tulip and *Umesha et al. (1990)* on *Ocimum gratissimum*.

### 2.A.3: Number of flowers per plant:

In both seasons all treatments insignificantly increased the number of flowers per plant. As shown in Table (18) data indicate that 20 plants/m<sup>2</sup> increased the number of flowers per plants (3.01 fls) also 16 plants/m<sup>2</sup> gave the next value in this concern. While the lowest number of flowers per plant was produced with 10 and 24 plants/m<sup>2</sup> as 2.02 and 2.10 fls/plant, respectively. Similar results were obtained in second season as shown in Table (19).

The results agree with those reported by *Mohamed (1992)* on *Tagetes erecta* who found that the best planting distance for highest production of flower per plant were 36X 50 cm and 48 X 50 cm, while 12 X 50, 24 X 50 or 60 X 50 decreased the number of flower per plant, *Patil et al. (1990)* on Aster they found that the highest density gave the highest number of flowers per plant and *Hoeven (1991)* on chrysanthemum reported that the highest yield of flowers/plants was obtained with a plant density of 35-40 plants/m<sup>2</sup>.

### 2.A.4. Number of flower per m<sup>2</sup> :

Data presented in Table (18), show that the plant population as 20 plants/m<sup>2</sup> produced the maximum numbers of flowers/m<sup>2</sup> as compared to



Table (19): Effect of plant density on the growth and flowering of Mercedes Roses in the winter flush during in the second season (1992/93).

Number of plants/m <sup>2</sup>	No. of Lvs. per flower stem	Fresh wt. of flower stem with leaves gm	Dry wt. of flower stem with leaves gm	No. of flowers per plant	No. of flowers per m <sup>2</sup>	Mean length of a flower stem cm	Mean diameter of flower stem cm	Mean diameter of a flower cm	Fresh wt. of flower gm	Dry wt. of flower gm
10 Plants/m <sup>2</sup>	21.90	40	12.93	2.30	20.30	66.30	0.93	10.40	12.20	3.71
16 plants/m <sup>2</sup>	20.10	34.90	11.73	2.50	40	75.70	0.94	10.10	11.30	3.11
20 plants/m <sup>2</sup>	19.70	39.10	12.13	2.90	58	79.10	0.95	9.90	11.90	2.79
24 plant/m <sup>2</sup>	18.90	36.70	9.96	2.40	57.60	77.50	0.92	9.30	10.10	2.83
L.S.D at 5%	0.71	0.81	0.93	N.S	7.91	1.17	N.S	N.S	0.37	0.39
1%	0.94	1.01	1.11	N.S	9.01	1.83	N.S	N.S	0.54	N.S

other treatments. The number of flowers in this cases was 60.20 fls/m<sup>2</sup> compared to 50.4, 44.8 flowers with 24 or 16 plants/m<sup>2</sup> respectively. The least number as 20.2 fls/m<sup>2</sup> resulted with 10 plants/m<sup>2</sup>. Statistical analysis showed significant differences among these treatments during the two seasons.

Data of (1992/93) shown in Table (19) appear similar trend of results to those obtained in (1991/92).

the results agree with those obtained by *Mohamed (1988)*, who found that plant density as 12 plants/m<sup>2</sup> increased the number of flowers per m<sup>2</sup> compared with 6 or 3 plants/m<sup>2</sup> of Rouge meiliand and Baccara roses. *Mohamed and Wahba (1993)* who demonstrated that the closer spacing increased the number of flowers per unit area of Tagetes erecta.

#### 2.A.5. Mean length of a flower stem in cms:

The statistical analysis of results for flower stem length of (1991/92) in Table (18) indicated that the differences among the treatments were significant. It is evident that the 20 plants/m<sup>2</sup> produced the longest stem as 80.2 cm compared to other planting distance. Also 24 or 16 plants/m<sup>2</sup> gave the next values as 78.3 and 77.6 cms. respectively. While the lowest value was produced with 10 plants/m<sup>2</sup> as 65.3 cms.

The results of the second season 1992/93 Table (19) showed the same pattern of results as the first is the planting distance 20 plants/m<sup>2</sup> gave the highest value (79.1 cms) length for the flower stem, while the 10 plants/m<sup>2</sup> results in shortest length as 66.3 cms of flower stem length. It can be concluded that enviromental conditions especially light, temperature, minerals prevailing in 20 plants/m<sup>2</sup> caused tallest in flower stem. Such increase in flower stem might be due to the inhancement in cell division and/or cell division resulting in taller stem.

