RESULTS AND DISCUSSION

Results and Discussions

The first Part

I - Effect of micro-elements (Manganese, Zinc and Iron) on both flushes :

1- Effect of Manganese on The Vegetative growth and flowering of violet plants in both flush :-

I - A- Winter Flush :-

I - A - 1 - Number of leaves per plant :-

The number of leaves per plant was affected by the different rates of Mn sprayed plants in both seasons . Since the mean number of leaves per plants was 40.22 Lvs. for plants treated with 125 ppm Compared with 17.42 Lvs. for control plants in the first season Table (1) and it was 39.46 Lvs. for plant treated with 125 ppm compared with 18.07 Lvs. for untreated plants in the second season Table (2) .

All concentrations gave more leaves than control and in most cases the differences were significant at 0.05 and 0.01 levels in both seasons .

Manganese was essential in numerous of physiological processes such as enzymatic reactions and citric acid cycle, (Mc Elory and Nason 1954), consequently, the number of leaves of viola plants could be increased .

This result is in agreement with findings of Mohamed safaa (1985) on dahlia plant, Taylor and Joiner (1963) on ***Chrysanthemun morifolium*** .

I - A - 2 - Whole plant leaf area in (cm^2) :-

In both seasons data in tables (1,2) show that spraying with Mn at 125 ppm level increased the leaf area over other treatments . the leaf area in this case was 370.02 cm^2 in the first Season and 366.19 cm^2 in the second one .

similar trend of results was obtained by Mohammed (1985) on dahlia plants who mentianed that leaf area and dry weight were significantly increased by Mn treatments . These results were due to the increase in the length and width of viola leaves, as a result of using the suitable concentration of Mn, accordingly the leaf area could be increased also the number of leaves per plant increased under this experiment .

I - A - 3 - Number of flower per plant :-

Results of number of flowers per plant in the first season table (1) indicated that the concentration of Mn at 125 ppm gave the maximum number of flowers . While the control plants produced the minimum. Similar data were obtained in the results of second season table (2) statistical analysis showed significant differences among treatments during the first and second seasons .

These results are in agreement with those reported by Savva (1977) on ***Dianthus chinensis***, Mousa and El-Lakany (1984) on ***Tagates erecta*** .They found that Mn increased the yield of flowers . these results were probably due to that previous concentration led to improve the vegetative growth . As result, the net assimilation rate would be increased which, consequently, led to produced vigorous plants with highest number of flower . Also Mn is essential in numerous physiological processes such as enzymatic reactions concerned with carbohydrate metabolism, phosphorylation and citric acid cycle (Mc Elory and Nasan, 1954) . On the other hand, it activates the enzyme sucrose synthetase in the leaves (Patil and Joshi, 1975) .

I - A - 4 - Mean length of flower pedicel in cms :-

In Tables (1, 2) it is shown an increasing in the flower pedicel length of viola plants when using Mn . the tallest flower pedicel was obtained from treating plants at 125 ppm . The means were 9.84 and 9.96 cm in both seasons respectively . Whereas the control plants gave the least flower pedicel length in both seasons the differences between treatments were significant in both seasons .

The results obtained due to Mn treatments are in agreement with Mohamed safaa (1985) on Dahlia plants .

I - A - 5 - Fresh and Dry Weights of leaves per plant in gms :-

All concentrations gave more weight than control (table 1, 2) Mn at 125 ppm gave the maximum weight in both fresh and dry weights . the control plants gave the least fresh and dry weight, in this respect . These differences among treatments were significant in both seasons .

I - A - 6- Fresh weight of flowers per plant :-

It was concluded from Table (1) that fresh weight of flowers per plant increased progressively with increasing the level of Mn, and that conected with the progressive increase in different growth parameters .

Table (1) : Effect of Mn on vegetative growth and flowering of *viola odorata* in the winter flush from December to February in the first season (1991 / 92)

Treatments	No. of Lvs. per plant	Leaf area / plant (cm^2)	No. of flower per plant	Mean length of flower pedicel (cm)	Fresh wt. of leaves per plant (gm)	Dry wt. of leaves/plant (gm)	Fresh wt. of flowers per plant (gm)
Mn at 00.0 ppm	17.42	119.15	5.87	7.25	101.20	21.00	0.94
Mn at 75 ppm	28.13	225.32	9.80	8.92	107.31	21.90	1.66
Mn at 100 ppm	29.65	244.32	10.72	9.23	121.00	22.00	1.83
Mn at 125 ppm	40.22	370.02	12.05	9.84	176.70	24.00	2.71
L.S.D at 5%	3.40	10.10	2.22	0.17	9.37	2.73	0.02
L.S.D at 1%	5.14	15.45	3.37	0.27	13.11	3.01	0.03

Table (2) : Effect of Mn on the vegetative growth and flowering of *viola odorata* in winter flush from December to February in the second season (1992 / 93)

Treatments	No. of Lvs. per plant	Leaf area / plant (cm^2)	No. of flower per plant	Mean length of flower pedicel (cm)	Fresh wt. of leaves per plant (gm)	Dry wt. of leaves/plant (gm)	Fresh wt. of flower s per plant (gm)
Mn at 0.00 ppm	18.07	81.68	6.35	7.40	100.03	20.00	0.82
Mn at 75 ppm	27.56	207.25	11.35	9.54	104.9	21.71	1.78
Mn at 100 ppm	29.50	228.04	10.10	9.33	120.36	21.80	1.47
Mn at 125 ppm	39.46	366.19	10.75	9.96	174.63	22.53	1.63
L.S.D at 5%	3.23	8.85	1.73	0.15	10.12	1.97	0.02
L.S.D at 1%	4.90	13.94	2.60	0.25	14.06	2.73	0.06

I - B- Spring Flush :-

I - B - 1 - Number of leaves per plant :-

In the first season, data in Table (7) indicate that number of leaves per plant was increased by the applied concentrations of Mn, the 125 ppm produced the maximum number of leaves The leaves number in this case was 63.71% over control . The highest increase due to 125 ppm application was also noticed in the second year, and the results take the similar trend Table (7) This differences among treatments were significant in both seasons. These results were in agreement with those reported by Tibabishe (1972) on onion .

I - B - 2 - Whole plant leaf area (cm^2) :-

Generally, the date on Tables (3,4) Show that Mn at the rate of 125 ppm gave the largest leaf area . While The control plants produced the minimum leaf area in both seasons From the above mentioned data it is clear that Mn has a stimulatory effect on leaf area of viola plants . These differences among treatments were significant in both seasons .

I - B - 3 - Number of flower per plant :-

It is obvious from the results in Table (3) that plants which were sprayed with Mn at all concentration gave significantly higher number of flowers per plant as compared with untreated plants .

Data of (1992 / 93) shown in Table (4) appear similar trend of results to those obtained in 1991 / 92, the differences among treatments were also significant in the second season .

I - B - 4 - Mean Length of flower pedicel in (cm) :-

The results also reveal that flower pedicel was increased by increasing the concentration of Mn in the two seasons . Higher length was obtained by treating plants with 125 ppm (highest level) . The averages were 10.09 cm in the first season and 10.31 cm in the second . In the meantime, the control plants resulted only 8.33 and 8.45 cm for the first and second seasons, respectively, the differences between treatments were significant in both seasons . Tables (3, 4) .

I - B - 5 - Fresh and Dry Weights of leaves per plant in (gm) :-

Date in tables (3, 4) show that all Mn levels increase the fresh and dry weights than control in both seasons .And the highly concentration of Mn as 125,100 ppm produced the largest fresh and dry weights. While the control plants gave the minimum fresh and dry weight in both seasons. The differences between the treatments were significant in the first and second seasons.

I - B - 6- Fresh weight of flowers per plant :-

The application of Mn increased significantly the fresh weight of flower per plant . This increment increased with Mn level. However there are great differences between the results in the tested two seasons, and that may be due to the prevailing environmental factors .

Table (3) : Effect of Mn on the vegetative growth and flowering of *viola odorata* in the spring flush form March to Mayin the first season (1991 / 92)

Treatments	No. of Lvs. per plant	Leaf area / plant (cm^2)	No. of flower per plant	Mean length of flower pedicel (cm)	Fresh wt. of leaves per plant (gm)	Dry wt. of leaves/plant (gm)	Fresh wt. of flowers per plant (gm)
Mn at 00.0 ppm	44.17	270.32	7.92	8.33	162.93	23.97	1.26
Mn at 75 ppm	68.09	556.30	18.92	9.31	188.11	25.01	3.21
Mn at 100 ppm	70.65	604.76	17.12	9.45	189.07	24.99	2.13
Mn at 125 ppm	72.18	626.52	19.75	10.09	191.11	25.42	4.45
L.S.D at 5%	18.61	17.06	4.00	1.31	12.03	2.36	0.01
L.S.D at 1%	—	—	6.05	—	16.61	2.91	0.02

Table (4) : Effect of Mn on the vegetative growth and flowering of *viola odorata* in the sprin flush from March to May in the second season (1992 / 93)

Treatments	No. of Lvs. per plant	Leaf area / plant (cm^2)	No. of flower per plant	Mean length of flower pedicel (cm)	Fresh wt. of leaves per plant (gm)	Dry wt. of leaves/plant (gm)	Fresh wt. of flowers per plant (gm)
Mn at 00.0 ppm	54.91	415.12	10.25	8.45	159.88	22.17	1.32
Mn at 75 ppm	67.78	620.19	18.32	9.42	179.63	24.11	2.88
Mn at 100 ppm	81.67	782.40	15.57	9.45	201.16	26.79	2.27
Mn at 125 ppm	88.18	866.81	22.27	10.31	211.37	27.03	3.55
L.S.D at 5%	14.25	60.20	2.22	1.67	15.95	1.02	0.01
L.S.D at 1%	—	117.43	4.27	—	18.06	1.64	0.02

2 - Effect of Zinc on the vegetative growth and flowering of violet plants :-

A - Winter flush :-

2 - A - 1 - Number of leaves per plant :-

In The following table (5, 6) it is clear that the number of leaves per plant was significantly increased by Zinc treatments in both seasons . The maximum value was obtained from treating plants by 125 ppm zn in both seasons . the average were 35.65 and 38.67 Lvs / plant in the first and second seasons, respectively . While untreated plants gave the least number of leaves as 17.42 Lvs in the first season and 18.07 Lvs in the second one .

Similer results were obtained by Mohamed safaa (1985) on ***Dahlia hybrida*** (cv . Moon light sonata), and Peterburgskii and lyashika (1978) on tulip .

2 - A - 2 -Whole plant leaf area (Cm^2) :-

The maximum leaf area was obtained from plants treated with zinc at 125 ppm . Tables (5, 6) On the other side, the minimum leaf area was resulted from control plants .

While Zinc at 75 ppm gave the next value in this concern the differences among the treatments were significant in both seasons . The above mentioned results are in harmony with those obtained by Mohammed safaa (1985) on Dahlia plants .

2 - A - 3- Number of flowers per plant :-

Data of number of flowers per plant in 1991/92 Table (5) revealed that zn concentration 125 ppm gave the maximum number of flowers as compared to other concentrations .

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

Data of 1992 / 93 in Table (6) revealed that maximum number of flowers was obtained with 125 ppm concentration and the least number of flowers per plant was produced with untreated plants .

The results were agree with those obtained by Hasek and Farnham (1976) on ***Lililun longiflorum*** Cv. Ario, Savva (1977) on ***Dianthus Chinensis*** .

2 - A - 4 - Mean Length of flower pedicel in Cms :-

Data in Tables (5, 6) clear that zinc treatments significantly increased flower peduncle length in both seasons due to concentration used which gave more lengths gradually, . Generally, The high concentration showed the maximum length of flower pedicel . The tallest flower pedicel was obtained from treating plants with the concentration of zn 125 ppm with the mean 9.83 and 10.50 cm. in both seasons, respectively. While the control plants gave only 7.40 in the first season and 7.25 cm. in the second one . On the other hand, 100 ppm of zn produced the next average in this concern .

The differences betwen treatments were significant in both seasons .

These effect on the length may be due to many physiological roles of zinc in plant and using the suitable concentration of zn, accordingly the flower pedicel could be increased .

2 - A - 5 - Fresh and dry weight, of leaves per plant in gms :-

In the first and secand seasons, data in Tables (5, 6) indicate that fresh and dry weight of leaves per plant were increased by all concentration of zn ; The treatment of 125 ppm gave the best fresh and dry weight of leaves / plant in both seasons . Also Zn at 100 ppm produced the next value in this concern . The untreated plants gave the least fresh and dry weight of leaves per plant in both seasons . The differences between treatments in both seasons were significant .

2 - A - 6 - Fresh weight of flowers per plant :-

It may be concluded that Zn increased the productivity of flowers. Such stimulatory effect increeased with increasing Zn level .

Table (5) : Effect of Zn on the vegetative growth and flowering of *viola odorata* in Winter flush from December to February in the first season (1991 / 92)

Treatments	No. of Lvs. per plant	Leaf area / plant (cm^2)	No. of flower per plant	Mean length of flower pedicel (cm)	Fresh wt. of leaves per plant (gm)	Dry wt. of leaves/plant (gm)	Fresh wt. of flowers per plant (gm)
Zn at 00.0 ppm	18.07	99.57	6.35	7.40	101.93	21.14	1.02
Zn at 75 ppm	27.53	226.57	8.85	8.86	135.37	22.31	1.34
Zn at 100 ppm	31.44	249.32	10.55	9.28	164.01	22.69	1.69
Zn at 125 ppm	38.67	370.84	12.65	9.83	191.73	23.72	1.72
L.S.D at 5%	5.17	8.78	3.07	1.00	12.03	1.75	0.06
L.S.D at 1%	7.82	13.32	4.02	1.51	17.32	2.01	0.08

Table (6) : Effect of Zn on the vegetative growth and flowering of *viola odorata* in Winter flush from December to February in the second season (1992 / 93)

Treatments	No. of Lvs. per plant	Leaf area / plant (cm^2)	No. of flower per plant	Mean length of flower pedicel (cm)	Fresh wt. of leaves per plant (gm)	Dry wt. of leaves/plant (gm)	Fresh wt. of flowers per plant (gm)
Zn at 00.0 ppm	17.42	84.31	5.87	7.25	100.99	20.13	0.76
Zn at 75 ppm	29.41	251.75	10.10	9.19	136.20	21.11	1.49
Zn at 100 ppm	32.60	261.78	11.20	9.47	162.23	21.37	3.77
Zn at 125 ppm	35.65	351.87	14.25	10.50	189.6	22.29	2.23
L.S.D at 5%	4.93	5.77	3.80	0.93	11.39	1.89	0.09
L.S.D at 1%	6.81	—	4.70	1.43	13.95	2.15	0.12

2 - B - Spring flush :-

2 - B - 1 - number of leaves per plant :-

It is clearly noticed from data in tables (7, 8) for seasons (1991 / 92) and (1992 / 93) that Zn at 125 ppm produced the maximum numbers of leaves per plant as compared to other concentrations . Also Zn at 100 ppm gave the next value in this concentrations .While the lowest value was produced with control plants in both seasons .