These results are in agreement with those reported by *Mohamed and Wahab (1993)*, *Mohamed (1992)* on Tagetes erecta, *Nilimesh and*

*Roychow Dhury (1990)* on gladiolus, *Farina and Paterniani (1989)* on chrysanthemum.

#### **2.A.6- Mean diameter of a flower stem in cms:**

All plant density treatments, indicated that the differences between all plant population were very narrow and insignificant in the first and second seasons as shown in Tables (18,19).

#### **2.A.7. Mean diameter of a flower in cms:**

It is clearly noticed from data in Tables (18,19) for season (1991,92) and (1992/93) that the 10 and 16 plants increased the diameter of Marcedes flowers as 10.7, 10.3 cms. In the first season and 10.4, 10.1 cms in the second season respectively, the planting distance as 10 or 16 plants/m<sup>2</sup> would be most suitable for biosynthesis in Marcedes roses. The diameter of flower response was strongly influenced by consistency of carbohydrate. At the mean time 10 or 16 plants/m<sup>2</sup> produced the best vegetative growth.

The differences between these treatments were significant in both seasons at 5% only. These results agree with obtained by *Mohamed (1988)* on roses, *Gowda and Jayanthi (1989)* on charysanthemum.

#### **2.A.8- Fresh and dry weights of a flower in Gms:**

Results of the first season in Table (18) show that the fresh and dry weights of flower were also affected with different plant density. The heaviest fresh weight/flower as 12.8 gms was produced with 10 plants/m<sup>2</sup> compared to 10.6 gms with 20 plants/m<sup>2</sup>. While 16 plants/m<sup>2</sup> gave the next value in this concern as 11.5 gms. Similar trend was true in the next season 1992/93 Table (19). Also all differences were high significant in both seasons.

The dry matter of flower showed a similar trend of results as the fresh weight tables (18,19) in both seasons. Generally, it appears that 10 plants/m<sup>2</sup> resulted in an increase in both vegetative growth and flowering. These results may be interpreted in some ways, suitable temperature between 10 plants/m<sup>2</sup> about the anther plant density table (23) may be cause change in carbohydrates content, respiration, nucleic acid, activity of some enzyme and mitachandrial activity. Another way, the suitable conditions of light and minerals in case of 10 plants/m<sup>2</sup>, which in turn, increased the plant capacity in building metabolites and resulted in more might be due to the activation of the anabolic processes in plant, which were translocated from the leaves and or the rootes leading to more growth and flowering.

Gnerally, it can be concluded that the density of 10 or 16 plants/m<sup>2</sup> could be advised for the best quality of Marcedes roses in Egypt especially for the exportation during winter.

## **B- Spring flush:**

### **2.B.1. Number of leaves per flower stem:**

Concerning the number of leaves an a flower stem of Marcedes roses as the mean of spring flush Tables (20,21), the numbers these showed a very narrow variation in both seasons for the results of different plant density. The mean values .of number of leaves/flower stem ranged between 17.1 to 18.3 in the first season 1991/92 and 16.9 to 17.8 in the second one. It is clear that the mean of the number of leaves flower stem are insignificantly in both seasons.

### **2.B.2. Fresh and dry weights of flower stem with leaves in Gms:**

In both seasons, the plant density treatments at 10 and 16 plants/m<sup>2</sup> gave the heaviest fresh weight of leaves compared to 20 or 24 plant/m<sup>2</sup> Tables (20, 21), 25.81 gms leaves produced with 10 plants/m<sup>2</sup> and m<sup>2</sup>

**Table (20):** Effect of plant density on the growth and flowering of Mercedes Roses in the Spring Flush during in the first season (1991/92).