These effects were probably due to the use of suitable concentration of zinc . Zinc activated the enzymes triosphosphate dehydrogenase Vallee et al (1956) and carbonic anhydrase Veeranjaneyulu and Dase, (1982) which concerned with the metabolism of carbohydrates . As a result, the vegetative growth of viola plants could be encouraged and many of leaf primordias may be initiated, consequently , the number of leaf per plant would be increased

2- B - 2 - Whole plant leaf area (cm^2) :-

In Table (7) for first season it is clearly noticed that the concentration of Zn at 125 ppm increased the leaf area .

In the second season data in Table (8) indicate also that the leaf area of viola plants significantly increased over the control as a result of Zn treatment especially at 125 ppm . While the least value resulted from the control treatment .

2 - B - 3- Number of flowers per plant :-

The number of flowers per plant was affected by the different rates of zinc sprayed on plants in both seasons .

Results of (1992 / 93) Table (8) were in harmony with those of (1991 / 92) Table (7) .

All treatments gave more flowers than control and in most cases the differences were significant at 0.05 and 0.01 levels . It is obivous that zinc has promoting effect on flowers number which may be due to the role zinc in plants. Using zinc at a specific concentration plays an important role on the production and regulation of auxins in plants Takaki and Kushizaki (1978) Therefore flowering of some plants was associated with a suitable levels of auxin (Lang, 1952), consequently, The number of flowers was increased .

2 - B - 4 - Mean Length of flower pedicel in cms :-

the flower pedicel length was also affected with the different concentrations of Zn since the longest flower pedicel was produced with Zn at 125 ppm while 100, 75 ppm gave the next value in this concern . The shortest flower pedicel, was noticed with untreated plants .

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

Table (8) appears similar results of 1992 / 93 to those obtained in 1991 / 92 . The tallest flower pedicel was obtained from plants treated with 125 ppm and the minimum flower pedicel as 8.45 cm. was obtained with control plants .

Similar trend of results was found by Mohamed saffa (1992) on some annual ornamental plants and the same auther (1992) on ***Dahlia Pinnata*** .

2 - B - 5 - Fresh and Dry Weight of leaves per plant in (gm) :-

The maximum fresh and dry weight of leaves per plant were obtained from plants sprayed with zn at 125 ppm in the first and second seasons, tables (7, 8) . On the other hand the untreated plants gave the minimum fresh and dry weight of leaves per plant in both seasons . The differences among the treatments were significant in both seasons .

2 - B - 6 - Fresh weight of flowers per plant :-

It could be concluded that Zn increased significantly the flower fresh weight of violet plant . This flower induction reached into the maximum with 125 ppm Zn during the frist seasons or 100 ppm Zn during the second season .

Table (7) : Effect of Zn on vegetative growth and flowering of *viola odorata* in the spring flush from March to May in first season (1991 / 92)

Treatments	No. of Lvs. per plant	Leaf area / plant (cm^2)	No. of flower per plant	Mean length of flower pedicel (cm)	Fresh wt. of leaves per plant (gm)	Dry wt. of leaves/plant (gm)	Fresh wt. of flowers per plant (gm)
Zn at 00.0 ppm	45.91	305.76	9.40	8.45	170.13	24.05	1.51
Zn at 75 ppm	62.38	512.14	14.27	9.50	178.43	24.71	2.16
Zn at 100 ppm	80.10	631.19	16.90	9.63	181.31	25.16	2.71
Zn at 125 ppm	86.51	833.96	17.52	10.75	194.13	26.01	1.82
L.S.D at 5%	10.13	34.54	1.10	1.12	13.18	1.86	0.02
L.S.D at 1%	16.95	40.51	3.02	2.15	16.24	2.19	0.05

Table (8) : Effect of Zn on vegetative growth and flowering of *viola odorata* in spring flush from March to May in the second season (1992 / 93)

Treatments	No. of Lvs. per plant	Leaf area / plant (cm^2)	No. of flower per plant	Mean length of flower pedciel (cm)	Fresh wt. of leaves per plant (gm)	Dry wt. of leaves/plant (gm)	Fresh wt. of flowers per plant (gm)
Zn at 00.0 ppm	44.17	233.22	7.92	8.33	160.36	23.08	1.02
Zn at 75 ppm	58.83	438.28	10.17	9.35	171.08	23.90	1.51
Zn at 100 ppm	61.11	381.33	10.82	9.74	178.11	24.07	1.64
Zn at 125 ppm	78.37	691.22	15.05	10.21	189.36	25.13	1.86
L.S.D at 5%	12.91	40.79	3.10	1.14	14.07	1.61	0.01
L.S.D at 1%	19.56	—	4.72	N.S	17.11	1.95	0.02

3 - Effect of Iron " Fe " on the vegetative growth and flowering of violet plants :-

A - Winter flush :-

3 - A - 1 - Number of leaves per plant :-

Data in Tables (9, 10) indicated that the different levels of iron increased the number of leaves per plant in both seasons (1991 / 92 and 1992 / 93) . The most responsive treatment for increasing the leaves number was 100 ppm which recorded 31.80 and 31.75 Lvs. per plant in the first and second season, respectively .

The control plants produced the least number as 17.42 and 18.07 Lvs / plants in both seasons , respectively, statistical analysis showed significant differences between treatments and control plants during the two seasons .

In this connection Mohamed safaa (1992) stated that Fe at 150 ppm increased the number of leaves of ***Dahlia pinnate*** , L. also the same author (1992) found that the number leaves of ***Callistephus chinensis***, L., ***Delphinium grandiflorum***, L., ***Mathiola incana***. L.and ***Antirrhinum majus*** were increased by
Fe at 100,125 or 150 ppm .

3 - A - 2 - Whole plant leaf area (Cm^2) :-

It is clear that the average of leaf area was increased when using Fe treatments Tables (9, 10).

The highest values were obtained from treatment 125 ppm in both seasons, . The control plants gave the lowest values in the this respect .

The differences between treatments were significant in both seasons .

3 - A - 3 - Number of flowers per plant :-

Regarding the effect of Fe treatments as shown in Tables (9, 10) The maximum number of flowers per plant were obtained from treating with highest rate in both seasons . respectively . The differences between the treatments were significant with all cases .

Similar results were obtained by Mohamed safaa (1992) on some annual ornamental plants and Mousa and El-akany (1984) on africana marygold .

3 - A - 4 - Mean length of flower pedicel in cms :-

The treatments of Fe at 125 ppm gave the maximum length of flower pedicel while control plants produced the minimum length in this connection .

The differences between treatments were significant in the first and second season . Tables (9, 10) .

These results are in a harmony with Mohamed safaa (1992) on Dahlia Pinnata and same author (1992) on some annual ornamental plants . She mentioned that Fe increased the length of flower stem .

3 - A - 5- Fresh and dry weights of leaves per plant in gms :-

Results in Tables (9, 10) for the first and second season clear that Fe at 100 ppm gave the maximum fresh weight of leaves per plant in both season . Also Fe at 125 ppm produced the next value in this concern. The control plant and Fe at 150 ppm gave the minimum fresh weight of leaves per plant in the first and second seasons .

As for dry weight, Fe at 100 ppm gave the heaviest dry weight of leaves per plant in both seasons . The control plants produced least dry weight in the first and second seasons Tables (9, 10) . Statistical analysis showed significant differences among the treatments during the two seasons .

3 - A - 6- Fresh weight of flowers per plant :-

It may be concluded that diffdrent levels of Fe increased significantly the flower production of viola plant . The highest productivity in both seasons was shown by 150 ppm Fe treated plants .

Table (9) : Effect of Fe on vegetative growth and flowering of *viola odorata* in Winter flush from December to February in the first season (1991 / 92)

Treatments	No. of Lvs. per plant	Leaf area / plant (cm^2)	No. of flower per plant	Mean length of flower pedciel (cm)	Fresh wt. of leaves per plant (gm)	Dry wt. of leaves/plant (gm)	Fresh wt. of flowers per plant (gm)
Fe at 00.0 ppm	17.42	101.73	5.87	7.25	101.20	21.00	0.93
Fe at 100 ppm	31.80	276.98	8.20	9.39	179.3	23.61	1.14
Fe at 125 ppm	30.48	274.02	9.60	10.20	156.72	21.79	1.36
Fe at 150 ppm	30.94	244.43	12.70	9.79	114.3	21.09	1.97
L.S.D at 5%	9.64	3.14	2.77	1.03	12.07	1.36	0.02
L.S.D at 1%	—	4.56	4.20	1.57	16.65	1.77	0.04

Table (10) : Effect of Fe on vegetative growth and flowering of *viola odorata* in Winter flush from December to February in the second season (1992 / 93)

Treatments	No. of Lvs. per plant	Leaf area / plant (cm^2)	No. of flower per plant	Mean length of pedciel (cm)	Fresh wt. of leaves/per plant (gm)	Dry wt. of leaves/plant (gm)	Fresh wt. of flowers per plant (gm)
Fe at 00.0 ppm	18.07	81.50	6.35	7.40	100.03	20.00	0.82
Fe at 100 ppm	31.75	267.34	9.45	8.74	176.50	22.41	1.12
Fe at 125 ppm	31.12	377.17	9.03	9.75	157.43	21.22	1.74
Fe at 150 ppm	30.72	261.43	11.25	9.31	112.2	20.15	2.01
L.S.D at 5%	7.36	5.59	2.17	0.69	11.96	1.45	0.01
L.S.D at 1%	—	8.24	—	1.04	16.31	1.81	0.3

3 - B- Spring flush:-

3 - B - 1 - Number of leaves per plant :-

Application of Fe at 125 ppm was effective in increasing the number of leaves while control plants gave the minimum number of leaves per plants, Table (11). The differences among the treatments were significant in both seasons. Similar results were obtained in the data of 1992/93 Table (12).

Mohamed safaa (1992) reported that Fe at 125 or 150 ppm increased the number of leaves of Antirrhinum majus .

3 - B - 2 - Whole plant leaf area (cm^2) :-

As for leaf area, data in Tables (11, 12) show that the highest value was gained from treating plants by Fe at 125 ppm in both seasons

The differences between the treatments were significant in both seasons.

Similar results were obtained by Attoa (1981) on sweet peas and El-Ghdban (1994) on Mentha Viridis .

3 - B - 3- Number of flowers per plant :-

Data also clear that the highest number of flower was obtained from spraying plants with 150 ppm in both seasons .

While, the untreated plants gave the lowest values in this respect.

The differences between the treatments and the control were significant in both seasons .

The present results mostly agree with those of Mohamed safaa (1992) on ***Dahlia Pinnata*** Rutland and Bokovok (1968) on Chrysanthemum . They found that application of Fe increased the number of flowers .

3 - B - 4- Mean length of flowers pedicel in (cm) :-

In Tables (11, 12) for first and second seasons, it is clearly noticed that Fe at 150 ppm increased the length of flower pedicel during the two seasons .

The least value of flower pedicel length was with the control plants in both seasons . The differences among treatments were significant in the two seasons .

In conclusion, all concentration of Fe gave more vegetative growth and flowering comparing with untreated plants .

These results might be attributed to the needs of viola plants, under the condition of the experiment to Fe at suitable concentrations .

Iron has been shown to be a metal constituent of number of enzymes concerned with respiration and other oxidation systems, as in cytochromes bond C, catalase per oxidase, hydrofenes, xanthine oxidase and oldehyde oxidase (Wallace 1961) . The stimulatory effect of foliar application of Fe in increasing growth and flower parameters could be explained by the action of the tested trace elements in plant metabolism . It was involved in the activation of several enzymes, chlorophyll formation and carbohydrate metaboli (Leopold and Kriedemann 1975)

3 - B - 5 - Fresh and dry weights of leaves per plant in (gm) :-

In the first season (1991 / 92) results in Table (11) indicate that the fresh and dry weights of leaves per plant were increased by using Fe at 100, 125 ppm . The Fe at 100 ppm gave the heaviest fresh and dry weights in the first seasons .

The control plants gave the least fresh and dry weights of leaves per plant . Similar results were obtained in the second season Table (12) . The differences between the treatments were significant in both seasons .

3 - B - 6- Fresh Weight of flowers per plant :-

Fe stimulated significantly the flower production of viola odorata plant, and the highest value was obtained under 150 ppm in Fe treated plants during the frist season and 125 ppm Fe during the second one .

Table (11) : Effect of Fe on vegetative growth and flowering of *viola odorata* in spring flush from March to May in the first season (1991 / 92)

Treatments	No. of Lvs. per plant	Leaf area / plant (cm^2)	No. of flower per plant	Mean length of flower pedciel (cm)	Fresh wt. of leaves/per plant (gm)	Dry wt. of leaves/plant (gm)	Fresh wt. of flowers per plant (gm)
Fe at 00.0 ppm	51.17	312.65	12.23	8.33	162.93	23.97	1.95
Fe at 100 ppm	60.50	425.92	17.30	9.92	201.37	26.11	2.40
Fe at 125 ppm	84.21	786.52	15.00	9.98	182.13	25.14	2.12
Fe at 150 ppm	76.55	577.19	20.97	10.22	167.83	24.01	3.25
L.S.D at 5%	10.01	14.70	2.12	0.84	12.37	2.01	0.01
L.S.D at 1%	—	17.31	3.25	1.28	17.08	2.44	0.02

Table (12) : Effect of Fe on vegetative growth and flowering of *viola odorata* in the spring flush from March to May in second season (1992 / 93)

Treatments	No. of Lvs. per plant	Leaf area / plant (cm^2)	No. of flower per plant	Mean length of pedciel (cm)	Fresh wt. of leaves/per plant (gm)	Dry wt. of leaves/plant (gm)	Fresh wt. of flowers per plant (gm)
Fe at 00.0 ppm	54.91	415.12	10.25	8.45	159.88	22.17	1.32
Fe at 100 ppm	83.75	639.85	16.87	9.95	193.17	25.83	2.01
Fe at 125 ppm	98.33	920.37	21.95	9.52	173.92	23.99	2.81
Fe at 150 ppm	80.88	667.26	23.60	10.01	160.23	22.25	3.11
L.S.D at 5%	12.31	12.08	1.95	0.42	12.42	2.03	0.01
L.S.D at 1%	20.72	20.35	3.07	0.83	17.12	2.46	0.02

II - Effect of Micro-elements (Mn, Zn, Fe) on chemical composition of violet leaves :-

A - Effect of Mn

A . 1 . Nitrogen content :-

Content of N as estimated in the leaves of ***viola odorata*** treated with Mn- fertilization is illustrated in Table (13) . It is noticed that Mn at 75 ppm gave the maximum value as 2.80, 2.85 % in the first and second Seasons, respectively . While 100 ppm of Mn gave the next value in this concern . However the highly level of Mn recorded little increment in nitrogen uptake .