Number of plants/m <sup>2</sup>	No. of Lvs. per flower stem	Fresh wt. of a flower stem with leaves gm	Dry wt. of a flower stem with leaves gm.	No. of flowers per plant	No. of flowers per m <sup>2</sup>	Mean length of flower stem cm	Mean diameter of flower stem cm	Mean diameter of a flower cm	Fresh wt. of flower gm	Dry wt. of flower gm
10 Plants/m <sup>2</sup>	18.1	25.81	9.10	3.6	36.0	59.7	0.80	9.3	10.31	2.12
16 plants/m <sup>2</sup>	18.3	24.72	8.03	3.0	48.0	64.2	0.81	9.1	10.05	2.27
20 plants/m <sup>2</sup>	17.3	21.16	7.70	2.8	56.0	69.9	0.83	8.5	9.73	2.53
24 plant/m <sup>2</sup>	17.1	21.73	6.50	2.5	60.0	73.0	0.82	8.4	9.44	2.59
L.S.D at 5%	N.S	0.90	0.81	0.43	8.87	1.07	N.S	0.51	0.59	N.S
1%	N.S	1.11	0.93	N.S	10.13	1.81	N.S	N.S	N.S	N.S

gave nearly values of 21.16 and 21.73 gms., respectively. In the second season 1992/93 data in Table (21) revealed the same trend. The differences among the treatments were significant in both seasons.

The same trend is observed with the dry matter Table (20,21). The treatments which produced the heaviest fresh weight of leaves and flower stem were those which produced the more dry weights. The differences between treatments were significant in the two seasons (1991/92) and (1992/93).

Generally, it appears that plant density 10 or 16 plants/m<sup>2</sup> resulted in an increase in both fresh and dry weights per flower stem with leaves. Such results may be attributed to the favourable opportunity of plants for suitable conditions of light, minerals and temperature between plants, which increasing the activation of the anabolic processes in plant, which were translocated from leaves and/or the roots leading to more fresh and dry weights.

### **2.B.3. Number of flowers per plant:**

In the first season, plant density 10 or 16 plants/m<sup>2</sup> significantly increased the number of flowers/plant as 3.6 and 3.0 fls. respectively Table (20) on the other side 20 or 24 plants/m<sup>2</sup> produced the minimum number of flowers per plant as 2-8 and 2-5 fls, respectively.

The data in the second season 1992/93 in Table (21) show insignificant differences between number of flowers per plant as affected by plant density treatments. At the treatment of mean time 10 or 20 plants/m<sup>2</sup> produced the maximum number of flower/plant as 3.4, 3.1 fls, respectively.

### **2.B.4. Number of flowers per m<sup>2</sup>:**

It is clear from the data illustrated in Table (20, 21) that the number of flowers/m<sup>2</sup> showed response to plant density treatments in both seasons, so that 24 or 20 plants/m<sup>2</sup> gave the maximum one. The 20 or 24

**Table (21):** Effect of plant density on the growth and flowering of Mercedes Roses in the spring fulsh during in the second season (1992/93).

Number of plants/m <sup>2</sup>	No. of Lvs. per flower stem	Fresh wt. of flower stem with leaves gm	Dry wt. of flower stem with leaves gm.	No. of flowers per plant	No. of flowers per m <sup>2</sup>	Mean length of flower stem cm	Mean diameter of flower stem cm	Mean diameter of flower cm	Fresh wt. of flower gm	Dry wt. of flower gm
10 Plants/m <sup>2</sup>	17.5	24.23	8.16	3.4	34.0	56.6	0.88	9.5	10.57	2.42
16 plants/m <sup>2</sup>	17.3	24.81	8.63	2.9	46.4	61.7	0.90	9.0	10.29	2.63
20 plants/m <sup>2</sup>	17.8	22.13	6.89	3.1	62.0	65.8	0.91	8.9	10.07	2.49
24 plant/m <sup>2</sup>	16.9	20.18	5.96	2.7	64.8	71.1	0.96	9.1	9.87	2.61
L.S.D at 5%	N.S	1.03	0.85	N.S	8.03	1.23	N.S	N.S	0.44	N.S.
1%	N.S	1.29	0.99	N.S	9.97	2.04	N.S	N.S	N.S.	N.S.

plants/ m<sup>2</sup> increased the number of flower per unite area by 55.56% and 66.67% over 10 plants/m<sup>2</sup> in the first and second season respectively. On the other hand, 16 plants/m<sup>2</sup> produced the next value as 48 fls and 46.4 fls/m<sup>2</sup> in the first and second season respectively. Statistical analysis showed high significant differences between these treatments during both seasons.

These results were agree with those obtained by *Mohamed (1988)* on roses, *Mohamed and Wahba (1993)* on *Tagetes erecta*, *Bunt and Powell (1982)* on carnation.