At the meantime, the control plants produced the least N content in both seasons .

These results are in agreement with those obtained by Sisler et al (1965) . They obtained higher N content when treated the plants with Mn .

A . 2 . Phosphorus content :-

All concentration of Mn increased the phosphorus content in the leaves of viola plants in both seasons, also positive relationship was noticed between increase the Mn concentrations and phosphorus up-take table (13) . The highest absorption of phosphorus was found in leaves of plants treated with Mn at 125 ppm for first and second seasons of trials .

The untreated plants gave the minimum P content in the leaves in both seasons .

A . 3. Potassium content :-

Data in both seasons as shown in Table (13) clear that all treatments of Mn increased the potassium content in dry leaves of viola odorata compared to the untreated plants . The lowest level of Mn (75 ppm) recorded the highest potassium content in the first and second seasons followed by the highest level of Mn (125 ppm) while the medium concentration Mn (100 ppm) gave little increase in this concern .

A . 4 . Iron content :-

The Fe content in leaves of viola odorata plants decreased with all concentration of Mn comparing with control plants . These decreases were more with increasing the concentration of Mn . This trend was true in the first and second seasons of trials table (13) . The untreated plants gave the maximum Fe contain in leaves as 159.03 and 155.25 ppm in both seasons, respectively .

A . 5 . Mn content :-

It could be Seen from table (13) that all applications of Mn increased the Mn content in leaves of violet plants in both seasons . The highest level of Mn (125 ppm) gave the maximum content of Mn in both seasons as 13.89 and 14.02 ppm, respectively . The medium level of Mn (100 ppm) produced the next value in this concern . The untreated plants gave the minimum content of Mn as 8.07 ppm in the first season and 8.50 in the second one .These results are in agreement with those obtained by Ravikovitch and Navrot (1976) on tomato and Abo- Zeid (1980) on citrus trees . They obtained higher Mn content when treated the plants with Mn .

A . 6 . Zn content :-

Data in table (13) show that Mn increased the Zn content of leaves in both seasons . The lower concentration (75 ppm) increased Zinc content by 35.2 %, while the higher one gave about 14.1 % increase over the untreated plants .

A . 7 . Total carbohydrate percentage :-

Table (14) shows that the treatments with Mn at the used concentrations, increased the total carbohydrate in leaves of viola plants in both seasons . The higher concentration of Mn (125 ppm) gave the maximum total carbohydrate as 8.32 and 8.06 % in the first and second seasons, respectively. The control plants produced the minimum total carbohydrate in dry leaves . These results are in agreement with those obtained by Mohamed safaa (1992) on Dahlia Pinnata . She obtained higher carbohydrate content when treated the plants with Mn .

A .8 . Chlorophyll A and B contents :-

The most promising effects of Mn application was showed with lower concentration (75 ppm) where increase the chlorophyll A and B in both seasons table (14). On the other hand, the higher level of Mn recorded little increase in this respect .While the least record for chlorophyll A and B was neticed with the control plants. This was true in two seasons . These results are in agreement with those obtained by Ohki (1981) on Soy bean . He obtained higher Chlorophyll content when treated the plants with Mn .

A . 9 . Concret oil percentage in violet flowers :-

The results in Table (14) shows that all Mn treatments increased the concrete percentage of violet flowers in both seasons . The best concentration of Mn which gave the high percentage of violet concrete was 125 ppm at the first season and 75 ppm at the second season, which recorded 0.126 and 0.125 % respectively . These results are in agreement with those obtained by Khater et al (1993) on Foeniculum vulgarea, Dulc . He obtained higher concrete percentage when treated the plants with Mn .

B - Effect of Zn .

B . 1 . Nitrogen content

It is clearly noticed from data in table (13) that the nitrogen content of leaves was increased to 3.003 % due to lower concentration of Zn (75 ppm) . While the medium level of Zn (100 ppm) produced the next value in this concern as 2.603 mg/gm dry matter . control plants gave the minimum nitrogen contend in both seasons . From the above results it could be concluded that spraying violet plants with Zn increase the nitrogen up-take in violet leaves especially with lower concentrations . These results are in agreement with those obtained by Harridy (1986) on Catharanthus roseus He obtained higher N content when treated the plants with Zn .

B . 2 . Phosphorus content :-

The results in table (13) showed that the nitrogen content was increased with different concentrations of Zn in both seasons . However the highest value of nitrogen content was obtained from treating plants at 75 ppm . while Zn at 100 gave the next average in this respect followed by 125 ppm .

The untreated plants produced the least average of phosphorus content . Data of (1992 / 1993) Shown in the same table appear similar trend of results to those obtained in (1991 / 1992) .

B . 3 . Potassium content :-

Concerning the effect of Zn on the potassium content, it could be noticed that the negative relationship between increasing the concentration of Zn and the value of potassium content in violet leaves, this trend was true with two seasons the maximum value of potassium was obtained with the lowest level of Zn (75 ppm) . the control plants gave the minimum value of potassium content in both seasons .

B . 4 . Iron content (ppm) :-

The obtained data in Table (13) show that low concentration of Zn resulted in an increase in the leaves content of iron of ***viola odorata*** . While the high concentration gave the next average in this concern . But the medium concentration of Zn produced the third value from iron content, this was true in both season . While untreated plants produced the least value of iron content in leaves in both seasons .

B . 5 . Manganese conten (ppm) :-

The results in Table (13) show the effects of Zn treatments as foliar application on Mn content in Violet leaves, it could be noticed that increasing the concentration of Zn decreased the Mn up-take in leaves of viola odorata . The highest Mn content was obtained from treating plants with 75 ppm Zn with the average of 11.97 ppm in the first season and 12.25 ppm in the second one while the control plants produced the minimum value as 8.07 and 8.50 ppm in both seasons, respectively .

B . 6 . Zinc content (ppm) :-

Data in Table (13) cleared that the average of Zn content increased by increasing the concentration of Zn . Data were announced especially the treatment of 125 ppm that produced the higher mean in both seasons . While control gave the least value in two seasons .

The results in this study were in harmony with finding of Mohamed Safaa (1992) on ***Gerbera jamesonii*** and Eraki, et al (1988) and Jones et al . (1973), Dhingra et al . (1966) and Sharma et al (1974) . They obtained higher Zn content when treated the plants with Zn .

B . 7 . Total carbohydrate percentage :-

Looking into data in Table (14) it could be noticed that the total carbohydrate content gradually increased due to increaseing the concentration of Zn application . The highest carbohydrate content was found with the highest level of Zn (125 ppm) in both seasons . On the other hand, control plants produced the minimum mean of total carbohydrate conten in leaves of Viola odorata in the first and second seasons .

B . 8 . Chlorophyll A and B contents :-

Concerning the effect of Zn on chlorophyll content, it could be noticed that, no obvious trend with the two seasons of trials, in spite of little increase was noticed in chlorophyll A in the second season of trials with lowest level of Zn, while all Zn treatments decrease the chlorophyll formation at the first season of the experiment. control plants gave the best result in this concern in table (14) .

B . 9 . Concret oil percentage in violet flowers :-

The effect of different concentrations of Zinc on violet concrete percentage of fresh flowers was shown in Table (14) . As well sprayed the violet plants with Zn levels 75, 100 or 125 ppm, it could be noticed that increasing the concentration of Zinc caused gradualy increases in concrete content of flowers . The highest concrete content was produced with highest level of Zinc (125 ppm) in both seasons, which recorded 0.132 and 0.135 % for the first and second seasons, respectively .

C - Effect of Fe :-

C . 1 . Nitrogen content :-

Data of chemical analysis in table (13) show that high increase from nitrogen content was found in leaves of viola plants which treated

with 125 ppm Fe in the second season (1992 / 1993) . While the nitrogen content was fixed around to (2.002 mg/gm) for Fe at 100, 125 and 150 ppm at the first seasons (1991/ 1992)
No obvious trend was noticed in both seasons to indicate that any experimental treatment had any particular effect .

C . 2 . Phosphorus content :-

In the first season, data in table (13) show that all Fe level increased the phosphorus content in leaves of viola odorata comparing to control plants which produced the minimum value in this concern . While during the second seasons, all Fe concentration (100, 125 or 150 ppm) decreased the phosphorus content comparing to untreated plants which gave the high phosphorus content in violet leaves . However the relationship between Fe concentration and phosphorus content was not clear .

C . 3 . Potassium content :-

Data in table (13) show that the least value of potassium content in violet leaves was found in plants spraying with Fe at 125 or 150 ppm in the first season . Also the low level of Fe (100 ppm) at the first season gave the same value of potassium content with control leaves as 3.94 mg/gm . During the second season all concentration of Fe decreased the potassium content in leaves comparing to control plants . However we can noticed the opposite relationship between Fe spraying and potassium up-take in the leaves where the better absorption of potassium was found with untreated plants .

C . 4 . Iron content (ppm) :-

The results in table (13) show that all iron applications increased the iron content in violet leaves and the positive relationship between Fe concentrations and the increment of iron content in leaves of viola odorata . The highest average of Fe was found with plants which treated by the high level of iron application (150 ppm) . On the other hand, the least content of Fe was found with control plants . From the presented data it can be concluded that iron was a main factor for stimulation the vegetative growth of viola plants .

C . 5 . Manganese content (ppm) :-

Results in the first and second seasons as show in table (13) all concentrations of iron increased the Mn content in dry mater of leaves . The medial concentration of iron (125 ppm) gave the highest content of Mn in both seasons as 11.21 and 11.75 ppm., respectively. While the control plants produced the least Mn content in two seasons .

C . 6 . Zinc content (ppm) :-

It is clearly noticed from results in table (13) that the Zinc content in leaves of violet plants was increased by all concentrations of iron especially with the low level of Fe (100 ppm) in both seasons. Fe at 125 or 150 gave the next value in this respect in two seasons . While the control plants produced the minimum Zinc content in the first and second seasons .

C . 7 . Total carbohydrate percentage :-

Data in table (14) show the effect of iron foliar applications on total carbohydrate of violet leaves . Iron at 100 or 125 ppm increased the total carbohydrate as 7.67 and 7.80 respectively than Fe at 150 ppm and untreated as 5.80 and 5.46 respectively . This trend was more clear with the second season .

The results were agree with those obtained by Aly et al (1993) on ***Capsicum annuum*** L . They obtained higher carbohydrate content when treated the plants with Fe .

C . 8 . Chlorophyll content :-

Data illustrated at table (14) clearly showed that spraying viola plants with iron increased the content of chlorophyll (A) and (B) in fresh leaves of viola during two seasons . The most promising effects of Fe spraying was showed with the lowest concentration of Fe (100 ppm) where increased the chlorophyll A and B formation in both seasons . While the lowest chlorophyll content was noticed with the highest level of Fe spraying . From the above data it could be concluded that spraying viola plants with the lowest level of Fe (100 ppm) could be suitable for increase chlorophyll A, B formation in viola leaves .

C . 9 . Concret oil percentage in violet flowers :-

The data in table (14) show that all Fe treatments increased the concrete percentage of viola odorata flowers . The medium concentration of Fe (125 ppm) gave the maximum concrete percentage of viola flowers in both seasons .

While Fe at 100 gave the next value in this respect follow by Fe at 150 ppm . On the other side, control plants produced the minimum violet concrete percentage in both seasons .

Generally, it can be say that Fe at 125 ppm was suitable for increase concrete percentage of viola flowers .

Those results are in agreement with Attoa (1981) who reported that, spraying sweet beas with Fe caused remarkabl increase the concreate oil percentage .

Table (13) Effect of Mn, Zn and Fe on some chemical composition (N, P, K, Mn, Zn, Fe) of violet leaves in both seasons (1991 / 92 & 1992 / 93) :-

season	Nitrogen %		phosphorus %		Potassium %		Iron ppm		Mn ppm		Zn ppm	
micro elements	first season	second season	first season	second season	first season	second season	first season	second season	first season	second season	first season	second season
control 0.00	1.401	1.801	0.171	0.214	3.94	4.64	163.93	64.25	8.07	8.50	7.38	8.00
Mn 75 ppm	2.80	2.85	0.213	0.225	5.68	4.85	159.03	155.25	10.42	10.25	9.99	10.75
Mn 100 ppm	2.00	2.10	0.224	0.228	4.18	3.83	150.31	147.00	12.03	12.25	9.32	10.25
Mn 125 ppm	1.68	1.80	0.253	0.235	4.80	4.41	139.89	141.50	13.89	14.02	8.42	8.90
Zn 75 ppm	3.003	3.093	0.299	0.299	4.18	2.44	198.92	199.50	11.97	12.25	9.01	19.50
Zn 100 ppm	2.603	2.002	0.246	0.257	4.06	2.09	160.01	159.50	9.32	9.50	9.15	9.75
Zn 125 ppm	2.402	1.802	0.235	0.235	3.36	1.86	176.84	177.25	8.61	8.75	9.41	10.25
Fe 100 ppm	2.002	1.801	0.203	0.264	3.94	3.83	170.01	170.25	9.43	9.75	9.02	9.75
Fe 125 ppm	2.002	2.802	0.203	0.193	3.71	3.94	175.82	175.75	11.21	11.75	8.11	8.50
Fe 150 ppm	2.002	1.801	0.193	0.161	3.71	4.04	190.04	189.5	9.81	10.01	7.93	8.25

able (14) Effect of Mn, Zn and Fe on (total carbohydrat, chl . content, concret oil percentage) of violet plant in both seasons (1991 / 92 & 1992 / 93):-

season / miciro - elements	Total carbo %		Ch / A mg / gm		Ch / B mg / gm		concrete oil %	
	first season	second season	first season	second season	first season	second season	first season	second season
control 0.00	5.46	5.07	0.69	0.62	0.40	0.53	0.091	0.067
Mn 75 ppm	7.41	6.50	0.91	1.01	0.75	0.67	0.123	0.125
Mn 100 ppm	7.67	6.75	0.81	0.78	0.58	0.41	0.122	0.114
Mn 125 ppm	8.32	8.06	0.71	0.75	0.61	0.40	0.126	0.121
Zn 75 ppm	7.41	6.50	0.26	0.77	0.32	0.38	0.114	0.119
Zn 100 ppm	7.41	7.80	0.14	0.60	0.21	0.46	0.122	0.120
Zn 125 ppm	7.80	7.94	0.41	0.33	0.39	0.47	0.132	0.135
Fe 100 ppm	7.67	7.15	0.81	0.97	0.50	0.53	0.123	0.122
Fe 125 ppm	7.80	7.93	0.74	0.94	0.46	0.58	0.131	0.160
Fe 150 ppm	5.80	5.72	0.70	0.92	0.41	0.53	0.109	0.110

The second part

II Effect of GA3 on vegetative growth and flowering of *viola odorata*, L in both flushes :-

II - A - Winter flush :-

II - A - 1 - Number of leaves per plant :-

The number of leaves per plant was affected by the different rates of GA3 sprayed on plants in both seasons . All concentrations gave more leaves than control plants and in most cases the differences were significant . The high concentration of GA3 at (300 ppm) gave the maximum number of leave followed by 200 ppm . While the control plants gave the least number of leaves in both seasons .Tables (15 &16) . GA3 has a regulatory function and can force numerous functional changes in the plant through the indirect activation of plant components . 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 . El Dabh et al (1978) demonstrated that GA was effective in promoting leaf formation Pal and Das (1990) on ***lilium langiflorum***, stated that GA3 increased the number of leaves / plant . Abo EL-Ghait and Wahba (1994) on ***Viola odorata*** Showed that GA3 increased number of leaves and offsets per plant .