#### **2.B.5: Mean length of a flower stem in cms:**

Mean values of length of flower stem in both seasons are given in Tables (20,21). The differences between the plant density treatments were statistically significant. The plant density as 16, 20 or 24 plants/m<sup>2</sup> showed the tallest flower stem which increased by 7.03%, 14.8% and 18.02% over 10 plants/m<sup>2</sup> in the first season. The results of second season showed a similar trend to those resulted from first season with a little differences.

These results are in agreement with those of *Mohamed (1992)* who obtained the longest plant of *Tegetas erecta* from 24 X 50 cm distance than plant distance as 48 X 50 and 60 X 50 cm.

#### **2.B.6. Mean diameter of a flower stem in cms:**

As show in Table (20,21) in the first and second season, it is clear that plant density treatments did not affect an the mean diameter of a flower stem and the little differences between plant density treatments were insignificant in 1991/92 and 1992/93.

#### **2.B.7. Mean diameter of a flower in cms:**

From the data presented in Table (20), it can be noticed that mean diameter of flower response to plant density and these response was



significant at 5% in the first season (1991/92). However the plant population as 10 or 16 plants/m<sup>2</sup> increased the diameter of flower as 9.3, 9.1 cms compared to 8.5, 8.4 cms with 20, 24 plants/m<sup>2</sup>, respectively in the first season. On the other hand, the differences between all different plant density in the second season 1992/93 were insignificant Table (21).

#### **2.B.8. Fresh and dry weights of a flower in Gms:**

Mean values presented in Table (20) indicated that 10 or 16 plants/m<sup>2</sup> produced the heavier fresh weight of flower as 10.3 and 10.05 gms than 9.73 and 9.44 gms which produced with 20 and 24 plants/m<sup>2</sup> respectively in the first season. Similar trend was true in the second season 1992/93 in Table (21). The differences within plant density treatments in both seasons were statistically significant at 5%.

Concerning the dry weight of a flower, it can be noticed that the differences among plant density treatments, were very little and insignificant in two seasons 1991/92 and 1992/93 Tables (20,21).

In conclusion, the results with spring flush indicated that the plant density is important factor which affect the vegetative growth and flowering extremely of Mercedes Roses. Plant population as 10 or 16 plants/m<sup>2</sup> increased the vegetative growth and flowering of Mercedes plants.

Also 20 or 24 plants/m<sup>2</sup> increased the flower production per unit area, at the mean time did not affect flowers quality which are preferable for local market supply of flowers during spring flush. This is very important for florists and economic of Egypt.

### **2.C. Effect of plant density on root parameters of Mercedes Rose.**

#### **2.C.1. Mean length of main root in cms:**

Mean values of length of main root of Mercedes plants in the first and second season recorded in Table (22), and illustrated in Fig (1) show

**Table (22):** Effect of plant density on some root parameters during first and second seasons (1991/92) and (1992/93).

Number of plants/m <sup>2</sup>	First season			Second season		
	Mean length of main root cms	Fresh wt. of roots gms	Dry wt. of roots gms	Mean length of main root cms	Fresh wt. of roots cms	Dry wt. of roots gms
10 plants/m <sup>2</sup>	56.3	160.11	48.80	60.60	181.30	48.30
16 plants/ m <sup>2</sup>	48.7	110.0	31.70	57.30	103.20	24.80
20 plants/ m <sup>2</sup>	48.0	116.3	39.50	52.10	141.80	30.50
24 plants/ m <sup>2</sup>	44.6	137.4	34.10	48.40	118.10	26.90
L.S. Dat.	2.31	7.39	2.17	2.11	8.12	2.93
5% 1 %	3.75	10.15	2.96	3.57	11.41	3.19

that 10 plants/m<sup>2</sup> accelerated the length of main root as (56.3 cms) compared with other treatments, which produced 48.7, 48.0 and 44.6 cms of main roots with 16, 20 and 24 plants/m<sup>2</sup>, respectively.

The differences among the results were significant in both seasons 1991/92 and 1992/93. Similar results were obtained in the second season as shown in the same Table.