II - A - 2 - whole plant leaf area (cm^2) :-

The largest leaf area of ***viola oborata*** resulted from GA3 at 250 and 300 ppm while GA3 at 200 ppm gave the next leaf area of viola plants . Control plants produced the least leaf area .

Data in the second season (1992 / 93) shown in Table (16) appear similar trend of results to those obtained in the first season (1991 / 92) .

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

II - A - 3 - Number of flowers per plant :-

Data presented in Table (15) indicate that the number of flowers per plant increased with spraying viola plants with GA3 at different concentration . The number of flower increased as the GA3 concentration increased . The highest number of flowers per plant was obtained with the highest concentration of GA3 at 300 ppm .

These results come with the same trend to vegetative growth results .

In the second season data in Table (16) indicate also that the number of flowers / plant of viola increased significantly over the control as a result of GA3 treatments . While the least value resulted from the control plants .

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 lest 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 compound. The accelerating and increasing effect on flowering induced by GA3 has been shown by many workers such as Syamal et al (1990) on ***Callistephus chinensis*** . Also singh et al (1992) on ***Tagetes erecta*** found that GA3 increased flower yield, flower weight And Abo- EL- Ghait (1994) on ***Viola odorata*** .

II - A - 4 - Mean length of flower pedicel in (cm) :-

In Table (16) for first season, it is clearly noticed that the concentration of GA3 at 300 ppm increased the length of flower pedicel to 16.96 cms compared to 7.25 cm for control plants. The next treatment which gave the longest pedicel flower as 14.87 and 13.39 cm with GA3 at 250 and 200 ppm respectively .

In the second season data in Table (16) indicate also that length of flower peduncle of viola plants significantly increased over the control as a result of GA3 at all treatments especially at 300 ppm .

The results agree with those reported by Abou- Talib (1989) on ***Callistephus chinensis*** and Mukhopadhyay (1990) on carnation who found that GA3 treatment increased the flower pedicel length .

II - A - 5 - Fresh and dry weight of leaves per plant in gms :-

Application of GA3 at 300 ppm was effective in increasing the fresh weight of plant as 171.7 gms compared to 145.7, 122.7 and 101.2 gms with 250, 200 and 0.00 ppm respectively . Table (15) .

The treatment which increased fresh weights of plant were the same which produced heavy dry weights in the same Table . The differences among the treatment were significant in both seasons .

Similar results were obtained in the data of 1992 / 93 Table (16) . On ***Anemone coronaria***, L and ***Ronunculus asiaticus***, Hassan et al (1985) found that GA3 increased the fresh and dry weight, of plants .

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

II - A - 6 - Fresh weight of flowers per plant :-

GA3 increased significantly the fresh weight of ***viola odorata*** flowers. This induction reached into the maximum when plants supplied by 300 ppm GA3 during the first season, or 250 ppm during the second one .

able(15) : Effect of GA3 on the vegetative growth and flowering of *Viola odorata* in Winter flush from December to February in the first season (1991 / 92) :

Concentration of GA3 ppm	No. of Lvs. Per plant	leaf area / plant (cm^2)	No. of flowers Per plant	Mean length of pedicel (cm)	Fresh wt . of leaves per plant (gm)	Dry wt. of leaves per plant (gm)	Fresh wt. of flowers per plant (gm)
GA3 at 0.0	17.42	101.73	5.87	7.25	101.2	21.0	0.93
GA3 at 200	27.84	293.43	11.07	13.39	122.7	21.0	1.84
GA3 at 250	30.67	446.86	11.05	14.87	145.7	23.0	1.41
GA3 at 300	41.97	616.12	17.55	16.96	171.7	26.8	2.58
L.S.D at 5%	10.28	9.27	3.80	2.84	12.03	2.88	0.01
L.S.D at 1%	16.62	14.06	5.77	4.30	17.32	3.27	0.02

Table(16) : Effect of GA3 on the growth and flowering of *Viola odorata* in Winter flush from December to February in the second season (1992 / 93) :

Concentration of GA3 ppm	No. of Lvs. Per plant	leaf area / plant (cm^2)	No. of flowers Per plant	Mean length of pedciel (cm)	Fresh wt . of leaves per plant (gm)	Dry wt. of leaves per plant (gm)	Fresh wt. of flowers per plant (gm)
GA3 at 0.0	18.07	81.50	6.35	7.40	100.0	20.0	0.82
GA3 at 200	32.67	281.94	10.97	15.87	135.8	21.8	1.48
GA3 at 250	38.31	399.96	11.67	16.26	149.4	24.7	2.13
GA3 at 300	45.33	614.22	11.77	18.79	166.3	27.5	2.87
L.S.D at 5%	7.65	17.07	2.77	1.64	12.49	2.04	0.01
L.S.D at 1%	11.59	22.63	4.95	2.49	16.06	2.86	0.02

II - B - Spring flush :-

II - B - 1 - Number of leaves per plant :-

Data of (1991 / 92) in Table (17) reveal that GA3 at 200 ppm gave the maximum number of leaves as 64.26 Lvs / plant compared to 44.17 Lvs / plant with control plants. GA3 at 250 and 300 ppm produced the next value in this concern as 57.98 and 53.38 Lvs / plant respectively

Statistical analysis showed significant differences between these treatment and control plants during the two seasons .

Data of (1992 / 93) in Table (18) appear similar results to those obtained in (1991 / 92) . The maximum number of leaves / plant with GA3 at 200 ppm and the least number of leaves per plant was noticed with control plants.

The results were agree with obtained by Abd El - fatah (1995) on varieties of hybrid tea rosa who found that GA3 at 300, 200 ppm increased the number of leaves per plant .

II - B -2 - Whole plant leaf area (cm^2) :-

The leaf area was also affected with the different concentrations of GA3 since the highest leaf area was produced with GA3 at 300 ppm. While 200 and 250 ppm gave the next values and the same trend . The least leaf area was obtained with untreated plants . Statistical analysis showed significant differences among these treatments during the both seasons . Table (17) appear similar results of 1992 / 93 to those obtained in 1991 / 92 .

II - B - 3 - Number of flowers per plant :-

Data of number of flowers per plant in 1991 / 92 Table (17) revealed that all GA3 concentrations increased the number of flowers per plant compared to control plant . While GA3 at 200, 250, or 300 ppm gave the heighest number, respectively .

Results in second season (1992 / 93) in Table (18) cleared that the plant which applicated GA3 at 200 or 300 ppm gave the maximum number of flowers per plant, respectively . While GA3 at 250 ppm produced the next value . On the o there hand, control plants gave the minimum number of flowers per plant .