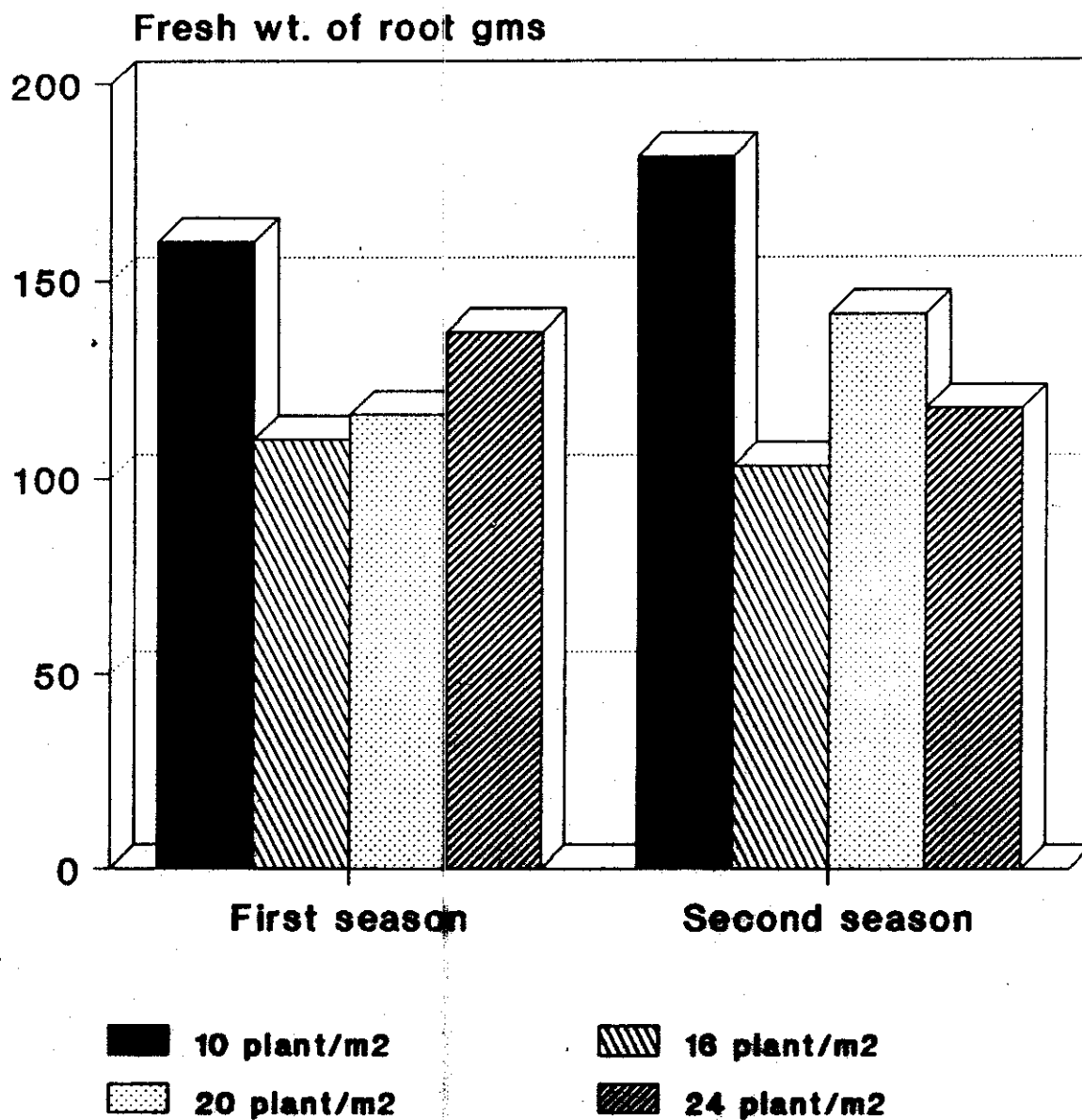
### 2.C.2. Fresh and dry weights of roots in Gms:

It is clear from the data tabulated in Table (22) and illustrated Fig. (2) that the fresh weight of roots showed response to the plant density treatments in both seasons 1991/92 and 1992/93 the plant population as 10 plants/m<sup>2</sup> gave the heaviest fresh weight of roots as 160.1, 181.3 gms in the first and second season, respectively.

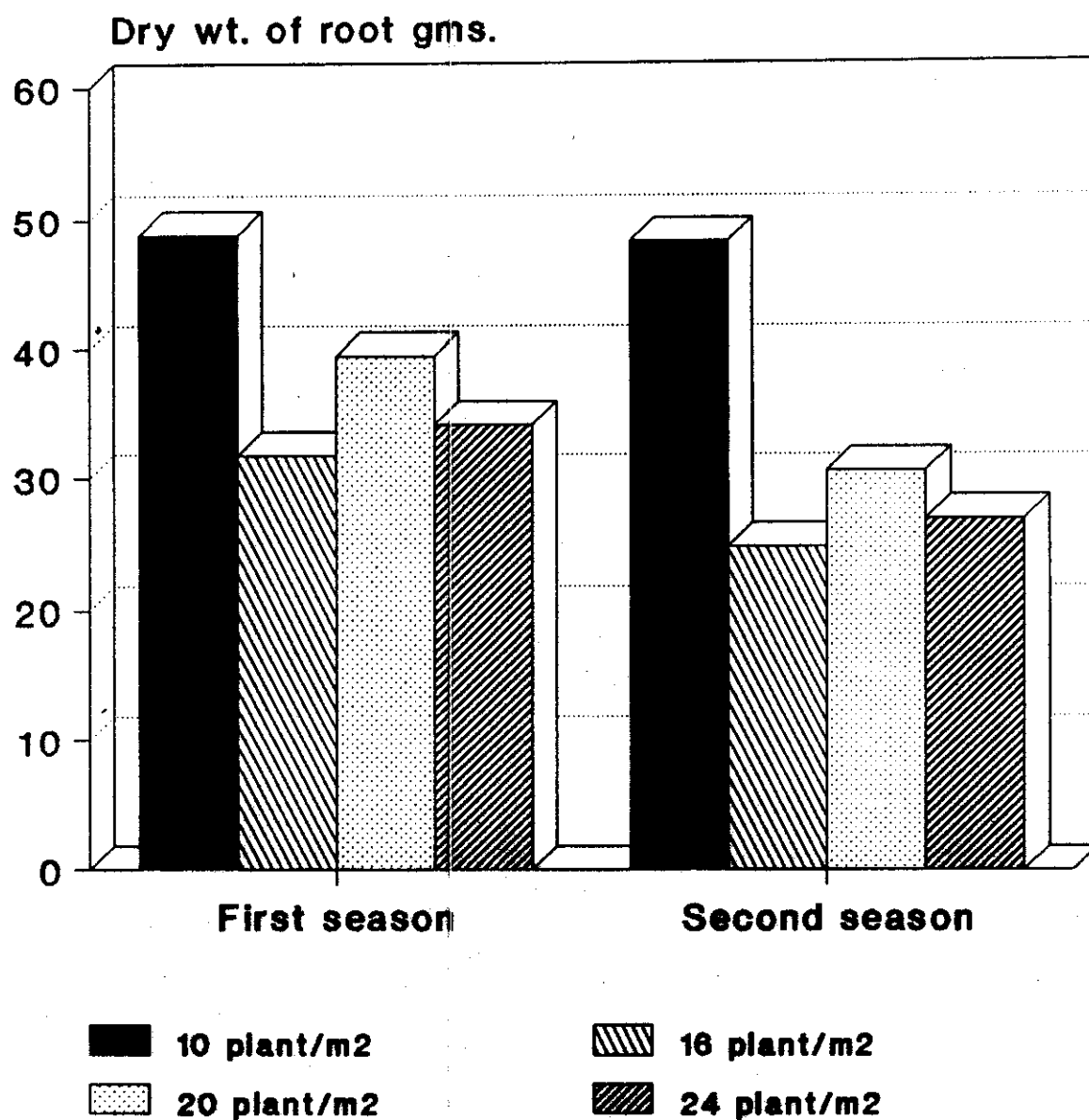
While 24 plants/m<sup>2</sup> produced the next value in this concern in the first season as 137.4 gms. But 20 plants/m<sup>2</sup> gave the next value in the second season as 141.8 gms. On the other hand 16 plants/m<sup>2</sup> produced the least fresh weight of roots/plant as 110.0 and 103.2 gms for the first and second season, respectively.

Concerning dry weight of roots, 10 plants/m<sup>2</sup> produced the heaviest dry weight of roots per plant in the first and second season Table (22) and Fig. (3). But 16 plants/m<sup>2</sup> gave the minimum dry weight of roots per plant. While 20 plants/m<sup>2</sup> produced the next value in this respect.