Statistical analysis showed significant differences between these treatments in both seasons. The results agree with those obtained by Syamal et al (1990) on marigold and china aster, Abd El-fatah (1995) on Mercedes rosa, He found that increased number of flowers per plant by GA3 applications .

II - B - 4 - Mean length of flower pedicel (cm) :-

It is evident from the data presented in Table (17) that GA3 as 300 ppm recorded significant increase in the length of flower pedicel to give 11.07 cms. GA3 at250 ppm gave the next value in this concern as 10.13 cms .

While GA3 at 200 ppm and control plants produced the shortest flower pedicel as 8.84 and 8.33 cms, respectively .

Data of the second seasons in Table (18) show that GA3 at 300 ppm gave the longest flower pedicel while GA3 at 250 or 200 ppm gave the next values . The untreated plants were the least treatment in this concern . Statistical analysis among these treatments were significant .

The results agree with those reported by Hassan et al (1985) on ***Anemone coronaria*** and ***Ranunclus asiaticus*** .

II - B - 5 - Fresh weight of flowers per plant :-

The highes stimulatory effect of GA3 on flower fresh weight per plant was gained by the rate of 250 ppm during the frist season and 300 ppm in the second one .

Table(17) : Effect of GA3 on the vegetative growth and flowering of *Viola odorata* spring flush from March to May in the first season (1991 / 92) :

Concentration of GA3 ppm	No. of Lvs. Per plant	leaf area / plant (cm^2)	No. of flowers Per plant	Mean length of Pedicel (cm)	Fresh wt. of flowers per plant (gm)
GA3 at 0.0 ppm	44.17	269.88	5.42	8.33	0.87
GA3 at 200 ppm	64.26	568.70	12.52	8.84	1.09
GA3 at 250 ppm	57.98	474.86	14.97	10.13	2.86
GA3 at 300 ppm	53.38	775.08	12.95	11.07	1.90
L.S.D at 5%	17.31	23.29	3.30	1.07	0.02
L.S.D at 1%	—	32.71	5.00	1.63	0.03

Table(18) : Effect of GA3 on the vegetative growth and flowering of *Viola odorata* in the spring flush from March to May in the second season (1992 / 93) :

Concentration of GA3 ppm	No. of Lvs. Per plant	leaf area / plant (cm^2)	No. of flowers Per plant	Mean length of Pedicel (cm)	Fresh wt. of per plant (gm)
GA3 at 0.0 ppm	54.91	470.03	10.25	8.45	1.32
GA3 at 200 ppm	80.23	750.95	16.82	9.25	1.82
GA3 at 250 ppm	75.22	738.66	13.12	9.33	1.39
GA3 at 300 ppm	67.36	738.94	17.20	10.43	2.73
L.S.D at 5%	19.92	16.03	1.22	0.79	0.01
L.S.D at 1%	—	23.34	2.80	0.98	0.02

II - Effect of GA3 on chemical composition of Viola odorata leaves in both seasons :-

II - 1 - Nitrogen content :-

The nitrogen content in violet plants increased with all concentrations of GA3 . These increase were more with increasing the concentration of GA3 from the low to the medium or to the high level, the control plants produced the minimum content of nitrogen . This trend was true in the first and second seasons of trials (Table 19) .

The results were in agreement with stated by Mohamed safaa (1992) on white godth and Osker gladiolus Cvs. and Abd El- fatah (1995) on Mercedes rosa .

II - 2 - Phosphorus content :-

In Table (19) showed the effect of GA3 as foliar application in phosphorus content in violet leaves . The highest phosphorus content was noticed with the highest concentration of GA3 (300 ppm) .

It could be noticed positive relationship between increasing the concentration of GA3 and amount of phosphorus in violet leaves .

Results of second season in the same Table were in harmony with those of first season . The results were in agreement these stated by selem (1984) on ***Chrysanthemum frutescens*** and Mohamed (1988) on Baccora and rouge Meillond Roses .

II - 3 - Potassium content :-

It is obvious from data in Table (19) that increaseing the concentration of GA3 gradually increased the potassium content in violet leaves where the highest level of potassium up-tacked was found with plants which sprayed by highest level of GA3 and medial increase from potassium content was noticed with the medium level of GA3 in the first season .

Data in the second season in Table (19), show that GA3 at 300 ppm. (The maximum concentration) gave the highest content of potassium in violet leaves, the control plants gave the next average in this concern . While GA3 at 200 or 250 ppm produced the least average of potassium content .

II - 4 - Total Carbohydrate percentage :-

Data in Table (19) summarized the different values of total carbohydrate of viola leaves which were affected by GA3 spraying . Looking to GA3 treatments it could be noticed that, increase the concentration of GA3 increased the accumulation of total carbohydrate in violet leaves in both seasons .

From the above data it could be concluded that spraying Viola odorata with GA3 especially at 300 ppm (high level) increased the nitrogen, phosphorus, potassium content and increase the amount of total carbohydrate which accumulated in viola leaves .

The results were agree with those obtained by Mohamed safaa et al (1992) on ***Alpinia nutans*** .and Abd El- fatah (1995) on Mercedes rosa . They found that GA3 at 300 ppm increased total carbohydrates percentage in leaves .

II - 5 - Chlorophyll Content :-

The results obtained showed that the chlorophyll A content in violet leaves, decreased by increasing the GA3 level in the two seasons but this decrease was small compared with control leaves . The higher value of chlorophyll A were obtained from untreated plants Table (19) .

As for chlorophyll B, generally, all GA3 application decreased the content of chlorophyll B in violet plants . The same trend also showed with the formation of both chlorophyll A and B in both seasons in the same Table .

The results were agree with those obtained by Mohammed (1992) on ***Dahlia Pinnata***, L. (winter flowering type) and Abd El- fatah (1995) on Mercedes roses, they found that GA3 decreased the chlorophyll content (A ‘ B) in leaves but this decrease was least compared with control plants .

II - 6 - Concret oil percentage in violet flowers :-

Data in Table (19) summarizes the different values for concrete percentage of violet flowers was influenced by GA3 spraying, where all GA3 treatments increased the concrete yield, especially when plants sprayed with lower concentration in both seasons .

On the other hand the range of variation between concentrations was narrow in two seasons . The control plants gave the lowest concrete percentage from flowers in the first and second seasons .

The results agree with those obtained by Abo EL- Ghait and Wahba (1994) ***onViola odrata***

Table (19) Effect of GA3 on Chemical composition of *Viola adorata* in both seasons (1991 / 92 & 1992 / 93) :-

mg / gn season growth regulators	Nitrogen %		Phosphorus %		Potassium mg %		Totol carb. %		Ch /. A mg / gm		Ch / . B mg / g m		concrete oil %	
	First season	Second season	First season	Second season	First season	Second season	First season	Second season	First season	Second season	First season	Second season	First season	Second season
control 00.0	1.401	1.801	0.171	0.214	3.94	4.62	5.46	5.07	0.69	0.92	0.40	0.53	0.081	0.067
GA_3 200 ppm	2.402	1.802	0.214	0.192	4.64	4.20	5.59	7.93	0.57	0.86	0.53	0.53	0.122	0.119
GA_3 250 ppm	2.602	1.832	0.246	0.224	4.91	4.41	7.28	7.93	0.51	0.78	0.45	0.48	0.118	0.112
GA_3 300 ppm	4.604	2.602	0.256	0.235	5.33	5.33	7.93	8.50	0.48	0.69	0.49	0.45	0.120	0.118