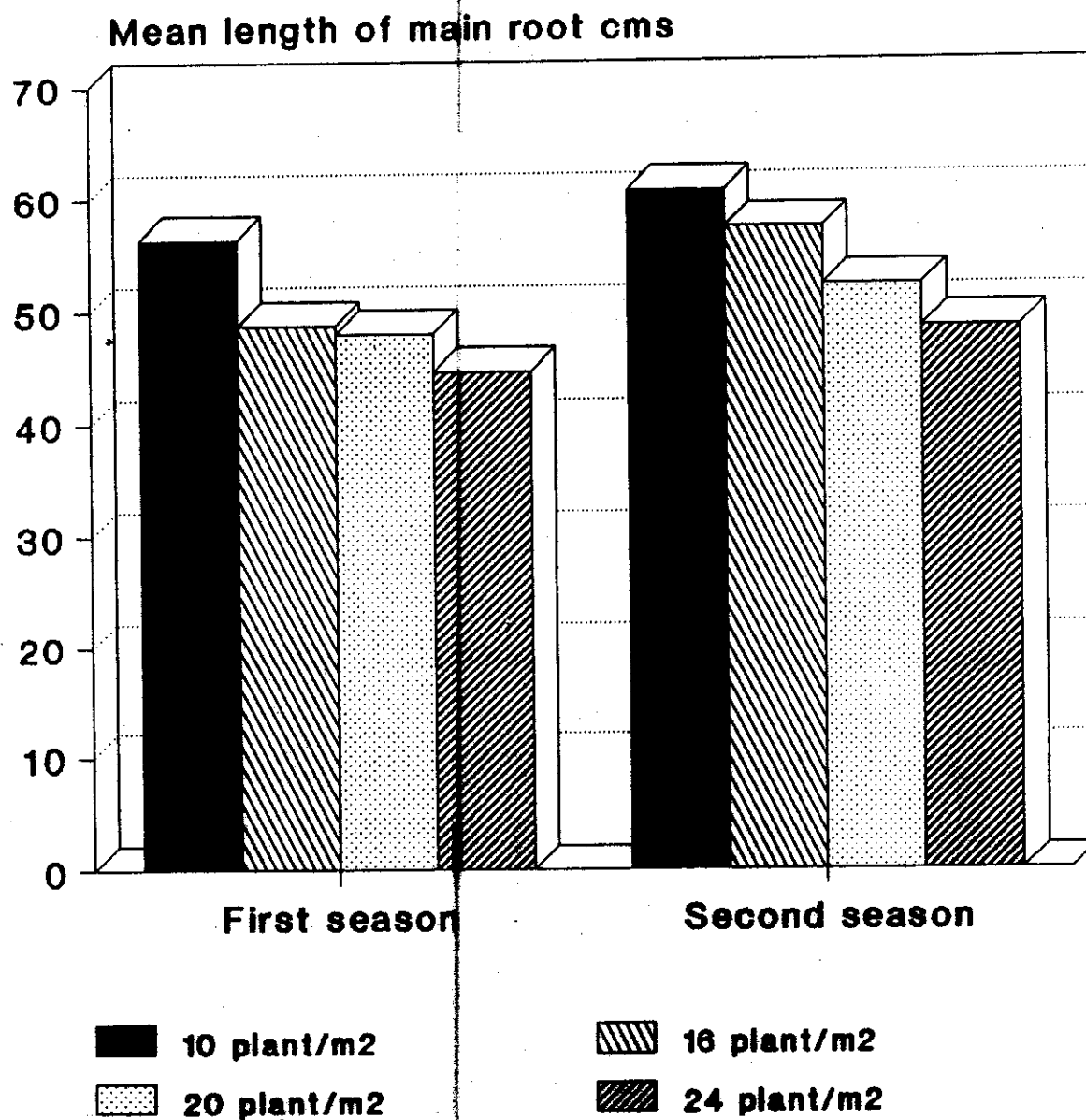
Data of second season (1992/93) shown in Table 6 and Fig. (3) appear similar results to those obtained in the first season (1991/92) the differences in this respect were significant in both seasons. Such increase in root characteristics due to the plant population as 10 plants/m<sup>2</sup> could be attributed to the promotive effects of this treatment on vegetative growth. Since this treatment play direct or indirect role in accumulation of dry matter in roots leading to the increase in root parameters. These accumulated of dry matter might be formed in the upper ground parts by the activation of the anabolic processes in these organs by the aid of this



**Fig.(2): Effect of plant density on fresh wt. of root gms during first and second season (1991/92) and (1992/93).**



**Fig.(3): Effect of plant density on dry wt. of root gms during first and second season (1991/92) and (1992/93).**



**Fig.(1): Effect of plant density on mean length of main root cms during first and second season (1991/92) and (1992/93).**

treatment. These results are in agreement with those obtained by *Mohamed (1992)* who reported that 36x 50 cm spacing gave the heaviest dry weight of roots per plant than 12 X 50 cm spacing of *Tagetes erecta*.

### III Effect of plant density on the chemical analysis;

#### III -1- Nitrogen content mg/gm.

It is clearly noticed from data in Table (23) that the nitrogen content of leaves was increased to 21.56 mg/gm due to the plant density of 16 plants/m<sup>2</sup> compared to that (19.94) which resulted from 24 plants/m<sup>2</sup> which gave least growth than other plant density treatments. While plant population as 10 or 20 plants/ m<sup>2</sup> gave the next value in this concern as 20.10 and 20.15 mg/gm dry matter, respectively. Data of 1992/93 show nitrogen in dry mater similar results to those obtained in 1991/1992 in the same table.

Nitrogen has its role in protein metabolism which reflects on all vital processes as well as growth. Similar conclusions were reported by *Mohamed (1988)* on Rouge Meilland and Baccara roses.

#### III 2. Total carbohydrate:

The maximum total carbohydrate of Mercedes leaves as 204.53 and 203.13 mg/gm dry matter were produced with 16 plants/m<sup>2</sup> treatment in the first and second seasons, respectively. While 10 or 20 plants/m<sup>2</sup> gave the next value in this concern as 202.15 and 201.16 mg/gm, respectively compared to the minimum one as 199.93 mg/gm with 24 plants/m<sup>2</sup> Tables (23).

On the other side, the differences between treatments of total carbohydrate were small. The results were agree with those reported by *Mohamed and Wahba (1993)* on *Tagetes erecta* who found that planting distance 50 X 36 cm gave the highest total carbohydrate percentage while the least value was obtained with plant spaced at 50 X 12 cm.

**Table (23):** Effect of plant density on the chemical composition:

treatment	Nitrogen content mg/gm		Total carbohyohate mg/gm		Chloophyll "A" mg/gm		Chlorophyll "B" mg/gm	
	Season		Season		Season		Season	
	First	Second	First season	Second	First	Second	First	Second
10 plants/ m <sup>2</sup>	20.10	21.97	202.15	198.59	5.21	5.03	5.07	4.96
16 plants/ m <sup>2</sup>	21.56	22.31	204.53	203.13	5.17	5.11	4.99	4.91
20 plants/m <sup>2</sup>	20.15	21.85	201.16	196.42	4.97	4.88	4.90	4.82
24 plants/m <sup>2</sup>	19.94	21.59	199.93	192.21	4.92	4.90	4.78	4.80



### III.3. Chlorophyll "A":

Data obtained on chlorophyll "A" as affected by plant density on Mercedes plants are presented in Table (23). It could be indicated that 10 or 16 plants/m<sup>2</sup> stimulated accumulation of chlorophyll "A" and gave the high value of chlorophyll "A" as 5.21 and 5.17 mg/gm fresh weight of leaves respectively. Whereas 20 and 24 plants/m<sup>2</sup> produced 4.97 and 4.92 mg/gm of chlorophyll "A" respectively.

Data of the second season as shown in the same table appear similar trend of results to those obtained in the first season.

### III.4. Chlorophyll "B":

Concerning of chlorophyll "B" mg/gm in fresh weight of leaves, 10 and 16 plants/m<sup>2</sup> treated plants gave the maximum value as 5.07, 4.99 mg/gm. While 24 plants/m<sup>2</sup> produced the least value in this respect as 4.78 mg/gm in the first season Table (23).

For the second season, chlorophyll "B" content was increased to 4.96 and 4.91 mg/gm in fresh weight due to the plant density of 10 and 16 plants/m<sup>2</sup>, respectively compared to the least content of 4.80 mg/gm in fresh weight which produced from 25 plants/m Table (24).